

## Effect of Pingers on Harbor Porpoise and Seal Bycatch

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### SUMMARY

Using the data collected by the Northeast Fisheries Observer Program, this manuscript reports on an investigation into the bycatch rate patterns of harbor porpoises and seals relative to the usage of pingers in the Closures as defined in the Harbor Porpoise Take Reduction Plan (TRP).

Nearly 21,000 gillnet hauls were observed in the Gulf of Maine since the implementation of the TRP. Harbor porpoise bycatch was observed in each month of the year. Harbor porpoise bycatch rates were the highest in the Western Gulf of Maine (WGOM) Closed Area and the Mid-Coast Closure, with the bycatch rate in the “Proposed Area” the next highest. Bycatch rates of seals (harbor seals, gray seals and unidentified seals) were greater than the bycatch rate of harbor porpoises in Cashes Ledge, Mid-Coast, Offshore, WGOM and outside all of the closures.

Since the implementation of the TRP, during all the times and areas that were totally closed to gillnets, there were at least a few observed hauls. The WGOM Closed Area had observed fishing during nearly every month, where most of the observed hauls were close to the western border of the WGOM Closed Area, and takes were observed in this Closed Area during November to March. Pinger usage dropped substantially in 2003 and increased again in 2007. Over all years, depending on the closure area, only 20-40% of the observed hauls within a closure area/time used the required number of pingers. During years of high levels of compliance, 60-80% of the observed hauls that were required to have pingers did have the full compliment of pingers. In nearly all cases, it was not known if an observed pinger was actually working, so this fact might affect the interpretation of the statistics below.

Over the years since the implementation of the TRP, within each closure area during the times pingers were required or the area was closed, harbor porpoise and seal bycatch rates of hauls without pingers were greater than the bycatch rates of hauls with the required number of pingers. Harbor porpoise bycatch rates of hauls with some pingers, but less than the required number, were much higher than bycatch rates of hauls without pingers; this might be due to the small number of observed hauls that were with less than the required number of pingers. In general for both harbor porpoises and seals, as the number of pingers used increased, the bycatch rate decreased. However, there was much more inter-annual variability in the patterns for seal bycatch than for harbor porpoise bycatch.

It appears that the low bycatch rates achieved when using pingers required nearly all of the required pingers to be used. On average, when 80% of the required pingers were used, the bycatch rate was nearly the same as when no pingers were used.

There does not appear to be habituation to the pingers by either harbor porpoises or seals, as is evident by the fluctuating annual bycatch rates and no trend in the annual bycatch rates.

## **INTRODUCTION**

For the waters in the Gulf of Maine, Georges Bank, and east and south of Cape Cod (the Northeast gillnet fishery), the Harbor Porpoise Take Reduction Plan (TRP) divides the waters into a series of time and area closures where they are either completely closed to all gillnets or closed to gillnets that do not use pingers (Table 1). The names of the Closure Areas are Northeast, Mid-Coast, Massachusetts Bay (Mass Bay), Offshore, and Cashes Ledge, and Cape Cod South (SCape). (Federal Register 1998). Two other areas of interest in the Gulf of Maine include 1) the Western Gulf of Maine Closure Area (WGOM), which was a fishery management action created that closed this region all year round, and 2) an area proposed for future management under the harbor porpoise TRP, which I will call “Proposed New Area”. For simplicity, in the rest of this document the region encompassing all of these closure areas, except the SCape Closure will be called the Gulf of Maine area.

This paper investigates the harbor porpoise and seal bycatch relative to the use of pingers in the Northeast gillnet fishery after the TRP was in effect (January 1, 1999). Using data collected by the Northeast Fisheries Observer Program (NEFOP), the levels of compliance to pinger management measures are documented, the patterns in the bycatch rates as related to pingers are described, and the presence/absence of habituation to the pingers are investigated.

## **DATA**

The observer data used in these investigations were only hauls that have complete latitude-longitude information. Thus, this restriction eliminated some hauls that were used in other analyses (e.g., bycatch estimates), and so the statistics may not match exactly to other analyses.

Data from 2007, which include only data collected during January 1 to May 31, are still preliminary and so have not been processed as completely as the older data. Only harbor porpoise bycatch during 2007 are included.

## **BYCATCH PATTERNS**

Nearly 21,000 gillnet hauls were observed in the Gulf of Maine since the implementation of the TRP. The Mid-Coast and Mass Bay Closure areas and the area outside all closures had the largest numbers of observed hauls in the Gulf of Maine region during the time period January 1, 1999 to May 31, 2007 (Figure 1). The Cashes Ledge Closure and WGOM Closed areas had the smallest numbers of observed hauls.

Harbor porpoise bycatch was observed in each month, January to December, in some part of the Gulf of Maine in at least one year (Table 2). There were no hauls observed in the Northeast Closure Area at any time of the year. Overall all years, the harbor porpoise bycatch rate was the highest in the WGOM Closed Area and the Mid-Coast Closure, with the bycatch rate in the Proposed Area the next highest (Table 2).

### **Compliance to Pinger Mitigation Measures**

All the times and areas that were closed to gillnets (Table 1) had at least a few observed hauls (Table 2) since the implementation of the TRP. The WGOM Closed Area had observed fishing during nearly every month, where most of the observed hauls were close to the western border of the WGOM Closed Area (Figure 2), and takes were observed in this Closed Area during November to March (Table 2).

Pinger usage dropped substantially in 2003 and increased again in 2007 (Figure 3). In all the Gulf of Maine closure times and areas that require pingers, the number of hauls that used at least 90% of the required number varied by year: 78%, 64%, 52%, 53%, 15%, 7%, 22%, 44%, and 74% in 1999 to 2007. Over all years, depending on the closure area, only 20-40% of the observed hauls within a closure area/time used the required number of pingers (Figure 4).

### **Harbor porpoise bycatch**

Over the years since the implementation of the TRP, within each closure area during the times pingers were required or the area was closed, the harbor porpoise bycatch rate of hauls without pingers (light blue bars) was greater than the bycatch rate of hauls with the required number of pingers (dark blue bars) (Figure 5). This pattern was followed in most years when pooled over all Gulf of Maine closure areas to inspect annual patterns (Figure 6). There were no observed harbor porpoise takes in Cashes and the Offshore Closure Areas during the times the TRP was in effect (Figure 5; Table 2).

Harbor porpoise bycatch rates of hauls with some pingers, but less than the required number, was much higher than bycatch rates of hauls without pingers (Figure 5). This pattern was consistent over the years when pooling over all closure areas (Figure 6) or when just looking at the Mid-Coast Closure area. This pattern is consistent when defining the bycatch rate as number of takes per number of observed hauls (Figure 7) or as number of takes per metric tons (mtons) of landings (Figure 6).

