

## **1.0 INTRODUCTION**

The U.S. Army Corps of Engineers (USACOE) is planning to perform maintenance dredging in Portland Harbor beginning in November 1998. As part of this process, the Corps is preparing an Environmental Assessment consistent with the National Environmental Policy Act (NEPA). The State has jurisdiction over maintenance dredging projects undertaken by the USACOE pursuant to Section 307(c)(1) of the federal Coastal Zone Management Act (CZMA), 33 U.S.C. sec. 1456(c)(1) and Section 401 of the federal Clean Water Act (CWA), U.S.C. sec. 1341. Section 307 (c)(1) of the CZMA provides in effect that the USACOE maintenance dredging projects must be consistent to the maximum extent practicable with State environmental laws approved by the National Oceanic and Atmospheric Administration as enforceable policies, or core laws, of the Maine Coastal Program. The core laws applicable to maintenance dredging include the Natural Resources Protection Act (38 M.R.S.A. sec. 480-A et seq.) and the State's wetland protection rules (Maine Department of Environmental Protection rules Chapter 310), as well as applicable State water quality standards (38 M.R.S.A. sec. 465-B). Subtidal habitats are coastal wetlands for the purposes of Chapter 310 rules. 38 M.R.S.A. sec. 480-C provides that a maintenance dredging activity may not unreasonably harm estuarine or marine fisheries habitat. Section 401 of the CWA provides that USACOE maintenance dredging and disposal activities must meet applicable State water quality standards. The State may condition its 401 certification. 38 M.R.S.A. sec. 480-D, subsection 9, as amended, provides that "the Commissioner of Marine Resources shall provide the Department {DEP} with an assessment of the impacts on the fishing industry of a proposed dredging operation in the coastal wetlands. The assessment must consider impacts to the area to be dredged and impacts to the fishing industry of a proposed route to transport dredge spoils to an ocean disposal site". Historically, the Department of Marine Resources (MDMR) has used a working guideline threshold value of 0.1 lobsters/m<sup>2</sup> as an indicator of important lobster habitat. Compensation for unavoidable wetland losses under the wetland protection rules (sec. 480-Z) includes restoration, enhancement, creation, or preservation of wetlands that have functions or values similar to wetlands impacted by the activity.

The Portland Harbor Dredging Committee, consisting of stakeholders in the project and representatives of state and federal permitting agencies, has been actively facilitating the dredging process. A Technical Subcommittee was formed to review and evaluate technical issues as they arose. As Portland Harbor has an active lobster fishery, a special Lobster Work Group was formed to examine fishery issues as they relate to the dredging project. In view of potential effects to the lobster population, MER Assessment Corporation was asked to conduct video surveys and determine lobster densities in areas proposed for dredging. MER Assessment Corporation's assessment of the winter-resident lobster population in the areas proposed for dredging indicate that lobster densities exceeded DMR guidelines at that time of year. MER was therefore tasked with the development of a proposed mitigation and compensation plan to be included in the Corps' Environmental Assessment and federal consistency determination for consideration by the State in making its water quality and costal zone management certification decisions. This document describes the proposed mitigation and compensation plan, as well as the process by which it was developed.

## **2.0 METHODS**

The Lobster Working Group was formed to identify and evaluate a number of alternatives to avoid and reduce dredging impacts to the lobster population in Portland Harbor. The Working Group discussed a variety of options and through a consensus process identified the following opportunities to avoid and minimize adverse effects on the lobster fishery:

1. Reduce the dredge depth,
2. Leave the most contaminated sediments in place,
3. Restrict dredging to the time of year least likely to adversely affect lobsters,
4. Sequence dredging activities in the Harbor to coincide with suspected lobster movements,
5. Avoid dredging the densely populated "side slope" areas, and
6. Lobster relocation.

Employment of these mitigation measures would still not completely avoid adverse effects to the lobster fishery. The Working Group is therefore considering and evaluating several compensation options including a lobster relocation effort, the possibility of habitat enhancement, and v-notch female stocking.

MER Assessment Corporation, assisted by Normandeau Associates, was asked to explore these mitigation alternatives, assess their feasibility, and determine likely costs. We undertook this investigation by literature review and discussion with experts in lobster biology (both academics and fishermen). We met with MDMR to fully understand their guidelines and goals for mitigation and asked other state and federal marine resource agencies including the Massachusetts Division of Marine Fisheries (MDMF), Rhode Island Department of Environmental Management (RIDEM), National Marine Fisheries Service (NMFS), and New Hampshire Fish and Game (NHFG) about their policy and approach to mitigation for lobster resources. We met with local lobster fishermen on June 9, 1998 and again during the MDMR public hearing on June 16, 1998, to solicit input on the feasibility of several compensation options.

