



Northeast Fisheries Science Center Reference Document 08-14

Predicted Bycatch of Harbor Porpoises under Various Alternatives to Reduce Bycatch in the US Northeast and Mid-Atlantic Gillnet Fisheries

by Debra L. Palka and Christopher D. Orphanides

August 2008

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

August 2008

Northeast Fisheries Science Center Reference Documents

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This document's publication history is as follows: manuscript submitted for review July 3, 2008; manuscript accepted through technical review August 1, 2008; manuscript accepted through policy review August 12, 2008; and final copy submitted for publication August 12, 2008. Pursuant to section 515 of Public Law 106-554 (the Information Quality Act), this information product has undergone a pre-dissemination review by the Northeast Fisheries Science Center, completed on August 1, 2008. The signed pre-dissemination review and documentation is on file at the NEFSC Editorial Office. This document may be cited as:

Palka DL, Orphanides CD. 2008. Predicted bycatch of harbor porpoises under various alternatives to reduce bycatch in the US Northeast and Mid-Atlantic gillnet fisheries. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-14; 31 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

TABLE OF CONTENTS

ABSTRACT	iv
LIST OF ACRONYMS	iv
INTRODUCTION	1
METHODS	1
GENERAL OVERVIEW OF METHODS	1
SPECIFIC METHODS FOR EACH ALTERNATIVE.....	2
RESULTS	14
DISCUSSION	16
REFERENCES	18

List of Tables

Table 1.	HPTRP measures for the Northeast gillnet fishery where times/areas are either closed to all gillnets or else closed to all gillnets that do not use pingers.....	19
Table 2.	HPTRP management measures for the large and small mesh gillnet fishery in the Mid-Atlantic gillnet fishery	20
Table 3.	A summary of the average bycatch estimates, by season and fishery, under the actual conditions data were collected during 2005 and 2006 and under the average situations for each alternative.....	21

List of Figures

Figure 1.	History of harbor porpoise bycatch estimates in gillnets from the US Northeast gillnet, US Mid-Atlantic gillnet, and Canadian gillnet fisheries	23
Figure 2.	Alternative 2: Immediate implementation of closures in New England.....	24
Figure 3.	Alternative 2: Immediate implementation of closures in the Mid-Atlantic.....	25
Figure 4.	Alternative 3: Expanded seasonal pinger requirements in New England.....	26
Figure 5.	Alternative 3: Expanded seasonal pinger requirements in the Mid-Atlantic.....	27
Figure 6.	Alternative 4 – Preferred: New England harbor porpoise Management Areas for gillnets (pre-bycatch trigger).....	28
Figure 7.	Alternative 4 – Preferred: New England harbor porpoise Management Areas for gillnets (post-bycatch trigger).....	29
Figure 8.	Alternative 4 – Preferred: Mid-Atlantic harbor porpoise Management Areas for gillnets.....	30
Figure 9.	By year, the level of compliance to all HPTRP requirements for gillnets in the Northeast fishery and for those off of New Jersey in the Mid-Atlantic fishery, as documented in the observed hauls	31

ABSTRACT

To reduce the bycatch of harbor porpoises in the US Northeast and Mid-Atlantic commercial gillnet fisheries, five different management alternatives have been proposed in an Environmental Assessment to revise the Harbor Porpoise Take Reduction Plan (HPTRP). The purpose of this manuscript is to evaluate the expected impacts of each alternative on the harbor porpoise bycatch. For each alternative, a range of both expected bycatch rates (observed harbor porpoise takes per observed metric tons (mtons) of landings) and expected fishing effort (mtons landed) were predicted, and the total predicted harbor porpoise bycatch was derived as the product of these two metrics. Other than the status quo alternative, predicted bycatch estimates for all of the proposed alternatives were below the Potential Biological Removal (PBR) level. The preferred alternative (Alternative 4) in the post-trigger time period generated the lowest predicted annual bycatch (275 to 470 porpoises), while the status quo alternative (Alternative 1) generated the highest (1,063 animals per year).

LIST OF ACRONYMS

CC Consequence Areas	=	Cape Cod South Expansion and Eastern Cape Cod Consequence Areas
EEZ	=	Exclusive Economic Zone
GOM	=	Gulf of Maine
HPTRP	=	Harbor Porpoise Take Reduction Plan
HPTRT	=	Harbor Porpoise Take Reduction Team
MA	=	Management Area
NMFS	=	National Marine Fisheries Service
NEFOP	=	Northeast Fisheries Observer Program
PBR	=	Potential Biological Removal
SMA MA	=	Southern Mid-Atlantic Management Area
SNE MA	=	Southern New England Management Area
ZMRG	=	Zero Mortality Rate Goal

INTRODUCTION

The Harbor Porpoise Take Reduction Plan (HPTRP) developed to reduce the bycatch of harbor porpoises in the US Northeast and Mid-Atlantic commercial gillnet fisheries (Tables 1 and 2), was implemented on 1 Jan 1999 (NMFS 1998). During the first few years after implementation, annual bycatch of harbor porpoises was below the Potential Biological Removal (PBR) level (Figure 1), which is currently 610 harbor porpoises. However, during 2003–2006 annual bycatch exceeded PBR. As a consequence, the Harbor Porpoise Take Reduction Team (HPTRT) was reconvened in Dec 2007 to develop recommendations for potential management measures to reduce bycatch to below PBR and, if possible, to below the Zero Mortality Rate Goal (ZMRG) level (10% of PBR). Using the management measures that were discussed by the HPTRT, the National Marine Fisheries Service (NMFS) Northeast Regional Office developed five management alternatives (Figures 2-8), which are detailed in an Environmental Assessment. The purpose of this manuscript is to document the expected annual harbor porpoise bycatch likely to occur under each of these alternatives.

METHODS

GENERAL OVERVIEW OF METHODS

For each alternative, the proposed management measures are enumerated and a description provided of how each measure is assumed to affect both the bycatch rate (observed harbor porpoise takes per observed metric tons [mtons] of landings) and level of fishing effort (mtons landed) in the US commercial Northeast and Mid-Atlantic gillnet fisheries, which are conducted off the Northeast coast of the US from Maine through North Carolina. The predicted bycatch rates and fishing effort levels were multiplied together to estimate the predicted total annual harbor porpoise bycatch expected under each alternative. Bycatch rates were calculated from information in the Northeast Fisheries Observer Program (NEFOP) database, and fishing effort data were obtained from the Northeast Vessel Trip Report and Commercial Landings databases. Similar strata and analytical methods were used in deriving the predicted bycatch estimates for each of the alternatives as were used in estimating the 2005 and 2006 annual harbor porpoise bycatch estimates (Belden 2007; Belden and Orphanides 2007).

The management measures for each of the five alternatives were retrospectively applied to 2005 and 2006 data to assess what changes in harbor porpoise bycatch could have occurred had the management measures of each alternative been implemented in these two years. The predicted annual bycatch in 2005 and 2006 for each alternative were then averaged to account for inter-annual variability, and the average bycatch considered the most appropriate metric to compare among the alternatives.

In cases where it was difficult to know how the proposed management measures would affect the bycatch rate or landings, a range of values was used. This generated a range of predicted bycatch rates. For example, in the years following implementation of the HPTRP, the level of compliance with the present HPTRP has varied (Figure 9) and the bycatch rates of hauls that complied with the HPTRP were lower than the bycatch rates in hauls that have not complied (Palka *et al.* in review). It is not known what level of compliance will be achieved in the future under any of the proposed alternatives. Thus, the lower bound for the expected bycatch rate

under an alternative was assumed to be the bycatch rate that resulted from 100% compliance, while the upper bound was assumed to be the average observed bycatch rate which incorporates data from both compliant and non-compliant hauls.

SPECIFIC METHODS FOR EACH ALTERNATIVE

ALTERNATIVE 1: No Action. Status quo; no additional restrictions.

The status quo was represented as the average annual bycatch of harbor porpoises during 2005 and 2006, the most recent two years for which complete bycatch data are available. This average is 1,063 animals (1,100 harbor porpoises in 2005, and 1,026 harbor porpoises in 2006).

ALTERNATIVE 2: Closures. Immediate implementation of new closures, including the Coastal Gulf of Maine Closure Area (Oct and Nov), the Eastern Cape Cod Closure Area (Feb–Apr), the Cape Cod South Expansion Closure Area (Feb–Apr), and the Mudhole South Management Area (MA) to large and small mesh gillnets (1 Feb–15 Mar). See Figures 2 and 3 for the locations of these areas.

It was assumed that the predicted bycatch in both the Northeast and Mid-Atlantic fisheries during summer (Jun–Aug) and the predicted bycatch in the Southern Mid-Atlantic MA was the average of that observed in 2005 and 2006 (*i.e.* no change).

For the Gulf of Maine, south and east of Cape Cod, and the New Jersey areas, during winter (Northeast: Jan–May; Mid-Atlantic: Jan–Apr), and fall (Sep–Dec), the predicted bycatch estimates were calculated as follows.

a) Bycatch rate:

Predicted bycatch rates for the three new closures were assumed to be zero.

Predicted bycatch rates for those areas remaining open, but which are not presently managed, were the bycatch rates observed during 2005 and 2006.

Predicted bycatch rates for the existing MA not closed under this alternative ranged from the:

- i) average bycatch rate of hauls with 100% compliance as observed from 1 Jan 1999–31 May 2007 (0.031 harbor porpoises per mtons landed for the Massachusetts Bay and Mid-Coast MAs, 0.023 harbor porpoises per mtons landed for the areas south and east of Cape Cod, and 0.203 harbor porpoises per mtons landed in the New Jersey area), to the
- ii) average bycatch rate of hauls observed from 1 Jan 1999–31 May 2007 in the MAs, irrespective of the level of compliance (0.058 harbor porpoises per mtons landed for the Massachusetts Bay and Mid-Coast MAs, 0.041 harbor porpoises per mtons landed for the areas south and east of Cape Cod, and 0.233 harbor porpoises per mtons landed for the New Jersey area).

If a stratum did not have an observed take in 2005 or 2006, then the predicted bycatch rate was assumed to be zero.

For the time/areas where an observed take occurred in 2005 or 2006, the predicted bycatch rate under Alternative 2 could be as low as the rate for fully compliant hauls under the

existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability.

b) Fishing effort:

A range of predicted fishing effort (mtons landed) expected to occur under this alternative was explored.

The maximum fishing effort was assumed to be the landings that occurred in 2005 and 2006. Thus, it is assumed any fishing which had previously taken place in the new closures was displaced into surrounding areas or times within the same season and stratum.

