Food for thought on evaluating the reductions in bycatch due to aspects of the proposals that involve expanded pinger requirements and closed areas

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Abstract

Two proposals suggested expanding pinger requirements to more areas more of the time. The scientist's proposal suggested expanding pinger usage year round to the Mid-Coast and Southern New England Management Areas (MA), and expanding the full closures (no gillnets) to the Southern New England MA during December through February. The Laist proposal suggested expanding pinger usage from December – May in the waters from 40° – 42° N, and from October – March in the waters north of 42°N.

Making some broad simplifying assumptions, the Laist proposal could possibly result in a 21 – 28% reduction, while the scientist's proposal could possibly result in a 28 – 47% reduction of the current average annual bycatch. The big difference between the two proposals is the relatively large reduction that would be due to the complete closure of the Southern New England management area for three months with no re-allocation of fishing effort (and therefore no re-allocation of the harbor porpoise bycatch). These predicted reductions are highly dependent on the levels of past and future compliance to the pinger regulations (that is, using functional pingers in the proper numbers) and have not accounted for any shifts/changes in fishing effort. The times and areas where most of the harbor porpoise bycatch has been documented are already in management areas that are regulated by closures or pingers, so the factors that could further reduce the bycatch appear to be either additional closures or increased compliance with the pinger regulations (and thus an assumed decrease in bycatch). Unfortunately, using the presently collected data it is not possible to accurately determine what level of reduction would result from using fully compliant pingered strings because (1) the number of functional pingers was not known in the past, so estimating an accurate bycatch rate based on fully compliant past hauls is not possible; and (2) the levels of both future and past compliance are unknown.

Finally, we discuss possible ways that could be used to evaluate the effectiveness of certain types of proposals that may be developed by the team at this upcoming webinar meeting. Depending on the content of the final proposal, we request input from the team's members with regards to assumptions about future bycatch rates, levels of compliance, and fishing effort.

This information is distributed solely to inform discussions of Harbor Porpoise Take Reduction Team, and is subject to future review and revision. It has not been formally disseminated by NOAA. It does not represent any final agency determination or policy.

Introduction

Two proposals suggested expanding pinger requirements to more areas more of the time.

- The scientist's proposal suggested expanding pinger usage year round to the Mid-Coast and Southern New England Management Areas (MA), and expanding the full closures (no gillnets) to the Southern New England MA during December through February.
- Laist's proposal suggested expanding pinger usage from December – May in the waters from 40° – 42° N, and from October – March in the waters north of 42° N.

The additional proposed regulated times/areas are detailed in Table 1. Note, under Laist's proposal we made a couple assumptions that are as follows:

- It was assumed that the monthly closures will continue to be closed for the Cashes Ledge management area (MA) (located inside the Offshore MA), and the Cape Cod South MA (located inside the Southern New England MA). It was also assumed that since the Cashes Ledge and Cape Cod South MAs are within larger MAs which are regulated to use pingers, when these two MAs are not closed they follow the pinger regulations for the larger MA (which is specified in another row in Table 1).
- Since the Western Gulf of Maine (GOM) year-round closure area has had observed bycatch and it is within the proposed north of 42°N region, it is assumed that with additional pinger requirements for the north of 42° N region, the bycatch in this closure area will be reduced. This document will discuss these proposals and attempt to provide some insight into the amount of reduction in bycatch that could result from implementation of these proposals.
- It was also assumed that in the north of 42°N region, for the MAs that currently require pingers in May, the pingers would still be required in May under this proposal. If we remove this assumption, the predicted bycatch under this proposal would go up.

Table 1. Comparisons of current harbor porpoise take reduction plan and portions of two of the proposals that suggest additional usage of pingers or closures.