### **3.0 RESULTS**

The literature search to-date, although far from exhaustive, has provided considerable information on lobster behavior but only limited information on habitat loss mitigation or compensation. Most of the information on mitigation and past efforts has come through interviews and personal communications.

Our meeting with Dr. Linda Mercer, Directory of MDMR's Boothbay Harbor Laboratory, established that the goal of MDMR's mitigation guideline is to minimize adverse impacts to the lobster resource to the extent practicable. It is understood that zero mortality is not practicable. MDMR has undertaken compensation for dredging impacts to lobsters in the form of relocation in the past. According to Sterl and Schick (1976), in 1976, a maintenance dredging project in Cape Porpoise was halted when it was determined that lobster densities exceeded  $0.1/m^2$ . In order to

avoid excessive impact to the lobster population, MDMR carried out a lobster relocation effort using both trapping and SCUBA diving methods for a period of 9 days. The relocation effort was continued until lobster densities decreased and trapping no longer yielded large numbers of lobsters.

Other states were queried about their policy for mitigation of fishery resources, particularly lobsters. Tom Angell, RIDEM, indicated that compensation for lobster losses resulting from the 1997 North Cape oil spill will take the form of release of legal-sized females. Mitigation for loss of cobble habitat resulting from Boston's Central Artery Project will take the form of an artificial reef according to Bruce Estrella, MDMF and Eric Hutchins, NMFS. Massachusetts uses relocation as a means to compensate for impacts to shellfish resources, specifically clams, but has not used it for lobsters. Bruce Smith, NHFG, was unaware of compensation efforts for lobsters in that state. Although none of the agency representatives we spoke to had implemented a compensation plan for lobsters, all indicated they would be watching the Portland Harbor dredge project closely.

Meetings with the lobstermen were fruitful in the evaluation of the feasibility of mitigation options. There was consensus that timing and sequencing were good ideas, especially if geared towards the known lobster habits in Portland Harbor. All agreed that relocation was also a good idea and believed it would result in reduced impacts to the resident population. Furthermore, there was willingness among the fishers to support and participate in the relocation program.

### **4.0 PROPOSED MITIGATION PLAN**

#### **4.1 AVOIDANCE AND MINIMIZATION**

**4.1.1. Reduced dredging depth:** Originally, the community wished to deepen Portland Harbor to 45 feet (MLW) in order to accommodate larger vessels. This would have resulted in a far more extensive project, requiring dredging of the entire channel. For a number of reasons, deepening was determined to be not feasible and reduced to maintenance dredging, removal of all material in shoal areas with depth less than

the 35 feet, approximately 800,000 cy. Under the new, reduced plan, approximately 30% of the channel will be dredged, leaving the remainder non-dredged areas exposed to only indirect dredging effects. The non-dredged areas offer a potential refuge for lobsters to inhabit during and after dredging.

**4.1.2. Avoidance, dredging contaminated sediments:** Portland Harbor sediments have undergone an extensive evaluation for the suitability for ocean disposal. Bulk chemical analysis, coupled with biological testing, indicated all sediments with the exception of one area near Bug Light (named area "BB") could be disposed at the Portland disposal site without adverse impacts to natural resources. The potential for risk to marine organisms from dredging Area "BB", assuming upland disposal, would be further reduced by leaving Area BB in place. Although the U.S. Coast Guard has specifically requested its removal, dredging this area is not *essential* for safe navigation and passage into the harbor, it was decided not to dredge Area BB.

**4.1.3. Time of year restrictions:** The timing of dredging is critical to minimize adverse effects to the lobster fishery. Lobster fishing takes place year-round in the Fore River, however, Cumberland County landings from 1995-1997 show a decrease in catch beginning anywhere between August (1995) and November (1996, 1997), reaching its lowest point from December through May. Landings have extended later into the season over the last three years. The exact reasons for this are not clear and it is further unclear whether this trend will continue in 1998. It was originally estimated that dredging would take 10 months to complete, thus requiring a two-year period if the peak lobster fishing season was to be avoided. However, the USACOE has agreed to attempt to confine operations to a six-month period, specifically November 1 - April 30. This is an aggressive schedule, particularly considering weather constraints. Fishermen favor even further delay of the start-up until December, but this approach risks extending the dredging into spring if delays are encountered. According to the data collected to-date, impacts to the Portland Harbor lobster population will be substantially minimized by restricting dredging activities to the period November 1 through April 30 when lobster densities are lowest. This time of year restriction can be ensured if it is included as a condition of the NRPA permit. Further contractual incentives/disincentives for the dredge operator might also be provided by the Corps to ensure timely completion of the project.

