

Feasibility of mitigating physical disturbances to eelgrass in northern Casco Bay: Impacts and Options

Prepared by

**MER Assessment Corporation
14 Industrial Parkway
Brunswick, Maine 04011
207-798-7935 (V)
207-729-4706 (F)
207-751-3696 (C)
mer@maine.com**

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Executive Summary

This report has been prepared in response to a requirement set forth in the Maine Department of Environmental Protection's permit issued to the Maine Department of Inland Fisheries and Wildlife for construction of an all-tide boat launch facility on Merepoint Neck, Brunswick, Maine that calls for the development of a feasibility guide of mitigation options in northern Casco Bay for physical disturbance impacts to eelgrass, *Zostera marina*, occurring there.

Water quality in northern Casco Bay, which includes the waters of Maquoit Bay, Merepoint Bay, and Middle Bay north of a line drawn from Little Flying Point on the Freeport shore on the west to Wilson Cove on the western shore of Harpswell Neck at the east, is generally very good. The Town of Brunswick, which accounts for the majority of the shoreline and watershed drainage into the bays, enacted an ordinance in 1992 that restricts development in much of the bays' watersheds and is specifically focused on reducing nitrogen discharges to the bays. Water clarity is also generally good and turbidity is normally only elevated as a result of snow-melt or storm runoff events and during coastal storms.

This report, consequently, focuses on the physical disturbances that have occurred, or continue to occur, to eelgrass in northern Casco Bay. Physical disturbances to eelgrass that occur in the region are associated primarily with fishing activity, mushroom anchor-chain boat moorings, propeller scarring by boats traveling through eelgrass beds at or near low water, and structures extending into the subtidal zone.

Moderate altitude aerial photographs of the northern Casco Bay region taken in 1993 and subsequent aerial photos taken in 2001-02 were reviewed to determine general distribution of eelgrass throughout the region over the period. Additionally, a new series of lower altitude aerial photos was produced to allow a more detailed and up-to-date view of physical damages to eelgrass within the northern Casco Bay area. A total of 334 photographs were taken during an early-morning flight on August 30, 2007 during a low draining tide of -0.9 ft. Of these, sixteen images were selected for detailed review and analysis.

The comparison between the 1993 and 2001 aerial photographs of the northern Casco Bay region shows eelgrass distribution in the area to be dynamic over time and eelgrass in the northern Casco Bay region to be currently at or near its maximum areal distribution. Nevertheless, physical disturbances to eelgrass were identified that are caused by fishing and aquaculture activity, boat moorings, propeller scarring, and structures, including private and commercial floats and possibly the stone pier at Simpson Point in Merepoint Bay.

Shellfishing for clams, worm harvesting, and aquaculture disturbances are difficult to distinguish from natural patchiness in the shallow subtidal but may account for disturbances totaling 2,315 ft² (0.05 acres/0.02 hectare); these disturbances are orders of magnitude smaller than those caused by mussel harvesting during the 1990s. A total of 95 visible and measurable mooring scars, averaging approximately 544 ft² each, account for a total of approximately 51,650 ft² (1.19 ac, 0.48 ha) of disturbance. The total area of scarring attributable to propellers is estimated at 7,025 ft² (0.16 ac, 0.07 ha). Private floats account for approximately 870 ft² (0.02 ac/0.01 ha) of direct coverage and increasing this by 50% to account for shading and disturbance around the float increases the disturbance area to just over 1,300 ft² (0.03 ac/0.01 ha). The float system associated with Paul's Marina in Merepoint Bay directly covers an estimated 1,800 ft² (0.08 ac/0.03 ha), but because of the greater amount of activity associated with these commercial floats the estimated area affected by shading and disturbance has been doubled thereby increasing the disturbance area to 3,600 ft² (0.08 ac/0.03 ha).

The present extent and density of eelgrass within the northern Casco Bay area makes identification of “off-site” mitigation opportunities very difficult since nearly all areas suitable for eelgrass growth appear to be occupied to some degree of coverage. Nevertheless, opportunities to mitigate existing and on-going physical disturbances do exist.

The harvesting of blue mussels, although currently not a problem, could result in substantial physical disturbances in the future. The Town of Brunswick has a non-legally-binding, “gentlemen’s agreement” with one of the large mussel harvesting companies in Maine, but the agreement does not currently apply to other mussel harvesters, including those in Casco Bay. An opportunity may therefore exist to expand the existing agreement to include additional, perhaps even all, mussel harvesters along the coast following a process model recently developed by the Maine Department of Marine Resources for Taunton Bay, Franklin, Maine that engages stakeholders in discussions leading to a combined marine habitat conservation/protection and marine resource exploitation plan.

Two measures are available to mitigate or completely correct mooring-related disturbances: 1) mooring removal and relocation, and 2) mooring replacement. Relocation of an existing mooring located within an eelgrass bed to a deeper location beyond the eelgrass band is relatively easy where the eelgrass band is narrow and the distance to the new location from shore is only slightly greater than to the previous location; however, where eelgrass coverage is extensive, relocation of moorings beyond the eelgrass coverage area could result in moorings being relocated several hundreds of yards from their original location thus posing not only a substantial inconvenience to the mooring owner but also exposing the owner to greater risk given the added distance between shore and the mooring.

Replacement of traditional moorings with embedment moorings is feasible in some cases and would reduce physical disturbance to eelgrass by eliminating the sweeping chain of traditional moorings; such have proven effective elsewhere but are relatively uncommon in Casco Bay and some failures have been experienced locally. Concern over reliability and the added cost of installation cause some owners to be reluctant to replace existing, functioning traditional moorings; however, town mooring fee waivers may help defray added costs.

Private and commercial floats are permitted and account for a small amount of disturbance; few options exist to mitigate their associated physical disturbances. Removal of the stone pier at Simpson Point, on the other hand, could result in an estimated 800,000 ft² or 18 acres of eelgrass habitat were the surrounding area to become revegetated with eelgrass following removal.

The stone pier, originally constructed in 1899, is admittedly a man-made structure, but since it has been in place for 100+ years, the intertidal hard substrate provided by the structure constitutes habitat for flora and fauna requiring such substrate and removal of the structure would ultimately result in the substitution of one habitat for another and a decision to move forward with such a project would, therefore, require a habitat-value and substitution judgment to be made.

Removal of the pier is technically feasible; however, the total financial cost of removal, including pre-removal studies, project permitting, physical removal, and follow-up monitoring of effectiveness would be substantial. Additionally, although temporary, there would likely be an environmental cost associated with the disturbance created during the removal process, all of which would need to be considered during project planning.

In view of the limited opportunities to mitigate impacts associated with physical disturbances in northern Casco Bay and the difficulties associated with these, additional consideration might be given to extending measures to protect water quality in the northern Casco Bay region, specifically those focused on restoration of vegetated buffer zones around agricultural lands and expansive lawn areas, and adoption of enhanced stream buffer requirements for new development.

Introduction

The Maine Department of Inland Fisheries and Wildlife (IF&W) received a permit in 2006 from the Maine Department of Environmental Protection (DEP) to construct a full-tide boat launching ramp at a site on the west side of Merepoint Neck, on Merepoint Bay, Brunswick, Maine. Among the requirements set forth in the permit is the development of a feasibility guide of mitigation options in northern Casco Bay for physical disturbance impacts to eelgrass, *Zostera marina*, occurring there.

Impacts to eelgrass can result from a number of causes: 1) excessive nutrient loading leading to algal growth and consequent competition for light and space, 2) increased turbidity resulting in the loss of light, 3) shading, also resulting in reduced light, and 4) physical disturbances causing reduced growth, damage, or complete uprooting and destruction of the plants.

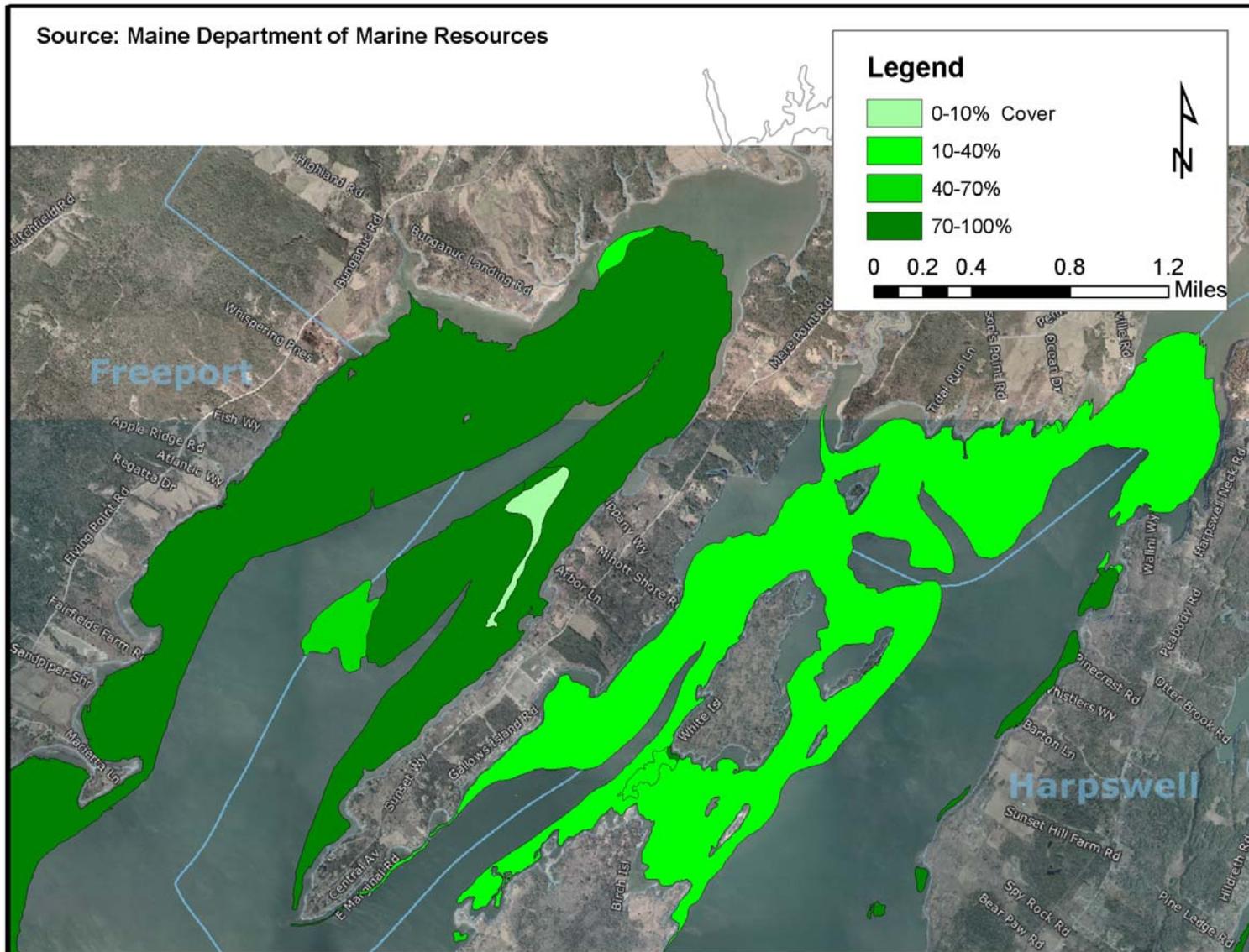
Water quality in northern Casco Bay, which includes the waters of Maquoit Bay, Merepoint Bay, and Middle Bay north of a line drawn from Little Flying Point on the Freeport shore on the west to Wilson Cove on the western shore of Harpswell Neck at the east, is generally very good. There are no major rivers draining into the bays, Bunganuc Brook on the western shore of Maquoit Bay being the largest single source of freshwater entering the bays. Numerous smaller drainages exist along the shores of Maquoit, Merepoint, and Middle Bays, but most run primarily during snow melt and following rain events and turbidity is normally elevated only during these events and coastal storms. Development within the watersheds flowing into the bays is still generally light to moderate with the exception of certain areas of concentrated development, such as along certain sections of Merepoint Neck. Furthermore, the Town of Brunswick, which accounts for the majority of the shoreline and watershed drainage into the bays, enacted an ordinance in 1992 that restricts development in much of the bays' watersheds and is specifically focused on reducing nitrogen discharges to the bays (Brunswick Zoning Ordinance Section 209). The towns of Freeport and Harpswell, which share the remainder of the shoreline of northern Casco Bay, do not have similar nitrogen or nutrient limiting ordinances. Nevertheless, given Brunswick's restrictive ordinance and other constraints on development in both Harpswell and Freeport, water quality in northern Casco Bay should continue to remain good.

In view of the generally good water quality and normal turbidity levels, no impacts associated with these are expected in the foreseeable future. This report, therefore, focuses on the physical disturbances that have occurred to eelgrass in northern Casco Bay. Physical disturbances to eelgrass that occur in the region are associated primarily with fishing activity, mushroom anchor-chain boat moorings, propeller scarring by boats traveling through eelgrass beds at or near low water, and structures extending into the subtidal zone. The report outlines the methods used to initially determine and document the current extent of physical disturbances in northern Casco Bay by type and discusses options available to mitigate the impacts related to these disturbances as well as the feasibility of their implementation.

Current distribution of eelgrass in northern Casco Bay

Eelgrass in northern Casco Bay covers much of the lower intertidal and shallow subtidal areas to a depth of approximately 3 m (Neckles et al, 2005); eelgrass distribution in northern Casco Bay has fluctuated over the years. Working in Maquoit Bay, Neckles et al. (2005) calculated annual coverage increases and decreases of 27.5 hectare (ha) and 4.4 ha, respectively, for the period 1993 to 2000 (net annual increase of 23.1 ha), and 37.2 and 2.6, respectively, for the period 2000-2001 (net annual increase of 34.6 ha). They also estimated the area of eelgrass cover in Maquoit Bay as of 2001 at 570.1 ha (1,408.7 ac). No similar estimate has been made of the eelgrass cover in Merepoint and upper Middle Bay, but similar expansion of the eelgrass coverage in these areas has occurred and appears to be at least half the area covered in Maquoit Bay, as shown in Figure 1; if so, eelgrass cover within northern Casco Bay would be approximately 805 ha (1,990 ac). According to Seth Barker of the Maine Department of Marine Resources (DMR) GIS and habitat mapping office, eelgrass in the northern Casco Bay region is at or near its maximum areal distribution.

Figure 1 Distribution of eelgrass in northern Casco Bay based on interpretation of 2001-02 aerial photographs (Seth Barker, Maine DMR).



Identification of physical disturbance causes and estimation of area

Determination of feasibility of mitigation is linked to the extent of impact for which mitigation is being sought, therefore, an estimate of the extent to which eelgrass has been impacted in the area was necessary. To adequately examine the entire area of northern Casco Bay we relied on analysis of aerial photographs of the area.

Aerial photographs of the northern Casco Bay region taken in 1993 and available at the Maine DMR website at <http://www.maine.gov/dmr/aerialphotos/preview/zone2/zone2.html> and subsequent aerial photos taken in 2001-02, provided by Seth Barker of DMR, were reviewed to determine general distribution of eelgrass throughout the region over the period. Although very helpful in clearly showing overall distribution, the altitude of 6,000 ft at which these aerial photos were taken and the resulting large area covered by individual photographs preclude their use in identifying individual physical disturbances, most of which are small and not discernable at the original 9" by 9" photo scale of 1:12,000.