	Current		Laist's proposal	Scientist's proposal	
Management Areas	with pingers	closures (no gillnets)	additional pingers	additional pingers	additional closures (no gillnets)
Northeast		Aug 15 - Sep 13	Sep 14 – Mar		
Cape Cod South		Mar	(See S. New England MA row)		
S. New England	Dec - May		0	Jun – Nov	Dec – Feb
Cashes Ledge		Feb	(See Offshore MA row)		
Mass Bay	Nov - Feb, Apr - May	Mar	Oct		
Mid Coast	Sep 15 - May		0	Jun - Sep 14	
Off shore	Nov - May		Oct		
Stellwagen Bank	Nov - May		Oct		
Western GOM			Oct – Mar		
Outside[1] south 42°N			Dec – May		
Outside[1] north 42°N			Oct – Mar		

40 - 42° N: pingers Dec-May
north of 42° N: pingers Oct – Mar
S. New England pingered year round & closed from Dec – Feb
Mid-coast pingered all year round

[1] "Outside" means outside of the above applicable management areas

To predict a range of bycatch estimates for a given proposal, the approach we used to evaluate the effectiveness of past harbor porpoise and coastal bottlenose dolphin take reduction plans was to multiply a range of predicted bycatch rates and a range of predicted landings for each region. More specific to this fishery, we also could derive different predicted bycatch rates for hauls with and without pingers and use those values to estimate a weighted bycatch rate for times and areas that have a mix of hauls with and without pingers; this approach would mirror that used to estimate bycatch for the harbor porpoise SAR. Predicted bycatch estimates could then be compared to past bycatch estimates to determine the amount of reduction that could result for implementing these proposals.

However, since there are many assumptions to be made in the above approach we explored two other simplified approaches in this document. One of the difficulties is in using the existing observer data to estimate predicted bycatch rates for hauls with pingers. This is due to a couple of reasons: (1) the

number of functional pingers was not known in the past, so estimating an accurate bycatch rate for fully compliant hauls is not possible; and (2) the levels of both future and past compliance are unknown. For example, in the last few years under the 2010 harbor porpoise take reduction plan (HPTRP), the bycatch rate of hauls with a full complement of pingers (functionality unknown) was nearly the same as the bycatch rate on hauls with no pingers, and the bycatch rate on hauls with some pingers was surprisingly lower than both of these (pg 27, Table 10 in Palka B7 HPTRP document and Appendix in this document, Table A1). However, this differs considerably from the 2007-2010 (Palka B7) and 1999 – 2007 (Palka et al. 2008) time periods, when hauls with no pingers had a bycatch rate about three times higher than hauls with a full complement of pingers, and hauls with between 1 and 99% of the required pingers had a bycatch rate about six times higher than that of hauls with all the required pingers. So which pattern should be used in the present analysis to estimate the reduction of the bycatch due to an increase of pinger usage? Is the relationship seen in the most recent years an anomaly or a new pattern? In recent years did hauls with 100% of the required number of pingers have non-functional pingers resulting in similar bycatch rates to those observed in the past for hauls with missing pingers? Or is something else going on? It is impossible to know without more data on pinger functionality.

At the November 2012 meeting the Take Reduction Team assumed that bycatch estimates would decrease with increased pinger usage if they are functional and deployed in the proper numbers on the gillnet strings. This assumption is used in the approaches explored in this document.

Baseline estimates

Baseline estimates are required for comparison to bycatch predictions for the various proposals.. Bycatch estimates for the last five years (2007-2011) for all fisheries with harbor porpoise interactions, as documented in the SAR, are in Table 2. Bycatch estimates for the last five years (2007 – 2011) were calculated for two of the time-areas suggested for expanded pinger usage (Table 3). These estimates were created using the same prorated dealer data and pinger weighting process used in the annual bycatch estimates for the harbor porpoise SAR, though using only NEFOP data. ASM data were not used because of confusion between recording missing values and true zeros in the beginning of that time series.

