Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM XXVI TO AMENDMENT 3 TO THE AMERICAN LOBSTER FISHERY MANAGEMENT PLAN; DRAFT ADDENDUM III TO THE JONAH CRAB FISHERY MANAGEMENT PLAN

Harvester Reporting and Biological Data Collection

This draft document was developed for Management Board review and discussion. This document is not intended to solicit public comment as part of the Commission/State formal public input process. However, comments on this draft document may be given at the appropriate time on the agenda during the scheduled meeting. Also, if approved, a public comment period will be established to solicit input on the issues contained in the document.

ASMFC Vision Statement: Sustainably Managing Atlantic Coastal Fisheries

October 2017

Public Comment Process and Proposed Timeline

In January 2017, the American Lobster Management Board initiated an addendum to improve harvest reporting and biological data collection in the American lobster fishery. This draft Addendum seeks to utilize the latest technology to improve reporting, collect greater effort data, increase the spatial resolution of harvester reporting, and advance the collection of biological data offshore. This document presents background on the Atlantic States Marine Fisheries Commission, the addendum process and timeline, a statement of the problem, and management measures for public consideration and comment. Given the Jonah crab fishery is jointly managed by the Lobster Board and reporting requirements in the two fisheries mirror one another, this addendum proposes changes to the reporting and biological sampling requirements in both the lobster and Jonah crab fisheries.

The public is encouraged to submit comments regarding the proposed management options in this document at any time during the addendum process. The final date comments will be accepted is **Month, Day 201X at 5:00 p.m**. **EST.** Comments may be submitted by mail, email, or fax. If you have any questions or would like to submit comments, please use the contact information below.

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February-October 2017	Draft Addendum for Public Comment Developed
October 2017	Board Reviews Draft and Makes Any Necessary Changes
November 2017 – January 2018	Public Comment Period Including Public Hearings
February 2018	Management Board Reviews Public Comment, Selection of Management Measures, Final Approval of Addendum XXVI
TBD	Implementation of Provisions in Addendum XXVI

Executive Summary

Recent management action in the Northwest Atlantic, including the protection of deep sea corals, the declaration of a national monument, and the expansion of offshore wind projects, have highlighted deficiencies in the current lobster and Jonah crab reporting requirements. These include a lack of spatial resolution in harvester data and a significant number of fishermen who are not required to report. As a result, efforts to estimate the economic impacts of these various management actions on the lobster and Jonah crab fisheries have been hindered and states have been forced to piece together information from harvester reports, industry surveys, and fishermen interviews to gather the information needed. In addition, as the lobster and Jonah crab fisheries continue to expand offshore, there is a greater disconnect between where the fishery is being prosecuted and where biological sampling is occurring. More specifically, while most of the sampling occurs in state waters, an increasing volume of lobster and Jonah crab are being harvested in federal waters. The lack of biological information on the offshore portions of these species can impede effective management.

The Board initiated Lobster Draft Addendum XXVI/Jonah Crab Draft Addendum III to improve harvester reporting and biological data collection in state and federal waters. The goals of this addendum are to: 1) utilize the latest technology to improve reporting; 2) increase the spatial resolution of harvester data; 3) collect greater effort data; and 4) advance the collection of biological data offshore.

The Draft Addendum includes three issues. The first issue asks what percentage of harvesters should be required to report in the lobster and Jonah crab fisheries. The Addendum recommends, but does not require, the implementation of electronic reporting by the states as a cost-effective method to increase harvester reporting. The second issue asks whether the data elements currently collected should be expanded to collect a greater amount of information on the lobster and Jonah crab fisheries. The third issues asks how, and at what resolution, spatial information should be collected. In addition, the addendum provides several recommendations to NOAA Fisheries, including implementation of 100% federal harvester reporting, creation of a fixed-gear VTR form, and expansion of a biological sampling program offshore.

Table of Contents

1.0 Introduction

The Atlantic States Marine Fisheries Commission (ASMFC) has coordinated the interstate management of American lobster (*Homarus americanus)* and Jonah crab *(Cancer borealis)* from 0-3 miles offshore since 1996 and 2015, respectively. American lobster is currently managed under Amendment 3 and Addenda I-XXIV to the Fishery Management Plan (FMP). Jonah crab is managed under the Interstate Fishery Management Plan and Addenda I-II. Management authority in the Exclusive Economic Zone (EEZ) from 3-200 miles from shore lies with NOAA Fisheries. The management unit for both species includes all coastal migratory stocks between Maine and Virginia. There are ten states which regulate American lobster and Jonah crab in state waters and regulate the landings of lobster in state ports.

The Board initiated this addendum to improve harvester reporting and biological data collection in state and federal waters. Through Lobster Addendum X (2007) and the Jonah Crab FMP, states are required to implement, at a minimum, 10% harvester reporting and 100% dealer reporting. In addition, states are required to complete fishery dependent and independent biological sampling, such as sea and/or port sampling. For lobster, states are also required to conduct a fishery-independent survey, such as an annual trawl survey, a ventless trap survey (VTS), or a settlement survey. *De minimis* states are exempt from the biological sampling requirements in the lobster and Jonah crab fisheries.

Recent management action has highlighted several deficiencies in the data collection requirements for lobster and Jonah crab. One of the foremost deficiencies is the lack of spatial information collected. While harvesters are required to report the statistical area in which they fish, this information is too coarse to respond to the increasing number of marine spatial planning efforts which require fine-scale data. Another concern is that not all fishermen are required to report landings to either the state or NOAA Fisheries. Currently, only 10% of lobster and crab permit holders in Maine are selected to submit landings reports each year and vessels which are only issued a federal lobster permit are exempt from Vessel Trip Reports (VTRs). Given that roughly 83% of lobster is landed in Maine and the fishery continues to move further offshore, the lack of harvester reporting in these areas results in data gaps in the fishery. Deficiencies in the collection of biological data were also highlighted in a January 2016 report by the American Lobster Technical Committee (TC) which noted that while inshore waters are adequately sampled, little biological sampling occurs offshore. This is a growing problem as, due to species shifts and a decline of the inshore population, an increasing percentage of lobster is being harvested from federal waters and the Jonah crab fishery is primarily conducted offshore.

This Addendum seeks to address these issues by improving the resolution and quality of data collected in the lobster and Jonah crab fisheries. The goals of this addendum are to: 1) utilize the latest technology to improve reporting; 2) collect greater effort data; 3) increase the spatial resolution of harvester reporting; and 4) advance the collection of biological data offshore.

2.0 Overview

2.1 Statement of Problem

Recent management action in the Northwest Atlantic, including the protection of deep sea corals, the declaration of a national monument, and the expansion of offshore wind, have highlighted the fact that current harvester reporting requirements do not provide the level of information needed to respond to management issues. Furthermore, while the lobster fishery continues to move further offshore and the Jonah crab fishery is primarily conducted in federal waters, the majority of biological data is collected inshore. This disconnect hinders effective management of the two species. The Board initiated this addendum to improve harvester reporting and biological data collection in state and federal waters. The management measures in this addendum are intended to utilize the latest technology to improve the spatial resolution of harvester data, increase the collection of fishery effort data, and promote the collection of biological data offshore.

2.2 History of Reporting Requirements for American Lobster

American lobster is currently managed under Amendment 3 and its subsequent addenda. Amendment 3, which was finalized in 1997, required states to, at a minimum, maintain their current reporting and data collection programs. At the time of implementation, the Atlantic Coastal Cooperative Statistics Program (ACCSP) was still being developed and data collection standards had not been completed for lobster. As a result, action to specify monitoring and reporting requirements was deferred until completion of a coastwide statistics program by ACCSP.

By 1999 data collection standards for ACCSP were nearly complete and Addendum I (1999) established data collection guidelines in the lobster fishery. Importantly, while it encouraged states to adopt monitoring and reporting standards, state agencies were not required to make any changes to their current reporting system. It wasn't until Addendum VIII (2006) that a consistent set of reporting requirements were implemented in the lobster fishery. Specifically, states were required to collect trip-level data from at least 10% of the lobster fishery. This included information on landings (i.e: catch in pounds) and effort (i.e: trap hauls, soak time, number of trips, total traps set, number of traps fished per trip). All dealers were required to report lobster landings, by weight, on a trip level basis. States were also required to implement fishery dependent data programs, such as sea sampling and port sampling, to collect information on lobster length, sex, and cull status.

2.3 Current Reporting Requirements

2.3.1 State Reporting Requirements

American Lobster

Addendum X (2007) outlines the current reporting requirements in the lobster fishery. These requirements build upon those established in Addendum VIII and ensure that the collection programs meet ACCSP standards. For catch reporting, Addendum X requires at least 10% harvester reporting, with the expectation of 100% harvester reporting over time, and 100% dealer reporting. All states have implemented 100% harvester reporting, with the exception of Maine which has 10% harvester reporting (Table 1). Harvester reports are required to include

information such as vessel number, trip start date, statistical area, number of traps hauled, number of traps set, pounds of lobster harvested, and trip length. Dealer reports are required to include information on the species landed, the pounds harvested, the state and port of landing, market grade, and price per pound.

Addendum X also requires biological sampling from fishery independent and dependent sources. States are required to conduct sea sampling to characterize commercial catch and collect data on length, sex, v-notch, egg-bearing status, discards, cull status, and traps sampled. Port sampling is also required to collect information on length, sex, cull status, and market category. Sufficient sea sampling can replace port sampling. In addition, Addendum X requires states to implement fishery-independent sampling programs, with each state conducting either an annual trawl survey, a ventless trap survey (VTS), or a settlement survey. The VTS is designed to sample lobster habitats which may not be accessible to a trawl survey and provides information regarding the abundance of sub-legal lobsters (<53mm CL). Settlement surveys provide information on the youngest life stages of lobster (Stages IV and V). Several states carry out multiple fishery-independent sampling programs including Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut (Table 1). *De minimis* states (currently Delaware, Maryland, and Virginia) are not required to complete the biological collection programs prescribed in Addendum X.

Table 1: Harvester reporting, dealer reporting, and biological data collection programs for American lobster. New Hampshire and New York's trawl surveys are conducted in conjunction with Maine and Connecticut, respectively. *De minimis* states are not required to implement biological data collection programs.

	De Minimis Status in 2016	% Dealer Reporting	% Harvester Reporting	Sea Sampling	Port Sampling	Trawl Survey	Ventless Trap Survey	Settlement Survey
ME		100%	10%	✓		✓	✓	✓
NH		100%	100%	✓	✓	✓	✓	✓
MA		100%	100%	✓		✓	✓	✓
RI		100%	100%	✓(none in 2016)	✓	✓	✓	✓
CT		100%	100%	✓(none in 2016)		✓		✓
NY		100%	100%	✓	✓	✓		
NJ		100%	100%	✓		✓		
DE	✓	100%	100%			✓		
MD	✓	100%	100%	✓		✓		
VA	✓	100%	100%					
NOAA Fisheries		100%	VTR if permitted for another species	✓	✓	✓	*	

**NOAA supports ventless trap surveys through grants.*

Maine 10% Harvester Reporting

Maine currently requires 10% harvester reporting; however, this sampling is stratified by state fishing zone (Zones A through G) and license class (Table 2). More specifically, within each combination of zone and license class, a proportion of harvesters (i.e. 10%) are annually selected to complete trip reports. All Maine lobster license holders, except those chosen the previous year, are included in the annual random draw, including licenses that had no landings the previous year and permits that are required to submit VTRs. Those permit holders that are

required to submit VTRs do not submit duplicate reports to the Maine harvester logbook, but continue to report only through the VTR process.

Table 2: Maine license classes in the lobster and crab fishery.

License Class	Abbreviation	Description
Class I	LC1	No crew
	LCO	No crew, permit holder over 70 years old
Class II	LC2	1 crew
	LC2O	1 crew, permit holder over 70 years old
Class III	LC3	2 crew
	LC3O	2 crew, permit holder over 70 years old
Student	LCS	Student license
<18 License	LCU	Commercial license for those under 18 years old
Tribal	various	Native American affiliation
Non-Commercial	LNC	Recreational permit
Non-resident	various	Not a resident of Maine

Jonah Crab

Under the Jonah Crab FMP, participation in the directed Jonah crab fishery is tied to a lobster permit. As a result, the FMP extends the reporting requirements in the lobster fishery to the Jonah crab fishery. This means that states are required to implemented 100% mandatory dealer reporting and 100% harvester reporting; however, jurisdictions that currently requires less than 100% of harvesters to report in the lobster fishery are required to maintain, at a minimum, their current programs and extend them to Jonah crab. Harvester reports must include a unique trip ID, vessel number, trip start date, NMFS statistical area, traps hauled, traps set, pounds landed, trip length, soak time, and target species. Dealer reports must include a unique trip ID, species landed, quantity landed, state and port of landing, market grade and category, areas fished, trip length, and price per pound.

In addition, the Jonah Crab FMP states that, at a minimum, state and federal agencies shall conduct port/sea sampling to collect information on carapace width, sex, discards, egg-bearing status, cull status, shell hardness, and crab parts, where possible. The FMP also encourages states to extend current fishery-independent lobster surveys to Jonah crab.

2.3.2 Federal Reporting Requirements

For many federally permitted fisheries, catch information (including species caught and discarded, gear quantity, fishing location, and depth) is collected on a trip-level basis through Vessel Trip Reports (VTRs). However, a federal lobster permit does not contain a federal reporting requirement. This means that if a vessel is issued a federal lobster permit and that vessel has no other federal permits, the vessel is not required to fill out a VTR. As a result, a portion of the lobster and Jonah crab fleet which fishes in federal waters is not required to submit landings reports. This portion varies spatially, with a smaller percentage reporting in nearshore waters of the Gulf of Maine (GOM) and a higher portion reporting in Southern New

England (SNE) and the Mid-Atlantic. For example, only 10% of all Maine federal permit holders and 3% of the total Maine lobster fleet report through VTRs. In statistical area 514 (Massachusetts coast), 25% of permits report with VTRs. This percentage increases with distance from shore as roughly 63% of the lobster fleet which fishes in statistical area 537 (south of Cape Cod) reports through VTRs and 98% of the fleet in statistical area 515 (near Hague line) reports with VTRs. A high portion of vessels (95%) hailing from New Jersey through Virginia submit VTRs.

The NMFS Northeast Fisheries Science Center also conducts a bottom trawl survey which has collected data on lobster and Jonah crab abundance since the 1960's (Table 1). The bottom trawl survey is conducted twice a year, in the spring and fall, and extends from the Scotian Shelf to Cape Hatteras, including the GOM and Georges Bank (GBK). The survey uses a random sampling design and stratifies the survey area by depth. Data from the bottom trawl survey has been consistently incorporated into the lobster stock assessments and provides important information regarding Jonah crab abundance offshore.

2.5 Deficiencies with Current Harvester Reporting

2.5.1 Spatial Resolution of Data

Recent management actions have highlighted serious data deficiencies in the lobster and Jonah crab fisheries. These deficiencies have hindered the ability to effectively manage the resource, respond to the growing use of marine spatial planning, and assess the status of the offshore populations.

One of the largest deficiencies is the lack of spatial information collected in the two fisheries. While harvester reports are required to indicate statistical area fished, information regarding Lobster Conservation Management Areas (LCMAs) (see Appendix 1) or depth are not consistently collected (Table 3). This can hinder lobster management as a single statistical area can span multiple LCMAs, each of which has a unique set of regulations. For example, statistical area 521 spans LCMAs 1, 2, 3, and Outer Cape Cod (OCC), each of which has a different combination of lobster gauge size requirements. Furthermore, the coarse resolution of data collected by statistical area makes it difficult to determine potential impacts to the fisheries from fine-scale marine spatial planning in the Northwest Atlantic. As an example, recent action to protect deep-sea corals in GBK and the GOM required information on the magnitude of lobster and Jonah crab fishing in specific areas in order to calculate potential economic impacts. Without this fine scale spatial information, impacts to the lobster and Jonah crab fisheries had to be estimated by piecing together information from harvester reports, industry surveys, and fishermen interviews. Moreover, as the ocean continues to be divided between user groups, the lack of spatial resolution in harvester data collected has impeded the ability to accurately assess impacts to the lobster and Jonah crab industries.

Another deficiency is the lack of data collected on the depth at which the lobster and Jonah crab fisheries takes place. Recent management actions, including the establishment of a national monument, have considered a series of options which differ by depth. Given that information regarding the depth of fishing activity is not consistently collected among the

states (Table 3), it is challenging to respond to these management actions and illustrate potential economic consequences to the lobster fishery. This situation is made worse by the poor spatial resolution of the data.

Table 3: Data components collected in current harvester reports along the coast.

	Reports Submitted	Trip Length	# Of Crew	Traps Hauled	Active Traps Fished	Soak Time	Depth Fished	Stat Area	LCMA	Lat/ Long	Distance from Shore	Port Landed	Pounds Landed	Dispo-sition	Avg. Traps Per Trawl
ME	Monthly	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓
NH	Monthly	✓		✓	✓	✓		✓				✓	✓		✓
MA	Monthly	✓	✓*	✓	✓	✓		✓	✓			✓	✓	✓	✓*
RI	Quarter	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	
CT	Monthly	✓	✓	✓	✓	✓		✓				✓	✓	✓	
NY	Monthly	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
NJ	Monthly	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	
Federal VTR	Weekly or Monthly*	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓

* Massachusetts collects information on number of crew and average number of traps per trawl through an annual recall survey.

2.5.2. Percentage of Harvester Reporting

In addition to the lack of spatial resolution of harvester data, the percentage of harvesters reporting, in some areas, limits the ability to assess trends in the fisheries. Addendum X requires a minimum of 10% harvester reporting in the lobster fishery and this baseline requirement is extended to the Jonah crab fishery. Importantly, the expectation at the time was that all states would eventually implement 100% harvester reporting. Currently, Maine is the only state which has not implemented 100% harvester reporting and this is largely due to the size of the fishery. For context, more trips are taken by Maine lobstermen each year than the combined number of trips taken for all species in the states of New Hampshire, Rhode Island, Connecticut, New York, New Jersey, Delaware, South Carolina, and Georgia. As a result, expanding the Maine harvester reporting program to all lobster and Jonah crab fishermen could cost the state an additional $500,000 a year, under current paper reporting methods. Furthermore, not all federally licensed lobstermen are required to submit harvester reports as those vessels which only have a lobster permit are not required to complete VTRs.

The lack of 100% harvester reporting in Maine and in federal waters means that assumptions must be made about the activity of the lobster and Jonah crab fisheries. While 100% dealer reporting along the coast provides information on the total amount of lobster and Jonah crab landed in each state, it is not always clear where these lobster and Jonah crab are caught and what level of effort is required to harvest them. Moreover, information regarding the effort and location of catch from those harvesters which do report must be assumed to be representative of the whole Maine fishery. Given Maine accounts for over 80% of lobster landed in the U.S. and the offshore portion of the lobster fishery in SNE is becoming increasingly scrutinized as lobster abundance continues to decrease inshore, the scaling of a sub-sample of data to the whole fishery may be of concern.

In order to assess the effectiveness of the 10% harvester reporting requirement, the Board tasked the Technical Committee (TC) with determining a statistically valid sample of harvester reporting. A statistically precise sample of harvester reporting is needed to accurately scale up a subset of trip level reports to the full fishery. In their October 2017 report to the Board, the TC recommended 100% harvester reporting in the lobster and Jonah crab fisheries to accurately account for all trap hauls and the spatial extent of effort. Given the scale of the Maine fishery, the TC recommended that this 100% harvester reporting be achieved through electronic reporting, as this reduces the administrative burden on the state. In the interim, the TC did find that the current 10% harvester reporting in Maine is sufficiently precise, in large part due to the immense size of the Maine lobster fishery. Moreover, analysis showed that 10% harvester reporting results in a low coefficient of variation, a statistical measure of precision, for metrics such as trap hauls and landings (Figure 1). Furthermore, the scaling landings reported by the sub-sample of harvesters to the entire Maine fishery fell within the 95% confidence interval of state-wide dealer landings. This suggests that 10% harvester reporting is representative of the whole Maine fishery.

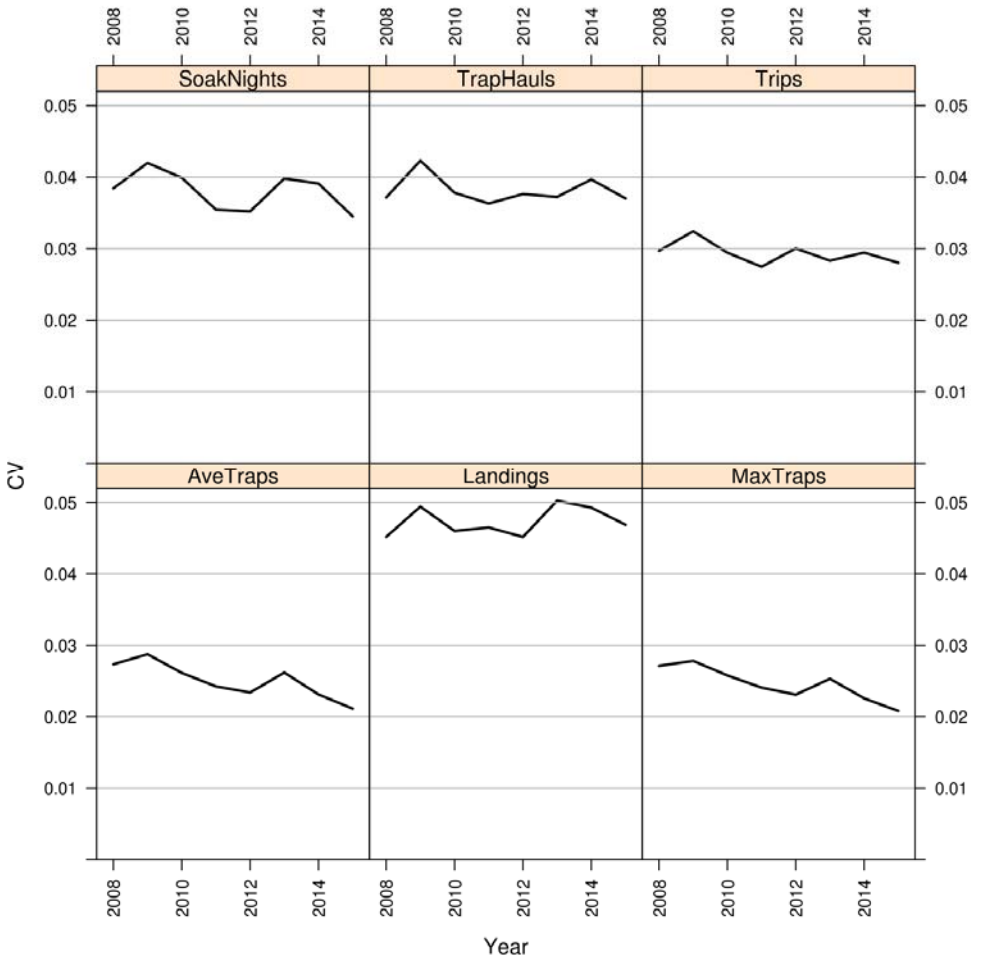

Figure 1: Calculated CVs from harvester data (pooled across license types), by year, for various reporting fields. For all metrics, the CVs are below 0.05 meaning the 10% reporting achieves CV's below 5% for all metrics considered.

While the TC did conclude that 10% harvester reporting is sufficiently precise, improvements could be made under the current level of harvester reporting to increase the precision and tracking of harvester behavior. Through their analysis, the TC concluded that sampling efforts by states which do not require 100% harvester reporting are best served if they focus on those permit classes which contain a large number of vessels and have a higher variance in landings. This optimized sampling allocation, rather than a proportional sampling allocation, improves the statistical precision of the harvester reporting program while maintaining the current workload of the state. As an example, in Maine the TC found that latent licenses (those licenses with no landings reported for the year) are being oversampled, creating inefficiencies and a lower statistical precision. By evaluating the number of vessels in a license class, the standard deviation of landings, and relative sampling costs, the TC found an optimal sampling approach would place greater sampling effort on active LC1, LC2, and LC3 permits and less effort would be allocated to latent and recreational permits (Table 4). A comparison of the CV's between Maine's current proportional and optimal allocation is shown in Figure 2.

Table 4: A comparison of the current proportional 10% harvester reporting in Maine versus the optimal allocation of reporting recommended by the TC. Licenses for individuals 70 years and older were combined into one license type (LCO). Tribal and non-resident licenses were not included in the analysis due to the small number of these licenses.

Licenses Type and Status	Current Proportional Reporting		Optimal Allocation of Reporting		
	# Vessels	% of Licenses	Allocation %	# Vessels	% of Licenses
LC1 Active	41	9.2%	8.4%	44	9.87%
LC1 Latent	70	15.3%	4.0%	21	4.58%
LC2 Active	190	11.4%	36.4%	188	11.26%
LC2 Latent	20	13.0%	2.7%	14	9.09%
LC3 Active	100	8.2%	28.2%	146	11.97%
LC3 Latent	4	10.3%	1.8%	10	25.64%
LCO Active	30	8.1%	7.6%	40	10.75%
LCO Latent	14	8.3%	1.7%	9	5.36%
LCS Active	36	7.3%	5.0%	26	5.26%
LCS Latent	27	8.1%	2.5%	13	3.90%
LCU Active	3	9.7%	0.4%	3	9.68%
LCU Latent	1	7.7%	0.3%	2	15.38%
LNC	114	6.4%	1.0%	6	0.34%

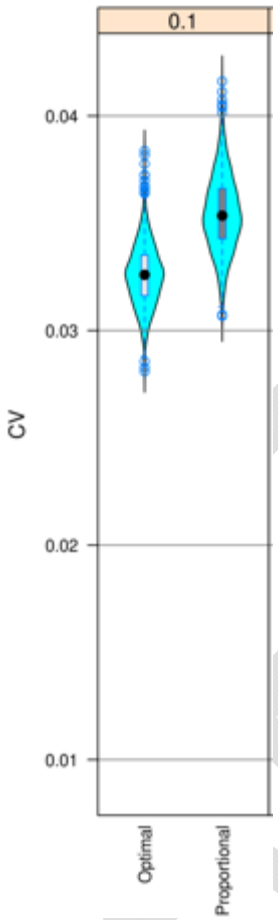

Figure 2: Comparison of CVs for trap hauls with optimal sampling (left side) vs. proportional sampling (right side) under 10% harvester reporting. The black dots represent the mean while the width and length of the shape represents the distribution of the data.

2.6 Deficiencies in Current Biological Data Collection Programs

In a January 2016 report to the Board, the TC stated that while current biological collection programs are sufficient to characterize catch in states waters, the resolution of biological data is lacking in federal waters. Currently, states administer a suite of biological sampling programs (i.e. sea sampling, port sampling, VTS, larval surveys, trawl surveys) to assess the status of the lobster and Jonah crab stocks; however, much of this effort is contained to state waters or takes place in nearshore waters which are accessible via a day trip. Table 5 and Appendix 2 show the location and depth of trawl surveys and VTS used in the 2015 American Lobster Stock Assessment. While the surveys span a broad length of the coast, most state trawl surveys do not extend past the 12 mile territorial sea boundary. The deepest trawl survey is the NEFSC Bottom Trawl Survey which samples depths up to 365m. While NOAA Fisheries has an extensive fishery dependent observer program, the lobster and Jonah crab fisheries have not historically been considered a sampling priority.

Table 5: Location and depth of trawl surveys and ventless trap surveys by jurisdiction.

		Location	Depth
Trawl Surveys	**ME-NH Inshore Trawl Survey**	Downeast Maine to New Hampshire	4 strata: 5-20 fathoms, 21-35 fathoms, 36-55 fathoms, > 56 fathoms out to the 12 mile territorial limit.
	MA Trawl Survey	Cape Ann to Buzzards Bay	6 strata: 0-30ft, 31-60ft, 61-90ft, 91-120ft, 121-180ft, 191ft-12 mile territorial boundary
	RI Trawl Survey	Narragansett Bay, Rhode Island Sound, Block Island Sound	6 strata; Narragansett Bay: 10-20ft, >20ft; RIS/BIS: 10-30ft, 30-60ft, 60-90ft, 90-120ft, >120ft
	CT-NY Trawl Survey	Groton, CT to Greenwich, CT in both CT and NY waters	4 strata: 0-9m, 9.1-18.2m, 18.3-27.3m, and 27.4+ m
	NJ Trawl Survey	Sandy Hook, NJ to Cape Hemlopen DE	18-90ft
	NEFSC Bottom Trawl Survey	Scotian Shelf to Cape Hatteras	7 strata: <9m, 9-18m, >18-27m, >27-55m, >55-110m, >110-185m, and >185-365m.
Ventless Trap Surveys	**ME VTS**	SAs 511, 512, 513 excluding estuaries of Kennebec and Penobscot Rivesr	3 strata: 1-20m, 21-40m, 41-60m
	NH VTS	SA 513 excluding Great Bay, Piscataqua River, and Hampton Harbor	3 strata: 1-20m, 21-40m, 41-60m
	MA VTS	SA 514, 538 excluding the southwest corned of Cape Cod Bay, Vinyard Sound, and Nantucket Sound	3 strata: 1-20m, 21-40m, 41-60m
	RI VTS	539 state waters of Narragansett Bay and Block Island Sound	3 strata: 1-20m, 21-40m, 41-60m

The dearth of biological sampling offshore is a growing concern given the increasing portion of lobster which is being harvested outside of state waters. In 1998, 87% of lobster harvested in SNE were from the inshore portion of the stock; however, by 2011, a greater portion of lobster (55%) were harvested from the offshore portion of the stock than the inshore portion (Figure 1). A similar trend can be seen in the GOM where the percentage of trips occurring at distances greater than 3 miles from shore has increased from 13% in 2008 to 20% in 2015. This issue is

further compounded by the fact that the Jonah crab fishery is primarily conducted in federal waters.

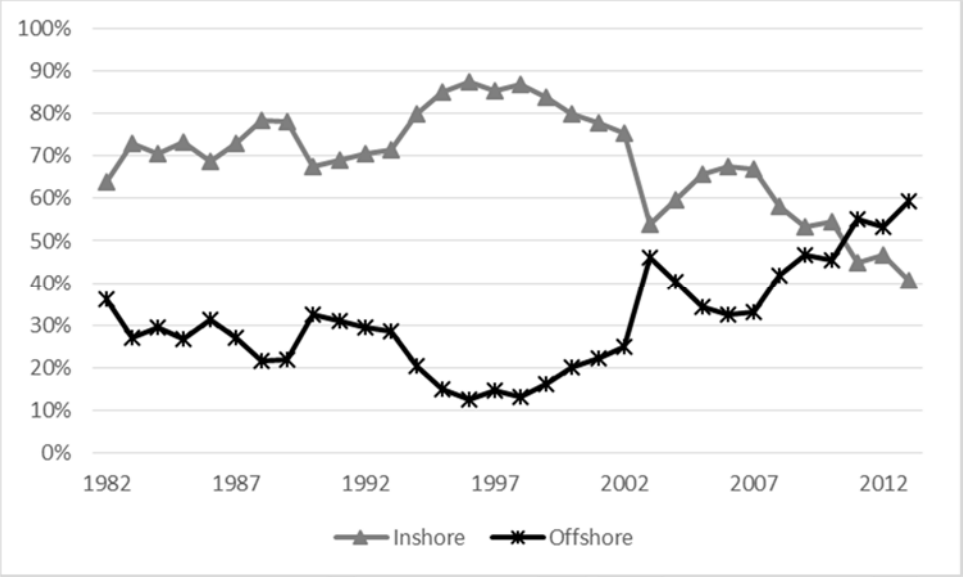

Figure 1: Percentage of landings in SNE occurring in the inshore and offshore fishery. The inshore fishery is defined as landings from statistical areas 538, 539, 611, 612, 613, 614, 621, 625, 631, and 635. The offshore fishery is defined as landings from statistical areas 533, 534, 537, 615, 616, 622, 623, 624, 626, 627, and 632.