The minimum fishing effort for the Northeast fishery was assumed to be $\frac{1}{2}$ of the observed landings from 2005 and 2006 for the ports/seasons affected by the closures (Winter: south of Cape Cod, east of Cape Cod and the Cape Cod South MA; Fall: south of Maine, New Hampshire, north of Boston, south of Boston, Mid-Coast and Massachusetts Bay MAs) because the proposed closed time period constitutes about $\frac{1}{2}$ of the season. Hence, fishing which previously had occurred in the closed times and areas was assumed to be completely eliminated (*i.e.* not simply displaced in either time or space). The minimum fishing effort for the New Jersey area within the Mid-Atlantic gillnet fishery was $\frac{3}{4}$ of the landings in 2005 and 2006, because the closed time/area accounts for about $\frac{1}{4}$ of the observed effort in the New Jersey area during the winter.

c) Total bycatch estimate:

Within each year, for each port group or MA stratum, the predicted minimum bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated predicted minimum bycatch estimates for 2005 and 2006, and predicted maximum bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

ALTERNATIVE 3: Pingers. Expansion of seasonal pinger requirements throughout the harbor porpoise range: Require pingers from 15 Sep–31 May for Gulf of Maine outside of the Northeast Closure Area and associated offshore waters, (pingers required west and south of a line drawn from the shoreline of Maine at 68°55'W, south of 43°30'N, and east along this latitude to the Exclusive Economic Zone [EEZ]), and Southern New England (SNE); from 1 Jan–30 Apr for the Mid-Atlantic. See Figures 4 and 5 for the locations of these areas.

It was assumed that under this alternative the predicted bycatch in both the Northeast and Mid-Atlantic fisheries during summer (Jun–Aug) and in the Southern Mid-Atlantic MA from 1 May–31 Dec was the average of the annual bycatch estimates in 2005 and 2006 for the respective time/areas (*i.e.* no change).

In the Gulf of Maine and Southern New England area during 1 Sep to 31 May:

a) Bycatch rate

If a port/season stratum had an observed take during 2005 or 2006, the predicted bycatch rate under this alternative for that stratum ranged from the:

- i) average bycatch rate of hauls with 100% compliance as observed from 1 Jan 1999–31 May 2007 (0.031 harbor porpoises per mtons landed for the Massachusetts Bay and Mid-Coast MAs, 0.023 harbor porpoises per mtons landed for the areas south and east of Cape Cod),
to the
- ii) average bycatch rate of hauls observed from 1 Jan 1999–31 May 2007 in the MAs, irrespective of the level of compliance (0.053 harbor porpoises per mtons landed for the all of the Gulf of Maine, and 0.041 harbor porpoises per mtons landed for the areas south and east of Cape Cod).

If a stratum did not have an observed take, the assumed bycatch rate was zero.

Hence, the predicted bycatch rate under Alternative 3 could be as low as the rate for fully compliant hauls under the existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability.

b) Fishing effort

Under this alternative, it was assumed that the predicted fishing effort (mtons landed) would be the same as the average landings during 2005 and 2006 (*i.e.* no change). In essence, this assumes that the use of pingers does not affect the amount of fish landed.

c) Total bycatch estimate

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

For the Mid-Atlantic during 1 Jan–30 Apr:

It was not known what the bycatch rate would be for hauls in the Mid-Atlantic fishery if gillnets are equipped with pingers and do not use the gear modifications currently required by the HPTRP, as these practices have not been previously required in this fishery. Because the most recent takes have been in the New Jersey area within the Mid-Atlantic fishery in hauls targeting monkfish, the bycatch rate of observed hauls using pingers and targeting monkfish in the Northeast gillnet fishery were investigated to determine if these could provide an indication as to what the bycatch rate might be in pingered hauls in the Mid-Atlantic fishery in the New Jersey area. From 1 Jan 1999–31 May 2007, only 75 observed hauls fit these criteria (there were an additional 1,020 observed monkfish hauls that did not use pingers). In these 1,095 observed monkfish hauls, 14 harbor porpoises were caught, all in non-pingered hauls. As there were so few observed monkfish hauls with pingers, the information from the Northeast gillnet fishery

was considered insufficient to provide an indication of the probable bycatch rate in Mid-Atlantic pingered hauls.

Nonetheless, pingers are expected to reduce the bycatch of harbor porpoises in the Mid-Atlantic gillnet fishery. Another approach to address the question of how much bycatch might be reduced in this fishery when using pingers is to reduce the average annual bycatch during the pre-HPTRP time period when there were no gear modifications (1996–1998) by the percentage values that pingers reduced bycatch in the Cape Cod South MA, the closest area to the Mid-Atlantic where pingers have been used.

The estimated average annual bycatch of harbor porpoises in the Mid-Atlantic area in 1996–1998 was 443 animals (1996: 311; 1997: 572; 1998: 446).

In gillnets that fished in the Cape Cod South MA since the implementation of the HPTRP, the annual bycatch percentage reduction due to pingers has ranged from 22.1% to 69.3%. That is, in gillnets which used some or all of the required number of pingers, the observed bycatch rate was reduced to 30.7% to 77.9% of the rate in hauls that did not use pingers. Specifically using data from the Cape Cod South MA:

- a) observed post-HPTRP bycatch rate for hauls that did not use any pingers was 0.0751 harbor porpoises per mtons landed, and the observed post-HPTRP bycatch rate for hauls that used all of the required number of pingers was 0.0230 harbor porpoises per mtons landed. Hence, using the required number of pingers reduced the bycatch rate to 30.7% of the bycatch rate from hauls that did not use pingers.
- b) observed post-HPTRP bycatch rate for hauls that did not use any pingers was 0.0751 harbor porpoises per mtons landed, and the observed post-HPTRP bycatch rate for hauls that used some or all of the required number of pingers was 0.0585 harbor porpoises per mtons landed. Hence, using some or all of the required number of pingers reduced the bycatch rate to 77.9% of the bycatch rate from hauls that did not use pingers.

Thus, the estimated annual bycatch of harbor porpoises in the Mid-Atlantic under this alternative is 136 to 345 animals (Table 3), which was derived from the product of the average bycatch estimate in the Mid-Atlantic during the pre-HPTRP time period [443 animals] and the reduction due to pingers in hauls observed in the Cape Cod South MA [30.7% to 77.9%].

ALTERNATIVE 4: Preferred.

A: New England:

1. Expand pinger use to include Nov in the Massachusetts Bay MA.
2. Expand the Massachusetts Bay MA by incorporating the small area between the Massachusetts Bay MA and the groundfish Western Gulf of Maine Closure Area by moving the boundary that is currently along latitude line 42°12'N up to latitude line 42°15'N.
3. Create Stellwagen Bank MA; require pingers Nov–May.
4. Establish Coastal Gulf of Maine (GOM) Consequence Closure Area; require closure (until ZMRG is achieved or the HPTRT and NMFS establish new measures) in Oct and Nov only if, after the most current two years, the average bycatch rate exceeds the average bycatch rate of 0.031 harbor porpoises per mtons landed (identified from observed compliant hauls from the Mid-Coast,

Massachusetts Bay, and Stellwagen Bank MA). When the closure is not in effect, continue current pinger requirements for the three individual areas and maintain the March closure in the Massachusetts Bay MA.

5. Create Southern New England MA – an expansion of existing Cape Cod South MA; require pingers from Dec–May; keep March closure area in the current Cape Cod South MA.
6. Establish Cape Cod South Expansion Consequence Closure Area and Eastern Cape Cod Consequence Closure Area; require closure (until ZMRG is achieved or the HPTRT and NMFS establish new measures) from Feb–Apr if, after the most current two years, the average bycatch rate exceeds the average rate of 0.023 harbor porpoises per mtons landed (identified from observed compliant hauls south of Cape Cod). When the closures are not in effect, continue the current pinger requirements for the Southern New England MA.

B: Mid-Atlantic:

1. Establish Mudhole South MA: closed from 1 Feb–Mar 15; implement the gear requirements consistent with those in the Mudhole North MA from 1–31 Jan, 16–31 Mar, and 21–30 Apr for large mesh gillnet gear (currently 1–20 Apr closure remains) and from 1–31 Jan and 16 Mar–30 Apr for small mesh gillnet gear.
2. Modify tie-down requirement for large mesh gillnets in both the Waters off New Jersey and Southern Mid-Atlantic MA from no more than 15 ft. to no more than 24 ft.
3. Modify the exempted waters in Virginia from Chincoteague to Ship Shoal Inlet (currently landward of 37°52'N, 75°24.30'W to 37°11.90'N, 75°48.30'W) to the 72 COLREGS demarcation lines.
4. Extend the eastern boundary of the Waters off New Jersey MA (72°30'W) north to the south coast of Long Island (at 40°50.1'N) and remove the current northern boundary of the intersection of 40°40'N and 72°30'W. See Figures 6–8 for location of areas.

It was assumed that the predicted bycatch in both the Northeast and Mid-Atlantic fisheries during summer (Jun–Aug) and the predicted bycatch in the Southern Mid-Atlantic MA were equal to the average annual bycatch in 2005 and 2006 for the respective time/areas (*i.e.* no change).

Minimum predicted bycatch estimates were derived by combining all minimum values of the ranges for each proposed change, as described below. Maximum predicted bycatch estimates were derived by combining all maximum values of the ranges for each proposed change, as described below.

A: NEW ENGLAND

1) Expand pinger use to include Nov in the Massachusetts Bay MA.

For Massachusetts Bay MA in the fall (Sep–Dec) the following was assumed:

a) Bycatch rate:

Observed takes from 2005 and 2006 in the region within the Massachusetts Bay MA during Nov were removed from the corresponding port group strata and added into the Massachusetts Bay MA stratum. The predicted bycatch rates for the altered port groups were then recalculated using the new observed takes and landings.

For the Massachusetts Bay MA stratum, a range of predicted bycatch rates were investigated, ranging from the:

- i) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs with 100% compliance from 1 Jan 1999–31 May 2007 (0.031 harbor porpoises per mtons landed) to the
- ii) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs from 1 Jan 1999–31 May 2007, irrespective of the level of compliance (0.068 harbor porpoises per mtons landed).

Hence, the predicted bycatch rate could be as low as the rate for fully compliant hauls under the existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability.

b) Fishing effort:

Observed and total landings during Nov 2005 and Nov 2006 in the region of the Massachusetts Bay MA were removed from the corresponding port group strata and added into the Massachusetts Bay MA stratum, which now covers Nov and Dec. Thus, the proposed management measure is assumed not to affect the amount of fish landed.

c) Total bycatch estimate:

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

2) Expand the Massachusetts Bay MA by incorporating the small area between the Massachusetts Bay MA and the groundfish Western Gulf of Maine Closure Area by moving the boundary that is currently along latitude line 42°12'N up to latitude line 42°15'N.