In addition, the harbor porpoise bycatch rate of hauls with less than half of their required number of pingers (pink bars) was greater than the rate of hauls with more than half of their required number, but less than the required number (yellow bars) (Figures 6 and 7). One possible reason for this pattern is the number of hauls observed that had pingers but not the required number was very small (Figures 3 and 4), so there is insufficient statistical power to calculate a reliable bycatch rate. Another possible reason is it is not known if any of the pingers are actually working.

During January 1999 to May 2007, in the Mid-Coast Closure Area in the times pingers were required, the harbor porpoise bycatch rate of hauls without any pingers was 0.017 takes/haul. In the same time and area, the bycatch rate of hauls with all the required (or more) pingers was 0.008 takes/haul, that is less than half the rate of hauls without pingers. The bycatch rate of hauls with 90% or more, and 80% or more of the required pingers was 0.011 and 0.014 takes/haul. The same pattern is observed if the bycatch rate is defined as takes/mtons of landings (Figure 5), and if you look at the fall (September to December) separately from the winter (January to May), and if you pool the data for all the closure areas. This pattern might indicate that nearly all the pingers are needed to achieve a low bycatch rate.

The harbor porpoise bycatch rates of hauls with pingers fluctuate from year to year in the Mid-Coast Closure (Figure 7) and in all the closures in the Gulf of Maine (Figure 6). There does not appear to be an increasing or decreasing trend over years. If habituation to pingers is demonstrated by an increasing trend over years in the bycatch rate of hauls with pingers, then these data do not provide evidence of habituation of harbor porpoises to pingers.

### **Seal bycatch**

At least one species of seal were observed taken in all of the closure areas at some time since January 1999 (Table 3). Most of the takes were off of New Hampshire (Figure 8); however, most of the gray seals were taken east of Cape Cod, not in any of the closures. Most of the observed seal takes were harbor seals, and most takes were observed within the Mid-Coast closure area (Table 3). Over all the years since the implementation of the TRP, the bycatch rate of seals was greater than the bycatch rate of harbor porpoises in the Cashes Ledge, Mid-Coast, Offshore, WGOM and outside all of the closures (Figure 9).

Over the years since the implementation of the TRP, within each closure area during the times pingers were required or the area was closed, the seal (all species) bycatch rate of hauls without pingers (light blue bars) was greater than the bycatch rate of hauls with the required number of pingers (dark blue bars) (Figure 10). However, when looking at the annual bycatch rates (Figure 11), there does not appear to be any pattern; during half of the years bycatch rates in hauls without pingers were less than the bycatch rates in hauls with the required number of pingers.

The seal bycatch rates of hauls with pingers fluctuates from year to year (Figure 11). There does not appear to be an increasing or decreasing trend over years. If habituation to pingers is demonstrated by an increasing trend over years in the bycatch rate of hauls with pingers, then these data do not provide evidence of habituation of seals to pingers.

### **REFERENCE**

Federal Register 1998. Taking of Marine Mammals incidental to commercial fishing operations: Harbor porpoise take reduction plan regulations. Vol. 63, No 231 pg 66464-66490.

**Table 1.** Times areas in the Northeast gillnet fishery that are either closed to all gillnets (closed) or else closed to all gillnets that do not use pingers.

AREA	DATES	STATUS OF GILLNETS
Northeast	August 15 - September 13	Closed
Mid-Coast	September 15 - May 31	Closed – pingers <sup>1</sup> allowed
Massachusetts Bay	December 1 - February 28/29	Closed - pingers <sup>1</sup> allowed
	March 1 - 31	Closed
	April 1 - May 31	Closed - pingers <sup>1</sup> allowed
Offshore	November 1 - May 31	Closed - pingers <sup>1</sup> allowed
Cashes Ledge	February 1 - 28/29	Closed
Western Gulf of Maine	All year round	Closed
Cape Cod South	December 1 - February 28/29	Closed - pingers <sup>1</sup> allowed
	March 1 - 31	Closed
	April 1 - May 31	Closed - pingers <sup>1</sup> allowed

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

**Table 2.** By month and closure area, (A) the number of takes and (B) resulting **harbor porpoise** bycatch rates (sum of number of observed takes/sum of landings (in mtons)), using data from 01 January 1999 to 31 May 2007. Yellow shaded cells indicate the time/areas when pingers are required. Cells with diagonal shading indicate the time/areas that are closed to all gillnets.

**A. Number of observed takes (Number of observed hauls)**

Month	Cashes Ledge	Mass Bay	MidCoast	Offshore	WGOM	Proposed	Outside	TOTAL
1999 to 2007								
Jan	0 (0)	0 (273)	1 (139)	0 (55)	1 (67)	3 (377)	0 (433)	5 (1344)
Feb	0 (21)	0 (193)	0 (177)	0 (79)	2 (98)	7 (396)	0 (281)	9 (1245)
Mar	0 (13)	1 (61)	3 (199)	0 (95)	1 (153)	2 (499)	1 (370)	8 (1390)
Apr	0 (13)	0 (0)	0 (30)	0 (145)	0 (0)	0 (0)	5 (649)	5 (837)
May	0 (0)	0 (326)	0 (5)	0 (77)	0 (22)	0 (200)	1 (614)	1 (1244)
1999 to 2006								
Jun	2 (24)	0 (721)	1 (195)	0 (124)	0 (29)	0 (286)	0 (639)	3 (2018)
Jul	0 (0)	0 (397)	2 (944)	0 (127)	0 (60)	0 (210)	0 (630)	2 (2368)
Aug	0 (30)	0 (488)	1 (888)	0 (82)	0 (67)	0 (214)	0 (746)	1 (2515)
Sep	0 (36)	2 (496)	4 (728)	0 (46)	0 (67)	0 (252)	0 (806)	6 (2431)
Oct	0 (53)	0 (38)	11 (790)	0 (150)	0 (60)	0 (5)	0 (722)	11 (1818)
Nov	0 (18)	2 (95)	26 (925)	0 (83)	5 (74)	0 (5)	1 (681)	34 (1881)
Dec	0 (13)	3 (466)	7 (325)	0 (76)	1 (31)	6 (280)	2 (476)	19 (1667)
TOTAL	2 (221)	8 (3554)	56 (5345)	0 (1139)	10 (728)	18 (2724)	10 (7047)	104 (20758)

