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New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John F. Quinn, J.D., Ph.D., *Chairman* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: November 27, 2017

TO: Groundfish Committee

FROM: Groundfish Plan Development Team

SUBJECT: **Draft biological impacts analysis for Framework Adjustment 57**

The Groundfish Plan Development Team (PDT) met on November 15 and 27, 2017, via webinar and discussed biological impacts analysis for Framework Adjustment 57. This document briefly summarizes PDT's work on biological impacts analysis for the Atlantic halibut management measures – gear restricted areas, GRAs (see attachment). It includes recommendations for refining the GRAs, as requested by the Groundfish Committee at its November 9, 2017 meeting.

Analysis of Atlantic halibut catch rates in the current Accountability Measure areas

Introduction

Data collected by Northeast Fisheries Observers and At-Sea Monitors were analyzed to look for spatial and temporal patterns of halibut catch rates in the Accountability Measure (AM) areas. Under the current regulations, the federal groundfish fishery is held accountable for any overages of the catch limits. If the AM is triggered, gear restricted areas are put into place for the entire fishing year. Trawl vessels fishing in the trawl gear AM area would be required to use an approved selective trawl gear, while gillnet and longline fishermen would be prohibited from fishing within the halibut fixed gear AM areas (Figure 1). This analysis is intended to inform discussion on Framework 57 Alternative 4.3.1.1.2.2 - Sub-Option 2B: Modified Gear Restricted Areas.

Methods

Data collected by Northeast Fisheries Observers and At-Sea Monitors were analyzed to look for spatial and temporal patterns of halibut catch rates in the Accountability Measure (AM) areas.

Large Mesh Trawl Tows – There were 4,184 observed large mesh trawl (NEGEAR code = 050) tows with kept catch (any species) recorded in the database, and the data were collected between January, 2011 and August, 2016. Only one location was recorded for each observed tow in the database, and the PDT could not determine whether that location corresponded to the beginning or end of the tow path. The reported tow durations ranged from 0.33 to 11.4 hours (mean = 4.3 hours). The PDT cautions that the relatively long tow durations for observed tows in the mobile gear AM area increases the possibility that a single tow could occur in multiple ten-minute squares, which may make this level of data analysis less appropriate. Halibut CPUE was calculated for each tow as total halibut catch (kg) observed per hour of trawling. A total of 12,713kg of halibut catch was observed on large mesh trawl trips in the mobile gear AM area during this time period, the majority of which were discarded (8,912kg).

The data were aggregated by year and month to examine temporal trends, and by ten minute squares to investigate spatial patterns of halibut catch in the AM area. This level of spatial and temporal resolution was chosen to investigate relevant trends without compromising the confidential nature of the information. The halibut mobile gear AM area is comprised of 18, ten-minute squares. For the spatial analysis, the observed large mesh trawl tows were plotted and assigned to a ten-minute square using the “Spatial Join” function in ArcGIS 10.4.

Gillnet Hauls – From 2011 to 2016 there were 936 observed gillnet hauls (NEGEAR code = 100) in the Platts Bank fixed gear AM area (AM area 2), and 2,130 hauls in the Stellwagen Bank fixed gear AM area (AM area 1). Gillnet hauls from the two fixed gear AM areas were treated separately during the analysis. Each dataset contains observed hauls of both large and extra large mesh gillnets. It is important to note that the halibut catch rates were not standardized with respect to the mesh size, soak time, the number of panels hauled, or the gear configuration. Because the fixed gear AM areas are so small, spatial analysis were not pursued. Instead, the data were aggregated across years, quarters, and months to examine temporal trends in the catches that may be relevant to management.

Longline Hauls – From 2011 to 2016 there were 1,792 observed longline hauls in the dataset, which included fishing effort in the Gulf of Maine, Great South Channel, and Georges Bank. The primary target species reported on these longline hauls was cod (41%), haddock (24%), tilefish (17.3%), and spiny dogfish (12.2%). Atlantic halibut was only listed as the primary target species on one of the 1,792 observed longline hauls. Only four hauls were observed in the Platts Bank fixed gear AM area, and 233 hauls were observed in the Stellwagen Bank AM area. Halibut were only present in four of the 1,792 observed hauls (0.22%), none of which occurred within the fixed gear AM areas. Therefore, the longline data from observed trips were not pursued for further analysis.

Results

Large Mesh Trawl Tows – Observed large mesh trawl effort decreased in the halibut mobile gear AM area from 2011 to 2016, although 2016 data only represents a partial year of observations. There was little interannual variability in the proportion of observed tows that encountered a halibut (Table 1). The greatest halibut catches in the AM area occurred in 2012, while the smallest observed catches were reported in 2016. CPUE was fairly low (< 1kg/tow) in each year, without any discernible trend throughout the time period.