It was assumed this management measure would not significantly affect the predicted bycatch estimate. There were no observed hauls in this small area during 2005 and 2006.

3) Create Stellwagen Bank MA; require pingers Nov – May.

For the Stellwagen Bank MA in Nov–May the following was assumed:

a) Bycatch rate:

Observed takes in 2005 and 2006 that occurred in the Stellwagen Bank MA during Nov–May were removed from the corresponding port group strata and placed into the Stellwagen Bank MA stratum. For port groups that had some fishing in the Stellwagen Bank MA, the predicted bycatch rates were recalculated using the hauls that remained.

For the Stellwagen Bank MA in winter and fall, it was assumed the predicted bycatch rate ranges from the:

- i) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs with 100% compliance from 1 Jan 1999–31 May 2007 (0.031 harbor porpoises per mtons landed),
to the
- ii) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs from 1 Jan 1999–31 May 2007, irrespective of the level of compliance (0.068 harbor porpoises per mtons landed).

Hence, the predicted bycatch rate could be as low as the rate for fully compliant hauls under the existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability

The observed average (2005 and 2006) bycatch rate when no pingers were required in the Stellwagen Bank MA was 0.116 harbor porpoises per mtons landed during the winter, and 0.089 harbor porpoises per mtons landed during the fall.

b) Fishing effort:

Observed and total landings from the Stellwagen Bank MA during Nov–May in both 2005 and 2006 were removed from the corresponding port group strata (north of Boston, south of Boston, and southern Maine) and placed into the Stellwagen Bank MA stratum. This assumes that the creation of the Stellwagen Bank MA does not affect the amount of fishing effort, as the landings are simply placed into a stratum with a different name.

c) Total bycatch estimate:

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

- 4) Establish Coastal GOM Consequence Closure Area; require closure (until ZMRG is achieved or the HPTRT and NMFS establish new measures) in Oct and Nov only if, after the most current two years, the average bycatch rate exceeds the average bycatch rate of 0.031 harbor porpoises per mtons landed (identified from observed compliant hauls from the Mid-Coast, Massachusetts Bay, and Stellwagen Bank MAs). When the closure is not in effect, continue current pinger requirements for the three individual areas and maintain the March closure in the Massachusetts Bay MA.**

a) Before triggered closure:

i) Bycatch rate:

It was assumed that this measure would result in the following range of bycatch rates for areas not affected by any of the other actions within this alternative:

- (1) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs with 100% compliance from 1 Jan 1999–31 May 2007 (0.031 harbor porpoises per mtons landed) to the
- (2) average bycatch rate of hauls observed in the Massachusetts Bay and Mid-Coast MAs from 1 Jan 1999–31 May 2007, irrespective of the level of compliance (0.068 harbor porpoises per mtons landed).

ii) Fishing effort:

It was assumed that the establishment of the Coastal GOM Consequence Closure Area would not influence the amount of landings taken prior to the closure of the Area.

iii) Total bycatch estimate:

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

b) After triggered closure:

After making changes due to the pre-trigger actions within this Alternative (A1-A5, B1-B4):

i) Bycatch rate:

For the Coastal GOM Consequence Closure Area, the predicted bycatch rate is zero as the area will be closed during Oct and Nov. For other port groups and MAs that previously fished in the Coastal GOM Consequence Closure Area, the predicted bycatch rate was that determined by the other measures within this alternative. Thus, these predicted bycatch rates incorporate the effects of the other measures within this alternative, as well as the effects of non-compliance documented elsewhere in this alternative.

ii) Fishing effort:

Observed and total landings during 2005 and 2006 which occurred in the Coastal GOM Consequence Closure Area during Oct and Nov were removed from the port group strata (north of Boston, and Mid-Coast MA), and placed into the Coastal GOM Consequence Closure Area stratum.

A range of predicted fishing effort (mtons landed) resulting from implementation of this alternative was explored.

A minimum value of predicted fishing effort is the gillnet landings that remain after the landings which occurred in the Coastal GOM Consequence Closure Area during 2005 and 2006 are removed. This assumes that the fishing effort during the time/area closure will not be able to be made up at another time or place.

A maximum value of the predicted fishing effort is the same as that in 2005 and 2006. This assumes that the fishing effort which was in the Coastal GOM Consequence Closure

Area will be made up in another area within the same port group/MA and/or within the same season (Sep–Dec).

iii) *Total bycatch estimate:*

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

5) Create Southern New England MA – an expansion of existing Cape Cod South MA; require pingers from Dec–May; keep March closure area in the current Cape Cod South MA.

For the Southern New England Management Area (SNE MA) in winter (Jan–May) and fall (Sep–Dec):

a) *Bycatch rate:*

Observed takes in 2005 and 2006 that occurred in the SNE MA from Dec–May were removed from the corresponding port group strata, and placed into the SNE MA stratum. For port groups that had some fishing effort in the SNE MA, the predicted bycatch rates were estimated by recalculating the bycatch rates using the hauls that remained in that port group.

For the SNE MA in winter and fall, predicted bycatch rates were assumed to range from the:

- i) average bycatch rate of hauls observed in the Cape Cod South MA with 100% compliance from 1 Jan 1999–31 May 2007 (0.023 harbor porpoises per mtons landed) to the
- ii) average bycatch rate of hauls observed in the Cape Cod South MA from 1 Jan 1999–31 May 2007, irrespective of the level of compliance (0.041 harbor porpoises per mtons landed).

Hence, the predicted bycatch rate would be as low as the rate for fully compliant hauls under the existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability.

The observed average (2005 and 2006) bycatch rate under the current HPTRP during winter (Jan–May) in the SNE MA is 0.120 harbor porpoises per mtons landed, and 0.011 harbor porpoises per mtons landed during Dec.

b) *Fishing effort:*

Observed and total landings from 2005 and 2006 which occurred in the SNE MA from Dec–May were removed from the port group strata (south of Cape Cod, east of Cape Cod, north of Boston, south of Boston, and Cape Cod South MA), and placed in the SNE MA stratum. This assumes that the creation of the SNE MA does not affect the amount of fishing effort, as the landings are simply placed into a stratum with a different name.

c) Total bycatch estimate:

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

6) Establish Cape Cod South Expansion Consequence Closure Area and Eastern Cape Cod Consequence Closure Area; require closure (until ZMRG is achieved or the HPTRT and NMFS establish new measures) from Feb–Apr if, after the most current two years, the average bycatch rate exceeds the average rate of 0.023 harbor porpoises per mtons landed (identified from observed compliant hauls south of Cape Cod). When the closures are not in effect, continue the current pinger requirements for the Southern New England MA.

For both the Cape Cod South Expansion and Eastern Cape Cod Consequence Areas (CC Consequence Areas):

a) Before triggered closure:

See action 5 within this alternative (Alternative 4), the establishment of the SNE MA.

b) After triggered closure:

After making changes due to the pre-trigger actions within this Alternative (A1-A5, B1-B4):

i) Bycatch rate:

For the CC Consequence Areas, the predicted bycatch rates are zero as these areas are to be closed from Feb–Apr. For other port groups and MAs that previously fished in the CC Consequence Areas (*e.g.* SNE MA), the predicted bycatch rate was that determined by other measures within this alternative. Thus, these bycatch rates incorporate the effects of the other measures within this alternative, as well as the effects of non-compliance documented elsewhere in this alternative.

For port group/MA strata not specifically mentioned above, the predicted bycatch rate was the average rate during 2005 and 2006. For example, the Offshore MA and Northern Maine port group were not modified, so the predicted bycatch is the same as that observed during 2005 and 2006. Hence, the proposed changes in this alternative are assumed not to cause any changes in the bycatch rate or landings in times/areas not mentioned above.

ii) Fishing effort:

Observed and total landings in 2005 and 2006 which occurred in the CC Consequence Areas during Feb, Mar, and Apr were removed from the corresponding port group stratum (Southern New England MA), and placed in the Cape Cod South Expansion or East Cape Cod Consequence Closure Areas strata.

A range of predicted fishing effort (mtons landed) resulting from implementation of this measure was explored.

A minimum value of predicted fishing effort is the landings that remain after removing the landings during this time/area closure. This assumes that fishing effort during the time/area closure is not made up at another time or place.

A maximum value of the predicted fishing effort is the landings that occurred in 2005 and 2006. This assumes that fishing effort in this time/area closure is able to be made up in another area within the same port group/MA and/or within the same season (Jan–May).

iii) *Total bycatch estimate:*

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

B: MID-ATLANTIC

- 1) Establish Mudhole South MA: closed from 1 Feb–15 Mar; implement the gear requirements consistent with those in the Mudhole North MA from 1-31 Jan, 16-31 Mar, and 21-30 Apr for large mesh gillnet gear (1-20 Apr closure remains) and from 1-31 Jan and 16 Mar – 30 Apr for small mesh gillnet gear.**

For the Mudhole South MA during Jan–Apr:

a) *Bycatch rate:*

The predicted bycatch rates resulting from this alternative range from the:

- i) average bycatch rate of hauls observed in the New Jersey area in 100% compliance from 1 Jan 1999–31 May 2007 (0.203 harbor porpoises per mtons landed) to the
- ii) average bycatch rate of hauls observed in the New Jersey area from 1 Jan 1999–31 May 2007, irrespective of the level of compliance (0.233 harbor porpoises per mtons landed).

Hence, the predicted bycatch rate could be as low as the rate for fully compliant hauls under the existing HPTRP, or as high as the average bycatch rate observed under the existing HPTRP, which includes all hauls (compliant and non-compliant) and reflects normal inter-annual variability.

b) *Fishing effort:*

A range of predicted fishing effort (mtons landed) that would result from this alternative was explored.

The maximum amount of predicted fishing effort for the New Jersey area is the landings which occurred in 2005 and 2006. This assumes that fishing effort during this new closure is displaced to surrounding areas and/or times within the same season.

The minimum amount of predicted fishing effort for the New Jersey area is 70% of the landings in 2005 and 85% in 2006, which are the percentages of observed effort in the closed time/area relative to the observed effort for the entire New Jersey area.

c) Total bycatch estimate:

Within each year, for each port group or MA stratum, the minimum predicted bycatch was estimated as the product of the minimum predicted bycatch rate and the minimum level of predicted fishing effort, and the maximum predicted bycatch was estimated as the product of the maximum predicted bycatch rate and the maximum level of predicted fishing effort. This process generated minimum predicted bycatch estimates for 2005 and 2006, and maximum predicted bycatch estimates for 2005 and 2006. The average of the 2005 and 2006 minimum and maximum estimates are also reported (Table 3).