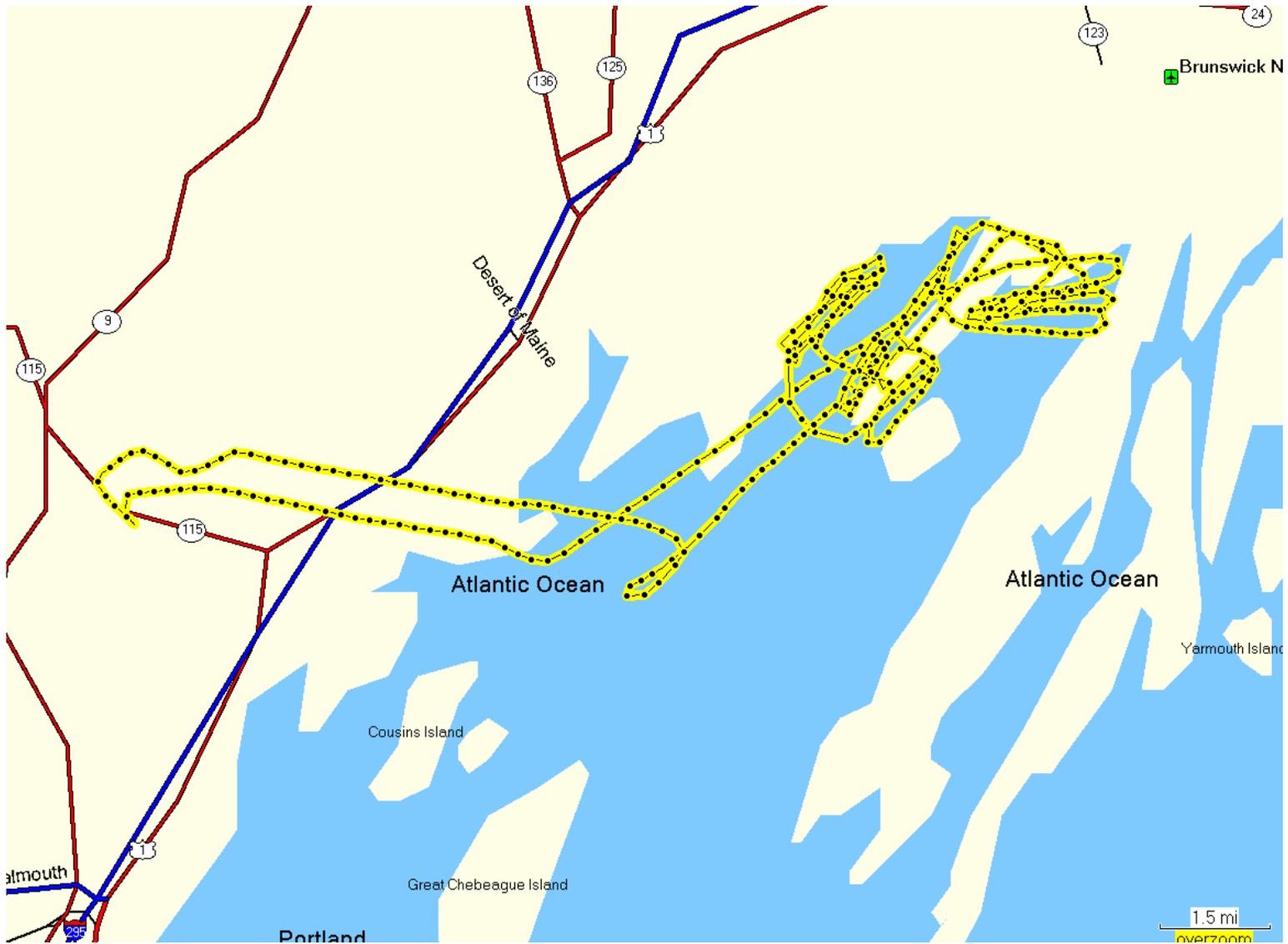
An effort was therefore undertaken to produce a new series of lower altitude aerial photos that would allow a more detailed and up-to-date view of physical damages to eelgrass. To accomplish this, vertical aerial photographs were taken from an Aeronca 7AC aircraft in level flight attitude between 06:20 to 06:50 on August 30, 2007. On that date, a -0.9 ft. low tide at Flying Point, Freeport was predicted to occur at 06:48. A Nikon D70 35mm digital camera equipped with a Nikon 18-55mm f/3.5 - 5.6G lens was strut mounted and controlled through a USB 2.0 cable attached to an IBM T43 ThinkPad using Nikon Camera Control Pro software. Focus was fixed with tape at infinity. Focal length was set at 35 mm resulting in an equivalent focal length of 53 mm for minimal distortion. Aperture speed was 1/200th second with aperture varying depending on light, typically f 5.6. Altitude flown was 2,600 ft. MSL +/- 100 ft. Airspeed was held at 75 mph with groundspeed varying between 65 and 85 mph with a 10 mph tail/headwind. Position and altitude for photography was independently tracked at 10 second intervals using a handheld Garmin GPS 60; flight path is shown in Figure 2. Additional flights to increase aerial photo coverage were planned, but were constrained by the need to coordinate tide height with time of day for proper light (early morning), weather, water clarity, and access to restricted air space around the Brunswick Naval Air Station approach.

A total of 334 photographs were taken during the August 30, 2007 flight; many of the photos were duplicates resulting from several passes over the same area. The aerial photographs are submitted on two CDs accompanying this report and a list is provided in Appendix I. All photographs were submitted to MER Assessment Corporation (MER) unprocessed in JPEG format. All photos were initially reviewed "on-screen" and a selection made of the best contiguous photos representing areas along the shoreline where impacts to eelgrass could be discerned. Sixteen (16) images were selected for detailed review and analysis and printed as 8" by 10" color prints (yielding an approximate scale of 1:2,000); these are attached as Appendix II. Each image is identified by a number corresponding to the original numerical sequence used during flight.

Image clarity over shallower areas is very good and allows clear view of physical disturbances to eelgrass; however, water clarity over deeper areas is obscured by what appears to be a phytoplankton bloom affecting much of the northern Casco Bay area at the time of the flight.

Identification of physical disturbances was done through careful review of images using both printed copies and on-screen imagery allowing the reviewer to zoom in and out on the image. Each of the selected 16 images was imported into Corel Draw[®] to allow delineation and enumeration of each disturbance; delineation of irregularly shaped areas was approximated by using common shape, *i.e.* circles, ovals, and squares. Estimation of area of each disturbance was made by creating a scale based on known measured distances, *e.g.* floats of known width (8 ft), applying the scale to measure diameter or length and width of the common shaped delineations, and calculating the delineated area to within ± 50 ft².

Figure 2 Flight path of August 30, 2007 aerial photography.



Analysis results

Natural change over time

The comparison between the 1993 and 2001 aerial photographs of the northern Casco Bay region shows the dynamic nature of eelgrass distribution in the area over time. The increase in extent and density of eelgrass over this period in Maquoit Bay has been previously reported by Neckles et al. (2005). In upper Maquoit Bay, shown in Figure 3(a) 1993 and 3(b) 2001, eelgrass is seen having extended around the area of Bunganuc Rock (indicated by the arrow and “1” in Figure 3(b)), across much of the area along the western Bunganuc Bluffs shore (indicated by the arrow and “2” in Figure 3(b)), and along the eastern shore north just above the small projection of land (indicated by the arrow and “3” in Figure 3(b)); the mussel dragging scars caused by mussel dragging in June 1999 and studied by Neckles et al. (2005) are indicated by the arrow and “4”.

Similar changes in eelgrass distribution in Merepoint Bay, primarily in the upper section, are shown in Figure 4(a) 1993 and (b) 2001. In 2001 eelgrass had extended into most of Smith Cove (indicated by the arrow and “1” in Figure 4(b)), and had covered much of the area between Merepoint Neck and Whites Island, (indicated by the arrow and “2” in Figure 4(b)), an area having only sparse cover in 1993. Similarly, the area between the north end of Birch Island and south end of Whites Island, nearly devoid of eelgrass in 1993, showed a substantial increase in eelgrass cover in 2001, (indicated by the arrow and “3” in Figure 4(b)). Finally, the area between Whites and Scrag Islands, (indicated by the arrow and “4” in Figure 4(b)), extending north of Crow Island and beyond into Miller Cove, (not shown in Figure 4(a)), areas nearly devoid of eelgrass in 1993, also showed substantial increase in eelgrass cover in 2001. The aerial photos taken in 2007 indicate that eelgrass continues to persist in the areas occupied in 2001, at least within the areas covered by the aerial transects.

Physical disturbance to eelgrass

Based on the detailed review of the selected aerial photos, the identified physical disturbances or scarring fall into four cause categories: 1) fishing activity, 2) boat mooring, 3) propellers, and 4) structures. Estimated areas of disturbance related to these causes were determined through review and interpretation of the 2007 aerial photos. It should be noted that the delineation of these areas is based on the estimated shape and dimension of disturbance as discernable from the photos. Although every effort has been made to accurately delineate the areas, in many cases the actual boundary of disturbed area is not clear; to more accurately determine the area of disturbance the scar would need to be measured on-site by boat or by diver. Where irregular shapes are encountered the estimated area is based on an estimated average width and length.

Eelgrass coverage within the disturbance area also cannot be estimated solely from the aerial photos, but would need to be determined through direct on-site observation and, as with dimension verification, measured on-site by boat, if sufficiently shallow, or by diver. For the purposes of this report, the estimated areas of disturbance assume 100% loss within the delineated area, thus representing a worst-case estimate. Finally, despite the low draining tide of -0.9 ft on August 30, 2007, the presence of the phytoplankton bloom across the area limited the depth of view and consequently examination of the lower subtidal end of the eelgrass beds; it is therefore possible that additional disturbances exist within the area that remain undetected from the photos. However, most of the disturbances identified through this analysis are located well within the viewable depth range, thus the number of disturbances going undetected would be expected to be small.

Figure 3 Aerial photos of upper portion of Maquoit Bay taken in 1993 (a) and 2001 (b) showing extent of expansion of eelgrass over the period

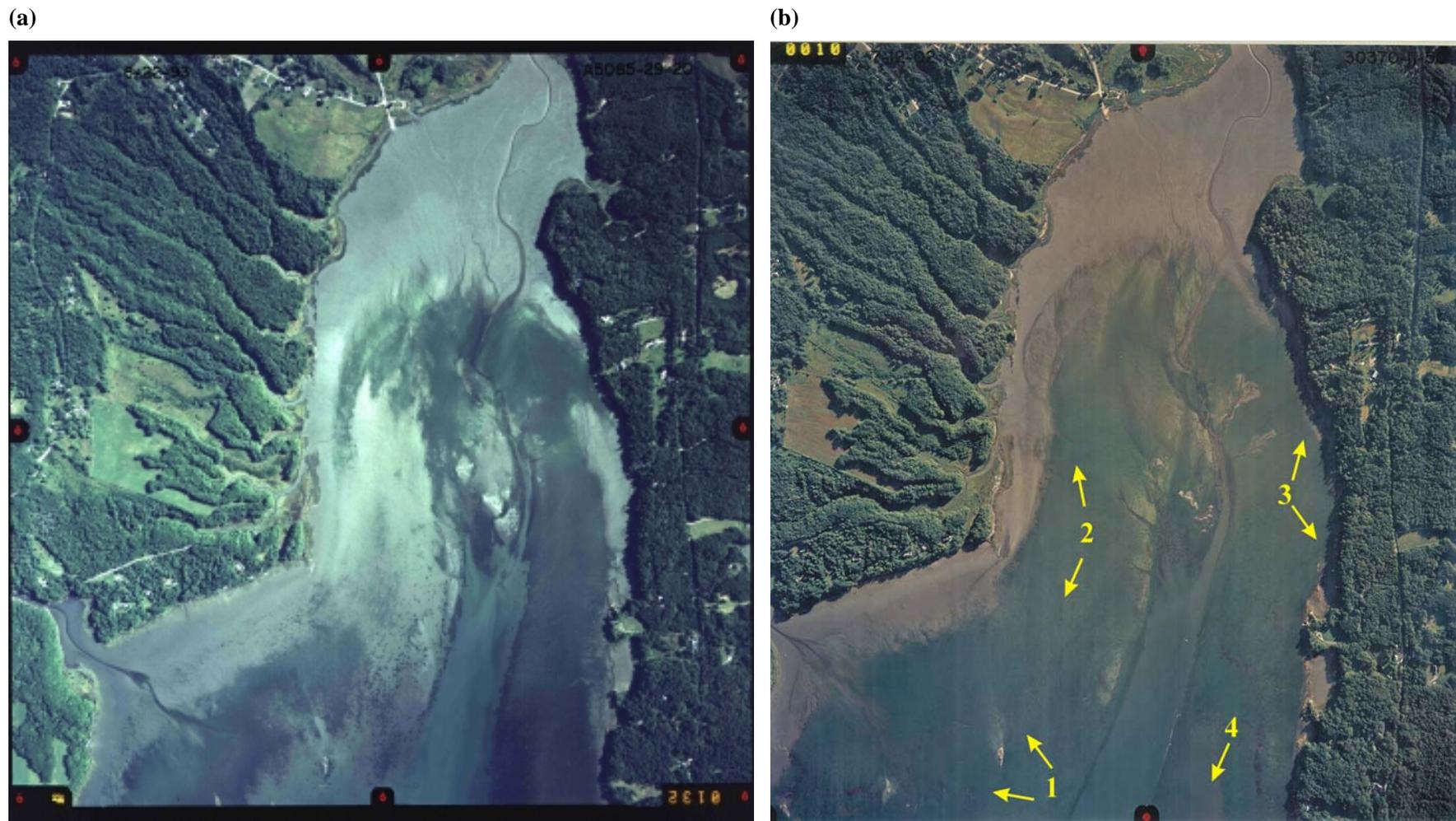
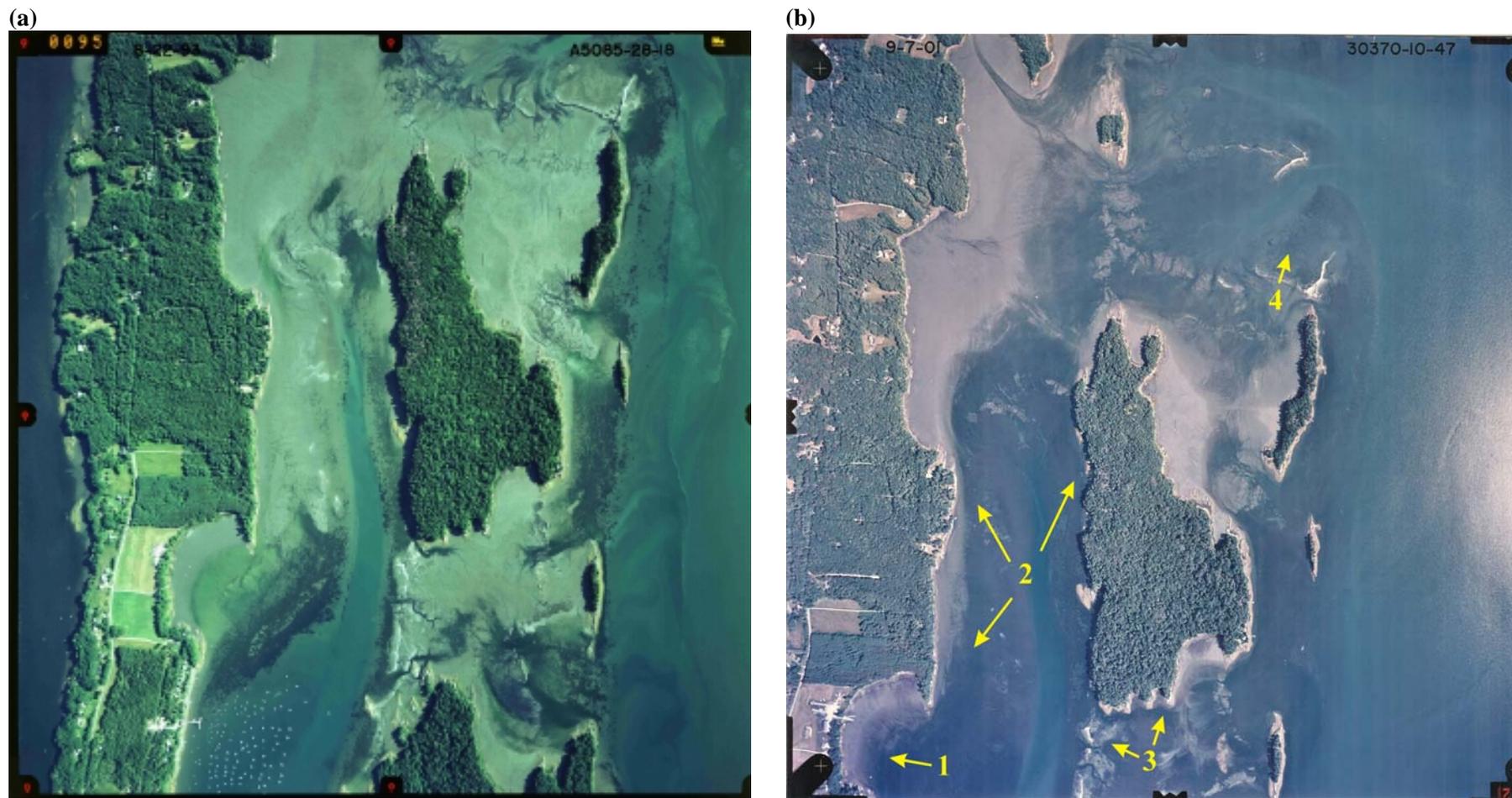


Figure 4 Aerial photos of upper half of Merepoint Bay taken in 1993 (a) and 2001 (b) showing extent of expansion of eelgrass over the period



Fishing activity

Commercial fishing in northern Casco Bay is focused on American lobsters, *Homarus americanus*, rock crab, *Cancer irroratus*, Jonah crab, *C. borealis*, soft-shell clam, *Mya arenaria*, northern quahog, *Mercenaria mercenaria*, blue mussel, *Mytilus edulis*, and worms, the blood worm, *Glycera dibranchiata*, and sand worm, *Nereis virens*.

