



New England Fishery Management Council

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John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: January 14, 2011
TO: Groundfish Oversight Committee
FROM: Groundfish Plan Development Team (PDT)
SUBJECT: **PDT Meeting, January 10, 2011**

1. The PDT met in Newburyport, MA to discuss haddock catch cap issues, accountability measures, and accumulation limits/fleet diversity. PDT members participating in the discussions were Tom Nies and Anne Hawkins (NEFMC), Sally Roman (SMASST Dartmouth), Steve Correia (Mass DMF), Kohl Kanwit (Maine DMR), Tom Warren and Doug Christel (NERO), and Paul Nitschke (NEFSC). Eric Thunberg (NEFSC) participated via conference call. Others in attendance included Dr. Jamie Cournane (UNH/EDF) and Mark Gran (NERO) via conference call, and Dan Caless and Michael Lanning (NERO). Members of the public present were David Ellenton, Peter Moore, and Declan Conneely.

2. The primary purpose of the meeting was to discuss herring fishery haddock catch cap issues. The PDT referred to discussions during its earlier conference call, summarized in a report dated December 22, 2010. In some instances this report revises or supersedes information in the earlier report.

Haddock Catch Cap

3. The PDT noted that it is not clear what the purpose is for the proposed framework action as the Council was unclear what “bycatch cap issues” are to be addressed. The current cap was adopted by Framework 43 and described the purpose of that action as follows:

“The primary purpose of this framework adjustment is to modify regulations for the multispecies fishery to address bycatch in the herring fishery by:

1. Establishing a haddock catch cap and monitoring program and a multispecies incidental catch allowance for the directed herring fishery; and
2. Modifying the current classification of herring fishing gear as *exempted gear* relative to the multispecies fishery.

This action is needed because the current absolute prohibition on the possession of haddock by vessels targeting herring appears to be unrealistic, given the current abundance of haddock on GB. Unless action is taken to modify the existing provisions to reflect current conditions in the fishery, it appears likely that herring midwater trawl vessels may decrease and/or eliminate fishing time on GB (Area 3) due to concern about enforcement actions that could result from possession of even small amounts of haddock bycatch. Such an interruption in the herring fishery would have negative impacts on the fishery participants and could impact the supply of herring used as bait for the lobster fishery. It also would reduce opportunities for the herring TAC in Area 3 (and OY) to be fully utilized. Perhaps most important, reduced fishing effort in the Area 3 herring fishery may result in a shift of effort into Area 1A during the summer and fall, exacerbating concerns about the inshore GOM component of the resource and the impacts of concentrated midwater trawl fishing effort in this area. The Herring PDT has frequently recommended that development of the herring fishery should be encouraged in offshore areas like GB, where the herring resource appears to be larger and more robust.” *(emphasis added)*

Note the cap was adopted in order to provide a mechanism to allow prosecution of the herring fishery on GB. It is unclear if the current action was initiated for the same reason, if the cap is to prevent herring fishery haddock catches from exceeding some limit that is selected for a specified reason, or if the Committee wants to redesign the cap to encourage herring vessels to reduce catches of haddock.

4. An overview of the existing regulations is provided (enclosure (1)).

5. During the December conference call the PDT identified data elements to be examined to support decisions for the herring fishery haddock catch cap. At this meeting the PDT reviewed these data. Key elements are summarized and discussed in the following paragraphs.

6. Estimates of haddock catches by the herring midwater trawl fishery: As reported in the December 22, 2010 conference call summary (call held December 9, 2010), the NEFSC believes that it is possible to estimate haddock catches in the herring fishery based on observer data. The NEFSC estimated catches of haddock by the herring fishery by expanding observer data by total landings. Estimates developed in future assessments may differ slightly due to updated data or different analytic techniques. Based on a preliminary analysis that showed very low catches in the purse seine fishery, the analyses presented here focus on the mid-water trawl fishery. This estimate used an analytic approach similar to the Standardized Bycatch Reporting Methodology (SBRM) used to estimate discards. Unlike the current method used to monitor the existing haddock catch cap (which only sums the observations by observers, dealer landings, and dockside monitoring by enforcement) these numbers provide a total estimate of catches by this gear. The analytic approach is detailed in (reference , attached). A summary of the results is provided in Table 1 and Table 2. The first table estimates catches for trips where herring was 90 percent or more of the catch, while the second table looks at all MWT trips (the numbers are nearly identical because few trips targeting mackerel were observed in the Gulf of Maine or Georges Bank). The southern New England area has more trips targeting mackerel, but no haddock bycatch was observed in southern New England. The PDT does not consider the estimates before 2005/2006 as reliable given the low observer coverage and questions about observer procedures during this period. Coverage increased and practices were revised in recent years.

Generally, the estimates show that annual catches of haddock in the MWT fishery are usually less than 5 mt in the Gulf of Maine (GOM), near 0 in southern New England, and range from 0-

280 mt on Georges Bank (GB). In some years the estimates have relatively large coefficients of variation (CVs); this is a function of the number of observed trips. The largest estimate is for 2006, a year when there were only four observed trips on GB; this estimate is accompanied with the highest CV of the time series.

The majority of the haddock catches in the herring fishery occur on GB. The MWT catch estimates for GB haddock are put into context in Table 4 by comparing them to GB haddock SSB, GB TACs/ACLs, commercial landings of GB haddock, and the estimated fishing mortality for GB haddock. The catch estimates are small compared to the available GB haddock TACs. They are larger than the amount tracked by the quota monitoring program since 2006. In only one year did they exceed the total haddock catch cap quota. The catches of GB haddock by MWT vessels was 7 percent of the U.S. catch in 2006 (280 mt). The estimates are all less than one percent of the U.S. TTAC/ACL.

7. Relation of haddock to herring catch: The PDT plotted the catch of haddock and herring on a tow by tow basis to see if there is evidence of a relationship between the catches of haddock and herring. These plots are shown in **Figure 1** through Figure 2. Based on these plots there does not appear to be a recognizable relationship at the tow level between haddock and herring catches by MWT. Most tows have no haddock bycatch regardless of the amount of herring caught. However large haddock bycatch tows can rarely occur. Only three tows had haddock bycatch estimates between 10 and 22 thousand pounds.

8. Length/frequency of haddock caught by MWT: The PDT plotted the length/frequency of observed haddock in MWTs, by year and haddock stock area (Figure 3). There are few observations in the GOM. On GB the large number of haddock around 25 cm in 2005 shows the presence of the unusual 2003 year class of haddock. Unfortunately, limited observer coverage in 2004 makes it difficult to determine if this same exceptional year class would have been seen at smaller sizes. The PDT noted the few fish below 25 cm measured in recent years but whether this is a function of weaker year classes and/or lower selectivity of smaller fish is unknown.

9. Distribution of haddock catches: In order to determine the location of haddock catches in the herring fishery, catches of haddock in the directed herring fishery (all gears combined) were plotted and compared to herring fishing activity in two-month time periods (Figure 4 and Figure 5). In addition, catches of haddock and herring in MWT gear were also plotted. Both of these analyses show that the major area of concern is along the 100-m curve on the north side of GB and into the GOM. For MWT gear, the largest events occur along the north side of GB (Figure 6; Figure 7). It is also clear that, based on observer reports, catching haddock in a herring tow is a relatively rare event (Table 3).

10. Distribution of commercial haddock catches: Observer data was queried for the years 2006-2009 to determine where bottom trawl vessels are catching haddock. Catches are widely distributed across GB and in the GOM (Figure 8). Haddock has been observed in trawl tows throughout the GOM and GB but the areas with most of the observed catch are on GB. According to dealer data, 90 percent of the landings in 2007-2009 came from statistical areas 514/521/522/525/561/562. This is a change from the distribution when FW 43 was adopted.

11. Correlation between haddock catches and other metrics: Catch estimates of haddock by MWT gear on GB were compared to the number of observed trips, Area 3 catches of herring, GB haddock SSB, and GB haddock numbers using Spearman's rank coefficient. The correlation

coefficients were examined for statistical significance using a t-test and all were determined not to be significant (Table 5 and Table 6).

12. From examining these data there the PDT drew the following broad conclusions:

A. Catches of haddock in the herring fishery are primarily an issue for MWT gear. *This suggests a cap could be applicable to this gear alone.*

B. MWT catches of haddock primarily have occurred in the GB stock area, and are largely confined to Herring Management Area 3. MWT catches of haddock have been observed in well-defined areas along the northern edge of GB and along the 100-m curve in the GOM. *This suggests the area that is closed when a cap is reached could be more narrowly defined.*

C. There is not a statistically significant correlation between MWT catches of haddock on GB and GB haddock SSB, GB haddock numbers, total herring catches in Area 3, or the number of observed trips. *This suggests it may not be possible to predict a cap amount based on changes in SSB, observer coverage, or herring TACs.*

E. The estimates of GB haddock catch by MWT vessels in recent years were a small percentage of the available GB haddock TTAC/ACL. *This suggests the catches of haddock in the herring fishery are unlikely to have substantial biological impacts.*

13. After reviewing these data the PDT modified its list of possible measures to address the haddock bycatch cap issues that were previously suggested (Table 7). This table presents only the broadest outline of possible measures and once the Committee selects the alternatives it wishes to develop considerable work will be needed to flesh out the details.

14. While Table 7 talks about measures to implement a cap, it does not address the difficult question of what is the appropriate amount for any cap. This will not be necessary if the fishery is incorporated into the “other sub-components” part of the ACL for haddock. Given the relatively recent changes in the observer program and limited coverage in early years it does not appear there is sufficient information to base the cap on catches over any time period. A further complication is that the reaction of the herring fishery to the cap changes the catches in any given year. There is not yet sufficient information to base the cap on an estimate of future catches, as is done with the scallop fishery and yellowtail flounder. And as mentioned earlier, it is not clear what the cap is designed to do. Three ideas that the PDT surfaced include:

- If an estimate of haddock catch based on expanding observer data is applied to the cap, set the cap at 1 percent of the haddock ACL as was discussed in FW 43.
- Attempt to determine what the herring fishery has contributed to haddock mortality in the past and set the cap accordingly. This may be difficult to do since the time series of haddock discard estimates is short.
- Set the cap so bycatch does not increase from recent estimates.

15. It should be clear that any change in the cap will have allocation impacts that will be examined in the framework document once the measures are identified. In addition, any changes to the cap will have to be carefully coordinated to make sure they do not conflict with herring management plan objectives.

Accountability Measures

16. The PDT has begun work to support improvements Accountability Measures (AMs) for ocean pout, windowpane flounder, Atlantic halibut, wolffish, and SNE/MA winter flounder. Possession of four of these species is prohibited and none of them are allocated to sector vessels. When common pool vessels become subject to a hard TAC in FY 2012 there will only be limited AMs for these species, particularly since most of the fishery is expected to be fishing under sector rules.

17. The PDT identified two broad approaches to improve the AMs for these stocks: allocate them to the common pool and individual sectors and develop specific AMs that apply if a sector or common pool exceeds its allocation, or use an ACL at the sector and common pool level and develop an AM that applies to both the common pool and sectors should the ACL be approached or exceeded.

a. Individual sector allocations: If these stocks can be allocated to individual sectors then they could be managed the same as all other allocated stocks. Sectors could be allowed to land them, trade ACE between sectors, and if the ACE is exceeded fishing activity could stop in the stock area. Each sector is thus responsible for its own catch. Other AMs might be considered as well, such as gear restrictions, reduced numbers of trips, etc.

A method for the initial allocation needs to be determined for five of the six stocks (this is not a problem for SNE/MA winter flounder since PSCs can be calculated for that stock). The Council decided against using a landings-history based allocation for these stocks in A16 because much of the catch has been discarded. The PDT examined study fleet data on tow-by-tow trawl catches to determine if a relationship could be identified between these species and other allocated stocks, but the results do not support such an approach. The ACL could be divided equally among all sectors, or divided as a function of sector size and sectors could then trade as necessary to distribute the allocations.

This approach is it may be considered an expansion of the number of so-called “choke stocks”.

b. Broad-based allocation: The ACL could be divided only between sector and common pool vessels (or not at all) and measures such as area restrictions, gear requirements, trip limits, etc. could apply to all vessels if the ACL is approached or exceeded. This approach does not promote individual accountability for catches.

18. The PDT will continue to examine available data to determine if there are seasonal changes that can be used to design appropriate AMs, but an indication of which approach the Committee prefers would be helpful.

Accumulation Limits

19. PDT members reviewed a draft scoping document and suggested minor changes. The PDT urges the Committee to clearly define the objectives for this amendment.

- Enclosure: (1) Overview of current herring fishery haddock bycatch cap regulations
- (2) Palmer et al. 2011. Estimation of haddock bycatch in the northeast United States midwater trawl Atlantic herring fishery. Working paper for use of the NEFMC Large Mesh Multispecies Plan Development Team
- (3) Courane. 2011. Identification of haddock bycatch in the directed Atlantic herring fishery (to be distributed)

Table 1 - Estimation of haddock bycatch in the midwater trawl herring fishery. Midwater trawl trips have been filtered to include only those hauls/subtrips where the catch was composed of $\geq 90\%$ herring.

Gulf of Maine				Georges Bank				Southern New England/mid-Atlantic			
Mid-water trawl (170, 370)				Mid-water trawl (170, 370)				Mid-water trawl (170, 370)			
Year	Observed trips	Catch (mt)	CV	Year	Observed trips	Catch (mt)	CV	Year	Observed trips	Catch (mt)	CV
1994				1994				1994			
1995	4	0.00		1995				1995			
1996				1996				1996			
1997				1997				1997			
1998				1998				1998			
1999	2	0.00		1999				1999	1	0.00	
2000	3	0.00		2000				2000	8	0.00	
2001				2001	1	0.00		2001			
2002				2002				2002			
2003	8	0.00		2003	10	0.35	0.77	2003	1		
2004	58	1.23	0.66	2004	20	33.64	0.64	2004	2	0.00	
2005	87	3.89	0.37	2005	34	54.16	0.35	2005	19	0.00	
2006	13	0.00		2006	4	277.70	0.99	2006	12	0.00	
2007	7	1.73	0.90	2007	8	1.44	0.54	2007	1		
2008	14	0.00		2008	20	63.86	0.48	2008	9	0.00	
2009	31	0.04	0.65	2009	38	57.46	0.30	2009	16	0.00	

Table 2 - Estimation of haddock bycatch in the midwater trawl herring fishery. Data have not been filtered; all midwater trawl data are included, regardless of catch composition.

