

Appendix V

Spatial and Temporal Analysis of River Herring Bycatch in the Northern Shrimp Fishery

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Purpose

At its September 2011 meeting, the New England Fishery Management Council (NEFMC) passed a motion,

to modify Section 3.3.2.2 [Amendment 5 DEIS] to exempt vessels fishing under the small mesh northern shrimp fishery exemption with the finfish excluder device as described in CFR §648.80 or vessels fishing with mesh greater than 5 ½ inches from the provisions under Options 1 and 2 in the section.

This prompted the Atlantic herring plan development team (PDT) to investigate the river herring bycatch in the Northern shrimp fishery. In particular, this work 1) summarizes past studies to reduce bycatch in the Northern shrimp fishery and 2) evaluates if spatial management measures designed to address river herring bycatch in the Atlantic herring fishery also interact the Northern shrimp fishery.

Past Studies to Reduce Bycatch in the Northern Shrimp Fishery

The finfish-excluder device (FED), the Nordmore grate, has been mandatory in the Gulf of Maine Northern shrimp (*Pandalus borealis*) fishery since April 1992. Prior to its use, juvenile groundfish bycatch in the shrimp fishery was of primary concern (Howell and Langan 1992). Groundfish bycatch has been substantially reduced through the use of the Nordmore grate (Richards and Hendrickson 2006), and a new gear innovation, the “topless” trawl, also greatly reduces pelagic fish bycatch (He et al. 2007).

Richards and Hendrickson (2006) examined bycatch before and after use of the Nordmore grate in the shrimp fishery, using observer data from NEFOP and MA DMF. Primarily, they examined individual groundfish and flatfish species bycatch, but they did also summarize pelagic species bycatch as a group. In their analysis, pelagic species included alewife (*Alosa pseudoharengus*), butterfish (*Peprilus triacanthus*), blueback herring (*Alosa aestivalus*), Atlantic herring (*Clupea harengus*), unidentified herring (Clupeidae), Atlantic mackerel (*Scomber scombrus*), Atlantic menhaden (*Brevoortia tyrannus*), American shad (*Alosa sapidissima*), and hickory shad (*Alosa mediocris*). Prior to the use of the Nordmore grate, primary bycatch species included groundfish and flatfish, and secondarily pelagic fish (see Table 3 of Richards and Hendrickson 2006). With the grate in place, groundfish and flatfish bycatch was greatly reduced, while pelagic fish bycatch shifted up in importance based on percentage bycatch composition.

For these reasons, additional gear modifications have been investigated to reduce pelagic species bycatch. Previous experiments demonstrate that the “topless trawl” used with the Nordmore grate further reduces finfish bycatch especially for pelagic species in the shrimp fishery (He et al.

2007). Bycatch of Atlantic herring was reduced by 86.6% with some increase in the catch of shrimp and flatfish bycatch. Modest reductions in blueback herring were also evident from the experiments.

GMRI monitored and documented bycatch of regulated groundfish and non-regulated species for the 2008-2009 Northern shrimp fishing season, augmenting NEFOP data collection during the same time (Eayrs et al. 2009). Eayrs et al. (2009) found that shrimp catch was 96% (GMRI data) and 92% (NOAA data) of total catch weight, of this less than 2% of total catch weight was regulated bycatch, rarely exceeding 5% of total catch weight in a single haul (roughly 55 lbs of regulated bycatch per haul in GMRI data). Eayrs et al. (2009) also looked at the effect of Nordmore grate orientation and noted orientation did not appear to impact performance, but noted limitations of the preliminary study. Eayrs et al. (2009) indicated data collection included river herring and Atlantic herring length measurements. Analysis, however, focuses on groundfish species, and therefore results for herring species are not directly provided.

Recent preliminary work suggests that spatial and temporal characteristics in bycatch in the Northern shrimp fishery may inform bycatch reduction strategies (Rillahan and He 2011). Rillahan and He (2011) analyzed 300 research tows using standard shrimp trawl nets by shrimp fishing vessels in New Hampshire and Maine between the months of February and June from 2004 to 2010. They noted that bycatch levels varied from 0.7 to 86.7% of total catch within a tow, with overall bycatch less than 20% of total catch observed. They identified 26 bycatch species, of which silver hake (*Merluccius bilinearis*) was the primary bycatch species. Silver hake bycatch predominately occurred in late spring with May landings the highest (average at 89.5% of all bycatch by weight). They noted that other pelagic bycatch species included Atlantic and blueback herring as primary bycatch species in February and March. Flatfish species including American Plaice (*Hippoglossoides platessoides*) and witch flounder (*Glyptocephalus cynoglossus*) were also important bycatch species in April, May and June. Preliminary length-frequency analysis of silver hake, American plaice and Atlantic herring suggests that the majority of species ranged from 10-25 cm total length. Forthcoming analysis will examine patterns in more detail to improve bycatch mitigation strategies.

