

New England Management Areas: Harbor Porpoise Bycatch Patterns during 1 January 2007 to 31 May 2012

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Summary

As a follow-up to Palka et al. (2008a), harbor porpoise (*Phocoena phocoena*) bycatch patterns in the New England gillnet fisheries from 1 January 2007 to 31 May 2012 are explored. The New England gillnet fisheries are a portion of the US Atlantic gillnet fishery north of 40°N and west of 72°30'W and currently includes eight harbor porpoise take reduction plan (HPTRP) management areas (Northeast, Mid-Coast, Massachusetts Bay, Stellwagen Bank, Offshore, Cashes Ledge, Southern New England, and Cape Cod South Management Areas (MAs)) and four other relevant areas (Western Gulf of Maine Closure Area, Cape Cod South Expansion Consequence Closure Area (CCA), Eastern Cape Cod CCA, and Coastal Gulf of Maine CCA). Since 1 January 2007, the Northeast Fisheries Observer Program (NEFOP) observed 12,405 gillnet hauls (3777 trips) in the New England region. Since 1 May 2010 the At-Sea Monitor (ASM) program observed 13,338 gillnet hauls (3427 trips) in this region. Since 1 January 2007, 231 harbor porpoises were observed taken, most of which were within the Mid-Coast, Massachusetts Bay, Stellwagen Bank and Southern New England MAs. Annual observer coverage ranged from about 2-4% in 2007 – 2009 in the Cape Cod South, Stellwagen Bank, Mid-Coast MAs to over 30% in 2010 – 2011 in the Offshore, Cashes Ledge, and Mid-Coast MAs.

Few hauls were observed in the times and areas that were totally closed to gillnets, as defined by the two HPTRPs. Compliance with the HPTRP requirement that the pingers must be functional was not investigated in this paper. Compliance to the regulated required number of pingers increased during January 2007 to May 2012, with an annual average of 57% of the observed hauls using the correct number of pingers and a maximum of 76% in January – May 2012. However, even in the more compliant time period, under the 2010 HPTRP (ending in May 2012), the overall level of compliance was only 67% of the observed hauls that had the correct number of pingers. It appears that under the 2010 HPTRP time period non-compliance was fairly wide spread, with a concentration by a small number of vessels. That is, the worst non-compliant observed hauls (which had $\leq 50\%$ of the required number of pingers) were spread out among ports (65%) and vessels (47%). However, most of these worst non-compliant hauls were concentrated among only nine vessels. That being said, these nine vessels had also been observed at other times to have had the correct number of pingers on other observed hauls.

The majority of the harbor porpoise bycatch was located in two regions (in order of magnitude): 1) in the Southern New England MA; and 2) just west of the western boundary of the Western Gulf of Maine Closure Area which is in the Stellwagen Bank, Mid-Coast, and northern portion of the Massachusetts Bay MAs. In general, under both HPTRP's (starting 1 January 2007), the highest bycatch rates and approximate total monthly bycatch estimates were during November – May. Since the implementation of the 2010 HPTRP, in general, the levels of bycatch decreased.

A statistical Generalized Additive Model that best predicted the bycatch rates in this region included the following factors (in order of importance): Julian day of the year, bottom depth at location of haul (in fathoms), surface water temperature at location of haul (°C), which management area the haul was located in, soak duration (hrs), and twine size (mm). One way to interpret this model is that time and area (Julian day of the year and bottom depth at the location of the haul) best explains the bycatch rates patterns that result for fishing under the regulations from the two HPTRPs, where springtime and depths ranging from about 50 – 100 fathoms had the highest bycatch rates. Note, bycatch in other times and areas could be low due to the HPTRP regulations, to the lack of fishing or harbor porpoises. The next two factors brought into the model, surface water temperature and management areas, appears to help explain variability between years and within the New England region, where hauls fished in colder waters and in the Mid-Coast MA had a highest bycatch rate. Only after time and area factors were brought in the model did fishing practice factors start to be included: soak duration and twine size. Hauls with higher than average bycatch rates were those that had soak durations greater than about 48 hrs had and hauls with twine sizes that were very small (< 0.4 mm which may help distinguish the handful of haul targeting lobsters) or were about 0.6 – 0.7 mm.

Under the 1998 HPTRP, from 1 January 2007 to the implementation of the 2010 HPTRP, the overall bycatch rate of hauls with all of the required number of pingers (0.005 harbor porpoises/haul or 0.018 takes/mtons landed) was less than half that of hauls with none of the required number of pingers (0.015 harbor porpoises/haul or 0.045 takes/mtons landed). Under the 2010 HPTRP, ending on 31 May 2012, the overall bycatch rate for hauls without pingers was nearly the same as hauls without pingers under the 1998 HPTRP time period (starting in January 2007). However, the bycatch rate of hauls with the required number of pingers under the 2010 HPTRP (0.011 takes/haul or 0.043 takes/mtons landed) was also nearly the same as that without pingers (0.015 takes/haul or 0.047 takes/mtons landed). It appears the high bycatch rates of hauls with the required number of pingers under the 2010 HPTRP were concentrated in the Mid-Coast and Stellwagen Bank MAs. The reason for this concentration is unclear from the current analyses.

Data and Stratification

Patterns of observer coverage, harbor porpoise (*Phocoena phocoena*) bycatch, and compliance to the two harbor porpoise Take Reduction Plans (HPTRP) within the New England region were examined using the Northeast Fishery Observer Program (NEFOP) gillnet data collected during 1 January 2007 – 31 May 2012 and the At-Sea Monitor (ASM) Program gillnet data collected during 1 May 2010 – 31 May 2012.

These data were temporally divided into two time periods. The first time period (referred to as “1998 HPTRP”) started in 1 January 2007 and ended when the 2010 HPTRP was implemented, which varied by management area (MA)¹. The second time period (referred to as “2010 HPTRP”) started when the 2010 HPTRP was implemented and ended on 31 May 2012.

¹ For most management areas the 2010 HPTRP was implemented on 22 March 2010 (FR75-7383, 19 February 2010). For simplicity, and because the 2010 HPTRP did not result in immediate management differences for these management areas, the 2010 HPTRP time period used in this analysis started 1 April 2010. However, for the Stellwagen Bank and Southern New England Management Areas the 2010 HPTRP was implemented on 15 September 2010 (FR75-12699, 17 March 2010).

These data were also spatially divided into the MAs as defined by the 2010 HPTRP, even if the haul was observed under the 1998 HPTRP (Figure 1). Only in a few small areas are the MAs from the two HPTRPs different. For the purpose of investigating patterns over all the months and years, the hauls that fall into MAs which overlap (such as the Offshore and Cashes Ledge MAs and the Southern New England and Cape Cod South MAs) were included in both of the overlapping MAs. In addition, to investigate what happened in the Consequence Closure Areas (CCAs), which were created in the 2010 HPTRP and have not yet been implemented, three additional strata had been created that cover these regions during 1 January 2007 – 31 May 2012. Thus, a single gillnet haul could be included in more than one of the MAs and CCAs. Because the Western Gulf of Maine Closure Area is closed to all gillnets all year round, hauls observed within this Closure Area were only included in this Closure Area and not in an overlapping MA. If an observed haul or VTR trip was recorded right on the western border of the Western Gulf of Maine Closure Area (that is, the longitude = -72.25°W), then the haul was assigned to the MA adjacent to the Closure Area, not to the Western Gulf of Maine Closure Area.

The Vessel Trip Report (VTR) fisher logs from 1 January 2007 – 31 May 2012 were used as the source of total fishing effort and were divided spatially and temporally like the above observer data. The VTR fisher logs are not a complete census of the fishing effort in these MAs, though it is close for the New England region.

Analysis Methods

To investigate the monthly and annual patterns in the harbor porpoise bycatch the total bycatch by MA was estimated for each month. The total monthly bycatch was simply estimated as the product of the observed bycatch rate using the pooled NEFOP and ASM data and the total effort as documented in the VTR data:

$$\text{Approximate total bycatch} = \left(\frac{\text{observed takes}}{\text{observed mtons landed}} \right) * \text{VTR mtons landed}$$

These monthly bycatch estimates should be considered approximations to demonstrate general patterns. They are approximate estimates because the bycatch estimates do not explicitly account for the hauls with and without pingers, do not explicitly account for the potential effects of the ASM data, and do not expand the VTR to incorporate dealer recorded mtons landed when calculating the total mtons landed from the entire fishery. These complications are correctly accounted for in the seasonal/annual bycatch estimates in Orphanides (2010, 2011 and 2012).

To investigate factors that relate to the bycatch rates, Generalized Additive Models (GAMs) were used in a stepwise fashion to develop a model. Akaike Information Criteria (AIC) was used to choose the factor that best fit the data during each of the steps. To avoid problems with missing values, after missing values were filled in using the standard methods developed in Warden and Orphanides (2008), the Splus function `na.replace` was used to fill in the remaining handful of missing values.

To investigate the compliance and effectiveness of pingers, only hauls that were observed in times and areas that required pingers were investigated, where the HPTRP regulations that were in place at the time of the haul determined if the haul required pingers. In addition, the ASM hauls before 1 September 2011 that did not record anything in the data field with the

number of pingers were excluded because there was confusion among the observers and it was not clear if a missing value meant there were no pingers.

Observer coverage

There was only one trip observed in the Northeast MA (in March 2011) that caught no harbor porpoise, so this management area will not be discussed further.

In the New England region from 1 January 2007 – 31 May 2012, there were 9019 hauls under the 1998 HPTRP and 16,724 hauls under the 2010 HPTRP that were observed by the NEFOP and ASM programs (Table 1A; Figure 2). Of these, 1437 hauls and 11,901 hauls were observed by the ASM program under the 1998 and 2010 HPTRPs, respectively.

The number of hauls observed within each management area varied by month and time period (Table 1B – 1H, Table 2A – 2C and Figures 3 and 4). In general, during the 1998 HPTRP, the MAs with the most observed hauls were the Southern New England MA (3623) and Stellwagen Bank (1865), and the areas with the least number of observed hauls were the Western Gulf of Maine Closure Area (150) and Cashes Ledge MA (166). In general, the numbers of average monthly hauls observed peaked in the first part of the year (January – May) in the Cape Cod South Expansion CCA, while the average monthly hauls observed in Coastal Gulf of Maine CCA was nearly year round, with the lowest in April and December (Figure 3).

With the start of the ASM program, the number of observed hauls in all MAs increased. Under the 2010 HPTRP, the Mid-Coast MA (4452) and Stellwagen Bank MA (3917) had the highest numbers of observed hauls, and the Cashes Ledge MA (432) and Cape Cod South MA (928) had the lowest numbers of observed hauls (Table 1). The monthly average numbers of observed hauls in the MAs south of Cape Cod did not increase as much as those MAs north of Cape Cod (Figure 4). In particular, the average numbers observed in the Mid-Coast in the summer (July – September) increased from 100 – 200 per month under the 1998 HPTRP (starting in January 2007) to 800 – 900 observed hauls per month under the 2010 HPTRP (ending in May 2012).

When defining observer coverage as the amount of observed landings (mtons) per amount of landings (mtons) recorded in the VTR data, annual observer coverage ranged from about 2-4% in 2007 – 2009 in the Cape Cod South, Stellwagen Bank, Mid-Coast MAs to over 30% in 2010 – 2011 in the Offshore, Cashes Ledge, and Mid-Coast MAs (Figure 5). For most MAs the observer coverage increased dramatically in 2010 and afterwards due to the ASM program. The annual observer coverage south of Cape Cod (Cape Cod South and Southern New England MAs) had lower annual coverage than the MAs north of Cape Cod.

Compliance

Only a few hauls were observed in the times and areas that were totally closed to gillnets as required by the HPTRPs:

- Cape Cod South MA in March had 3 observed hauls in 1 trip in 2007 with no takes;
- Cashes Ledge MA in February had 12 observed hauls: 2 hauls in 1 trip in 2007 and 10 hauls in 1 trip in 2011 – with no takes;
- Massachusetts Bay in March had 8 observed hauls: 3 hauls in 3 trips in 2007, 1 haul in 1 trip in 2009, 2 hauls in 2 trips in 2011, and 2 hauls in 2 trips in 2012. There were

3 harbor porpoises taken on one of the 2011 hauls, while no harbor porpoises were taken on the rest of these hauls.

However, within the Western Gulf of Maine Closure Area (closed year round to all gillnets since May 1998 as required by a fishery management plan), there were observed fishing during nearly every month, where most of these observed hauls were close to the western border of the closed area (Figure 2). During the 1998 HPTRP time period starting in January 1, 2007, 150 hauls (in 75 trips) were observed from 23 different vessels (Table 1E). During the 2012 HPTRP time period ending 31 May 2012, 1008 hauls (in 448 trips) were observed from 16 different vessels by the NEFOP program and 28 different vessels by the ASM program (some vessels were observed by both programs). Only 1 harbor porpoise was observed taken in the 1998 HPTRP time period, while 12 were observed in the 2010 HPTRP time period – all by the ASM program. Thus the bycatch rate increased in the recent 2010 HPTRP time period (0.012 takes/haul = 0.038 takes/mtons landed) relative to the 1998 HPTRP time period (0.007 takes/haul = 0.016 takes/mtons landed; Table 1E).

