E.7.2.10.1 No Action

Under the no action alternative, Atlantic herring would continue to be managed through a combination of the Commission's Atlantic Herring FMP, a Preliminary Management Plan in federal waters, and state regulations.

The existing management mechanisms do not include any controls on the harvest of herring by domestic vessels. Herring landings have increased rapidly in the last five years, particularly in the inshore Gulf of Maine area, and may continue to do so as markets are developed. Without controls on the harvest of herring by domestic vessels, herring could be overfished. Intense fishing pressure from foreign fleets in the 1970's resulted in the collapse of the herring resource on Georges Bank. The resource took over ten years to recover from this collapse. Given the key role of herring as a forage species in the ecosystem, a similar collapse in the Gulf of Maine could have far-ranging impacts on other species, from marine mammals to rebuilding groundfish species.

For the most part, under the existing management regime most herring fishing has occurred in the inshore Gulf of Maine. Landings from Georges Bank have been less than 3,000 mt since 1977, but are expected to exceed 20,000 mt in 1998. In the southern New England area, landings were less than 10,000 mt between 1977 and 1994, increasing to 20,000 mt in 1996 and 1997. By contrast, landings from the Gulf of Maine have steadily increased from a low of nearly 25,000 mt in 1983 to a high of over 81,000 mt in 1996. Under the no action alternative, fishing effort is expected to continue to concentrate in the inshore Gulf of Maine area until the resource can no longer support it.

In addition, existing management plans do not adequately protect individual spawning components. The existing Commission FMP implements spawning restrictions that can only be enforced by the states that have adopted the regulations (Massachusetts, Net Hampshire, and Maine). Vessels from other states that fish in the EEZ during the spawning closures are only subject to the restrictions if they choose to land their catch in one of these three states. The spawning restrictions in the Commission's proposed amendment are designed to complement closures in the EEZ. By limiting the spawning restrictions to state waters in the Gulf of Maine, the states are leaving it to the Council to provide protection in the EEZ. If action is not taken by the Council, individual spawning components could be eliminated, weakening the ability of the resource to survive normal population fluctuations. Almost all of the recent increase in landings is from harvest of herring in the Gulf of Maine. Current landings exceed an estimate of the long term yield of this spawning component. Continued fishing at this level, or increased fishing pressure, could collapse this resource. As a key forage species, overfishing the herring resource would also adversely impact other fisheries in the northeast.

The Commission's pending amendment to its FMP adopts many of the same measures that are being proposed by the Council. These measures will apply in state waters. Without action by the Council, many of the measures could be extended into federal waters as well. This would require additional action by the Commission's herring section and the Secretary of Commerce which would delay implementation of the FMP. Another difficulty is that absent action by the Secretary

of Commerce, the ability to enforce any of these measures is constrained by a lack of jurisdiction in the EEZ, and a lack of enforcement resources.

E.7.2.10.2 Controlled Access

The Council considered establishing a controlled access or limited entry system for the herring fishery, particularly in the Gulf of Maine. The system proposed would have matched effort to the available resource. The system would have included establishment of a TAC and effort controls to complement the limits on capacity. Because the primary control on fishing mortality was the use of a TAC, as in the adopted open access system, there should be little difference in the biological impacts on the resource of the two approaches to management. One potential advantage to a limited entry or controlled access scheme is the limited number of participants in the fishery may make it easier to monitor the TAC.

Days at sea limitations, considered as part of the controlled access option, would help to limit harvests by restricting fishing effort. Vessels would be allowed to fish a specific number of days of their own choice.

E.7.2.10.3 Other Management Alternatives

There were several additional management measures considered for use in the open access system. Closed seasons and closed areas could be used to restrict harvests. Both closed season and closed areas must be implemented for extended periods to significantly reduce landings and fishing mortality. In the case of herring, a closed season or area may be more effective if scheduled when herring are aggregated and easy to catch—such as just prior to spawning.

Establishment of a minimum fish size can discourage the harvest of juvenile fish. The biological benefit of this measure is that more fish may grow to adults and spawn before they are caught. Such a measure may be problematic in this fishery, however, as it is difficult for fishermen to target herring by size during periods when adults and juveniles are mixed. The danger is that this provision may result in excessive discards of juvenile fish that are taken while fishing for larger fish.

In theory, gear restrictions may help limit catches, reduce bycatch, target specific fish sizes, or address other concerns. The reality is that during plan development, the only specific measure that was identified was the use of a trynet to determine if a particular school of fish should be harvested. The use of a minimum mesh size is not viewed as an effective way to control mortality on juvenile fish because the large catches soon prevent escapement through the mesh. No bycatch reduction devices were identified. These techniques merit additional inquiry an may be adopted in the future through framework adjustment action.

E.7.2.11 Impacts of the Proposed Action on Protected Species

The management measures proposed in the Atlantic Herring Plan are found in Section 3.0. There have been no limits on the harvest of Atlantic herring prior to the adoption of this plan, although there is increased interest in the development of the fishery. The primary management measures are intended to control fishing mortality on a resource that is considered to be underutilized and where fishing mortality is currently assessed at low levels. Accordingly, management measures do not reduce fishing mortality, but establish controls so that as the fishery expands, there is protection for individual spawning components and fishing mortality is maintained at levels consistent with the overfishing definition. The impacts of establishing a conservative overfishing definition, from both a herring resource and ecosystem perspective, are discussed in section E.7.2.1. Other measures are discussed below relative to their impacts on protected species, either ESA-listed species or those managed under the MMPA.

E.7.2.11.1 Impacts of the Management Measures

E.7.2.11.1.1 Background on Recent Management Actions Affecting Protected Species in the Northeast

Right Whales: Following an unprecedented number of northern right whale deaths in 1996, NMFS determined that the continued operation of fishing under the Council's Northeast Multispecies FMP was likely to jeopardize the continued existence of the northern right whale. To remove the threat of jeopardy, the Council adopted the reasonable and prudent alternative provided by NMFS in their December 13, 1996 Biological Opinion. The action was implemented as Framework 23 to the Northeast Multispecies FMP and closed right whale critical habitat in Cape Cod Bay and the Great South Channel to sink gillnet gear during times of peak whale abundance.

In addition, in July, 1997 NMFS published the interim rule for the Atlantic Large Whale Take Reduction Plan (ALWTRP), a program to reduce takes of right, humpback fin and minke whales in four east coast fisheries, including the multispecies sink gillnet fishery. Accordingly, consultation was reinitiated again in 1997 to consider the ALWTRP and the operation of the sink gillnet fishery, among others. With the conclusion that the fishery may affect but would not jeopardize the continued existence of any listed species of whale or turtle under NMFS jurisdiction, the ALWTRP was substituted as an expanded reasonable and prudent alternative. It is anticipated that implementation of the ALWTRP in November, 1997, in concert with other recovery efforts by NMFS and other agencies, will remove the threat of jeopardy to the northern right whale represented by the multispecies fishery. The ALWTRP final rule was published in February, 1999. Several improvements were made to enhance the effectiveness of the plan, but none that affect any gear types operating under the Atlantic Herring FMP.

Harbor Porpoise: Although NMFS has made a final determination that listing the Gulf of Maine/Bay of Fundy population of harbor porpoise as threatened under the Endangered Species Act is not warranted at this time, concerns remain because of the high level of bycatch in gillnet as

well as several other fisheries. Because of the historic bycatch problem, a number of framework adjustments to the Multispecies FMP (4, 12, 14, 16 and 19) were proposed by the Council and implemented specifically to protect harbor porpoise beginning in 1994.

Building on several of the time/area closures implemented under the Northeast Multispecies FMP, NMFS published a Harbor Porpoise Take Reduction Plan (HPTRP) for the Gulf of Maine and mid-Atlantic waters in December, 1998. The plan is intended to meet the Potential Biological Removal level of 483 animals established for this species by requiring the expanded use of acoustic deterrents, in addition to time and area closures. The effect of HPTRP is further enhanced by the implementation of Framework Adjustments 25 and 26 to Multispecies FMP, actions that reduce catches of Gulf of Maine cod and protect the stock during the spring spawning season. Coupled with the HPTRP, these closures of additional areas to all gear capable of catching groundfish provide more protection for harbor porpoise as well as endangered whales by reducing the risk of entanglement.

In addition to the Gulf of Maine and mid-Atlantic coastal gillnet fisheries, harbor porpoise interact with the Canadian herring gillnet and weir fisheries. These fisheries occur mostly in the western Bay of Fundy, in summer and early autumn. Trippel et al (1996) reported that estimated bycatch levels in gillnets in 1986 were 116 animals, and 130 animals in 1989. Based on information collected through an observer program, porpoise bycatch in the Bay of Fundy during 1993 was estimated to be 424. In the mid-1990s, fishery closures, required pinger use, expanded observer coverage and outreach and education programs contributed to a significant reduction in the Bay of Fundy bycatch. The Canadian Department of Fisheries and Oceans has subsequently formalized these activities by publishing a *Harbor Porpoise Conservation Strategy for the Bay of Fundy*. Since implementation of the program, bycatch has been reduced to approximately 20 to 50 harbor porpoise per year.

E.7.2.11.1.2 Specifications

After consulting with the Council, the NMFS Regional Administrator will determine the annual specifications for OY, DAH, DAP, JVPt, JVP, IWP, BT, USAP and the Reserve, using the best available scientific information. The Council acknowledged the key role of herring in the ecosystem by setting the 1999 specifications at a conservative level based on historic fluctuations in herring abundance, uncertainty about current stock size, which, according to SAW 27 could be overestimated, and a possible negative bias in fishing mortality. To avoid overfishing in the early years of the plan, catch levels are capped well below ABC until information becomes available through required reporting and record keeping and can be evaluated.

With OY set at 224,000 mt and a total herring biomass estimated at 2.9 million mt, scientists project a 39 percent increase overall in stock size. This initial allocation should function as the Council intended, allowing controlled industry growth and ensuring an adequate forage base for numbers of marine species in the Northeast and mid-Atlantic regions, including those that are listed as threatened and endangered under the ESA.

By adopting this precautionary approach, based on the Goals and Objectives which are articulated in section 2.3 of this document, the Council also provides clear guidance to the Regional Administrator in determining the annual specifications after 1999. The Regional Administrator is further bound by NMFS's responsibilities under the Endangered Species Act --- to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved --- and by the Marine Mammal Protection Act, to achieve optimum sustainable populations keeping in mind the carrying capacity of the habitat (commensurate with sound policies of resource management).

E.7.2.11.1.3 General Administrative Provisions --- Permit Requirements, Observers/Sea Samplers, Reporting and Record Keeping Requirements, Foreign Processing Vessels, FMP Monitoring and Framework Adjustment Measures

Permit requirements for the various sectors of this fishery which include vessels, operators, dealers, and processors are not expected to have any detrimental impacts on any protected species, although they should contribute toward better resource management and help prevent overfishing. Indirect benefits may accrue because no comprehensive reporting requirements for vessels fishing for herring in the EEZ currently exist. Participants in the fishery will be identified and landings and purchases of herring will be reported. Vessels that transport herring from catcher vessels to a dealer or processor and foreign processor vessels must submit fishing logs and reports.

With the level of detailed reporting required (see section 3.3.3), catches will be better monitored enabling managers to more accurately calculate estimates of fishing mortality and resource status. Weekly reporting will facilitate tracking of TACs, reducing the likelihood that they will be exceeded. The use of observers or sea samplers in the fishery, including those required aboard foreign processor vessels, similarly will contribute to more accurate tracking of catches, catch rates and bycatch. Information collected, along with improvements in state and federal reporting that will be adopted through ACCSP, should improve the quality and reliability of information used to manage this resource.

The FMP monitoring system calls for an annual review of the status of the stock and the fishery as well as the development of any necessary adjustments to the management measures, including recommended specifications. Negative impacts of the fishery on the herring resource or any protected species would therefore be addressed in a timely manner.

As in other Council FMPs, the framework adjustment process allows changes to be made to specified management measures over the course of two Council meetings. While still providing opportunities for public input and requiring biological and economic analyses, this process avoids some of the more lengthy aspects of amendment development and permits the Council to address problems in a timely manner. Framework adjustments have been used to protect harbor porpoise and right whales in the Northeast Multispecies FMP. Measures to address issues related to protected resources are also available in the Herring FMP. The plan specifies that closed areas may be approved via a framework adjustment for purposes of providing adequate forage, to

reduce marine mammal/fishery interactions or to limit fishing mortality on a particular stock component. Other measures that may be implemented through frameworks are listed in section 3.3.6. If proposed by the Council, these actions would be evaluated at that time in an Environmental Assessment using the most current information available to make a determination of the impacts on protected resources.

E.7.2.11.1.4 Management Areas

Management areas identified in the plan (section 3.4) provide the basis for TAC distribution and have been established to avoid the over-exploitation of individual spawning components that are included within the stock complex. The sub-division of Management Area 1 makes it possible to protect herring in the fully exploited inshore Gulf of Maine region during spawning periods and from over-fishing, particularly if the fishery expands.

The careful use of area management may benefit protected resources in that the distribution of several species, but especially harbor porpoise, overlaps with the period of greatest fishing activity in Management Area 1 --- principally June through November. The majority of the porpoise population (minimum population estimate 48,289) is concentrated in this area and the lower Bay of Fundy between July and September (Waring et al 1997) and is heavily dependent on herring as a prey species during this period. Gannon et al (1998) described herring as the most important prey of porpoise during autumn, contributing 44 percent of the prey mass in the stomachs of the 95 animals examined in the study. While the complexities of predator-prey relationships have not been adequately studied and are not fully understood, this example illustrates the importance of using management areas to protect spawning components. This, in combination with effort controls, will maintain herring biomass at levels that will sustain a healthy ecosystem and ensure adequate forage for protected resources.

E.7.2.11.1.5 Spawning Closures

While they are intended to protect fish when they aggregate to spawn and become especially vulnerable to fishing gear, spawning closures also may provide short-term protection to endangered and threatened species and other marine mammals that have the potential to become entangled in the gear types used in the herring fishery. These are most likely to be mid-water trawls and purse seines given that the use of stop seines and weirs has declined dramatically in recent years. The duration of the closures are short-term, just less than a month, but overlap with the distribution of marine mammals that are feeding in the Gulf of Maine in late summer and early fall.

Alternatively, negative impacts on protected species could result from effort shifts as fishermen compensate for the loss of landings during the closure periods. Maine fishermen could move inshore of the closures or the open areas off the coasts of New Hampshire and Massachusetts, although the most likely scenario would be to fish inside state waters because of the closer proximity to ports and processing facilities. Potential negative impacts could be mitigated, however, by the year-round Western Gulf of Maine Closure implemented under the Northeast Multispecies FMP to conserve the stock of Gulf of Maine cod, and the management measures in

the Harbor Porpoise and Atlantic Large Whale Take Reduction Plans, each recently finalized by NMFS.

E.7.2.11.1.6 TACs and Effort Controls

Although the Herring Plan will not limit entry into the herring fishery in federal waters, the plan will restrict harvest through a TAC system. The TACs will provide information necessary to evaluate the condition of the resource and indicate the need for modifications. The TAC will be distributed in different areas, both to protect various spawning components and to encourage the development of the offshore fishery.