Table 2. Estimate harbor porpoise bycatch, as reported in the SAR, for 2007 – 2011 for all fisheries

Year	New England	(CV)	Mid-Atlantic	(CV)	Canadian gillnet	Canadian weir	Bottom Trawl	(CV)	TOTAL	(CV)
2007	395	(0.37)	58	(1.03)	43	3	5.6	(0.46)	505	(0.31)
2008	666	(0.48)	350	(0.75)	43	0	5.3	(0.47)	1064	(0.39)
2009	591	(0.23)	201	(0.55)	43	0	5.1	(0.50)	840	(0.21)
2010	387	(0.30)	257	(0.89)	43	1	0	(0)	688	(0.37)
2011	324	(0.23)	123	(0.40)	43	1	?		496	(0.18)
Avg	473	(0.17)	198	(0.38)	43	1	5.3	(0.27)	720	(0.15)

Table 3. Estimated landings (in mtons), bycatch rate, and total harbor porpoise (HP) bycatch levels for the expanded pinger usage times and areas in the region north of 42°N, called Gulf of Maine region (GOM); and the region within 40° – 42°N, called the Southern New England (SNE) region and the proposed closure area in the SNE management area.

Laist's proposal				
Year	**Pinger Expansion Area**	**Landings**	**Bycatch Rate**	**HP Estimate**
2007	GOM (Oct-March)	3863.06	0.008	30
2008	GOM (Oct-March)	4678.18	0.059	277
2009	GOM (Oct-March)	3365.61	0.106	355
2010	GOM (Oct-March)	3082.76	0.006	18
2011	GOM (Oct-March)	2765.32	0.058	161
Annual Averages		**3550.99**	**0.047**	**168**
2007	SNE (Dec-May)	2920.25	0.126	367
2008	SNE (Dec-May)	3057.10	0.080	244
2009	SNE (Dec-May)	3023.35	0.064	194
2010	SNE (Dec-May)	3893.9	0.070	271
2011	SNE (Dec-May)	3134.28	0.011	36
Annual Averages		**3205.78**	**0.070**	**222**

Scientist's proposal				
Year	**Closure**	**Landings**	**Bycatch Rate**	**HP Estimate**
2007	SNE (Dec-Feb)	2075.64	0.117	243
2008	SNE (Dec-Feb)	790.97	0.123	97
2009	SNE (Dec-Feb)	725.55	0.076	55
2010	SNE (Dec-Feb)	677.73	0.085	58
2011	SNE (Dec-Feb)	565.00	0.066	37
Annual Averages		**966.98**	**0.093**	**98**

Effect on bycatch of proposals

Two approaches were explored to estimate the amount of bycatch reduction that might result from implementing these proposals under a variety of assumptions. The first approach was to use the NEFOP observed data collected during 2007 – 2011, manipulate the past observed data to simulate the results if the proposal had been implemented at that time, apply the same general analytical methods used to produce the annual SAR estimates, and then see what the resulting bycatch would have been for each of the past years if the proposal had been implemented at that time. These predicted bycatch estimates for the proposed times and areas could then be compared to the past bycatch estimates in Table 3 to determine the percent reduction due to the implementation of the proposal.

As an example of how this first approach could be applied, the predicted percent reduction from Laist's proposal is explored. Specifically, the past data were re-stratified into the regions north of 42°, termed Gulf of Maine (GOM) and between 40° – 42°, termed Southern New England (SNE). For each time/area stratum that has some observed hauls with pingers and other observed hauls without pingers, the annual SAR bycatch rates are weighted bycatch rates of the pingered and non-pingered nets, where the weight is the number of hauls that have one or more pingers and the number of hauls that have no pingers, respectively. These predicted bycatch estimates use modified counts of hauls that used one or more pingers (Table 4). This was done in two ways: 1) modifying the weighted bycatch rates of only the hauls outside of existing management areas, and 2) modifying the weighted bycatch rates on all hauls in the time-area under consideration. The first way assumed fishing in existing management areas would remain the same, and the second way presumed that pinger use would increase in all areas, including in existing management areas. Both ways assume that, though pingers may be used on an increased number of hauls, compliance with regards to having the right number of pingers on nets would not change. It also assumes fishing distribution and levels would be similar, on average, in the future as it was in the past.