Gulf of Maine			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994			
1995	4	0.00	
1996			
1997			
1998			
1999	2	0.00	
2000	3	0.00	
2001			
2002			
2003	8	0.00	
2004	59	1.23	0.66
2005	87	3.92	0.37
2006	14	0.06	1.07
2007	7	1.77	0.90
2008	14	0.00	
2009	32	0.04	0.65

Georges Bank			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994	1	0.00	
1995			
1996			
1997			
1998			
1999			
2000	1	0.00	
2001	1	0.00	
2002			
2003	10	0.35	0.77
2004	20	34.02	0.64
2005	37	52.19	0.35
2006	4	280.48	0.99
2007	10	1.62	0.60
2008	23	67.66	0.49
2009	39	56.78	0.30

Southern New England/mid-Atlantic			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994	31	0.00	
1995	33	0.00	
1996			
1997			
1998			
1999	1		
2000	9	0.00	
2001			
2002	1		
2003	6	0.06	0.92
2004	12	0.00	
2005	27	0.00	
2006	27	0.00	
2007	5	0.00	
2008	23	0.00	
2009	29	0.00	

Table 3 - Frequency table of haddock bycatch (lbs) in observed hauls and sets for directed herring trips by gear type and bimonthly blocks. Gear categories include bottom otter-trawls (OT), purse seines (PS), and mid-water trawls-single and paired (PR). Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Source: NEFOP Database 2005-2009.

<i>Jan-Feb</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		100	248	0	348
1 - 15		0	0	0	0
> 15 - 50		0	1	0	1
> 50 - 145		0	1	0	1
> 145 - 610		0	0	0	0
> 610 - 21,363		0	0	0	0
maximum= 57	ALL	100	250	0	350

<i>Mar-Apr</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		4	112	0	116
1 - 15		0	2	0	2
> 15 - 50		0	2	0	2
> 50 - 145		0	1	0	1
> 145 - 610		0	2	0	2
> 610 - 21,363		0	2	0	2
maximum= 10,292	ALL	4	121	0	125

<i>May-Jun</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		0	130	69	199
1 - 15		0	4	0	4
> 15 - 50		0	1	0	1
> 50 - 145		0	3	0	3
> 145 - 610		0	0	0	0
> 610 - 21,363		0	0	0	0
maximum= 100	ALL	0	138	69	207

<i>Jul-Aug</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		20	117	152	289
1 - 15		14	9	0	23
> 15 - 50		0	10	0	10
> 50 - 145		0	7	0	7
> 145 - 610		0	8	0	8
> 610 - 21,363		0	4	0	4
maximum= 3,000	ALL	34	155	152	341

<i>Sep-Oct</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		23	266	63	352
1 - 15		1	14	0	15
> 15 - 50		1	27	0	28
> 50 - 145		2	21	0	23
> 145 - 610		0	25	0	25
> 610 - 21,363		0	29	0	29
maximum= 21,363	ALL	27	382	63	472

<i>Nov-Dec</i> Haddock Weight (lbs)		Gear Category			ALL
		OT	PR	PS	
none		16	244	4	264
1 - 15		0	3	0	3
> 15 - 50		0	5	0	5
> 50 - 145		0	3	0	3
> 145 - 610		0	3	0	3
> 610 - 21,363		0	2	0	2
maximum= 1,000	ALL	16	260	4	280

Table 4 – Comparison of MWT GB haddock catch to GB haddock SSB, landing, catch, bycatch cap. All weights in metric tons.

(1) 2008 and 2009 catch estimates are preliminary.

Calendar Year	GB Haddock	US GB Haddock Landings⁽¹⁾	US GB Haddock Landings plus Discards⁽¹⁾	US GB Haddock TAC/ACL	US GB Haddock Catch as % of TTAC/ACL	Bycatch Cap (GOM and GB combined)	Quota Monitoring Catch	Estimated MWT GB Haddock Catch (mt)	MWT Catch % of US Catch	MWT Catch % of TTAC/ACL
2000	75,111	3,203	3,280	6,252	52%			0.0	0.00%	0.00%
2001	90,118	4,820	5,037	11,700	43%			0.0	0.00%	0.00%
2002	104,085	6,532	6,741					0.0	0.00%	
2003	126,003	5,760	5,954					0.4	0.01%	
2004	115,770	7,375	8,415	14,955	56%			34.0	0.40%	0.23%
2005	142,954	6,604	7,278	12,282	59%			52.2	0.72%	0.42%
2006	265,994	2,643	3,938	35,309	11%	73.2	8.2	280.5	7.12%	0.79%
2007	315,975	2,930	4,864	90,599	5%	183.7	6.1	1.6	0.03%	0.00%
2008		5,744	6,087	106,731	6%	245.8	16.8	67.7	1.11%	0.06%
2009		5,320	5,453	76,515	7%	143.4	23.8	56.8	1.04%	0.07%

Table 5 - Spearman Correlation Matrix for GB MWT Catch

	Area 3 Herring Catch	MWT GB Haddock Catch	Observed GB MWT Trips	GB Haddock SSB	GB Haddock Numbers
Area 3 Herring Catch	1				
MWT GB Haddock Catch	-0.571	1			
Observed GB MWT Trips	0.18	0.371	1		
GB Haddock SSB	-0.786	0.543	0.086	1	
GB Haddock Numbers	-0.571	0.536	0.468	0.524	1

Table 6 – Results (p-values) of t-test for significant of Spearman correlation matrix

	Area 3 Herring Catch	MWT GB Haddock Catch	Observed GB MWT Trips	GB Haddock SSB
MWT GB Haddock Catch	0.71			
Observed GB MWT Trips	0.43	0.36		
GB Haddock SSB	0.77	0.31	0.47	
GB Haddock Numbers	0.71	0.31	0.33	0.31

Table 7 – Preliminary list of measures to address herring fishery haddock bycatch cap issues

Possible Measure	Pros	Cons
No Action	Measure in place Constrains haddock catches Strong deterrent to herring fleet because of closure implications	Potential to lose herring yield Does not account for differences between haddock stocks Only based on observed catches; sensitive to observer coverage levels No spatial sensitivity – the entire cap could be caught on GB and the GOM closes
Existing cap provisions, but revise areas that close if cap exceeded	No changes to existing cap, monitoring provisions Reduced impact on herring fishery by limiting areas affected by closure	Potential to lose herring yield Does not account for differences between haddock stocks Only based on observed catches; sensitive to observer coverage levels May be easier to implement
Adjust existing cap based on expected level of observer coverage; continue to only apply catches observed to count against cap	Simple Quick to implement Could be a backstop approach for another option should observer coverage be insufficient to estimate total catch	Little time between determination of observer coverage levels and start of fishing year complicates administration Does not make use of available information on catches by fleet Little justification for cap levels
Incorporate herring fishery haddock catches into “other sub-components” of ACL and monitor for future changes	No loss of herring yield likely Consistent with treatment of other fisheries with small groundfish catches Reduced in-season monitoring requirements	No constraint on haddock catches If catches exceed desired amount, requires a subsequent management action unless preplanned response built-in May be difficult to monitor
Apply an estimate of total haddock catch, by stock area, to cap	Accounts for difference between haddock stocks Potentially less constraining to herring fishery Less sensitive to observer coverage levels Amount of cap could be based on past	Potential to lose area specific herring yield May complicate monitoring because of need to track catches in two stock areas

Possible Measure	Pros	Cons
haddock catches or other goals		
Apply an estimate of total haddock catch, by stock area, to cap; amount of cap based on predicted haddock catch, by stock area (similar to YTF calculations for scallop fishery)	Links cap to changes in herring and haddock stock size	Potential to lose herring yield May complicate monitoring Examination of available data suggests it may not be possible to develop a prediction at this time This approach presumes a relationship that may not exist
Individual trip limits, possibly supplemented by an overall cap on the fishery as a whole	Places responsibility for avoiding haddock on individual vessels	Difficult to monitor and enforce Difficult to hold vessels accountable Difficult to account for unusual events May need haddock stock area specific caps
Catch share approach	Places responsibility for avoiding haddock on individual vessels May allow exchange of haddock between herring and groundfish fisheries	Requires an amendment Requires referendum if structured as an ITQ

Figure 1 - Plot of herring/haddock on observed MWT tows. 1994-2009

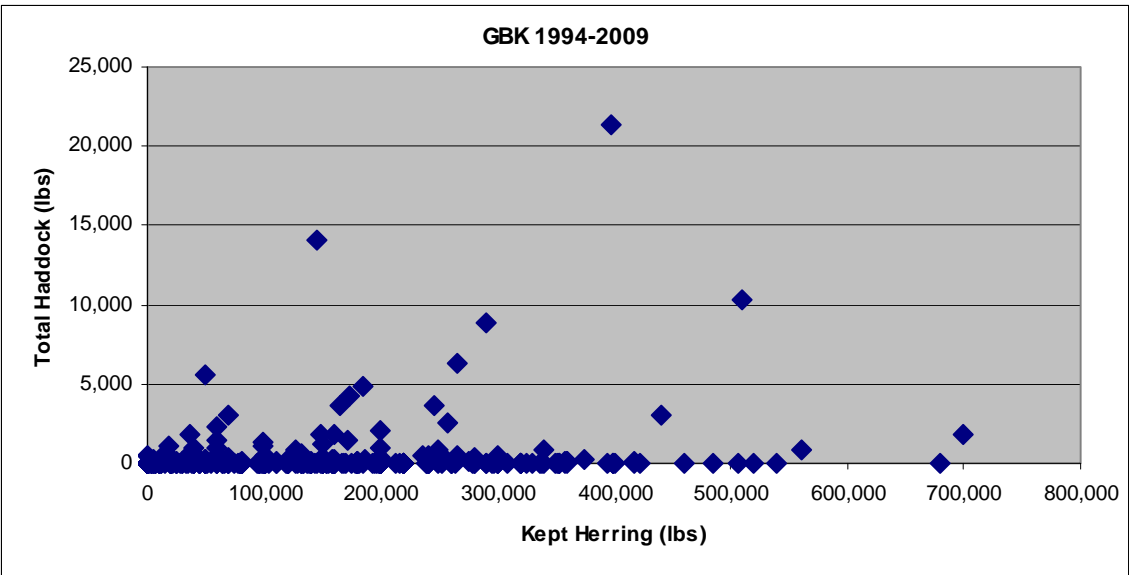
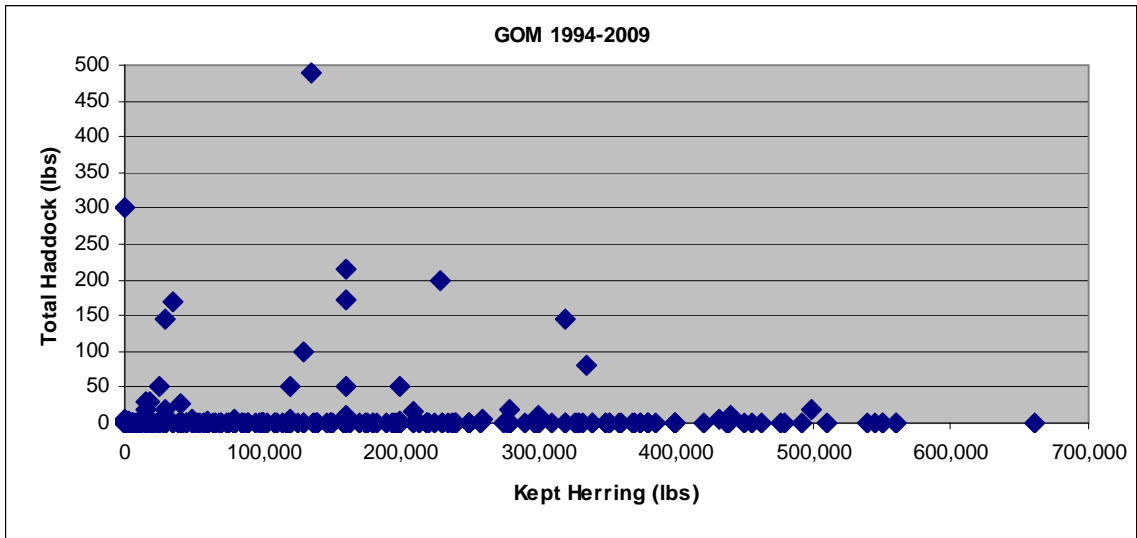