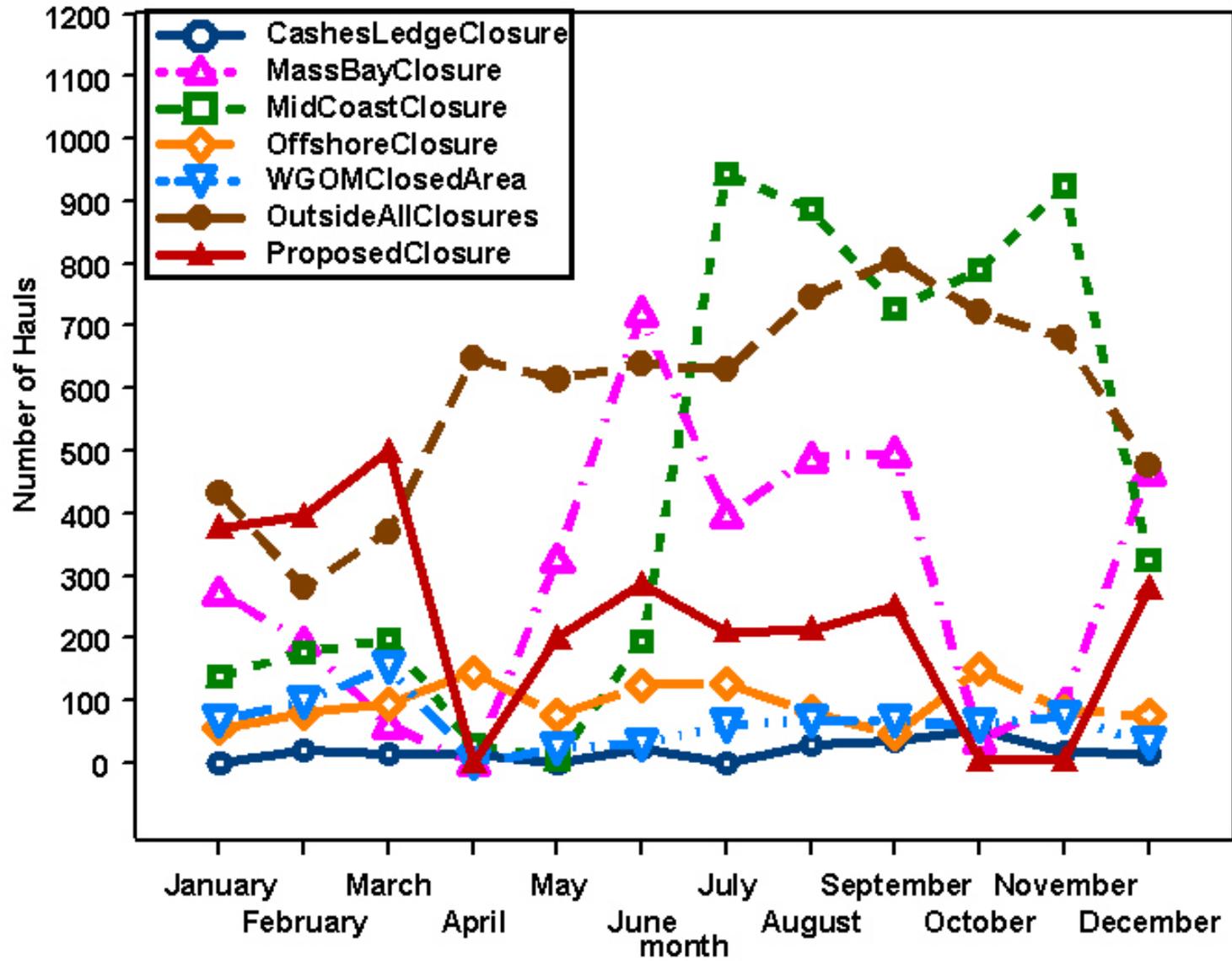
**B. Bycatch rate (number of observed takes/observed mtons of landing)**

Month	Cashes Ledge	Mass Bay	MidCoast	Offshore	WGOM	Proposed	Outside	TOTAL
1999 to 2007								
Jan	0	0	0.045	0	0.082	0.047	0	0.022
Feb	0	0	0	0	0.192	0.192	0	0.056
Mar	0	0.267	0.156	0	0.047	0.037	0.017	0.038
Apr	0	0	0	0	0	0	0.069	0.040
May	0	0	0	0	0	0	0.010	0.005
1999 to 2006								
Jun	0.332	0	0.032	0	0	0	0	0.007
Jul	0	0	0.010	0	0	0	0	0.003
Aug	0	0	0.006	0	0	0	0	0.002
Sep	0	0.023	0.028	0	0	0	0	0.010
Oct	0	0	0.066	0	0	0	0	0.023
Nov	0	0.052	0.121	0	0.145	0	0.005	0.066
Dec	0	0.043	0.071	0	0.095	0.079	0.018	0.044
TOTAL	0.023	0.016	0.052	0	0.056	0.040	0.005	0.022

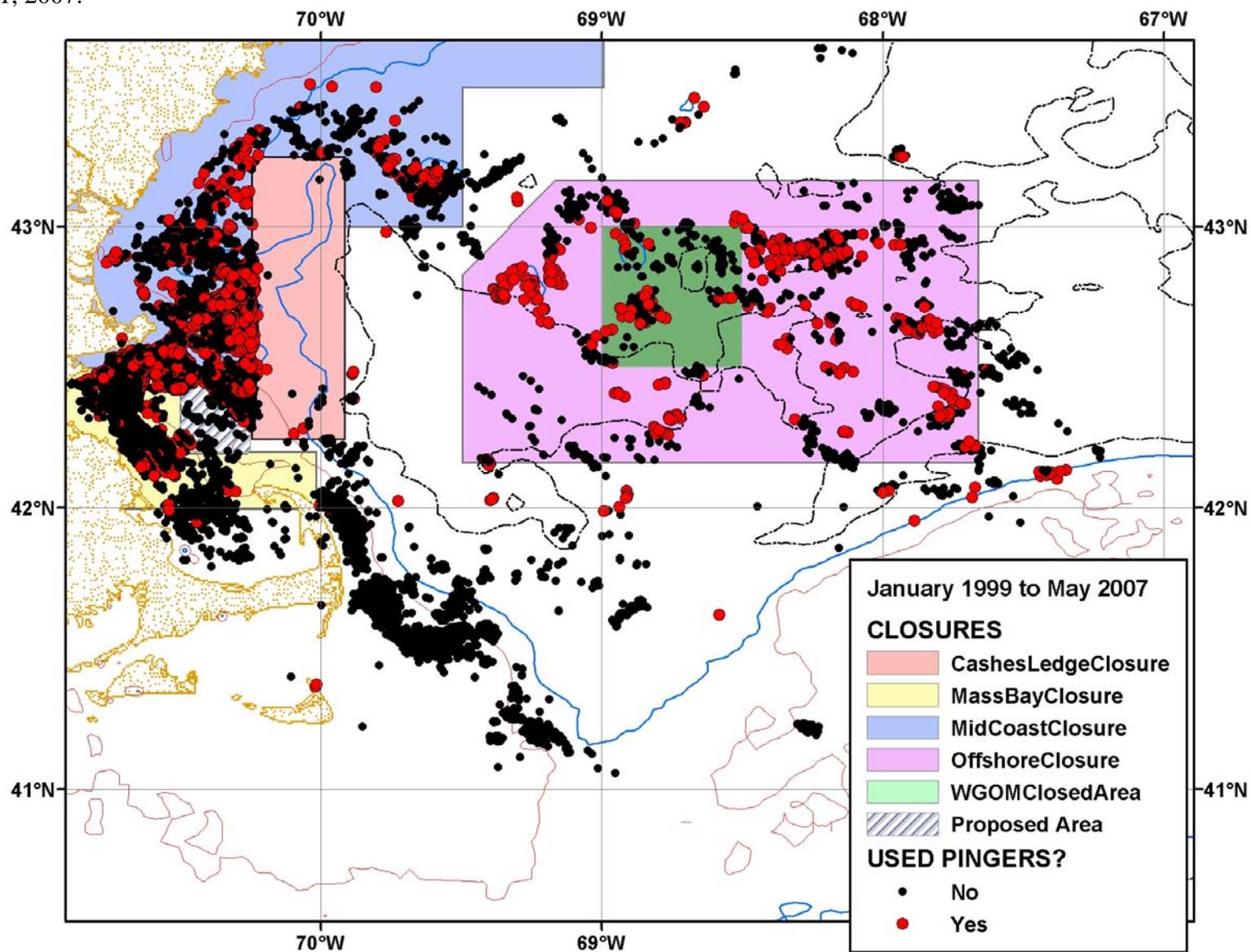
**Table 3.** Types of **seals** observed taken in the closures during months when the TRP was in effect.

