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Bycatch of Harbor Porpoises in Three U.S. Gillnet Management Areas: Southern Mid-Atlantic, Offshore, and Western Gulf of Maine

by Christopher D. Orphanides and Debra L. Palka

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**Bycatch of Harbor Porpoises
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Southern Mid-Atlantic, Offshore,
and Western Gulf of Maine**

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Abstract

The conservation benefits of three gillnet management areas (Southern Mid-Atlantic Area, the Offshore Management Area, and the Western Gulf of Maine Closure Area) in reducing harbor porpoise bycatch during 2005 and 2006 were investigated retrospectively by estimating the bycatches that would have occurred if the management measures in the first two areas had not been implemented and the Closure Area not enacted. Bycatch estimates were derived based upon re-opening the Southern Mid-Atlantic Management Area during February 15–March 15, and removing the pinger requirement in the Offshore Management Area during November 1–May 31. Under these assumptions, the estimated annual bycatch of harbor porpoise in the Southern Mid-Atlantic Area during February 15 to March 15 would have been 2 and 3 animals in 2005 and 2006, respectively. In the Offshore Management Area, the estimated annual bycatch of harbor porpoise during November to May in 2005 and 2006 would have ranged between 0 and 32 animals. The estimated annual bycatch of harbor porpoises in the Western Gulf of Maine Closure Area during 1989–1997 (before the area was closed) averaged 585 animals, varying between 57 animals in 1997 to 748 animals in 1990. These results suggest that all three gillnet management areas provide significant benefits in reducing incidental takes of harbor porpoise.

List of Acronyms

CFDBS	=	Commercial Fisheries Database System
HPTRP	=	Harbor Porpoise Take Reduction Plan
HPTRT	=	Harbor Porpoise Take Reduction Team
NCDMF	=	North Carolina Division of Marine Fisheries
NEFOP	=	Northeast Fisheries Observer Program
PBR	=	Potential Biological Removal
SMA	=	Southern Mid-Atlantic
VTR	=	Vessel Trip Report
WGOM	=	Western Gulf of Maine
ZMRG	=	Zero Mortality Rate Goal

INTRODUCTION

A Take Reduction Plan to reduce harbor porpoise bycatch (HPTRP) in US Northwest Atlantic commercial gillnet fisheries was implemented on January 1, 1999. The bycatch of harbor porpoises for the first few years after the HPTRP was implemented was below the Potential Biological Removal (PBR) level, which was 483 harbor porpoises in 1999. However, the bycatch for the past 4 years (2003–2006) has been above PBR (747 porpoise in 2006). Thus, the Harbor Porpoise Take Reduction Team (HPTRT) was reconvened in December 2007 to develop management actions to reduce the level of bycatch to below PBR and if possible to below the Zero Mortality Rate Goal (ZMRG) level, which is 10% of PBR.

Possible management actions discussed by the HPTRT included rescinding management measures in the Southern Mid-Atlantic (SMA) and Offshore Management Areas (Figure 1), and making the Western Gulf of Maine (WGOM; Figure 1) multispecies fishing closure a permanent closure under a revised HPTRP. Under the current HPTRP, the SMA Management Area is closed to large mesh (≥ 7 and < 18 in) gillnets from February 15–March 15, while the Offshore Management Area requires pingers on nets from November 1–May 31. Contained within the Offshore Management Area is the Cashes Ledge closure, which prohibits gillnet fishing during February. The Cashes Ledge closure would stay in place under the proposed management action. While not part of the HPTRP, the WGOM closure has been in place year-round since May 1, 1998, and has limited harbor porpoise bycatch for the entire time period that the HPTRP has been implemented. This manuscript documents the predicted bycatch if the required actions in the SMA and Offshore Management Areas were removed, and estimates harbor porpoise bycatch in the WGOM prior to its closure.

METHODS AND RESULTS

Overview

Bycatch rates under the proposed management scenario were calculated using Northeast Fisheries Observer Program (NEFOP) data. The bycatch rates were then applied to landings derived from the Commercial Fisheries Database System (CFDBS), Vessel Trip Report (VTR) data, and North Carolina Division of Marine Fisheries (NCDMF) trip level data. If there was 100% compliance with the HPTRP, then no large mesh fishing effort would have occurred within the SMA area between mid-February and mid-March, and all gillnets deployed in the Offshore Management Area during November–May would have had a full complement of pingers. However, neither of these scenarios is true; therefore data from both before and after the implementation of the HPTRP were used to derive estimates of harbor porpoise bycatch.

