

**Final Report to Maine Sea Grant
On Development Funds Grant
For the Symposium on National Ocean Policy**



**Symposium on National Ocean Policy
October 15 & 16, 2010
Bowdoin College, Brunswick, Maine**

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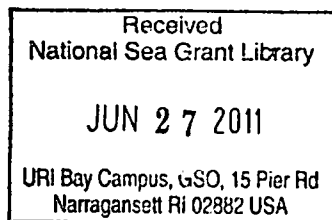
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Introduction

Background:

Roughly 99% of the world's biosphere is in the sea. The U.S. has 95,000 miles of coastline and the largest Exclusive Economic Zone of any country. Millions of American jobs and billions of dollars in annual economic activity depend on the oceans and Great Lakes. In addition to the food we eat, the air we breathe, and the water we drink, they provide energy, mineral resources, transportation, and recreation. The most amazing thing is that by simply being a citizen of the U.S., one is entitled to ownership of this incredible resource. The problem is that there are 309,000,000 "partners" who have co-ownership rights of the country's ocean resources, each of whom has their own ideas about how the partnership's possessions should be managed. Because of this extremely complex ownership structure, a myriad of laws have been created to manage marine resources, each designed to protect the rights and interests of specific stakeholders. This hodgepodge of laws is administered by hundreds of agencies from federal, state, and local governments. Most of these laws were created independently, without coordination with previously existing laws. So, not surprisingly, the goals of many ocean governance laws contradict each other.

Major reforms in ocean policy are underway in the United States. Over the past two decades, there has been increasing pressure to adopt ecosystem-based strategies to manage marine natural resources. Ecosystem-based management (EBM) is a more proactive, holistic approach to resource management than is the current piecemeal approach. However, there are significant obstacles impeding adoption of EBM, including insufficient scientific data on ecosystem structure and function, a need to reorganize and coordinate the fragmented regulatory structure, and a need to develop a system for coastal and marine spatial planning (CMSP).

Two independent commissions, the Pew Oceans Commission (convened by the Pew Charitable Trusts) and the U.S. Commission on Ocean Policy (convened by President Bush, pursuant to the Oceans Act of 2000), were created almost a decade ago to evaluate the health of marine ecosystems, examine the existing ocean policy framework, and recommend policy changes to improve the efficacy of governance. These commissions reported their findings in 2003 and 2004, respectively (Pew Oceans Commission, 2003; U.S. Commission on Ocean Policy, 2004). Both commissions recommended adoption of EBM. Relatively few policy changes have been made in the years since both commissions released their final reports. However, dramatic reforms are expected to occur over the next five years. President Obama formed the Interagency Ocean Policy Task Force (OPTF) in June 2009, which was charged with developing a new, comprehensive national ocean policy that would "ensure protection, maintenance, and restoration of oceans, our coasts and the Great Lakes." Final recommendations of the task force were released on July 19, 2010 (Interagency Ocean Policy Task Force 2010). These recommendations echo many of those made by the Pew Oceans Commission and U.S. Commission on Ocean Policy. On the same day that the OPTF's final recommendations were released, President Obama signed Executive Order 13366 (Obama 2010) making those recommendations the new federal ocean policy, which is now referred to as the National Ocean Policy, or NOP. The NOP could fundamentally

change marine resource governance throughout the United States' Exclusive Economic Zone, and have significant implications for many stakeholders. The specific effects of the NOP will depend on how the agencies interpret and implement the executive order. According to the OPTF:

The National Policy includes a set of guiding principles for management decisions and actions toward stewardship that ensures that the ocean, our coasts, and the Great Lakes are healthy and resilient, safe and productive, and understood and treasured so as to promote the well-being, prosperity, and security of present and future generations. It prioritizes actions, including ecosystem-based management, regional ecosystem protection and restoration, and strengthened and integrated observing systems, that seek to address some of the most pressing challenges facing the ocean, our coasts, and the Great Lakes. These strategies and objectives provide a bridge between the National Policy and action on the ground.

The National Policy identifies coastal and marine spatial planning as a priority. Marine spatial planning offers a comprehensive, integrated approach to planning and managing uses and activities over the long term. Under the National Policy, coastal and marine spatial planning would be regional in scope, developed cooperatively among Federal, state, tribal, and local authorities, and include substantial stakeholder, scientific, and public input. The coastal and marine spatial planning framework:

- *Establishes a new regional approach to how we use and protect the ocean, our coasts, and the Great Lakes to decrease user conflicts, improve planning and regulatory efficiencies and decrease costs and delays, and preserve critical ecosystem services.*
- *Creates a comprehensive alternative to sector-by-sector and statute-by-statute decision-making.*
- *Establishes regional planning bodies, bringing Federal, state, and tribal partners together in an unprecedented manner to jointly plan for the future of the ocean, our coasts, and the Great Lakes.*
- *Ensures science-based information is at the heart of decision-making.*
- *Emphasizes stakeholder and public participation (Interagency Ocean Policy Task Force, 2010).*

With the release of the OPTF's final recommendations and the signing of the executive order "Stewardship of the Ocean, Our Coasts, and the Great Lakes," which created the National Ocean Policy, the time was right to convene a public meeting to discuss how these new policies might affect stakeholders in the Gulf of Maine region. Bowdoin College held the Symposium on National Ocean Policy on October 15 and 16, 2010. This was the first public meeting of its kind, which brought together over 100

representatives from private industry, government, environmental organizations, community development organizations, and academia (natural sciences, social sciences, and arts) to discuss the NOP (see list of participants in Appendix 1). Symposium participants identified potential benefits and problems that the NOP may create, specific elements to include and pitfalls to avoid during the implementation process, and strategic opportunities for the Gulf of Maine region that may become available as a result of the NOP.

Symposium Goals:

The specific objectives of the symposium were to:

- evaluate likely effects of policy reforms on biodiversity preservation, ecosystem health, economic stability, and the cultural fabric of coastal communities;
- identify issues related to ocean policy reform on which there is broad agreement among diverse constituencies;
- provide a collegial venue in which various constituencies can build relationships that will allow them to collaborate over the long-term on solving some of the more vexing management problems in the Gulf of Maine;
- contribute to public education on the proposed reforms and foster dialogue about marine resource management;
- provide a mechanism for stakeholders to contribute to the public dialog on marine resource management at this critical point in time; and
- synthesize information to assist the government with efficient and fair implementation of the policy reforms.

Questions to Address:

Two broad questions served to frame all of the presentations and guide the discussions:

1. *How will the NOP affect the Gulf of Maine and the stakeholders who depend on it?*
2. *What recommendations can we make as a group regarding its implementation?*

Presenters, discussion facilitators, and the panel moderator were also asked to address a series of specific questions that related to these two broad framing questions and to the symposium's overall goals. These questions are listed in Appendix 2.

Symposium Format & Speakers

The symposium featured posters contributed by participants, oral presentations given by invited experts, "breakout" discussion groups, and an open panel discussion (see the symposium's agenda in Appendix 3).

Ten high-profile experts representing diverse fields from marine research, conservation, and industry gave lectures and/or participated in the panel discussion. Presentations were designed to raise questions, stimulate discussion, and focus attention on specific aspects of the NOP. Invited speakers and panelists included:

Tom Allen, former Congressman from Maine's First District

Ron Beck, Chief of the First Coast Guard District Energy and Facilities Branch and Co-Chair of the Ocean Energy Planning and Management sub-committee for the Northeast Regional Ocean Council

Elliott Norse, President of the Marine Conservation Biology Institute

Ted Ames, founding board member of Penobscot East Resource Center and Bowdoin College Coastal Studies Scholar.

Jim Wilson, Professor of Marine Sciences and Economics, University of Maine

Philip Conkling, President of the Island Institute

John Duff, Associate Professor and Graduate Program Director, Environmental, Earth & Ocean Sciences Department, University of Massachusetts/Boston

George LaPointe, Commissioner of the Maine Department of Marine Resources

Betsy Nicholson, Northeast Lead of the NOAA Coastal Services Center

Ted Hoskins, founding board member of Penobscot East Resource Center, co-founder of the Stonington Fisheries Alliance, board member of the Northwest Atlantic Marine Alliance and Cobscook Bay Resource Center, member of Maine's Lobster Advisory Council, and an ordained minister of the United Church of Christ.

See speaker biographies in Appendix 4.

Attendees were given a set of simple ground rules for participating in the symposium:

1. Be respectful. It is perfectly acceptable to disagree. However, disagreements should be viewed as challenges to be solved rather than as battles to be won.
2. Be open-minded and empathetic. Put yourself in the place of members from other stakeholder groups.
3. Offer creative ideas and reframe contentious issues to promote constructive dialogue.
4. Don't dwell on differences among constituencies; strive to find common ground.
5. Be actively engaged. Ask questions of the speakers and panelists and participate in the discussion.

See text of Damon Gannon's welcoming address and charge to symposium participants in Appendix 5.

Synopses of Sessions

There were four types of formal sessions during the Symposium: (1) a poster session, (2) invited talks, (3) breakout discussion sessions, and (4) a panel discussion (Appendix 3). Each session is summarized below.

Poster Session:

There were 19 posters offered by undergraduate and graduate students, college/university faculty, and staff from government agencies and nongovernmental organizations. Topics of these posters included natural science, social science, and policy, and spanned levels of organization from molecules to ecosystems. Abstracts of the posters are in Appendix 6.

Invited Oral Presentations:

Oral presentations on specific aspects of the NOP were made by six of our invited experts:

- **Tom Allen:** "*A National Ocean Policy: moving ocean management into the 21st century*" (Keynote Address)
- **Ron Beck:** "*National Ocean Policy - an Overview*"
- **Elliott Norse:** "*National Ocean Policy: A Way to Win for Both Marine Ecosystems and Ocean Users*"
- **Jim Wilson:** "*A Skeptical View of the NOP*" (Appendix 7A)
- **Ted Ames:** "*Marine Spatial Planning and Commercial Fishing in the Gulf of Maine*" (Appendix 7B)
- **Philip Conkling:** "*Wind and Water: Offshore Planning*"

Breakout Sessions:

Four concurrent breakout sessions took place. Symposium participants were randomly assigned to each breakout group. The breakout groups were given a list of questions to help promote constructive discussions (Appendix 2). These questions were intended to serve as starting points for the conversation rather than to set boundaries on the discussion. Summaries of the four breakout group discussions are in Appendix 8.

Panel Discussion:

These discussion questions are listed in Appendix 2. Many of the themes that emerged in during the panel discussion are captured in the *Main Results* section.

Main Results: Issues of Concern and Recommendations

There was broad agreement among symposium participants that fragmented governance, weak institutions, spatiotemporal mismatches between the scales of governance and those of natural processes, and unlimited mobility of resource users lead to unsustainable resource use. The real debate was over whether the NOP, as it is currently envisioned, could solve these problems. Throughout the symposium, participants identified several issues of concern. The most significant problems and those that were expressed most often by participants are summarized below, in no particular order. The context of many of these topics can be gleaned from Appendix 8.

- **Conflicting Goals:** The NOP's nine *National Priority Objectives* will inevitably conflict with each other. Yet, the NOP provides no guidance on how such conflicts would be resolved. Therefore, a hierarchy of priorities must be created within the nine *National Priority Objectives* and a clear and equitable process for resolving conflicts must be developed.
- **Broadly-Applicable, Measurable Goals:** The nine *National Priority Objectives* must be operationalized. That is, the objectives should be relevant to local areas,

easily understandable, and objectively measurable. The problem(s) that each objective seeks to address should be clearly identified and measured quantitatively with a high degree of precision. The ability to measure progress toward policy goals is essential; the only way to accomplish this is to develop objective, quantitative metrics.

- **Local Control:** There was a strong sense among many participants that the NOP and its regional planning bodies should lay out broad goals and allow local entities to achieve these goals by whatever means are most appropriate in that region, including ones that make use of existing informal institutions.
- **Bureaucratic Complexity:** One of the primary goals of the NOP is to solve problems created by the fragmented governance structure. The approach taken by the NOP is to introduce new governance bodies to bridge the gaps between existing bodies. However, the NOP does not integrate or streamline the governance structure in any way. The resulting framework described on pages 19 and 20 of the final report of the Ocean Policy Task Force greatly increases the complexity of the existing system. For many participants, this complex bureaucracy raises the concern that the governance will be inefficient.
- **Stakeholder Participation:** Many stakeholders expressed concern about the process by which the NOP was created and by which it will be implemented. Despite language to the contrary in the final report of the Ocean Policy Task Force, many symposium participants expressed the opinion that the NOP is a top-down initiative. The definitions of “Bottom-up,” “transparent,” and “inclusive” differ depending on where you are from and your level within the political “food chain.” What seems inclusive to someone in Washington, DC may seem completely top-down to someone in Washington County, Maine. One participant made the distinction between *public input* and *public participation*. *Public input* can occur after a policy has been drafted and it may or may not influence the final policy that is adopted. *Public participation* refers to a bottom-up approach where there is a two-way exchange of information between government agencies and members of the public during every step of the policy drafting process, and the policy is only formed once all participants have reached consensus through deliberation.