Closure	Number of Takes			
	Harbor seals	Gray seals	Unknown seals	TOTAL
Cashes Ledge	0	1	0	1
Mass Bay	2	0	1	3
Mid-Coast	60	4	9	73
Offshore	1	1	1	3
WGOM	6	2	3	11
South Cape	9	8	4	21
TOTAL	78	16	18	112

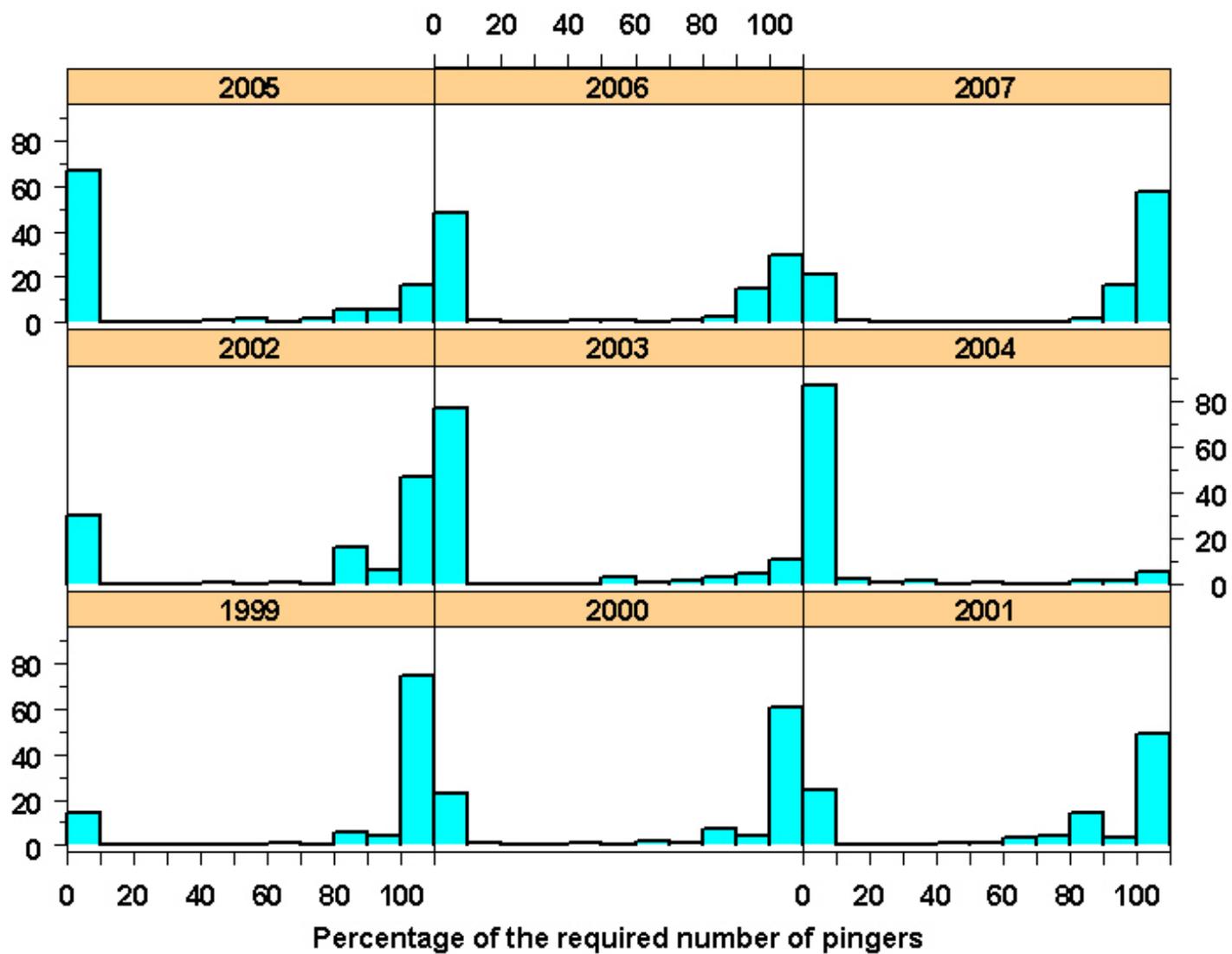
**Figure 1.** By month, the number of observed hauls within each closure and outside all closures, using data from 01 January 1999 to 31 May 2007.