Figure 2 – Plot of herring/haddock on observed MWT tows. 2006-2009

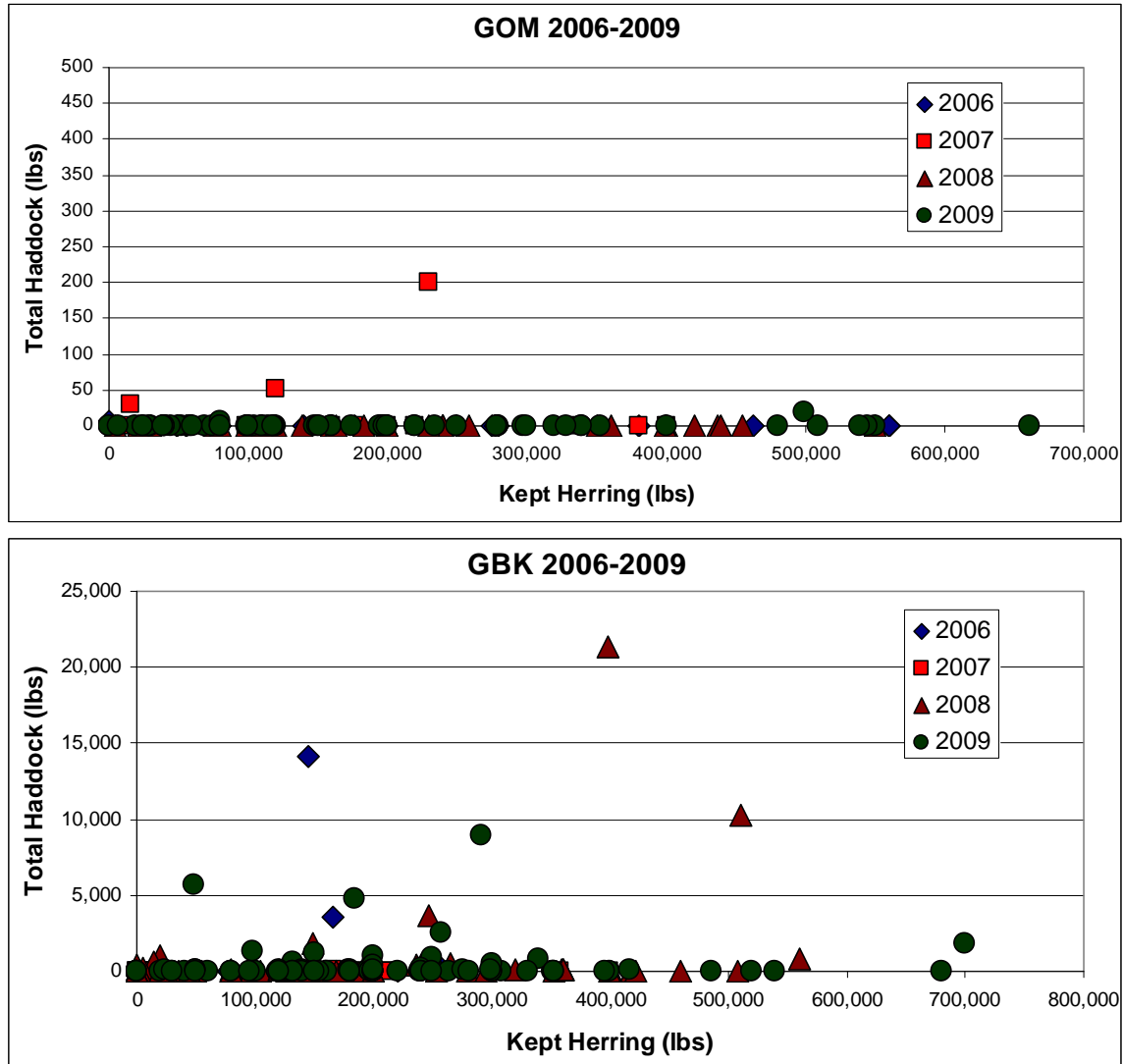


Figure 3 – Length-frequency of haddock on observed MWT tows, 200 - 2009

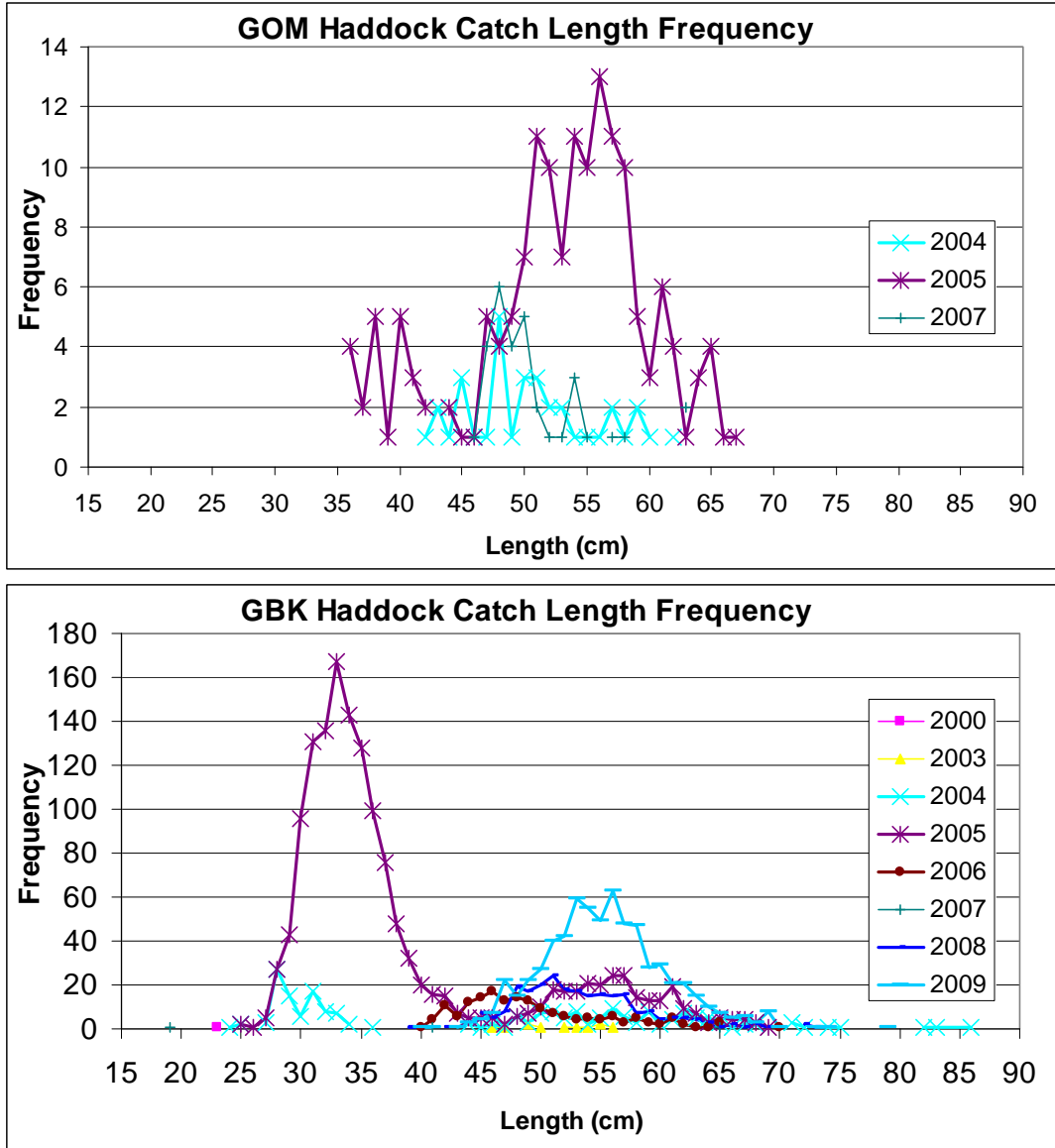


Figure 4 - Reported trips (VTR) and observed hauls and sets (NEFOP) during January - December, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

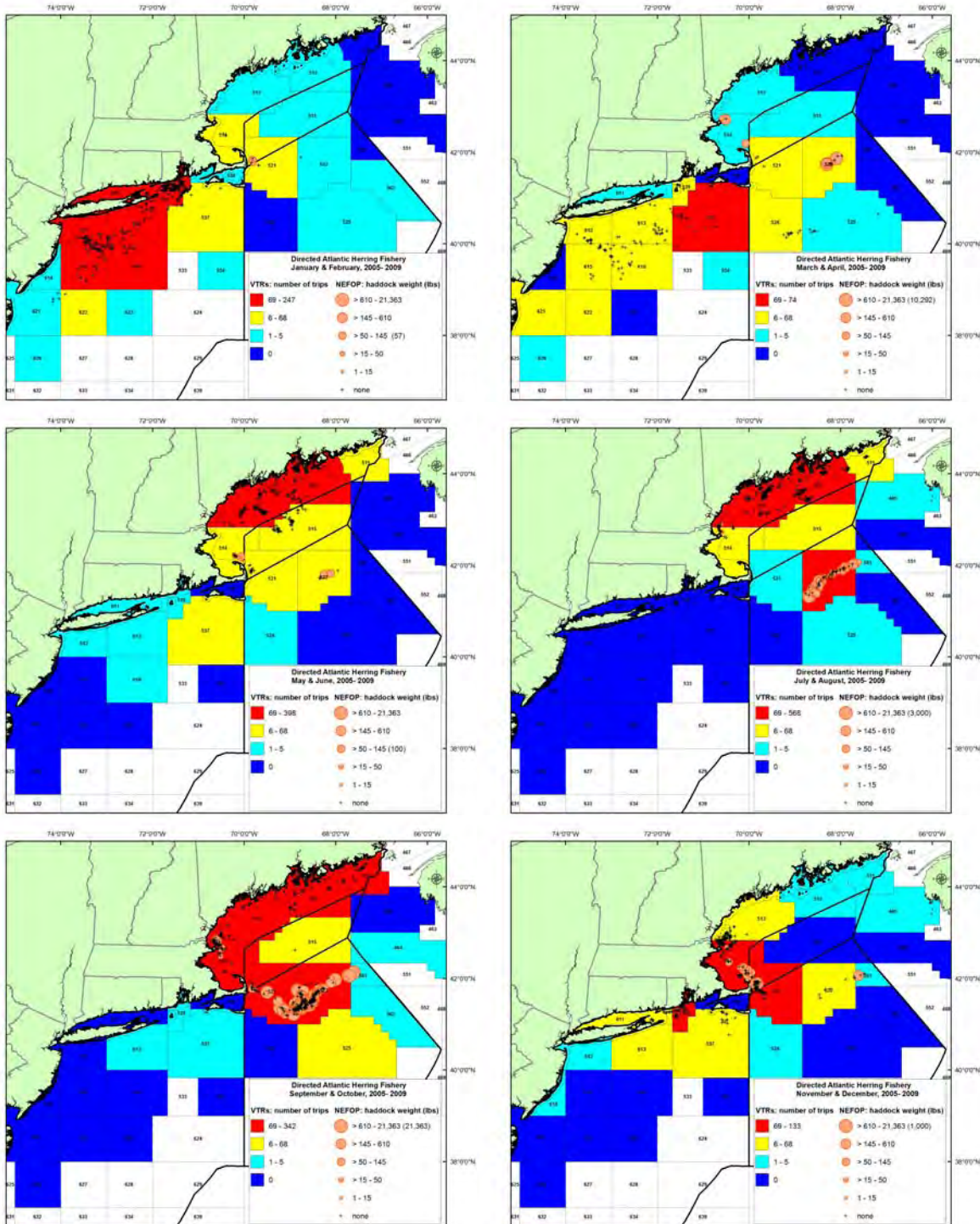


Figure 5 - Observed hauls and sets (NEFOP) from January- December, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired) and current spatial management, five groundfish closed areas (red polygons) and herring exemption area (gray shaded area). Scaled orange circles represent haddock bycatch (lbs) in observed hauls and sets for directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul or set did not catch river herring. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