To change this sentiment of exclusion among stakeholders (whether or not it is a fair assessment), stakeholders should be engaged as early and as often as possible. Effective communication is critical. For example, stakeholders who work in commercial fisheries tend not to spend much time using email, Facebook, or other internet resources. Therefore, these constituents need to be contacted through other means, such as trade publications, local newspapers, meetings of industry

associations, and one-on-one in their home ports. Partnerships should be formed with State Sea Grant offices, private marine education organizations, and advocacy organizations to educate the general public about the NOP and to communicate regularly with stakeholders.

Meetings of the regional CMSP planning body and other management councils could be made more accessible to all stakeholders in three ways: 1) make the meetings open to the public; 2) stream video of meetings over the internet; and 3) partner with colleges, universities, and civic organizations to hold "satellite meetings" in which two-way internet conferencing technology would be used to allow attendees of the satellite meetings to participate fully in the proceedings. The goal should be to have a number of satellite meetings that are distributed along the coast such that no coastal-based stakeholder would have to drive more than an hour to attend a meeting (either the main meeting or the satellite meetings). Every university, college, and community college, as well as many nonprofit and civic organizations, possess the meeting facilities and internet conferencing technology to make this possible. As most of these organizations include public service as part of their missions, it is likely that they would be eager to host these satellite meetings for little or no compensation.

- **Mismatch between the Scale of Governance and that of Natural Processes:** In many cases, the scale of governance (i.e., the nine Regional Planning Areas) does not appear to match either the ecological scale of the resources being managed or the scale at which the resource users operate. A "one size fits all" approach would be ineffective. Thus a multi-layered, multi-scale approach seems warranted; one that spans the range from individual bays to entire ocean basins. Therefore, adjacent regional planning areas should cooperate on managing highly migratory species and human activities that span their borders. Within each of the nine regional planning areas, finer management units should be created to manage processes and species that operate at finer scales, such as crustaceans, bivalves, and urchins.
- **Spatial Exclusion of Traditional Resource Users:** Some stakeholders expressed concern that CMSP will result in exclusion of traditional resource users (e.g., fishing) in favor of newer economic activities, such as energy development or aquaculture. Likewise, some were concerned that CMSP may cause geographic displacement of activities, resulting in a shift and possible intensification of existing conflicts, as well as the creation of new conflicts.
- **Treat Problems at their Sources:** Many threats to local marine ecosystems within the United States' EEZ originate either on land or on the high seas, beyond our

EEZ. However, the NOP focuses on the area of the ocean within the US EEZ. The NOP should recognize the origin of threats and take steps to cure them at their sources, rather than simply trying to treat the symptoms as they appear at “downstream” locations.

- **Lack of Funding:** Many of the social scientists and policy experts in attendance expressed concern over lack of funding for NOP initiatives. Because there is no enacting legislation for the NOP, these meeting participants expressed doubt regarding whether there will any dedicated funds available to implement this policy. Effective marine spatial planning and ecosystem-based management will require additional research funding. Engaging stakeholders and the general public will also require a significant investment. Given the current fiscal condition of the federal government, it is hard to imagine that these funds can be obtained from the normal appropriations process. One possible solution is the creation by Congress of a “National Endowment for the Oceans.” Such a bill had been introduced in Congress but died in the Senate.

Summary:

There was widespread agreement among participants in the symposium that marine resource policy could be improved. However, there was no consensus on the likelihood that the NOP will achieve the needed changes. At the time of the symposium, few details were available regarding how the policy would be implemented. Many at the symposium expressed frustration due to a perceived lack of information coming from the federal agencies and a feeling of being locked out of the process. The key to the NOP’s success will be for the National Ocean Commission and CMSP Regional Planning Bodies to communicate effectively with stakeholders. The stakeholder community is diverse and geographically dispersed, which makes effective communication difficult. However, there are public and private agencies that are well-equipped to assist the National Ocean Council and CMSP Regional Planning Bodies to reach their constituents.

Despite frustrations over the process, there was a great deal of optimism regarding the NOP. This optimism was signified by a spirit of cooperation and collegiality shared among the symposium participants, many of whom represented constituencies that are often at odds with one another. Support from the stakeholder community is essential for the successful implementation of the NOP. Therefore, maintaining the sense of optimism, cooperation, and collegiality among the stakeholders is important. The Symposium on National Ocean Policy was tremendously beneficial in this regard, as it provided an opportunity for stakeholders to learn about recent policy developments, encouraged stakeholders from diverse backgrounds to interact with each other and with

staff members from government agencies, and allowed stakeholders to identify entry points into the policy process. It was the first meeting of its kind in the country, and should serve as a model for other regions.

Acknowledgments

Many thanks to the symposium attendees, particularly the speakers, poster presenters, symposium organizing committee, and volunteers. The organizing committee was composed of Ted Ames, Anne Hayden, Ta Herrera, DeWitt John, Amy Johnson, Dan Thornhill, Mike Kolster, John Lichter, Rosemary Armstrong, and Eileen Johnson. Rosie Armstrong went above and beyond the call of duty in putting the symposium together. Rick Burroughs, John Duff, Ta Herrera, DeWitt John, Amy Johnson, Dan Thornhill, and Anne Hayden ably facilitated the breakout group discussions. Ted Hoskins moderated our panel discussion.

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The symposium was co-sponsored by Bowdoin's Coastal Studies Center, the Bowdoin Scientific Station on Kent Island, the McKeen Center for the Common Good, the Environmental Studies Program, and the Departments of Government and Biology.

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Appendix 1: Registered Participants of the Symposium on National Ocean Policy.

	First Name	Last Name	Organization
1	Kelsey	Abbott	freelance science writer
2	Tom	Allen	
3	Cris	Alvarez	
4	Ted	Ames	Bowdoin College
5	Rosemary	Armstrong	Bowdoin College
6	Aslaug	Asgeirsdottir	Bates College
7	Regina	Asmutis-Silvia	Whale and Dolphin Conservation Society
8	Nick	Battista	Congresswoman Chellie Pingree Tufts Friedman School of Nutrition Science & Policy - Agriculture, Food & Environment program
9	Amanda	Beal	
10	Ronald	Beck	U.S. Coast Guard
11	Andy	Bell	
12	Amy	Bishop	
13	Scott	Bodwell	Bodwell EnviroAcoustics
14	Ellen	Bolen	Ocean Conservancy
15	Richard	Burroughs	University of Rhode Island
16	Kristina	Cammen	Duke University
17	Nancy	Carter	
18	Caitlin	Cleaver	School of Marine Sciences, University of Maine
19	Eric	Chien	Bowdoin College
20	Judy	Colby-George	Spatial Alternatives, Inc.
21	Philip	Conkling	Island Institute
22	Laura	Connolly	Bowdoin College
23	John	Coon	University of New Hampshire
24	Hannah	Dean	UMass Boston, EEOS Department
25	Nathan	Dill	Woods Hole Group
26	Michael	Dixon	University of Maine School of Law
27	Christopher	Doane	U.S. Coast Guard
28	Aaron	Dority	Penobscot East Resource Center
29	Bryant	Dossman	Bowdoin College
30	John	Duff	UMass Boston
31	Paul	Dumdey	
32	Betsy	Duncan	Rockweed Coalition
33	Reginald	Elwell	Brunswick Conservation Commission
34	Myrick	Freeman	Bowdoin College
35	Michael	Gale	
36	Damon	Gannon	Bowdoin College
37	Janet	Gannon	Bowdoin
38	Lynn	Gelhar	MIT
39	Carla	Guenther	Penobscot East Resource Center

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40	Katie	Guttenplan	Bowdoin College
41	Gin Swen	Ham	Whale and Dolphin Conservation Society
42	Heidi	Hansen	Whale and Dolphin Conservation Society
43	Jill	Harlow	Gulf of Maine Research Institute
44	Anne	Hayden	Bowdoin College
45	Maryellen	Hearn	Bowdoin College
46	Rita	Heimes	University of Maine School of Law
47	James	Henderson	Publius Research
48	Guillermo	Herrera	Bowdoin College
49	Porter	Hoagland	Woods Hole Oceanographic Institution
50	Jeff	Holden	
51	Ted	Hoskins	Penobscot East Resource Center
52	Linda	Hoskins	
53	Sherman	Hoyt	Univ. Maine Sea Grant
54	Lewis	Incze	University of Southern Maine
55	Mahima	Jaini	Darling Marine Center
56	Phoebe	Jekielek	University of Maine
57	Eileen	Johnson	Bowdoin College
58	Amy	Johnson	Bowdoin College
59	Joshua	Stoll	Duke University
60	Paul	Joyce	Marine Resources
61	Christopher	Kan	Bowdoin College
62	Bozhidar	Karanovsky	Bowdoin College
63	Michael	Kolster	Bowdoin College
64	Gary	Lakin	U.S. Coast Guard
65	Gordon	Lane	
66	Samantha	Leahy	
67	Lynne	Lewis	Bates College
68	Julia	Livernore	Bowdoin College
69	Gina	Lonati	Bowdoin College
70	Bruce	MacDougal	friends of Bowdoin Cape Cod Commercial Hook Fishermen's Association
71	Ben	Martens	
72	Patrick	Martin	Bowdoin College
73	Tristan	McCormick	
74	Peter	McDougall	Freelance Science Writer
75	Marissa	McMahan	Gulf of Maine Research Institute/Uno-SMS
76	Shelagh	Merrill	Bowdoin College
77	Kim	Meuse	UMA
78	Jim	Millinger	Sea Education Association, Woods Hole MA
79	Peter	Moore	Sustainable Fisheries Coalition
80	Colin	Morrow	
81	William	Muellenhoff	Retired from Shaw Environmental and Infrastructure Harpwell Conservation Commission & H Heritage Land Trust
82	Mary Ann	Nahf	

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83	Richard	Nelson	member-Maine Lobstermen's Association
84	Laura	Newcomb	Bowdoin College
85	Betsy	Nicholson	NOAA Coastal Services Center
86	Elliott	Norse	Marine Conservation Biology Institute
87	Susan	Olcott	Marine Spatial Planning Outreach Manager
88	Chris	Petersen	College of the Atlantic
89	James	Reynolds	Booz Allen Hamilton (working for the USCG)
90	Laura	Rideout	Maine Law
91	Seth	Rivard	University of Southern Maine
92	Stephen	Robbins III	Stonington Lobster Co-op
93	Sage	Santangelo	Biology
94	Richard Robin	Schwartz	Colby College Shoals Marine Lab, Appledore Island, ME (Cornell University)
95	Hadlock	Seeley	
96	J. Sarah	Sorenson	Colby College Environmental Studies Program
97	Peter	Taylor	Waterview Consulting
98	Kimberly	Tess-Wanat	Bowdoin College
99	Elsie	Thomson	Bowdoin College
100	Daniel	Thornhill	Bowdoin College
101	Mary Beth	Tooley	O'Hara Corp/Small Pelagic Group
102	Theresa	Torrent-Ellis	Maine Coastal Program
103	Sam	Truesdell	University of Maine
104	Roger	Tuveson	
105	Kathy	Tuveson	
106	Heidi J.	Vierthaler	
107	Lisa	Walsh	Bowdoin Coastal Studies Center
108	Jim	Wilson	University of Maine
109	Patrick	Wycko	U.S. Coast Guard
110	Hank	Wyman	Colby College
111	Toby	Zitsman	Bowdoin College

Appendix 2: Discussion questions for breakout sessions and panel discussion.

Questions for afternoon discussion groups

Governance:

1. How will the National Ocean Policy (NOP) affect the Gulf of Maine region?
2. Will the strengthened and more centralized governance structure created by the National Ocean Policy support or conflict with regional, state, or local interests?
3. Can we balance the application of federal policy with locally-based, hierarchical co-management of marine resources?
4. If you could provide one piece of advice to the federal government regarding implementation of the NOP, what would it be?