A limit on days-at-sea, "no fishing days", will slow catch rates when 95 percent of the TAC is projected to be taken (see section 3.6.4). At that time, the directed herring fishery will close and the remaining 5 percent will be set aside to allow the incidental catch of herring in other fisheries to continue. Incidental catch in an area closed to fishing will be limited to 2,000 pounds per trip. An analysis provided in Section E.7.2.5.2.1 demonstrates the low probability that the continued harvest of herring in the bottom trawl, shrimp and gillnet fisheries will cause the TAC to be exceeded. This system of slowing down the harvest within a management area is not likely to have a detrimental impact on protected species. This is not a certainty, however, because exceeding the TACs will not result in a prohibition on the landing herring nor will it result in the closure of the fisheries that are not targeting herring. If not addressed, overfishing could occur to the point where the abundance of herring as a marine mammal prey species is affected.

E.7.2.11.1.7 Transfers at Sea

The Herring FMP allows U.S. vessels to transfer up to 2,000 pounds of herring per day in areas subject to spawning closures or effort controls. As stated in the plan, the measure may complicate enforcement, but is proposed so that lobster and tuna fishermen may obtain fresh bait. There is little possibility that this measures will affect protected species, except that it could reduce potential marine mammal encounters with small untended bait nets that are commonly used throughout the Gulf of Maine when bait for sale is in short supply.

Under Framework Adjustment 16 to the Northeast Multispecies FMP the deployment of bait nets is limited, but only in areas where gillnets are prohibited for the purpose of reducing the bycatch of harbor porpoise. In those areas vessels may fish with a single pelagic gillnet which is no longer than 300 feet. The net also must be attached to the boat and deployed in the upper two-thirds of the water column. The majority of vessels that are likely to sell herring as bait use gear types that may pose less of a threat than nets that are often left to soak for several hours, in areas where protected species are likely to occur and which have accounted for at least one documented take of an endangered species. This may not hold true if observer coverage aboard mid-water trawl vessel determines that the gear type poses significant risks to protected species.

E.7.2.11.1.8 Vessel Size Limits

The relationship between vessel size, towing speed, length and width of the net and other parameters such as horsepower --- and the likelihood of marine mammal interactions --- is very

poorly documented in the available literature. The Council's decision to limit vessel size to 165 feet is probably appropriately precautionary from both a herring resource conservation and protected species perspective. It is possible, however, that the potential for entanglements exists in vessel size classes that are already represented in the domestic fleet (Berrow et al. 1998). Such sparse evidence runs counter to the anecdotal information provided by herring fishermen at public meetings of the Council. Industry representatives have consistently indicated that the small boats used by the majority of the fleet are neither large enough nor have the ability to tow at speeds that would have the potential to entangle marine mammals. Observer coverage on the mid-water trawl vessels may answer the outstanding questions that are associated with this controversial management measure.

E.7.2.11.1.9 Roe Fishery

No prohibition on a roe fishery exists in this plan to date, but harvest for this purpose could be controlled by the authority of the Regional Administrator if the Council recommends such an action. Roe fisheries have been a cause for concern because of the wasteful practice of discarding the carcass, the associated difficulty in monitoring catches and discards of male herring. The Council has elected to monitor this fishery by requiring the retention of carcasses. The action should not affect protected species.

E.7.2.11.1.10 Measures to Reduce and Monitor Bycatch and VMS

No measures are proposed to specifically reduce bycatch in the herring fishery, although vessels are required to report all herring caught, including discards. Potential negative impacts could result if misreporting occurs, not only forestalling closures as TACs are caught up, but affecting stock size and fishing mortality estimates. The use of Vessel Monitoring Systems as well observers could provide a system of checks and balances to improve the quality of the data collected and the overall effectiveness of the management program. As proposed, the measure should not have any direct negative impacts on protected species, but could result in indirect impacts if accurate calculations of stock status are jeopardized because fishery catches are misreported.

E.7.2.11.1.11 Joint Venture Restrictions

Observers aboard foreign joint venture processing operations that were conducted 1980's in the squid and mackerel fisheries documented takes of marine mammals in the catches transferred from pelagic trawl vessels. It is uncertain whether similar impacts will occur in the herring fishery, but data reporting and observer requirements as well as the implementation of management area restrictions will provide monitoring to determine of the level of interactions with protected species, if any.

E.7.2.11.1.12 Impacts of the Alternatives, Including No Action

The biological consequences of taking no action, and the associated impacts on the herring resource as prey species, are discussed in section E.7.2.10.1. The major difference between the proposed action and other alternatives not selected is the inclusion of a controlled access system (see section E.7.2.10.2). The potential impacts on protected species are largely dependent on not

only how many participants engage in the harvest of herring, but the types of gear used and the allocation of TACs within the three management areas. With the low level of protected species interactions documented in the major gear types used in the herring fishery to date, a controlled access program may have very little impact on protected species. Of the other measures considered under alternative management scenarios --- closed areas, minimum fish sizes, and gear restrictions, the use of closed areas has the greatest potential to affect protected species. Without greater detail, however, it is not possible to draw any meaningful conclusions about impacts in this discussion.

E.7.2.11.2 Impacts of the Herring Fishery

A description of the major commercial gear types used in the herring fishery is provided in sectionE.6.4.2.2. As discussed, in recent years purse seine and mid-water trawl gear has accounted for the majority of landings, while the use of fixed gear (stop seines and weirs) has declined significantly since 1994. A large number of bottom trawl vessels fish for herring on a sporadic basis, but actually account for a fraction of the overall landings (Table E.13). Although poorly documented, herring fishing to obtain bait for the lobster and tuna fisheries has increased along with the expansion of those fisheries. The issue is discussed earlier in this section in more detail under the proposal to allow the transfer of herring at sea.

The impacts of bottom trawling on endangered and threatened species of cetaceans, sea turtles and fish under NMFS jurisdiction, as well as the impacts on northern right whale critical habitat were considered in formal consultations pursuant to Section 7 of the Endangered Species Act (ESA) for Northeast Multispecies Plan Amendment 5 in 1993 and Amendment 7 in 1996, and in the National Marine Fisheries Service Biological Opinions issued on November 30, 1993, and February 16, 1996. The Biological Opinion issued on December 13, 1996 following an unusual right whale mortality event earlier in that year altered the conclusion that existing fishing activities and related management measures proposed under these amendments may affect, but were not likely to jeopardize, the continued existence of any endangered or threatened species. The Council's response to the jeopardy opinion and the implementation of the ALWTRP are discussed above.

As required by Section 118 of the MMPA, NMFS issues an annual List of Fisheries (LOF) which classifies U.S. fisheries according to the rate of serious injury and mortality of marine mammal stocks taken incidentally in each fishery. Rates are quantified relative to a Potential Biological Removal level (PBR) assigned to each stock. (PBR is the number of animals that can be removed from a stock annually by human activities without preventing the stock from reaching or maintaining its optimum sustainable population size.)

Fisheries are placed in one of three categories, with Category I representing the highest level of take (50 percent or more of PBR). Consistent with their evaluation in previous years, NMFS listed the North Atlantic bottom trawl as a Category III fishery in 1999, one with a remote likelihood of causing incidental mortality and/or serious injury to marine mammals. While long

and short-finned pilot whales, white sided dolphin, striped dolphin and the coastal and offshore stocks of bottlenose dolphins are listed as marine mammal species that have been either incidentally injured or killed in the bottom trawl fishery, there are no documented takes of endangered or threatened cetaceans. Similarly, the Gulf of Maine Atlantic herring purse seine fishery is classified as Category III, with takes of harbor porpoise, harbor seal and grey seal listed. Because of the low levels of takes and observer coverage, there are no estimates of marine mammal bycatch in these fisheries.

The herring mid-water trawl fishery, however, has been added to the 1999 LOF as a Category II fishery, one that has an occasional likelihood of causing incidental mortality and/or serious injury to marine mammals. The change from the 1998 Category III classification to Category II is an interim action that allows collection of data to more accurately determine levels of takes in this fishery through observer coverage. No estimates of marine mammal bycatch are currently available for this fishery. The Council supported the revision based on the potential for incidental takes of marine mammals, particularly the Gulf of Maine/Bay of Fundy harbor porpoise, and the likely increase of the number of vessels currently participating in the fishery.

The Council also noted that the practice of pair trawling in the herring fishery has increased over the last several years and that vessels fishing in pairs in other fisheries have accounted for takes of marine mammals and sea turtles. A Maine Department of Marine Resources study conducted during the summer and fall of 1997 (Stevenson and Scully 1999) documented the take of a harbor seal by herring pair trawlers operating off Portland Head, Maine. Vessels fishing singly for herring also may be associated with some level of harbor porpoise bycatch given the close predator/prey relationship between porpoise and herring.

Concerns over the bycatch of marine mammals in mid-water trawl gear are based on a number of studies of bycatch in pelagic fisheries, both in the U.S. and in Europe. Waring et al. (1990) discusses a significant number of takes of pilot whales and common dolphins by foreign vessels operating in the DWF Atlantic mackerel and squid fisheries during between 1977 and 1988. The authors attributed the timing and location of the interactions (mid-winter to late spring) of these species to their seasonal distribution, which is concentrated along the southern New England shelf edge and coincident with the operation of these fisheries. It also should be noted that a juvenile right whale was taken in the *Loligo* fishery during this period.

In summarizing information collected on the few observed trips taken aboard domestic mid-water trawl vessels in the herring fishery to date, the Northeast Fisheries Science Center advised the Council that “the working hypothesis should be that mid-water trawling for pelagic species will result in some marine mammal bycatch. Arguments based on the lack of observations on herring trawlers are not sufficient basis for disregarding this possibility.” Further basis for this position may be found in Morizur et al. (1997). Observations of marine mammals caught in four pelagic trawl fisheries led the authors to conclude that the bycatch of (oceanic) cetaceans was not insignificant and recommended regular monitoring of these fisheries. Their report also included an account of a herring trawl fishery in which four grey seals were caught during approximately 100

hours of towing. White-sided dolphins were the primary species incidentally caught in the Dutch pelagic trawl fishery for mackerel during 1992-1994 southwest of Ireland (Couperous 1997). In conducting a review of the global data on cetacean interactions with trawl gear, Fertl and Leatherwood (1997) found that at least 15 cetacean species, including minke, fin and humpback whales feed in association with trawling, both in association with the same prey species caught in commercial fishing gear or when scavenging in or around the trawl nets.

Critical information lacking in nearly all of the studies reviewed, but identified as a significant determinant of cetacean bycatch by Morizur et al. (1997) included target species, prevalence of mammals coincident with the fishery, susceptibility of mammal species to entrapment, tow duration, level of tow in the water column, size of net opening, haulback speed, gear design and time of day.

E.7.2.11.3 Ecological Relationships

Generalities and assumptions concerning the impacts of marine mammals on fisheries and fisheries on marine mammals are possible, but in reality are neither straightforward nor easily predictable. This is further complicated by the fact that there is insufficient data with which to determine cetacean population trends (Waring et al., 1997). Most recently, Kenney et al. (1997) discusses the trophic impacts of cetaceans on the Northeast Shelf ecosystem, describing them as significant predators and estimating their annual consumption of fishery resources as approximately one-third to more than three times greater than the annual harvests in fisheries. The authors maintain that direct competition may be low, but also point out that some cetaceans may compete directly for some resources, such as herring and mackerel.

Cetaceans most likely to have such direct interactions are endangered humpback and finback whales, minke whales as well ad several species of small cetaceans --- harbor porpoise, white-sided and white-beaked dolphins. Perhaps the most noteworthy event affecting these species was the large-scale decline of herring and mackerel on Georges Bank and the associated trophic level changes that appear to have occurred as a result. As the abundance of sand lance increased in response to the absence of predators, a shift in humpback whale distribution from the northern Gulf of Maine to the southwestern Gulf of Maine took place in the late 1970s and early 1980s --- reflecting a shift in diet from herring to sandlance (Weinrich 1997).

Payne (1990) speculated that declining sand lance populations in Massachusetts Bay in 1986 and an increase in dense swarms of copepods caused plankton-eating right and sei whales to replace the piscivorous humpback and fin whales. Kenney et al. (1996) further suggest that the distribution of harbor porpoise shifted away from Georges Bank to inshore areas after the herring stock collapse. The increase in the bycatch of porpoise in the multispecies sink gillnet fishery may have occurred as densities of porpoise increased in coastal and nearshore Gulf of Maine waters. The potential impacts of overfishing, coupled with natural shifts in fish stock abundance and the complex predator-prey linkages in the Gulf of Maine/Georges Bank ecosystem argue for the conservative management of herring stocks under the proposed FMP.

E.7.2.11.4 Sea Turtles

Based on information collected in similar fisheries, the major gear types used in the herring fishery may have interactions with sea turtles, although information is inadequate to determine impacts because of the extremely low level of observer coverage. There is no reason to conclude, however, that the herring fishery represents a major source of human-induced serious mortality at this time.

E.7.2.11.5 Shortnose Sturgeon

The potential for takes of shortnose sturgeon in this fishery is unknown, but is likely to be low, given the distance between the rivers which this species inhabits and the operation of the majority of vessels in the herring fishery

E.7.2.11.6 Seabirds

Like marine mammals, seabirds are vulnerable to entanglement in some types of commercial fishing gear. The interaction has not been quantified in the New England and Mid-Atlantic herring fishery, but impacts are not considered significant. Human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered the major threats to some seabird populations. Endangered and threatened bird species, which include the roseate tern and piping plover, are unlikely to be impacted by the gear types employed in the herring fishery.

E.7.2.11.7 Right Whale Critical Habitat Designation

The National Marine Fisheries Service acted on a petition from the federally-appointed Right Whale Recovery Team and designated critical habitat for the northern right whale on June 3, 1994. Two of the areas designated are in the Northeast. The area in Cape Cod Bay is located principally in Massachusetts state waters. The other is in the exclusive economic zone, in a region known as the Great South Channel. It has been identified as a spring and early summer feeding and nursery ground for a majority of the population. Actions have been taken to reduce the likelihood of entanglements in fishing gear first by the Council through Framework Adjustment 23 to the Northeast Multispecies FMP and subsequently by NMFS through implementation of the Atlantic Large Whale Take Reduction Plan. The proposed action should not affect the area or right whale utilization of the area.

E.7.2.12 Impacts on Habitat and Other Biota

The Council has prepared a comprehensive review of essential fish habitat and the impacts of fishing and other activities on this habitat. Applicable elements of that review are incorporated by reference into this FMP.

E.7.2.13 Impacts on Stellwagen Bank National Marine Sanctuary

The designation of Stellwagen Bank as a National Marine Sanctuary does not restrict commercial fishing in the area and is intended to protect and enhance sanctuary resources. To the extent the proposed action is expected to protect fish stocks, the impacts are expected to be positive and consistent with sanctuary objectives. Other specific measures, such as the establishment of spawning area restrictions under various alternatives, are also consistent with the resource protection mission of the Sanctuary.

E.7.3 Economic Impacts of the Alternatives

Economic assessment requires consideration of the benefits and costs of the proposed action. The following discussion is a qualitative analysis of the impacts of the proposed action on net benefits, as well as an estimate of the administrative costs for implementing the management plan. Because of the lack of an analytical assessment model for herring that links fishing effort, landings, and fishing costs, a quantitative assessment of all expected costs could not be developed. There is limited information available on fishing costs for the mid-water trawl and purse seine fishing sectors, the primary gears used to land herring. This makes it difficult, if not impossible, to accurately quantify the impacts on vessel costs that may result from the proposed management measures.