Evaluation of Spatial Management Measures

Data

Data was provided by the Northeast Fisheries Observer Program (NEFOP). The data includes NEFOP data from observed trips between 2005 and 2010 fishing with shrimp trawl gear (NEGEAR = 058). NEFOP excluded hauls without catch from the dataset. For this analysis, alewife and blueback herring bycatch data was combined and evaluated as river herring bycatch.

Data Selection

From this data, data was aggregated into bimonthly groupings (Jan-Feb, Mar-Apr, May-Jun, Jul-Aug, Sep-Oct, Nov-Dec), as previously defined for the river herring bycatch in the Atlantic herring fishery analysis. Data was combined for all years. It was determined that data between May- October did not meet confidentiality requirements and was therefore omitted from the analysis. In addition, there were no observations of fishing activity in April and November. Remaining data met NOP Confidentiality Guidelines (at least 3 vessels for each aggregation). In

addition, data was restricted to observed hauls north of latitude 42° N. This resulted in 339 observed hauls and, that identified primary targets as Northern shrimp, SHRIMP, PANDALID (NORTHERN) and in some cases as unclassified shrimp, SHRIMP, NK.

Methods

The starting location of fishing activity from December- March was mapped on a single map, showing presence and absence of river herring bycatch within an observed haul (Figure 1). Data from the three bimonthly groupings was overlaid with the river herring monitoring/avoidance areas and protection areas (Figures 2-4) and summarized in a table (Table 1). In addition, summary statistics on river herring bycatch were provided for each bimonthly grouping (Table 2).

Results

From the NEFOP data, the Northern shrimp fishery operates exclusively in Herring FMP 1A, mostly nearshore (i.e. less than 30 NM from shore) and north of Cape Cod, MA extending to Downeast, Maine (Figure 1). The fishery is primarily prosecuted in January-February, but also extends into March and December. The greatest observed haul with river herring bycatch was 40 lbs in January-February (Table 2). Observed total river herring bycatch by bimonthly grouping was highest in January-February (703.8 lbs), then November-December (102.4 lbs), with less in March-April (29.2 lbs). The median river herring bycatch was 0.2 (January-February), 0.1 (March-April), and 0 lbs (November-December). Overall percent occurrence of river herring bycatch for all hauls was 53.4%. Percent occurrence by bimonthly grouping was 55.6% for January-February and March-April, and 41.2% for November-December.

$$\text{Percent Occurrence} = \frac{\text{number of hauls with river herring present}}{\text{number of hauls with river herring present} + \text{number of hauls with river herring absent}}$$

Interaction with River Herring Monitoring/Avoidance Areas

The fishery overlaps with the Ipswich Bay river herring monitoring/avoidance area from December- March, for the November-December (Fig. 4), January-February (Fig. 2), and March-April (Fig. 3) river herring bimonthly areas. In addition during December, the fishery overlaps with the monitoring/avoidance area directly east of the Ipswich Bay area (Fig. 4).

Interaction with River Herring Protection Areas

The fishery overlaps with the Ipswich Bay river herring protection area for the November-December bimonthly grouping (Fig. 4), with two observed hauls both with river herring bycatch (6 and 15.3 lbs). NEFOP data suggests that most fishing in the Ipswich Bay river herring protection area is occurring between January and March, when the area is open to fishing (Figures 2-4).

References

Eayrs, S., N. Stephens and M. Raymond. 2009. A contemporary assessment of the bycatch of regulated species and the Nordmore grate in the Northern shrimp fishery. Final Report. Gulf of Maine Research Institute, Portland, Maine.

He, P., D. Goethel, and T. Smith. 2007. Design and test of a topless shrimp trawl to reduce pelagic fish bycatch in the Gulf of Maine pink shrimp fishery. *J. Northw. Atl. Fish. Sci.*, 38: 13–21.

Howell, W. H., and Langan, R. 1992. Discarding of commercial groundfish specie in the Gulf of Maine shrimp fishery. *North Am. J. Fish. Manage.* 12, 568-580.