2) Modify tie-down requirement for large mesh gillnets in both the waters off New Jersey and Southern Mid-Atlantic MAs from no more than 15 ft. to no more than 24 ft.

It was assumed that the distance between tie downs would not influence either the bycatch rate or the amount of fish landed.

3) Modify the exempted waters in Virginia from Chincoteague to Ship Shoal Inlet (currently landward of 37°52'N, 75°24.30'W to 37°11.90'N, 75°48.30'W) to the 72 COLREGS demarcation lines.

It was assumed that the changes in the exempted Virginia waters would not influence either the bycatch rate or the amount of fish landed.

4) Extend the eastern boundary of the waters off New Jersey MA (72°30'W) north to the south coast of Long Island (at 40°50.1'N) and remove the current northern boundary of the intersection of 40°40'N and 72°30'W.

It was assumed that the proposed changes in the boundaries in the Mid-Atlantic would not influence either the bycatch rate or the amount of fish landed.

ALTERNATIVE 5: Modified Alternative 4. Includes all the management actions within Alternative 4, as well as the following measures which were discussed by the HPTRT at the December 2007 meeting.

- A: Include the year-round groundfish Western Gulf of Maine Closure Area within the regulations implementing the HPTRP.
- B: Eliminate Offshore MA
- C: Eliminate the Southern Mid-Atlantic MA large mesh gillnet closure period (15 Feb–15 Mar)

It was assumed that the predicted bycatch estimates in all port groups and MAs (other than the Offshore and Southern Mid-Atlantic MAs) are the same as in Alternative 4.

A: Include the year-round groundfish Western Gulf of Maine Closure Area within the regulations implementing the HPTRP

It was assumed that including the already existing year-round Western Gulf of Maine groundfish Closure Area would not influence either the bycatch rate or the amount of fish landed, and therefore not affect the bycatch estimate.

B: Eliminate Offshore MA

The Offshore MA requires pingers on nets from Nov–May. Thus, elimination of the Offshore MA means that pingers will no longer be required in this Area during any part of the year. However, contained within the Offshore MA is the Cashes Ledge Closure Area, where gillnets are prohibited during Feb. The Cashes Ledge Closure Area will remain in place under this proposed management measure. It was assumed this measure would affect both the pre-trigger and post-trigger bycatch estimates.

Estimates of harbor porpoise bycatch in the Offshore MA if pingers are no longer required from Nov–May range from 0 to 32 harbor porpoises (Orphanides and Palka 2008), which consists of 0 to 2 animals in the fall and 0 to 30 animals in the winter. To incorporate this management measure, this range of bycatch was added to the bycatch estimates in Alternative 4.

C: Eliminate the Southern Mid-Atlantic Management Area (SMA MA) large mesh gillnet closure period (15 Feb–15 Mar)

If the SMA MA closure period is opened to large mesh gillnet fishing, harbor porpoise bycatch is expected to increase. It was assumed this action will affect both the pre-trigger and post-trigger bycatch estimates. Predicted annual bycatch would then increase by 2 to 3 animals over and above the harbor porpoise bycatch estimates in Alternative 4 (Orphanides and Palka 2008).

RESULTS

ALTERNATIVE 1: No Action

The average annual bycatch of harbor porpoises in both the New England and Mid-Atlantic regions during 2005 and 2006 (the last two years for which complete data are available) is 1,063 animals (1,100 in 2005 and 1,026 from 2006). The average annual bycatch in the Northeast gillnet fishery is 572 animals; while the average annual bycatch in the Mid-Atlantic gillnet fishery is 491 animals (Table 3). Thus, under the No Action alternative, annual bycatch would continue to exceed the PBR for harbor porpoises (currently 610 animals).

ALTERNATIVE 2: Closures

Annual predicted bycatch under this alternative for both the New England and Mid-Atlantic regions would range from 358 to 586, which is below PBR (Table 3). Under this alternative, annual predicted bycatch in the Northeast gillnet fishery (238 to 403 animals) would decrease to 42% to 70% of the status quo bycatch (572 animals), while annual predicted bycatch in the Mid-Atlantic gillnet fishery (120 to 183 animals) would decrease to 24% to 37% of the status quo level (491 animals).

ALTERNATIVE 3: Pingers

Annual predicted bycatch under this alternative for both the New England and Mid-Atlantic regions would range from 287 to 577, which is below PBR (Table 3). Under this alternative, annual predicted bycatch in the Northeast gillnet fishery (151 to 232 animals) would decrease to 26% to 41% of the status quo bycatch (572 animals), while annual predicted bycatch in the Mid-Atlantic gillnet fishery (136 to 345 animals) would decrease to 28% to 70% of the status quo level (491 animals).

ALTERNATIVE 4: Preferred

Pre-trigger:

Annual predicted bycatch under this alternative for both the New England and Mid-Atlantic regions would range from 311 to 470 animals, which is below PBR (Table 3). Under this alternative, the annual predicted bycatch in the Northeast gillnet fishery (187 to 287 animals) would decrease to 33% to 50% of the status quo bycatch (572 animals), while the annual predicted bycatch in the Mid-Atlantic gillnet fishery (124 to 183 animals) would decrease to 25% to 37% of the status quo level (491 animals).

Post-trigger:

During the time period after a Consequence Area is closed, annual predicted bycatch under the different closure options are all below PBR:

- 1) When only the Coastal GOM Consequence Closure Area is closed, annual predicted bycatch for both the New England and Mid-Atlantic regions would range from 295 to 470 animals.
- 2) When only the Cape Cod South Expansion and Eastern Cape Cod Consequence Closure Areas are closed, annual predicted bycatch for both the New England and Mid-Atlantic regions would range from 291 to 470 animals.
- 3) When all Consequence Areas (Coastal GOM, Cape Cod South Expansion, and Eastern Cape Cod Consequence Closure Areas) are closed, annual predicted bycatch for both the New England and Mid-Atlantic regions would range from 275 to 470 animals (Table 3). When all three Consequence Areas are closed, the annual predicted bycatch in the Northeast gillnet fishery (151 to 287 animals) would decrease to 26% to 50% of the status quo bycatch (572 animals), while the annual predicted bycatch in the Mid-Atlantic gillnet fishery (124 to 183 animals) would decrease to 25% to 37% of the status quo level (491 animals).

ALTERNATIVE 5: Modified Alternative 4

Pre-trigger:

Annual predicted bycatch under this alternative for both the New England and Mid-Atlantic regions would range from 313 to 505 animals, which is below PBR (Table 3). Under this alternative, annual predicted bycatch in the Northeast gillnet fishery (187 to 319 animals) would decrease to 33% to 56% of the status quo (572 animals), while the annual predicted bycatch in the Mid-Atlantic gillnet fishery (126 to 186 animals) would decrease to 26% to 38% of the status quo level (491 animals).

Post-trigger:

Annual predicted bycatch under this alternative for both the New England and Mid-Atlantic regions when the Coastal GOM and the CC Consequence Areas are closed would range from 277 to 505 animals, which is below PBR (Table 3). Under this alternative, annual predicted bycatch in the Northeast gillnet fishery (151 to 319 animals) would decrease to 26% to 56% of the status quo (572 animals), while the annual predicted bycatch in the Mid-Atlantic gillnet fishery (126 to 186 animals) would decrease to 26% to 38% of the status quo level (491 animals).

DISCUSSION

In evaluating the bycatch of harbor porpoises under all of the alternatives, the effects of future additional fishery management regulations were not considered in deriving the predicted bycatch estimates.

In all cases, calculating a variance on the point estimate of the predicted bycatch was not attempted. However, the ranges of the bycatch estimates provide an indication of the general level of variability.

ALTERNATIVE 1: No Action

The status quo was assumed to be the average annual bycatch of harbor porpoises during 2005 and 2006. This assumes that the future levels of compliance with the HPTRP would be similar to that in 2005 and 2006. It was not possible to determine if this assumption is valid.

ALTERNATIVE 2: Closures

It was assumed that the predicted bycatch rate in the new closure areas would be zero. It was not possible to determine what the level of compliance to these closures would actually be.

In estimating the predicted bycatch under all of the alternatives, the effects of the proposed management measures on where and when fishing would occur were evaluated on a broad spatial-temporal basis, using three seasons and the strata used in the bycatch estimation process. A potentially more precise way of evaluating where fishing will occur under these measures would be to predict where an vessel might fish as determined from the vessel's past history and the past history of vessel's from the same port (Bisack and Magnusson, in press).

ALTERNATIVE 3: Pingers

Because the bycatch rate of harbor porpoises is influenced by the number of pingers used on a gillnet (Palka et al., in review), in all alternatives that involved use of pingers, the range of predicted bycatch rates was derived from the rate for fully compliant hauls under the existing HPTRP to the average bycatch rate observed under the existing HPTRP (which includes all hauls, compliant and non-compliant). However, even on fully compliant hauls, it was not known if all the pingers were actually working and it was shown that in a small sample of tested pingers, the number of working pingers varied markedly from year to year (Palka et al., in review). Thus, it is possible that gillnets with all of the required number of working pingers would have a bycatch rate even lower than the “fully compliant” bycatch rates presented here. On the other hand, if compliance is lower in the future, bycatch rates could be higher than the rates used in the current analysis.

ALTERNATIVE 4: Preferred

The estimated effect of closing the Consequence Areas was not large. That is, annual predicted bycatch before the trigger closes all of the Consequence Areas (311 to 470 harbor porpoises) is similar to annual predicted bycatch after the trigger closes all of the Consequence Areas (275 to 470 harbor porpoises). The limited effect of closing the Consequence Areas is due to these areas being closed for only a couple of months in a limited region. Thus, it was assumed that the limited spatial-temporal scope of the closures would allow fishers to fish in neighboring areas and/or in other months within the same season. If this assumption is not valid, then the effects of closing the Consequence Areas in reducing harbor porpoise bycatch could be much greater.

ALTERNATIVE 5: Modified Alternative 4

The discussion under Alternative 4 (Preferred) also applies to this alternative.