The first approach applied to the Laist proposal resulted in some past years for which the predicted bycatch estimates actually increased instead of decreased, and similar overall average predicted reductions between the Gulf of Maine and Southern New England regions (Table 4). The average reduction in bycatch over the five years within each region was between 21 and 28%, though increases in estimated predicted bycatch were seen in the most recent two years in the Gulf of Maine and in the most recent year in Southern New England. If these two regions within the specified times are assumed to represent nearly all of the annual bycatch in the New England gillnet fishery, then we can assume the predicted bycatch reduction due to Laist's proposal would be about 21 – 28% of the average annual New England gillnet bycatch estimate.

A similar type of analysis could be conducted for the scientist's proposal, but was not conducted at this time. It can be noted that given past fishing practices little additional reduction in bycatch would be expected by expanding pinger use in Southern New England from June-November because bycatch is relatively rarely observed in this area during these months (see the Appendix Tables A2 and A3). Also the analysis of the scientist's proposal should account for some shifting of fishing effort from the proposed closure in the Southern New England MA during December – February to neighboring times and areas.

The second approach uses the approximate monthly average bycatch estimates from the Tables 5 and 7, pgs 20 and 22 in Palka B7 HPTRP document (also copied in the Appendix in this document in Tables A2 and A3) and makes general assumptions about the level of reduced bycatch. We assumed an average reduction of 60% in predicted bycatch rates for times and areas for which pingers were not previously required but would now be required under the proposal (average of 50 – 70% reduction as documented in the past – Palka et al. 2008). In addition, we assumed an average reduction of 20% for times and areas for which pingers were already required; this additional reduction was assumed based on the

presumption of increased compliance with pinger requirements and therefore reduced bycatch (Table 5). The 20% value was chosen because it is roughly the difference in the approximate bycatch rates in the Coastal Gulf of Maine Consequence Closure Area during the 1998 HPTRP time period (1 Jan 2007 – 1 May 2010) versus the 2010 HPTRP time period (1 May 2010 – 31 May 2012) as documented in Tables 4 and 6, pgs 19 and 21 in Palka B7 HPTRP document. This Consequence Closure Area required pingers for nearly the entire Area during both time periods, and we documented an increase in compliance over time, as measured by the number of observed hauls with 100% of the required number of pingers (Figure 5, pg 36 in Palka B7 HPTRP document). So assuming the decrease in bycatch was due to the increased compliance, the bycatch rate of 0.043 harbor porpoises/mtons during the 1998 HPTRP time period decreased to 0.035 harbor porpoises/mtons during the 2010 HPTRP time period (=18.6% reduction). This approach also assumes effort levels and spatial-temporal patterns do not vary from the past. For the scientist's proposed three month closure in the Southern New England MA it was simply assumed that the past takes in this time/area disappeared with no re-allocation of fishing effort, thus resulting in an upper limit to the predicted reduction from this proposal. These percent reductions were then applied to the average annual bycatch during 2007 – 2011 for all of the New England areas (= 473 from Table 2) to yield a predicted annual bycatch of all of the New England areas (Table 6).

The second approach resulted in an average 2% reduction in the annual New England bycatch estimate based on the new components of Laist's proposal. If the Laist proposal also leads to increased compliance in existing areas, then the total reduction to the annual New England bycatch estimate could be about 21%. The new components of the scientist's proposal might result in a 28% reduction, of which 23.5% reduction was due to the closure of the New England MA during December – February. If the scientist's proposal also leads to increased compliance in existing areas, then the total reduction could be up to about 47%. The resulting annual average bycatch estimates for all of the New England area are in Table 6.