Richards, A. and L. Hendrickson. 2006. Effectiveness of the Nordmore grate in the Gulf of Maine Northern shrimp fishery. *Fisheries Research* 81: 100-106.

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Tables

River Herring Weight (lbs)	Number of hauls		
	Jan-Feb	Mar-Apr	Nov-Dec
none	100	28	30
0.01 - 40	125	35	21
total	225	63	51
grand total			339

Table 1: Frequency table of the number of Northern shrimp fishery hauls with river herring bycatch present (0.01-40 lbs) and absent (none) by bimonthly grouping (January-February, March-April, and November-December). Source NEFOP 2005-2010.

Summary Statistics	River Herring Weight (lbs)		
	Jan-Feb	Mar-Apr	Nov-Dec
minimum	0	0	0
maximum	40	4	20
sum	703.8	29.2	102.4
mean	3.13	0.46	2.01
median	0.2	0.1	0
standard deviation	6.58	0.91	4.13

Table 2: Summary statistics for Northern shrimp fishery hauls with river herring bycatch by bimonthly grouping (January-February, March-April, and November-December). Source NEFOP 2005-2010.

Figures

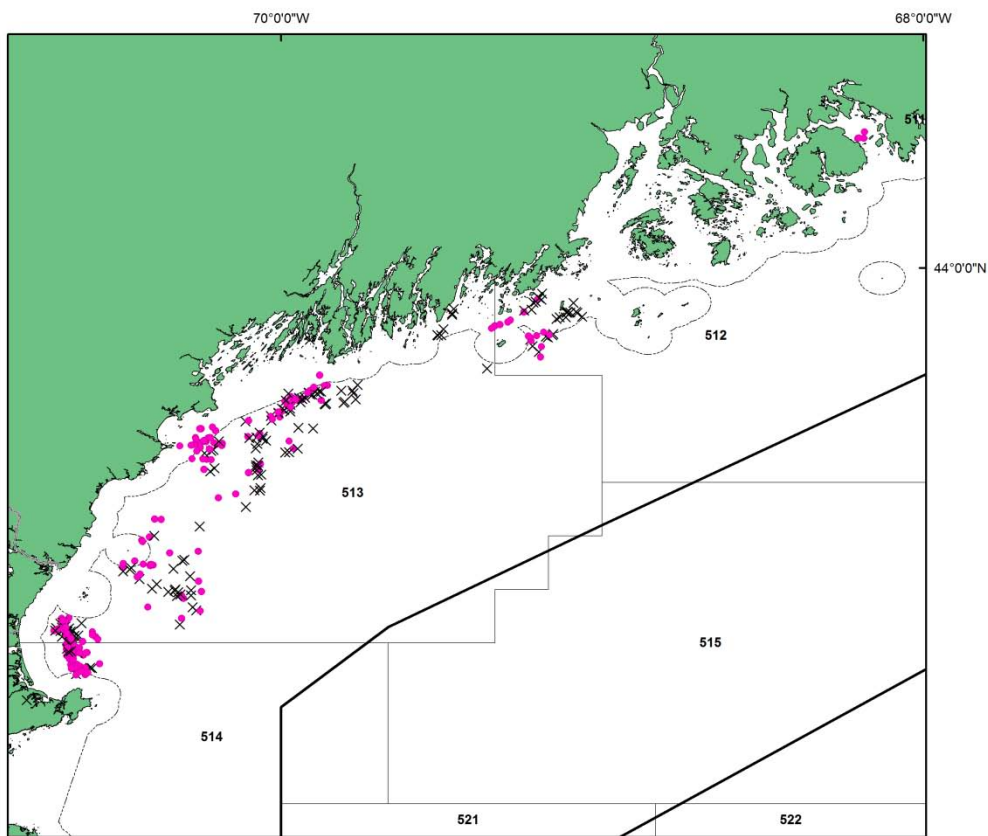


Figure 1: The starting location of observed Northern shrimp fishing activity from December-March, showing presence (circles) and absence (x') of river herring bycatch within an observed haul. Source NEFOP 2005-2010.