2.6.1 External Biological Data Collection Programs

Given financial and geographic constraints on sampling conducted by states, external institutions have begun to implement their own fishery dependent sampling programs in order to collect greater information on the lobster and Jonah crab fisheries. One example of this is the Commercial Fisheries Research Foundation (CFRF), a non-profit foundation which conducts collaborative fisheries research projects. Established by commercial fishermen, CFRF collaborates with industry members to collect biological data and support fisheries research. One of the programs conducted by CFRF has been their On-Deck Data Program, through which participating commercial lobster and/or Jonah crab vessels conduct at-sea sampling during specified trips each month. The On-Deck Data application randomly selects trawls to sample throughout a trip and fishermen collect biological information on carapace length/width, sex, shell disease, presence of eggs, v-notching, shell hardness, and disposition. Participating vessels also deploy ventless traps which expand the spatial extent of the state's ventless trap programs to areas further offshore. In addition, participating vessels collect Jonah crabs to determine maturity status. Currently, 17 vessels participate in the CFRF program. As of August 2017, 97,913 lobster and 39,493 Jonah crab have been sampled. Biological information collected from CFRF was incorporated into the 2015 American Lobster Stock Assessment.

The geographic range of the CFRF program stretches from New Hampshire to New Jersey. Table 6 shows specific statistical areas in which CFRF participating vessels sample as well as the

magnitude of sampling in those areas. The largest amount of sampling occurs in statistical areas 537 and 539 (south of Cape Cod and Rhode Island) with additional sampling occurring in GBK (statistical areas 525 and 526) and offshore GOM (statistical areas 464 and 512). Limited levels of sampling occurs off of Long Island (statistical area 613) (Table 6).

Table 6: The geographic distribution of CFRF lobster and Jonah crab sampling, by statistical area, as of September 6, 2017. Data provided by CFRF.

Statistical Area	Commercial Lobster Sessions	Ventless Lobster Sessions	Lobsters Sampled	Commercial Jonah Crab Sessions	Ventless Jonah Crab Sessions	Jonah Crabs Sampled
464	38	5	3,939	11	1	951
465	10	9	1,552	4	0	129
512	40	27	5,179	10	0	440
515	15	21	1,306	4	0	128
522	1	0	83	0	0	0
525	113	24	3,483	64	16	5,323
526	48	21	2,970	19	16	2,005
537	335	342	17,954	86	64	7,729
539	739	1073	43,295	365	102	18,568
561	25	2	2,666	27	0	1,006
562	107	168	9,135	30	40	2,575
613	36	50	1,756	10	24	805
616	76	137	6,357	2	0	173
622	5	2	392	3	2	797
626	1	0	12	0	0	0

2.6.2 Identification of Data Gaps In Offshore Sampling

In order to provide guidance on where additional biological sampling efforts should be conducted in the lobster fishery, the TC reviewed the spatial distribution of various sampling efforts, including sea sampling, port sampling, and CFRF data programs, in relation to current landings. The TC set a baseline sampling threshold of 3 samples from each statistical area in each season. This threshold was identified as, for statistical areas which do not meet this baseline in the stock assessment, data is borrowed from other statistical areas. Results of the analysis showed that 13 statistical areas did not meet the 3-sample baseline in both 2015 and 2016, and an additional 17 statistical areas did not meet this sampling baseline in 2015 or 2016 (see Appendix 3, Table 1). Many of these statistical areas are found in GBK and some are found in SNE. Statistical areas the TC noted as high priority for increased sampling (based on high landings and low sampling) included 522, 525, 526, 561, and 562 in GBK, and 616 in SNE. In addition, the TC's analysis noted the variance in federal sampling through the Standardized Bycatch Reporting Methodology (SBRM) program from year to year as well as the critical role which CFRF plays in collecting biological samples. More specifically, the SBRM program assigned 619 sampling trips to the lobster fishery in 2015 but less than 50 sampling trips in 2016. Further, if the CFRF program did not exist, an additional 2.77 million pounds of lobster caught in GBK and SNE would not be sampled.

2.7 Atlantic Large Whale Take Reduction Team

The Atlantic Large Whale Take Reduction Team (ALWTRT) was established in 1996 in order to reduce the risk of serious injury and death of large whales due to entanglement in commercial fishing gear. The Take Reduction Plan (TRP), which was first published in 1997, specifies gear modifications and restrictions, such as weak links, gear markings, and seasonal prohibitions on locations where traps can be set.

A critical component of the TRP is the co-occurrence model, which pairs information regarding the distribution of whales and commercial fishing gear to predict areas where whales may be prone to entanglement. In May 2016, a subset of the ALWTRT met to discuss deficiencies in the collection of fishing effort data as it pertains to the co-occurrence model. To this end, the ALWTRT identified specific data elements which would inform the co-occurrence model but are not consistently collected by the states and NMFS. These include information regarding the number of traps per trawl, number of vertical lines, length of vertical lines, rope gauge, weight of traps, and buoy configuration. In April 2017, the ALWTRT met to consider ways to collect fishery effort data independent of the states. An outcome of that meeting was the potential development and implementation of an annual recall survey which would be sent to fishermen to collect information regarding fishing activity and gear used per month. Currently, the ALWTRT is developing this annual survey; information being considered for collection in that survey include the color of the buoy line and buoy, the weight of each trap, the number of traps per trawl, the buoy configuration, the buoy line diameter, the weight of anchor lines, and general fishing areas. The survey is still under development and it is expected the survey would be implemented December 2018 or thereafter.

This addendum provides an opportunity to proactively address some of the data needs of the ALWTRT; however, much of the information requested by the ALWTRT is more specific than what is typically required in a harvester trip report. Furthermore, state trip reports are often used for multiple species, limiting the ability to specifically ask questions regarding lobster gear configurations. There may be an opportunity to collaborate on the collection of some data (i.e. traps per trawl, number of endlines), particularly if electronic reporting is pursued by the states.

2.8 Reporting Work Group

Recognizing the need to assess current data collection in the lobster and Jonah crab fisheries, the Board established a Reporting Work Group to discuss data deficiencies and ways to improve them. The Work Group, which met in September 2016, was comprised of state agency staff, TC members, Board members, federal representatives, ACCSP staff, and ASMFC staff. As a part of their discussion, the Work Group developed five goals for harvester reporting.

1) Improve the spatial resolution of harvester reporting
2) Utilize the latest technology to improve and increase reporting
3) Collect greater effort data in harvester reports
4) Define inshore vs. offshore areas in the lobster fishery
5) Proactively address data concerns of the ALWTRT

In order to achieve these goals, the Work Group compiled a list of recommendations (Table 7). The recommendations were categorized as short-term (less than 1 year), intermediate (1-2 years), and long-term (greater than 2 years). The short-term recommendations sought to maximize commercial harvester reporting under the current framework and provide a uniform set of definitions for inshore vs. nearshore vs. offshore areas. The intermediate recommendations intended to build upon the existing reporting programs by requiring increased harvester reporting and the collection of additional data components. The long term recommendations sought to incorporate new technology into the lobster fishery in order to efficiently and effectively report landings, monitor compliance, and identify critical areas for the lobster fishery. These goals and recommendations provided a basis for the development of this addendum.

Table 7: Recommendations from the Lobster Reporting Work Group on ways to improve reporting in the lobster fishery.

Short Terms Recommendations
-Maximize ME's 10% harvester reporting by only including commercial license holders who have actively fished in the past two years
-Defined the inshore fishery as 0-3 miles, the nearshore fishery as 3-12 miles, and the offshore fishery as >12 miles
Intermediate Recommendations
- Require 100% active harvester reporting for all state and federally permitted lobster license holders; for resource limited jurisdictions unable to achieve 100% harvester reporting, at a minimum, states should require reporting from a statistically valid sample of harvester reporting
- Add the following data components to current harvester reporting coastwide: number of trap hauls, soak time, catch disposition, gear configuration, number of vertical lines, LCMA, depth
- Further delineate NMFS statistical areas on harvester trip reports
Long Term Recommendations
- Establish an electronic swipe-card system for harvester and dealer reports
- Incorporate VMS or another locator beacon to all lobster vessels
- Establish an electronic fixed-gear VTR for all federal permit holders

2.9 Status of the Stocks

American Lobster

The 2015 peer-reviewed stock assessment report indicated a mixed picture of the American lobster resource, with record high stock abundance throughout most of the GOM and GBK and record low abundance and recruitment in SNE.

The assessment found the GOM/GBK stock is not overfished and not experiencing overfishing. GOM and GBK were previously assessed as separate stock units; however, due to evidence of seasonal migrations by egg-bearing females between the two stocks, the areas were combined into one biological unit. While model results show a dramatic overall increase in stock abundance in the GOM/GBK, population indicators show young-of-year estimates are trending

downward. This could indicate a potential decline in recruitment and landings in the coming years.

Conversely, the assessment found the SNE stock is severely depleted. Recruitment indices show the stock has continued to decline and is in recruitment failure. The inshore portion of the SNE stock is in particularly poor condition with surveys showing a contraction of the population. This decline could impact the offshore portion of the stock if it is dependent on recruitment from inshore areas.

Jonah Crab

Jonah crab are distributed in the waters of the Northwest Atlantic Ocean primarily from Newfoundland, Canada to Florida. The life cycle of Jonah crab is poorly described, and what is known is largely compiled from a patchwork of studies that have both targeted and incidentally documented the species. Female crab (and likely some males) are documented moving inshore during the late spring and summer. Motivations for this migration are unknown, but maturation, spawning, and molting have all been postulated. It is also widely accepted these migrating crab move back offshore in the fall and winter. Due to the lack of a widespread and well-developed aging method for crustaceans, the age, growth, and maturity of Jonah crab is poorly described. As a result, the status of the Jonah crab resource is relatively unknown and no range wide stock assessment has been conducted.

2.10 Status of Commercial Fishery

American Lobster

The American lobster fishery has seen incredible expansion in landings over the last 40 years, with coastwide landings rising from roughly 39 million pounds in 1981 to over 158 million pounds in 2016. Ex-vessel value in 2016 set a new record at over $660 million. Much of this increase can be attributed to high landings in the GOM, and in particular, the state of Maine; since 1981, Maine lobster landings have risen over 500% from 22.6 million in 1981 to 131.9 million in 2016. In contrast, landings in states such as Connecticut and New York have dramatically decreased from their peak in the 1990s. In 1996, New York lobster landings were 9.4 million pounds but in 2016, only 218,354 pounds were landed in the state. A similar trend can be seen in Connecticut. These rapid decreases in landings are the result of several factors including warming waters, increased predation, and continued fishing pressure.

Jonah Crab

Historically, Jonah crab was taken as bycatch in the lobster fishery; however, in recent years a directed fishery has emerged causing landings to rapidly increase. Throughout the 1990's, landings fluctuated between approximately 2 and 3 million pounds and the overall value of the fishery was low. In the early 2000's landings began to increase with over 7 million pounds landed in 2005. By 2014, landings had almost tripled to 17 million pounds and a value of nearly $13 million dollars. This rapid and recent increase in landings can be attributed to an increase in the price of other crab (such as Dungeness), creating a substitute market for Jonah crab, as well as a decrease in the abundance of lobsters in SNE, causing fishermen to supplement their income with Jonah crab. Today, Jonah crab and lobster are considered a mixed crustacean

fishery in which fishermen can target lobster or crab at different times of the year based on slight gear modifications and small shifts in the areas in which the traps are fished. While the majority of Jonah crab is harvested as whole crabs, fishermen from numerous states, including Maine, New York, New Jersey, Delaware, Maryland and Virginia land claws.

3.0 Management Options

This section proposes to replace Section 4.1 of Addendum X to American Lobster Amendment 3 and Section 3.4.1 of the FMP for Jonah Crab. The intent of these management options is to improve harvester reporting and biological data collection.

3.1 Dealer and Harvester Reporting

The following outline the requirements for dealer reporting in the lobster and Jonah crab fisheries.

1. There is 100% mandatory dealer reporting. Dealer reports include: unique trip ID (link to harvester report), date, species, quantity (lbs), state and port of landing, areas fished (NMFS stat area), price per pound, and market grade and category.
2. There is a two-ticket system for dealer and harvester reports. This is used to provide verification between the two landings information. Harvesters report trip data and catch estimates (in pounds) and dealers report landing weights (in pounds).
3. Harvester and dealers are required to report standardized data elements for each trip on a monthly basis.
4. Permit holders are linked to federal vessel or individual permit/license level reporting for lobsters using ACCSP protocol (http://www.accsp.org/cfstandards.htm).
5. ACCSP stores lobster landings information.

3.1.1 Electronic Reporting

This document considers increases in the percent of active harvester reporting in the lobster and Jonah crab fisheries (see *Issue 1*). Given increases in harvester reporting under the current methodology (ie: paper reports) may result in large costs to some states, it is highly recommended that states implement electronic reporting. Electronic reporting represents a cost effect method to collect data as it reduces the need for staff to convert paper reports into an electronic format. Furthermore, electronic reporting provides the flexibility to collect expanded data elements. This could be particularly important given the ALWTRT is currently considering an annual survey to collect information on gear configurations and electronic reporting may provide an opportunity to streamline some of these data collection. At present, electronic reporting is not widely used throughout the lobster and Jonah crab fisheries. In Massachusetts, 24% of lobster-only permit holders (i.e. permit holders who do report through VTR) submit harvester reports electronically. In Rhode Island, 56% of state-only permit holders report electronically. No lobster fishermen in Maine, which has roughly 6,000 license holders, or Connecticut report electronically.

Should states implement electronic reporting, it is recommended that states use the SAFIS application eTrips, or eTrips Mobile, given this platform can be implemented at little to no cost to the states or fishermen, it is approved by GARFO as a platform to submit eVTRs, and there is

a well-established working relationship between ASMFC and ACCSP. States may choose to use an electronic reporting platform other than eTrips; however, this platform must implement the ACCSP Data Standards and be compatible with the eTrips Application Programming Interface (eTrips API), in order for the data to be seamlessly consolidated with other sources.

States wishing to use a different platform may submit a proposal to the Board which outlines why the state is pursuing a different electronic reporting platform and demonstrates that the platform meets the reporting requirements of this Addendum. Furthermore, states must demonstrate that the alternative electronic reporting platform can accommodate the large scale of the lobster fleet. Proposals must be reviewed and approved by the Board.

Issue 1: Percent Harvester Reporting

This issues asks what the minimum percentage of harvester reporting should be in the lobster and Jonah crab fisheries. States are encouraged to use electronic reporting as a cost-effective method to increase harvester reporting. Section 3.1.1. outlines the requirements for electronic reporting. For this addendum, an active harvester is defined as an individual who landed lobster and/or Jonah, in any amount, during the past two calendar years

Option A: Minimum 10% Harvester Reporting (Status Quo)

Under this option, at least 10% of active commercial harvesters in the lobster and Jonah crab fisheries are required to report trip level landings, with the expectation of 100% harvester reporting over time. States which currently require greater than 10% harvester reporting are required to maintain that higher level of reporting.

Option B: Maintain Current Harvester Reporting Effort and Allocate Reporting Through an Optimal Approach

Under this option, states which currently have 100% harvester reporting are required to maintain this level of reporting. States which have less than 100% harvester reporting are required to maintain, at a minimum, their current effort associated with harvester reporting and distribute reporting across an optimal, rather than a proportional, allocation. For example, an optimal allocation scheme based on license class in Maine would use the percentages below. It is expected that states will work towards 100% harvester reporting over time through the use of electronic reporting.

Licenses Type and Status	Allocation %
LC1 Active	8.4%
LC1 Latent	4.0%
LC2 Active	36.4%
LC2 Latent	2.7%
LC3 Active	28.2%
LC3 Latent	1.8%
LCO Active	7.6%
LCO Latent	1.7%

LCS Active	5.0%
LCS Latent	2.5%
LCU Active	0.4%
LCU Latent	0.3%
LNC	1.0%

Option C: 100% Harvester Reporting
Under this option, 100% of active commercial harvesters in the lobster and Jonah crab fisheries are required to report trip level landings. States which currently require less than 100% active commercial harvest reporting may phase-in the higher level of reporting over 5 years, such that in year 1 there is a minimum requirement of 20% active commercial harvester reporting; in year 2 there is a minimum requirement of 40% active commercial harvester reporting; in year 3 there is a minimum requirement of 60% active commercial harvester reporting; in year 4 there is a minimum requirement of 80% active commercial harvester reporting; and in year 5 there is 100% active commercial harvester reporting.

Issue 2: Harvester Reporting Data Components
This issue asks what data elements must be collected in harvester reports. Options B and C are not mutually exclusive, meaning the Board can chose Option B, Option C, or Options B and C.

Option A: Status Quo
Harvester trip-level reports must include: a unique trip ID (link to dealer report), vessel number, trip start date, location (NMFS Statistical Area), number of traps hauled, traps set, species, quantity (lbs), and trip length. Soak time is also required on Jonah crab harvester reports. For clarification, 'traps set' means the total number of traps that are in the water for a permit holder, including traps that were hauled and re-set as well as traps which are in the water but were not hauled.

Option B: Expanded Data Elements
In addition to the data components listed in Option A, trip-level harvester reports must include an expanded set of data elements. These include depth (most common depth fished at during trip), bait type, and soak time. States which conduct an annual recall survey in the lobster/Jonah crab fishery can collect information on bait type through this survey, instead of on trip-level reports. Currently, all states collect information regarding soak time so this option would codify this ongoing practice in the lobster fishery. Option B is not mutually exclusive from Option C, meaning the Board can implement both Options B and C.

Option C: Expanded Data Elements Regarding Gear Configuration
In addition to the data components listed in Option A, trip-level harvester reports must include an expanded set of data elements focused on gear configuration. These include number of traps per trawl (most common during trip), and number of buoy lines (total number of buoy lines in the water). The intent of this option is to proactively address some of the data needs of the ALWTRT. States which conduct an annual recall survey in the lobster/Jonah crab fishery can

collect information on number of traps per trawl and number of buoy lines through this survey, instead of on trip-level reports. Option C is not mutually exclusive from Option B, meaning either or both Options B and C can be chosen.

Issue 3: Spatial Resolution of Harvester Data

This issue asks how, and at was resolution, spatial data in the lobster and Jonah crab fisheries should be collected. Currently, harvesters report by NMFS statistical area; however, this resolution is too coarse to respond to on-going marine spatial planning efforts including offshore wind projects and coral protection zones. Option E can be chosen in combination with Option A, B, C, or D. This allows for a specification of the spatial resolution of harvester reporting along with the development of an electronic tracking pilot program.

Option A: NMFS Stat Area (Status Quo)

Under this option, harvesters will continue to report their fishing location by NMFS statistical area on harvester reports.

Option B: NMFS Stat Area and LCMA

Under this option, harvesters will report both the NMFS statistical area and LCMA in which they fish on harvester reports.

Option C: NFMS Stat Area and Distance from Shore

Under this option, harvesters will report both NMFS statistical area and distance from shore on harvester reports. Distance from shore will be categorized as 0-3 miles from shore, 3-12 miles from shore, or greater than 12 miles from shore. This option allows managers to separate landings between the inshore, nearshore, and offshore fisheries.

Option D: 10 Minute Squares

Under this option, harvesters will report their fishing location based on 10' squares which divide the North Atlantic coast. The intent of this option is to provide more fine-scale data on where the fishery is occurring. This will allow managers and states to better estimate the economic impacts of marine spatial planning activities on the lobster and Jonah crab fisheries. See Appendix 4 for a figure of 10 minute squares along the Atlantic coast.

Option E: Electronic Tracking

The intent of this option is to pursue electronic tracking in part, or all, of the lobster and Jonah crab fisheries. As a first step, a one year pilot program will be established to test electronic tracking devices on lobster and/or Jonah crab fishing vessels. Given the variety of vessels and the spatial distribution of the fishery (both in distance from shore and breadth along the coast), the pilot program will allow multiple tracking devices to be tested in various conditions to identify which device(s) are applicable to the lobster and Jonah crab fisheries.

To design and implement the pilot program, a Subcommittee of Board members, PDT members, industry, and law enforcement will be convened. Fishermen interested in participating in the program will be identified through state agencies and industry associations.

Ideally, fishermen from different states, fishing grounds, and with varying boat sizes will participate in the pilot program. Multiple technologies can be tested when conducting the pilot program; however, the systems must have a fast ping rate (at least 1 ping every minute) and be a low cost to fishermen. In particular, the Subcommittee, during their review and consideration of various technologies, should analyze the costs associated with the electronic tracking systems. The PDT recommends that specific technologies be explored, including solar powered devices and tracking through the eTrips Mobile application, given that these are generally low cost technologies with fast ping rates.

Success of the tracking technology will be evaluated by looking at the ease of compliance (or non-compliance), ability to determine trap hauls from steaming, industry feedback, cost-per fisherman, and law enforcement feedback. Following the one year pilot program, results of the program (including successes, challenges, and participant perspectives) will be presented to the Board. At that time, the Board may decide, through Board action, to end the pilot program, extend the pilot program for another year, or consider adoption of electronic tracking devices in part, or all, of the lobster and Jonah crab fisheries. Should the Board consider adoption of electronic tracking in part, or all, of the fisheries, a second round of public comment will be held.

Option E can be chosen in combination with Options A, B, C, or D.

3.2 Fishery Dependent Sampling

Non *de minimis* states are required to conduct fishery dependent sampling in the lobster and Jonah crab fisheries. This sampling allows for the collection of biological data on the fisheries and the data is incorporated into stock assessment models. States are required to conduct, at a minimum, 10 sea and/or port sampling trips per year in the lobster and Jonah crab fisheries, collectively. This minimum sampling requirement is meant to be a baseline and is not representative of the total populations. States which comprise greater than 10% of coastwide landings in either the lobster or Jonah crab fisheries should conduct additional sampling trips complementary to their level of harvest. For example, if a state comprises 20% of coastwide lobster landings, they should conduct 20 sea and/or port sampling trips per year in the lobster/Jonah crab fishery. Sufficient sea sampling can replace port sampling. If a state is unable to complete the required number of sampling trips in the lobster and/or Jonah crab fisheries, they must notify the Board during Annual Compliance reports as to why the sampling trips were not completed and outline future efforts to conduct sampling trips.

3.2.1 Port Sampling

The following outlines the requirements of port sampling.

1. In order to characterize lobster commercial catch, the following data elements must be collected: length, sex, v-notched, egg bearing status, cull status. In addition, the following data elements are recommended for collection in the lobster fishery, but not required: tissue for genetic or toxicity analysis, stomach contents for food habit assessments, gonads for maturity schedule data.

2. In order to characterize Jonah crab commercial catch, the following data elements should be collected, where possible: carapace width, sex, discards, egg-bearing status, cull status, shell hardness, and whether landings are whole crabs or parts.
3. The number of port sampling trips, as well as the number of lobster/Jonah crab sampled, will be reported in Annual State Compliance Reports.

3.2.2. Sea Sampling

The following outlines the requirements of sea sampling.

1. In order to characterize lobster commercial catch, the following data elements must be collected: length, sex, v-notch, egg bearing status, cull status, fishing location (NMFS Statistical Area, and total trawls or traps sampled. In addition, the following data elements are recommended for collection, but not required: tissue for genetic or toxicity analysis, stomach contents for food habit assessments, gonads for maturity schedule data.
2. In order to characterize Jonah crab commercial catch, the following data elements should be collected, where possible: carapace width, sex, discards, egg-bearing status, cull status, shell hardness, and whether landings are whole crabs or parts.
3. The number of sea sampling trips, as well as the number of lobster/Jonah crab sampled during sea sampling will be reported in Annual State Compliance Reports.

3.3 Fishery Independent Sampling

Non-de minimis states are required to conduct at least one of the following fishery dependent surveys each year in the lobster fishery: an annual trawl survey, a ventless trap survey, and/or a young-of-year survey. States should expand fishery-independent surveys to collect information on Jonah crab, including size distribution, sex composition, ovigerous condition, claw status, shell hardness, and location information.

4.0 Compliance

If the existing lobster and Jonah crab management plans are revised by approval of this draft addendum, the American Lobster Management Board will designate dates by which states will be required to implement the addendum. A final implementation schedule will be identified based on the management tools chosen.

5.0 Recommendations for Actions in Federal Waters

The management of American lobster and Jonah crab in the EEZ is the responsibility of the Secretary of Commerce through the National Marine Fisheries Service. The Atlantic States Marine Fisheries Commission recommends that the federal government promulgate all necessary regulations in Section 3.0 to implement complementary measures to those approved in this addendum. In addition, ASMFC recommends the following be adopted in federal waters:

- Establish a harvester reporting requirement for lobster-only federal permit holders – There is currently no federal permitting requirement attached to a federal lobster permit. One of the deficiencies identified in this Addendum is that not all lobster and Jonah crab harvesters are required to complete trip level reports. This impedes effective management of the stock as it is unclear where lobster and Jonah crab are being

harvested and what effort is associated with the catch. As ASFMC works to improve harvester reporting and data collection, it is recommended that NOAA Fisheries establish a harvester reporting requirement for all federal lobster permit holders to the level approved by the Board or higher. This percentage of federal harvester reporting should be achieved in all statistical areas, in particular those in the GOM where the number of federal lobster permit holders who do not report with VTRs is highest.

- Creation of a fixed gear VTR for federal permit holders – As identified by the Reporting Work Group, one of the major hurdles in federal lobster reporting is that a single VTR form is used by a wide variety of gear types. This limits the amount of information that can be collected and creates confusion on how specific data elements apply to the lobster fishery. ASMFC recommends that a fixed-gear VTR form be established to fulfill the data needs specific to these fisheries, including information on soak time, number of hauls, and total gear in water.
- Implementation of a targeted lobster sampling program in federal waters – As outlined in Section 2.6 of this Addendum, the biological sampling programs currently conducted in federal waters are insufficient to characterize commercial catch or understand the biological conditions of the offshore stock. This is particularly concerning given an increasing portion of the lobster fishery is being executed in federal waters. ASMFC recommends NOAA Fisheries support a targeted biological sampling offshore program offshore. Appendix 3 outlines recommendations from the TC for a sampling program in offshore waters, including areas where future sampling efforts should be focused.

6.0 References

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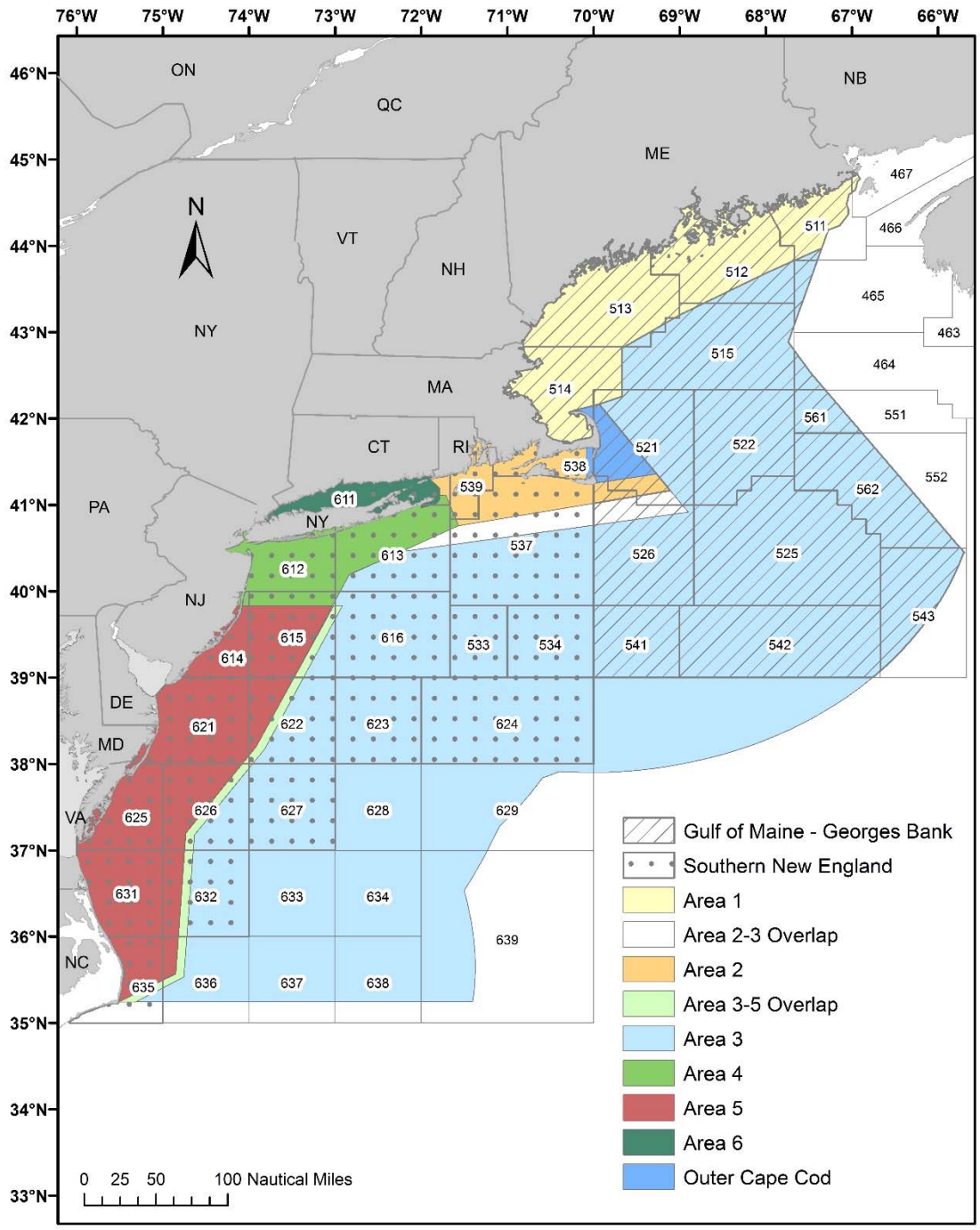
Appendix 1: American Lobster Biological Stocks and Lobster Conservation Management Areas.