Conclusions and discussion of a way forward

Making some broad simplifying assumptions, Laist's proposal could possible result in a 21 – 28% reduction, while the scientist's proposal could possible result in a 28 – 47% reduction of the current average annual bycatch. The big difference between the two proposals is the relatively large reduction that would be due to the complete closure of the Southern New England management area for three months with no re-allocation of fishing effort (and therefore no re-allocation of harbor porpoise bycatch). These predicted reductions are highly dependent on the levels of past and future compliance to the pinger regulations (that is, using functional pingers in the proper numbers) and have not accounted for any future shifts/changes in fishing effort that may be due to fish management plans or the HPTRP. The times and areas where most of the harbor porpoise bycatch have been documented are already in management areas that are regulated by closures or pingers, so the factors that could further reduce the bycatch appear to be either additional closures or increased compliance with the pinger regulations (and thus an assumed decrease in bycatch). Unfortunately, using the presently collected data it is not possible to accurately determine what level of reduction would result from using fully

compliant pingered strings because (1) the number of functional pingers was not known in the past, so estimating an accurate bycatch rate based on fully compliant past hauls is not possible; and (2) the levels of both future and past compliance are unknown.

This manuscript used two approaches to attempt to estimate the potential benefit to the two proposals. A third approach, which had been used to evaluate past proposals to the harbor porpoise and coastal bottlenose dolphin take reduction plans is to multiply a range of predicted bycatch rates and a range of future predicted landings for each area to yield a range of predicted bycatch estimates that could result if the proposal was implemented. We did not attempt this third approach at this time because we felt we needed input from the team regarding the parameters needed to generate the range of bycatch rates. The advantage of the second approach (using approximate monthly bycatch estimates for all the areas and making simple assumptions about the amount of reduction a proposal might make) is that it is fast and easy, therefore we can quickly evaluate a variety of proposals, but it may not be the most accurate approach. The advantage of the first approach (going back to the raw observer data, modifying it to simulate a proposal, and seeing the effect on the bycatch estimate) is it is more accurate and reflects the fine detail characteristics of the data more completely. The disadvantage of both of these approaches, as implemented in this document is that they did not account for future changes in fishing effort and distribution.

If we are to use any of these three approaches, a combination of these approaches, or some other approach to evaluate the proposal(s) that will be developed by the team at this upcoming webinar, we feel we need input from the team on at least one issue, quantifying future fishing effort. For example, for the coastal bottlenose dolphin take reduction plan evaluation, the fishers on the team told us what was happening as the dogfish fishery was being shut down in the Mid-Atlantic. They noted that in the near future, there would be no fishing for dogfish (per the regulations) and there would be an increase in small mesh fishing of species such as weakfish and croaker. Following this recommendation we used the previously collected observer data, simulated these new fishing practices and then calculated the resulting predicted bycatch rates that were used to evaluate the effectiveness of the proposed plan. Perhaps such an approach is appropriate for the New England gillnet fishery?

Table 4. Harbor porpoise (HP) bycatch estimates applying bycatch rates from hauls with pingers to hauls not using pingers

		Historical Data		*Pinger Expansion (only non-MAs)*				*Pinger Expansion (all areas)*			
Year	**Landings**	**Bycatch Rate**	**HP Estimate**	**Bycatch Rate**	**HP Estimate**	**HP Diff from Historical**	**% diff from Historical**	**Bycatch Rate**	**HP Estimate**	**HP Diff from Historical**	**% diff from Historical**
					GOM (Oct – Mar)						
2007	3863.06	0.0079	30.4	0.0063	24.4	-5.9	**-19.6%**	0.0058	22.5	-7.9	**-25.8%**
2008	4678.18	0.0592	276.8	0.0480	224.6	-52.2	**-18.9%**	0.0437	204.3	-72.5	**-26.2%**
2009	3365.61	0.1056	355.4	0.0661	222.4	-133.0	**-37.4%**	0.0560	188.4	-167.0	**-47.0%**
2010	3082.76	0.0057	17.6	0.0070	21.5	4.0	**22.7%**	0.0072	22.2	4.6	**26.4%**
2011	2765.32	0.0582	161.0	0.0598	165.4	4.4	**2.7%**	0.0606	167.5	6.5	**4.0%**
Annual Averages		**0.0473**	**168.2**	**0.0374**	**131.7**	-36.6	**-21.7%**	**0.0347**	**121.0**	-47.2	**-28.1%**
					SNE (Dec – May)						
2007	2920.25	0.1256	366.8	0.1979	577.8	211.0	**57.5%**	0.2131	622.3	255.5	**69.6%**
2008	3057.1	0.0797	243.5	0.0027	8.1	-235.4	**-96.7%**	0.0000	0.0	-243.5	**-100.0%**
2009	3023.35	0.0642	194.0	0.0018	5.3	-188.7	**-97.3%**	0.0000	0.0	-194.0	**-100.0%**
2010	3893.9	0.0696	271.1	0.0492	191.7	-79.4	**-29.3%**	0.0478	186.1	-85.0	**-31.3%**
2011	3134.28	0.0114	35.7	0.0117	36.7	1.0	**2.7%**	0.0119	37.2	1.4	**4.0%**
Annual Averages		**0.0701**	**222.2**	**0.0526**	**163.9**	-58.3	**-26.2%**	**0.0546**	**169.1**	-53.1	**-23.9%**