From 2011 to 2016 the greatest proportion of positive tows and the highest mean halibut CPUE were observed in March (Table 2; Figure 2). However, March also represents the month with the fewest observed trawl tows in the mobile gear AM area. Aside from March, the observed halibut CPUE and percent of positive tows with halibut are rather consistent across months, although it should be noted that observed halibut catch rates are lowest in the mobile gear AM area in June and July. Across the six year time period, the lowest monthly halibut catches were observed in June, while the greatest catches were observed in September and October (Table 2; Figure 2).

Observed large mesh trawl fishing effort was not distributed homogenously within the halibut mobile gear AM area (Table 3; Figure 3). The highest amount of observed trawl effort was reported in the southeastern portion of the mobile gear AM area, particularly in ten minute squares 416824 and 416834. Across the entire time period, the proportion of observed tows that encountered halibut was also comparatively low in these two ten minute squares (Figure 4).

From 2011 to 2016 the proportion of trawl tows that encountered halibut were greatest for trawl tows that were made in the central and western portions of the mobile gear AM area, particularly in the ten minute squares that are adjacent to the northern boundary of Closed Area 1 (e.g., 416936, 416831, and 416832; Figure 4). The proportion of positive tows was relatively lower in the three ten-minute squares along the eastern boundary of the mobile gear AM area (Figure 4).

From 2011 to 2016, ten minute square 416832 had the highest observed halibut catches (kg), followed by ten minute squares 416936, 416833, and 416824 (Figure 5). Because fishing effort was not distributed evenly throughout the mobile gear AM area, the ten minute squares with the lowest encounter rates did not necessarily have the smallest observed halibut catches. For example, encounter rates were low in ten minute square 416824 (Figure 4), but this ten-minute square also had a relatively high amount of observed fishing effort over the six year period (Figure 3; Table 3). The magnitude of

halibut catches was relatively low for the six northernmost ten-minute squares in the mobile gear AM area (Figure 5), but there were also relatively low rates of trawl effort in these six ten-minute squares (Figure 3).

Large mesh trawl effort in each ten-minute square from 2011 to 2016 were aggregated by quarter to examine seasonal trends in halibut catch locations (Figure 6) and the proportion of positive tows in each ten-minute square (Figure 7). Some general trends emerge when the data is aggregated by seasons. Halibut catches (kg) were typically lower in the northern portion of the mobile gear AM area, although there are exceptions (e.g., ten minute square 416814 in quarter 1). Halibut catches also appear to vary considerably between adjacent ten-minute squares (especially in quarters 3 and 4), which could be reflective of patterns in fishing effort, resource distribution, or a combination of both factors.

Gillnet Hauls – The percentage of gillnet hauls that encountered halibut in the Platts Bank fixed gear AM area has generally declined since 2011, although there are relatively few observations available in 2016 (Table 5). Average catch rates were generally similar across years, with the exception of 2015, when the mean catch rates were noticeably greater than other years (Table 5). The PDT cautions that interannual variability in catch rates may be indicative of changes in fishing practices or gear configuration, and may not necessarily represent changes in halibut abundance over the time period. From 2011 to 2016, the proportion of positive tows was lowest in the first quarter, and highest in the second quarter (Table 6). Although catch rates in the third quarter were intermediate, the third quarter accounted for the majority of halibut catches in this area, because the majority of fishing effort occurred in quarter 3 (Table 6). Halibut were not observed in gillnet hauls from the Platts Bank fixed gear AM area in January and February, and relatively low catch rates and catch amounts were also observed in November and December, but observed gillnet was relatively low in these months (Table 7). The majority of observed gillnet hauls in the Platts Bank fixed gear AM area occurred from July through October, and halibut catch rates were generally high across these four months (Table 7).

The percentage of gillnet hauls that encountered halibut within the Stellwagen Bank AM area was generally consistent from 2011 to 2013, lower in 2014, and increased in 2015 and 2016 (Table 8), although 2016 represents only a partial year of observations. Across all years, the average catch rates in the Stellwagen Bank AM area were lower than those observed in the Platts Bank AM area (Tables 5 and 8). Across all years, the greatest encounter rates in the Stellwagen Bank area were observed in second quarter, and encounter rates were relatively low the rest of the year (Table 9). Across all quarters, the encounter rates and mean catch rates were lower in the Stellwagen Bank AM area than in the Platts Bank AM area (Tables 6 and 9). Halibut were encountered on <10% of all observed gillnet hauls in the Stellwagen Bank AM area in all months except April and May (Table 10). The mean halibut catch rates were <1 kg/tow in all months except April and June. Monthly catch rates are generally lower in the Stellwagen Bank AM area than the Platts Bank AM area (Tables 7 and 10).

