NOT A PUBLIC RECORD: INTRA-AGENCY POLICY DELIBERATION

FISHERIES WORKGROUP
FINAL REPORT

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Mission
The Fisheries Workgroup was tasked with identifying areas in the Commonwealth's ocean management planning area that are important to living marine resources, particularly those that support fisheries. Determinations are based upon the distribution and abundance of fisheries resources and areas that are commonly fished. Since hundreds of species of finfish and invertebrates exist in Massachusetts' coastal waters, the workgroup considers its primary mission to focus on species that are caught in the recreational and commercial fisheries. The Fisheries Workgroup will also collaborate with the Habitat Workgroup to identify areas important to key species that deserve special consideration, due to their ecological role or relative scarcity.

Data

A. Fisheries Dependent Data
Fisheries dependent data are derived from commercial and recreational harvests and include port sampling, at-sea observer data, in addition to harvester and dealer reporting. These data are often used to evaluate fisheries performance, inform management actions, as well as answer social and economic questions. For some species, they can also be used to estimate changes in abundance or distribution.

1. Commercial Fisheries

Three sources of commercial fisheries dependent data were used in this analysis: Massachusetts Division of Marine Fisheries (DMF) annual commercial fishermen catch reports, Standard Atlantic Fisheries Information System (SAFIS) dealer reports, and Federal Vessel Trip Reports (VTRs) collected by the National Marine Fisheries Service (NMFS).

Data from eleven fishery-specific DMF catch reports were used, representing a variety of species and gear types (Table 1). Fishermen participating in these fisheries are required to submit an annual report detailing their catch and fishing effort according to a series of fourteen Statistical Reporting Areas (SRAs), encompassing all of State Waters (Figure 1). Some of these reports have been collected by DMF since the 1960s, while others have been collected for only the past couple of years. All years that were in a consistent and readily accessible format were used for this analysis. While these reports were not originally developed with the intention of describing all commercial fishing activity in Massachusetts waters, when combined with other sources (SAFIS dealer reports and Federal VTRs), they provide a nearly comprehensive account of the Massachusetts commercial fishery. However, even with the combination of data sources, there are components of the commercial fishery that are not represented here, and as such not accounted for in this analysis (Table 2). To address this shortfall of our current fishery-dependent data collection system, the Fisheries Workgroup proposes taking steps to replace the fishery-specific annual state catch reports with a single state fisherman trip report, covering all fisheries. See the Non-Extant Data section of this report for more details.

Table 1. Commercial fisheries data sources used in the analysis.

Data Source	Years Used	Spatial Component
DMF Coastal Lobster Catch Report	1994-2007	SRA
DMF Seasonal Lobster Catch Report	1994-2007	SRA
DMF Gillnet Catch Report	2001-2007	SRA
DMF State Waters Groundfish Catch Report	2006-2007	SRA
DMF Sea Urchin Catch Report	2003-2007	SRA
DMF Striped Bass Catch Report	2002-2007	SRA
DMF Fluke Catch Report	2006-2007	SRA
DMF Fish Weir Catch Report	2002-2007	SRA
DMF Scup Pot Catch Report	2001-2007	SRA
DMF Black Sea Bass Catch Report	2001-2007	SRA
DMF Bluefin Tuna Purse Seine Catch Report	1988-2007	Loran or Lat/Lon → SRA
SAFIS Dealer Reports (Shellfish only)	2006-2007	DMF DSGA
NMFS Vessel Trip Reports	2006-2007	Lat/Lon → SRA

Table 2. Commercial fisheries not represented by existing fishermen reporting methods.

Species	Description of data gap
Black Sea Bass	Landings of non-Federal vessels, other than fish pots
Bluefish	Landings of non-Federal vessels, other than fish weirs and gillnets
Cod	Landings of non-Federal vessels taking advantage of the <75 lb exemption
Dogfish	Landings of non-Federal vessels, other than gillnets or the SW groundfish fishery

Herring	Landings of non-Federal vessels
Mackerel	Landings of non-Federal vessels
Menhaden	Landings of non-Federal vessels
Sand eels	Landings of non-Federal vessels
Scup	Landings of non-Federal vessels, other than fish weirs and fish pots
Shrimp	Landings of non-Federal vessels
Silver Hake, Red Hake, Cusk & Halibut	Landings of non-Federal vessels, other than gillnets
Skate	Landings of non-Federal vessels, other than gillnets or the SW groundfish fishery
Squid	Landings by non-Federal vessels, other than fish weirs
Tautog	Landings of non-Federal vessels, other than tautog bycatch in fish pots

Several sources of fishermen-reported shellfish data exist, however most capture only a portion of the total shellfishing activity. Fortunately, dealer reported data are available that provide a more comprehensive view. Starting in 2005, Massachusetts seafood and bait dealers purchasing directly from fishermen were required to report every purchase of marine species, which is stored in the SAFIS database. This database provides a complete look at the quantity and value of all Massachusetts landings of fish, shellfish and crustaceans. Furthermore, harvest area information has also been reported for shellfish species since 2006, providing the spatial information necessary for this analysis. Each shellfish transaction refers to one of the 303 Designated Shellfish Growing Areas (DSGA) that encompass all of Massachusetts State Waters (figure 1). Both aquaculture and wild harvested shellfish are represented in these data. For a more detailed description of aquaculture in the Massachusetts, see the Aquaculture section.

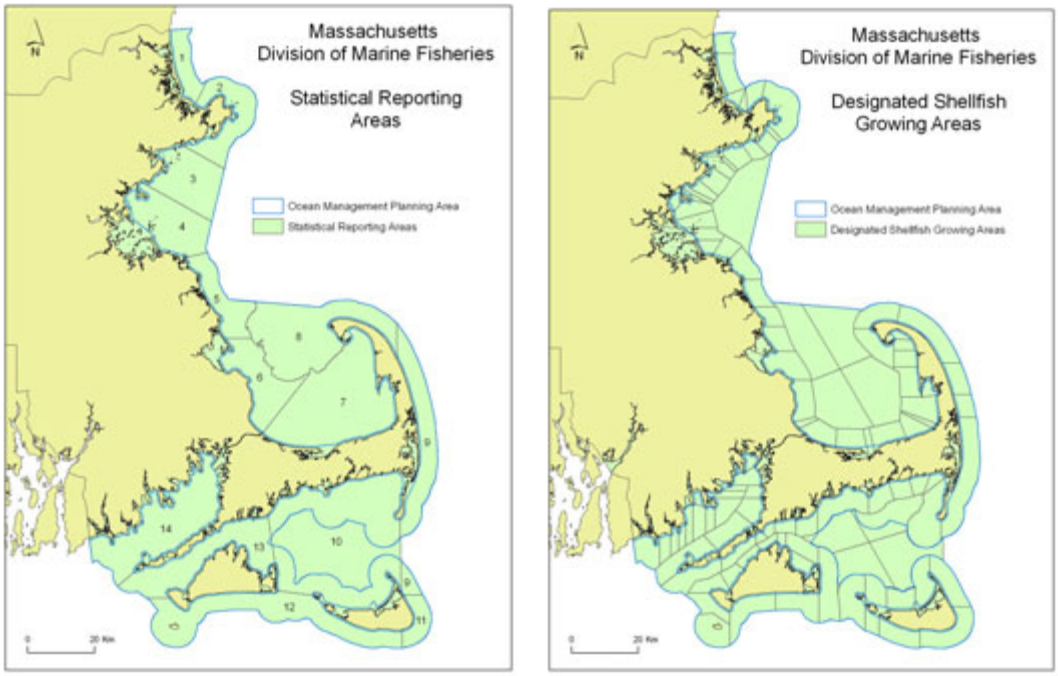

Figure 1. DMF Statistical Reporting Areas (left) and Designated Shellfish Growing Areas (right).
Note: the planning area starts 0.3 nautical miles from shore.

The National Marine Fisheries Service regulates commercial fishing vessels that fish in Federal waters. Once a vessel becomes federally-permitted, it is required to submit a Vessel Trip Report for each commercial fishing trip it makes (with some exceptions), regardless of whether that trip occurs in Federal Waters or State Waters. Consequently, there is significant overlap between the Federal VTR data and the DMF catch report data. Any trips that were also reported via DMF catch reports were excluded from the analysis, so as to avoid any duplication. Each VTR includes catch and effort information, as well as the trip location (latitude/longitude or loran). While many years of VTR data are available, only the last two were used, as it becomes increasingly difficult to combine with DMF catch report data prior to that time.

Several additional sources of Massachusetts commercial fisheries data exist, yet were not included in the analysis, as they were either considered redundant, lacked a spatial component, or did not apply to the planning area (Appendix A)

2. Recreational Fisheries

Since 1983, DMF has conducted intercept and random telephone surveys to estimate recreational saltwater catch and effort, as a part of the coast-wide Marine Recreational Information Program (MRIP). Unfortunately, the area-fished component to this survey is not of sufficient resolution to identify areas important to the recreational fishery. The current survey only asks whether fishing activity occurred within three miles from shore or beyond. Despite the lack of spatial data, the Massachusetts recreational saltwater fishery is a critically important activity that occurs in the planning area, with over one million anglers estimated fishing in our coastal waters annually. Potential impacts to this fishery need to be considered in the ocean planning process. The Fisheries Workgroup proposes modifying the survey format to include a finer-scale area-fished component. See the Non-Extant Data section in this report for more details.

Other sources of recreational fishing data exist (Table 3), but were not included in the analysis, as they represent only a small portion of the total recreational activity and would not adequately characterize the areas of importance to the entire recreational fishery.

Table 3. Recreational fishery data sources.

Data Source	Description	Spatial Component
MRIP Survey	Intercept and random telephone survey	< or > 3 miles from shore
DMF Recreational Lobster Report	Recreational lobstermen are required report their catch and effort to renew their permit	SRA
NMFS Charter/Party Vessel Trip Report	For-hire vessels that fish in Federal waters are required to submit VTRs, regardless of whether trip occurred in Federal or State Waters	Lat/Lon

B. Fisheries Independent Data

Fisheries independent data are collected independently of commercial or recreational efforts and ordinarily include survey datasets. These data typically provide information on many species, not necessarily just the ones targeted by fisheries, and are often used to examine resource trends.

The DMF Resource Assessment Bottom Trawl Survey is the primary source of data used to determine areas important to fisheries resources. The survey is one of the longest running inshore surveys on the east coast of the United States and has proved to be an invaluable source of scientific data for management needs since 1978. The survey allocates its sampling effort according to a series of 23 strata, based on five bio-geographic regions and six depth zones (Fig. 2). Trawl sites are allocated in proportion to stratum area and randomly chosen in advance within each sampling stratum. Tows of standard speed and duration are made with a bottom trawl that has had the same design specifications since the survey began. Total weight and length-frequency are collected for all finfish and a subset of invertebrates. Additional information such as age, sex and maturity are collected from a list of priority species.

While few states have a more comprehensive fishery-independent data source to rely on, the Resource Assessment Trawl Survey does have some limitations. First, the survey gear cannot be deployed over very shallow or very rough bottom types and therefore those areas are not sampled. Second, some fast-swimming or pelagic finfish (e.g. striped bass, bluefish and tunas) and most shellfish species are not vulnerable to bottom trawl gear and are not well represented in the survey catch. Finally, the survey is conducted during daylight hours only, and during a limited timeframe in spring and fall (May and September), therefore some species could be unavailable due to timing.

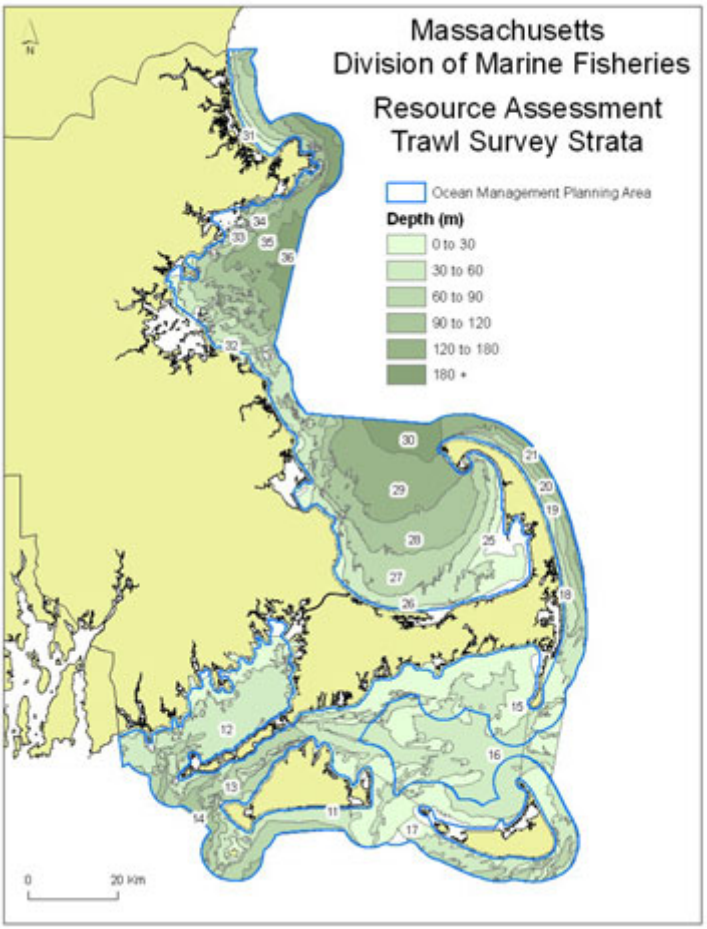

Figure 2. DMF Resource Assessment Trawl Survey strata.

C. Non-Extant Data (additional details provided in Appendix B)
The Fisheries Workgroup was requested to provide a list of data sources that do not exist, but would be useful to better address its mission.

1. Comprehensive Fishermen Trip-Level Reporting
The current fishery-dependent reporting system is extremely fragmented. A Massachusetts Commercial permit holder might have to complete up to sixteen individual fishery-specific annual catch reports, if the permit holder participated in each of those fisheries; furthermore, if Federally-permitted, there may be requirements to report those same landings to NMFS on VTRs. In addition to this problem of duplicative reporting, some components of the commercial fishery are not reported at all (Table 2).

We propose replacing the suite of fishery-specific fishermen catch reports with a single fishermen trip-level report that covers all commercial fishing activities. Requiring these trip-level reports of all non-Federally permitted Massachusetts commercial fishermen would both eliminate the duplicative reporting and fill in the current data gaps. Trip-level data is also of much higher quality and offers greatly

expanded analysis possibilities than the by-month summaries and estimates currently provided on annual catch reports.

2. Area-Fished from Recreational Catch and Effort Surveys

Over two decades worth of catch and effort data are available for the Massachusetts recreational saltwater fishery. Unfortunately, the only spatial component that is collected is whether the fishing activities occurred within three miles from shore or beyond. That level of spatial resolution prevents making determinations as to which areas within Massachusetts coastal waters are important to recreational fishermen.

We propose modifying the existing survey to include a record of where fishing trips occur. Not only will this provide us with the ability to incorporate recreational fishing in the ocean planning process, it will be a significant benefit to the stock assessment process.

Analysis

The Fisheries Workgroup has separated its analyses into two distinct categories: **Fisheries Activity** (fishing effort and landings), and **Fisheries Resource** (abundance of fish, shellfish, crustaceans important to fisheries) as they should be considered separately when evaluating the impacts of proposed actions in the planning area. In addition, a discussion on implementing a habitat-based approach is included.

A. Fisheries Activity - Commercial

1. Methods

Two metrics were chosen to identify areas important to commercial fisheries: fishing effort and landings value.