Appendix 2: Maps of Trawl Surveys Conducted by Jurisdictions

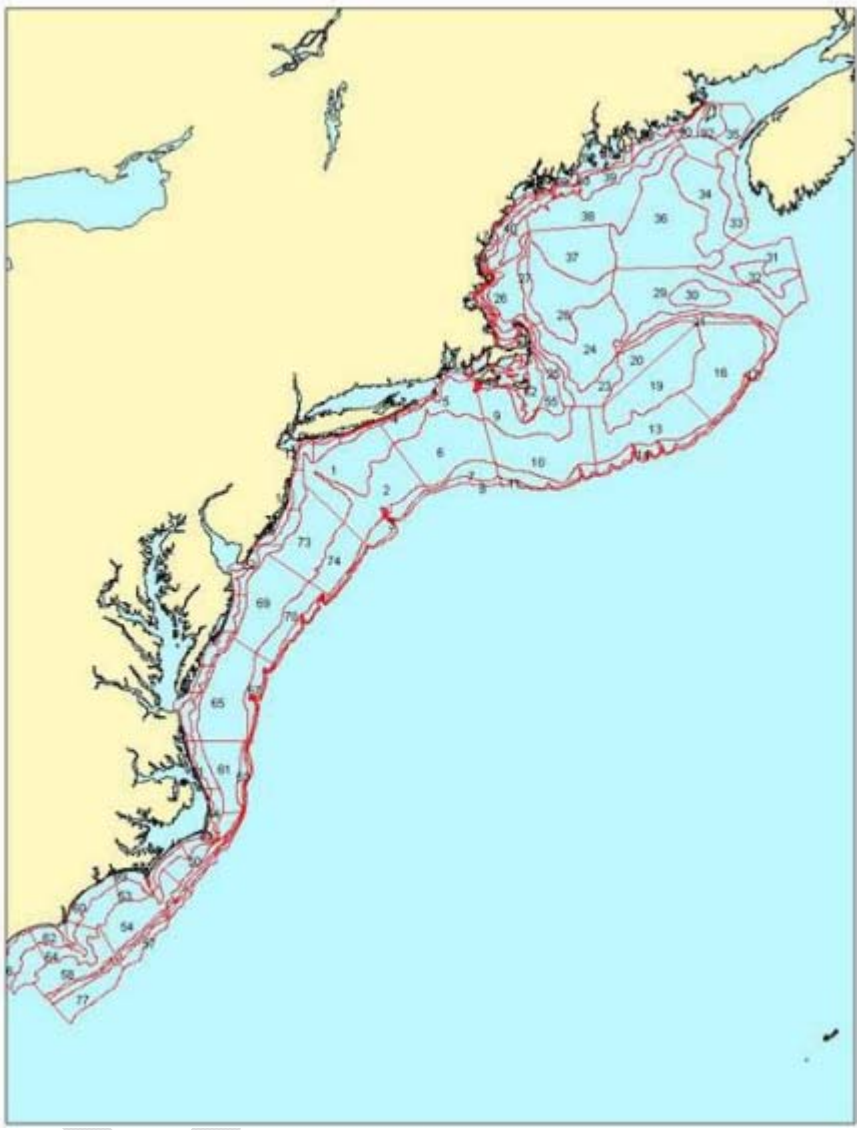


Figure 1: Map of area sampled by the NEFSC Bottom Trawl Survey. The survey is stratified by depth (<9m, 9-18m, >18-27m, >27-55m, >55-110m, >110-185m, >185-365m) and stations are randomly selected within each strata. (Source: NEFSC)

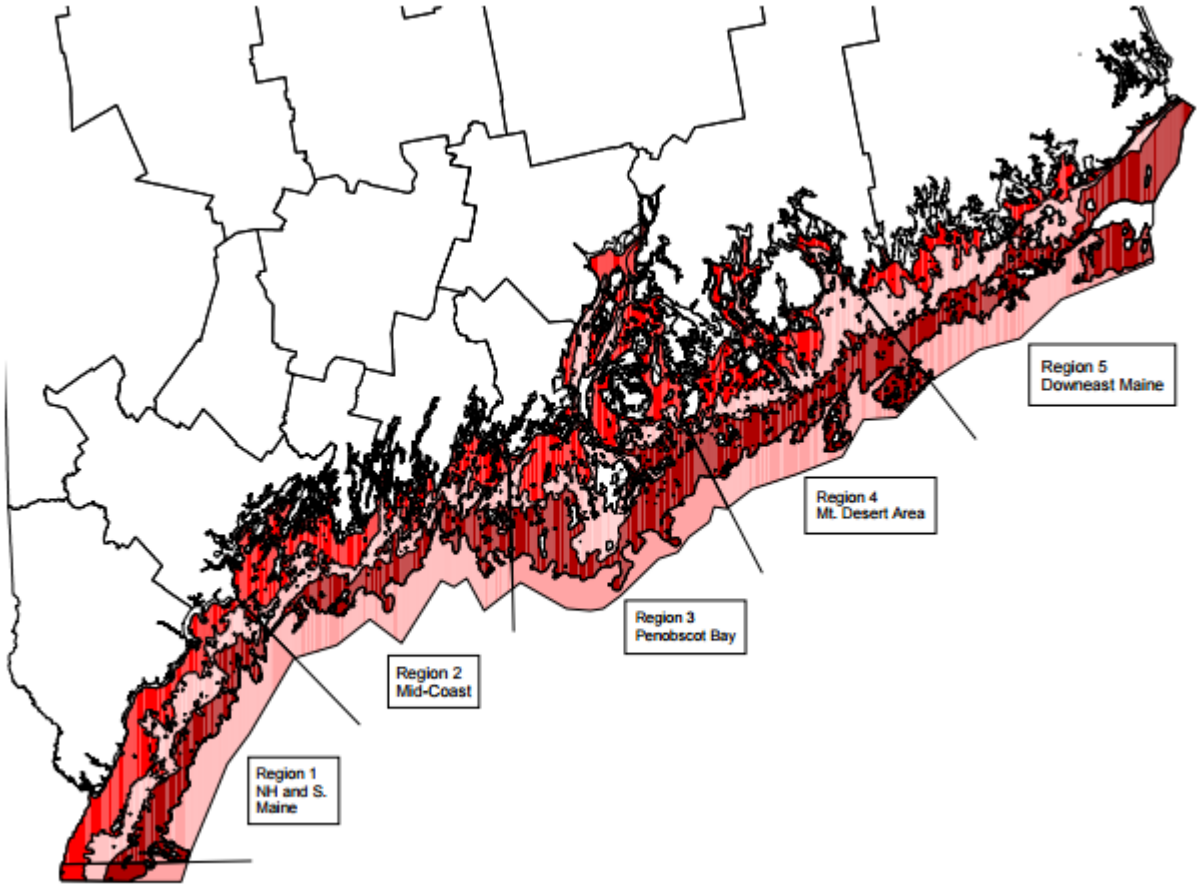


Figure 2: Map of area sampled by the Maine-New Hampshire Inshore Trawl Survey. The survey samples five regions and is stratified by four depth strata (5-20 fathoms, 21-35 fathoms, 36-55 fathoms, and greater than 56 fathoms to the 12 mile line). (Source: ME DMR)

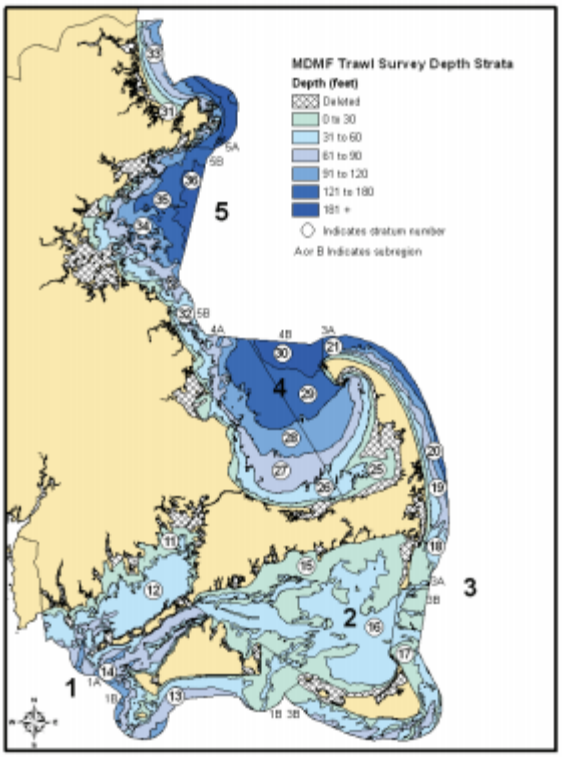


Figure 3: Location of the Massachusetts Trawl Survey. The survey is stratified based on five regions and six depth zones (0-30ft, 31-50ft, 61-90ft, 91-120ft, 121-180ft, >181ft out to 12 mile line). (Source: MA DMF)

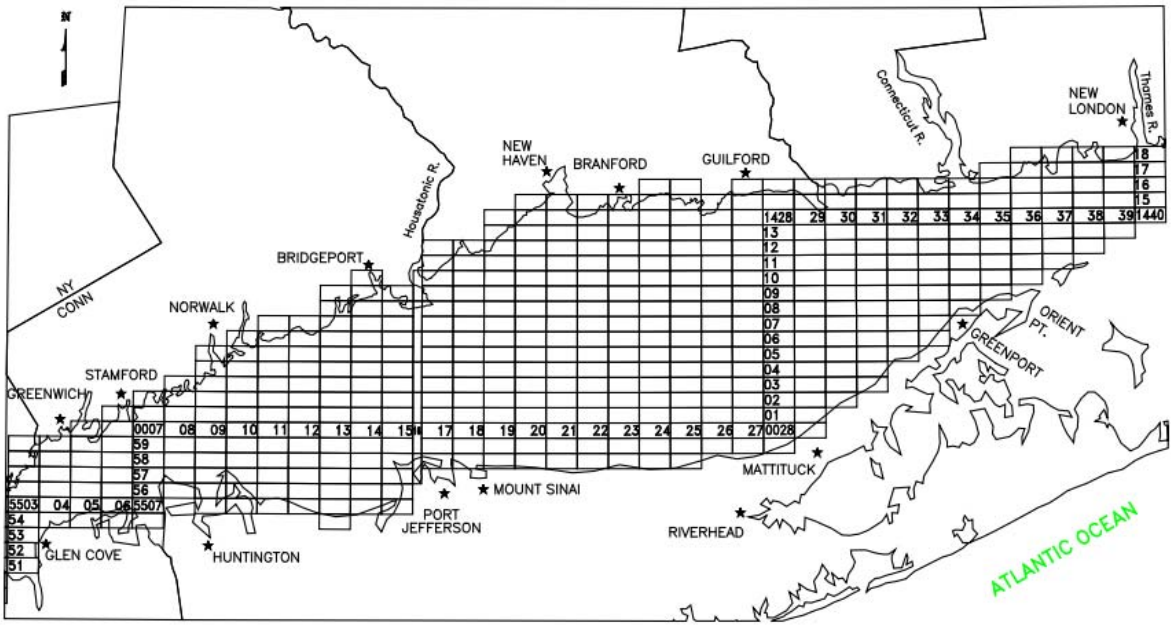


Figure 4: Connecticut – New York trawl survey grid. Each sampling site is 1x2 nautical miles with the first two digits representing the row number and the last two digits representing the column number. (Source: CT DEP)

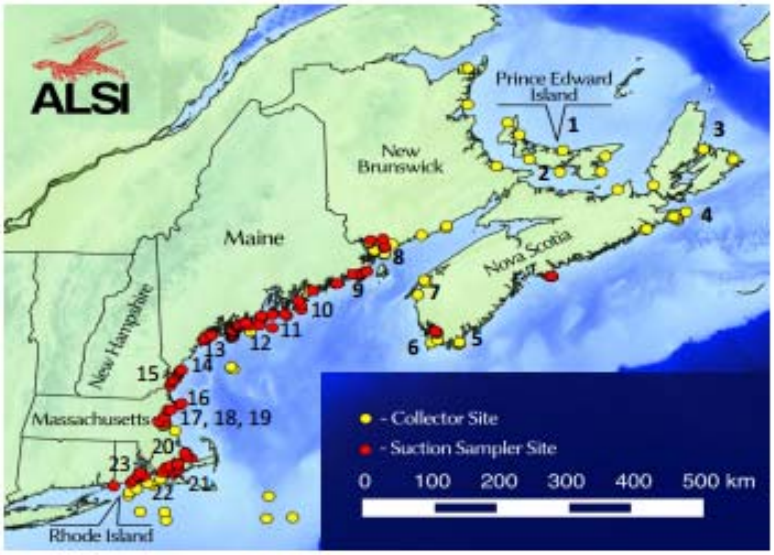


Figure 5: Locations sampled as a part of the 2015 American Lobster Settlement Index. Sites span New Brunswick, Canada down to Rhode Island. (Source: ALSI)

Appendix 3: Offshore Biological Sampling Program for American Lobster

The following comprises excerpts of the TC's October 2017 report to the Board and highlights data needs in the offshore lobster fishery. It is intended to provide guidance on where data gaps exist and how they can be addressed.

Problem Statement: In recent years the lobster fishery has expanded offshore; however, limited biological sampling occurs in these areas. This impedes the effective assessment and management of these offshore lobster fisheries.

Sampling Program: The TC recommends a federal, targeted lobster biosampling program offshore. It is recommended that this program be independent of the Standardized Bycatch Reporting Methodology (SBRM) sampling to ensure adequate sampling of federally-permitted vessels. The sampling frame should include all federally-permitted vessels, not just vessels with VTR requirements and should, at a minimum, randomize vessel selection. The program should be stratified by statistical area. In statistical areas in overlapping waters, state and federal programs should coordinate to ensure complementary sampling programs and increased efficiency to meet the needs of the assessment.

Baseline Sampling Threshold: The TC recommends that offshore sampling programs collect the minimum number of samples needed to meet the assessment gap-filling threshold. More specifically, the TC recommends a baseline sampling threshold of 3 samples from each statistical area (with lobster landings) per quarter and year. Statistical areas with lobster landings will be identified from the last year of landings data in the most recent stock assessment. Given that the 3-samples per statistical area/quarter/year is a minimum threshold, sampling should appropriately increase in statistical areas with high lobster harvest.

Location of Sampling: The TC recommends offshore sampling programs in much of GBK and parts of SNE. Through analysis which assessed current sampling efforts by stat area, including port sampling, sea sampling, federal SBRM sampling, and CFRF sampling, the TC identified data gaps in the lobster fishery. Sampling holes were prioritized by the magnitude of landings from that statistical area. Table 1 illustrates the results of this analysis, with statistical areas ordered by landings. Statistical areas with the greatest need for increased sampling include 522, 525, 526, 561, 562, and 616. More specifically, four of these statistical areas (522, 525, 526, and 616) do not meet the minimum sampling threshold is three out of the four quarters.

Table 1: Statistical areas by quarter which did not meet the minimum recommended threshold of 3-samples in 2015 and/or 2016. Samples include both port and sea sampling, as well as sampling by SBRM and CFRF. Statistical areas are ordered by magnitude of landings, with areas of high landings at the top of the table.

StatArea	Season	# Port and Sea Samples		# Years 3-Sample Threshold Not Met
		2015	2016	
525	4	9	2	1
525	3	7	2	1
562	1	1	3	1
526	4	21	2	1
522	2	1	0	2
522	3	20	0	1
522	1	1	0	2
616	3	5	1	1
561	4	14	1	1
525	1	3	1	1
561	2	2	5	1
515	4	5	2	1
623	3	0	0	2
515	3	2	3	1
521	1	0	0	2
612	1	4	2	1
465	2	4	0	1
537	1	0	1	2
526	2	5	2	1
616	4	8	1	1
611	2	1	6	1
623	4	0	0	2
623	2	0	0	2
465	3	0	0	2
616	1	2	0	2
526	1	7	1	1
538	4	0	0	2
611	1	0	0	2
538	1	0	0	2
611	4	0	1	2

Type of Sampling: The TC recommends sea sampling as the preferred sampling method as it provides information on discarded lobsters in addition to landed lobsters, which are characterized by port sampling. Port sampling should be considered a secondary sampling method that is used during poor sampling conditions (i.e. winter) or if there is limited funding. Both sex and length data are of primary importance when conducting a sampling program as they are critical for characterizing sex ratios and size composition.

Revisiting of Sampling Priorities: Given the on-going shifts in effort in the lobster fishery, the TC recommends that an evaluation be conducted on a regular basis to determine where landings are occurring in the fishery and associated sampling holes. This evaluation should be conducted during each stock assessment (5 year basis). Intermittently, the success of sampling programs at achieving current goals can be assessed through annual compliance reports.

Appendix 4: Atlantic Coast with 10 Minute Square Grid

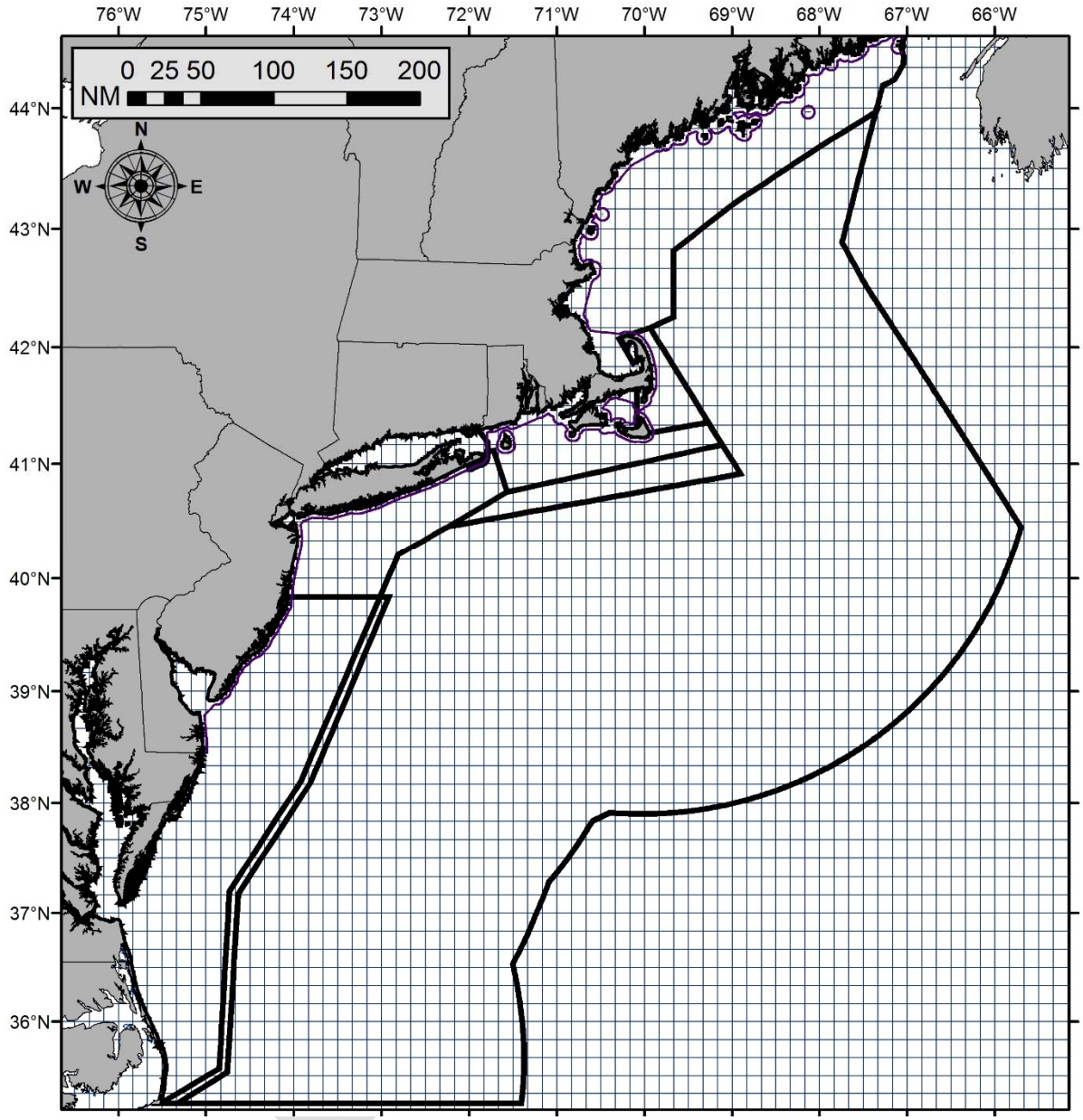


Figure 1: 10 minute squares along the Atlantic coast with outlines of the LCMAs.

Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: American Lobster Management Board

FROM: American Lobster Technical Committee

DATE: October 8, 2017

SUBJECT: Harvester Reporting and Biological Sampling in the Lobster Fishery

The Technical Committee (TC) was tasked with evaluating the current 10% minimum harvester reporting requirement as well as identifying biological sampling gaps in the lobster fishery. The purpose of these tasks is to help inform Draft Addendum XXVI, which the Board initiated in January 2017. The report is split into three sections: 1) Executive Summary; 2) Lobster Harvester Reporting Analysis; and 3) Biological Sampling Gaps.

1. Executive Summary

Harvester Reporting

The TC was tasked with identifying a statistically valid sample of harvester reporting in the lobster fishery. This task was prompted by the fact that, while Addendum X implemented a minimum of 10% harvester reporting with the expectation that states will eventually implement 100% harvester reporting in the lobster fishery, Maine continues to require 10% of harvesters to fill out logbooks. Given that Maine accounts for the vast majority of lobster landings (>80%), this has prompted questions about the efficacy of 10% harvester reporting.

Overall, the TC provides the following conclusions and recommendations to the Board.

- To best characterize the US lobster fishery, the TC supports 100% harvester reporting to accurately account for all trap hauls and the spatial extent of the effort. In conjunction, the TC recommends states, in particular Maine, move towards electronic reporting given that the scale of the Maine lobster fishery (~6,000 licenses and more than 265,000 trips annually) may make the current paper logbooks inefficient and cost prohibitive for 100% reporting. Reporting programs that sample less than 100% of harvesters should be reviewed every three to five years to verify the adequacy of the program.
- In the interim, the TC finds the current 10% harvester reporting to be sufficiently precise to track trends in the lobster fishery. The TC finds the 10% reporting achieves CVs below 5% for all metrics considered and is accurate relative to dealer landings. The TC does note that the statistical precision of the current reporting sub-sample is, in large part, due to the immense size of the lobster fishery. As a result, changes in the number of license holders, particularly decreases, may lower the precision of the current reporting scheme and require sampling a larger portion of the fishing fleet.

- Although the TC finds that the current level of 10% harvester reporting is acceptable, the analyses indicate that latent licenses are being oversampled creating inefficiencies and lower precision in the current system of sub-sampling. Using past data, patterns in variability, and current Maine Harvester Logbook Program effort, the TC proposes an optimized sampling approach, rather than a proportional one, to ensure the program is spending the greatest effort on active permits in the fishery. More specifically, under this optimal allocation, greater sampling effort is placed on active LC1, LC2, and LC3 permits and less effort is allocated to some latent efforts or recreational permits. Additional sampling is also allocated to latent LC3 permits as there is currently a trend for these licenses to become active. This improves the statistical precision of the harvester reporting program by focusing effort on permits who actively participate in the fishery.

Biological Sampling

Recent biological data (2015-2016) were reviewed to identify gaps in the current lobster sampling program and provide recommendations on increased biosampling in the fishery. Data reviewed included sea sampling and port sampling by state agencies and NOAA Fisheries (i.e. the Standardized Bycatch Reporting Methodology (SBRM) observer program), as well as additional sea samples from the Commercial Fisheries Research Foundation (CFRF). Samples for each season/stat area/year (i.e., stratum) were compared to the landings from the respective stratum for the last year of available data in the 2015 benchmark stock assessment (2013).

Overall, the TC provides the following conclusions and recommendations to the Board.

- The greatest gaps in biological sampling occur in LCMA 3, including offshore Gulf of Maine and Georges Bank. 13 stat area and quarter combinations did not meet the threshold (3 samples per stratum) for combined sea and port sampling during both 2015 and 2016 while an additional 17 stat area and quarter combinations did not meet the threshold in one of the two years.
- The TC recommends that NOAA Fisheries implement a lobster biosampling program independent of the Standardized Bycatch Reporting Methodology (SBRM) sampling to ensure adequate sampling of federally-permitted vessels. The sampling frame should include all federally-permitted vessels, not just vessels with VTR requirements.
- The TC recommends collecting a minimum of 3 samples from all stratum with landings to meet the assessment threshold and avoid gap-filling. When less than 3 samples are available for a stratum in the assessment, data are borrowed from similar strata as a proxy.
- Sea samples are preferred over port samples because they provide information on discarded lobsters in addition to landed lobsters.

2. Lobster Harvester Reporting Analysis

Problem Statement

In February 2007, Addendum X under Amendment 3 to the ASMFC Lobster Fishery Management Plan was approved to increase and improve the data collection in the US lobster fishery. In response to the Addendum, all states except Maine developed 100% harvester data programs to collect catch and effort data. Contained within Addendum X, was the minimum requirement for 10% of harvesters to report trip level catch and effort data (logbooks). The Lobster Technical Committee (TC) reviewed the efficacy of this 10% harvester reporting in a March 2007 report, but the analysis was primarily completed using available Connecticut harvester data as a proxy for the larger fishery in Maine, where data were not available. Ten years later, the Board has asked the TC to revisit the 10% requirement because it is still being used by the State of Maine. Specifically, the Board tasked the TC with identifying a statistically valid sample of harvester reporting. This document revisits the TC's 2007 review regarding the representative nature of sub-sampling catch and effort data in the Maine lobster fishery using available Maine Dealer data and Harvester Logbooks.

Background

Maine's fishery has nearly 6,000 commercial lobster license holders selling to approximately 300 dealers completing more than 265,000 dealer transactions or trips. Historically, Maine's landings were collected on a voluntary basis with dealers reporting monthly, while a sub-sample of effort data was collected through port and sea sampling programs. In 2004, Maine instituted mandatory monthly reporting at the dealer level. Prior to 2004, it was estimated that landings were underestimated by 25-35% (Wilson et al. 2004). In 2007, when the Addendum X was approved, the State of Maine did not have a mandatory trip level data collection program for catch or effort. In 2008, Maine implemented a 100% Dealer Reporting Program at the trip level for landings, but, with nearly 6,000 licenses, the cost to implement a 100% Harvester Logbook Program using traditional paper logbooks was too high. Addendum X allowed for at least 10% of harvesters reporting through logbooks with the expectation of 100% reporting in time. Since 2008, Maine's Harvester Logbook Program has been collecting catch and effort data from 10% of each Maine license type in each of Maine's seven fishing zones (see below).

The original 2007 TC analysis was based on the Connecticut lobster fishery, which was (and still is) much smaller than Maine's with several hundred commercial license holders as compared to several thousand in Maine. Connecticut implemented mandatory trip level reporting by harvesters and dealers in the 1980s. This two-ticket system was deemed ACCSP compliant and provided a check and balance for catch and effort information. Connecticut was the model on which the TC recommended all states adopt similar reporting standards. The 2007 TC report used 1997 and 2003 Connecticut harvester data for annual landings and trap hauls as a proxy for the Maine fishery. The choice of those two years reflected when resource conditions were favorable (1997) and poor (2003). Using the Connecticut data, the TC determined that 30% was the optimal target for a statistically valid sample for landings and trap hauls, but due to financial constraints, 10% was adequate.

The original intent of Addendum X was for all harvester reporting to be at 100% coverage of the active harvesters when financially and logistically possible. With Maine Dealer Reporting Program data available for 2008-2016 and Harvester logbook data available for 2008-2015, the TC was asked to revisit the efficacy analysis using Maine data to determine if 10% harvester reporting in Maine is sufficiently precise for characterizing and tracking harvester behavior.

Description of existing sampling programs

Since 2008, the Maine Harvester Logbook Program has been using a stratified random 10% sample of harvesters to produce a representative dataset of Maine harvesters. More specifically, fishermen are categorized by their license type and fishing zone, and 10% of harvesters from each combination of license type and zone are selected to report for the upcoming calendar year (more information below). All Maine lobster license holders, except those chosen the previous year, are included in the annual random draw, including licenses that had no landings the previous year and permits that require Federal Vessel Trip Reports (VTRs). Vessel selection for the coming year is based on their license type from the previous year. Thus, the final proportion of vessels across license types is not exactly 10% because vessels may change license types and enter or leave the fishery over this two-year period. Those permit holders that are required to submit VTRs do not submit duplicate reports to the Harvester Logbook Program but continue to report only through NMFS's VTRs. To complete the data set of all licenses selected, the VTR permits selected as part of the annual 10% process were added to the Maine harvester logbook dataset.

Between 650 and 700 harvesters are chosen annually. All reports are submitted on paper, fax or email. The Harvester Logbook Program enters about 30,000 records annually. A record is a line of data for each trip or monthly "did not fish" entry. If a harvester is selected and does not submit the required logbooks, his license cannot be renewed the next year.

Current Stratification: licenses and zones

The license types are based on age (<18 years old, 18-70 years old, and > 70 years old) and number of unlicensed crew allowed to work on the boat in addition to the captain (none, 1, or 2) (Table 1). There are a few license types that were excluded from below analyses including tribal licenses and non-residential licenses. Apprentice licenses are not required to report and were also excluded. Maine has seven lobster management zones, A-G (Figure 1).

Table 1. Maine lobster license types and descriptions.

License Type	Description
LC1	Lobster/Crab Type 1, no crew
LCO	Lobster/Crab Type 1, >70
LC2	Lobster/Crab Type 2, one crew
LC2O	Lobster/Crab Type 2, >70
LC3	Lobster/Crab Type 3, two crew
LC3O	Lobster/Crab Type 3, >70
LCS	Lobster/Crab Student
LCU	Lobster/Crab Under Age 18
LNC	Lob/Crab Non-Commercial
NLC1	Non-resident Lobster/Crab, Type 1
NLC2	Non-resident Lobster/Crab, Type 2
NLC3	Non-resident Lobster/Crab, Type 3
NLCU	Non-resident Lobster/Crab, <18
various	Tribal Lobster/Crab

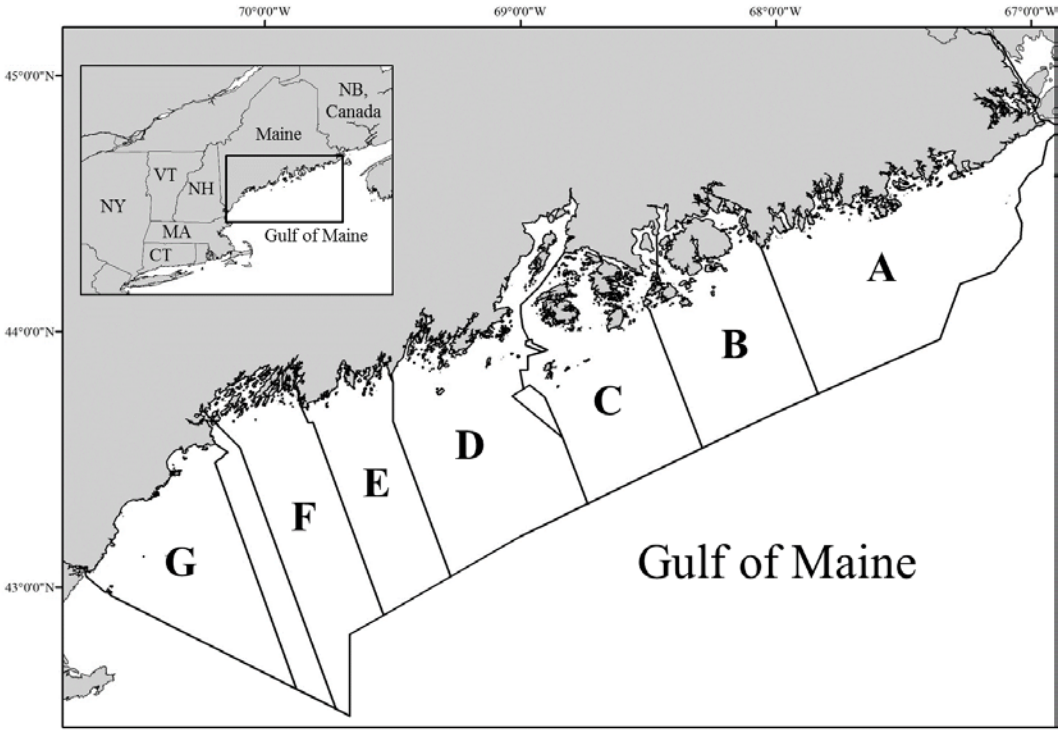

Figure 1. Map of Maine Lobster Management Zones in Area 1.

Objectives

1. Evaluate the precision of the current 10% reporting in Maine and assess the metrics provided by the Harvester Logbook Program.

2. Evaluate the benefits of a higher percentage of harvester reporting in Maine.
3. Evaluate methods and benefits of optimizing the current Harvester Logbook Program to improve precision and efficiency, particularly looking at the stratification and allocation of harvester reporting among license holders.

Statistical Validity of 10% Harvester Reporting

Using only the harvester data from 2008 – 2015, the coefficient of variation (CV) was calculated for six different metrics from the harvester reports: number of trips per year, number of trap hauls per year, total landings, total soak nights, average number of traps in the water, and maximum number of traps in the water for the year. A CV is a measure of variability from the mean and can be used to determine the precision of results; a lower CV means less variation and greater statistical confidence. Data were first aggregated to vessel levels and then merged with the license data to assign license types to each vessel. Stratified CVs were then calculated, treating license type as strata.

CVs tended to be low and stable across all six variables (Figure 2). The CV for landings was highest, being just below 0.05 with trap hauls and soak nights both averaging around 0.04 and number of trips averaging around 0.03. CVs for average number of traps and max number of traps were both below 0.03 and declined across the time series.

We also examined the CVs for these six variables by license type (Figure 3). CVs for all metrics averaged below 0.1 and were stable for LC2 and LC3 licenses, with LC1 vessels averaging around 0.1. CVs for LCS, LCO, LCU, and LNC licenses were typically higher and much more variable across years, probably due to both variability of fishing activities and smaller sample sizes.

Finally, we examined the accuracy and precision of the current harvester reporting by comparing estimates of total landings to dealer landings. Using the harvester data, we calculated the total landings and 95% confidence intervals for each year and plotted them against the total landings by year as reported in the dealer data (Figure 4). The two data sets compare admirably well with most mean harvester-based landings estimates being at or slightly below total dealer landings. Harvester confidence intervals (CIs) were about 10% of the mean estimate, varying from +/- 6 to 12 million pounds across years. Only in 2009 did the estimated CI for harvester landings (70.8 +/- 6.9 million pounds) not encompass the actual value of dealer-reported landings (81.2 million pounds).

Conclusions for 10% validity

We evaluated the current system and found that the 10% harvester reporting with the current stratification is producing data with low and stable CVs over time for the metrics of total annual trap hauls, total soak nights, trips, average traps hauled per day, and maximum traps in the water. When the metrics are calculated for each license type, the CVs are higher but the three license classes that encompass most of the fishery (LC1, LC2, and LC3) had CVs 10% or lower. The licenses types with higher CVs have fewer permit holders (e.g. LCU) or high variability in

fishing status (e.g. LCO). Overall, the 10% harvester reporting seems to be producing a sufficiently precise representation of the Maine fishery.