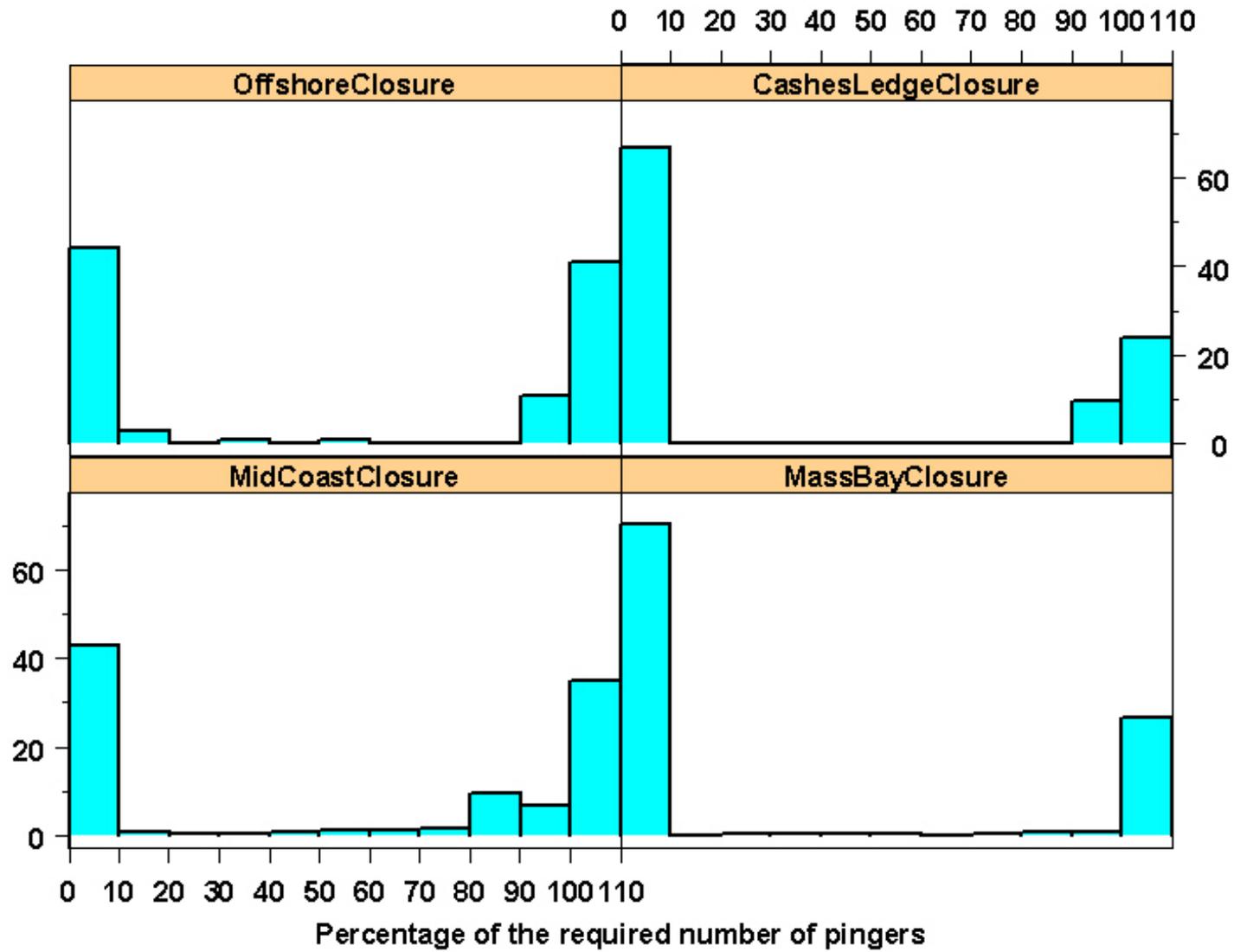
**Figure 2.** Location of hauls that did not use pingers (black dots) and hauls that did use pingers (red circles) during January 1, 1999 to May 31, 2007.



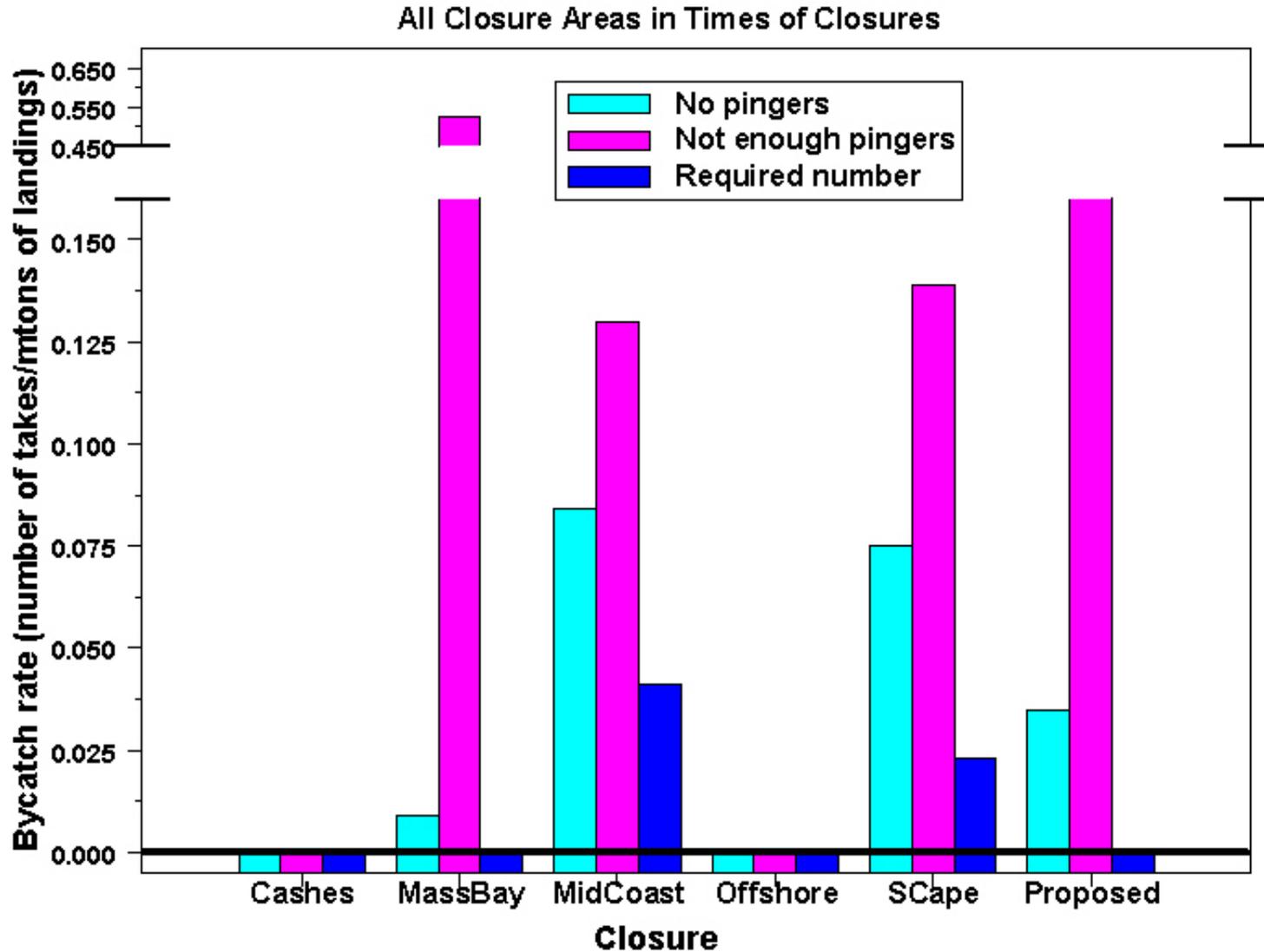
**Figure 3.** Percentage of the required number of pingers used on strings in the Gulf of Maine closure areas by year.



