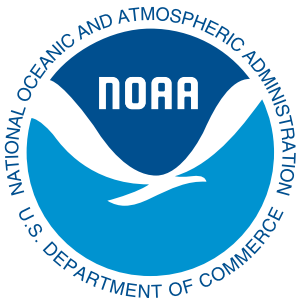

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ABSTRACT

This report provides estimated bycatch of 6 species of small cetaceans and pinnipeds bycaught in the New England sink (NESG) and mid-Atlantic (MAG) gillnet fisheries. The 2014 serious injuries and total mortalities in the NESG fishery were 128 (coefficient of variation [CV] = 0.27) harbor porpoises (*Phocoena phocoena*), 111 (CV = 0.47) short-beaked common dolphins (*Delphinus delphis*), 10 (CV = 0.66) Atlantic white-sided dolphins (*Lagenorhynchus acutus*), 917 (CV = 0.14) gray seals (*Halichoerus grypus*), 390 (CV = 0.39) harbor seals (*Phoca vitulina concolor*), and 57 (CV = 0.42) harp seals (*Pagophilus groenlandicus*). The NESG estimates are based on observed bycatch consisting of 28 harbor porpoises, 11 short-beaked common dolphins, 2 Atlantic white-sided dolphins, 159 gray seals, 59 harbor seals, and 9 harp seals. The 2014 serious injuries and total mortalities in the MAG fishery were 22 (CV = 1.03) harbor porpoises, 17 (CV = 0.86) short-beaked common dolphins, 19 (CV = 1.06) harbor seals, and 22 (CV = 1.09) gray seals. The MAG estimates are based on observed bycatch consisting of 1 harbor porpoise, short-beaked common dolphin, harbor seal, and gray seal.

INTRODUCTION

The United States (US) Marine Mammal Protection Act (MMPA) of 1972 mandates the annual reporting of serious injury and mortality estimates for marine mammal stocks interacting with US commercial fisheries (Waring et al. 2015b). An interaction that involves direct contact between a marine mammal and commercial fishing gear and results in a serious injury or mortality is termed a bycatch event. Bycatch has been cited as a significant threat to marine mammal populations (Read 2008), with particular concern for the impacts of drift and sink gillnet gear on small cetacean and pinniped stocks (Reeves et al. 2013).

In US Northwest Atlantic waters, fishing vessels that use drift or sink gillnet gear constitute the New England sink (NESG) or mid-Atlantic (MAG) gillnet fishery. Both fisheries operate year round, with the NESG fishery ranging from Maine to New York and the MAG fishery ranging from New York to North Carolina (NMFS 2014; Waring et al. 2015b). Observed fishing hauls are assigned to the NESG or MAG fishery based on the geographic location of fishing activities, with the 72°30'W longitudinal line used to demarcate the 2 fishing fleets (NMFS 2014; Waring et al. 2015b).

For 2014, 6 species of small cetaceans and pinnipeds were observed bycaught in drift and sink gillnet gear from US Northwest Atlantic waters. These include harbor porpoise (*Phocoena phocoena*), short-beaked common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), gray seal (*Halichoerus grypus*), harbor seal (*Phoca vitulina concolor*), and harp seal (*Pagophilus groenlandicus*). The purpose of this report is to: (1) esimate bycatch for small cetaceans and pinnipeds in the 2014 NESG and MAG fisheries and (2) explore gear characteristics of observed hauls in relation to the 2010 Harbor Porpoise Take Reduction Plan (HPTRP).

MATERIALS AND METHODS

Five datasets were used in estimating annual bycatch of small cetaceans and pinnipeds in the NESG and MAG fisheries. These included observer data collected by the Northeast Fisheries Observer Program (NEFOP) and the Northeast Fisheries At-Sea Monitoring Program (ASM) as well as commercial fishing effort from vessel trip reports (VTRs), dealer weigh out slips, and the North Carolina Division of Marine Fisheries (NCDMF) trip ticket program. Observer records (NEFOP and ASM) were used to estimate bycatch rates, defined as the number of animals bycaught per metric ton (mt) of landed catch, for the NESG and MAG fisheries. Estimated bycatch from the entire gillnet fleet was then obtained by applying estimated bycatch rates to commercial fishing effort, defined as the weight of commercial landings in mt.

Data

Observer data

Observer data were recorded by 2 survey programs, NEFOP and ASM. For 2014, 55% and 45% of all hauls observed were from NEFOP and ASM, respectively. Both survey programs used complete sampling protocols (or complete trips), for which observers sampled both catch and discard of fishes for biological information. During complete sampling, observers were not explicitly watching haul backs and may have missed bycatch of marine mammals that fell out of the net prior to being hauled on board. Unlike ASM, NEFOP also used limited sampling protocols (or limited

trips) for which the observer explicitly watched the net during haul backs, reducing the chances of unnoticed bycatch. It should also be noted that both survey programs collected environmental, gear, haul, and vessel characteristics during observed fishing trips. However, ASM only collected a subset of the data required by NEFOP and only monitored fishing trips that were declared into the Northeast multispecies groundfish fishery. For this reason, ASM data may not be representative of all gillnet fishing effort with the potential for marine mammal bycatch. Any potential bias introduced into the analysis through the use of ASM data was addressed as described in the bycatch estimates section below.

