M U S C O N G U S B A Y
E C O S Y S T E M C O M P O S I T I O N W O R K S H O P

Waldoboro, Maine

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Nearshore Ecosystem Collaborative Steering Committee

Foundations

The Process

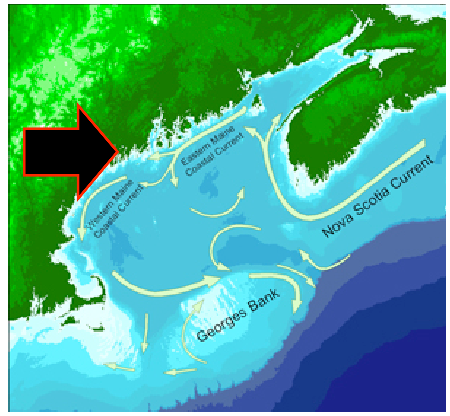
The following is the first step in an iterative process to examine the core variables that have an impact on the ecological function of Muscongus Bay in mid-coast Maine. The point of this initiative is to develop a common framework for examining the processes structuring the Muscongus Bay ecosystem. These results stem from a knowledge-holder workshop undertaken December 5, 2007. The goal of the workshop was to contribute science underpinnings to a conceptual model (e.g. joint vision) of the core variables impacting ecosystem function. For this preliminary workshop we assembled 24 regional experts from both marine and terrestrial backgrounds and a range of private and governmental institutions and organizations (Appendix I). The point of this narrative is to capture the results of the workshop with minimal modification or interpretation. Later discussions will interpret and synthesize the outcome of this and other interactions. The workshop was chaired by Jennifer Atkinson of the Quebec-Labrador Foundation, Charles Curtin of Ecological Policy Design, and Herman Karl of the USGS and MIT who each oversaw different breakout groups engaged in the process.



Examples of key variables identified by all groups were a strong lobster fishery, the southern-most puffin population, and shallow and protected waters that make Muscongus an ideal "small boat bay". These factors have key implications for the ecology and socio-economic processes that structure the bay shaping it past and its future.

For a warm-up exercise the assembled were broken out into three groups and each person was to write down what distinguished Muscongus from other Maine bays. A few of these impressions were discussed within each group. With this preliminary session in mind each group was next asked to sketch out the core features of this bay system as a whole. These features were characterized as either physical, biological, or socio-economic; marked on "post-it" notes; and then placed on a flipchart (one group further separating them into areas of the chart marked land, sea, or mixed). The "collage" that emerged was to tell a story of how the greater bay ecosystem was put together. After this process each group reflected on their results and assembled an overall depiction of how the bay was assembled that was presented to the others. Each group was given 10 to 15 minutes for their presentation (Appendix II).

After lunch each group was given a chance to reflect on what they heard from other groups and to revise their "vision" based on the other participants' input. The groups were asked to consider the similarities and differences they noticed between the three presentations and to revisit their preliminary analysis. This resulted in a second, more refined "model" of the system's composition (Appendix III). In a final synthesis involving all participants, the three models were combined into a single, joint vision of the core pieces that distinguish Muscongus from other bays, or that are crucial pieces for ecosystem function. This distillation process combined the literally dozens of pieces nominated in the preliminary discussion down to a short-list of approximately 20 variables in each of the three core categories, i.e. physical, biological, and socio-economic (Appendix IV). This list was in turn distilled down to a final group of 20 core variables that will help form key components of a model of ecosystem composition (Appendix V).



Outcomes

Key Variables

In looking across the abiotic (physical), biotic (biological), and socio-economic variables there emerged a number cross-cutting themes that can be used as frameworks for developing a unified understanding of ecosystem processes. The most striking of these was the underlying physical, biological, and cultural diversity and integrity that stem from the region being a important transition zone across a hierarchy of different processes.