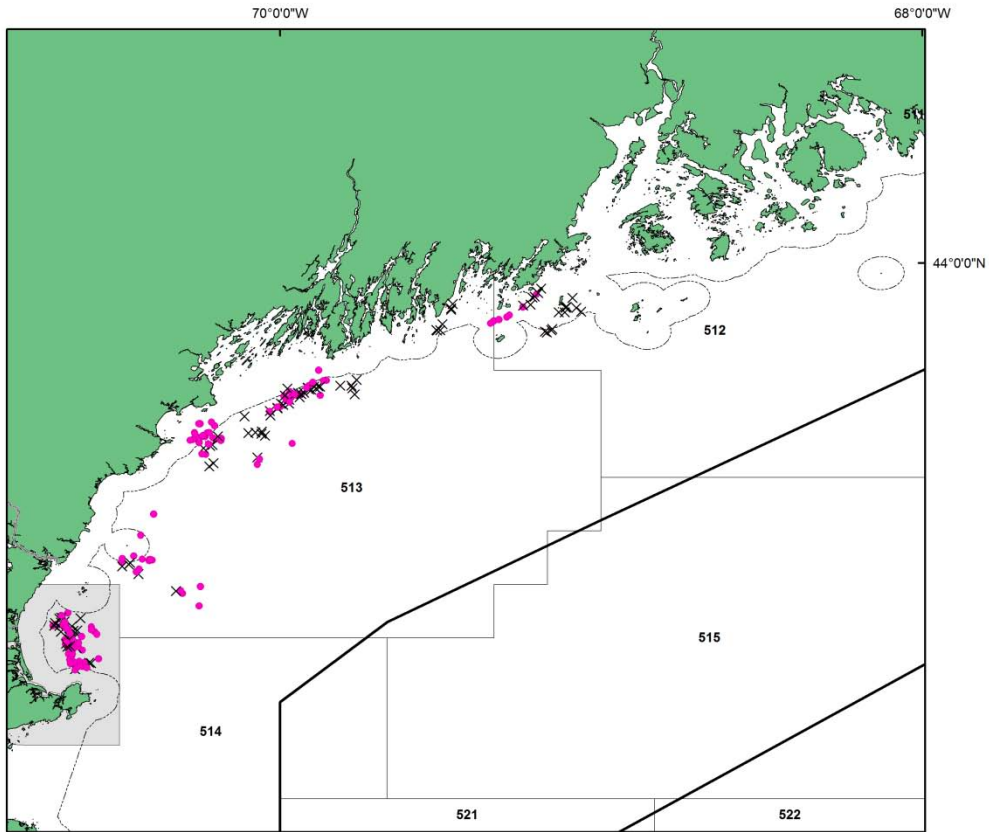


Figure 2: The starting location of observed Northern shrimp fishing activity from January-February, showing presence (circles) and absence (x') of river herring bycatch within an observed haul, overlapped with the river herring monitoring/avoidance area for January- February (gray box/ Ipswich Bay). There are no overlapping river herring protection areas. Source NEFOP 2005-2010.