Table 5. For each management area, the predicted average annual bycatch reduction (% reduction) in the New England gillnet fishery that could result from the new components of the two proposals and to increased compliance. The data used were collected during the 2010 harbor porpoise take reduction plan (HPTRP) time period (May 2010 – May 2012) and during the 1998 HPTRP time period (Jan 2007 – May 2010). Input data in Appendix Tables A2 – A3. Assumptions explained in the text and in the footnotes.

	Laist			Increase compliance		Scientists			
Management Area	Months additional pingers	% reduction - 2010 HPTRP	% reduction – 1998 HPTRP	% reduction - 2010 HPTRP	% reduction – 1998 HPTRP	additional pingers	additional closures	% reduction - 2010 HPTRP	% reduction – 1998 HPTRP
Northeast	Sep 14 - Mar	0	0	0	0				
Cape Cod South	--	NA	NA	NA	NA				
S. New England	0	0	0	6.71	10.6	*Jun - Nov*[1]	Dec - Feb	27.41[3]	21.92[3]
Cashes Ledge	--	NA	NA	NA	NA				
Mass Bay	*Oct*[1]	*0.75*	*0*	1.08	0.95				
Mid Coast	0	0	0	2.7	3.44	*Jun - Sep 14*[1]		4.87	2.65
Off shore	*Oct*[1]	0	0	0.11	0				
Stellwagen Bank	*Oct*[1]	*0.34*	*0*	3.03	*9.79*				
Western GOM	Oct - Mar[2]	2.22	0.27						
Outside south of 42	Dec - Mar	?	?						
Outside north of 42	*Oct - Mar*[1]	0	*0.73*						
% reduction of annual bycatch estimate		**3.31**	**1.00**	**13.63**	**24.78**			**32.28**	**24.57**
Average % reduction due to proposed plan		**2.16**		**19.21**				**28.43**	

[1] For areas not currently required to use pingers, the predicted bycatch would be 0.4 times the current average bycatch (i.e., a 60% reduction).
[2] For areas currently requiring pingers, the predicted bycatch would be 0.8 times the current average bycatch (i.e., a 20% reduction).
[3] The percent reduction due to only the Dec – Feb closure was 26.6% in the 2010 HPTRP time period and 20.4% in the 1998 HPTRP time period.

Table 6. Using percent reductions calculated in Table 5, the predicted bycatch for the entire Northeast (NE) region for Laist's and the scientists proposals.

	Laist's new components	Increased compliance	Scientist's new components	Laist's new + increased compliance	Scientist's new + increased compliance
Percent reduction	2.16	19.21	28.43	21.37	47.64
Predicted NE bycatch	463	382	339	372	248

Appendix

Table A1. For each management area and all management areas, the number of observed hauls and bycatch rate of hauls that had various percentages of the required number of pingers. Bycatch rate defined as sum of observed harbor porpoise takes per observed sum of mtons of landings and as sum of observed harbor porpoise takes per sum of number of observed hauls. Data from only times and areas where pingers were required were divided into two time periods: (A) 1 January 2007 to the implementation of the 2010 harbor porpoise take reduction plan (HPTRP), and (B) the implementation of the 2010 HPTRP to 31 May 2012.

