REVISED DRAFT – In consideration of pubic comments through December 31, 2006.

Report to the Joint Standing Committee on Marine Resources of the 123rd Maine Legislature on a Proposed Comprehensive Resource Management Plan for Taunton Bay, Maine

Background and Historical Context

Beginning in 2000, Taunton Bay was closed to bottom dragging. The moratorium, lasting five years, was prompted by the pending replacement of the Route 1 "Singing Bridge" with a higher structure that would allow access to Taunton Bay by a larger size class of commercial mussel draggers. While scallops, urchins and mussels in Taunton Bay had been dragged for decades, the vessels and gear that could access the bay were relatively small in comparison to the more contemporary mussel dragging fleet. By 2000, both the urchin and scallop fishery had been all but depleted (ultimately by a diver fishery) with only mussels remaining in commercially viable quantities. With the potential for more and larger draggers entering the bay, questions were raised about the sustainability of the remaining mussel fishery and the potential effects of larger scale dragging on Taunton Bay's habitats, water quality, wildlife and harvestable resources. Included in the moratorium legislation was a directive to the Department of Marine Resources (DMR) to assess the impacts of mussel dragging in Taunton Bay and report back to the Legislature with findings and recommendations. Ostensibly, those findings and recommendations would aid the Legislature in deciding the future of dragging in Taunton Bay.

In 2005, the DMR submitted its Taunton Bay Assessment to the Legislature (Moore, 2005). In it were three recommendations:

1) Continue the prohibition on use of drags in Taunton Bay, with the possible exception of intensely managed dragging conducted in accordance with a comprehensive plan.
2) Establish a stakeholder-staffed working group charged with developing an area-focused, science-based comprehensive resource management plan.
3) Promote efforts to characterize the short and long-term ecological consequences of dragging and other methods of harvest that result in consistently significant seabed disturbance.

As the Legislature's Marine Resources Committee considered the recommendations of the DMR dragging impacts study and extension of the dragging moratorium, they also considered progress on coastwide bay management legislation passed the previous year. The Bay Management bill required the Land and Water Resources Committee[1], through the DMR and State Planning Office, to evaluate the potential for more regional management of coastal waters. As part of that work, the Friends of Taunton Bay were awarded one of two small competitive grants to conduct the *Taunton Bay Study - a Pilot Project in Collaborative Bay Management.* Since the final report for the *Taunton Bay Study* could potentially make recommendations on dragging, one year after expiration of the original dragging moratorium, the Marine Resources Committee extended the moratorium to allow time for both pilot projects and larger Bay Management Study to complete their work. However, because the Marine Resource Committee was reluctant to close the bay permanently to dragging, the moratorium

[1] This committee consists of Maine's natural resource agency commissioners.

extension included a directive to the DMR to prepare a comprehensive resource management plan for Taunton Bay, due January 12, 2007 (see box), This timetable would allow the Legislature time to consider and potentially adopt resource management legislation before the dragging ban expired in July 2008.

Sec. 2. Report. No later than January 12, 2007, the Department of Marine Resources shall submit to the joint standing committee of the Legislature having jurisdiction over marine resources matters a science-based comprehensive resource management plan for Taunton Bay. The plan must address the principal user groups, including recreational, scientific and commercial mussel harvesting interests, in the context of sustaining the ecological processes, functions and values of Taunton Bay. The plan may include proposed legislation to implement the department's recommendations for resource management in Taunton Bay.

Throughout development of this plan, every attempt has been made ensure that each measure be consistent with the guiding principles of the *Taunton Bay Study*, the LWRC's Bay Management Study, the Maine Coastal Policies Act of 1978 and ecosystem based management.

Resource Management Goals for Taunon Bay

Three municipal, seven state, and six federal agencies have separate and sometimes overlapping jurisdictions, each with its own set of management priorities. The potential for conflicting goals is real and constrains any proposed management plan at its outset. Nevertheless, a clear set of goals and objectives to direct management and provide benchmarks against which performance may be assessed is still possible.

To a large extent, the goal for this Taunton Bay plan was predefined by the enabling Legislation of 2000; "The plan must address the needs of principal user groups, including recreational, scientific and commercial mussel harvesting interests, in the context of sustaining the ecological processes, functions and values of Taunton Bay." As a public trust resource, Taunton Bay's water, subtidal lands, and fisheries and wildlife are held for all the people of Maine, a goal consistent with that of the *Taunton Bay Study* that concluded that the "primary coastal management goal is to sustain those resources for the long-term benefit of all citizens."

The premise of the original legislation was that uncontrolled dragging was incompatible with the overall goal of sustaining ecological processes, functions and values or the resources within Taunton Bay. It is important to note, however, that the Legislature acknowledged that "intensely managed dragging" might be possible if "conducted in accordance with a comprehensive plan, " hence this proposal.

Proposed Goal – The goal of the Taunton Bay Comprehensive Resource Management Plan is to manage human uses of Taunton Bay in a manner that will