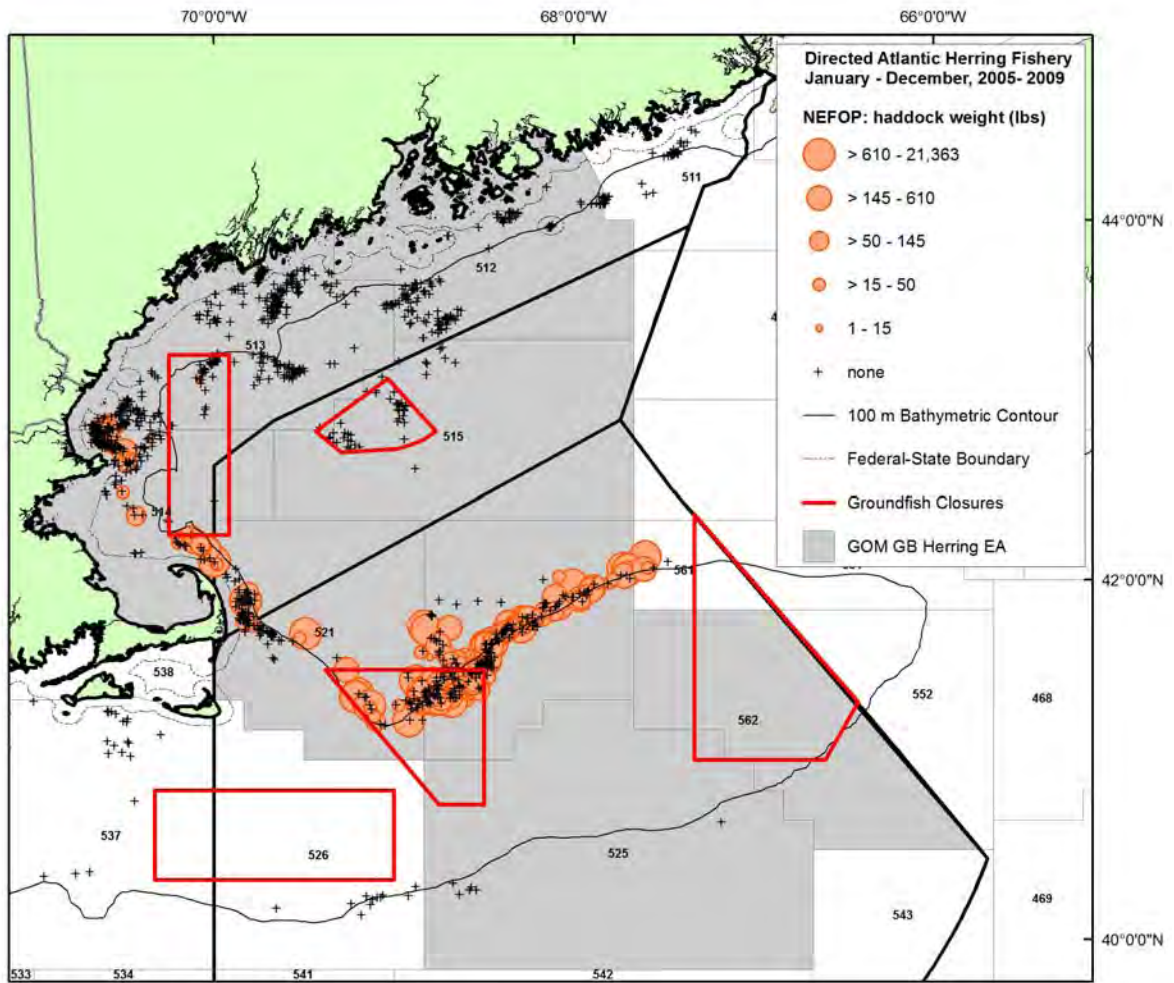


Figure 6 – Observed MWT herring catches

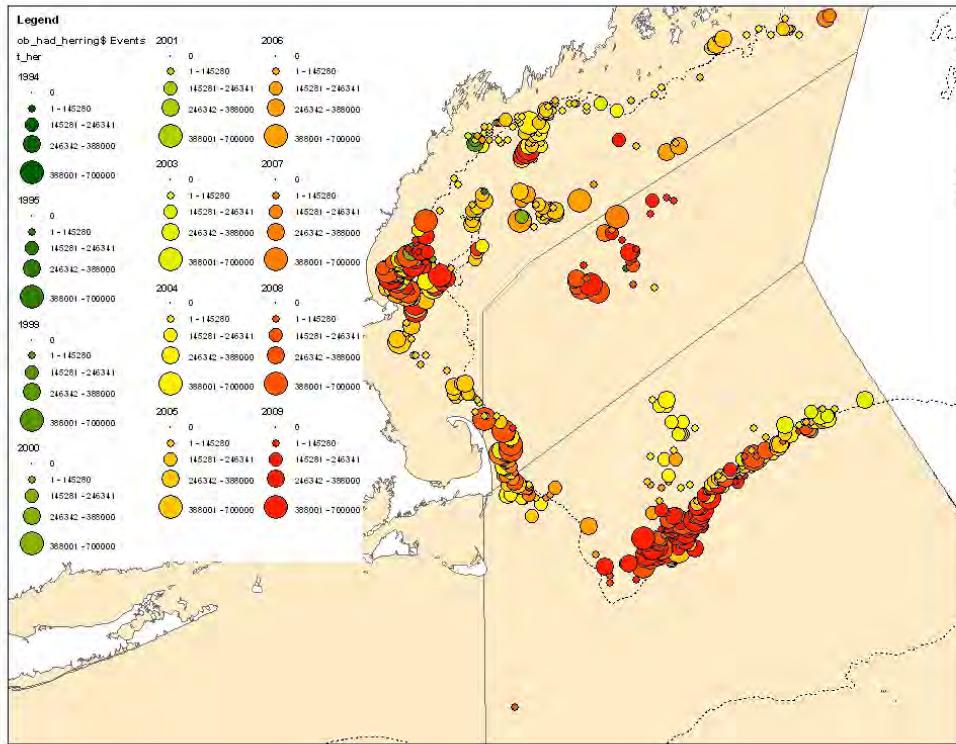


Figure 7 – Observed MWT haddock catches

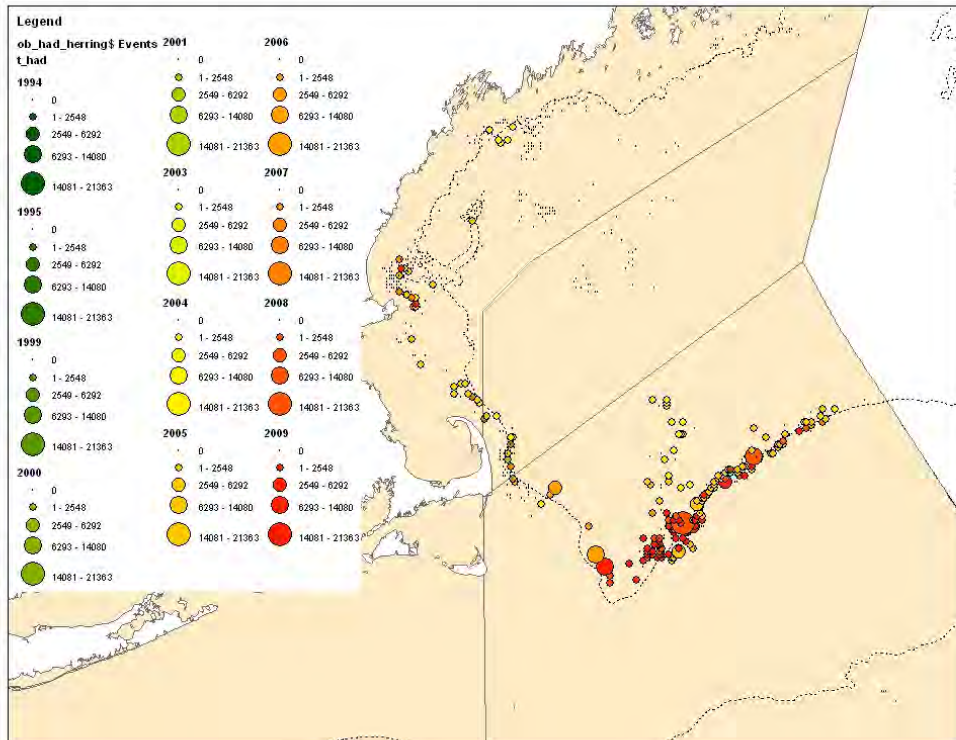
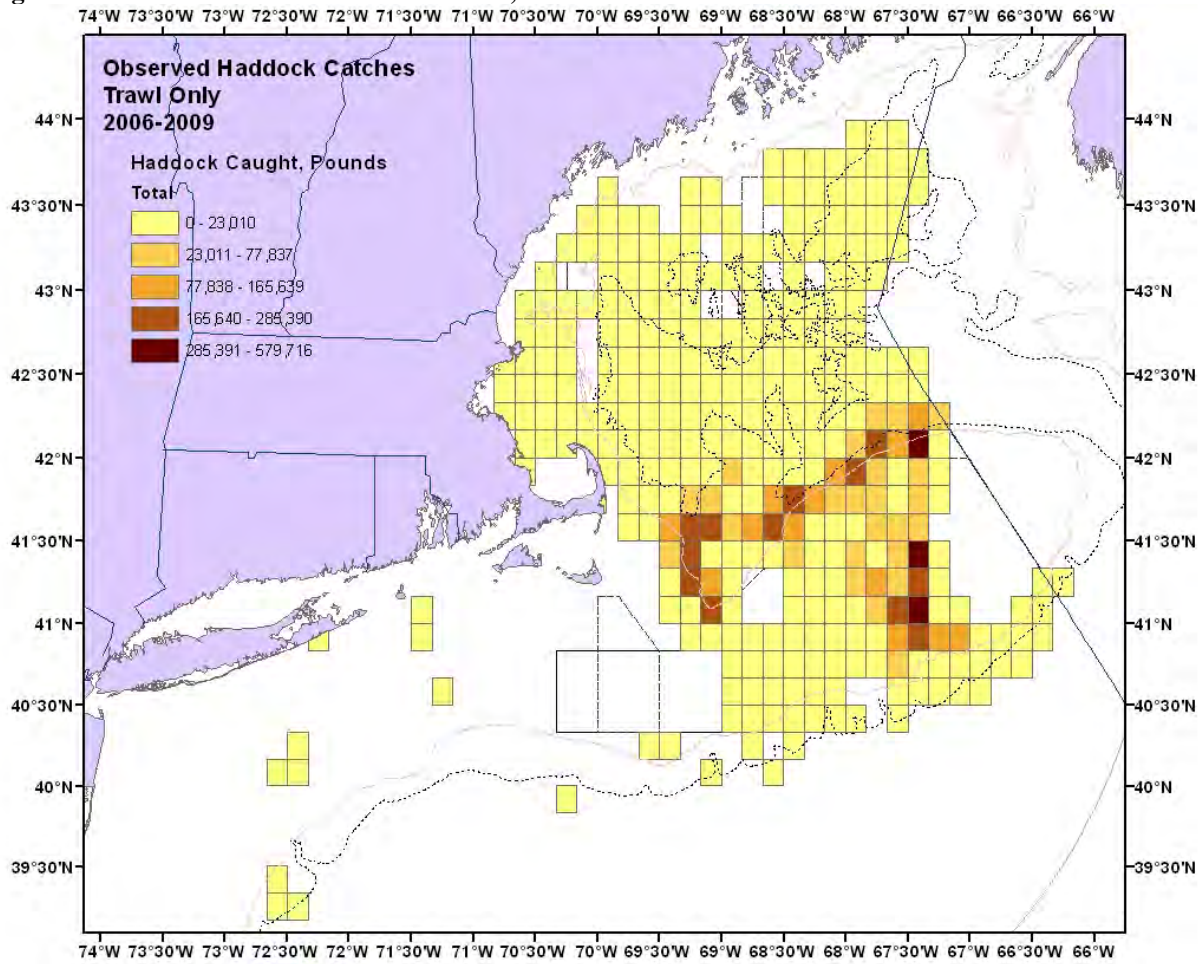


Figure 8 – Observed trawl catches of haddock, CY 2006 -2009



Enclosure (1)
Haddock Cap Catch Overview

This paper briefly summarizes the existing haddock cap catch regulations that apply to the herring fishery. These regulations were first adopted in Multispecies Framework 43. The cap amount was incorporated into the groundfish ACL/AM structure adopted by Amendment 16, and a corresponding accountability measure was adopted in Amendment 1 to the Herring FMP. This summary does not address additional requirements when fishing in CAI

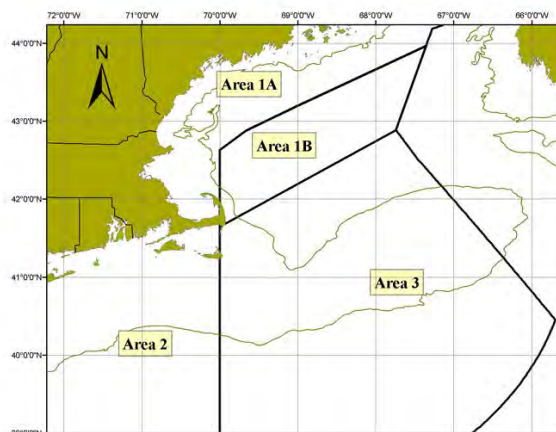
Herring Fishery Status

Herring midwater trawls and purse seines are no longer considered exempted gear because they are known to catch groundfish. FW 43 redefined these gears as an exempted, or certified bycatch, fishery but did not change access to closed areas by these gears. Exempted fisheries are regulated by groundfish regulations. Early groundfish amendments only allowed exempted fisheries if their groundfish bycatch was 5 percent or less of the total catch by weight. Amendment 13 acknowledged that exempted fisheries may catch more groundfish as stocks rebuild and left open the possibility they could be allowed even if catching more than 5 percent groundfish. Amendment 13 also says that they can be restricted if groundfish catches are less than 5 percent – for example, if the fishery is determined to catch excessive amounts of juvenile fish.

Herring Permits

There are four herring permit categories affected by the cap. These are:

- Category A: Limited access all areas permit, no limit on herring landings
- Category B: Limited access herring area 2 and 3 permit, no limit on herring landings
- Category C: Limited access incidental catch herring permit; limited to 55,000 pounds of herring per trip with one landing per calendar day; a Category B permit can also hold a Category C permit and use it in Area 1
- Category D: Open access herring permit, limited to 3 mt of herring per trip and one landing per calendar day



Groundfish Possession Limits

Category A and B herring vessels are required to land all haddock brought on deck or pumped onboard, but it cannot be sold for human consumption. They may land up to 100 pounds of other groundfish.

Haddock Catch Cap Amount

The cap is equal to 0.2% of the combined GB and GOM haddock ACL and is calculated based on the calendar year (January-December) but monitored based on the groundfish fishing year (May-April).

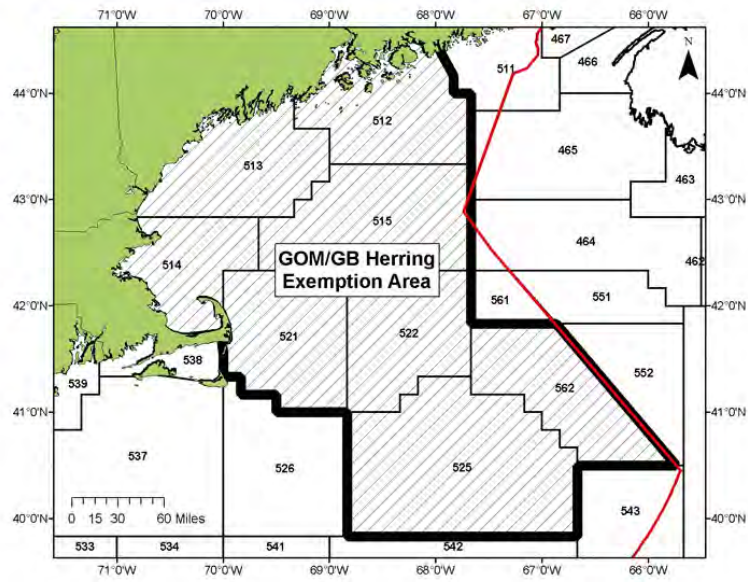
Monitoring

Only haddock catches on category A and B permitted vessels that are from the following sources count towards the cap: (1) dealers via Dealer Electronic Reporting to either the Standard Atlantic Fisheries Information System (SAFIS) or the Federally Licensed Seafood Dealers Trip Ticket System; (2) NOAA Fisheries Service Observer Program, through audited observer reports submitted by the Northeast Fisheries Science Center; and (3) from the NOAA Fisheries Office of Law Enforcement via reports resulting from actual dockside inspections of catch. by observers and/or reported by dealers are counted against the cap. Observed catch rates are not expanded to an estimate of total: observer data from the NMFS observer program and dockside monitoring conducted by the states.

Only catches by Category A and B permits are counted against the cap.

Accountability Measure

If the cap is reached all herring vessels issued a herring permit (all gears, all categories) are prohibited from possessing or landing more than 2,000 pounds of Atlantic herring per trip in the Herring Exempted Area (see chart below). The possession limit of haddock is reduced to 0 for Category A and B permits



[Working paper for use by the NEFMC Large Mesh Multispecies Plan Development Team]

Last update: January 14, 2011

Estimation of haddock bycatch in the northeast United States midwater trawl Atlantic herring fishery

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Executive summary

Haddock bycatch in the Atlantic herring midwater fishery is estimated for the years 1994 to 2009. Bycatch of haddock occurs primarily in the Georges Bank region where annual bycatch estimates range from 0 – 280 mt; estimates for Gulf of Maine were less than 5 mt annually. Bycatch amounts were estimated with moderate to poor precision with coefficients of variation ranging from 0.30 to 0.99.

Introduction

Non-governmental groups have communicated concern over the bycatch of haddock, *Melanogrammus aeglefinus*, in the northeast United States Atlantic herring, *Clupea harengus*, fishery. In response to these concerns an incidental catch allowance was established for Category 1 and limited access herring vessels participating in the fishery. Historically, the haddock incidental catch quotas have been monitored through a combination of direct observations by at-sea observers, dealer reported landings and landings reported by law enforcement officials. To date, no attempt has been made to generate fleet-wide estimates of the amount haddock bycatch occurring in the herring fishery.

In this paper we provide estimates of haddock bycatch in the northeast United States midwater trawl herring fishery. The bycatch estimates include both discarded and landed haddock caught by both paired-midwater trawls (two vessels towing a single large net) and midwater trawls (single vessel towing a single net). Atlantic herring are also targeted using purse seine gear, through previous analyses have indicated that the haddock bycatch is negligible in this fishery (< 0.01 mt/year, *M. Palmer unpublished*).

Methods

The bycatch estimation analyses utilize the same basic methodology as used for the Standardized Bycatch Reporting Methodology (SBRM; Wigley et. al 2007). The method employs a combined haddock catch-to-total landings ratio estimated from observed trips. The ratio is expanded using total fleet landings to achieve a fleet-wide bycatch estimate. Stock assessments typically rely on the commercial dealer data as the most reliable source of fleet landings information. In these analyses, the use of the commercial dealer data was problematic due to the prevalence of missing area information in the midwater trawl landings,

especially since 1999 (Table 1). The high incidence of missing area information in the midwater trawl landings is a result of the paired midwater trawl landings not entering the allocation procedure that is used to assign area to dealer landings (Wigley et al. 2008). Given the limitations of the dealer data, vessel trip report (VTR) data were used as the source of the fleet landings. There is generally good agreement (> 90%) between the total midwater trawl fleet landings estimated using dealer data compared to the VTR-based estimates (Table 2).

Northeast Fisheries Observer Program data

At-sea observer data from paired midwater (négear=170) and midwater trawl (négear=370) were used to calculate discard ratios. Training trips, aborted trips, and hauls with no catch reported were eliminated from the analytical data set. Only standard sea sampling trips were included (program code = '000'). Additionally, any fish catch records recorded as previously discarded (discard reason = '039') were excluded from the analyses. Prior to any analyses, standard conversion factors were applied to convert any dressed weight data to the live weight equivalents.

Vessel Trip Report (VTR) data

VTR landings from trip reporting either 'OTM' or 'PTM' gear were used in the analyses. As with the observer data, standard conversion factors were applied to convert the reported landings to the live weight equivalents.

Stratification and data filtering

The bycatch estimation was stratified by area. For these analyses, the northeast region was divided into three subareas roughly corresponding to the Atlantic herring management areas (Figure 1). These areas are the Gulf of Maine (Areas 1A and 1B), Georges Bank (Area 3), southern New England/Mid-Atlantic (Area 2).

Bycatch estimates were not stratified by quarter or half-year block as is commonly done in SBRM analyses because of the small number of observed trips, particularly early in the time series (Table 3 and 4). All discard estimates were calculated using an aggregate annual estimate. Without temporal stratification the combined ratio method becomes nearly identical to the separate ratio method that was also investigated in Wigley et al. (2007).

These analyses were primarily concerned with estimating the bycatch of haddock in the directed Atlantic herring fishery. Midwater trawl gear is also used to target other species such as Atlantic mackerel, *Scomber scombrus*. The target fishery can only be determined indirectly through an examination of the catch composition. In an attempt to filter out only directed herring trips from both the observer and VTR data, a catch composition filter was placed at the haul and subtrip level respectively. Hauls or subtrips where herring did not make up $\geq 90\%$ of the catch were excluded from the analyses.