**4.1.4. Sequential dredging:** The potential for adverse effects from dredged material disposal could be further reduced by sequential dredging and disposal, which would allow for the "cleanest" sediments to be the final cover at the Portland Disposal site, covering less clean materials. Sequential dredging would also reduce potential impacts to lobsters because seasonal movements begin first in the upstream areas, west of the Casco Bay Bridge, where waters cool more quickly because of the shallow depths. As migration proceeds, the lobsters move further downstream into deeper areas. According to local fishermen the areas west of the Casco Bay Bridge, already shown to have lower lobster densities during winter months, are also the first areas to experience early Fall migrations. Fishermen also report that migrants leave along the southern, South Portland, side of the harbor.

The plan presented here calls for sequential dredging to follow normal seasonal lobster movements so that dredging occurs, at least in theory, in areas where migrants have already left in the Fall and prior to their return in Spring. Specifically, dredging is to start on November 15, 1998 at Site #7 (MER Dredge Site Chart), then proceed to Sites #5, #6, #8, #9, #9A, #10, and finally back to #4 adjacent to the Casco Bay Bridge. However, on or about January 1, 1999, regardless of level of completion of sites west of the Casco Bay Bridge, dredge operations will be moved to Site #1, the easternmost dredge area at the entrance to the Fore River. Upon completion of Site #1 dredging will proceed westward towards the Casco Bay Bridge to Site #2, then Site #3, with all sites east of the Casco Bay Bridge to be completed on or prior to April 1, 1999. On or about April 1, 1999 dredge operations will be moved west of the Casco Bay Bridge to resume dredging where left off on or about January 1, 1999. All dredging should be completed by April 30, 1999.

Either the timing of dredging or the sequencing of sites to be dredged alone would be expected to reduce impacts to the lobster population, but it is hoped that substantial reduction of impacts will be achieved by combining these two options.

**4.1.5. Avoidance, side slope areas:** The recent survey of lobsters in Portland Harbor (MER Assessment Corp., 1998) showed that lobster burrows are concentrated along the side slopes of the portions of the existing channel. These areas of highest lobster density should be avoided by the dredging contractor, further reducing impacts to the lobster population. Specific reference to such avoidance should be included in the specifications of the dredge contract.

#### **4.1.6. Pre-dredge lobster relocation:**

4.1.6.1. Pre-relocation/pre-dredge survey: The MER Assessment surveys provided information on the winter-resident lobster population, but it is expected that, at the start of dredging in November, the population will be considerably larger. The pre-dredge/pre-relocation survey would, therefore, have two goals: first, to determine the areas that exceed the 0.1 m<sup>2</sup> density guideline and second, to establish a baseline for comparison following dredging. As the first project of this scope, it is vitally important to determine the effectiveness of the relocation effort. We envision that the survey would begin in mid-October when the first relocation efforts are expected to begin, just before initiation of dredging. Survey would also precede each of the individual dredging events at the 11 locations along the harbor. The methodology (video and burrow occupancy survey) would be identical to that used in the March/April survey.

4.1.6.2. Trapping program: When developing this plan, we considered both diver relocation and a trapping program. Given the relatively high population density and large area, plus the difficulty of diver recovery given the muddy substrate and consequent poor visibility, it was decided that a trapping program would be more efficient and effective. The MER-generated carapace length (CL) distribution for the winter-resident Fore River lobsters, particularly when compared to the MDMR trapping study, suggests that conventional traps with disabled vents would not capture the breadth of size ranges of lobsters in Portland Harbor. We therefore recommend construction of *shrimp wire* traps without vents in order to ensure that lobsters as small as 28 mm CL are captured for relocation. These traps could become the property of a resource agency, non-governmental agency, or academic institution and thus be used for other studies and/or similar, future mitigation efforts. Discussions with lobstermen indicated that 100-150 traps could be fished on a rotating three-night set basis, that is, 33-50 traps would be fished each day. This would be a manageable number of traps to fish and could readily be relocated for maximum effectiveness. It is likely that the fishermen may request compensation for the extra effort. The timing of the trapping program is critical; it should be late enough to avoid relocating migrants on their way out of the harbor but early enough to ensure lobsters are still catchable. Some of the details of the trapping program will need to be worked out later, with flexibility necessary to accommodate the dredging schedule, weather conditions, and the unpredictable nature of the fishery. The other aspect of trapping yet to be determined is the level of effort: ideas include a fixed time period, episodic trapping in each area immediately prior to dredging, or continual trapping until the catch is reduced to a fixed percentage of the original catch indicating that most of the individuals that could be caught have indeed been caught