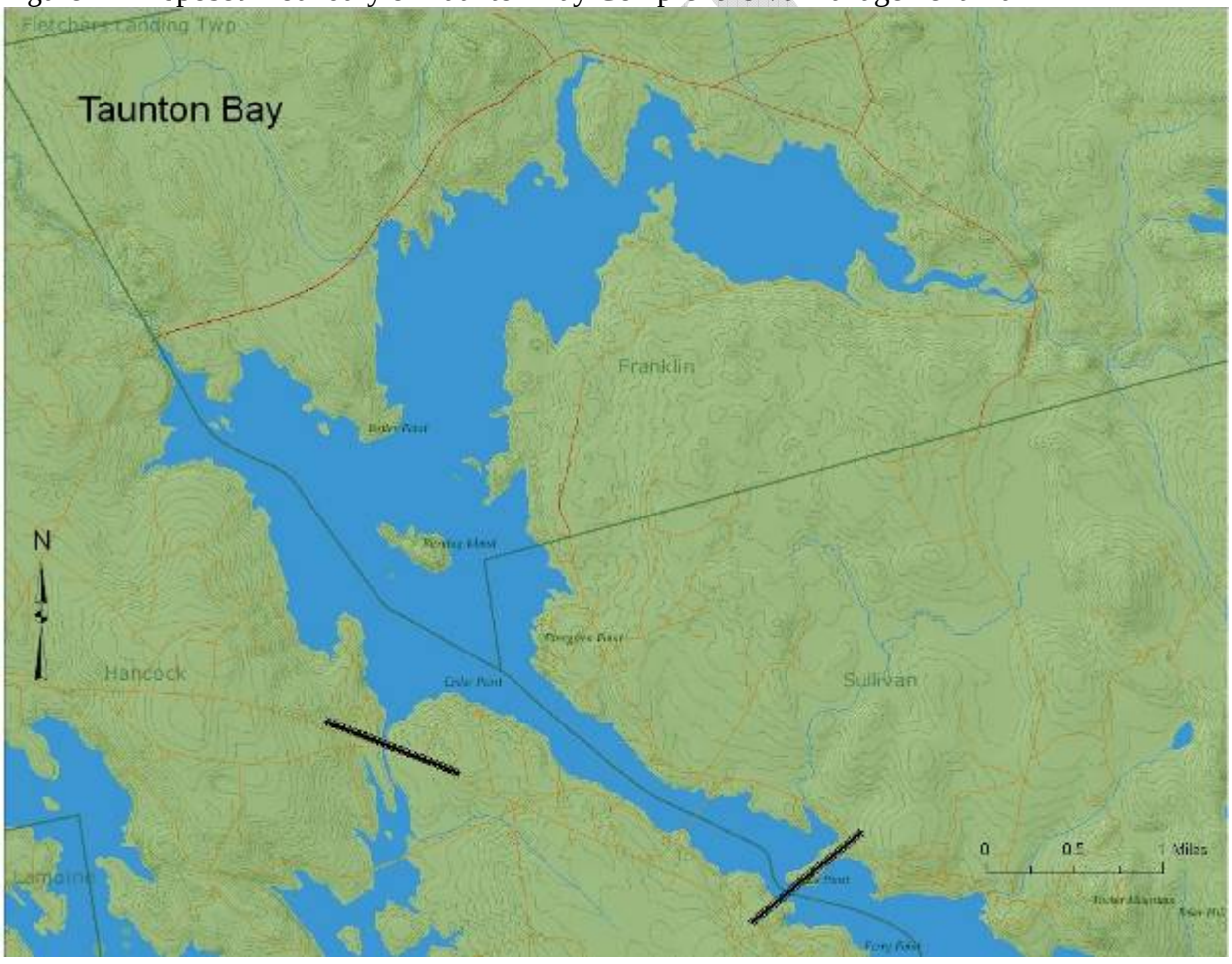
1.) protect and sustain ecological functions and values, and
2.) manage marine resources for the long-term use and enjoyment of all citizens of Maine.

Geographic Boundary

Taunton Bay is a defined geographic feature yet an ecologically open system. Atmospheric contaminants are deposited on Taunton Bay from around the globe, water flows in and out with the tides through Frenchmans Bay which in turn derives from North Atlantic Slope Water via the Eastern Maine Coastal Current. Finfish, mammals and birds enter and exit seasonally affecting biological communities and nutrient budgets. Even many apparently sedentary species of invertebrates, shellfish and plants are immigrants, having drifted into the bay as plankton from areas far from Taunton Bay. In other words, not all Taunton Bay resources are derived within or confined to Taunton Bay.

Several members of the public recommended that the management area include the land watershed and Frenchmans Bay. In some respects, this makes sense. However, we suggest that there are a sufficient number of activities and uses within Taunton Bay that combine with a suffient number of public trust resources within Taunton Bay to, at least initially, focus on the bay. The original dragging moratorium was one such activity and remains a primary concern. Delineating the bay as the management unit does not preclude work outside the bay. However before external factors are addressed, there should first be a finding that work beyond the immediate bounds of the bay will effectively contribute toward achieving the overall management plan's goals and objectives. The boundary for the TBCMP is to include the State owned public trust resources comprised by water, fisheries, and subtidal bottom, fish, plants and wildlife that are inland of Sullivan-Hancock Tidal Falls (Figure 1).

Figure 1 - Proposed Boundary of Taunton Bay Comprehensive Management Plan



Governance

From the many meetings and discussions with individuals living around and working on Taunton Bay, there appears to be unanimous support for more direct local involvement in Taunton Bay's management, some wanting no State involvement whatsoever. Nonetheless, by statute, the State is ultimately responsible for marine resource management of Taunton Bay. And the principles set forth in both the *Taunton Bay Study* and the Bay Management Study principles acknowledge the necessary role of state government.

Upholding State responsibility and fostering more and direct local involvement in public resource management are not mutually exclusive. The State has long supported local involvement and public participation in managing marine resources. Many municipalities, for example, have been given authority to manage their softshelled clam resource and various councils advise the Department and State on resource management. Some, such as the Lobster Zone Councils, Urchin Zone Councils, Scallop Council, and DMR Advisory Council are established in statute. Others, like the Maine Seaweed Council, are informal. Regardless of origin, all actively participate in resource management and decision making and each contributes local knowledge and perspectives on management measures, research needs, and emerging concerns. Recently, the Bay Management Study concluded that direct involvement at the local and regional scale is a sensible path forward to regional resource management.

Proposed Governance

To respect the desire for local involvement at the earliest stages of this project, we propose a temporary steering committee that represents a broad range of perspectives and interests. Our original proposal consisted of eight members to favor what we believed would be more efficient meetings. However the public made a convincing case in favor of broader representation. Therefore, the DMR Commissioner will invite volunteers to represent the interests listed in Table 1. In some cases, a single individual may represent multiple interests.

These volunteers would form the Interim Taunton Bay Resource Management Advisory Group with an trial period of one year. The responsibility of this group would be to refine the goals and objectives of the management plan, develop a workplan timeline, identify priorities for funding, and make recommendations to the DMR Commissioner to improve the plan. First items of business would be for the group to decide how they wish to conduct business, how decisions are to be made, the frequency of meetings, committee structure, and what if any workgroups are needed. We strongly recommend that the interim group strive to work through consensus rather than majority vote. Consensus does not prevent all sides of an issue from being aired nor does it necessarily mean enthusiastic acceptance by all parties. It does, however, mean that, at a minimum, everyone can live with the decision. The benefit of consensus is that it allows minority positions to be more fully discussed past the point when a majority vote has been achieved. We also do not intend to preclude interim members from serving beyond the initial year, if that is the will of the group.