Balancing interests in the Gulf of Maine/Involving Stakeholders

1. What industries in the New England region will be affected most by the NOP?

Science and Policy:

1. The National Ocean Policy "places science-based information at the heart of decision-making." But science cannot tell us the relative importance of potentially conflicting (e.g. economic, cultural, national security, and conservation) goals. What will be the specific roles of science and politics under the new national ocean policy?
2. How can we improve the incorporation of scientific knowledge about the oceans into ocean policy decisions?

Habitat and Biodiversity

1. What are the greatest conservation gains that are likely to be realized in the Gulf of Maine due to the NOP?

2. How will the national ocean policy affect efforts to manage or mitigate eutrophication, harmful algal blooms, ocean acidification, sea level rise, bioinvasions, habitat loss, biodiversity loss, and other environmental issues? What are the specific items that the National Ocean Council should consider in its strategic action plan to enhance biodiversity conservation or economic stability in the Gulf of Maine region?

Ecosystem Based Management

1. Given uncertainties with regard to ecosystem structure and function, and the complexities of coupled human-natural systems, do we really have the capability to implement effective EBM at this time and at this scale?
2. What are the critical data gaps limiting implementation of EBM? (i.e., What are the most important research questions we need to answer to make effective EBM feasible?)
3. Can EBM effectively integrate social, economic, and biological dimensions?

Marine Spatial Planning

1. Is it possible to perform marine spatial planning in a manner similar to land-use planning, or does the dynamic nature of the ocean introduce too much complexity?

Questions for Panelists

Governance:

1. What will the new National Ocean Policy (NOP) look like and what will be its implications for the Gulf of Maine region?
2. How will the NOP integrate existing state and federal laws, such as the Magnuson-Stevens Fishery Management & Conservation Act and the Marine Mammal Protection Act?
3. Will the strengthened and more centralized governance structure created by the National Ocean Policy support or conflict with regional, state, or local interests?

4. Can we balance the application of federal policy with locally-based, hierarchical co-management of marine resources?
5. One of the problems with the old way of managing our oceans is that there are many individual laws being implemented by many government agencies. Some of these laws result in conflicting mandates. The NOP doesn't appear to change this; it simply layers more bureaucracy on top of these existing laws and agencies. How is this going to result in more efficient governance?
6. Will the NOP require significant reconfiguration of executive branch agencies, particularly NOAA?
7. Can NOP reforms be enacted entirely by the executive branch or will they also require new legislation?
8. What will happen if some state or local governments do not want to change the management structure? Would a lack of cooperation by a few states jeopardize the entire initiative?
9. How is ecosystem based management (EBM) defined under the NOP, and what are its benefits and drawbacks?
10. What is marine spatial planning and what can it accomplish?
11. What will be the function of the National Ocean Council and how will it interact with existing regional governance structures, such as the Northeast Regional Ocean Council and the New England Fisheries Management Council?
12. Does the NOP provide authority to regulate land-based activities that can affect marine ecosystems (e.g., forestry activities, dam construction & modification, effluent release, air pollution, etc.)?
13. The National Marine Fisheries Service's mandate is broad and complex, and it doesn't have the resources necessary to fulfill all of its legal obligations. This forces the agency into a state of crisis management; they have to deal with whichever issue is critical at the moment and put aside everything else. It has become widely accepted among stakeholder groups that in order to get the agency to meet its obligations, it is necessary to sue them. So lawsuits have become standard operating procedure when doing business with the agency. Will the NOP improve this situation and allow the agency to be more proactive?

Balancing interests in the Gulf of Maine/Involving Stakeholders

1. When conflicts among the NOP's goals (and stakeholder groups) arise, what is the process for resolution? Are the goals of the Policy going to be prioritized in a hierarchy?

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2. Will there be formal mechanisms to facilitate stakeholder participation in Regional Ocean Policy Council activities?
3. If I am a lobsterman who fishes in state waters of Maine, how exactly will the NOP affect me?
4. How will the NOP affect the groundfish fishery, which operates in federal waters and how will NOP affect efforts to manage overfishing?
5. Will the NOP make it easier to site and develop wind farms or tidal power generators?

Science and Policy:

1. How can we improve the incorporation of scientific knowledge about the oceans into ocean policy decisions? What will be the specific roles of science and politics under the new national ocean policy?

Habitat and Biodiversity

1. Will the NOP change how we deal with endangered species conservation?
2. Does the NOP provide for any international cooperation in the management of migratory (or "highly migratory") species, for purposes of either resource management or biodiversity conservation?

Appendix 3: Symposium Agenda.

Schedule and Presentations

Friday, October 15

4:30 PM

Registration and Poster set up
Morrell Lounge, Smith Union

5:30 PM Welcome Reception and Poster Session
Morrell Lounge, Smith Union

7:30 PM Introduction and Keynote address

Former Congressman **Tom Allen**: *"A National Ocean Policy: moving ocean management into the 21st century"*

Kresge Auditorium, Visual Arts Center

** Please note: No Registration is needed to attend the keynote address*

Saturday, October 16

8:00 AM

Registration and light breakfast
Smith Auditorium, Sills Hall

8:15 AM

Welcome, **Dean Cristle Collins Judd**

8:25 AM

Damon Gannon: Issuing the charge to symposium participants

8:30 AM

Ron Beck: "National Ocean Policy - an Overview."

8:50 AM

Elliott Norse: "National Ocean Policy: A Way to Win for Both Marine Ecosystems and Ocean Users."

9:50 AM

Break- refreshments in Smith Auditorium Lobby

10:05 AM

Jim Wilson: "A Skeptical View of the NOP"

11:05 AM

Ted Ames: "Marine Spatial Planning and Commercial Fishing in the Gulf of Maine"

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12:00 PM- 1:00 PM

Brunch, Thorne Hall, Daggett Lounge

1:15 PM

Philip Conkling: *"Wind and Water: Offshore Planning"*

2:15 PM

Announcements & charge for breakout sessions, Sills Hall

2:25 pm

Breakout sessions, Sills Hall

3:45 PM

Break- refreshments in Smith Auditorium Lobby

4:00 PM

Breakout Group Reports, Smith Auditorium

5:30 PM-6:30 PM

Panel Discussion: *A 'town hall' moderated forum
Free and Open to the Public, no registration required
Smith Auditorium, Sills Hall*

The panel will be moderated by Ted Hoskins; panel members will include Ted Ames, Philip Conkling, John Duff, George LaPointe, Betsy Nicholson, Elliot Norse, and Jim Wilson. The panel will discuss the problems that the new national ocean policy is meant to solve, the policy's likely effects on stakeholders, and potential pitfalls that may develop during implementation.

6:30 PM- 7:30 PM

Reception, ES Common Room
Adams Hall

Sunday, October 17

Optional Field Trip to Bowdoin College's Coastal Studies Center

For more information and to register please click [here](#).

We will leave campus at 9:00 AM

(Meet at the Bowdoin polar bear outside Smith Union at 8:45 AM)

Appendix 4: Speaker Biographies

Tom Allen

In April 2009, former Congressman Tom Allen joined the Association of American Publishers as its President and Chief Executive Officer. As President of the AAP, Mr. Allen seeks to foster the association's ongoing mission of protecting copyright in the ever-changing landscape of the digital world and help publishers meet 21st-century challenges.

In 1996 Mr. Allen was elected to Congress and served the people of the 1st District of Maine from 1996-2008. As a Member of Congress, Mr. Allen served on the Energy and Commerce Committee, the Budget Committee, the Armed Services Committee, and Government Reform Committee. On the Energy and Commerce Committee Mr. Allen worked on a range of issues, from health care to climate change to telecommunications legislation. He also co-founded the House Oceans Caucus, which was created to raise awareness of the need for a coordinated global oceans resources policy.

From 1974 until 1993, Mr. Allen practiced law at the firm Drummond Woodsum Plimpton and MacMahon, where he was a partner and member of the Board of Directors. During this time he also served on Portland City Council from 1989-1995 and as Mayor of Portland.

Mr. Allen was born and raised in Portland, Maine. After graduating from Deering High School, where he was co-captain of the Deering Football team as well as senior Class President, Mr. Allen studied at Bowdoin College where he received a B.A. in English. After graduating from Bowdoin, he received a Rhodes Scholarship to the University of Oxford, from which he received a B. Phil in Politics in 1970. He worked a year in Washington for U.S. Senator Ed Muskie and then attended Harvard Law School and graduated with a J.D. in 1974.

Edward (Ted) Ames

MacArthur Fellow (2005) and Co-founder, Penobscot East Resource Center

Ted Ames is a founding board member of Penobscot East Resource Center in Stonington, Maine and director of the organization's Zone C Lobster Hatchery. Ames is both a fisherman and a researcher in historical fisheries ecology and fishermen's ecological knowledge. His work mapping spawning areas for cod in the Gulf of Maine and analyses of historical fishing grounds led to identification of the fine scale stock structure of cod in the GOM. Ames is the recipient of a 2005 MacArthur Award, the 2007 Geddes W. Simpson Distinguished Lecturer at the University of Maine and is the Visiting Coastal Studies Scholar at Bowdoin College for 2010. He fished for groundfish and scallops for 24 years, lobsters for 27 years, with extensive additional commercial fishing experience. A former Executive Director of the Maine Gillnetters Association, Ames is captain/owner of the lobster boat *F/V Mary Elizabeth*.

Ronald E. Beck

Mr. Beck is the Chief of the First Coast Guard District Energy and Facilities Branch - regional USCG program manager for energy projects including permitting and operations of liquefied natural gas (LNG) and offshore wind facilities. The First Coast Guard District extends from the Canadian border to New Jersey.

Mr. Beck is also Co-Chair of the Ocean Energy Planning and Management sub-committee for the Northeast Regional Ocean Council. He is a 1967 graduate of the Coast Guard Academy and holds Masters Degrees in Naval Architecture and Marine Engineering and Industrial and Operations Engineering. In 1978 he became a licensed Professional Engineer and currently holds a U.S. 100-Ton Master's License. Assignments in the Coast Guard included chief engineer aboard Coast Guard cutters, Assistant Professor at the Coast Guard Academy, and Chief of the Industrial Department at the Coast Guard Yard. He retired from the Coast Guard as a Commander.

Philip Conkling

President, Island Institute

For the past 25 years, Philip Conkling's life has been grounded by experiences among the 5,000 or so islands in the archipelago of Gulf of Maine. There he has visited more than 1,000 islands, initially for purposes of collecting and analyzing ecological information. As founder and President of the Island Institute, his focus has been to provide strategic, creative and developmental leadership for the organization. He oversees a staff of approximately 40 in the Institute's publications, marine, education and community development programs and 12-14 Island Fellows who live and work in isolated and rural coastal communities.

As part of his work, he has traveled extensively on voyages to Arctic and sub Arctic regions of both the Pacific and Atlantic oceans and written extensively on the effects of global warming on coastal villages, fishing fleets and ecosystems of northern regions. In particular, he has been interested in how the changes in the northern North Atlantic will affect marine and coastal life on the islands and coast of Maine. He is the author of *Islands in Time, A Natural and Cultural History of the Islands of the Gulf of Maine* (1999) and *Lobsters Great and Small-How Fishermen and Scientists are Changing Our Understanding of a Maine Icon* (2001) He also is the editor of *From Cape Cod to the Bay of Fundy-An Environmental Atlas of the Gulf of Maine* (1995).

John Duff

Associate Professor and Graduate Program Director, Environmental, Earth & Ocean Sciences Department, University of Massachusetts/Boston

John Duff received his J.D. from Suffolk University Law School in Boston and his LL.M. from the Law and Marine Affairs Program at the University of Washington. He also holds degrees in business (B.S.B.A.) from the University of Lowell and Journalism

(M.A.) from the University of Mississippi. Over the course of the last twenty years he has worked as a newspaper reporter; an attorney in private practice; served as general counsel to a nonprofit organization focusing on marine habitat protection issues; and, has directed the marine law research programs at the law schools of the universities of Mississippi and Maine. His work earned him a Fulbright Senior Fellowship in 1998. Since 2004, Professor Duff has served as a faculty member in the Environmental Earth and Ocean Sciences Department at the University of Massachusetts/Boston where he teaches courses on climate change and clean energy law, environmental policy, ocean and coastal law and land use. Professor Duff is currently working on research related to ecosystem-informed management, ocean planning and the increasing privatization of offshore public resource assemblages, technology and public policy.

Prof. Duff's research has been published in a variety of journals and professional reports. He is co-editor of the book *International Ocean Law*; he serves on the editorial board of *Ocean Development and International Law*; and, he is past president of The Coastal Society. He is a Faculty Advisor in the United Nations-Nippon Foundation Law of the Sea Fellowship Programme and a consultant to municipal, state and intergovernmental agencies.