PDT Discussion and Recommendations

- The council could consider exempting longline vessels from the current fixed gear AM areas. Halibut were not captured on any observed longline hauls in the fixed gear AM areas between 2011 and 2016. Further, the observer data demonstrates that federally permitted longline vessels targeting haddock, cod, spiny dogfish and tilefish rarely encounter halibut.
    - Alternatively, the Council could consider a gear modification that would apply to the longline vessels when fishing in the fixed gear AM areas. For example, the Council may implement a maximum hook size for longline vessels within the fixed gear AM areas. Although the PDT did not have the opportunity to examine the hook sizes that were used on the observed longline hauls that were included in this analysis, the PDT notes the hooks used by the longline fleet when fishing in the fixed gear AM areas appear to have a low gear selectivity for halibut.
- The PDT notes that the current fixed gear AM areas are likely too small to allow the Council to refine the spatial extent of the areas. Instead, the Council may wish to refine the seasonality of the AM areas.
    - The lowest halibut catch rates for observed gillnet hauls in the Platts Bank AM area occurred from November to February. The Council could choose to allow gillnet fishing in this area from November to February, which would allow for additional fishing opportunities, while minimizing the potential for interactions with halibut. However, the PDT recognizes that this measure may have limited impact, as there is relatively little observed effort in the Platts Bank fixed gear AM area during these months.
- The halibut catch rates and proportion of observed tows that encountered halibut are generally lower in the Stellwagen Bank fixed gear AM area than in the Platts Banks AM area. The Council may choose to remove the Stellwagen Bank AM area, and leave the Platts Bank AM area in place, in order to increase fishing opportunities, while limiting the possibility of interactions with halibut.
    - Alternatively, the Council may wish to change the seasonality of the Stellwagen Bank AM area, and consider a quarter 2, rather than a year-round closure.
- The Council could chose to keep the mobile gear AM in place year round, or make changes to the size and/or duration of the mobile gear AM area. The PDT notes that there are no clear seasonal trends in the proportion of observed large mesh trawl tows that encountered halibut in the mobile gear AM area, although halibut catch rates were lowest in June and July.

Tables and Figures

Table 1. Number of observed large mesh trawl tows (NEGEAR = 050) in the halibut mobile gear AM area each year from 2011 to 2016, and the percentage of tows where a halibut was recorded in the catch.

Year	Number of tows	Number of tows without halibut	Number of tows with halibut	% Positive	Observed halibut catch (kg)	Mean observed CPUE (kg/hour)
2011	802	694	108	13.5%	1540	0.48
2012	1309	1141	168	12.8%	3979	0.65
2013	702	601	101	14.4%	2785	0.92
2014	670	607	63	9.4%	1903	0.65
2015	532	472	60	11.3%	1982	0.88
2016	161	139	22	13.7%	525	0.74

Table 2. Number of observed large mesh trawl tows in the halibut mobile gear AM area each month from 2011 to 2016, and the percentage of tows where a halibut was recorded in the catch.

Month	Number of tows	Number of tows without halibut	Number of tows with halibut	% Positive	Mean CPUE (halibut(kg) per hour)	Total halibut catch (kg)
1	501	439	62	12.4%	0.6	1224
2	343	296	47	13.7%	0.8	1056
3	157	112	45	28.7%	1.2	807
4	239	205	34	14.2%	0.7	633
5	197	171	26	13.2%	0.9	852
6	180	169	11	6.1%	0.5	298
7	294	266	28	9.5%	0.7	978
8	417	361	56	13.4%	0.7	1339
9	508	451	57	11.2%	0.6	1656
10	462	387	75	16.2%	1.1	2230
11	360	331	29	8.1%	0.5	753
12	518	466	52	10.0%	0.4	888

Table 3. Number of observed large mesh trawl tows within each of the 18, ten-minute squares that comprise the halibut mobile gear AM area from January 2011 to August 2016.

Ten Minute Square ID	Number of observed tows	Number of tows without halibut	Number of tows with halibut	% positive tows
416811	44	40	4	9.1%
416812	44	38	6	13.6%
416813	80	69	11	13.8%
416814	178	161	17	9.6%
416821	63	53	10	15.9%
416822	186	158	28	15.1%
416823	432	394	38	8.8%
416824	705	649	56	7.9%
416831	92	72	20	21.7%
416832	353	261	92	26.1%
416833	370	312	58	15.7%
416834	510	488	22	4.3%
416915	165	154	11	6.7%
416916	150	134	16	10.7%
416925	176	157	19	10.8%
416926	124	101	23	18.5%
416935	247	211	36	14.6%
416936	257	202	55	21.4%

Table 4. Number of observed large mesh trawl tows, and proportion of positive tows, by quarter for each ten-minute square within the halibut mobile gear AM area from 2011 to 2016.