Table 1
Invited Representation to the Interim Taunton Bay Resource Management Advisory Group[2]

1. Municipalities
    a. Franklin
    b. Hancock

[2] *denotes principle user identified in legislation

    c. Sullivan
2. Commercial Harvester*
    a. Mussel harvester
    b. Lobster harvester
    c. Wormer
    d. Clammer
3. Aquaculturist
4. Conservationist
5. Business owner
6. Non-local citizen
7. Science*
8. Recreation*
9. DMR representative

Measurable Management Objectives

Clearly defined objectives and benchmarks help in evaluating progress and success of most plans. Objectives that are measurable (and within the capability, budget and technology of those responsible for measuring them) are more helpful than those that are not measureable. Use of science and local knowledge can assist to identify and set measureable objectives. From the *Taunton Bay Study*, a list of indicators of Taunton Bay's ecological health emerged. A few of these indicators are suitable to form the basis for management objectives. For some objectives, we are ready to propose measures or thresholds that can be monitored. For others, we can at this point only describe general qualities. Over time, however, the appropriateness of these objectives will be learned.

All objectives must be regularly reassessed to ensure they remain appropriate in the context of ecological science. If objectives are not being attained, then one must determine whether management needs to change or whether the objective itself should be reconsidered. The possibility of revising objectives should not be understated, especially in biological systems that we are still trying to understand. In a sense, measureable objectives become testable hypotheses awaiting to be disproved. Even (or especially) if found false, knowledge is advanced. All parts of the Taunton Bay system are in dynamic relationship with one another, each responding to changes in other parts of the system. The achievement of one objective may result in the non-attainment of another. This is especially true with interspecific competition where rises in one population correspond to declines of another (e.g. predator – prey, habitat displacement) and vice versa.

Governance

How the Taunton Bay plan is implemented may be as important as what this plan achieves. Since one of the goals for Taunton Bay is that it be managed for the long term use and enjoyment of all the citizens of Maine, it is important that the measurable objectives benefit from broad representation by harvesters, community members, managers and scientists.

Objectives –

- *Management of Taunton Bay will reflect a diversity of interests and uses as listed in Table 1.*
- *At least twice annually, the Interim Taunton Bay Resource Management Advisory Group will report to the DMR Commissioner on issues, findings and progress on the plan and make recommendations for improvements.*

Protected Marine Wildlife Resources

A number of wildlife species that depend on Taunton Bay are of particular interest. Bald eagles, osprey, harbor seals and at least six species of migratory shorebirds inhabit the bay for part or all of the year. These are designated as Protected Species under State and/or federal law. Although the direct taking of these species is prohibited, indirect effects of changing habitat, toxic contamination and food resource availability have been raised as concerns. With the exception of some shorebirds, the wildlife noted above do not appear to require additional protection in Taunton Bay.

Regarding shorebirds, many of these birds use Taunton Bay as a staging and feeding area for brief periods of time, especially late summer, enroute to South America and beyond. Given that shorebird populations are affected by many factors, most of which are outside Taunton Bay, employing shorebirds as indicators of the health of Taunton Bay is probably inappropriate. Rather, we propose that objectives for the mudflat ecosystem be established to ensure that Taunton Bay contributes to the health of shorebirds.

Disturbance from landside development is now being addressed through changes in the Natural Resource Protection Act. Restrictions on development within 250' of Significant Wildlife Habitat (designated by the Maine Department of Inland Fisheries and Wildlife) are aimed at protecting habitat use, specifically shorebird foraging mudflats.

A second concern around shorebirds is that commercial digging of worms and clams either repels birds from foraging or digging reduces food available to the birds (Shepherd and Boates, 1999). The importance of mudflat organisms to shorebirds, especially amphipods, polychaetes and biofilms (e.g. epibenthic diatoms) is widely known. To address these concerns, we consulted scientists working on shorebirds both in the Bay of Fundy and Maine. They conclude that shorebirds birds are more opportunistic than previously believed. Although, not surprisingly, reduction of organisms within dug areas was significantly reduced, commercial digging did not appear to result in a sufficient reduction of food resources over the larger intertidal area sufficient to raise concerns. Birds seemed to either moved to adjacent flats where digging was absent and they habituated to diggers foraging behind in the overturned mud. Some investigators believe digging enhances food availability by exposing invertebrates.

We conclude that more information, especially on Taunton Bay's mudflats, is needed before recommending specific measures related to shorebirds. Studies to assess shorebird food availability could easily be incorporated into a larger mudflat benthic infauna monitoring plan (proposed below) and clam and worm research projects.

Objectives – Protected Marine Wildlife Resources

- *Conditions in the bay are sufficient to support healthy populations of eagles, osprey, harbor seals and shorebirds.*

Habitat

The *Taunton Bay Study* identified six principle habitats: mud, gravel, salt marsh, eelgrass, kelp and rockweed. The water column is also a habitat but is covered separately under the water quality section. And some habitats actually house other habitats, (e.g. mud and eelgrass), so the distinction is not always clear. Within the intertidal and shallow subtidal, physical disturbance from hand harvest of clams and worms, boat propeller scars, and pipelines are easily noted. The ecological significance of hand harvest is currently being studied (Will Ambrose, personal communication). Impact of physical disturbance is driven by frequency, areal extent, intensity, timing and habitat type. Recovery varies

from days in dynamic habitats that are subject to natural disturbance (e.g. shifting sands) to decades in habitats that are structurally complex (e.g. eelgrass and corals). The severe decline in eelgrass between 2000 and 2002, shortly into the moratorium, raised widespread concern. Was this event a result of a natural or human activity? Has eelgrass absence contributed to resuspension of bottom sediments and decreased water clarity? What has been the effect on Taunton Bay's ability to support fish?

Maine's Natural Resources Protection Act (NRPA) regulates disturbance of soils and vegetation in, on, and adjacent to coastal wetlands such as Taunton Bay. Two activities, aquaculture and commercial fishing, are exempted from NRPA review (together with 24 other exemptions). Both activities are found in Taunton Bay. Aquaculture leases undergo extensive separate and multiple public reviews intended to prevent harm, including an assessment of effects on marine habitat. Commercial fishing, on the other hand, has traditionally received less review.

Historically, impacts from fishing were limited in size, scope and intensity. Fewer fishermen spread over the coast also meant long periods of time between harvests for most systems to recover. As overall habitat degradation from non-harvest activities (e.g. residential and commercial development, recreational boating and fishing) combine with fishery harvest impacts, habitat impacts are cumulatively greater than ever before. Consequently, it is important to reduce and minimize impacts from all activities, including those from fishing.