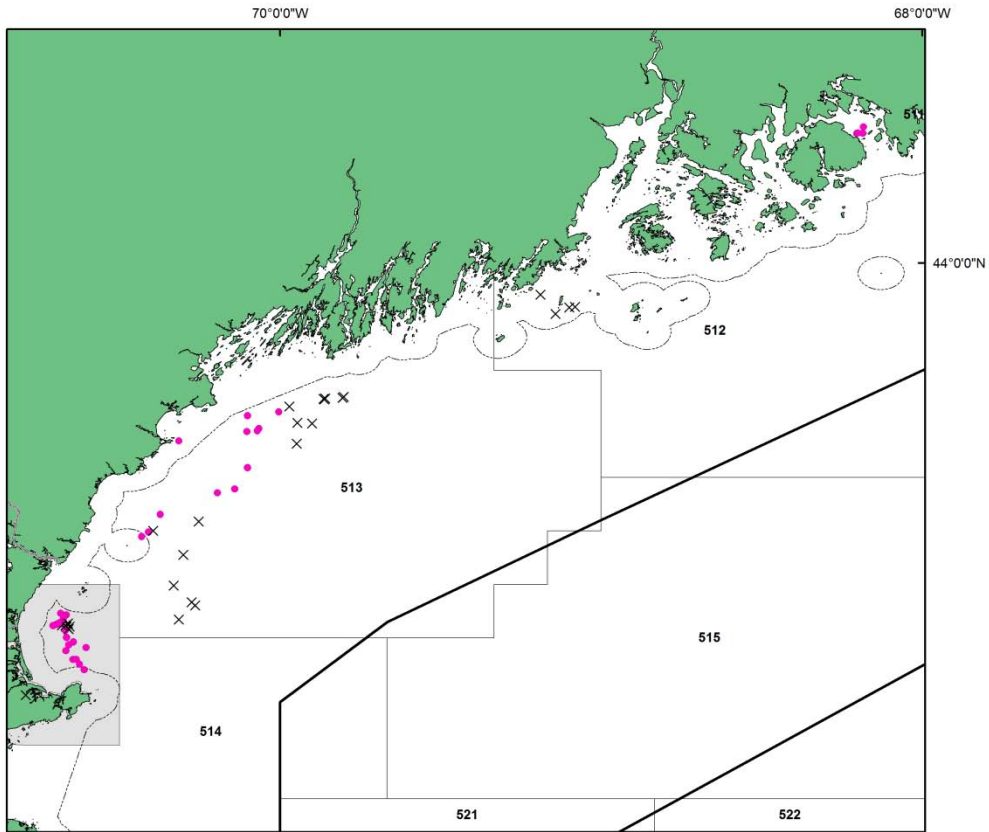


Figure 3: The starting location of observed Northern shrimp fishing activity from March-April, showing presence (circles) and absence (x') of river herring bycatch within an observed haul, overlapped with the river herring bycatch monitoring/avoidance area for March-April (gray box/Ipswich Bay). There are no overlapping river herring protection areas. Source NEFOP 2005-2010.

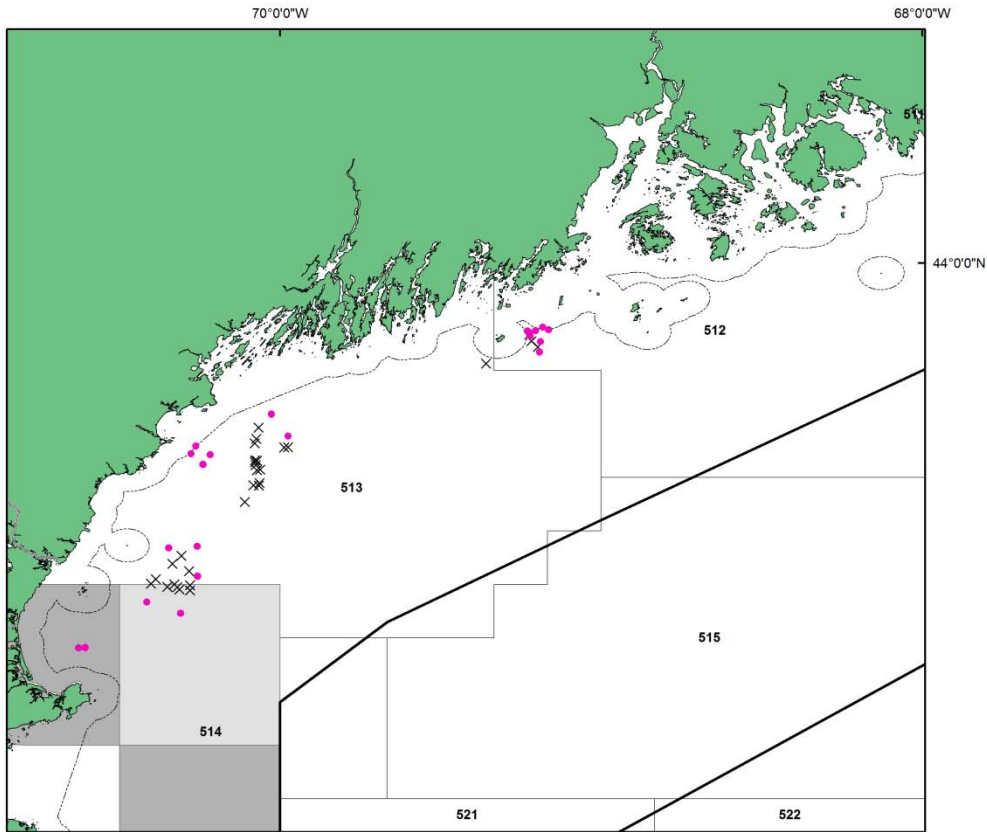


Figure 4: The starting location of observed Northern shrimp fishing activity from November-December showing presence (circles) and absence (x') of river herring bycatch within an observed haul, overlapped with the river herring bycatch monitoring/avoidance areas (light and dark gray boxes) and overlapping river herring protection areas (dark gray boxes) for November-December. Source NEFOP 2005-2010.