Lobstering and crabbing are strictly subtidal fisheries, usually carried out in deeper water. However, during the spring when lobsters migrate back into shallower water, the fishery can move into these shallower areas potentially subjecting eelgrass to temporary “flattening” under traps and some, albeit very limited, disturbance and uprooting as traps are dragged across the bottom during hauling. The spring fishery usually lasts from mid-May through July as lobster again move into deeper water and traps are relocated to follow them (D. Millar, pers. comm.). Lobster fishing in the northern section of Casco Bay and the upper reaches of Maquoit, Merepoint, and Middle Bays has been heavy in the past, however in recent years lobster fishing in these areas has declined as more gear is fished in deeper water; a few local area fishermen, however, continue to fish predominantly in these areas (D. Millar, pers. comm.).

Clamming for soft-shell clams is primarily an intertidal fishery that takes place on mudflats. Occasionally soft-shell clams can be found in the lower extreme of the intertidal area, but rarely, if ever, in the subtidal where they are heavily preyed upon by crabs, primarily the green crab, *Carcinus maenas*. Clam harvesting results in a “turning” of the substrate that can potentially damage eelgrass through trampling, cutting, or uprooting. However, harvesting in the lower intertidal is limited and the potential for damage to eelgrass is similarly limited (pers. obs., C. Heinig).

Northern quahogs, or hard-clams, occur within the intertidal area but extend into the shallow subtidal area and are known to exist within eelgrass beds (pers. comm., Dana Wallace; pers. obs. C. Heinig). Harvesting of soft-shell clams is only allowed using hand implements (12 MRSA §6623, 1.), that is, hand-held rakes or “hoes” and hydraulic or mechanical dredging is not allowed unless specifically permitted (12 MRSA §6623, 2.). Dredging or dragging for quahogs is permitted under the law. Historically, the upper sections of Maquoit and Middle Bays supported a lucrative quahog fishery (pers. comm., Dana Wallace), but since the peak of the fishery in the 1950s, little, if any, quahog fishing takes place in these areas even with hand implements and none by dragging or dredging.

Blue mussels occur both intertidally and subtidally and can extend to a depth of several meters. In Maine they can be harvested by both hand implements (12 MRSA §6745) or mechanical drags (12 MRSA §6746). Intertidal mussel beds are usually separate from eelgrass and harvesting of such beds should not result in any physical damage to eelgrass. Mussels are known to settle on eelgrass during the late-larval stage when seeking firm substrate for settlement (Newell et al., 1991; Reusch, 1998; pers. obs. C. Heinig) sometimes resulting in the smothering of the eelgrass and development of extensive mussel beds in the subtidal area. The Maine DMR does not currently impose any restrictions on the harvesting of subtidal mussels within or adjacent to eelgrass beds and these mussels are subject to mechanical harvesting. When harvesting of such beds occurs, the eelgrass within and adjacent to the beds can be destroyed or severely damaged as extensively documented in Maquoit Bay by Neckles et al., (2005).

Blood worm and sand worm harvesting takes place in the intertidal area, but can extend into the extreme lower intertidal zone where eelgrass may be encountered. However, as with soft-shell clams, worm harvesting is only allowed using hand implements (12 MRSA §6771). Worm harvesting does take place in northern Casco Bay, but is extremely limited (pers. comm., Dan Devereaux, Brunswick Marine Warden). Worm harvesting is methodical and creates linearly symmetrical patterns as opposed to the more chaotic and unpredictable patterns of clam harvesting, both shown in Figure 5; propeller scars and clam harvesting patterns are shown in Figure 6.

Figure 5 Clam and worm harvesting patterns in intertidal area of Maquoit Bay, August 30, 2007



Figure 6 Propeller scars (small yellow arrows) and clam harvesting patterns (larger red arrows) in intertidal area of Merepoint Bay, August 30, 2007



Mooring scars

Traditional mushroom anchor-chain boat mooring assemblies cause damage or complete destruction of eelgrass within a circular pattern over the bottom through which the chain passes with the changing of the tide. The area of physical disturbance depends on the size of the vessel attached to the mooring, the depth of water, and scope of chain-anchor line; generally, the larger the vessel the greater the damage.

Except for certain moorings located at Paul's Marina (an Army Corps of Engineers-permitted commercial marina in Merepoint Bay), based on the review of the 2007 aerial photographs, most of the moorings within the eelgrass band are located relatively closed to shore. This is understandable since boat owners with shorefront property locate moorings to minimize the distance needed to row from shore or their float to reach their moored boat(s); distance from shore increases with size of vessel, but in most cases, boats moored within the eelgrass areas appear to be in the 18 to 24-foot class or smaller.

Based on our review of the 2007 aerial photos there are 95 visible and measurable mooring scars averaging approximately 544 ft² each for a total of approximately 51,650 ft² (1.19 ac, 0.48 ha).

Propeller scarring

Propeller scars are visible within the intertidal and subtidal areas where damage to or removal of eelgrass is evident. Scars within the intertidal area appear to be caused by clam diggers arriving at flats between 2 to 3 hours before low water. In such cases, little impact to eelgrass would be anticipated since these are usually small aluminum boats in the 12-14 foot class powered by 15-25 hp outboards, many of them short-shafted, crossing the eelgrass well before low water; departure from the flats usually mirrors time of arrival, thus height of tide is usually similar.

Propeller scarring is also found in the vicinity of certain floats and where the bottom has a shallow grade and shallow water extends a considerable distance before deeper water is reached (see aerial photo 1227, Appendix II). Very few propeller scars are seen that are not associated with a float, dock, or shellfish harvesting area. These random scars are likely attributable to unintended departures from channels by boaters unfamiliar with the area; often these scars are curved, suggesting an attempt to reverse direction following intrusion into the shallows. The total area of scarring attributable to propellers is estimated at 7,025 ft² (0.16 ac, 0.07 ha).

Structures

Private docks and floats are the most common and numerous structures that extend beyond the shore into the water. Due to the rather steep shoreline around most of the bays' area, in nearly all cases the narrow (4-6 ft wide) fixed structure of the docks extends only over the intertidal area and not into or over the eelgrass (refer to aerial photos 1211-1214, 1261, and 1326-1328 Appendix II). The end of the fixed structure portion is equipped with a narrow ramp extending down to a float, the size of which varies (100-200 ft²). Of the 37 private docks with floats found within the area, 31 were found restricted to the intertidal area and only 6 were found extending into and over eelgrass beds resulting in 868 ft² (0.02 ac/0.01 ha) of direct coverage; increasing this by 50% to account for shading and disturbance around the float increases the disturbance area to just over 1,300 ft² (0.03 ac/0.01 ha). It is important to note that the floats intrude only into the upper boundary of the eelgrass beds and, in most cases, eelgrass remains contiguous beyond the area of shading and disturbance around the floats.

A more extensive float system associated with Paul's Marina in Merepoint Bay directly covers an estimated 1,800 ft² (0.08 ac/0.03 ha). Because of the greater amount of activity associated with these commercial floats the estimated area affected by shading and disturbance has been doubled thereby increasing the disturbance area to 3,600 ft² (0.08 ac/0.03 ha).

The largest man-made structure extending from the shoreline into the eelgrass habitat within northern Casco Bay is the stone pier at Simpson Point. The pier, or “wharf”, was constructed in 1899 and extends perpendicularly from shore approximately 400 feet (Brunswick Telegraph: June 21, 1899, p.3 Brief Notes). The article references the “new wharf” being built “out into the channel” suggesting that the waters off Simpson Point were deeper at the time and that sedimentation over the past 100+ years has caused the general uppermost area of Merepoint Bay to become shallower.

A review of the 2007 aerial photos of the Simpson Point landing area that include the stone pier (aerial photos 1031-1033) show that the shoreward, upper boundary of the eelgrass band stretches from the rocky point of land just to the east, westward over to the end of the stone pier. Further to the east, however, the shoreward boundary of the eelgrass band stretches from one rocky point to the next. A likely reason for this may be that sediment has slowly accumulated on either side of the stone pier over time causing this area to become intertidal or too shallow at low water to support eelgrass; unfortunately, no historical photos exist to support the assumption that eelgrass existed in this area at any time in the past. Nevertheless, had eelgrass existed in the area prior to the construction of the stone pier and had the pattern of distribution been similar to what exists today, the area may have supported an additional 18+ acres of eelgrass, as shown later in Figures 6 and 7.

Table 1, below, summarizes the area of physical disturbance for each of the cause categories; a detailed listing for each category is presented in Appendix III. It should be noted that the Fishing category does not include the dragging scars reported and documented by Neckles et al. (2005) since these were either only partly or not at all visible in the photos; furthermore, substantial recovery of the scarred area makes identification difficult. The possible physical disturbances caused by the Simpson Point pier are separated from the observed disturbances because it is presently unknown whether eelgrass existed in that area prior to construction of the stone pier.

Table 1. Summary of physical disturbance area by cause

Cause	Total ft²	Total acres	Total hectares
Fishing (not including 1993-99 Maquoit “scars”)	1,275	0.03	0.01
Aquaculture	1,040	0.02	0.01
Propeller scars	7,025	0.16	0.07
Mooring	51,650	1.19	0.48
Private docks and floats (@ 150%)	1,300	0.03	0.01
Commercial docks and floats (@ 200%)	3,600	0.08	0.03
Total observed	65,890	1.51	0.61
Simpson Point stone pier	800,000	18.37	7.43
Total observed and Simpson Pt. pier	865,890	19.88	8.04

Based on the previously estimated eelgrass cover in northern Casco Bay of 805 ha (1,990 ac), the total observed physical disturbance is small at approximately 0.61 ha (0.07%); including the potentially affected area around Simpson Point, the 8.04 ha (19.9 ac) represents 1% of the eelgrass covered area of northern Casco Bay.

Mitigation options

The present extent and density of eelgrass within the northern Casco Bay area makes identification of “off-site” mitigation opportunities very difficult since nearly all areas suitable for eelgrass growth appear to be occupied to some degree of coverage. Indeed, mitigation opportunities and options were exhaustively reviewed during the 2004-05 Maine IF&W application process for the Merepoint Boat Launch facility; few existed then and few exist now. Consequently, the mitigation options considered here are focused on opportunities for on-site correction of those causes currently resulting in physical disturbance.

Fishing activity

As stated before, soft-shell clam, quahog, and worm harvesting account for a relatively small amount of physical disturbance to eelgrass in northern Casco Bay since these activities are generally confined to the intertidal mudflat area and arrival and departure from harvesting areas usually occurs well before and after low water thereby reducing the potential for propeller scarring; additionally, the traditional aluminum boats used by harvesters are increasingly being replaced by small airboats that cause very limited and temporary disturbance to eelgrass, if any. The shellfish aquaculture operation along the Freeport shore similarly appears to cause only limited physical disturbance to eelgrass, although boat moorings associated with the operation cause similar disturbances as private boat moorings; these moorings are therefore treated along with private moorings.

By comparison to these fishing activities mussel dragging has the potential to cause substantially greater physical disturbance, as documented by Neckles et al (2005). Maine coastal municipalities which have adopted a shellfish conservation ordinance are granted jurisdiction over the management of certain shellfish resources in the intertidal area within the municipality’s boundaries under Maine law (12 MRSA §6671). Although the definition of “low water” within the definition of “intertidal” remains unclear, most municipalities currently interpret the definition of “intertidal” as the area between the high water mark and the lower low water mark. Additionally, under current law, the definition of “shellfish” is shellstock clams, quahogs other than mahogany quahogs, and oyster shellstock (12 MRSA §6601, sub-§6.). According to this definition, a municipality does not have authority to manage harvesting of mussels within its intertidal jurisdiction.

Pending legislation currently before the Maine State Legislature, however, seeks to allow municipalities the authority to designate certain areas within which mussel dragging will be limited to the degree necessary to support the goals of the shellfish conservation program (LD 2006, item 1, 123rd Maine State Legislature - An Act to Give Municipalities Control of Mussels Located in Intertidal Zones). All three municipalities around northern Casco Bay (Freeport, Brunswick, and Harpswell) have adopted shellfish conservation plans and actively manage their respective soft-shell clam and quahog resources. Therefore, if this legislation passes, it will allow all three municipalities to manage and regulate intertidal mussel harvesting, if they so choose, but only for purposes of shellfish resource conservation, not protection of eelgrass. According to the National Oceanic and Atmospheric Administration (NOAA) Tide Predictions, lower low water in northern Casco Bay reaches -1.8 ft MLLW, or -0.55 m MLLW. According to Neckles et al. (2005) the 1993-99 mussel dragging impact areas in Maquoit Bay ranged in depth from -0.2 to -1.5 m MLW, the majority (49.8 of 53.2 ha) being at a depth \geq -0.6 m. Consequently, although the pending legislation may afford some coincidental protection of a portion of the eelgrass in northern Casco Bay from dragging, a large portion of the area covered by eelgrass and potentially harvestable by mussel draggers would remain beyond the jurisdiction of the municipalities.

However, as a result of the work of Neckles et al. agreement was reached in 2000 with certain mussel draggers on a moratorium on dragging in Maquoit Bay; to-date, no mussel dragging has since occurred in the bay (pers. comm., D. Devereaux). This agreement, however, is not legally-binding, but is instead characterized as a “gentlemen’s agreement” and it does not currently apply to other mussel

harvesters, including those in Casco Bay (refer to Appendix IV). The Maine DMR is currently reviewing options to insure continued harvesting by dragging while managing and minimizing impacts to avoid unreasonable habitat damage (pers. comm., J. Sowles, DMR). An opportunity may therefore exist to expand the existing agreement to include additional, perhaps even all, mussel harvesters along the coast. The Maine DMR has recently developed a process to engage stakeholders in discussions leading to a combined marine habitat conservation/protection and marine resource exploitation plan for Taunton Bay, Franklin, Maine that may serve as a model for similar planning in northern Casco Bay. The Casco Bay Estuary Partnership has been actively engaged in marine issues related to Casco Bay for nearly two decades and perhaps could serve as a facilitator for such discussions.

Moorings

Compared to the magnitude of previous fishing impacts of 53.2 ha, the estimated total area of physical disturbance caused by boat moorings of 0.48 ha is small, but represents a persistent rather than temporary form of disturbance. Two measures are available to mitigate or completely correct these disturbances: 1) mooring removal and relocation, and 2) mooring replacement.

The Brunswick Harbor Ordinance (April 4, 2005) requires registration of all mooring and specifically charges the harbormaster with the responsibility for setting the location of registered moorings. The ordinance also sets forth standards for moorings and authorizes the harbormaster to require removal or relocation of moorings, both new and existing, that do not comply with the standards. The standards specifically state that moorings shall not be located in areas that unreasonably affect natural resources or in areas inconsistent with the terms or conditions offered to, or required by, any federal, state, or local agency as part of a regulatory permitting process. The Harpswell Harbor and Waterfront Ordinance (amended March 11, 2006) makes no reference to location standards other than requiring that moorings be located within Harpswell waters classified as Harbor or Anchorage or adjacent to riparian owner's property, and no further than one half mile from the applicant's point of land access. The Freeport Coastal Waters Ordinance (June 5, 2007) details regulation of moorings located within the Town of Freeport anchorage with particular emphasis on the Harraseeket River Anchorage, but makes no reference to location standards for moorings placed outside of the Harraseeket River (see Appendix V).