Compliance with the HPTRP requirement that the pingers must be functional was not investigated in this paper.

Of the observed hauls that were in times and areas that required pingers during the 1998 HPTRP (starting January 2007) 50% had the correct number of pingers when the net was hauled in, as compared to 67% from the 2010 HPTRP time period (ending May 2012), where this compliance rate was defined as the ratio of the number of observed hauls that hauled in the required number of pingers (one more pinger than the number of nets within the string) to the number of observed hauls in times and areas requiring pingers. On an annual basis for the two time periods 57% was the average of the annual overall compliance rates (Figure 6). Most of the observed hauls in all years (Figure 7) and in all MAs (Figures 8 and 9) had more than 80% of the required number of pingers. The number of observed hauls with no pingers (when pingers were required) decreased each year from 2007 to 2012 (Figure 7). The overall annual compliance rates (Figure 6) for all areas were about the same during 2007 to 2010 (about 50%), then increased during 2011 – 2012, to an overall average of 76% compliant in 2012 (January – May only). The hauls observed in the Offshore MA (Figure 6 and 8) had the lowest annual levels of compliance (average 37%, ranging from 13 – 65%), while the MAs with the highest annual levels of compliance were the Massachusetts Bay MA (average 71%, ranging from 47 – 88%) and Stellwagen Bank (average 71%, ranging from 66 – 77%).

To investigate if non-compliance to the required number of pingers regulation was localized or a more general phenomenon, observed hauls that had $\leq 50\%$ of the required number of pingers during the 2010 HPTRP time period were examined further (this did not include hauls with missing or unknown number of pingers). About 6.5% of the observed hauls during the 2010 HPTRP time period (ending in May 2012) in times/areas where pingers were required had $\leq 50\%$ of the required number of pingers (512 observed hauls (169 trips) out of 7926 observed hauls (1867 trips; Table 3). The hauls with $\leq 50\%$ of the required number of pingers were from 47% of the hull numbers (either the state registration number or the US Coast Guard document number; Table 3). Of these 512 hauls with $\leq 50\%$ of the required number of pingers, 49% were from only nine (9) hull numbers out of 132 unique hull numbers observed during the 2010 HPTRP time period. However, when looking at the history of observing these nine vessels during 1 January 2007 – 31 May 2012 in times/areas that require pingers, 32% of their observed hauls had the correct number of pingers in the 1998 HPTRP period (starting in January 2007), while 64% of their observed hauls had the correct number of pingers in the 2010 HPTRP period (ending in May 2012).

The 512 hauls that had $\leq 50\%$ of the required number of pingers during the 2010 HPTRP time period in times/areas where pingers were required came from 20 of the 31 ports (65%) observed during this time period (Table 3). About two-thirds (66%) of the observed hauls with $\leq 50\%$ of the required number of pingers during the 2010 HPTRP time period in times/areas where pingers were required came from four (4) ports – Gloucester, MA; Portland, ME; Scituate, MA, and New Bedford, MA. However, these four ports also comprise 70% of the observed hauls during the 2010 HPTRP time period in times/areas where pingers were required, so the hauls with $\leq 50\%$ of the required number of pingers seem to fully represent the fishery.

In comparison, during the 1998 HPTRP time period in times and areas when pingers were required, 24% of the observed hauls had $\leq 50\%$ of the required number of pingers which were from 59% of the different hull numbers observed and 84% of the ports that use waters which require pingers (Table 3).

In summary, compliance rates to the number of pingers regulation increased under the 2010 HPTRP (ending in May 2012) as compared to the compliance rates observed under the 1998 HPTRP (starting in January 2007). However, even in the more compliant time period, under the 2010 HPTRP (ending in May 2012), the levels of compliance were still far from perfect; overall only 67% of the observed hauls had the correct number of pingers. It appears that the worst non-compliant hauls ($\leq 50\%$ of the required number of pingers) under the 2010 HPTRP were spread out among ports (65%) and vessels (47%). However, most of these worst non-compliant hauls were concentrated among only nine vessels. That being said, these nine vessels had also been observed to have had the correct number of pingers on other hauls.

General bycatch patterns

Under the 1998 HPTRP, starting in 1 January 2007, there were 2470 trips observed which took 116 harbor porpoises, resulting in observed bycatch rates of 0.013 takes/haul and 0.028 takes/mtons landed (Table 1A). Under the 2010 HPTRP, ending in 31 May 2012, there were 4734 trips observed which took 115 harbor porpoises, resulting in observed bycatch rates of 0.007 takes/haul and 0.020 takes/mtons landed, which are lower bycatch rates than that observed under the 1998 HPTRP (Table 1A).

Within both time periods, 91.8% of the observed hauls that had a harbor porpoise take caught 1 harbor porpoise (190 hauls), 11 hauls caught 2 harbor porpoises (5.3%), 5 hauls caught 3 harbor porpoises (2.4%), and 1 haul caught 4 harbor porpoises (0.5%). This general pattern held during each time period. Under the 1998 HPTRP, the number of hauls with 1, 2, 3, and 4 observed harbor porpoises were 86 (88%), 7 (7%), 4 (4%), and 1 (1%), respectively. Under the 2010 HPTRP, the number of hauls with 1, 2, 3, and 4 observed harbor porpoises were 104 (95%), 4 (4%), 1 (1%), and 0 (0%), respectively.

The majority of the harbor porpoise bycatch was located in two regions: 1) in the Southern New England MA; and 2) just west of the western boundary of the Western Gulf of Maine Closure Area which is in the Stellwagen Bank, Mid-Coast, and northern portion of the Massachusetts Bay MAs. There were smaller concentrations of high bycatch in two other regions: 3) east of Cape Cod; and 4) east of Western Gulf of Maine Closure Area off Maine in the Mid-Coast and Offshore MAs (Figure 2).

Patterns of the landings as recorded in the VTR for each MA are in Figure 10. Maps of the location of VTR trips, observed hauls, and hauls with takes are displayed by month and year in Figures 11 – 22. By the two time periods, the distributions of the numbers of observed

harbor porpoises by MA are displayed in Figures 23 – 24. The average monthly bycatch rates by month and MA are in Tables 4 and 6. The average monthly approximate total bycatch by time period and MA are in Tables 5 and 7 and in Figures 25 – 26. The monthly approximate total bycatch estimates by year and MA are in Figure 27.

In general under both HPTRPs (starting in January 2007) the highest bycatch rates and approximate total bycatch estimates were during about November – May.

In the waters south of Cape Cod, some general patterns include:

- Peak VTR landings were in the summer, May – August, where most of the fishing was in the Cape Cod South Expansion CCA region. The VTR landings increased recently, particularly in 2010 – 2011 during the summer months. The number of trips (and landings) in the southern part of the Southern New England MA appear to have increased over the years, particularly during November – June.
- Most of the observed takes and approximate total bycatch were during the winter and spring months, November – May. Since the implementation of the 2010 HPTRP, the levels of bycatch have in general decreased.

In the waters north of Cape Cod, most of the fishing and harbor porpoise takes centered in Stellwagen Bank, the northern part of Massachusetts Bay, and the southern part of the Mid-Coast MAs (Figure 3). Some general patterns include:

- Under both HPTRPs, in general VTR landings peak during the summer months (June – August) with a secondary smaller peak in the winter (November – February). In general, the Mid-Coast MA had the most landings, with Stellwagen Bank the second most, and the Offshore and Massachusetts Bay MAs with the lower levels of VTR landings. Landings outside all of the MAs have been decreasing over the years.
- In general in the summer (particularly June – July), the observed number of takes, observed bycatch rates, and approximate total bycatch estimates were lower than that from the rest of the year. In general, the approximate total bycatch estimates were lower under the 2010 HPTRP.
- In the Massachusetts Bay MA, VTR landings peaked in summer (June – August) with a secondary peak during November – February. In the 2010 HPTRP time period, VTR landings increased in the summer and decreased in the winter over that seen in the 1998 HPTRP time period. Bycatch was highest in September – March, and none in the summer (May – August). Bycatch in recent years (2009 – 2011) increased slightly during the fall (October – December). Note, the Massachusetts Bay MA is closed to all gillnets in March according to the HPTRPs. Since there were three (3) harbor porpoises taken on one of the four hauls observed in this closed area during the 2010 HPTRP time period the estimated bycatch rate and approximate total bycatch were extremely high, which may not be representative of what really happened.
- In the Mid-Coast MA, VTR landings were lowest during January – May and increased to a peak in July – August. In general in the summer (June – August) VTR landings increased from 2007 to 2012, in contrast to the fall (September – December) where landings in 2010 – 2011 were lower than in previous years. Bycatch in the Mid-Coast MA was nearly year-round, with the least in summer (June – July) under both HPTRPs and the most in the fall (September – November) and spring (March – May) under the 1998 HPTRP. The estimated total bycatch under the 2010 HPTRP

was much lower than under the 1998 HPTRP. Bycatch in the Mid-Coast MA was in general higher than in other MAs north of Cape Cod.

- In Stellwagen Bank MA (which was not managed under the 1998 HPTRP), VTR landings peaked in summer (June – August). VTR landings under the 2010 HPTRP was in general less than that under the 1998 HPTRP. Most of the bycatch in Stellwagen Bank MA was during December – March, with less in the years under the 2010 HPTRP.
- In the Offshore MA during January 2007 – May 2012, only two (2) takes were observed, which were in July and December 2010. There were relatively low levels of VTR landings all year round with a slight peak in summer (June – August); and, in general, VTR landings were similar (with inter-annual variability) during the two HPTRPs.

Bycatch rates (number of observed harbor porpoises per observed mtons landed) of categorizations of many factors are listed in Table 8. Some of the values of factors with high bycatch rates include:

- Time/area factors: months January – May; the year 2009; hauls landing in Massachusetts, Rhode Island and New Hampshire; areas with intermediate steep bottom slopes (0.2 – 0.5); areas that were of intermediate depth (40 – 100 ft); colder sea surface temperature $\leq 5^{\circ}\text{C} = \leq 40^{\circ}\text{F}$; south of Cape Cod particularly under the 1998 HPTRP;
- Fishing practice factors: hauls targeting monkfish, yellowtail flounder, haddock, cod and unknown groundfish; strings with major damage to the nets; longer soak durations (> 60 hrs); when observed by the NEFOP program;
- Gear characteristic factors: hang ratios ≥ 0.5 ; twine sizes of 0.57 – 0.62 mm; longer string lengths (>5000 ft); and using droplines under the 1998 HPTRP.

The three Consequence Closure Areas encompassed the areas with most of the observed takes. Over the entire time period (1 January 2007 – 31 May 2012), 45% of the observed takes were in the Coastal Gulf of Maine CCA, 32% in the Cape Cod South Expansion CCA, 6% in the Eastern Cape Cod CCA, and 17% outside of these CCA (Table 2 versus Table 1A). Looking only at the 2010 HPTRP time period (ending May 2012), the approximate total bycatch in the Coastal Gulf of Maine CCA was slightly more than the Cape Cod South Expansion CCA, with only a few estimated bycatch in the Eastern Cape Cod CCA, 77.4, 69.2, 1.6, respectively (Table 7). For all three CCAs, the approximate total bycatch from the 1998 HPTRP time period (starting January 2007) was more than double that from the 2010 HPTRP time period (ending May 2012; Tables 5 and 7).

When looking at only the Coastal Gulf of Maine CCA and comparing the activities in October and November with those in February and March, the observed bycatch rates before 2008 were similar (Figure 28). However, from 2008 – 2011, the observed bycatch rates in February/March were higher than those observed in October/November; where most of the difference was in 2008 and 2009. When comparing the approximate total bycatch estimate for this area in October/November to that in February/March, the approximate total bycatch estimates in October/November were generally higher or about equal before 2006, about equal in 2006 and 2007, much lower in 2008, and lower in two of the three years during 2009 - 2011 (Figure 28).

The Generalized Additive Model (GAM) that best predicted the bycatch rate patterns in the New England region included the following factors (in order of importance): Julian day of the year, bottom depth at location of haul (in fathoms), surface water temperature at location of haul (°C), which management area the haul was in, duration the string was in the water (soak duration; hrs), and twine size (mm) (Table 9). Figure 29 indicates the values of each factor (x-axis) that had higher than average bycatch rates, where y=0 represents an average bycatch rate and y-values greater than zero (above the horizontal line) represents higher than average bycatch rates.

One way to interpret this model is that time and area (Julian day of the year and bottom depth at the location of the haul) best explains the bycatch rates patterns that result for fishing under the regulations from the two HPTRPs, where springtime and depths ranging from about 50 – 100 fathoms had the highest bycatch rates. Note, bycatch in other times and areas could be low due to the HPTRP regulations. The next two factors brought into the model, surface water temperature and management areas, appears to help explain variability between years and within the New England region, where hauls fished in colder waters and in the Mid-Coast MA had a highest bycatch rate. Only after time and area factors were brought in the model did fishing practice factors start to be included: soak duration and twine size. Hauls with higher than average bycatch rates were those that had soak durations greater than about 48 hrs had and hauls with twine sizes that were very small (< 0.4 mm which may help distinguish the handful of haul targeting lobsters) or were about 0.6 – 0.7 mm.