Perhaps the best way to characterize Muscongus Bay is as a transition zone or crossroads where multiple factors meet and intersect. At the physical level nearshore, several kinds of parent material are present leading to a complex mosaic of different kinds of rock formations. A striking feature is the granitic islands interspersed among a primarily muddy bottom. This has a number of implications for social factors in that the muddy bottom makes for good habitat for clams, while the ledges and rocks make more difficult navigation for larger boats and there are few "gunkholes" that make attractive cruising destinations. This has led to a bay that is more commonly frequented by local fishermen (and more recently sea kayakers) and one that is less popular with yachts. The lack of a long-term interest by yachts has perhaps protected it from extensive shoreline development as has occurred in Bar Harbor or Boothbay.

ABIOTIC	BIOTIC	SOCIO-ECONOMIC
Abiotic Transition Zone (Cold Ocean Current Terminous)	Biotic Transition Zone (Forest Cover change, birds)	Socio-Economic Transition Zone (Interaction between economies)
Shallow and Salty	Globally Significant Lobster Fishery - High Landings of Other Species.	Not a Tourist Destination (Poor Access)
Two Small Watersheds	Anadromous Fish Runs	Lack of Bridges and Dams
More Oceanic then Riverine	Relatively Unfragmented Landscape	No Major Service Centers
Complex Parent Material	Extensive Eelgrass Beds	Strong Local Culture

The bay lies at the intersection of the eastern and western coast currents with cold deep ocean water washed directly into the mouth of the bay at the southern terminus of the Eastern Maine Coastal Current (EMCC). The mixing of ocean currents may contribute to the world's largest settlement of juvenile lobsters (D. Cowan, Lobster Conservancy, pers. com) and may suggest a great potential for high productivity and diversity. The EMCC is an important boundary between eastern and western Maine with marked differences in marine biota between the two zones. The colder, highly oxygenated water of the EMCC is associated with historically high catches of cod and other fish of commercial and ecological importance.

The bay also represents a confluence of northern and southern bird populations with the southern-most population of northern species (e.g. Arctic terns and Atlantic puffins) and the northern-most populations of roseate terns on the East Coast. The islands are also an important stopover point for migratory songbirds. The bay's St. George River is purportedly host to the longest running bald eagle population in Maine.

Also noteworthy are the extensive eelgrass beds that provide habitat for fish and other marine animals as well as the relatively good runs of anadromous fish including herring (*Alosa aestivalis*), rainbow smelt (*Osmerus mordax*), and alewife (*Alosa pseudoharengus*). Muscongus Bay has the only uninterrupted commercial harvest of alewife in Maine. Forage fish like these form a crucial part of the food chain that facilitate energy transfer across different levels of the ecosystem. Some of these species are also favored for use as lobster fishing bait.

It was striking that this group of regional experts selected for their knowledge of biotic resources also focused on social aspects of the bay. In contrast to Boothbay to the south or Camden, Rockland, or Bar Harbor to the north the Muscongus Bay region is largely bypassed as a tourist destination. U.S. Route 1, the major transportation corridor along the coast, runs inland at this point and there are no major service centers in the region. The bay's Medomak River is among the last of the free flowing rivers along the coast of New England. There are few bridges spanning the bay's estuaries and inlets. All these factors mean the region is relatively unfragmented by roads and development compared to surrounding regions and is in many respects much more similar to downeast Maine economically and culturally. It has a fishing and hunting-based culture that is more similar to how the region was historically and it seems to experience slower rates of change than surrounding areas. The area as a whole does not attract large numbers of tourists with few points of access for marine fuel. And while there are numerous coves they tend to be shallow, making poor anchorages in contrast to surrounding regions that have developed extensive tourist economies that cater to yachts and recreation. The presence of "dry" towns (i.e. where liquor sales are prohibited) may also indirectly reduce the opportunity for commercial gathering places, such as bars or restaurants, that are likely to attract visitors.