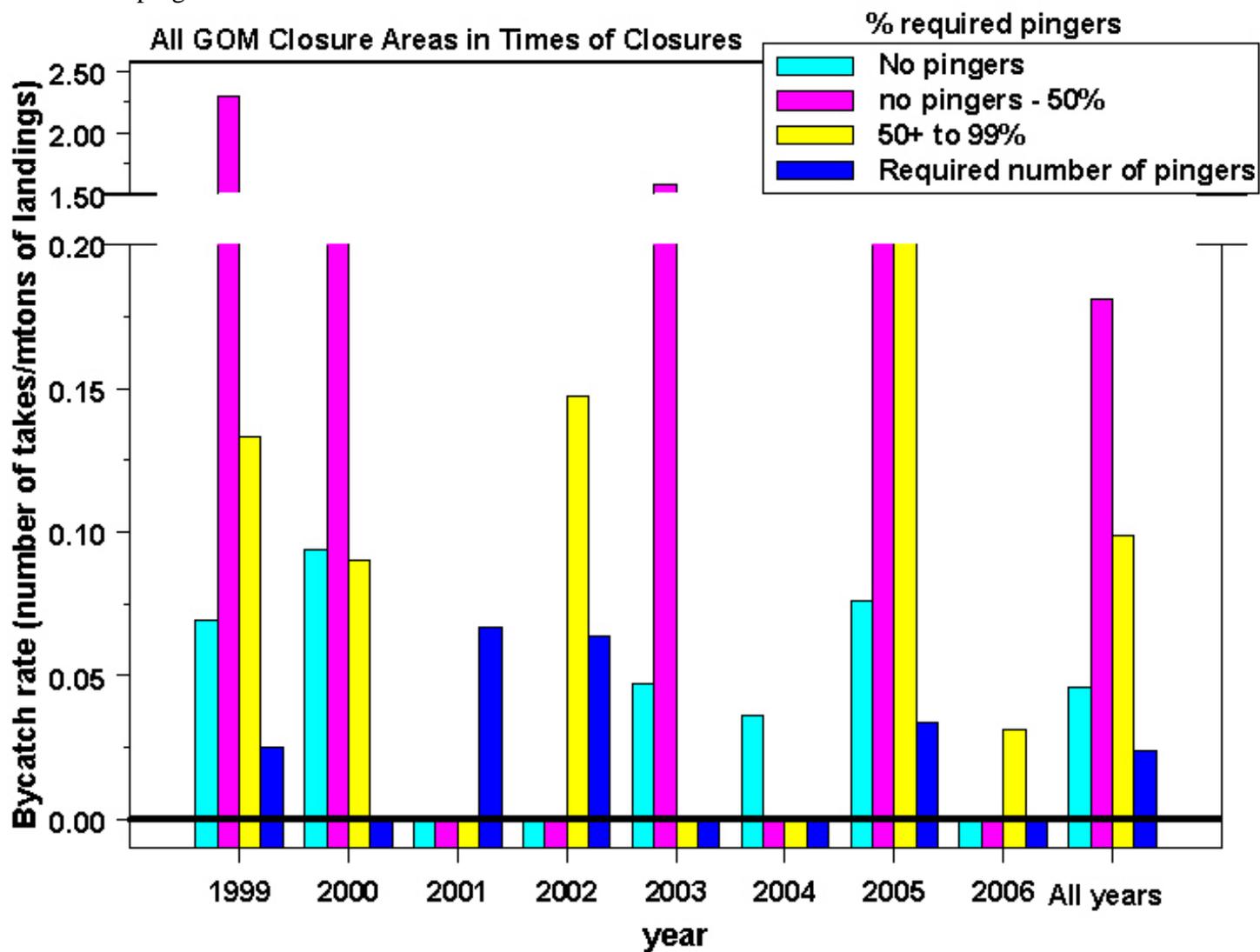
**Figure 4.** Percentage of the required number of pingers used on strings in the Gulf of Maine closure areas by closure area.



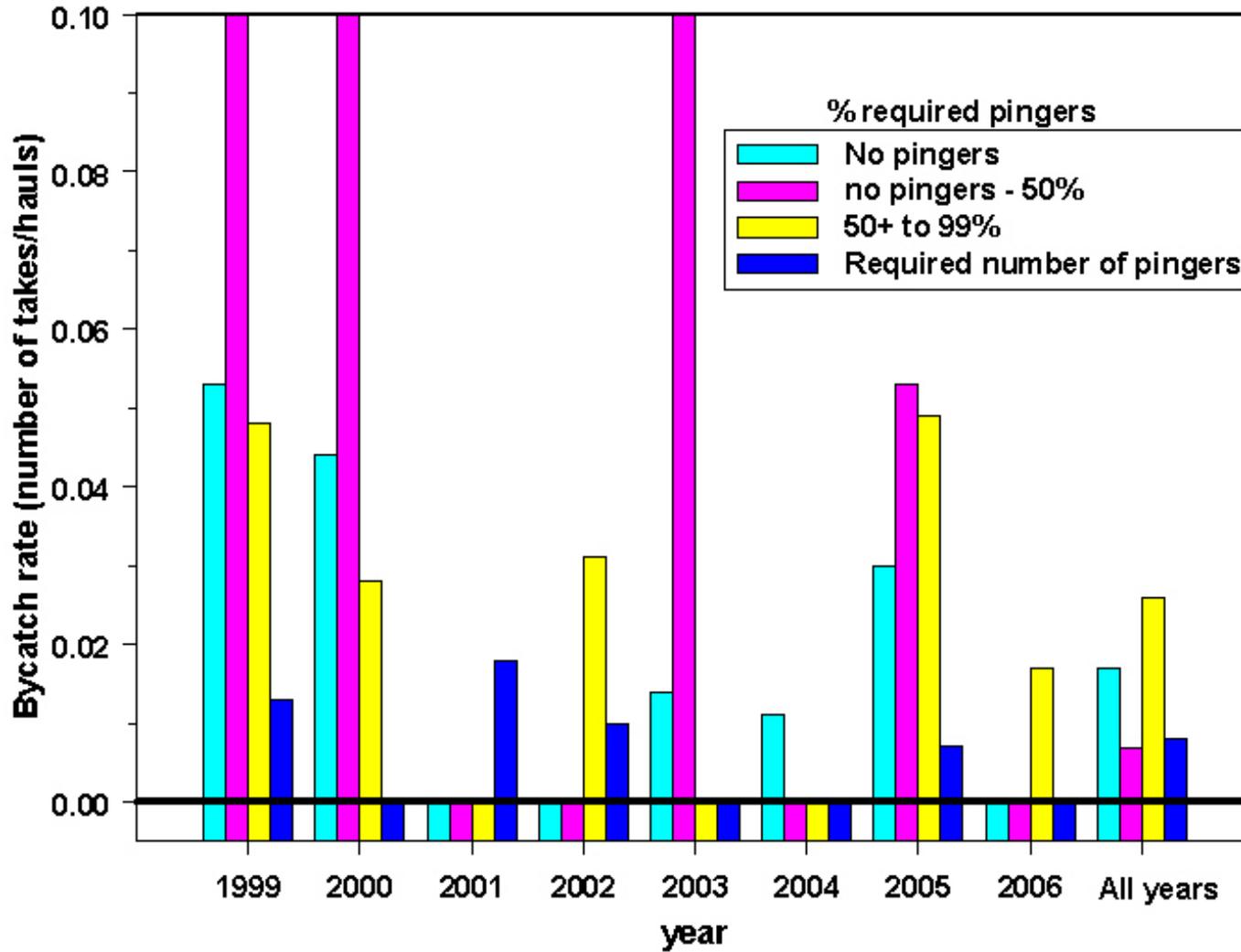
**Figure 5.** Within each closure area, pooled over all years, the **harbor porpoise** bycatch rates(number of takes/mton of landings) of hauls that had no pingers, some pingers, and the required number of pingers.