For the purposes of estimating serious injuries and mortalities of small cetaceans and pinnipeds, bycatch was considered to be any specimen whose condition was recorded as dead (fresh or under varying stages of decomposition) or alive with serious injury. Bycaught specimens having recorded conditions of moderately to severely decomposed were further examined to ensure that observed decomposition stages were plausible given the recorded soak duration (i.e., the amount of time the gear was in the water). Final serious injury and mortality determinations for specimens observed in the 2014 NESG and MAG fisheries will be made available in a similar format to Waring et al. (2014, 2015a). Animals that could not be identified to the species level, including 8 unknown seals and 1 unknown dolphin, were removed from the analysis.

Commercial fishing effort

Vessel trip reports (VTRs) were considered to be a near census of commercial fishing trips for the NESG and MAG fisheries, except for those landing catch in North Carolina. VTR data were augmented with information from dealer weigh out slips, as self-reported landings on VTRs were assumed to be biased low (Wigley et al. 2008; Murray 2009). Where possible, VTR trips were linked directly to dealer weigh out slips. For instances where a corresponding dealer weigh out slip(s) could not be located for a VTR, the landings on the VTR were scaled by an adjustment factor derived from stratification of the VTR and dealer weigh out data by state and season. This ensured that unmatched VTR landings in any stratum were equal to the unmatched landings in the dealer weigh out data (Orphanides 2013), which is assumed to be a near census of commercial catch (Wigley et al. 2008). Commercial fishing effort within bays and sounds was removed from this analysis to reflect fishing effort in oceanic waters where cetacean and pinniped bycatch has historically occurred.

Commercial fishing effort for gillnet trips in North Carolina were poorly represented in the VTR and dealer weigh out data, requiring the use of monthly gillnet landings reported by NCDMF (Orphanides 2011). For vessels landing catch in North Carolina, data from the NCDMF trip ticket program were combined with VTRs and dealer's weigh out slips to estimate observer coverage for the MAG fishery.

Data preparation

Data preparation is described in detail below and included the conversion of landed to live weights using standardized conversion factors (Palmer 2010) as well as imputing missing fishing locations, mesh sizes, and soak durations when needed.

Missing data

In 2014, 4% of observer records were missing latitude and longitude coordinates, while about 15% of commercial fishing records were missing detailed information on geographic fishing locations. Similarly, <1% of observer records were missing values of mesh size and about 1% of observer records were missing values of soak duration, while <1% of commercial fishing records were missing information on mesh size and about 10% of commercial fishing records were missing information on soak duration. Missing values were imputed following the methods outlined in Warden and Orphanides (2008). Less than 1% of observed hauls were missing information on pinger usage (none of which had incidental bycatch of marine mammals) and were subsequently removed from the analysis.

Bycatch estimates

As in previous years, bycatch rates were estimated with ratio and stratified ratio estimators, with strata defined to reflect the spatial and temporal distributions of marine mammals and commercial gillnetters (Rossman and Merrick 1999; Belden et al. 2006). For the NESG fishery, data were stratified temporally by season and spatially by portgroup or management area. Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December). The stratum-specific bycatch rates were then estimated by using NEFOP and ASM data, and were weighted by pinger use and NEFOP-observed groundfish/nongroundfish landings. Only NEFOP-observed groundfish/nongroundfish landings were used to ensure that estimated bycatch rates were representative of the entire NESG fishery, and not biased towards the part of the fleet monitored by ASM. In other words,

$$\hat{R}_{s,m} = \left(\frac{W_{s,m,g}}{W_{s,m}}\right)\left[\left(\frac{N_{s,m,g,p}}{N_{s,m,g}}\right)\frac{y_{s,m,g,p}}{x_{s,m,g,p}} + \left(\frac{N_{s,m,g,np}}{N_{s,m,g}}\right)\frac{y_{s,m,g,np}}{x_{s,m,g,np}}\right] \quad (1)$$

$$+ \left(\frac{W_{s,m,ng}}{W_{s,m}}\right)\left[\left(\frac{N_{s,m,ng,p}}{N_{s,m,ng}}\right)\frac{y_{s,m,ng,p}}{x_{s,m,ng,p}} + \left(\frac{N_{s,m,ng,np}}{N_{s,m,ng}}\right)\frac{y_{s,m,ng,np}}{x_{s,m,ng,np}}\right]$$

where:

$$N_{s,m,g} = N_{s,m,g,p} + N_{s,m,g,np}$$

$$N_{s,m,ng} = N_{s,m,ng,p} + N_{s,m,ng,np}$$

$$W_{s,m} = W_{s,m,g} + W_{s,m,ng}$$

$s =$ season

$m =$ portgroup or management area

$g =$ groundfish and $ng =$ nongroundfish

$p =$ pingers and $np =$ no pingers

$\hat{R} =$ stratum-specific bycatch rate

$W =$ NEFOP-observed weight of landed catch (mt)