Relocation of an existing mooring located within an eelgrass bed to a deeper location beyond the eelgrass band is relatively easy where the eelgrass band is relatively narrow and the distance to the new location from shore is only slightly greater than to the previous location. Indeed, moorings have recently been successfully relocated in the vicinity of the Merepoint Boat Launch facility where the previous mooring location presented a navigational hazard. However, in other areas where eelgrass coverage is extensive, relocation of moorings beyond the eelgrass coverage area could result in moorings being relocated several hundreds of yards from their previous location. In such cases, relocation poses not only a substantial inconvenience to the mooring owner but also exposes the owner to greater risk given the added distance between shore and the mooring. Under these circumstances, even if so authorized, the harbor master would likely be reluctant to require relocation of the mooring(s) and an alternative mooring replacement option would need to be entertained.

Embedment moorings, sometimes referred to as helix or helical anchors, provide an alternative to the traditional mushroom anchor-chain mooring; embedment anchors reduce physical disturbance to eelgrass by eliminating the sweeping chain of traditional moorings responsible for most of the disturbance. Embedment moorings have proven effective in other places but are relatively uncommon in Casco Bay and some failures have been experienced (Richard Keene and John Blood, Coastal Barge and Mooring). Consequently, some mooring owners are reluctant to consider having them installed. Additionally, the cost of installation for an embedment mooring is substantially higher than that of a traditional mooring, thereby adding to the reluctance to replace existing, functioning traditional moorings.

Many, if not most, of the moorings currently located within eelgrass beds hold boats in the 18-24 foot class or smaller and are generally in shallow water. Embedment anchors may therefore prove to be an effective alternative for traditional moorings now being used for these boats. However, proper installation of embedment moorings requires sufficient sediment depth for complete insertion and torque of the anchor into the bottom; embedment anchors cannot be used where depth to bedrock prevents complete burial of the anchor. Therefore, while the size of the boats moored in shallow water may make their existing moorings good candidates for replacement with embedment anchors, their proximity to the shoreline and the consequent possibility of shallow depth to bedrock may preclude proper installation.

In some cases where embedment mooring installation proves to be a feasible alternative, the cost of replacement may deter the owners from switching. In such cases, the municipality in which the mooring is located might consider a waiver of any annual registration fee for such time as would be necessary to compensate the mooring owner for the difference in cost between a traditional and embedment anchor. The Town of Harpswell currently charges a \$12 per year registration fee for resident moorings, \$60 for non-resident moorings, and \$50 for rental moorings; the Town of Brunswick does not currently charge a mooring registration fee, but is considering such a fee. The Town of Freeport does not charge a mooring registration fee for residential recreational moorings outside of the Harraseeket River anchorage, but does charge an annual registration fee for all other types of moorings within the Town of Freeport anchorage; annual registration fees range from \$95 to \$350.

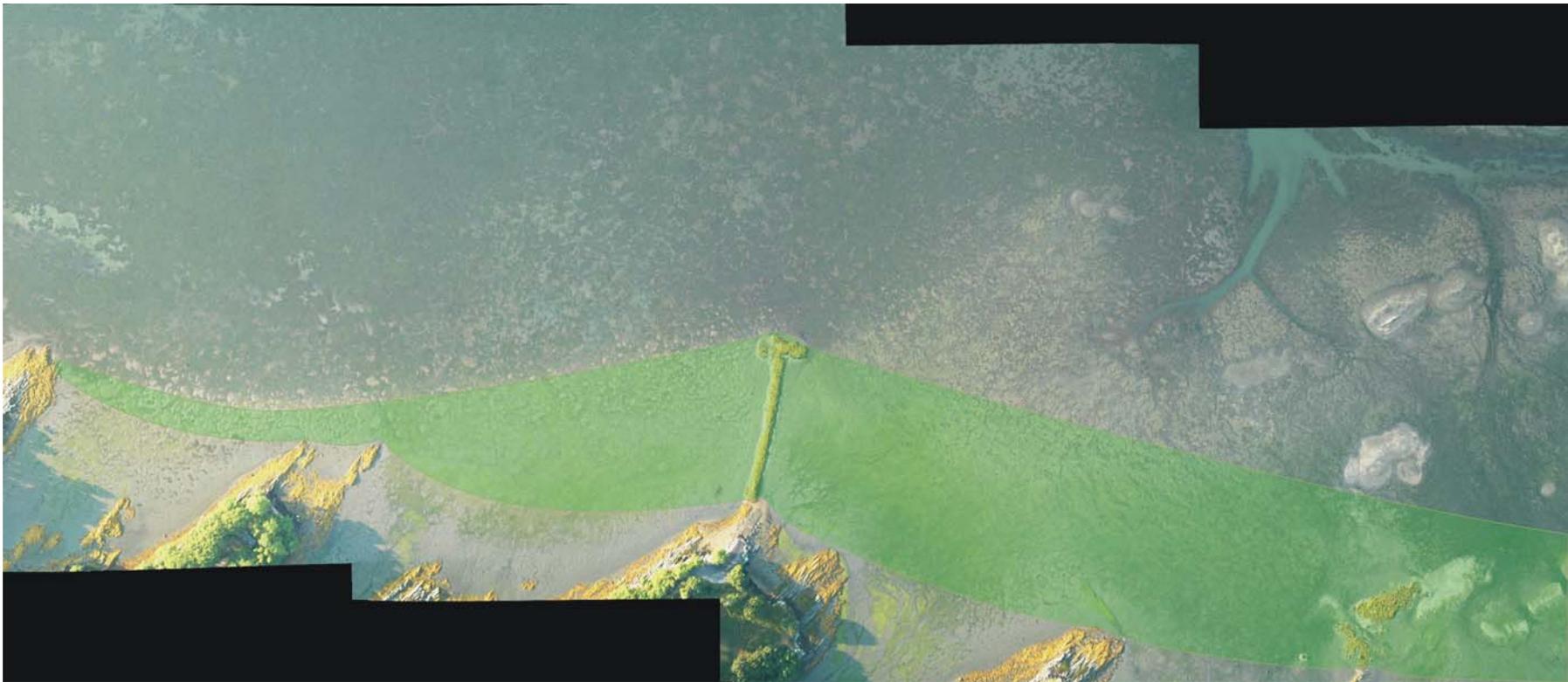
Structures

As stated earlier, most private wharfs, docks, and floats in the northern Casco Bay area do not directly affect eelgrass, and the few that do account for a very small area of disturbance; consequently these do not offer much in the way of mitigation opportunities. The floats at Paul's Marina account for about 3,600 ft² of disturbance, however this facility is fully permitted by the U.S. Army Corps of Engineers as a commercial marina.

Removal of the stone pier at Simpson Pt. represents, perhaps, the largest eelgrass physical disturbance mitigation possibility. However, since the structure has been in place for a little over 100 years it is difficult to determine if the area surrounding the pier was covered with eelgrass at the time of construction and therefore whether it would become suitable habitat for eelgrass following removal of the structure; unfortunately, at the time of construction in 1899 the Brunswick Telegraph did not carry photographs and we are currently unaware of any historical photos of the area.

Based on the eelgrass distribution pattern along the shoreline adjacent to, but beyond the influence of, the stone pier it is estimated that more than 800,000 ft² or 18 acres of eelgrass habitat might be created if the stone structure were removed and the surrounding area were to become revegetated with eelgrass (see Figure 7). Furthermore, it is also difficult to determine if the lack of eelgrass around the structure today is due to sedimentation around the stone pier that, over time, has raised the seafloor to the point that it is no longer suitable as eelgrass habitat. If so, removal of the stone pier by itself may not be sufficient to insure reoccupation of the area by eelgrass; additional removal of sediment may be required if tidal currents alone fail to return the area to its former depth. Clearly, additional work would need to be done to provide high-resolution bathymetry of the area surrounding the pier and the hydrodynamics of the area would need to be studied to develop the necessary models to predict sediment redistribution within the area following removal of the pier.

Figure 7 Stone pier at Simpson Point showing possible eelgrass coverage (green overlay) following removal of the structure.



Although the stone pier is admittedly a man-made structure, since it has been in place for 100+ years, the intertidal hard substrate provided by the structure constitutes habitat for flora and fauna requiring such substrate. Therefore, removal of the structure would ultimately result in the substitution of one habitat (shallow subtidal soft-bottom, eelgrass) for another (intertidal hard-rockweed habitat) and a decision to move forward with such a project would require a habitat-value judgment to be made.

Removal of the pier is undoubtedly technically feasible; however, the total financial cost of removal, including pre-removal studies, project permitting, physical removal, and follow-up monitoring of effectiveness would be substantial. Additionally, although temporary, there would likely be an environmental cost associated with the disturbance created during the removal process, all of which would need to be considered during project planning.

Propeller damage

Propeller damage is found primarily associated with floats where boats routinely arrive and depart over the same bottom. Propeller scars are found outside of these areas that are characteristically curved or hook-shaped indicating an apparent inadvertent intrusion into shallow water followed by an attempt to return to deeper water; such intrusions into shallow water are likely caused by boaters unfamiliar with the area. Although there are few discernable examples of such occurrences, as the number of boaters increases over time the number of such occurrences is also likely to increase. One possible way of avoiding such damage would be to install navigational aids along the sides of the main channels within northern Casco Bay to maintain boaters within channels and direct them away from eelgrass areas. The navigational aids would end at the end of the channel, which in most navigable waters indicates the end of a channel opening into deeper water, thus ending restrictions on direction of navigation. In this case, however, the end of the navigational aids would indicate little or no water ahead at low water and a yellow cautionary buoy might be installed in the middle of the end of the channel indicating "End of Channel".

Conclusion

Water quality in Casco Bay in general and northern Casco Bay in particular is good and measures have been adopted by the municipalities surrounding the region to insure water quality remains good into the future to protect marine resources, including eelgrass.

Physical disturbances to eelgrass in northern Casco Bay have and continue to occur. The most extensive and severe of these disturbances have been associated with mussel dragging and measures have been put in place to minimize, although not entirely eliminate, the possibility of such impacts occurring in the future. Boat moorings, docks and floats, and propeller scarring are the other causes of physical disturbance identified through this effort, but the magnitude of the combined area of disturbance associated with these causes is small, particularly in comparison to the overall current expanse of eelgrass in northern Casco Bay as well as the natural fluctuations in annual areal coverage. Nevertheless, these do represent anthropogenic disturbances that should be corrected if reasonably possible.

Eelgrass in northern Casco Bay is currently at historically high levels and occupies most, if not all of the available habitat, thus making identification of mitigation opportunities rather difficult. Mitigation options do exist to correct some of these causes of physical disturbance at the source, but all are constrained to one extent or another by difficulties. Implementation of these corrective measures must therefore take into account the possible creation of other conflicts, protection of individual and public safety, existing laws and ordinances, and the associated economic and environmental costs.

In view of the limited opportunities to mitigate impacts associated with physical disturbances in northern Casco Bay and the difficulties associated with these, additional consideration might be given to the extension of measures to protect water quality in the upper bay region. As previously stated, the Town of Brunswick has already adopted an ordinance to protect against nutrient loading in Maquoit, Merepoint, and Middle Bays. The towns of Harpswell and Freeport, which share a portion of the shorelines of these bays, have not adopted similar ordinances and an effort might therefore be undertaken to have all three municipalities work together to provide consistent protection against nutrient loading in the region, perhaps at a minimum to restore vegetated buffer zones around agricultural lands and expansive lawn areas, and adopt enhanced stream buffer requirements for new development.

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Town of Brunswick Ordinances – Chapter 11 Marine Activities, Structures and Ways
<http://www.brunswickme.org/clerk/ordinances/Ch011.pdf>

Town of Brunswick Zoning Ordinance
[http://www.brunswickme.org/planning/zoning/Entire%20Zoning%20Ordinance%20for%20Web%20\(original\)%20.pdf](http://www.brunswickme.org/planning/zoning/Entire%20Zoning%20Ordinance%20for%20Web%20(original)%20.pdf)

Town of Harpswell Harbor and Waterfront Ordinance – amended March 11, 2006
<http://www.harpswell.maine.gov/vertical/Sites/%7B3F690C92-5208-4D62-BAFB-2559293F6CAE%7D/uploads/%7B722F6A19-1457-483D-9123-BE1D5ED5554A%7D.PDF>

Town of Freeport – Coastal Waters Ordinance, Chapter 31
<http://www.freeportmaine.com/codes/chap31.doc>

Appendix I

Inventory of aerial photos taken in August 2007 over northern Casco Bay

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Aerial Photo Inventory			
Aerial photo #	Location	Aerial photo #	Location
1006	Mere Point West shore across from smith Cove.	1053	Across mouth of Middle Bay Cove to Crow Island
1007	Mere Point West shore across from smith Cove.	1054	Across mouth of Middle Bay Cove to Crow Island
1008	Mere Point West shore across from smith Cove.	1055	Across mouth of Middle Bay Cove to Crow Island
1009	Mere Point West shore across from smith Cove.	1056	Across mouth of Middle Bay Cove to Crow Island
1010	Mere Point West shore across from smith Cove.	1057	Across mouth of Middle Bay Cove to Crow Island
1011	Over Merepoint peninsula	1058	Across mouth of Middle Bay Cove to Crow Island
1012	Over Merepoint peninsula	1059	Across mouth of Middle Bay Cove to Crow Island
1013	Over Merepoint peninsula	1060	Turn at Crow down and across Merepoint Neck
1014	Miller Cove	1061	Turn at Crow down and across Merepoint Neck
1015	Miller Cove	1062	Turn at Crow down and across Merepoint Neck
1016	Miller Point	1063	Turn at Crow down and across Merepoint Neck
1017	Over land	1064	Turn at Crow down and across Merepoint Neck
1018	Over land	1065	Turn at Crow down and across Merepoint Neck
1019	Intersection Pennellville Way	1066	Back toward Crow Island
1020	Over land	1067	Back toward Crow Island
1021	Over land	1068	Back toward Crow Island
1022	Over land	1069	Tip of Crow Island
1023	Over land	1070	Across Upper Merepoint and Middle Bays to Harpswell
1024	West shore Middle Bay Cove	1071	Across Upper Merepoint and Middle Bays to Harpswell
1025	West shore Middle Bay Cove	1072	Across Upper Merepoint and Middle Bays to Harpswell
1026	Pennellville shoreline to Simpson's Pt.	1073	Across Upper Merepoint and Middle Bays to Harpswell
1027	Pennellville shoreline to Simpson's Pt.	1074	Barnes Point, Harpswell Neck
1028	Pennellville shoreline to Simpson's Pt.	1075	Harpswell Neck
1029	Pennellville shoreline to Simpson's Pt.	1076	Harpswell Neck
1030	Pennellville shoreline to Simpson's Pt.	1077	Harpswell Neck
1031	Pennellville shoreline to Simpson's Pt.	1078	Turn back toward Mere Pt.
1032	Pennellville shoreline to Simpson's Pt.	1079	Across Middle Bay to Mere Pt.
1033	Simpson's Pt.	1080	Across Middle Bay to Mere Pt.
1034	Across Mere Pt. eastern shore toward Crow Island	1081	Across Middle Bay to Mere Pt.
1035	Across Mere Pt. eastern shore toward Crow Island	1082	Across Middle Bay to Mere Pt.
1036	Across Mere Pt. eastern shore toward Crow Island	1083	Across Middle Bay to Mere Pt.
1037	Across Mere Pt. eastern shore toward Crow Island	1084	Across Middle Bay to Mere Pt.
1038	Across Mere Pt. eastern shore toward Crow Island	1085	Across Middle Bay to Mere Pt.
1039	Across Mere Pt. eastern shore toward Crow Island	1086	Mere Pt.
1040	Upper Merepoint Bay	1087	Mere Pt.
1041	Upper Merepoint Bay	1088	Mere Pt.
1042	Crow Is. and Simpson's Pt. to Harpswell shoreline	1089	Mere Pt.
1043	Crow Is. and Simpson's Pt. to Harpswell shoreline	1090	Mere Pt.
1044	Crow Is. and Simpson's Pt. to Harpswell shoreline	1091	Mere Pt.
1045	Crow Is. and Simpson's Pt. to Harpswell shoreline	1092	Mere Pt.
1046	Crow Is. and Simpson's Pt. to Harpswell shoreline	1093	Upper Maquoit Bay
1047	Crow Is. and Simpson's Pt. to Harpswell shoreline	1094	Upper Maquoit Bay
1048	Mouth of Middel Bay Cove	1095	Upper Maquoit Bay
1049	Turn back toward Barnes Pt., Harpswell	1096	Upper Maquoit Bay
1050	Over land at Harpswell Neck	1097	Upper Maquoit Bay