Some forms of harvest, like worming and clamming, are essentially the same today as they were 100 years ago. Other fishing methods like bottom dragging have benefited from greater horsepower, navigational technology and stronger materials. Not only have previously inaccessible areas been made available to new gear and techniques, but the size and weight of equipment has increased the intensity of fishing impacts.[3] In Taunton Bay, harvest of mussels, clams and worms, all abundant in specific areas of the bay, is, probably the major source of human habitat disturbance within the bay.

The DMR's Taunton Bay Assessment (Moore, 2005), concluded that uncontrolled dragging was incompatible with the long term sustainability of the bay. Controlling bottom dragging, specifically, and physical habitat disturbance in general must be addressed by this plan. Setting quantitative objectives at this point may be considered arbitrary by some, however, a start can move knowledge and management forward. Eelgrass was formerly prevalent in the bay and is a key habitat for a number of species, especially juveniles life stages, one objective is designed to address protection of eelgrass habitat.

Objectives – Habitat

- *Physical disturbance will be managed to promote the acreages in the bay of three eelgrass density classes to within 90% of those mapped in 1996.*
- *Physical disturbance to other rare and sensitive habitats will be managed to simulate that of natural variability.*

Water Quality

Water quality is an obvious driver of ecosystem health. One natural feature, in particular, predisposes Taunton Bay to water quality stress. Taunton Bay's inland distance from the Gulf of Maine results in water returning on incoming tides. Despite the fact that more than half of Taunton Bay's water

[3] Note that some activities, like diver harvests, may have little if any effect on habitats yet can very thoroughly deplete a population.

volume drains twice a day on the tides, this remoteness leads to retention of pollutants. Four water quality concerns emerged from our public meetings; siltation (e.g. turbidity), eutrophication (nutrient overenrichment), sewage, and toxic contamination.

Siltation is a concern for at least two reasons. Suspended in the water column, silts and clays reduce photosynthesis of phytoplankton and submerged macrophytes. When these particles settle, they can clog gills of sedentary animals such as shellfish as well as cover leaves of rockweed, kelp and eelgrass, also reducing photosynthesis and productivity. On a statewide basis, sedimentation of water bodies has declined greatly over the past 15 years due to new laws, enforcement, techniques, technology and education programs targeted at homeowners, contractors, developers, foresters, and road maintenance crews. Taunton Bay is a mudflat dominated ecosystem. Waves, heavy rain, and ice regularly result in naturally high levels of water column sediment turbidity. Bluff erosion, soil disturbance in the watershed, bottom dragging and hand digging of mudflats are observable and measureable in Taunton Bay. However, we do not know the natural variability of sediment in the water column to put human contributions into context. What type, when and under what circumstances do the human sources of sediment suspension become detrimental?

Nutrient enrichment can result in excess growth of plants that in turn can shift eelgrass and rockweed plant communities to plant communities dominated by phytoplankton. Phytoplankton blooms reduce light penetration through the water column to where inadequate light reaches bottom dwelling eelgrass. Overgrowth of diatoms on eelgrass leaves can also reduce light penetration through the leaf surface. If nutrient supply and conditions are right, phytoplankton can grow to nuisance numbers leading to dissolved oxygen depletions. Ratios of nutrients can change to favor one species over another leading to toxic algae blooms. In Maine, atmospheric deposition is a major source of nutrients to coastal water bodies. Based on water clarity and some limited water sampling, conditions in Taunton Bay do not appear to be eutrophic.

Toxic contaminants come from a variety of sources, near and far. Contaminants include pesticides, heavy metals, petroleum by products, pharmaceuticals, personal health care products, and specific industrial compounds. While worldwide, some environmental contaminants such as lead, PCBs, and several pesticides have declined in recent years, others such as flame retardants, appear to be increasing. Two groups of contaminants, heavy metals and pesticides, regularly arise in public discussions. In the 1800s, a number of small silver and copper mines were located around Taunton Bay. Metal mines are known sources of metal to waterbodies. Stratigraphy by Osher et al. (2006) showed evidence of heavy metal deposition to the bay at the time the mines were active. However, concentrations of metals in surficial sediments were below those considered toxic to marine life (Long and Morgan, 199-) and typical of concentrations generally found coastal Maine sediments (USEPA, 200---). The second concern regards toxic contamination from the use of pesticides, especially herbicides, in the watershed and their effect on eelgrass. Trace amounts of hexazinone have been detected in Taunton Bay sediments although their role in the recent eelgrass decline is inconclusive (Laurie Osher, personal communication).

In addition to the nutrients and toxic contaminants in it, sewage threatens water quality by adding human pathogens. This can present a direct risk to humans through water contact (swimming) and consumption of contaminated shellfish. Currently, eight shellfish closures in Taunton Bay prohibit or restrict the taking of shellfish. All of these are closed based actual monitoring data. Testing results are reviewed frequently and may result in the promulgation of new closures or the repeal of existing closures (Robert Goodwin, personal communication).

Objectives – Water Quality

- *Maintain the light penetration depth through the water column to protect historically mapped eelgrass beds*
- *Maintain stable or declining levels of toxic contaminants*
- *Prevent an increase in shellfish closures*
- *Sedimentation from human activities does not negatively affect other ecological or human uses*
- *Attain State of Maine swimming standards*

Harvested Marine Resources

Aside from the obvious benefit as economic resources, living harvestable resources play important ecological roles in Taunton Bay. They recycle nutrients, filter the water column, process and stabilize sediments and are food for wildlife. In some cases marine resources are themselves habitat for other organisms. Arguably their condition may most comprehensively reflect whether the overall goal for Taunton Bay is being attained. Unfortunately, the condition of each stock is based largely on anecdotal reports. Setting measurable objectives for this group requires additional information.

Horseshoe crabs in Maine are in low numbers relative to more southern parts of the eastern seaboard. In 2003, as a result of an apparent decline in numbers observed during the State's annual census, Maine's horseshoe crab fishery was closed statewide during their breeding season. After the closure, populations appear to have at least stabilized and in most cases, including in Taunton Bay, are increasing (Peter Thayer, personal communication).

