

Characterization of the offshore American lobster and Jonah crab trap fishery in Lobster Conservation Management Area 3 in and around the Southern New England and Georges Bank canyons

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Background

The Atlantic States Marine Fisheries (ASMFC) initiated a mail survey to collect information on the extent and value of the offshore American lobster and Jonah crab trap fishery occurring in and around the deep-water canyons in Southern New England (Lobster Conservation Management Area (LCMA) 3). The purpose of this survey was to characterize the canyon fishery, as current lobster and Jonah crab trip reports include data only to the broad level of NMFS statistical reporting area. Information on the distribution of effort, fishing patterns, and value of harvest in and around the canyons was requested by the New England Fishery Management Council (NEFMC) as they draft an Omnibus Deep-Sea Coral Amendment to modify several Fishery Management Plans. The Amendment may establish discrete deep-sea coral protective zones, as well as broad deep-sea coral regions along the edge of the continental shelf from the Alvin canyon to the Exclusive Economic Zone (i.e. Hague Line). A region identified as the ‘NEFMC Area of Interest’ encompasses 21 Southern New England/Georges Bank canyons (Figure 2). The NEFMC is expected to debate potential gear restrictions within the Area of Interest. As such, the comprehensive data collected through this survey provided an important context on the American lobster and Jonah crab trap fisheries occurring in this unique region of LCMA 3.

Methods

On February 23, 2016, a cover letter and survey (Appendix A) and self-addressed postage-paid return envelope were mailed to all 97 of the 2015 commercial lobster permit holders with a trap allocation in LCMA 3. Two reminder letters were sent in the weeks following the survey to encourage additional participation. The final response deadline was June 15, 2016. In general, the mail survey inquired about fishing locations, effort, and value of American lobster and Jonah crab landings within the NEFMC Area of Interest from 2014 to 2015. Fishermen were asked to specify the canyons, depths, and seasons they fished and how their effort and revenue were allocated across those variables. Nautical charts that identified the proposed NEFMC Area of Interest and the discrete canyons within it were included with the survey for clarification. Optional demographic data were collected at the end of the survey including vessel name, permit, and homeport, as well as comments about the survey or topic. The survey indicated that all confidential data would be protected and an individual's data would not be shared. Survey responses were categorized, summarized, and reported below. Most results are provided as the percentage of responses relevant to the statement being made "(X%)" out of the total number of survey responses obtained for that particular question "(n=X)".

Results

Survey Response

A total of 34 of the 97 surveys were returned within five weeks of the original mailing date, for an overall response rate of 35%. One additional survey was received during the reminder period; however it was not included in the analysis because data for that vessel had already been received in a previous survey.

Of the 34 completed surveys, 19 (56%) were applicable, meaning that individuals fished traps within the NEFMC Area of Interest in 2014-2015. Forty-four percent of returned surveys were either for vessels that did not fish in LCMA 3 (n=2), did not fish near the LCMA 3 canyons (n=11), or did not fish with traps (n=2) (Figure 1). Of the total potentially applicable survey pool, the response rate for those fishing traps within the Area of Interest was 23% (19 of 82).

Response rates were also categorized by trap allocation and by state on permit. This was possible because identifying information was provided by respondents for all but one (97%) of the 34 surveys. Of the 97 total permit holders, 56 had trap allocations exclusively in LCMA 3 (Figure 1). Excluding the anonymous survey, 43% of these individuals responded to the survey and 17 provided applicable surveys meaning that they fished traps within the NEFMC Area of Interest in 2014-2015. The other 29% (7) of individuals with an allocation only in LCMA 3 reported that they did not fish in the vicinity of the canyons in 2014-2015.

Forty-one of the 97 permit holders had allocations in more than one LCMA (LCMA 3 *and* LCMA 1, 2, 4, and/or 5) (Figure 1). Excluding the anonymous survey, 22% of those with mixed-area allocations responded to the survey, and only one survey was applicable. Eight were not applicable because four individuals did not fish in the vicinity of the canyons, two did not fish in LCMA 3, and two did not fish with traps (Figure 1).