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Aerial photo #	Location	Aerial photo #	Location
1051	Over land at Harpswell Neck	1098	Upper Maquoit Bay
1052	Barnes Pt	1099	Wharton Point
1100	Miller Cove	1150	Merepoint both sides, near Paul's Marina
1101	Miller Point area across to Pennellville	1151	Maquoit Bay
1102	Miller Point area across to Pennellville	1152	Maquoit Bay
1103	Miller Point area across to Pennellville	1153	Maquoit Bay
1104	Miller Point area across to Pennellville	1154	Maquoit Bay
1105	Miller Point area across to Pennellville	1155	Maquoit Bay
1106	Miller Point area across to Pennellville	1156	Maquoit Bay
1107	Miller Point area across to Pennellville	1157	Maquoit Bay
1108	Pennellville	1158	Maquoit Bay
1109	Middle Bay Cove	1159	Banking turn (circle back)
1110	Middle Bay Cove	1160	Wharton Pt.
1111	Pennellville Rock/Points	1161	Down center of upper Maquoit
1112	South of Pennellville Rock/Points	1162	Down center of upper Maquoit
1113	Pennellville Rock West/Simpson Pt.	1163	Down center of upper Maquoit
1114	Simpson Pt. Stone Pier	1164	Down center of upper Maquoit
1115	Simpson's Pt. heading west	1165	Down center of upper Maquoit
1116	Shoreline then to Crow	1166	Down center of upper Maquoit
1117	Miller Point flats	1167	Down center of upper Maquoit
1118	Miller Point flats	1168	Down center of upper Maquoit "Scar"
1119	Miller Point flats	1169	Open water Maquoit
1120	Miller Point flats	1170	Open water Maquoit
1121	Miller Point flats	1171	Open water Maquoit
1122	Miller Point flats	1172	Open water Maquoit
1123	Crow Island	1173	Open water Maquoit
1124	Crow Island	1174	Open water Maquoit
1125	Miller Pt.	1175	Open water Maquoit
1126	Miller Pt.	1176	Open water Maquoit
1127	Simpson Pt. Road just south of Pennellville Rd.	1177	Open water Maquoit
1128	View of Pennellville on turn	1178	Open water Maquoit
1129	Simpson Point Road/Miller Point area	1179	Open water Maquoit
1130	Simpson Point Road/Miller Point area	1180	Open water Maquoit
1131	Simpson Point Road/Miller Point area	1181	Open water Maquoit
1132	Miller Creek	1182	Banking turn over Merepoint and new landing
1133	Across Merepoint Neck to west shore	1183	Up Merepoint shore west side "Sunset Way"
1134	Across Merepoint Neck to west shore	1184	Up Merepoint shore west side
1135	Across Merepoint Neck to west shore	1185	Up Merepoint shore west side
1136	Across Merepoint Neck to west shore	1186	Off western Merepoint shore
1137	Across Merepoint Neck to west shore	1187	Turn over Smith Boatyard
1138	Across Merepoint Neck to west shore	1188	Turn over Smith Cove toward Paul's
1139	West Merepoint shore headed south	1189	Turn over Smith Cove toward Paul's
1140	West Merepoint shore headed south	1190	Turn over Smith Cove toward Paul's
1141	West Merepoint shore headed south	1191	North edge of mooring field at Paul's Marina
1142	West Merepoint shore headed south	1192	Paul's Marina
1143	West Merepoint shore headed south	1193	Paul's Marina
1144	West Merepoint shore headed south	1194	Paul's Marina
1145	West Merepoint shore headed south	1195	Southeast edge Paul's Marina, area off Birch Island

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Aerial photo #	Location	Aerial photo #	Location
1146	West Merepoint shore headed south	1196	West shoreline Birch Island flying south
1147	West Merepoint shore headed south	1197	West shoreline Birch Island flying south
1148	West Merepoint shore headed south	1198	West shoreline Birch Island flying south
1149	West Merepoint shore headed south - old scar	1199	West shoreline Birch Island flying south
1200	Birch Island southwest shore	1250	Maquoit Bay
1201	Tip of Merepoint	1251	Freeport shore
1202	Merepoint east shore E Marginal Rd" flying northeast	1252	Freeport shore
1203	Merepoint flying northeast over new landing	1253	Turn over land- west, north, east out and small "hook"
1204	Merepoint flying northeast over new landing	1254	Over Freeport
1205	Merepoint flying northeast "Windemere Rd"	1255	Over Freeport
1206	Paul's Marina	1256	Over Freeport
1207	Smith Cove	1257	Over Freeport
1208	North along Merepoint east shore "Minot Shore Rd"	1258	Freeport shoreline headed north
1209	Merepoint east shore at Paul's mooring field	1259	Freeport shoreline headed north
1210	Merepoint east shore at Paul's mooring field	1260	Freeport shoreline headed north
1211	Paul's Marina flying southwest	1261	Oyster farm
1212	Paul's Marina flying southwest	1262	Northwest head Maquoit Bay at Bunganuc
1213	Paul's Marina flying southwest	1263	Top of Maquoit eelgrass in Bunganuc
1214	MP Landing	1264	Bunganuc Bluffs
1215	New Landing	1265	South toward Freeport shore
1216	New Landing	1266	South toward Freeport shore
1217	East shore Merepoint to tip	1267	South toward Freeport shore
1218	East shore Merepoint to tip	1268	Oyster farm
1219	East shore Merepoint to tip	1269	Oyster farm
1220	Tip Merepoint	1270	South of oyster farm toward "hook" on Freeport shore
1221	Tip Merepoint	1271	South of oyster farm toward "hook" on Freeport shore
1222	Across to Little Flying Point	1272	South of oyster farm toward "hook" on Freeport shore
1223	Across to Little Flying Point	1273	South of oyster farm toward "hook" on Freeport shore
1224	Across to Little Flying Point	1274	Turn back up Freeport shore from south
1225	Across to Little Flying Point	1275	Turn back up Freeport shore from south
1226	Across to Little Flying Point	1276	Turn back up Freeport shore from south
1227	Cove south of Little Flying Point causeway	1277	Turn back up Freeport shore from south
1228	Little Flying Pt.	1278	Turn back up Freeport shore from south
1229	Up Freeport shore of Maquoit headed north	1279	Turn back up Freeport shore from south
1230	Up Freeport shore of Maquoit headed north	1280	Up Freeport shore from south
1231	Up Freeport shore of Maquoit headed north	1281	Up Freeport shore from south / oyster farm
1232	Up Freeport shore of Maquoit headed north	1282	Up Freeport shore from south / oyster farm
1233	Up Freeport shore of Maquoit headed north	1283	Up Freeport shore from south
1234	Up Freeport shore of Maquoit headed north	1284	Up Freeport shore from south at Bunganuc
1235	Up Freeport shore of Maquoit headed north	1285	Maquoit Bay west
1236	Up Freeport shore of Maquoit headed north	1286	Oyster farm
1237	Northwest Maquoit Bay at Bunganuc Creek	1287	Oyster farm
1238	Northwest Maquoit Bay at Bunganuc Creek	1288	Oyster farm
1239	Bunganuc Bluffs	1289	Oyster farm
1240	Upper Maquoit Bay - intertidal	1290	Oyster farm
1241	Upper Maquoit Bay	1291	Freeport shore headed south
1242	Upper Maquoit Bay	1292	Freeport shore headed south
1243	Upper Maquoit Bay	1293	Freeport shore headed south

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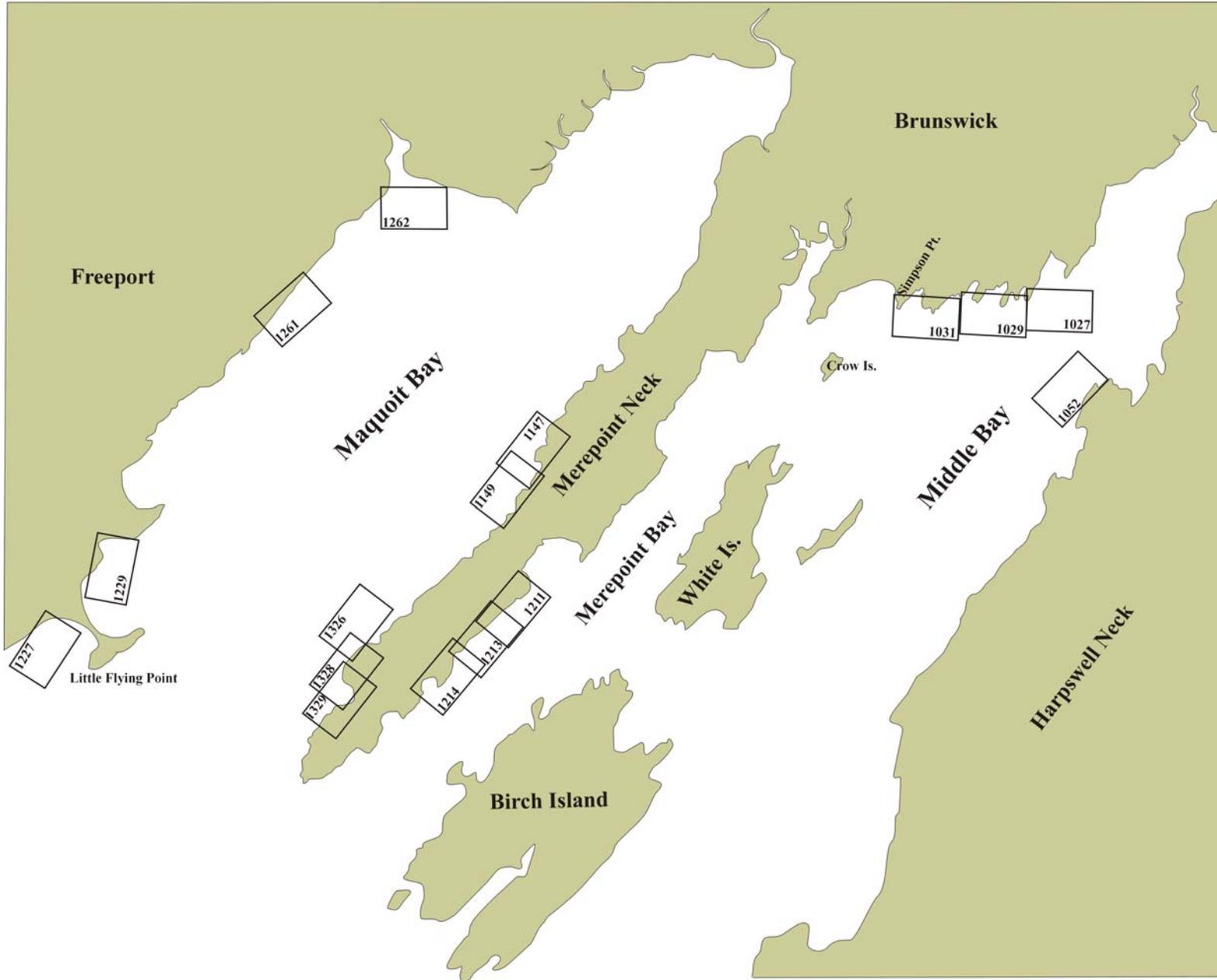
Aerial photo #	Location	Aerial photo #	Location
1244	Upper Maquoit Bay	1294	Freeport shore headed south at "hook"
1245	Maquoit Bay	1295	East across Maquoit to Merepoint
1246	Maquoit Bay	1296	East across Maquoit to Merepoint
1247	Maquoit Bay	1297	East across Maquoit to Merepoint - phytoplankton
1248	Maquoit Bay	1298	East across Maquoit to Merepoint - phytoplankton
1249	Maquoit Bay	1299	East across Maquoit to Merepoint - phytoplankton
1300	Approaching Merepoint eelgrass band		
1301	Crossing Merepoint west to east south of Smith Cove		
1302	Birch Island across from Pauls headed northwest		
1303	Both side of Merepoint just south of new landing headed west		
1304	Lobster boat hauling trap w. cloud (Maquoit)		
1305	Over water in Maquoit		
1306	Merepoint western shore at angle		
1307	Over water - phytoplankton		
1308	Over water - phytoplankton		
1309	Over water - phytoplankton		
1310	Over water - phytoplankton		
1311	Western shore Merepoint Neck		
1312	Western shore Merepoint Neck		
1313	Cove on west shore of Merepoint headed north		
1314	Same trap hauls?		
1315	Turn at end of Merepoint headed west		
1316	Maquoit Bay		
1317	Maquoit Bay		
1318	Maquoit Bay		
1319	Maquoit Bay		
1320	Maquoit Bay		
1321	Maquoit Bay		
1322	Maquoit Bay		
1323	West shore Merepoint headed south		
1324	West shore Merepoint headed south		
1325	West shore Merepoint headed south		
1326	West shore Merepoint headed south		
1327	West shore Merepoint headed south		
1328	West shore Merepoint headed south		
1329	West shore Merepoint headed south		
1330	Off western shore Merepoint - phytoplankton "front"		
1331	Off western shore Merepoint - phytoplankton "front"		
1332	Off western shore Merepoint - phytoplankton "front"		
1333	Off western shore Merepoint - phytoplankton "front"		

Appendix II

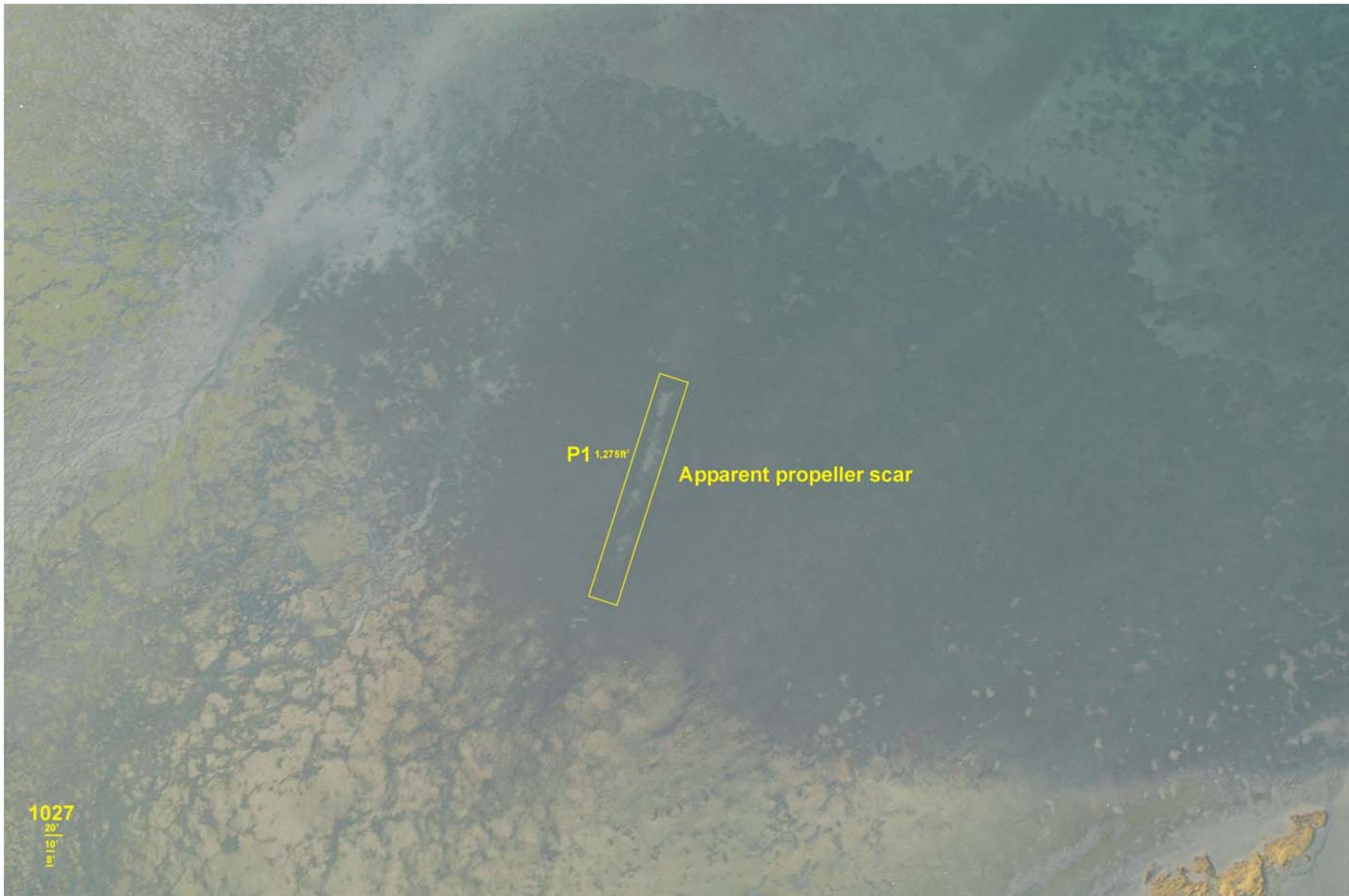
Aerial photos taken in August 2007 showing areas of physical disturbance to eelgrass