For each DMF catch report, the total number of trips per SRA per year were calculated and then averaged over all available years. The average trips per SRA were then divided by the square kilometers of each SRA to achieve a measure of fishing effort per unit of area (Appendix C). Likewise, the average annual catch by species per unit of area was calculated, and then multiplied by its 2007 state-wide landings-weighted average price to represent value of landings (Appendices C and E).

Data for all VTR-reported commercial fishing trips occurring in State Waters during 2006-2007 were initially collected. Any trips that were also reported on DMF catch reports were removed; If a VTR trip recorded landing fluke, striped bass, sea urchins, lobster (by trap only), black sea bass (by pots only) or scup (by pots only) it was removed. Furthermore, the trip was also removed if gillnets or fish weirs were the reported gear type. The remaining trips were then tallied by SRA and treated in the same fashion as DMF catch report data.

Each shellfish transaction in the SAFIS dealer database was considered to represent one fisherman trip. Total number of trips and value of landings were tallied by

DSGA and averaged over the available years. These figures were then divided by the square kilometers of each DSGA to obtain average trips and landings value per square kilometer.

All sources of commercial fishing effort and landings value data were then converted to a 250 m^2 raster grid and condensed into 2 layers representing the combined fishing effort across all commercial fisheries, and the combined value of landings generated by those fisheries. To prevent the scale of commercial fisheries in one part of the state overshadowing the importance of those in other parts of the state, the planning area was broken into 2 regions: north of Cape Cod and south of Cape Cod (Figure 3).

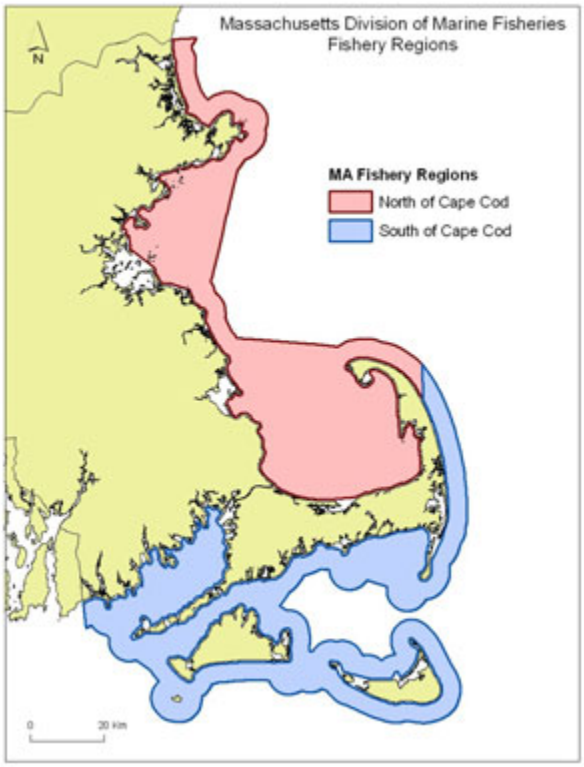

Figure 3. Regions used in Fisheries Workgroup analyses.

The two raster layers (combined fishing effort and total landings value) were then re-classified into 10-percentile bins, *within* each of those regions. With the two layers now on the same relative scale, they were added together (i.e. given equal weight). The resulting combination was re-classified into high, medium and low categories, again within each region. The 'High', 'Medium', and 'Low' categories represent the top 25%, middle 50% and bottom 25% of combined data values (Figure 4).

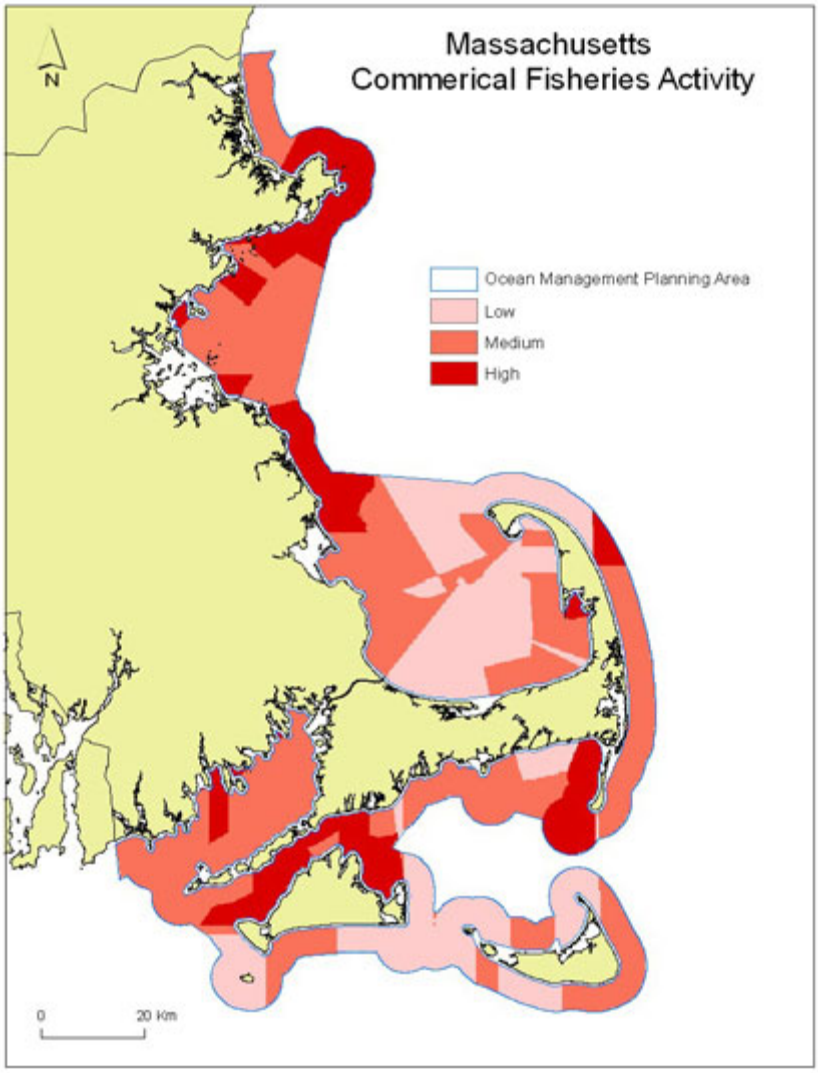

Figure 4. Final raster map of Massachusetts commercial fisheries activity.

2. Discussion

While approximately 25% of the planning area has been categorized here as having a "low" level of commercial fisheries activity, it is important to recognize that those areas may still support hundreds of commercial fishermen and yield millions of dollars worth of landings each year. They are considered "low" only when placed on the scale of fisheries occurring elsewhere in the state. Some areas are very important seasonally to a particular fishery, but when compared to areas where more year-round fisheries occur, there are less total trips and landings per year. For the fishermen that participate in those localized seasonal fisheries, access to that area can represent a critical portion of their annual income.

Many of the reporting areas used in this analysis are quite large and range from 2 to 1,420 square kilometers in size. In nearly all fisheries, effort and landings are not homogenously distributed within a particular reporting area. Therefore, it is possible

for distinct portions of a "low" activity area to support fishing effort and landings on par with "high" activity areas. Likewise, the opposite situation is also possible. This issue of scale needs to be considered when interpreting the results of this analysis. The level of fishing activity impacted by a proposed action at a specific location is not necessarily the same as the aggregate level of activity for the entire reporting area.

Several other factors can influence the spatial pattern of fishing activity, including regulations (time/area closures), distance from shore-side infrastructure (dockage, dealers, etc), and natural events (weather, red tides, etc). Areas identified as having low activity in some fisheries may not be due to a diminished resource, but rather limited access to that area.

Spatial patterns of fisheries activity also change over time: areas receiving high amounts of fishing pressure one year can drop to low levels the following year, with the fleet moving on to a another area. While all available and readily accessible years worth of data were used in this analysis, some fisheries are represented by only a few of years, whereas others may be represented by up to 20 years of data. This analysis represents the level of fishing activity that occurred during the years covered by the input data, and may be different from the distribution of fishing activity in the future.

B. Fisheries Resource

1. Methods

A list of species that occur in the Massachusetts commercial and recreational fisheries was prepared (Appendix F). Twenty-two species were selected from that list for consideration, based on 2 criteria: 1) they were adequately sampled by the Resource Assessment Trawl Survey and 2) they were considered to be an important component of commercial or recreational fisheries within the planning area (Table 4). For two species, Atlantic cod and black sea bass, it was also considered important to include the abundance of young-of-year fish as a separate piece of information, since the biomass index may not adequately represent the areas important to YOY fish for these species.

Table 4. Species selected for consideration in Fisheries Resource analysis

American Lobster	Scup
Atlantic Cod	Sea Scallop
Black Sea Bass	Silver Hake
Channeled Whelk	Spiny Dogfish
Haddock	Summer Flounder
Horseshoe Crab	Tautog
Jonah Crab	Windowpane Flounder
Knobbed Whelk	Winter Flounder
Little Skate	Winter Skate
Loligo	Witch Flounder
Red Hake	Yellowtail Flounder

For each year/species/season/stratum combination, the mean biomass per tow was calculated, with the exception of jonah crabs, where the mean *number* per tow was used. The tri-mean ([1st quartile + 2*median + 3rd quartile] / 4) of the annual values for each species/season/stratum was then calculated. The tri-mean of the annual values was chosen because it is less influenced by outlier years than the mean and less sensitive to zero years than the median.

For each species/season considered, one or more 'sets' of survey strata were identified, over which the data were normalized. For a stratum to be included in a set for a particular species/season, it had to have at least 6 years of non-zero catches. Furthermore, more than one strata-set was defined for some species, as the planning area encompasses multiple stock units (Appendix G). The normalization algorithm involved dividing each tri-mean value by the total of the values in its strata set. This has the effect of giving each species approximately equal influence in the model. The median of the normalized tri-mean values for all species/seasons was then determined for each stratum and used to create a 250 m^2 raster grid.

The final normalized tri-mean values were re-classified into high, medium and low categories based on top 25%, middle 50% and bottom 25% of the data (Figure 5). As with the Fisheries Activity data, the re-classification routine occurred separately within 2 regions: north of Cape Cod, and south of Cape Cod.

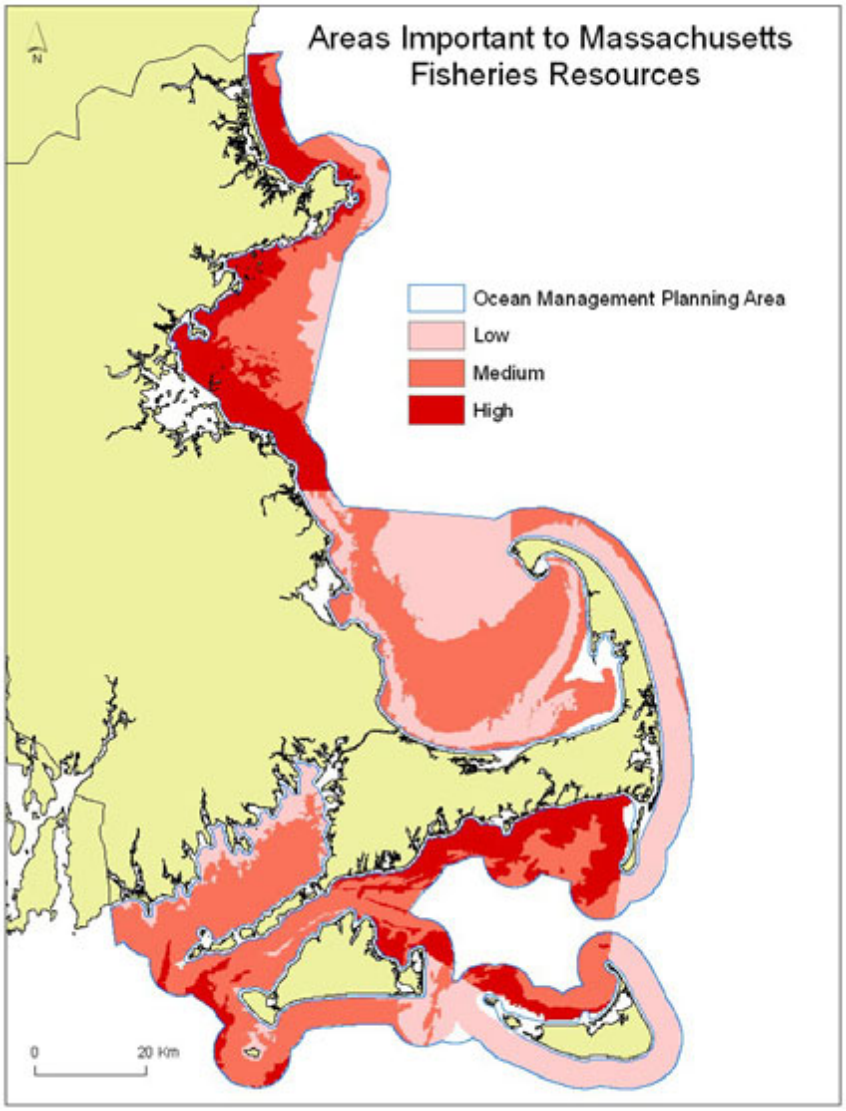

Figure 5. Final raster map of areas important to Massachusetts fisheries resources.

2. Discussion

Sampling Design

The basic sampling unit in the Resource Assessment Trawl survey is the tow, which covers approximately 0.00385 square nautical miles or 5400 square meters. Sampling intensity is approximately 1 tow per 19 square nautical miles. Tow locations are allocated in proportion to stratum area and randomly chosen in advance within each sampling stratum. Within each sample, counts and weights of each species are recorded. Several issues regarding species selectivity and size selectivity in the survey are important to understand. The catchability (the fraction of encountered fish captured by the survey gear) varies by species. Some fast-swimming pelagic species such as striped bass, bluefish, and the various tunas can actively avoid the gear and have low catchability (adult bluefish, striped bass) or zero catchability (bluefin tuna).

Similarly, within a species, size selectivity occurs and certain sizes of fish (juveniles/ adults) are either more vulnerable or less vulnerable to the survey gear. Generally, the assumption that survey indices are proportional to population abundance is reasonable for species that are available in time (daylight hours in May and September) and space (near bottom over less complex habitats) and vulnerable to the survey method (cannot escape a trawl net).

Over the period 1978-2007, the survey conducted a total of 5,563 standard tows (2,874 spring, 2,689 fall). A total of 122,336 observations of either count or weight with location exists for the 22 species used in this analysis. For many species, additional information on size structure, age structure, sex, maturity and spawning condition is available, but is not considered in this study. The index method we use categorizes catch information by strata into 3 categories: low, medium and high. This data summary results in a substantial loss of information content regarding spatial-temporal patterns of distribution. The loss of details may be very important to consider in the decision making process.

Spatial Scales

The tow is the finest resolution of spatial scale in the survey. Information as to where species are captured within the tow is unknown. For each species within each stratum, season and year, the relative abundance (number per tow) or relative biomass (kg per tow) are summarized using mean and standard errors for each stratum.

For each species in this analysis, we compare either the relative abundance or relative biomass for each stratum within a strata set. Information at the tow level is lost by providing summary information at the strata level. For species with catches that tend to be more homogeneously distributed within a stratum, the information loss may not be important. Aggregating to the stratum level for species with persistent highly clumped spatial distributions results in information loss (i.e. sub-areas within the stratum may be more important/less important to the species).