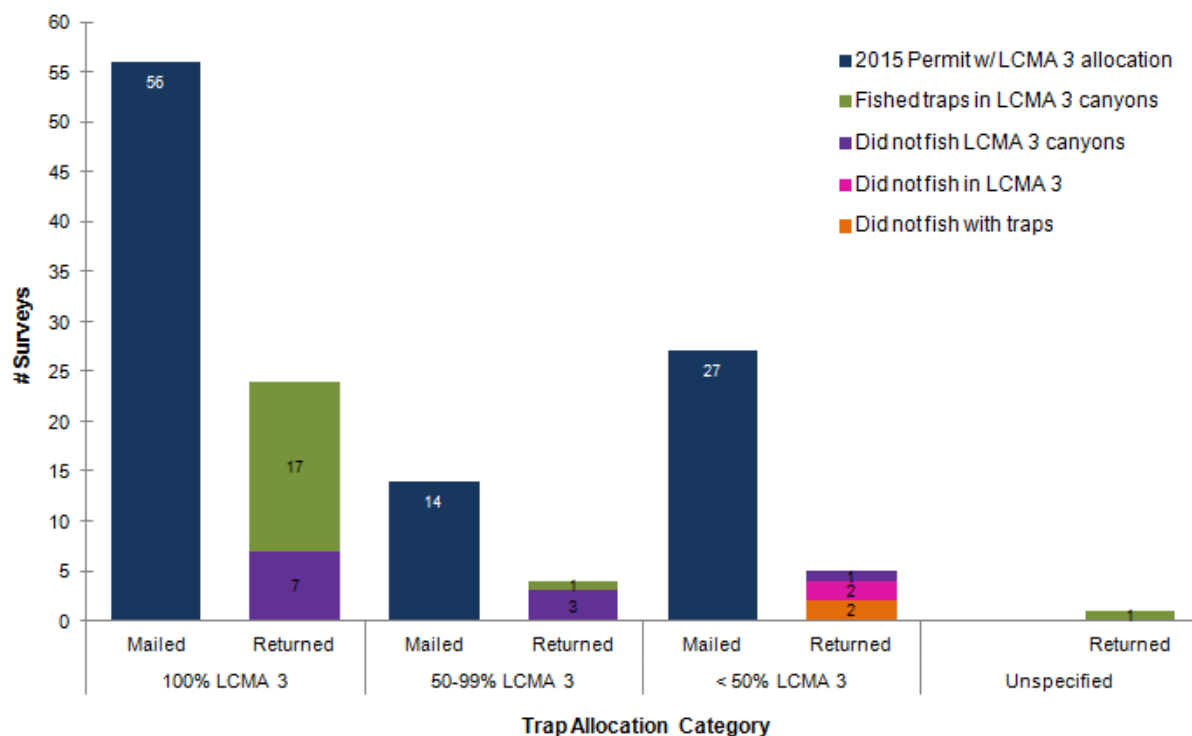


Figure 1. Number of surveys mailed to 2015 commercial lobster permit holders with LCMA 3 trap allocations and the number of surveys returned, categorized by each individual's trap allocation (%) in LCMA 3 (of their total allocation among LCMA 1 to 5).

Response rates were favorable across states (by permit) (Table 1). The 19 total respondents that fished traps within the NEFMC Area of Interest for lobster and/or Jonah crab in 2014-2015 hailed from the states of Massachusetts, New Hampshire, or Rhode Island (Table 1). Each of these respondents provided detailed information on fishing practices and revenue generated from within the LCMA 3 canyons region.

Table 1. Survey response rates by state (from 2015 commercial lobster permit).

| State | Surveys Mailed | Surveys Returned | Response Rate | Applicable Surveys |
|--------------|----------------|------------------|---------------|--------------------|
| ME | 8 | 2 | 25% | 0 |
| NH | 12 | 4 | 33% | 1 |
| MA | 36 | 11 | 31% | 10 |
| RI | 28 | 14 | 50% | 8 |
| CT | 1 | 0 | 0% | 0 |
| NY | 4 | 1 | 25% | 0 |
| NJ | 8 | 2 | 25% | 0 |
| Total | 97 | 34 | 35% | 19 |

Nearly all (95%) of those fishing within the Area of Interest indicated that they report trips and catches using the NMFS Fishing Vessel Trip Reports (VTR) (n=19). At the time of the survey, 79% of individuals fishing the Area of Interest were aware that the NEFMC was considering the development of an Amendment to several Fishery Management Plans to protect deep sea corals in the region.

Locations Fished

All six of the NMFS statistical reporting areas (SRA) that span the NEFMC Area of Interest, including SRA 525, 526, 534, 537, 541, and 562, were reported fished in 2014-2015 by survey respondents (Figure 2). A majority of fishermen (74%, n=19) fished in SRA 525, which encompassed the highest number of canyons (12 of 21 canyons), and SRA 526 (63%, n=19), which encompassed Veatch Canyon, the canyon fished by most respondents (see text below, and Figure 2). Fewer fishermen (16%) reported fishing in SRAs 534 and 541, the only statistical areas that do not overlap entire canyons (or canyon heads) (Figure 2). Fishermen often fished in more than one statistical area *per trip*; 68% reported this at least once in 2014-2015 (n=19). Additionally, differences in statistical areas fished by home port were noted. Vessels from

Massachusetts fished in all six statistical areas within the NEFMC Area of Interest, while those from Rhode Island fished in three (SRAs 525, 526 and 537), and New Hampshire in two (SRAs 525 and 526) (Figure 3).

All but two of the 21 canyons located within the NEFMC Area of Interest were fished in 2014-2015 by respondents (Figure 2 and Figure 4). Individual fishermen set traps in anywhere from two to ten discrete canyons (average 4.4 ± 0.5 SE canyons) in 2014-2015. Veatch canyon was fished by the most (42%) respondents, followed by Hydrographer (37%), Atlantis (32%), Alvin, Gilbert, Lydonia, Oceanographer (each 26%), and Clipper, Dogbody, Heel Tapper, Munson, Nygren, Powell, and Welker (each 21%). Fewer reported fishing Heezen, Nantucket, Shallop, Sharpshooter, and Unnamed canyons (each 16%) (Figure 2 and Figure 4). Chebacco and Filebottom canyons were the only canyons not fished by those who responded (Figure 2 and Figure 4). Most canyons were fished by several fishermen regardless of vessel origin. The only evident regional difference was that Rhode Island fishermen were less likely to transit to the canyons furthest east (Nygren, Unnamed, and Heezen) (Figure 4).

All fishermen reported fishing between canyons as well in and around them (n=19). A majority (84%) reported that they most often set traps both at the heads of canyons and between canyons, while the remaining 16% were split evenly as to whether they most often fish at the heads of the canyons, between canyons, or neither (i.e. set on a loran line).

