TITLE

Estimates of Harbor Porpoise Bycatch in the 2010 New England Sink Gillnet and Mid-Atlantic Gillnet Fisheries

ABSTRACT

This report provides incidental take estimates for harbor porpoise (*Phocoena phocoena*)observed in the 2010 New England sink gillnet (NESG) and Mid-Atlantic gillnet (MAG) fisheries and documents the methodology used to produce the estimates. The estimated incidental takes in the 2010 NSEG fishery were 387 (CV = 30%) harbor porpoises. For the MAG fishery, the estimated 2010 incidental takes were 257 (CV = 89%).

INTRODUCTION

Section 117 of the Marine Mammal Protection Act (MMPA) states that estimates of annual human-caused mortality and serious injury to marine mammal stocks must be reported in annual stock assessment reports (SAR) for each stock of marine mammal that occurs in waters under U.S. jurisdiction. In 1989, the Northeast Fisheries Science Center (NEFSC) Northeast Fisheries Observer Program (NEFOP) was initiated to document the bycatch of marine mammals taken incidentally in commercial fishing operations (Waring et al. 2004). Since the initiation of the observer program, the estimation of total incidental takes for harbor porpoise (*Phocoena phocoena*) has been the focus of much attention due to frequent observations of incidental takes occurring in the New England sink gillnet (NESG) fishery[1] (NMFS 1998). This attention led to the development of a stratification method designed to estimate the total annual incidental takes of harbor porpoise (Bisack 1993; Smith et al. 1993; Bravington and Bisack 1996; Bisack 1997; Rossman and Merrick 1999; Bisack 2003). The regional scope of the NEFOP was expanded into the Mid-Atlantic region in 1995 to learn more about marine mammal interactions occurring in Mid-Atlantic gillnet fisheries.

Rossman and Merrick (1999) documented the methods used to estimate harbor porpoise bycatch in the NESG and Mid-Atlantic gillnet (MAG) fisheries. These methods were subsequently used to estimate the

[1] The New England sink gillnet fishery (NESG) was called the Northeast sink gillnet fishery in cetacean and pinniped gillnet bycatch estimating documents prior to 2011 (e.g., Orphanides 2010). This name change was made to be consistent with recent Harbor Porpoise Take Reduction Plan (HPTRP) documents (e.g. NOAA 2010) and to avoid confusion with the HPTRP Northeast Management Area. This change is in name only; the fishery being specified and its extent have not changed from previous cetacean and pinniped gillnet bycatch estimating documents. Also, this fishery still called the Northeast sink gillnet fishery in NOAA's List of Fisheries which classifies fisheries into categories based on the level of marine mammal interactions in the fishery.

bycatch of other marine mammal species incidentally caught in the NESG and MAG fisheries (Blaylock et al. 1995; Waring et al. 1997; Waring et al. 2004; Belden et al. 2006; Belden 2007; Belden and Orphanides 2007; Orphanides 2010; Orphanides 2011).

The NESG fishery extends from Maine to Connecticut and is dominated by bottom-tending sink gillnets. Less than 1% of the fishery utilize a drift gillnet (not anchored and not tending toward the ocean bottom). Monofilament twine is typically used with stretched mesh sizes ranging from 6-12 in (Waring et al. 2004). According to data collected by the NEFOP from 1999 through May 2012, string lengths ranged from 100 to 15,000 ft, where half of the observed strings were about 2700 – 4500 ft, and the median length was about 3,000 ft. Mesh size and string lengths varies by the primary fish species targeted for catch (Waring et al. 2004).

The MAG fishery generally ranges from Connecticut to North Carolina and utilizes both drift and sink gillnets. These nets are most frequently attached to the bottom, although unanchored drift or sink nets are also utilized to target specific species. Monofilament twine is again the dominant material and is used with stretched mesh sizes typically ranging from 2.5-12 in (Waring et al. 2004). According to data collected by the NEFOP from 1999 through May 2012, string lengths ranged from 100 to over 11,000 ft, where half of the observed strings were about 900 - 1300 ft, and the median length was 1200 ft. The mesh sizes and string lengths vary by the primary fish species targeted for catch (Waring et al. 2004).

After the 2005 bycatch estimates, the division between the New England and Mid-Atlantic changed from a system based on vessel home port (divided at the Connecticut-Rhode Island border) to one based on reported fishing location. For the 2006-2010 bycatch estimates, the NESG and MAG fisheries were defined by a division at 72˚30'W longitude, extending south to the North Carolina/South Carolina border.

The present analysis of the 2010 data uses the same general ratio estimator methodology that was used to calculate cetacean and seal bycatch for the 2006-2009 NESG and MAG fisheries (Belden and Orphanides 2007, Orphanides 2010, Orphanides 2011). However, this analysis differs from past years due to the availability of an additional new observer data source, the At-Sea-Monitoring (ASM) data, and due to recent changes in gillnet management areas (MAs). These changes and the resulting bycatch estimates are described in this report.

METHODS

Data Sources

Five databases were used to estimate the total marine mammal incidental takes in 2010: NEFOP, ASM, Allocated Commercial Landings, Northeast Vessel Trip Reports (VTR), and the NMFS gillnet hanging ratio study database (A.I.S. 2010). The NEFOP and ASM data were used to estimate the bycatch rate of harbor

porpoise and the Allocated and VTR data were used to estimate the total effort of the fishery. The hanging ratio database was used to account for experimental fishing effort.

Observer Data

The NEFOP has two types of sampling protocols when observing gillnet fishing trips: (1) complete fish sampled trips where the observer samples the catch for fish discard information, thus the observer is not able to watch the net as it is being hauled in and so might miss an incidental take; and (2) limited fish sampled trips where the observer watches the net for incidental takes as it is being hauled in and thus should not miss any incidental takes. In the NESG and MAG fishery, hauls observed from both trip sampling protocols were used to estimate bycatch rates for all species. This had been done in past MAG estimates since 2006 (Belden and Orphanides 2007, Orphanides 2010, Orphanides 2011), and in past NESG fisheries since 2004 (Belden et al. 2006; Belden 2007; Belden and Orphanides 2007; Orphanides 2010, Orphanides 2011).