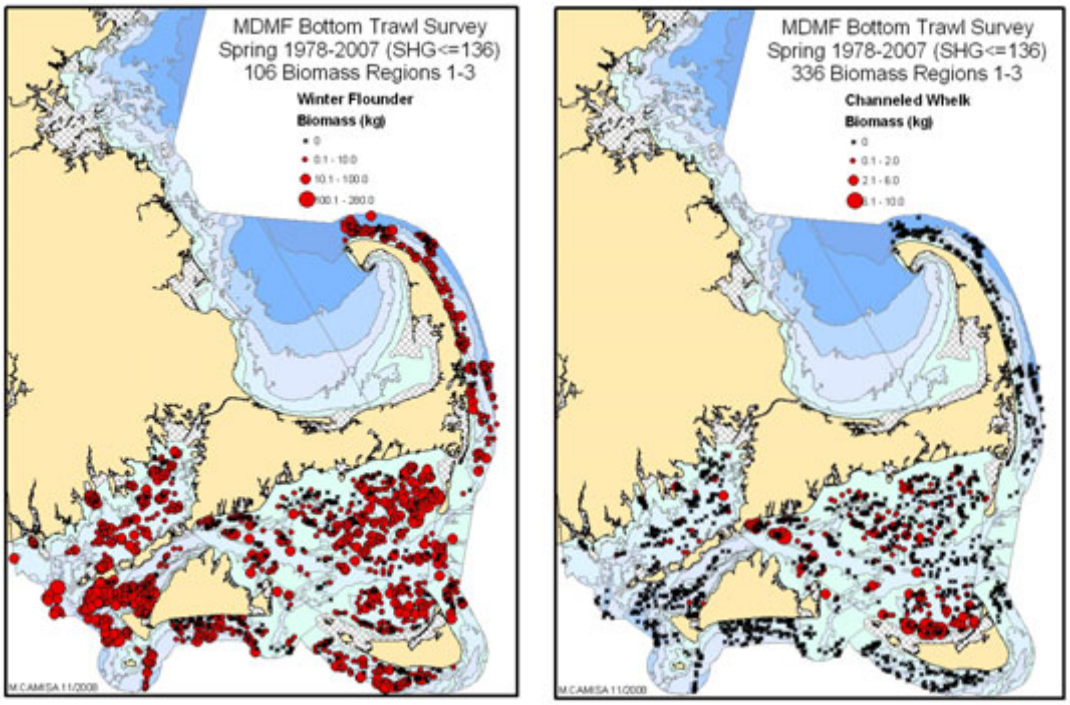

Figure 6. Distribution of spring survey catches (biomass) in the Southern Region for two species. Left panel: winter flounder (illustrating a species with more homogeneous distribution of survey catches within strata). Right panel: channeled whelk (illustrating a species with a more clumped distribution). Areas without circles or x's are areas that can not be surveyed.

Figure 6 shows the distribution of catches for two species: winter flounder (more homogeneous distribution) and channeled whelk (more clumped distribution). For channeled whelk, large catches occur primarily in Nantucket Bight and Falmouth shores within the shallow water of Nantucket Sound (stratum 15). Although knowing that stratum 15 has the highest relative abundance of channeled whelk is useful, knowing that the catches are concentrated in approximately two areas (at least during May) would be important in assessing location options for projects. In contrast, winter flounder catches are more widely distributed throughout each stratum in May.

Summarizing and comparing data at the strata level are consistent with the survey design and allows comparison of species at the same spatial scales and across years. Although post-stratification may be helpful in addressing species with clumped distributions, other factors could impact the analysis such as deciding on the criteria for defining new strata for post-stratification and the inverse relationship between the size of the new strata and the number of zero tows.

Temporal scales

The survey has a seasonal component (sampling occurs in May and September). Species composition, catch distributions, and the distribution by size/age component within species varies between the two seasons. Often, the spring survey occurs when the adult component of many species are available to the survey, whereas the juvenile and young-of-the-year of various species are available to the survey in the fall. The

survey does not provide spatial-temporal information on how the distribution of adults and juveniles differs at times other than May and September. Seasonally, many species show inshore/offshore movements, often outside the survey area. For example, mature loligo squid, scup and sea bass move into inshore state waters in the spring and move well offshore in the fall. Adult winter flounder south of Cape Cod move into shallow estuaries to spawn in winter/spring and move offshore during the summer. In addition, the survey is conducted during daylight hours only and therefore may not represent species that nocturnally move into the survey strata.

The survey database spans a 30-year timeseries, covering the years 1978-2008. During this period, the relative biomass and abundance of many species has markedly changed. Some species have indices that fluctuate without trend, others have strong trends. Annual variation can be caused by measurement error, changes in population abundance/biomass, or availability (e.g., water temperatures influencing the timing of movements into or out of survey area). Similarly, the spatial distribution of certain species can also change over time. Changes in the biomass and spatial distribution of winter flounder abundance in the Northern Region are shown in Figures 7, 8 and 9.

Figure 7 shows the overall trend in relative biomass for winter flounder in the Northern Region, while Figure 8 shows the timeseries of relative biomass for each stratum. Comparing the median across each stratum is analogous to the method used for ranking strata in this analysis. Several prominent features are worth noting. The timeseries for strata 27, 28, 36, and 30 have annual variation around the median but show little trend. Here the median does a fairly good job of capturing the central location of timeseries observations. Note however that shallow strata (25, 31) show declining trends while deeper strata (29, 35) show increasing trends. These shifts in survey distributions suggest that the importance of these strata, as measured by differences in relative biomass, is changing over time. Figure 9 shows a timeseries of annual Gini coefficients for mean catch per tow across strata. The Gini coefficient is a statistical measure of dispersion; a value of 0 indicates perfect equality of catches among strata, and a value of 1 indicates perfect inequality (all catches in 1 stratum, zero in other strata). From 1985 to 2000, winter flounder catches have become more equally distributed among strata. Again, this illustrates that the relative distribution of winter flounder across strata are changing over time. For each species, a significant amount of information with respect to changes in geographic distribution is lost by pooling over spatial and temporal scales.

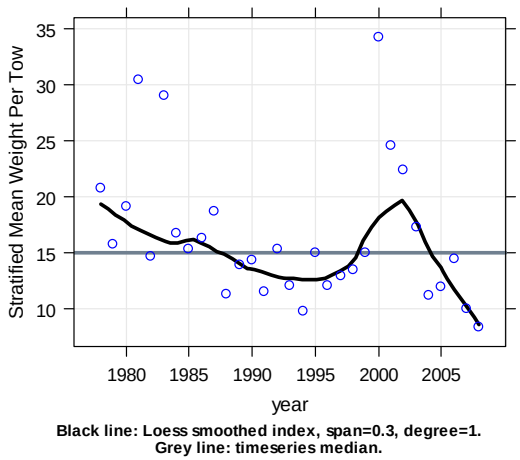

Figure 7. Trends in stratified mean weight per tow for winter flounder in the Northern Region. Black line is loess fit. Gray line is timeseries median.

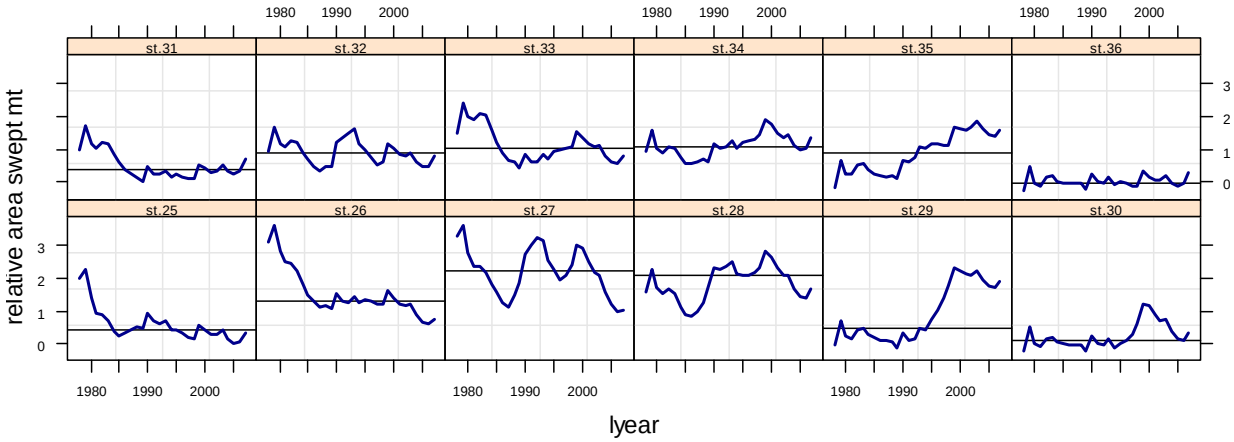

Figure 8. Trends in the relative area swept of winter flounder by stratum for the Northern Region. Strata are listed from left to right in order of increasing depth. The black line is the median of the stratum's timeseries. *Note how relative area swept biomass has declined in the shallowest strata (25, 26 and 31) and has increased in the deeper strata (35 and 29).*

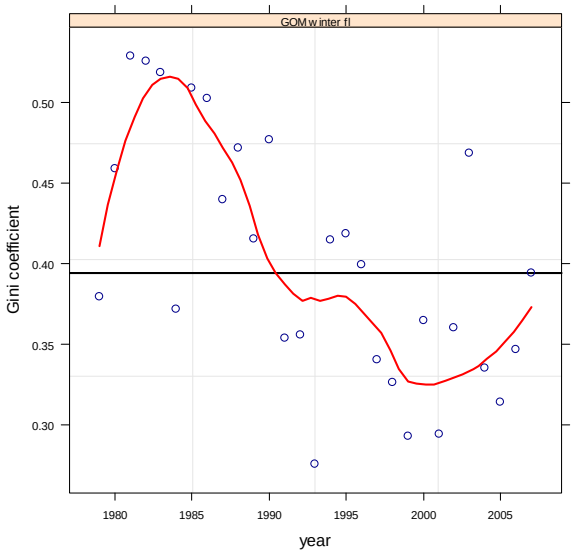

Figure 9. Trends in Gini coefficient for winter flounder in the Northern Region. Red line is loess fit. Declining trend indicates that annual mean catch in biomass has become more evenly distributed across strata.

Functionality

The method used in the Fisheries Resource analysis assumes that the importance of strata to a species can be indexed by comparing the relative distribution of catches among strata. The ranking of strata for winter flounder in the Northern Region is shown in Figure 10. Functionality of particular strata areas are not addressed by this method. For example, stratum 31 is a shallow area (less than 30ft) in Massachusetts Bay and would be ranked as medium based on the survey. Functionally, stratum 31 plays an important role in spawning (aggregation of spawners and spawning) and nursery habitat for early stage juveniles. The survey index method does not address the importance of these strata for a couple of reasons: 1) peak spawning occurs in winter/spring prior to the survey and likely in water shallower than that surveyed, 2) early life stages (larvae, post-settlement, and very small juveniles) may not be available to the survey because of timing, lack of sampling due to depth restrictions, and low catchability of the gear.

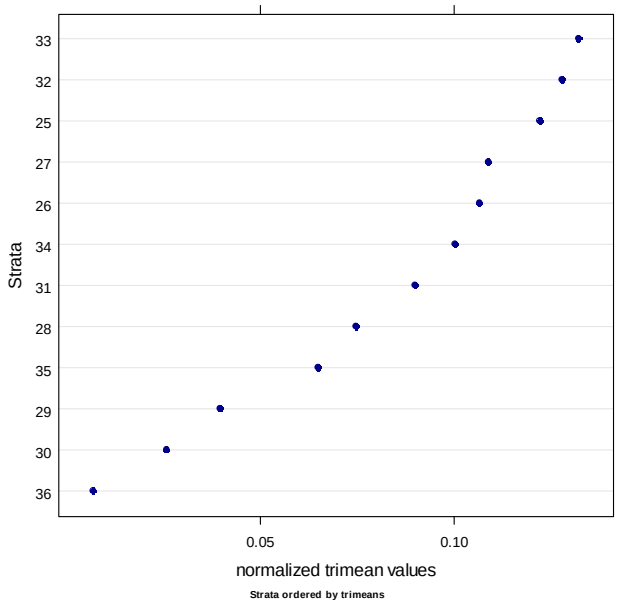

Figure 10. Normalized strata scores for winter flounder in the Northern Region. For this species, the strata with the lowest three scores would be ranked low, the highest three would be ranked high, and the rest would be ranked medium. Note that in the method used in ranking strata, strata scores are ranked after aggregating all species.

The method ranks strata by aggregating summary statistics of many species. Some areas may be very important to a particular species. Figure 11 shows the distribution of normalized trimean scores by strata. Although Strata 36 is the lowest rank strata in the Northern Region, the stratum is ranked high for witch flounder in the fall and witch flounder and haddock in the spring. Other examples are worth examining. Stratum 25 would rank high for winter flounder, but is only ranked medium when aggregated across all 22 species. Stratum 25 is shallow water (<30ft) in Cape Cod Bay and is an important spawning and nursery area for winter flounder and might be considered “critical habitat” for winter flounder. For silver hake in the spring, stratum 36 is ranked as “high” but is ranked as “low” overall. Overall, this pattern of the importance of strata varying by species is expected. However, the population dynamics of individual species is not completely independent of other members in community. Impacts to one species may have unanticipated impacts on another.

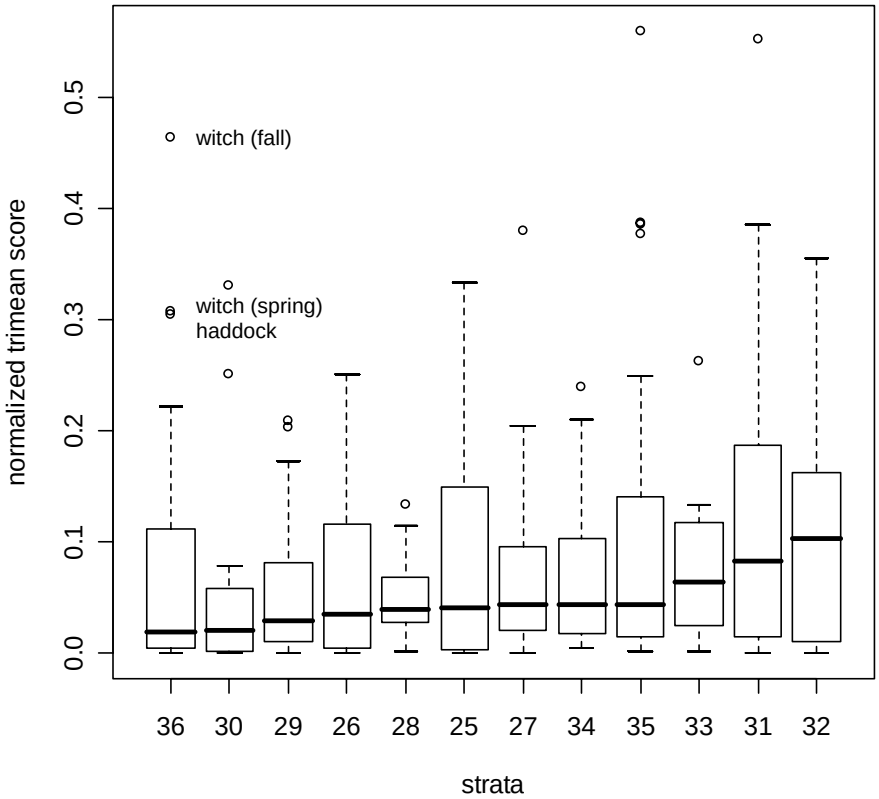

Figure 11. Boxplot of the distribution of normalized trimean values for individual species by strata for the Northern Region. The heavy black line is the median, the box covers the interquartile range (25th-75th quantiles). The whiskers are 1.5 times the interquartile range. Points are considered outliers. Outliers are identified for stratum 36.