Bycatch rates of pingered strings

As background, using data from 1 January 1999 – 31 May 2007, bycatch rates of strings that had varying levels of compliance were discussed in detail in Palka et al. (2008b). For example, during this time period, in the Mid-Coast MA during times pingers were required, the harbor porpoise bycatch rate of hauls without any pingers was 0.017 harbor porpoises/haul. In the same time and area, the bycatch rate of hauls with all of the required number of pingers was 0.008 harbor porpoises/haul; that is less than half the rate of hauls without pingers. The bycatch rates of hauls with 90% or more and 80% or more of the required number of pingers were 0.011 and 0.014 harbor porpoises/haul, respectively. The same pattern was observed if the bycatch rate was defined as harbor porpoises/mtons landed, when looking only at the fall (September – December) or only the winter (January – May) and when data from all Gulf of Maine HPTRP management areas were pooled. Note, this is just related to the number of pingers on the string, and not related to whether the pingers are working or not.

Investigating the more recently collected observer data under the 1998 HPTRP (starting in January 2007), the overall bycatch rate of hauls with all of the required number of pingers (0.005 harbor porpoises/haul = 0.045 takes/mtons landed) was less than half that of hauls with none of the required number of pingers (0.015 harbor porpoises/haul = 0.018 takes/mtons landed; Table 10). Note these bycatch rates are similar to those observed during 1 January 1999 – 31 May 2007. Under the 2010 HPTRP (ending in May 2010) the overall bycatch rate for hauls without pingers (0.015 takes/haul = 0.047 takes/mtons) was nearly the same as hauls without pingers under the 1998 HPTRP. However, the bycatch rate of hauls with the required number of pingers under the 2010 HPTRP (0.011 takes/haul = 0.043 takes/mtons landed) was nearly the same as that without pingers (0.015 takes/haul = 0.047 takes/mtons landed). It appears the high bycatch rates of hauls with the required number of pingers under the 2010 HPTRP was concentrated in both the Mid-Coast and Stellwagen Bank MAs, the reason for this is unknown.

In an attempt to find characteristics of hauls that explain the bycatch rate patterns in hauls that were in times and areas that required pingers, stepwise GAMs were used to fit the bycatch rate data collected by NEFOP only during the times and areas pingers were required. The variables that statistically explained the bycatch rate patterns were similar to those in the GAM for all times and areas. These variables included (in order of importance): water depth (in fathoms), Julian day of the year, twine size (in mm), length of tie downs (in ft), total length of the string (in ft), and which MA the haul was located in (Table 11). The two most important factors explaining the bycatch rate patterns of hauls in the times and areas that require pingers were the same as when examining all hauls (bottom depth and Julian day of the year), which seems to define the times and areas with the highest levels of interaction (Figure 30). The next couple factors in the model were gear characteristics, twine size, length of the tie down, and total length of the string, though they did not explain much of the variability in the bycatch rate patterns, at least compared to the time and area first two factors. Hauls with higher than average bycatch rates had small twine sizes (<0.4 mm), either short (<3 ft) or long (>5 ft) tie down lengths, and long string lengths (>6000 ft). Fishing characteristics related to pingers were not chosen in the GAM model. More work is needed to more fully explore how these fishing gear characteristics relate to the bycatch rates.

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Table 1. Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for all management areas (MAs) and each area separately. The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

A. All management areas

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	2690	2235	1934	2160 (1437)	9019 (1437)	4554 (3618)	9251 (6412)	2919 (1871)	16,724 (11,901)
Total observed trips (ASM only)	672	541	590	667 (457)	2470 (457)	1470 (1054)	2547 (1546)	717 (370)	4734 (2970)
Unique NEFOP vessels (Unique ASM vessels)	165	149	144	90 (53)	216 (53)	78 (83)	126 (98)	52 (60)	148 (114)
Total observed takes (ASM only)	35	30	33	18 (6)	116 (6)	31 (28)	66 (45)	18 (10)	115 (83)
Bycatch rate (takes/hauls)	0.013	0.013	0.017	0.008	0.013	0.007	0.007	0.006	0.007
Bycatch rate (takes/landings)	0.031	0.036	0.054	0.012	0.028	0.020	0.018	0.024	0.020

B. Massachusetts Bay management area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	188	177	202	25	592	357 (260)	594 (311)	279 (160)	1230 (731)
Total observed trips (ASM only)	67	69	91	11	238	175 (134)	253 (150)	117 (63)	545 (347)
Unique NEFOP vessels (Unique ASM vessels)	29	23	32	9	41	17 (26)	30 (23)	12 (14)	36 (35)
Total observed takes (ASM only)	0	2	3	0	5	2 (2)	5 (1)	2 (1)	9 (4)
Bycatch rate (takes/hauls)	0	0.011	0.015	0	0.008	0.006	0.008	0.007	0.007
Bycatch rate (takes/landings)	0	0.071	0.081	0	0.055	0.015	0.027	0.079	0.026

Table 1 (cont.). Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for all management areas (MAs) and each area separately. The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

C. Mid Coast management area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	398	398	366	19	1181	1766 (1560)	2496 (1905)	190 (97)	4452 (3562)
Total observed trips (ASM only)	119	125	130	7	381	619 (539)	751 (588)	60 (32)	1430 (1159)
Unique NEFOP vessels (Unique ASM vessels)	48	49	56	5	80	28 (50)	46 (49)	13 (14)	57 (63)
Total observed takes (ASM only)	2	6	8	0	16	18 (15)	19 (15)	2 (0)	39 (30)
Bycatch rate (takes/hauls)	0.005	0.015	0.022	0	0.014	0.010	0.008	0.011	0.009
Bycatch rate (takes/landings)	0.015	0.049	0.067	0	0.042	0.030	0.023	0.090	0.027

D. Stellwagen Bank management area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	274	307	436	848 (599)	1865 (599)	511 (386)	2210 (1402)	1196 (715)	3917 (2503)
Total observed trips (ASM only)	75	83	167	323 (232)	648 (232)	184 (142)	589 (370)	286 (172)	1059 (684)
Unique NEFOP vessels (Unique ASM vessels)	31	29	44	37 (32)	58 (32)	13 (23)	31 (30)	17 (16)	35 (36)
Total observed takes (ASM only)	1	6	11	0	18	2 (2)	21 (9)	7 (5)	30 (16)
Bycatch rate (takes/hauls)	0.004	0.020	0.025	0	0.010	0.004	0.010	0.006	0.010
Bycatch rate (takes/landings)	0.033	0.132	0.157	0	0.038	0.016	0.047	0.068	0.045

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Table 1 (cont.). Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for all management areas (MAs) and each area separately. The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

E. Western Gulf of Maine closure area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	60	31	59	0	150	313 (289)	566 (471)	129 (99)	1008 (859)
Total observed trips (ASM only)	30	14	31	0	75	152 (138)	237 (197)	59 (47)	448 (382)
Unique NEFOP vessels (Unique ASM vessels)	16	8	16	0	23	7 (20)	11 (24)	4 (9)	16 (28)
Total observed takes (ASM only)	0	1	0	0	1	6 (6)	5 (5)	1 (1)	12 (12)
Bycatch rate (takes/hauls)	0	0.032	0	0	0.007	0.019	0.009	0.008	0.012
Bycatch rate (takes/landings)	0	0.076	0	0	0.016	0.052	0.027	0.085	0.038

F. Offshore management area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	193	272	163	40	668	443 (273)	698 (441)	183 (95)	1324 (809)
Total observed trips (ASM only)	18	20	15	6	59	30 (21)	51 (30)	14 (9)	95 (60)
Unique NEFOP vessels (Unique ASM vessels)	11	10	10	3	19	5 (7)	10 (11)	4 (4)	13 (12)
Total observed takes (ASM only)	0	0	0	0	0	2 (2)	0	0	2 (2)
Bycatch rate (takes/hauls)	0	0	0	0	0	0.005	0	0	0.002
Bycatch rate (takes/landings)	0	0	0	0	0	0.012	0	0	0.004

Table 1 (cont.). Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for all management areas (MAs) and each area separately. The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

G. Cashes Ledge management area (overlaps the Offshore management area)

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	27	83	37	19	166	127 (83)	243 (167)	62 (36)	432 (286)
Total observed trips (ASM only)	7	8	3	3	21	17 (12)	20 (12)	7 (5)	44 (29)
Unique NEFOP vessels (Unique ASM vessels)	4	5	3	2	10	8 (5)	8 (7)	3 (2)	7 (9)
Total observed takes (ASM only)	0	0	0	0	0	0	0	0	0
Bycatch rate (takes/hauls)	0	0	0	0	0	0	0	0	0
Bycatch rate (takes/landings)	0	0	0	0	0	0	0	0	0

I. Cape Cod South management area (overlaps the Southern New England management area)

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	378	232	168	221 (155)	999 (155)	102 (47)	557 (334)	269 (234)	928 (615)
Total observed trips (ASM only)	105	59	37	53 (31)	254 (31)	19 (7)	126 (75)	75 (64)	220 (146)
Unique NEFOP vessels (Unique ASM vessels)	43	24	17	24 (11)	53 (11)	9 (3)	34 (19)	26 (22)	32 (30)
Total observed takes (ASM only)	11	0	0	2 (1)	13 (1)	0	5 (5)	3 (2)	8 (7)
Bycatch rate (takes/hauls)	0.029	0	0	0.009	0.013	0	0.009	0.011	0.009
Bycatch rate (takes/landings)	0.125	0	0	0.011	0.033	0	0.017	0.014	0.016

Table 1 (cont.). Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for all management areas (MAs) and each area separately. The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

J. Southern New England management area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	1123	771	516	1213 (838)	3623 (838)	520 (368)	2193 (1605)	814 (641)	3527 (2614)
Total observed trips (ASM only)	278	172	119	318 (226)	887 (226)	175 (143)	564 (422)	159 (126)	898 (691)
Unique NEFOP vessels (Unique ASM vessels)	91	69	54	49 (27)	116 (27)	16 (18)	54 (40)	24 (35)	68 (54)
Total observed takes (ASM only)	30	15	11	18 (6)	74 (6)	1 (1)	16 (15)	6 (3)	23 (19)
Bycatch rate (takes/hauls)	0.027	0.019	0.021	0.015	0.02	0.002	0.007	0.007	0.007
Bycatch rate (takes/landings)	0.054	0.042	0.050	0.015	0.032	0.007	0.011	0.012	0.011

H. Outside management areas

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	454	279	192	15	940	644 (482)	494 (276)	128 (64)	1266 (822)
Total observed trips (ASM only)	85	58	37	2	182	135 (95)	102 (65)	22 (14)	259 (174)
Unique NEFOP vessels (Unique ASM vessels)	41	34	22	2	56	20 (24)	23 (25)	6 (11)	35 (43)
Total observed takes (ASM only)	2	0	0	0	2	0	0	0	0
Bycatch rate (takes/hauls)	0.004	0	0	0	0.002	0	0	0	0
Bycatch rate (takes/landings)	0.008	0	0	0	0.004	0	0	0	0

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Table 2. Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for the three Consequence Closure Areas (CCAs). The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. Each CCA overlaps with one or more management areas (see Figure 1C). The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

A. Coastal Gulf of Maine Consequence Closure Area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	741	756	877	887 (599)	2374 (599)	2117 (1764)	4488 (3031)	1587 (952)	8192 (5747)
Total observed trips (ASM only)	217	225	322	337 (232)	1101 (232)	800 (666)	1268 (878)	360 (214)	2428 (1758)
Unique NEFOP vessels (Unique ASM vessels)	64	64	76	51 (32)	96 (32)	58 (55)	67 (55)	30 (23)	73 (66)
Total observed takes (ASM only)	3	12	21	0	36	20 (19)	37 (18)	11 (6)	68 (43)
Bycatch rate (takes/hauls)	0.004	0.016	0.024	0	0.011	0.009	0.008	0.007	0.008
Bycatch rate (takes/landings)	0.019	0.076	0.116	0	0.043	0.03	0.032	0.078	0.035

B. Cape Cod South Expansion Consequence Closure Area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	540	412	278	375 (191)	1605 (191)	134 (58)	1039 (702)	640 (503)	1813 (1263)
Total observed trips (ASM only)	150	97	62	79 (37)	388 (37)	22 (8)	207 (133)	134 (107)	363 (248)
Unique NEFOP vessels (Unique ASM vessels)	66	50	33	38 (12)	87 (12)	9 (3)	48 (31)	39 (31)	50 (41)
Total observed takes (ASM only)	25	12	8	9 (2)	54 (2)	0	15 (14)	5 (3)	20 (17)
Bycatch rate (takes/hauls)	0.046	0.029	0.029	0.024	0.034	0	0.014	0.008	0.011
Bycatch rate (takes/landings)	0.112	0.085	0.059	0.031	0.068	0	0.032	0.013	0.022

Table 2. Statistics on the bycatch of harbor porpoises (*Phocoena phocoena*) in the New England region from 1 January 2007 – 31 May 2012 are described for the three Consequence Closure Areas (CCAs). The total unique vessels for a time period is the number of unique vessels observed one or more times during the time period. Thus the total for the time period will not be the sum of the number of unique vessels for each individual year within a time period. Hauls are represented more than once in overlapping MAs. Each CCA overlaps with one or more management areas (see Figure 1C). The date separating the 1998 harbor porpoise take reduction plan (HPTRP) and 2010 HPTRP is 1 April 2010 for all MAs except the Southern New England and Stellwagen MAs, which is 15 September 2010.