Mussels are an economically important resource in Maine. As filter feeders in the Taunton Bay system they play a role in maintaining water clarity and their reefs are habitat to numerous organisms and life stages, including juvenile lobsters. Prior to the moratorium, the mussel fishery received light but reportedly sustainable harvests. A study of the mussel beds was attempted in 2005 to estimate the effect of harvest on mussel population age structure. The study was not completed. Since the moratorium, Taunton Bay's mussels are reported to have grown too old, pearled, or weathered to be marketable (Heath Hudson, personal communication). The mussel resource once was locally valuable and if it is properly managed may again support a limited fishery.

Worms and clams support the greatest number of harvesters in Taunton Bay. The Taunton Bay Study (Friends of Taunton Bay, 2006) concluded that these fisheries were also the most economically valuable. As noted earlier, worms are also important forage species for wildlife, especially, shorebirds. Of the three towns bordering Taunton Bay, only Sullivan has a municipal soft-shelled clam program. Some industry members maintain that both resources are adequately managed through self regulation. As abundance drops, the incentive to dig also drops and populations recover. We have seen, however, that high market prices can compensate for low return on effort and result in continuation of digging pressure (Hannah Annis, personal communication). Ambrose et al. (2006) recently reported on blood worm population trends from the Wiscasset Conservation Area where digging has been prohibited since the 1960s. Absent harvest, populations fluctuated between near zero to 13 per square meter lending support to harvesters' claim that populations rise and fall independent of digging pressure. Recently, many worm industry members have been returning culled (short) worms to flats with apparent increased productivity (Donald Bayrd, personal communication). Knowledge of inter-annual variability of commercial worms and clams in Taunton Bay, an evaluation of cull replanting, and other

studies could help identify optimize worm (and clam) management or whether management is needed at all.

Scallop and urchin stocks in Taunton Bay once supported a modest drag harvest. More recently, these fisheries have become diver harvests for a few individuals. With depressed spawning stocks, recruitment is low and natural recovery may take years. Opportunity for restocking and restoring populations exists to increase the overall harvest.

Lobsters, crabs, river herring and seaweeds (kelps and rockweed)
This grouping of species shares in common the perception that these fisheries are now being harvested at sustainable levels. Lack of data on stock trends within and removal rates from Taunton Bay make quantitative assessment impossible. No changes in management are proposed for these resources at this time.

American eel
The elver fishery is regulated through season, limited entry, gear restrictions, and a 2-day closure every week. The coastal pot fishery and inland pot fishery are regulated by gear definitions. The inland weir fishery is under a moratorium and has declined by attrition. One segment of Mill Brook in Franklin has a special regulation that restricts elver fishing to dip net only between May 1 and May 31.

In 2000 the Atlantic States Marine Fisheries Commission (ASFMC), a compact formed by the 15 Atlantic coastal states including Maine, adopted the *Interstate Fisheries Management Plan for American Eel* (Plan). As described in the Plan, the current status of the American eel population is poorly understood due to the scarcity of long-term standardized indices of abundances collected throughout the range of this species. For example, total annual eel harvest from 1950-2005 for the Atlantic coastal states have declined steadily from a peak of about 1792 metric tons in 1979. However, harvest data are poor indicators of abundance because harvest is dependent on demand. Harvest data without corresponding effort data are of little value, and harvest data from individual states did not all reflect the same pattern. In 2005 and again in 2006, the American Eel Stock Assessment Committee of the ASMFC reviewed available fisheries-dependent and fisheries-independent data sets, and concluded that insufficient data prevented the committee from developing reference points or quantifying the stock status. (Gail Wippelhauser, personal communication).

Aquaculture in Taunton Bay is found in both the bay and on its shores. Activity in the bay is restricted to one oyster lease, within which, American oysters are grown in floating trays and on the bottom. To address a concern that aquacultured oysters might reproduce and outcompete local species, a lease condition requires annual monitoring of potential oyster habitat. Two years into the lease, no oysters have been found off the lease site.

On land, the University of Maine and U.S. Department of Agriculture operate a recirculating aquaculture research facility. Species reared include Atlantic salmon, halibut, cod, and marine worms. The facility has a permit to discharge small volumes effluent with controls on the amount of nutrients, solids, and organic matter discharged to the bay. Monthly monitoring of the effluent quality is required.

Objectives

- *Egypt and Hog Bay horseshoe crab populations - to remain stable or increase*

- *Mussels, scallops and urchins - restore populations to a population age structure that supports an annual commercial harvest.*
- *Worms, clams, lobsters, crabs, finfish, and seaweed – support sustainable commercial and recreational harvests*
- *Aquaculture - measurable impacts from aquaculture operations are confined to the lease site or vicinity of discharge.*

Methods to Achieve Objectives

In general, there has been wide spread public support for the above broad goals and narrower objectives of this plan. On the other hand, resolving the actual methods to pragmatically achieve the above objectives has been the challenge. Below is a set of revised proposals to be considered by the Interim Taunton Bay Resource Management Advisory Group for early implementation. One method may address several objectives while one objective may require several methods.

Management of Harvestable Marine Resources

Establishment of Designated Dragging Zones

Bottom disturbance was the impetus for the initial dragging moratorium and ultimately this proposed management plan. Hand harvest for mussels was employed during the dragging moratorium but found to be neither cost effective nor safe (Heath Hudson, personal communication). Other methods, such as diver operated air-lift systems hold promise but are still commercially unproven. Suspended aquaculture avoids bottom major disturbance resulting from harvest but requires sufficient water depth. Until less disruptive methods of harvest are shown to be commercially viable, bottom dragging remains a preferred method of harvest by the industry. On the other hand, progress toward more benign methods will not be made if incentives to do so are lacking.

From the dragging study conducted by the DMR in 2003-2004, we concluded that dragging for mussels might be acceptable if it was controlled to

- protect sensitive habitats and non-target resources and
- allow for sustainable harvest of the target resources.

Mussels are not the only resource harvested by drag. Urchins and scallops are also harvested this way. As a first step to control disturbance due to dragging in Taunton Bay, we propose that areas be designated at the beginning of each year, after ice out, by Taunton Bay Resource Management Advisory Group. Dragging on mud flats not currently supporting eelgrass will be managed to avoid jeopardizing efforts to meet and maintain eelgrass target acreages in a timely manner. To begin, we propose two areas (Figure 2) be designated as dragging areas to allow harvest of mussels, scallops and urchins. No dragging would be allowed outside these areas. These areas were selected to limit disturbance to recovering eelgrass habitat (see Habitat Objectives above) and potential interaction with breeding horseshoe crabs.