Ted Hoskins (Panel Discussion Moderator)

Ted Hoskins is a founding board member of Penobscot East Resource Center in Stonington.

Ted also serves on the boards of the Northwest Atlantic Marine Alliance and Cobscook Bay Resource Center and is a member of Maine's Lobster Advisory Council, as well as being co-founder of Stonington Fisheries Alliance. An ordained minister of the United Church of Christ, Ted is Pastor Emeritus of Saugatuck Congregational Church of Westport, Connecticut and summer minister on Isle au Haut for some 45 years. He was "boat minister" aboard the Maine Seacoast Mission's vessel, Sunbeam, and then served the Mission as "Minister To Coastal Communities and Fisheries". Presently, Ted is actively organizing the commercial fishermen of Belize for participation in resource management.

George LaPointe

Commissioner, Maine Department of Marine Resources

George is a veteran state and federal marine fisheries manager. He received his BS in Wildlife Biology from the University of Massachusetts and holds a M.S. in Wildlife from the University of Minnesota.

Commissioner Lapointe formerly held the position of Director, Interstate Fisheries Management Program, with the Atlantic States Marine Fisheries Commission (ASMFC), Washington, D.C. from December 1994 - September 1998. George directed ASMFC's fishery management planning activities; supervised the preparation and implementation of fishery management plans for 19 Atlantic Coast species, seeking state based solutions to fishery management issues; coordinated activities with state marine fisheries agencies,

federal agencies, academic and scientific organizations, conservation organizations, and members of the public to promote efficiency, outreach and public participation in the ASMFC fishery process.

Betsy Nicholson

Northeast Lead, NOAA Coastal Services Center

Betsy Nicholson has 10 years of experience at the National Oceanic and Atmospheric Administration, working on coastal and ocean management issues at both the national and regional levels. After receiving her Bachelor of Arts degree from Williams College, 1995 and her Masters in Coastal Environmental Management from Duke University in 2001, Ms. Nicholson came to NOAA as a Sea Grant Fellow in 2000. There she served as the National Ocean Service representative to the NOAA political leadership team for 2 years, and as the NOAA Policy Advisor to the Secretary of Commerce before moving north. She is now positioned as the Northeast Lead for the NOAA Coastal Services Center, which includes leading her NOAA colleagues in New England to better coordinate and tailor their products and services to fit customer needs, serving as federal chair of the Northeast Regional Ocean Council, and coordinating Coastal and Marine Spatial Planning activities among federal, state and non-governmental partners.

Elliott Norse

President, Marine Conservation Biology Institute

Dr. Norse has worked at the conservation science-policy interface for his entire career. After earning his B.S. in Biology from Brooklyn College, he studied the ecology of blue crabs in the Caribbean for his Ph.D. at University of Southern California and his Postdoctoral Fellowship at University of Iowa. Starting in 1978 he worked at the US Environmental Protection Agency, President's Council on Environmental Quality (where he defined biological diversity as conservation's overarching goal), Ecological Society of America, Wilderness Society and Ocean Conservancy before founding MCBI in 1996. Dr. Norse's 140+ publications include 4 books: *Conserving Biological Diversity in Our National Forests* (1986), *Ancient Forests of the Pacific Northwest* (1990), *Global Marine Biological Diversity: A Strategy for Building Conservation into Decision Making* (1993) and *Marine Conservation Biology: The Science of Maintaining the Sea's Biodiversity* (2005). He is a Pew Fellow in Marine Conservation and Adjunct Professor of Marine Conservation Science and Policy at Duke University Marine Laboratory, served as President of the Society for Conservation Biology's Marine Section, received the Nancy Foster Award for Habitat Conservation from the National Marine Fisheries Service and Brooklyn College named him its 2008 Distinguished Alumnus.

James (Jim) Wilson

Professor of Marine Sciences and Economics, School of Marine Sciences, University of Maine

My research interests, and to a large extent that of my colleagues in marine policy, can be very simply stated: "How do we build a social environment in which marine resources, especially fisheries, can be sustained?" I've found that the answers to that question are anything but simple and are likely to come only through an integration of the social and natural sciences and a thorough understanding of the human environment, i.e., the real people involved. As a result my own work has tended to become strongly interdisciplinary incorporating resource economics, fisheries ecology, anthropology and, lately, political science. An on-going involvement with fishermen and their associations is a deliberate part of this broad research plan.

Here in Maine we have started down the road of working out practical fisheries governance systems. We've started with the lobster fishery which has been divided into seven zones; each zone has a council elected by licensed fishermen from that zone. Each zone has control over rules whose primary impact is at the local level - internalizing costs and benefits in the jargon of economics. At the State-wide level there is a council of councils that has control of rules whose impacts extend beyond a single zone. The point of this governance system is to allow us to address ecological and human events at multiple scales and to do that in a way that builds stewardship incentives in individual fishermen and communities. As we gain experience in the lobster fishery the intention is to extend this system or modifications of it, to the rest of the State's fisheries. Down the road, perhaps not too far, is the adaptation of this approach to other environmental problems such as watershed and coastal zone management.

Appendix 5: Text of Damon Gannon's welcoming address and charge to symposium participants.

Welcome to Bowdoin College and to the Symposium on National Ocean Policy. I am Damon Gannon, director of the Bowdoin Scientific Station and a member of the Biology Department. This Symposium was the idea of Bowdoin College's Coastal Studies Faculty Advisory Committee and is funded by a gift from Bowdoin trustee Geoff Rusack '78 and Alison Wrigley Rusack, and by Maine Sea Grant. I would like to thank the Rusacks and Maine Sea Grant for their generous support of these proceedings. The symposium is co-sponsored by Bowdoin's Coastal Studies Center, the Bowdoin Scientific Station on Kent Island, the McKeen Center for the Common Good, the Environmental Studies Program, and the Departments of Government and Biology.

Roughly 99% of the world's biosphere is in the sea. The U.S. has 95,000 miles of coastline and the largest Exclusive Economic Zone of any country. Millions of American jobs and billions of dollars in annual economic activity depend on the oceans and Great Lakes. In addition to the food we eat, the air we breathe, and the water we drink, they provide energy, mineral resources, transportation, and recreation. And the amazing thing is that by simply being a citizen of this country, you are entitled to ownership of this amazing resource. The bad news is that there are 310,000,000 other co-owners in your partnership, all of whom have different ideas about how the partnership's possessions should be managed. Because of this extremely complex ownership structure, a myriad of laws have been created to manage marine resources, each designed to protect the rights and interests of specific stakeholders. This hodge podge of laws is administered by hundreds of agencies from federal, state, and local governments, often with little coordination. So, not surprisingly, the goals of many ocean governance laws contradict each other.

Two and a half months ago, the federal government released the first National Ocean Policy, which is an attempt to coordinate governance of the oceans and Great Lakes. This is not a new initiative; it is the culmination of decades of research and deliberation. The main goal of the new National Ocean Policy is to ensure *"that the ocean, our coasts, and the Great Lakes are healthy and resilient, safe and productive, and understood and treasured so as to promote the well-being, prosperity, and security of present and future generations."* These goals are worthy because our oceans are precious. Implementation of the new policy is just now getting underway, so the exact nature of the changes to be made is still unclear. The devil is in the details, so to speak.

We are a diverse group representing industry, nonprofit organizations, government, and academia. We mostly come from New England, but several people among have traveled from well beyond New England to enjoy this spectacular Maine weather, including one representative from Australia.

Just by looking at the titles of today's talks, you can see that there are differences of opinion regarding the NOP. But we should not dwell on these differences. Instead, we should recognize that there are points on which most of us agree. There is broad

agreement in this room that the oceans are complex and therefore difficult to manage. I suspect that we all want to have healthy, diverse marine systems that support stable, sustainable industries. And I think that most of us believe that the fragmented structure of ocean policy is inefficient and ill-suited for resolving conflicts. Our challenge is to help the resource managers implement this new policy in the most effective manner possible and to identify the opportunities that this policy creates for the Gulf of Maine. By focusing first and foremost on topics for which there is broad agreement, we can provide useful, constructive guidance to managers immediately.

This forum provides an opportunity to learn more about the details of the National Ocean Policy. Specific objectives of the symposium and panel discussion are to:

- evaluate likely effects of the new policy;
- identify issues related to ocean policy reform on which there is broad agreement among diverse constituencies;
- provide a collegial venue in which various constituencies can build relationships that will allow promote collaboration; and
- synthesize information that can assist the government with efficient implementation of the policy reforms.

Throughout the day, we will focus on two questions that will frame our discussions. The first of these questions is:

How will the NOP affect the Gulf of Maine and the stakeholders who depend on it?

As we progress toward answering this first question, we then want to consider the second:

What recommendations can we make regarding its implementation?

We are very lucky to have a stellar lineup of speakers and panel members. We are going to hear five talks this morning and early afternoon. After each talk, we will have a Q&A period. During the mid-afternoon, we will break up into small groups to discuss specific aspects of the policy. And this discussion will be framed by these two central questions. Late in the afternoon, we will reconvene as one group and the discussion leaders for each breakout group will summarize the main themes of their discussion. The final formal event of the symposium, the panel discussion, will take place at 5:30.

To keep our discussions productive and constructive, we will follow five simple ground rules throughout the day:

1. **Be respectful.** It's OK to disagree. A lot of what we will discuss today is subjective; there is no right or wrong answer, so disagreement is inevitable. Just be respectful. Disagreements are challenges to be solved; not battles to be won.
2. **Be open-minded and empathetic.** Put yourself in the place of members from other stakeholder groups.
3. **Offer creative ideas and reframe contentious issues** to promote constructive dialogue.
4. **Don't dwell on differences among constituencies;** strive to find common ground.
5. **Be actively engaged.** Ask questions of the speakers and panelists and participate in the discussion.

Now that we have laid out the goals, schedule, and ground rules for the day, it is time to introduce our first speaker, Ron Beck. Mr. Beck is the Chief of the First Coast Guard District Energy and Facilities Branch - regional US Coast Guard program manager for energy projects including permitting and operations of liquefied natural gas (LNG) and offshore wind facilities. Mr. Beck is also Co-Chair of the Ocean Energy Planning and Management sub-committee for the Northeast Regional Ocean Council. He graduated from the Coast Guard Academy and holds Masters Degrees in Naval Architecture & Marine Engineering and in Industrial & Operations Engineering. He is a licensed Professional Engineer and holds a 100-Ton Master's License. His assignments in the Coast Guard have included being chief engineer aboard Coast Guard cutters, Assistant Professor at the Coast Guard Academy, and Chief of the Industrial Department at the Coast Guard Yard.

Ron is an avid sailor and has sailed the coast of Maine extensively, so this region holds a special place in his heart. This morning he is going to provide a brief overview of what the National Ocean Policy is and what it is not. Please join me in welcoming Ron Beck.

Appendix 6: Poster Abstracts.

Investigation of nitrate values at the Harpswell Sound buoy: A comparison of methods

Amy M. Anderson, 2012

Bowdoin College Dept. of Earth and Oceanographic Science

Mentor: Collin Roesler

Nutrients provide the basic building blocks for any species to live. Phytoplankton, the single-celled aquatic photosynthesizers, needs phosphate, silicate, and nitrogen compounds to meet their basic needs and function. Thus, the dynamics of phytoplankton growth in the natural environment can be controlled by nutrient availability. Nutrient dynamics are complicated, but by examining the major sources of nitrogen (in the form of nitrate, NO_3 , and nitrite, NO_2), we are exploring the role nutrients play in the occurrences and blooms of *Alexandrium fundyense*, the harmful algal species that causes paralytic shellfish poisoning (PSP) in coastal Maine and is commonly known as red tide. We focused our study in Harpswell Sound, a sentinel site for *A. fundyense* appearance and early closures for PSP toxicity in shellfish. Research completed over the summer aimed to find a way to accurately estimate the concentration of nitrate hourly using instruments deployed on the Harpswell Sound buoy. Specifically, we wanted to measure nitrate using the absorption spectrum. In the laboratory, we developed standard curves relating nitrate concentration to absorption peak height by chemically reconstructing seawater to understand its complexities. This allowed for the in situ determination of natural nutrient concentration at the same scale as phytoplankton and to shed light on the role nutrient dynamics play in phytoplankton. In understanding nutrient dynamics, we can apply this knowledge to occurrences of *A. fundyense*. When the harmful algae are consumed by other organisms, the effects are far felt. As a shellfish ingests the algae, it will store the toxin within its tissues and with increased exposure the higher the concentration of the toxin. The *A. fundyense* toxin progresses to other species as others consume the poisoned shellfish, the toxin transfers and can result in fatality. The toxins in red tide cause the closures of fisheries in many communities. By gaining information into an aspect of this detrimental organism, we have greater insight into its development.