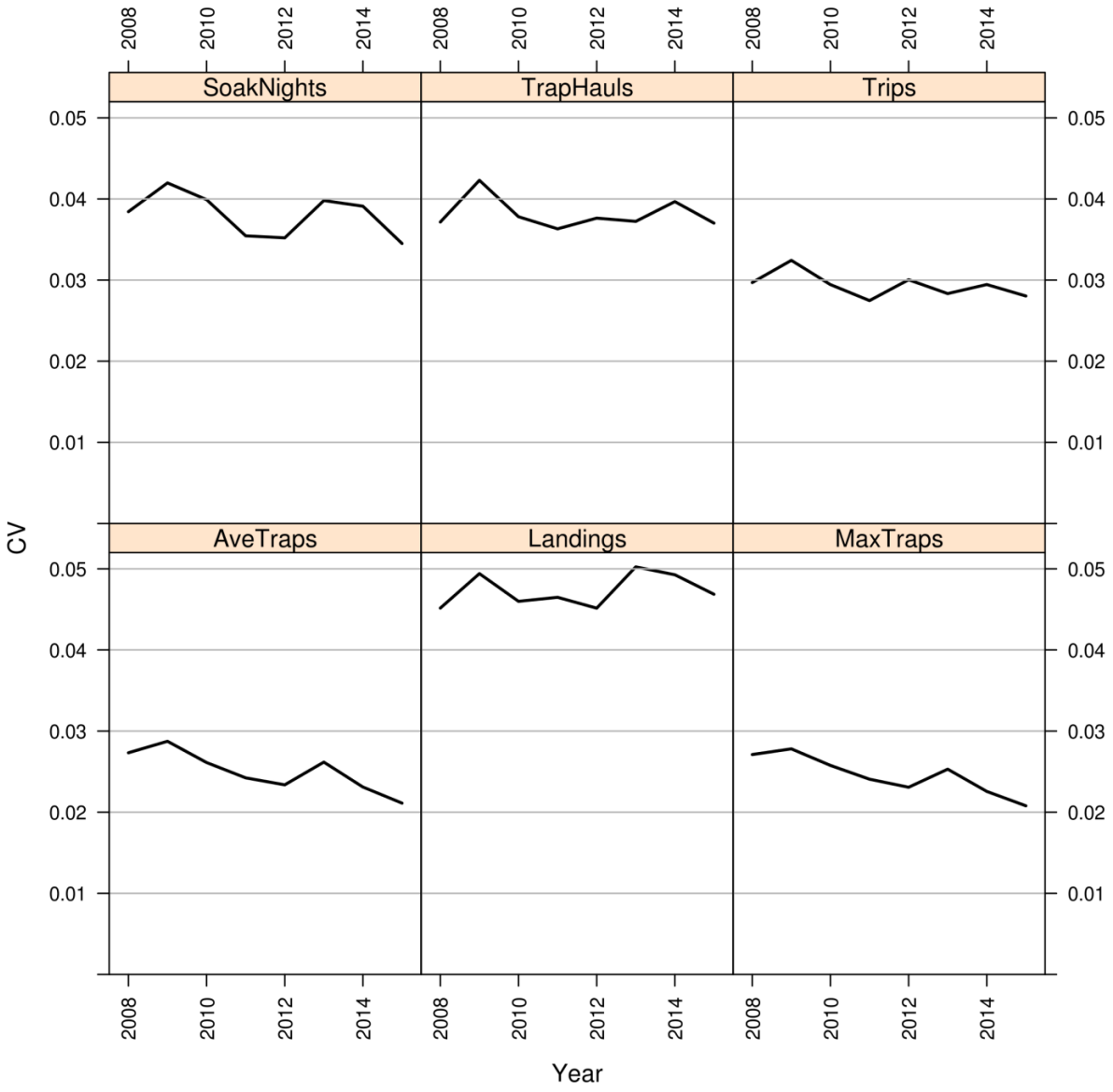

Figure 2. Calculated CVs from harvester data (pooled across license types), by year, for various reporting fields.

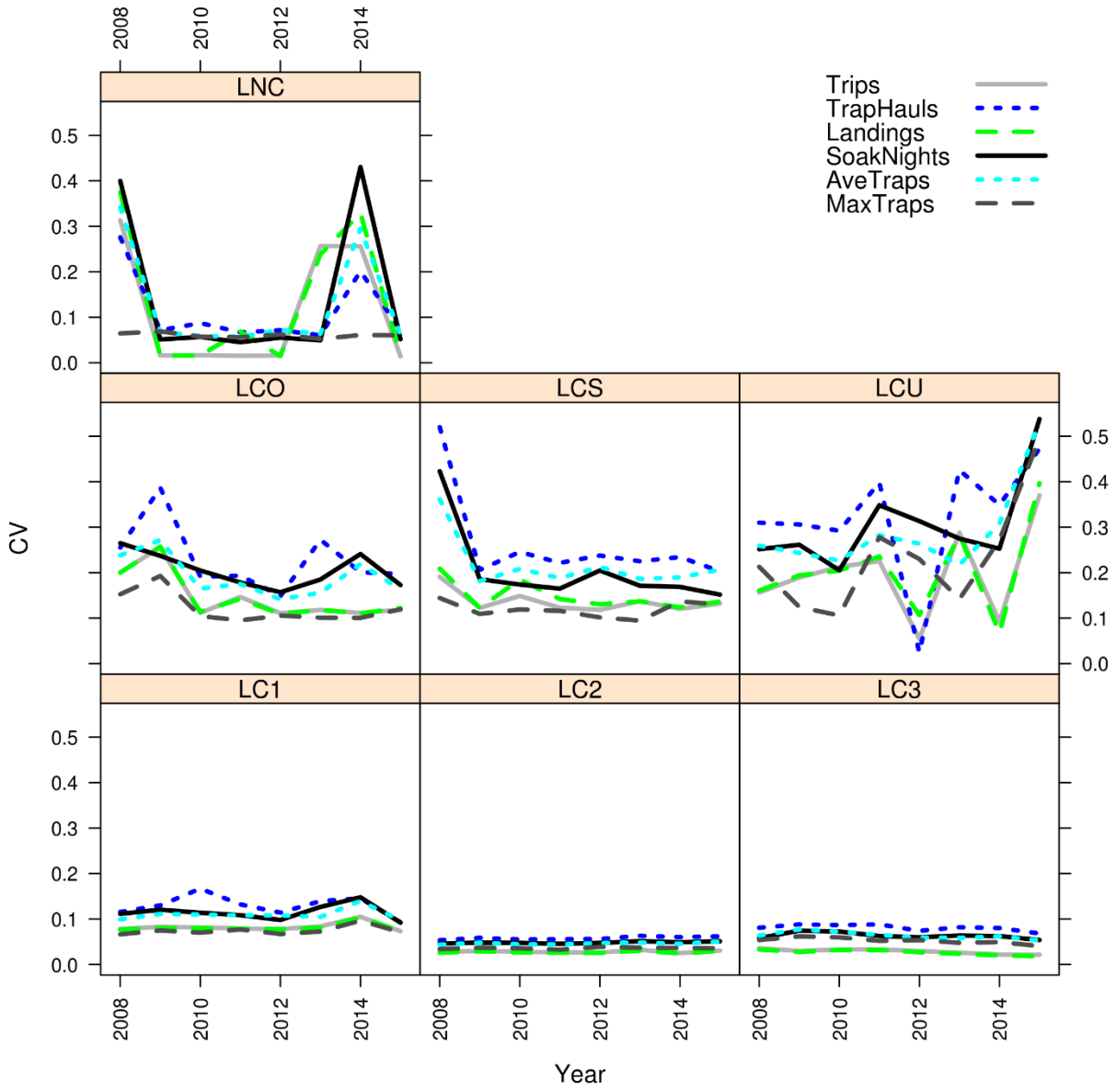

Figure 3. Time series of calculated CVs by license type across reporting fields.

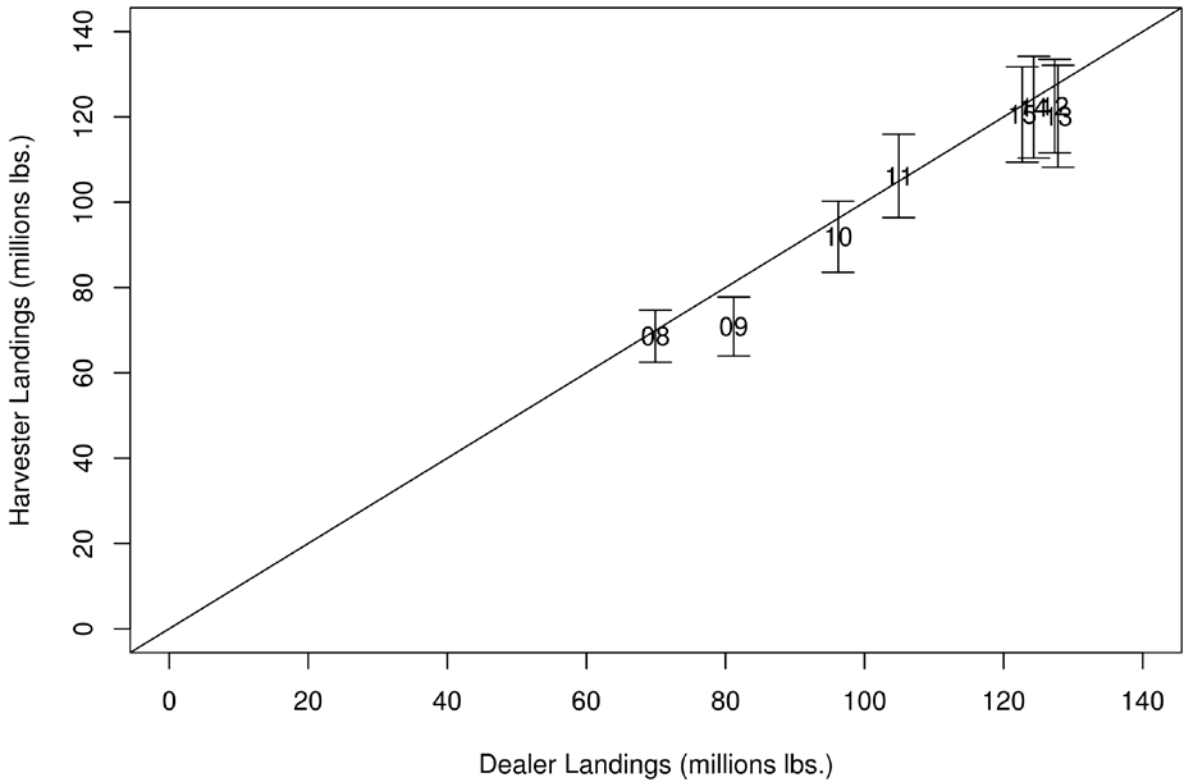

Figure 4. Harvester-estimated total landings (+ / - 95% CI) compared to dealer-reported landings. 2008 – 2015. Digits represent landings year. The diagonal line is the 1:1 proportional line.

Analyzing Potential Benefits of Increasing the Minimum Percentage of Harvester Reporting
Next, the TC evaluated potential benefits of increasing the percentage of harvester reporting in the Maine lobster fishery, particularly looking at the resulting CVs. The TC examined the effect of increasing the percentage of harvester reporting from 10% through 50%, in 10% intervals through bootstrapping CVs for trap hauls from the Maine harvester logbook data. Increasing sampling effort decreased trap haul CVs from around 0.035 at 10% proportional reporting to 0.012 at 50% proportional reporting (Figure 5). Reported CVs from bootstrapping are probably biased slightly high, particularly for higher reporting levels, as the bootstrapping procedure is necessarily resampling with replacement where actual harvester reporting would be selecting vessels without replacement. Overall, the TC notes that all of the CVs for 10% through 50% harvester reporting are quite low and small improvements in the CVs may come at large expenses to the state.

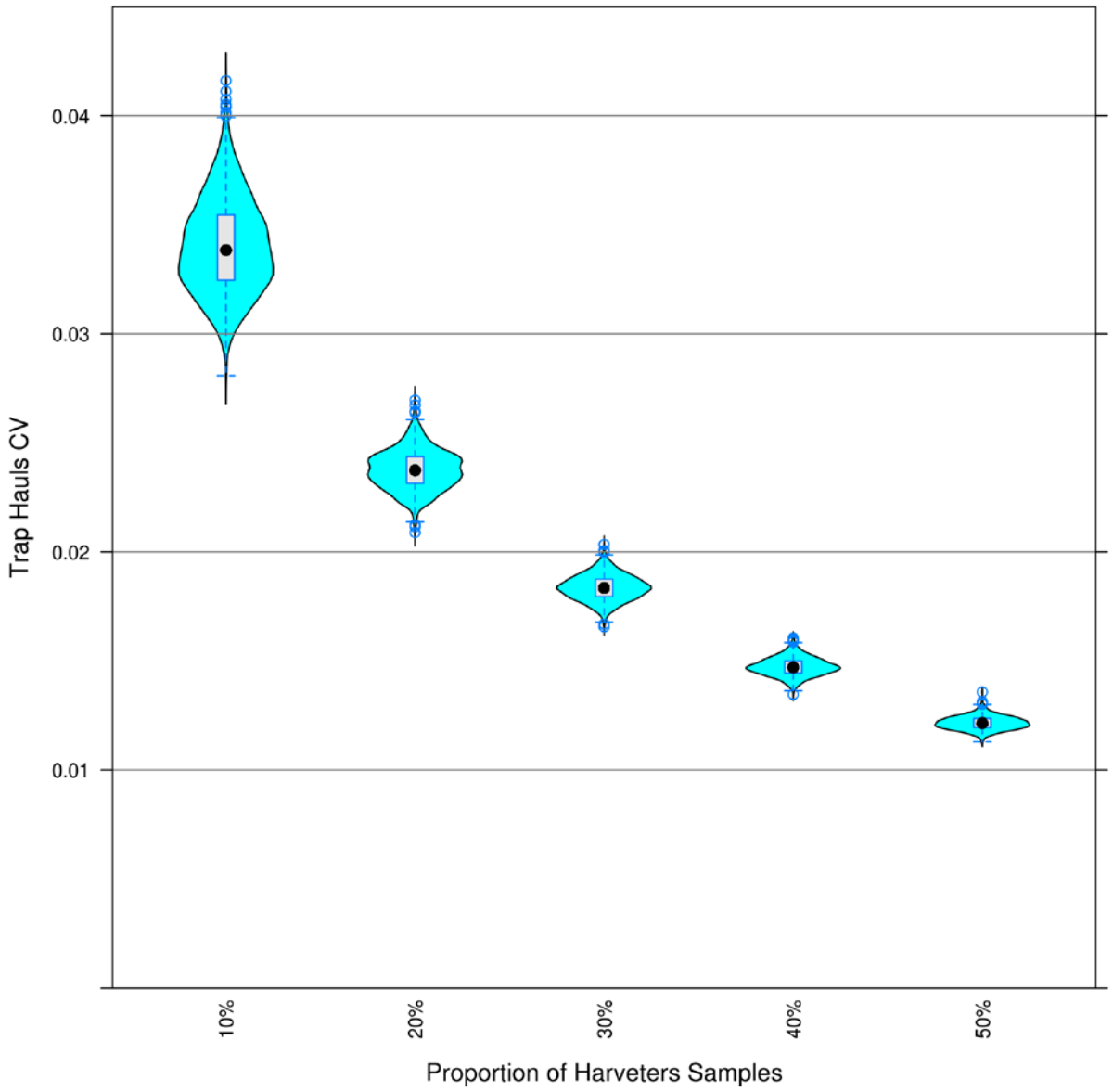

Figure 5. Comparison of trap haul CVs with proportional sampling under 10 – 50% harvester reporting.

Methods to Improve Harvester Reporting Under Current 10% Minimum Requirement

While the CVs that result from 10% harvester reporting are low, there may be ways to improve the precision of the estimates from harvester data or increase the efficiency of the system. To this end, the TC investigated what factors are important in explaining the variation in trap hauls and landings in the Maine lobster fishery and what method of allocating harvester reporting across permit holders results in a lower CV.

Evaluation of License Stratification

Generalized linear models (GLMs) were used to evaluate characteristics (factors) that might explain variation in metrics of interest from Maine's lobster fishery, and thus be beneficial to incorporate into a stratification scheme. The characteristics used in the current stratification, license type and zone, were included in the models in addition to license status (i.e., active vs latent) and year. License status was included in models as it is expected to have an effect on metrics and is an indication of future status. Proportionally, license status tends to be relatively stable over time (Figure 6), but some harvesters did change status between selection and reporting years (Figure 7). Due to these observed changes, latent licenses cannot be perfectly predicted and, therefore, cannot be excluded from selection as they contribute to the distribution of metrics.

License types were divided between license statuses during selection year (e.g., LC1 active and LC1 latent). Year was included in models to determine if variation in metrics is due to a year effect and if allocation should be based on data from a subset of years or all data combined. An interaction between license type and status and zone was included in GLMs to evaluate if licenses should be stratified by license type and status and zone combinations. Metrics evaluated included trap hauls from the harvester logbook data and landings from dealer data. Since dealer data includes 100% of landings, we used this dataset when examining factor effects on landings. However, since dealer data does not include effort information, we had to use the harvester dataset to examine factor effects on trap hauls.

License types for harvesters 70 and older (LCO, LCO2, LCO3) were combined into one license type. Non-resident and tribal licenses were dropped from the analysis due to small numbers of these licenses. Recreational licenses were also dropped from the analysis due to much smaller trap limits (5) than most commercial licenses (800) and because recreational harvesters do not sell their catch to dealers. Latent licenses were determined by assuming that any license that did not sell landings to dealers did not fish during the year.

A negative binomial GLM was used for total annual trap hauls by license. The delta-lognormal method (Lo et al. 1992) was used to evaluate characteristics' effects on two different processes, a binomial GLM to evaluate effects on license status during the reporting year and a normal GLM to evaluate effects on the distribution of annual landings on the log scale by active licenses. Comparison of GLMs was made based on Akaike information criterion (AIC) and relative percent deviance explained by the model. Lower relative values of AIC and higher relative percent deviance explained indicate better model fit. These criteria are used to measure the quality of one model against another when predicting a data set.

The negative binomial GLM estimating trap hauls with an interaction between license type and status and zone resulted in the lowest AIC (Table 2). Percent deviance explained and AIC were very similar among models with license type and status, but deteriorated for all models without license type and status. These results indicate that license type and status are the best predictors of trap hauls among the factors evaluated and additional factors provide little information in estimating trap hauls.

Model-generated estimates of annual trap hauls varied by license type and status, with nearly all (85%) direct comparisons being significantly different (for example, LC1 active compared to LC1 latent) (Table 3).

The normal GLM estimating landings from active licenses with a year effect and an interaction between license type and status and zone resulted in the lowest AIC and highest percentage of deviance explained (Tables 4, 5). Similarly, the binomial GLM estimating reporting status with an interaction between license type and status and zone produced the best results. Adding year and zone to the models only resulted in marginal improvements, at best, suggesting that these characteristics add relatively little information when compared to the models with only license type and status as a factor.

Conclusions for evaluation of stratification

Given the similar results from models estimating trap hauls from harvester logbook data and landings from dealer data, stratifying harvesters for selection based on license type and status is a reasonable balance between statistical power (i.e., marginal increase in AIC) and logistics (i.e., stratification by one characteristic as opposed to a combination of two or more). Including year provided little, if any, improvement to models and supports the use of the full data set for allocating reporting requirements. Including zone also results in relatively little improvement compared to license type and status. However, the potential need to develop estimates by lobster management zone for spatial characterization justifies some allocation to ensure data are available from across zones. Samples within license type and status could be allocated post-stratification proportional to the licenses in each zone.

Table 2. AIC and percent deviance explained for negative binomial GLMs using harvester logbook data.

Model	AIC	Percent Deviance Explained
Trap Hauls~Year+License Type and Status*Zone	70,307	20.83
Trap Hauls~License Type and Status*Zone	70,304	20.81
Trap Hauls~License Type and Status+Zone	70,314	19.76
Trap Hauls~License Type and Status	70,343	19.18
Trap Hauls~Zone	71,353	1.51
Trap Hauls~Year	71,368	0.10
Trap Hauls~1	71,359	NA

Table 3. Differences in annual trap hauls between commercial license type and status. An asterisk indicates a significant difference ($p<0.05$) and a blank indicates no significant difference.

	LC1 Active	LC1 Latent	LC2 Active	LC2 Latent	LC3 Active	LC3 Latent	LCS Active	LCS Latent	LCU Active	LCU Latent	Over 70 Active	Over 70 Latent
LC1 Active												
LC1 Latent	*											
LC2 Active	*	*										
LC2 Latent	*	*	*									
LC3 Active	*	*	*	*								
LC3 Latent		*	*	*	*							
LCS Active	*	*	*	*	*	*						
LCS Latent	*	*	*	*	*	*	*					
LCU Active		*	*	*	*		*	*				
LCU Latent	*		*	*	*	*			*			
Over 70 Active		*	*	*	*		*	*		*		
Over 70 Latent	*	*	*	*	*	*		*	*		*	

Table 4. AIC and percent deviance explained for normal GLMs using dealer data.

Model	AIC	Percent Deviance Explained
log(landings)~Year+License Type and Status*Zone	51,555	48.56
log(landings)~License Type and Status*Zone	52,450	46.61
log(landings)~License Type and Status+Zone	52,545	46.25
log(landings)~License Type and Status	54,034	42.82
log(landings)~Zone	65,948	6.35
log(landings)~Year	66,753	3.18
log(landings)~1	67,529	NA

Table 5. AIC and percent deviance explained for binomial GLMs using dealer data. Reporting status is active or latent two years after the initial license type and status used as a factor in the model.

Model	AIC	Percent Deviance Explained
Reporting Status~Year+License Type and Status*Zone	21,322	40.92
Reporting Status~License Type and Status*Zone	21,317	40.92
Reporting Status~License Type and Status+Zone	21,356	40.56
Reporting Status~License Type and Status	21,410	40.39
Reporting Status~Zone	35,499	1.11
Reporting Status~Year	35,849	0.13
Reporting Status~1	35,891	NA

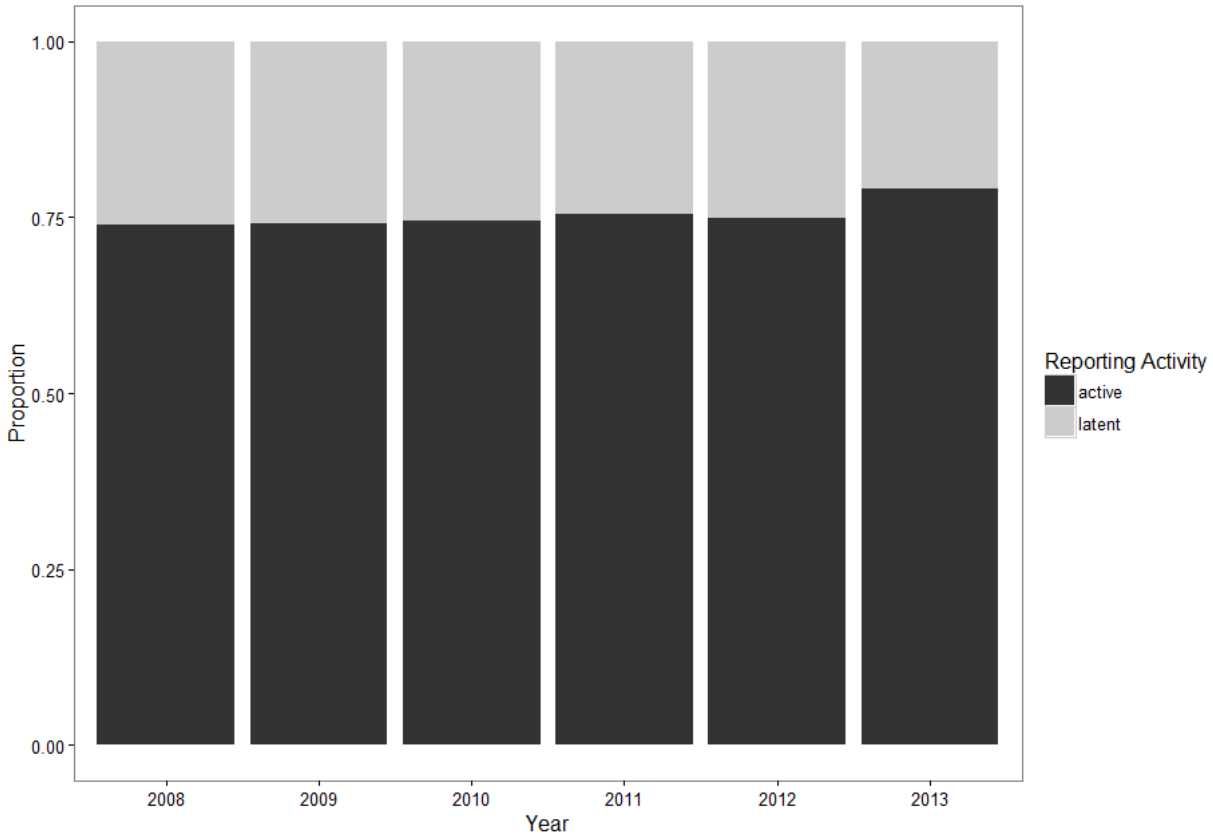

Figure 6. License reporting status (i.e. two years later) by year from the Maine dealer data.

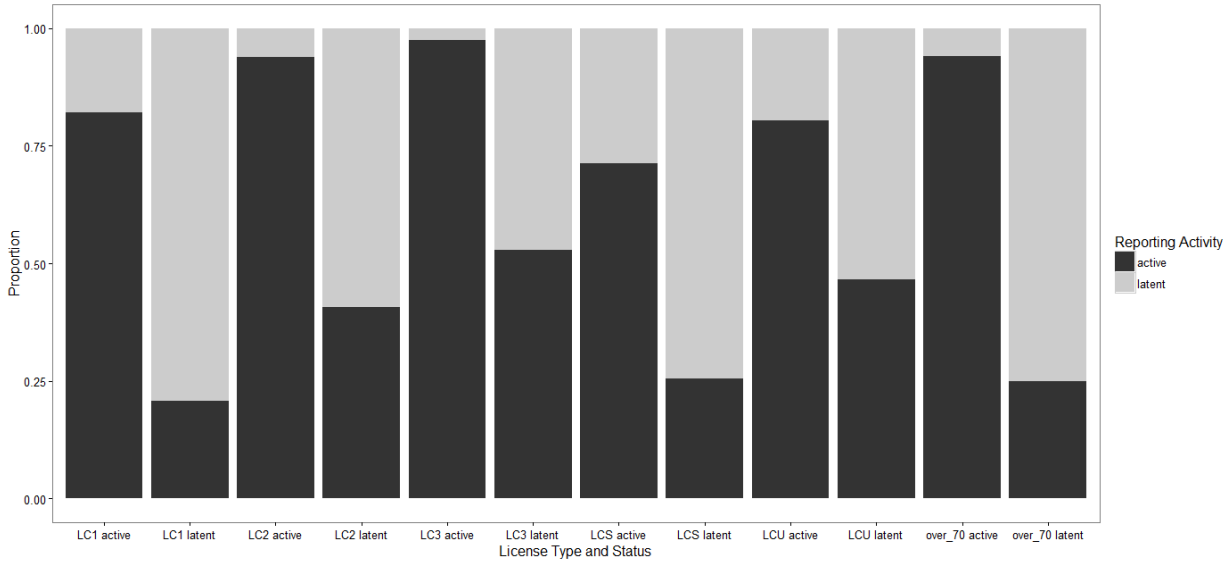

Figure 7. License reporting status (i.e. two years later) by license type and status during potential selection year as determined from the Maine dealer data.

Optimal Allocation for Current Harvester Logbook Program

The final part of this analysis looks to optimize the current harvester reporting program in Maine. One problem with harvester reporting is that many licenses are not actively fishing in a given year, and, thus, a portion of the harvester reporting resources are being assigned to such latent licenses. The sampling of latent licenses occurs because vessels are selected for reporting in the coming year based on the license type they purchased in the previous year, thus incurring a 2-year lag between the basis for selection and actual reporting.

Table 6 shows the sampling history of Maine's Harvester Reporting from 2008 – 2015 by license type and status in the same year. Vessels selected for reporting but with no reported landings are considered latent. Total number of vessels selected for reporting ranged from 744 in 2008 to 650 in 2015. Across all years, most vessels selected to report were active LC2 (30.5%), followed by recreational permits (LNC, 18.6%), active LC3 permits (14.0%) and latent LC1 permits (11.0%). Notably, most selected LC1 permits were latent but most selected LC2 and LC3 permits were active. The total number of LC1 and LC2 permits declined over these years while the number of LC3 permits increased. The large number of latent permits being sampled, particularly for LC1, suggests that efficiency in harvester reporting could be gained by taking a vessel's history of status (active or latent) into account when selecting vessels for coming years.

Table 6. Number of vessels selected to submit harvester reports by license type and status (active vs latent status was determined based on dealer data).

License Class	Status	2008	2009	2010	2011	2012	2013	2014	2015	Ave % of all reporting vessels
LC1	Active	63	62	63	53	50	47	47	48	7.80%
	Latent	90	91	79	88	61	75	62	65	11.00%
LC2	Active	256	200	241	233	216	193	184	167	30.50%
	Latent	15	17	26	10	22	16	15	13	2.40%
LC3	Active	86	77	70	94	92	108	119	128	14.00%
	Latent	1	4	2	2	6	4	7	6	0.60%
LCO	Active	30	33	40	37	35	40	39	41	5.30%
	Latent	20	15	8	10	24	19	19	18	2.40%
LCS	Active	28	26	28	31	26	37	34	33	4.40%
	Latent	19	11	9	13	18	15	18	14	2.10%
LCU	Active	6	7	8	1	5	6	3	2	0.70%
	Latent	0	1	2	1	1	0	0	1	0.10%
LNC	NA	130	123	141	141	140	127	111	114	18.60%
Total		744	667	717	714	696	687	658	650	100.00%

It is possible to optimize the allocation of sampling resources in a stratified survey, if certain characteristics of the strata are known (Cochran 1977). The optimal allocation of effort across strata can be calculated as:

$$p_L = \frac{(NumVessels_L * sdPar_L * \sqrt{Cost_L})}{\sum(NumVessels_L * sdPar_L * \sqrt{Cost_L})}$$

Where L is a given license type and status, p_L is the proportion of all sampled vessels to be drawn from a license type, $NumVessels_L$ is the number of vessels in a license type, $sdPar_L$ is the standard deviation of the parameter to be optimized for a license type, and $Cost_L$ is the cost (effort) associated with sampling a vessel from a license type. Thus, a license type and status will be sampled more heavily if it contains a larger number of vessels, has a higher standard deviation, and a lower sampling cost.

For this analysis, we treat the combination of license type and status (active vs latent) as our sampling strata, based on the prior evaluation of stratification, and calculated an optimal allocation of sampling resources across license type and status, based on each of our six variables. Management zone was excluded from the analysis for simplicity and because it was found to be of minor importance in describing the variability in trap hauls and landings in the above GLM analysis. The number of vessels in each license type and status was taken from license and dealer data in 2015, as there were clear shifts in the numbers of licenses and license status across years. Standard deviations for each of the six variables were derived from harvester data and calculated across all years as sampling of some combinations of license types and status were not sufficient in some years to get stable estimates, and there were no trends for these values to change across time. The time lag in the system was modeled by calculating the standard deviations from the harvester data, matched to a vessel's license and status from two years earlier. The cost of harvester reporting for each license type and status was based on the number of records for each from harvester data, again averaged across all years, assuming this is a suitable proxy for the amount of time that Maine DMR staff spend entering data and providing support for a reporting vessel. The same two-year lag was applied to costs by matching the number or records from a license with its license type and status two years prior. Also, for the calculation of vessel costs, vessels with less than 12 reports in a year were assumed to have filed 12 reports that year (monthly) and corrected accordingly.

The resulting number of vessels of each license type can then be calculated as:

$$n_L = \frac{\sum(p_L * Cost_L)}{Cost_{total}}$$

Where n_L is the number of vessels selected from license type L and $Cost_{total}$ is the total amount of resources available for sampling. Under this scenario, we assumed that the total number of reports that Maine DMR staff would be able to process remained constant, so $Cost_{total}$ was fixed at the number of reports the harvester reporting program handled in 2015. Using these estimates of number of vessels in each license type and status, standard deviations of variables, and costs of monitoring vessels, we calculate the appropriate number of vessels in each license type and status that should be reporting.