1.) Between Rte 1 bridge and Hancock Falls with no seasonal closure. This areas was not including in the original moratorium. Its bottom is coarse owing to the higher current velocities.
2.) Egypt Bay area within lines from Cedar Pt and southernmost tip of Burying Island and the northern most tip Burying Island to Havey Point. To protect breeding horseshoe crabs, this area would have a seasonal closure between May 1 and September 30.This area defines a larger area than necessary for enforcement purposes. West of the central channel that bisecting the area, mussels are scarce and the habitat mud. Eelgrass was present in 1998.

Horseshoe crabs were observed to overwinter in the channel and could be vulnerable to dragging.

While the above areas may limit damage to habitat and non-target resources, it alone does not prevent over harvest and resource depletion within the areas. Tools such as special licenses, total allowable catches, and limited entry are very unpopular with Maine's fishing communities. Nevertheless, some measure is needed to prevent resource depletion, especially considering that this plan will concentrate effort within a small fishable area. In addition to minimizing conflicts with non-harvestable resources and habitats, this should address concerns expressed by wormers, clammers and fixed gear fishermen.

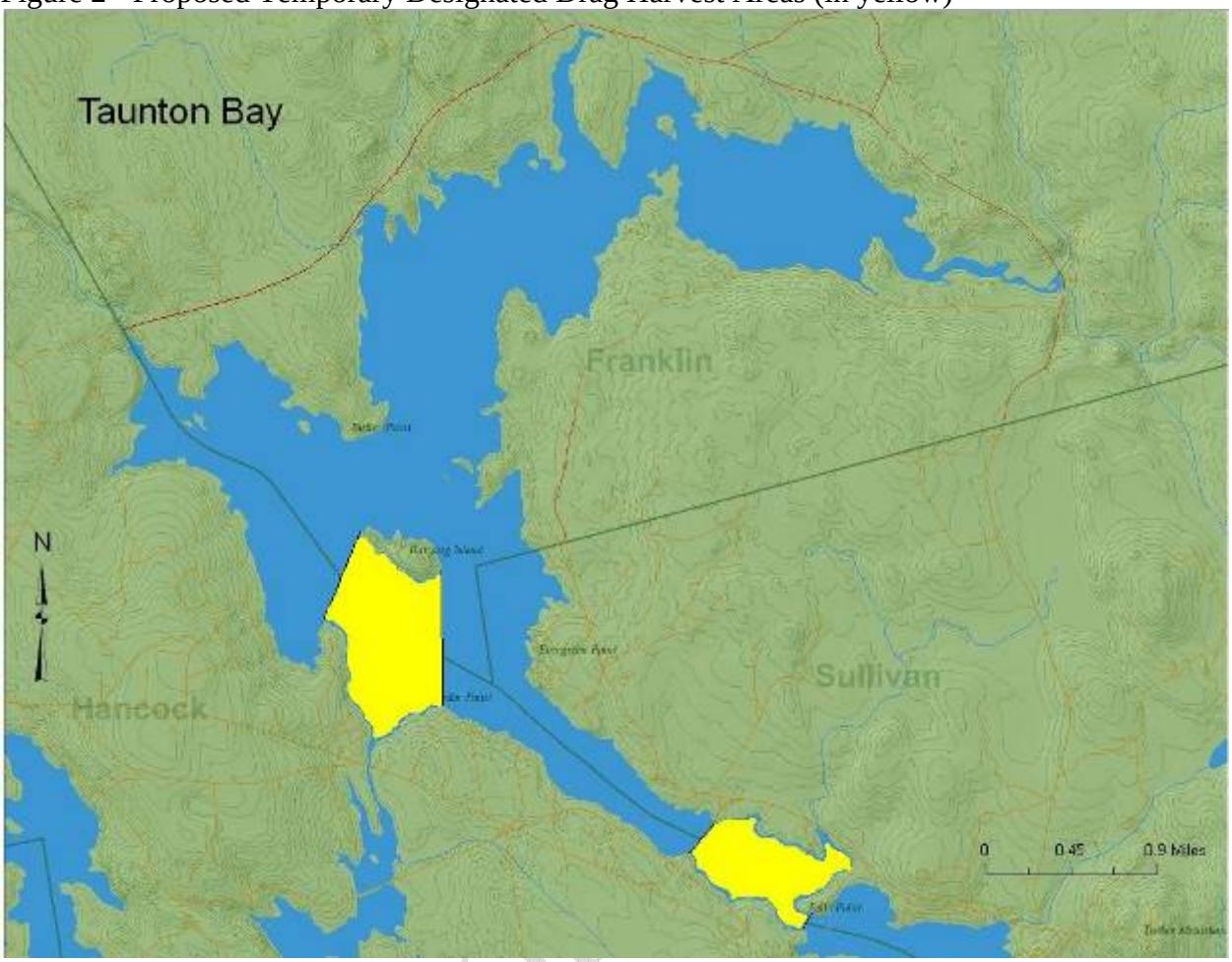
Rather than the State deciding who and how many harvesters may fish in the bay, we propose a requirement that all drag harvesters participate in a monitoring program designed to provide information on harvested resource. Harvesters themselves will decide whether the effort to participate is worth the return in harvested product. Although this alone should reduce harvest pressure, we also propose that a maximum harvest from each of the two areas be established at approximately 75% of the estimated legal biomass present each spring after ice-out. This approach would be tested the first year and evaluated for its practicality and enforceability.

Harvesters using drag gear will be required to, at a minimum

- maintain trip logs recording date, time, gear type and dimensions, effort in distance towed, volume of total catch, volume of catch retained, by-catch of key species. These logs will be submitted to the DMR and considered confidential fisheries statistics.
- collect GPS tracks of each tow and submit to DMR.
- Notification, by telephone, a designee of the Interim or Final Taunton Bay Resource Management Advisory Group prior to fishing in the bay.

The designated areas and harvest control measures would be established by the Commissioner of DMR through technical rulemaking as prescribed in Title 12, Section 6171 following advice and consent of the Marine Resources Advisory Council. In subsequent years, these areas may be adjusted through rulemaking, in consideration of management objectives, sensitive habitats and species, as harvestable product becomes available.