$N=$ observed number of hauls

$y =$ observed number of bycaught animals

$x =$ observed weight of landed catch (mt)

The weighted bycatch rate explicitly accounts for observed fishing effort targeting groundfish versus nongroundfish and the use of pingers on gillnet strings (Palka et al. 2008; Orphanides 2013). The Massachusetts Bay Management Area was not retained for the purposes of estimating bycatch during the 2014 fall season to address concerns with small sample size (4 hauls) and was pooled with the South of Boston port group. The Cape Cod South Closure Area was retained for the purposes of estimating bycatch during 2014 to address concerns with inshore/offshore differences in fishing practices.

For the MAG fishery, data in the Waters off New Jersey Management Area were stratified temporally by season as well as by mesh size (i.e., < 7 in or ≥ 7 in) and soak duration (i.e., ≤ 72 hours or > 72 hours) (Orphanides 2013). More formally this can be expressed as:

$$\hat{R} = \frac{y}{x} \tag{2}$$

where:

$\hat{R} =$ stratum-specific bycatch rate

$y =$ observed, stratum-specific number of bycaught animals

$x =$ observed, stratum-specific weight of landed catch (mt)

For a more in-depth treatment of the rationale behind the data stratification presented in this report, refer to Orphanides (2011, 2013).

Estimates of bycatch in any stratum ($\hat{B}$) were then obtained through the product of stratum-specific bycatch rates ($\hat{R}$) and the total commercial fishing effort (E) associated with that stratum. More formally this can be expressed as:

$$\hat{B} = \hat{R}E \tag{3}$$

Seasonal subtotal and total bycatch estimates were obtained through the summation of stratum-specific bycatch estimates. Uncertainty around seasonal subtotal, total, and stratum-specific bycatch estimates were calculated using nonparametric stratified bootstrapping techniques, with $(1-\alpha)\%$ confidence intervals constructed through the bias-corrected and accelerated (BCa) method using 10,000 iterations with the R "boot" library (Canty and Ripley 2012; Efron and Tibshirani 1993). The resampling unit used for bootstrapping was an entire fishing trip, to account for interdependence among hauls nested within trips (Bisack 2003).

For strata with high observer coverage (i.e., $\geq 10\%$) the finite population correction factor (fpc) was applied to the bootstrapped estimate of the standard error used in calculating the coefficient of variation (CV), where the fpc for each stratum was defined as:

$$fpc = \sqrt{\frac{W - w}{W - 1}} \tag{4}$$

where:

W = stratum-specific weight of commercial landings

w = observed, stratum-specific weight of landed catch

Observer coverage was defined as the percentage of commercial landings observed by NEFOP and ASM for each stratum (i.e., $w/W \times 100\%$).

RESULTS

Observed hauls were concentrated in the Gulf of Maine, southern New England, and off New Jersey, Delaware, Maryland, and North Carolina (Figure 1). Marine mammal bycatch was observed in waters off New Jersey and farther north, with the majority of bycatch being observed in coastal Gulf of Maine waters, as well as off Cape Cod, MA and southern New England (Figure 1).

New England sink gillnet fishery

The annual observer coverage for the 2014 NESG fishery was 18% (Table 1). Stratum-specific observer coverage rates for the NESG fishery can be found in Table 1 and ranged between 0% in the Great South Channel Management Area during the summer and 41% in the Offshore Management Area during the winter. The 2014 serious injuries and mortalities in the NESG fishery were 128 (CV = 0.27) harbor porpoises (Table 2), 111 (CV = 0.47) short-beaked common dolphins (Table 3), 10 (CV = 0.66) Atlantic white-sided dolphins (Table 4), 917 (CV = 0.14) gray seals (Table 5), 390 (CV = 0.39) harbor seals (Table 6), and 57 (CV = 0.42) harp seals (Table 7). The NESG estimates are based on observed bycatch consisting of 28 harbor porpoises, 11 short-beaked common dolphins, 2 Atlantic white-sided dolphins, 159 gray seals, 59 harbor seals, and 9 harp seals.