C. Eastern Cape Cod Consequence Closure Area

	Time Period / Year								
	1998 HPTRP					2010 HPTRP			
	2007	2008	2009	2010	Total	2010	2011	≤5/2012	Total
Total observed hauls (ASM only)	184	124	105	183 (143)	596 (143)	281 (219)	614 (496)	11 (4)	906 (719)
Total observed trips (ASM only)	39	28	28	75 (62)	170 (62)	107 (93)	208 (174)	4 (2)	319 (269)
Unique NEFOP vessels (Unique ASM vessels)	16	15	14	18 (14)	28 (14)	16 (14)	18 (15)	4 (2)	19 (21)
Total observed takes (ASM only)	0	3	2	8 (4)	13 (4)	1 (1)	0	0	1 (1)
Bycatch rate (takes/hauls)	0	0.024	0.019	0.022	0.022	0.004	0	0	0.001
Bycatch rate (takes/landings)	0	0.114	0.071	0.047	0.049	0.013	0	0	0.002

Table 3. Comparison of the percents of hauls, trips, hull numbers and ports that were associated with observed hauls that had $\leq 50\%$ of the required number of pingers in times and areas which required pingers during the times when the 1998 harbor porpoise take reduction plan (HPTRP) was in effect versus when the 2010 HPTRP was in effect. The number of hauls (trips, hull numbers or ports) that had $\leq 50\%$ of the required number of pingers and the total number of hauls (trips, hull numbers or ports) in the time period that were in times and areas which required pingers are also reported.

Time period	Hauls		Trips	
	%	number $\leq 50\%$ / number all	%	number $\leq 50\%$ / number all
1998 HPTRP	24	535/2228	25	151/602
2010 HPTRP	6.5	512/7926	9.1	169/1867

Time period	Hull numbers		Ports	
	%	number $\leq 50\%$ / number all	%	number $\leq 50\%$ / number all
1998 HPTRP	59	81/138	84	21/25
2010 HPTRP	47	62/132	65	20/31

Table 4. Monthly bycatch rate (takes/mtons landed) 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.

Bycatch rates during 1998 HPTRP

Month	Cape Cod South	Southern New England ¹	Cashes Ledge	MassBay	Mid-Coast	Off shore	Stellwagen ¹	Western GOM	Out side	Cape Cod South-CCA ¹	Coastal GOM-CCA ¹	Eastern Cape Cod-CCA ¹	Total Area ²
Jan	0.104	0.118	0.000	0.046	0.032	0.000	0.081	0.000	0.000	0.109	0.046	0.180	0.068
Feb	0.528	0.149	0.000	0.243	0.444	0.000	0.117	0.382	0.000	0.184	0.146	0.000	0.112
Mar	0.000	0.126	0.000	0.000	1.094	0.000	0.369	0.000	0.000	0.146	0.477	0.000	0.134
Apr	0.000	0.030	0.000	0.000	0.295	0.000	0.000	0.000	0.045	0.039	0.590	0.000	0.034
May	0.011	0.080	0.000	0.000	0.428	0.000	0.000	0.000	0.000	0.046	0.000	0.976	0.058
Jun	0.012	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.002
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.009	0.000	0.002
Aug	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.001
Sep	0.000	0.000	0.000	0.034	0.053	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.012
Oct	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.046	0.000	0.007
Nov	0.000	0.014	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.038	0.062	0.016
Dec	0.000	0.030	0.000	0.074	0.018	0.000	0.000	0.000	0.000	0.000	0.032	0.137	0.017
Total	0.033	0.032	0.000	0.055	0.042	0.000	0.038	0.016	0.004	0.068	0.043	0.049	0.028

¹ Was not a managed area under the 1998 HPTRP.

² Bycatch rates in the “Total Area” were 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 5. 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	Stellwagen 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 6. Monthly bycatch rate (takes/mtons landed) 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.

Bycatch rates during 2010 HPTRP

Month	Cape Cod South	Southern New England	Cashes Ledge	Mass Bay	Mid Coast	Off shore	Stellwagen	Western GOM	Out side	Cape Cod South-CCA	Coastal GOM-CCA	Eastern Cape Cod-CCA	Total Area ²
Jan	0.032	0.062	0.000	0.000	0.180	0.000	0.078	0.059	0.000	0.055	0.081	0.000	0.062
Feb	0.000	0.118	0.000	0.144	0.517	0.000	0.086	0.229	0.000	0.118	0.113	0.000	0.095
Mar	0.000	0.012	0.000	12.417 ¹	0.336	0.000	0.136	0.125	0.000	0.013	0.193	0.000	0.087
Apr	0.098	0.013	0.000	0.000	0.328	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.031
May	0.020	0.009	0.000	0.000	0.309	0.000	0.013	0.212	0.000	0.013	0.011	0.000	0.014
Jun	0.000	0.000	0.000	0.000	0.014	0.000	0.026	0.000	0.000	0.000	0.013	0.000	0.006
Jul	0.000	0.000	0.000	0.000	0.003	0.020	0.000	0.000	0.000	0.000	0.003	0.000	0.002
Aug	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.005
Sep	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.047	0.000	0.000	0.018	0.000	0.005
Oct	0.000	0.005	0.000	0.136	0.050	0.000	0.010	0.046	0.000	0.000	0.045	0.015	0.021
Nov	0.000	0.000	0.000	0.024	0.033	0.000	0.012	0.044	0.000	0.000	0.029	0.000	0.016
Dec	0.041	0.026	0.000	0.028	0.030	0.034	0.066	0.000	0.000	0.037	0.046	0.000	0.030
Total	0.016	0.011	0.000	0.026	0.027	0.004	0.045	0.038	0.00	0.022	0.035	0.002	0.020

¹ Calculated from only four observed hauls where three harbor porpoises were taken on one haul.

² Bycatch rates from 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 7. 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	Stellwagen	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	60.7 ¹	2.7	0.0	9.1	2.2	0	3.3	14.9	0.0	78.1
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	67.8 ¹	43.8	2.4	38.8	37.3	0.0	69.2	77.4	1.6	263.2

¹ Calculated from only four observed hauls where three harbor porpoises were taken on one haul. Average annual approximate total bycatch for the Massachusetts Bay MA without the March takes was 7.2 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.

Table 8. Bycatch rates (Byc rate in takes/mtons landed) of factors, during the two time periods. Bycatch rates ≥ 0.04 takes/mtons landed are shaded. * indicates cell has <100 observed hauls.

Categories	1998 HPTRP		2010 HPTRP		Categories	1998 HPTRP		2010 HPTRP	
	Num hauls	Byc Rate	Num hauls	Byc Rate		Num hauls	Byc Rate	Num hauls	Byc Rate
MONTH					STATE				
Jan	759	0.068	1187	0.062	CT	44*	0.044	143	0.077
Feb	741	0.112	1232	0.095	MA	6785	0.031	11400	0.017
Mar	716	0.134	902	0.087	ME	514	0.007	2360	0.017
Apr	509	0.034	672	0.031	NH	605	0.029	2141	0.028
May	972	0.058	1618	0.014	NJ	10*	0.000	0*	0.000
Jun	606	0.002	1265	0.006	NY	310	0.000	220	0.018
Jul	1004	0.002	1857	0.002	RI	747	0.020	468	0.024
Aug	1029	0.001	1835	0.005	VA	4*	0.000	0*	0.000
Sep	871	0.012	1758	0.005	GEAR CONDITION				
Oct	761	0.007	1592	0.021	none	6837	0.023	13693	0.019
Nov	617	0.016	1440	0.016	<25% ¹	1422	0.040	1941	0.012
Dec	434	0.017	1374	0.030	<50% ²	459	0.020	775	0.045
YEAR					object in net	35*	0.126	44*	0.000
2007	2690	0.031	NA	NA	>50% ³	92*	0.200	120	0.032
2008	2235	0.036	NA	NA	balled up	67*	0.046	32*	0.000
2009	1934	0.054	NA	NA	unknown	107	0.000	127	0.000
2010	2160	0.012	4554	0.020	USED TIED DOWNS				
2011	NA	NA	9255	0.018	no	5474	0.025	12083	0.020
2012	NA	NA	2923	0.024	on all nets	3487	0.030	4624	0.018
TARGET SPECIES					on some nets	58*	0.059	20*	0.000
Am. lobster	17*	3.211	33*	0.000	unknown	0*	0.000	5*	0.000
Atl cod	2969	0.037	5840	0.039	DROPLINES USED?				
Atl. bonito	40*	0.000	28*	0.000	No	7554	0.037	32*	0.000
Redfish	45*	0.000	10*	0.000	Yes	20*	0.104	9*	0.000
dogfish	294	0.007	888	0.006	unknown	8*	0.000	NA	0.000
haddock	27*	0.179	170	0.148	HANG RATIO				
monkfish	1796	0.066	2898	0.025	Unknown	1552	0.010	11965	0.019
other	287	0.000	68*	0.000	≤ 0.25	28*	0.047	0*	0.000
other flounder	207	0.000	244	0.000	0.33	1897	0.026	411	0.006
other hakes	1*	0.000	36*	0.000	-0.4	24*	0.061	3*	0.000
other skates	175	0.015	84*	0.000	≥ 0.5	5518	0.040	4353	0.025
pollock	769	0.005	2609	0.010	Footnotes:				
striped bass	42*	0.000	57*	0.000	¹ Small number of tears, < 25% of any net				
unk groundfish	664	0.036	1620	0.021	² < 50% of the meshes torn				
white hake	68*	0.000	247	0.000	³ $\geq 50\%$ of the meshes torn				
winter flounder	197	0.000	55*	0.000					
winter skate	1219	0.010	1044	0.004					
yellowtail									
flounder	202*	0.049	801	0.080					

This information is distributed solely to inform discussions of the 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.

Table 8 (cont). Bycatch rates (Byc rate in takes/mtons landed) of factors, during the two time periods. Bycatch rates ≥ 0.04 takes/mtons landed are shaded. * indicates cell has <100 observed hauls.

Categories	1998 HPTRP		2010 HPTRP		Categories	1998 HPTRP		2010 HPTRP	
	Num hauls	Byc Rate	Num hauls	Byc Rate		Num hauls	Byc Rate	Num hauls	Byc Rate
OBSERVER PROGRAM					LENGTH OF TIE DOWNS (ft)				
ASM	1437	0.005	11904	0.018	< 2.5	270	0.060	1378	0.014
NEFOP	7582	0.037	4828	0.023	2.5+ thru 3.0	1357	0.038	433	0.036
AREA					3.0+ thru 3.5	456	0.042	2330	0.017
GOM	6490	0.020	14393	0.020	3.5+ thru 4.0	1040	0.017	132	0.000
SNE	2529	0.044	2339	0.019	4.0+ thru 5.0	154	0.020	77*	0.074
NUMBER OF SPACES					> 5.0	176	0.051	0*	0.000
Unknown	5861	0.024	15464	0.019	BOTTOM SLOPE				
0+ thru 5	721	0.053	143	0.000	0.0+ thru 0.1	2736	0.030	3603	0.021
5+ thru 10	1328	0.034	670	0.057	0.1+ thru 0.2	2502	0.019	4426	0.015
10+ thru 15	658	0.042	258	0.040	0.2+ thru 0.3	2213	0.025	4941	0.027
15+ thru 20	236	0.044	98*	0.000	0.3+ thru 0.4	1087	0.041	2246	0.021
20+ thru 40	215	0.024	99*	0.000	0.4+ thru 0.5	217	0.041	789	0.008
TWINE SIZE (mm)					0.5+ thru 2.0	178	0.033	617	0.012
<=0.52	551	0.106	790	0.011	BOTTOM DEPTH (ft)				
0.57	1164	0.051	2099	0.031	< 20	334	0.000	2319	0.004
0.62	2955	0.031	156	0.126	20+ thru 40	2390	0.001	4252	0.030
0.66	390	0.026	164	0.000	40+ thru 60	2263	0.037	3231	0.045
0.7	224	0.009	136	0.024	60+ thru 80	1549	0.078	1863	0.027
0.81	229	0.023	703	0.006	80+ thru 100	766	0.100	2979	0.011
>=0.9	1606	0.033	0*	0.000	100+ thru 150	825	0.030	1726	0.004
SHIP'S GROSS TONS					150+ thru 200	675	0.000	194	0.000
0+ thru 20	712	0.048	NA	NA	> 200	217	0.000	0*	0.000
20+ thru 40	470	0.046	NA	NA	TOTAL LENGTH OF STRING (ft)				
40+ thru 60	139	0.028	NA	NA	0+ thru 1000	315	0.000	1517	0.029
60+ thru 120	151	0.000	NA	NA	1000+ th 2000	1345	0.034	6635	0.025
AVERAGE MESH SIZE (in)					2000+ th 3000	2545	0.027	2013	0.043
2.0+ thru 6.0	326	0.000	272	0.031	3000+ th 4000	1717	0.024	3630	0.015
6.0+ thru 6.5	2799	0.025	7509	0.017	4000+ th 5000	1820	0.023	1712	0.001
6.5+ thru 7.0	2034	0.030	4038	0.038	5000+ th 6000	547	0.079	545	0.005
7.0+ thru 8.0	624	0.013	725	0.032	6000+ th 7000	424	0.022	459	0.013
8.0+ thru 11.9	334	0.076	652	0.031	7000+ th 16000	278	0.014	0*	0.000
11.9+ to 14.0	2902	0.028	3536	0.012					

Table 8 (cont). Bycatch rates (Byc rate in takes/mtons landed) of factors, during the two time periods. Bycatch rates ≥ 0.04 takes/mtons landed are shaded. * indicates cell has <100 observed hauls.