A. January 1, 2007 - 2010 HPTRP

	Mass Bay			MidCoast			Offshore		
Amount of pingers	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul
0%	50*	0	0	132	0.096	0.030	177	0	0
1 - 99%	49*	0	0	239	0.103	0.033	169	0	0
100%	237	0.127	0.017	394	0.009	0.003	178	0	0

	Southern New England			Stellwagen Bank			Overall		
Amount of pingers	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul
0%	98	0.075	0.031	0	NA	NA	407	0.045	0.015
1 - 99%	100	0.235	0.090	0	NA	NA	508	0.092	0.031
100%	295	0	0	0	NA	NA	1104	0.018	0.005

B. 2010 HPTRP - May 31, 2012

	Mass Bay			MidCoast			Offshore		
Amount of pingers	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul
0%	71*	0	0	97	0.038	0.010	104	0	0
1 - 99%	115	0.047	0.009	414	0.051	0.014	225	0	0
100%	583	0.023	0.003	1205	0.059	0.016	278	0	0

	Southern New England			Stellwagen Bank			Overall		
Amount of pingers	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul	num hauls	takes/ mtons	takes/ haul
0%	54*	0.294	0.093	79*	0	0	201	0.047	0.015
1 - 99%	417	0.022	0.010	634	0.012	0.002	1805	0.024	0.007
100%	1072	0.023	0.012	2190	0.079	0.011	5328	0.043	0.011

* categories with less than 90 hauls have on average little chance to see a bycaught harbor porpoise.

Table A2. Approximate average monthly total bycatch by Management Area (MA) during 1998 harbor porpoise take reduction plan (HPTRP) starting in 1 January 2007. Yellow shaded times and areas require pingers under the 1998 HPTRP, gray shaded times and areas were closed to all gillnets under the 1998 HPTRP. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South Consequence Closure Area (CCA) and Eastern Cape Cod CCA are parts of the Southern New England MA, and the Coastal Gulf of Maine CCA overlaps parts or all of the Mid-Coast, Stellwagen Bank, and Massachusetts Bay MAs.

Approximate average total bycatch during 1998 HPTRP

Mon	Cape Cod South	Southern New England[1]	Cashes Ledge	Mass Bay	Mid Coast	Off shore	Stell-wagen[1]	Western GOM	Out side	Cape Cod South-CCA[1]	Coastal GOM-CCA[1]	Eastern Cape Cod-CCA[1]	Total Area[2]
Jan	13.9	38.6	0.0	3.3	1.1	0.0	13.2	**0.0**	0	29.5	11.6	2.6	56.1
Feb	26.1	47.9	**0.0**	9.0	3.2	0.0	14.7	**6.5**	0	45.7	24.1	0.0	81.2
Mar	**0.0**	32.7	0.0	**0.0**	15.6	0.0	49.9	**0.0**	0	24.9	71.2	0.0	98.1
Apr	0.0	21.4	0.0	0.0	5.5	0.0	0.0	**0.0**	5.8	16.9	2.0	0.0	32.7
May	6.0	101.2	0.0	0.0	0.5	0.0	0.0	**0.0**	0	34.2	0.0	17.1	101.8
Jun	8.4	5.4	0.0	0.0	0.0	0.0	0.0	**0.0**	0	6.7	0.0	0.0	5.4
Jul	0.0	0.0	0.0	0.0	0.0	0.0	4.1	**0.0**	0	0.0	6.6	0.0	4.1
Aug	0.0	0.0	0.0	0.0	12.3	0.0	0.0	**0.0**	0	0.0	5.1	0.0	12.3
Sep	0.0	0.0	0.0	1.0	17.5	0.0	0.0	**0.0**	0	0.0	19.4	0.0	18.6
Oct	0.0	0.0	0.0	0.0	13.1	0.0	0.0	**0.0**	0	0.0	12.4	0.0	13.1
Nov	0.0	6.6	0.0	0.0	21.8	0.0	0.0	**0.0**	0	0.0	19.1	4.3	28.5
Dec	0.0	10.8	0.0	10.4	3.6	0.0	0.0	**0.0**	0	0.0	14.8	8.0	24.7
Total	54.5	264.6	0.0	23.6	94.3	0.0	81.9	6.5	5.8	157.9	186.4	32.0	476.7

[1] Was not a managed area under the 1998 HPTRP.