Annual predicted bycatch did not significantly increase due to the removal of several management measures that are presently implemented in the HPTRP. That is, in the pre-trigger time period, the annual predicted bycatch under Alternative 4 ranges from 311 to 470 animals, while the annual predicted bycatch under Alternative 5 ranges from 313 to 505 animals. However, predicting the changes in bycatch resulting from the removal of the Offshore MA pinger requirements and the Southern Mid-Atlantic MA large mesh gillnet month-long closure is difficult (Orphanides and Palka 2008). The prediction is difficult because it was necessary to use data from before the implementation of the HPTRP to assess future bycatch, and since that time the fisheries have changed. This increases the uncertainty associated with the predicted bycatch estimates for these two proposed management actions.

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Table 1. Harbor Porpoise Take Reduction Plan (HPTRP) measures for the Northeast gillnet fishery where times/areas are either closed to all gillnets (Closed) or else closed to all gillnets that do not use pingers (Closed – pingers allowed).

AREA	DATES	STATUS OF GILLNETS
Northeast	Aug 15 - Sep 13	Closed
Mid-Coast	Sep 15 - May 31	Closed – pingers ¹ allowed
Massachusetts Bay	Dec 1 - Feb 28/29	Closed - pingers ¹ allowed
	Mar 1 – 31	Closed
	Apr 1 - May 31	Closed - pingers ¹ allowed
Offshore	Nov 1 - May 31	Closed - pingers ¹ allowed
Cashes Ledge	Feb 1 - 28/29	Closed
Cape Cod South	Dec 1 - Feb 28/29	Closed - pingers ¹ allowed
	Mar 1 – 31	Closed
	Apr 1 - May 31	Closed - pingers ¹ allowed

¹ A pinger is defined as an acoustic deterrent device which, when immersed in water, broadcasts a 10kHz (± 2 kHz) sound at 132 dB (± 4 dB) re 1 micropascal at 1 m, lasting 300 milliseconds (± 15 milliseconds), and repeating every 4 seconds (± 2 seconds).

Table 2. HPTRP management measures for large and small mesh nets in the Mid-Atlantic gillnet fishery. Note, a net tagging program for both large and small mesh nets were specified in the HPTRP, but were not implemented.

LARGE MESH FISHERY (7 inches to 18 inches)

Floatline length:	
NJ Mudhole	<= 3,900 ft
NJ waters (excluding the Mudhole)	<= 4,800 ft
Southern Mid-Atlantic waters	<= 3,900 ft
Twine Size	>= 0.90 mm
Tie Downs	Required
Net Number per Vessel	80 nets
Net Size	<= 300 ft
Number of Nets within a Net String	
NJ Mudhole	<= 13 nets
NJ waters (excluding the Mudhole)	<= 16 nets
Southern Mid-Atlantic waters	<= 13 nets
Time/Area Closures:	
NJ waters (including the Mudhole)	Closed from Apr 1 – 20
NJ Mudhole	Closed from Feb 15 – Mar 15
Southern Mid-Atlantic waters	Closed from Feb 15 – Mar 15
Gear Modification Requirements:	
NJ waters (excluding the Mudhole)	Jan 1 – Mar 30 and Apr 21 – 30
NJ Mudhole	Jan 1 – Feb 14; Mar 16 – Mar 31; and Apr 21 – 30
Southern Mid-Atlantic waters	Feb 1 – Feb 14 and Mar 16 – Apr 30

SMALL MESH FISHERY (> 5 inches to < 7 inches)

Floatline length:	
NJ waters (including the Mudhole)	<= 3,000 ft
Southern Mid-Atlantic waters	<= 2,118 ft
Twine Size	>= 0.81 mm
Tie Downs	Prohibited
Net Number per Vessel	45 nets
Net Size	<= 300 ft
Number of Nets within a Net String	
NJ Waters (including the Mudhole)	<= 10 nets
Southern Mid-Atlantic waters	<= 7 nets
Time/Area Closures:	
NJ Mudhole	Closed from Feb 15 - Mar 15
Gear Modification Requirements:	
NJ waters (excluding Mudhole)	Jan 1 – Apr 30
NJ Mudhole	Jan 1 – Feb 14 and Mar 16 – Apr 30
Southern Mid-Atlantic waters	Feb 1 – Apr 30

Table 3. A summary of the average bycatch estimates, by season and fishery (Northeast and Mid-Atlantic gillnet fisheries), under the actual conditions data were collected during 2005 and 2006 and under the average situations for each Alternative. The seasons for the Northeast (NE) fishery are winter: Jan–May; summer: Jun–Aug; and fall: Sep–Dec.

Time/Area	2005 Actual bycatch estimates	2006 Actual bycatch estimates	Alternative 1. Average 2005 and 2006	Alternative 2. Closures		Alternative 3. Pingers	
				Min	Max	Min	Max
Winter NE	306	420	363	147	248	57	101
Summer NE	52	37	44	44	44	44	44
Fall NE	272	57	165	47	111	50	87
NORTHEAST SUBTOTAL	630	514	572	238	403	151	232
New Jersey Mid- Atlantic (Jan– Apr)	470	512	491	120	183	136	345
GRAND TOTAL	1,100	1,026	1,063	358	586	287	577

Time/Area	Alternative 4. Preferred. Pre-trigger time period		Alternative 4. Preferred. Post-trigger time period with only Coastal GOM Consequence Closure Area closed		Alternative 4. Preferred. Post-trigger time period with only CC Consequence Closure Areas closed	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Winter NE	94	151	94	151	74	151
Summer NE	44	44	44	44	44	44
Fall NE	49	92	33	92	49	92
NORTHEAST SUBTOTAL	187	287	171	287	167	287
New Jersey Mid- Atlantic (Jan– Apr)	124	183	124	183	124	183
GRAND TOTAL	311	470	295	470	291	470

Table 3 continued.

Time/Area	Alternative 4. Preferred. Post-trigger time period with CGOM and CC Consequence Closure Areas closed		Alternative 5. Preferred alternative plus other actions. Pre-trigger		Alternative 5. Preferred alternative plus other actions. Post-trigger time period with CGOM and CC Consequence Closure Areas closed	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Winter NE	74	151	94	181	74	181
Summer NE	44	44	44	44	44	44
Fall NE	33	92	49	94	33	94
NORTHEAST SUBTOTAL	151	287	187	319	151	319
New Jersey Mid-Atlantic (Jan–Apr)	124	183	126	186	126	186
	275	470	313	505	277	505

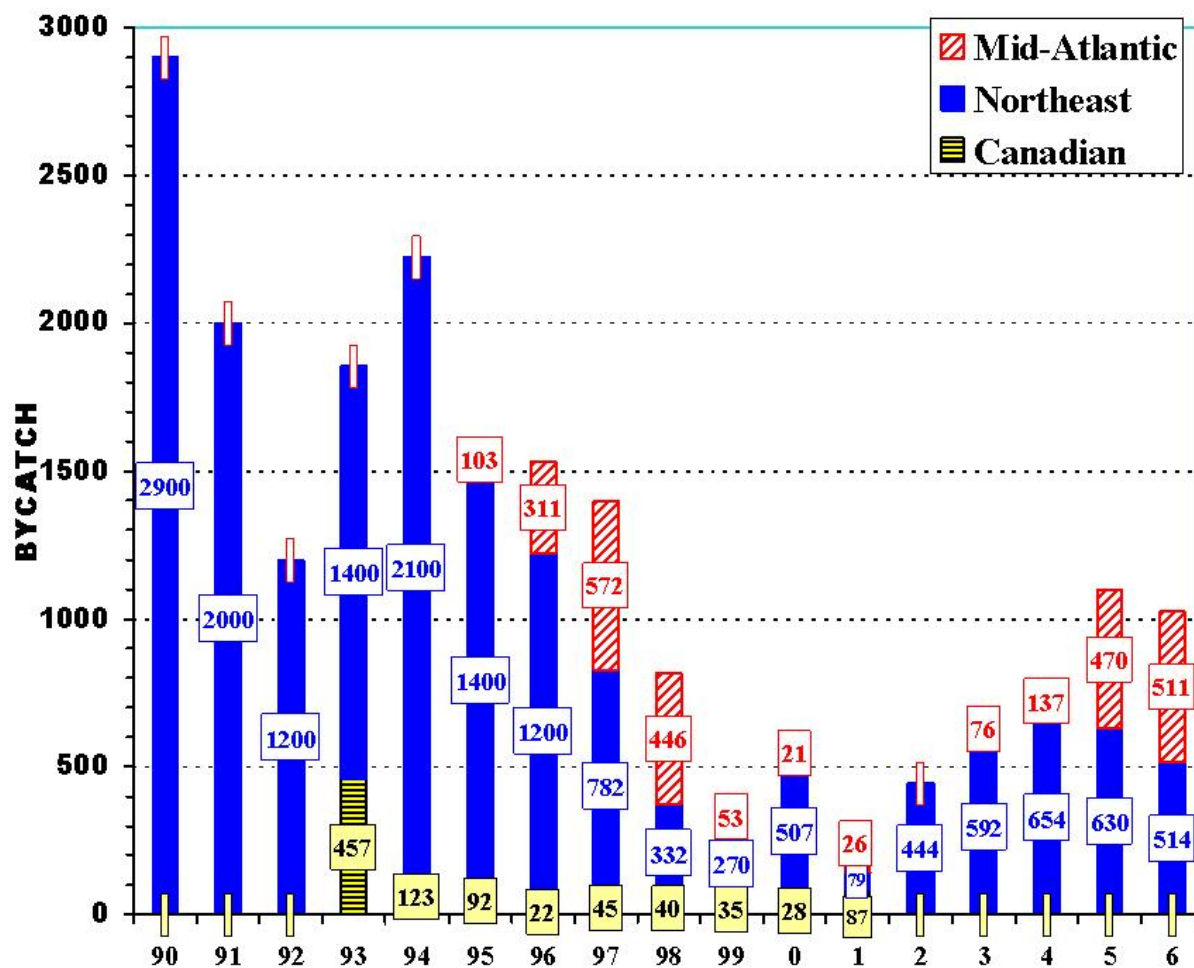


Figure 1. History of harbor porpoise bycatch estimates in gillnets from the US Northeast gillnet (solid blue bars), US Mid-Atlantic gillnet (red diagonal bars) and Canadian gillnet (yellow horizontal bars) fisheries. For reference, the HPTRP was implemented on 1 January 1999, the PBR applied to the 1999 through 2005 bycatch estimates was 747 and the PBR applied to bycatch from 2006 was 610. Bars that do not have a labeled bycatch estimate are time/areas where the fishery was not observed and thus no estimate was calculated.