Categories	1998 HPTRP		2010 HPTRP		Categories	1998 HPTRP		2010 HPTRP	
	Num hauls	Byc Rate	Num hauls	Byc Rate		Num hauls	Byc Rate	Num hauls	Byc Rate
NET HEIGHT (ft)					SEDIMENT TYPES¹				
< 6.0	116	0.000	531	0.033	br	99*	0.000	27*	0.000
5.9+ thru 6.0	460	0.038	360	0.000	cl-st/sd	949	0.058	1524	0.018
6.0+ thru 7.0	78*	0.215	1149	0.010	gr	288	0.033	510	0.025
7.0+ thru 8.0	682	0.039	685	0.017	gr-sd	1124	0.026	1697	0.050
8.0+ thru 9.0	399	0.021	4053	0.015	sd	4452	0.014	6035	0.014
9.0+ thru 10.0	1973	0.016	617	0.026	sd-cl/st	405	0.147	951	0.015
10.0+ thru 11.0	532	0.042	6092	0.017	sd-st/cl	741	0.032	2753	0.020
11.0+ thr 12.0	2291	0.030	523	0.009	sd/st/cl	947	0.006	2163	0.014
12.0+ thr 13.0	325	0.026	593	0.009	SOAK DURATION (hrs)				
13.0+ thr 14.0	206	0.011	663	0.085	< 12	570	0.007	903	0.003
>= 14	334	0.022	0*	0.000	12+ thru 18	501	0.005	8528	0.018
					18+ thru 24	3548	0.009	298	0.000
					24+ thru 36	189	0.007	2309	0.024
					36+ thru 60	1350	0.018	2903	0.024
					60+ thr 120	2198	0.041	816	0.038
					120+ thr 240	596	0.098	112	0.105
					> 240	55*	0.159	0*	0.000

¹ cl=clay; sd=sand, gr=gravel, st=silt.

Table 9. Models of the bycatch rates of harbor porpoises (*Phocoena phocoena*) in the New England region using only the NEFOP data collected during 1 January 2007 – 31 May 2012. The fourth column is the difference in the Akaike Information Criterion (AIC) from the row above, the larger the difference the more that factor contributed to explaining the bycatch rate patterns. The lower the AIC the better the model fits.

All of New England region

Model number	Factors	AIC	Difference from above	% difference
1	None	1559	0	-
2	Julian day of the year	1403	156	10.0
3	Above + Bottom depth	1277	126	9.0
4	Above + Surface water temperature	1260	17	1.3
5	Above + Management Areas ¹	1244	16	1.3
6	Above + Soak duration	1233	11	0.9
7	Above + Twine size	1223	10	0.8

¹Management areas include Massachusetts Bay, Mid-Coast, Offshore, Southern New England, Stellwagen Bank, Western Gulf of Maine, and outside the other areas.

Table 10. 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									
Amount of pingers	Mass Bay			MidCoast			Offshore		
	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
Amount of pingers	Southern New England			Stellwagen Bank			Overall		
	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									
Amount of pingers	Mass Bay			MidCoast			Offshore		
	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
Amount of pingers	Southern New England			Stellwagen Bank			Overall		
	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 11. Models of the bycatch rates of harbor porpoises (*Phocoena phocoena*) in the New England region using only the NEFOP data that were in times and areas that required pingers during 1 January 2007 – 31 May 2012. The fourth column is the difference in the Akaike Information Criterion (AIC) from the row above, the larger the difference the more that factor contributed to explaining the bycatch rate patterns. The lower the AIC the better the model fits.

Only times and areas that require pingers

Model number	Factors	AIC	Difference from above	% difference
1	None	657	0	-
2	Depth	605	52	7.9
3	Above + Julian day of the year	570	35	5.8
4	Above + Twine size	547	23	4.0
5	Above + length of tie downs	535	12	2.2
6	Above + String length	525	10	1.9
7	Above + Management area ¹	516	9	1.7

¹Management areas include Massachusetts Bay, Mid-Coast, Offshore, Southern New England, Stellwagen Bank, Western Gulf of Maine, and outside the other areas.

Figure 1A. Management areas in the New England region under the 1998 harbor porpoise take reduction plan and times and areas that were closed to all gillnets and that required the use of pingers.

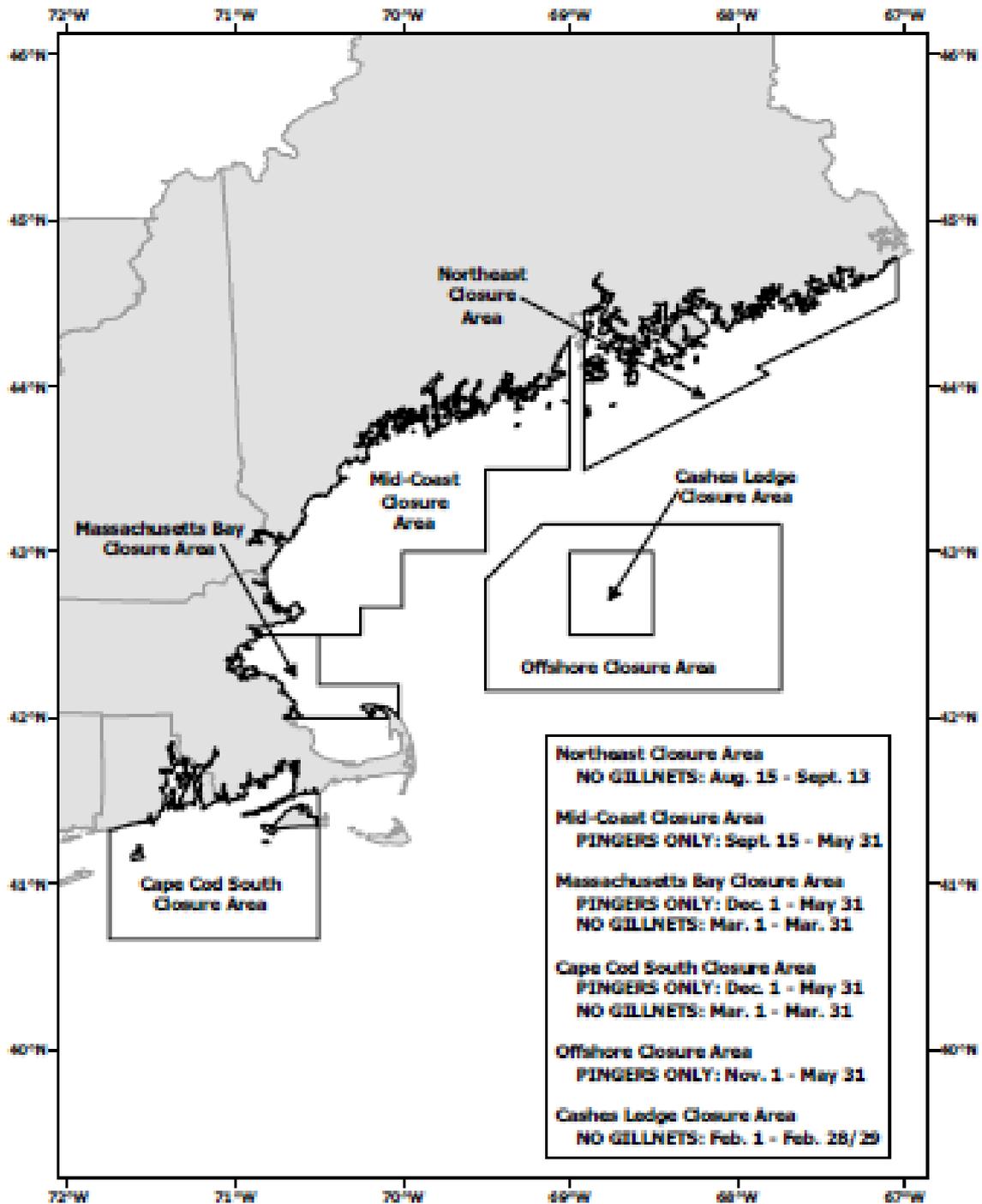


Figure 1B. Management areas in the New England region under the 2010 harbor porpoise take reduction plan and times and areas that are closed to all gillnets and that require the use of pingers.

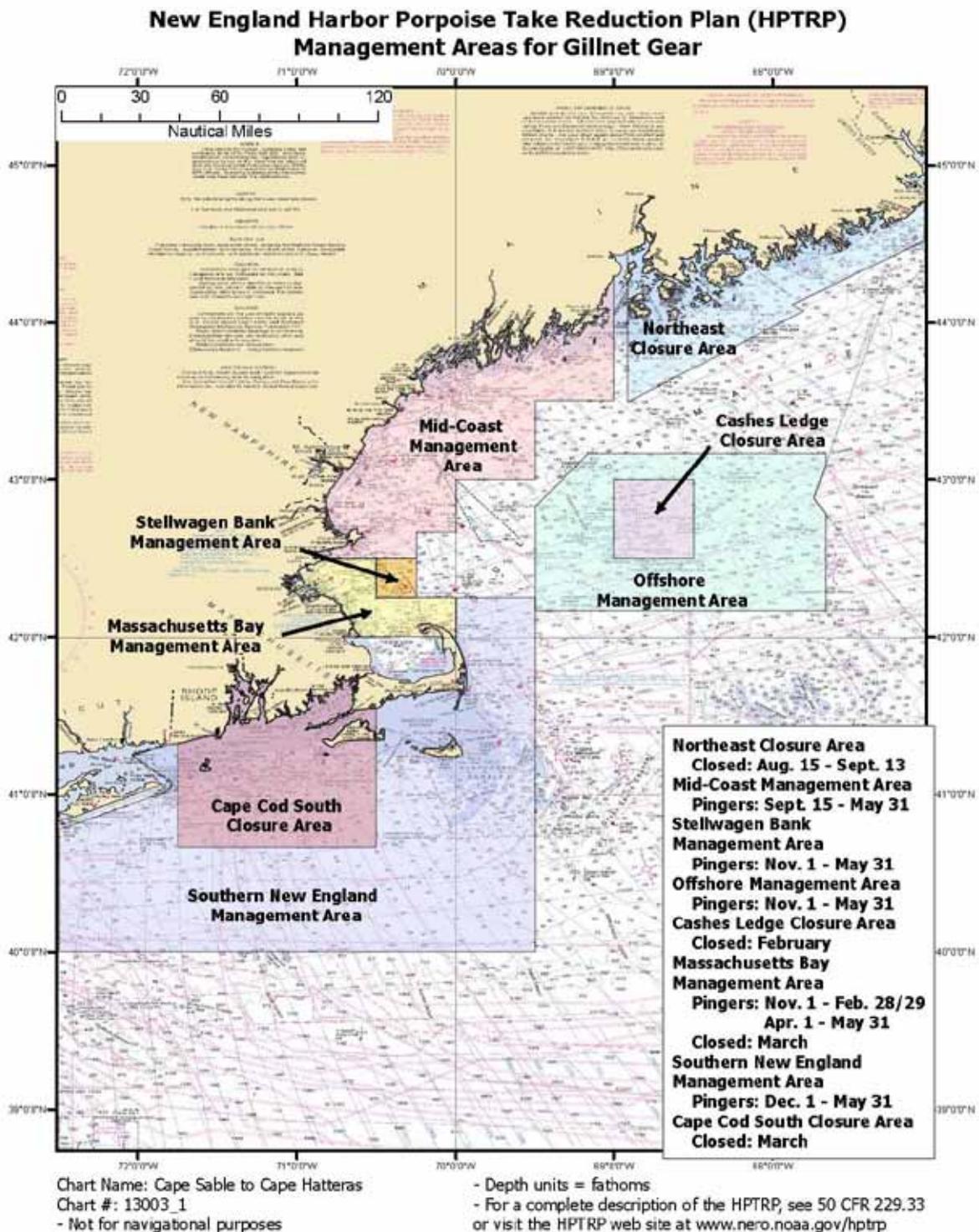


Figure 1C. Consequence Closure Areas in the New England region under the 2010 harbor porpoise take reduction plan and times they would be closed only if a specific harbor porpoise bycatch rate is exceeded.