Synthesis:

In sum, the intrinsic physical and biological richness and cultural integrity make Muscongus Bay stand out among mid-coast bays. Though other bays have received attention due to their currently existing biodiversity, Muscongus has immense biological potential (species number and diversity) due to the rich resources both in existence and possible though restoration. These factors coupled with relatively little fragmentation and shoreline development, as well as a local culture that is distinctive from coastal "tourist" destinations, make Muscongus a potentially important natural laboratory for understanding how to conserve and restore natural and cultural resources.

Standout features that are likely to comprise a model of ecosystem composition include the Eastern Maine Coastal Current as a major driving variable. Biotic features that are significant ecologically, culturally, and economically and therefore likely to serve as core indicators include lobster, anadromous fish, and perhaps eelgrass and marine mammals. Songbirds might serve as an important indicator of landscape fragmentation, while marine birds are indicative of changes in ocean resources. Good water quality is another important (and monitorable) factor that could play a key role in sustaining ecosystem health.

The next steps following this workshop will include: pooling information from biological and social workshops; examining long-term data; looking for gaps in what data is needed versus what is available; and integrating the conceptual models with spatial information generated from the upcoming GIS atlas of Muscongus Bay.

APPENDIX I. PARTICIPANTS

1. Ron Aho, Dept. of Marine Resources
2. Ted Ames, Penobscot East Resource Center
3. Jane Arbuckle, Maine Coast Heritage Trust
4. Deb Chapman, Maine Coast Heritage Trust/Creative Consensus (MBP)
5. Sam Chapman, Waldoboro Shad Hatchery
6. Diane Cowan. The Lobster Conservancy
7. Heather Deese, UMaine School of Marine Sciences (MBP)
8. Betsy Ham, Maine Coast Heritage Trust (MBP)
9. Jean Hewitt, Georges River Tide Water Association
10. Sherman Hoyt, UMaine Cooperative Extension, Knox & Lincoln Counties (MBP)
11. Phil McKean, GRLT/Recr. Fisherman
12. David Mention, Maine Island Trail
13. Linda Mercer, Dept. of Marine Resources
14. Slade Moore, Biological Conservation Services (MBP)
15. Annette Naegel, Georges River Land Trust
16. Liz Petruska, Medomak Valley Land Trust (MBP)
17. Sid Quarrier, Maine Island Trail Association
18. Katie Renwick, Medomak Valley Land Trust
19. Amanda Rudy, Knox-Lincoln Soil & Water Conservation District (MBP)
20. Sue Schubel, National Audubon Project Puffin
21. Marilyn Tenbrink , MIT/USGS Science Impact Collaborative
22. Rick Wahle, Bigelow Laboratory of Ocean Sciences (MBP)
23. Theo Willis, University of Southern Maine
24. Carl Wilson, Dept. of Marine Resources

Appendix II

Group A

BAY

PHYSICAL
Rocky shore
Deeply incised coastline
Mixed of currents
Rocky to muddy
Ford-like

BIOLOGICAL
Lobster density
Seabird colonies
Marine mammals
Plankton

SOCIAL
Former groundfish fishery
Former herring fishery
High Trap Density
Ghost gear
Complexity of marine governance
Ocean traffic patterns

LAND/SEA INTERFACE

PHYSICAL
Snow Melt
Unimpounded rivers
Water quality

BIOLOGICAL
Alewives
Eelgrass
Clam resource
Bald eagles
Macro alge
Nursery habitats

SOCIAL
Yacht building
Recreation
Historic shipbuilding
Working waterfront
Recreational fishing

LAND

PHYSICAL
Two watersheds
Lakes
Erosion

BIOLOGICAL
Freshwater mussels
Moose, deer, etc.
Large blocks habitat

SOCIAL
Quarries and mining
Seasonal-local interactions
Conserved Property
2 Counties
Traffic patterns
Not highly industrialized
Farming
Property values
Local identity
No major service centers.