Another difficulty with comparing the economic impacts of the alternatives is that in every alternative (including the no action alternative), gross revenues of herring are expected to remain constant or increase if the offshore fishery is developed. The primary economic benefit of the preferred alternative is that it reduces the likelihood of overfishing and protects individual spawning components of herring. This is of most value with respect to the inshore Gulf of Maine (Management Area 1A) and, to a lesser extent, the offshore Gulf of Maine (Management Area 1B). These areas have provided the majority of herring for the domestic fishery, most taken during the late summer and early fall while herring are aggregating for spawning. Landings from this area peaked in 1996 at over 80,000 mt as demand for herring increased. Under the status quo, there are no limits on the domestic harvest of herring and there is a risk that the fishery in this area will be overfished. This would have a negative impact on both operating costs and total revenues. Because of the lack of an assessment model for individual spawning components, it is impossible to determine if present landings would lead to overfishing of this component. As a result, a quantitative comparison between total revenues under the status quo and the preferred alternative cannot be made. The key difference in the proposals is their impact on the costs to the industry. Because of a lack of information on the cost structure of the industry, a quantitative estimate of the differences between the alternatives could not be determined.

E.7.3.1 Specifications

The FMP does not allow directed foreign fishing. Under open access this may be preferable in order to have benefits from the fishery accrue to domestic fishermen. The expansion of the herring fishery will require domestic fishermen to develop markets and invest in the vessels and

processing capability to enter those markets. Any foreign fishing in U.S. waters will directly compete with the attempts of fishermen to enter those markets. According to the testimony of industry personnel, directed foreign fishing would discourage additional U.S. investment in the herring fishery.

The plan does provide for some foreign participation in the fishery through joint venture or internal waters processing. JVs and IWPs provide alternative processing platforms to land-based processing. Restricting JV/IWP amounts at the beginning of a fishing year through fairly arbitrary formulas which depend on estimating DAP may complicate finding markets. JV and IWP operators would not want to operate without some assurance of having herring to process but these arrangements are left to negotiations between the JV/IWP operator and domestic harvesters or their representatives.

A separate specification for the amount of herring transported to Canada by Canadian herring carriers (vessels) establishes a basis for accounting for these herring. The allocation insures that the U.S. and Canadian sardine industries will be able to continue a long-standing relationship that has provided economic benefits to both. At the same time, the specification reduces the concern of U.S. processors that an unlimited transfer of herring between these two groups would adversely impact their supply of herring.

Under the controlled access/limited entry system not selected by the Council (with conservation and development permits issued to some fixed group of domestic interests), this restriction is not necessary. The main purpose of the controlled access option is to discourage the building of permanent herring fishing capacity for the portion of the stock that may be temporary (in time, not area). When herring are abundant in offshore areas, holders of development permits could contract other vessel owners to harvest herring on a temporary basis. In theory, these contracts could be with domestic or foreign vessels. If they are foreign vessels, then some benefits still accrue to the domestic permit holder.

E.7.3.2 Management Areas

The designation of management areas is not expected to have any direct economic impacts. The establishment of the areas does not impose any additional requirements on vessel operators, does not directly limit participation in the fishery, and does not restrict catches. The areas are, however, used to guide the distribution of the TACs, which will determine how much herring can be caught in a particular area. This distribution will have economic impacts on vessels that are discussed in section E.7.3.4.1.

E.7.3.3 Spawning Area Closures

In general, the proposed spawning area closures increase fishing costs and may decrease revenues. Herring aggregate prior to spawning, making them easier to catch. This is also the period when fat content is the highest and the fish are most valuable to the market. The value of a roe fishery

cold be even higher than that of high fat content herring. By limiting fishing on spawning aggregations, these provisions force fishing activity when the herring are not as easy to catch and are worth less, reducing vessel revenues. Spawning closures also make it more difficult, if not impossible, to develop a roe fishery.

The proposed spawning closures may also have an impact on total landings and revenues, subject to the ability of fishermen to locate herring in other areas or at other times. Under the existing Commission management plan, there are four spawning closures along the coast from Cape Cod to Maine. All of the existing closures extend from the coast to the seaward boundary of Management Area 1. The three closures along the Maine coast allow directed herring fishing, subject to the limitation that no more than 20 per cent, by number, of the herring harvested may contain spawn (roe or milt). This allows the harvest of either spent or juvenile herring that can be used in the bait and sardine markets. In recent years, a significant amount of the annual catch and revenues have been harvested from the Maine closure areas 1B and 1C (similar to the proposed Western Maine area) during the closure periods (Table E.56).

Year	Area 1A		Area 1B		Area 1C	
	Total	Closure	Total	Closure	Total	Closure
1995	322	36	22,136	4,896	8,757	125
1996	470	0	21,492	5,055	18,493	643
1997	411	70	34,862	7,521	11,275	5,084

Table E.56 - Catches in Maine Spawning Closure Areas 1A, 1B, 1C (metric tons) (Maine closure area designations should not be confused with the proposed Council management areas) (Source: Maine DMR)

In preparing this FMP, the recommended spawning closures were closely coordinated with the Commission to insure that complementary closures would be adopted in state and federal waters. As noted in section 3.12.1, for state waters of the Gulf of Maine, the Commission has adopted restrictions that will prevent a vessel from landing herring if more than 20 percent of the load contains spawn herring. This restriction will apply for the period August 1 through October 31. Similar to the closures in place in Maine waters in 1996 and 1997, this measure allows herring fishermen to continue to fish as long as they direct their efforts away from spawn herring. In order to evaluate the impacts of the proposed Council spawning closures when combined with the Commission's new measures, 1997 landings were plotted by ten-minute squares of latitude and longitude for the time periods of the proposed closures. These landings were examined to determine the amount that fell within state waters and those that were taken in federal waters. The results are summarized in Table E.57. For the period August 1 through October 12, the landings in 1997 totaled 31,606 mt. One-third of these landings were taken in areas that will be closed to herring fishing under the Council's proposed action.

The actual decline in landings due to the spawning closures is likely to be less, however. First, this review is based on landings from only one year of data and may not represent average fishing

conditions. Second, it makes no allowance for the displacement of effort from the closed areas. Fishermen will try to locate herring in other open areas – either in state waters or in the open portions of federal waters. Third, the Council's proposed action actually opens to fishing a large area south of 42^{o} 30' N. that was closed to fishing in 1997 for a three week period starting September 15. Fishermen are likely to catch herring in this area that will partially offset losses from other areas. Finally, because of the lack of detail provided by assigning landings to ten minute squares, the analysis assumes all landings from the Mt. Desert rock area were taken in federal waters. Based on discussions with fishermen, at least some of these landings were probably taken from state waters in 1997.

Time Period	1997 Landings, All Areas (mt)	Proposed Closure Area	Total 1997 Landings from Proposed Closed Area	1997 Landings from EEZ within Closed Area	Percent of 1997 landings that were from the EEZ in an area that will be closed (Column 5/Column 2)
August 1 – August 14	6,558	Cashes Ledge	1,260	1,260	19%
August 15 – August 31	7,062	Eastern Maine Cashes Ledge	1,976 1,148	1,976 (986) 1,148	44%
September 1 – September 11	5,212	Eastern Maine Western Maine Cashes Ledge	634 2,897 23	634 (Source:634) 1,955 23	50%
September 12 – September 14	780	Western Maine Cashes Ledge	175 0	0 0	0%
September 15 – September 28	6,582	Western Maine Cashes Ledge JL/SBNMS	3,716 0 1,361	1,965 0 1,361	51%
September 29 – October 12	5,412	JL/SBNMS	0	0	0
August 1 – October 12	31,606		13,190	10,322	33%

Table E.57 – 1997 landings from areas of the proposed spawning closures (Note: Table assumes all landings from the Mt. Desert Rock area were caught in federal waters in 1997. Mt. Desert Rock area landings are shown in parentheses.)

E.7.3.3.1 Other Spawning Area Closure Alternatives

The Council originally considered four areas that closely matched the boundaries of the existing Commission closures, and, through complementary Commission action, may have extended to the shore. These proposed spawning restrictions along the coast did not include any provision to allow directed fishing subject to the limitation on catch of spawning fish—the only herring fishing allowed would be limited to 2,000 pounds per trip. The original proposal area also created an offshore boundary, providing a limited opportunity for fishermen to move into these offshore areas. Because these open areas consist of deeper water, it is unlikely that fishermen would find herring in quantities similar to those encountered in the closure areas. Vessels that were unable to travel to these areas (approximately 30-40 miles offshore) may move to other open areas along the coast or may shift into other fisheries during this time period. Smaller herring vessels in Maine ports would have greater difficulty landing herring during the spawning closures than larger herring vessels that may be able to move into other areas. Because of the steep competition in herring markets, smaller vessels that cannot continue to fish during the closure would be at risk of losing their market, and may not regain it when the closed areas re-open.

For all of the above reasons, the Central, Western, Eastern Maine, and Massachusetts/New Hampshire closures, as originally considered, would have resulted in a significant decline in landings from the status quo since directed herring fishing would not be allowed in these areas. The expected result of the original Council proposal was the potential loss of all herring landed during the Commission's existing closures. This loss would have been mitigated by the opportunity of the fishermen to fish seaward of the closure boundaries. Fishermen may also have been able to harvest the herring after the closure – a delay in the catch, rather than a complete loss.

The proposal adopted by the Council makes significant changes. All closure areas only apply to federal waters (the Commission's plan allows herring fishing in state waters, subject to a limit on the amount of spawn fish that can be landed). The closure area off Massachusetts/New Hampshire has been significantly reduced in size to two areas that cover Jeffreys Ledge and the Stellwagen Bank National Marine Sanctuary. The impact of these changes is to significantly reduce the negative economic impacts of the spawning closures. By reducing the area covered by the closures, the Council's proposed action should reduce the impact of the closures on landings. The Council plan will also open an area south of 42^{o} 30'N that had previously been limited to an incidental catch limit. While the amount of catch in this area cannot be predicted due to a lack of information on harvest rates and effort in this area, this should result in higher catches of herring, further reducing the economic impact of the closures. In a qualitative sense, the proposed alternative should also reduce impacts on smaller vessels, as it provides options to fish seaward of the boundary, in state waters, or in areas of federal waters that remain open, and reduce the necessity for any vessel to fish seaward of the closure boundaries. Both of these results will help maintain operating costs at current levels.

The Council considered a number of variations for determining the starting dates of the closures. These alternatives determined the starting or ending dates of the closures by determining biological condition of the fish. This would have resulted in the actual closure dates being announced just prior to the implementation of the closures. This would allow the closures to be timed to peak spawning activity, providing the greatest protection. While the economic impacts of the alternatives are not likely to differ significantly from the chosen alternative (closure length and area would be the same as the adopted proposal), this approach would introduce uncertainty into the timing of the closures. The fixed date alternative chosen by the Council allows vessels and dealers to plan fishing operations around known closure dates and was preferred by many in the industry. It also avoids the administrative costs necessary to operate a sampling program that would determine the closure dates.

The Council also considered not establishing any spawning area restrictions in Management Areas 1A or 1B. In the short term, landings and revenues would have increased if this option had been selected. Over a longer period, the practice of fishing on spawning aggregations in this intensely fished area is expected to have a negative impact on the biological condition of the resource. Failure to provide protection during the spawning periods could result in the elimination of individual spawning components, even while remaining within overall mortality goals set by the TAC. This would have either resulted in lower TACs to reduce effort on spawning fish, or, in the extreme, could damage the resource sufficiently that no fishing would be allowed in the area. Either result would reduce revenues from this area. As vessels moved into other areas to find herring, operating costs would be expected to increase with the additional transit time offshore.

E.7.3.4 Catch Controls

Under the open access alternative, with all proposed restrictions adopted, the herring FMP will consist of:

1) area TACs;
2) closed spawning areas;
3) days out of the fishery if TACs are expected to be exceeded;
4) vessel size limits;
5) roe fishery restrictions;
6) JV/IWP location restrictions.

The area TACs and the closed spawning areas are the major conservation provisions. For the foreseeable future, the total of the assigned TACs will be an increase over recent landings of herring – in 1999, the OY of 224,000 mt more than doubles the recent highest landings (104,000 mt in 1996), resulting in a potential increase in gross revenues of $13.6 million at an average price of $0.05/pound (1997). Under the management plan, revenues are able to increase. Whether this occurs will be a result of market conditions rather than due to the management measures adopted.

The mandatory days out of the fishery will be used to spread the TAC in each area over an annual

time period. Vessel size limits – while they will not have the same conservation effect as if they were applied to a fixed number of vessels – are also intended to limit overall capacity and harvest rates. With this set of restrictions under open access, an incentive is created for fishermen to take as much of the available TAC as possible before the area is closed. This pattern has been seen in a number of fisheries managed through quotas. "At best, this has resulted in reduced economic rent being generated from the fishery and, at worst, has resulted in declines or collapses in the stock" (Morgan, 1997). There are factors in the Atlantic herring fishery that may limit the extent of this behavior, such as market conditions, weather, and the mandatory days out provisions. Particularly in the herring fishery, market conditions will be a key determinant of the speed with which the TAC is obtained.

With any open access system, there is a concern that there will be a rapid increase of fishing capacity into the fishery that can lead to overfishing, or that prevents realizing the maximum economic benefits from the resource. There is a long list of fisheries that followed this pattern. There is some evidence, however, that in the Atlantic herring fishery there may be factors that reduce the likelihood of this happening. For sixteen years, landings of herring have not been limited by anything other than availability and market demand, yet there has not been a significant increase in harvesting capacity until recently. Figure E.11 shows the relative landings of herring by major gear type. The percent of the harvest from each gear type is relatively constant until the introduction of mid-water trawl vessels into the fishery within the last four years. Some of the reasons may be the cost of converting a bottom-trawl vessel to a mid-water trawler (estimated at between $150,000 to $250,000), the limited price for herring, and the difficulty in developing markets. Average ex-vessel prices have been essentially unchanged for over twenty years. The limited market available may serve to inhibit the introduction of new capacity.

E.7.3.4.1 TAC Distribution

Under the existing management scheme, there are no limits on the domestic harvest of herring. While overall revenues could increase under the management plan, there will be changes in what management areas supply those revenues. Historically, most herring landings have come from the inshore Gulf of Maine area, now defined as Management Area 1A. Landings from the Gulf of Maine (Management Area 1) were an estimated 81,000 mt in 1996 and 73,000 mt in 1997. Of these totals, an estimated 8,700 mt came from statistical area 515 in 1996, and 2,300 mt came form this area in 1997. Area 515 corresponds closely to the proposed Management Area 1B. This gives an estimate from the proposed Management Area 1A of 73,300 mt in 1996, and 70,900 mt in 1997. The initial TAC established for Management Area 1A is 45,000 mt. Other options considered by the Council also reduced the expected landings from Management Area 1A from current levels. Table E.58 provides estimates of the loss in revenues from the inshore Gulf of Maine that may be experienced under the various TAC distribution options (including the preferred option). The management system is designed to encourage fishing in other areas which may replace the loss in revenue from the Gulf of Maine. These estimates do not include revenues that may be taken outside Management Area 1A; thus, declines should be viewed as a maximum lost revenue.