Figure 8 shows the optimal allocation proportions as calculated specifically based on each of our six harvester variables (trips, trap hauls, soak nights, max traps, landings, and average traps hauled per day). Proportional allocations were distributed similarly across the various license types for each of the six variables examined, with active LC2 and LC3 usually getting the highest proportions of the allocations, the exception being the number of trips, which would allocate additional effort to the recreational vessels. Latent vessels were consistently allocated less sampling effort than active vessels across license types. The similarity in allocation distributions for the different metrics suggests that optimally allocating sampling based on one variable is likely to perform reasonably well for many of the other metrics of potential interest.

Because it is not simple to optimize allocation simultaneously for multiple variables, we used the optimal allocation proportions for trap hauls in this analysis, as this is a variable that is particularly important to track from harvester reporting. Table 7 shows a comparison between the current proportional sampling design and potential optimal sampling design, based on the 2015 harvester data. LC2_Active and LC3_Active both have a large number of vessels, and high standard deviations but high numbers of records submitted each year (cost) and so make up >60% of vessels sampled under optimized sampling. LC3_Latent vessels have a small number of licenses and low number of records but comparably high variances and, thus, are also prioritized under optimized sampling. Conversely, recreational permits represent the largest type of licenses but have a low standard deviation so are sampled less under optimal sampling (114 vessels under proportional sampling vs 6 vessels under optimal sampling). Similarly, latent permits tend to be sampled less (LC1_Latent: 70 vessels under proportional sampling vs 21 vessels under optimal sampling). Because the optimization tends to shift sampling effort to license types with higher costs for monitoring and we are using a fixed cost, the total number of vessels selected for reporting would go down from 650 for proportional sampling to 522 for optimal sampling. It is noteworthy that, of the factors determining the proportions in optimal allocation, the number of vessels and standard deviation of the data are well defined. However, the cost associated with sampling a vessel, based on # records submitted/year, could be better refined, which would change the allocation of sampling.

Using this optimal allocation across licenses and status, we bootstrapped CVs for our six variables of interest from harvester reporting data and compared the results to bootstrapped CVs from proportionally allocated harvester reporting (Figure 9). Optimizing allocation for trap hauls only marginally decreased estimated CVs, from 0.035 to 0.032, compared to proportional allocation. Similarly, CVs decreased marginally from proportional sampling for landings (from 0.047 to 0.041). CVs for soak nights were similar but more variable for optimal sampling. Conversely, CVs for number of trips, average traps, and max traps were also more variable but increased marginally with the mean CV for number of trips increasing from 0.026 to 0.037. Based on the optimal allocation for other variables (Figure 8), these observed increases in CVs and increased variance of the CVs are probably the result of decreasing sampling and small sample sizes for student (LCS) and recreational (LNC) licenses. Although the optimized allocation had mixed results for different metrics, the trap haul variable is the highest priority variable and can only be characterized by harvester reports and this approach improves the precision.

Since the goal of Addendum X was to achieve 100% harvester reporting, incrementally if necessary, we examined the interaction between increasing overall sampling effort and optimal allocation of vessel selection. For this analysis, we bootstrapped the CV of annual trap hauls, allowing the total cost of sampling to vary and thus the total percentage of vessels sampled to increase from 20 - 50%. Similar to increasing the percentage of vessels sampled, increasing sampling effort resulted in decreased CVs with optimally-allocated vessel selection modestly outperforming proportional sampling (Figure 10). However, bootstrapped CV were also ~20% less variable under optimal allocation than proportional allocation, suggesting that future estimates could be more both more precise and consistent.

It is important to recognize that the above analysis on optimal allocation is preliminary and that additional work would be appropriate before implementing this methodology for the State of Maine. In particular, averaging across allocations that were optimized for different variables may be able to further improve the performance across all variables with minimal loss in precision to individual variables. Addition collaboration with the State of Maine could also better quantify the effort costs of monitoring different license classes, making for better cost estimates and further improving the cost estimates used in the allocation.

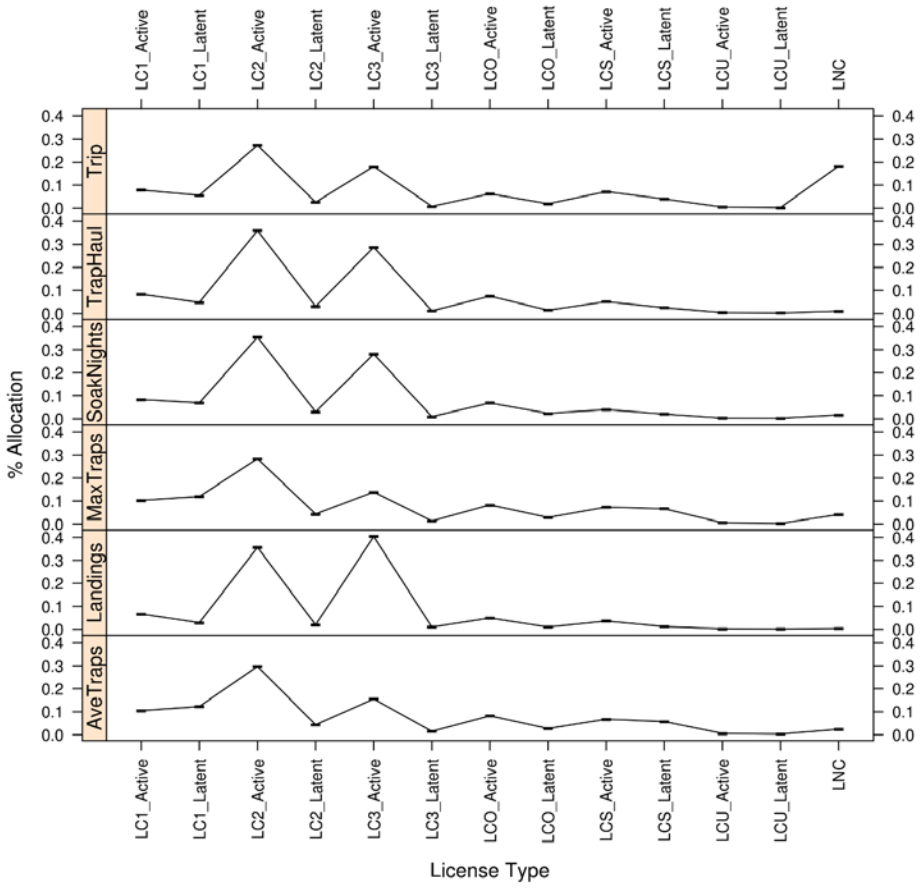

Figure 8. Optimal allocation of vessels for 2015 across license type and status, based on different harvester parameters.

Table 7. For each license type and status, the total number of licenses in 2015, mean annual cost to sample each vessel (i.e., average number of harvester reports by vessel by year), the standard deviation of annual trap hauls, the number of vessels and % of licenses sampled under current 10% system, and, under the proposed optimal allocation scheme, the % of the total sampling effort, # of vessels selected, and % of all licenses in that type selected. Data here are based on a two-year lag, where vessel selections were made in 2013 for the 2015 reporting year.

				Current 10% Reporting		Optimal Allocation		
License Status	Total # Licenses	# Records / Year	SD TrapHauls	# Vessels	% of licenses	Allocation	# Vessels	% of licenses
LC1_Active	446	52.9	8,034	41	9.2%	8.4%	44	9.87%
LC1_Latent	459	37.8	3,157	70	15.3%	4.0%	21	4.58%
LC2_Active	1669	78.6	11,344	190	11.4%	36.4%	188	11.26%
LC2_Latent	154	41.5	6,684	20	13.0%	2.7%	14	9.09%
LC3_Active	1220	95.1	13,242	100	8.2%	28.2%	146	11.97%
LC3_Latent	39	13.0	9,941	4	10.3%	1.8%	10	25.64%
LCO_Active	372	50.6	8,523	30	8.1%	7.6%	40	10.75%
LCO_Latent	168	16.7	2,427	14	8.3%	1.7%	9	5.36%
LCS_Active	494	27.1	3,085	36	7.3%	5.0%	26	5.26%
LCS_Latent	333	17.5	1,826	27	8.1%	2.5%	13	3.90%
LCU_Active	31	38.5	5,067	3	9.7%	0.4%	3	9.68%
LCU_Latent	13	21.0	6,396	1	7.7%	0.3%	2	15.38%
LNC	1790	18.0	141	114	6.4%	1.0%	6	0.34%
Total Vessels				650			522	

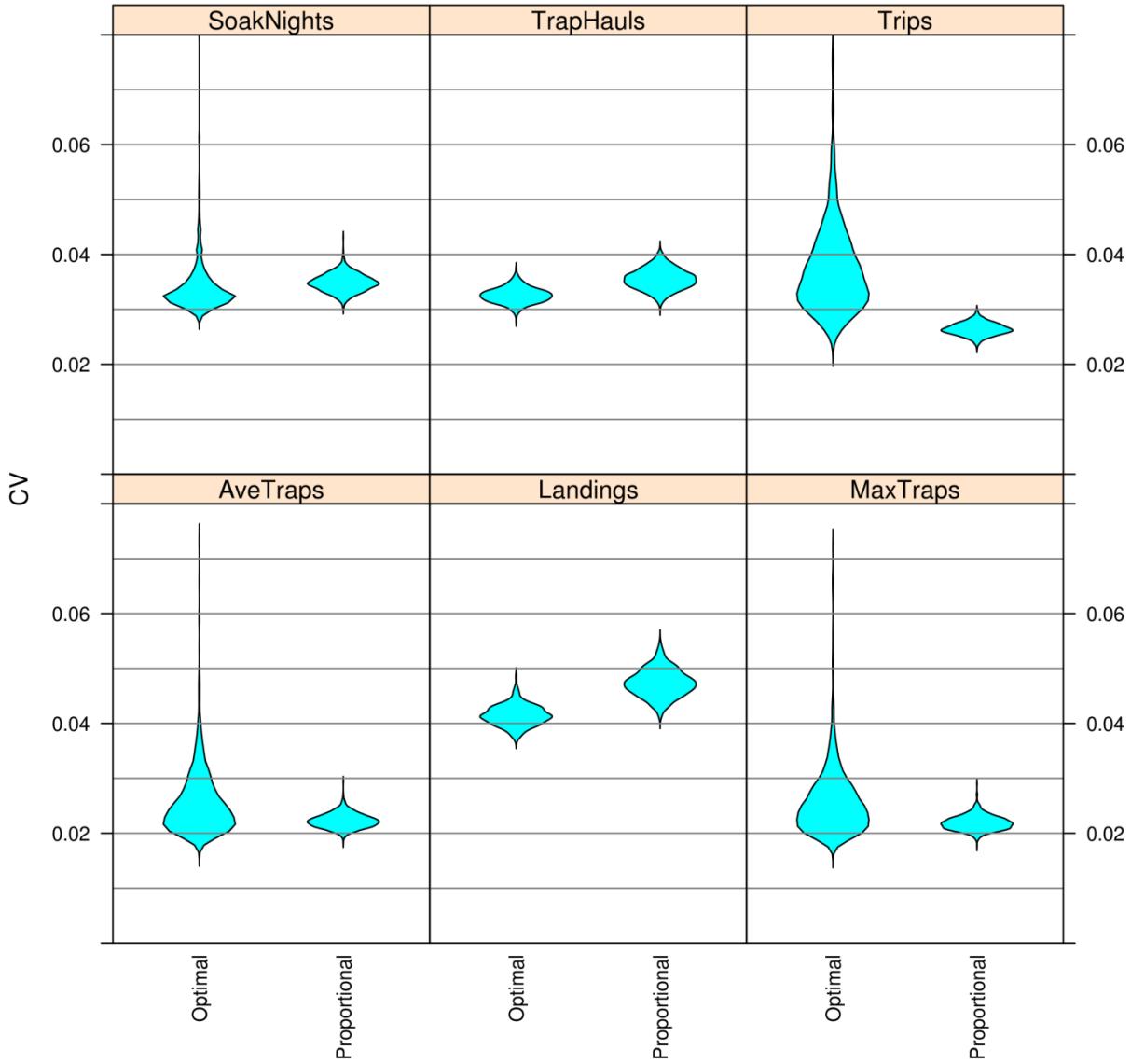

Figure 9. Bootstrapped distributions of CVs under current proportional allocation and optimal allocation based on trap hauls, assuming current sampling effort.

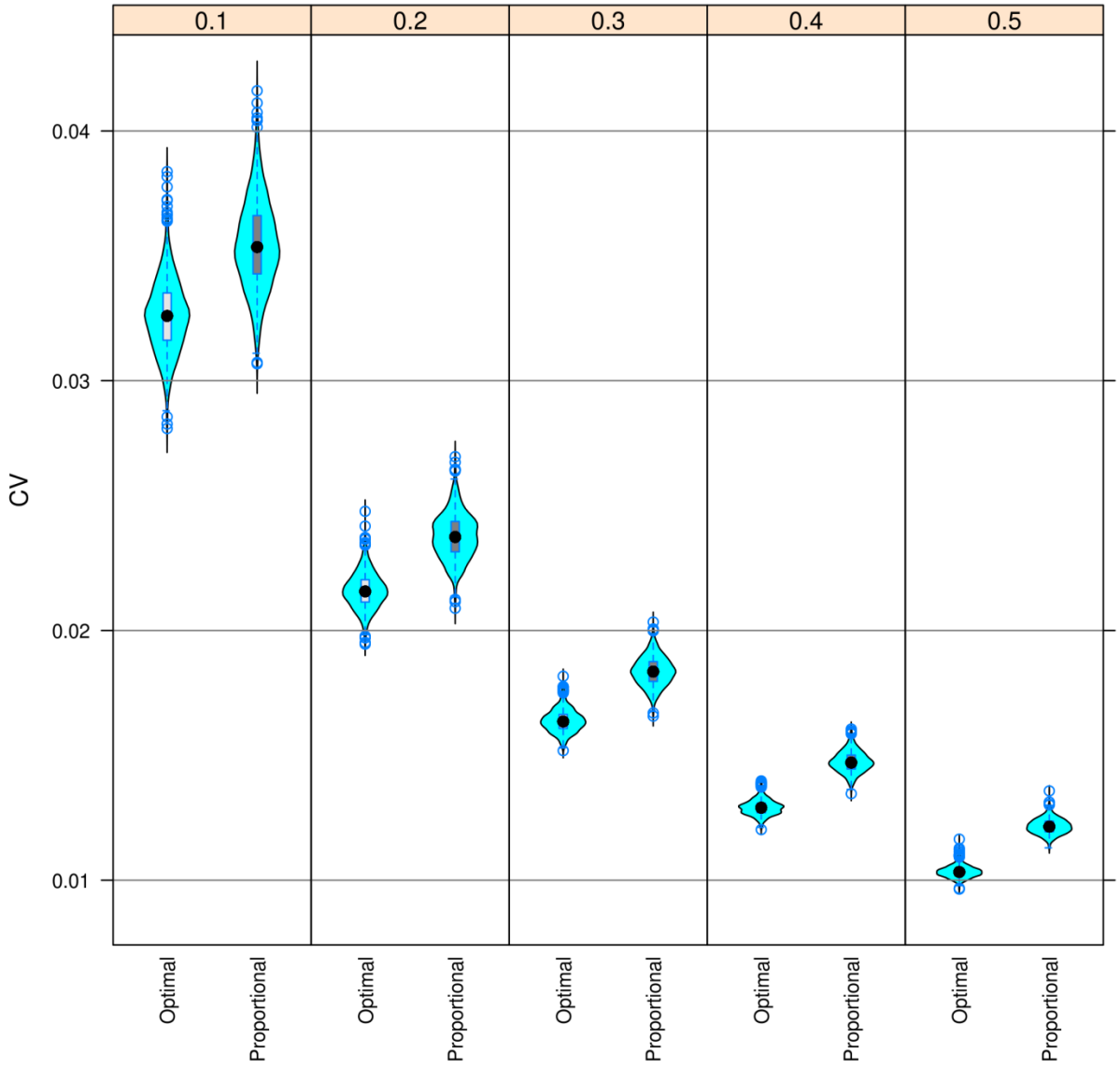

Figure 10. Comparison of Trap Haul CVs with optimal vs proportional sampling under 10 – 50% harvester reporting

Overall summary and Recommendations

To best characterize the US lobster fishery, the TC believes 100% harvester reporting is preferable to accurately account for all trap hauls and the spatial extent of the effort. Given the scale of the Maine lobster fishery with nearly 6,000 licenses and more than 265,000 trips annually, collecting this large amount of data with paper reports is challenging and inefficient. As a result, the TC recommends the state move towards electronic reporting.

The 2007 TC analysis on reporting levels using Connecticut's 100% coverage of harvester reports of their smaller fleet as a proxy for Maine's larger fishery indicated that 30% reporting

was necessary to minimize the CV's of trap hauls in the Maine fishery. Addendum X found compromise with 10% minimum reporting level and required stratification by license class and Maine lobster zone. Tasked to revisit the 2007 conclusions and recommendations, the current TC analyses support a change of recommendations. The TC determined, due to the large scale of the Maine lobster fishery and subsequent large sample sizes, that 10% reporting is statistically significant and achieves CVs below 5% for all metrics considered. The expanded harvester data for total landings is statistically accurate when compared to the total dealer landings. Increasing the percentage of reporting between 10% and 100% provides marginal benefit to precision of the estimates.

Although the TC finds that the current level of 10% is statistically sufficient, the analyses identify that latent licenses are being oversampled creating inefficiencies and lower precision in the system of subsampling. The TC confirms the use of Maine license class as an appropriate stratification using zones for spatial coverage, but determined that active or latent status should be incorporated into the stratification. Using past harvester and dealer data, patterns in variability, and current Maine Harvester Logbook Program costs, the TC proposes an optimized sampling approach, rather than a proportional one, to assure the program is spending the greatest effort on active permits in the fishery but does not disregard the unpredictable latent permits in the system that also contribute to landings and effort.

3. Biological Sampling Gaps

Recent biological data (2015-2016) were reviewed to identify gaps in the current lobster sampling program and provide recommendations on increased biosampling in the fishery. Data reviewed included sea sampling and port sampling by state agencies and NOAA Fisheries (i.e. the Standardized Bycatch Reporting Methodology (SBRM) observer program), as well as additional sea samples from the Commercial Fisheries Research Foundation (CFRF). Both sex and length data are of primary importance during sampling as this data is used to characterize the catch sex ratio and size composition. Port samples can only be used to characterize size composition and sex ratio of landed lobsters, while sea samples with disposition codes (i.e., discarded or retained) can be used to characterize size composition and sex ratio of all lobsters caught (discards and landings). However, sea sampling is generally more expensive.

All biological samples were assigned to stat area, quarter, and year (i.e., stratum) of collection, the current level of detail used to characterize catch in the stock assessment. For port sampling, a sample is one vessel or one walk down the dock, depending on the sampling program. For sea sampling, a sample is all data collected by a sampler for a day within a stat area. Sample sizes were compared to the landings from the respective stratum for the last year of available data in the 2015 benchmark stock assessment (2013). Strata were filtered to those that accounted for at least 100,000 pounds of landings to determine the most important strata. Strata with sample sizes less than three were identified as strata that need increased biological sampling. A threshold of three samples was used as, during the previous stock assessment, stat areas which did not meet this number required gap-filling. Moreover, when the threshold number of

samples was not available for a stratum in the assessment, data were borrowed from similar strata as a proxy. Collecting at least three samples from strata should reduce or eliminate the need to gap-fill biological data in future assessments, in turn, reducing data uncertainty in the assessments.

Results of the analysis indicate that the majority (>90%) of the fishery is sufficiently sampled, particularly inshore GOM which is well covered by the states except in the winter (Tables 8-9, Figures 11-12). Nineteen stat area and quarter combinations did not meet the sampling threshold for sea sampling (i.e, biological data on total catch) during both years, while an additional twenty five stat area and quarter combinations did not meet the threshold in one of the two years (Table 8). Figure 12 shows sea sampling coverage. Thirteen stat area and quarter combinations did not meet the threshold for combined sea and port sampling (i.e., landing biological data) during both years, while an additional seventeen stat area and quarter combinations did not meet the threshold in one of the two years (Table 9). Figure 12 shows combined sea and port sampling coverage. Much of the gaps in sampling are in LMA3 (offshore Gulf of Maine and George's Bank). Many stat area and quarter combinations met the threshold in 2015, but did not meet the threshold in 2016 due to a change in sampling effort in the SBRM observer program. This highlights the dependence of many stat area and quarter combinations (particularly those in the George's Bank region) on SBRM observer sampling. The fishery is also dependent on CFRF sampling, particularly in years when there are fewer SBRM sea days allocated to the lobster fishery. CFRF sampling is contingent on grant funding and, therefore, could be discontinued if that funding is not available. Without CFRF sea sampling, an additional eight stat area and quarter combinations would not have met the sample size threshold during both years (Table 10). Notably, in the absence of CFRF sampling, much of offshore SNE falls below our sampling threshold (Figure 13), which would make it more difficult to track this stock which is rapidly changing.

Recommendations

- The TC recommends that NOAA Fisheries implement a lobster biosampling program independent of the Standardized Bycatch Reporting Methodology (SBRM) sampling to ensure adequate sampling of federally-permitted vessels. The sampling frame should include all federally-permitted vessels, not just vessels with VTR requirements (this change in the SBRM sampling frame is currently being considered at the Council level) and should, at a minimum, try to randomize vessel selection. The program should be stratified by statistical area. In statistical areas in overlapping waters, state and federal programs should coordinate to ensure complementary sampling programs and increased efficiency to meet the needs of the assessment.
- The TC recommends collecting the minimum number of samples to meet the assessment threshold (3) and avoid gap-filling from all stat area/quarter/years with landings. Stat areas with landings should be identified based on data from the most recent stock assessment. Importantly, the number of samples should be appropriate to characterize landings in the stat area/quarter/year; sample sizes should increase for

areas with a high volume of landings. See Figures 11-13 for guidance on stat area and quarter combinations that have not met this threshold over the last two years.

- Sea samples are preferred over port samples because they provide information on discarded lobsters in addition to landed lobsters. However, port samples should be collected if sea sampling is not feasible (e.g., not enough funding, poor sampling conditions – winter, reluctant cooperation).
- As fishing effort continues to shift, this evaluation will need to be updated on a regular basis to identify priority sampling areas in the fishery. Stock assessments provide an optimal time for this evaluation as landings by stat area are updated and sampling data is compiled. Annual compliance reports also provide an opportunity to evaluate the success and implementation of current sampling recommendations.

Table 8. Sea sample size by stat area, quarter, and year for strata that accounted for at least 100,000 pounds of landings in 2013.

		N Sea Samples	
Stat Area	Quarter	2015	2016
525	4	8	1
464	3	41	2
525	3	7	1
526	3	18	2
561	3	56	1
562	1	1	1
526	4	20	0
522	4	7	0
464	1	14	2
522	2	1	0
465	4	9	2
522	3	20	0
464	2	2	1
522	1	0	0
525	2	10	1
616	3	5	0
561	4	10	0
525	1	2	0
561	2	1	3
515	2	11	2
515	1	7	2
515	4	1	0
623	3	0	0
515	3	1	1
616	2	4	0
521	1	0	0
561	1	3	2
612	1	4	0
465	2	3	0
537	1	0	1
526	2	2	0
464	4	5	2
616	4	8	0
611	2	1	6
623	4	0	0
465	1	4	0
623	2	0	0
465	3	0	0
616	1	2	0
526	1	4	0
538	4	0	0
611	1	0	0
538	1	0	0
611	4	0	1

Table 9. Combined port and sea sample size by stat area, quarter, and year for strata that accounted for at least 100,000 pounds of landings in 2013.

		N Port and Sea Samples	
Stat Area	Quarter	2015	2016
525	4	9	2
525	3	7	2
562	1	1	3
526	4	21	2
522	2	1	0
522	3	20	0
522	1	1	0
616	3	5	1
561	4	14	1
525	1	3	1
561	2	2	5
515	4	5	2
623	3	0	0
515	3	2	3
521	1	0	0
612	1	4	2
465	2	4	0
537	1	0	1
526	2	5	2
616	4	8	1
611	2	1	6
623	4	0	0
623	2	0	0
465	3	0	0
616	1	2	0
526	1	7	1
538	4	0	0
611	1	0	0
538	1	0	0
611	4	0	1

Table 10. Sea sample size by stat area, quarter, and year without CFRF sea samples included for strata that accounted for at least 100,000 pounds of landings in 2013.

		N Sea Samples	
Stat Area	Quarter	2015	2016
562	3	50	0
537	3	15	2
537	4	4	1
525	4	5	0
562	4	18	0
464	3	37	0
525	3	7	0
526	3	18	0
539	3	6	0
561	3	55	0
562	1	0	0
526	4	20	0
522	4	7	0
464	1	12	0
522	2	1	0
465	4	6	0
522	3	20	0
464	2	1	0
562	2	10	0
522	1	0	0
525	2	8	0
616	3	0	0
561	4	8	0
525	1	0	0
561	2	0	0
515	2	10	0
515	1	7	0
539	2	2	0
515	4	1	0
623	3	0	0
515	3	1	0
616	2	2	0
521	1	0	0
561	1	3	0
612	1	4	0
465	2	3	0
537	1	0	1
526	2	2	0
539	4	1	0
464	4	2	0
616	4	4	0
611	2	1	6
623	4	0	0
465	1	4	0
623	2	0	0
465	3	0	0
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611	1	0	0
538	1	0	0
611	4	0	1

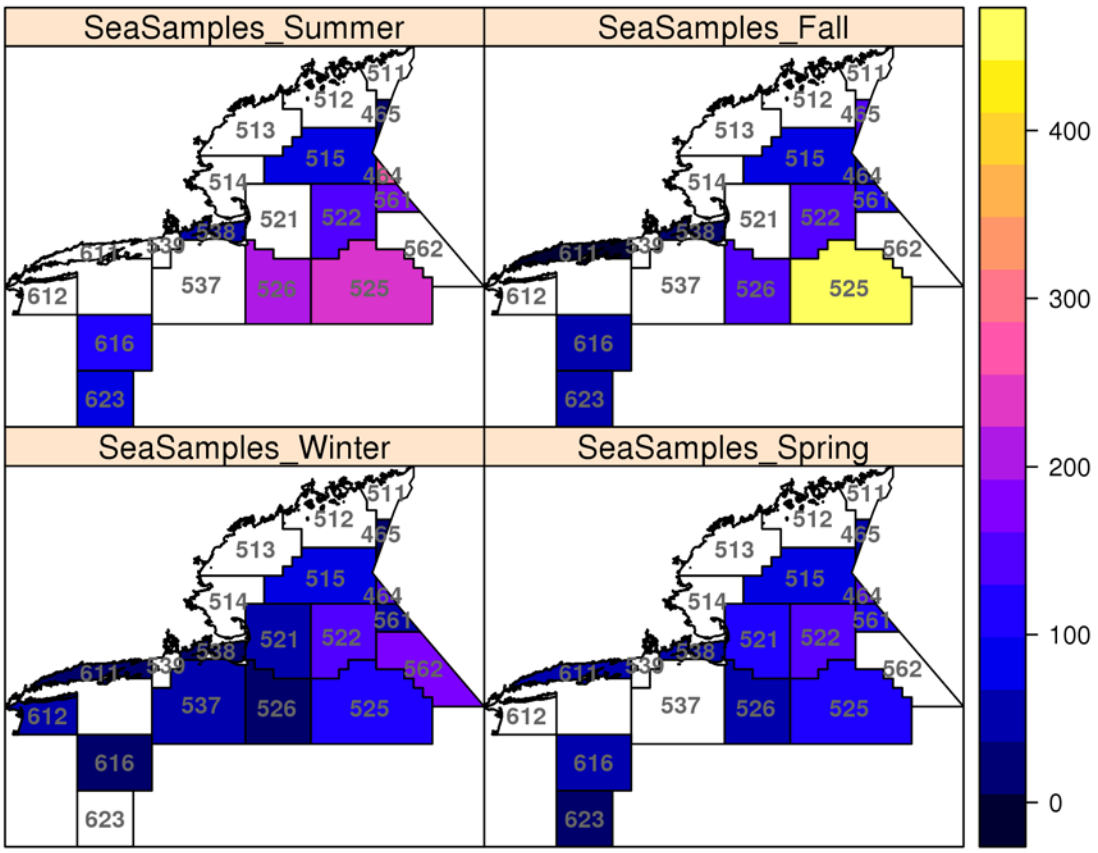

Figure 11. Coverage of sea sampling from 2015-2016 by stat area and quarters that accounted for at least 100,000 pounds of landings in 2013. The color scale indicates pounds landed in 2013 for stat area and quarters with inadequate sea sampling (n<3) during at least one year over that span. Any stat area and quarter combinations in white had at least three samples collected for both 2015 and 2016.

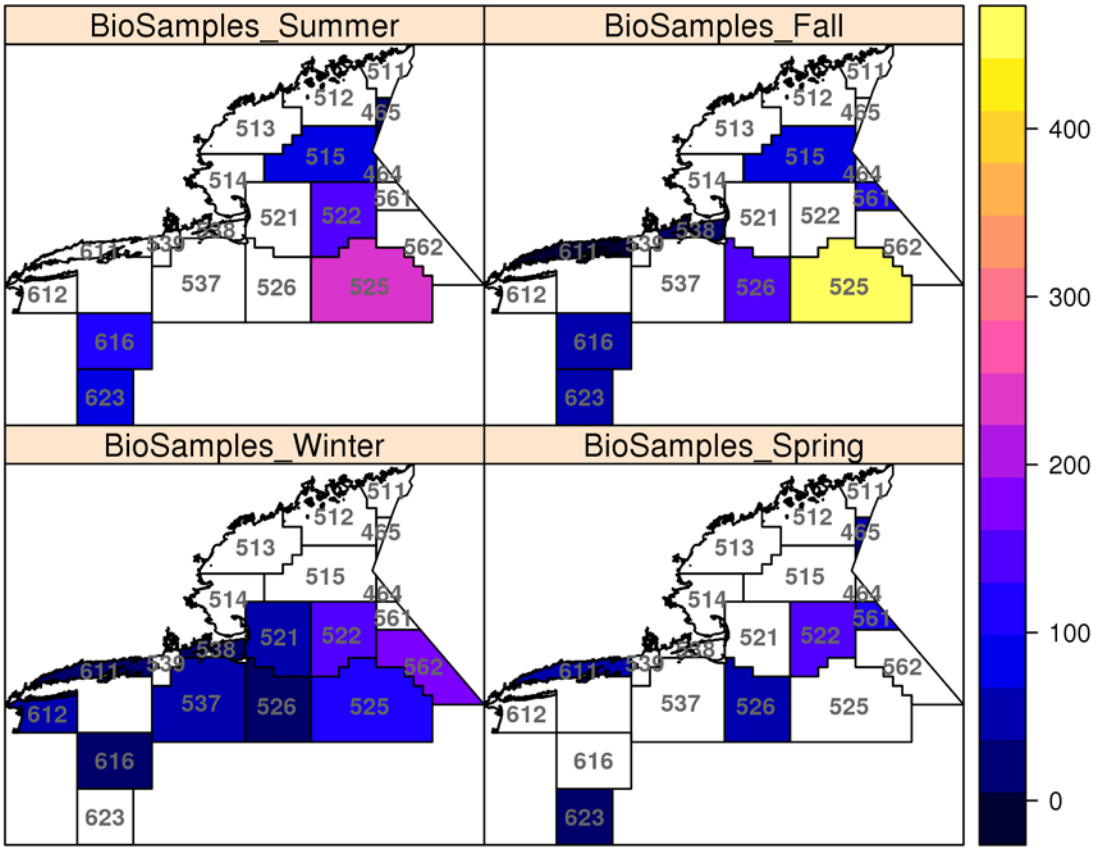

Figure 12. Coverage of biosampling (port and sea samples combined) from 2015-2016 by stat area and quarters that accounted for at least 100,000 pounds of landings in 2013. The color scale indicates pounds landed in 2013 for stat area and quarters with inadequate sea sampling (n<3) during at least one year over that span. Any stat area and quarter combinations in white had at least three samples collected for both 2015 and 2016.