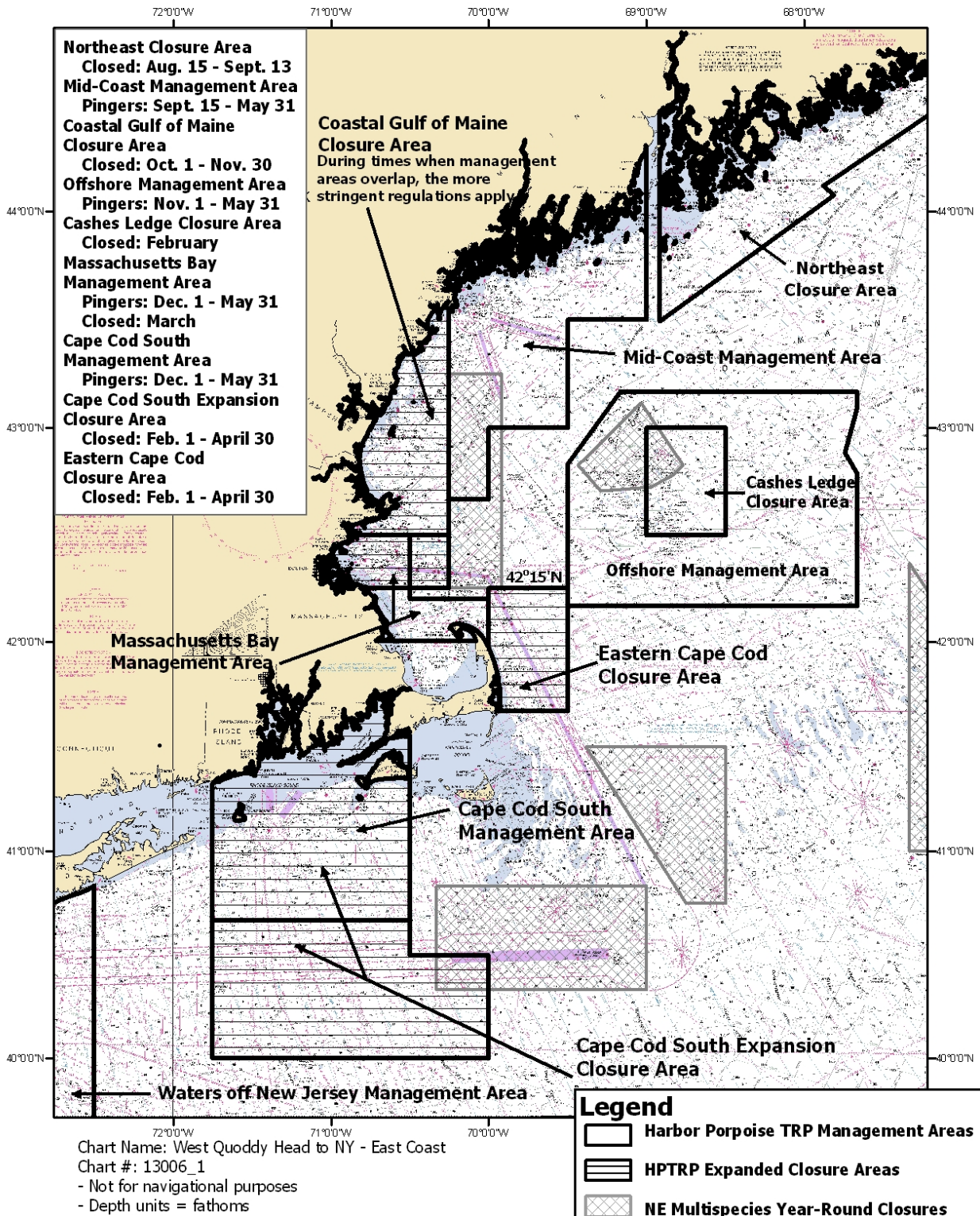


Figure 2. Alternative 2: Immediate implementation of closures in New England

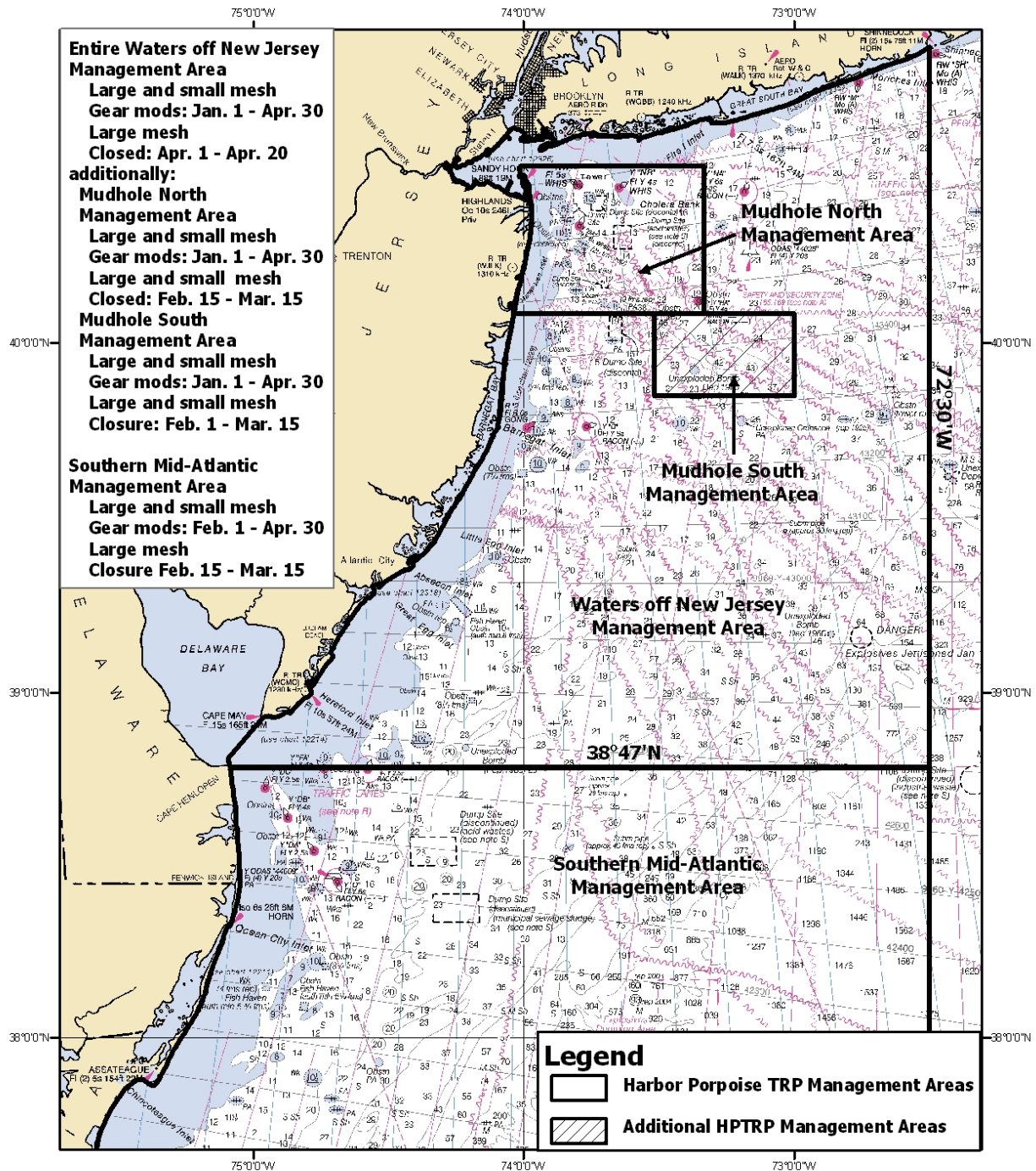


Chart Name: Cape Sable to Cape Hatteras
 Chart #: 13003_1
 - Not for navigational purposes
 - Depth units = fathoms

- Note that the southern boundary of the Southern Mid-Atlantic Management Area is the NC/SC border (33°51'N)

Figure 3. Alternative 2: Immediate implementation of closures in the Mid-Atlantic