The ecosystem is arranged in a hierarchical structure with many different scales (populations consisting of species, communities, and trophic levels). Interactions among various species (e.g., predation and competition) are important in maintaining ecosystem structure and also influence growth rates of individual populations. Many species not considered in this analysis may play key roles in the ecosystem. For example, Breen and Mann (1976) discuss the interaction of lobster (a predator of sea urchins), sea urchin (which graze on kelp), and kelp beds in Nova Scotia. They report that a 50% decrease in lobster abundance was followed by an increase in sea urchin abundance. The increase in sea urchins was followed by a 70% decline in kelp beds. In our analysis, the list of species was limited to twenty-two commercially or recreationally important species available to the survey. Other species of little value to commerce may be very influential in overall ecosystem function.

3. Additional Analyses

While several analysis options were considered, the one presented here was chosen based on the best judgment of the Fisheries Workgroup, given the timeframe of this project. However, there are several additional analyses of existing survey datasets that could be explored to more fully understand the importance of the area to marine resources, including:

a) A spatial analysis of the survey data utilizing the individual tow locations, or post-stratifying the tow locations.
b) Investigate measures of diversity (e.g., species richness, eveness, combined indices) and how they relate to the abundance of fisheries species.
c) Identify life history requirements of fisheries species and relate to maps of physical habitat features (see "potential habitat" approach under Fisheries Habitat section).
d) Examine shifts in temporal abundance and spatial distribution for correlation with climatic events.
e) Investigate the functionality and trophic connections of the components of the ecosystem.

In addition, an attempt should be made to supplement existing datasets with fisheries independent information unavailable from the Resource Assessment Trawl Survey, including:

a) Information on fisheries species in the planning area during months other than May and September
b) Information on fisheries species inadequately sampled by bottom trawl gear (i.e., pelagic species, shellfish species).

C. Fisheries Habitat

Massachusetts is a relatively data-rich coastal state, and we are fortunate to have a consistent multi-season, multi-year, stratified-random trawl survey dataset with which to examine trends in fish abundance and distribution. However, the spatial analysis presented in this report is limited in a variety of ways due to the dynamic nature of fish distributions, as is discussed in the previous sections. Therefore, the Fisheries Workgroup feels it is important to also consider a habitat-based approach in identifying areas important to fisheries species within the planning area.

Habitat is the environment in which an organism lives. There are over 200 species of fish that utilize the planning area, and it is safe to say that 100% of the planning area is habitat for something. For a preliminary examination of this issue, the Fisheries Workgroup considered selecting 13 species of particular importance in the planning area: Atlantic cod, American lobster, and winter flounder were selected due to their significant role (as measured by commercial and cultural importance) within the Gulf of Maine ecosystem; alewife, blueback herring, Atlantic halibut, Atlantic sturgeon, Atlantic wolffish, barndoor skate, cusk, rainbow smelt, sand tiger shark, and thorny skate were also selected, as these species are listed as "Species of Concern" according to NOAA Fisheries' Office of Protected Resources in an area including Massachusetts coastal waters, and may have particular sensitivity or uniqueness in the planning area. However, simply overlaying the distribution information for these species was deemed insufficient to create a "habitat" map.

Despite the limitations of the survey data in identifying habitats, life history information is fairly well known for the major species and species groups. As such, it is common for fishermen to fish in areas with particular habitat features. A list of such features, and a brief description of why and how they are used, is provided in Table 1. In order to map out these features, the Fisheries Workgroup proposes a "potential habitat" approach. This type of approach is used in many other ocean planning regions, including Australia, the United Kingdom, Canada, and California. Using work in Canada and the United Kingdom as a guide, in combination with input from Habitat and Fisheries Workgroup members, we propose that the following suite of parameters are required to conduct potential habitat modeling: depth, sediment composition (average grain size, sorting, organic carbon, carbonate composition), temperature, salinity, water column stratification, wave base, near-bed sheer stress, light attenuation, primary and secondary productivity, frontal probability, and biotic structure forming organisms (SAV, kelp, invertebrates).

Table 1. Habitat features of apparent preference to fisheries species.

Habitat Features	Influence on Fisheries Species
3D Structure: Abiotic (cobble/rocky/boulder/ledge bottom (not shell) often called "rock piles")	Many species utilize this type of bottom for shelter. Some species' life histories require this type of habitat (e.g. juvenile cod and lobster).
3D Structure: Biotic (SAV, kelp, and structure-forming inverts)	Many species utilize this type of bottom for shelter. Some species' life histories require this type of habitat.
Upwelling	Important to driving productivity by bringing in nutrients; may be more important on a local scale in Massachusetts.
Deeper waters (channels, depressions, basins)	Temperature and storm wave refugia.
Estuaries, river mouths	Turbidity front at fresh-salt water interface can influence productivity. Staging areas for anadromous fish species.
Shell Habitat	Settling habitat for invertebrates, may provide shelter
Shallow waters (<5 feet) (mud flats, salt marshes)	Critical nursery areas; mud flats are of high value to infauna.
Frontal boundaries	Represent important "edge" habitat for a wide variety of resident and migratory pelagic species.
Tide rips	Smaller frontal boundary features; sportfishing species; variety of species utilize these features and are popular fishing spots
Mud bottom	Has potential to provide abundant forage; lower resiliency to recurrent impacts in cold/deep mud bottom

These parameters represent critical underpinnings of how to define a particular ecosystem and examine the rarity or vulnerability of habitats in a given region. Essentially, these parameters are pieces of a puzzle that can be combined in different ways to examine

impacts of human and natural drivers, from management actions to storms. However, how to combine them is a challenging question, and examples from other ocean planning efforts around the world should be considered for their applicability in Massachusetts. Also, it is possible that additional features critical to fisheries species (e.g. magnetic field lines) have been missed. Such features may be a necessary component of future work.

Additional habitat-based approaches should also be considered, such as using community analyses, to capture the complexity of the fisheries habitat. In addition, habitat "hotspots" could be identified within the planning area by examining the homogeneity of a species distribution, as was initially explored with the Gini index in Figure 9. Lastly, the trawl survey data could be used to explore the spatial patterns of species richness or other measures of bio-diversity in the planning area (Figure 12).

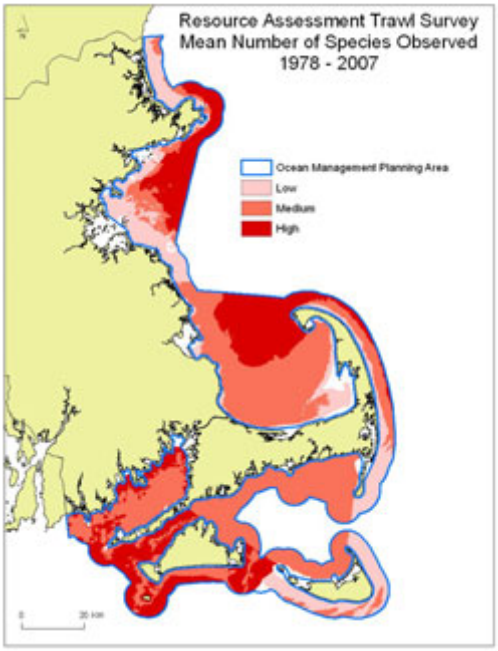

Figure 12. Mean number of unique species observed per tow from the Resource Assessment Trawl Survey (1978-2008). Survey strata were grouped into categories of high, medium and low based on the top 25%, middle 50% and bottom 25% of the data. Note the difference between this figure and the results of the Fisheries Resource analysis (Figure 5). This difference highlights the need to clearly define management goals and understand the limitation of these analyses.

Aquaculture

All shellfish aquaculture that occurs in the planning area is captured in the analysis of fisheries activity, as the source dataset includes both wild and aquaculture harvests. However, it is a distinct type of fishery activity, and is tightly regulated by DMF to control for the introduction of shellfish diseases, non-native/exotic shellfish species and other pests or predators that can be by-products of aquaculture farming.

Aquaculture is defined in Massachusetts as "the farming of aquatic marine organisms including, but not limited to fish, mollusks, crustaceans, echinoderms, and plants.

Farming implies some sort of intervention in the rearing process to enhance production including, but not limited to controlled propagation, feeding, protection from predators, etc." (322 CMR 15.02). About 304 aquaculture permits are issued each year by DMF and annual reports regarding the status of the aquaculture program are available. Aquaculture is generally divided into three main types: commercial, research, and municipal propagation.

Commercial

The exclusive form of commercial marine aquaculture engaged in Massachusetts is bivalve molluscan culture, employing several methods of cultivation to grow quahogs (*Mercenaria mercenaria*), oysters (*Crassostrea virginica*), bay scallops (*Argopecten irradians*), soft shell clams (*Mya arenaria*), and to a lesser extent surf clams (*Spisula solidissima*) and blue mussels (*Mytilus edulis*). The Massachusetts aquaculture industry is comprised of 374 aquaculture farms on 935 acres of tidelands worth an estimated $6.3 million (DMF 2006). Note that some permits cover more than one farm, which explains the discrepancy between the number of permits and the number of farms. The shellfish aquaculture industry in Massachusetts has been steadily growing at a rate of 10% each year for the past decade (NOAA 2007). Since 1998, the number of shellfish farms in Massachusetts has grown by 47% from 1998 to 2005 with an increase in sales of 57% over the same time period (USDA 2006). In 2005, Massachusetts was the seventh largest producer of cultured shellfish in the United States (USDA, 2006) with over 30,000 bushels of oysters and 25,000 bushels of quahogs marketed (DMF 2006). Significant benefits to the economies of the state's working waterfronts have been realized: Oyster sales, in particular, exploded, increasing 165% during that time reflecting production from both established and new farms (USDA 2006). In addition, there has been development of the soft shell clam as a viable alternative crop, creating jobs, and generating income. Successes include the establishment of a number of farms on the North Shore, provision of assistance to Massachusetts' communities with public enhancement of soft shell clams, and, most recently, assistance to farmers in southeastern Massachusetts to culture this new species

Permit holders utilize both on-bottom and off-bottom culturing techniques in twenty-seven coastal communities throughout the state: Aquinnah, Barnstable, Brewster, Chatham, Chilmark, Dennis, Duxbury, Eastham, Edgartown, Essex, Fairhaven, Falmouth, Gosnold, Ipswich, Marion, Mashpee, Mattapoisett, Nantucket, Oak Bluffs, Orleans, Plymouth, Provincetown, Rowley, Wareham, Wellfleet, Westport, and Yarmouth. By encouraging municipal oversight with technical assistance by DMF, MA Department of Agricultural Resources and the state Aquaculture Centers, Massachusetts has been successful at encouraging aquaculture while controlling for the introduction of shellfish diseases, non-native/exotic shellfish species and other pests or predators into Massachusetts waters. There are 75 acres of blue mussel aquaculture sites in the early licensing stage at four locations within state waters located on Martha's Vineyard in Aquinnah, West Tisbury, and Chilmark. These sites will then be subdivided into individually licensed sites. Since the planning area largely excludes tidelands, aquaculture within the planning area is limited to within Wellfleet Harbor which contains 47 licensed sites in the planning area as of 2006. Offshore aquaculture has been proposed

for Massachusetts, but due to market pressures, use conflicts, and the possibility of environmental impacts, there are currently no offshore commercial aquaculture activities within the planning area.

In order to better explain the process of planning and conducting aquaculture, DMF has written an Aquaculture Strategic Plan. One of the critical components affecting both shellfish and finfish aquaculture in the Planning Area is siting. Due to the diversity of aquaculture and constantly emerging technologies, many different areas of the ocean are suitable for some type of aquaculture. For example, relatively shallow areas of the Wellfleet Harbor area are suitable for bottom and off bottom culture of oysters. Deeper water sites can be used for long line culture of blue mussels or other shellfish. Some important factors to consider are accessibility (proximity to ports, etc.), relative shelter, existing natural resources, conflicting uses (shipping lanes, etc.), substrate, among others. Recent technological advances in aquaculture methods and improved understanding of oceanographic conditions are renewing interest in offshore aquaculture (NH SeaGrant 2006). In Massachusetts, user conflict is a confounding factor primarily inshore, which has become an impetus for research into offshore techniques. Therefore, careful site assessment planning is crucial. It is probably best to examine locations within the planning area where aquaculture is not feasible as a first step toward spatial planning for aquaculture. A better assessment of both market conditions and food security issues may increase the prioritization and siting of aquaculture activities in Massachusetts.

Research
There are two research aquaculture activities in Massachusetts: the Salem State experimental mussel aquaculture off of Gloucester and Rockport and the Wellfleet oyster restoration project by the Town of Wellfleet, The Nature Conservancy, and the Audubon Society. The Salem State facility is a research activity. The Wellfleet project is a restoration project and will be open to harvest in the future.

Municipal propagation
In addition to commercial and research aquaculture activities, municipal propagation of shellfish is also regulated by DMF. Propagation is a method by which shellfish seed are grown out in town waters and then distributed for the benefit of recreational and commercial fishermen. It is similar to the stocking of lakes with trout, so is not considered a commercial aquaculture activity.

Regulatory Summary

See Appendix H

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Appendix A – Massachusetts Division of Marine Fisheries Data Sources

Data Source	Data Category	Spatial Resolution	Temporal Resolution	Species	Key Fields	Begin Year	End Year	Notes	Storage Format
Lobster Catch Reports (Coastal, Offshore + Seasonal)	Commercial Fishery (Fishermen Report)	SRA	Month	Lobster, Crabs (unclassified)	Catch (pounds), Effort (max traps; avg hauls; set-over-days; trips)	1967	current	but DMF Statistical Reporting Areas began in their current form in 1990. Prior to 1994 in Rbase format	Oracle (Fish2000)
Striped Bass Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Striped Bass	Catch (pounds, # fish), Effort (hours, trips)	1986	current	1986-2000 in archived Rbase format	Oracle (Fish2000)
Fluke Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Fluke	Catch (pounds), Effort (max traps, avg hauls, set-over-days, trips)	2001	current	2001-2005 fluke reports did not have areas fished (just a list of transactions)	Oracle (Fish2000)
Groundfish Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	10 'regulated' groundfish spp (+ monkfish, dogfish, skates)	Catch (pounds), Effort (trips; tows, hooks or hours)	2006	current	2006 did not have monkfish, dogfish + skates; Does not include Federally-permitted fishermen fishing in state waters	Oracle (Fish2000)
Gillnet Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Any caught by gillnet	Catch (pounds), Effort (max nets; avg hauls; trips)	1990	current	1990-1999 in archived Rbase format	Oracle (Fish2000)
Shellfish Catch Report	Commercial Fishery (Fishermen Report)	DSGA	Year	Wild harvested bivalve shellfish + seaworms	Catch (pounds)	1990	current	1990-2004 reported by town, not DSGA	Oracle (Fish2000)
Fish Weir Catch Report	Commercial Fishery (Fishermen Report)	SRA	Day	Any caught by weir	Catch (pounds), Effort (weirs operating; weir lifts)	1990	current	1990-1999 in archived Rbase format; 2000-2001 in Oracle (FISH)	Oracle (Fish2000)
Scup Pot Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Scup (by pot only)	Catch (pounds), Effort (max traps; avg hauls; set-over-days; trips)	1994	current	1994-1999 in archive Rbase format	Oracle (Fish2000)
Black Sea Bass Pot Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Black Sea Bass (by pot only)	Catch (pounds), Effort (max traps; avg hauls; set-over-days; trips)	1988	current	1988-1999 in archive Rbase format	Oracle (Fish2000)
Conch Pot Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Conch (by pot only)	Catch (pounds), Effort (max traps; avg hauls; set-over-days; trips)	1992	current	Does not overlap with shellfish CR; 1992-1999 in archive Rbase format	Oracle (Fish2000)
Sea Urchin Catch Report	Commercial Fishery (Fishermen Report)	SRA	Month	Sea Urchin	Catch (pounds), Effort (hours)	2003	current	Can be broken out by divers + dredges	Oracle (Fish2000)
Horseshoe Crab Catch Report	Commercial Fishery (Fishermen Report)	Town / Beach or DSGA	Day	Horseshoe Crabs	Catch (# of males; # of females)	?	current	Reported by Town + Beach, from which DSGA would be determined; Trip-level format going to Oracle starting in 2008	Excel
American Eel Catch Report	Commercial Fishery (Fishermen Report)	Town / River	Day	American Eel	Catch (pounds), Effort (pots)	2000	current	Trip-level format going to Oracle starting in 2008	Excel / Oracle (Fish2000)
Bluefin Tuna Seine Catch Report	Commercial Fishery (Fishermen Report)	Point (lat/lon)	Day (reported by set)	Bluefin Tuna	Catch (pounds, # fish), Effort (sets)	1988	current	Does not include sets where catch = 0	Excel
Surf Clam / Ocean Quahog / Quahog Dredge Catch Report	Commercial Fishery (Fishermen Report)	DSGA	Day	Surf Clam, Ocean Quahog + Northern Quahog	Catch (bushels or lbs)	?	current	Overlaps with shellfish CR; Trip-level format going to Oracle starting in 2008	Excel / Paper