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Guide to location of aerial photos used in physical disturbance analysis (does not include full set of aerial photos taken)

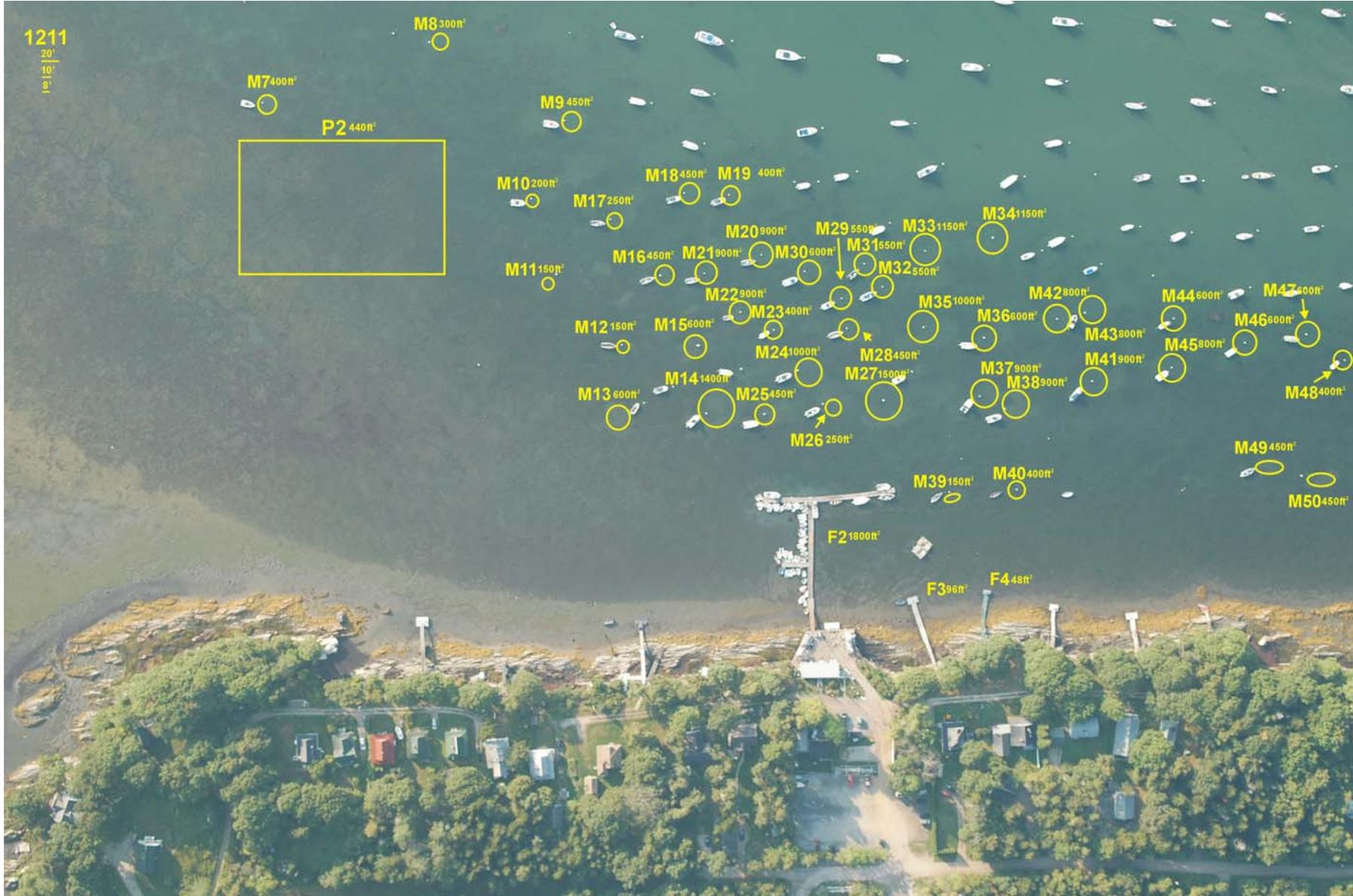
















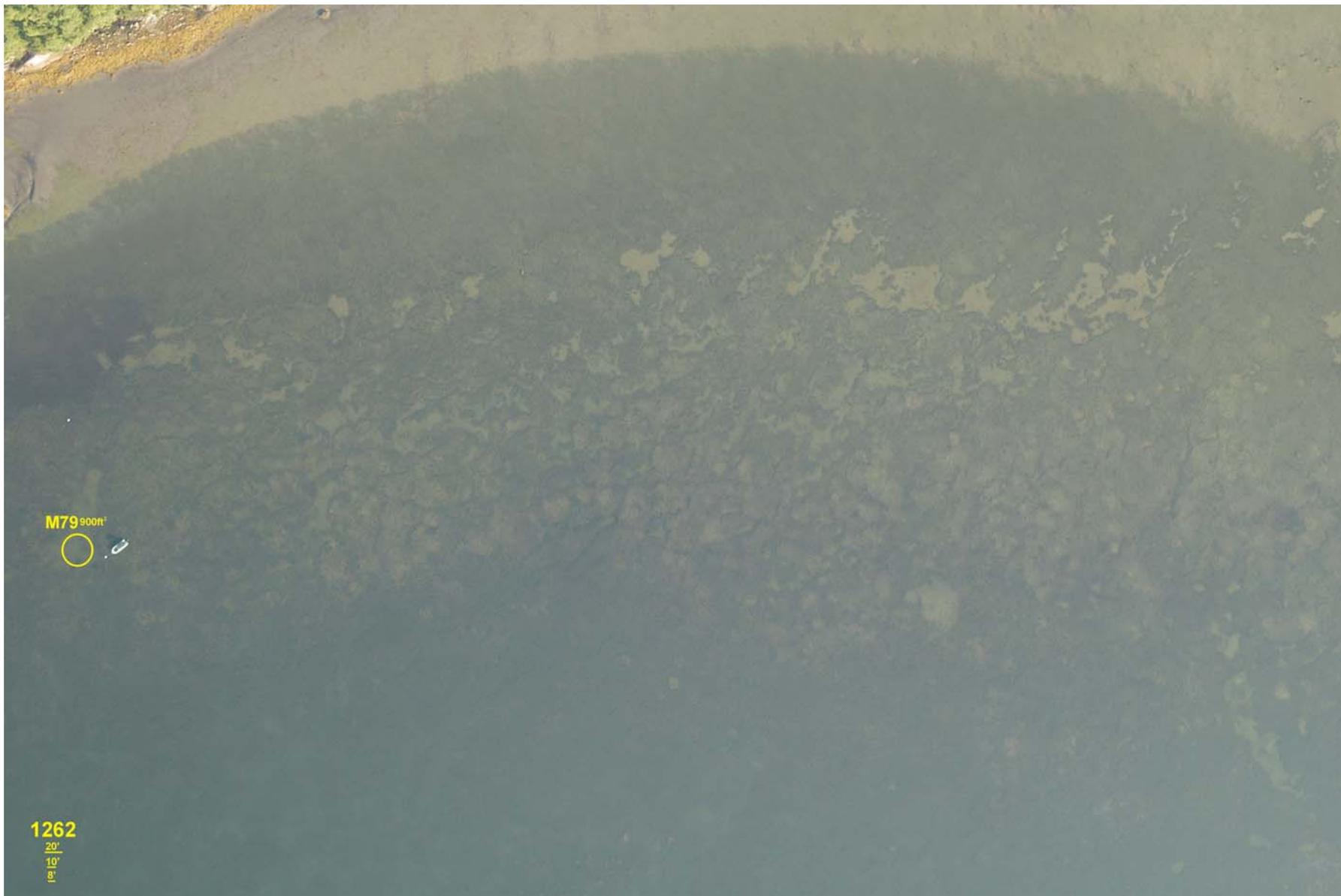


















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Appendix III

Listing of physical disturbances giving identification number, aerial photo number, and square footage of disturbance

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Mooring #	Photo#	scar area (ft ²)		Mooring #	Photo#	scar area (ft ²)
M1	1052	450		M50	1211	450
M2	1052	300		M51	1213	150
M3	1052	250		M52	1213	400
M4	1052	250		M53	1213	400
M5	1052	250		M54	1213	400
M6	1052	250		M55	1213	450
M7	1211	400		M56	1214	250
M8	1211	300		M57	1329	150
M9	1211	450		M58	1329	450
M10	1211	200		M59	1329	450
M11	1211	150		M60	1329	400
M12	1211	150		M61	1329	150
M13	1211	600		M62	1329	250
M14	1211	1,400		M63	1329	100
M15	1211	600		M64	1329	450
M16	1211	450		M65	1329	100
M17	1211	250		M66	1329	150
M18	1211	450		M67	1329	200
M19	1211	400		M68	1329	400
M20	1211	900		M69	1328	300
M21	1211	900		M70	1328	600
M22	1211	900		M71	1328	700
M23	1211	400		M72	1328	550
M24	1211	1,000		M73	1328	600
M25	1211	450		M74	1328	700
M26	1211	250		M75	1326	300
M27	1211	1,500		M76	1326	400
M28	1211	450		M77	1326	200
M29	1211	550		M78	1326	1,250
M30	1211	600		M79	1262	900
M31	1211	550		M80	1149	900
M32	1211	550		M81	1149	200
M33	1211	1,150		M82	1149	450
M34	1211	1,150		M83	1261	450
M35	1211	1,000		M84	1261	800
M36	1211	600		M85	1261	200
M37	1211	900		M86	1261	400
M38	1211	900		M87	1261	450
M39	1211	150		M88	1261	800
M40	1211	400		M89	1261	750
M41	1211	900		M90	1261	850
M42	1211	800		M91	1227	1,500
M43	1211	800		M92	1227	300
M44	1211	600		M93	1227	1,000
M45	1211	800		M94	1227	700
M46	1211	600		M95	1227	900
M47	1211	600			Total ft²	51,650
M48	1211	400			Total ac.	1.19
M49	1211	450			Total ha	0.48

Propeller scars				
Prop scar #	Photo #	ft ²		
P1	1027	1,275		
P2	1211	440		
P3	1328	150		
P4	1328	470		
P5	1227	1,200		
P6	1227	240		
P7	1227	300		
P8	1227	2,950		
		Total ft²	Total ac.	Total ha
		7,025	0.16	0.07

Fishing/harvest scars - not including Maquoit Bay 1999 "scars"				
Scar #	Photo #	ft ²		
H1		1,275		
		Total ft²	Total ac.	Total ha
		1,275	0.03	0.01

Aquaculture				
Aqua#	Photo #	ft ²		
A1	1261	1,040		
		Total ft²	Total ac.	Total ha
		1,040	0.02	0.01

Private floats					
Float #	Photo #	Dimensions	ft ²		
F1	1052	10' x 14'	140		
F3	1211	8' x 12'	96		
F4	1211	6' x 8'	48		
F5	1329	10' x 20'	200		
F6	1328	12' x 16'	192		
F7	1328	12' x 16'	192	144.7	
			Total ft²	Total ac.	Total ha
			868	0.02	0.01
@ 150%			1,302	0.03	0.01

Commercial floats					
Float #	Photo #	Dimensions	ft ²		
F2	1211	6' x 300'	1,800		
			Total ft²	Total ac.	Total ha
			1,800	0.04	0.02
@ 200%			3,600	0.08	0.03

Appendix IV

Agreement between the Town of Brunswick and Great Eastern Mussel Farms

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AGREEMENT TO CEASE DRAGGING ACTIVITIES

This agreement is entered into by and between the Town of Brunswick and Great Eastern Mussel Farms to cease dragging activities:

WHEREAS, a scar exists in the bottom of Maquoit Bay due to mussel dragging; and

WHEREAS, the mussel resource is limited in the area of the scar; and

WHEREAS, the Town of Brunswick and the State of Maine Department of Inland Fisheries & Wildlife have proposed to conduct experimental measures to enhance the natural seed set of the eelgrass in the scar; and

WHEREAS, the Town of Brunswick acknowledges the eelgrass conservation efforts of Great Eastern Mussel Farms; and

WHEREAS, Great Eastern Mussel Farms recognizes restoration of the scar will enhance Maquoit Bay;

NOW, THEREFORE, the Town of Brunswick and Great Eastern Mussel Farms agree as follows:

1. Great Eastern Mussel Farms will not conduct drags in the area of Maquoit Bay east of a line that extends from the tip of Mere Point to the tip of Bunganuc Point.
2. This cessation of dragging activities will be maintained long enough for eelgrass restoration to occur in the scar.
3. Should Great Eastern Mussel Farms determine it would like to drag in this particular area after restoration of eelgrass, Great Eastern Mussel Farms will provide the Town of Brunswick 90 days notice and an opportunity to discuss alternatives.

Dated at Brunswick, Maine this _____ day of _____ 2004.

WITNESS

GREAT EASTERN MUSSEL FARMS

By: _____

Print name: _____

Its: _____

WITNESS

TOWN OF BRUNSWICK

By: _____

Print name: _____

Its: _____

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Appendix V

**Harbor and moorings ordinances for Towns of Brunswick, Harpswell, and Freeport
(Only those sections pertaining to moorings)**

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**Chapter 11
MARINE ACTIVITIES, STRUCTURES AND WAYS***

* **Cross References:** Conservation commission, § 2-76 et seq.; buildings and building regulations, Ch. 5; fire prevention and protection, Ch. 7; housing, Ch. 8; solid waste, Ch. 13; streets, sidewalks and other public places, Ch. 14; discharge of sewerage into surface waters prohibited, § 16-26; zoning and subdivision of land, App. A; marine construction, App. A, § 407.
State Law References: Waters and navigation, 38 M.R.S.A. § 1 et seq.

Art. I. Harbor, Coastal, Tidal and Navigable Fresh Waters, §§ 11-1--11-25

Art. II. Reserved, §§ 11-26--11-70

Art. III. Shellfishing, §§ 11-71--11-165

Div. 1. Generally, §§ 11-71--11-95

Div. 2. Marine Resource Committee, §§ 11-96--11-110

Div. 3. Shellfish Regional Advisory Commission, §§ 11-111--11-130

Div. 4. License, §§ 11-131--11-160

Div. 5. Regulations, §§ 11-161--11-165

**ARTICLE I.
HARBOR, COASTAL, TIDAL AND NAVIGABLE FRESH WATERS**

Sec. 11-1. Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Channels: Those paths designated by this chapter for navigation in or access to the harbor, coastal, tidal and navigable fresh waters of Brunswick.

Commercial use: A use with profit as a primary aim.

Idle speed: The minimum speed necessary to maintain steerage and control of a moving watercraft

Mooring: An underwater device either helix, granite block or mushroom, which tethers boats. A temporary mooring is one which is constructed to be hauled out of the water seasonally. A permanent mooring is one which is constructed to winter over in the water. A flats mooring is one which is located on the mud flats at low tide.

Riparian owner: An owner of land with a minimum of one hundred (100) feet of shorefront.

Watercraft: Any type of vessel, boat, barge, float, or craft used as a means of transportation on the water.

(Ord. of 4-4-05)

Sec. 11-2. Channels.

(a) *Establishment of channels.* Two (2) channels are established, described as follows:

(1) Commencing at the Bath Road bridge (formerly Route #1) as it crosses the New Meadows River, thence following the high water mark of the New Meadows River southerly to the southerly tip of Howard Point, thence easterly to the town line between Brunswick and West Bath, thence following the town line northerly to the Bath Road bridge, thence westerly along the Bath Road bridge to the point of beginning.

(2) Commencing at the mean high water line on the Merepoint Boat Launch ramp surface and extending approximately three hundred fifty (350) feet to the southeast between buoys marking the fifty (50) foot wide approach lane to the ramp.

(b) *Passage of vessels.* A person shall not use any watercraft or any other device or structure within the described channels so as to interfere with or impede the passage of vessels in the channel in any manner.