In 2010 the ASM program was established in response to Amendment 16 of the Northeast Multispecies Fishery Management Plan (FMP) to monitor catch and discards in the large mesh portion of this fishery. Specifically, ASM data are used to monitor sector Annual Catch Entitlements (ACE) and Annual Catch Limits (ACL) of each stock managed by the FMP as of May 1, 2010 and to verify area fished as well as catch and discards by species and gear type (NOAA Fisheries 2011b, 15 CFR Part 902, 50 CFR Part 648). ASM trips monitor fishing occurring under the large mesh portion of the Northeast Multispecies FMP, which manages an assemblage of 13 species: (Atlantic cod (*Gadus morhua*), American plaice (*Hippoglossoides platessoides*), Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic wolffish (*Anarhichas lupus*), haddock (*Melanogrammus aeglefinus*), ocean pout (*Macrozoarces americanus*), pollock (*Pollachius virens*), redfish (*Sebastes marinus*), white hake (*Urophycis tenuis*), windowpane flounder (*Lophopsetta maculata*), winter flounder (*Pseudopleuronectes americanus*), witch flounder (*Glyptocephalus cynoglossus*), and yellowtail flounder (*Limanda ferruginea*)). Under certain circumstances, the species landed can also include monkfish, skate, and spiny dogfish in addition to the 13 listed in the FMP (15 CFR Part 902, 50 CFR Part 648).

Since the ASM program monitors what is typically called the "groundfish" fishery (even though it occasionally catches other species), trips subject to ASM coverage will be referred to as "groundfish" trips[2]. Groundfish trips are subject to ASM coverage based on their trip declaration as a Northeast Multispecies trip, which includes trips participating in an approved sector and the "common pool" (i.e., those vessels not participating in an approved sector). Some groundfish trips were observed by NEFOP and rather than by ASM, and NEFOP also observed non-groundfish trips. Together the ASM and NEFOP

[2] In a recent report (Orphanides 2012) what are referred to here as "groundfish" trips were referred to as "sector" trips. These two terms are referring to exactly the same types of trips, the terminology was simply changed to be more consistent with other NOAA documents discussing this fishery, its management, and the ASM data.

observer programs aim to achieve a high coverage level, with the majority of that coverage occurring through the ASM program. In 2010 the combined NEFOP and ASM individual sector coverage ranged from 12.6% to 43.5%, with a fishery-wide average of 31.7%. The average fishery-wide NEFOP sector coverage was 7.3% and ASM coverage was 24.4% (Palmer pers. comm. 2011).

ASM observers receive nearly the same training as the NEFOP observers (NOAA Fisheries 2010a, NOAA Fisheries 2011a) in that both types of observers must demonstrate the same skills, are tested the same during training, and go through the same level of reviews and debriefing after an observed trip (Van Atten pers. comm. 2011). In fact, some observers collect data for both types of trips. One difference between the two programs is that ASM observers collect data on fewer variables than NEFOP observers, though the data collected by ASM observers match fields in NEFOP data. For complete information on the fields collected in ASM and NEFOP data, see the ASM Program Manual and the NEFOP Fisheries Observer Program Manual at http://www.nefsc.noaa.gov/fsb. Another difference between the two programs is that some NEFOP trips are dedicated to watching the net for protected species (e.g., marine mammals, sea turtles) incidental takes (termed "limited" trips), while other NEFOP trips are focused on catch and discards (termed "complete" trips) as on an ASM trip. All NEFOP and ASM observed trips are directed to document incidental takes, though a trip dedicated to processing fish may have a higher likelihood of missing an incidental take that falls out of a net.

The primary difference between the NEFOP and ASM programs is that the ASM program sampled only fishing effort associated with the Northeast Multispecies (groundfish) fishery in 2010 (with approximately 24% coverage). So, the ASM data will not represent all gillnet fishing effort in a particular time and area if a significant fraction of the fishing effort is not associated with the Northeast Multispecies fishery. In contrast, the NEFOP program is designed to sample all types of gillnet fishing efforts, though the coverage rate is typically only 2-8%. Consequently, when using the ASM data for calculating incidental take bycatch rates, care was taken to combine the ASM data with NEFOP data in a manner that ensured the final sample was representative of the sector/non-sector (i.e., Northeast Multispecies fishery/other fisheries) distribution in the NEFOP data (see Bycatch Rates section of the Methods below for more details).

In order to prepare the 2010 datasets (NEFOP and ASM) datasets for analysis, recorded dressed landed weights were converted to live weights using established conversion factors (Warden and Orphanides 2008; Palmer 2010) that have been used in past bycatch estimate and compliance calculations (e.g., Orphanides 2011; Orphanides 2010). Rare missing location values were imputed using medians from representative strata using methods described in Warden and Orphanides (2008) as has also been done in past bycatch estimate and compliance calculations (e.g., Orphanides 2011; Orphanides 2010). For the 2010 data, original location values were present in over 97% of hauls and no incidental takes were associated with imputed locations.

Study Data

From February through April of 2010, NMFS conducted year two of a study to examine the effects of gillnet hanging ratios on harbor porpoise bycatch (A.I.S. Inc. 2010). In essence, the observer and fishing effort data from this study was totally separated from the rest of the observer and fishing effort data and so became its own separate strata which had 100% observer coverage within the strata. That is, the observed landings from the hauls in the hanging ratio study were subtracted from the Winter South of Cape Cod and Winter Waters off New Jersey port-group area strata prorated metric tons of landings, and put in their own study strata (Tables 1 and 2). Since within these study strata there was 100% observer coverage, the total takes for these strata was calculated as simply summing up the number of observed takes. Thus, the number of harbor porpoise incidentally caught as part of this study was added directly to bycatch estimate totals and were not used in calculating bycatch rates for other strata. The observed hauls, trips, and landings from the hanging ratio study was considered observed effort and so were used in the calculation of the overall New England and Mid-Atlantic observer coverage.