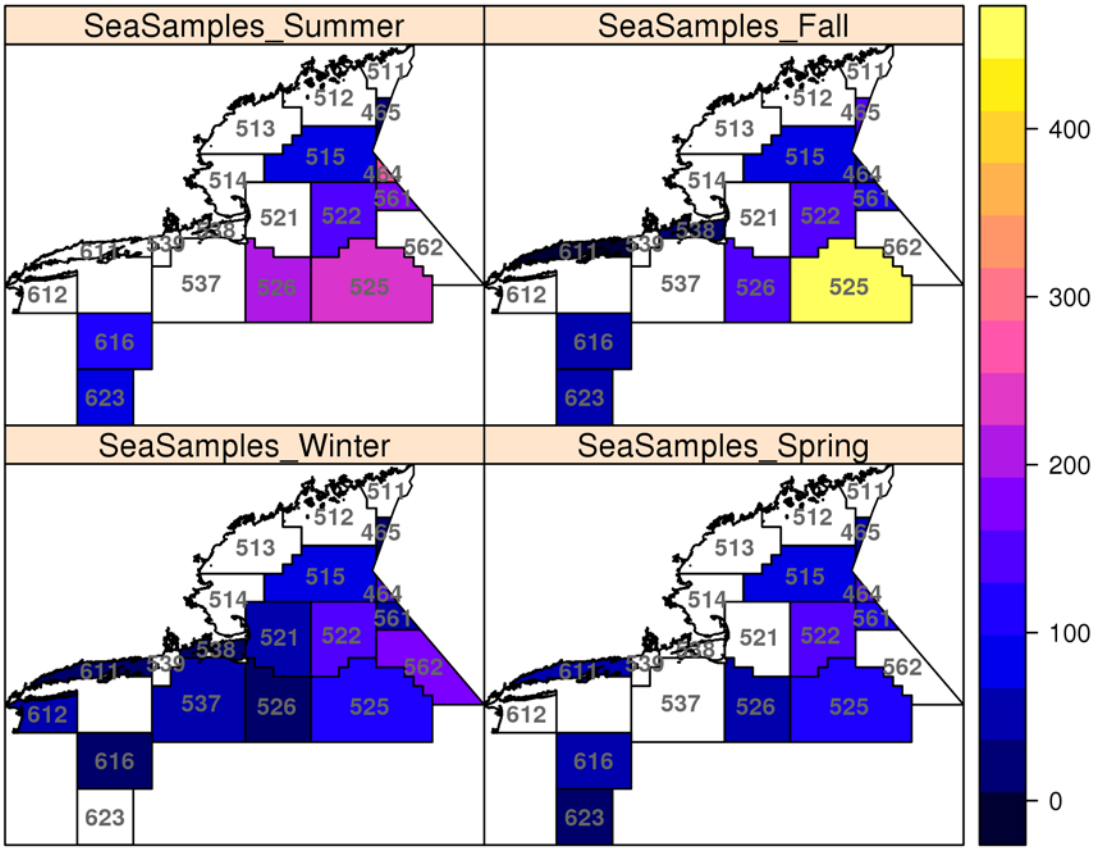

Figure 13. Coverage of sea sampling without CFRF sea samples from 2015-2016 by stat area and quarters that accounted for at least 100,000 pounds of landings in 2013. The color scale indicates pounds landed in 2013 for stat area and quarters with inadequate sea sampling (n<3) during at least one year over that span. Any stat area and quarter combinations in white had at least three samples collected for both 2015 and 2016.

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2017 REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN

FOR AMERICAN LOBSTER (*Homarus americanus*)

2016 FISHING YEAR

Prepared by the Plan Review Team

Table of Contents

2017 REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR AMERICAN LOBSTER (*Homarus americanus*)

***This document covers fishery activities in 2016 as well as trap reductions which took place ahead of the 2017 fishing year*.**

1.0 Status of the Fishery Management Plan

Year of ASMFC Plan's Adoption:	Amendment 3 (1997)
Framework Adjustments:	Addendum I (1999) Addendum II (2001) Addendum III (2002) Addendum IV (2003) Addendum V (2004) Addendum VI (2005) Addendum VII (2005) Addendum VIII (2006) Addendum IX (2006) Addendum X (2007) Addendum XI (2007) Addendum XII (2008) Addendum XIII (2008) Addendum XIV (2009) Addendum XV (2009) Addendum XVI (2010) Addendum XVII (2012) Addendum XVIII (2012) Addendum XIX (2013) Addendum XX (2013) Addendum XXI (2013) Addendum XXII (2013) Addendum XXIII (2014) Addendum XXIV (2015)
Management Unit:	Maine through North Carolina
States with a Declared Interest:	Maine through Virginia (Excluding Pennsylvania and DC)
Active Committees:	American Lobster Management Board, Technical Committee, Lobster Conservation Management Teams, Plan Development Team, Plan Review Team, Advisory Panel

2.0 Status of the Fishery

2.1 Commercial Fishery

The lobster fishery has seen incredible expansion in landings over the last 40 years. Between 1950 and 1975, landings were fairly stable around 30 million pounds; however, from 1976 – 2008 the average coastwide landings tripled, reaching 92 million pounds in 2006. Landings have continued to increase over the last decade, reaching a high of 158 million pounds in 2016 (Table 1). The largest contributors to the 2016 fishery were Maine and Massachusetts with 83% and 11% of landings, respectively. Landings, in descending order, also occurred in New Hampshire, Rhode Island, New Jersey, Connecticut, New York, Maryland, Delaware, and Virginia. The ex-vessel value for all lobster landings in 2016 was $666.7 million, the highest value on record for the American lobster fishery.

Table 2 shows the break-down of commercial landings by Lobster Conservation Management Area (LCMA). Area 1 has historically had the highest landings and accounted for 80% of total harvest between 1981 and 2012. This is followed by LCMA 3 which accounted for 9% of total landings between 1981 and 2012. Yearly trends in Table 2 show that while landings have generally increased in LCMA 1, they have decreased in LCMA's 2, 4, and 6. Landings by LCMA are updated through each benchmark stock assessment.

Landings trends between the two biological stocks have also changed, as a greater percentage of lobster are harvested from the Gulf of Maine/Georges Bank (GOM/GBK) stock. In 1997, 26.3% of coastwide landings came from the Southern New England (SNE) stock. However, as the southern stock declined and abundance in the Gulf of Maine increased, this percentage has significantly changed. In 2000, only 15.6% of landings came from the SNE stock and by 2006, this declined to 7%. In 2016, approximately 2.1% of coastwide landings came from the SNE stock.

2.2 Recreational Fishery

Lobster is also taken recreationally with pots, and in some states, by hand while SCUBA diving. While not all states collect recreational harvest data, some do report the number of pounds landed recreationally and/or the number of recreational permits issued. In 2016, New Hampshire reported 8,281 pounds of lobster harvested recreationally, representing 0.14% of total landings in the state. New York reported 2,433 pounds of lobster harvested recreationally in 2016, representing 1.1% of state landings. Massachusetts reported the highest value of recreational catch at 212,112 pounds, representing 1.17% of total state landings. This was harvested through traps and by hand while diving. Connecticut and Rhode Island do not collect information on the number of pounds recreationally harvested but did issue 254 and 532 recreational lobster licenses, respectively.

3.0 Status of the Stock

The 2015 peer-reviewed stock assessment report indicated a mixed picture of the American lobster resource, with record high stock abundance throughout most of the GOM/GBK and record low abundance and recruitment in SNE (Table 3).

The assessment found the GOM/GBK stock is not overfished and not experiencing overfishing. GOM and GBK were previously assessed as separate stock units; however, due to evidence of seasonal migrations by egg-bearing females between the two stocks, the areas were combined into one biological unit. While model results show a dramatic overall increase in stock abundance in the GOM/GBK, population indicators show young-of-year estimates are trending downward. This indicates a potential decline in recruitment and landings in the coming years.

Conversely, the assessment found the SNE stock is severely depleted and in need of protection. Recruitment indices show the stock has continued to decline and is in recruitment failure. The inshore portion of the SNE stock is in particularly poor condition with surveys showing a contraction of the population. This decline is expected to impact the offshore portion of the stock, which is dependent on recruitment from inshore.

Both the Technical Committee and the Peer Review Panel highlighted the need for management action in SNE. Specifically, the Panel recommended close monitoring of the stock status along with implementing measures to protect the remaining lobster resource in order to promote stock rebuilding.

The next stock assessment is scheduled for 2020.

4.0 Status of Management Measure

4.1 Implemented Regulations

Amendment 3 established regulations which require coastwide and area specific measures applicable to commercial fishing (Table 4). The coastwide requirements are summarized below.

Coastwide Requirements and Prohibited Actions

- Prohibition on possession of berried or scrubbed lobsters
- Prohibition on possession of lobster meats, detached tails, claws, or other parts of lobsters by fishermen
- Prohibition on spearing lobsters
- Prohibition on possession of v-notched female lobsters
- Requirement for biodegradable “ghost” panel for traps
- Minimum gauge size of 3-1/4”
- Limits on landings by fishermen using gear or methods other than traps to 100 lobsters per day or 500 lobsters per trip for trips 5 days or longer
- Requirements for permits and licensing
- All lobster traps must contain at least one escape vent with a minimum size of 1-15/16” by 5-3/4”
- Maximum trap size of 22,950 cubic inches in all areas except area 3, where traps may not exceed a volume of 30,100 cubic inches.

Amendment 3 to the Interstate Fishery Management Plan for American Lobster (December 1997)

American lobster is managed under Amendment 3 to the Interstate FMP for American Lobster. Amendment 3 establishes seven lobster management areas. These areas include the: Inshore Gulf of Maine (Area 1), Inshore Southern New England (Area 2), Offshore Waters (Area 3), Inshore Northern Mid-Atlantic (Area 4), Inshore Southern Mid-Atlantic (Area 5), New York and Connecticut State Waters (Area 6), and Outer Cape Cod (OCC). Lobster Conservation Management Teams (LCMTs) comprised of industry representatives were formed for each management area. The LCMTs are charged with advising the Lobster Board and recommending changes to the management plan within their areas.

Amendment 3 also provides the flexibility to respond to current conditions of the resource and fishery by making changes to the management program through addenda. The commercial fishery is primarily controlled through minimum/maximum size limits, trap limits, and v-notching of egg-bearing females.

Addendum I (August 1999)

Establishes trap limits in the seven lobster conservation management areas (LCMAs).

Addendum II (February 2001)

Establishes regulations for increasing egg production through a variety of LCMT proposed management measures including, but not limited to, increased minimum gauge sizes in Areas 2, 3, 4, 5, and the Outer Cape.

Addendum III (February 2002)

Revises management measures for all seven LCMAs in order to meet the revised egg-rebuilding schedule.

Technical Addendum 1 (August 2002)

Eradicates the vessel upgrade provision for Area 5.

Addendum IV (January 2004)

Changes vent size requirements; applies the most restrictive rule on an area trap cap basis without regard to the individual's allocation; establishes Area 3 sliding scale trap reduction plan and transferable trap program to increase active trap reductions by 10%; and establishes an effort control program and gauge increases for Area 2; and a desire to change the interpretation of the most restrictive rule.

Addendum V (March 2004)

Amends Addendum IV transferability program for LCMA 3. It establishes a trap cap of 2200 with a conservation tax of 50% when the purchaser owns 1800 to 2200 traps and 10% for all others.

Addendum VI (February 2005)

Replaces two effort control measures for Area 2 – permits an eligibility period.

Addendum VII (November 2005)
Revises Area 2 effort control plan to include capping traps fished at recent levels and maintaining 3 3/8" minimum size limit.

Addendum VIII (May 2006)
Establishes new biological reference points to determine the stock status of the American lobster resource (fishing mortality and abundance targets and thresholds for the three stock assessment areas) and enhances data collection requirements.

Addendum IX (October 2006)
Establishes a 10% conservation tax under the Area 2 trap transfer program.

Addendum X (February 2007)
Establishes a coastwide reporting and data collection program that includes dealer and harvester reporting, at-sea sampling, port sampling, and fishery-independent data collection replacing the requirements in Addendum VIII.

Addendum XI (May 2007)
Establishes measures to rebuild the SNE stock, including a 15-year rebuilding timeline (ending in 2022) with a provision to end overfishing immediately. The Addendum also establishes measures to discourage delayed implementation of required management measures.

Addendum XII (February 2009)
Addresses issues which arise when fishing privileges are transferred, either when whole businesses are transferred, when dual state/federal permits are split, or when individual trap allocations are transferred as part of a trap transferability program. In order to ensure the various LCMA-specific effort control plans remain cohesive and viable, this addendum does three things. First, it clarifies certain foundational principles present in the Commission's overall history-based trap allocation effort control plan. Second, it redefines the most restrictive rule. Third, it establishes management measures to ensure history-based trap allocation effort control plans in the various LCMAs are implemented without undermining resource conservation efforts of neighboring jurisdictions or LCMAs.

Addendum XIII (May 2008)
Solidifies the transfer program for OCC and stops the current trap reductions.

Addendum XIV (May 2009)
Alters two aspects of the LCMA 3 trap transfer program. It lowers the maximum trap cap to 2000 for an individual that transfers traps. It changes the conservation tax on full business sales to 10% and for partial trap transfers to 20%.

Addendum XV (November 2009)
Establishes a limited entry program and criteria for Federal waters of LCMA 1.

Addendum XVI: Reference Points (May 2010)
Establishes new biological reference points to determine the stock status of the American lobster resource (fishing mortality and abundance targets and thresholds for the three stock assessment areas). The addendum also modifies the procedures for adopting reference points to allow the Board to take action on advice following a peer reviewed assessment.

Addendum XVII (February 2012)
Institutes a 10% reduction in exploitation for LCMAs within Southern New England (2, 3, 4, 5, and 6). Regulations are LCMA specific but include v-notch programs, closed seasons, and size limit changes.

Addendum XVIII (August 2012)
Reduces traps allocations by 50% for LCMA 2 and 25% for LCMA 3.

Addendum XIX (February 2013)
Modifies the conservation tax for LCMA 3 to a single transfer tax of 10% for full or partial business sales.

Addendum XX (May 2013)
Prohibits lobstermen from setting or storing lobster traps in Closed Area II from November 1 to June 15 annually. Any gear set in this area during this time will be considered derelict gear. This addendum represents an agreement between the lobster industry and the groundfish sector.

Addendum XXI (August 2013)
Addresses changes in the transferability program for Areas 2 and 3. Specific measures include the transfer of multi-LCMA trap allocations and trap caps.

Addendum XXII (November 2013)
Implements Single Ownership and Aggregate Ownership caps in LCMA 3. Specifically, it allows LCMA 3 permit holders to purchase lobster traps above the cap of 2000 traps; however, these traps cannot be fished until approved by the permit holder's regulating agency or once trap reductions commence. The Aggregate Ownership Cap limits LCMA fishermen or companies from owning more traps than five times the Single Ownership Cap.

Addendum XXIII (August 2014)
Updates Amendment 3's habitat section to include information on the habitat requirements and tolerances of American lobster by life stage.

Addendum XXIV (May 2015)
Aligns state and federal measure for trap transfer in LCMA's 2, 3, and the Outer Cape Cod regarding the conservation tax when whole businesses are transferred, trap transfer increments, and restrictions on trap transfers among dual permit holders.

4.2 On-Going Management Action

In May 2016, the Board initiated draft Addendum XXV to address the poor condition of the SNE stock by lowering fishing mortality and increasing egg production. At their May 2017 meeting, the Board approved a 5% increase in egg production, to be achieved through gauge size changes, season closures, and trap reductions, and tasked the LCMTs with developing proposals. At the August 2017 meeting, the Board decided not to move forward with Addendum XXV for management use at the current time. After reviewing TC input, which found only one out of the five proposals put forth by the LCMTs to be sufficient to achieve the 5% increase in egg production, the Board decided not to approve the Draft Addendum. Some members felt the proposed measures did not go far enough to protect the stock, while others were concerned the majority of LCMT proposals would not achieve the required 5% increase in egg production. Others believed significant reductions have already occurred in the fishery and no further action was needed. Ultimately, the Board decided to establish a Workgroup to discuss ways to manage SNE lobster in light of changing environmental conditions. Discussions by the workgroup, and subsequent recommendations to the Board, will occur this fall.

At its January 2017 meeting, the Board initiated Draft Addendum XXVI to improve harvester reporting and biological data collection in state and federal waters. This was prompted by recent management action in the Northwest Atlantic which highlighted several data deficiencies in the lobster fishery, including the poor spatial resolution of harvester data, the fact that not all lobstermen are required to report landings, and the lack of biological data collected offshore. The PDT continues to develop the management alternatives for this addendum and is expected to present a draft document to the Board in late 2017 or early 2018.

In response to signs of reduced settlement in the GOM/GBK stock, the Board initiated Draft Addendum XXVII in August 2017 to increase the resiliency of the stock. To this end, the Draft Addendum considers the standardization management measures in the GOM/GBK stock. A draft of Addendum XXVII will be developed over the coming months and be considered for public comment in 2018.

5.0 Ongoing Trap Reductions

Addendum XVIII established trap reductions in LCMA 2 and 3. The intention of this Addendum was to scale the size of the SNE fishery to the size of the resource by prescribing a series of trap reductions in LCMAs 2 and 3. Specifically, a 25% reduction in year 1 followed by a series of 5% reductions for 5 years were established in LCMA 2; a series of 5% reductions over five years were established in LCMA 3. The second year of reductions took place ahead of the 2016 fishing year and affect trap allocations in the 2017 fishery. Per Addendum XVIII, states with fishermen in Areas 2 and 3 are required to report on the degree of consolidation that has taken place. In total, 6,781 traps were retired in Area 2 and 8,008 traps were retired in Area 3. Trap reductions by jurisdiction can be found in Table 5. It is important to note that trap reductions also occur as the result of trap transfers as, per Addendum XIX, there is a 10% conservation tax on partial business transfers.

6.0 Fishery Monitoring

Addendum X requires states to conduct sufficient biological sampling to characterize commercial catch. Specifically, it requires states weight sampling intensity by area and season to match the 3-year average of the area's seasonal commercial catch. This volume of sampling, however, well exceeds current state budgets for lobster biological sampling. Addendum X also requires states to conduct 100% mandatory dealer reporting and at least 10% reporting of active harvesters. Table 6 describes the level of reporting and sampling by each state.

Overviews of the states' port and sea sampling are below. Several states, including Rhode Island and Connecticut, did not complete sea sampling trips in 2017; however, both states noted staffing limitation and budget constraints. In particular, Connecticut noted an attrition in the staff at CT Marine Fisheries Program without the ability to fill these vacancies. A couple states commented that there are issues identifying fishermen for sea sampling trips. This is in part due to a decrease in the number of active fishermen in SNE, and in part due to a lack of cooperation on the part of fishermen to take state samplers out on their boats. States reported that fishermen are wary of the management implications of participating in sea sampling programs, making it difficult to identify fishermen for this program.

- Maine: Completed 168 sea sampling trips aboard 146 boats from 65 different ports. In total, 237,525 lobsters were sampled from 37,241 traps. Maine suspended its port sampling program following the 2011 sampling year.
- New Hampshire: Sampled 9,564 lobsters during 20 sea sampling trips and 1,200 lobsters through 12 port sampling trips.
- Massachusetts: Conducted a total of 71 sea sampling trips and 45,130 lobsters in LCMA's 1, 2, and OCC. No port sampling was conducted.
- Rhode Island: Conducted 6 port sampling trips and sampled 1,167 lobsters. No sea sampling was conducted by the state due to staffing and budget constraints.
- Connecticut: No sea sampling or port sampling trips were conducted in 2016.
- New York: Staff conducted 10 sea sampling trips in 2016 and sampled 1,693 lobsters. NY also inspected 2 vessels through port sampling and sampled 355 lobsters. In addition, the state conducted 9 market sampling trips, evaluating 282 lobsters.
- New Jersey: Conducted 5 sea sampling trips and sampled 3,710 lobsters.
- Delaware: No sea sampling or port sampling trips were conducted in 2016.
- Maryland: Conducted 2 sea sampling trips and sampled 542 lobsters.
- Virginia: No sea sampling or port sampling trips were conducted in 2016.

7.0 Status of Surveys

Addendum X also requires fishery independent data collection by requiring statistical areas be sampled through one of the following methods: annual trawl survey, ventless trap survey, or young-of-year survey. *De minimis* states are not required to conduct biological sampling of their lobster fishery.

7.1 Trawl Surveys

Maine and New Hampshire: The Maine-New Hampshire Inshore Trawl survey began in 2000 and covers approximately two-thirds of the inshore portion of Gulf of Maine. The spring portion of the survey completed 122 tows and sampled 30,041 lobsters. Spring survey abundance indices increased from 2015, particularly in statistical area 513 and 511. The fall survey completed 83 tows and sampled 24,835 lobsters. Fall survey abundance indices slightly decreased from 2015, with the exception of sublegal lobsters in statistical area 511 which increased (Figure 2).

Massachusetts: The Division of Marine Fisheries conducts spring and autumn bottom trawl surveys in the territorial waters of Massachusetts. Only data collected from the autumn portion of the inshore trawl survey is used to calculate lobster relative abundance indices. In the GOM, relative abundance indices have generally increased over the last decade. In contrast, relative abundance indices in SNE remain low with the most recent values near or below the time series median (Figure 3).

Rhode Island: The RIDFW Trawl Survey program conducted seasonal surveys in the spring and fall. In 2016, 44 trawls were conducted in both the spring and fall. Spring 2016 mean CPUEs were 0 and 0.14 for legal and sub-legal lobsters, respectively. Fall 2016 CPUE were 0.05 for legal lobsters and 1.00 for sub-legal lobsters. All abundances were low except for the fall sub-legal abundance which showed a slight increase in 2015 and 2016 (Figure 4).

Connecticut and New York: Juvenile and adult abundance are monitored through the Long Island Sound Trawl Survey (LISTS) during the spring (April, May, June) and the fall (September and October) cruises. The spring 2016 lobster abundance index (geometric mean = 0.33 lobster/tow) was the second lowest in the time series but similar to the 2013-15 indices (0.44, 0.45, 0.31, respectively). The fall 2016 index (0.02) ranked lowest in the time series, joining all indices since 2005 as collectively the lowest in the 33-year time series (Figure 5).

New Jersey: An independent Ocean Trawl Survey is conducted from Sandy Hook, NJ to Cape May, NJ each year. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), offshore (60'-90'). The mean CPUE, which is calculated as the sum of the mean number of lobsters per size class collected in each sampling area weighted by the stratum area, increased from 2015 to 2016 for all three size classes (Figure 6).

7.2 Young of Year Index

Several states conduct young-of-year (YOY) surveys to detect trends in abundance of newly-settled and juvenile lobster populations. These surveys attempt to provide an accurate picture of the spatial pattern of lobster settlement. States hope to track juvenile populations and generate predictive models of future landings.

Maine: In 2000, settlement surveys were expanded to cover all seven of Maine's lobster management zones (LMZ) in order to create a statewide index of settlement. Settlement

surveys in 2016 continued to show low values in all statistical areas sampled (Figure 7). Survey index values were below the average in all statistical areas.

New Hampshire: New Hampshire Fish and Game (NHF&G) conducted a portion of the coastwide American Lobster Settlement Index (ALSI). In 2016, a total of 20 juvenile lobsters were sampled from three sites, 19 of which were deemed older juveniles and one which was a YOY. Figure 8 depicts the CPUE of lobsters for all NH sites combined, from 2008 through 2016. For each of these four indices, CPUE shows a general upward trend to a time series high in 2011, with sustained low levels from 2012 through 2016.

Massachusetts: Annual sampling for early benthic phase/juvenile (EBP) lobsters was conducted from August to September in 2015. Sampling was completed at 21 sites spanning 7 regions in Massachusetts coastal waters. Data for all sites were used to generate annual density estimates of EBP lobster and other decapod crustaceans. In 2016, densities of YOY lobsters were relatively low compared to the time series average in all sampling location (Figure 9). In LCMA 1, there were no YOY lobsters found in two of the five locations (South Shore and Cape Cod Bay). In 2016, there were no YOY lobsters found in the Vineyard Sound sampling location.

Rhode Island: For 2016, the YOY Settlement Survey (Suction Sampling) was conducted at a total of six fixed stations with twelve randomly selected 0.5-meter quadrats sampled at each survey station. Average site abundance of lobster at suction sampling sites has generally declined since the mid-1990's with a time-series low in 2011 (Figure 10). The 2016 YOY settlement survey index was 0.31 YOY lobster/m^2.

Connecticut: The CT DEEP Larval Lobster Survey in western Long Island Sound (WLIS) was discontinued in 2013. Alternative monitoring data are available for the eastern Sound (ELIS) from the Millstone Power Station entrainment estimates of all stages of lobster larvae. Both programs show a decline in abundance following the 1999 die-off (Figure 11).

7.3 Ventless Trap Survey

To address a need for a reliable index of lobster recruitment, a cooperative random stratified ventless trap survey was designed to generate accurate estimates of the spatial distribution of lobster length frequency and relative abundance while attempting to limit the biases identified in conventional fishery dependent surveys.

Maine: The Maine Ventless Trap Survey changed strategies in 2015 and 2016 to cover more area by eliminating the vented traps at each site. This change allowed the survey to double the number of sites with ventless traps and increase the sampling coverage spatially to 276 sites. Traps were set during the months of June, July, and August. The survey catches 90% sub-legal lobsters. The stratified mean was calculated for each area using depth and statistical area. Overall, there were increases the number of sub-legal and legal lobsters caught in 2016, compared to the previous year (Figure 12).

New Hampshire: Since 2009, NHF&G has been conducting the coastwide Random Stratified Ventless Trap Survey in state waters (statistical area 513). A total of six sites were surveyed twice a month from June through September in 2016. Catch per unit effort (stratified mean catch per trap haul) from 2009 through 2016 is presented in Figure 13. The highest catch values of the time series were recorded in 2015 and 2016.

Massachusetts: The coast-wide ventless trap survey was initiated in 2006 and expanded in 2007 with the intention of establishing a standardized fishery-independent survey designed specifically to monitor lobster relative abundance and distribution. The survey was not conducted in 2013 due to a lack of funding; however, starting in 2014 the survey has been funded with lobster license revenues and will continue as a long-term survey. Relative abundance of sub-legal (< 83 mm CL) and legal-sized (≥ 83 mm CL) lobsters for Area 514 (part of LCMA 1) is shown in Figure 14 as the stratified mean CPUE. The mean CPUE in 2016 was the second highest observed at 6.44 and was above the time series average of 4.99. Legal sized lobsters comprised roughly 10% of catch over the survey's time series.

Figures 15 and 16 show the time series of relative abundance (stratified mean CPUE) for sub-legal (<86 mm CL) and legal-sized (≥ 86 mm CL) lobsters in the southern MA region (Area 538 and northern Area 537; part of LCMA 2). The average catch of sub-legal lobsters was higher than the catch of legal-sized lobsters, and generally declined from 2006 through 2010 (the original time series). The spatial extent of the survey area was expanded in 2011 to include deeper waters outside Buzzards Bay, where thermal conditions are more tolerable. This expansion in survey area necessitates that the data from 2011 onwards be treated as a new survey index. In 2016, sublegal CPUE in the original survey area rebounded from low values in 2014 and 2015 and was above the time series average (Figure 15). The CPUE of legal sized lobsters also increased in 2016 and was the highest observed in the time series at 0.50. In the expanded survey area, the CPUE of sub-legal lobsters was the highest observed in the 5-year time series at 3.0 (Figure 16). The CPUE of legal sized lobsters was also the highest observed in the time series at 0.67.

Rhode Island: In 2016, the Ventless Trap Survey was conducted during the months of June-August over 18 sampling sites. A total of 3,482 lobsters were collected from 830 traps. All sampling was conducted in LCMA 2, NMFS Statistical Area 539. In general, the CPUE of legal lobsters has increased since 2014 while the CPUE of sub-legal lobsters has remained steady since 2010. The mean CPUE Index values for 2016 were 0.24 and 3.04 per trap for legal and sub-legal lobsters, respectively (Figure 17).

8.0 State Compliance

States are currently in compliance with all required biological management measures under Amendment 3 and Addendum I-XXIV; however, the PRT notes that Connecticut and Rhode Island did not conduct any sea sampling, as specified in Addendum X. Both states noted staffing and budget constraints as contributors to the lack of sampling.

9.0 De Minimis Requests

The states of Virginia, Maryland, and Delaware have requested *de minimis* status. According to Addendum I, states may qualify for *de minimis* status if their commercial landings in the two most recent years for which data are available do not exceed an average of 40,000 pounds. Delaware, Maryland, and Virginia meet the *de minimis* requirement.

10.0 Regulatory Changes

Maine made the following changes to lobster regulations in 2016

- Based on a referendum of Chebeague Island lobster license holders and a recommendation from the island limited entry committee, Maine DMR adopted regulations to remove Chebeague Island from the island limited entry program.
- Based on a referendum of Swans Island lobster license holders and a recommendation from the interim island limited entry committee, Maine DMR adopted regulations to add Swans Island to the island limited entry program, with a base number of licenses of 72.
- DMR adopted regulations to require any individuals fishing in a zone other than their declared zone to have a secondary tag in their trap for the purpose of enforcing the requirement to fish a majority of their traps in their declared zone.
- DMR adopted regulations to expand the existing lobster and crab harvesting closure in the Penobscot River in order to protect public health due to the risk of mercury contamination.
- Statutes were amended to modify the entry system for lobster licenses to provide additional time for students to convert to a commercial lobster license, and improve the methodology by which the calculation for entry off the waiting lists in limited entry zones is conducted.

Massachusetts DMF made the following amendments to its lobster related regulations:

- Amended 322 CMR 4.00 and 12.00 to adopt the relevant provisions of the Atlantic Large Whale Take Reduction Plan (as amended in 2015).
- Amended 322 CMR 6.00 to prohibit the on-the-water possession and setting of non-trap structures designed to attract lobsters.
- Amended 322 CMR 6.00 to implement the LMA2 trap reduction schedule.
- Amended 322 CMR 7.00 to allow the transfer of offshore lobster trap permits with a federal trap allocation.
- Amended 322 CMR 7.00 to allow the issuance of new offshore lobster trap permits for LMA2 provided an existing federal lobster trap allocation is held.

11.0 Enforcement Concerns

- Maine Marine Patrol continues to look for solutions to fishermen utilizing untagged sunken trawls in an effort to exceed the trap limit and stop Patrol from inspecting gear at sea.
- MA took action to suspend a commercial lobster permit for 3 months due to violations of the size limit, v-notch, and egger rules. A commercial lobster permit was also revoked

due to theft and molestation of lobster gear owner by another individual, violation of protected species regulations (weak links), and improperly marked fishing buoys.

- RI noted concerns about the ability for enforcement to determine whether lobsters came from a lobster trap associated with a lobster trap allocation, or a trap targeting a different fishery (e.g. rock crab, black sea bass) operated by an individual with a lobster trap allocation.
- NY noted several enforcement challenges that occurred in 2016, including fishermen having traps in the water during a season closure, traps which have no trap tags, have multiple undersized vents, or inoperable escape panels, and several cases of undersized lobsters.

12.0 Research Recommendations

The following research recommendations are from the 2015 Stock Assessment and were compiled by the Lobster TC and Stock Assessment Subcommittee.

- ***Ventless Trap Survey***- Calibration work is needed to determine how catch in ventless trap surveys relates to catch in the bottom trawl surveys. It is likely that at low densities, when trawl survey indices have dropped to near zero, ventless trap surveys will still catch lobsters due to the attractive nature of the gear and the ability to fish the gear over all habitat types. Conversely, it is possible that trawl surveys may be able to detect very high levels of lobster abundance, if trap saturation limits the capacity of the ventless traps. Ventless traps may be limited in their ability to differentiate between moderately high and extremely high abundance, and calibration with bottom trawl surveys may help to clarify how catchability might change with changes in lobster density.
- ***Maturation and Growth*** **-** Increases in water temperatures over the past several decades have likely resulted in changes to size at maturity and growth patterns. Maturity data currently used are more than 20 years old. Changes in size at maturity will subsequently affect growth, since female molting frequency decreases after reaching sexual maturity. It is critical to collect updated information on maturity and growth in order to appropriately assign molt probabilities to lobsters.
- ***Stock Connectivity*** **-** There is need for a comprehensive large scale tagging study to examine stock connectivity between the GOM and GBK. Historical tagging studies demonstrate movement from the inshore GOM to locations east of Cape Cod in the inshore portions of GBK, and from inshore areas east of Cape Cod to inshore GOM. What is lacking is a tagging study of lobsters in the fall/winter on GBK proper, prior to seasonal migrations which occur in the spring. This information would be extremely valuable to help complement other data used to justify the combination of the GOM and GBK stock and to confirm the connectivity of the GOM and GBK.
- ***Temperature*** **–** Given the importance of temperature in the life history of lobster, techniques should be developed to incorporate environmental data into population modeling.