Results

The bycatch estimation was run both with (Table 3), and without (Table 4) the herring catch composition filters. The filters had minimal impact on the number of observed trips and overall bycatch estimates. The fleet landings used to estimate fleet bycatch from the calculated discard ratios are provided in Table 5 for both the filtered and unfiltered runs. The total commercial haddock landings are presented in Table 6 to provide scale to the bycatch estimates. In general, unfiltered haddock bycatch estimates in the herring fishery ranged from 0 to 11% on Georges Bank. The 11% estimate was based on four observed trips in 2006.

References

Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design, and Estimation of Precision and Accuracy (2nd Edition). US Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 07-09; 156 p.

Wigley SE, Hersey P, Palmer JE. 2008. A description of the allocation procedure applied to the 1994 to 2007 commercial landings data. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-18; 61 p.

Table 1. Annual midwater trawl landings reported in the commercial dealer data between 1994 and 2009. The fraction of the total landings where area is not available is shown.

Year	Total landings (mt)	Landings w/ known area (mt)	Landings w/ unknown area (mt)	Fraction of landings w/ unknown area
1994	8,195	7,891	304	0.04
1995	34,863	34,604	259	0.01
1996	47,082	43,349	3,733	0.08
1997	49,592	44,814	4,778	0.10
1998	61,473	51,864	9,609	0.16
1999	57,511	16,488	41,023	0.71
2000	53,414	9,064	44,350	0.83
2001	89,170	11,206	77,964	0.87
2002	78,883	8,769	70,115	0.89
2003	110,977	32,196	78,782	0.71
2004	95,251	36,107	59,144	0.62
2005	109,507	47,212	62,294	0.57
2006	130,838	49,298	81,540	0.62
2007	61,852	17,989	43,864	0.71
2008	71,930	10,289	61,641	0.86
2009	83,972	28,684	55,287	0.66

Table 2. Annual comparison of midwater trawl landings reported in the commercial dealer and vessel trip report (VTR) data.

Year	Commercial dealer landings (mt)	VTR landings (mt)	Commercial dealer landings/VTR landings
1994	8,195	15,234	0.54
1995	34,863	46,295	0.75
1996	47,082	60,311	0.78
1997	49,592	57,792	0.86
1998	61,473	66,476	0.92
1999	57,511	63,881	0.90
2000	53,414	82,006	0.65
2001	89,170	109,635	0.81
2002	78,883	96,279	0.82
2003	110,977	118,760	0.93
2004	95,251	127,183	0.75
2005	109,507	120,667	0.91
2006	130,838	130,399	1.00
2007	61,852	68,510	0.90
2008	71,930	75,094	0.96
2009	83,972	95,425	0.88
Average 2003 - 2009			0.90

Table 3. Estimation of haddock bycatch in the midwater trawl herring fishery. Midwater trawl trips have been filtered to include only those hauls/subtrips where the catch was composed of $\geq 90\%$ herring.

Gulf of Maine				Georges Bank				Southern New England/mid-Atlantic			
Year	Mid-water trawl (170, 370) Observed			Year	Mid-water trawl (170, 370) Observed			Year	Mid-water trawl (170, 370) Observed		
	trips	Catch (mt)	CV		trips	Catch (mt)	CV		trips	Catch (mt)	CV
1994				1994				1994			
1995	4	0.00		1995				1995			
1996				1996				1996			
1997				1997				1997			
1998				1998				1998			
1999	2	0.00		1999				1999	1	0.00	
2000	3	0.00		2000				2000	8	0.00	
2001				2001	1	0.00		2001			
2002				2002				2002			
2003	8	0.00		2003	10	0.35	0.77	2003	1		
2004	58	1.23	0.66	2004	20	33.64	0.64	2004	2	0.00	
2005	87	3.89	0.37	2005	34	54.16	0.35	2005	19	0.00	
2006	13	0.00		2006	4	277.70	0.99	2006	12	0.00	
2007	7	1.73	0.90	2007	8	1.44	0.54	2007	1		
2008	14	0.00		2008	20	63.86	0.48	2008	9	0.00	
2009	31	0.04	0.65	2009	38	57.46	0.30	2009	16	0.00	

Table 4. Estimation of haddock bycatch in the midwater trawl herring fishery. Data have not been filtered; all midwater trawl data are included, regardless of catch composition.

Gulf of Maine			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994			
1995	4	0.00	
1996			
1997			
1998			
1999	2	0.00	
2000	3	0.00	
2001			
2002			
2003	8	0.00	
2004	59	1.23	0.66
2005	87	3.92	0.37
2006	14	0.06	1.07
2007	7	1.77	0.90
2008	14	0.00	
2009	32	0.04	0.65

Georges Bank			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994	1	0.00	
1995			
1996			
1997			
1998			
1999			
2000	1	0.00	
2001	1	0.00	
2002			
2003	10	0.35	0.77
2004	20	34.02	0.64
2005	37	52.19	0.35
2006	4	280.48	0.99
2007	10	1.62	0.60
2008	23	67.66	0.49
2009	39	56.78	0.30

Southern New England/mid-Atlantic			
Year	Mid-water trawl (170, 370)		
	Observed trips	Catch (mt)	CV
1994	31	0.00	
1995	33	0.00	
1996			
1997			
1998			
1999	1		
2000	9	0.00	
2001			
2002	1		
2003	6	0.06	0.92
2004	12	0.00	
2005	27	0.00	
2006	27	0.00	
2007	5	0.00	
2008	23	0.00	
2009	29	0.00	

Table 5. Total VTR fleet landings (mt) used to derive discard estimates provided in tables 3 and 4.

Year	Total VTR landings (mt) w/filter			Total VTR landings (mt) w/out filter		
	Gulf of Maine	Georges Bank	Southern New England/mid-Atlantic	Gulf of Maine	Georges Bank	Southern New England/mid-Atlantic
1994	12,754	720	462	12,754	720	1,760
1995	26,073	497	14,809	26,075	678	19,443
1996	27,460	1,619	24,358	27,504	2,241	30,421
1997	22,618	5,521	21,642	22,641	5,534	29,476
1998	20,616	17,845	15,290	22,594	17,942	24,383
1999	31,783	6,130	17,962	32,095	6,994	24,224
2000	35,180	16,372	24,419	35,180	16,692	30,134
2001	34,692	53,053	14,099	34,696	53,053	21,888
2002	42,463	18,880	9,410	42,528	19,689	34,061
2003	43,961	26,909	12,830	43,994	26,909	47,856
2004	39,766	22,312	9,785	39,877	22,560	64,746
2005	46,155	19,646	12,581	46,568	19,655	54,278
2006	43,106	21,292	16,106	43,113	21,505	65,473
2007	14,823	13,026	8,951	15,123	20,353	32,548
2008	18,236	16,434	13,333	18,236	21,834	33,862
2009	20,891	31,598	16,518	20,892	31,849	41,737

Table 6. Total haddock landings (mt) in the northeast United States commercial fishery from 1994 to 2009. Unfiltered midwater trawl haddock bycatch estimates and the percentage of haddock bycatch to total haddock landings are also shown.

Year	Gulf of Maine			Georges Bank			Total		
	Haddock landings	k bycatch	Percent bycatch	Haddock landings	Haddock bycatch	Percent bycatch	Haddock landings	Haddock bycatch	Percent bycatch
1994	122			206	0.00	0.0%	329	0	0.0%
1995	178	0.00	0.0%	231			410	0	0.0%
1996	254			320			574	0	
1997	624			880			1,504	0	
1998	924			1,914			2,838	0	
1999	571	0.00	0.0%	2,572			3,143	0	0.0%
2000	799	0.00	0.0%	3,203	0.00	0.0%	4,002	0	0.0%
2001	1,007			4,820	0.00	0.0%	5,827	0	0.0%
2002	1,009			6,532			7,541	0	
2003	1,026	0.00	0.0%	5,760	0.35	0.0%	6,786	0	0.0%
2004	947	1.23	0.1%	7,375	34.02	0.5%	8,323	35	0.4%
2005	978	3.92	0.4%	6,604	52.19	0.8%	7,581	56	0.7%
2006	622	0.06	0.0%	2,644	280.48	10.6%	3,266	281	8.6%
2007	693	1.77	0.3%	2,938	1.62	0.1%	3,631	3	0.1%
2008	608	0.00	0.0%	5,744	67.66	1.2%	6,352	68	1.1%
2009	521	0.04	0.0%	5,311	56.78	1.1%	5,832	57	1.0%

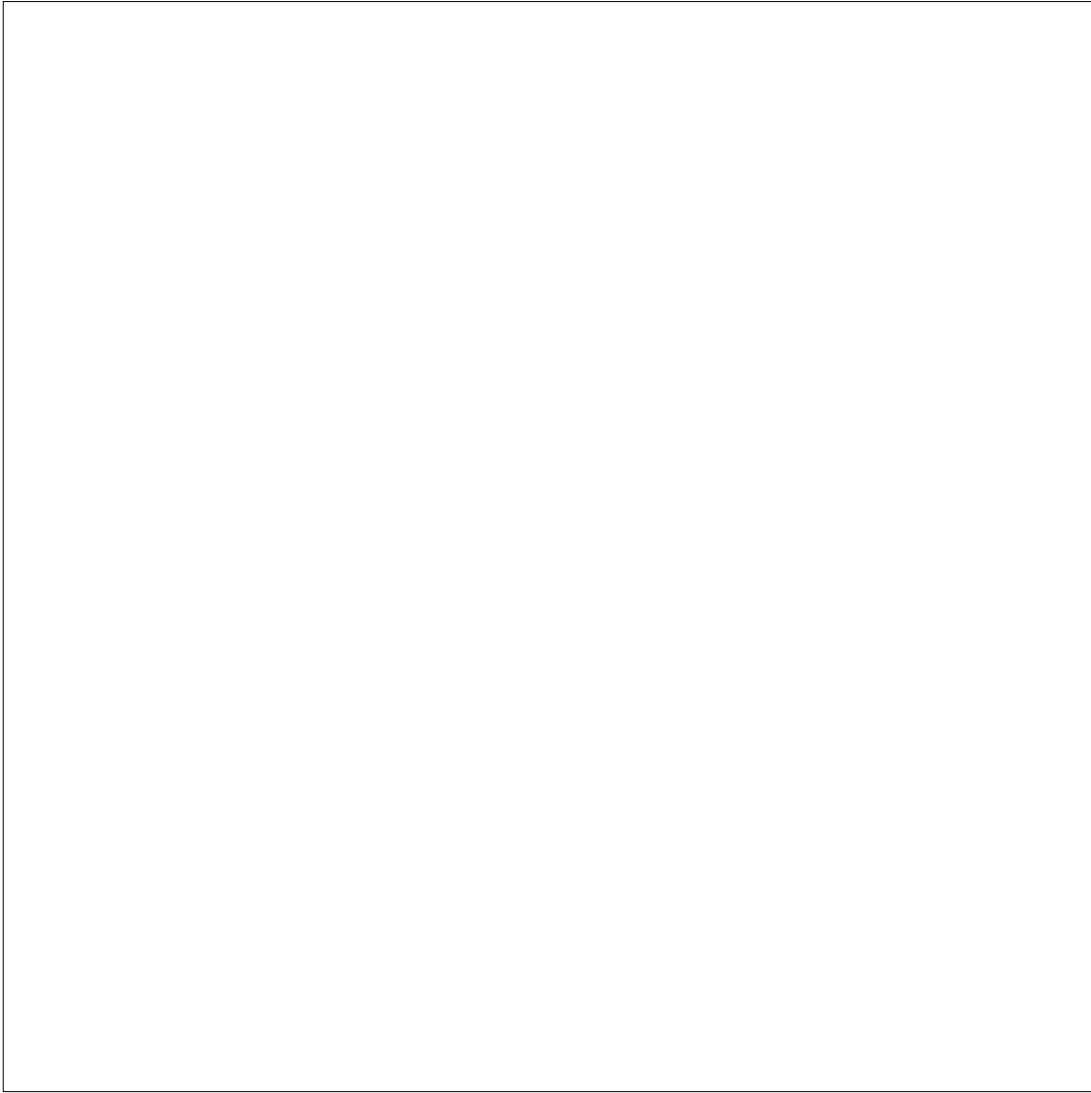


Figure 1. Geographic regions used for estimation of haddock bycatch in the midwater trawl herring fishery.

DRAFT

**Identification of haddock bycatch in
the directed Atlantic herring fishery**

Prepared for the Groundfish PDT

by

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January 2011

Background

At its November 2010 meeting, the New England Fishery Management Council (NEFMC) initiated Framework 47 to the Groundfish Fishery Management Plan (FMP) with the objective of addressing the bycatch cap for haddock, *Melanogrammus aeglefinus*, in the directed Atlantic herring, *Clupea harengus*, fishery. Since then, the Groundfish Plan Development Team (PDT) has been working on this issue.

The following is a summary report prepared for the Groundfish PDT. It includes preliminary findings to identify times and areas that haddock bycatch has occurred in the directed Atlantic herring fishery in the recent past.

Study Area

The study area includes the Atlantic herring FMP areas (1A, 1B, 2, and 3) within the Eastern US Continental shelf (Figure 1).

Datasets and Data Selection

Multiple fishery data sources were used in this analysis. These sources included Vessel Trip Report (VTR) and Northeast Fishery Observer Program (NEFOP) databases. The most recent 5 years, 2005-2009, of fishery data were pooled in this analysis. Fishery data also included three broad gear categories: bottom otter-trawl, purse seine, and mid-water trawl (single and pair mid-water combined); all of which were pooled in this analysis.

Data from directed herring trips were selected from VTR and NEFOP databases and grouped into bimonthly blocks (Tables 1-2). Here, directed herring trips were defined as 2,000 lbs of kept Atlantic herring on a trip. Data from other non-directed trips was not included in the analysis.

Haddock data from observed directed herring trips (NEFOP) were presence/absence and weight (lbs) from each haul or set. Data from the Massachusetts Division of Marine Fisheries and the Maine Department of Marine Resources portside surveys were excluded because spatial information was not available for all years and all trips.

Methods

Fishing Effort and Haddock Bycatch

To understand where and when the directed herring fishery operated throughout the fishing year, bimonthly maps were constructed using VTRs. Fishing effort was approximated by the total number of VTRs for each Statistical Area, since each time a vessel fishes in a new Statistical Area, a new VTR is completed (see Tables A1-A6 in Appendix). Bimonthly maps of fishing effort were color-coded from high (red) to low (blue) to identify fishing effort concentration areas (Figs. 2-7). VTRs by Statistical Area were binned into quartiles (4 bins) using all years and months combined and then mapped separately in bimonthly blocks.

These maps were overlaid with bimonthly NEFOP data on haddock bycatch events from observed hauls/sets. Haddock data from observed directed Atlantic herring trips (NEFOP) were presence/absence and weight (lbs) from each haul/set. Positive bycatch events were binned into

quintiles (5 bins) using all years and months combined, and then mapped separately in bimonthly blocks. Plotted circles of increasing size represent the magnitude of the bycatch event (Figs. 2-7). The relative weights are represented by orange circles of increasing size. Black crosses indicate an observed tow/set without haddock bycatch.