4.1.6.3. Relocation: Handling is another critical aspect of the relocation effort. As relocation will take place over the winter months, precautions will need to be taken to minimize lobster mortality during trapping and handling. Care must be taken to minimize hypothermic injury or mortality from cold winter air when transferring lobster from the water. The lobsters could be kept individually in small containers if immediate relocation will take place. Alternatively, lobsters could be placed in crates with seaweed and stored in temporary holding tanks for later relocation. The Marine Patrol Division of DMR has indicated a willingness to transport lobsters. DMR's Marine Patrol participation would serve to lessen the complications involved with multiple vessels engaged in transporting large numbers of sub-legal lobsters and would increase the reliability of proper relocation site location. Less schedule coordination with Marine Patrol would be required if lobster could be temporarily housed until transport, as long as a nearby holding tank is available. A project coordinator may be necessary to manage the trapping, handling, and relocation efforts to ensure that all aspects of the effort are synchronized.

The relocation site(s) has yet to be determined. Lobster fishermen indicated that several sites inside the harbor, but outside the Fore River, would be preferable. Outer harbor sites near Long, Cushing, and House Islands were mentioned as possibilities. Known scalloping areas should be avoided.

MDMR suggests that sites with similar substrate be selected to minimize the "adjustment process". Other researchers have suggested relocating lobsters to preferred substrate, that is harder, cobble bottom to avoid increased competition in less suitable, mud-bottom habitats. A combination of substrate types may be most effective. In any case, a quick density survey, both before and after the relocation effort, would assist in assessing the relocation effort impact on the receiving site(s).

4.1.6.4. Post-relocation/immediately pre-dredge survey: Given the extent of the effort that will be required by the relocation project, post-relocation surveys should be conducted at each site following the individual site relocation effort and immediately before dredging is to be begin, first, to evaluate the effectiveness of the relocation effort by comparing pre- and post-relocation population densities, and second, to determine the extent of the lobster population remaining "in harms way" following the relocation effort. The methodology (video and burrow occupancy survey) would be identical to that used in the March/April survey.

## 4.2 COMPENSATION/FOLLOW-UP STUDIES

Even if all of the avoidance and minimization measures are employed in the Portland Harbor maintenance dredging project, there will still be unavoidable losses to the lobster population. The Lobster Working Group felt that compensation should be undertaken to reduce impacts to this important fishery. The compensation plan would have the following components:

- Task 1. Summer survey
- Task 2. Follow-up studies

**4.2.1. Summer survey**: Historically, lobster migrants return to Portland Harbor in May or June, as indicated by increased catches of hard shells. By mid-June, migrants have returned and are beginning the molting process, which results in decreased catches. A density survey in July would estimate the population densities at their peak and allow comparison between these peak values and those observed during the March/April surveys. Furthermore, a summer survey in 1998 could be used as the pre-dredge baseline against which to compare any future summer post-dredge survey results to determine the rate of resource recovery following dredging. It is important that identical methodologies be used in these summer surveys as were used in the March/April surveys (*i.e.* video survey and occupancy estimation) to allow direct comparison of results.

**4.2.2. Follow-up studies**: Follow-up studies are key in order to determine the effectiveness of the compensation. Pre- and Post-dredging/relocation studies will enable us to assess the recolonization of Portland Harbor. However, only a tagging study will allow us to determine whether relocated lobsters migrate back to Portland Harbor following dredging. We recommend using both a temporary (which do not survive the molting process) and permanent tag (an internal tag with a longer lifespan). The tags would need to carry a tracking number and phone number or address for reporting. Posters and advertising are necessary for a successful program, and a reward would increase the response rate. The number of tags needed will depend on the number of lobsters relocated and the estimated rate of recovery, neither of which have been determined.

A Post-dredge/Post relocation survey is recommended in July following completion of dredging. By June, new migrants will be returning to Portland Harbor, and density levels will indicate whether they return to newly-dredged areas. Recovery will likely take a period of years, so additional surveys (either in March/April and/or July, to allow comparison with previous surveys) may be required to adequately assess recolonization success. Consistent methodology with previous surveys should be used.