Offshore HPTRP Management Area

To assess what the bycatch of harbor porpoise would have been during November–May 2005 and 2006 if pingers had not been required in the Offshore Management Area, a range of bycatch rates were derived and the minimum and maximum rates applied to the 2005 and 2006 landings. This assumes that landings would not have been affected if the pinger requirement had not been enacted. The November–May period overlaps two seasons typically used in deriving

harbor porpoise bycatch estimates: fall (September–December) and winter (January–May). To maintain consistency with previous harbor porpoise bycatch estimation procedures (Belden and Orphanides 2007; Waring et al. 2007), bycatch rates from both seasons in 2005 and 2006 were used to estimate the bycatch.

As pingers were not required in the Offshore Management Area prior to 1999, NEFOP data from 1989–1998 were analyzed to determine the maximum bycatch rate of harbor porpoise in this area before pingers were prescribed. During 1999–2006, 62% of observed fall landings (from 95 hauls) and 50% of observed winter landings (from 152 hauls) were landed on strings having no pingers. However, no harbor porpoise bycatch was observed in the Offshore Management Area during this period regardless of pinger usage (Table 1). This suggests possible additional changes in the fishery besides pinger usage, or a shift in harbor porpoise distribution. However, it is not known whether these possible changes were linked to the HPTRP restrictions, and also whether the bycatch rate would (a) remain similar to the recent time period (1999–2006) if the management measures were lifted or (b) revert to a rate similar to the pre-TRP time period (1989–1998). Given the large differences between the harbor porpoise bycatch in these two time periods, the 1989–1998 fall and winter bycatch rates (0.0102 and 0.1172 harbor porpoise/metric ton of fish landed, respectively) were used to derive the maximum seasonal bycatch estimates, with the minimum seasonal bycatch estimates assumed to be zero. The analyses assumed that the Cashes Ledge Management Area remained closed, and resulted in estimated average annual (November–May) bycatches in 2005 and 2006 ranging between a minimum of 0 animals to a maximum of 32 harbor porpoise (Table 2).

Southern Mid-Atlantic HPTRP Management Area

To assess what the harbor porpoise bycatch might have been if the SMA Management Area had been re-opened in 2005 and 2006 to large mesh gillnets during February 15–March 15, monthly bycatch rates were calculated using 1994–1998 NEFOP data and applied to the landings reported in the SMA during 2005 and 2006. Fishing effort from inside bays and sounds was removed from all of the datasets (NEFOP, dealer, VTR, and NCDMF) as these regions are not managed under the HPTRP.

Because the SMA Management Area has been closed since the HPTRP was implemented in 1999, NEFOP data obtained in this area from 1994–1998 were considered to best reflect fishing practices before large mesh gillnet fishing was restricted. During these five years, observed effort during February and March was skewed towards the first two weeks in February and the first 2 weeks in March, with little coverage during the first 2 weeks of the closure (last 2 weeks in February) or the last 2 weeks in March. This trend in effort was also seen in the Dealer data until 2005 and 2006¹. Therefore, a combined bycatch rate from all of February and March was used, rather than a bycatch rate from only the closure period. The average February–March bycatch rate during 1994–1998 was 0.0364 harbor porpoise/metric ton of fish landed (Table 3).

To determine the amount of fishing effort that might occur during the closure period, it was assumed that amount of fishing effort observed 2 weeks before and after the closure period

¹ Despite the HPTRP regulations, there was some large-mesh gillnet fishing observed since 1999 in the SMA area during the closed period. The observed bycatch rates from February and March since 1999 were in the same approximate range as that observed before the HPTRP (Table 2). However, because the amount of observed effort was so low, the post-HPTRP estimates are less reliable.

(4 weeks total) would have been the same as expended during the 4-week closure period. Hence, for each 2-week period, the percentage of total gillnet landings attributed to large mesh (using the most appropriate data for each state) was multiplied by the total gillnet landings (again, using the most appropriate data for each state). The estimated large mesh gillnet landings for each 2-week period was then multiplied by the combined February and March bycatch rate to derive the harbor porpoise bycatch in that 2-week period. The 2-week bycatch estimates were then summed. Had large mesh gillnetting been allowed in the SMA during the February–March closure period in 2005 and 2006, an estimated 2 harbor porpoise would have been taken in 2005 and 3 harbor porpoise in 2006 (Table 4).