Compliance of observed hauls to management regulations stipulated in the 2010 HPTRP was measured in terms of full pinger deployment (i.e., correct number of pingers on a gillnet string). For 2014, full pinger deployment was highly variable, ranging from 33 - 100% (Table 8). The lowest proportion of observed hauls with the correct number of pingers occurred during the fall season within the Cape Cod South, Offshore, and Southern New England Management Areas (Figure 1) where only 65%, 33%, and 41% of observed hauls were compliant with the 2010 HPTRP, respectively (Table 8). Two observed hauls were found to be fishing in the Cashes Ledge Closure Area during the time-area closure (Table 8), although full pinger deployment was 100%.

Mid-Atlantic gillnet fishery

The annual observer coverage for the 2014 MAG fishery was 4% (Table 9). Stratum-specific observer coverage rates for the MAG fishery can be found in Table 10, and ranged between 4% and 6%. The 2014 serious injuries and mortalities in the MAG fishery were 22 (CV = 1.03) harbor porpoises, 17 (CV = 0.86) short-beaked common dolphins, 19 (CV = 1.06) harbor seals, and 22

(CV = 1.09) gray seals (Table 11). The MAG estimates are based on observed bycatch consisting of 1 each of harbor porpoise, short-beaked common dolphin, harbor seal, and gray seal.

Compliance of observed hauls to management regulations stipulated in the 2010 HPTRP was explored for a subset of the mandated gear modifications (i.e., floatline length, twine size, tie downs, net size, and nets in a string), as tie down spacing, tie down length, and net number could not be assessed because of a large number of missing values. Compliance ranged between 70 - 100% for large-mesh gillnets and 79 - 100% for small-mesh gillnets (Tables 12, 13). Two observed hauls using large-mesh gillnets were found to be fishing in the Mudhole South Management Area during the time-area closure (Table 12). Similarly, 2 observed hauls using large-mesh gillnets were also found to be fishing in the Southern Mid-Atlantic Management Area during the time-area closure (Table 12). None of the 4 observed hauls fishing in the mid-Atlantic time-area closures had marine mammal bycatch.

DISCUSSION

The majority of small cetacean and pinniped bycatch occurring in US waters is from gillnet gear (Read et al. 2006), with the most frequently bycaught species in 2014 being gray seals, followed by harbor seals, harbor porpoises, short-beaked common dolphins, harp seals, and Atlantic white-sided dolphins. Bycatch estimates were significantly higher in the 2014 NESG fishery for gray and harbor seals, relative to the MAG fishery, while there was overlap in 95% confidence intervals for harbor porpoise and short-beaked common dolphin bycatch (although this does not preclude statistically significant differences). For 2014, Atlantic white-sided dolphin and harp seal bycatch was observed in the NESG fishery but not in the MAG fishery.

Compliance to regulations stipulated in the 2010 HPTRP was high for 2014. Overall, the NESG fishery had a compliance rate of 87%, which refers to the correct number of pingers on a gillnet string and not functionality. This rate is high relative to historical pinger compliance rates of 43% reported for the 2009-2010 fishing season (Orphanides 2012) and roughly 0 - 40% in 2004 (Palka et al. 2008). In the mid-Atlantic, compliance rates for the 2014 MAG fishery were 77% and 79% for large-mesh and small-mesh gillnets, respectively. This rate is a large improvement for large mesh from the most recent calculations when compliance for large- and small-mesh gillnets was 44% and 84%, respectively (Orphanides 2012).

Assessing the status of marine mammal stocks is fraught with uncertainty (Williams et al. 2008), which is usually compounded by inadequate funds to achieve necessary observer coverage of relevant fisheries with historical bycatch. Relatively imprecise estimates make it difficult to detect trends in bycatch over time (i.e., increasing, decreasing, or stable), a situation that is complicated by the rarity with which marine mammals and gillnets interact. Since increased observer coverage in the NESG or MAG fishery is unlikely, other estimators or stratification schemes could be explored to improve the precision of marine mammal bycatch estimates for future years.