(c) *Moorings.* A person shall not place, anchor, or moor any watercraft within the described channels without the permission of the harbormaster.
(Ord. of 4-4-05)

Sec. 11-3. Harbormaster.

(a) *Appointment.* The town shall appoint a harbormaster annually on May 1st.

(b) *Duties.* The harbor master shall have the following powers and duties:

(1) To the extent of jurisdiction, enforce any and all federal, state and local laws, ordinances, codes, rules or regulations relating to the management and control of Brunswick's harbor, coastal, tidal and navigable fresh waters, shores, coastline, boat launch facilities, and floats; and provide information or seek input as appropriate from any source, including the marine resources committee, marine wardens, town manager, town council, or town attorney.

(2) Approve and control the placement of moorings within the harbor, coastal, tidal and navigable fresh waters of Brunswick.
(Ord. of 4-4-05)

Sec. 11-4. Moorings.

(a) *Registration.* All moorings located in the harbor, coastal, tidal and navigable fresh waters of Brunswick shall be registered. Registration shall be on forms provided by the harbormaster that, at a minimum, require the following information:

- (1) Description and weight of the watercraft moored;
- (2) Type of mooring ball or buoy;
- (3) Type and weight of mooring;
- (4) Type and size of bottom and top chains.

Existing moorings: All existing moorings in the harbor, coastal, tidal and navigable fresh waters of Brunswick shall be registered within ninety (90) days of the effective date of this article. The harbormaster shall send via First Class U.S. Mail notification of the registration requirement and a copy of this article to all owners of existing moorings.

New moorings: After the effective date of this article, all moorings shall be registered prior to location of the mooring.

(b) *Placement standards.* The harbormaster shall approve the location of all moorings in the harbor, coastal, and tidal waters of Brunswick, except for existing commercial moorings in mooring fields already approved by the Army Corps of Engineers and the Maine Department of Environmental Protection. All moorings shall meet the following standards:

- (1) Moorings shall be reasonably adequate for the size, weight and windage of the watercraft.
- (2) Moorings shall be located in areas that do not interfere with navigation.
- (3) Moorings shall not encroach into the channels of Brunswick.
- (4) Moorings shall be located in areas that do not unreasonably affect natural resources.
- (5) Moorings shall not be located in areas that are inconsistent with the terms or conditions offered to, or required by, any federal, state or local agency as part of a regulatory permitting process.

All new moorings that meet the above standards but are not placed in the location approved by the harbormaster shall be moved by the owner at his or her own expense in accordance with the instructions of the harbormaster. Any existing moorings that do not meet the above standards shall be removed, repaired, replaced or relocated as applicable. In the event of the failure of the owner to comply with this subsection (b), the harbormaster shall move or remove the improperly located mooring and the cost shall be borne by the owner of the mooring.

(c) *Identifying numbers.* Identifying numbers shall be issued to mooring owners, and mooring balls and buoys must be clearly marked with the issued number. Numbers shall be a minimum of four (4) inches and visible at all times. Replacement mooring balls and buoys shall maintain the originally assigned number.
(Ord. of 4-4-05)

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**TOWN OF HARPSWELL
HARBOR AND WATERFRONT ORDINANCE
ENACTED MARCH 9, 1991
AMENDED MARCH 14, 1992
AMENDED MARCH 12, 1994 EFFECTIVE JANUARY 1, 1995 ART. 18
AMENDED MARCH 11, 1995 ART. 26
AMENDED MARCH 16, 1996 ART. 30
AMENDED MARCH 6, 1999 ART. 19
AMENDED MARCH 8, 2003 ART. 78
AMENDED MARCH 11, 2006 ART. 20**

Section 1 PURPOSE

The Town of Harpswell Harbor and Waterfront Ordinance is hereby established to regulate marine activities within the Town, to ensure the safety of its property, its inhabitants and the general public, to guarantee the availability and use of a valuable public resource, and to create a fair and equitable framework for administration of these goals.

Section 2 AUTHORITY AND ADMINISTRATION

2.1 Authority

2.1.1 This Ordinance is adopted pursuant to Home Rule Powers as provided for in Article VII-A of the Maine constitution and 30-A M.R.S.A., Chapter 187, Subchapter IV, as the same may be amended from time to time.

2.1.2 This Ordinance is also adopted pursuant to Title M.S.R.A. Subchapter I, as the same may be amended from time to time. All provisions of Title 38 M.R.S.A. Subchapter I are adopted as part of this Ordinance, except to the extent its provisions are inconsistent with the expressed terms herein.

2.1.3 This Ordinance shall be known as the Town of Harpswell Harbor and Waterfront Ordinance, and shall govern specified activities within the limits of the Town of Harpswell.

2.2 Administration

This Ordinance shall be administered by the Selectmen of the Town of Harpswell who may be assisted by a Harbor and Waterfront Committee (“the Committee”)

2.3 Severability and Separability

Should any section or provision of this Ordinance for any reason be held void and invalid it shall not affect the validity of any other section or provision.

2.4 Designations of Gender, Singular and Plural

2.4.1 Wherever the masculine gender is used herein, it shall be construed to include the feminine.

2.4.2 Wherever the singular is used herein, it shall be construed to include the plural.

Section 3 CLASSIFICATION OF WATERS

3.1 Classification

All the waters of Harpswell shall be classified by affirmative vote at a Town Meeting as either Harbors, Anchorages, or Open Coastline.

3.2 Classifications Plan

3.2.1 The classification of areas shall be recorded on a map of the Town, hereinafter referred to as the Waters Classification Plan, prepared for that purpose and maintained by the Committee. Copies of the Plan may be made from time to time and may be distributed, but the official copy shall be that maintained by the Committee. A copy of the current Plan shall be filed at the Town office and made available for viewing by the Public upon request.

3.2.2 The Classifications of Harpswell waters shall be placed on the Waters Classification Plan and adopted at a Town Meeting.

3.3 Change in Classifications

3.3.1 Requests for changes in classifications shall be presented in writing to the Committee, and the Committee shall transmit the requested change to a Town Meeting with its recommendation either for approval or rejection by those voting at such Town Meeting.

3.3.2 All classification changes must be approved by affirmative action of a Town Meeting, either at the Annual Meeting or at a Special Meeting called for that purpose.

3.3.3 A record of all adopted modifications to the Waters Classification Plan indicating the date of the change(s), the reason for the recommended change(s), and the specifics of the change(s) shall be maintained by the Committee.

Section 4 DEFINITIONS – REGULATION AND ADMINISTRATIVE PROCESS

4.1 Abandoned Moorings

A mooring in waters classified as Harbor and/or Anchorage shall be considered abandoned unless it is used by the owner or his family during the 90 day period July 1 – October 1, unless the owners notified the town in writing of his intent to not use the mooring, registers mooring in accordance with Section 5, and grants permission for the use of the mooring to-be assigned to others. Any mooring which is unused for 365 days by-the owner or his family shall be considered abandoned when the Harbormaster decides it is abandoned.

4.2 Abandoned Vessel

Any vessel which is unattended and determined by the Harbormaster to constitute a danger to navigation, or which is sinking or already sunk, or which is stranded on any property without the permission of the owner of the property.

4.3 Commercial Vessel

Any vessel used principally to generate income.

4.4 Waters of Harpswell

All waters below the ordinary high tide mark and extending seaward three miles from the shoreline of property located within the boundaries of the Town of Harpswell

4.5 Anchorage

All areas within the waters of Harpswell specifically designated as Anchorage or Special Anchorage on the Waters Classification Plan. (For use as mooring areas but have no clear Zones or buffer zones specifically designated).

4.6 Harbor

All areas within the waters of Harpswell which have been classified as Harbors on the Waters Classification Plan and which have clear zones, buffer zones, mooring locations, etc. specifically established.

4.7 Open Coastline

All areas within waters of Harpswell not defined as Anchorage or Harbors pursuant to Paragraphs 4.5 and 4.6.

4.8 Harbormaster

The person appointed to serve as such by the Board of Selectmen.

4.9 Mooring

An anchoring device not carried aboard a vessel as regular equipment.

4.10 Rental Mooring

A mooring which is leased or rented to a person other than the holder of the mooring registration.

4.11 Non-Resident

Any individual who does not maintain a legal residence within the Town of Harpswell.

4.12 Non-Resident Taxpayer

A non-resident who pays real estate taxes to the Town of Harpswell.

4.13 Resident

An individual who maintains a legal residence in the Town of Harpswell.

4.14 Riparian Owner

An owner of a parcel of land contiguous to waters in Harpswell.

4.15 Town Float

A float owned and maintained by the Town of Harpswell

4.16 Town Landing

An area of land contiguous to waters of Harpswell which is owned by the town of which is impressed with a public right of access.

4.17 Vessel

A vessel shall include boats of all sizes powered by sail, machinery or by hand; scows; dredges, and craft of any kind.

Section 5 REGISTRATION OF MOORINGS

5.1 Registration

All moorings located below low water line in waters of Harpswell shall be registered with the Town Clerk before May 1 of each year. For Moorings registered after May 1, a penalty of double the normal mooring fee will be assessed. Any applicant who completes re-registration by May 1 of any year shall be given preference for the location occupied by the registrant's mooring the prior year, unless the Harbormaster determines that a demonstrated need for that site has been shown by someone higher on the list of priorities in section 5.5.3 below. In such an event, the Harbormaster will provide a new site agreeable to the original registrant and relocate the mooring, in the same condition as at its original site, at the expense of the mooring owner taking over the old site. Determinations by the Harbormaster may be appealed to the Selectmen. In 2006 the Selectmen, at their discretion, may waive this penalty.

5.2 Registration Fees

Unless the fee amount is otherwise determined by the Selectmen, the following fees shall apply:

Personal use by resident or
non-resident taxpayer: \$12.00/Year
Personal use by non-resident: \$60.00/Year
Rental use: \$50.00/Year

5.2.1 Registration Stickers

Upon registration, the Town Clerk will issue a registration sticker showing year and number which is to be attached to the mooring float, or if this is not practical, to the port bow of the boat. In this case, the registration number is to be painted or burned on to the mooring float ("R#").

5.3 Rental Moorings

No registration of any rental mooring shall be effected without proof that an Army Corps Permit has been issued in the name of the applicant for registration; and where such application is pending, registration by the Town shall be temporary pending final Army Corps approval.

5.4 Unregistered Moorings

If any moorings in the waters of Harpswell are unregistered after May 1, the Town Clerk shall notify the owner. If registration is not completed within thirty (30) days of the date of notice, the Harbormaster may have the mooring removed at the expense of the mooring owner and a fee of \$100.00 to be paid to the Town. In 2006 the Selectmen, at their discretion, may waive this penalty.

5.5 Assignment of Mooring Space

5.5.1 Registered moorings shall be assigned locations in Harbors and Anchorages by the Harbormaster on a first-come first served basis as space permits with due regard to navigation and the safety of persons and property, and, where feasible, the prior year location, New mooring permits will not be issued for a mooring that is located more than one-half mile from the applicant's point of land access.

5.5.2 If there is insufficient space to assign allocations for all registered moorings in location requested, the applications not assigned mooring locations shall be placed on a waiting list which will be maintained by the Town Clerk, posted and available for inspection in the Town Office.

5.5.3 As space in Harbors and Anchorages of the waters of Harpswell becomes available, assignments of mooring locations shall be made from the waiting list in accordance with the terms of 38 M.R.S.A. (7-A) (2) on the basis of the date of the applicant's request and with the following priorities:

5.5.3.1 Riparian Owner with respect to a location adjacent to shoreline;

5.5.3.2 Resident Commercial Fisherman;

5.5.3.3 Resident Taxpayer;

5.5.3.4 Commercial Uses;

5.5.3.5 Resident;

5.5.3.6 Non-Resident Taxpayer;

5.5.3.7 Non-Resident.

Sale of a mooring to a second party, when a waiting list exists, shall not convey the assigned location, unless sold to the person holding the next assignment on the mooring list. The Harbormaster shall be notified of all sales in Harbors and Anchorages.

5.5.4 When any mooring with the waters of Harpswell is located such that danger to other property is inherent due to its position, the Harbormaster shall be responsible for relocating the mooring or moorings involved whenever he is notified of the danger. Such relocating shall be handled in accordance with the priority list in Section 5.5.3, and the expense shared equally by the mooring owners involved.

5.6 Removal of Abandoned Moorings

The Selectmen shall notify the owner of an abandoned mooring of his duty to remove the mooring within thirty(30) days of the date of the notice. If the mooring is not removed or re-registered within the applicable thirty (30) day period, it may be removed by the Harbormaster at the expense of the owner in accordance with the provision of 38 M.R.S.A., S 4. Nothing in this Section shall impede enforcement (Section 8.1.7) or collection of penalties (Section 8.2).

5.7 Removal of Abandoned Vessels

Except where the vessel constitutes an immediate hazard to public health, safety and welfare, the Selectmen shall notify the owner of an abandoned vessel of his duty to remove any abandoned vessel within thirty (30) days of the date of the notice. If the vessel is not removed within the applicable thirty (30) day period, it may be removed by the Harbor Master at the expense of the owner in accordance with the procedures of 38 M.R.S.A. Sec 5. Where the Selectmen determine that the abandoned vessel constitutes a threat to public health, safety and welfare, they may authorize the Harbor Master to remove the vessel immediately and without notice at the expense of the owner. Nothing in this section shall prevent the Town from enforcing Section 8.1.5 or from collecting penalties (Section 8.2).

Freeport
CHAPTER 31 COASTAL WATERS ORDINANCE

ARTICLE IV HARBORMASTER

1. The Harbormaster shall enforce all federal, state and local laws, ordinances, rules and regulations over which he or she has been given jurisdiction, including specifically, but not limited to the Coastal Waters Ordinance of the Town of Freeport and the provisions of 38 M.R.S.A., Sections 1-13.
2. The Harbormaster shall oversee the Town's moorings, floats, gangways, wharves, and channels and ensure their proper maintenance is provided for.
3. The Harbormaster shall regularly attend the Coastal Waters Commission meetings and inform the Commission of his/her activities as well as provide such available information as may be requested by the Commission for the execution of its duties.

ARTICLE V MOORING ASSIGNMENTS

1. **Registration:** Persons desiring to place moorings in the Harraseeket River anchorage shall apply for mooring assignments each year. During or before January of each year, the Harbormaster shall mail an application to each person who received a mooring assignment the previous year and in fact used this assignment for its prescribed use, and to other applicants who have asked to receive a mooring application. The completed application shall be returned to the Harbormaster by the applicant no later than March 1st of that year. Mooring Applications which are between one and seven days late will be assessed a \$50 (fifty dollar) late fee. Mooring applications which are more than seven days late will be added to the bottom of the waiting list. The burden of proof in determining residence, legitimacy of business usage, principal use of a vessel or any issues of adequacy of design or construction, shall be upon the applicant. There shall be a maximum of 350 moorings, not including flats moorings, located in the Harraseeket River anchorage. The Harbormaster shall decide on the number of moorings applicable in all Freeport tidal waters taking into consideration the concerns of area residents, the ease of access to moorings and any other applicable factors.
 - a. Persons desiring to place moorings anywhere in the anchorage of the Town of Freeport, excluding the Harraseeket River anchorage, shall complete a mooring application. Information relative to the application shall be followed as noted above in 1. Registration. This article does not apply to boats eight (8) feet or under that are not on a permanent mooring.
2. **Termination:** All persons who had been assigned a mooring the entire previous year whose mooring assignment is to be terminated by the Harbormaster for reasons of non-compliance with the Coastal Waters Ordinance or any other reason shall receive written notification from the Harbormaster no later than January 31. This notice shall state the fact of termination and the reason for termination, and inform the applicant of his/her right to appeal the decision of the Harbormaster to the Coastal Waters Commission as prescribed in Article XI below.

MER Assessment Corporation

- 3. Mooring Assignment Application:** Each application shall contain the following:
- (a) The applicant's name (or applicants' names in the event the mooring assignment is to be held jointly by spouses), complete address, home telephone number, place of employment and work telephone number;
 - (b) The boat name, State or Federal registration number, the vessel identification number, the engine number, name and address of boat owner(s);
 - (c) The type of boat, i.e. sail, power, inboard or outboard;
 - (d) Length of boat and hull configuration, i.e. deep keel, shallow draft;
 - (e) If the boat is less than twenty feet (20') in length, the type of mooring desired, temporary or permanent;
 - (f) Name, address and telephone number of person who will set, service and inspect the mooring;
 - (g) The signature of the applicant and date of application;
 - (h) Payment of the appropriate fee.
 - (i) A signed consent from the applicant attached to the application allowing the Harbormaster, at any time the boat is occupied, to board and inspect any tanks, valves, pumps and lines, including but not limited to, "Y" valves and electric systems such as Electra San, to insure such tanks, valves, systems, etc. are not set in a position that would allow the discharge of sanitary wastes into a Freeport anchorage.