A single map of current spatial management was overlaid with all haddock bycatch events from 2005-2009, regardless of month (Fig. 8). These measures include the five groundfish closures (Closed Area 1, Closed Area 2, Nantucket Lightship Closed Area, Cashes Ledge Closure, and the Western Gulf of Maine Closure) and the Gulf of Maine/Georges Bank Herring Exemption Area.

Results

Fishing Effort and Haddock Bycatch

Visual differences in the spatial and temporal distribution of directed herring trips were evident from maps of fishing effort (Fig. 2-7). In general during the first six months of the year, fishing effort shifted from the northern Mid-Atlantic Bight and southern New England waters (January-February; Fig. 2) to primarily southern New England waters (March-April; Fig. 3), and then to the Gulf of Maine (May-June; Fig. 4). Then, fishing effort concentrated in the Gulf of Maine and Georges Bank (July-August and September-October; Figs. 5-6), contracting to the Gulf of Maine and southern New England waters (November-December; Fig. 7) at the end of the year.

Using NEFOP haul and set data, haddock bycatch events were visually inspected for each bimonthly block (Figs. 2-7). Haddock bycatch events occurred in every bimonthly block, but most notable July-October on the western edge of Georges Bank (Table 3, Figs. 5-6) and November-December off Cape Cod and in Massachusetts Bay (Fig. 7). Haddock bycatch in the directed herring fishery appeared to be correlated with the 100m bathymetric contour (Fig. 8). Haddock bycatch events also occurred in the northern portion of Closed Area 1 (Fig. 8). In addition, haddock is often absent in observed tows/sets within these same areas (Table 3, Figs. 5-8).

Tables

<i>Jan-Dec</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	77	774	200	1051	
2006	150	739	175	1064	
2007	414	389	365	1168	
2008	109	304	246	659	
2009	203	406	225	834	
ALL	953	2612	1211	4776	

<i>Jan-Feb</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	10	89	0	99	
2006	52	108	0	160	
2007	140	141	0	281	
2008	56	101	0	157	
2009	79	128	0	207	
ALL	337	567	0	904	

<i>Mar-Apr</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	5	48	0	53	
2006	19	71	0	90	
2007	15	65	0	80	
2008	7	44	0	51	
2009	26	55	0	81	
ALL	72	283	0	355	

<i>May-Jun</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	7	151	25	183	
2006	0	158	27	185	
2007	0	75	52	127	
2008	0	25	53	78	
2009	1	18	53	72	
ALL	8	427	210	645	

<i>Jun-Aug</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	7	182	88	277	
2006	12	202	94	308	
2007	163	0	187	350	
2008	17	12	177	206	
2009	27	9	121	157	
ALL	226	405	667	1298	

<i>Sep-Oct</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	20	195	82	297	
2006	25	143	54	222	
2007	64	52	126	242	
2008	10	68	16	94	
2009	25	128	45	198	
ALL	144	586	323	1053	

<i>Nov-Dec</i>		Gear Category			
Year	OT	PR	PS	ALL	
2005	28	109	5	142	
2006	42	57	0	99	
2007	32	56	0	88	
2008	19	54	0	73	
2009	45	68	6	119	
ALL	166	344	11	521	

Table 1: Number of directed herring trips separated by gear, year and bimonthly groupings for VTRs by Statistical Area. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. See Tables 1-6 in Appendix for VTRs by gear by Statistical Area. Source: Vessel Trip Report Database 2005-2009.

<i>Jan-Dec</i> Gear Category				
Year	OT	PR	PS	ALL
2005	15	465	95	575
2006	64	120	0	184
2007	59	75	27	161
2008	8	209	69	286
2009	35	437	97	569
ALL	181	1306	288	1775

<i>Jan-Feb</i> Gear Category				
Year	OT	PR	PS	ALL
2005	0	39	0	39
2006	36	72	0	108
2007	37	19	0	56
2008	4	44	0	48
2009	23	76	0	99
ALL	100	250	0	350

<i>Mar-Apr</i> Gear Category				
Year	OT	PR	PS	ALL
2005	0	21	0	21
2006	0	3	0	3
2007	0	22	0	22
2008	0	41	0	41
2009	4	34	0	38
ALL	4	121	0	125

<i>May-Jun</i> Gear Category				
Year	OT	PR	PS	ALL
2005	0	64	5	69
2006	0	6	0	6
2007	0	3	0	3
2008	0	28	25	53
2009	0	37	39	76
ALL	0	138	69	207

<i>Jul-Aug</i> Gear Category				
Year	OT	PR	PS	ALL
2005	3	112	47	162
2006	16	17	0	33
2007	11	0	18	29
2008	4	15	36	55
2009	0	11	51	62
ALL	34	155	152	341

<i>Sep-Oct</i> Gear Category				
Year	OT	PR	PS	ALL
2005	12	111	43	166
2006	8	20	0	28
2007	3	15	9	27
2008	0	42	8	50
2009	4	194	3	201
ALL	27	382	63	472

<i>Nov-Dec</i> Gear Category				
Year	OT	PR	PS	ALL
2005	0	118	0	118
2006	4	2	0	6
2007	8	16	0	24
2008	0	39	0	39
2009	4	85	4	93
ALL	16	260	4	280

Table 2: Observed hauls/sets from directed herring trips separated by gear, year and bimonthly groupings. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Source: NEFOP Database 2005-2009.

<i>Jan-Feb</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		100	248	0	348
1 - 15		0	0	0	0
> 15 - 50		0	1	0	1
> 50 - 145		0	1	0	1
> 145 - 610		0	0	0	0
> 610 - 21,363		0	0	0	0
maximum= 57	ALL	100	250	0	350

<i>Mar-Apr</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		4	112	0	116
1 - 15		0	2	0	2
> 15 - 50		0	2	0	2
> 50 - 145		0	1	0	1
> 145 - 610		0	2	0	2
> 610 - 21,363		0	2	0	2
maximum= 10,292	ALL	4	121	0	125

<i>May-Jun</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		0	130	69	199
1 - 15		0	4	0	4
> 15 - 50		0	1	0	1
> 50 - 145		0	3	0	3
> 145 - 610		0	0	0	0
> 610 - 21,363		0	0	0	0
maximum= 100	ALL	0	138	69	207

<i>Jul-Aug</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		20	117	152	289
1 - 15		14	9	0	23
> 15 - 50		0	10	0	10
> 50 - 145		0	7	0	7
> 145 - 610		0	8	0	8
> 610 - 21,363		0	4	0	4
maximum= 3,000	ALL	34	155	152	341

<i>Sep-Oct</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		23	266	63	352
1 - 15		1	14	0	15
> 15 - 50		1	27	0	28
> 50 - 145		2	21	0	23
> 145 - 610		0	25	0	25
> 610 - 21,363		0	29	0	29
maximum= 21,363	ALL	27	382	63	472

<i>Nov-Dec</i>		Gear Category			
Haddock Weight (lbs)		OT	PR	PS	ALL
none		16	244	4	264
1 - 15		0	3	0	3
> 15 - 50		0	5	0	5
> 50 - 145		0	3	0	3
> 145 - 610		0	3	0	3
> 610 - 21,363		0	2	0	2
maximum= 1,000	ALL	16	260	4	280

Table 3: Frequency table of haddock bycatch (lbs) in observed hauls and sets for directed herring trips by gear type and bimonthly blocks. Gear categories include bottom otter-trawls (OT), purse seines (PS), and mid-water trawls-single and paired (PR). Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Note this table corresponds with the scaled orange circles in Figs. 2-7. Source: NEFOP Database 2005-2009.

Figures

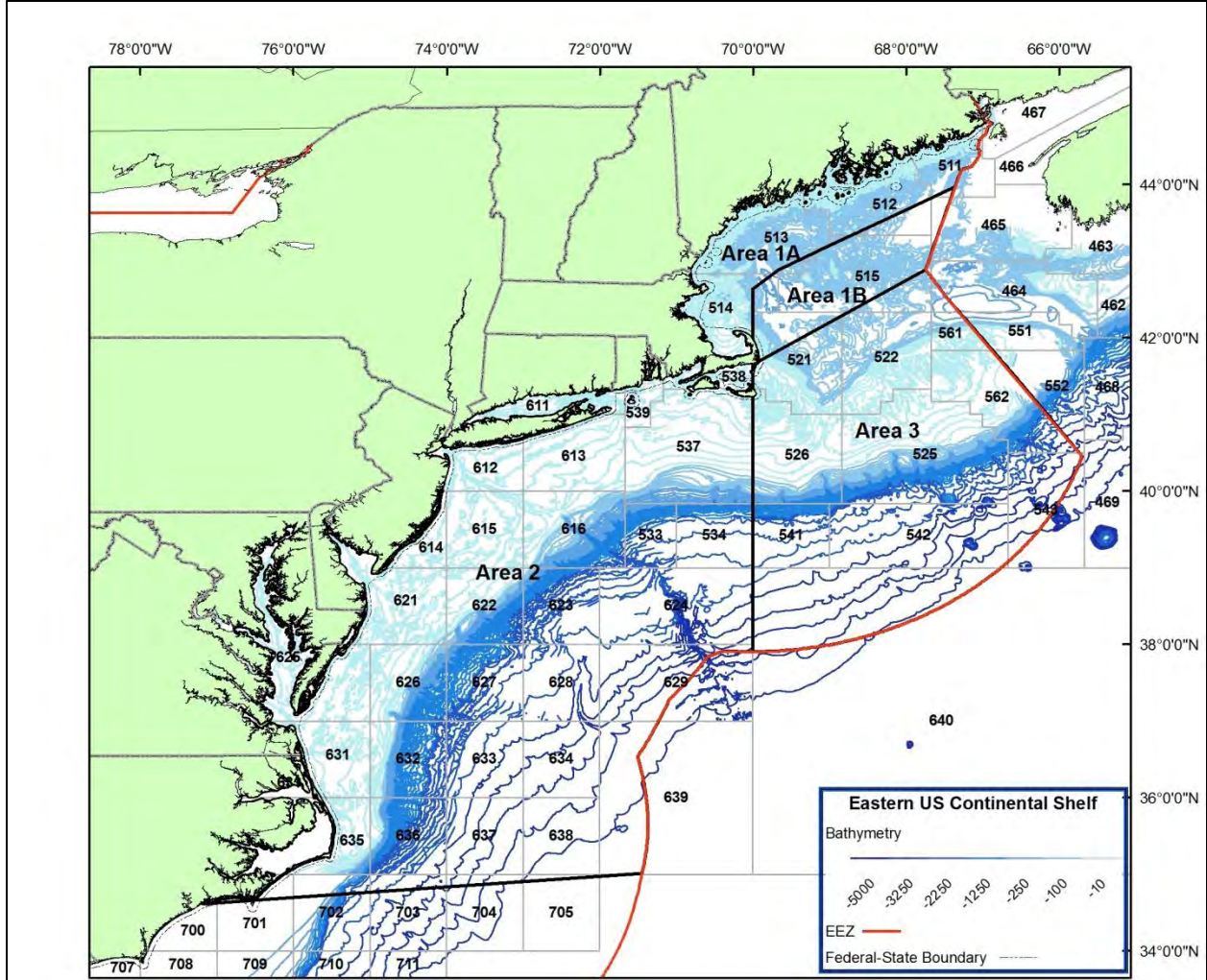


Figure 1: Study area of the Eastern US Continental Shelf. Overlapping Atlantic herring fishery management plan areas (Area 1A, 1B, 2, and 3) and fisheries management statistical areas (400-700s) indicated.

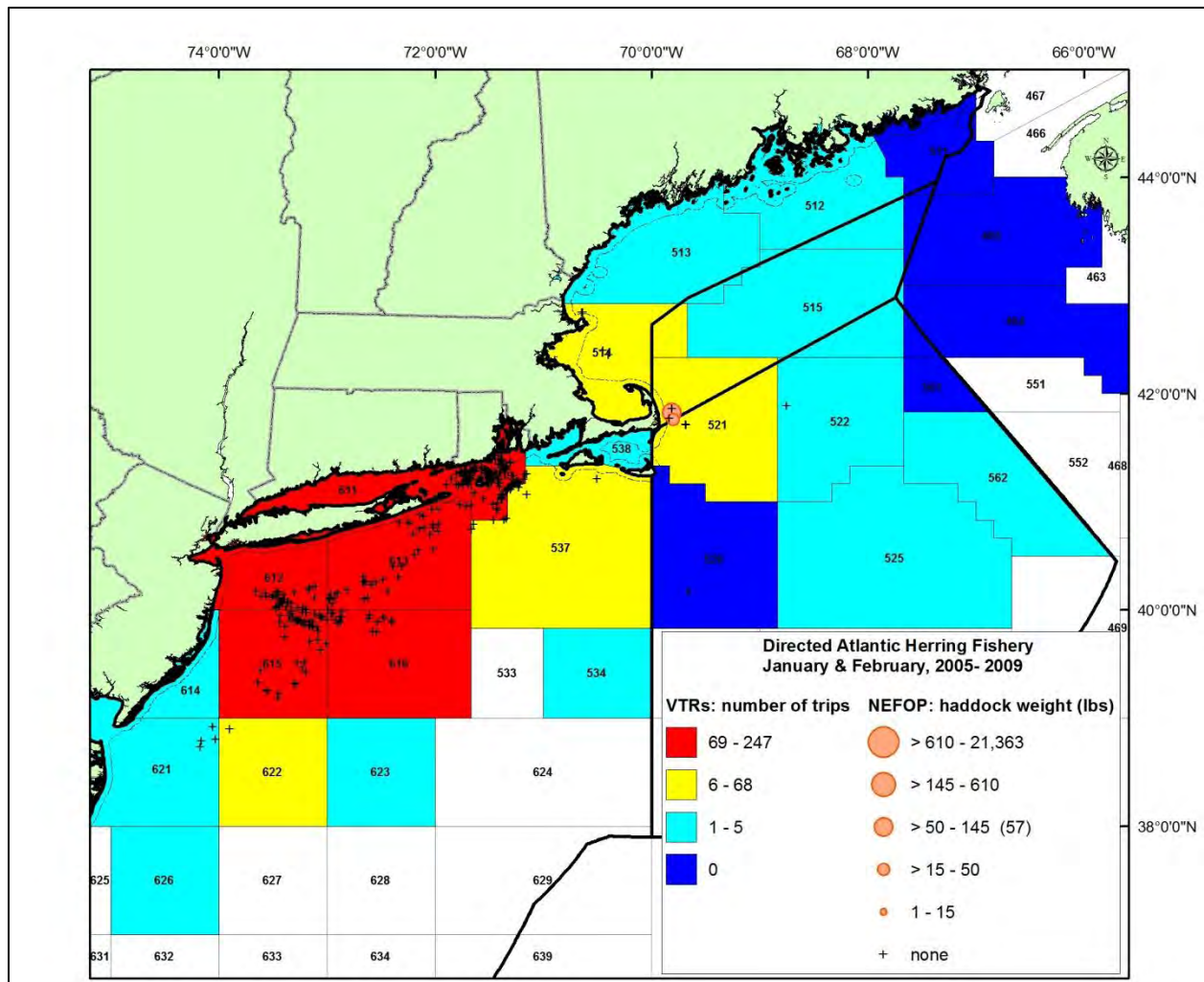


Figure 2: Reported trips (VTR) and observed hauls and sets (NEFOP) during January and February, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-247 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. All the colored Statistical Areas represent the spatial extent of fishing throughout the year. Blue indicates zero VTRs in a Statistical Area for a bimonthly block. However in a later bimonthly block, those blue areas may be greater than zero, represented by green, yellow, or red. White areas represent those Statistical Areas without any VTRs. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