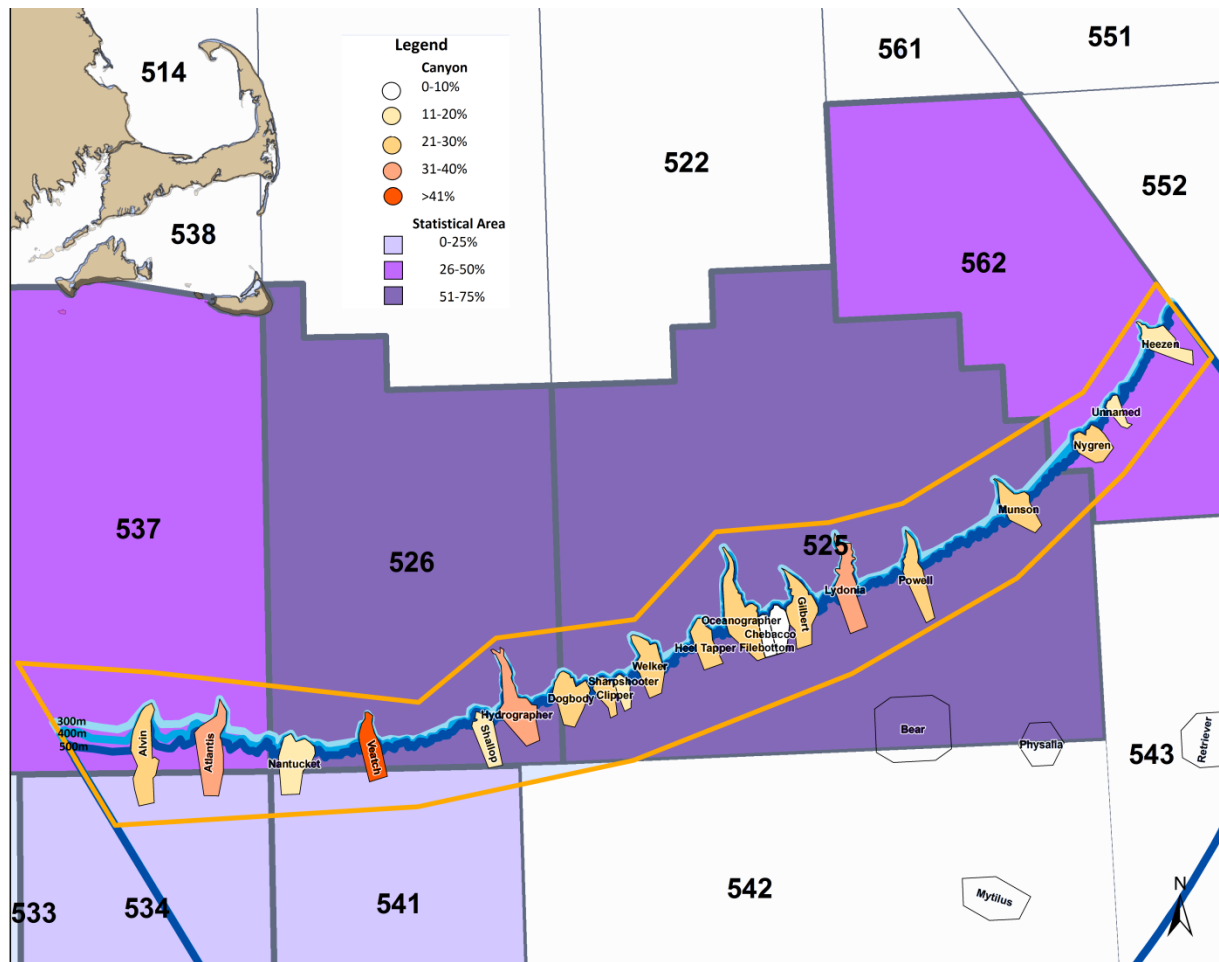


Figure 2. Comparative fishing effort by canyon and by NMFS statistical reporting area within the NEFMC Area of Interest (orange line) as the percentage of respondents citing the canyon(s) or statistical area(s) fished for lobster and/or Jonah crab in 2014-2015. For canyons, the darker the color orange, the more frequently the canyon was named. For statistical area, the darker the color purple, the more frequently the statistical area was named. Depth contours at 200 m, 400 m, and 500 m within the NEFMC Area of Interest are indicated in shades of blue.

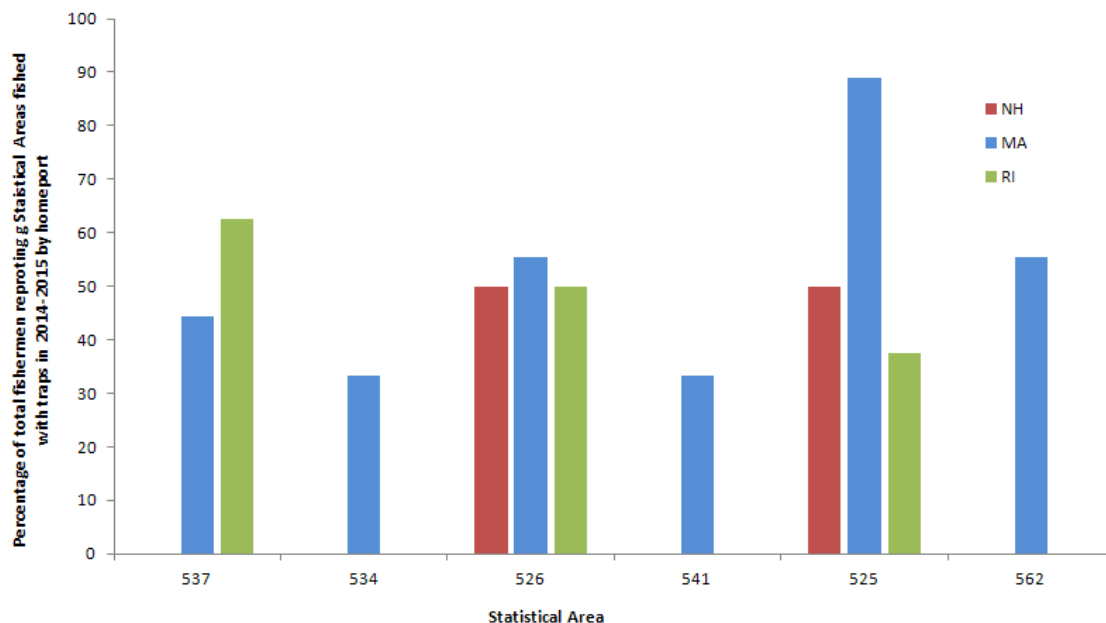


Figure 3. Percentage of fishermen reporting NMFS statistical area fished (within the NEFMC Area of Interest) in 2014-2015 by state/homeport. Statistical areas are listed in west to east orientation (L-R).