4. Fees: In addition to the following fees, a \$2.00 (two dollar) per foot of boat length over all fee (LOA) shall be paid for all boats on moorings in the Harraseeket River anchorage of the Town of Freeport. Slips located in the Harraseeket River anchorage shall be charged a registration fee of twenty dollars (\$20.00) per slip.

All skiffs/dinghies on the town floats must be registered with the Town of Freeport each season and the owner must pay a \$45.00 yearly fee to the Town of Freeport.

1) Resident Commercial Fisherman	\$95.00
2) Resident/Recreational in the Harraseeket River anchorage.....	\$ 80.00
3) Resident Commercial Marine Enterprise.....	\$350.00
4) Non-Resident Commercial Fisherman.....	\$350.00
5) Non-Resident Commercial Marine Enterprise.....	\$350.00
6) Non-Resident Recreational.....	\$350.00

MER Assessment Corporation

7) Marina.....	\$165.00
8) Yacht Club.....	\$
80.00	
9) Commercial Passenger Boat.....	\$140.00
10) Resident Subsequent (more than one per household)	\$210.00
11) Non-Resident Subsequent (more than one per household).....	\$350.00

The Coastal Waters Commission shall review fees at least once every two years and may make recommendations for adjustments to the Town Council.

5. Mooring Assignment: All persons who received and used a mooring assignment in the previous year, and whose mooring application was received in a complete and timely fashion, will receive a mooring assignment for the current year on March 15 of that year, unless a delay is announced due to a change in law, environment, etc. After March 16 the Harbormaster will award any remaining mooring assignments to persons who have been on the waiting list. The Harbormaster and the Coastal Waters Commission will maintain a balance of not less than ten percent (10%) non-resident mooring assignments. At all times the following priority order shall be maintained:

- (1) Resident Commercial Fisherman;
- (2) Resident/Recreational;
- (3) Commercial Passenger Boat
- (4) Resident Commercial Marine Enterprise;
- (5) Non-Resident Commercial Fisherman;
- (6) Non-Resident Commercial Marine Enterprise;
- (7) Non-Resident Recreational;
- (8) Resident Subsequent;
- (9) Non-Resident Subsequent.

In any one year not more than 25% of new mooring assignments shall be assigned to non-recreational applicants.

6. Waiting List: The Harbormaster shall maintain one chronological waiting list with complete application information of all applicants who have applied for but not received a mooring assignment. Persons desiring a place on the waiting list may apply at any time by making out a mooring application form and filing it with the Harbormaster. The list shall be in eight sections, each section in chronological order as to when the application was received with recreational applications being limited to natural persons:

- (1) Resident Commercial Fisherman;
- (2) Resident/Recreational;
- (3) Resident Commercial Marine Enterprise;
- (4) Non-Resident Commercial Fisherman;
- (5) Non-Resident Commercial Marine Enterprise;

- (6) Non-Resident Recreational;
- (7) Resident Subsequent;
- (8) Non-Resident Subsequent.

A copy of this waiting list, composed of all information required in Article 5 Section 3 of this Ordinance, shall be posted in the Town Office and shall be provided to all members of the Coastal Waters Commission, and made available for any Commercial Marine Enterprise or any others who request a copy.

7. Numbers:

(a) Marinas shall be assigned a total of not more than 15 mooring assignments each. These may not be located in the Commercial zone without approval by the Harbormaster. If any of these moorings shall be rented they shall be considered rental moorings.

(b) Yacht Clubs in existence as of January 1, 1999 shall be allowed not more than 4 (four) mooring assignments each.

(c) All other categories listed in Article V.5 (I)-(II) may apply for one mooring assignment each. Applicants desiring more than one mooring assignment must apply to the Coastal Waters Commission and prove need.

8. Leasing: All mooring assignments (with the exception of Marina Rental Moorings) shall be used exclusively for the personal use of the applicant solely for the boat listed in the application. No leasing, subleasing, or assignment of moorings or mooring numbers shall be allowed.

9. Abandonment of Assignment: The Harbormaster shall deem abandoned any mooring assignments substantially unused by the applicant for his/her vessel for a period of more than one season. Subsequent application for a mooring number assignment by that person must be in accordance with the procedure outlined for new applications, including placement in chronological sequence on the waiting list.

10. Placement: The Harbormaster shall develop a plan for the placement of moorings in the Harraseeket River anchorage. He/she shall annually assign locations to each mooring and ensure placement in the correct location. All moorings not located in the correct location shall be moved by the owner at his/her own expense in accordance with the instructions of the Harbormaster. In the event of the failure of the owner to comply with these instructions, the Harbormaster shall move or remove the improperly located mooring and the cost shall be borne by the owner of the relocated mooring. Resident commercial fishing vessel owners who request a place in the Commercial zone shall have their moorings assigned there by the Harbormaster as soon as possible.

11. Construction:

(a) After April 1, 1987, all moorings in the Harraseeket River anchorage for boats in excess of 20 feet shall be permanent moorings.

(b) Boats under 20 feet in length may be placed upon temporary moorings.

(c) All mooring construction and placement, in the Harraseeket River anchorage of the Town of Freeport, must be approved by the Harbormaster.

12. Construction Standards in the Harraseeket River Anchorage: The mooring owner is responsible for the adequacy of all mooring gear, tackle and maintenance.

(a) All permanent moorings shall comply with the following minimum specifications throughout the anchorage.

(1) Each permanent mooring shall consist of a granite block or helix with heavy steel bottom chain attached to a lighter top chain, mooring buoy and a nylon pennant. Nylon or synthetic material as approved by the Harbormaster, may be substituted for the top chain.

(2) All granite blocks shall be constructed of solid granite with steel staples or eyebolt extending completely through the block. Cement blocks, old engines and other miscellaneous weighted objects are unacceptable as mooring anchors in the harbor.

(3) The mooring scope shall be approximately two times the water depth at maximum high water. Total scope shall include bottom chain and top chain together, each of which shall consist of approximately half the total length.

(4) Each mooring must have at least one swivel, which must be placed above the top chain. All swivels and shackles must be larger than the chain diameter. All shackles and swivel pins shall be properly seized. All eyes in the nylon rode shall be fitted with appropriate size thimbles. Pennants connecting the mooring buoy to the moored boat shall be fastened to the lower eye of the mooring buoy and shall consist of nylon line equal to 1 1/2 to 2 times the freeboard at the bow of the boat.

(5) Mooring tackle shall meet the following minimum:

Up to 20' As approved by the Harbormaster.

Registered Boat length (ft)	Granite Block(lb)	Bottom Chain	Chain/Top Rode	Nylon
20 - 25	2000	1/2	3/8	5/8
25 - 35	2500	1/2	3/8	5/8
35 - 40	3000	3/4	1/2	3/4
40 +	As approved by the Harbormaster			

(6) Standards for helix moorings are the same as for other types.

(7) Despite dimension standards established herein, any part of a mooring showing excessive wear or any mooring or gear, which does not meet with the Harbormaster's approval, shall not be permitted.

(8) All moorings shall be white in color with a blue horizontal stripe, be at least 18 inches in diameter, and show 2/3 above the water at all times. This device will be marked with owner's name and permit number in a manageable and legible manner.

(9) All moorings shall be of appropriate size and design for the largest size boat likely to be placed thereon.

(10) Wire cable will not be allowed in the anchorage.

(11) Old discarded moorings, mooring chain and related items must be removed from the anchorage.

(b) Temporary Moorings:

(1) The design and construction of all temporary moorings shall be approved by the Harbormaster prior to placement in the water and shall be of either mushroom or Dor-Mor construction.

(2) Hand mixed cement blocks, old engines, and other miscellaneous weighted objects are unacceptable as mooring anchors in the harbor.

(c) Winter:

(1) Wooden spars and hard plastic net buoys may not be used in the Harraseeket River anchorage. Floating rope may be used, but must be counterweighted to prevent excess rope from floating on the surface. Temporary winter mooring items must be approved by the Harbormaster and may not be set before October 15 and must be removed by May 1 each year. Winter hardware remaining in the water after May 1 shall be removed by the Harbormaster at the expense of the owner and an appropriate fine levied in accordance with Article X, Item 3.

(2) Pennants must be removed no later than 21 December.

13. Setting:

(a) No temporary mooring shall be set before sunrise on the first working day in April without the express consent of the Harbormaster.

(b) If the applicant who has received a mooring assignment disposes of the boat on that mooring, he or she shall notify the Harbormaster whether the boat will be replaced or the mooring is no longer needed.

14. Inspection:

(a) The Harbormaster or his appointed deputy shall inspect and approve or be otherwise satisfied that each mooring is in safe condition before it is placed in the anchorage.

(b) Every second year permanent moorings in the Harraseeket River anchorage shall be inspected at the owner's expense and a report submitted to the Harbormaster. The Harbormaster has the authority to require any necessary maintenance or replacement of parts or the whole mooring, tackle and/or gear.

(c) The Harbormaster shall maintain a file on each mooring, listing the date of the last inspection and the name of the person who last inspected it.

15. Anchoring:

(a) Boats may anchor only in those areas and for the length of time permitted in writing by the Harbormaster.

(b) The owner or operator of a boat desiring to anchor must provide a signed consent allowing the Harbormaster, at any time the boat is occupied, to board and inspect any tanks, valves, pumps and lines, including, but not limited to “Y” valves and electric systems such as Electra San, to insure such tanks, valves, systems, etc. are not set in a position that would allow the discharge of sanitary wastes into a Freeport anchorage.

16. Other Floating Objects: No mooring in this harbor shall be utilized to secure any floating object other than a single boat without express written permission of the Coastal Waters Commission. The term "boat" as used in this subsection shall include mooring derricks.

(a) Houseboats whether temporary or permanent are prohibited from mooring or anchoring in the Coastal Waters of the Town of Freeport except at marinas, which provide the following:

- 1) A permanent float, dock or slip from which the houseboat may be directly boarded from land;
- 2) Connection to a public water supply by means of an individual anti-back flow valve;
- 3) A sewer connection to a public sewage system;
- 4) A year-round, all weather supply of electricity;
- 5) Parking as required by the codes and ordinances of the Town of Freeport;

(b) All lobster floats in the Harraseeket River shall be subject to the approval of the Harbormaster. Maximum size float size will be 640 Square feet and will required to have no less than 2 moorings, one fore and aft. Mooring weight and tackle will be determined by the minimum mooring requirements. If boats are tied to these floats, then the mooring requirements will be greater than the minimum standards as determined by the Harbormaster.

17. Flats mooring: Vessels drawing less than six inches unladen, and other vessels with the express permission of the Harbormaster, may utilize a flats mooring. Flats moorings shall be located and built of such construction as the Harbormaster may approve. They shall be marked by some system to be determined by the Harbormaster so as to be readily identifiable by him. These moorings shall not be included within the 350 mooring limitation contained in Article V, Section 1 above.

18. Ownership: Nothing in this Chapter conveys any property rights in a mooring assignment in the Harraseeket River anchorage. A transfer of a commercial mooring may be made to family members by request at the death of the person holding the mooring. If unassigned, the mooring assignment reverts to the town and shall be assigned to the next eligible person. If a case should arise where a person holding a resident/recreational mooring assignment requests a change to commercial, and then requests a change back to resident/recreational, the request shall be granted. A husband and wife may hold any mooring in common.

19. **Residency Status and Fees:** If a person who holds a valid mooring assignment changes residency status, whether from resident to non-resident or from non-resident to resident, he/she is expected to notify the Harbormaster immediately. In the case of change from resident to non-resident, the Harbormaster will make a determination about fee increase. In the case of non-resident to resident, there will be no remission of fees. Failure to accurately report resident or non-resident status will be considered fraud, and will be subject to penalties under Article X of this ordinance as well as immediate forfeiture of the mooring assignment after notice and hearing.

Appendix VI

Letter from Towns of Brunswick Harbor Master January 25, 2008

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Town of Brunswick, Maine

INCORPORATED 1739

Harbor Master

28 FEDERAL STREET BRUNSWICK, MAINE 04011-1581
TELEPHONE (207) 725-6631 FAX (207) 725-6663

VANESSA LEVESQUE
Natural Resource Planner

DANIEL DEVEREAUX
Marine Resource Warden /
Harbor Master

January 25, 2008

MER Assessment
Chris Heinig
14 Industrial Parkway
Brunswick, Maine 04011

RE: Feasibility Study

Mr. Chris Heinig,

I'm contacting you as a result of a meeting we had on January 23, 2008 at MER Headquarters. In that meeting you mentioned that MER is currently working on a feasibility study regarding eelgrass mitigation opportunities in the northwestern portions of Casco Bay, much of which lies within Town of Brunswick's jurisdiction.

As you are aware I have been the Brunswick Marine Resource Officer for the last 10 years and within the last year have taken on the additional role of Harbor Master. Over the course of my tenure here I have witnessed increased coverage of eelgrass in Maquoit and Middle Bay as well as the New Meadows River. With this being said and based on my local knowledge and experience there are limited opportunities to conduct eelgrass mitigation, particularly in this portion of Casco Bay.

In 2000 I assisted in a study conducted by USGS, Patuxent Wildlife Research Center, Maine Department of Marine Resources, and the University New Hampshire. This study looked at the effects of mussel dragging in eelgrass meadows. During that time it was determined that the vast majority of eelgrass destruction was coming from commercial mussel draggers. Since then we have established gentlemen agreements with commercial draggers and I have witnessed no dragging activities in these areas.

MER, Brunswick Harbor Master Office, and the Department of Inland Fish and Wildlife have worked diligently over the past year trying to find opportunities for mitigation for the newly constructed Merepoint Boat Launch. As you are aware we did locate some opportunity, through the replacement and relocation of moorings, however, this in and of itself has proved challenging for many reasons.

Mooring owners have been reluctant to agree to switch to an embedment anchor (helix), which supports eelgrass and allows the vessel to remain in the same location. This in part is due to the lack of historical holding information on the fairly new embedment and elastic rigging. These same mooring owners also have been unenthusiastic to relocate deeper location based solely on the concept that the block and chain style mooring is causing negative impacts to eelgrass meadows, especially when both bays currently support some of the most prolific eelgrass meadows in New England. It should be

MER Assessment, Chris Heinig
January 25th, 2008 (Page 2)
Brunswick Harbor Masters Office

noted that vast majority of the existing moorings, including many of Paul's Marina Army Corp of Engineers permitted moorings are situated in eelgrass meadows.

This office has serious concern that moving existing mooring holder's farther out into the bays (beyond the eelgrass habitat) could present public safety issues. Locating any mooring further from land causes mooring owners to row/motor excessive distances to reach the moored vessel. There are also navigational concerns, as moorings are moved further out they begin to encroach on our deep water navigable channels that are continually being used more by boaters.

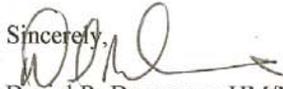
During the initial planning stages of the Merepoint Boat Launch I was involved in locating areas for mitigation. During that time the removal of the old peer structure located of Simpson's Point Boat Launch in Middle Bay was considered. I remained convinced that this mitigation opportunity remains the most practicable and feasible opportunity that exists.

As a Harbor Master I'm charged with not only promoting and ensuring the health of the Bay's within our jurisdiction but even more importantly the safety of those citizens using these Bays. As MER moves forward with this study I request that you seriously consider the severity and the constraints prior to determining mooring replacement and/or relocation as major mitigation alternative. Moorings that are currently placed in the jurisdictional waters of Brunswick come under the direct authority of this office and we are reluctant to force a replacement or relocation of an existing and established mooring based solely on the effects that the mooring may or may not present to the surrounding eelgrass.

Please be advised that any new moorings situated along our coastline are approved through the Harbor Master Office. We have begun to closely scrutinize all new moorings to ensure that they do not present any negative environmental or navigational impacts.

We look forward to working with MER in the future on any mitigation efforts conducted within Brunswick's jurisdiction. If you have any questions please feel free to contact me.

Sincerely,


Daniel R. Devereaux HM/MRO
Brunswick Police Department
Harbor Master/Marine Resources