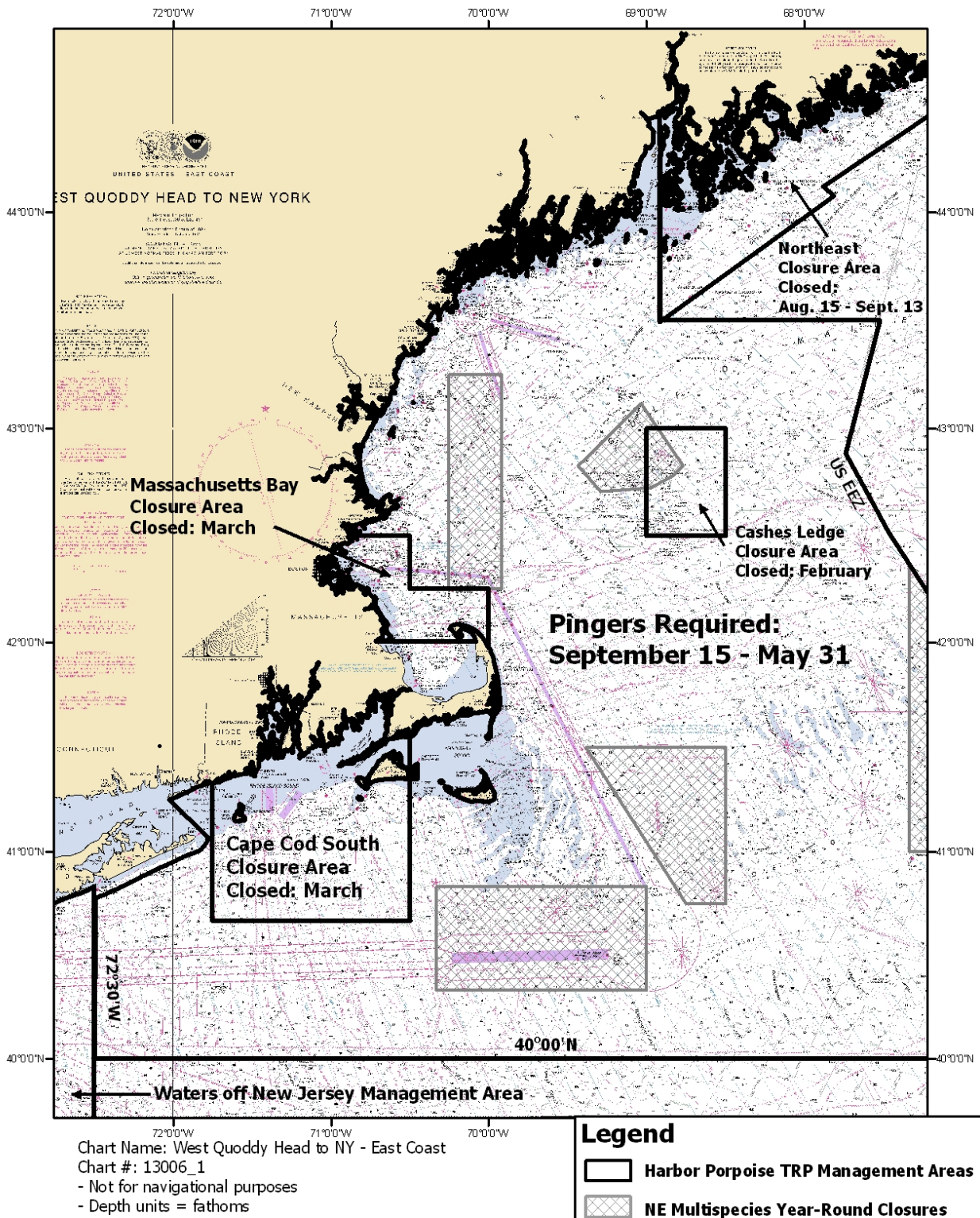


Figure 4. Alternative 3: Expanded seasonal pinger requirements in New England

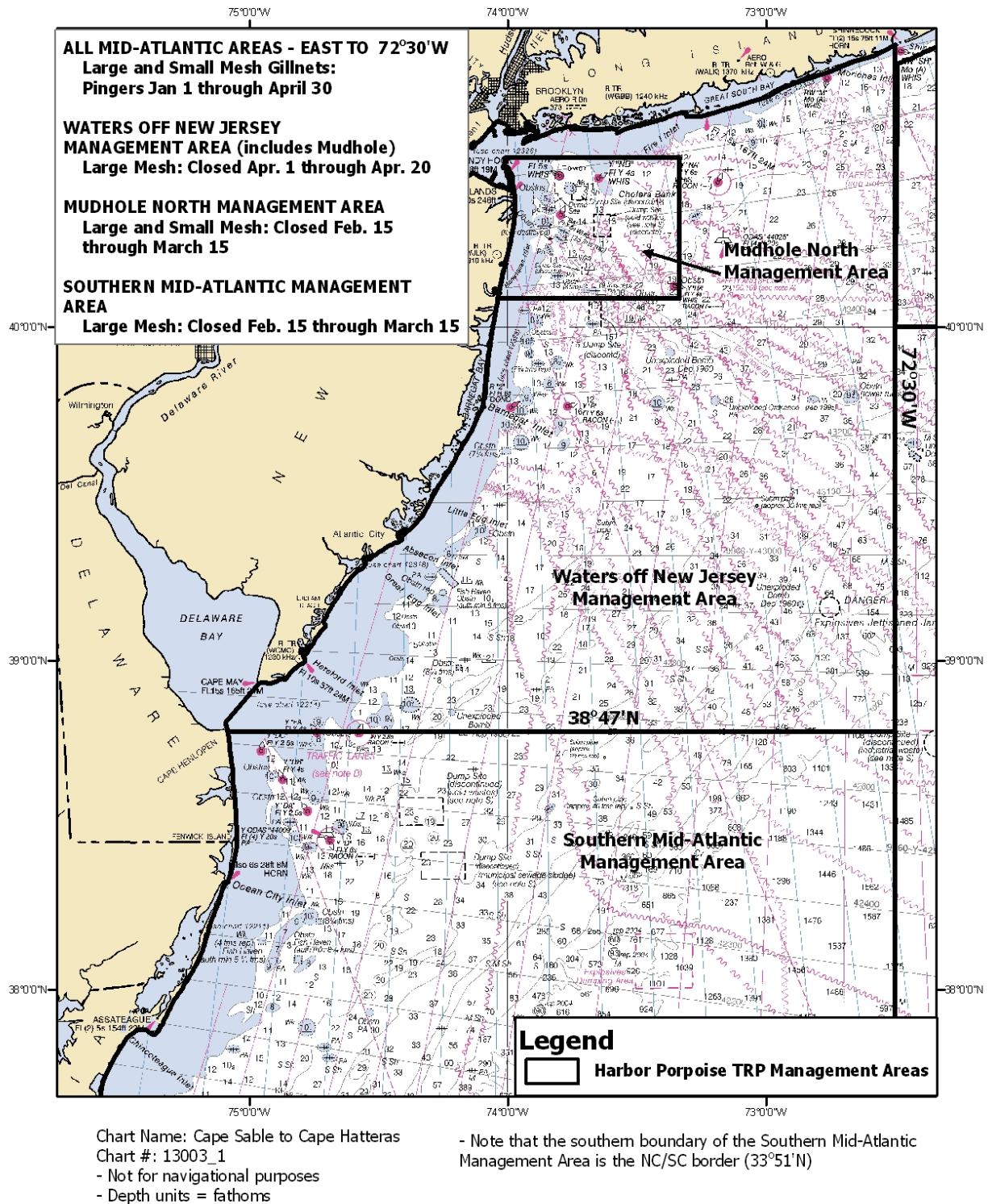


Figure 5. Alternative 3: Expanded seasonal pinger requirements in the Mid-Atlantic

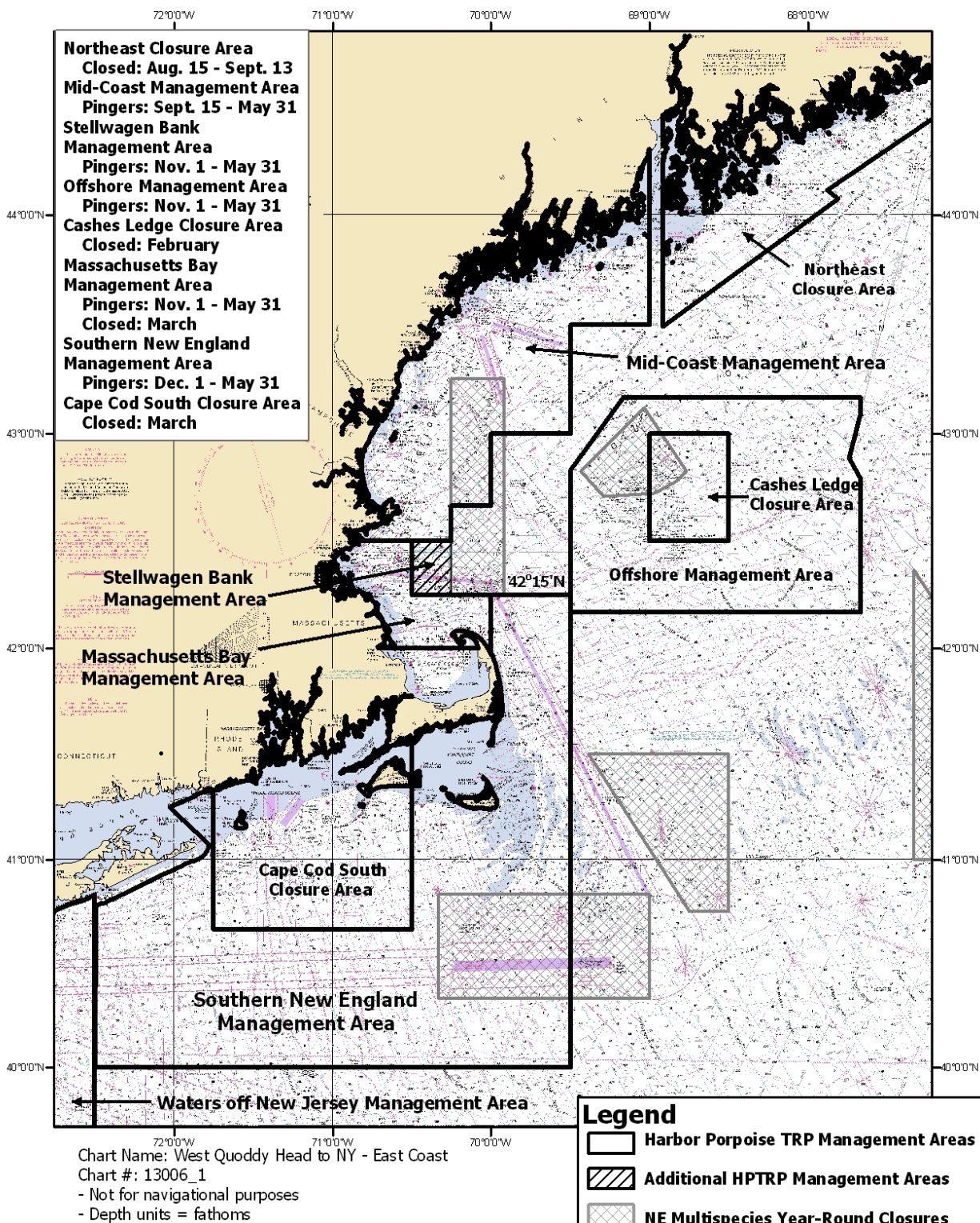


Figure 6. Alternative 4 – Preferred: New England harbor porpoise Management Areas for gillnets (pre-bycatch trigger).