Take Reduction Teams and the Marine Mammal Protection Act (MMPA): Feel Good or Fail Bad(ly)

Regina Asmutis-Silva, Sharon B. Young

Whale and Dolphin Conservation Society, Humane Society of the United States

In 1972, the Marine Mammal Protection Act (MMPA) mandated that commercial fisheries reduce serious injury and mortality of marine mammals to levels that approach a zero rate. But it was not until 1994 that the Act provided a mechanism to reduce incidental bycatch of cetaceans. The 1994 Amendments specified a timetable in which takes should be reduced to sustainable levels developed under a Congressionally

mandated formula and established a stakeholder process to devise a plan to reduce mortality. While the legal mandates of the MMPA are clear, the actual reduction in bycatch is often more time-consuming than intended and require iterations toward success. In many cases, the process has also required the ongoing legal intervention of the conservation community to ensure compliance with mandates. While some of the ten take reduction teams (TRT) convened to address MMPA mandates for various cetacean stocks have met with great success (e.g., the Pacific Offshore Cetacean TRT, which met all timelines and developed a highly successful strategy for reducing bycatch to mandated levels) others have not (e.g., the Atlantic Large Whale TRT, which has missed virtually all legal deadlines, still has not achieved mandated reductions in mortality, and whose measures are subject to repeated litigation). Most of the TRTs have missed legally mandated timelines but plans developed by this multi-stakeholder process have largely met with success in reducing bycatch.

Ecological and Economic Recovery of the Kennebec and Androscoggin Rivers, Estuary, and Nearshore Marine Environment

Andrew Bell, 2011, Benjamin Towne, 2012, Catherine Johnston, 2012, Cory Elowe, 2011, Henry Berghoff, 2011, Holly Jacobson, 2011, Paul Hinman, 2011

Department of Biology, Bowdoin College

Professor John Lichter, Professor Guillermo Herrera

Merrymeeting Bay is a freshwater tidal ecosystem in Midcoast Maine that supports a diverse and complex food web. Historically, migratory waterfowl and anadromous fish thrived in the bay. Human activities led to a collapse of the ecosystem in the second half of the twentieth century. Since then, water quality of the bay was able to rebound much faster than the biotic components of the bay. Improvements are still underway for populations of submerged aquatic vegetation, macroinvertebrates, and fish. Our research this summer focused on surveying populations of the bay and Lower Kennebec to begin to understand the current state of the ecosystem and the implications for human use. Although Merrymeeting Bay may never recover to the ecosystem it once was, advancements can be made through local environmental awareness and involvement and also from a continued investigation of the changes and improvements that occur in the future.

The effects of climate change on the growth and calcification of the green sea urchin, *Strongylocentrotus droebachiensis*

J. Roger Brothers, 2011

Bowdoin College

Mentors: Amy Johnson, Dan Thornhill

Increasing global atmospheric CO₂ and increasing ocean temperatures have complex, and sometimes contrasting, effects on calcification and growth rates of marine calcifiers such

as the sea urchin, *Strongylocentrotus droebachiensis*. For example, higher temperatures increase growth rates of *S. droebachiensis* smaller than 1 cm, but decrease growth rates of larger individuals. Increasing CO₂ decreases food intake in these urchins and also induces the dissociation of CaCO₃, which is needed for skeletal growth. Thus, the growth rate of small *S. droebachiensis* will be increased by higher temperatures, but decreased by higher CO₂; the net effect is difficult to predict. We will grow small sea urchins in combinations of temperature and pH chosen based on moderate and extreme warming scenarios for 2100 predicted by the International Panel on Climate Change. Growth rates will be quantified by weighing urchins at two weeks intervals for two months. Skeletal calcification will be assessed by measuring ashed skeletal weight, the ratio of wet to ashed weight, skeletal density, calcium content and skeletal thickness. These data, in combination with data from Newcomb et al's study on mussels and corals grown simultaneously with these urchins, will give insight into the consequences to marine calcifiers of increasing global CO₂ and ocean temperatures.

Phosphate Source-Sink Dynamics in Androscoggin River Sediments

Andrew Cardamone, 2011

Department of Chemistry, Bowdoin College

Mentor: Professor Dharni Vasudevan

Throughout the twentieth century, pulp and paper mill waste as well as agricultural runoff caused high levels of inorganic phosphate (P_i) input into the Androscoggin River in Central Maine. As the river water becomes cleaner, questions remain over whether the P_i currently bound to the sediment will reenter the water column and adversely affect the river ecosystem. To examine this dynamic, sediment samples were collected at two locations on the Androscoggin River: Gulf Island Pond (GIP) and Merrymeeting Bay (MMB). GIP is an impoundment located immediately downstream from pulp and paper mills while Merrymeeting Bay is a freshwater, tidal ecosystem located at the mouth of the Androscoggin. These sediments were used in sorption experiments conducted as a function of P_i concentrations in river water. Results of the sorption experiments allowed for the extrapolation and comparison of the equilibrium phosphorus concentration (EPC₀). At all sites, experimentally determined EPC₀ was much less than measured aqueous P_i concentrations, suggesting the sediment at both locations will continue to act as a sink (uptake) of P_i into the future. Experiments to understand the sorption mechanisms and sediment characteristics that result in the sediments acting as a sink for P_i are currently in progress.

Watching the Grass Grow: Investigating the Effect of Light Availability on Eelgrass Growth in the Bay of Fundy, New Brunswick, Canada

Shem Dixon, 2011

Bowdoin College

Mentor: Dr. Damon Gannon

Zostera marina, common eelgrass, is an important component of subtidal ecosystems throughout Northeastern coastal and estuarine habitats. Eelgrass beds provide nursery habitat for young fish species, act as sediment traps, and serve as forage for species of waterfowl. Eelgrass is a vascular plant consisting of a rhizome and leaf bundle system where each leaf bundle contains multiple blades with independent growth rates; younger leaves are elongating as older mature blades are being shed. I studied the effect of light availability on *Z. marina* growth by transplanting eelgrass to sets of buckets in the intertidal zone where light availability was manipulated using different mesh types and the presence or absence of algae. Algae present treatments contained an *Ectocarpus* species of brown filamentous algae found extensively in the intertidal and subtidal zones around Kent Island, New Brunswick, Canada. Eelgrass growth was measured with a mark and harvest method whereby plants in each bucket were scarred with a needle and then harvested after a growth period. Algae presence has a negative effect on the elongation of existing blades and algae presence and less available light as manipulated by mesh types has a negative effect on the growth of newly initiated leaves.

Ecosystemic Regime Developments in the Gulf of Maine

John Duff, J.D., LL.M.,* Hannah Dean, J.D.°

UMass Boston, Department of Environmental Earth and Ocean Sciences

Mentor: John Duff

In 1984, the International Court of Justice (ICJ), at the behest of the United States and Canada, delineated a maritime boundary – the Hague Line - between the two nations partitioning the Gulf of Maine. In doing so, the ICJ did what King Solomon would have counseled against, slicing a living system in two. Twenty-five years after the decision, with a wealth of new information about the status, trends, and challenges of the Gulf of Maine ecosystem, a simple question arises: does the Hague Line (along with other jurisdictional boundaries and delineations) facilitate or frustrate ecosystemic regime building? This research effort employs a law/policy analytical framework to examine how, if at all, five boundary lines have played a role in efforts to engage in ecosystem management in the Gulf of Maine: 1) the Hague Line; 2) the Massachusetts state-US Federal boundary line; 3) the Maine state-US Federal boundary line; and 4-5) the New Hampshire state maritime boundary lines with Maine and Massachusetts.

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° Graduate Student, Environmental, Earth and Ocean Sciences Department, University of Massachusetts Boston, 100 Morrissey Blvd., Boston, MA 02125

Nest site selection and burrow switching in Leach's Storm-petrel.

Evan Fricke and Katie Blizzard

Bowdoin Scientific Station

Mentor: Damon Gannon

Leach's Storm-petrels are long-lived pelagic seabirds that nest in burrows on offshore islands in the northern Atlantic and Pacific Oceans. Individuals more frequently occupy preexisting burrows than construct new ones. On the scale of the burrow, certain microhabitat characteristics may provide microclimatic and antipredator benefits. Previous studies of breeding habitat use have examined various habitat correlates of burrow density, but no study has quantified preferences between individual burrows. We quantified preferences between burrows by comparing the physical characteristics of burrows to their rates of occupancy, using a classification and regression tree analysis to build a predictive model of nest site selection. To evaluate this model, we tracked individuals that switched burrows over the study period, comparing characteristics of the burrows that these birds initially inhabited to those they inhabited in 2009. Leach's Storm-petrels preferentially occupied burrows that were drier, longer, and had larger nest chambers. Our analysis of burrow switching supported this predictive model, indicating that individuals that switched burrows "traded up" to preferred burrows that were drier, longer, and had larger nest chambers.

Preserving Maine's Intertidal Habitat

Robin Hadlock Seeley, Ph.D.

Shoals Marine Laboratory, Cornell University, 2010 TogetherGreen Audubon Fellow

Rockweed (*Ascophyllum nodosum*) beds are an essential habitat of rocky intertidal shores. Rockweed provides critical ecological services (food, shelter) to over 100 species and supplies carbon for coastal and marine ecosystems.

Decaying rockweed has been used as fertilizer in Maine since the 1600's. However, the demand for *Ascophyllum* as a raw material has created a global industry requiring cutting of live rockweed which is processed into cosmetics; nutraceuticals; meat shelf-life enhancers; fertilizers; livestock feed additives; and upscale pet foods. The world's largest independent manufacturer of seaweed-based specialty products has recently expanded its cutting operation from the Canadian maritime provinces to Maine.

Rockweed was 96% (11.7 million pounds) of the seaweed landed in Maine in 2008¹. In 2009, Maine passed a law to manage rockweed cutting in Cobscook Bay by

- prohibiting the cutting of rockweed in state, and local conservation areas, and
- capping the annual rockweed biomass removed in each sector of the Bay.

All other areas of the Maine coast lack these protections.

A wise, precautionary approach to rockweed habitat management in Maine requires answers to the following questions before further rockweed cutting is allowed: "are

current and projected levels of rockweed cutting sustainable?", and "does the legal term 'fishing' include cutting rockweed?"

Diversity and Phylogenetics in Marine Siboglinid Worms

William Hatleberg, 2011

Bowdoin College

Mentor: Daniel Thornhill

Siboglinids are a highly specialized group of annelid worms that completely lack a digestive system. Instead, siboglinids rely on symbiotic bacteria that are capable of sequestering chemical energy from the environment, much like a plant can make energy from the sun. We currently recognize four main lineages of siboglinid worms: the frenulates, the vestimentiferans, Osedax, and the moniliferans. The most well known species of siboglinid worms, the vestimentiferans, are large (1-2m long) deep-sea worms found at hydrothermal vent and hydrocarbon seep environments. In contrast, very little is known about the moniliferan, Osedax or frenulate species, even though the frenulates are the most diverse (~140 described species), widespread, and accessible group of siboglinid worms. Previous examination of siboglinid phylogeny revealed a basal polytomy among the major siboglinid lineages; however, the current study suggests two possible evolutionary scenarios for siboglinid evolution: one in which the vestimentiferans species are the ancestral group and one where the frenulates are the most ancient lineage. The newest phylogenies also indicate a complex evolutionary history among the frenulate lineage, suggesting that there is an internal evolutionary structure among frenulate taxa that is not supported by previous methods of morphological identification.

Fine-scale Dynamics of Human Adaptation in Coupled Natural and Social Systems:

Adaptive Agent-Modeling of Fisheries

Anne Hayden^{1,2}, Peter Hayes¹, Caitlin Cleaver¹

¹University of Maine, ²Bowdoin College

Mentors: James Wilson, James Acheson, Teresa Johnson, Robert Steneck, Yong Chen, University of Maine; Clare Bates Congdon, University of Southern Maine

Adaptive agent modeling of interactions among fishermen and between fishermen and the marine environment has been shown to replicate significant aspects of the social behavior that emerges among Maine lobster fishermen as a result of their ongoing interaction with a dynamic and patchy resource¹. The sea urchin fishery in Maine and the cod fisheries of the Northwest Atlantic represent fisheries conducted at very different scales, targeting organisms with very different life histories compared to the Maine lobster fishery. The current study will compare model results for the three fisheries to see if the findings of the lobster modeling effort hold true for a broader range of fisheries. The broad hypothesis driving the study is that the informal social structure that emerges from competitive interactions among fishermen reflects the particular circumstances of

the natural system. In some cases, successful competition requires secretive non-cooperative behavior; in others, cooperation tends to yield better competitive results. These different outcomes have different, and not always obvious, impacts on the feasibility and effectiveness of resource management.