- ***Post-Larval Settlement –*** There is a need to examine post-larval settlement dynamics in relation to the movement and re-distribution of spawning stock. Habitat suitability models for spawning stock and settling post-larvae should be developed.
- ***Natural Mortality –*** Methods should be explored to determine age or length-varying natural mortality, as well as looking at more rigorous ways of determining time-varying natural mortality for lobster. These may be driven by climactic shifts and changing predator fields.
- ***Shell Disease*** **-** With the high prevalence of shell disease in the SNE stock, particularly in ovigerous females, some exploration of the potential sub-lethal effects of disease should be examined. These effects could include negative impacts to larval quality, fecundity issues in females who need to re-direct physiological resources to dealing with the disease, and male sperm quality

13.0 Plan Review Team Recommendations

The following are issues and recommendations the Plan Review Team would like to raise to the Board:

- The PRT recommends the Board approve the *de minimis* requests of DE, MD, and VA.
- The PRT notes an increase in the number of enforcement concerns reported by the states in their compliance reports. The PRT recommends improved enforcement of lobster management measures, especially the at-sea enforcement of trap limits. For areas which rely on permit specific trap limits as the primary metric for management, marine patrol enforcement needs to have a greater presence, particularly as trap reductions take place in LCMAs 2 and 3. In addition, greater enforcement efforts need to be directed offshore.
- The PRT recommends increased biological sampling, particularly offshore, as the spatial distribution of the fishery changes.
- The PRT recommends research is conducted to update growth and maturity data. Given the increase in water temperature over the last several decades, the TC believes it is likely that there have been changes to size at maturity and growth patterns which are not captured in the current data.
- The PRT recommends the Board investigate the best way to quantify effort in the lobster fishery. Through Amendment 3 and subsequent addenda, the Board has largely managed effort in the lobster fishery through trap allocations. However, the effectiveness of trap allocations to reduce effort is confounded by their ambiguous relationship to trap hauls and the expansion of the Jonah crab fishery. Monitoring the true level of effort in the lobster fishery (whether than be through the number of permits, trap allocations, or trap hauls) will provide the Board with much needed information regarding fishery trends, particularly as stock conditions change in the GOM/GBK and SNE.
- In addition to the tagging studies noted above by the TC and SASC, the PRT recommends investigating the connectivity between the offshore portion of SNE and GBK. Catch in the offshore portion of SNE had remained fairly stable and may indicate some biological relationship with GBK.

14.0 Tables

Table 1. Landings (in pounds) of American Lobster by the states of Maine through Virginia.
C= confidential data

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	Total
1981	22,631,600	793,400	11,220,500	1,871,067	1,010,800	890,200	593,700	55,700	63,200	2,200	39,132,367
1982	22,730,100	807,400	13,150,900	2,254,930	1,094,100	1,121,600	846,300	90,700	64,800	4,700	42,165,530
1983	21,976,500	1,310,560	12,421,000	5,020,895	1,854,000	1,207,500	769,900	56,700	86,500	600	44,704,155
1984	19,545,600	1,570,724	14,701,800	5,064,760	2,011,600	1,308,100	927,700	103,800	98,900	17,400	45,350,384
1985	20,125,000	1,193,881	16,295,100	5,080,163	1,676,000	1,240,900	1,079,600	118,500	82,300	1,100	46,892,544
1986	19,704,400	941,100	15,057,600	5,513,831	1,656,100	1,407,100	1,123,000	109,000	57,700	1,000	45,570,831
1987	19,747,800	1,256,170	15,116,800	5,217,300	1,735,591	1,146,700	1,397,100	84,100	49,900	1,000	45,752,461
1988	21,738,800	1,118,900	15,866,312	4,758,990	2,053,800	1,779,890	1,557,300	66,200	23,000	300	48,963,492
1989	23,368,800	1,430,400	15,444,300	5,725,641	2,096,900	2,345,051	2,059,600	76,500	17,500		52,564,692
1990	28,068,238	1,658,200	17,054,434	7,258,175	2,645,800	3,431,111	2,198,867	68,300			62,383,125
1991	30,788,646	1,802,035	16,528,168	7,445,170	2,674,000	3,128,246	1,673,031	54,700			64,093,996
1992	26,830,448	1,529,292	15,823,077	6,763,085	2,439,600	2,651,067	1,213,255	21,000			57,270,824
1993	29,926,464	1,693,347	14,336,032	6,230,855	2,177,022	2,667,107	906,498	24,000			57,961,325
1994	38,948,867	1,650,751	16,094,226	6,474,399	2,212,000	3,954,634	581,396	8,400			69,924,673
1995	37,208,324	1,834,794	15,755,840	5,363,810	2,536,177	6,653,780	606,011	500	2,855		69,962,091
1996	36,083,443	1,632,829	15,323,277	5,579,874	2,888,683	9,408,519	640,198		28,726	1,252	71,586,801
1997	47,023,271	1,414,133	15,087,096	5,766,534	3,468,051	8,878,395	858,426	648	34,208	2,240	82,533,002
1998	47,036,836	1,194,653	13,277,409	5,618,440	3,715,310	7,896,803	721,811			1,306	79,462,568
1999	53,494,418	1,380,360	15,533,654	8,155,947	2,595,764	6,452,472	931,064			6,916	88,550,595
2000	57,215,406	1,709,746	15,802,888	6,907,504	1,393,565	2,883,468	891,183			311	86,804,071
2001	48,617,693	2,027,725	12,132,807	4,452,358	1,329,707	2,052,741	579,753			19	71,192,803
2002	63,625,745	2,029,887	12,853,380	3,835,050	1,067,121	1,440,483	264,425	551			83,087,146
2003	54,970,948	1,958,817	11,385,049	3,474,509	671,119	946,449	209,956	2,831	22,778		71,683,639
2004	71,574,344	2,097,396	11,295,474	3,064,412	646,994	996,109	370,112	15,172	14,931	13	90,074,957
2005	68,729,861	2,556,232	9,879,983	4,343,736	713,901	1,154,470	369,264	5,672	39,237	21,255	87,813,611
2006	72,662,294	2,666,344	10,966,322	3,749,432	792,894	1,242,601	470,877	3,315	26,349	28,160	92,608,588
2007	63,959,191	2,468,811	10,143,301	3,268,075	568,696	716,300	680,392	5,918	6,128	26,765	81,843,577
2008	69,863,132	2,567,031	10,597,614	3,528,445	426,292	712,075	632,545	4,884	32,429	17,701	88,382,148
2009	81,175,847	2,985,166	11,781,490	3,174,618	451,156	731,811	179,740	6,067	30,988	21,472	100,538,355
2010	95,506,383	3,658,894	12,768,448	3,258,221	432,491	813,513	641,556	4,574	30,005	16,345	117,130,430
2011	104,693,316	3,917,461	13,717,192	2,513,255	191,594	344,232	627,077	C	C	C	126,066,050
2012	125,759,424	4,236,740	14,917,238	2,932,388	236,846	275,220	919,260	C	C	C	149,336,623
2013	127,773,264	3,822,844	15,738,792	2,149,266	133,008	248,267	660,367	C	C	C	150,621,935
2014	124,440,799	4,939,310	15,060,352	2,387,321	141,988	216,630	526,367	C	C	C	147,805,965
2015	122,212,133	4,716,084	16,418,796	2,879,874	158,354	146,624	445,195	C	C	C	147,037,850
2016	130,844,773	5,773,909	17,939,236	2,259,876	226,426	218,355	352,085	C	C	C	157,672,465

Table 2. Estimated lobster landings (in pounds) by lobster conservation management area (LCMA)* (*Source, ASMFC Lobster Data Warehouse*). This table can only be update in years when stock assessment reports are being conducted.

Coastwide Estimated Lobster Landings (lbs) by Lobster Conservation Management Area (LCMA)*								
Year	LCMA 1	LCMA 2	LCMA 3	LCMA 4	LCMA 5	LCMA 6	LCMA OCC	Grand Total
1981	32,369,320	527,284	4,321,500	441,478	115,653	1,220,159	134,327	39,129,721
1982	32,123,750	1,656,479	4,961,680	622,674	99,093	1,359,058	163,105	40,985,839
1983	32,826,685	2,958,366	5,645,179	633,254	71,804	2,428,633	198,448	44,762,369
1984	29,862,411	2,978,985	6,409,741	795,180	135,652	2,704,070	208,832	43,094,871
1985	31,590,759	2,992,330	5,853,851	964,043	170,998	2,273,337	261,929	44,107,247
1986	30,080,507	3,081,903	5,829,275	1,084,282	125,969	2,362,128	298,747	42,862,811
1987	30,682,754	3,219,900	5,357,273	1,473,841	98,486	2,378,765	276,250	43,487,269
1988	32,362,492	3,259,336	5,132,943	1,666,439	85,142	3,195,208	295,985	45,997,545
1989	36,800,166	4,175,114	5,450,786	2,232,935	106,126	3,735,250	352,155	52,852,532
1990	41,720,481	4,374,062	8,783,629	2,431,198	237,410	4,250,654	581,447	62,378,881
1991	43,648,773	4,140,145	8,537,053	2,096,138	115,020	4,393,986	740,267	63,671,382
1992	39,055,380	3,795,367	7,124,248	1,448,866	77,854	4,362,551	738,026	56,602,292
1993	40,962,969	3,772,494	6,773,992	1,597,447	89,495	3,968,663	938,486	58,103,546
1994	51,597,880	5,602,507	5,684,252	554,367	26,013	5,738,398	848,181	70,051,598
1995	49,771,715	4,960,453	5,008,551	962,077	45,054	8,564,325	1,000,609	70,312,784
1996	47,992,628	4,880,328	4,896,782	978,376	52,758	11,705,439	852,532	71,358,843
1997	58,016,197	5,324,775	5,549,295	1,162,862	36,623	11,650,701	849,126	82,589,579
1998	56,187,841	5,273,463	5,043,939	1,534,067	41,963	10,575,143	797,019	79,453,435
1999	65,375,535	6,938,658	6,166,601	1,346,509	77,621	8,331,142	739,904	88,975,970
2000	69,265,611	5,651,160	5,436,618	1,123,486	53,364	3,802,880	765,801	86,098,920
2001	57,531,942	3,862,054	5,525,209	762,408	55,537	3,013,551	611,242	71,361,943
2002	73,607,600	3,445,004	5,483,983	442,425	14,838	2,230,869	786,137	86,010,856
2003	63,005,041	1,110,534	6,978,808	423,583	17,394	1,448,011	804,355	73,787,725
2004	80,448,651	1,184,942	6,722,671	480,203	93,270	1,534,130	993,689	91,457,556
2005	76,240,627	1,464,433	7,442,771	457,275	54,181	1,673,396	966,787	88,299,470
2006	80,846,400	1,853,505	7,588,539	516,130	59,928	1,840,308	1,048,051	93,752,862
2007	70,862,089	1,430,836	6,375,646	617,978	56,866	1,263,648	1,132,991	81,740,055
2008	78,914,865	1,168,921	6,124,979	440,108	322,916	920,951	1,127,422	89,020,163
2009	91,133,844	1,051,241	6,960,119	488,792	308,212	896,594	1,256,201	102,095,002
2010	106,458,701	1,022,528	7,955,472	522,037	184,409	966,505	1,209,482	118,319,134
2011	116,042,515	730,889	7,890,340	488,977	148,587	306,079	1,244,299	126,851,685
2012	138,762,843	627,051	8,111,396	782,684	154,455	286,215	1,223,279	149,947,922
Grand Total	1,886,148,973	98,515,048	201,127,121	31,572,119	3,332,690	115,380,746	23,445,109	2,359,521,806

*Landings data are not collected by LCMA in all states. To separate landings by LCMA, NMFS statistical areas are placed into a single LCMA. For a complete description of how estimates are completed contact Megan Ware, at mware@asmfc.org

Table 3. Threshold reference points with stock status variables for lobsters in each stock area. (Source: 2015 Benchmark Stock Assessment).

Variable	GOM	GBK	GOM/GBK	SNE
Effective Exploitation				
Effective exploitation threshold	0.54	1.83	0.5	0.41
Recent effective exploitation (2011-2013)	0.48	1.54	0.48	0.27
Effective exploitation below threshold?	YES	YES	YES	YES
Reference Abundance (millions)				
Abundance threshold	52	0.8	66	24
Recent abundance (2011-2013)	247	1.57	248	10
Abundance above threshold?	YES	YES	YES	NO

Table 4. 2016 LCMA specific management measures

Mgmt Measure	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	OCC
Min Gauge Size	3 1/4"	3 3/8"	3 17/32"	3 3/8"	3 3/8"	3 3/8"	3 3/8"
Vent Rect.	1 15/16 x 5 3/4"	2 x 5 3/4"	2 1/16 x 5 3/4"	2 x 5 3/4"	2 x 5 3/4"	2 x 5 3/4"	2 x 5 3/4"
Vent Cir.	2 7/16"	2 5/8"	2 11/16"	2 5/8"	2 5/8"	2 5/8"	2 5/8"
V-notch requirement	Mandatory for all eggers	Mandatory for all legal size eggers	Mandatory for all eggers above 42°30'	Mandatory for all eggers in federal waters. No v-notching in state waters.	Mandatory for all eggers	None	None
V-Notch Definition[1] (possession)	Zero Tolerance	1/8" with or w/out setal hairs[1]	1/8" with or w/out setal hairs[1]	1/8" with or w/out setal hairs[1]	1/8" with or w/out setal hairs[1]	1/8" with or w/out setal hairs[1]	State Permitted fisherman in state waters 1/4" without setal hairs Federal Permit holders 1/8" with or w/out setal hairs[1]
Max. Gauge (male & female)	5"	5 ¼"	6 3/4"	5 ¼"	5 ¼"	5 ¼"	State Waters none Federal Waters 6 3/4"
Season Closure				April 30-May 31[2]	February 1-March 31[3]	Sept 8-Nov 28[4]	February 1-April 30

[1] A v-notched lobster is defined as any female lobster that bears a notch or indentation in the base of the flipper that is at least as deep as 1/8", with or without setal hairs. It also means any female which is mutilated in a manner that could hide, obscure, or obliterate such a mark.

[2] Pots must be removed from the water by April 30 and un-baited lobster traps may be set one week prior to the season reopening.

[3] During the February 1 – March 31 closure, trap fishermen will have a two week period to remove lobster traps from the water and may set lobster traps one week prior to the end of the closed season.

[4] Two week gear removal and a 2 week grace period for gear removal at beginning of closure. No lobster traps may be baited more than 1 week prior to season reopening.

Table 5: Trap allocations, transfers, and reductions as required by Addendum XVIII for LCMA 2 and 3 fishermen. Trap reductions for MA, RI, and CT in LCMA 2 include state, federal, and dual permit holders. Number of traps retired includes traps retired due to the 10% conservation tax on trap transfers.

	Jurisdiction	# of Trap Allocated (For 2017 Fishing Year)	# of Traps Transferred	# of Traps Retired (from 2016 to 2017 Fishing Year)
LCMA 2	**MA**	33,730	2,126 (traps transferred to MA) 1,140 (traps transferred out of MA)	1,746
	RI	83,259	1,748	4,562
	CT	3,935	0	238
	NOAA (ME, NH, NY, NJ)	3,345		235
LCMA 3	**NOAA**	128,910	10,485	8,008

Table 6. 2016 sampling requirements and state implementation. All states have 100% active harvester reporting except for Maine which has 10% harvester reporting. Sufficient sea sampling can replace port sampling. *De minimis* states (denoted by *) are not required to conduct biological sampling of their lobster fishery.

State	100% Dealer Reporting	10% Harvester Reporting	Sea Sampling	Port Sampling	Ventless Trap Survey	Settlement Survey	Trawl Survey
ME	✓	✓ (10%)	✓		✓	✓	✓
NH	✓	✓	✓	✓	✓	✓	✓ (w/ ME)
MA	✓	✓	✓		✓	✓	✓
RI	✓	✓	None in 2016	✓	✓	✓	✓
CT	✓	✓	None in 2016			✓	✓
NY	✓	✓	✓	✓			✓ (w/ CT)
NJ	✓	✓	✓				✓
DE*	✓	✓	None in 2016				✓ (no lobsters encountered)
MD*	✓	✓	✓				✓
VA*	✓	✓	None in 2016				

15.0 Figures

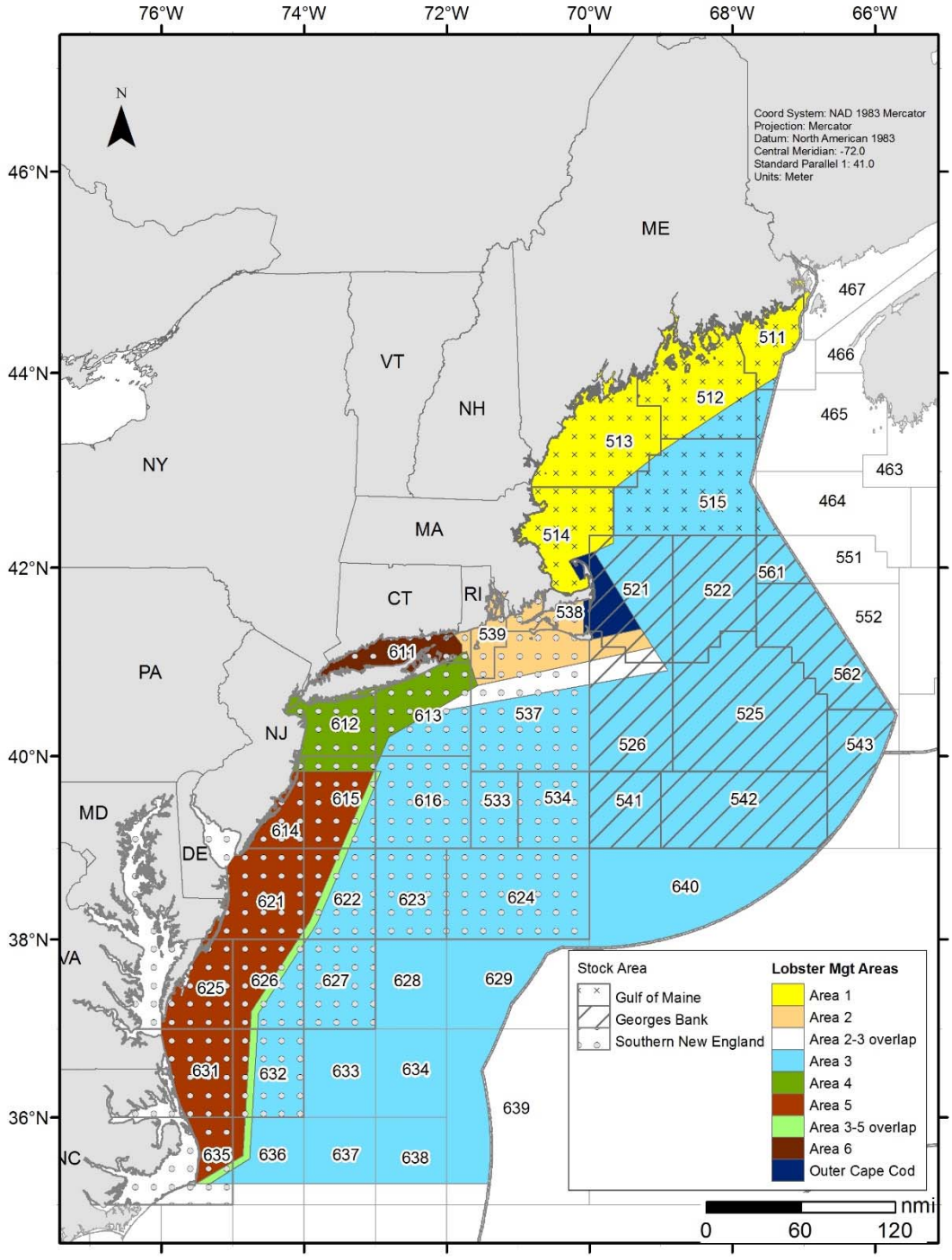

Figure 1: Lobster Conservation Management Areas (LCMAs) and stock boundaries for American lobster.

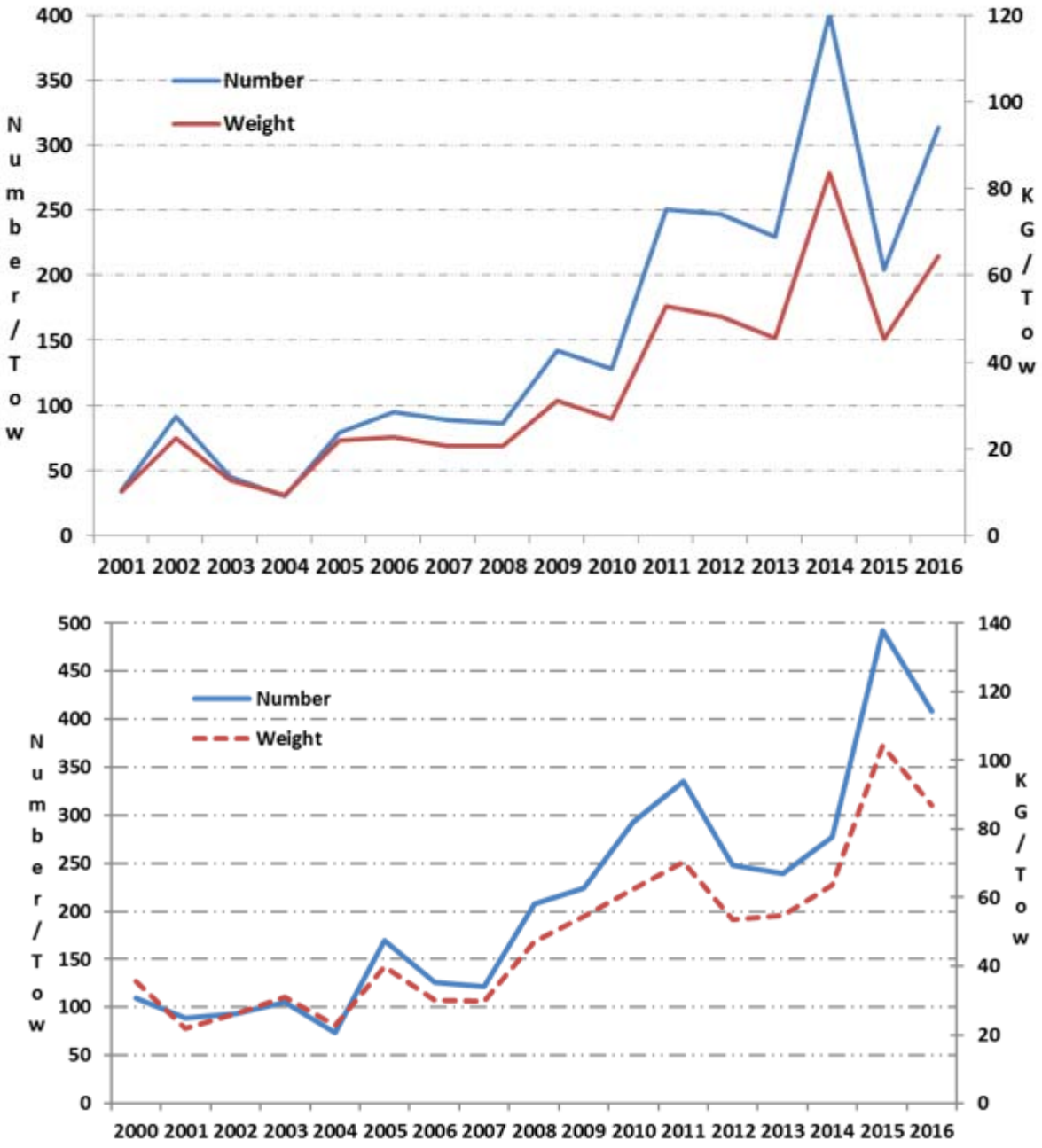

Figure 2: Maine-New Hampshire survey abundance indices for lobster, 2001-2016. Results of the spring survey are on the top and results from the fall survey are on the bottom.

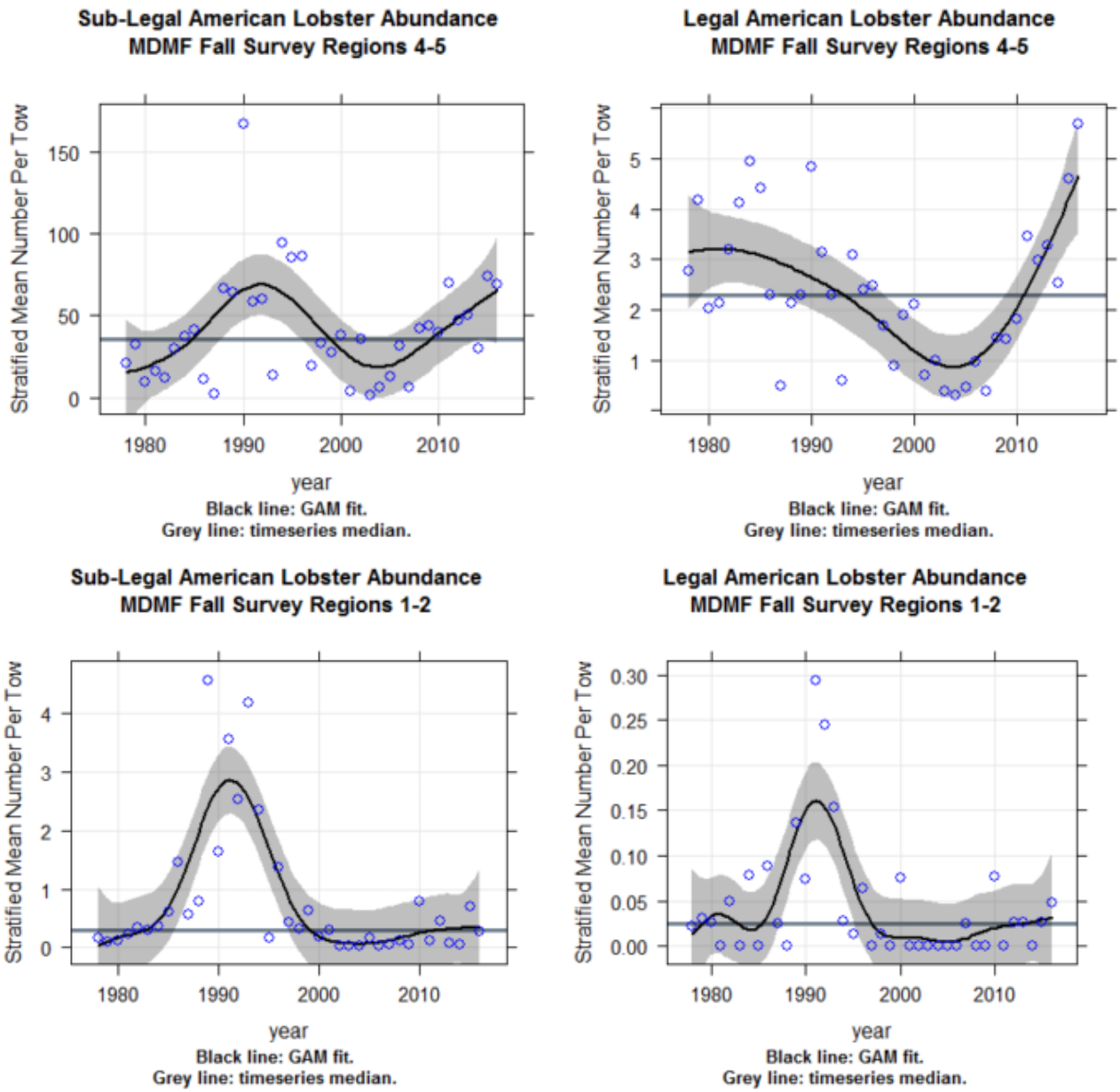

Figure 3: MADMF Fall Trawl Survey sub-legal and legal indices from 1978-2016. The top charts are from Gulf of Maine and the bottom charts are from Southern New England. For reference, Regions 4 and 5 are located off of Cape Ann and in Cape Cod Bay. Regions 1 and 2 are located along the southern portion of the Cape and Islands, as well as Buzzards Bay.

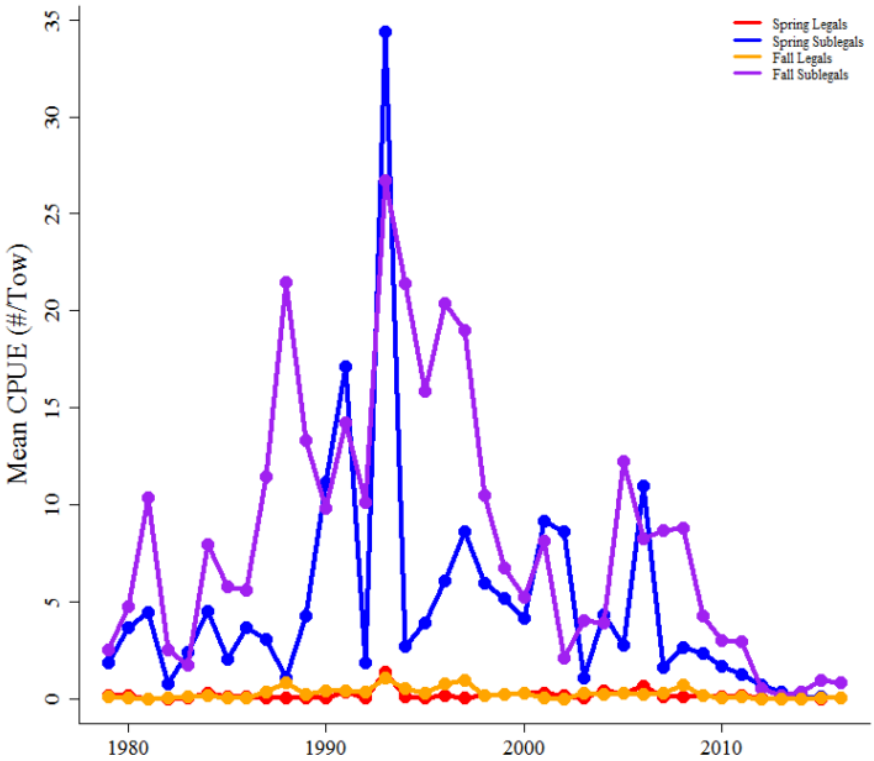

Figure 4: RIDFW Seasonal (Spring and Fall) Trawl lobster abundances. CPUE is expressed as the annual mean number per tow for sub-legal (<85.725mm CL) and legal sized (>=85.725mm CL) lobsters.

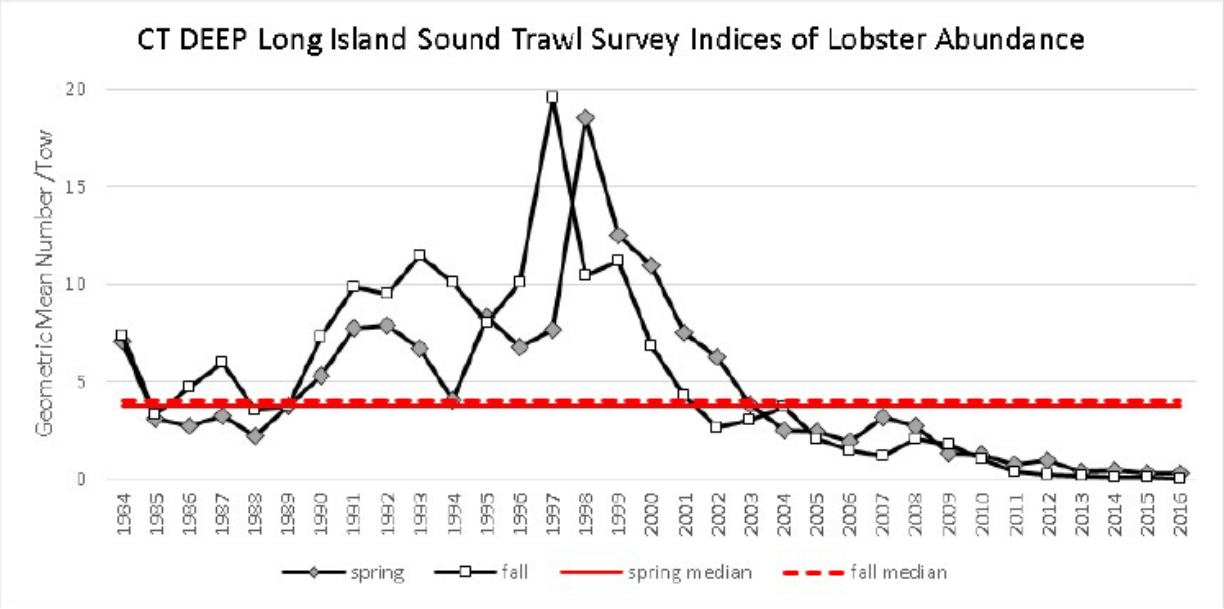

Figure 5: Results of the Long Island Sound Trawl Survey during spring (April-June) and fall (September-October) within NMFS statistical area 611.