Dealer and Self Reported Data

The Allocated Commercial Landings and Northeast Vessel Trip Reports (VTR) were used to calculate the total landings of all finfish caught north of North Carolina, as has been done for the last three annual gillnet bycatch estimates (Orphanides 2011, Orphanides 2010). The Allocated Commercial Landings data merges by trip the VTR logbook data (which contain fishing locations and gear characteristics) and Northeast Dealer Report data (which do not contain fishing locations or gear characteristics), wherever possible (75% of VTR gillnet trips in 2010 were matched to Northeast Dealer Report data). Thus the location and gear characteristic information of the VTR logbooks is linked with the near census of landings in the Dealer Report data (Wigley et al. 2008). This approach provides a more accurate bycatch estimate by greatly limiting the amount of proration applied to the commercial landings data. Prior to the use of the Allocated Commercial Landings data, Commercial Landings data were not directly matched to VTR trips. So, the VTR data were used to prorate all Commercial Landings data to spatial-temporal strata (e.g., Belden and Orphanides 2007). Now, using Allocated Commercial Landings data, much of this proration is unnecessary since many of the VTR trips are directly linked to the Allocated Commercial Landings data. This approach also provides a more accurate split between the New England and Mid-Atlantic fisheries because locations are now known for much of the commercial landings data.

In the cases where VTR and Allocated trips were successfully matched one to one, the Allocated landings, locations, and other characteristics for these trips were used in this analysis. In the cases where the VTR and Allocated trips could not be matched one to one, a proration scheme was used which was based on strata defined by state, season, and year, as was done in previous years (e.g., Belden and Orphanides 2007, Orphanides 2010, Orphanides 2011). That is, for strata where the total Allocated landings were greater than total VTR landings, the landings of each VTR trip in those strata were multiplied by a raising factor that ensured the total VTR landings for the strata equaled the total Allocated landings for the same strata. Thus, it was assumed that the available VTR trips were spatially and temporally representative of the trips that did not provide VTR logbooks or under-reported landings in their VTR logbooks. In the cases where the VTR landings in a stratum were larger than landings in the

corresponding stratum in the Allocated data (11% of all VTR trips in 2010, or 45% of the unmatched VTR trips), the Allocated landings were retained, unless no Allocated landings were present for those strata, in which case the VTR landings were used. In 2010 there were no strata that contained VTR landings but no Allocated landings. This approach respects the assumption that the commercial Northeast Dealer Report landings data represents a near census of all landings in the fishery, while still allowing for a limited amount of flexibility that ensures that the spatial and temporal distribution of landings is representative of effort in the VTR. The resulting landings combining the VTR and Allocated data will be referred to as the prorated metric tons of landings.

In past years North Carolina Division of Marine Fisheries (NCDMF) data were used for North Carolina fishing effort because of deficiencies in the North Carolina portion of data within the VTR and Dealer databases (Orphanides 2011). However, in 2010 this was not necessary because no marine mammal gillnet bycatch was observed.

Analysis

An "incidental take" or "bycatch" is defined as any observed incidentally caught marine mammal that was recorded as either alive with injuries or dead (fresh or under various stages of decomposition). If an incidental take was recorded as being either moderately or severely decomposed when incidentally caught, the gear's soak duration was examined to see if the incidental take could have reached the recorded state of decomposition within the given the soak time, i.e., whether the marine mammal could have been alive when entangled in the net. Incidental takes not identified to species were not included in the bycatch estimates.

The level of sampling (observer coverage) within each stratum was calculated by dividing the observed metric tons (mtons) of landings by the prorated metric tons of landing recorded in the effort datasets. Thus, the observer coverage represented the fraction of total landings that were sampled. Both NEFOP and ASM hauls were used to calculate observer coverage. The majority of ASM data was in New England, though some ASM hauls were observed in the Mid-Atlantic, and these hauls were treated the same as NEFOP observed hauls in the Mid-Atlantic.

The general data analysis process involved first stratifying the data to encompass the spatial-temporal distribution of the fishery and bycaught species. Then within each stratum, the total bycatch was estimated by the product of the bycatch rate (estimated from the observer datasets) and the fishing effort (calculated from the effort datasets). The total bycatch from the NMFS experimental study strata is simply the sum of the observed bycatch, since all experimental hauls were observed. Then the total bycatch within a fishery is the summation of the strata-specific bycatch estimates.

Data Stratification

Data stratification used to estimate NESG fishery bycatch was nearly the same as that defined in 1999 (Rossman and Merrick 1999), with a few significant exceptions. As in 1999, the 2010 and 2011 NESG fishery data were stratified temporally by season, spatially by port group-area and management area (Figure 1, Table 1), and also by the presence/absence of pingers. Seasons were defined as winter (January to May), summer (June to August), and fall (September to December). The temporal/spatial/pinger strata were based on the harbor porpoise take reduction plan (HPTRP) in effect during 2010, which also relates to the general migration patterns of the harbor porpoise. For 2010, two new spatial strata were developed as a result of the new 2010 HPTRP MAs. Also, two additional strata were developed for 2010 to reflect NMFS experiments on gillnet hanging ratios: two winter strata for the hanging ratio studies in the Southern New England and Waters off New Jersey regions (Tables 1 and 2). These three study strata only included data from these experiments and did not include an NEFOP or ASM observer data.

The other major change in the NESG bycatch estimates involved estimating the bycatch rate using both the NEFOP and ASM observer data, which had not been available in previous years. The ASM and NEFOP data were both stratified spatially, temporally, and by pinger use, as described above. However, to appropriately include the ASM data (which had a higher coverage rate in only a portion of the gillnet fishery), the ASM data were weighted to ensure that the combined NEFOP-ASM sample was representative of the fishery as a whole and was not biased towards the portion of the fishery sampled by the ASM program. Further details can be found in the Bycatch Rates section of the Methods.