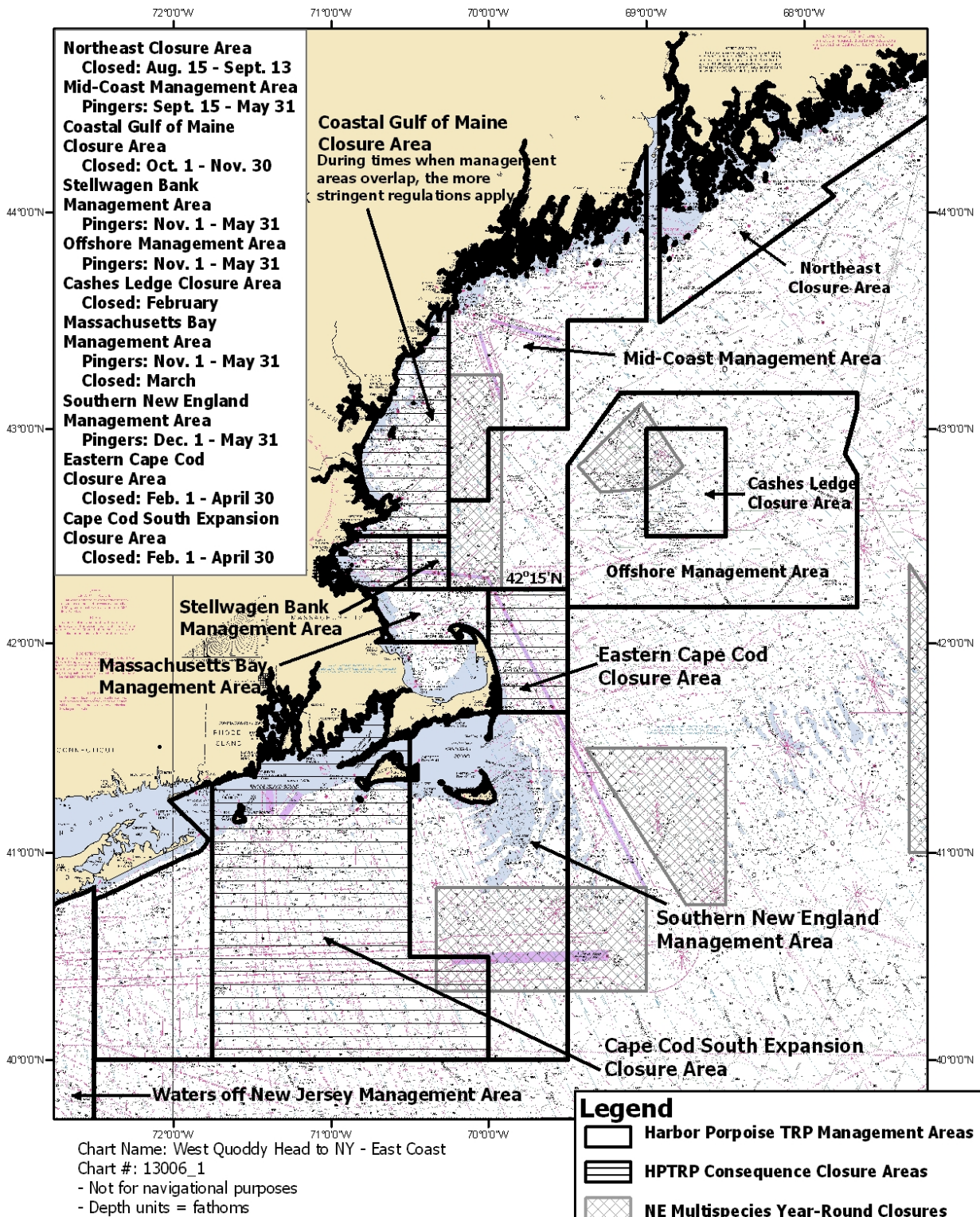


Figure 7. Alternative 4 – Preferred: New England harbor porpoise Management Areas for gillnets (post-bycatch trigger).

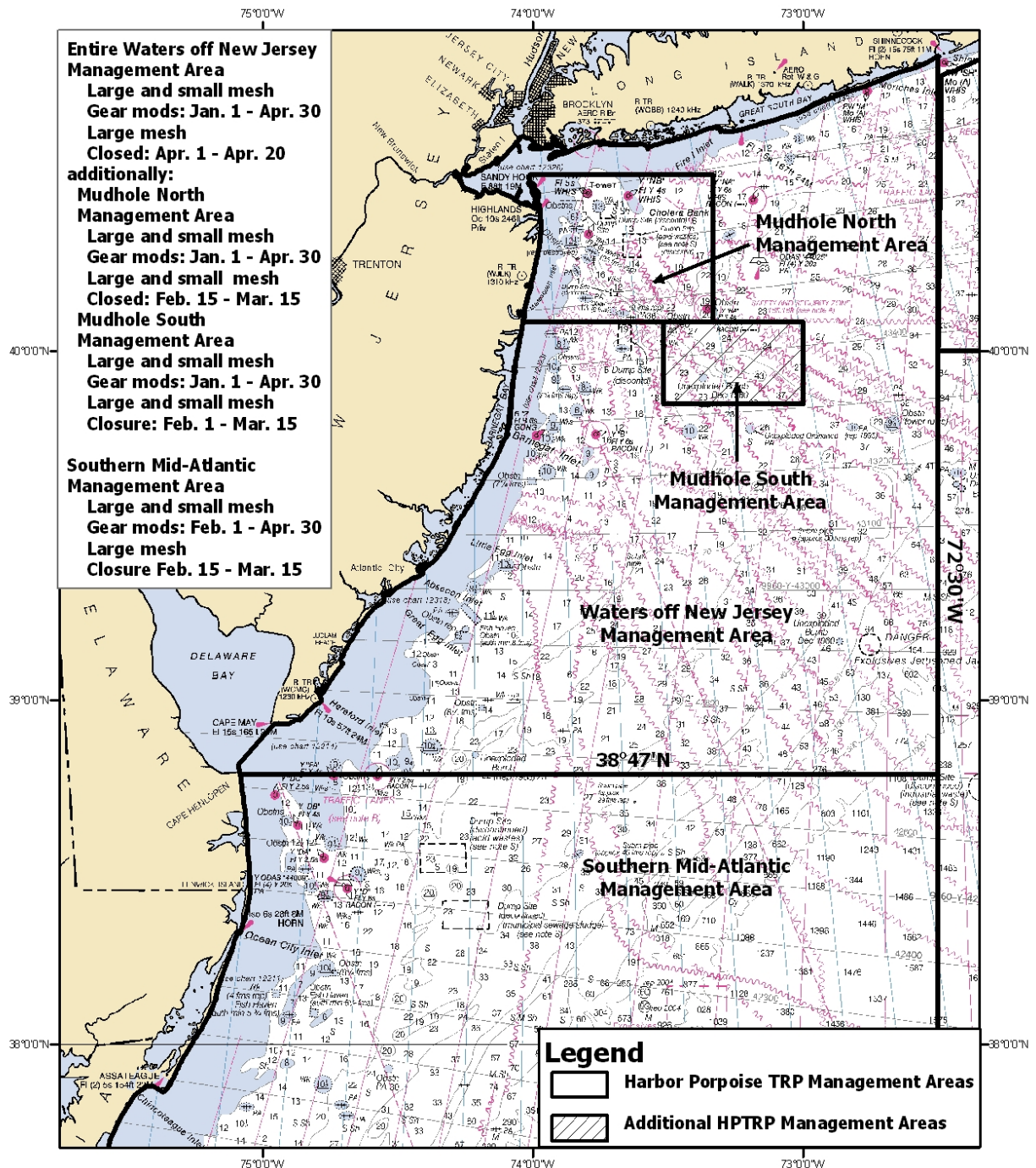


Chart Name: Cape Sable to Cape Hatteras
 Chart #: 13003_1
 - Not for navigational purposes
 - Depth units = fathoms

- Note that the southern boundary of the Southern Mid-Atlantic Management Area is the NC/SC border (33°51'N)

Figure 8. Alternative 4 – Preferred: Mid-Atlantic harbor porpoise Management Areas for gillnets.

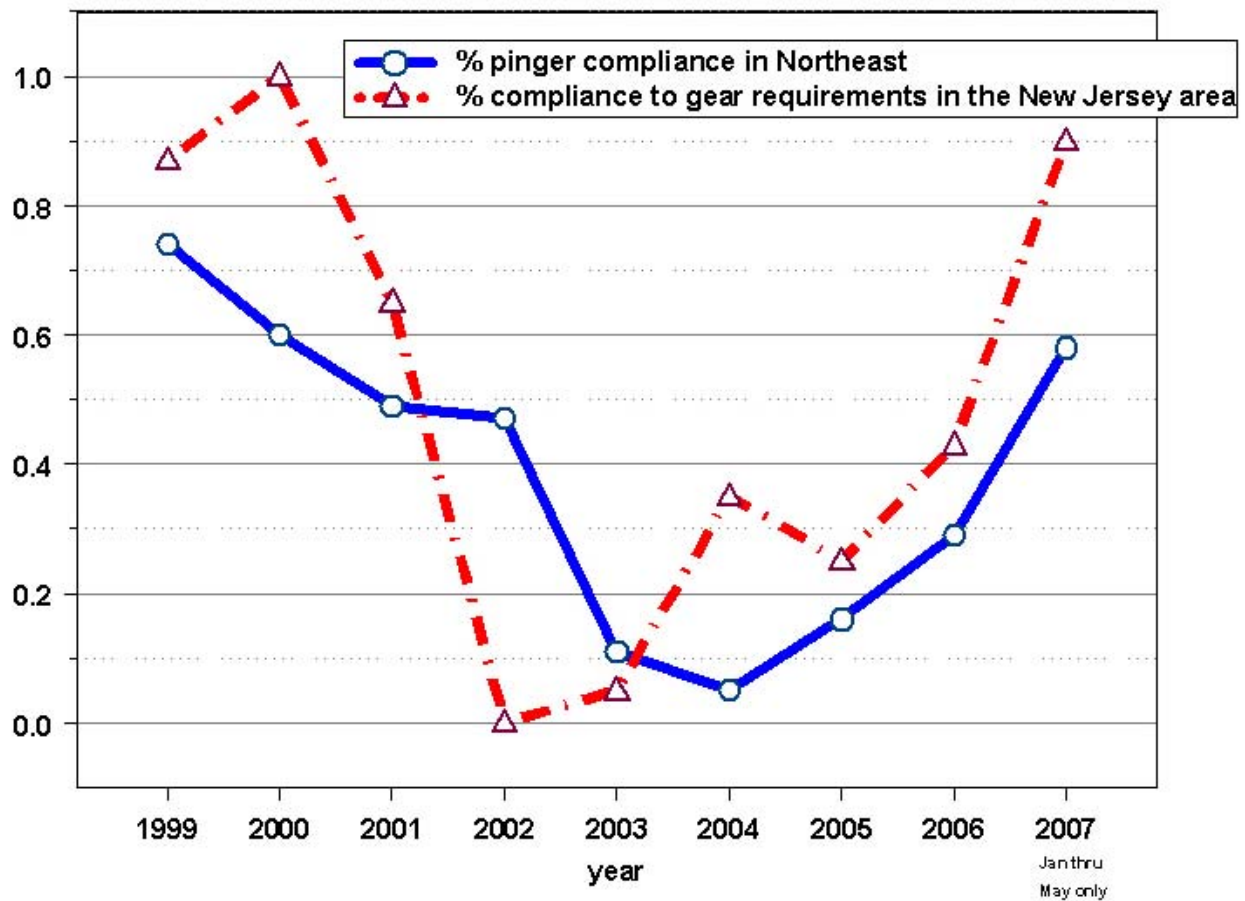


Figure 9. By year, the level of compliance to all HPTRP requirements for gillnets in the Northeast fishery (blue circles) and for those off of New Jersey in the Mid-Atlantic fishery (red triangles), as documented in the observed hauls. Note: the data for 2007 only include hauls observed during Jan–May.

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