TAC Option	1999 Area 1A TAC (mt)	Gain (loss) in revenue from Area 1A compared to 1996 ($0.6/lb)	Gain (loss) in revenue from Area 1A compared to 1997 ($0.05/lb)
1	59,250	($1,858,815)	$22,050
2	60,000	($1,759,590)	$121,275
3	60,000	($1,759,590)	$121,275
4	60,000	($1,759,590)	$121,275
5	N/A	N/A	N/A
Proposed Action	45,000	($3,744,090)	($1,863,225)

Table E.58 - Potential changes in revenue under various TAC options, Management Area 1A (estimated average 1999 ex-vessel price $0.06/lb)

E.7.3.4.2 Mandatory Days Out of the Fishery

As the TAC in an area is approached, the plan proposes to limit the number of days that vessels are allowed to fish in the area by establishing mandatory days out of the fishery – "no fishing" days. This measure is intended to slow the rate of harvest so that the herring TAC is not reached as quickly. The primary advantage of this approach is that it provide a supply of herring to the market for a longer period than if there were no controls put in place until the overall TAC is reached and the fishery is closed. By using area specific TACs, it is likely that there will be some areas that remain open when one area is closed. Vessels may shift their effort into those areas, providing a steady supply of herring to markets even during the days out of the fishery. One possible negative impact of this approach is that it may encourage larger vessels to fish exclusively in the near shore areas until the effort controls are put in place, than shift to offshore areas to continue to supply markets. This may place smaller vessels unable to move offshore at a disadvantage in retaining their markets in the competitive herring fishery.

The effort controls gradually increase the restrictions on fishing time until 95% of the TAC is attained, when fishing is restricted to an incidental catch amount. This approach places significant administrative burdens and costs on the NMFS to monitor reported landings, project when the TAC will be reached, and notify the industry of the imposition of effort controls. To assist in that effort, the plan adopts mandatory reporting requirements for vessels and dealers that will improve timeliness of the information used by managers to monitor the fishery. Through the Commission, state fisheries agencies have agreed to assist in disseminating notification of effort restrictions. Finally, the relatively small size of the current herring fishery (with less than 20 vessels landing 97 percent of the catch) make it easier to monitor landings and notify major participants of restrictions.

Throughout development of the plan, the Council was cautioned that while a TAC would protect

the resource, it could also lead to interruptions in the supply of herring provided to the market. The Council attempted to find a way to extend the TAC and reduce the likelihood of a "race to fish" by imposing effort controls that would slow the catch rate. An early suggestion was the use of trip limits, rejected because of concerns over discards, enforcement difficulties, and difficulty in creating an equitable system. Another alternative considered was to apportion the TAC over a shorter time period – for example, over a three month period rather than an annual basis. This alternative was rejected because it would result in increased administrative costs to monitor the TAC. The gradual imposition of days out of the fishery was selected by the Council over other alternatives because it minimizes impacts on the industry while extending the season. It allows fishing activity to continue unfettered in management areas where landings are at a lower level and are not approaching the TAC. This will encourage a shift in effort from areas with restrictions into other open areas, particularly when three or four days are closed to the directed fishery. The boats most likely to move into the other areas are the larger vessels that can catch the most herring. Moving these vessels into other areas should slow the catch rates in the areas subject to effort controls, extending the season even more. This will insure a supply of herring to the markets.

The impact of the initial step in the controls (two days out of the fishery) will vary each year. In 1996 and 1997, for example, herring in the Gulf of Maine were easily located and many vessels routinely did not fish on Saturday or Sunday until the peak part of the season in mid-summer. In these circumstances, the initial effort control may have only a limited impact on catch rates. Preliminary reports in 1998, however, show that as vessels had increasing difficulty locating herring, many fished through the weekends. Under these conditions, the first two days out of the fishery will have more of an impact on the catch rates and will extend the season. The next two steps – three or four days out of the fishery – will significantly slow catch rates, particularly during the summer months when most herring landings occur. Few vessels in recent years have fished less than four or five days a week during this period.

At plan implementation, Management Area 1A will be most susceptible to early closure under open access. Processing facilities on the coast of Maine, which rely on a steady flow of product, could be adversely impacted by having periods of product gluts and shortages. Some amelioration is possible by the ability of these companies to supplement their supply of herring with Canadian herring, or by trucking fish from other ports. This could be made worse or better depending upon how the TAC is divided by area. Regardless, if market conditions improve, then incentives for peak load processing will exist. This problem can be mitigated if offshore processing alternatives existed simultaneously, encouraging vessels to fish offshore rather to supply these processors rather than inshore. It may also be mitigated if alternative open areas are identified that have sufficient herring to support the processors if Area 1A is closed. In 1998, increased landings from the Georges Bank area indicate that this may be the case. The following section describes the expected overall impacts on the effort controls in Management Area 1A using the first year TAC of 45,000 mt.

As noted above, the effort control system imposes significant administrative burden on NMFS to

monitor and announce the closings. There is the potential for at least three notice actions in each of the four areas once total catches approach the overall TAC. The measure is structured to allow NMFS to project and announce the closure of the directed fishery at the same time the agency announces the imposition of four days out of the fishery, eliminating the requirement for four notices to announce the closure of the fishery. Another factor that will help ease the burden is the current pattern in the fishery – herring fishing occurs in different areas at different times of the year, spreading out the notice actions and allowing NMFS to focus its attention on a few areas at a time. For example, the Area 2 fishery occurs primarily in the winter months. Generally, the Area 1A and 1B fisheries occur in the mid-summer and early fall, while the Area 3 fishery occurs in the summer into late fall and early winter. NMFS has had mixed success projecting landings for other quota managed fisheries. None of these fisheries, however, have used the IVR system that is required for herring fishing vessels. This should help speed the collection of catch information necessary to accurately project landings.

E.7.3.4.3 Overall Impact of Catch Controls

The effectiveness of mandatory days out will be depend largely on the time of year the restrictions are imposed. If it is during the summer months when vessels are normally fishing for the entire week, there will be substantial reductions in effort. If they are imposed during times of the year when vessels are typically not fishing for portions of the week then a mandatory day out may be taken when the vessel would not have fished anyway. Vessels may also be able to compensate by making larger trips during the days available for fishing. Mandatory days out will principally affect vessels fully employed in herring fishing. This is a relatively small number of vessels, but these vessels do catch a large portion of the annual harvest.

Several options considered by the Council would have divided the TAC into shorter time periods to help spread harvesting over the year. However, these options would have increased operating and administrative costs and would have caused more frequent disruptions to the industry (as effort controls are imposed more frequently). Regardless of these efforts to make the TAC last, the incentive still remains to catch the TAC too quickly in whatever period is defined. This could result in a shutdown of the fishery in a particular area and an interruption in the supply of herring to the market that reduces overall economic benefits. It is unlikely that in the initial years of the plan that all areas will be closed at the same time, so market should be supplied by open areas even if a management area is closed to directed fishing.

The most likely area to be subject to effort controls when the plan is adopted is the inshore Gulf of Maine area, Management Area 1A. Most landings have come from this area in recent years. An attempt was made to estimate when the TAC would be reached in Management Area 1A using the proposed management scheme. The reported landings in 1996 and 1997 in Management Area 1 were first plotted against dates (note that in 1996, some of the apparent jumps in the amount landed is due to an inability to assign all landings on a trip basis). Landings reported from the proposed Management Area 1B were removed, and the estimated impact of the proposed effort controls was applied to the remaining landings. Two methods for estimating the impact were

attempted. The first method (Model 1, described in section E.7.2.5.3) estimated the percentage of fishing trips that would have been impacted by the proposed effort controls, and subtracted the same percentage in landings. The second method (Model 2) subtracted landings made on the days that would have been closed to fishing if the effort controls were in place. The two models gave similar results that are almost indistinguishable when plotted together. Finally, an estimate of the impact of the spawning area closures was applied to these reduced landings (Model 3). The impact of the spawning closures was assumed to be the loss of 50% of the landings from the Central and Western Maine closures in 1996 and 1997. The results of these three models are shown in the figures at the end of this section.

The catch rates in 1997 would have resulted in closure of the Area 1A fishery by the middle of September (if the TAC had been set at 45,000 mt). Effort controls as proposed by the plan would have extended the season until early October. With a complete spawning closure (that is, no replacement in lost landings from areas that remain open to fishing), the area would have remained opened until the beginning of November. In 1996, the catch rates without effort controls would have resulted in closure of the Area 1A fishery in the beginning of September (if the TAC had been set at 45,000 mt). Effort controls would have extended the fishery until the end of the month, December, and a spawning closure as proposed in the plan would have extended the fishery until the first week of October (Figure E.22 and Figure E.23).

This analysis assumes the effort controls are perfectly effective (for Model 1, a percentage reduction in the number of trips results in the same percentage reduction in landings from Management Area 1A; for the second model, fishermen cannot make up lost landings on other days). It does not account for any compensatory actions that may be taken by fishermen to replace landings lost due to the effort controls. Model 3 is optimistic in assuming that none of the catch during the spawning closures is replaced by fishing effort in the open areas of Area 1A. The combined impact of the management measures, then, is that absent a significant change in fishing activity, the Area 1A directed fishery can be expected to close sometime between September and the beginning of November in 1999. If the TAC prompts a race for fish as has occurred in some quota fisheries, the closure could be even earlier. This is a significant change for both vessels and processors in the herring fishery. The August/September period is typically one of the most productive periods for herring fishermen in the Gulf of Maine, so any limitation on harvest during this period can be expected to decrease revenues and may increase vessel operating costs. Overall revenues may not decline if vessels are able to locate and catch herring in other open management areas. For the same reason, the supply of herring for the market may not be interrupted because of herring that may be caught in other areas.

While this discussion has focused on the impact on the directed fishery in Management Area 1A, there also will be impacts on other vessels that obtain some of their revenue from herring. Some vessels in the whiting fishery target herring at certain times of the year. This is done using a small mesh bottom trawl in the whiting grate fishery, or by fishing in the small mesh exemption areas. In 1998, 42 vessels had permits for the experimental grate fishery. Seventeen of these vessels landed a total of 59 mt of herring. The vessels that use small mesh in the small mesh areas do not

have a special permit category and their landings cannot be specifically identified in the vessel logbook database. To get a sense of the possible herring landings from these vessels, landings were examined from vessels that landed both herring and whiting. In 1997, there were 100 vessels that caught 823 mt of herring, while also landing 4,000 mt of whiting. The average herring landings were 3.5 mt (worth approximately $470 at an ex-vessel price of $0.06), with a minimum of 0.01 mt and a maximum of 30.4 mt (worth approximately $4,000) . According to the vessel rip report database, herring caught by all bottom trawl vessels (126 vessels) totaled 915 mt in 1997 (the dealer weighout database attributes additional landings to bottom trawl vessel, possibly due to miscoding of entries). The mean for these vessels was 7.3 mt, and the maximum was 368.8 mt. The fishery in the small mesh area is only allowed during the period July 15 through November 15. If the herring fishery closes in Area 1A closes in September, it will limit the ability of this group of vessels to target herring using a whiting net. Many of these vessels are small and are unlikely to relocate to other areas to fish for herring.

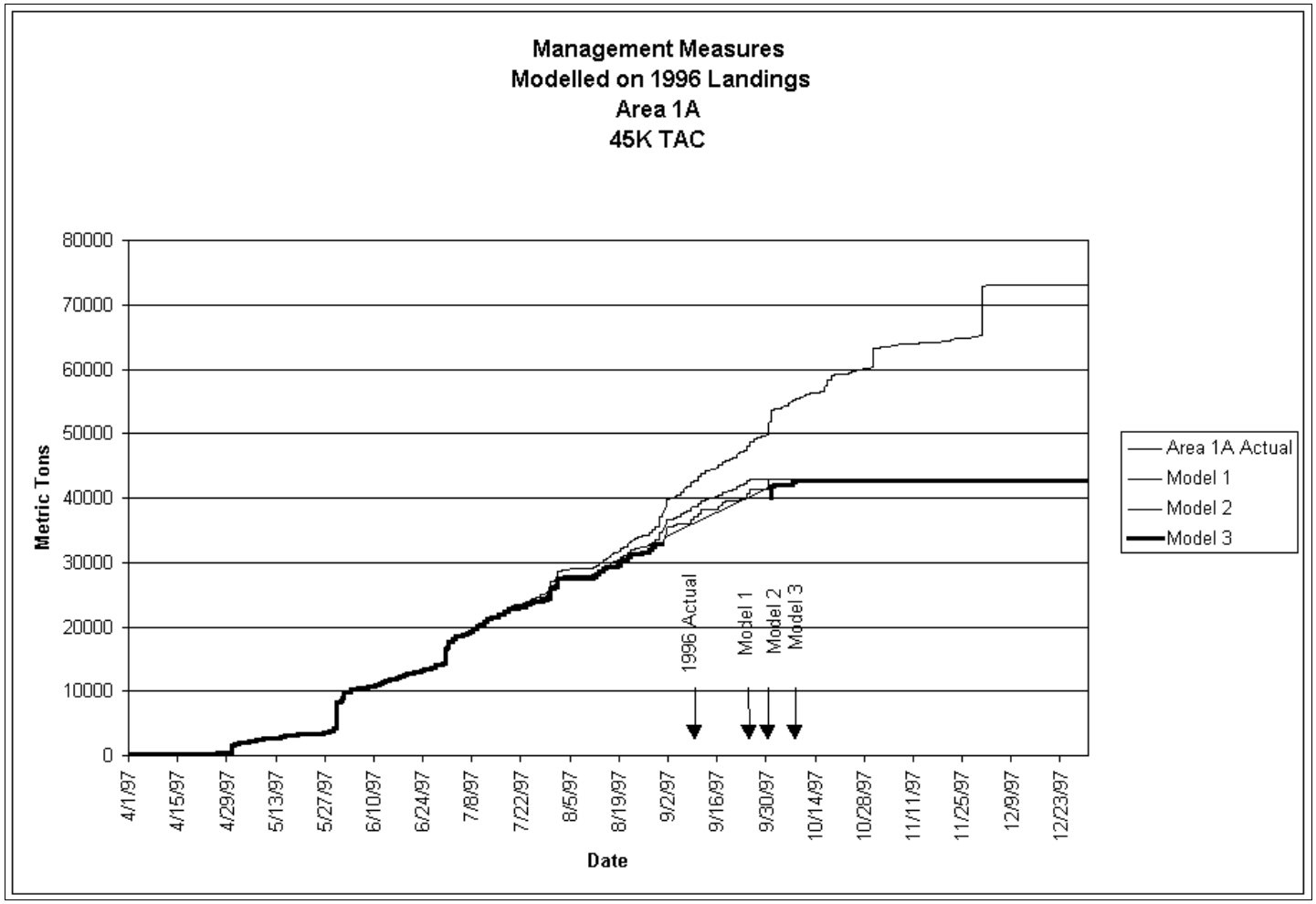

Figure E.22 - Management measures modeled on 1996 catch (Source: Maine DMR)