Since 2010 was the first year of ASM data collection, there was a problem encountered with what was recorded in the ASM pinger usage data field. Initially, there was some confusion as to what should be recorded in the pinger usage data field when there were no pingers on the net. It was not clear whether a missing value represented zero pingers used on a gillnet string or a field that was missed. This problem was fixed as of September 2011. Therefore, prior to September 2011, New England ASM hauls with missing values were dropped from the bycatch rate calculation process. The ASM hauls with missing pinger use values were treated similarly to the hanging ratio experiments in that the takes were counted towards the final bycatch estimate but did not factor into the bycatch rate calculation. Also, observed landings on these hauls were subtracted from the prorated metric tons of landings from the dealer and VTR data. This ensures that the observed bycatch rate in NEFOP hauls and ASM hauls with valid pinger information was not multiplied by landings in which the takes were already accounted for. Essentially the takes in these hauls were treated as separate strata for which the total bycatch was known.

Since 2006, the 72˚30'W longitude line (Figure 1) was used to divide the NESG and the MAG fisheries (Belden and Orphanides 2007, Orphanides 2010, Orphanides 2011). As a result, trips landing in Connecticut, New York, and New Jersey which fished east of 72˚30'W were included in the NESG fishery and were within the South of Cape Cod port group or Southern New England management area depending on the time of year, while data from trips which fished west of this line were included in the MAG fishery (Tables 1 - 2).

Since 2008, the stratification for the harbor porpoise bycatch estimate in the Waters off New Jersey was by season (January – April) and by mesh size (< 6.535", 6.535-9.150", and > 9.150") (Orphanides 2011, Orphanides 2010). Including mesh size in the Mid-Atlantic harbor porpoise stratification was suggested by Orphanides (2009) in a thorough examination of the most appropriate means to estimate harbor porpoise bycatch in the northwestern Atlantic U.S. gillnet fisheries. Harbor porpoise bycatch rates were shown to be different in nets with different mesh sizes (Orphanides 2009; Palka et al. 2009), as has also been shown for other marine mammals (Palka and Rossman 2001) and sea turtles (Murray 2009).

Bycatch Estimate

The estimated number of marine mammal bycatch (B) is the sum of the estimated number of incidental takes within each stratum (i) where there are a total of S strata:

$$B = \sum_{i=0}^{S} incidental\ takes_i$$

$$B_i = \sum_{i=0}^{S} bycatch\ rate_i\ *\ total\ effort_i$$

The estimated number of incidental takes within a stratum (B_i) is the product of the observed bycatch rate within that stratum (bycatch $rate_i$) multiplied by the total effort within that stratum (total $effort_i$). Bycatch rates were calculated as the number of observed harbor porpoise incidental takes per observed metric tons (mtons) of live fish landed. The bycatch estimate explicitly accounts for two factors: observed fishing effort in the groundfish and non-groundfish fisheries, and bycatch rates for pingered and non-pingered hauls.

In order to include the ASM data in the calculation of the NESG bycatch estimates, the estimating process was changed from previous years (e.g., Orphanides 2011). The ASM data are by definition a subset of the entire gillnet fishery as it is designed to only sample groundfish trips. Therefore, there was the possibility that groundfish fishing effort would be over-represented and the total sample would not be representative of the entire NESG fishery. In order to account of this, when calculating the joint NEFOP-ASM bycatch rates NEFOP data were separated into groundfish and non-groundfish trip types using the NEFOP fleet id code (NOAA Fisheries 2010b). The NEFOP groundfish trips were then pooled with the ASM groundfish trips and used to calculate a groundfish bycatch rate for each stratum. Similarly, non-groundfish NEFOP data were used to calculate a non-groundfish bycatch rate for each stratum.

Pinger use was taken into account when calculating the bycatch rate for groundfish effort of each stratum. Similarly, pinger use in non-groundish effort was also accounted for when calculating the non-groundfish bycatch rate for each stratum. Some gillnets in the NESG fishery are equipped with pingers, and the bycatch rate of nets with pingers are expected to differ from the rate of nets without pingers (Palka et al. 2008b). To accommodate this difference, a weighted bycatch rate (WBR) was calculated for strata that have both hauls with and without pingers. This was done separately for groundfish and non-groundfish hauls. Within a stratum and effort type (groundfish/non-groundfish), two weighted bycatch rates were first calculated, one from hauls with pingers (WBRp) and one from hauls without pingers (WBRnp):

$$WBR_p = \frac{observed\ takes_{with\ pingers}}{observed\ landings_{with\ pingers}} * observed\ hauls_{with\ pingers}$$

$$WBR_{np} = \frac{observed\ takes_{no\ pingers}}{observed\ landings_{\ no\ pingers}} * observed\ hauls_{no\ pingers}$$

Next, within a stratum and effort type (groundfish/non-groundfish), a total weighted bycatch rate (WBR) was calculated that incorporates hauls both with and without pingers:

$$WBR = \frac{WBR_p + WBR_{np}}{total\ hauls}$$

At this point in the process, two pinger-weighted bycatch rates had been calculated for each stratum, one using only observed groundfish hauls (accounting for pingers) and the other using only observed non-groundfish hauls (accounting for pingers). Calculating a final bycatch rate for each stratum that incorporated both NEFOP and ASM data (Joint NEFOP ASM Byc $_{stratum}$) was complicated by the need to account for the fact that there were more ASM data than NEFOP data and ASM data were only recorded from groundfish trips. Thus the Joint NEFOP ASM byc$_{stratum}$ was calculated using:

$$\begin{aligned} Joint\ NEFOP\ ASM\ Byc_{stratum} \\ &= (Groundfish\%_{stratum} * GroundfishByc_{stratum}) \\ &+ (NonGroundfish\%_{stratum} * NonGroundfishByc_{stratum}) \end{aligned}$$

To preserve the groundfish/non-groundfish ratio of the NEFOP data and retain consistency with how the target bycatch rates were originally calculated from NEFOP data, the percentage of landings from the two trip types (groundfish and non-groundfish) was recorded for each stratum (Groundfish%$_{stratum}$ and NonGroundfish% $_{stratum}$). The NEFOP groundfish and non-groundfish landings percentages (Groundfish%$_{CCA}$ and NonGroundfish% $_{stratum}$) were used to weight the groundfish and non-groundfish

bycatch rates so that the groundfish bycatch rate had an influence proportional to the amount of groundfish trip landings in the NEFOP data.