Adaptive agent models are a form of agent-based modeling in which the behavioral rules governing the actions of agents evolve (rather than being specified by the modeler) using computational techniques borrowed from artificial intelligence and machine learning. This methodology makes it possible to model the aggregate behavior that emerges from the strategic interactions of individual agents.

¹Wilson, J., L. Yan, and C. Wilson. 2007. The precursors of governance in the Maine lobster fishery. *Proceedings of the National Academy of Sciences*, vol. 104:39.

Size-Scale Strategies for Understanding Biodiversity in the Gulf of Maine Area

(First presented at the Census of Marine Life Symposium, Royal Society, London, 3-4 October 2010)

Lewis S. Incze¹, Peter Lawton^{2,3}, Sara L. Ellis¹, Peter J. Auster⁴, Anna Metaxas⁵, Ellen Kenchington⁶, Paul V.R. Snelgrove⁷, Nicholas H. Wolff¹, Stephen J. Smith⁶, Michelle E. Greenlaw², Scott Gallager⁸

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⁷ Memorial University, St. John's, NF, Canada, ⁸ Woods Hole Oceanographic Institution

The Gulf of Maine Area (GoMA) covers 228,000 km² and extends from the intertidal to ~3,000 m depth, and from approximately 40° to 44.5° N along the North American Atlantic coast and to 45.8° N in the Bay of Fundy. The region is one of the most studied marine environments in the world, yet in 2000 there existed no systematic assessment of the known biodiversity and no coordinated, system-level framework for identifying gaps in biodiversity knowledge, promoting research, and using the results to help understand and sustain ecological functioning at the regional scale. This poster looks at three examples of work on biodiversity patterns and processes at different levels of detail and spatial scale within this system, and how they can be used. Comparisons include a national marine sanctuary (2,181 km², the smallest scale and greatest over-all detail presented here); a wide “corridor” containing numerous “representative” benthic and pelagic habitats extending from the coast to the continental slope; and a gulf-wide analysis of multiple benthic (infaunal and epifaunal) and demersal fish databases collected over many years.

The smallest scale allows, as much as possible, for an analysis of benthic and pelagic processes and their interactions, including the effects of advection, migrations, natural events, climate change and direct anthropogenic impacts. Additional information is needed for the context of full biodiversity, but the sanctuary presents a good focal point in a heterogeneous section of coastal shelf with considerable historical data and public use and interest. The corridor (named "The Discovery Corridor") promotes the concept of sampling all depth, hydrologic and substrate environments as a requirement for understanding the entire ecosystem. The size of the corridor dictates a nested strategy of selected sites within a geophysically varied but conceptually coherent environmental context. It is not scientifically necessary to confine sampling to sites within the corridor, but this approach affords ample habitats for comparison within and outside the corridor, and has the advantage of providing a readily visualized mission that the public and managers can support as well as a context for communicating results to them. The gulf-wide analysis enables comparison of broad-scale patterns and environmental influences on a taxonomic subset of the other two scales. The three scales and data sets do not intermesh perfectly, yet they represent a wealth of information that contributes to a regionally integrated approach to biodiversity.

Analysis of relationships between seabed species/assemblages in the Gulf of Maine and their physical environment using Random Forests statistical methods

(First presented at the Ocean Sciences Meeting, Portland, OR, February 2010)

Peter Lawton¹, Stephen J. Smith¹, Lewis S Incze², Michelle Greenlaw¹, Nicholas H. Wolff², Jessica Sameoto¹, Roland Pitcher³, Nick Ellis³

1. Dept. Fisheries and Oceans Canada, St. Andrews, NB, Canada, 2. Aquatic Systems Group, University of Southern Maine, Portland, ME, USA, 3. Marine and Atmospheric Research, CSIRO, Cleveland, QLD, Australia.

The distribution and abundance of marine species and assemblages is of fundamental interest to science and of considerable importance to management and conservation. For most marine species, such information is severely lacking, partly due to the great expense and time required for biodiversity surveys. There is increasing interest in the use of more easily obtained/existing data on the physical environment (or satellite data such as chlorophyll) as surrogates for predicting biodiversity patterns. As a contribution to the International Census of Marine Life (CoML), we are analyzing datasets from the Great Barrier Reef system, Australia, the Gulf of Mexico, and the Gulf of Maine areas using Random Forests (a bootstrapped randomized classification/regression tree method). Contributing CoML programs have collated regional broad-scale biological survey datasets comprising site-by-species abundance data from trawls, benthic sleds, and grabs/cores, as well as site-by-physical (or chlorophyll) datasets comprising variables that should be important for influencing marine distributions at mesoscales. In this poster we focus on results emerging from analyses of the Gulf of Maine data. Newly-developed methods collate split points from regression trees and change in deviance information for each species and environmental variable. Results are expressed as cumulative frequency distributions of splits, weighted by deviance, and summed over multiple species within

different levels of aggregation. These distributions represent patterns of biological (change) response along gradients for each environmental variable. The outputs also summarize the potential prediction performance of environmental surrogates and identify the variables that contribute most. Through development of these Random Forest analyses we hope to: (1) summarize the extent to which physical surrogates may explain biological patterns; (2) rank the importance of environmental variables for structuring biological patterns; (3) examine common biological responses to their gradients; and (4) identify critical values for each variable that correspond to 'threshold' changes in biological patterns; where "biological patterns" may be many individual species, multi-species assemblages, and some diversity attributes. These new statistical methods have significant potential to: (1) yield a robust method to compare across surveys using disparate sampling and tools; (2) contribute to understanding of ecological drivers in the marine environment; (3) provide information to facilitate design of future biodiversity sampling programs; and (4) assist in first-order seabed characterization in data poor situations (e.g., for spatial planning, effective ecosystem based management and conservation planning).

Testing the effects of climate change on the calcification and growth of the temperate coral, *Astrangia poculata*, and the blue mussel, *Mytilus edulis*

Laura Newcomb, 2011

Bowdoin College

Mentors: Daniel Thornhill and Amy Johnson

Anthropogenic carbon emissions have led to global atmospheric CO₂ concentrations 80 ppm greater than in the past, resulting in increased global temperatures and decreased ocean pH. For marine calcifying organisms, scientists predict decreased oceanic pH, known as ocean acidification, will slow growth and calcification because increased CO₂ decelerates formation of CaCO₃. However, higher temperatures increase metabolic rate leading to more rapid calcification. In the Gulf of Maine, local calcifiers that may be affected by climate change include the temperate coral, *Astrangia poculata*, and the blue mussel, *Mytilus edulis*. At Bowdoin College's Coastal Studies Center Marine Lab, we are manipulating temperature and pH to replicate two warming scenarios, one extreme and one moderate prediction of climatic conditions in 2100, as estimated by the International Panel on Climate Change 2007 report. Calcification and growth will be measured during the experiment every four weeks through buoyant wet weight and polyp counts for corals and size measurements for mussels. After two months, we will assess density of symbionts and tissue biomass for corals and measure shell thickness, shell density, calcium content, breaking strength and the shell mass to body mass ratio for mussels. The results, along with those of Brothers et al., should illuminate how climate change will affect some marine calcifiers.

A new chain-of-custody: The role of community-supported fisheries in connecting economies, ecosystems, communities, and food systems

Joshua Stoll¹, Brett Trolley²

(1) Community Forestry and Environmental Partnership Fellow, Duke University, and (2) Community Organizer and Policy Advocate, Northwest Atlantic Marine Alliance

Community-supported fisheries (CSFs) have garnered national attention since their humble start in rural, Maine in 2008. Arguably, part of their appeal - to consumers, fishers, and management - is their quadruple bottom-line approach that recognizes that long-term solutions require the integration of economic, ecological, socio-political, and food systems. This poster examines how CSFs are challenging traditional fisheries management by creating new chains-of-custody that recognize the interconnectedness and complexity of these systems. To do this, we draw on case studies from across North America, highlighting examples of success and innovation.

Investigating the relationship between phytoplankton fluorescence and bloom composition in Harpswell Sound

Caitlin J. Stratton '13

Bowdoin College

Mentor: Collin Roesler

Phytoplankton are single-celled aquatic photosynthesizers, which use chlorophyll to convert light into energy. Because chlorophyll cannot absorb green underwater light, phytoplankton produce taxonomically-unique green-absorbing accessory photosynthetic pigments that can. These pigments change the absorption spectra and associated fluorescence response, allowing for taxonomic identification. My project focuses on using the 3X1M, an instrument which measures chlorophyll fluorescence in response to excitation at three wavelengths (435nm, 470nm, 532nm). The goal is to use these observations to identify taxonomic changes in phytoplankton blooms, based upon their pigmentation and fluorescence response difference. The specific application is to identify transitions between the common, harmless diatoms and the potentially Red-Tide-causing dinoflagellates, by looking at changes in their characteristic pigments, fucoxanthin and peridinin, respectively. Chlorophyll derived from 435nm-stimulated fluorescence compared well overall with that determined analytically, although variations due to fluorescence quenching and species composition were observed. By comparing the ratio of chlorophyll fluorescence intensity resulting from excitation at 435nm:470nm measured in Harpswell Sound to those obtained from monoculture calibrations, the ratio value distinguishing diatoms or dinoflagellates was quantified. The relationship between the fluorescence ratio 435nm:470nm and the fucoxanthin:peridinin ratio was statistically significant, confirming the relationship between fluorescence ratios and bloom composition.

Phytoplankton Diversity in the Arabian Sea

Tricia Thibodeau

Dr. Collin Roesler and NASA Ocean Biology and Biogeochemistry

Bowdoin College

Mentor: Collin Roesler

Due to climate change and a shift in monsoon weather patterns over India, the phytoplankton *Noctiluca scintillans* has been overtaking phytoplankton blooms in the Arabian Sea and producing vast low dissolved oxygen zones when it dies that can lead to massive fish kills. Identifying *N. scintillans* distributions and natural abundances will provide a better indication of the environmental conditions that favor this species. One way to assess phytoplankton composition in the ocean is through pigment-based taxonomic differences. These pigment differences can be quantified using multi-excitation chlorophyll fluorescence specifically with the custom made ECO 3X1M sensor. The absence of factory calibrations to the utility requires routine calibrations of each sensor with a standard culture; calibration with multiple species of diverse pigmentation to define species-specific response; a means to quantify a transfer function in order to calculate the species-specific fluorescence response *between* sensors. Fluorescence ratios among the three emitted wavelengths can then be compared and used to assess pigment ratios as a taxonomic tool. By isolating zones of uniform fluorescence ratios at three stations measured in the Arabian Sea, seven phytoplankton populations of different pigmentation have been discovered. These populations will be evaluated for specific pigment analysis and the taxonomic composition identified.

Soft Shell Clam, *Mya arenaria*, burrow depth response to European Green Crab, *Carcinus maeneus*, predators in different sediment types

Elsie Thomson

Bowdoin College

Mentor: Damon Gannon

Soft shell clams, *Mya arenaria*, live burrowed in a wide range of soft sediment types in the intertidal and subtidal zones of the North American Atlantic Coast. The European Green Crab, *Carcinus maenas*, is an invasive species, which feeds on *M. arenaria* in these areas. *M. arenaria* have a soft shell and avoid predation by burrowing deeply in the sediment. Studies have shown *M. arenaria* increase burrow depth on mud flats in the presence of *C. maenas* chemical cues, which effectively minimized predation risk. This study investigated the response of *M. arenaria* to *C. maenas* when burrowed in different sediments. Artificial habitats of mud, sand, and gravel were created in the intertidal around which crabs were placed in cages to expose clams to crab chemical cues. A pre-measured tether glued to each clam was used to determine burrowing depth. Clams exposed to crabs burrowed deeper than control clams in all sediment types. However, only *M. arenaria* in mud burrowed significantly deeper than controls, which may be due to lower burrowing costs and higher predation risk in mud compared to the other

sediments. Further experiments will investigate growth costs of increased burrow depth in the three sediment types.