Large mesh gillnet effort in the SMA was determined using two different methods because of deficiencies in some datasets describing North Carolina effort. Effort from the states of Maryland south through Virginia was calculated using one method, while North Carolina effort was calculated using a different method.

Federal VTR data from 2005 and 2006 (which includes recorded mesh size) were used to estimate the percentage of large mesh gillnet effort from Maryland through Virginia. Total gillnet landings (all mesh sizes) was calculated using dealer data from Maryland through Virginia. The large mesh gillnet landings were then determined by multiplying the percentage of total effort attributed to large mesh gillnets in the VTR data from Maryland through Virginia by the total gillnet landings in this area.

In North Carolina, NEFOP data were used to estimate the percentage of large mesh gillnet effort in North Carolina since federal VTR data are considered incomplete in North Carolina and NCDMF mesh size data were recorded in categories which were not split at 7 inches. To estimate the percentage of large mesh effort, the North Carolina NEFOP landings were divided by mesh size and species, and the percentage of each species captured in large mesh was recorded, as done in Palka and Rossman (2001). The large mesh percentages were then applied to NCDMF species-level landings to estimate the total large mesh landings in North Carolina. NCDMF data were used for the landings because of recent problems with electronic dealer reporting in North Carolina. The complete February and March 1994–2006 North Carolina NEFOP time series was used to calculate the large mesh percentages because of the limited number of total observed hauls in North Carolina during February and March 2005 and 2006.

Western Gulf of Maine Multi-species Closure

NEFOP data were used to estimate annual bycatch rates (observed harbor porpoise per observed metric tons of fish landings) in the WGOM closure during 1989–1993 and 1996–1997 (i.e., before the closure was implemented on May 1, 1998). Each of the annual bycatch rates was then applied to the respective annual WGOM landings to estimate the annual harbor porpoise bycatch in the WGOM area. An overall average annual bycatch rate (covering all years) and an average annual bycatch were also calculated (Table 5).

For 1989–1993, total WGOM effort data (landings) were taken directly from the CFDBS using the latitude and longitude recorded in this database. In 1994, the VTR system was implemented and fishing latitude and longitude were recorded in the VTR, but were no longer recorded in the CFDBS. Unfortunately, the data from the first years of the VTR collection process (1994 and 1995) are considered of poor quality and were therefore excluded from analysis. Without latitude and longitude data for 1994 and 1995, it was not possible to determine

if landings occurred within the WGOM, and therefore landings estimates and bycatch estimates could not be calculated for these 2 years. Due to a low number of observed hauls and an unrepresentative bycatch rate in 1990, an average annual bycatch rate from the remainder of the time series (1989, 1991–1997) (0.112) was used to estimate the 1990 bycatch.

For 1996 and 1997, CFDBS landings were prorated to the WGOM region using VTR landings and locations using a method similar to that used for the annual harbor porpoise estimates (Belden and Orphanides 2007, Waring et al. 2007). CFDBS and VTR data were both stratified by port group, month, and year. Within each VTR stratum, the percentage of landings attributed to the WGOM region was calculated. VTR data were considered to be slightly less than a full census of the fishery, so this percentage was applied to the corresponding CFDBS landings to calculate the total estimated WGOM landings. In those cases where VTR landings were present in a port group-month-year stratum, but not in the corresponding CFDBS stratum, the VTR landings were used as the total effort for that stratum.

Although some fishing effort has actually occurred within the borders of the closure area since 1998, this effort has been very limited and primarily along the eastern border of the closure. As this fishing activity was not believed to be representative of the pattern of fishing activity that might take place within the closure if the area was reopened to fishing, it was not examined further.

The estimated annual bycatch of harbor porpoise in the WGOM Closure Area during 1989–1997 averaged 585 animals, and ranged from 57 animals in 1997 to 748 animals in 1990 (Table 5).