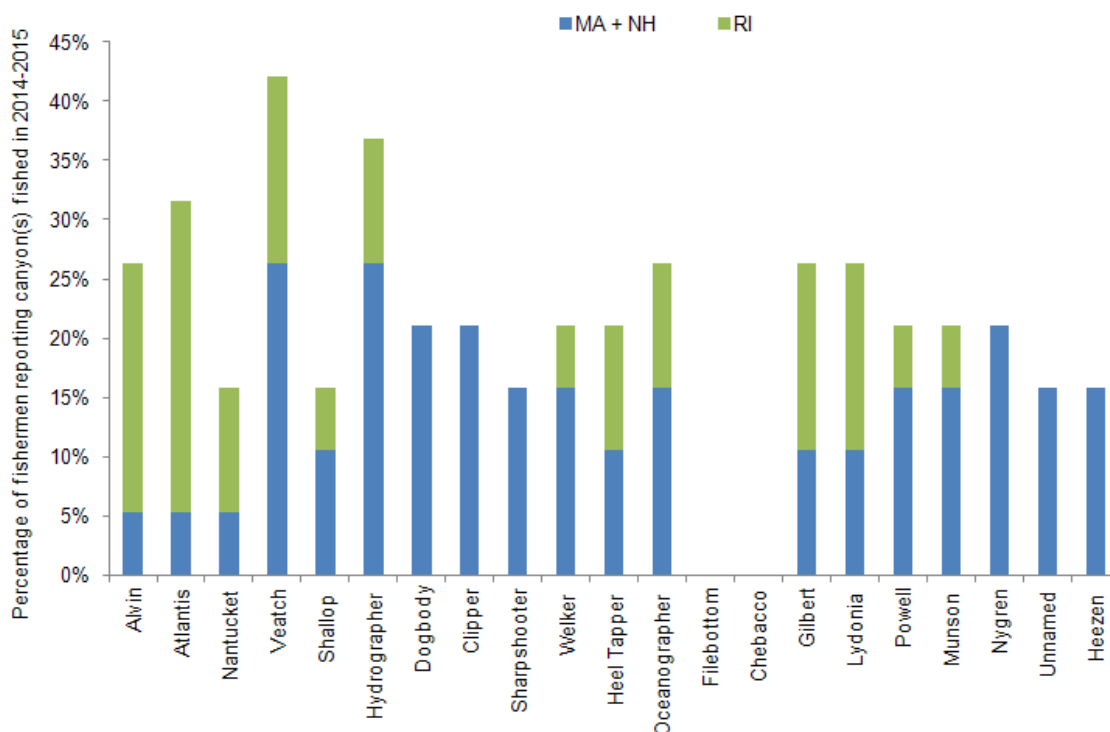


Figure 4. Percentage of fishermen reporting individual canyon(s) fished (within the NEFMC Area of Interest) in 2014-2015 by state/homeport. Massachusetts and New Hampshire fishermen were combined to preserve confidentiality (NH <3 respondents). Canyons are listed in west to east orientation (L-R).

Depth Fished

All canyon fishermen reported the maximum depth at which they fished traps (for lobster and/or Jonah crab) in 2014-2015. This was an open-ended response and consistently reported in fathoms, which were then converted to meters. Maximum depth fished per fisherman ranged from 220 to 549 meters (120 to 300 fathoms), with an average of 406 meters \pm 22 SE (222 fathoms). Cumulatively, 100% of fishermen set their deepest traps in water 200+ meters deep, 76% in 300+ meters, and 48% 400+ meters of water (n=19) (Table 2). Of the 48% of fishermen with traps set in over 400 meters of water, 14% of them set traps deeper than 500 meters.

Nearly half of (47%) respondents fished traps in deepest waters across two or more seasons, with all seasons represented (n=19). Winter (January to March) was the season most commonly named for deep trap sets (74% of responses), followed by spring (April to June; 42%), and fall (September to December; 32%). Traps were least likely to be set in the deepest waters during the summer (July to August) (named in 11% of responses).

Fishermen also indicated how their trap distribution varied by depth within the NEFMC Area of Interest. On average, 96% of an individual's traps were fished in 0 to 400 meters (0 to 219 fathoms) (Table 2 and Figure 5). Of the five depth categories provided, the most traps (35%) were allocated to 200-300 meters (109-164 fathoms). Only 4% of an individual's traps were set deeper than 400 meters (Table 2). Although fewer traps were apportioned to this deepest stratum, over a quarter (27%) of fishermen reported fishing traps over 400 meters depth (Table 2), thus the overall total traps fished in this stratum may be considerable (n=15).

Fishermen reported variable fishing patterns when asked to explain (open-ended response) their trawl configurations by depth during a single trip, e.g. whether they fished a consistent depth along the shelf or if depth fished varied across canyons. A majority of fishermen (42%) described setting traps at both consistent and varied depths along the shelf and across canyons within a trip (n=19). Patterns were often broadly illustrated and changed with areas fished but area was not well specified. Several fishermen (21%) indicated that fishing patterns changed seasonally, and as a result were unable to specify practices made during a single trip. Another 26% of fishermen reported fishing a range of depths, but did not indicate within canyons or along the shelf. A small percentage (11%) reported fishing on specific depth contours, or on a

specific loran line across many depths (5%). As reported earlier, a majority of fishermen set traps both in and between canyons. Several comments indicated that individuals fish in proximity to each other, and that they maintain organization of trap sets in and around the canyons by working with each other's fishing patterns.

Table 2. Distribution of fishing effort and revenue in the NEFMC Area of Interest in 2014-2015 by depth category.

| Depth category (meters) | Max. depth fished by % fishermen | Ave. % traps allocated by depth | % Fishermen fishing at depth | Ave % revenue by depth | % Fishermen with revenue at depth |
|-------------------------|----------------------------------|---------------------------------|------------------------------|------------------------|-----------------------------------|
| <100 | 0 | 17 | 47 | 23 | 67 |
| 100-200 | 0 | 21 | 87 | 33 | 87 |
| 200-300 | 26 | 35 | 93 | 23 | 67 |
| 300-400 | 32 | 23 | 73 | 18 | 53 |
| >400 | 42 | 4 | 27 | 3 | 13 |
| n Respondents | 19 | 15 | 15 | 15 | 15 |