Standard bootstrapping techniques were used to derive the confidence intervals and coefficients of variation (CV) for the bycatch estimates for each stratum. The re-sampling unit used was an entire trip rather than an individual haul to ensure that any within trip dependence was carried over into the estimated CV (Bisack 2003).

Results

New England sink gillnet fishery

The overall annual observer coverage from both the ASM and NEFOP programs in the NESG using both limited and complete trips was 11.8%, ranging from 5.8% in the winter to 24.14% in the fall (Table 1). The observer coverage levels presented here only include hauls used in the bycatch estimate calculations and do not include ASM data removed from the analysis due to unknown pinger use and ASM coverage in May of 2010; otherwise, the coverage level would be larger. The 2010 coverage level presented here is about three times the coverage level in 2009, which was 3.8% (Orphanides 2010). In the 2010 NESG fishery 44 harbor porpoises were incidentally taken and observed by the NEFOP and ASM programs (Tables 3). These takes do not include takes that occurred on ASM hauls in May 2010. Takes on these hauls included 7 harbor porpoise. In addition, 1 unknown small cetacean was also incidentally taken in this fishery and observed by either ASM or NEFOP observers. Among the animals observed incidentally taken in the NESG fishery, 1 harbor porpoise was incidentally caught during a 2010 experimental study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. This animal was included in the total bycatch estimate, but was not used to calculate bycatch rates. Unidentified animals were not included in the bycatch estimates.

The estimated incidental takes in the 2010 NSEG fishery was 387 (CV = 30%) harbor porpoises (Table 3).

Mid-Atlantic gillnet fishery

The 2010 observer coverage for the MAG fishery using both complete fish sampling trips (i.e., complete trips) and limited fish sampling trips (i.e., limited trips) was 3.9% (Table 2), a percentage point higher than 2009 (2.9%). Observer coverage for specific Mid-Atlantic bycatch strata (Table 4) was similar to the overall coverage rate (Table 2)There were 18 harbor porpoises observed incidentally taken in the MAG fishery in 2010 (Table 5). All MAG observed incidentally taken animals were taken in the Waters off New Jersey. Among the animals observed incidentally taken in the MAG fishery, 10 harbor porpoise were taken in the NMFS hanging ratio experiment.

The 2010 estimated total incidental takes for cetaceans in the MAG fishery included 257 (CV = 89%) harbor porpoises.

Discussion

The 2010 harbor porpoise bycatch calculations differed from previous year's calculations in a few ways, but the primary difference was the inclusion of ASM data. The ASM data should be as representative of the groundfish fishery as the traditional NEFOP data since it shares many allocation protocols. The challenge in using these data occurs when a region's fishing effort contains other fisheries besides the groundfish fishery. In the Gulf of Maine the groundfish fishery dominates the fishing effort in the times and areas when cetacean and pinniped bycatch are most likely to occur (Orphanides 2012a, Orphanides 2012b). In this region combining ASM and NEFOP data should not present a problem since both data types are sampling the same population using the same protocols. In southern New England the monkfish fishery is more prominent and is not fully covered by the ASM program, unlike the NEFOP program which monitors all types of gillnet effort. The steps taken adjust for the percentage of groundfish in this fishery have already been used in harbor porpoise bycatch rate analysis and should properly account for these differences (Orphanides 2012a, Orphanides 2012b). Additional analysis is underway comparing NEFOP and ASM data during the first year the ASM data was collected.

Given that the ASM data began in May of 2010, it is likely that there would be a small adjustment period for the new data collection program. Given this likelihood, the first month of data collection was not used. Not including May of 2010 also makes the New England winter bycatch season (Jan-May) more cohesive and not unduly influenced by a surge of ASM observed hauls in only one month, May. Among the adjustments made in the beginning of the ASM data collection program was a refinement of recording pinger use. Because of the uncertainty in how to interpret the value of this variable at the beginning, a number of hauls were dropped from the bycatch rate calculation. Although, this had a limited effect on bycatch estimates because most of the hauls dropped occurred in the summer months when few marine mammal bycatch events are observed. Therefore, dropping many summer ASM hauls did not greatly impact bycatch rates during these months. Additionally, use of at least some pingers on a haul was high in the fall of 2010 due to harbor porpoise regulations and few trips were dropped during this period, resulting in a limited impact on bycatch estimates. For example, New England harbor porpoise bycatch estimates only differed by about 3% when calculated with and without ASM hauls that were dropped due to uncertain pinger use. Lastly, given that the NEFOP and ASM are sampling the same groundfish fishery, bycatch rates should differ little between the two sources and so the effect of including the ASM data is a reduction in the estimates of the CVs.

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TABLES

Table 1. 2010 New England sink gillnet totals for observed trips, observed hauls, limited hauls, observed metric tons of fish landed, prorated total metric tons of fish landed, and percent observer coverage, by season and port group or closure strata.