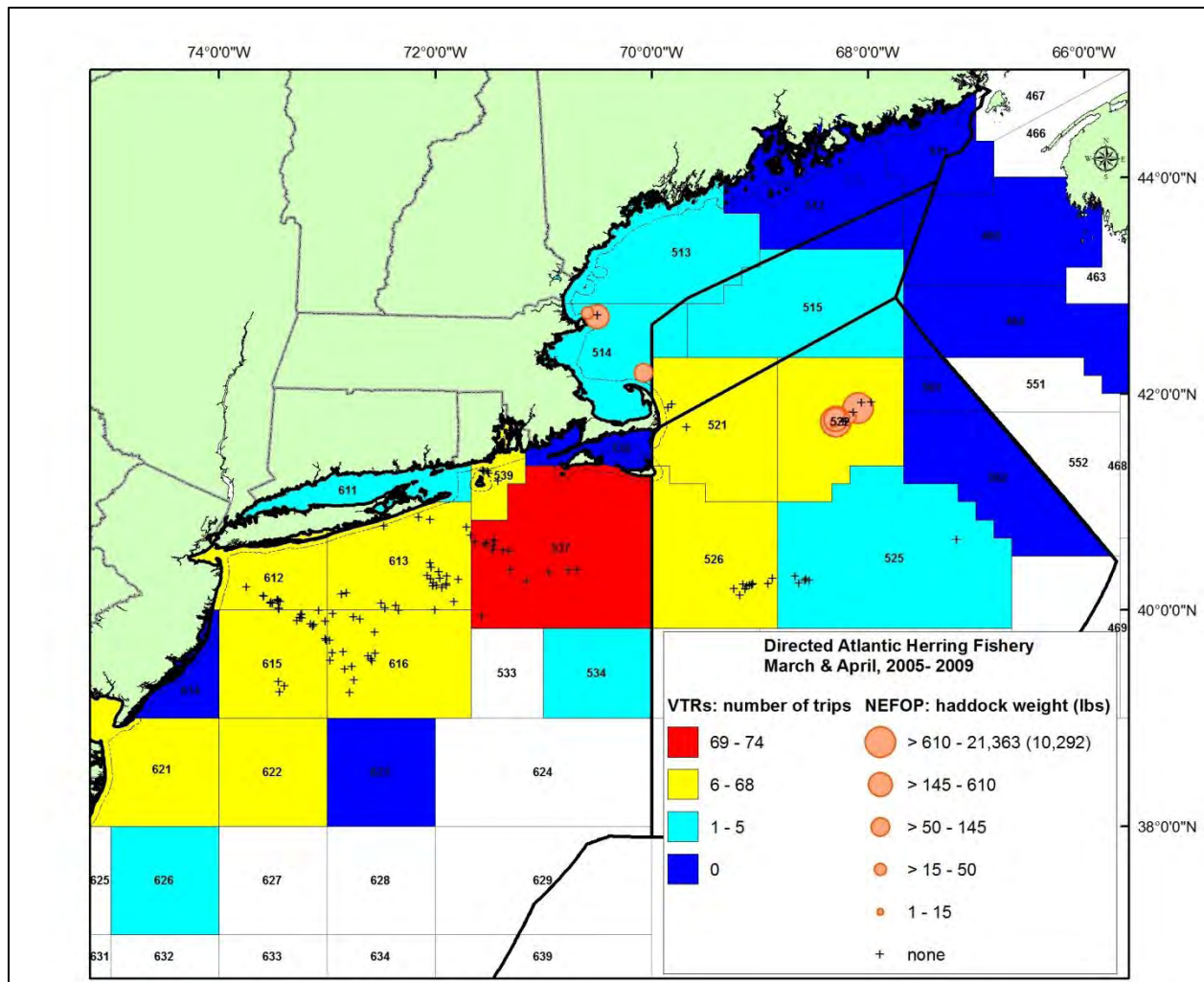


Figure 3: Reported trips (VTR) and observed hauls and sets (NEFOP) during March and April, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-74 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

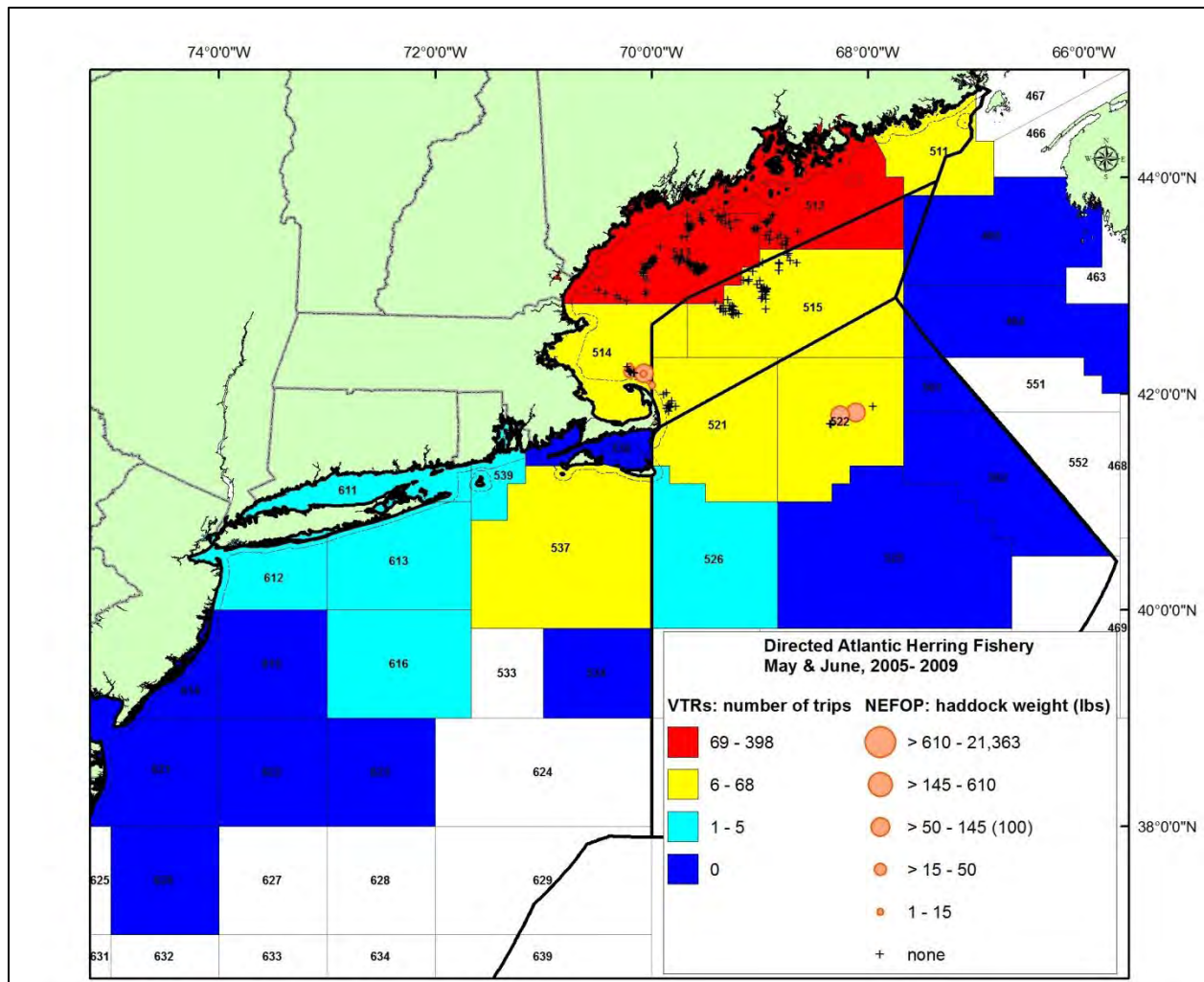


Figure 4: Reported trips (VTR) and observed hauls and sets (NEFOP) during May and June, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-398 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

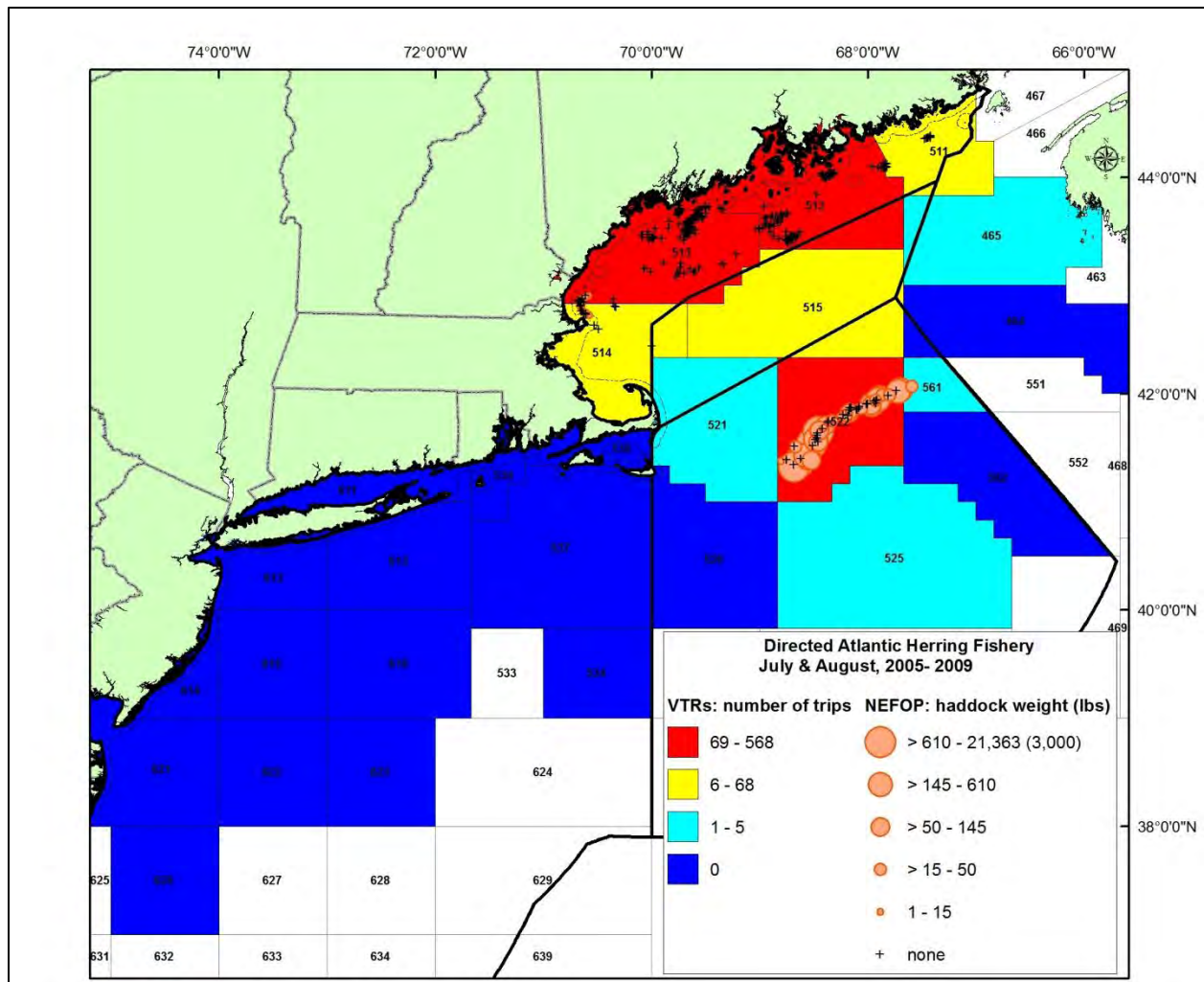


Figure 5: Reported trips (VTR) and observed hauls and sets (NEFOP) during July and August, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-568 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

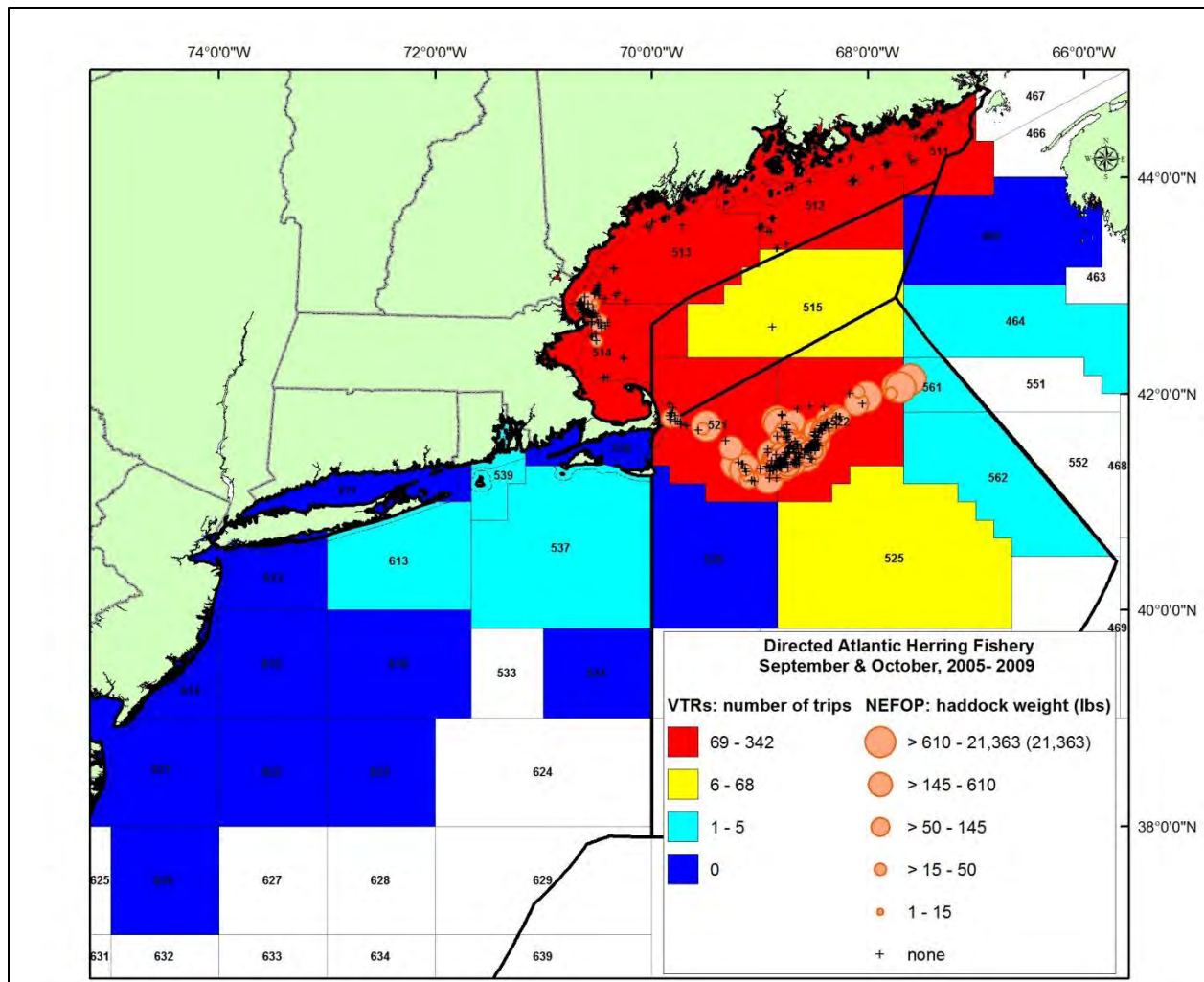


Figure 6: Reported trips (VTR) and observed hauls and sets (NEFOP) during September and October, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-342 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