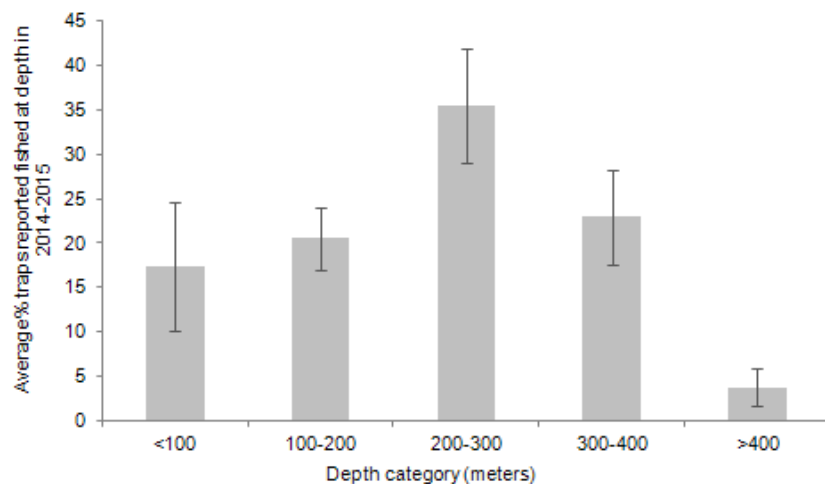


Figure 5. Average percentage of total traps fished per depth category per fisherman, within the Area of Interest in 2014-2015 (n = 15).

Effort

The average annual number of trips made by each fisherman to the NEFMC Area of Interest in 2014-2015 was $30 \pm \text{SE } 1.3$ (2014-2015 median = 29, n=19) with a fairly wide range of trips per year, from 15 to 49 (Table 3). Total number of trips to the Area of Interest in 2014-2015 for the 19 vessels was 1,124 (570 in 2014 and 554 in 2015).

Most (89%) fishermen reported that individual traps tended to be set more than once within a single trip, while two (11%) indicated traps were not re-hauled within trips (n=18). In 2014-2015, the average number of trap-hauls *per trip*, including re-hauls, was $1,779 \pm \text{SE } 106$ (median 1,614; range of 1,100 to 2,600 trap-hauls, n=18) which did not differ by homeport state (unpaired t-test $p = 0.26$) (Table 3). Note, that because of confidentiality concerns with less than three respondents, a comparison of the average trap-hauls per trip (or year) for those who do reset versus those who do not reset was not made. The *annual* average number of trap-hauls per vessel was roughly 53,000 in 2014 and 2015, with a total of over 950,000 trap-hauls per year for the 18 vessels combined (Table 3).

Most (74%) fishermen stated that there was no seasonal difference as to when they had the highest number of traps in the water in the NEFMC Area of Interest (n=19). Of the 26% whose trap totals varied by season, most reported setting the highest number of traps across several seasons. Trap totals were commonly higher in summer (July to September), followed by fall (October to December), and spring (January to March). No one reported having the highest number of traps in the water in winter (January to March), which is also when traps were reported to be set deepest.

These patterns of fishing effort are expected to persist, as the majority (74%) of fishermen did not expect their fishing effort in the NEFMC Area of Interest to change substantially over the next five years (n=19). Of the minority, 21% expected their fishing effort to increase substantially, and 5% expected it to decrease over the next five years.

Revenue

There was a high dependence on the NEFMC Area of Interest for revenue for all who fished within the Area. In 2014, $77\% \pm 5 \text{ SE}$ (median = 82%, range 35-100%) of an individual's lobster and Jonah crab revenue came from the Area of Interest, and in 2015 that figure increased to $79\% \pm 5 \text{ SE}$ (median = 85%, range 37-100%, n=18) (Table 3). The average combined revenue *per trip* from lobster and Jonah crab harvest within the NEFMC Area of Interest in 2014-2015 was \$32,514 (median \$31,841, n=19) with a range of \$9,000 to \$85,000 reported per trip per fisherman (Table 3). There was an overall 8%, or \$2,595, increase in combined revenue per trip from years 2014 to 2015 (Table 3).

Revenues for 2014-2015 were described as typical (63%) or higher than normal (16%) for the majority of fishermen (n=19). Several (21%) stated they did not have a characteristic earning with which to compare. No one reported that revenues in 2014-2015 were below normal. Accordingly, revenues generated from lobster and Jonah crab catches in and around the canyons over the past five years have steadily increased (37%) or remained constant (32%) for most. Others noted that combined revenue changed without pattern (26%) over that time frame, or for one, steadily decreased (5%) (n=19).

When breaking down earnings within the NEFMC Area of Interest by fishery, 88% of fishermen reported higher revenue from lobster than from Jonah crab (n=17). For these individuals, the value of lobster was on average six (in 2014) to eight (in 2015) times higher than for Jonah crab. For the two vessels (12%) reporting higher Jonah crab revenue than lobster, Jonah crab value was about three times that of lobster in 2014 and 2015 (figures not disclosed, <3 respondents). The average *annual* revenue from **lobster** fishing in the NEFMC Area of Interest in 2014-2015 was \$717,284 \pm SE \$106,491 (median \$665,400, range \$75,000 to \$1.8 million, n=17). Annual earnings from lobster increased by an average of 10% or \$66,370 from 2014 to 2015 (Table 3). Total lobster revenue from the NEFMC Area of Interest for the fourteen individuals who responded was \$11.6 million in 2014 and \$12.8 million in 2015 (Table 3).

The average *annual* revenue from **Jonah crab** fishing in the NEFMC Area of Interest in 2014-2015 was \$182,784 \pm SE \$55,868 (median \$97,000, range \$0 to \$825,000, n=17). Earnings from Jonah crab were highly variable among respondents but similar from year to year within respondents. Total average annual revenue from Jonah crab decreased by 15% or \$28,360 from 2014 to 2015 (Table 3). Total Jonah crab revenue from the NEFMC Area of Interest for the 17 individuals who responded was \$3.3 million in 2014 and \$2.9 million in 2015 (Table 3).