Ten Minute Square	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	Number of tows without halibut	Number of tows with halibut	% Positive	Number of tows without halibut	Number of tows with halibut	% Positive	Number of tows without halibut	Number of tows with halibut	% Positive	Number of tows without halibut	Number of tows with halibut	% Positive
416811	17	2	10.5%	1	0	0.0%	7	1	12.5%	15	1	6.3%
416812	5	1	16.7%	3	1	25.0%	9	2	18.2%	21	2	8.7%
416813	19	1	5.0%	1	0	0.0%	17	3	15.0%	32	7	17.9%
416814	48	14	22.6%	11	1	8.3%	48	0	0.0%	54	2	3.6%
416821	3	2	40.0%	2	1	33.3%	9	0	0.0%	39	7	15.2%
416822	41	8	16.3%	12	2	14.3%	31	6	16.2%	74	12	14.0%
416823	118	18	13.2%	64	2	3.0%	61	5	7.6%	151	13	7.9%
416824	177	23	11.5%	145	9	5.8%	155	10	6.1%	172	14	7.5%
416831	6	3	33.3%	7	2	22.2%	24	6	20.0%	35	9	20.5%
416832	18	15	45.5%	45	16	26.2%	93	37	28.5%	105	24	18.6%
416833	40	8	16.7%	54	5	8.5%	130	33	20.2%	88	12	12.0%
416834	10	1	9.1%	98	7	6.7%	245	11	4.3%	135	3	2.2%
416915	85	6	6.6%	2	0	0.0%	39	4	9.3%	28	1	3.4%
416916	74	6	7.5%	15	2	11.8%	29	5	14.7%	16	3	15.8%
416925	76	10	11.6%	5	2	28.6%	37	3	7.5%	39	4	9.3%
416926	29	9	23.7%	4	1	20.0%	29	3	9.4%	39	10	20.4%
416935	54	14	20.6%	29	5	14.7%	80	7	8.0%	48	10	17.2%
416936	27	13	32.5%	47	15	24.2%	35	5	12.5%	93	22	19.1%
Grand Total	**847**	**154**	**15.4%**	**545**	**71**	**11.5%**	**1078**	**141**	**11.6%**	**1184**	**156**	**11.6%**

Table 5. Number of observed gillnet hauls, and proportion of positive hauls, by year within the Platts Bank halibut fixed gear AM area from 2011 to 2016.

Year	Number of Observed Hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
2011	196	23.5%	803.3	4.1
2012	118	22.0%	423.5	3.6
2013	151	25.2%	693.4	4.6
2014	335	17.6%	1466.6	4.4
2015	117	19.7%	827.7	7.1
2016	19	10.5%	80.3	4.2

Table 6. Number of observed gillnet hauls, and proportion of positive hauls, by quarter within the Platts Bank halibut fixed gear AM area from 2011 to 2016.

Quarter	Number of Observed Hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
1	68	11.8%	132.7	2.0
2	130	24.6%	697.9	5.4
3	550	21.3%	2425.5	4.4
4	188	19.7%	1038.6	5.5

Table 7. Number of observed gillnet hauls, and proportion of positive hauls, by month within the Platts Bank halibut fixed gear AM area from 2011 to 2016.

Month	Number of observed gillnet hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
1	18	0.0%	0	0.0
2	17	0.0%	0	0.0
3	33	24.2%	132.7	4.0
4	40	27.5%	265.8	6.6
6	90	23.3%	432.1	4.8
7	142	25.4%	660.45	4.7
8	247	16.6%	820.8	3.3
9	161	24.8%	944.25	5.9
10	110	25.5%	898.6	8.2
11	34	8.8%	85	2.5
12	44	13.6%	55	1.3

Table 8. Number of observed gillnet hauls, and proportion of positive hauls, by year within the Stellwagen Bank halibut fixed gear AM area from 2011 to 2016.

Year	Number of Observed Hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
2011	701	5.8%	314.3	0.4
2012	559	5.9%	174.6	0.3
2013	188	6.4%	61.3	0.3
2014	316	3.8%	185.3	0.6
2015	238	8.4%	578.7	2.4
2016	128	13.3%	245.4	1.9

Table 9. Number of observed gillnet hauls, and proportion of positive hauls, by quarter within the Stellwagen Bank halibut fixed gear AM area from 2011 to 2016.

Quarter	Number of Observed Hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
1	643	5.4%	181	0.3
2	557	11.1%	879	1.6
3	472	4.2%	288	0.6
4	458	3.9%	212	0.5

Table 10. Number of observed gillnet hauls, and proportion of positive hauls, by month within the Stellwagen Bank halibut fixed gear AM area from 2011 to 2016.