2010	Observed	Observed Hauls	Observed	Prorated	Coverage
Winter (Jan-May)	**Trips**	**(Limited Hauls)**	**Metric Tons**	**Metric Tons**	**(Metric Tons) %**
Port Group-Area Strata					
Northern Maine	0	0 (0)	0.00	0.20	0.00
Southern Maine	1	3 (0)	0.54	23.49	2.30
New Hampshire	0	0 (0)	0.00	3.29	0.00
North of Boston	35	82 (34)	28.31	1142.64	2.48
South of Boston	20	62 (12)	7.78	249.58	3.12
South Of Cape Cod	17	106 (83)	87.22	2128.89	4.10
East Of Cape Cod	16	83 (28)	42.54	854.55	4.98
Offshore	1	13 (0)	7.46	66.53	11.21
Management Areas					
Offshore	9	161 (5)	56.01	271.90	20.60
Cashes Ledge Closure	0	0 (0)	0.00	0.00	-
Midcoast	12	36 (16)	6.15	196.88	3.12
Massachusetts Bay	12	48 (14)	6.78	228.29	2.97
Cape Cod Bay	0	0 (0)	0.00	8.90	0.00
South Cape Closure	20	60 (31)	30.89	871.91	3.54
Great S. Channel Closure	0	0 (0)	0.00	8.23	0.00
Hanging Ratio Study					
South Of Cape Cod Study	18	72 (72)	76.70	76.70	1.00
Subtotal	161	726 (295)	350.38	6055.28	5.79
	Observed	**Observed Hauls**	**Observed**	**Prorated**	**Coverage**
Summer (Jun-Aug)	**Trips**	**(Limited Hauls)**	**Metric Tons**	**Metric Tons**	**(Metric Tons) %**
Port Group-Area Strata					
Northern Maine	0	0 (0)	0.00	33.47	0.00
Southern Maine	53	215 (0)	78.98	216.05	36.56
New Hampshire	62	181 (0)	65.28	655.48	9.96
North of Boston	130	340 (0)	172.08	1433.07	12.01
South of Boston	59	157 (0)	64.45	766.36	8.41
South Of Cape Cod	28	125 (29)	94.88	2205.53	4.30
East Of Cape Cod	118	439 (0)	405.50	2428.12	16.70
Offshore	5	87 (0)	30.53	162.44	18.80
Management Areas					
Northeast Closure	0	0 (0)	0.00	0.00	-
Great S. Channel Closure	0	0 (0)	0.00	29.11	0.00
Subtotal	455	1544 (29)	911.70	7929.63	11.50
	Observed	**Observed Hauls**	**Observed**	**Prorated**	**Coverage**
Fall (Sep-Dec)	**Trips**	**(Limited Hauls)**	**Metric Tons**	**Metric Tons**	**(Metric Tons) %**
Port Group-Area Strata					
Northern Maine	0	0 (0)	0.00	20.94	.
Southern Maine	17	80 (4)	49.87	149.57	33.34
New Hampshire	28	91 (0)	16.88	57.93	29.14
North of Boston	97	328(19)	76.75	328.68	23.35
South of Boston	23	66 (0)	17.14	109.40	15.67
South Of Cape Cod	17	82 (22)	31.01	562.00	5.52
East Of Cape Cod	131	380 (9)	107.63	328.82	32.73
Offshore	6	60 (0)	34.56	192.75	17.93
Management Areas					
Northeast Closure	0	0 (0)	0.00		
Offshore	1	19 (0)	19.57	46.97	41.66
Midcoast	232	790 (23)	287.04	859.80	33.39
Stellwagen Bank	89	273 (13)	64.85	209.18	31.00
Massachusetts Bay	53	141 (6)	42.09	117.27	35.89
South Cape Closure	8	57 (14)	11.47	120.86	9.49
Southern New England	9	42 (0)	7.68	71.08	10.81
Subtotal	711	2409 (110)	766.54	3175.25	24.14
2010 Total	**1327**	**4679 (434)**	**2028.62**	**17160.16**	**11.82**

Table 2. 2010 Mid-Atlantic state gillnet totals for observed trips, observed hauls, limited hauls, observed metric tons of fish landed, prorated total metric tons of fish landed, and percent observer coverage, by season and state. Effort inside bays and sounds was not included in this table (e.g., Delaware Bay, Chesapeake Bay, Albemarle Sound, and Pamlico Sound).

Winter (Jan-May)	Observed Trips	Observed Hauls (Limited Hauls)	Observed Metric Tons	Prorated Metric Tons	Coverage (Metric Tons) %
Massachusetts	0	0 (0)	0	0	-
Rhode Island	1	5 (0)	0.73	1.38	52.90%
Connecticut	0	0 (0)	0	0.26	0.00%
New York	0	0 (0)	0	25.26	0.00%
New Jersey	35	117 (61)	38.44	1047.52	3.67%
New Jersey (Hanging Ratio Study)	2	8 (8)	4.36	4.36	100.00%
Delaware	0	0 (0)	0	6.92	0.00%
Maryland	0	0 (0)	0	177.01	0.00%
Virginia	56	234 (137)	70.19	691.42	10.15%
North Carolina	55	316 (296)	65.45	3806.34	1.72%
Subtotal	149	680 (502)	179.17	5760.47	3.11%
Summer (June-Aug)	**Observed Trips**	**Observed Hauls (Limited Hauls)**	**Observed Metric Tons**	**Prorated Metric Tons**	**Coverage (Metric Tons) %**
Massachusetts	0	0 (0)	0	1.71	0.00%
New York	1	4 (4)	0.92	73.42	1.25%
New Jersey	17	59 (38)	19.38	479.73	4.04%
Delaware	0	0 (0)	0	0	-
Maryland	0	0 (0)	0	14.45	0.00%
Virginia	7	24 (24)	1.5	171.57	0.87%
North Carolina	3	5 (5)	0.06	70.86	0.08%
Subtotal	28	92 (71)	21.86	811.74	2.69%
Fall (Sept-Dec)	**Observed Trips**	**Observed Hauls (Limited Hauls)**	**Observed Metric Tons**	**Prorated Metric Tons**	**Coverage (Metric Tons) %**
Massachusetts	0	0 (0)	0	1.06	0.00%
New York	2	9	1.92	43.59	4.40%
New Jersey	58	234	81.1	879.23	9.22%
New Jersey (Sturgeon Study)	30	120 (120)	25.12	25.12	100.00%
Connecticut	0	0 (0)	0	0.32	0.00%
Delaware	0	0 (0)	0	3.01	0.00%
Maryland	2	4	0.02	189.07	0.01%
Virginia	32	158	22.09	402.4	5.49%
North Carolina	48	261	13.06	765.82	1.71%
Subtotal	172	666 (464)	143.31	2309.62	6.20%
Annual Totals	349	1550 (1149)	344.34	8881.83	3.88%

Table 3. 2010 harbor porpoise bycatch estimate in the NESG.