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Table 1. Summaries of observed hauls, observed trips, observed landings, prorated commercial landings, and observer coverage by season and port group (P)/management area (MA) for the 2014 New England sink gillnet fishery (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Hauls[a]	Observed Trips	Observed Landings (mt)	Commercial Landings (mt)	Observer Coverage
W	Cape Cod South (MA)	149 (42)	31	73.57	877.36	0.08
W	Cashes Ledge (MA)	2 (0)	1	0.11	N/A	N/A
W	East of Cape Cod (P)	4 (0)	3	1.28	5.19	0.25
W	Massachusetts Bay (MA)	55 (1)	20	5.39	19.86	0.27
W	Mid-Coast (MA)	207 (0)	49	60.19	150.39	0.40
W	North of Boston (P)	48 (0)	6	10.29	41.12	0.25
W	Offshore (MA)	277 (14)	25	69.23	170.43	0.41
W	Offshore (P)	45 (0)	7	8.38	32.14	0.26
W	South of Boston (P)	6 (6)	1	0.14	2.78	0.05
W	South of Cape Cod (P)	27 (17)	10	3.63	163.78	0.02
W	Southern Maine (P)	66 (8)	15	6.44	61.67	0.10
W	Southern New England (MA)	335 (93)	77	248.93	1736.79	0.14
W	Stellwagen Bank (MA)	210 (22)	68	26.89	96.51	0.28
W	Subtotal	1431 (203)	313	514.47	3358.02	0.15
S	East of Cape Cod (P)	564 (0)	195	595.66	2662.13	0.22
S	Great South Channel (MA)	0 (0)	0	0.00	2.60	0.00
S	New Hampshire (P)	353 (0)	103	132.47	823.13	0.16
S	North of Boston (P)	340 (23)	75	87.91	519.47	0.17
S	Offshore (P)	299 (0)	19	82.25	264.60	0.31
S	South of Boston (P)	126 (9)	32	29.77	149.11	0.20
S	South of Cape Cod (P)	327 (122)	61	136.03	1784.41	0.08
S	Southern Maine (P)	472 (0)	94	149.38	414.87	0.36
S	Subtotal	2481 (154)	579	1213.47	6620.32	0.18
F	Cape Cod South (MA)	65 (57)	15	32.66	436.84	0.07
F	East of Cape Cod (P)	467 (6)	158	559.69	2136.82	0.26
F	Mid-Coast (MA)	915 (33)	229	249.16	796.43	0.31
F	New Hampshire (P)	83 (5)	18	21.78	92.22	0.24
F	North of Boston (P)	181 (12)	49	46.15	152.21	0.30
F	Offshore (MA)	98 (0)	8	34.44	158.09	0.22
F	Offshore (P)	162 (0)	13	63.71	258.20	0.25
F	South of Boston (P)	22 (4)	6	5.90	65.24	0.09
F	South of Cape Cod (P)	177 (26)	39	82.47	1520.56	0.05
F	Southern Maine (P)	93 (11)	24	22.18	128.50	0.17
F	Southern New England (MA)	55 (31)	12	17.35	206.00	0.08
F	Stellwagen Bank (MA)	53 (0)	16	13.90	40.86	0.34
F	Subtotal	2371 (185)	587	1149.39	5991.97	0.19
	Total	6283 (542)	1479	2877.33	15970.31	0.18

[a] Parentheses indicate the number of limited hauls out of the total (i.e., complete + limited).

Table 2. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of harbor porpoise (*Phocoena phocoena*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	Mid-Coast (MA)	11	0.183	27.52	0.45	11	80
W	Cape Cod South (MA)	3	0.037	32.46	0.74	3	121
W	Southern New England (MA)	3	0.014	24.32	0.72	3	99
W	Subtotal	17	-	84.30	0.38	35	182
F	Mid-Coast (MA)	10	0.040	31.86	0.25	16	56
F	South of Cape Cod (P)	1	0.008	12.16	1.11	1	65
F	Subtotal	11	-	44.02	0.34	22	95
	Total	28	-	128.32	0.27	69	225

Table 3. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of short-beaked common dolphin (*Delphinus delphis*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	Cape Cod South (MA)	1	0.012	10.53	1.01	1	48
W	Southern New England (MA)	1	0.004	6.95	0.80	1	24
W	Subtotal	2	-	17.48	0.65	2	62
S	South of Cape Cod (P)	8	0.050	89.22	0.62	20	275
S	Subtotal	8	-	89.22	0.56	20	275
F	East of Cape Cod (P)	1	0.002	4.27	0.78	1	13
F	Subtotal	1	-	4.27	0.81	1	13
	Total	11	-	110.97	0.47	36	297

Table 4. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of Atlantic white-sided dolphin (*Lagenorhynchus acutus*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	Southern New England (MA)	1	0.004	6.95	0.89	1	28
W	Subtotal	1	-	6.95	0.89	1	28
F	Mid-Coast (MA)	1	0.004	3.19	0.82	1	10
F	Subtotal	1	-	3.19	0.89	1	10
	Total	2	-	10.14	0.66	2	36

Table 5. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of gray seal (*Halichoerus grypus*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	Mid-Coast (MA)	2	0.033	4.96	0.88	2	31
W	Cape Cod South (MA)	4	0.055	48.25	0.55	11	125
W	Southern New England (MA)	63	0.269	467.20	0.24	271	774
W	Stellwagen Bank	7	0.260	25.09	0.44	8	68
W	Subtotal	76	-	545.50	0.21	344	858
S	East of Cape Cod (P)	66	0.111	295.50	0.16	205	413
S	New Hampshire (P)	1	0.007	5.76	0.99	1	21
S	Subtotal	67	-	301.26	0.16	211	423
F	East of Cape Cod (P)	10	0.018	38.46	0.34	15	79
F	Mid-Coast (MA)	4	0.016	12.74	0.41	4	29
F	Offshore (P)	1	0.015	3.87	0.80	1	26
F	Cape Cod South (MA)	1	0.035	15.29	0.93	1	56
F	Subtotal	16	-	70.36	0.28	37	131
	Total	159	-	917.12	0.14	687	1234