Diversity, Dispersal, and Abundance of Free-living *Symbiodinium* in the Florida Keys

Lisa Lenoble Walsh, 2011

Bowdoin College

Mentor: Daniel Thornhill

Coral reefs are the most diverse marine ecosystem, and understanding their ecology will play a vital role in protecting them. Reef-building corals form an obligatory symbiosis with the photosynthetic dinoflagellate *Symbiodinium*. These endosymbionts are crucial to the survival of corals, but most corals do not pass them on to offspring, so juveniles must acquire free-living *Symbiodinium*. The relationship between a coral and its symbiont tends to be specific, so the dispersal free-living *Symbiodinium* could theoretically determine the composition of corals on a reef. Gaining a better understanding of symbiont distribution and dispersal from a reef may help predict how corals will respond to the changing climate and how to better protect reefs. To investigate gene flow, Little Grecian Reef in the Florida Keys was sampled for the presence of free-living *Symbiodinium* in the water column and sediment along a transect leading off the reef. Using cultures and specific number of cells, the protocol used in extracting DNA detects *Symbiodinium* with a density as low as 1,000 cells per liter of water.

Appendix 7 (A&B). Abstracts from invited talks (abstracts were only available for two talks).

Appendix 7A

Abstract:
A skeptical view of the NOP
Jim Wilson

We have done a very bad job governing our activities in the ocean. Currently we have a multiplicity of mostly Federal agencies regulating one or another part of human activity in the ocean. There is a potential for growing conflict among users and, with our current system of governance, there is the potential for protracted indecision by regulators. The Executive summary of the NOP notes "Challenges and gaps arise because of the complexity of current governance." It urges "Ecosystem ... and ... adaptive management ... in a coordinated and collaborative approach." The question is "how can the governance of a complex multiscale system be coordinated in a way that yields reasonable public results?" What makes governance (or management) adaptive and responsive is the ability to obtain, understand and use feedback from multiple sources at multiple scales. The outline of the NOP, which is admittedly vague, suggests a system of governance ill-suited to a complex system. The NOP appears to be headed in the direction of single scale, top down governance that will get bogged down in conflicts that are irreconcilable at the scale at which it will operate. I will discuss several examples of governance/management of complex systems; my point is that we have learned in many instances how and how not to govern complexity. Examples will include: Groundfish in the Gulf of Maine, the sea urchin fishery, the lobster fishery, computer programming, everyday terrestrial governance, the governance of international trade, corporate governance and others. The point of the examples is to note that complex systems tend to be self-organized into 'messy' spatial and temporal hierarchies, what Vincent Ostrom calls polycentric systems. Governance that works tends to mirror the organization of these natural systems. NOP does not appear designed to follow this pattern.

Appendix 7B.

Abstract:

Marine Spatial Planning and Commercial Fishing in the Gulf of Maine

Ted Ames

The National Ocean Policy Initiative (NOP) is potentially a great idea. A properly designed approach with spatial management could dramatically reduce the siege of claims and lawsuits brought by competing interests and at the same time, a proposed collaborative approach could prevent further degradation of fragile coastal ecologies and perhaps reverse the decline of fisheries. Today's Gulf of Maine has become very crowded when compared to its earlier usage. The number and variety of issues confronting the Initiative that need resolution is impressive and a more unified approach is needed. However, this raises several questions... Will the political pressure from the several powerful competing interests be so overwhelming of fisheries and the marine environment interests will be neutralized? Can the patchwork management structure and relative independence of different agencies actually work together collaboratively? Is it possible to do marine spatial management without ending up simply parsing out convenient sites for the most persuasive user groups? Will spatial planning component be used to address the ecological issues that increasingly threaten commercial fishing? Or will spatial management continue to fragment and marginalize this remaining small business bastion. Will a list of priorities be designed that preferentially preserves critical marine habitats? And will the goal of fishery habitat preservation be based on today's status quo or target the rebuilding of more robust fisheries? The problems confronting fisheries are far more involved than a simple debate about which fishing grounds will be used for what. My discussion will explore some of the effects marine spatial planning may have on GOM fisheries, how it relates to the current single species management approach and its disconnect from the patchy, multi-scale interactions found in marine ecosystems, and consider possible ways to modify management into a more ecologically sound approach that addresses not only the ecological needs of the fish, but creates motives for fishermen to support efforts to create sustainable fisheries.

Appendix 8 (A-D): Summaries of the discussions that took place during each of the four breakout sessions.

Appendix 7A.

**Symposium on National Ocean Policy
Bowdoin College, Oct 15-16, 2010
Breakout Discussion Group #1**

Participants: John Duff, Damon Gannon, Mary Beth Tooley, Richard Nelson, Carla Guenther, Aaron Dority, Jim Henderson, Paul Joyce, Therea Torrent-Ellis, Lachaye Ervin, Lisa Walsh, Eileen Johnson

1. What should the NOP look like?
 - a. Broad, understandable, measurable goals applicable to local areas
2. Important to identify stakeholders and to tailor process for different stakeholders and agencies to interact and help shape system
 - a. Important to be engaged in the process early on
 - b. In defining process, it is important to consider both the vertical and horizontal dimensions. The vertical process refers to how information is integrated into the broader decisions and the lateral process is integrating information across agencies.
 - c. Enable community and statewide organizations to feed into the policy
 - d. Important to identify all stakeholders. For example, the aquaculture industry needs to be engaged. Example: offshore energy siting process here in Maine.
 - e. Gulf of Maine Council's role – in response to the need to integrate the ecosystem across federal and state boundaries as a way of developing policy and the need to bring information back to decision makers
 - f. National Policy should be broad enough such that local level can construct their involvement.
3. Ecosystem and economic - what do you want the Gulf of Maine (GOM) to be in terms of its ability to deliver a suite of results. When you look out at the ocean – what do you want to see?
 - a. Average person thinks of “offshore” as being a point in the distance – the problem is that the GOM is surrounded by land so offshore is not the same thing. Why are people suddenly interested in dividing up the ocean? For the average person, they can conceive now for the first time of divvying up the ocean and that can be a scary thing.
 - i. Haven't lobstermen been doing this for decades?

- ii. Once lobster zones came in – took traditional lines and then put arbitrary lines in
 - iii. Has always been a blank slate – remapping has given names and identities to areas
 - iv. Do “good fences make good neighbors”? Do we like this idea? Does it represent a fencing in or fencing out? The only history we have is on the land – a few people ended up with a lot of land the land was then further divided, with certain populations losing their rights. Can this be a correlate to small fishermen?
 - v. “Something there is that doesn’t love a wall” (from Robert Frost’s *Mending Wall*): What are the tradeoffs of erecting walls? Do good fences really make good neighbors?
 - vi. Who and what would the walls divide?
 - 1. Uses? Should marine uses be segmented?
 - 2. Fishing, aquaculture, transportation, recreation, energy –
 - vii. What is driving this emerging issue of “walls”: Energy development? Aquaculture? Fisheries management? Biodiversity conservation? Are we getting into a matrix of uses?
 - viii. Every wall has a cost
 - ix. What is the role of mapping? Answer: to help us visualize the bottom and help us to maintain enough of the ecosystem
 - x. “Use the oceans but don’t use them up”
 - xi. What we are trying to do is to define all of the uses – do the walls allow us to do that better and do we want to draw exclusive lines for different uses?
 - xii. Aren’t we doing that already with Marine Protected Areas and Time-Area Closures?
 - xiii. We don’t have the benthic information – some information for parts – we don’t have much information on the GOM. The data we have are not at the appropriate spatial or temporal resolution.
 - xiv. Precautionary principle might dictate that we operate under restraint, but the term is charged
4. Do we need a global ocean policy to address problems of a global scale (e.g., plastics, ocean acidification, climate/oceanographic change)?
5. We cannot develop a federal program without identifying the problems. What are the problems. Major problems:
- a. Loss of biodiversity
 - b. Sustainable fisheries
 - i. Spawning habitat
 - c. Energy and fishing incompatibility.

- d. Ocean acidification
- e. Other issues raised:
 - i. Pew report – failure to bring stakeholders to the table
 - ii. Are Spatial planning and fishing compatible?
 - iii. Habitat restoration
 - 1. Herring
 - 2. Wetlands
 - 3. Nontarget fish species
 - f. We don't know how deep those problems are
- 6. Marine spatial planning, federal policy is needed for fisheries
- 7. What are the remedies? What areas do we focus on?
 - a. Areas that biodiversity has been trampled on – need to stop trampling in order to prevent limiting our options in the future.
 - b. We might define biodiversity in different ways: species composition, benthic habitat structure, organism behavior (e.g., spawning habitat)
- 8. Important to measure progress
- 9. What is the goal of NOP? Answer: “sustainability” (which might include cultural, economic, and/or ecological sustainability).
- 10. Current approaches:
 - a. NMFS – some felt that this is a closure of area –
- 11. Does the NOP actually specifically require marine spatial planning? It is a goal
- 12. Are “silos” a problem? Isn't solving the problem of “silos” the primary goal of the NOP?
- 13. Do some threats to marine systems originate elsewhere? Do we need to send a message back to promulgators
 - a. NOP is fixated on the ocean but a fair number of threats originate outside of the marine system. There is a problem in assuming that these other problems are being addressed.
 - i. Land use & Watershed management (hydrology, eutrophication, nonpoint pollution,)
 - ii.
 - iii. Energy use/Air quality (atmospheric deposition of pollutants, climate change, ocean acidification)
- 14. Need to have metrics. Example might include sea grass bed density, increase in quality and amount of habitat
- 15. The value of marine spatial planning is dependent upon accurate data. Also, in using the term, it seems as though CMSP is often thought of as the goal, when it is actually just a tool that can be used to help us achieve certain policy objectives.
 - a. Don't get caught up on the tools and processes

- b. Collecting information and writing reports does not necessarily accomplish anything
- 16. Important to enable local governing bodies to become involved.
- 17. How much of the breadth should be in the NOP - maybe the National Policy should just identify problems to be solved and allow local entities to solve them in whatever manner makes most sense at that location.
- 18. There are some issues in how we define the regional structure of the NOP – For example should Rhode Island and Connecticut be part of the Northeast or Mid-Atlantic? Challenges of how we define the scale...
- 19. Implementation should be consistent with local and state approaches – and it is important to have these perspectives respected – there needs to be a required stronger voice from the local level.
- 20. Many stakeholders are concerned about the process. They fear that it will consist of a bunch of government bureaucrats communicating with other government bureaucrats. Where are the stakeholders in the process? The definitions of “Bottom-up,” “transparent,” and “inclusive” differ depending on where you are from. What seems like an inclusive process to someone working for the government in Washington, DC may seem completely top-down to someone living in Washington County, Maine.
- 21. Problem
 - a. Loss of biodiversity
 - b. Fishery sustainability
 - c. Energy/fisheries conflict
- 22. Remedies
 - d. Redistricting of areas around biodiversity
 - e. Stem external threats – such as acidification
- 23. Implementation
 - f. Who – NMFS – how effective?
 - g. CO2 –CAP AND TRADE
- 24. Evaluate
 - h. Seagrass coverage, density
 - i. Other Indicator species
 - j. Other approaches? Multivariate approaches?

Appendix 7B.

**Symposium on National Ocean Policy
Bowdoin College, Oct 15-16, 2010
Breakout Discussion Group #2**

Discussion Leaders: DeWitt John & Rick Bourroughs

**Participants: Robin Hadlock Seeley, Elliott Norse, Betsy Nicholson, Sam Turvell,
Mike Dickson, Phoebe Jekielek, Heidi Vierthaler**

Seeley: How do principles actually get implanted?

Norse: Marine spatial management.

Joey: Management zoning questions

Heidi- Keeping the oceans clean, and effects these new energy policies may have on wildlife and water pollution. "Environmental Assessments"

-Before carrying out new plans need to take into account their repercussions

Besty- How to make ideas effective to New Englanders?

Sam- Ocean resource users and management relationships

Phoebe- Stakeholder involvement. Large scale knowledge being able to be passed to small scale communities.

Bringing information to local scale from global scale and vice versa. How to impress the importance of ocean policy on those who don't live on the coast or who are not directly impacted by these policies?

What are the important factors that will determine the effectiveness of the NOP?

- Communication, communication, communication!
- funding
- How can state and federal plans be made specifically regional for maximum benefits
- Effective management planning
- State policies way head of federal agencies on policies, need to move forward together

- Start small

In this region are we able to respond to scale and data in this bottom up approach?

- Yes, we need to combine data from science, fishermen, and social science workers. Get all engaged for optimum planning.
- Need to be able to take regional needs to a national level
- Develop specific data sets and label them high, medium, or low importance in hopes of making data usable in reality. (Extensive data sets also make it possible to receive funding for projects)

One recent project didn't formulate scales and data sets to present ideas for change. They took a backwards approach and sought out state legislators for insight and what racks to take.