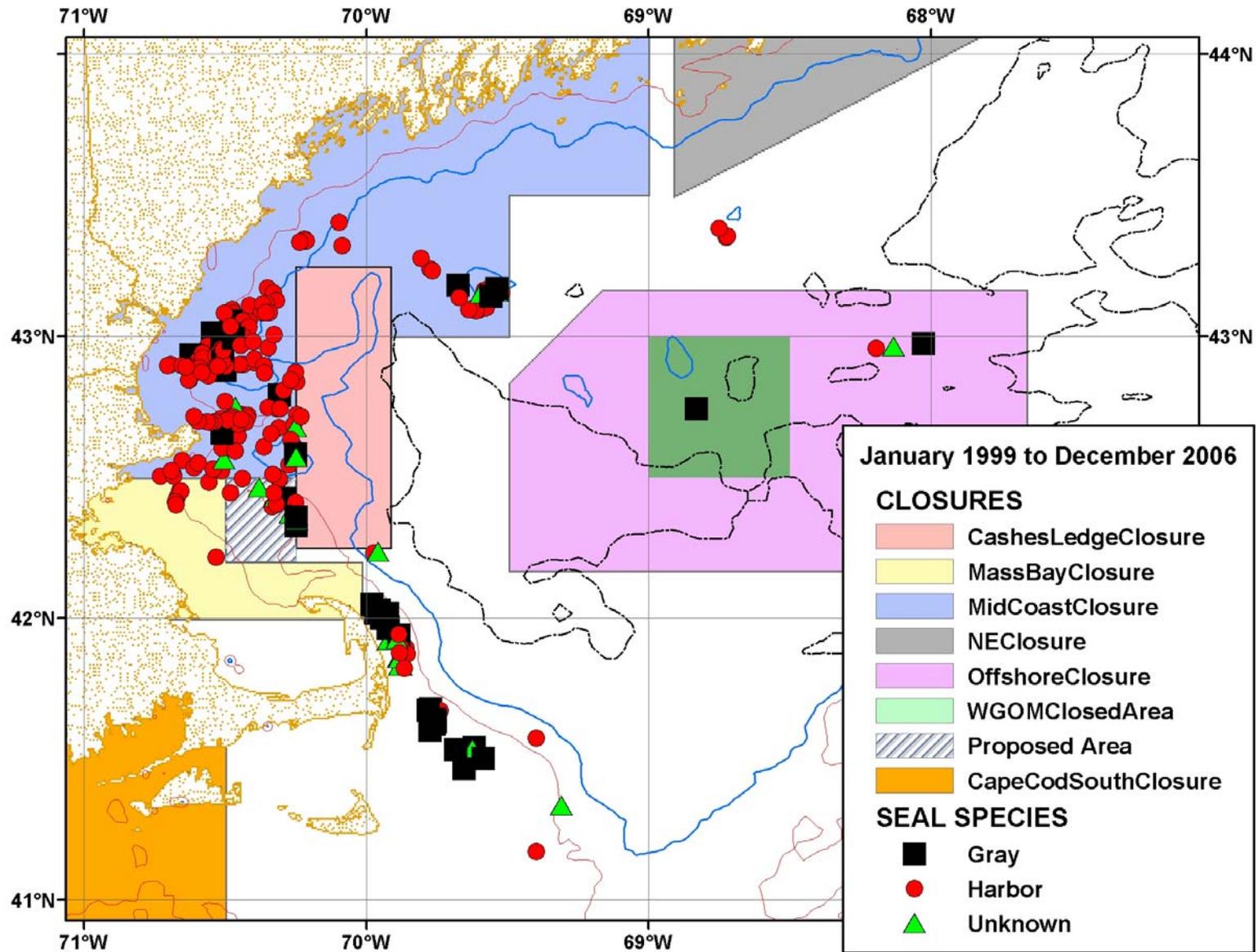
**Figure 6.** For each year, pooled over all Gulf of Maine closure areas, the **harbor porpoises** bycatch rates (number of takes/mton of landings) of hauls that had no pingers, less than half of the required number of pingers, more than half of the required number of pingers, and the required number of pingers. Light blue bars are hauls without pingers. Dark blue bars are hauls with all of the required number of pingers.