Month	Number of observed gillnet hauls	% positive hauls	Total halibut catch (kg)	Mean catch/haul (kg)
1	239	5.0%	59	0.2
2	210	4.8%	49	0.2
3	194	6.7%	73	0.4
4	25	36.0%	56	2.2
5	289	10.0%	267	0.9
6	243	9.9%	556	2.3
7	269	5.2%	211	0.8
8	135	2.2%	28	0.2
9	68	4.4%	49	0.7
10	133	5.3%	52	0.4
11	178	5.1%	150	0.8
12	147	1.4%	10	0.1

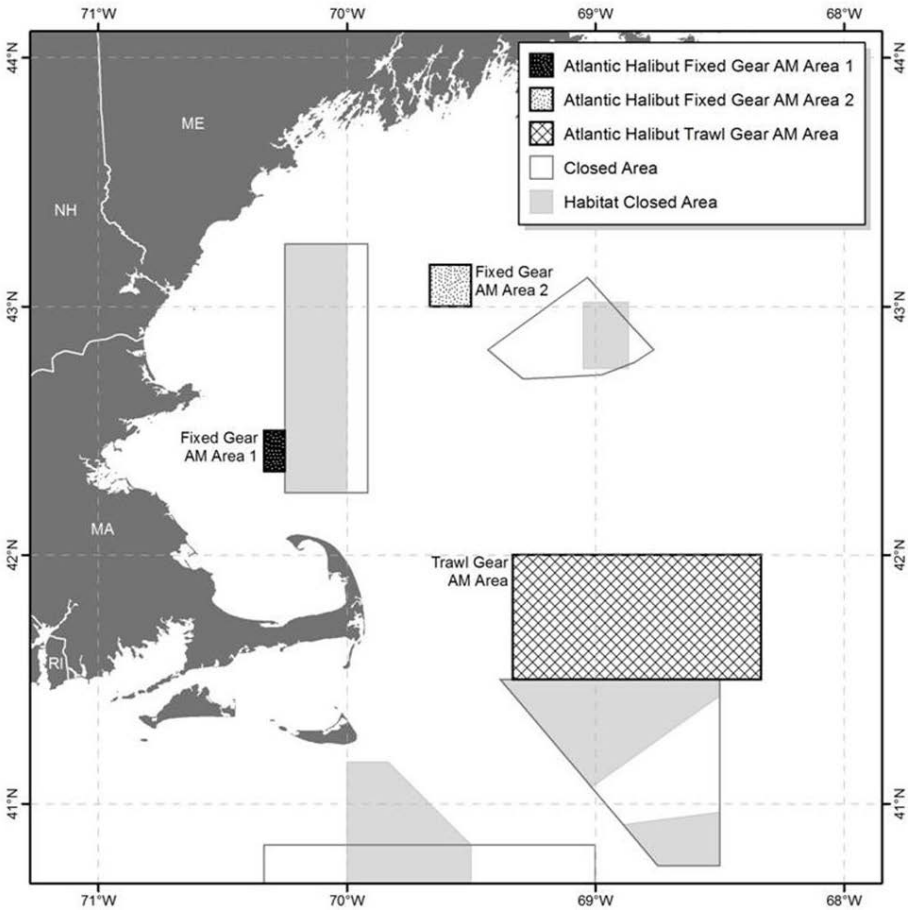

Figure 1. Map of the current Atlantic halibut Accountability Measure areas. Fixed Gear area 1 is referred to as the "Stellwagen Bank" area in this document, while Fixed Gear area 2 is referred to as the "Platts Bank" area.

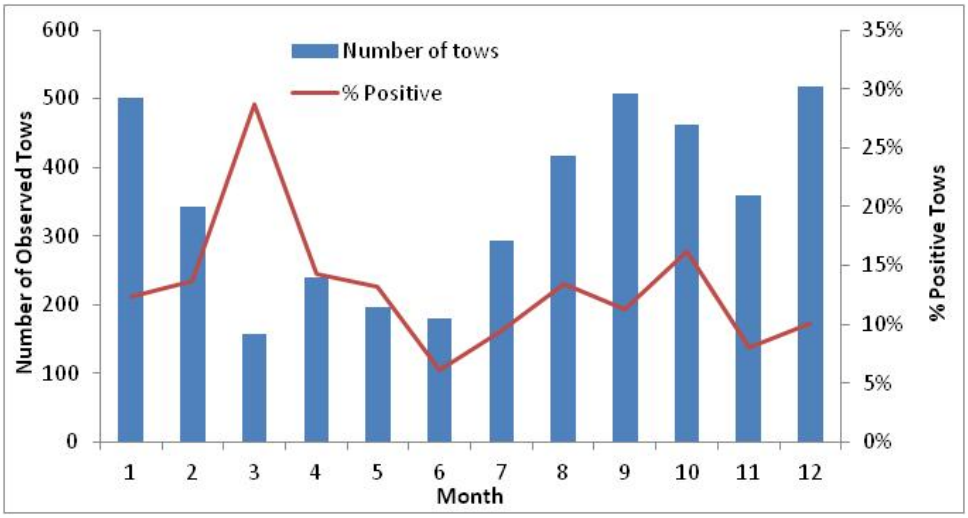

Figure 2. Number of observed large mesh trawl tows in the halibut mobile gear AM area each month from 2011 to 2016, and the percentage of tows where a halibut was recorded in the catch.