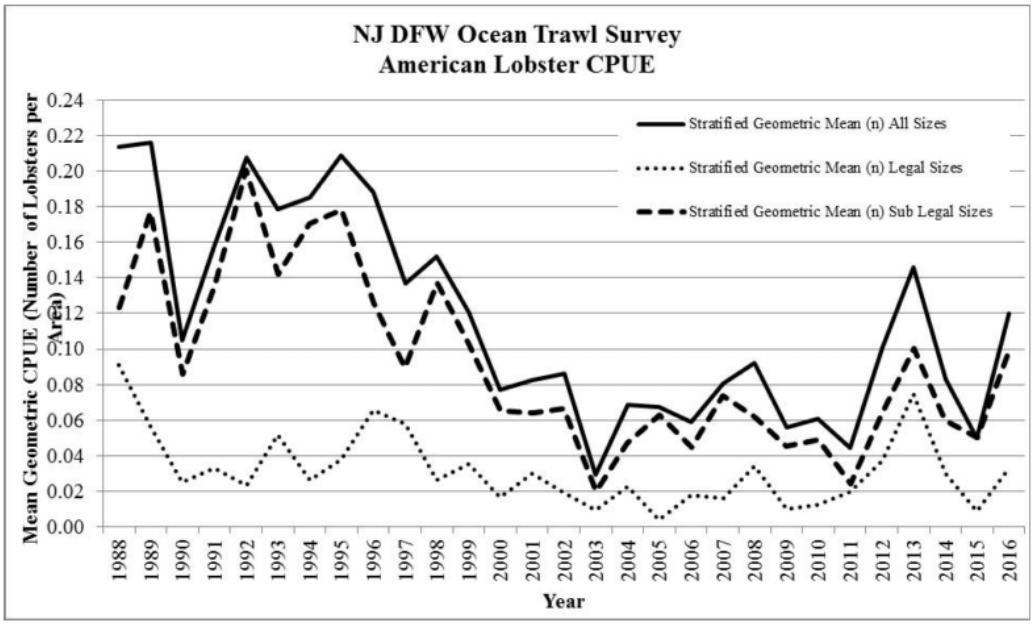

Figure 6: Stratified mean CPUE of all lobsters collected aboard the NJDFW Ocean Trawl Survey. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), offshore (60'-90'). The mean CPUE was calculated as the sum of the mean number of lobsters per size class collected in each sampling area weighted by the stratum area.

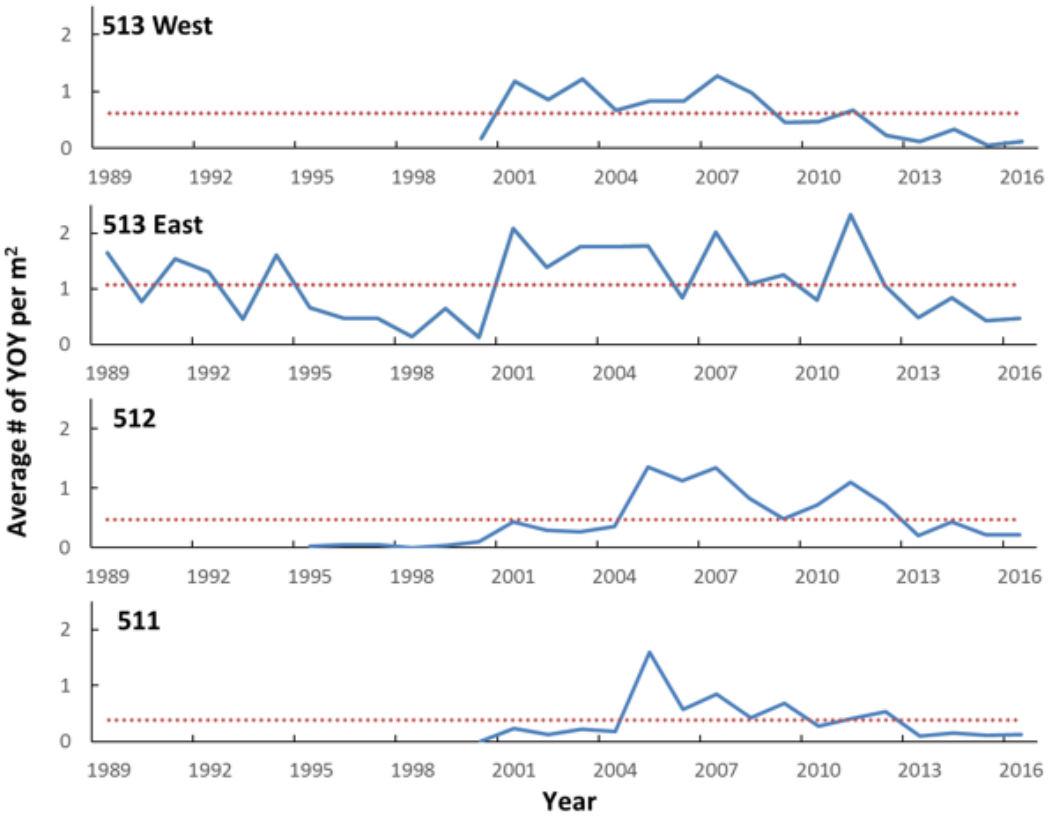

Figure 7: Settlement survey index for each statistical area in Maine (1989-2016).

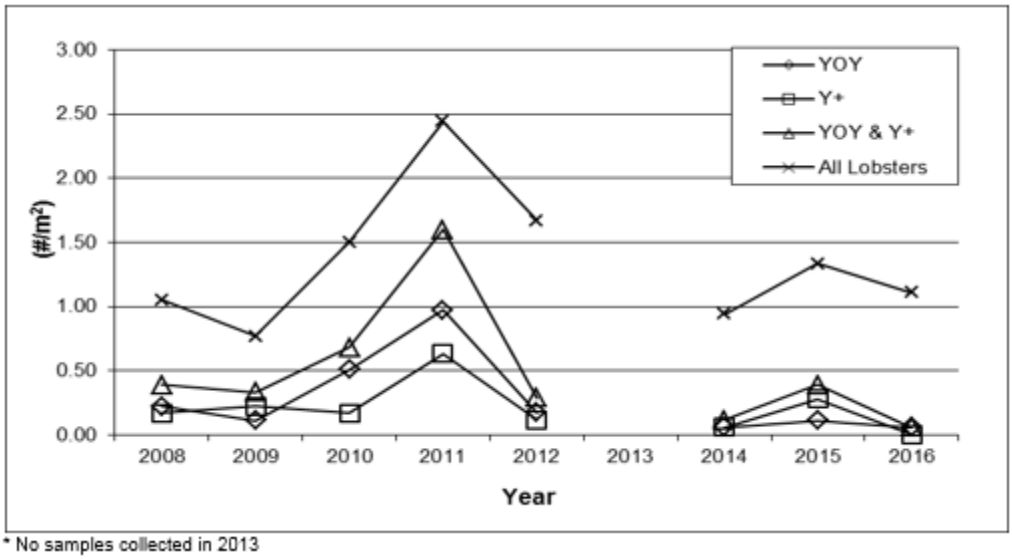

Figure 8: Catch per unit effort (#/m2) of YOY, Y+, and YOY/Y+ combined and all lobsters during the American Lobster Settlement Index, by location, in New Hampshire, from 2008 through 2016.

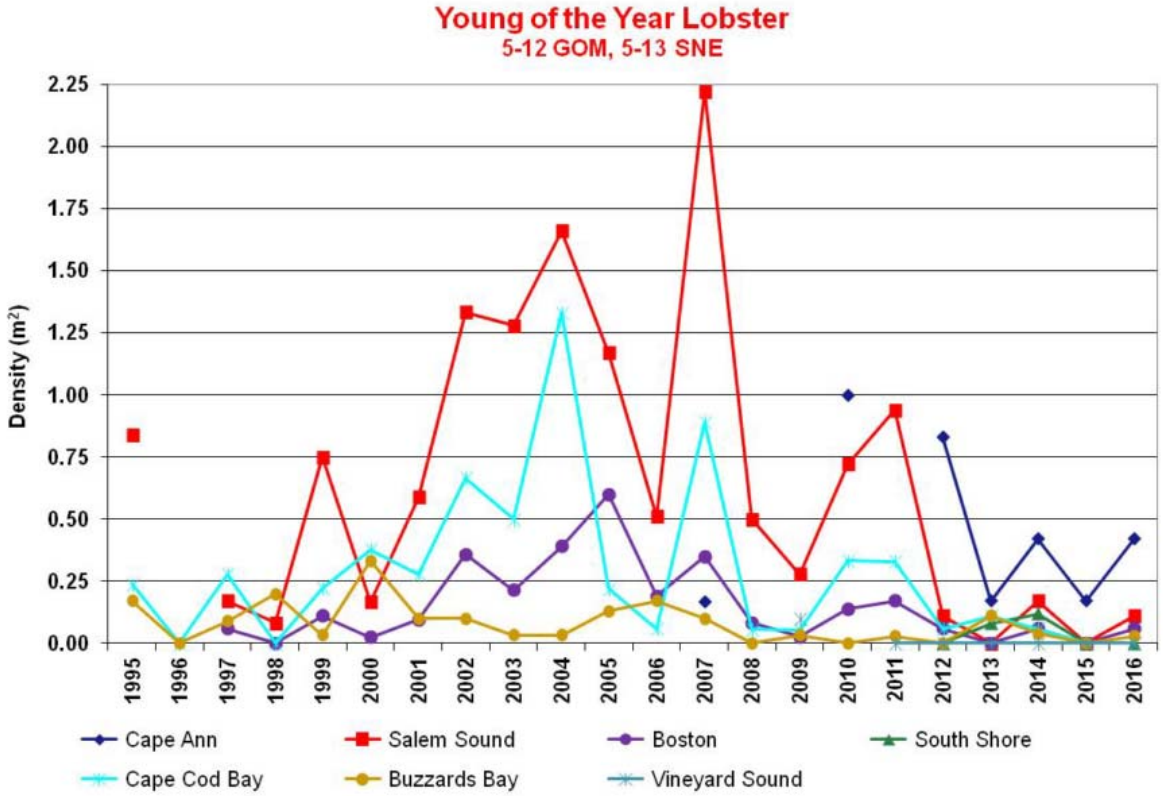

Figure 9: Young-of-year lobster density in seven Massachusetts regions; LCMA 1 – Cape Ann, Salem Sound, Boston, South Shore, Cape Cod Bay, LCMA 2 - Buzzards Bay, Vineyard Sound.

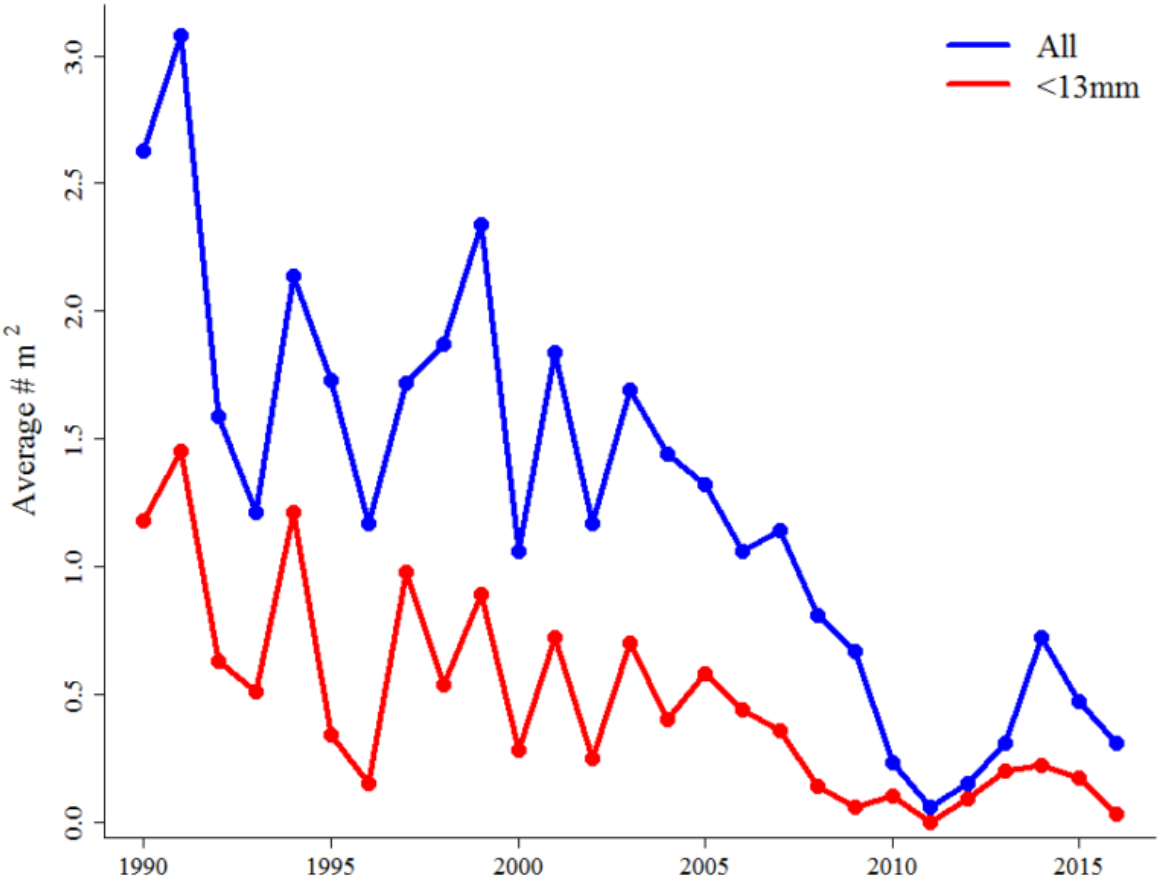

Figure 10: Average abundance of American lobster in Rhode Island suction sampling sites. Abundances are presented for lobsters less than or equal to 13mm (blue) and all lobster collected in sampling (red).

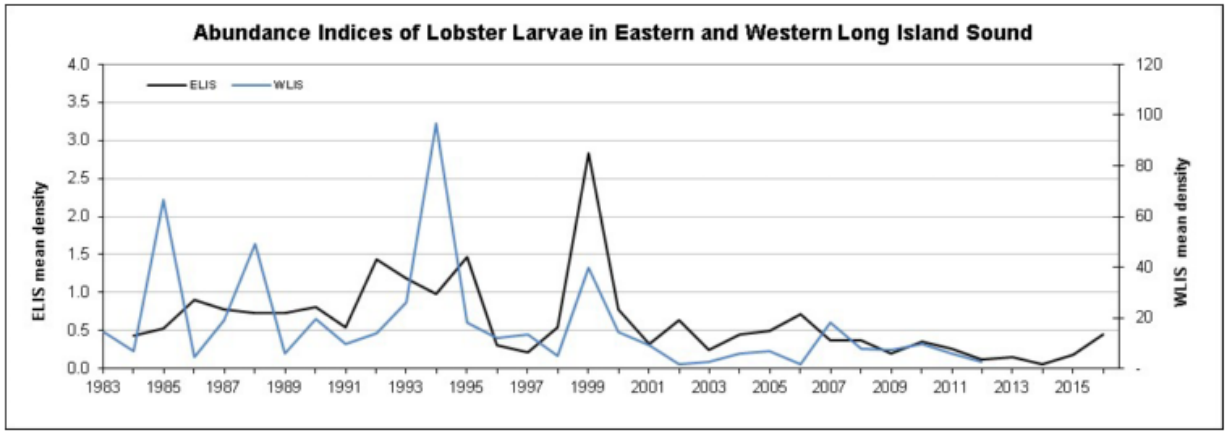

Figure 11: Abundance indices of lobster larvae from the Connecticut DEEP Larval Lobster Survey in western Long Island Sound and from the Millstone Power Station entrainment estimates in eastern Long Island Sound. The Connecticut DEEP survey was discontinued in 2013.

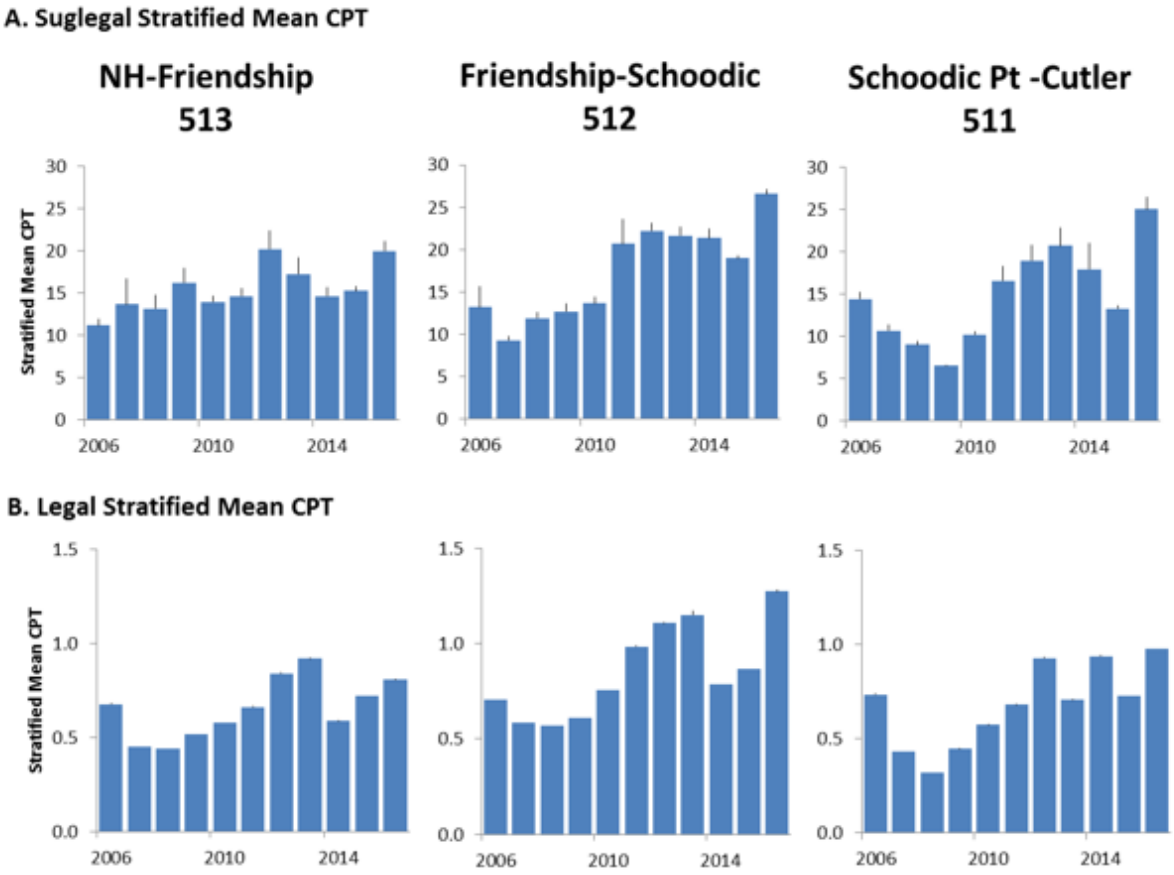

Figure 12: CPUE stratified mean for both sublegal and legal lobsters from Maine's Ventless Trap survey, 2006-2016, by statistical area. Only ventless traps were included in the analysis.

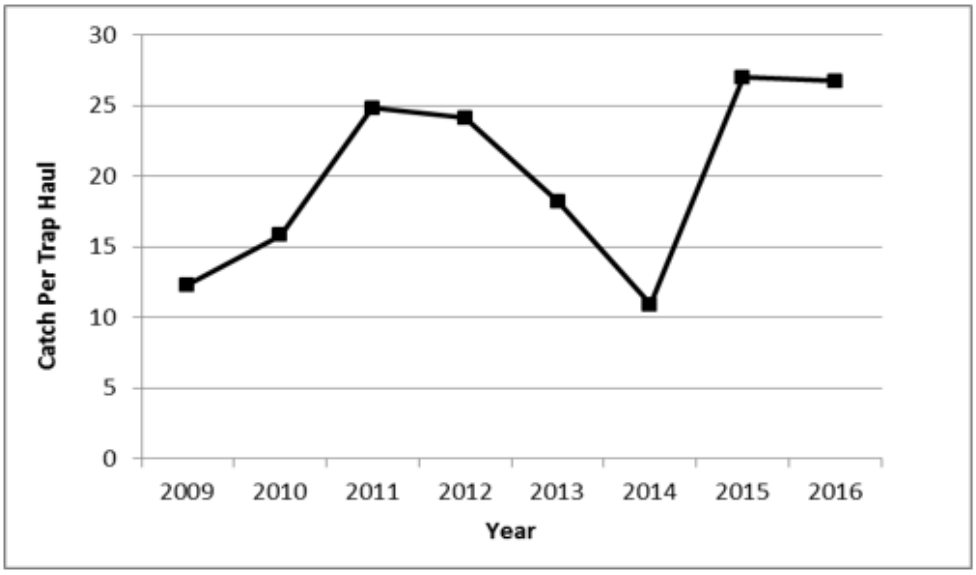

Figure 13: Stratified mean catch per trap haul, for all lobsters captured during the coast-wide random stratified Ventless Trap Survey in New Hampshire state waters from 2009 through 2016.

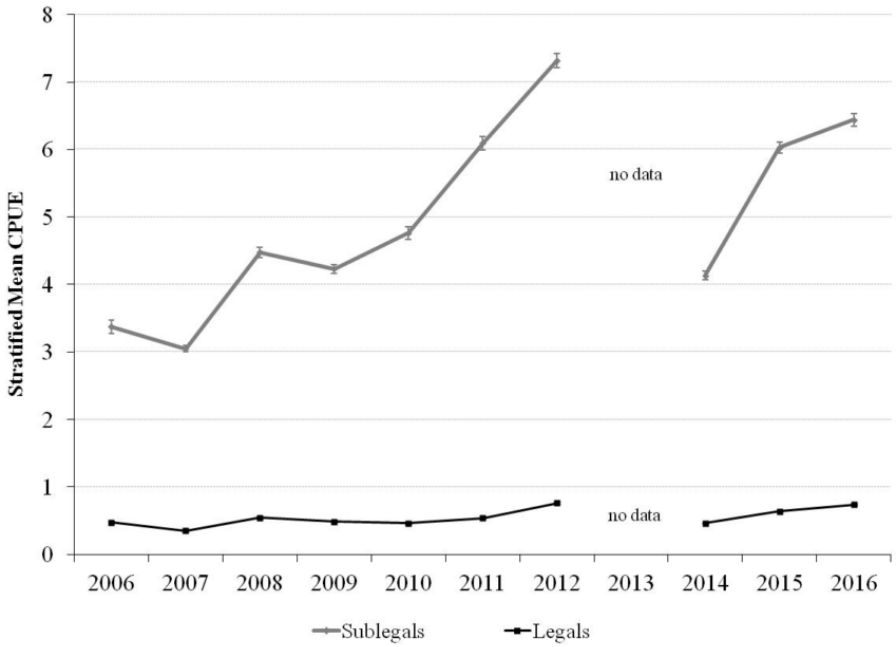

Figure 14: Stratified mean catch per trap haul (±S.E.) of sublegal (< 83 mm, grey line) and legal (≥ 83 mm, black line) lobsters in NMFS Area 514 from MADMF ventless trap survey. The figure includes lobsters from both the vented and ventless traps in the survey.

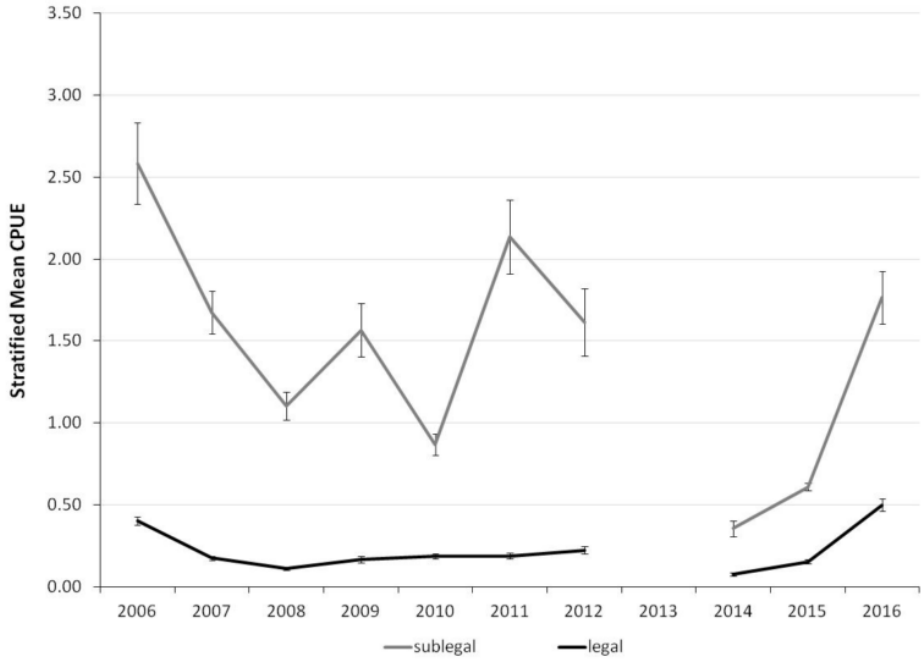

Figure 15: Stratified mean catch per trap haul (±S.E.) of sublegal (< 86 mm, grey line) and legal (≥ 86 mm, black line) lobsters in Area 538 and northern 537 (2011-2014) from MADMF ventless trap survey. The break in the time series from 2010 to 2011 and the subsequent dashed lines illustrate when the survey was expanded (starting in 2011), which should be interpreted as a new time series relative to the 2006-2010 time period. The figure includes lobsters from both the vented and ventless traps in the survey.

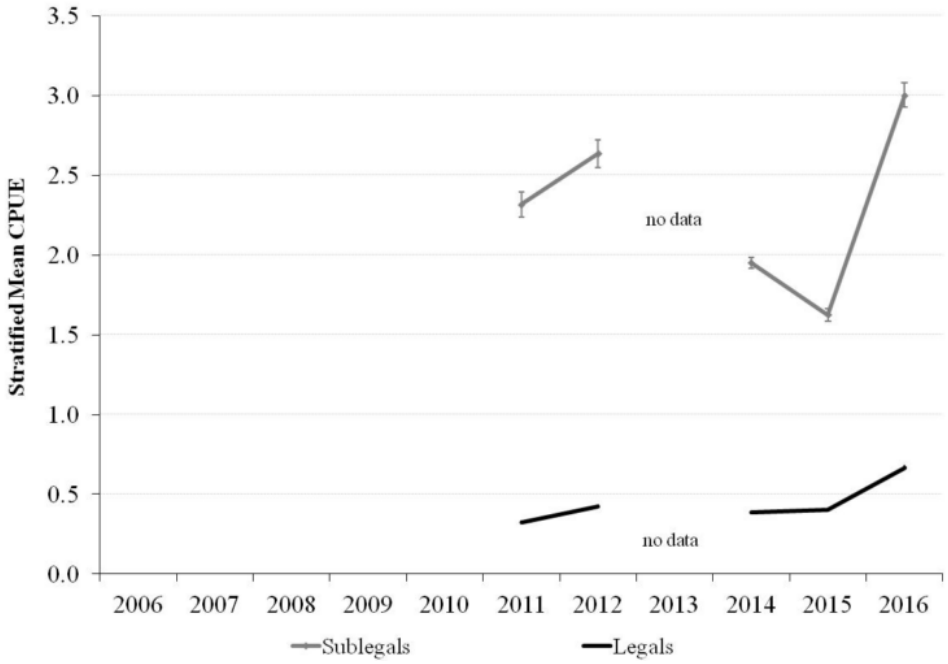

Figure 16: Stratified mean catch per trap haul (+/- S. E) of sublegal (<86 mm, grey line) and legal (>=86 mm, black line) lobsters in the expanded MA SNE survey area, which includes NMFS Area 538 and the northern portion of Area 537. The figure includes lobsters from both the vented and ventless traps in the survey.

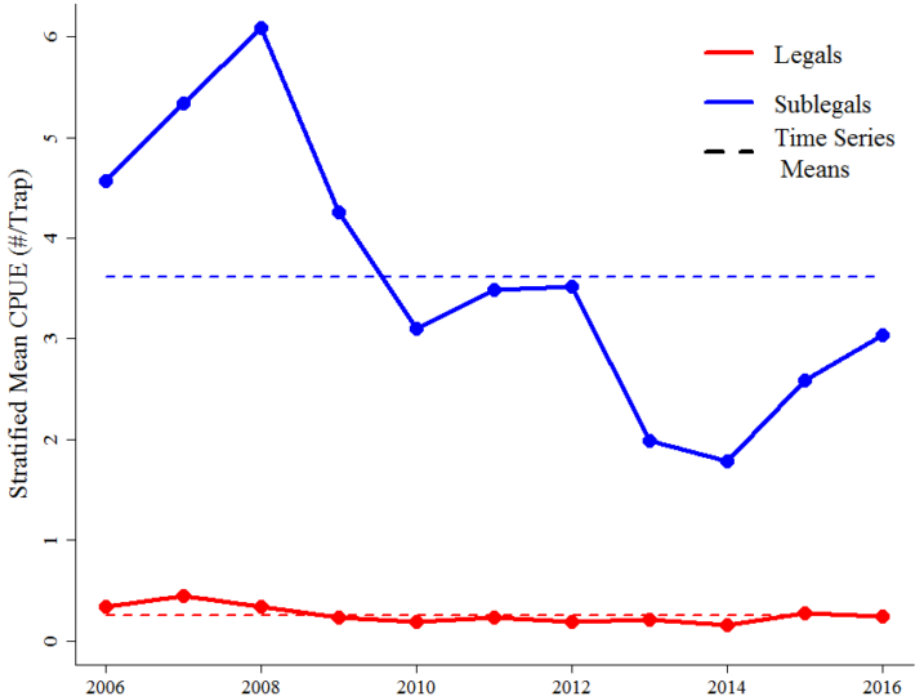

Figure 17: Stratified mean catch (#) per trap-haul for sublegal (<85.725 mm CL) and legal-sized (>=85.725mm CL) lobsters from RIDEM ventless trap survey. The figure includes lobsters from both the vented and ventless traps in the survey.

American Lobster and Jonah Crab

Activity level: High

Committee Overlap Score: Low

Committee Task List

- TC – February 1: Complete task evaluating conservation benefits of changes to the minimum and maximum gauge size for Addendum XXVII
- 2020 Benchmark stock assessment
    - TC ≈ March: Data Deadline
    - TC & SAS ≈ May: Data Workshop
- TC – August 1: Annual compliance reports for both American lobster and Jonah crab due

TC Members:

American Lobster: Kathleen Reardon (ME, TC Chair), Joshua Carloni (NH), Peter Clarke (NJ), Colleen Giannini (CT), Jeff Kipp (ASMFC), Kim McKown (NY), Conor McManus (RI), Tracy Pugh (MA), Burton Shank (NOAA), Megan Ware (ASMFC), Angel Willey (MD)

Jonah Crab: Derek Perry (MA, TC Chair), Joshua Carloni (NH), Peter Clarke (NJ), Jeff Kipp (ASMFC), Conor McManus (RI), Allison Murphy (NOAA), Kathleen Reardon (ME), Burton Shank (NOAA), Jeffrey Shields (VA), Megan Ware (ASMFC), Craig Weedon (MD)

SAS Members:

American Lobster: Kim McKown (NY, SAS Chair), Joshua Carloni (NH), Larry Jacobson (NOAA), Jeff Kipp (ASMFC), Conor McManus (RI), Tracy Pugh (MA), Kathleen Reardon (ME), Burton Shank (NOAA), Megan Ware (ASMFC)

Jonah Crab: None