Need to take these issues and make them applicable to Maine to get all involved. Good top down communication right now. Corps/projects heads/feds are making information available to local fisherman. These fishermen are eager and willing to take this into account.

Many proposals are made in a rigid hierarchical fashion and built from the top down, but we must ensure the proposal's ideas are communicated all the way down the chain.

If our new projects cause disturbances in the fishing community what can we do to help them and keep them and their communities afloat economically?

- In Australia one project passed an ordinance allowing fishing in certain areas but not others, so as not to completely eliminate the fishing industry. At first, the habitat and/or size of the area allowed to be fished was not sufficient to support the fisheries. So the managers kept changing the allotted area to be fished until it was optimal.
- Fishing is a large part of the economy in coastal ME, so this approach may not work. Each project needs its own specific details, no two areas are the same. But it is important to find what has and has not worked in other regions.

How would you split New England up into zones? (How much use and protection is needed in each area?)

States, coast/inland, north or south of cape. Many ideas, subgeographic units.

- Concerns because one zone can include many different types of geographical landscapes. Can the policies of one zone take into account the needs of each geographic area in the zone. Each policy must be able to do this to make it useful for everyone the lives in the zone.

Amount of federal authority involvement in each project.

- use force from Washington or locals?
- What do feds have to do to encourage strong local input
- are there local structures in place to makes this reality.

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- To make policies effective need both federal information to be made public and local structures in place. Harmony between local and federal input, cannot have local input without federal support and also cannot have federal support without local involvement either.

Insight on Implementation, in general.

-Nine regions, nine different proposals. The region that brings the most to the table will receive immediate funding.

-Each region will be able to set its own guidelines. Take into account each region's culture and needs.

-Enforcement of policies in each zone.

- If a group makes a case that eastern ME should be its own zone, and is economically, socially, and environmentally sound can they take this case to higher power and get this case passed?

-The more energy and innovations from a zone will make their support and funding skyrocket-must be profitable.

-To ensure implementation, a lot of funding must be available for each region to want to follow through. If there is a lot of funding for a profitable project it would be suicide for a zone not to accept the funding and carry out the proposal.

NOT JUST ONE WAY TO DO THIS- not about just drawing maps and looking at figures. Each planning area is unique. Suitability is regional, not national.

Appendix 7C.

**Symposium on National Ocean Policy
Bowdoin College, Oct 15-16, 2010
Breakout Discussion Group #3**

Is the NOP a top-down or bottom-up approach? What are the pros and cons of this approach?

- system doesn't have any bottom-up place to start, we need at least an intermediate system in between where we govern and where people are working now.
- We're going to end up working from both ends, scales will be too large for bottom-up and too small for top-down; we need some top levels to be involved.
- inventory of coastal shelf, gaping hole in midcoast Maine, even lobster fishery isn't accounted for, must have a more comprehensive survey.
- VMLA and regional zone groups for lobster fisherman: opportunity for all the groups to work together to represent the industry.
- But east of ____ harbor, total of 0 ground fishermen, those stocks are still depleted, due to fishing, but won't be noted as due to fishing b/c there is no one there – are we trying to take care of current fisheries or allowing former fisheries to recover? We could have much more fish than we do now.
- Deficiency of the true bottom-up approach, there's no one to advocate for this “on the ground” at the local level because the fishery has already depleted and many have left the industry. Need a middle level management.
- Economic benefit of letting the ecosystems bounce back would be incredible for small fishing communities.
- There is a problem with starting with today as a baseline – works well for the already well regulated lobster fisheries, but not for degraded fisheries like the ground fish industry. How can we create local co-management regimes—similar to that of the lobster fishery--for other fisheries like the groundfish fishery? Do we want to?
- Keep in mind that the concerns are much bigger and broader than just groundfish
- Communities might benefit from advocates that come and talk about the potential for industries
- We're at the tail end of it. There's no group there to do the advocating, so we have to salvage the fishery. Currently, an enormous portion of Maine's coastal economy depends on one species. This is an invitation for ecological disaster. Before we

could switch to ground fish and other species, which relieved the pressure on over-fished species. Now there is nothing left to switch to.

-If wind turbines could bring jobs to the many lobster fishermen and their sternmen, I'd say let's do it. But I don't see any employer that could provide nearly as many jobs as does the ocean.

-There is a dichotomy between current use and historical use – to be fair, probably won't be either. Neither is the answer. We can be looking at the new potential, research

-The NOP looks remarkably top-down. There's an attempt to make it bottom-up, but their idea of bottom-up is at the same level as the Fisheries Management Council. The FMCs haven't worked all that well because they really aren't bottom-up.

-New groups that don't have a structure yet; in the 70s, they wanted to create a coalesced system, never did. Now its not one place, but a complex, spread out system

-Who's got the biggest stick...who's going to be the best at getting what they need out of the system – issues with this “bottom-up” structure

-Getting it to be from the bottom-up will be difficult when it is already set up as pretty top-down.

-Bottom-up structure comes from how people have a principal place to go with issues of agencies running into one another.

-NOP is a response to bottom people asking for a new system, money flowing down from federal level.

-The number of agencies involved is an issue.

– Making it easier to understand how one can make anything happen on/in the ocean (like wind projects); that's what the NOP is a response to. It is not a response to fishers.

-Coordinating the regional action of fed agencies; streamlining isn't to cut things out but make the process easier

-We have NEPA and EIS, etc. These processes already exist on some level, and we don't do well with what we already have. So what is the NOP going to do? Not sure if building more on top of it is going to help. It's just a huge bureaucratic framework.

-Migratory species of fish, ocean traffic, and energy development and distribution are best handled at the federal level. But when you get into local fisheries, which have local subcultures, they are better managed by the states, If you try to put them all into

one category, we'll spend a lot of time in meetings but we'll get nothing accomplished. Have to handle a lot of these things on the state level.

-The consultation processes already exist. Whether they are used or not is another issue. We're not using to its full capacity. Frameworks weren't built to function like that.

-The idea of ecosystem based marine spatial planning is problematic because there is no guidance on how to define ecosystems. The scale could be from the head of a pin to the whole globe. Who decides how to define these ecosystems?

-To break an area into small enough government units, it is not necessary that each area has a separate voice, but to recognize as different, smaller scale governance structures to address peculiarities

-The point of the mapping (CMSP) is to define ecosystems. Scientists draw the maps, objectivity?

-Hoping for participation from the local community...some way to bring in goodwill and good intent, the decision of who to try to bring into these lower levels, haven't been made.

-NOAA has put out funding; NROC should (may be) trying to get to the regional, local levels.

-There is a misconception that public input is the same as public participation. One meeting in the northeast, even in every town, isn't participation, not a "you tell me what you think and I'll tell you what I think about it."

-The NROC approach will look like Canada

-The Coastal and Marine Spatial planning process will end up looking like the FEMA mapping process, using the best science they have. It will be an opportunity for people to say something, but to figure out how to make it right for your area, have to spend a lot of money.

-It would be great if that's how this process could work, if feds could provide the money.

Advice for Federal Government:

-Federal government should provide money to local communities to obtain needed data

-People in Maine should decide what happens to their fisheries and resources

-One of the problems is that they bring scientists from "away" to look at the fisheries. They say it is sustainable, but we have some of the best scientists here already, much

more in tune with what's going on locally, biggest mistake is to not take their advice into account.

-If an Alaskan wanted to strip their land, we want a say in saying no.

-The NOP should provide broad guidelines, but decisions on how to manage resources (within the NOPs guidelines) should be made at the local level.

-The 9 standards set out in the NOP work against one another. It is not clear how we can prioritize these standards.

-Local scientists and industry should come up with sustainable methods, based on knowledge and history. This approach would stand a better chance of success than someone coming in from the outside and looking only at data.

-lobster zones are great for their areas, but we need an intermediate level in between individual lobster zones and the state/regional zone. To give extracted info from, only way to do it is to have it local, could be a committee assigned with responsibilities for that particular section of coast, which is what the feds need to feed into their system

-How does a small section in Maine get heard over Portland, if we have a council that has seats based on sections of coast, sections of fishery units?

-How do you design something where people can come together and come away knowing it will work for themselves

-The geographic scale of it is the big question; have to break it down spatially. Want something in between lobster zones and the Northeast region.

-Authority, if it is set up as an advisory council – the rep from above can listen and not do anything.

-There has to be some sort of mandate. Otherwise they just won't even really try to cooperate in that meeting. Goals must be set before the meetings (before any advisory council is convened), so that individuals on the advisory council are not just acting in their own self interest.

What is the role of science in this process?

-People study where things are, where they already know things are, studies have big gaps because scientists have data gaps

-Acoustic data – whales don't talk all the time, doesn't mean they aren't there

-Whale and migratory fish reproduction, they have specific sites for reproduction, then we go to the next site and wipe out the next group of reproducers

-Fishermen know a great deal about very little – putting that knowledge into scientific data – collaborative research, now we need the gov't structure that will allow that group of people to work together to improve the connectivity -- need all the fishermen to get on facebook

-The Marine Stewardship Council is a relevant model – is there an opportunity here, in terms of things like wind energy, to make “win wins” out of the interagency system? If you create the opportunity for that, the win wins will happen.

-This is a chance for everyone who's interested to get together – we can't think of this stuff, but if there was a forum, the people who are out there every day, they'll get together in the side room before the meeting, find ways to work together

-How realistic is it in a land of homeland security? Restriction zone, no take zones, win wins that aren't about extraction.

-The amount of data that we have already is enormous, but a lot of the data we have aren't organized in a way that would make them useful for management. There is a lot we know that could be packaged differently and communicated better – there's a fair amount out there that is great and interesting and important.

-How science is packaged is important, people hear a lot of, “oh, you don't know, then...”

-Will windmills drive the fish away? Spawning areas for fish? A lot of research to be done.

-How do we get the NROC to fund all of this research?

Appendix 7D.

**Symposium on National Ocean Policy
Bowdoin College, Oct 15-16, 2010
Breakout Discussion Group #4
Discussion Leaders: Dan Thornhill & Amy Johnson**

- **Community Awareness?**
 - Coastal communities currently near the proposed plans seem to know, do others know?
 - The importance of outreach
 - How do you distribute these wind turbines?
 - We seem to be focused on where not to place them
- **Issues of Scale?**
 - What do you do about spatial uses that get out ahead of spatial planning?
 - How do you incorporate scale flexibility into the NOP?
 - From a bottom up approach you can split these 9 regions up into multiple sub-regions.
 - But there are limitations. No one puts limits on the scale that each of these 9 regions encompasses and so it may miss out
 - Should we decentralize the NOP?
 - Questionable—but thoughts are that sub-regions can make these decisions on spatial scale.
 - Taxa by Taxa approach? How would a finer management scale work?
 - Depends, you must in essence act as a “roving bandit”. Ground fisherman must scour the oceans for fish to make a living.
 - Question of boundaries?
 - We must draw new boundary lines. Fisheries are tied to single taxa licenses, which affects their abilities to be flexible with changes in fish communities and still make a living (Problem with the silo system).
 - NOAA- boundary mapping
 - Issue between temporal and spatial scales.
 - Political scales operate on shorter times scale (campaign)
 - While the science and economics are a much longer time commitment and so how do we merge these scales?
 - How do we match up these fields with their differing temporal scales?
 - What happens when these nine regions overlap?
 - Species don't obey these boundaries so how will these groups address this issue?
 - Fix NE and Mid-Atlantic border.
 - Areas of mutual interest- where regions both participate and both govern—just one example of this though

- We still have a lot to learn about the ecological scale at which these species are occupying.
 - Example- Urchins operate at a much finer scale, while tuna operate at a relatively coarse scale.
 - Policy decisions must operate at ecological scales of the species—another case for the species by species management approach.
 - We could look at oceanographic features as possible boundaries, since these often delineate ecological boundaries.
- What about the interface between land-use planning and ocean planning?
 - Coastal Planning? Shouldn't we take land-use planning into consideration given our coastal use?
- So what's the big picture for MAINE?
 - What will NOP do for Maine?
 - Account for local knowledge and expertise.
 - But these require local advocacy!
 - Is it an improvement to the "silo" methodology?
 - Perhaps for some regions/communities – California.
 - If the NOP is going to work it must be organized at a local level! Its related to the level of scale we are interested in.
 - Lobster fishery is a great model for the local management.
- **There seems like there are many issues with this policy, but are there solutions to them?**
 - More research is needed.
 - Cost of communication- how do we improve communication? This is one area of potential further research.

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