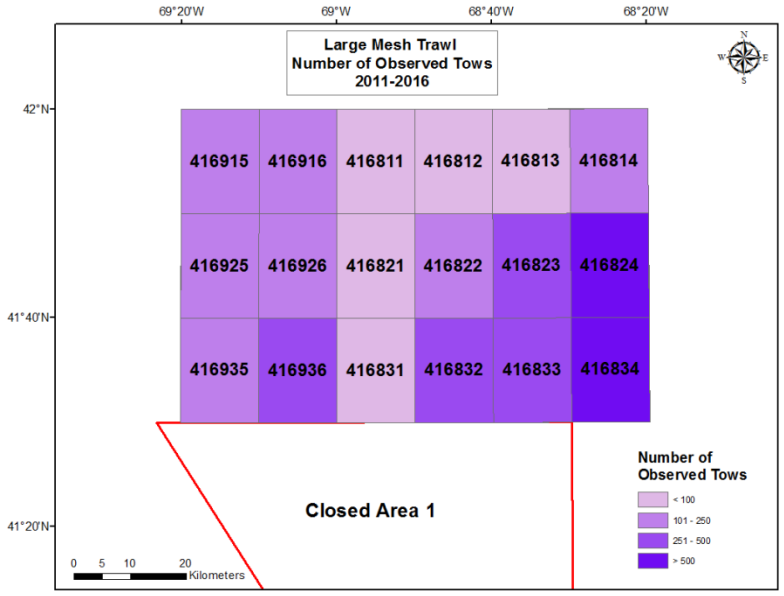

Figure 3. The number of observed large mesh trawl tows reported from 2011 to 2016 in each of the ten minute squares that comprise the halibut mobile gear AM area.

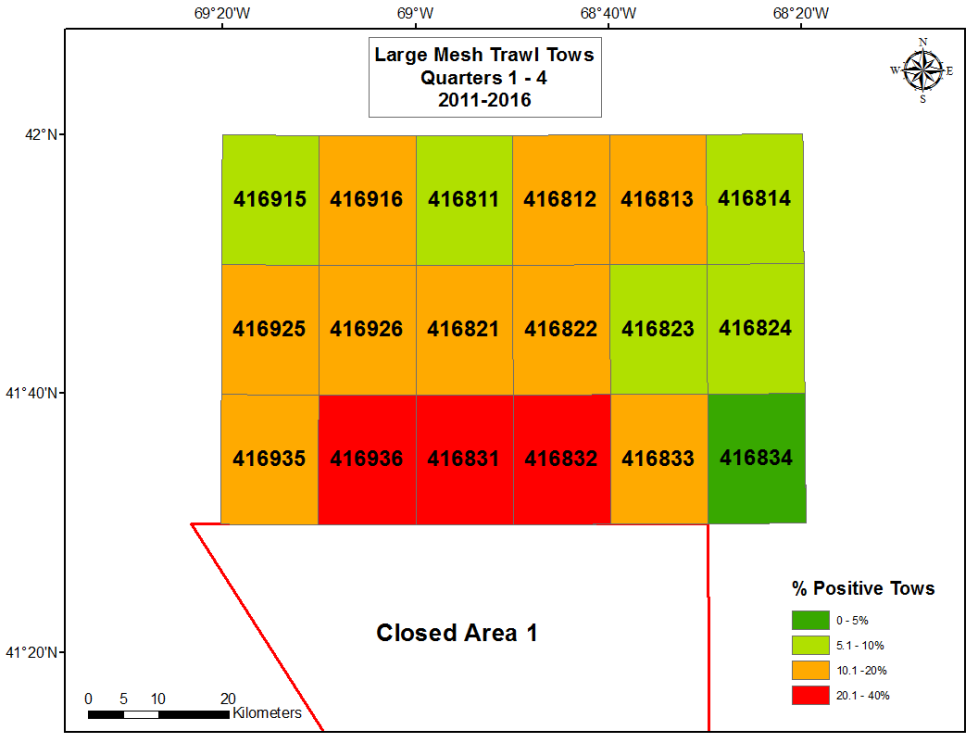

Figure 4. Proportion of tows that encountered halibut in each ten-minute square of the mobile gear AM area from January 2011 to August 2016.