Table 6. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of harbor seal (*Phoca vitulina concolor*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	North of Boston (P)	1	1.517	62.38	2.21	1	428
W	Cape Cod South (MA)	9	0.126	110.55	0.40	41	227
W	Southern New England (MA)	2	0.009	15.63	0.65	2	49
W	Subtotal	12	-	188.56	0.80	54	574
S	East of Cape Cod (P)	1	0.002	5.32	0.74	1	13
S	North of Boston (P)	5	0.053	27.53	0.38	10	58
S	New Hampshire (P)	3	0.022	18.11	0.52	6	48
S	Southern Maine (P)	1	0.007	2.90	0.79	1	13
S	Subtotal	10	-	53.86	0.27	28	96
F	East of Cape Cod (P)	1	0.002	4.27	0.76	1	13
F	Mid-Coast (MA)	18	0.071	56.55	0.26	31	107
F	North of Boston (P)	12	0.323	49.16	0.53	12	169
F	New Hampshire (P)	3	0.139	12.82	0.48	4	34
F	Offshore (P)	1	0.016	4.13	0.81	1	25
F	South of Boston (P)	1	0.226	14.74	1.02	1	51
F	Cape Cod South (MA)	1	0.014	6.12	1.94	1	44
F	Subtotal	37	-	147.79	0.26	84	254
	Total	59	-	390.21	0.39	224	760

Table 7. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals (CI) of harp seal (*Pagophilus groenlandicus*) bycatch in the New England sink gillnet fishery for 2014, by season and port group (P)/management area (MA) (Figure 1a). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Port group (P)/ Management Area (MA)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI	
						L	U
W	Mid-Coast (MA)	1	0.017	2.56	0.82	1	15
W	Southern New England (MA)	7	0.029	50.37	0.47	14	123
W	Stellwagen Bank	1	0.037	3.57	0.84	1	18
W	Subtotal	9	-	56.50	0.43	19	131
	Total	9	-	56.50	0.42	19	131

Table 8. Summary of 2014 full pinger deployment for Northeast Fisheries Observer Program observed hauls within times and areas where pingers were required by the 2010 Harbor Porpoise Take Reduction Plan (HPTRP). Seasons were defined as "W" (winter: January - May), "S" (summer: June - August), and "F" (fall: September - December).

Season	Management Area	Full Pinger Deployment Hauls	Total Observed Hauls	Full Pinger Deployment Proportion
F	Mid-Coast	280	307	0.91[a]
F	Offshore	12	36	0.33
F	Cape Cod South	40	62	0.65
F	Southern New England	18	44	0.41
F	Stellwagen Bank	22	23	0.96
F	Subtotal	372	472	0.79
W	Cashes Ledge	2	2	1.00
W	Massachusetts Bay	21	23	0.91
W	Mid-Coast	130	136	0.96[a]
W	Offshore	102	119	0.86
W	Cape Cod South	108	113	0.96[a]
W	Southern New England	252	293	0.86[a]
W	Stellwagen Bank	122	123	0.99
W	Subtotal	737	809	0.91
	Total	1109	1281	0.87

[a] Stratum with observed harbor porpoise (*Phocoena phocoena*) bycatch.

Table 9. Summaries of observed landings, prorated commercial landings, and observer coverage by the 2010 Harbor Porpoise Take Reduction Plan (HPTRP) management areas for the 2014 mid-Atlantic gillnet fishery (Figure 1b). Data were spatially stratified by the 2010 HPTRP management areas and temporally stratified by whether or not the 2010 HPTRP was in effect.

HPTRP In Effect	Management Area	Observed Landings (mt)	Commercial Landings (mt)	Observer Coverage
Yes	Waters off New Jersey	2.16	211.41	0.01
	Mudhole north	3.68	61.38	0.06
	Mudhole south	1.44	45.79	0.03
	Southern Mid-Atlantic	181.07	4262.66	0.04
	Subtotal	188.35	4581.24	0.04
No	Waters off New Jersey	104.15	1893.88	0.05
	Mudhole north	28.46	543.49	0.05
	Mudhole south	18.00	214.12	0.08
	Southern Mid-Atlantic	110.89	3914.36	0.03
	Subtotal	261.50	6565.85	0.04
	Total	449.85	11147.09	0.04

Table 10. Summaries of observed hauls, observed trips, observed landings, prorated commercial landings, and observer coverage by season, region, mesh size, and soak duration for strata with bycatch in the 2014 mid-Atlantic gillnet fishery.