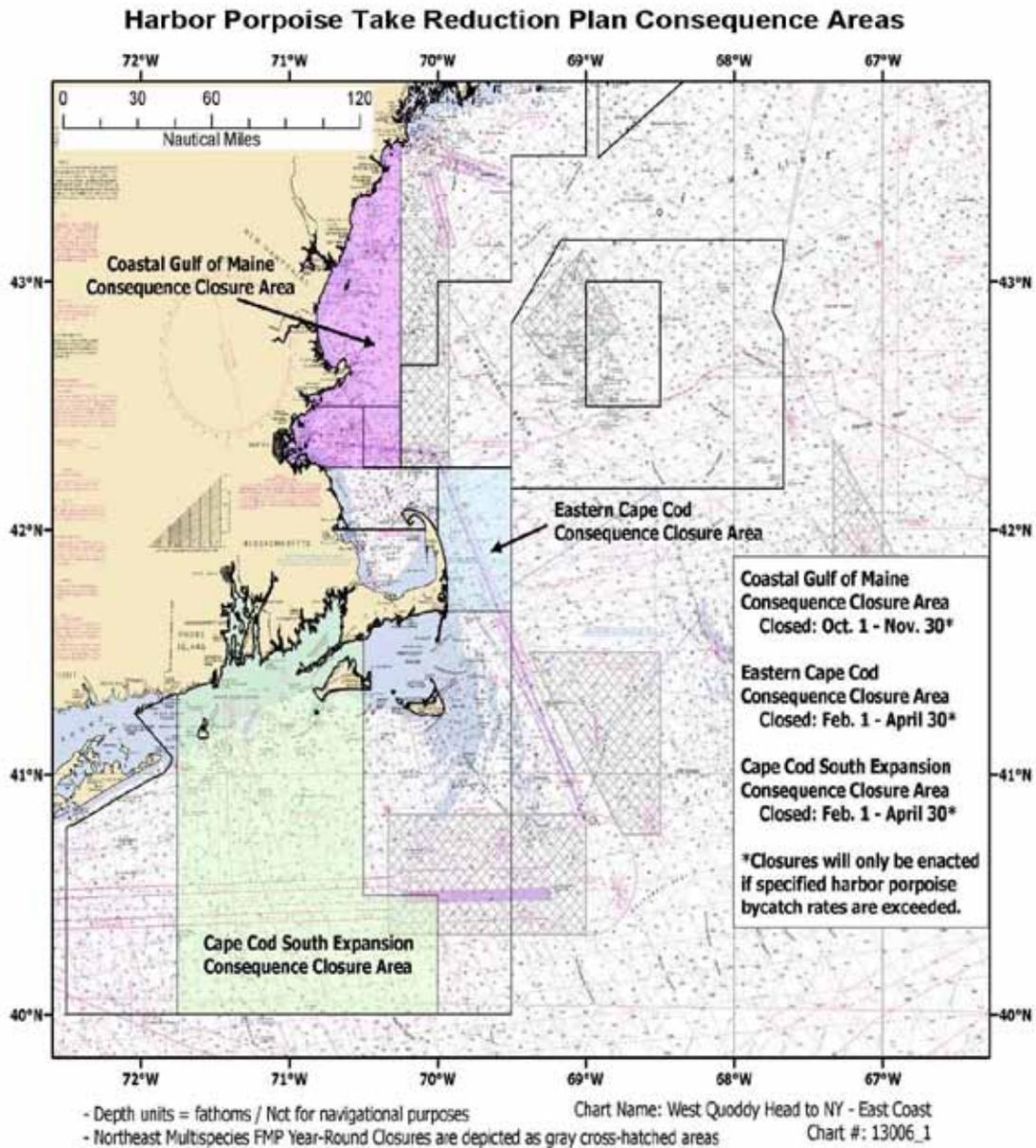


Figure 1D. All management areas in the New England region under the 2010 harbor porpoise take reduction plan displaying the color scheme of each area that were used in other figures below.

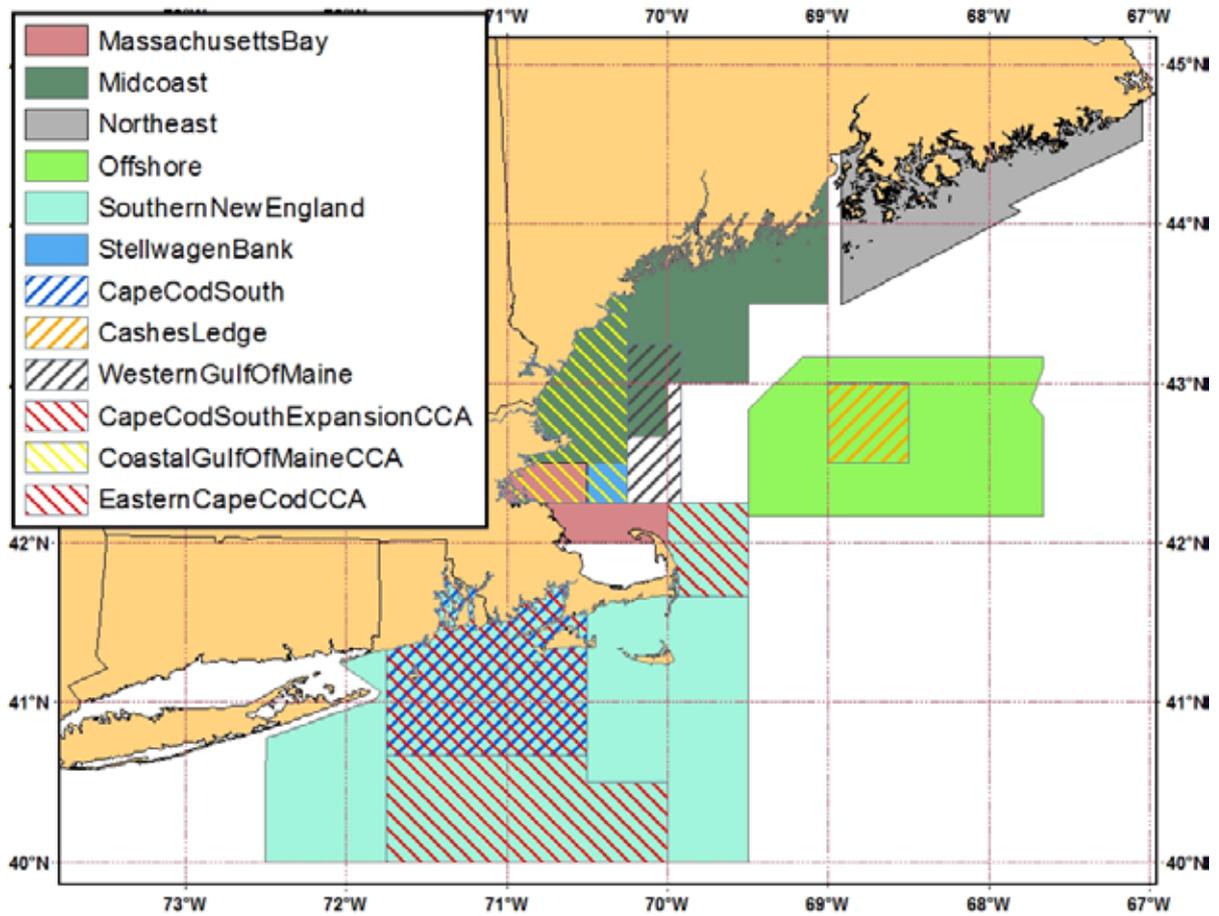


Figure 2. Locations of all observed hauls without takes (black circles), hauls with takes under the 1998 harbor porpoise take reduction plan beginning in January 2007 (red circles) and hauls with takes under the 2010 HPTRP ending in May 2012 (yellow circles).

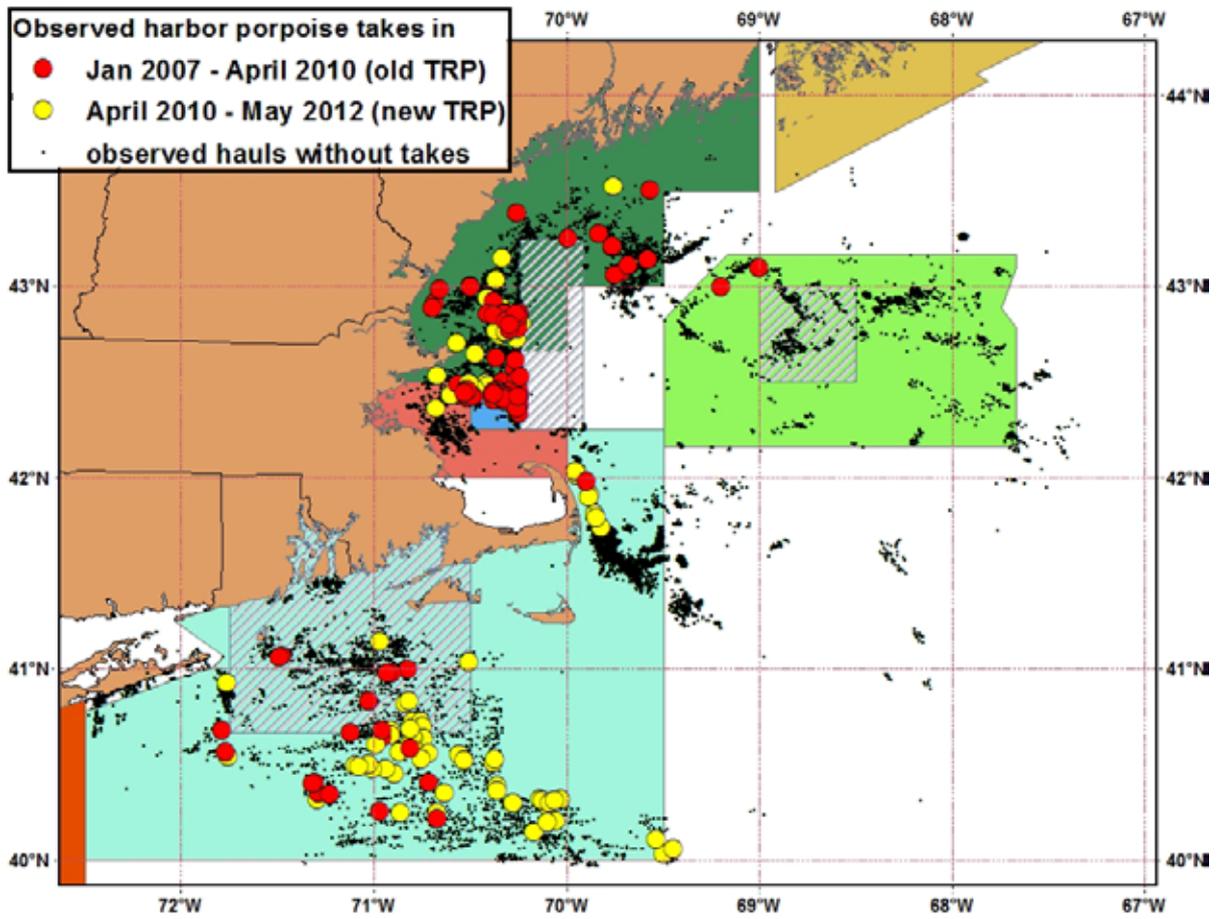


Figure 3. Total number of observed hauls (NEFOP and ASM) per month by management area under the 1998 harbor porpoise take reduction plan (HPTRP), starting 1 January 2007. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern 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. Note, range on y-axes differ.

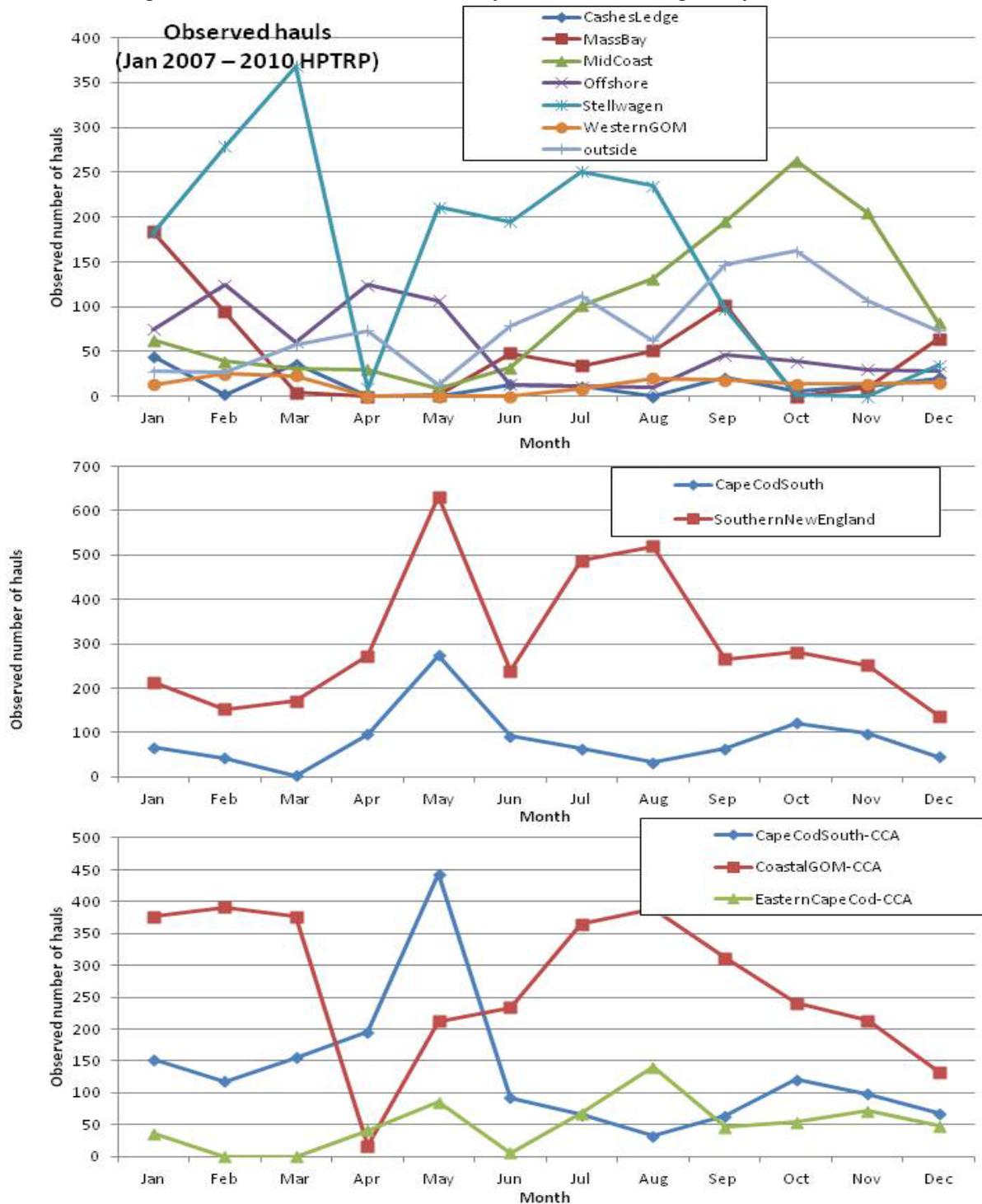


Figure 4. Total number of observed hauls (NEFOP and ASM) per month by management area under the 2010 harbor porpoise take reduction plan (HPTRP), ending 31 May 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern 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. Note, range on y-axes differ.