Group B

BAY

PHYSICAL
Bathymetry
Temperature
Substrate
Water quality
Islands

BIOLOGICAL
Lobster
Feeding seabirds

SOCIAL
Mix of fisheries
Lobster
Working boats
Hunting ethic
Lack of welcome to outsiders

LAND/SEA INTERFACE

PHYSICAL
Weather, storms
Substrate
Water quality
Tides
Complex shorelines

BIOLOGICAL
Forage species
Fisheries
Clams
Feeding/Roosting Shorebirds
Nesting Seabirds

SOCIAL
Bypassed by major roads on coast
Complex history

LAND

PHYSICAL
Sediments
Water quality
Topography

BIOLOGICAL

SOCIAL
Small Scale Structures
New Comers and Preservation of local
culture
Sense of small community
Real estate development
Climbing land values

Group C

BAY

PHYSICAL
Southern most reach of ME coastal current.
Offshore mud
Salty
Shallow
Oceanographic front between coastal and offshore currents.
Enclosed bay

BIOLOGICAL
Productive system – urchins and lobsters, shrimping
Hotspot for larval settlement including
lobsters and urchins

SOCIAL
Not a cruising destination
Valuable fisheries

LAND/SEA INTERFACE

PHYSICAL
Two small watersheds
Diverse/Complex geology

BIOLOGICAL
Anadromous river runs
Mixing northern and southern seabirds
Extensive clam flats
Southern most puffins

SOCIAL
Camp and group use on islands
Last 5-masted schooner
Ecotourism – kayaks
Island development small
Primarily a "working" bay
Direct connection to water and sense of "Nature"
Hunting/rec fishing culture

LAND

PHYSICAL
Small watersheds
No big hills or mtns

BIOLOGIAL
Relatively unfragmented or bisected by major roads

SOCIAL
Dry towns
Few views
No major coastal roads and views of the water
No major service centers

Appendix III

Summary of System Properties (Group Summary)

Abiotic

Drowned river valley.
Complex parent material.
2 small watersheds.
Good water quality.
Muddy and Shallow.
Gradual slope w/relatively few gullies.
More oceanic than riverine.
Not dominated by a large river.
Relatively flat, muddy ocean bottom.
Extensive muddy intertidal, few deep water harbors.
Lack of knowledge about water characteristics (circ, salinity, temp).
Transition of EMCC.
Lack of bold landscape features.
Marine clays, shallow.
Relatively un-impounded river system.

Biotic

Highest concentration of juvenile lobsters and high landings.
Relatively good river herring runs (simplified from past but longest uninterrupted commercial alewife harvest.)
Relatively unfragmented forest/land tracts.
Biotic transition zone (land and sea).
Southern most Arctic terns, Atlantic puffins,
Northern most roseate terns,
Island songbird diversity.
Strongest and longest running bald eagle populations.
Shorebird habitat.
Highest comm'l clam landings.
Eel grass meadows.
St. George – high biodiversity.
Marine mammals.
Relatively "good" cmml. fisheries.

Social/Econ.

No major service centers.
Strong hunting/fishing culture (home rule).
Not a major tourist destination.
Not much marine fuel access.
Recreational industry – kayaking, fishing, hunting.
Fishery dependant community.
Arts sector – creative economy.
Development pressure.
Farming/logging.
Shore/water access – land trust dependent.
Rel. low pop. density

Appendix IV

Core System Properties

Lobster/Clams – Cultural identity, water quality.
Reliance on marine resources.
Less econ/cultural reliance on terrestrial resources.
Shallow-mud, not a great anchorage.
Southernmost boundary EMCC and a basis for high productivity.
Boundary zone for N and S species.
Healthier forage base, but w/o groundfish.
Economic resilience – diversified industries, add value to existing industries.
Eel grass.
Shallow/ledgy.
Fragmented navigation/transportation systems.
Few bridges.
Few dams.