Appendix A – Massachusetts Division of Marine Fisheries Data Sources

Data Source	Data Category	Spatial Resolution	Temporal Resolution	Species	Key Fields	Begin Year	End Year	Notes	Storage Format
Shellfish Aquaculture Catch Reports	Commercial Fishery (Fishermen Report)	DSGA	Year	All shellfish	Catch (bushels, pieces)	?	Current		Paper
SAFIS Dealer Reports (Shellfish)	Commercial Fishery (Dealer Report)	DSGA	Day (by transaction)	All shellfish	Catch (various -> lbs)	2005	current	Intended to capture all shellfish harvest, including aquaculture	Oracle (SAFIS)
SAFIS Dealer Reports (Finfish)	Commercial Fishery (Dealer Report)	*none*	Day (by transaction)	All marine species	Catch (pounds)	2005	current	Intended to capture 'primary purchases' of all marine species. No 'area-fished', but does have port-landed	Oracle (SAFIS)
Non-Commercial Lobster Report	Recreational Fishery (Fishermen Report	SRA	Year	Lobster	Catch (# of Lobster), Effort (maxtraps or hours-diving)	1998	current	Prior to 2007, not area-fished component	Oracle (SPORT)
MRIP Recreational Survey	Recreational Fishery (FD Sampling)	< or > 3 miles from shore	Day (by trip)	Species caught by recreational fishermen	Catch (# of fish), Effort (angler hours; # anglers)	1983	current	Formerly known as MRFSS	Oracle
Resource Assessment Bottom Trawl Survey	Scientific Survey (Biannual)	Tow (arcs/points) + Strata	Day (tow)	Any species caught by bottom trawl	CPUE	1978	current	There are many un-towable areas for which the data would not apply	Oracle (SOLE)
YOY Juvenile Winter Flounder Survey	Scientific Survey (Annual)	Haul (points)	Day (haul)	Juv. Winter Flounder (bycatch spp?)	CPUE	1976	current	Summer only. Six Nantucket Sound estuaries only.	MS Access
Lobster Ventless Trap Survey	Scientific Survey (Annual)	Haul (points)	Day (haul)	Lobster	CPUE	2006	current	May – September. Excludes Nantucket Sound, East of Cape Cod and Eastern Cape Cod Bay.	Oracle (Fish2000)
Juvenile Lobster Suction Sampling	Scientific Survey (Annual)	Fixed Stations	Day	Lobster	CPUE	1995	current		Oracle (Fish2000)
Anadromous Fish Counting Surveys	Scientific Survey (Annual)	River	Year	River Herring	Estimated Run Size (# of fish)	Varies	current	Selected runs	?
Anadromous Fish Spawning Habitat Surveys	Scientific Survey (Periodic)	River	One-time	Smelt, River Herring	Presence/Absence of spawning habitat	2001	2002	Smelt spawning habitat surveys were also conducted in 1988 and 1995.	MS Access
Smelt Fyke Net Monitoring	Scientific Survey (Annual)	River	Day	Smelt, Eel, R. Herring, Lamprey, W. Perch	Catch (# of fish)	2004	current	March - May only	MS Access
Eel Trap Monitoring	Scientific Survey (Annual)	River	Day	Eel	Catch (# of fish)	2001	current	April - June only	Excel

Appendix A – Massachusetts Division of Marine Fisheries Data Sources

Data Source	Data Category	Spatial Resolution	Temporal Resolution	Species	Key Fields	Begin Year	End Year	Notes	Storage Format
Industry Based Survey for GOM Cod	Scientific Survey (Annual)	Tow (arcs/points) + Strata	Day (by tow)	All species caugth by bottom trawl	Catch (pounds), Effort (standard tow)	2003	2007	November - May only; covers entire GOM out to 300'	Oracle (SOLE)
Commercial Lobster Trap Sampling	Commercial Fishery (FD Sampling)	Haul (points)	Day (trip)	Lobster (crabs)	Catch (# of lobster, weight), Effort (trap-haul)	1991	current		Oracle
Observer Data	Commercial Fishery (FD Sampling)	Tow / Haul / Set (points)	Day (trip)	Lobster, Groundfish, others?	Catch (weight), Effort (?)	?	current		Oracle (NOVA)

Appendix B – Non Extant GIS Data

Name: Comprehensive trip-level commercial fisheries catch & effort

Abstract: Currently catch & effort data are collected for some but not all MA commercial permit holders. These data target important fisheries either for the species that are caught, or because of the gear type used, and most of it is collected on an annual basis summarizing catch and effort on a monthly basis. In addition, not all permit holders submit catch and effort data. Comprehensive trip-level data would require all MA commercial permit holders to submit reports detailing their catch and effort activities by trip.

Purpose: Catch & effort information is a critical component in the fisheries workgroup model. However, gaps exist currently in that not all permit holders submit reports. In addition, because those data that are submitted are summarized monthly, and submitted on a yearly basis, are lacking with respect to areal resolution. Comprehensive trip-level reporting would provide much better resolution, for all permit holders, and it would be done in a more timely fashion – which may also improve accuracy.

Spatial Domain: Entire planning area and adjoining federal waters.

Data Type:

a. Data would be reported by existing reporting areas which are GIS-ready or by precise point coordinates (LAT / LONG or Loran).
b. Date would exist in Oracle database format.
c. Data does not exist as printed maps.
d. Data does not exist as text.

Data Location: These data have not been collected yet.

Estimated cost or timeframe for development: Cost could be significant depending on availability of supplemental federal funds. Estimates approach $60K per year to cover staffing needs mainly for data entry of paper-based reports. Several months would be required to hire staff and implement the program and to refine the database application(s) to enter and store the information. Cost and industry push-back are the biggest impediments.

Leverage: Trip-level catch and effort data is the industry standard established by all Atlantic states and the National Marine Fisheries Service (NMFS). The Atlantic Coastal Cooperative Statistics Program (ACCSP) was established over ten years ago to help all Atlantic states and NMFS collect and store standardized fisheries data in an effort to improve fisheries management. Many states are already collecting comprehensive trip-level data. Massachusetts has fallen behind in this effort due mainly to cost and potential industry push-back. It is possible that some funding will be available through ACCSP for this effort, and it is intended that all data will go to ACCSP as the primary repository. Thus MORIS would need to pull data from ACCSP.

Appendix B – Non Extant GIS Data

Name: Area-fished information from recreational catch & effort surveys

Abstract: Recreational saltwater fishing activity is currently estimated through an intercept and random telephone survey. Unfortunately, the only spatial component that is collected is whether the fishing activities occurred within 3 miles from shore or beyond. The survey should be modified to include a more specific area-fished component.

Purpose: That current level of spatial resolution prevents making determinations as to which areas within Massachusetts coastal waters are important to recreational fishermen. With over 1 million recreational saltwater anglers fishing in our coastal waters each year, it is crucial to include this piece of information in the ocean management planning process.

Spatial Domain: Entire planning area and adjoining federal waters.

Data Type:

a. Data would be reported by existing reporting areas which are GIS-ready.
b. Date would exist in Oracle database format.
c. Data does not exist as printed maps.
d. Data does not exist as text.

Data Location: These data have not been collected yet.

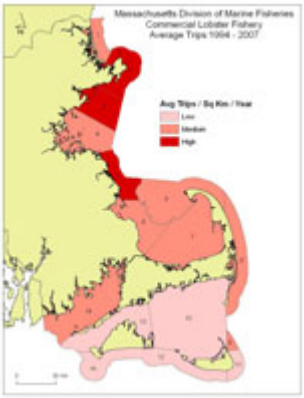
Estimated cost or timeframe for development: Modification of the current survey format is contingent upon the implementation of a Massachusetts Recreational Saltwater License, which will provide a complete sampling frame from which the selection of survey participants can be done in a statistically valid way.

Leverage: Many of Massachusetts fish species are managed by discrete stock areas through their Federal or interstate management plans. Because Cape Cod is considered one of the Atlantic coast's major "faunal breaks", Massachusetts coastal waters often includes 2 or more stock areas for a given species. Collecting finer-scale recreational catch and effort data would greatly improve the ability of stock assessment scientists to evaluate the status of a species by its component stock areas.

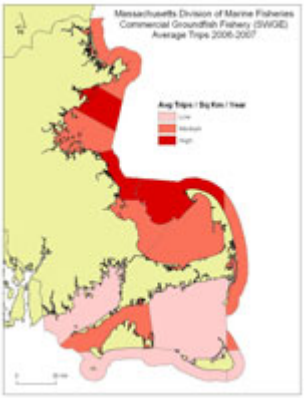
Appendix C – Fishery-specific maps of commercial fishing effort and landings

Average number of commercial trips / year / square kilometer by fishery.

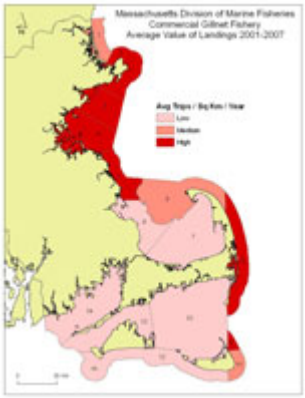
Lobster Trap



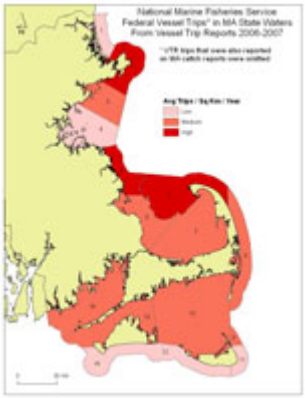
SW Groundfish



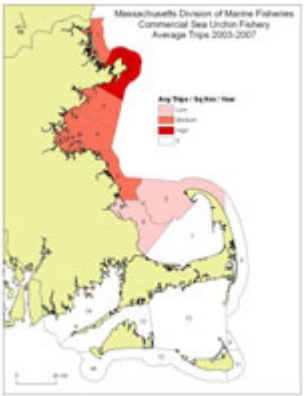
Gillnet



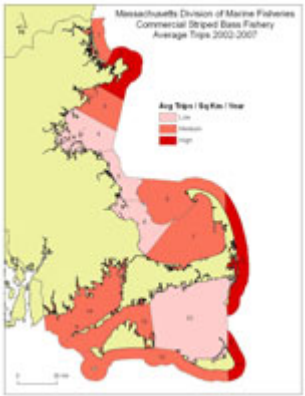
Federal VTR



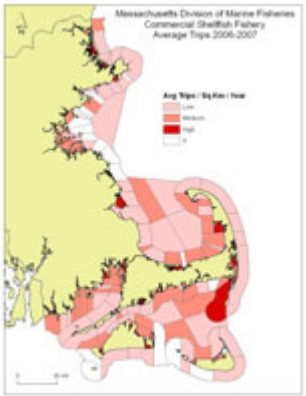
Sea Urchin



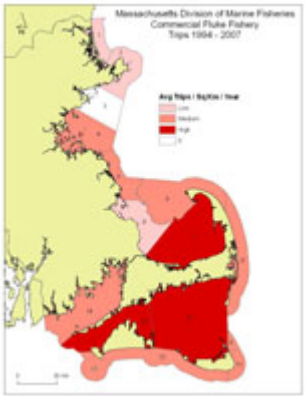
Striped Bass



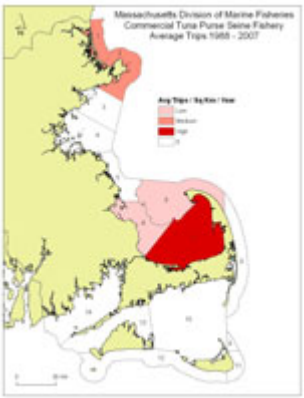
Shellfish



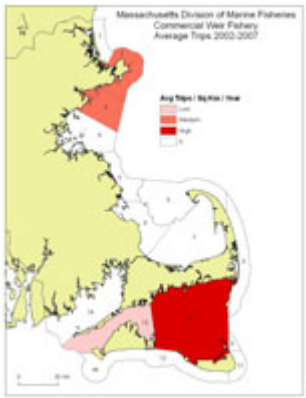
Fluke



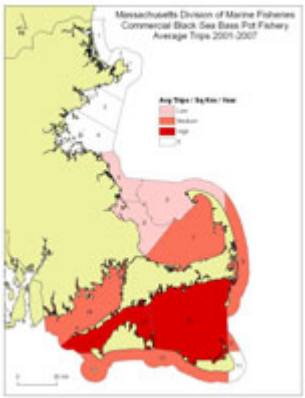
Tuna Purse Seine



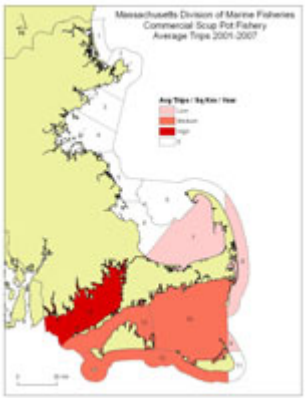
Fish Weir



Black Sea Bass Pot



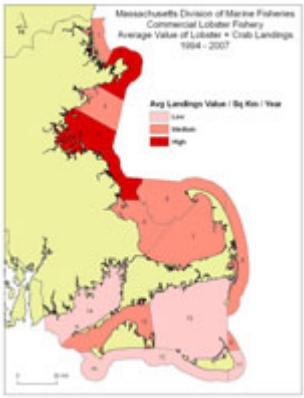
Scup Pot



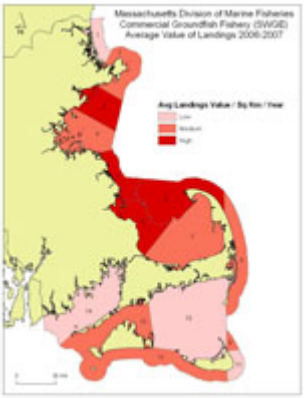
Appendix C – Fishery-specific maps of commercial fishing effort and landings

Average ex-vessel value of commercial landings (dollars) / year / square kilometer by fishery.