Figure 2 - Proposed Temporary Designated Drag Harvest Areas (in yellow)



Harvester Reporting and Stock Assessment

An earlier draft of this report proposed that all harvesters, not just those engaged in drag fisheries, record catch information and submit it to the DMR. The intent was to fill a void of information on the condition of stocks within the bay. Absent this information, management will almost invariably be less efficient and effective. The public and we question a) whether we have the resources (e.g. data management and analysis) to accomplish this, b) whether this is, in fact, the most accurate method, and c) that harvest information alone is of limited value without knowledge of stocks. We have therefore removed generic harvest reporting from the proposal. However, bay specific harvest reporting may eventually become an important tool to understand stock removal and replenishment rates.

Alternatively, we propose a statistically designed fisheries-independent survey specifically on scallops and urchins. Assessment may be done using a drop video camera as a quadrat sampling or diver video transects. And in lieu of a closure on these species, harvesters of these two species will be required to assist with the stock assessment in exchange for permission to harvest in Taunton Bay.

Assessing Progress - Ecosystem Studies

Mudflat Infauna

Given that mudflats are a dominant component of the Taunton Bay ecosystem, ensuring their health would address several objectives, including those for shorebird feeding, worm and shellfish managment, habitat, and water and sediment quality. Soft sediment infauna communities are routinely used to indicate ecosystem health. Sample collection can easily be done by trained volunteers. But sorting, identifying and enumerating individual animals requires a level of expertise not inexpensively available. Sample processing costs average $200-300 per sample and to characterize the whole of Taunton Bay would require hundreds of samples. Instead, initial work could focus on establishing reference areas thought to reflect unimpaired conditions. Other areas, for example those suspected of being impaired (e.g. by toxic contaminants, discharges, or heavy harvests), would be sampled and evaluated in the context of these reference conditions. This way, both a reference baseline would be established to measure change over time as well and provide context to address concerns by industry and the public over the health of the bay.

1. Benthic infauna community analyses once every three years at designated reference sites and select sites of concern.

Habitat Change

Changes in intertidal and shallow subtidal habitats can be tracked using aerial photography. The State currently collects high resolution color orthophotography of the entire coast that is digitized and available for GIS analyses. The current 10 year interval is inadequate for capturing sudden changes like the eelgrass loss that occurred around 2001. For Taunton Bay alone, we estimate that initial photo acquisition and post processing costs of high resolution orthophotography to exceed $15,000. Recent advances in computer software and digital photography enable near vertical photography to be affordably (<$1,000) collected from light fixed wing aircraft, georeferenced and rectified to quantify mudflat disturbance, changes in mussel reefs, eelgrass, and harvest intensity.

1. Supplement high resolution color orthophotography with less expensive but more frequent (annual) low level aerial color photography.

Water Quality

Protection of water quality is equally important to Taunton Bay's health yet many questions remain, especially as it relates to natural variability. While some studies require expensive analyses and specialized training, much can be done to answer many of the questions through a volunteer water quality monitoring program supported by training and a modest level of technical assistance. The simplest and least expensive test is water transparency requiring only time, a small skiff, and less than $20 of equipment. On the other hand, test for toxic contaminants, especially organic compounds such as pesticides, can cost several $100s. The State may be able to provide some assistance, especially when monitoring in Taunton Bay is done in conjuction with larger statewide or Gulf of Maine initiatives (e.g. Gulfwatch and public health programs), or addresses questions common to other areas of the coast (e.g. role of coastal development on eutrophication). The following is an initial list of water quality monitoring that we believe is affordable and currently supported by other state or regional programs.

1. Establish and support a volunteer water quality monitoring program to collect the following:
    a. Secchi disk water transparency, twice monthly,
    b. chlorophyll-a once, monthly in summer
    c. toxic contaminants in blue mussels, one index site once every 5 years
2. Maintain DMR shellfish sanitation program monitoring at current frequency and sites

Funding

No funds are specifically identified to support this plan. Because the DMR is responsible for managing marine resources for the entire coast, it is important to acknowledge that monetary support from the State will be limited. Nevertheless, forward progress can occur by integrating this plan with ongoing efforts of others. For example, DMR's water quality program for shellfish safety, University graduate theses, and competitive grants. With a well developed and widely supported management plan, the likelihood for support from competitive grants is significantly enhanced.

Stewardship

The principle of stewardship is a theme that runs throughout the coastwide Bay Management Study, the Taunton Bay Study and ecosystem based management. Stewardship presumes that each individual user has a responsibility to manage the resource in a sustainable way. By definition, a steward must actively participate in management. Roles for stewardship exist at every level, from individual, harvester, organization, through the various sectors of government.

Even with full funding, success of this plan will still depend on full participation of stewards. Not only is it impossible for any one individual or organization to carry the burden of stewardship, it is contrary to the principle and spirit of local participation. Each user has a responsibility to contribute something back to Taunton Bay, if even small in gesture.

Much, if not most, of the resource information in Taunton Bay has been collected through the generous donation of time by citizen volunteers. The Friends of Taunton Bay is a prime example of citizen volunteers who have served the bay as well as the people interested in the bay. As we have witnessed many time over, however, a small group of interested individuals commonly carry the bulk of the volunteer burden. It is hardly surprising that these few find they can not maintain their original level of effort alone. For this approach to be sustainable, stewardship must be shared by the many who use the bay. Below are roles and responsibilities for stewards named throughout this plan that could move the plan forward despite lack of identified funding.

Taunton Bay Resource Management Advisory Group

The role of this group is to act as a central coordinator to builds consensus views on the issues related to condition, vision and management of Taunton Bay.

1.) Find common ground among the various users and interests
2.) establish a set procedures by which they will operate (we recommend through consensus as opposed to majority)
3.) clarify and establish clear goals and objectives
4.) organize and convene meetings that represent a broad range of interests,
5.) develop a revised workplan in consultation with others
6.) develop Memorandum of Agreement between the State and municipal governments.
7.) advise the State on findings and make recommendations for improved management
8.) oversee harvester assessments (see Harvester Role below)

State of Maine

The State of Maine will work with the Taunton Bay Resource Management Advisory Group, harvesters, municipalities and the public to encourage and reward local involvement by providing technical support and advice to the extent resources allow.