Season	Region	Mesh Size (in)	Soak Duration (hrs)	Observed Hauls[a]	Observed Trips	Observed Landings (mt)	Commercial Landings (mt)	Observer Coverage
May	Waters off NJ	>7	≤72	25 (25)	9 (9)	16.94	378.83	0.04
Dec-Jan	Waters off NJ	>7	≤72	72 (11)	20 (4)	19.49	336.79	0.06
Dec-Mar	Waters off NJ	>7	≤72	76 (15)	21 (5)	20.11	375.42	0.05

[a] Parentheses indicate number of limited hauls out of the total (i.e., complete + limited).

Table 11. Observed number of bycatch, estimated bycatch rates, estimated bycatch, coefficient of variation (CV), and lower (L) and upper (U) limits on 95% confidence intervals of estimated harbor porpoise (*Phocoena phocoena*), short-beaked common dolphin (*Delphinus delphis*), harbor seal (*Phoca vitulina concolor*), and gray seal (*Halichoerus grypus*) bycatch in the mid-Atlantic gillnet fishery for 2014, by season, region, mesh size, and soak duration.

Species	Season	Region	Mesh Size (in)	Soak Duration (hrs)	Observed Bycatch	Bycatch Rate	Estimated Bycatch	CV	95% CI L	95% CI U
Harbor porpoise	May	Waters off NJ	>7	≤72	1	0.059	22.35	1.03	1	121
Short-beaked common dolphin	Dec-Jan	Waters off NJ	>7	≤72	1	0.051	17.18	0.86	1	68
Harbor seal	Dec-Mar	Waters off NJ	>7	≤72	1	0.050	18.77	1.06	1	112
Gray seal	May	Waters off NJ	>7	≤72	1	0.059	22.35	1.09	1	129

Table 12. Observed number of hauls using large mesh gillnets (7-18") following requirements for the mid-Atlantic 2010 Harbor Porpoise Take Reduction Plan (HPTRP). Observed hauls missing information for an assessed gear modification were assumed to be following the HPTRP for that gear characteristic. Locations are depicted in Figure 1b.

HPTRP In Effect	Management Area	Floatline length		Twine size	Tie downs	Net size	Nets in a string		Closure	Hauls Following HPTRP	Total	Proportion
		$\leq$ 4800ft.	$\leq$ 3900ft	$\geq$ 0.90mm	Used	$\leq$ 300ft.	$\leq$ 16 nets	$\leq$ 13 nets				
Yes	Waters off New Jersey	7	N/A	10	10	10	7	N/A	0	7	10	0.70
	Mudhole north	N/A	6	1 (5)	6	6	N/A	6	0	6	6	1.00
	Mudhole south	N/A	0	0	0	0	N/A	0	2	0	2	0.00
	Southern mid-Atlantic	N/A	6 (5)	5 (6)	11	11	N/A	11	2	11	13	0.85
	Total	19 (5)		16 (11)	27	27	24		4	24	31	0.77
No	Waters off New Jersey	105	N/A	113 (24)	146	148	107	N/A	N/A	93	148	0.63
	Mudhole north	N/A	14	11 (5)	16	16	N/A	14	N/A	14	16	0.88
	Mudhole south	N/A	27	31 (14)	41	45	N/A	27	N/A	27	45	0.60
	Southern mid-Atlantic	N/A	20 (10)	28 (10)	34	35	N/A	20	N/A	15	39	0.38
	Total	166 (10)		183 (53)	237	244	168		N/A	149	248	0.60

[a] Parentheses indicate the number of missing records out of the total.
[b] Tie down spacing, tie down length, and net number could not be assessed because of a large number of missing values.

Table 13. Observed number of hauls using small mesh gillnets (>5-<7") following requirements for the mid-Atlantic 2010 Harbor Porpoise Take Reduction Plan (HPTRP). Observed hauls missing information for an assessed gear modification were assumed to be following the HPTRP for that gear characteristic. Locations are depicted in Figure 1b.

HPTRP In Effect	Management Area	Floatline length		Twine size	Tie downs	Net size	Nets in a string		Closure	Hauls Following HPTRP	Total	Proportion
		$\leq$ 3000ft.	$\leq$ 2118ft	$\geq$ 0.81mm	Not used	$\leq$ 300ft.	$\leq$ 10 nets	$\leq$ 7 nets				
Yes	Waters off New Jersey	0	N/A	0	0	0	0	N/A	N/A	0	0	N/A
	Mudhole north	1	N/A	1	1	1	1	N/A	0	1	1	1.00
	Mudhole south	0	N/A	0	0	0	0	N/A	0	0	0	N/A
	Southern mid-Atlantic	N/A	220	163 (40)	220	209	N/A	199	N/A	173	220	0.79
	Total	221		164 (40)	221	210	200		0	174	221	0.79
No	Waters off New Jersey	96	N/A	80 (6)	102	101	100	N/A	N/A	79	102	0.77
	Mudhole north	52	N/A	52 (2)	54	54	54	N/A	N/A	52	54	0.96
	Mudhole south	0	N/A	0	0	0	0	N/A	N/A	0	0	N/A
	Southern mid-Atlantic	N/A	155	100 (23)	155	141	N/A	155	N/A	94	165	0.57
	Total	303		232 (31)	311	296	309		N/A	225	321	0.70

[a] Parentheses indicate the number of missing records out of the total.
[b] Tie down spacing, tie down length, and net number could not be assessed because of a large number of missing values.