2010	Observed	Bycatch Rate	Estimated	C.V.	95%
Winter (Jan-May)	**Takes**	**(Take/Ton)**	**Takes**	**(%)**	**C.I.**
Port Group-Area Strata					
Northern Maine					
Southern Maine					
New Hampshire					
North of Boston					
South of Boston					
South Of Cape Cod	6	0.069	141.60	44%	21-263
East Of Cape Cod	5	0.117	99.98	84%	5-264
Offshore					
Management Areas					
Offshore					
Cashes Ledge Closure					
Midcoast	1	0.140	27.56	95%	1-79
Massachusetts Bay					
Cape Cod Bay					
Cape Cod South	1	0.031	27.03	143%	1-103
Great S. Channel Closure					
Hanging Ratio Study					
South Of Cape Cod Study	1	-	1.00	-	-
Subtotal	14		297.17	38%	76-516
	Observed	**Bycatch Rate**	**Estimated**	**C.V.**	**95%**
Summer (Jun-Aug)	**Takes**	**(Take/Ton)**	**Takes**	**(%)**	**C.I.**
Port Group-Area Strata					
Northern Maine					
Southern Maine					
Southern Maine (ASM missing pinger info)	2		2.00	-	-
New Hampshire	1	0.015	9.83	101%	1-31
New Hampshire (ASM missing pinger info)	2		2.00	-	-
North of Boston	1	0.006	8.60	98%	1-25
South of Boston					
South Of Cape Cod					
East Of Cape Cod					
East of Cape Cod (ASM missing pinger info)	1		1.00	-	-
Offshore					
Offshore (ASM missing pinger info)	1		1.00	-	-
Management Areas					
Northeast Closure					
Great S. Channel Closure					
Subtotal	8		24.43	73%	8-47
	Observed	**Bycatch Rate**	**Estimated**	**C.V.**	**95%**
Fall (Sep-Dec)	**Takes**	**(Take/Ton)**	**Takes**	**(%)**	**C.I.**
Port Group-Area Strata					
Northern Maine					
Southern Maine	1	0.022	3.29	149%	1-12
New Hampshire					
North of Boston	2	0.024	7.89	64%	2-17
South of Boston					
South Of Cape Cod					
East Of Cape Cod	1	0.009	2.96	85%	1-7
Offshore					
Offshore (ASM missing pinger info)	1		1.00	-	-
Management Areas					
Northeast Closure					
Offshore					
Midcoast	15	0.051	43.85	23%	16-55
Stellwagen Bank	1	0.016	3.35	79%	1-8
Massachusetts Bay	1	0.024	2.81	81%	1-7
Cape Cod South					
Southern New England					
Subtotal	22		65.15	24%	34-95
2010 Total	44		386.75	30%	156-603

Table 4. For 2010 totals for harbor porpoise/time/area specific Mid-Atlantic strata, totals for observed trips, observed hauls, observed metric tons of fish landed, prorated total metric tons of fish landed, and percent observer coverage by season.

Species Applicability	2010 Time Period	State(s)	Mesh Size	Observed Trips	Observed Hauls (Limited Hauls)	Observed Metric Tons	Prorated Metric Tons	Coverage (Metric Tons) %
Harbor Porpoise	Jan-April	NJ	> 9.15"	19	81 (52)	17.57	546.72	3.21%

Table 5. 2010 Mid-Atlantic harbor porpoise bycatch estimates in the MAG.

Species	2010 Time Period	Area/State	NMFS Study	Mesh	Observed Takes	Bycatch Rate (Take/Ton)	Estimated Takes	C.V. (%)	95% C.I.
Harbor Porpoise	Jan-Apr	Waters off NJ	None	> 9.15"	8	0.455	246.77	89%	8-678
	Feb-Mar	Waters off NJ	Hanging Ratio	12"	10		10.00		
	Annual Total	Mid-Atlantic total					256.77	89%	8-678

FIGURES

FIGURE 1 A. New England Harbor Porpoise Take Reduction Plan (HPTRP) Management and Closure Areas.