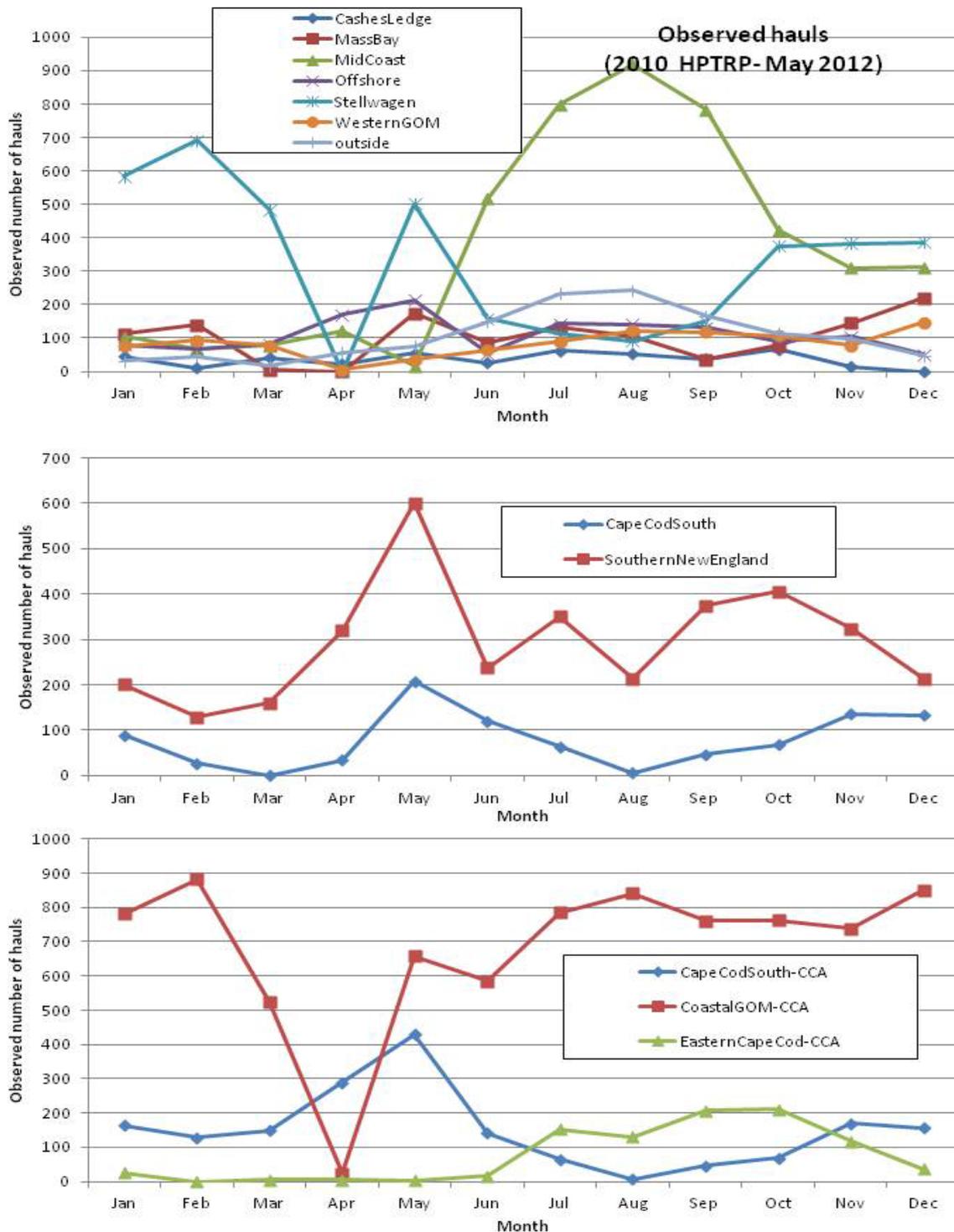


Figure 5. Percent observer coverage (observed amount of landings per amount of landings recorded in the VTR, measured in mtons) by year and management area. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern Cape Cod 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.

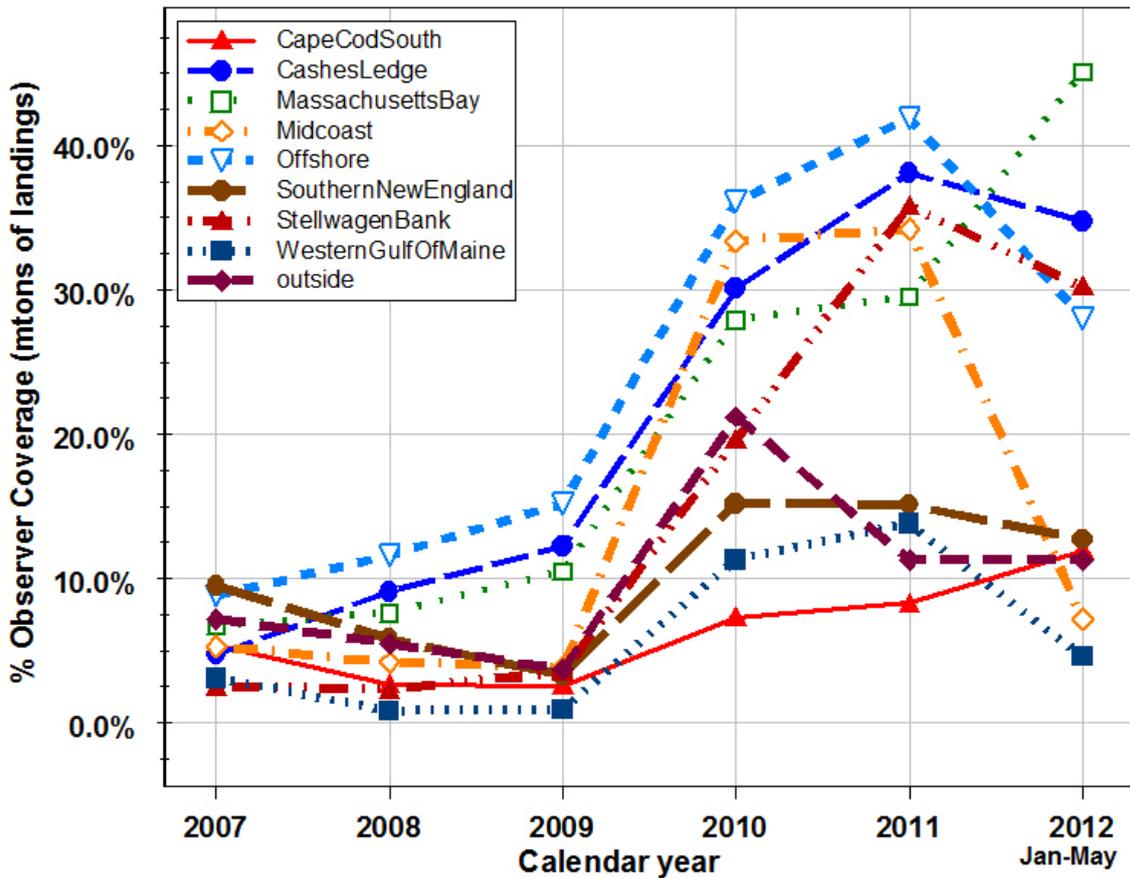


Figure 6. Percent of observed hauls that had the correct number of pingers as required by the two harbor porpoise take reduction plans (one more pinger than number of nets within the gillnet string), by year and management area during 1 January 2007 – 31 May 2012 only during times and areas that required pingers. 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 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.

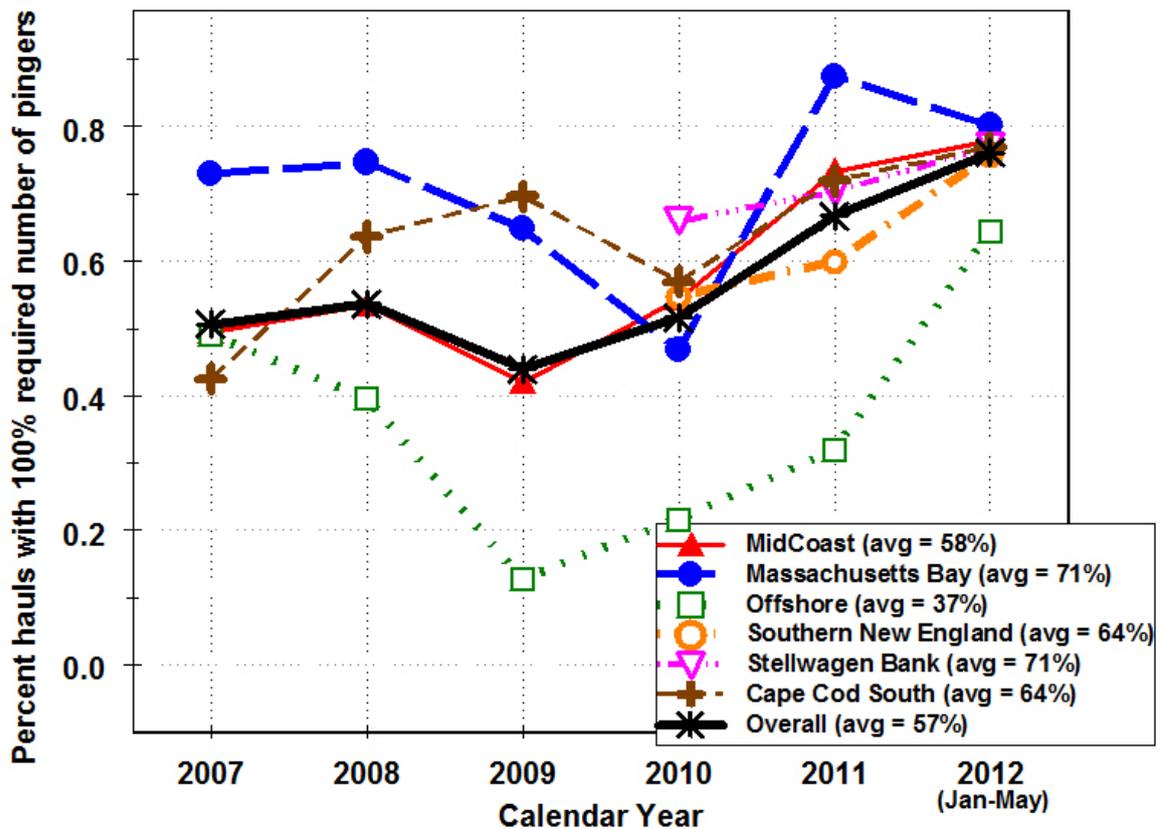


Figure 7. Histograms, by year, of the percentage of hauls with various amounts of the required number of pingers (0 – 100%) as seen on observed hauls in the New England region in times and areas where pingers were required during 1 January 2007 – 31 May 2012. Also the percentages of hauls with values of either missing (miss) or unknown (unk) were identified.