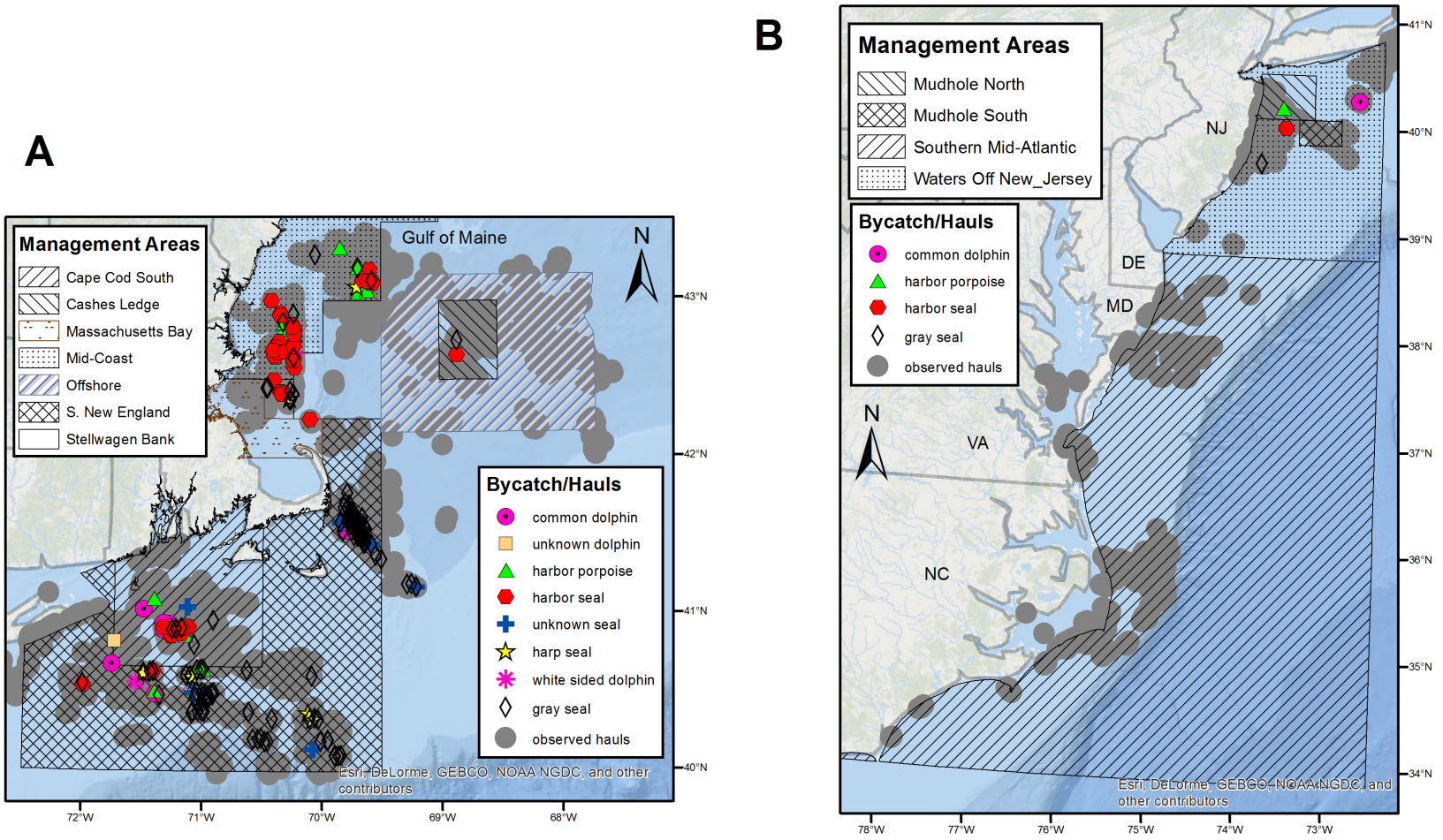

Figure 1. Locations of oberved hauls and marine mammal bycatch in the 2014 New England sink (A) and mid-Atlantic (B) gillnet fisheries. Observed bycatch consisted of harbor porpoise (*Phocoena phocoena*), short-beaked common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), gray seal (*Halichoerus grypus*), harbor seal (*Phoca vitulina concolor*), and harp seal (*Pagophilus groenlandicus*).

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