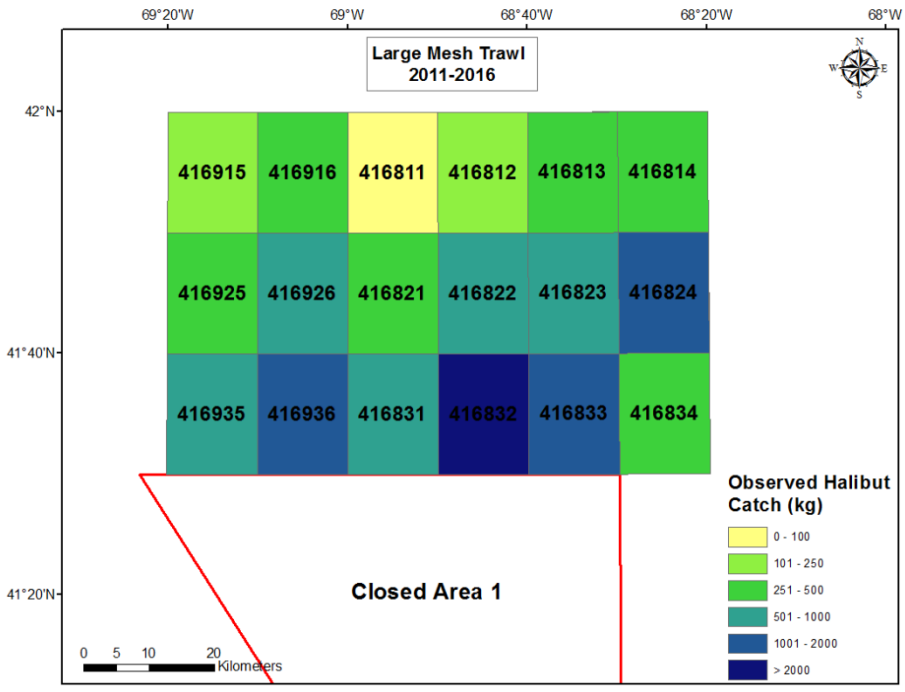

Figure 5. Observed catches of halibut (kept and discard) in each ten minute square of the halibut mobile gear AM area from 2011 to 2016.