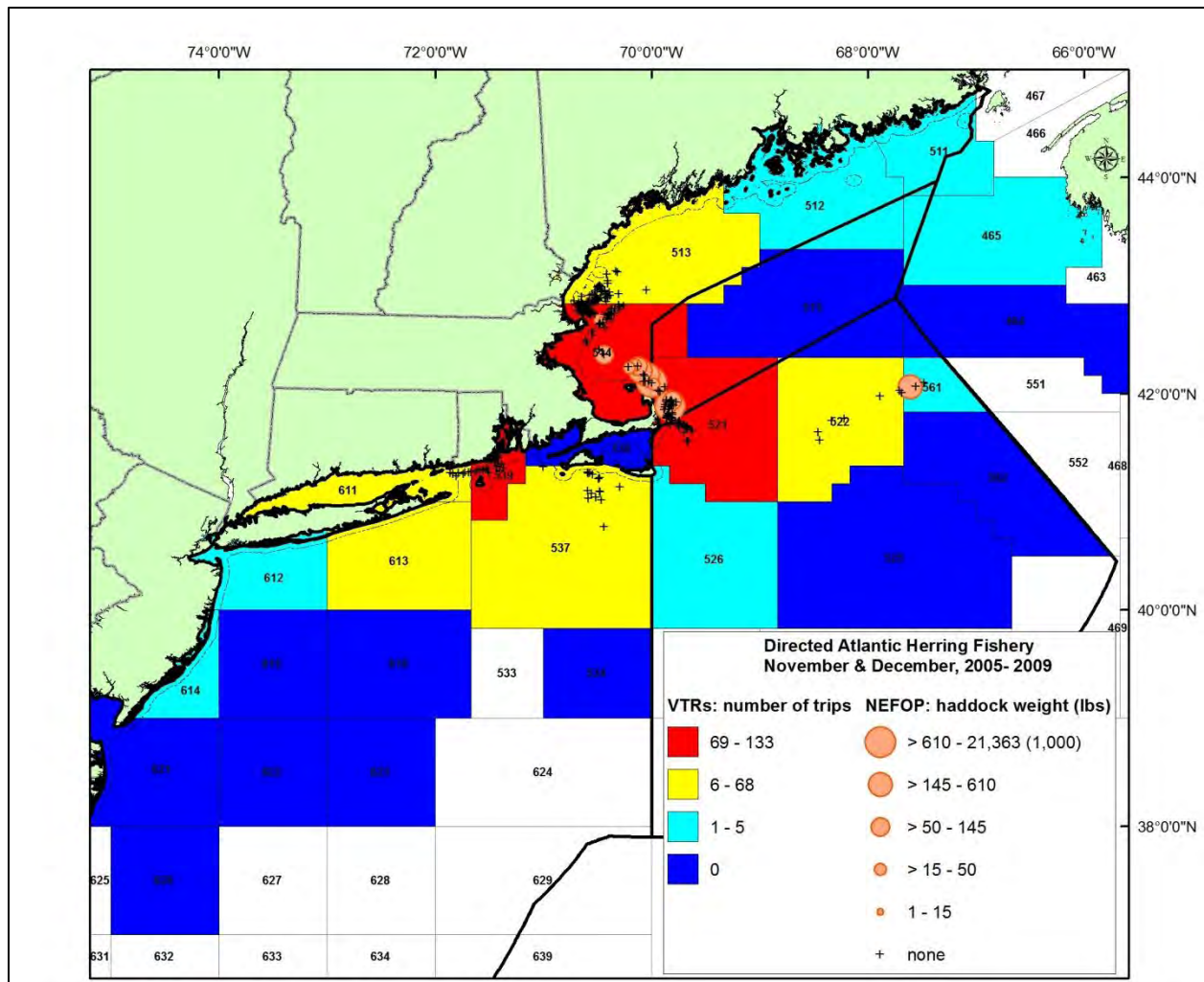


Figure 7: Reported trips (VTR) and observed hauls and sets (NEFOP) during November and December, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired). Trips by statistical area are grouped from 69-133 (red), 6-68 (yellow), 1-5 (aqua), and 0 (dark blue) trips. The maximum number of VTRs by Statistical Area within a bimonthly block is noted on the figure legend. Scaled orange circles represent relative haddock bycatch (lbs) in observed hauls/sets from directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul/set did not catch haddock. The maximum haddock weight is indicated on the figure legend in parenthesis. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

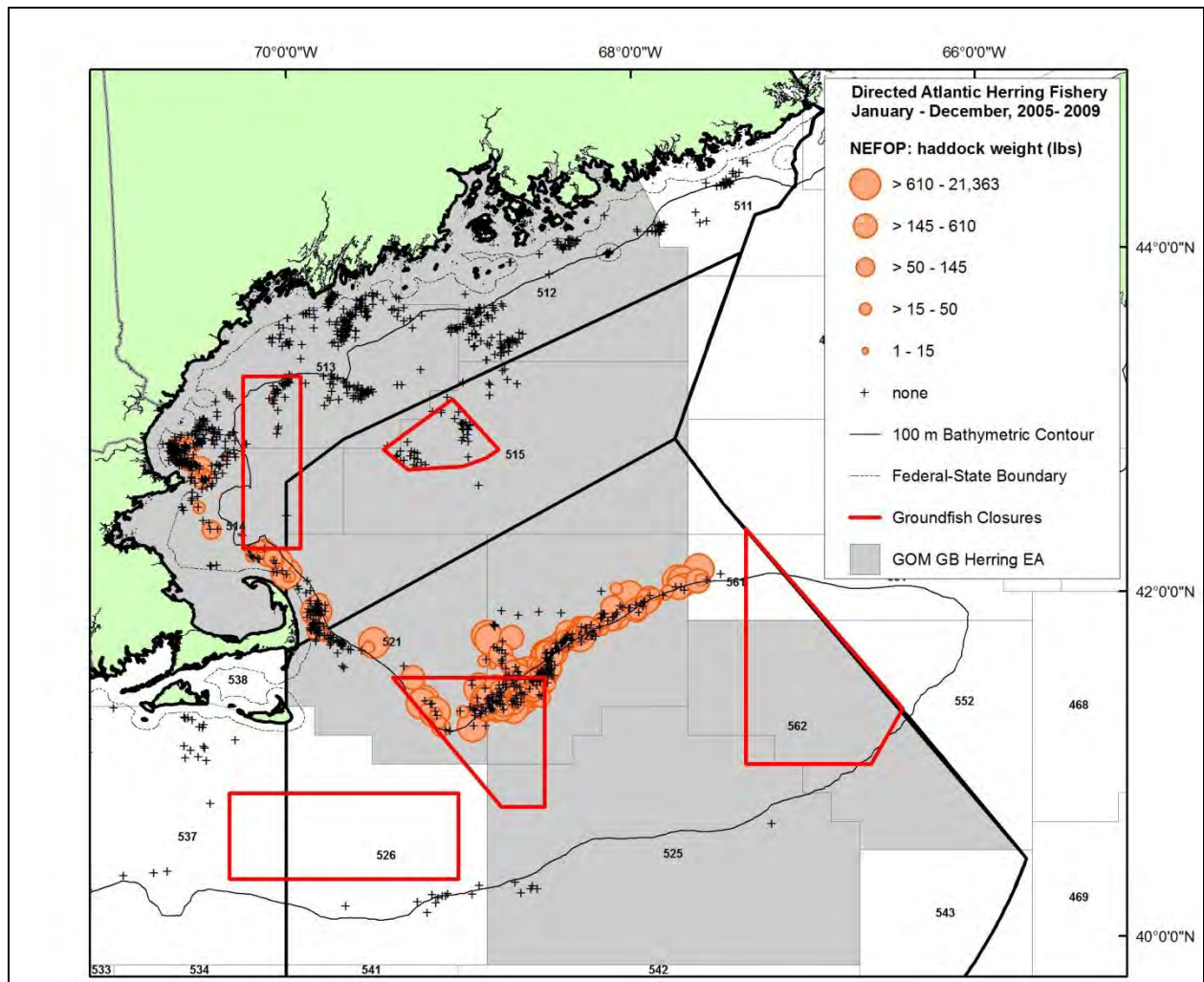


Figure 8: Observed hauls and sets (NEFOP) from January- December, 2005-2009 for directed herring trips by bottom otter-trawls, purse seines, and mid-water trawls (single and paired) and current spatial management, five groundfish closed areas (red polygons) and herring exemption area (gray shaded area). Scaled orange circles represent haddock bycatch (lbs) in observed hauls and sets for directed herring trips. The center of the circle is the location of the haul/set. A "+" signifies that an observed haul or set did not catch haddock. Directed herring trips are defined as 2,000 lbs of kept Atlantic herring on a trip. Sources: VTR Database 2005-2009 and NEFOP Database 2005-2009.

Appendix

<i>Jan-Feb</i> Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	0	0
465	0	0	0	0
511	0	0	0	0
512	0	1	0	1
513	0	2	0	2
514	0	14	0	14
515	0	1	0	1
521	1	22	0	23
522	0	2	0	2
525	0	1	0	1
526	0	0	0	0
534	1	1	0	2
537	40	24	0	64
538	2	2	0	4
539	144	103	0	247
561	0	0	0	0
562	0	2	0	2
611	77	31	0	108
612	6	100	0	106
613	20	95	0	115
614	0	1	0	1
615	23	99	0	122
616	19	51	0	70
621	1	3	0	4
622	3	9	0	12
623	0	1	0	1
626	0	2	0	2

Table A1: Number of directed herring trips separated by gear and statistical area for January-February. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 2. Source: Vessel Trip Report Database 2005-2009.

<i>Mar-Apr</i> Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	0	0
465	0	0	0	0
511	0	0	0	0
512	0	0	0	0
513	0	5	0	5
514	0	5	0	5
515	0	1	0	1
521	0	6	0	6
522	0	20	0	20
525	0	2	0	2
526	1	11	0	12
534	0	1	0	1
537	19	55	0	74
538	0	0	0	0
539	24	16	0	40
561	0	0	0	0
562	0	0	0	0
611	3	2	0	5
612	2	32	0	34
613	12	36	0	48
614	0	0	0	0
615	2	29	0	31
616	6	36	0	42
621	1	7	0	8
622	2	15	0	17
623	0	0	0	0
626	0	4	0	4

Table A2: Number of directed herring trips separated by gear and statistical area for March-April. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 3. Source: Vessel Trip Report Database 2005-2009.

<i>May-Jun</i> Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	0	0
465	0	0	0	0
511	0	8	2	10
512	0	10	76	86
513	1	276	121	398
514	0	35	1	36
515	0	34	8	42
521	0	35	2	37
522	0	7	0	7
525	0	0	0	0
526	0	1	0	1
534	0	0	0	0
537	1	20	0	21
538	0	0	0	0
539	2	0	0	2
561	0	0	0	0
562	0	0	0	0
611	1	0	0	1
612	1	0	0	1
613	1	1	0	2
614	0	0	0	0
615	0	0	0	0
616	1	0	0	1
621	0	0	0	0
622	0	0	0	0
623	0	0	0	0
626	0	0	0	0

Table A3: Number of directed herring trips separated by gear and statistical area for May-June. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 4. Source: Vessel Trip Report Database 2005-2009.

<i>Jul-Aug</i> Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	0	0
465	0	0	2	2
511	0	8	60	68
512	3	134	360	497
513	184	160	224	568
514	37	17	5	59
515	0	8	15	23
521	0	1	0	1
522	2	71	1	74
525	0	1	0	1
526	0	0	0	0
534	0	0	0	0
537	0	0	0	0
538	0	0	0	0
539	0	0	0	0
561	0	5	0	5
562	0	0	0	0
611	0	0	0	0
612	0	0	0	0
613	0	0	0	0
614	0	0	0	0
615	0	0	0	0
616	0	0	0	0
621	0	0	0	0
622	0	0	0	0
623	0	0	0	0
626	0	0	0	0

Table A4: Number of directed herring trips separated by gear and statistical area for July-August. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 5. Source: Vessel Trip Report Database 2005-2009.

Sep-Oct Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	1	1
465	0	0	0	0
511	0	24	112	136
512	0	31	77	108
513	69	153	120	342
514	72	115	5	192
515	0	5	6	11
521	1	92	0	93
522	1	153	2	156
525	1	6	0	7
526	0	0	0	0
534	0	0	0	0
537	0	1	0	1
538	0	0	0	0
539	0	1	0	1
561	0	1	0	1
562	0	1	0	1
611	0	0	0	0
612	0	0	0	0
613	0	3	0	3
614	0	0	0	0
615	0	0	0	0
616	0	0	0	0
621	0	0	0	0
622	0	0	0	0
623	0	0	0	0
626	0	0	0	0

Table A5: Number of directed herring trips separated by gear and statistical area for September-October. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 6. Source: Vessel Trip Report Database 2005-2009.

Nov-Dec Statistical Area	Gear Category			ALL
	OT	PR	PS	
464	0	0	0	0
465	0	1	0	1
511	0	1	0	1
512	0	1	0	1
513	2	35	5	42
514	9	118	6	133
515	0	0	0	0
521	6	120	0	126
522	0	12	0	12
525	0	0	0	0
526	0	1	0	1
534	0	0	0	0
537	2	19	0	21
538	0	0	0	0
539	93	21	0	114
561	0	1	0	1
562	0	0	0	0
611	43	10	0	53
612	2	1	0	3
613	8	3	0	11
614	1	0	0	1
615	0	0	0	0
616	0	0	0	0
621	0	0	0	0
622	0	0	0	0
623	0	0	0	0
626	0	0	0	0

Table A6: Number of directed herring trips separated by gear and statistical area for November-December. Directed herring trips defined as 2,000 lbs of kept Atlantic herring on a trip. Gear categories include bottom otter-trawl (OT), purse seine (PS) and mid-water trawl (PR). Mid-water trawl (PR) refers to pair and single mid-water trawls. The table corresponds to Figure 7. Source: Vessel Trip Report Database 2005-2009.