Table 3. Effort and revenue statistics for lobster and Jonah crab fishing within the NEFMC Area of Interest in 2014 and 2015, reported by fishermen.

| | Ave. trap-hauls per Trip (incl. re-hauls) | Total Number Trips to Area | | Total trap-hauls per Year | | % Revenue from Area of Interest | | Per Trip Revenue (USD) | | Annual Revenue (USD) Lobster | | Annual Revenue (USD) Jonah Crab | |
|------------------|---|----------------------------|------|---------------------------|---------|---------------------------------|------|------------------------|-----------|------------------------------|--------------|---------------------------------|--------------|
| | 2014-2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| Average | 1,779 | 30 | 29 | 53,668 | 52,853 | 77 | 79 | \$ 31,251 | \$ 33,846 | \$ 684,099 | \$ 750,469 | \$ 195,964 | \$ 167,605 |
| SE | 106 | 2.0 | 1.8 | 4,143 | 3,850 | 5.1 | 4.9 | \$ 3,549 | \$ 4,121 | \$ 99,733 | \$ 115,348 | \$ 63,418 | \$ 52,541 |
| Median | 1,614 | 28 | 30 | 53,125 | 51,911 | 82 | 85 | \$ 31,841 | \$ 31,650 | \$ 628,289 | \$ 734,468 | \$ 100,000 | \$ 94,830 |
| Min | 1,100 | 20 | 15 | 26,580 | 26,580 | 35 | 37 | \$ 10,000 | \$ 9,000 | \$ 120,000 | \$ 75,000 | \$ - | \$ - |
| Max | 2,600 | 49 | 45 | 82,500 | 85,800 | 100 | 100 | \$ 75,000 | \$ 85,000 | \$ 1,500,000 | \$ 1,800,000 | \$ 825,000 | \$ 650,000 |
| # of Respondents | 18 | 19 | 19 | 18 | 18 | 18 | 18 | 19 | 18 | 17 | 17 | 17 | 17 |
| Sum of Reported | | 570 | 554 | 966,023 | 951,353 | | | | | \$11,629,691 | \$12,757,974 | \$ 3,328,664 | \$ 2,845,774 |

Fishermen also identified how revenue from lobster and Jonah crab varied by depth within the NEFMC Area of Interest. On average, 97% of an individual's revenue came from traps fished from 0 to 400 meters (0 to 219 fathoms; n=15) (Figure 6). Of the five depth categories provided, the highest average revenue (33% of total) came from 100-200 meters, which differed from where the most traps were allocated (200-300 meters) (Table 2, Figure 5, and Figure 6). On average, only 3% of an individual's revenue came from traps fished deeper than 400 meters (Table 2, Figure 6). Individual fishermen reported anywhere from one to four depth categories (average = 3 ± 0.3 SE) that contributed to their combined revenue (n=15). Overall, 87% of fisherman reported that revenue came from traps fished in the 100-200 meter range, and only 13% reported revenue coming from the deepest depth stratum (>400 meters) (Table 2).

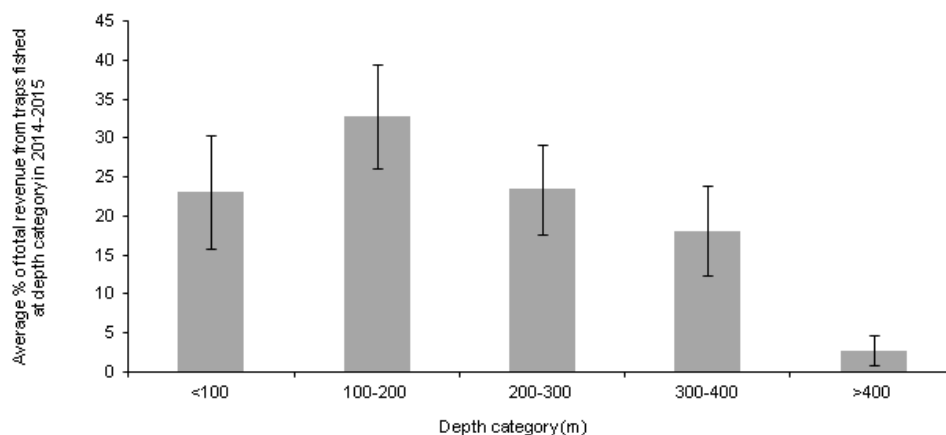


Figure 6. Average percentage of combined revenue from lobster and Jonah crab per depth category per fisherman, within the NEFMC Area of Interest in 2014-2015 (n = 15).

The top three individual canyons that contributed most to fishermen's **lobster** revenue from within the NEFMC Area of Interest were Veatch (35%), Lydonia (29%), and Atlantis (29%) canyons (n=17) (Figure 7 and Figure 8). For Jonah crab, seven individual canyons were named equally as top contributors to fishermen's **Jonah crab** revenue. These included Alvin, Atlantis, Veatch, Hydrographer, Powell, Munson, and Nygren canyons (n=16) (Figure 7 and Figure 9). The two vessels that reported greater revenue from Jonah crab than lobster named all canyons as most important to their combined revenues. For both lobster and Jonah crab, canyons distributed to the west and east were generally identified as important contributors more frequently than those centered in the NEFMC Area of Interest (Figure 7, Figure 8, and Figure 9).