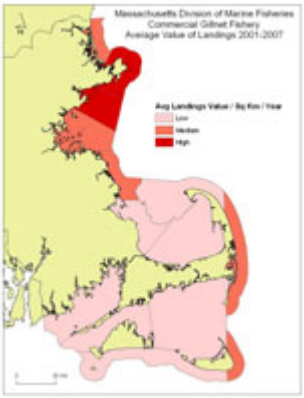
Lobster Trap



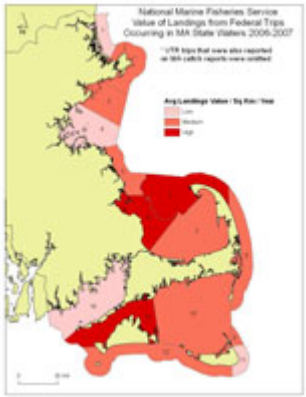
SW Groundfish



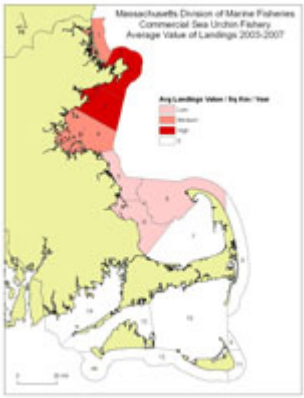
Gillnet



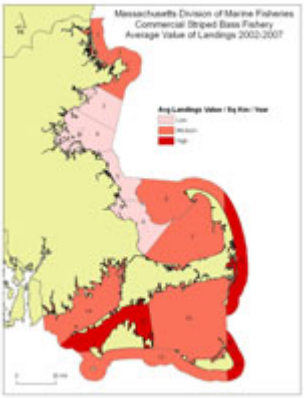
Federal VTR



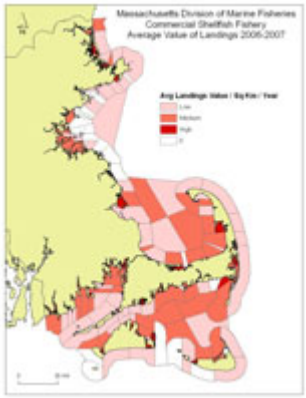
Sea Urchin



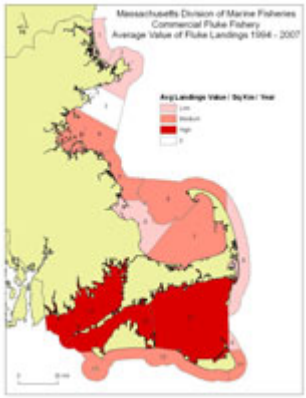
Striped Bass



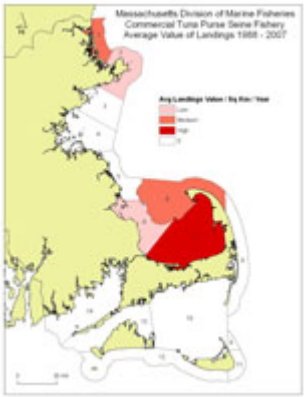
Shellfish



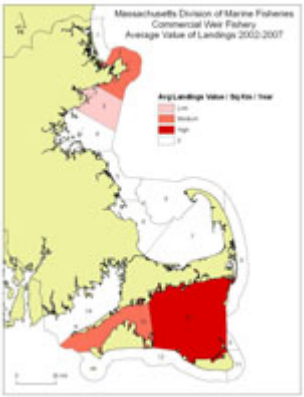
Fluke



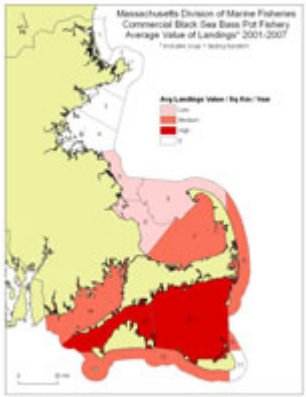
Tuna Purse Seine



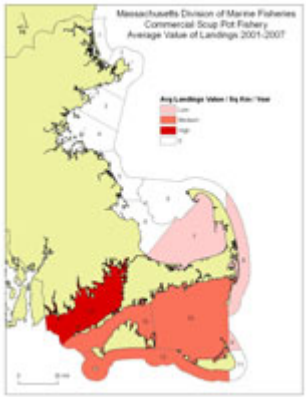
Fish Weir



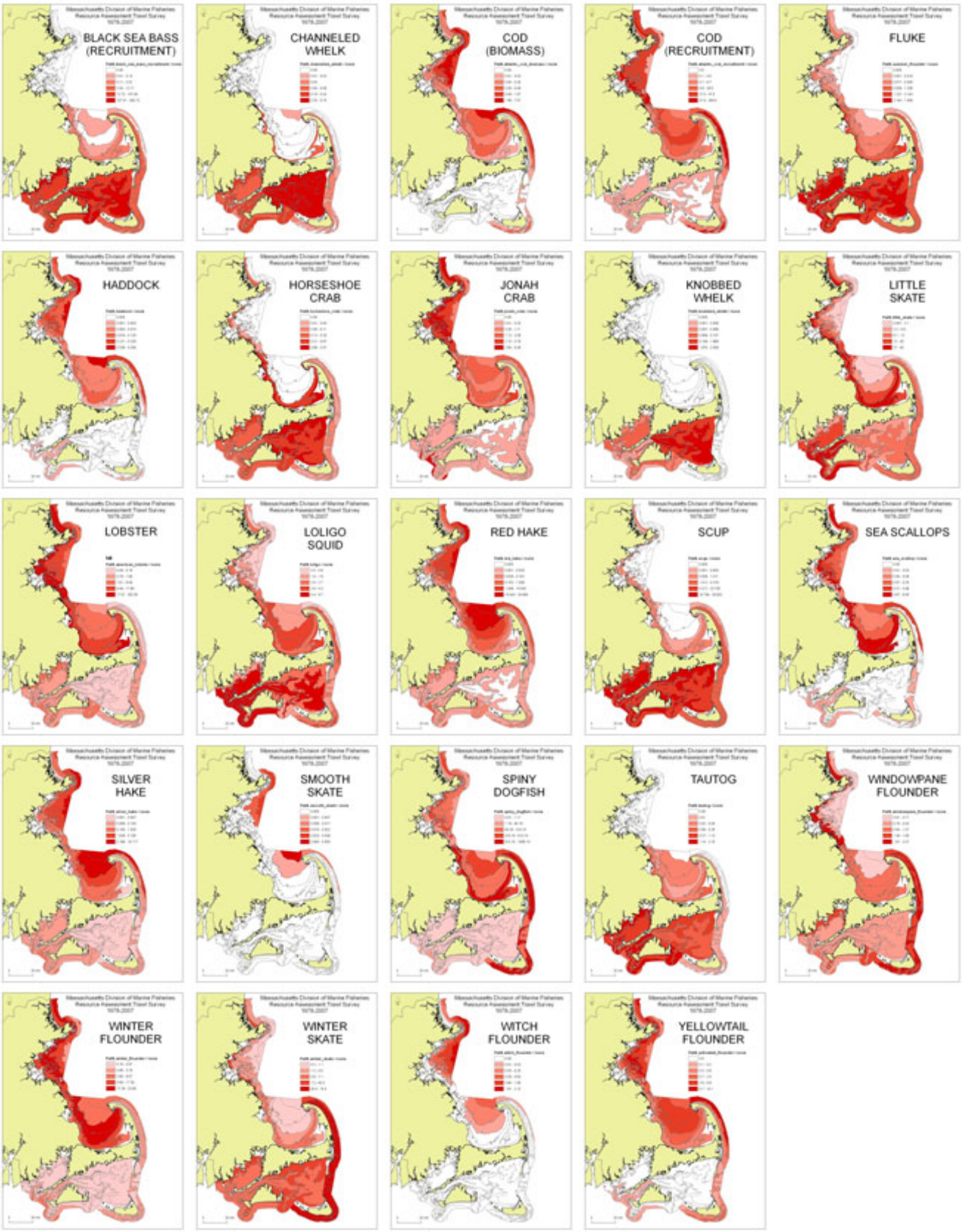
Black Sea Bass Pot



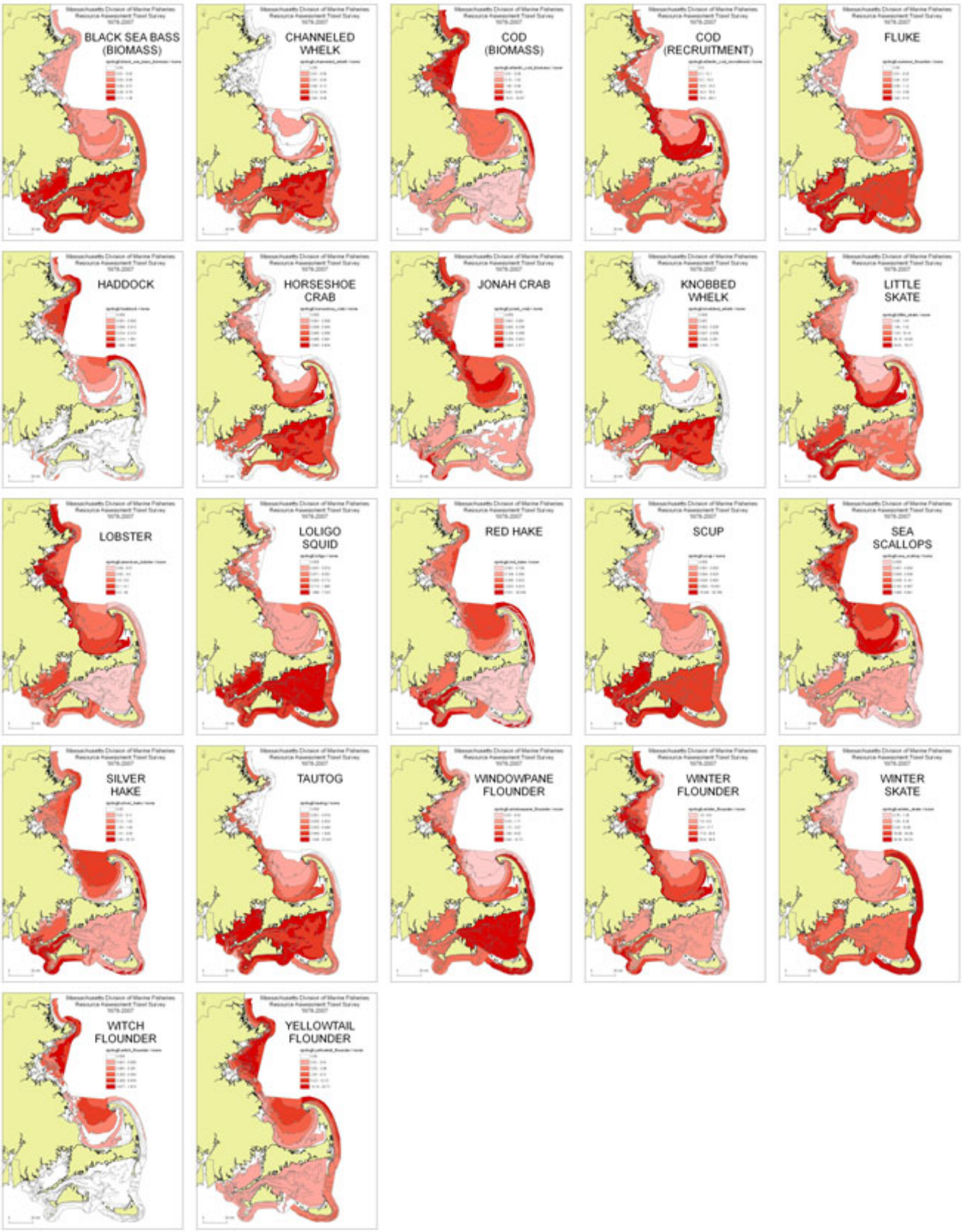
Scup Pot



Appendix D – Species-specific maps of CPUE values for the Spring Resource Assessment Trawl Survey 1978-2007. *Note: these figures are not normalized by strata set or region.*



Appendix D – Species-specific maps of CPUE values for the Fall Resource Assessment Trawl Survey 1978-2007. *Note: these figures are not normalized by strata set or region.*



Appendix E – 2007 landings-weighted state-wide average price per pound used to calculate landings value from Federal VTR and DMF catch report data

Species	Average Price	
American Lobster	$	5.03
American Plaice	$	1.61
Atlantic Cod	$	1.85
Atlantic Herring	$	0.09
Atlantic Mackerel	$	0.10
Atlantic Menhaden	$	0.09
Black Sea Bass	$	2.59
Black Whiting	$	0.47
Blue Crab	$	1.00
Blue Shark	$	1.10
Bluefin Tuna	$	8.45
Bluefish	$	0.52
Bonito	$	2.29
Butterfish	$	0.63
Conger Eel	$	0.56
Crab (Unspecified)	$	0.56
Cunner	$	0.92
Cusk	$	0.79
Dogfish (Unspecified)	$	0.23
Dusky Shark	$	1.10
False Albacore	$	0.25
Flounder (Unspecified)	$	1.04
Fluke	$	2.41
Haddock	$	1.75
Hake (Unspecified)	$	1.28
Halibut	$	5.28
Horseshoe Crab	$	1.25
Ilex Squid	$	1.07
Jonah Crab	$	0.59
Little Skate	$	0.09
Loligo Squid	$	0.86
Monkfish (Livers)	$	2.32

Species	Average Price	
Monkfish (Round)	$	1.41
Monkfish (Tails)	$	3.16
Pollock	$	0.50
Red Hake	$	0.30
Redfish	$	0.55
Rock Crab	$	0.51
Sculpin (Unspecified)	$	0.14
Scup	$	0.93
Shark (Unspecified)	$	1.10
Silver Hake	$	0.53
Skate (Unspecified)	$	0.08
Skate (Unspecified) (Wings)	$	0.57
Smooth Dogfish	$	0.21
Smooth Skate	$	0.08
Southern Flounder	$	1.04
Spanish Mackerel	$	0.12
Spiny Dogfish	$	0.23
Squid (Unspecified)	$	0.86
Starfish	$	0.14
Striped Bass	$	2.64
Tautog	$	2.17
Triggerfish (Unspecified)	$	0.68
Weakfish	$	1.88
White Hake	$	1.52
Windowpane	$	0.40
Winter Flounder	$	2.12
Winter Skate	$	0.28
Winter Skate (Wings)	$	0.50
Witch Flounder	$	2.46
Wolffish	$	0.79
Yellowtail Flounder	$	1.86

Appendix F – Species that are caught by the MA Commercial Fishery (SAFIS Dealer Reporting Database 2005-2007) and MA Recreational Fishery (MRIP Survey 1990-2007)

Commercial			Recreational
American Lobster	Goosefish	Sea Scallop	Albacore
American Plaice	Green Crab	Shark, Unclassified	Alewife
American Sand Lance	Greenland Halibut	Sheepshead,Atlantic	American Eel
American Shad	Grey Triggerfish	Shellfish,Other	American Lobster
Atlantic Bonito	Haddock	Silver Hake	American Shad
Atlantic Cod	Hagfish	Skates	Atlantic Cod
Atlantic Halibut	Hake, Unclassified	Smooth Dogfish	Atlantic Mackerel
Atlantic Mackerel	Horseshoe Crab	Snowy Grouper	Atlantic Menhaden
Atlantic Menhaden	Illex Squid	Softshell Clam	Atlantic Sea Herring
Atlantic Pollock	John Dory	Southern Flounder	Black Sea Bass
Atlantic Rock Crab	Jonah Crab	Spanish Mackerel	Blueback Herring
Atlantic Sea Herring	King Mackerel	Spider Crab	Bluefin Tuna
Bay Scallop	Knobbed Whelk	Spiny Dogfish	Bluefish
Bigeye Tuna	Lightning Whelk	Stimpson Clam	Bonito
Black Sea Bass	Little Tunny Tuna	Striped Bass	Butterfish
Bloodworms	Loligo	Summer Flounder	Conger Eel
Blue Crab	Mako Shark	Sunfishes	Cunner
Blue Mussel	Mantis Shrimp	Surf Clam	Cusk
Blue Runner	Mollusks,Unc	Swordfish	False Albacore
Blueback Herring	Northern Quahog	Tautog	Fluke
Bluefin Tuna	Northern Shrimp	Thresher Shark	Goosefish
Bluefish	Ocean Pout	Toadfish	Grey Triggerfish
Butterfish	Ocean Quahog	Tuna,Unc	Haddock
Calico Scallop	Opah	Wahoo	Ocean Pout
Channeled Whelk	Porbeagle Shark	Waved Whelk	Pollock
Clam, Unclassified	Porgies, Unclassified	Weakfish	Rainbow Smelt
Conger Eel	Rainbow Smelt	Whelk, Unclassified	Red Hake
Crab, Unclassified	Razor Clam	White Hake	Redfish
Cunner	Red Crab	White Perch	Scup
Cusk	Red Drum	Winter Flounder	Sea Robins
Dolphinfish	Red Hake	Witch Flounder	Shorthorn Sculpin
Dory, Unclassfied	Redfish	Wolffish	Silver Hake
Eastern Oyster	Rockweed	Yellowfin Tuna	Skates
Eel, Unclassified	Scallop,Unc	Yellowtail Flounder	Skipjack Tuna
Escolar	Sculpins	Windowpane Flounder	Smooth Dogfish
Fish, Unclassified	Scup		Spanish Mackerel
Flatfish, Unclassified	Sea Raven		Spiny Dogfish
Fourspot Flounder	Sea Robins		Striped Bass
			Tautog
			White Hake
			White Perch
			Windowpane
			Winter Flounder
			Wolffish
			Yellowtail Flounder

Appendix G – Normalized tri-mean values by stratum, with strata set definitions.