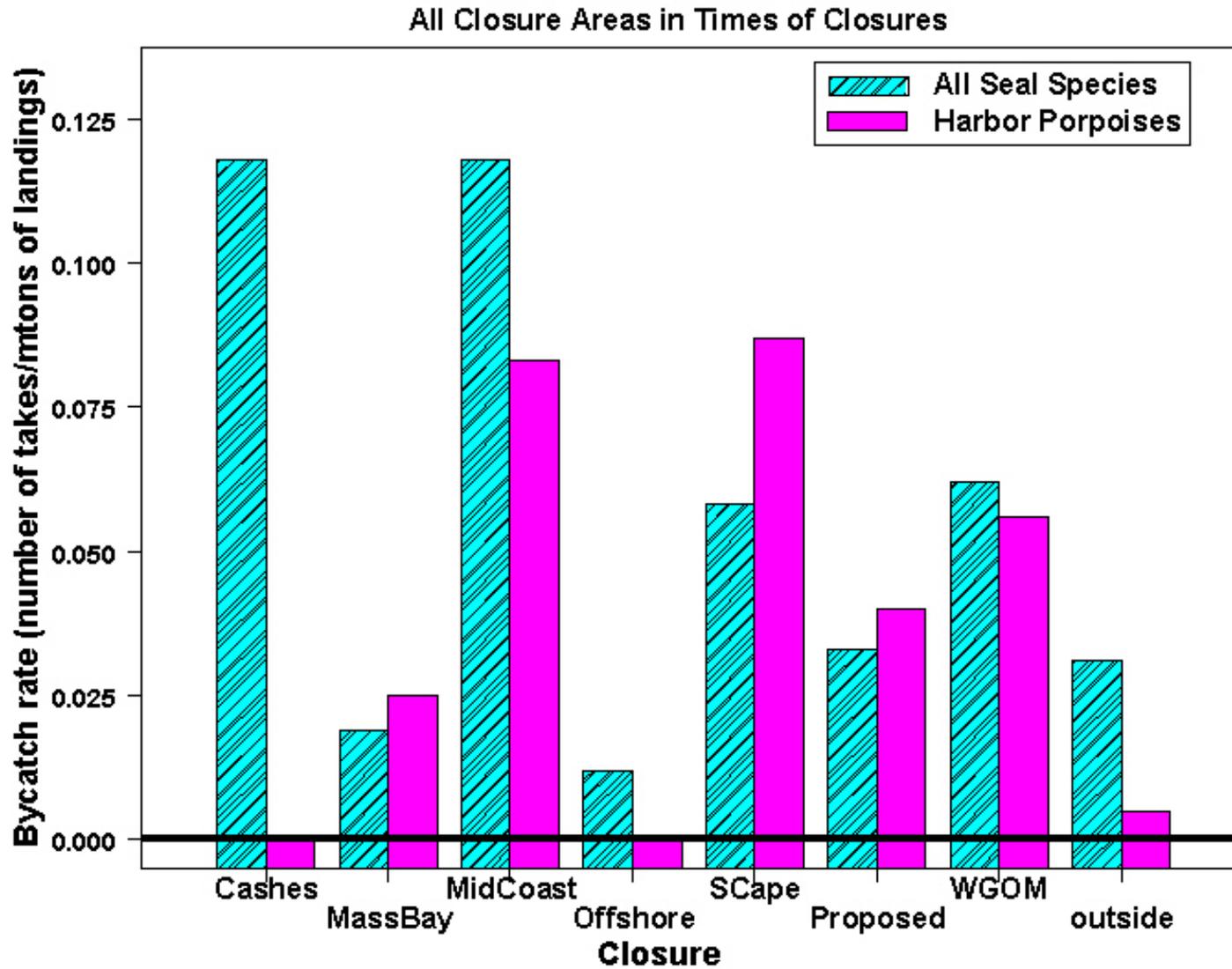
**Figure 7.** In only the Mid-Coast Closure during the times pingers are required, the **harbor porpoise** bycatch rates (total number of takes per hauls) by year and by the percentage of pingers that were required for that string length. Light blue bars are hauls without pingers. Dark blue bars are hauls with all of the required number of pingers.



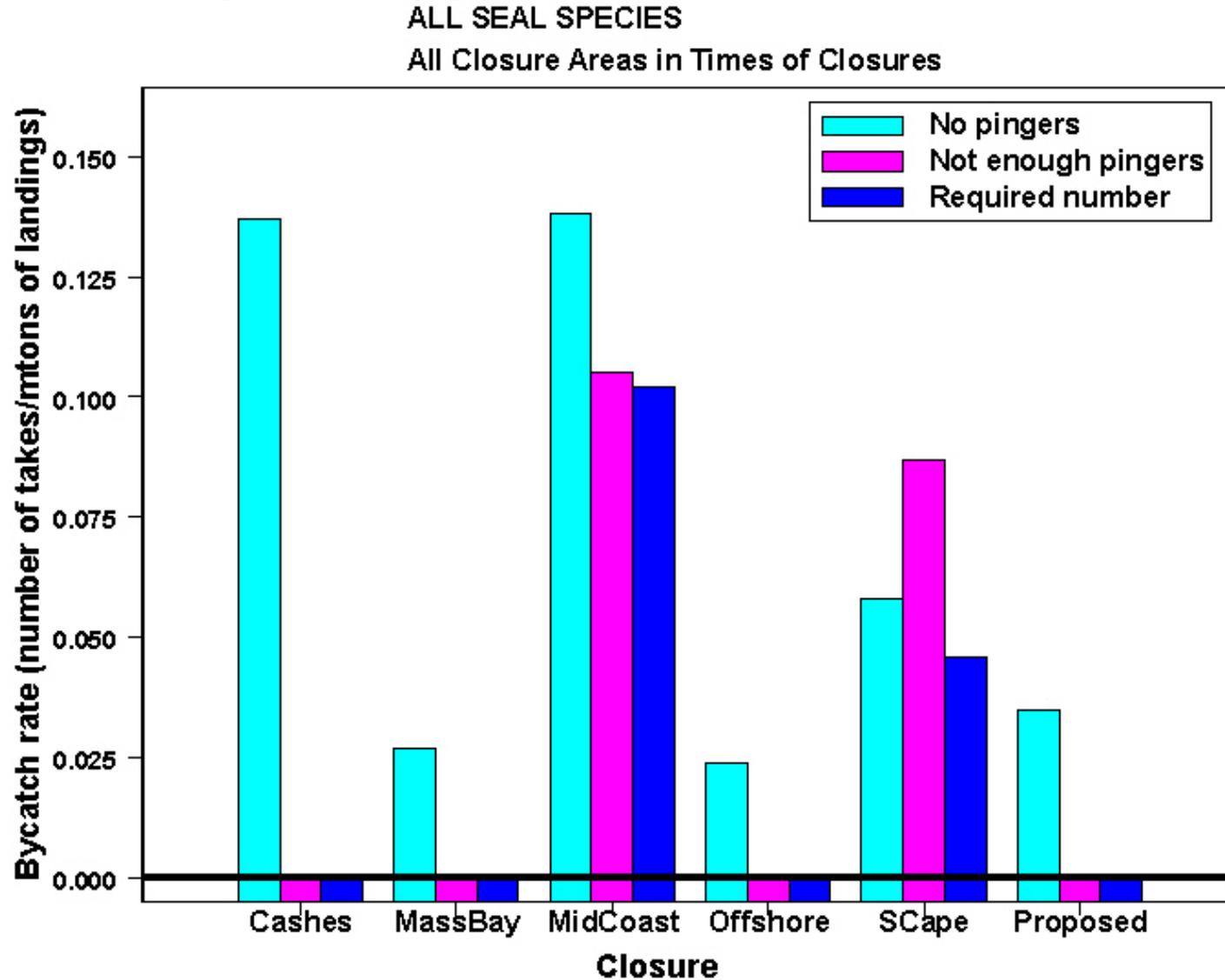
**Figure 8.** Location of seal takes, by species, from hauls observed during January 1999 to December 2006.



**Figure 9.** By closure area or other areas, the overall bycatch rate (number of takes/mtons of landings) of all **seal** species as compared to harbor porpoises. Data were from after the implementation of the TRP, during the months the closures were managed or during the entire time period for the WGOM and outside strata.



**Figure 10.** Within each closure area, pooled over all years, the **seal** (all species) bycatch rates (number of takes/mton of landings) of hauls that had no pingers, some pingers, and the required number of pingers. Light blue bars are hauls without pingers. Dark blue bars are hauls with all of the required number of pingers.



**Figure 11.** For each year, pooled over all Gulf of Maine closure areas, the seal (all species) bycatch rates (number of takes/mton of landings) of hauls that had no pingers, less than half of the required number of pingers, more than half of the required number of pingers, and the required number of pingers. Light blue bars are hauls without pingers. Dark blue bars are hauls with all of the required number of pingers.