1.) Commissioner of DMR will identify a staff member to staff the Interim Taunton Bay Resource Management Advisory Group.
2.) provide GIS, science, and policy support to the extent resources allow

3.) develop protocols for harvester stock assessments to the extent resources allow
4.) receive counsel and recommendations from the Taunton Bay Natural Resource Advisory Group, while still maintaining final jurisdiction.

Harvesters

As direct beneficiaries of goods from Taunton Bay, harvesters have a vested interest in the long term health and sustainability of the bay. Harvesters also assume a significant responsibility to ensure the success of the management plan by participating in implementation of the monitoring component of the plan. A number of municipal shellfish programs require a certain number of hours community service that are put toward the resource as a condition of their license. We propose that this be applied to all harvest activities in Taunton Bay, drawing from the following list:

1.) contribute local knowledge of Taunton Bay and associated fisheries
2.) engage in dialogue with the Taunton Bay Resource Management Advisory Group
3.) critique and propose solutions and alternatives to management and assessment
4.) Participate in research and resource assessments

Property Owners, Individuals, Researchers and Non-Government Organizations

This group also benefits directly, whether through increased property values, access to recreation and science opportunities, membership or enjoyment and peace of mind. At the same time, this sector impacts the bay by their mere presence. Whether through sewage, non-point source pollution, or restricting access, property owners, recreational users and organizations affect the long term use and enjoyment of Taunton Bay by others. This group can contribute to the management plan through specific ways:

1. assist in identifying and raising funds to implement the plan
2. engage in dialogue with the Taunton Bay Resource Management Advisory Group
3. work to improve harvesters access to Taunton Bay
4. Participate in volunteer monitoring and research

Municipalities

The three towns surrounding Taunton Bay have a role in helping to ensure that ordinances and their compliance is consistent with the overall goals of the management plan.

1. receive counsel and recommendations from the Taunton Bay Natural Resource Advisory Group
2. work to adopt recommendations of Taunton Bay Resource Management Advisory Group that are consistent with town goals that will lead to the success of the management plan.
3. work with the Taunton Bay Resource Management Advisory Group on the municipal role in shellfish management

Adaptive Management

Existing laws and regulations are adequate to move much of this plan forward. However, they also have the potential to hold it back. The real success of this plan lies in its ability to promptly self–correct. Adaptive management is one of the key principles of ecosystem-based-management. There will invariably be instances where a decision or management action should be implemented, changed or reversed. Even with scientific and public consensus, such changes may not be legally possible. For example, establishing special restrictions within Taunton Bay for species already managed under an overarching state law can only be changed through the Legislative process. This can take upwards of two years, depending on when the changes are first proposed.

Under the Administrative Procedures Act, agencies may, after public hearing, adopt rules and regulations. Some of these are routine and technical in nature and become effective immediately. Others, however, are "major substantive" and have legal effect only after review by the Legislature followed by final adoption by the agency. One law that would be important to review, in the context of furthering adaptive management in general and Taunton Bay's comprehensive plan, is Title 12, Section 6171 Subsection 5). "The commissioner may adopt rules that limit the taking of a marine organism for the purpose of protecting another marine organism. Rules adopted pursuant to this subsection are major substantive rules."

As the plan is implemented and matures and we learn more about the bay, we expect that many of the objectives, and especially the methods to achieve them, will need revision. Regardless of legal constraints, it is important that the governing body and public at large understand and apply the principle of adaptive management.

Special Management and Research Areas

Many of the objectives and methods to achieve them are, at this early stage, based on professional judgment and inference. It is very important, for both the people who use the bay as well as the resources themselves, to understand whether or not these proposals are effective and/or worthy of continuing. It is no one's interest to continue a flawed plan. A prerequisite to adaptive management is ensuring that information is continually being validated and refreshed. One tool to accomplish this is to set aside certain areas of the bay as special science areas. These areas do not necessarily have to be closed to harvest or other activities as long as the studies within them are protected nor must they be large. Indeed, the Wiscasset Conservation Area has provided much useful information in support of the worm industry. These special management areas would be identified based on management and research objectives and needs by the Taunton Bay Resource Management Advisory Group with ample advice of existing users.

The DMR Commissioner could designate, through technical rulemaking, public trust areas for bonafide research that are protected from disturbance only to the extent required by the specific research and for the minimum time and area necessary to conduct the science. The research would have to pass review by a panel (e.g. DMR Advisory Council). All data and results would be available to the public. This action may require Legislative approval as it would likely be considered a major substantive rule.

Recommendation

The dragging moratorium is scheduled to expire July 1, 2008. At least five paths forward are obvious.

1. Allow moratorium expire with no further action.
    a. Pro – no further effort required
    b. Con - does not accomplish goal of the original legislation, the recommendations of the Taunton Bay Assessment
2. Permanently ban dragging in Taunton Bay up river of bridge
    a. Pro – addresses dragging issue as originally framed
    b. Con - does not accomplish goal of the original legislation, the recommendations of the Taunton Bay Assessment
3. Extend moratorium, presumedly to allow time to resolve some as yet to be defined concern
    a. Pro – avoids having to make a decision
    b. Con – prolongs uncertainty for no clear gain

4. Allow moratorium to continue until July 1, 2008 while further refining the resource management plan.
    a. Pro – allows time for a larger group to refine the plan.
    b. Con – delays implementation of the plan postponing a real test for regional governance, stewardship and adaptive management. Few lessons would be learned.
5. Lift moratorium early, conditioned on formation of an Interim Taunton Bay Resource Management Advisory Group, an enforceable dragging plan with harvester participation and the scallop urchin assessment.
    a. Pro – Provides a real test of regional governance, stewardship and adaptive management and reopens area to fishing.
    b. Con – may not have adequate resources to implement.

We recommend Option 5 for the purposes of public discussion.

Rationale
Options 1,2, and 3 fail to deal with the issues and concerns that prompted the moratorium. One and 2 offer no solution and 3 avoids confronting the issue altogether. Option 4 is attractive, however it leaves the plan in an academic phase. Incentives to make it work would be lacking.

Option 5 takes the plan beyond conceptual and begins a trial. As imperfect as it is, it serves as the basis on which to grow. Sufficient information exists to day to safely begin. Nothing proposed here is likely to result in serious or irreversible harm and little additional information can be gained to refine the plan further. With the moratorium lifted, there is an incentive to make the plan work enabling us to learn early what is and is not feasible and begin the process of learning how to sustainably manage Taunton Bay's natural resources.