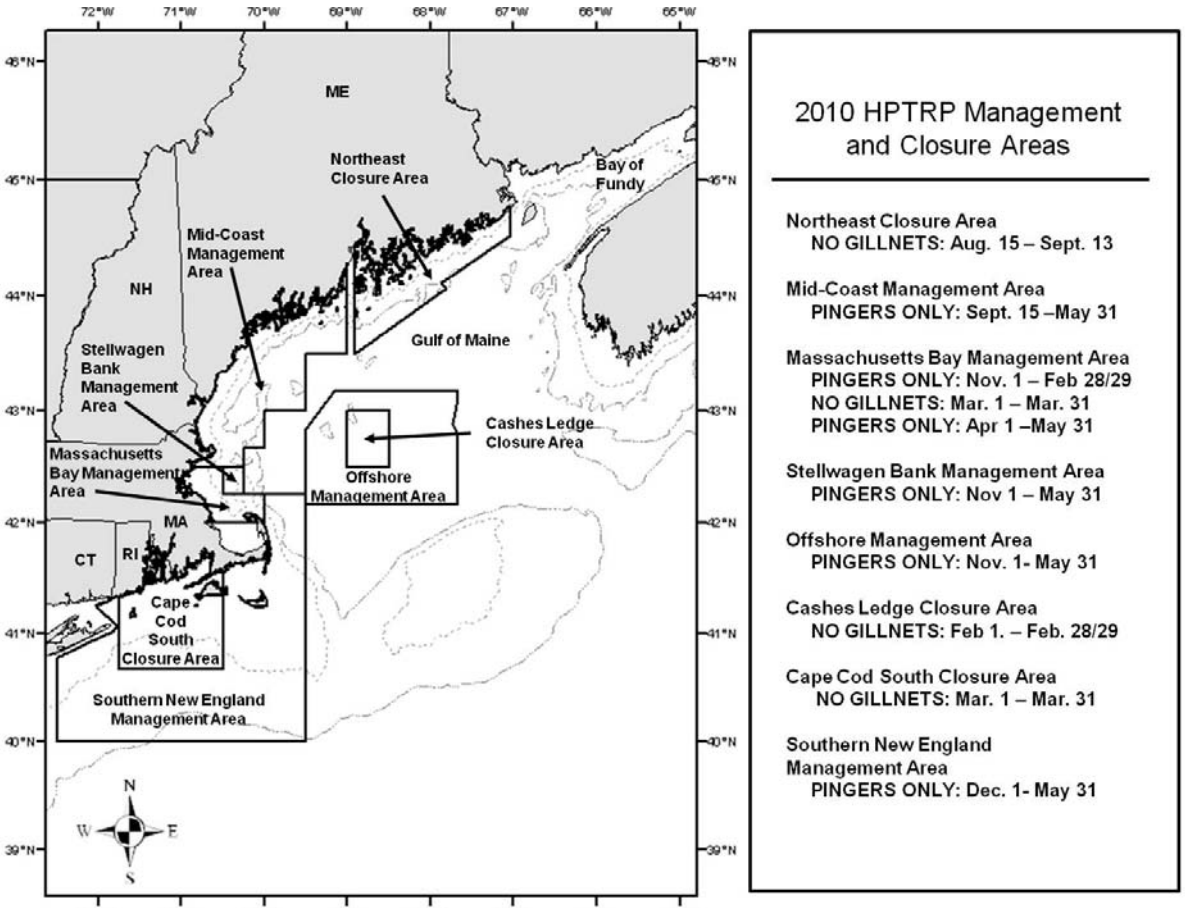
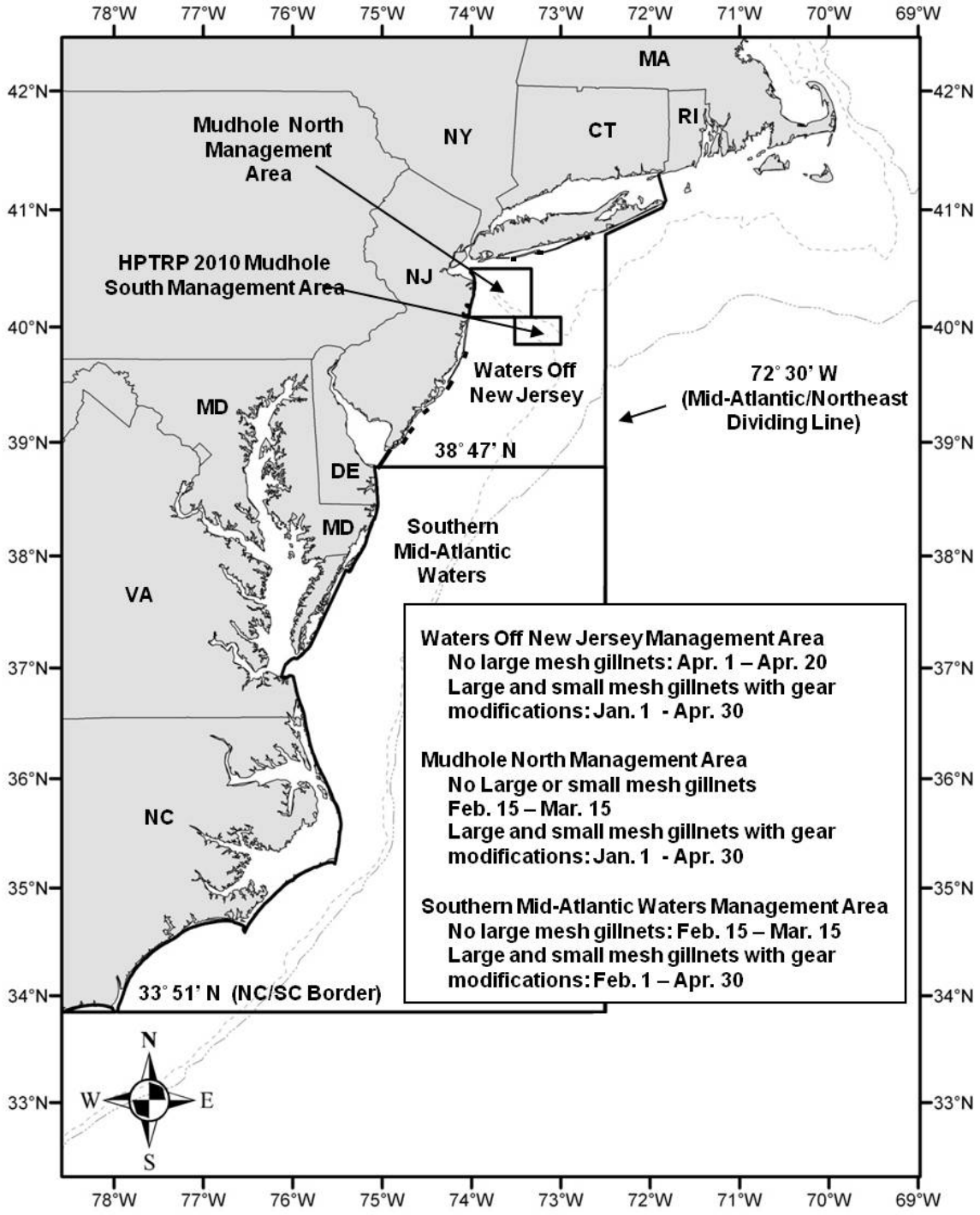
FIGURE 1B. Mid-Atlantic Harbor Porpoise Take Reduction Plan (HPTRP) Management and Closure Areas.