DISCUSSION

Our findings indicate all three gillnet management areas provide significant benefits in reducing incidental takes of harbor porpoise. The WGOM Management Area was the only non-HPTRP management measure investigated, but has a large conservation benefit. Compliance with this closure is relatively high, particularly compared with the SMA and Offshore Management Areas. Lack of full compliance with the SMA and Offshore management measures makes it difficult to accurately predict future harbor porpoise bycatch in these two areas. In the SMA, large mesh gillnet fishing was observed during the closure and it is unknown whether fishing effort would change significantly in this area if the regulations were lifted. Bycatch estimation for this area was affected by North Carolina data quality issues, resulting in the use of an indirect method to calculate the percentage of the gillnet fishery using large mesh. Better mesh size data would have allowed for estimating bycatch using a more direct approach. However, no matter the method used, bycatch in the SMA is likely to be small, minimizing the impact of any biases in methodology. Bycatch estimation in the Offshore Management Area was complicated by a lack of full compliance with pinger regulations (combined with an apparent shift in bycatch patterns independent of pinger usage) resulting in a wide range of the bycatch estimates.

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Table 1. Observed gillnet harbor porpoise bycatch, landings (metric tons), and bycatch rates in the Offshore Management Area by season and series of years.

Years	Season	Observed Harbor Porpoise Bycatch	Observed Landings	Observed Landings with Pingers	Observed Landings without Pingers	Bycatch Rates
89-98	Fall	1	98.248	0	98.248	0.0102
89-98	Winter	18	153.585	0	153.585	0.1172
99-06	Fall	0	102.758	39.087	63.671	0.0000
99-06	Winter	0	122.929	61.291	61.638	0.0000

Table 2. Observed landings (metric tons) and predicted minimum/maximum harbor porpoise bycatch in the Offshore Management Area by season during 2005-2006.

Year	Season	Total Offshore Landings	Minimum Bycatch Estimate*	Maximum Bycatch Estimate*
2005	Fall	105.14	0	1
2005	Winter	416.68	0	49
2006	Fall	293.40	0	3
2006	Winter	86.11	0	10
Annual Averages	Combined Season	450.66	0	32

* min bycatch rate = 0.0000, max fall bycatch rate = 0.0102, max winter bycatch rate = 0.11720

Note: Fall season is from September to December, but the Offshore closure begins in November. Winter season is from January to May, though in the 2005 SAR estimates, the winter season was modified due to grouping of bycatch of other species. Landings shown here for winter 2005 reflect the January to May landings and differ from what was reported in the SAR.

Table 3. Observed large mesh gillnet harbor porpoise bycatch, landings (metric tons), and bycatch rates in the Southern Mid-Atlantic Management Area during February and March in a series of years.

Years	Time Period	Observed Harbor Porpoise Bycatch	Observed Landings	Bycatch Rates
94-98	Feb -March	8	219.5883	0.0364
99-06	Feb -March	1	53.6840	0.0186
94-06	Feb -March	9	273.2723	0.0329

Table 4. Total landings (metric tons) and predicted harbor porpoise bycatch in the Southern Mid-Atlantic Management Area, during February 15 – March 15, 2005-2006.

Year	Time Period	Total Fishery Landings	Predicted Bycatch
2005	Feb 15 –March 15	61.79	2
2006	Feb 15 –March 15	95.61	3
Averages		78.70	3