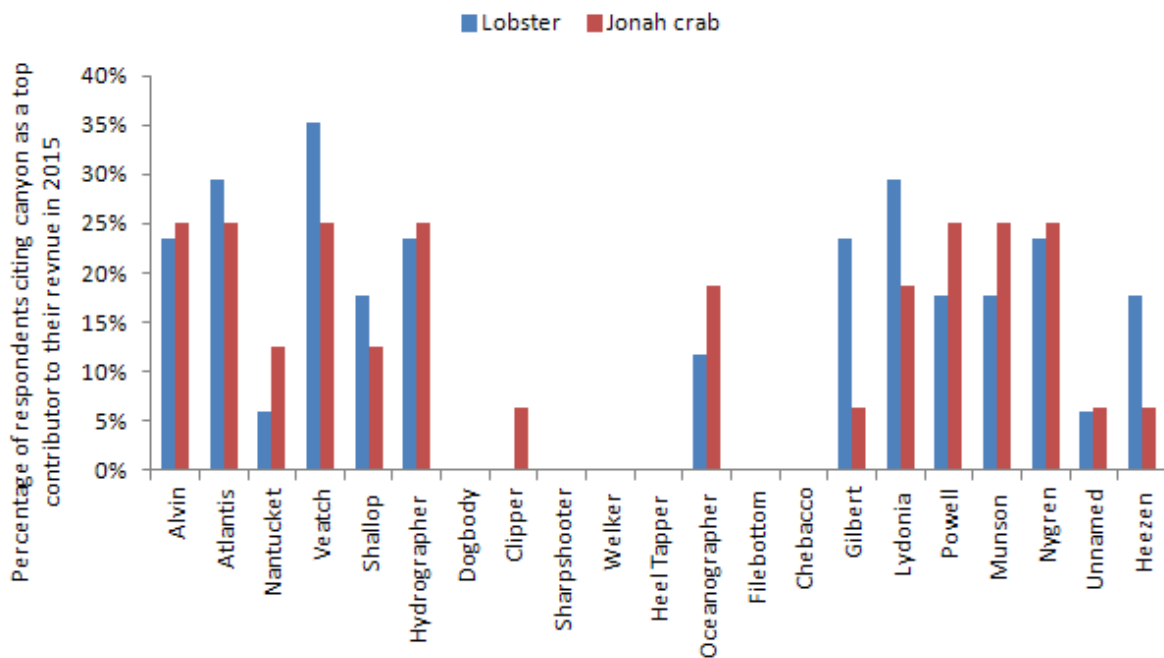


Figure 7. Importance of individual canyons as reported by the percentage of fishermen (lobster n=17; Jonah crab n=16) citing each of the top three that contributed most to their revenue from catches of lobster (blue) and Jonah crab (red) within the NEFMC Area of Interest in 2015. Canyons are listed in west to east orientation (L-R).

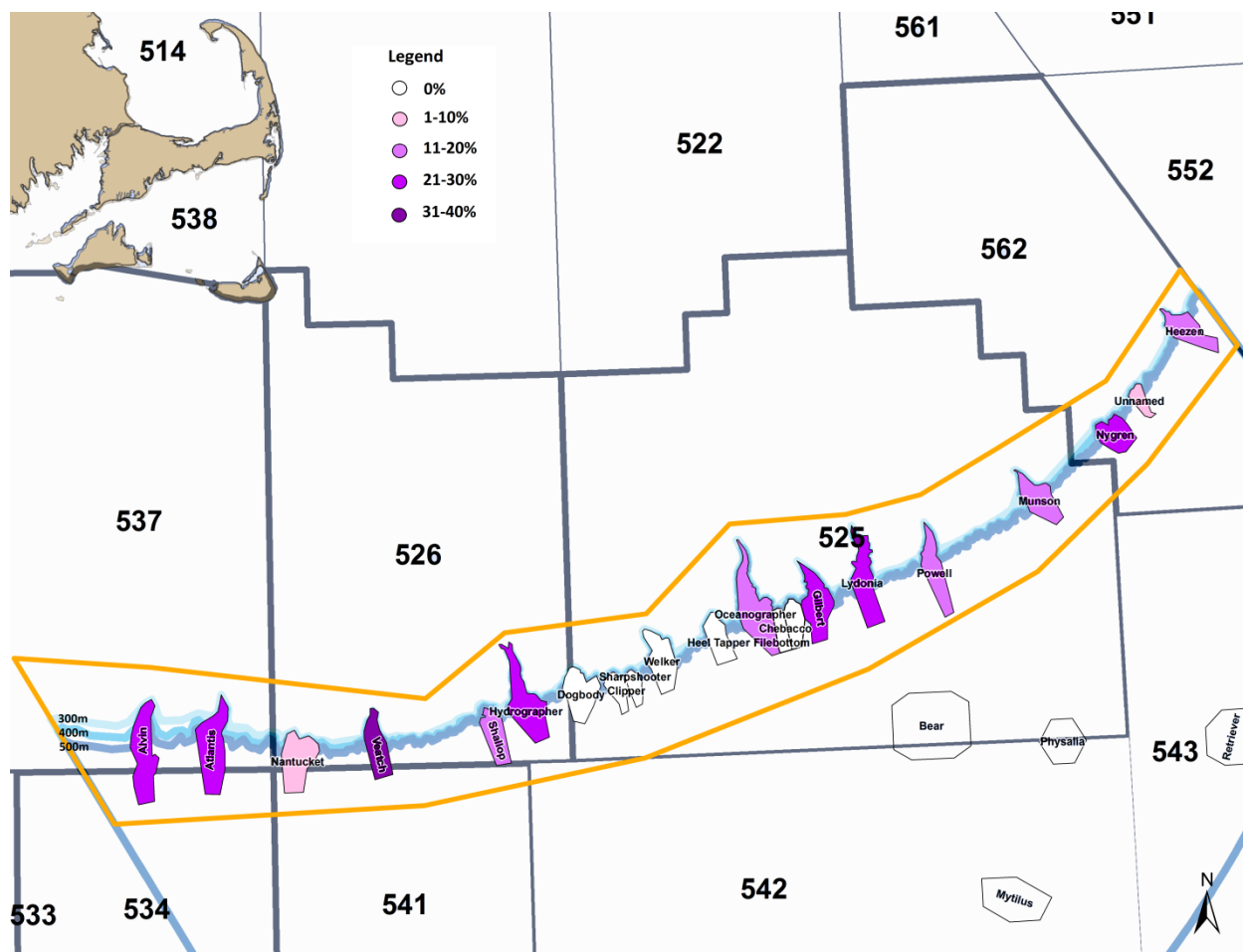


Figure 8. Importance of individual canyons to fishermen's revenue from **American lobster**, reported as the percentage of fishermen citing each as one of the top three that contributed most to their earnings from within the NEFMC Area of Interest in 2015. Canyons are listed in west to east orientation (L-R).