A census program would also allow an assessment of the recovery of the commercial fishery. Selected Fore River lobster fishermen could be asked to record their daily or weekly catches in 1998 and in the years following dredging. These records could be submitted anonymously for review and comparison. All data should be reported to and compiled by the DMR. Clearly, if a census effort is to be undertaken, to be successful, it must begin immediately.

#### 4.3 OTHER COMPENSATION OPTIONS

Several other compensation options have been evaluated and could be added to the compensation plan:

**4.3.1. Placement/creation of artificial habitat:** The introduction of artificial habitat has been utilized elsewhere in New England to compensate for lobster losses. The theory is that addition of rock substrate (rubble, cement blocks, other structures) enhances the carrying capacity of the existing habitat. However, placement of artificial substrate would result in the loss of existing habitat, which in Portland Harbor is relatively productive. Second, this method is employed when there is a shortage of cobble or rock substrate, which is the preferred habitat of the early benthic phase. This habitat does *not* appear to be a limiting factor to the lobster population in Casco Bay, thus lessening the appeal for the habitat enhancement option.

**4.3.2. Introduction of V-notched females:** Surprisingly, the introduction of V-notched reproductive female lobsters was not endorsed by the lobstermen, for, in the past, such introductions have resulted in catch reduction since hard-shelled v-notched females are readily trapped and dissuade other, legal, lobsters from entering the traps. In addition, and perhaps more important, a direct, or even indirect, linkage between larval production and legal-sized lobsters in Portland Harbor is tenuous. While it is generally agreed that enhancement of reproductive potential is normally a good practice, given the 3-4 week length of the lobster larval period and the tidal amplitude and currents experienced in the Gulf of Maine, and Casco Bay specifically, any benefit derived from such an effort would be spread over a wide geographic area. Consequently, any effort that would yield in detectable beneficial results would need to be massive.

**4.3.3. Post-dredge restocking of lobsters into the Fore River:** The possibility of restocking lobsters to the Fore River after dredging has also been evaluated. There is considerable uncertainty regarding the fate of relocated lobsters, i.e. will they survive the relocation effort, compete effectively once relocated, choose to permanently reside at the relocation site, etc. Some of the fishermen believe that, at least some, relocated lobsters will eventually return to their point of origin, so that the additional effort is not warranted. Furthermore, there may be insufficient food resources available immediately following dredging to support additional lobsters, so that premature reintroduction of lobsters might be ill-advised.

#### 5.0 ESTIMATED COSTS

Estimated costs for the dive work, relocation effort, and certain follow-up studies are included in Appendix A. As with the mitigation plan, every effort has been made to prepare a comprehensive and effective, yet realistic, budget. However, much of the work proposed in the plan has never before been undertaken, at least at the scale proposed here, and it is consequently difficult to determine exact costs. We have therefore included all proposed aspects of the plan, some of which may be eliminated later. Further, the trapping effort associated with the lobster relocation project has been budgeted liberally and assumes daily trapping to begin 30 days prior to initiation of dredging and to continue throughout the entire dredge period. Cost of long-term tags for a tagging effort have been included under the Lobster Relocation section of the budget. While the labor cost of tagging lobsters has been included under "Lobster handler", the costs associated with future information collection, analysis and reporting has not been included here since such a study appears to be beyond the scope of the mitigation/compensation plan. Funding for these aspects of the tagging study will have to be identified relatively soon since information collection should begin shortly after the lobsters are relocated.

## **6.0 SUMMARY**

The USACOE is planning to perform maintenance dredging in the Fore River in November 1998. Lobster densities are sufficient to require mitigation in order to avoid unreasonable harm to fisheries habitat. We have developed a consensus-based mitigation plan that focuses on practicable avoidance and minimization measures with the goal of reducing adverse effects to the lobster fishery. Many of the adverse effects will be avoided by a combination of timing and sequencing. Dredging will be timed to occur when lobster densities are lowest. Areas within the Fore River will be sequentially dredged from most contaminated to least contaminated so that the capping layers at the disposal site will consist of the cleanest materials. A relocation program has been developed to further minimize impacts to lobster resources. The plan consists of a trapping program immediately before dredging begins followed by relocation of lobsters to an area within Casco Bay but outside of the Fore River. Assistance from local lobstermen to fish the traps and DMR's Marine Patrol is critical to the success of the program. We recognize that a mitigation plan of this magnitude has yet to be undertaken in New England. Questions remain on the survival of lobsters during handling and after relocation as well as whether relocated lobsters will return to the Fore River. Follow-up studies have been proposed to address these questions.