[2] Approximate average total bycatch for the "Total Area" was calculated from the sum of the following MAs: Southern New England, Massachusetts Bay, Mid-Coast, Offshore, Stellwagen Bank, Western Gulf of Maine, and outside.

Table A3. Approximate average monthly total bycatch by Management Area (MA) during the 2010 harbor porpoise take reduction plan (HPTRP) ending 31 May 2012. Yellow shaded times and areas require pingers under the 2010 HPTRP, gray shaded times and areas are closed to all gillnets under the 2010 HPTRP. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South Consequence Closure Area (CCA) and Eastern Cape Cod CCA are parts of the Southern New England MA, and the Coastal Gulf of Maine CCA overlaps parts or all of the Mid-Coast, Stellwagen Bank, and Massachusetts Bay MAs.

Approximate average total bycatch during 2010 HPTRP

Mon	Cape Cod South	Southern New England	Cashes Ledge	Mass Bay	Mid Coast	Off shore	Stell-wagen	Western GOM	Out side	Cape Cod South-CCA	Coastal GOM-CCA	Eastern Cape Cod-CCA	Total Area[2]
Jan	4.1	14.0	0.0	0.0	2.8	0.0	7.3	**2.4**	0	10.6	10.2	0.0	26.5
Feb	0.0	31.9	**0.0**	1.9	1.0	0.0	6.6	**4.1**	0	29.8	10.4	0.0	45.5
Mar	**0.0**	3.3	0.0	**6.75**[1]	2.7	0.0	9.1	**2.2**	0	3.3	14.9	0.0	20.05
Apr	6.3	4.0	0.0	0.0	7.8	0.0	0.0	**0.0**	0	3.0	0.0	0.0	11.1
May	9.1	7.2	0.0	0.0	0.9	0.0	1.6	**11.1**	0	12.0	1.1	0.0	20.8
Jun	0.0	0.0	0.0	0.0	5.4	0.0	5.8	**0.0**	0	0.0	4.9	0.0	11.2
Jul	0.0	0.0	0.0	0.0	2.0	1.2	0.0	**0.0**	0	0.0	1.9	0.0	3.3
Aug	0.0	0.0	0.0	0.0	8.3	0.0	0.0	**0.0**	0	0.0	7.9	0.0	8.3
Sep	0.0	0.0	0.0	0.0	2.6	0.0	0.0	**3.0**	0	0.0	2.4	0.0	5.6
Oct	0.0	2.8	0.0	2.6	5.3	0.0	1.2	**4.7**	0	0.0	8.8	1.6	16.5
Nov	0.0	0.0	0.0	1.4	3.0	0.0	1.3	**9.8**	0	0.0	6.3	0.0	15.5
Dec	10.2	9.8	0.0	1.3	2.2	1.2	5.8	**0.0**	0	10.6	8.6	0.0	20.2
Total	29.7	73.0	0.0	13.95[1]	43.8	2.4	38.8	37.3	0.0	69.2	77.4	1.6	209.35

[1] Calculated from only four observed hauls where three harbor porpoises were taken on one haul resulted in an estimate of. Average annual approximate total bycatch for the Massachusetts Bay MA without the March takes was 7.2 harbor porpoises. The average March approximate total bycatch in the Massachusetts Bay MA when using trips as the unit of effort resulted in 6.75 harbor porpoises.

[2] Approximate average total bycatch estimates for the "Total Area" was calculated from the sum of the following MAs: Southern New England, Massachusetts Bay, Mid-Coast, Offshore, Stellwagen Bank, Western Gulf of Maine, and outside.