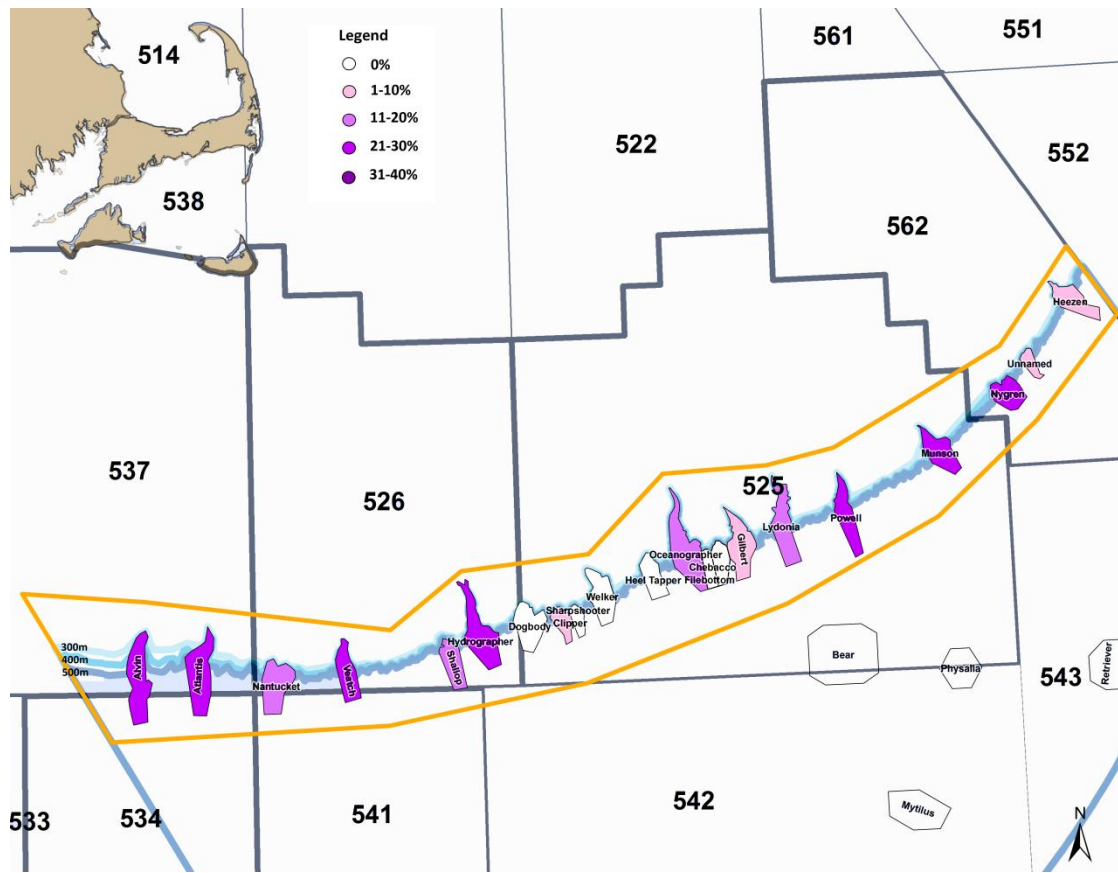


Figure 9. Importance of individual canyons to fishermen's revenue from **Jonah crab**, reported as the percentage of fishermen citing each as one of the top three that contributed most to their earnings from within the NEFMC Area of Interest in 2015. Canyons are listed in west to east orientation (L-R).

Conclusions

Nineteen lobstermen provided unique and comprehensive descriptions of lobster and Jonah crab trap fishing practices in and around the Georges Bank and Southern New England canyons within Lobster Conservation Management Area 3 (LCMA 3). Their contributions characterized individual canyons and depths fished, as well as revenues generated in each. The response rate of applicable surveys to total permits, excluding non-applicable surveys returned, was 23%. It is not known whether the data received represent most of the lobster and Jonah crab trap fishing effort within the NEFMC Area of Interest. However, analysis of trap allocations and response rates provides some insight into the importance of the Area of Interest for LCMA 3 fishermen. Of the original survey pool, the majority (58%) of the ninety-seven 2015 permit holders held trap

allocations exclusively in LCMA 3 (versus LCMA 3 *and* LCMA 1, 2, 4, and/or 5), meaning they were wholly dependent on LCMA 3. Comparatively, most (71%; 24 of 34) survey respondents held LCMA 3-only trap allocations. Over 70% of these individuals reported having fished the offshore canyons within the NEFMC Area of Interest in 2014-2015, suggesting this is a significant resource for fishermen in LCMA 3.

The self-reported survey data revealed that the fishery within the NEFMC Area of Interest occurs year-round, in and between at least 19 of the 21 canyons, from Alvin canyon in the west to Heezen canyon in the east. Characteristics of the fleet included high effort in terms of number of trips and traps hauled per trip, wide geographic spread of canyons that are most important to overall revenue, and a range of depths that are regularly fished. Depth of fishing in and around the canyons is best characterized as variable, with the highest portion of traps in less than 400 meters (219 fathoms) of water. However, this summation should be applied cautiously, as more than a quarter of respondents fished at least some traps in waters deeper than 400 meters. Seasonally, most traps were fished from spring to fall and were set at the deepest water depths in winter.

High earnings were a hallmark of this relatively small but active fleet. The reliance of the NEFMC Area of Interest on the fleet's bottom line was evident, as an average of 78% of an individual's total revenue came from the canyons area. Total combined value of lobster and Jonah crab landings from within the NEFMC Area of Interest for the nineteen respondents alone was \$30.6 million from 2014 to 2015.

Data on canyon-area lobster and Jonah crab fishing are limited, as effort and catch data are collected for a subset of Area 3 vessels only, and fishing activity on a trip is represented spatially by a single latitude/longitude coordinate on vessel trip reports. In some cases, only the NMFS statistical area is reported, and each statistical area encompasses multiple canyons. Survey respondents' submission of highly detailed and sensitive information conveyed the importance of the NEFMC Area of Interest to individual businesses practices as well as to the Southern New England lobster industry as a whole.

Acknowledgments

The ASMFC would like to thank all survey participants for their willingness to contribute to the survey and for their submission of highly detailed fishing information.