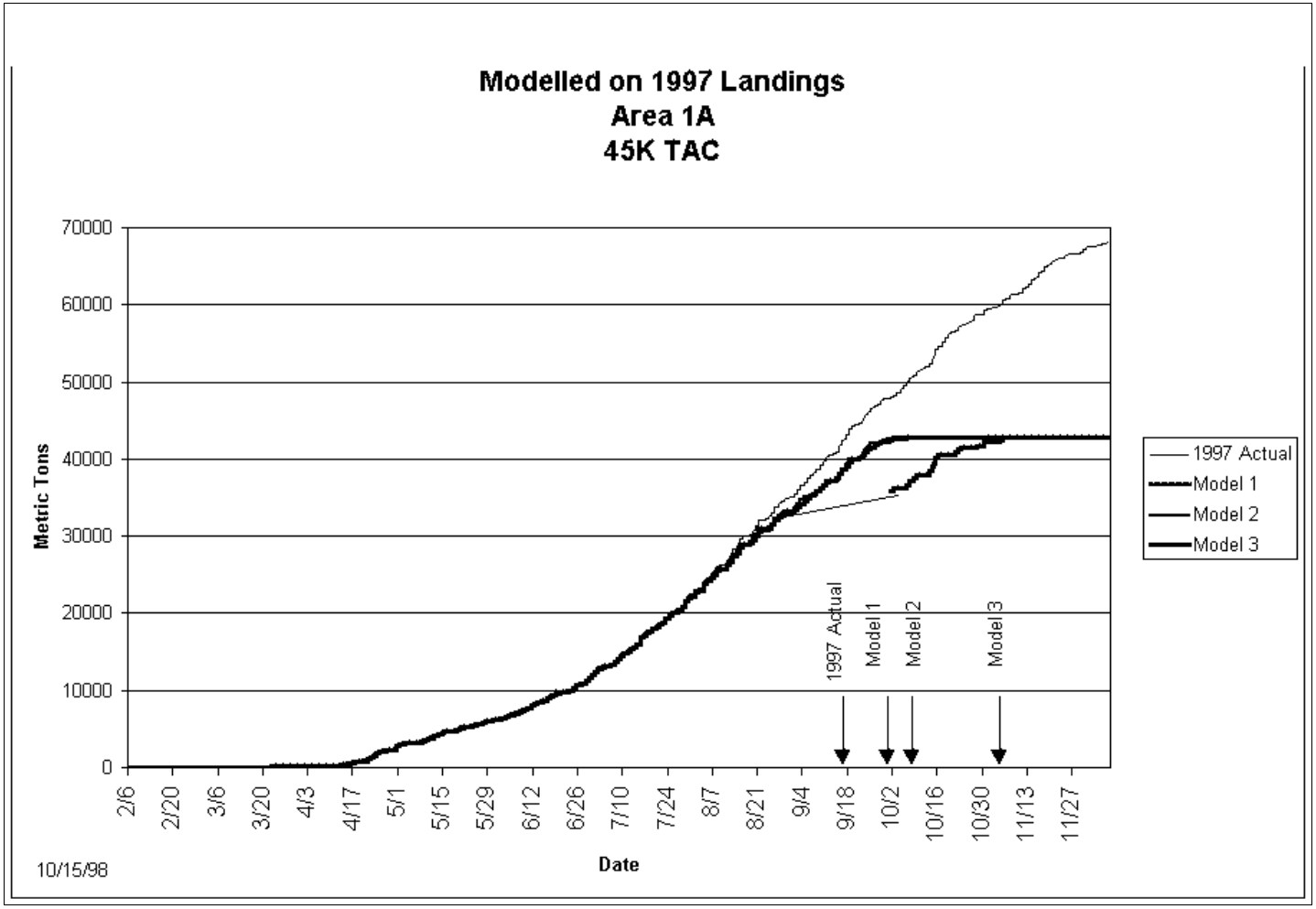

Figure E.23 - Management measures modeled on 1997 catch (see text for explanation of models) (Catch statistics source: Maine DMR)

E.7.3.4.4 Vessel Size Limits

The proposed size limit for domestic vessels was based upon current participants in the region's pelagic fisheries. For the vessels identified as having caught herring in 1997, the maximum length was 126 feet, the maximum horse power was 2,100, and the maximum GRTs was 246. There are mid-water trawl vessels that exceed these averages that may desire to participate in the fishery in the future, but there were no vessels that exceeded the proposed limit. This limit establishes a preference for existing vessels in the region to enter the fishery, while allowing some room for upgrades for current participants. It does not eliminate any of the current participants in the fishery. No vessel over the proposed size limit has a recent record of landing Atlantic herring. One vessel over the limit was planning to enter the fishery but was prevented from doing so through congressional action.

Total effort is comprised of the number of vessels in the fleet, the harvesting power and capacity of individual vessels in the fleet, and total fishing time. Limiting vessel size addresses the average capacity of the total fleet and not the total capacity. In the open access fishery the size limitation is really a limitation on each vessel's share of the catch. While vessel size limits may be ineffective in controlling total capacity under open access where the number of vessels could increase without limit, it may slow the development of the fishery. Existing large vessels that are currently participating in other fisheries could easily enter the herring fishery with limited additional investment. By contrast, the smaller vessels in the New England and Mid-Atlantic region that do not currently participate in pelagic fisheries must make a considerable investment – estimated between $100,000 to $250,000 – to convert to mid-water trawling. An analysis of existing harvesting capacity in the Northeast Region indicates that there is sufficient capacity to harvest the available herring resource should vessels choose to do so (see sectionE.1.1.1.1). Many of these vessels are under increasing restrictions in other fisheries and may desire to enter the herring fishery to supplement their income. In order to enter the fishery, these vessels will have to develop markets for herring and may need to alter their vessels to improve their ability to deliver quality herring to shore. The time it takes for them to do so will slow the introduction of harvesting capacity into the fishery.

There are advantages to allowing large domestic vessels into the fishery. Large vessels typically process on board, can remain at-sea for longer periods and in worse weather, and produce a product that can be sold into foreign markets. There are economies of scale, resulting in lower production costs per unit. They may help develop transportation infrastructure as they ship their cargo to other locations. At-sea processing may be cheaper than shoreside processing, helping at-sea processors to compete successfully in the world market furthering the development of additional markets for U.S. herring. A disadvantage is that large vessels rapidly introduce additional capacity into the region and increase catch rates. Allowing these vessels to enter the fishery may result in early attainment of the TAC and resultant interruptions in supply. Because of limited entry provisions in many northeast region fisheries, they have less flexibility to shift into other fisheries in the area during resource downturns. While not all existing herring fishery participants have permits in limited access fisheries, Table 6 shows that many of the vessels that

currently land herring do have a permit in another Northeast Region fishery.

Because the herring fishery is being managed as an open access fishery, however, a large number of small vessels entering the fishery could also result in excess harvesting capacity. Emphasizing this concern is recent experience with the development of excess capacity. There has already been one buyout of groundfish vessels in the northeast region, at a cost of over $24 million - a clear demonstration that a large number of small vessels can lead to overcapacity. The Council recently asked NMFS to consider a buyout for the scallop fishery. There are also examples of excess capacity in fisheries that use large factory trawlers. In the North Pacific, a negotiated agreement will result in a $90 million buyout of large factory trawlers ($20 million of federal funds) in order to address capacity concerns caused by large factory trawlers. While the question of excess capacity is not solely one of vessel size, given the existence of available capacity in the region and these recent attempts to reduce overall capacity in other U.S. fisheries, it makes little sense to introduce large domestic vessels until it is certain that the capacity they represent can be accommodated.

One of the objectives of the FMP is to provide opportunities to vessels in other New England and mid-Atlantic fisheries. As noted above, the limit on vessel size is a limit on each vessel's share of the catch. A limit on vessel size will help meet the plan's objectives by allowing a greater number of vessels into the fishery, regardless whether a controlled access or open access approach is chosen. For a given harvest level, this will increase the number of participants in the fishery. From a fishery specific viewpoint, the restriction may result in an inefficient use of resources. It may, however, help ease impacts of fishery rebuilding plans on vessels in other fisheries. The size limit also allows the fishery to expand under the existing business and social environment. The introduction of large vessels would significantly change the harvesting and marketing structure with the attendant social and economic disruption.

The plan creates an allocation for U.S. at-sea processing by vessels larger than 165 feet in length or 750 GRT. At the present time, there are not any domestic vessels in this size category in the Atlantic herring fishery. The creation of an allocation for a new category of processing participants provides the Council the opportunity to carefully consider the impacts of this activity on herring management. Because the current fishery does not have any vessels in this category, the benefits and risk are not clearly understood. This argues for a cautious approach, as the impacts of a rapid expansion in processing capacity can be as difficult a management problem as an increase in harvesting capacity. Recent efforts by the North Pacific Fishery Management Council to address inshore/offshore allocation issues culminated in legislation that defined the allocations and authorized $90 million to reduce both at-sea processing and harvesting capacity. Legislation establishing the buyout also restricts the development of additional shoreside capacity by restricting who can purchase Alaska groundfish.

One of the advantages to at-sea processors is that if there is a resource downturn, they can move to another area or shift into another fishery. In the Northeast Region, there are limited opportunities for such shifts due to the regulation and resource status of other fisheries. At-sea

processors are not limited to one geographic area, however, and could relocate to take advantage of resources in other areas. In the herring fishery, this could be an advantage as large processors – foreign or domestic – could be encouraged to enter the fishery on a short-term basis to take advantage of a "bloom" or temporary increase in abundance without developing permanent processing capacity. This option remains available for both foreign and domestic processors because the plan allows the specifications for USAP and JVPt to be set at on an annual basis.

For the 1999 fishing year, the allocation for large U.S. at-sea processing vessels is recommend as 0 mt. This will prevent large at-sea processors from entering the fishery, favoring participants that are similar to those currently in the fishery. Those vessels and processors that have made plans based on the current industry structure to implement their plans without a radical shift in processing capacity. The impacts of management measures – designed with the existing industry structure in mind – can be evaluated and adjustments made as necessary.

In addition to these concerns, the herring fishery in the Northeast Region has become inextricably tied to the lobster fishery. There are limited alternatives to fresh herring for bait. With an estimated 70% of the herring harvested being used for bait, any reduction in the amount of herring reaching land will negatively impact the lobster fishery. There is a concern that large domestic vessels, catching and processing at-sea, will reduce the amount of herring available for bait.

The negative impacts of the restriction on size of harvesting vessels, and the recommendation to allocate 0 mt to domestic at-sea processors in the first year of the plan, are due to the restriction on the free workings of the market to resolve allocation issues. Generally, measures which allow competition, including competition between shoreside and at-sea processing activities, are more likely to promote economically efficient use of herring. Less control over processing activities may ultimately result in more markets filled by a wider variety of industry participants. The best way to decide the optimal mix may not be by controlling participation, but by allowing market signals on prices to fishermen, processors, or bait dealers to decide the allocation of herring to different industry sectors. Attempting to engineer the market by limiting vessel size or banning offshore processing may result in inefficient outcomes.

As an example, there has been little interest by foreign vessels to participate in herring joint ventures in recent years (see section E.6.4.3.3). A large domestic at-sea processing vessel could hire catcher vessels to supply it with herring. This would provide an opportunity for some vessels in those fisheries subject to increasing restrictions (scallops and groundfish, for example) to supply herring to at-sea processing vessels. These vessels will now have to find shoreside markets for their herring if they want to enter the herring fishery. This may require additional investment to convert vessel holds to refrigerated sea water systems (RSW) if they intend to enter anything other than the bait market, or if they desire to fish offshore. The absence of a large at-sea processing vessel may also slow the marketing of frozen herring for human consumption. While this niche may eventually be filled by shoreside processors, higher shoreside processing costs may make it difficult for them to compete in the world market. A further illustration can be seen in the concern by the lobster industry that an at-sea processor will reduce the availability of lobster bait

because herring will be sold at-sea rather than transported to shore. If a shortage of bait were to develop, the price should increase, attracting additional vessels into this market and resolving the shortfall. By preventing vessels from having the opportunity to provide herring to an at-sea processing market, the plan may hold the price of herring bait to a lower level.

E.7.3.5 Roe Fishery

Allowing a roe fishery will provide additional flexibility for fishermen to pursue the optimal mix of outputs. Market conditions could change so that roe could be profitably pursued. If the resource is managed properly there is no reason to limit certain product forms. This provision may also encourage development of the offshore fishery, as a highly profitable roe fishery could encourage investment in the size and type of vessels necessary to pursue the offshore resource. The requirement to retain the carcass may slow production in the roe fishery and increase costs, but provides a needed way to monitor the catch.

In the Pacific Northwest, the price per pound of roe in the roe-on-kelp fishery has approached $30/pound. While a roe-on-kelp fishery could develop in the EEZ, it is more likely that the harvest of roe will be similar to the sac roe fishery in Alaska or the east coast of Canada. 1997 prices in the herring sac roe fishery in Alaska ranged from $180/ton to $600/ton (Alaska Department of Fish and Game, June 8, 1998; http://www.cdf.adfg.state.ak.us). This is higher than the average value for Atlantic herring of $110/mt in 1997. Average ex-vessel revenues in the herring fishery have remained nearly constant since 1980. Any development of a roe fishery will increase that average value and result in increased economic benefits. Prices are dependent on international markets, particularly those in Asia; any roe fishery would be subject to fluctuations based on international market conditions as well as demand. Development of an Atlantic herring roe fishery is likely to be more similar to the roe fishery in Canada. While the west coast product is primarily used for holidays in Japan, the east coast roe is used year round. (Kurita, pers. com.). Prices in the east coast Canadian roe fishery have ranged from $0.18 - $0.20/pound (Canadian) for whole herring for the roe market, though it declined to only $0.06/pound (Canadian) due to Japanese financial instability in 1998.

E.7.3.6 Joint Venture/Internal Waters Processing Restrictions

While joint venture operations may occur in any area, the Council has reserved the option to restrict them to certain areas through the allocation process. The purpose of this option is to encourage development of or protect employment and investment in current shoreside processing activity or reserve the harvest for shoreside processing in certain areas. By doing so, these options limit the flexibility of the harvester to pursue alternative markets. The result of these limits may be increased harvesting and processing costs because locations may be selected that are less than ideal. Sufficient product may be reserved for domestic processors through use of the allocation of DAP and JVP, but these allocation processes may not be sufficient to guarantee product to domestic processors when needed. There may also be other social or cultural reasons to implement these restrictions such as to support shoreside processors in rural communities.

E.7.3.7 Vessel Monitoring Systems

E.7.3.7.1 Vessel Costs

The FMP includes a requirement for a vessel monitoring system (VMS) for vessels that landed in the previous year, or intend to land in the current year, more than 500 mt of herring. Such a system allows the tracking of the vessel, facilitating the enforcement of closed areas or area TACs, reporting of catches, and tracking of days-at-sea. Vessels must declare their intention when entering the fishery and must have the VMS on board when they begin fishing. If a vessel does not have a VMS on board, it cannot catch more than 500 mt of herring during the fishing year.

The system is designed to record a vessel's hourly position throughout the year, including when the vessel is at the dock or on a mooring. While power requirements may be low there is a continuous drain on batteries, which can be a problem during port time, especially in cold weather. Many vessels do not have an independent electrical source (generator), and those that do would have to run the generators continuously to keep the batteries charged, even when on a mooring or sitting idly at the dock for an extended period. To avoid the additional costs and operational problems that result from requiring a VMS to transmit when moored, this FMP requires a VMS to transmit only when the vessel is underway in state or federal waters.