SPRING

Stratum	Lobster	Cod	Cod (Recruitment)	Black Sea Bass	Channeled Whelk	Haddock	Horseshoe Crab	Jonah Crab	Knobbed Whelk	Little Skate	Loligo Squid	Red Hake	Scup	Sea Scallop	Silver Hake	Spiny Dogfish	Summer Flounder	Tautog	Windowpane Flounder	Winter Flounder	Winter Skate	Witch Flounder	Yellowtail Flounder
11	0.074		0.140	0.091	0.054		0.111			0.049	0.050	0.001	0.167		0.000	0.008	0.212	0.754	0.062	0.063	0.048		
12	0.198		0.174	0.198	0.071			0.000	0.015	0.106	0.153	0.002	0.397		0.005	0.070	0.157	0.096	0.040	0.056	0.046		
13	0.082		0.259	0.149	0.000					0.289	0.067	0.030	0.102		0.040	0.069	0.201	0.015	0.032	0.141	0.058		0.000
14	0.172		0.129	0.145				0.044		0.331	0.029	0.406	0.031		0.507	0.310	0.104		0.020	0.356	0.046		0.000
15	0.021		0.123	0.227	0.521		0.531		0.721	0.019	0.333		0.145			0.001	0.087	0.103	0.174	0.057	0.023		
16	0.031		0.176	0.099	0.354		0.132		0.264	0.041	0.318	0.001	0.141		0.001	0.001	0.065	0.018	0.231	0.077	0.054		
17	0.101	0.000	0.057	0.014						0.030	0.012		0.000			0.000	0.048		0.103	0.034	0.187		0.005
18	0.136	0.001	0.250	0.019						0.062	0.026	0.000	0.013		0.000	0.027	0.062		0.181	0.064	0.211		0.015
19	0.039	0.003	0.629	0.053						0.068	0.012	0.007	0.004		0.011	0.086	0.061		0.157	0.065	0.198		0.018
20	0.044	0.059	0.032	0.000		0.006				0.004		0.001		0.005	0.010	0.074			0.001	0.038	0.087		0.065
21	0.100	0.161	0.032	0.006		0.269		0.000		0.003		0.047		0.018	0.028	0.111			0.001	0.050	0.043		0.126
25	0.073	0.004	0.327				0.192	0.039		0.200						0.000	0.000	0.008	0.159	0.122	0.189		0.004
26	0.059	0.008	0.251				0.033	0.037		0.246		0.006		0.208	0.001	0.023		0.005	0.145	0.107	0.127		0.004
27	0.051	0.019	0.035				0.000	0.132		0.175		0.057		0.380	0.028	0.034		0.000	0.028	0.109	0.056		0.026
28	0.046	0.031	0.009					0.103		0.033		0.114		0.034	0.085	0.038			0.023	0.075	0.008	0.026	0.040
29	0.034	0.036	0.003					0.094		0.006		0.085		0.015	0.095	0.082	0.001		0.011	0.040	0.017	0.203	0.042
30	0.019	0.021	0.002					0.059		0.002		0.075		0.000	0.079	0.065	0.002		0.002	0.026	0.019	0.059	0.030
31	0.169	0.015	0.080					0.083		0.150		0.000							0.280	0.090	0.327		0.012
32	0.301	0.074	0.241					0.273		0.107		0.000			0.002				0.232	0.128	0.099		0.031
33	0.085	0.118	0.041					0.039		0.060		0.005		0.039	0.005				0.067	0.132	0.103		0.118
34	0.066	0.147	0.009			0.033		0.054		0.014		0.006		0.239	0.005				0.034	0.100	0.028	0.028	0.210
35	0.050	0.228	0.002			0.388		0.045		0.008		0.043		0.055	0.025				0.018	0.065	0.015	0.377	0.213
36	0.047	0.075				0.304				0.000		0.113		0.007	0.073				0.002	0.007	0.011	0.307	0.039

FALL

Stratum	Lobster	Cod	Cod (Recruitment)	Black Sea Bass (Recruitment)	Channeled Whelk	Haddock	Horseshoe Crab	Jonah Crab	Knobbed Whelk	Little Skate	Loligo Squid	Red Hake	Scup	Sea Scallop	Silver Hake	Spiny Dogfish	Summer Flounder	Tautog	Windowpane Flounder	Winter Flounder	Winter Skate	Witch Flounder	Yellowtail Flounder
11	0.043			0.305	0.074		0.155	0.000	0.016	0.046	0.036	0.000	0.161		0.000		0.125	0.447	0.141	0.014	0.032		
12	0.072			0.181	0.043		0.020	0.002	0.007	0.081	0.108	0.000	0.212		0.000		0.162	0.413	0.037	0.022	0.014		
13	0.036			0.081	0.092		0.000	0.003		0.275	0.102	0.000	0.144		0.000		0.127	0.023	0.043	0.037	0.020		
14	0.299			0.019				0.168		0.335	0.178	0.003	0.118		0.004	0.000	0.254		0.117	0.310	0.015		
15	0.005			0.134	0.359		0.338		0.478	0.034	0.055		0.156			0.000	0.073	0.094	0.018	0.007	0.016		
16	0.057			0.269	0.431		0.115		0.499	0.055	0.093		0.169			0.000	0.112	0.010	0.022	0.005	0.015		
17	0.109			0.003	0.000					0.036	0.022		0.010			0.017	0.034		0.134	0.024	0.242		
18	0.181		0.000	0.005						0.075	0.037		0.016		0.000	0.119	0.034		0.150	0.060	0.194		0.000
19	0.035		0.012	0.002				0.000		0.042	0.067		0.012		0.000	0.208	0.008		0.097	0.074	0.145		0.006
20	0.075	0.008	0.561			0.354		0.039		0.011	0.001	0.003		0.042	0.028	0.248			0.199	0.178	0.209		0.180
21	0.087	0.153	0.427			0.222		0.039		0.010	0.001	0.087		0.062	0.091	0.098			0.043	0.269	0.098		0.289
25	0.204		0.005	0.000			0.334	0.058		0.140	0.041		0.002			0.001	0.059	0.012		0.042	0.091		0.000
26	0.046	0.001	0.051				0.039	0.025		0.215	0.047	0.001	0.000	0.211	0.002	0.102	0.010	0.002		0.104	0.160		0.003
27	0.029	0.007	0.096					0.085		0.160	0.044	0.010		0.205	0.020	0.069	0.004			0.159	0.049		0.022
28	0.018	0.002	0.070					0.039		0.044	0.051	0.088		0.016	0.068	0.037				0.133	0.033		0.050
29	0.021	0.015	0.092					0.031		0.004	0.026	0.173		0.003	0.209	0.018			0.005	0.038	0.008	0.055	0.043
30	0.004	0.058	0.028					0.026		0.001	0.005	0.330		0.000	0.252	0.014				0.010	0.005	0.043	0.026
31	0.320		0.045					0.094		0.173	0.023	0.000				0.000			0.653	0.075	0.287		0.001
32	0.196	0.004	0.150					0.134		0.166	0.022	0.000			0.001	0.011			0.345	0.098	0.156		0.011
33	0.070	0.004	0.128					0.126		0.054	0.008	0.001		0.262	0.008	0.025			0.082	0.105	0.134		0.073
34	0.044	0.057	0.210			0.104		0.084		0.035	0.018	0.011		0.166	0.028	0.016			0.014	0.148	0.070	0.052	0.148
35	0.028	0.560	0.101			0.250		0.036		0.008	0.013	0.070		0.030	0.084	0.011			0.002	0.085	0.006	0.385	0.141
36	0.020	0.129	0.025			0.071		0.013		0.000	0.002	0.222		0.002	0.203	0.005				0.003		0.464	0.007

= strata set A for that species/season
= strata set B for that species/season
= strata set C for that species/season

COMMONWEALTH OF MASSACHUSETTS
FISHERIES REGULATION SUMMARY

A. Introduction

This primer provides an overview of the entities and authorities/jurisdictions involved in fisheries management at the state, interstate and federal levels.

The Commonwealth, through M.G.L. c.130[1], the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA)[1], the Magnuson-Stevens Fishery Conservation and Management Act (MSA)[2], the Atlantic Striped Bass Conservation Act[3], the Sportfish Restoration Act[4], and the Atlantic States Marine Fisheries Commission Charter[5] is involved with fisheries management at multiple levels of government (state, interstate and federal). This involvement occurs through the Massachusetts Division of Marine Fisheries.

Fisheries often are identified and/or characterized with respect to state-federal jurisdictional boundaries and as a consequence there are varied and dynamic biological, political and socioeconomic considerations for fisheries management.

State-federal interactions have led to various combinations of authority with respect to fisheries management. Fisheries are managed under formal fisheries management plans (FMP), which are implemented by state and/or federal regulations. Some fisheries are conducted under a single FMP (either interstate or federal) or some combination of the two.

In the case of a single FMP, the jurisdiction without a formal plan often will implement complementary regulations in a sort of leadership hierarchy. For example, cod fishing in state waters is subject to Commonwealth regulations that complement the federal Northeast Multispecies Fishery Management Plan. Lobster fishing in federal waters is subject to NOAA Fisheries regulations that complement the Interstate Fishery Management Plan for American Lobster.

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[1] Chapter 130: Section 1A and 17 (excerpted). Division of marine fisheries Section 1A. The division of marine fisheries shall be under the administrative supervision of the director of marine fisheries. The division of marine fisheries shall administer all the laws relating to marine fisheries. It shall be responsible for the biological development of marine fish and fisheries.
Section 17. Powers of director. (10) Notwithstanding any contrary provision of law, the director of the division of marine fisheries may adopt, amend, or repeal all rules and regulations, with the approval of the Governor, necessary for the maintenance, preservation and protection of all marine fisheries resources between the mean high water mark of the commonwealth and a straight line extension of the lateral boundaries of the commonwealth drawn seaward to a distance of 200 miles.
[2] Public Law 94-265, as amended by P.L. 104-297 & 109-479
[3] Public Law 98-613.
[4] Public Law 81-681.
[5] Public Law 539

Fisheries managed under dual FMPs are often termed joint-management and generally result in one of the jurisdictions taking a lead authority role. Passage of time has resulted in numerous flip-flops between state and federal leadership of various fisheries; e.g., lobster management started out at the federal level but is now led at the interstate level.

Involvement in governance of fisheries extends beyond state and federal authorities and includes industry stakeholders, environmental groups and other interested parties. These entities (i.e., government, fisheries organizations, environmental groups, etc.) drive the fisheries management agenda and are a dynamic characteristic of fisheries management.

B. - Fisheries Management Authorities & Jurisdictions

Both the Commonwealth and federal government hold sovereign rights, in public trust, over living marine resources in mutually exclusive geographic areas of the United States (state versus federal waters). Currently states exert jurisdiction over living marine resources out to a three nautical miles (nm) seaward boundary from the mean low-water baseline[6], while Congress claims federal sovereignty over marine fishery resources seaward of the state boundary out to 200 nm (Figure 1).

Federal and state fisheries jurisdictions emanate from this split sovereignty but are neither mutually exclusive nor fixed in structure thereby leaving room for future changes in the federal-state fisheries management interaction. Prior to establishment of a federal fisheries law in 1976, state governments acted as the primary authority over fishing rights in the United States. Fisheries management regimes beyond territorial waters of the states did not begin in earnest until 1950 under the International Commission for the Northwest Atlantic Fisheries (ICNAF). Beginning in 1979 the Northwest Atlantic Fisheries Organization (NAFO) took over as the lead international fisheries science and management body for fishery resources in the Northwest Atlantic. But by that point the federal government had exerted exclusive authority over fishery resources in a Fisheries Conservation Zone (FCZ) extending 197nm beyond state waters.

Congress formalized federal jurisdiction over fisheries management in 1976 with passage of the Fishery Conservation & Management Act (P.L. 94-265), now known as the Magnuson-Stevens Fishery Conservation & Management Act (MSA). Congress upgraded fisheries management authority to a claim of sovereign rights shortly after President Reagan officially proclaimed a 200 nm Exclusive Economic Zone (EEZ) in 1983 (Presidential Proclamation 5030). This newly declared EEZ superseded the previously instituted Fisheries Conservation Zone (FCZ). President Reagan took another action in 1988 to establish the Territorial Sea seaward boundary at 12nm (Presidential Proclamation 5928), but explicitly he did not expand or contract state sovereignty in state waters. Thus state and federal sovereignty over marine fishery resources ends and begins, respectively, at the 3nm line.

[6] Provisions exist for drawing the baseline along irregular features of coastlines, including bays, rivers, and deltas (Kalo, Hildreth, Rieser, Christie, & Jacobson 2002).

State and federal fisheries management jurisdictions and authorities are based upon the split between sovereign powers, but the boundary certainly has been anything but set in stone. Section 306(a) (2) of the MSA extends some state fisheries jurisdiction but not sovereignty, into certain portions of the EEZ. It is by this exemption to federal jurisdiction that the Commonwealth gains direct fisheries jurisdiction in Nantucket Sound. A major portion of the 1996 re-authorization of the MSFMCA, the Sustainable Fisheries Act, clarified exemptions that extended state fisheries jurisdiction into the EEZ over those vessels which are registered under the law of that state, provided that either the federal government is not regulating the fishery in which the vessel is participating or state regulations are consistent with applicable federal regulations (Section 306(a)(3)). Federal fishery regulations governing marine species in the Northeastern United States, including Gulf of Maine cod, interpret statutory consistency to mean equally or more restrictive regulations (50 CFR 648.3(b)).