* predicted bycatch rate = 0.0364

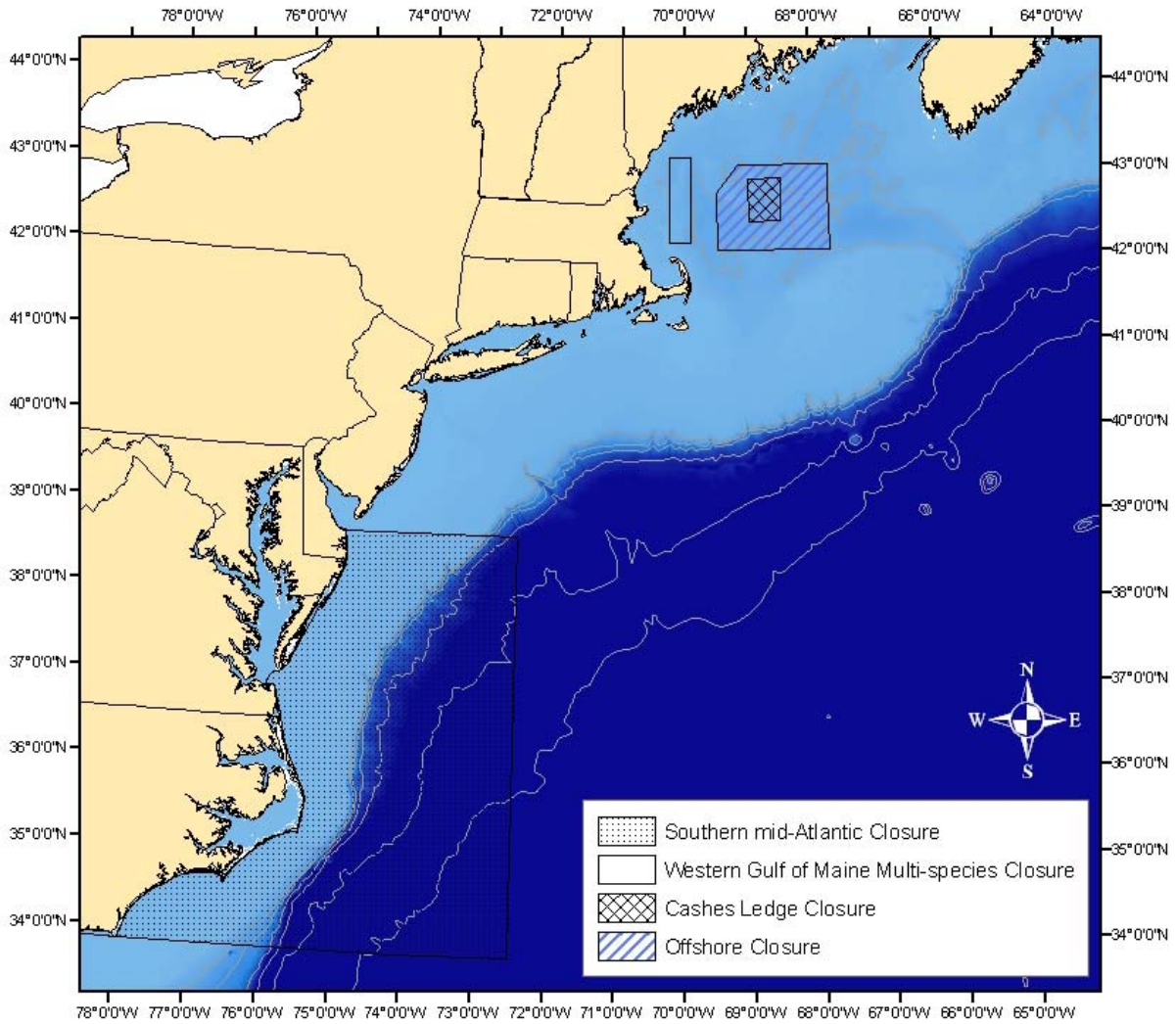
Table 5. Western Gulf of Maine Management Area bycatch rate, observed hauls, observed landings (metric tons), and estimated bycatch for 1989-1993, and 1996-1997.

Year	Observed Harbor Porpoise Bycatch	Observed Landings	Observed Bycatch Rate	Total WGOM Landings	Estimated harbor porpoise bycatch
1989	4	51.020	0.078	8760.78	687
1990*	6	12.821	0.468*	6657.59	748*
1991	5	53.204	0.094	3847.70	362
1992	4	55.768	0.072	3742.49	268
1993	7	40.548	0.173	4256.50	735
1994	42	184.098	0.228	Unknown	Unknown
1995	11	118.776	0.093	Unknown	Unknown
1996	12	90.382	0.133	1762.57	234
1997	3	106.688	0.028	2038.64	57
Total	94	713.305			
Average**			0.132	4438.04	585

* Due to a low number of observed hauls and an unrepresentative bycatch rate in 1990, an average annual bycatch rate from the remainder of the time series (1989, 1991-1997) (0.112) was used to estimate bycatch for 1990.

** The average bycatch rate is calculated as the total observed harbor porpoise bycatch (94) divided by total observed landings (713.305). This bycatch rate is then multiplied by the average annual total landings (4438.04) to calculate the average annual harbor porpoise bycatch. This approach provides the most robust estimate and allows for observed bycatch in 1990, 1994, and 1995 to be taken into account to estimate bycatch for the whole time series despite data issues that limit their applicability for estimating the annual bycatch for those particular years.

Figure 1. Locations of the Southern Mid-Atlantic, Offshore, Cashes Ledge HPTRP closures, and the Western Gulf of Maine multi-species closure.



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