Vessels may experience some benefits to VMS that have not been quantified. The system provides excellent an excellent communications link that may improve coordination between vessels and their markets. In addition, the improved communications link may provide some safety benefits – with the Boatracs system, for example, continuous satellite communications are possible with facilities ashore. This link is not as likely to be disrupted by weather or atmospherics as the HF-SSB and VHF-FM radios commonly used by the fleet. Unlike an Emergency Position Indicating Radiobeacon (EPIRB), the a VMS system not only determines the vessel location in case of an emergency, but allows a two-way communications link between the vessel and the shore.

The fixed costs of the system represent a proportionally larger part of the annual revenues of a small or part-time boat than a larger or full-time boat. For vessels that land a small amount of herring, the herring revenues will not fund the costs of a VMS. If these vessels are required to purchase a VMS, they may choose to forego herring revenues to avoid the VMS requirement. The requirement, as established, only applies to those vessels that harvest a minimum of 500 mt of herring. At this minimum level, VMS costs over a five year period are less than 5% of vessel revenues for one hourly transmission every day of the year. Actual costs may be less because the herring FMP does not require VMS messages when the vessel is in port.
The costs for the purchase, installation, and operation of a VMS required by the Atlantic herring FMP are estimated at $2,700 per year, per vessel. VMS systems selected for use must be approved by the Regional Administrator. Currently there is only one vendor that offers VMS equipment approved for use in the Northeast Region - Boatracs, Inc. There is the possibility,

however, that equipment based on the Inmarsat C communication system may be approved in the future. Boatracs system purchase and installation costs about $6,000. Boatracs offers a lease – to – own option at $4,258 / year for a 24-month lease or $3,029 / year for 36 months.[1] An Inmarsat C system installation will range from $3,400 to $5,400 because of various options available, with an additional $400 charge for installation. The annualized equipment costs based on a five-year amortization of the purchase and installation price is $1,200 for Boatracs and $1,160 (maximum) for an Inmarsat C system. These costs should be compared with the potential benefits from the regulations as will be discussed below. Table E.59 summarizes the total costs of VMS monitoring to the public under the proposed regulations.

The primary costs after purchase and installation of a VMS is the charge for the messages that communicate the vessel's position. The total costs for these messages depends on the system chosen for operation, either Boatracs or an Inmarsat system. There is no estimated maintenance charge for either system. Boatracs, Inc. currently charges a flat rate for messaging of $125/month, based on one message each hour of every day. In the case of the herring fishery, vessels will not have to transmit position reports when moored in port so the number of messages will be reduced, but it is uncertain if the company will reduce costs for fewer messages. Message costs are about $0.10 per message for Inmarsat, or about $75/month for a message each hour of every day.[2] Total annualized costs of VMS per vessel messaging are estimated to be $1,500 for Boatracs and $900 for an Inmarsat C system based on one message each hour of every day.

The costs to the industry from the VMS monitoring are expected, however, to be lower than estimated above. Cost estimates include message costs for one hourly message every hour of the year; the plan will only require messages when the vessel is underway, reducing communications costs. Some of the herring vessels have already installed VMS for private use. VMS will also have positive impacts on the industry through improved enforcement, compliance, and management of the fishery resources as summarized under item 1 of this analysis. VTS monitoring will also provide numerous benefits for vessels operations in terms of improved safety, flexibility, and vessel record keeping. Although these benefits to the public cannot be estimated in estimated in monetary terms, they are outlined below:

Benefits for vessel operations

- Improved safety
  - More precise location allows faster response by rescue platforms
  - 2-way communication allows vessels to communicate precise nature of problems
- Improved vessel record-keeping - more accurate plotting of tow results - catches, bottom characteristics and potential obstructions

- More accurate monitoring of vessel operations by owners who are not aboard the vessels
- Would provide secure 2-way communications between vessels and shore

[1] Information is based on personal communications with Bob Negroni of Boatracs, Inc.
[2] Information is based on personal communications with Sandra Yin of NMFS.

- Allows vessels /companies to communicate valuable information about catches, markets, logistics, etc.
- The VMS would back-up global positioning systems currently used by vessels - this benefit will be greater when the LORAN system is eliminated in the future.
- As closed areas become more enforceable, they could be smaller - yet still result in an equivalent level of conservation.
- Would increase the flexibility of vessels operations by making area closure smaller or by making feasible measures that apply trip limits to specific areas.

Elimination of future requirements with VMS monitoring

- Landings data could be handled electronically
- Would reduce administrative costs
- Would improve timeliness of data

Estimated Herring Fleet VMS Costs - Boatracs			
Number of Vessels	Annualized Cost per Vessel (Installation and Operation)	Total Costs	Percent of 1997 Fleet Revenues
20	$2,700	$54,000	0.5%
40	$2,700	$108,000	1.0%
60	$2,700	$162,000	1.5%

Table E.59 – Estimated fleet VMS costs based on Boatracs system. Annualized costs include installation and operation.

E.7.3.7.2 NMFS Costs

The annualized costs to the government for VMS reporting requirements under the Atlantic herring FMP are estimated at $20,000. The NMFS Northeast Region currently operates a VMS system for the Atlantic sea scallop fishery. The estimates of the annual administrative and enforcement costs to the federal government from this program are summarized in Table E.60. The costs were estimated by extrapolating the costs of the VMS experimental program to a year. The ongoing (recurring) costs amount to $300,00 a year and include staff costs, internet connection, training, travel and the annual costs for equipment and the back-up system.[3] These costs are not expected to increase with the VMS requirement for Atlantic herring fishermen. No additional costs are expected to be incurred from the requirement to monitor reports received from Atlantic herring fishing vessels, as the system is highly automated and is already established.

[3] Salary costs are those minimally associated with two GS-13 computer specialists and one GS-11 VMS technician required for daily operation and maintenance of the system. The costs include benefits.

The costs for expanding this program to another fishery are not well defined. The primary cost will be in the labor necessary to revise operating software to monitor another fishery with different regulations, protected areas, and other requirements. NMFS estimates that it costs approximately $100,000 to add 50-100 boats from another fishery to an existing VMS system. These costs were amortized over five years and added to the ongoing costs. The total annualized costs of VMS monitoring amount to $320,000. Only $20,000, however, is due to the requirement for VMS in the herring fishery since the other operating costs support the system's current use in the sea scallop fishery.

It is not possible to predict precisely at this moment if these costs would change in the future as more and more vessels are eventually added to the program. The NMFS Enforcement Office believes, however, that the present VMS monitoring capacity developed for the scallop program can handle a high number of vessels, including the 442 vessels with scallop limited access and multispecies individual days-at-sea permits, with no substantial increase in costs. At the present time, the system is only monitoring about 230 vessels in the sea scallop and multispecies fisheries. The addition of 25 vessels in the herring fishery is well within the capability of the existing system.

The overall administrative and enforcement costs, however, are expected to be lower than can be quantified within the framework of the present analysis. First, without the VMS system, the only way to verify reported catch locations is by examining sighting reports from enforcement units, a laborious process that is unlikely to be performed due to manpower limitations. Second, vessel-generated geographical information will allow more efficient deployment of enforcement resources and would, therefore, increase efficiency and effectiveness in the use of current resources.

Finally, VMS monitoring would reduce the need for expensive Coast Guard over-flights to enforce spawning area closures or mandatory days out of the fishery. A VMS system could potentially enable the Coast Guard to fully meet its fisheries program standards without additional resources. Consequently, VMS is expected to result in significant savings in enforcement costs if its use is broadened to include vessels under Atlantic herring FMP.

In addition to these monetary benefits, VMS in the herring fishery would significantly improve the Coast Guard's ability to detect violators and respond with the appropriate action. While the system does have some limitations, it will be of tremendous use in the enforcement of spawning and other area closures and effort controls. Herring vessels are allowed to fish in areas closed to groundfish vessels; the VMS requirement will help enforcement units sort vessels detected in the closed areas and determine who is fishing legally. It will augment cutter and aircraft patrols and allow them to be used to enforce other management measures. A VMS will also make boarding efforts more efficient, as it will help Coast Guard distribute boardings in a more equitable manner across all fleet sectors.

The actual life cycle costs to the government and users for a VMS system are not fully understood. The VMS used by a vessel must be approved by the Regional Administrator. In the

Northeast Region, only one vendor (Boatracs, Inc.) is currently approved for the multispecies and scallop VMS requirement. With only one certified vendor, and a regulatory requirement to use the VMS, there is no inherent cost-controlling mechanism such as would exist in a competitive marketplace with two or more vendors. This is a problem for the lease/purchase cost of the equipment, but is perhaps a greater problem for embedded, or hidden variable costs such as messaging charges or insurance. On the other hand, any further delay in the requirement to use VMS, may discourage other potential vendors from further development of their competing systems. In the future, other vendors may be able to receive approval for systems using the Inmarsat C system.

VMS Monitoring Annual Costs		
	Salary and Benefits[1]	$230,000
	Internet Connection[2]	$7,500
	Equipment [3]	$20,000
	Back-up System [4]	$38,960
	Software Licensing	$3,500
	Supplies[5]	$11,000
	Training and travel	**$8,000**
	Total Ongoing Costs	**$300,000**
Start-up Costs	Software adaptations	$100,000
	Total Fixed Costs	$100,000
	Annualized Start-up Costs (at 5 year amortization)	**$20,000**
Total Annual Costs [6]		**$320,000**
Previously Committed Costs		
Total Annual Costs[7]		**$300,000**
Net Annual Costs to Government from Herring VMS Monitoring		**$20,000**

Table E.60 – VMS costs to the government (Source: Data supplied by NMFS, Office of Enforcement, Northeast Regional Center, and NMFS Headquarters)

1. Salary and benefits, three program support personnel.
2. 24-hour maintenance of secure internet node at Gloucester, MA.
3. Lease and maintenance contract on CPU and monitor.
4. Lease and maintenance contract on CPU and monitor
5. Optical storage disks, repairs and supplies associated with non-lease equipment (modem, router, printer, thermal paper, WORM drive).
6. Estimated by adding up annualized start-up costs ($2,383) to total ongoing costs.
7. System operating costs currently funded to support program for the sea scallop fishery.

E.7.3.8 General Administrative Measures

The requirements for permits, vessel and dealer reporting, and monitoring of the FMP impose costs on both participants (vessels, dealers, and processors) and the government. The primary costs for participants in the herring fishery is due to the time necessary to complete forms in order to comply with the requirements. These costs are detailed in the Paperwork Reduction Act analysis (PRA), section 7.7 and Appendix VI. To summarize, vessels, dealers and processors will be required to obtain permits and comply with mandatory reporting requirements. Since some participants in the fishery already have a federal permit and comply with reporting requirements established by another fishery, the costs are estimated for new participants only. In the case of these management measures, the compliance costs are primarily due to the time required to complete and submit the necessary forms. Total vessel costs for these requirements are estimated as $7.80 for vessel permits, $25.32 for operator permits, $27.00 for vessel trip reports, and $52.00 (maximum) for interactive voice reports. Total costs per vessel are thus $112 per vessel. The total cost for dealers is estimated to be $1.58 for permits and $78.70 for weekly landing reports, for a total of about $80 per dealer. The costs for processors is also estimated to be $1.58 for permits and $7.83 for an annual report, or a total of $9.41 per processor. This costs are considered insignificant. The government will also incur some costs to monitor these programs, estimated to be $6,929 for all of these requirements.

E.7.3.9 Other Costs

E.7.3.9.1 Costs to Processors

Currently, the two primary uses of herring are as bait and as sardines (section E.1.1.1). While there are a number of fish that can be used for bait, herring is currently the only one that is plentiful and readily available. The sardine canneries require herring for their raw material. The management plan does not restrict the overall supply of herring, which could double under the proposed regulations. The plan does, however, allocate TACs to different areas in a way that may change existing fishing patterns. Processors may need to adapt their sources of supply as a result of these restrictions. For example, the inshore Gulf of Maine area will not supply as much herring as in recent years. Processors will need to identify vessels that harvest herring from other areas. If vessels are unable to locate herring in these areas, there may be temporary shortages.

E.7.3.10 Enforcement Costs

The management measures for Atlantic herring include area specific TACs, closed spawning areas, mandatory days out of the fishery, incidental catch limits, and limits on transfers at sea. All of these measures will impose additional enforcement burdens on enforcement agencies. The economic costs of these measures will depend on whether new revenues must be raised from taxpayers to pay for the added enforcement burden. The more likely scenario is that there will be opportunity costs for enforcement services that must be diverted from other activities.

In the event that no new revenues are raised from the public to pay for Atlantic herring enforcement, from a budgetary perspective, Atlantic herring enforcement costs are a transfer payment from one enforcement activity to another. Adding enforcement responsibilities with a new management plan will take away enforcement services that are devoted to other fisheries. The cost of adding Atlantic herring regulations is measured by the opportunity cost (i.e. foregone benefits) of reducing the enforcement services devoted to other activities. Unfortunately, no empirical studies have been conducted to measure the value of enforcement services provided in northeast region fisheries, making a quantitative estimate of enforcement costs impossible.

The primary management measure for preventing overfishing is the establishment of a TAC and its distribution by management area. Enforcement of this provision is complicated by the difficulty in proving that a vessel accurately reports the location that it catches herring. This would require comparison of sighting information from cutters or aircraft to be compared to catch locations reported by the vessel through the IVR or VTR system. Given the relatively few vessels that fish for herring and the wide area over which the range, significant enforcement resources would have to be devoted to locate vessel and confirm their fishing activity. Even this effort would be complicated since much herring fishing occurs at night. In order to facilitate this effort and reduce enforcement costs, the plan requires the vessels that land the majority of herring to be equipped with a VMS. This system will reduce enforcement costs in two ways. First, a record will be generated that tracks the location of herring vessels when underway. While VMS does not confirm fishing activity, it can be compared to reported catch locations to confirm that a vessel was located in that position at a given time. Second, the VMS will reduce the amount of time necessary for enforcement units to search for herring vessels, making it easier to confirm activity. In a similar fashion, the VMS will reduce the costs of enforcing the spawning area closures or mandatory days out of the fishery. Cutters and aircraft will be able to rapidly locate herring fishing vessels and make certain that they are not fishing in an area that is closed, either due to the imposition of effort controls or because of a spawning closure.

Vessels that intend to harvest more than 500 mt of herring, or that harvested 500 mt of herring in the previous year, will be required to operate a VMS (section 3.10). The costs for a VMS are described in section E.7.3.7.1. The annualized cost per vessel to purchase, install, and operate a VMS is estimated to be $2,700. Additional costs are incurred due to burden-hour estimates of the requirements associated with VMS, estimated as an additional $111 per vessel. At the 500 mt threshold, this is about 4% of annual revenues. When compared to the average herring revenues of the 19 vessels that landed most of the herring in 1997 and who would be required to have a VMS if based on 1997 landings, this cost is equal to about 0.5% of the average revenues for this group. Additional costs to the government to adapt the existing VMS system to the herring fishery is estimated as $20,000 per year (section E.7.3.7.2).