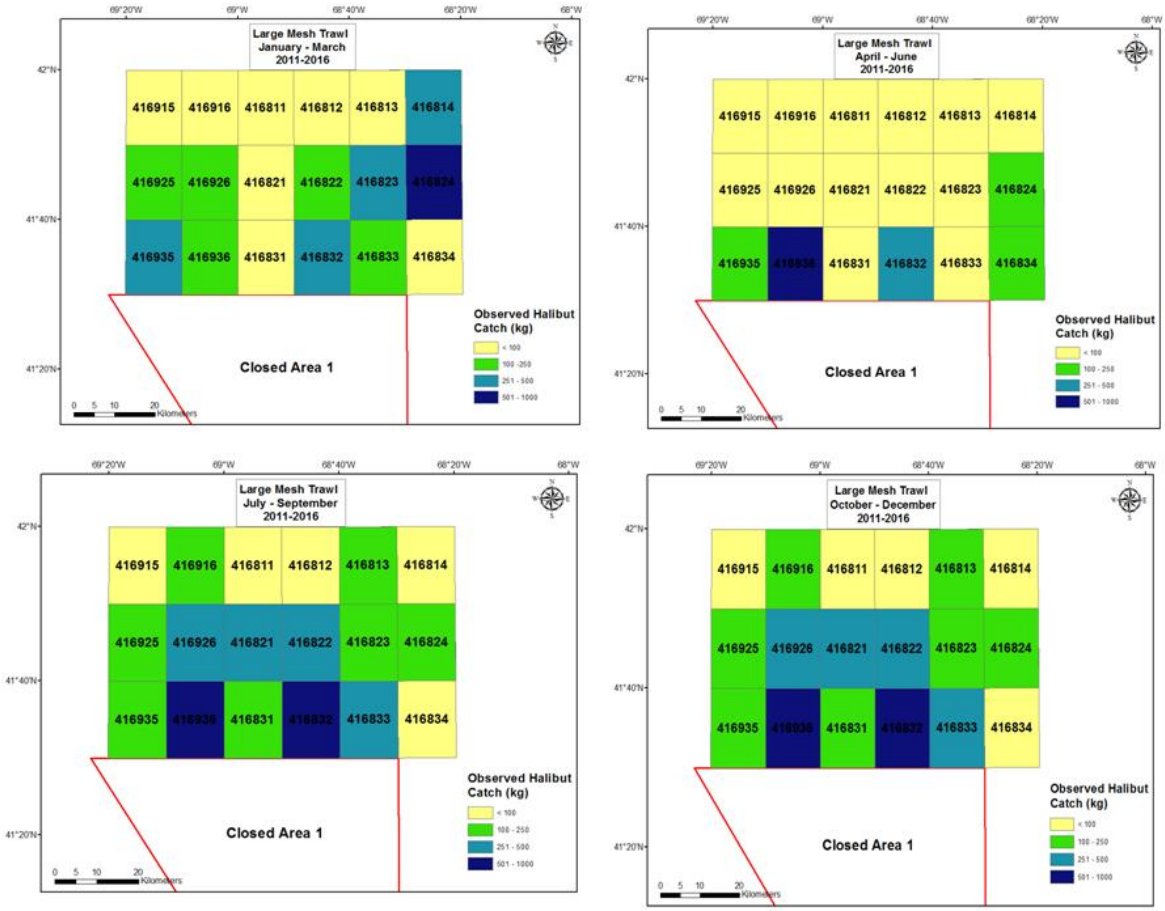

Figure 6. Observed halibut catches (total kept and discard) in each ten minute square of the halibut mobile gear AM area, by quarter, from January 2011 to August 2016. Top left = quarter 1, top right = quarter 2, bottom left = quarter 3, bottom right = quarter 4.

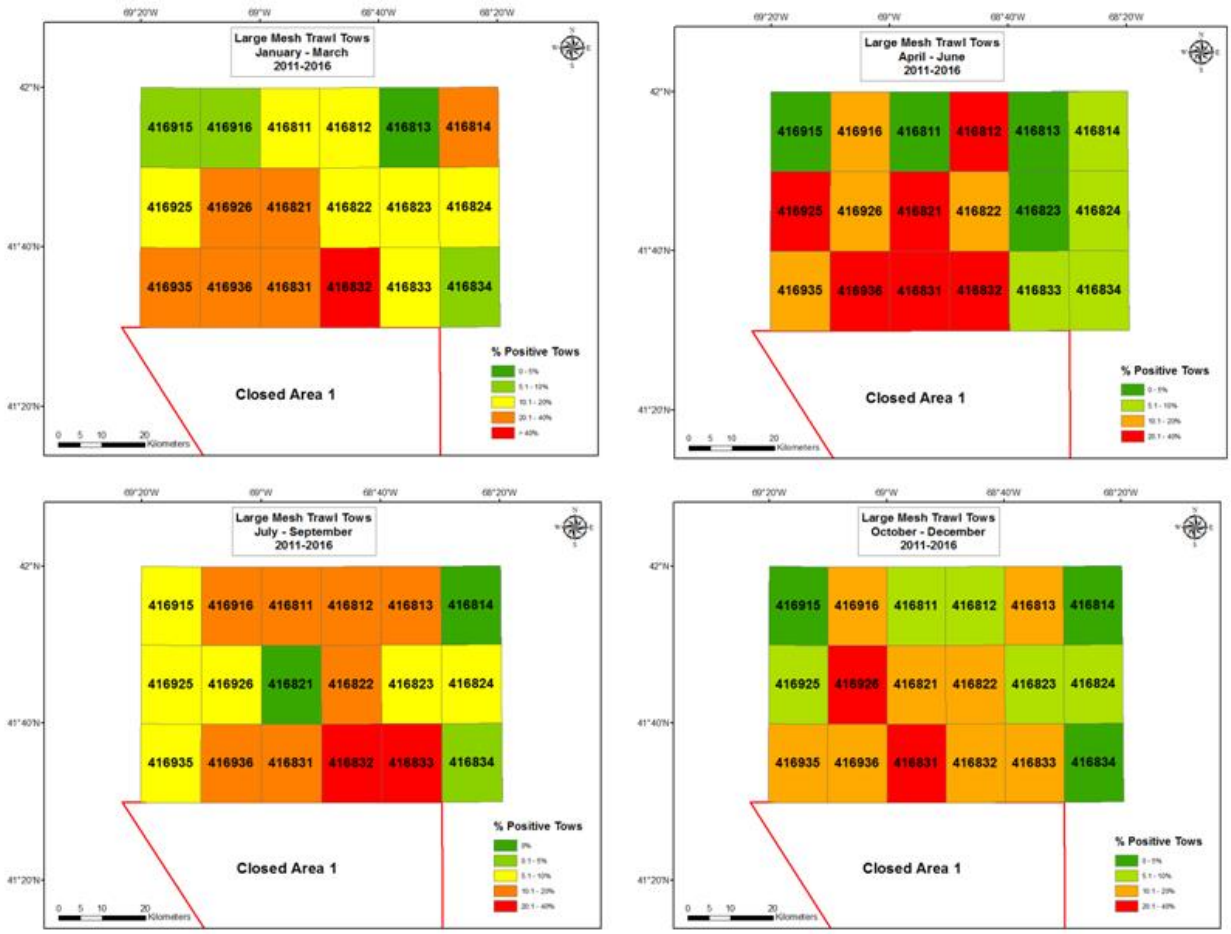

Figure 7. Proportion of positive tows observed in each ten minute square, by quarter. Top left = quarter 1, top right = quarter 2, bottom left = quarter 3, bottom right = quarter 4.