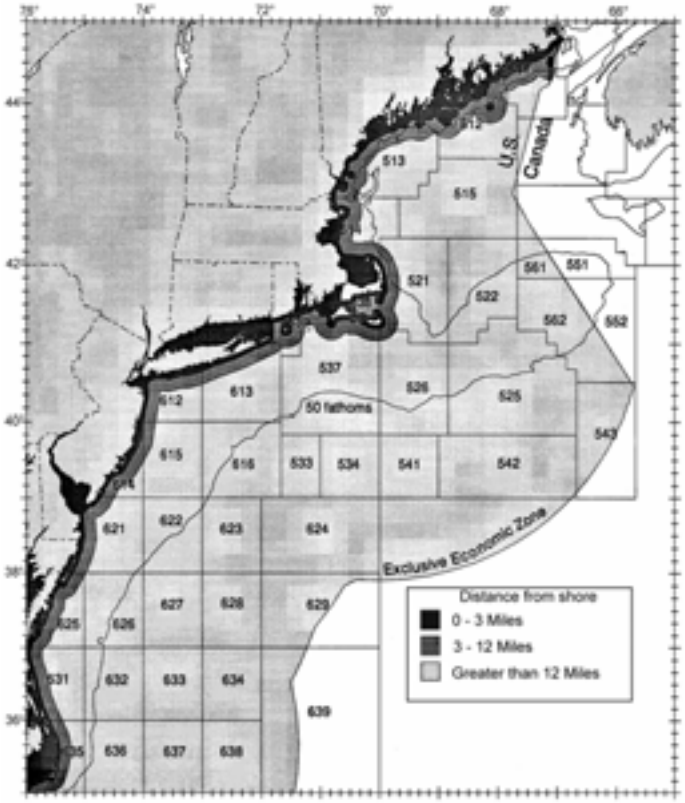


Figure 1. Map of state (0-3nm), territorial (3-12nm) and federal waters (3-200nm), including NOAA Fisheries statistical areas (Image from: Rountree 1997). Note that fisheries in Nantucket Sound are under state jurisdiction as provided by the MSA and the EEZ is inclusive of territorial waters.

Appendix H – Regulatory Summary

State

M.G.L. c. 130 lays out the Commonwealth's fishery management authorities. It primarily calls for the Director of the Division of Marine Fisheries to adopt, amend or repeal rules and regulations, subject to the approval of the Marine Fisheries Advisory Commission and the Commissioner of the Department of Fish & Game, which shall govern the manner of taking fish, legal size limits, seasons and amount of fish to be taken (§17A).

Division of Marine Fisheries (DMF)
DMF's mission is to manage the Commonwealth's living marine resources and the harvesting of those resources by the commercial and recreational fisheries, while maintaining a diverse number of self-sustaining fish populations at healthy levels of abundance in balance with the ecosystem; thus, providing wealth and enjoyment to all citizens of Massachusetts. In addition to administering the Division, the Division's Director represents the Commonwealth on both ASMFC and NEFMC.

Massachusetts Marine Fisheries Advisory Commission (MFC)
The MFC is a nine member board, representing conservation, recreational and commercial fishing interests (including seafood dealers), from various parts of Massachusetts. The MFC was established by the Legislature in 1961, and its members are "qualified in the field of marine fisheries by training and experience." Commissioners are appointed by the governor to three-year terms, and attend monthly business meetings as well as quarterly public hearings. Commission members are not compensated monetarily for the time they commit to the MFC. The Commission holds public hearings relative to matters within the jurisdiction of the Division, voting either up or down subsequent proposals of the Director regarding regulations and management of the Commonwealth's marine fisheries.

Interstate

In 1993, Congress formalized the current structure of interstate fisheries management with passage of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). ACFCMA gave "teeth" to ASMFC by allowing the Secretary of Commerce to place a moratorium on a state's fishery that is found out-of-compliance with an interstate fishery management plan.

Atlantic States Marine Fisheries Commission (ASMFC)
Formed by the 15 Atlantic coast states, the Potomac River Fisheries Commission, the District of Columbia and the two federal fisheries agencies in 1942 in recognition that fish do not adhere to political boundaries, ASMFC serves as a deliberative body, coordinating the conservation and management of the states

shared near shore fishery resources – marine, shell, and anadromous – for sustainable use.

The Commission's Interstate Fisheries Management Program (ISFMP) began in 1981, with the signing of a cooperative agreement with NOAA Fisheries. The ISFMP built upon the experiences of the cooperative State/Federal Fisheries Management Program, which started in 1971, and the Regional Fishery Management Council system, which was established under the Magnuson-Stevens Fishery Conservation and Management Act. The ISFMP operates according to the standards and procedures contained in its Charter.

The goal of the program is to promote the cooperative management of marine, estuarine, and anadromous fisheries in state waters of the East Coast through interstate fishery management plans. The major objectives of the ISFMP are to:

- Determine the priorities for interjurisdictional fisheries management in coastal state waters;
- Develop, monitor, and review fishery management plans;
- Recommend to states, regional fishery management councils, and the federal government management measures to benefit these fisheries;
- Provide an efficient structure for the timely, cooperative administration of the ISFMP; and
- Monitor compliance with approved fishery management plans.

Program Structure

The ISFMP operates under the direction of the ISFMP Policy Board and individual species management boards. The ISFMP Policy Board is composed of one representative from each member state, the District of Columbia, the Potomac River Fisheries Commission, NOAA Fisheries, and the USFWS. The Policy Board provides overall guidance and ensures consistency with the ISFMP Charter and between fishery management plans. Species management boards consider and approve the development and implementation of fishery management plans, including the integration of scientific information and proposed management measures. In this process, the species management boards primarily rely on input from two main sources – species technical committees and advisory panels.

Species technical committees provide scientific advice to the management boards, while advisory panels provide guidance about the fisheries that catch or land a particular species. Species technical committees are composed of technical staff from the Commission member states, NOAA Fisheries and the USFWS, and members of academia. Advisory panel members include representatives from the commercial, charterboat, and recreational fishing industries, as well as conservation interests. Members are appointed by the three Commissioners from each state with a declared interest in a species because of their particular expertise within a given fishery. The advisors' role is to provide input throughout the entire

fishery management process from plan initiation through development and into implementation.

The management boards also work with three standing committees of the Commission – the Committee of Economics and Social Sciences, the Habitat Committee and the Law Enforcement Committee. The first two committees help provide additional information to the fisheries management process on social and economic impacts of regulatory measures to the commercial and recreational fishing industries, as well as habitat considerations important to the conservation of the species. The Law Enforcement Committee composed of state and federal law enforcement representatives, provide guidance on the enforceability of proposed management measures.

Federal

In order to manage and conserve fish stocks, the MSA created eight regional fishery management councils that are overseen by the Secretary of Commerce. Each council develops fishery management plans (FMPs) for the stocks in their geographical region specifying how a fishery will be managed. These plans regulate, among other things, gear types, seasons, quotas, and licensing schemes.

New England Fishery Management Council (NEFMC)

Council Membership:
The Council is made up of eighteen voting members:

(1) The Regional Administrator of the National Marine Fisheries Service (NOAA Fisheries) (or her designee);

(5) The principal state official with marine fishery management responsibility (or their designee) for Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut.

(12) Twelve members nominated by the governors of the New England coastal states each serving no more than three consecutive terms.

In addition, four non-voting members represent the United States Coast Guard, U.S. Fish and Wildlife Service, U.S. Department of State, and the Atlantic States Marine Fisheries Commission.

Council Structure:

To more efficiently develop alternatives and management measures for Council consideration and eventual inclusion in a fishery management plan, each Council member serves on one or more oversight committees. Committees are generally related to a specific fishery or management issue.

Oversight Committees meet regularly to review and discuss individual FMPs and develop specific measures that will form the basis of the plan, plan amendment or framework adjustment to an FMP. Oversight committee recommendations are forwarded to the full Council for their approval before inclusion in any draft or final version of an FMP.

Advisory Panels are made up of members from the fishing industry (from both commercial and recreational sectors), scientists, environmental advocates, and others with knowledge and experience related to fisheries issues. They meet separately or jointly with the relevant oversight committee and provide input and assistance in developing management plan measures. Advisors are appointed every three years following a solicitation for candidates. After reviewing applications, the respective committee chairman selects new or returning advisors. The Council's Executive Committee provides the final approval of advisory panel members.

Plan Development Teams (PDTs) are made up of scientists, managers and other experts with knowledge and experience related to the biology and/or management of a particular species. Individuals serve as an extension of the Council staff. PDTs meet regularly to respond to any direction provided by the oversight committee or Council, to provide analysis of species-related information and to develop issue papers, alternatives, and other documents as appropriate. A member of the Council staff generally chairs each PDT and the team members are from state, federal, academic or other institutions.

NOAA Fisheries

Before the federal government approves and implements FMPs developed by the NEFMC, it must ensure all plans meet 10 National Standards (Appendix H1) set forth in MSA. Litigation based on meeting these standards has increased significantly over the years and has led to what many view as the inflexibility and impracticality of fisheries management at the federal level.

Key players: *Secretary of Commerce, Carlos Gutierrez; Undersecretary for NOAA, Conrad Lautenbacher; Assistant Administrator for Fisheries, William Hogarth, Regional Administrator for the Northeast Region, Patricia Kurkul.*

Appendix H1. Relevant state and federal fisheries laws and regulations.

Title	Reference	Summary
Atlantic Striped Bass Conservation Act	P.L. 98-613.	Approved October 31, 1984, (98 Stat. 3187, 16 U.S.C. 5151-5158), the ASBCA recognized the commercial and recreational importance, as well as the interjurisdictional nature, of striped bass, and established a unique state-based, federally backed management scheme.
Atlantic Coastal Fisheries Cooperative Management Act	P.L. 103-206	The Atlantic Coastal Fisheries Cooperative Management Act (Atlantic Coastal Fisheries Act) was signed into law in December 1993. It presents a new and innovative approach to coordinated management of coastal migratory fisheries along the U.S. Atlantic coast. The cooperative management process the law establishes involves the Atlantic States Marine Fisheries Commission (Commission), the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.
Magnuson-Stevens Fishery Conservation & Management Act	P.L. 94-265, as amended by P.L. 104-297 & 109-479	The Magnuson-Stevens Fishery Conservation and Management Act (MSA) is the primary law governing marine fisheries management in United States federal waters. The Act was first enacted in 1976 and amended in 1996. Most notably, the Magnuson-Stevens Act aided in the development of the domestic fishing industry by phasing out foreign fishing. To manage the fisheries and promote conservation, the Act created eight regional fishery management councils. The 1996 amendments focused rebuilding overfished fisheries, protecting essential fish habitat, and reducing bycatch.
Federal Aid in Sportfish Restoration Act	P.L. 81-681	This Act, commonly called the Dingell-Johnson Sport Fish Restoration Act, authorizes the Secretary of the Interior to provide financial assistance for state fish restoration and management plans and projects.
Atlantic States Marine Fisheries Commission Charter	P.L. 539	The purpose of this compact is to promote the better utilization of the fisheries, marine, shell and anadromous, of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries, and by the prevention of the physical waste of the fisheries from any cause. It is not the purpose of this compact to authorize the states joining herein to limit the production of fish or fish products for the purpose of establishing or fixing the price thereof, or creating and perpetuating monopoly.
Interstate Fishery Management Program Charter		The Commission carries out an Interstate Fisheries Management Program, authorized by Article IV of the ASMFC Charter's Rules and Regulations. (c) It is the policy of the Commission that its Interstate Fishery Management Program promote the conservation of Atlantic coastal fishery resources, be based on the best scientific information available, and provide adequate opportunity for public participation.

Appendix H2. Summary of fishery management plans in place for marine species harvested by Commonwealth fishermen (commercial and recreational).

Federal Fishery Management Plan

Developed by NEFMC

1. Northeast Multispecies
2. Small Mesh Multispecies
3. Atlantic Scallops
4. Atlantic Sea Herring
5. Red Crab
6. Skates
7. Atlantic Salmon

Developed by MAFMC

8. Surfclam and Ocean Quahog
9. Atlantic Mackerel, Squid and Butterfish

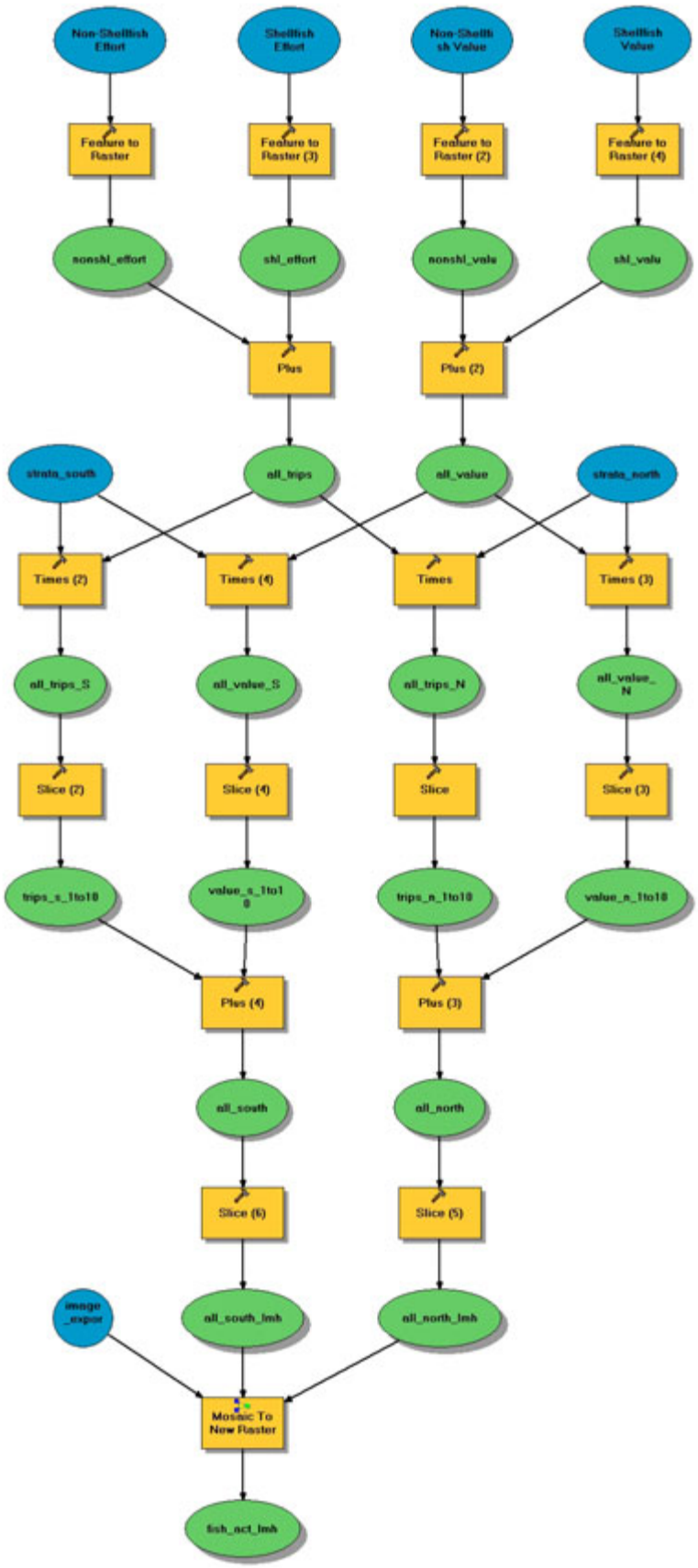
Interstate Fishery Management Plan

1. American Eel
2. American Lobster
3. Atlantic Sea Herring
4. Atlantic Menhaden
5. Horseshoe Crab
6. Northern Shrimp
7. Shad and River Herring
8. Coastal Sharks *(under development)*
9. Striped Bass
10. Tautog
11. Weakfish
12. Winter Flounder

Joint Fishery Management Plans

1. Bluefish *(MAFMC/ASMFC)*
2. Monkfish *(MAFMC/NEFMC)*
3. Spiny Dogfish *(MAFMC/ASMFC)*
4. Summer Flounder (Fluke), Scup and Black Sea Bass *(MAFMC/ASMFC)*

Appendix I – ArcGIS Models – Fisheries Activity



Appendix I – ArcGIS Models – Fisheries Resource