The small number of participants in the herring fishery will also tend to keep enforcement costs low. Even if the number of vessels landing more than 500 mt of herring were to double, there would still be less than 50 boats landing the majority of the herring catch – far less than the

thousands of boats that participate in other fisheries in the region. Because of the small number of participants, the opportunity costs to enforce the herring regulations are likely to be a small portion of the overall enforcement effort.

E.7.3.11 Alternatives Not Selected

E.7.3.11.1 No Action

Under the no action alternative, landings of herring are likely to increase in the short term if market demand increases. This will result in increased revenues from the fishery. Vessels can be expected to minimize costs while attempting to fill this demand, concentrating fishing effort in inshore areas and during spawning seasons when herring are most aggregated. Administrative and enforcement costs would be minimized.

Increased effort in the inshore areas could be expected to result in overfishing on those spawning components. The likely area that this may happen is in the inshore Gulf of Maine. As the resource is exhausted, vessels and dealers would be forced to locate herring in other areas. This would increase vessel costs and may result in interruptions of supply to herring markets. After collapse of the herring fishery on Georges Bank, the resource took nearly ten years to rebuild. A similar collapse in the inshore areas would be disastrous to the traditional herring fishery.

E.7.3.11.2 Limited Entry/Controlled Access

The controlled access/limited entry proposal limits the number of participants in the herring fishery. One approach to removing the incentive for using up the TAC at the beginning of the period is to distribute the TAC among the participants in days-at-sea equivalents (or individual effort quota) and allow fishing to take place in whatever manner was appropriate for each fishermen. This type of system would not replace the hard TAC however. It is the assurance that each fisherman's "balance" will not be taken by others that keeps them from going out to "get their share". Keeping the hard TAC makes it more difficult to assure fishermen that an area won't be shut down due to TAC being used up. As described, the controlled access option will only be effective in removing the derby incentive to the extent that fishermen believe that the days-at-sea allocation was done correctly. If days-at-sea allocations are correctly matched to the TAC and fishermen believe an area will not close, then the derby incentive is effectively removed. If days-at-sea allocations are too high and areas close early then the derby incentive remains.

The main difference between open access and controlled access is that controlled access allows for some control of the physical capital that can be applied to the herring resource. Open access allows permanent capacity to enter without any restrictions and leads to excessive harvest capacity development even with a hard TAC. The controlled access option allows herring to be used as it has been traditionally and as an alternative fishery for vessels in distressed fisheries but without the infusion of permanent harvest capacity. In addition, the controlled access option moves the fishery one step closer to establishing property rights by accounting for permits and

tying them to an effort allocation.

Other features of the controlled access alternative are discussed in that section 3.0. In general it provides flexibility by allowing transferability of either permits and or the days at sea (DAS) associated with the permanent and temporary permits, permit controlled harvest of “blooms” without generating permanent harvesting capacity and also flexibility in processing options.

Neither the controlled access nor the open access alternative control how the fishery will develop to one in which vessels of various sizes find appropriate and profitable niches in which to operate.

E.7.3.11.2.1 Controlled Access Qualification Criteria

The controlled access system proposed several possible qualification criteria. By definition, the entry criteria will exclude some vessels from the directed fishery for herring. The following tables characterize the vessels that would qualify for a Management Area 1 controlled access fishery under the various qualification criteria.

The adoption of any of these criteria limits the opportunities for other fishermen to enter the herring fishery. Particularly for the more restrictive criteria, this will restrict the benefits of increased herring landings to a small group.

Qualifying Option 1 – fished in area 1 in 1996 or 1997 and possessed herring exemption letter
(see table on following page for vessels qualifying under this option)

Gear	Vessels	Avg. horse power	Avg. length (ft.)	Avg. tons	Home state	Avg. yearly trips in area 1	Avg. yearly herring catch (mt) in area 1
Bottom otter trawl	2	512 425 min 600 max	62 45 min 79 max	50 32 min 69 max	MA	17 6 min 28 max	5 1.2 min 8.9 max
Mid-water trawl	11	928 348 min 1,300 max	90 49 min 126 max	157 39 min 199 max	MA	44 1 min 114 max	2,221 136 min 6,195 max
Purse seine	2	355 260 min 450 max	51 23 min 79 max	88 2 min 173 max	1 MA 1 ME	68 3 min 80 max	5,334 9.4 min 10,660 max

Table E.61 - Description of vessels qualifying under option 1 by principal herring gear

Qualifying option 2 - fished in area 1 in 1996 or 1997 and averaged > 2,000 lbs per trip in either year

Gear	**Vessels**	**Avg. horse power**	**Avg. length (ft)**	**Avg. tons**	**Home state**	**Avg. yearly trips in area 1**	**Avg. yearly herring catch (mt) in area 1**
Bottom otter trawl	18	379 180 min 730 max	57 42 min 80 max	63 11 min 180 max	9 MA 3 NH 2 ME, RI 1 DE, VA 1 unknown	9 1 min 75 max	30 1.2 min 216 max
Mid-water trawl	14	877 333 min 1300 max	88 49 min 126 max	159 39 min 199 max	12 MA 1 WV 1 unknown	44 1 min 114 max	2,316 2.2 min 7,303 max
Purse seine	15	435 200 min 970 max	53 23 min 84 max	61 2 min 192 max	6 ME 3 MA 1 RI, VA 4 unknown	42 1 min 162 max	2,795 3.3 min 14,677 max
Sink gillnet	1	480	48	37	MA	1	1
Weir	6	n/a	n/a	n/a	not federally permitted	3 1 min 7 max	56 1.1 min 171 max

Table E.62 - Description of vessels qualifying under option 2 by principal herring gear

Some vessels that landed herring in 1996 or 1997 would not qualify under this qualification criteria. The following table summarizes the characteristics of those vessels that would not qualify.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	1	2	2	10
GRT, Mean	2	35.5	66.5	179
Max.	2	39	69	199
Min.	2	32	64	158
HP, Mean	260	178	412	992
Max	260	600	425	1300
Min	260	248	400	450
Length, Mean	23	47	64.5	96.8
Max.	23	49	79	126
Min	23	45	50	77

TC < 5 GRT; TC2: 5 to 50 GRT; TC3: 50 to 150 GRT; TC4: 150 GRT and over
Table E.63 - Non-qualifying vessel characteristics by ton class, option 2

Option 3 Additional vessels from 1990-1995 that fished in Area 1 and averaged >2,000 lbs per trip in any year from 1990-1995

Under option 3, the qualification period is extended. The total number of vessels that would qualify includes those shown in Table E.61 and Table E.62.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	0	26	13	3
GRT, Mean		30	72	179
Max.		5	50	152
Min.		49	116	198
HP, Mean		324	446	828
Max		135	360	520
Min		600	871	1200
Length, Mean		47	64	89
Max.		31	56	81
Min		60	79	104

Table E.64 - Additional qualifying vessel characteristics by ton class, option 3

Option 4 Vessels that possess a multispecies, squid/mackerel/butterfish
Current (as of 5/12/98) multispecies, scallop, or squid/mackerel/butterfish permit holders. Total of 2,848 vessels.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	1	2	2	10
GRT, Mean	2	35.5	66.5	179
Max.	2	39	69	199
Min.	2	32	64	158
HP, Mean	260	178	412	992
Max	260	600	425	1300
Min	260	248	400	450
Length, Mean	23	47	64.5	96.8
Max.	23	49	79	126
Min	23	45	50	77

Table E.65 - Qualifying vessel characteristics, by ton class, option 4

E.7.4 Social Impacts of the Alternatives

Appendix I, prepared by Dr. Christopher Dyer and Dr. John Poggie under contract to the Council, contains an extended discussion of the social issues surrounding the herring fishery. This paper highlights the social impacts of many of the alternatives considered by the Council. The following discussion highlights the impacts of the management measures and draws from the conclusions in this paper, as well as the entire EIS. The herring fishery has a long history in New England and has been a key part of the state of Maine seafood processing industry since the late 1800's. More recently, it has become intertwined with the extremely valuable lobster fishery ($268 million in revenues in 1997) – as described elsewhere, over two-thirds of all herring harvested is used as bait, the vast majority believed to be in the lobster fishery. The proposed management plan takes into account these social impacts and minimizes any adverse effects.

Under the proposed management action, the current herring fishery will be allowed to nearly double in size. Gross revenues from this fishery could increase by $13 million at current ex-vessel prices, a potential boon to those communities suffering from reduced catches and revenues in other fisheries. An increase of $13 million is equal to one-third the value of cod, haddock, and yellowtail flounder landings in New England in 1997 (Table E.8). The opportunity provided by this fishery is bound to result in some changes in the various fishing communities. It is expected that for the most part, the communities that have been linked to the herring fishery in the past –

Rockland, Portland and other Maine ports, Gloucester, MA and Point Judith, RI – are those that are most likely to benefit from the increased landings. There is a possibility that other fishing communities, such as New Bedford, MA or Cape May, NJ, may also be able to take advantage of the opportunities in this fishery.

In general terms, the management plan should benefit the fishing communities of the mid-Atlantic and New England. By providing for a sustainable herring fishery, the plan will both protect the interests of traditional users of the resource and provide an opportunity for others to enter the fishery. There is room for expansion in shoreside processing that will be supported by increased revenues.

E.7.4.1 Spawning Area Closures

The proposed approach to spawning closures may result in a loss of revenues from some areas (section E.7.3.3). This is because the Council's proposal does not include the tolerance provision which allows fishing in the Commission's existing spawning closures. Many purse seine vessels have adapted to the tolerance provision to take advantage of the high concentrations of herring in the areas during the closures, while avoiding spawning fish. There is a possibility that there will be a reduction in landings and revenues during the closures. By working closely with the Commission, the Council has provided some opportunities for these vessels to minimize the disruption this may cause by fishing either in state waters or in areas of the EEZ that are not subject to the closures. Some vessels that were unable to take advantage of the tolerance provision will also benefit by the Council's action because the Council's closures off Massachusetts and New Hampshire are smaller than those in the Commission's plan, vessels will be able to fish for herring in a wider area. In sum, the spawning closures are not expected to have a significant impact on any of the communities that have grown reliant on herring.

E.7.4.2 Catch Controls

E.7.4.2.1 Total Allowable Catch

Over the long term, the establishment of the TAC will provide for a sustainable herring fishery at a higher level than current landings. The increased revenues that result will benefit fishermen and their communities – both those that have traditionally participated in the fishery, and those that enter the fishery as an alternative or supplement to fishing for other species. This may help counteract the adverse impacts of increased fishing regulations in other fisheries. The establishment of a TAC with an open access fishery, while providing sufficient protection for the resource, may encourage fishing behavior that will adversely impact communities that have grown dependent on herring. One concern is that fishermen may try to harvest as much herring as quickly as possible before any effort controls are imposed or the fishery is closed because the TAC is reached. If a "derby" style fishery results, with the TAC attained early in the season, there may be an interruption in supply of fresh herring from specific management areas. Over the long-term, the

demand for herring even after a closure should encourage investment in the types of activity that can meet this demand during a closure. This could include equipping vessels with RSW systems to preserve the herring until it can be landed, or developing the ability to store herring on shore until sold into the market. The immediate impact could be negative as the interruption in a steady supply raises the costs of herring to lobster fishers and other users. In one sense, this increased cost may benefit those who are able to supply the herring, whose ex-vessel cost has declined in real terms over the past twenty years. The effort control alternative - mandatory days out of the fishery - is designed to maintain product flow to the industry for as long as possible. Estimates still show that a closure in Management Area 1A is likely to occur during the initial year of the plan. This will result in some market disruptions.

The distribution of TACs by area using trimesters or time-specific TACs should not have a significant social impact on herring dependent communities. As long as present harvesters are able to continue seasonal band fishing without significant disruption of tracking of fish populations, then there should be minimal impact to present social yield of the fishery (Dyer and Poggie 1998). An important issue on limitations of the Gulf of Maine catch (Area 1A TAC) is the maintenance of sufficient supply to keep the sardine canneries and bait sectors supplied with herring. The adopted TAC distribution option will significantly reduce overall landings from the inshore Gulf of Maine (Management Area 1A) from the levels seen since 1989. The combined TAC assigned to Management Area 1A and 1B, if harvested, will hold catches in this area to the 70,000 mt level of 1997. This is the second highest U.S. landings in this area since 1980. The uncertain element in this equation is whether the landings from Management Area 1B will really reach the predicted level. Because there was no incentive to fish this area in the past, there has been little effort to fish for herring in this area. About 5,000 mt were taken in 1996, primarily from offshore banks, and there are reports that there has been additional fishing effort in this area in 1998 (Barbara Scully, Maine DMR, pers. comm.).

If the traditional Gulf of Maine harvesters are able to locate and catch enough herring in Area 1B to replace revenues lost from Area 1A, there should be few impacts on any of the Maine communities or sectors that have grown to rely on this herring. A failure to locate enough fish in this area will force these vessels to either temporarily exit the herring fishery or move into different fishing areas.

The initial reaction is likely to be an attempt to relocate to different fishing areas. None of the traditional purse seine vessels are currently equipped with refrigerated sea water systems for preserving herring catches. These boats must land their herring shortly after it is caught in order to land the quality needed for the sardine canneries. If they move into different areas, fishing in Area 2 or Area 3, they may choose to offload their catches in other ports. This may have negative impacts on northern Maine communities. While much of this herring may still be trucked to the canneries, there will be a reduced presence of herring boats in many ports. In the last two years, the port of Rockland has grown increasingly reliant on herring landings. The port increased its volume of herring landings from 13,800 mt in 1995 to 29,054 mt in 1997 (Table E.23). Revenues from herring in 1995 were 32% of the value of all landed species, increasing to 53% in 1997. If

there is a shift in fishing effort into areas other than Management Area 1, it may reduce the landings in this port.

Shifts in the sources of herring are not likely to have a significant impact on the Maine sardine canneries as long as they continue to have access to a supply of herring. As noted in section E.1.1.1, the canneries are an important component of the Maine economy, particularly in some isolated communities. According to a 1998 study (Reiling and Bennett), in 1996 the output from this industry was valued at $40 million. The total impact of this sector on Maine's economy was estimated at $62.8 million. According to public testimony, companies are currently operating at between 50% to 60% of capacity. The TAC system, by encouraging effort to move into other areas, may prove to benefit this industry by increasing the supply of herring that is delivered. This will only happen if herring is of sufficient quality to be used in the canneries, which may require additional investment in RSW vessels. As long as this development occurs, the canneries should be assured of sufficient herring to meet their needs. The move of effort into other areas, then should not have an adverse impact on the canneries.

E.7.4.2.2 Vessel Size Limits

E.7.4.2.2.1 Harvesting

The proposed action limiting vessels in the herring fishery to a maximum size will tend to maintain the existing industry structure. From the view of traditional users of the resource, this measure should minimize the social and economic disruption that would result if large catcher/processors began to harvest a significant part of the resource. Because the herring resource is currently underutilized, there is some room for growth in harvesting and processing capacity. A number of large vessels would rapidly reach the proposed limits on the TAC. At this point, the new entrants would compete with traditional users and there would be conflicts over access to the resource. The resultant rapid attainment of the TAC would reduce the supply of fresh herring to the bait and cannery markets. There is also the possibility that large catcher/processors would monopolize the resource.

One of the objectives of the FMP is to provide controlled opportunities for fishermen in other fisheries in New England and the mid-Atlantic region. Many fishermen are facing additional restrictions in the groundfish, scallop, monkfish, dogfish, and whiting fisheries due to poor resource conditions. The ability to enter the herring fishery provides an opportunity for them to shift their effort onto a robust resource until rebuilding plans in these fisheries can be accomplished. Shifting into herring fishing requires a significant investment in gear and, in some instances, modifications to vessel holds. The number of vessels that can enter this fishery is dependent on each vessel's share of the resource. As noted earlier, the limit on vessel size reduces the effective share of the TAC that can be harvested by each vessel. This will allow the largest number of vessels to enter the fishery, ameliorating the impacts of restrictions in other fisheries.

E.7.4.2.2.2 Processing

The impacts of large domestic at-sea processing on local communities are subject to much speculation. In the short term, restrictions on large domestic processors may limit the opportunity of new entrants into the fishery. If large vessels are allowed to process herring, for example, some vessels that cannot afford to convert to RSW systems could enter the herring fishery by selling fish over the side to processors. This would provide a lower cost way for these vessels to enter the fishery. This approach could be a way for fishermen suffering from reduced stocks and increasing regulation in other fisheries to supplement their incomes until stock rebuilding programs are successful. The increase in incomes would have a positive impact on their communities. It is uncertain, however, which communities would benefit from this activity. If at-sea processors hire local fishing vessels to supply herring, the benefits would accrue to communities that are under stress from increasing regulation in other fisheries. Some are concerned, however, that the companies that own these vessels may bring their own catcher vessels into the region. As a result, the benefits may accrue to regions that are less dependent on the fishing industry and culture.

In a similar fashion, the impact of these at-sea processors on other employment in the industry may prove negative. To the extent that at-sea processors reduce shoreside processing activity, there will be impacts on fishing related communities. Even if the only result is that people employed in shoreside processing shift their work location to vessels at sea, the movement of these jobs will change the nature of employment. For example, in the Maine sardine canneries, employment is often a part-time supplement to other income, with a strong local flavor (Dyer and Poggie, 1998). If the canneries were to lose access to herring and the processing jobs were to move to offshore processors, it is unlikely that the part-time nature will continue, or that the strong local connection will remain. Similar analogies can be made with other communities. If, however, large domestic at-sea processors transship their catch through local ports, some benefits may accrue due to the increase in cargo handling.

Catcher vessels that make conversions to supply domestic processing vessels are likely to do so with the minimum cost necessary. It is likely they will not add refrigerated sea water hold systems, relying on the rapid transfer of herring to the processing ship to insure the quality of the product. This will tend to limit the development of vessels that can travel to the offshore areas and return to land a quality herring product to shoreside processors. As landings in the near-shore areas approach the TAC, the herring available for the bait market and shore-side processors may be reduced. The impact of reduced herring landings if this happens would extend beyond the communities that are directly reliant on the fishery, into those communities that support fisheries that rely on herring bait. As noted in the discussion of economic impacts, a shortage of bait would severely impact the lobster industry. Since lobster has become such a key part of New England's seafood and tourist industry, communities dependent on the lobster industry would suffer (Dyer and Poggie 1998). Even this impact could benefit local communities if the price paid to herring fishermen for bait were to increase.

E.7.4.3 Roe Fishery

The use of herring roe should be considered as part of an overall management program that allows for the rational use of the product for all potential markets. Given the restrictions posed by the European market due to fat content and quality concerns, any alternative product developments should be considered as an overall plan favoring the maximization of domestic economic benefits across the region. Their may be increased social benefits to communities as a result of increased revenues. The roe fishery may prove to be a way for vessels to enter the herring fishery and rapidly recover their investment. In the Pacific Northwest, the price per pound of roe in the roe-on-kelp fishery has approached $30/pound. A more appropriate comparison for the likely development of the roe fishery in New England is the Alaska sac roe fishery, where 1997 prices ranged from $180/ton to $600/ton (Alaska Department of Fish and Game, June 8, 1998; www.cdf.adfg.state.ak.us). This is higher than the average value for Atlantic herring of $110/mt in 1997. In the Canadian east coast roe fishery, prices have ranged from $0.06 to $0.18 (Canadian) per pound (about $130 to $400 (Canadian) per metric ton).

An expanding roe fishery could divert herring from use in the bait market or other processing sectors. If allowed to develop unchecked, such a diversion would adversely impact the bait market and the canneries. The proposed plan will monitor the development of this sector carefully and will allow the imposition of management measures through framework action if necessary to regulate the roe fishery. In addition, the prohibition on roe stripping (discarding all males and female carcasses) will help insure that some herring continues to be available for these markets. The overall impact, then, of the roe fishery regulations should be beneficial and help maximize domestic net economic benefits (Dyer and Poggie 1998).

E.7.4.4 Safety Considerations

National Standard 10 requires that the impact of proposed management measures on the safety of life at sea be considered during the development of an FMP. In this fishery, the imposition of the TAC in an open access system may encourage the development of a derby fishery (section E.7.3.4). Coupled with mandatory days out of the fishery as the TAC is approached, vessels may risk fishing on bad weather days in order to catch their share of the resource. Some vessels may be unable or unwilling to fish in open areas during the mandatory days out of the fishery in a given area, choosing instead to fish, regardless of weather, only in the area subject to effort controls on the days it remains open. Most herring vessels are unlikely to participate in other fisheries during the days off, either because of a lack of permits or because it would be too difficult to constantly change gear types. Concern over loss of revenues and loss of a market may encourage vessels to fish on the open days regardless of the weather encountered. These concerns may also encourage some smaller vessels to transit farther offshore into open fishing areas. All of these possibilities may adversely impact vessel safety.

As the TAC is approached, vessels are required to take mandatory days out of the fishery. The proposed measure adopts Saturday and Sunday as the two consecutive days off, Friday/Saturday/Sunday as the three days off, and Friday/Saturday/Sunday/Monday as the four

days off. The options available to a vessel if an area is closed to directed fishing are to shift into another fishery, fish in a different area, fish during any days that the area remains open, or some combination of these choices. These are not "layover" days –a vessel does not have to remain at the pier. The option to fish in other areas or for other species will mitigate safety concerns to some extent for those vessels capable of moving into these areas.

While these are all possible responses to the TAC and the effort controls, the observed patterns of the fishery can be examined to gain a better sense of the impacts on vessel safety that may result from this regulation. Because the overall herring resource is underutilized, upon implementation of the FMP the TAC is likely to be approached only in Management 1A or 1B. Current landings in Management Area 2 are roughly one-fifth the TAC allowed by the plan. Landings in Management Area 3 in 1997 were also less than one-fifth the recommended TAC, but indications are that 1998 landings will be significantly higher and may approach 40% of the TAC.

If mandatory days out of the fishery are imposed in Management Area 1A, vessels will have to move approximately 30-40 miles offshore (to Area 1B) in order to fish during the days off, or relocate to another management area. If Management Area 1B is subject to effort controls while Management Area 1A is not, vessels will be able to fish closer to shore, reducing their risks; this alternative will not be discussed further. If effort controls apply to all of Area 1 rather than one of the sub-areas, vessels will have to travel to either Management Area 2 or 3 to fish during the days off or if the directed fishery is closed.

Effort controls are unlikely to be imposed in Management Area 2 in the near future. The total TAC available for this area is 100,000 mt and recent landings from this area have been in the range of 20,000 mt. As can be seen from Figure E.12 through Figure E.14, the herring fishery in Management Area 2 is prosecuted primarily in the winter months in areas close to shore, from Virginia to Rhode Island. If landings do increase and the area is subject to effort controls, vessels are likely to continue to fish close to shore, minimizing their risk due to weather. If the area is closed (an unlikely scenario under present conditions in the fishery but possible in the future), vessels may relocate into Management Area 1A or Area 1B in the early part of the year – these are also areas close to shore, minimizing risks due to weather.

Landings from Management Area 3 have only recently increased and it is difficult to draw conclusions on seasonal fishing patterns from this information, but it appears that fishing is concentrated in the summer and early fall (Figure E.12 through Figure E.14). Vessels that cannot fish in Management Area 3 either because it is closed or due to mandatory days out of the fishery will likely relocate to areas closer to shore or will choose not to fish for herring. The proposed measures would have their most potential impact on vessel safety if Management Area 3 were the only area open to herring fishing during the winter months. This is unlikely to occur because of the large available TAC in Management Area 2. There are also only a limited number of large, seaworthy vessels capable of transiting to this area and returning with a quality herring product.

In order to evaluate the hazards this measure may pose, current fishing practices were first

examined to determine the vessels that would be most impacted by these restrictions. Based on an analysis of the landings in 1996 and 1997 (see Figure E.22 and Figure E.23), the restrictions are most likely to be implemented in Management Area 1A in September/October. Herring landings are typically highest during this period, and then decline in November and December. While any mandatory no-fishing day will reduce the options available to a fisherman, they will only suggest unsafe behavior if the vessel would have routinely fished on those days and cannot substitute other days of the week. Using Maine DMR data to analyze herring trips in 1997, none of the vessels that landed herring from Management Area 1 fished every Friday, Saturday and Sunday during this period. Only five vessels fished more than half of these days during the September/October period in 1997. This indicates that few vessels would lose so many of their typical fishing days that they would ignore weather considerations if the three days off are Friday/Saturday/Sunday. 22 vessels fished on at least one day of the Saturday/ Sunday/Monday period during 1997, but again, only five vessels fished on more than half these days during the September/October time frame. The impact of four days out of the fishery is more severe. Twelve vessels fished for four or more days of the week in 1997 during the nine weeks of September through October. Eight of these vessels landed herring on four or more days of the week during more than half the weeks in this period. In this area, the mandatory days out of the fishery are not likely to encourage unsafe behavior, though the risk increases when vessels must take four days out of the fishery.

In Management Area 2, the TAC is not likely to be reached during the initial years of the plan and the mandatory days out of the fishery are not likely to be imposed because recent landings are less than half the proposed TAC. In addition, the primary fishing period is in the winter and a new TAC is assigned at the start of the fishing year in January. Nevertheless, trips during February (the month with the most activity) were examined to determine the possible impacts. In 1997,15 vessels reported landing one mt or more on at least one day during February. Only 5 boats ever landed herring on both Saturday and Sunday during this month, with only two boats doing so more than half the time. Only three boats ever landed herring on Friday, Saturday and Sunday, with only one boat doing so more than half the time. One boat, however, landed herring on every Friday, Saturday, Sunday, and Monday during February of 1997. For this period, only two boats landed herring four or more days per week more than half the month. Based on current fishing practices and landings, it is unlikely the TAC or mandatory days out of the fishery will encourage unsafe behavior in Management Area 2. This may change as landings increase.

The next consideration is typical weather to be encountered during the period the mandatory days out of the fishery may be imposed. For Management Area 1, Figure E.24, Figure E.25, and Figure E.26 summarize the weather patterns for the coastal area off Portland, ME for a ten year period. The weather is characterized by declining air temperatures with the approach of fall, and gradual increases in both average wind speed and average significant wave height. The maximum wind speed experienced actually declines from September to October. Imposition of effort controls is likely to occur at a time when weather is worsening, though it falls short of the weather experienced in the winter months. For Management Area 2, while the fishery occurs during winter weather, there is recent catches from the area indicate there is little likelihood the effort controls

will be imposed during the first months of the year (Figure E.27, Figure E.28, and Figure E.29 show weather for the vicinity of most herring landings from this area in 1997). The controls are likely to be imposed as the weather begins to improve during the spring months. For Management Area 3, the imposition of effort controls in the late fall or early winter would coincide with a worsening of the weather. For the ten year period examined, weather extremes were the worst in October, with average wind speeds of 50 knots and significant wave heights of up to 10 meters (Figure E.30 and Figure E.31).

The size of the vessels to be impacted by this measure also gives a sense of their ability to relocate to other areas. The average size of vessels landing more than 2,000 pounds of herring per trip in 1996 or 1997 was 47 feet for ton class 2 vessels, 64 feet for ton class three vessels, and 91 feet for ton class four vessels. The five vessels that fished more than half of the available Friday/Saturday/Sunday days in 1997 were all ton class three or four vessels. These are the larger vessels that may be more capable of shifting to the other management areas. (Whether they will be able to find fish in other areas is an economic issue considered in the EIS.). The result of this analysis is that the proposed days out of the fishery should not have a significant impact on vessel safety for up to three days out of the fishery.

The Council is also establishing a size limit on vessels participating in the herring fishery. Generally, larger vessels are more seaworthy in adverse weather. They may also be subject to additional regulations on loading, design, inspection, and licensing of crew that may improve vessel safety. The Council is recommending a size limit of 165 feet in length, and 750 GRT for catching, taking or harvesting herring. This limit is larger than any of the vessels that landed herring in 1996 or 1997. Most (if not all) groundfish and scallop vessels that have fished on George Bank since the adoption of the M-SFCMA have been less than 165 feet as well. While there have been a number of accidents involving these vessels over the years in all New England fisheries, most of these vessels have been operated safely and reliably. Many vessels smaller than 165 feet have operated safely in the herring fishery for a number of years. The proposed management measures are not believed to significantly change the ability of these vessels to safely participate in the fishery.

One characteristic of herring vessels that is not directly comparable to other New England fishing vessels is the large catches that must be transported to shore. Some of the herring vessels in the 100 – 130 foot range sometimes land 500,000 pounds or more of herring in a single trip. These large loads create stability concerns that must by considered in the design and operation of these vessels. While they can be handled safely if "tanked" in refrigerated salt water (RSW) holds, they can be dangerous if measures aren't taken to prevent shifting of cargo. If the cargo is stowed "wet" or with melting ice, stability concerns can be exacerbated by the free surface effect as sloshing water and fish effectively raises the metacentric height of the vessel, reducing its ability to resist heeling. These issues must be considered when groundfish boats are converted to herring fishing. In 1997, one herring vessel in the Gulf of Maine was endangered when its cargo shifted unexpectedly, but was able to recover assisted by other vessels (Artie Odlin, pers comm.) In September 1998, one 90 foot vessel loaded with an estimated 180,000 pounds of herring was lost

at sea while returning to port. While there are press reports this loss was caused by shifting cargo, the Coast Guard investigation of this accident is continuing and no conclusions have been released. The concern over shifting cargo is one that must be faced by all vessel operators, regardless of vessel size, but is of more concern in the herring fishery because of the large weight of the catches. The FMP is designed to allow the entry of additional vessels into the herring fishery. There has been interest expressed by groundfish vessels to enter this fishery as an alternative until groundfish stock can be rebuilt. While these vessels must consider the dangers of handling large loads of herring as part of their decision to fish for herring, the regulations do not restrict the ability of fishermen to adapt their vessels as appropriate. There aren't any gear restrictions or requirements, for example, that limit a fisherman's ability to adapt his vessel for herring.

One public suggestion that was not adopted for this plan is for a smaller size limit in other management areas. If future framework actions choose a smaller size limit, it may create a safety concern in the fishery. It is unlikely that a size limit will be selected that is smaller than current participants. Existing vessels have been chosen with regard to the weather conditions that may be encountered. Smaller size limits are also only likely to be adopted in areas that are close to shore, making it possible for vessels to rapidly evade poor weather.

No comments were received during development of the plan that the proposed measures encouraged unsafe behavior. The Coast Guard reviewed the plan and concluded it did not cause any safety concerns.