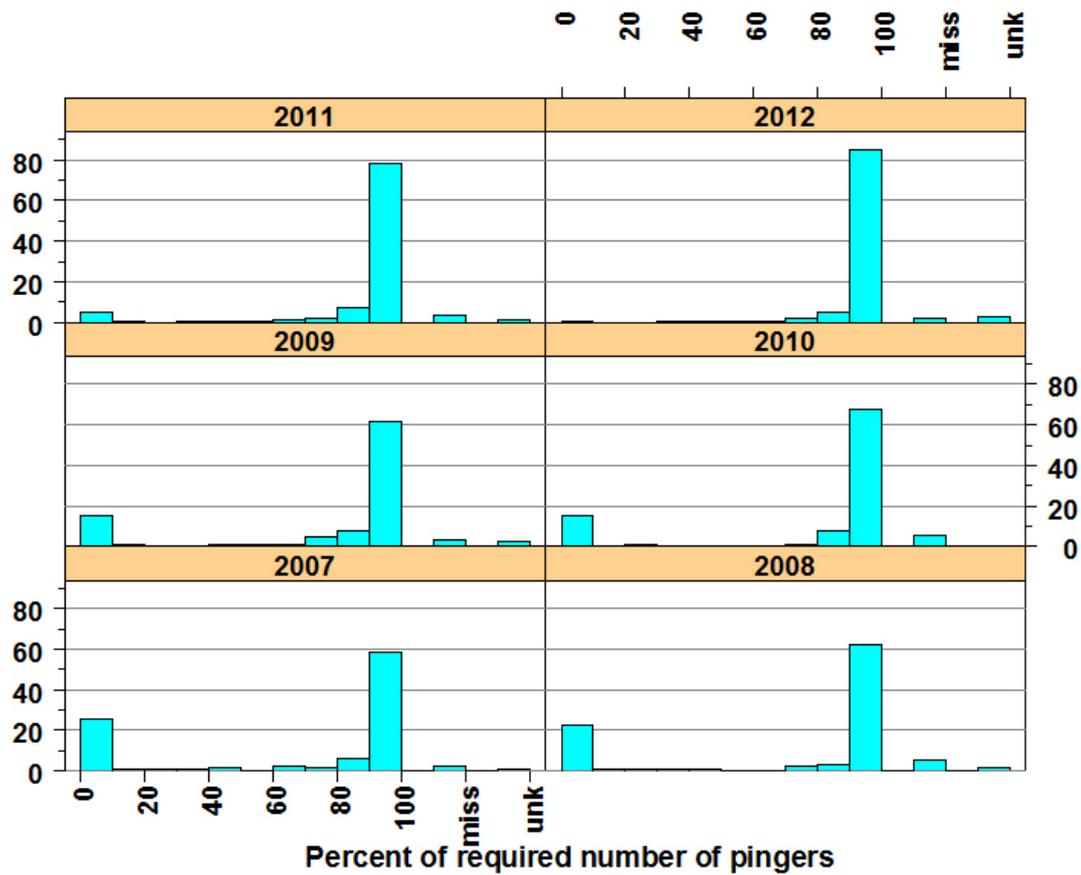


Figure 8. Histograms, by management areas, of the percentage of hauls with various amounts of the required number of pingers (0 – 100%) as seen on observed hauls in the New England region only in times and areas where pingers were required during 1 January 2007 – 31 May 2012. Also the percentages of hauls with values of either missing (miss) or unknown (unk) were identified. Note, the “CapeCodSouth/SNewEngland” plot is of hauls within times when pingers were required in the Cape Cod South MA during the 1998 harbor porpoise take reduction plan (HPTRP), and within the Southern New England MA during the 2010 HPTRP.

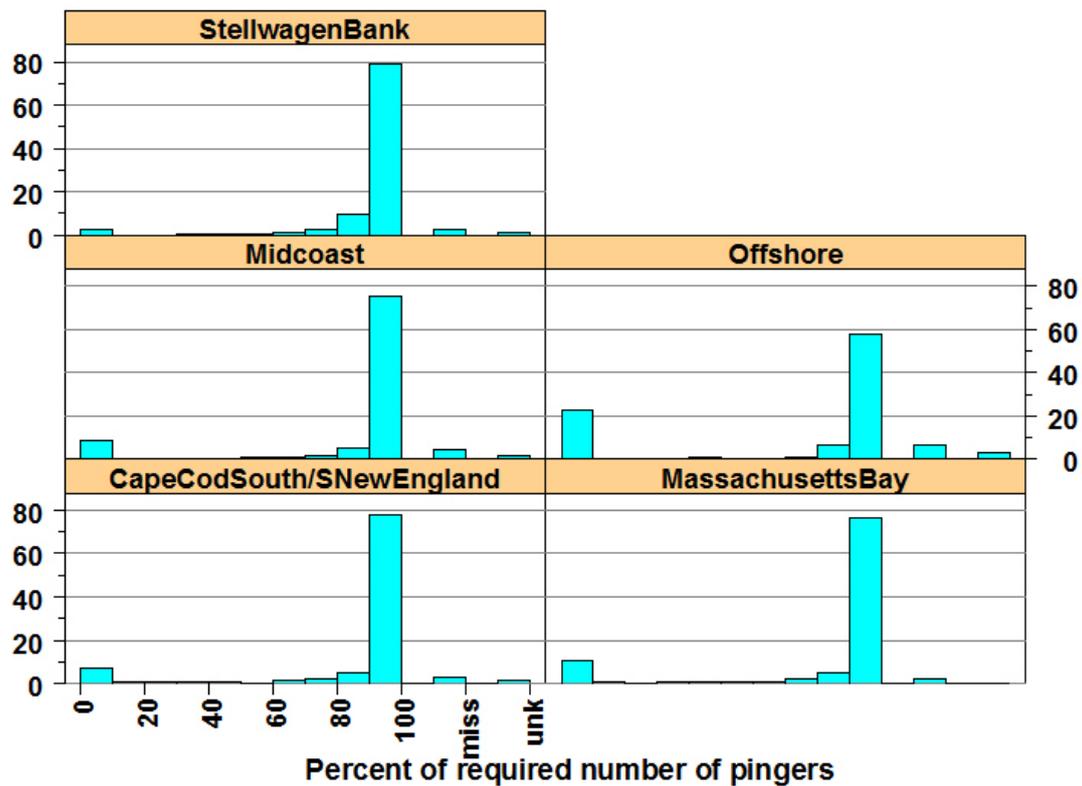


Figure 9. Histograms, by Consequence Closure Areas (CCAs), of the percentage of hauls with various amounts of the required number of pingers (0 – 100%) as seen on observed hauls in the New England region in times and areas where pingers were required during 1 January 2007 – 31 May 2012. Also the percentages of hauls with values of either missing (miss) or unknown (unk) were identified. The Cape Cod South 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.

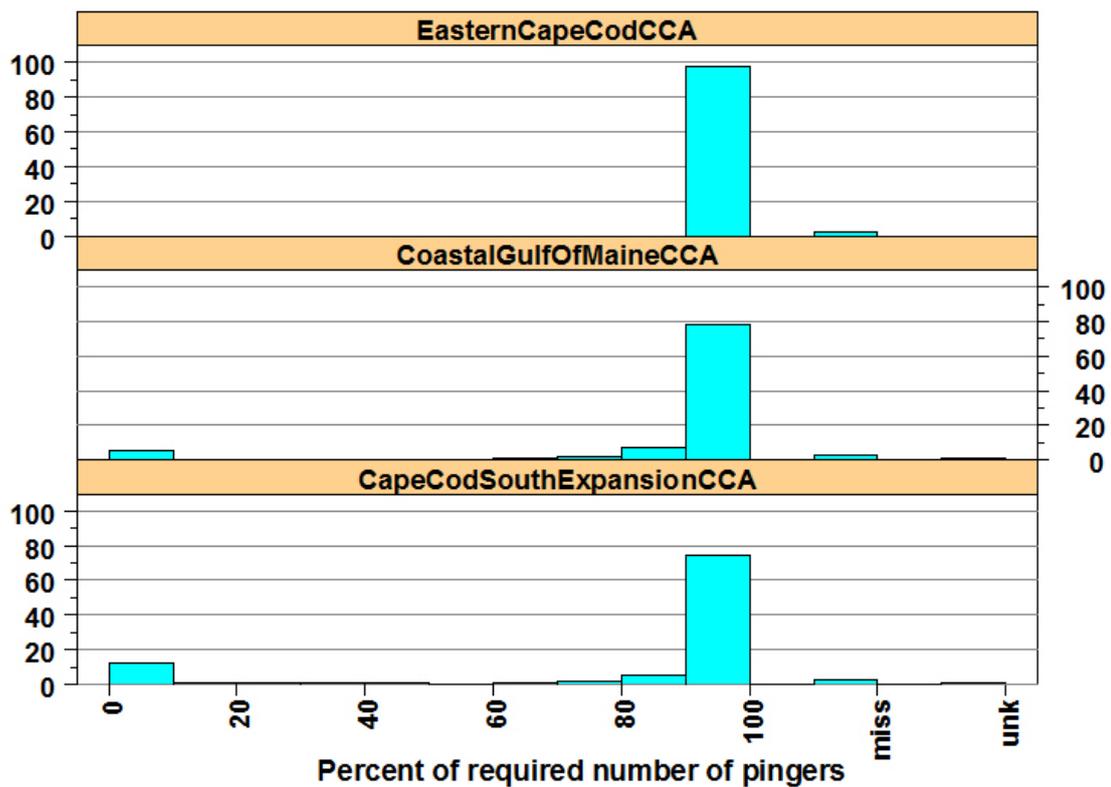


Figure 10. For each management area (MA), the amount of landings as recorded in the VTR by month and year (1 January 2007 – 31 May 2012). Note, range on y-axes differ.

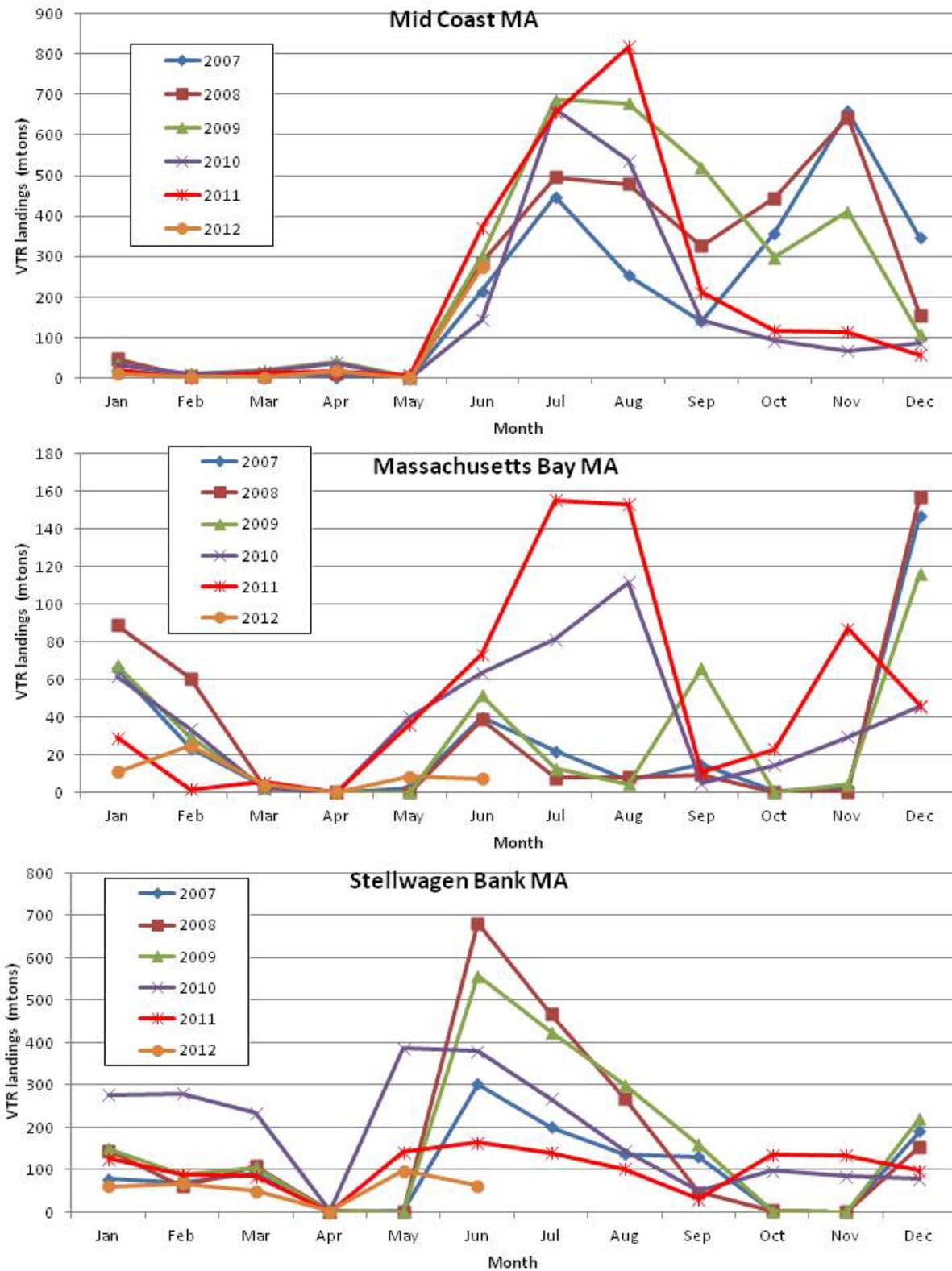


Figure 10 (cont). For each management area (MA), the amount of landings as recorded in the VTR by month and year (1 January 2007 – 31 May 2012). The Cape Cod South MA is part of the Southern New England MA. Note, range on y-axes differ.

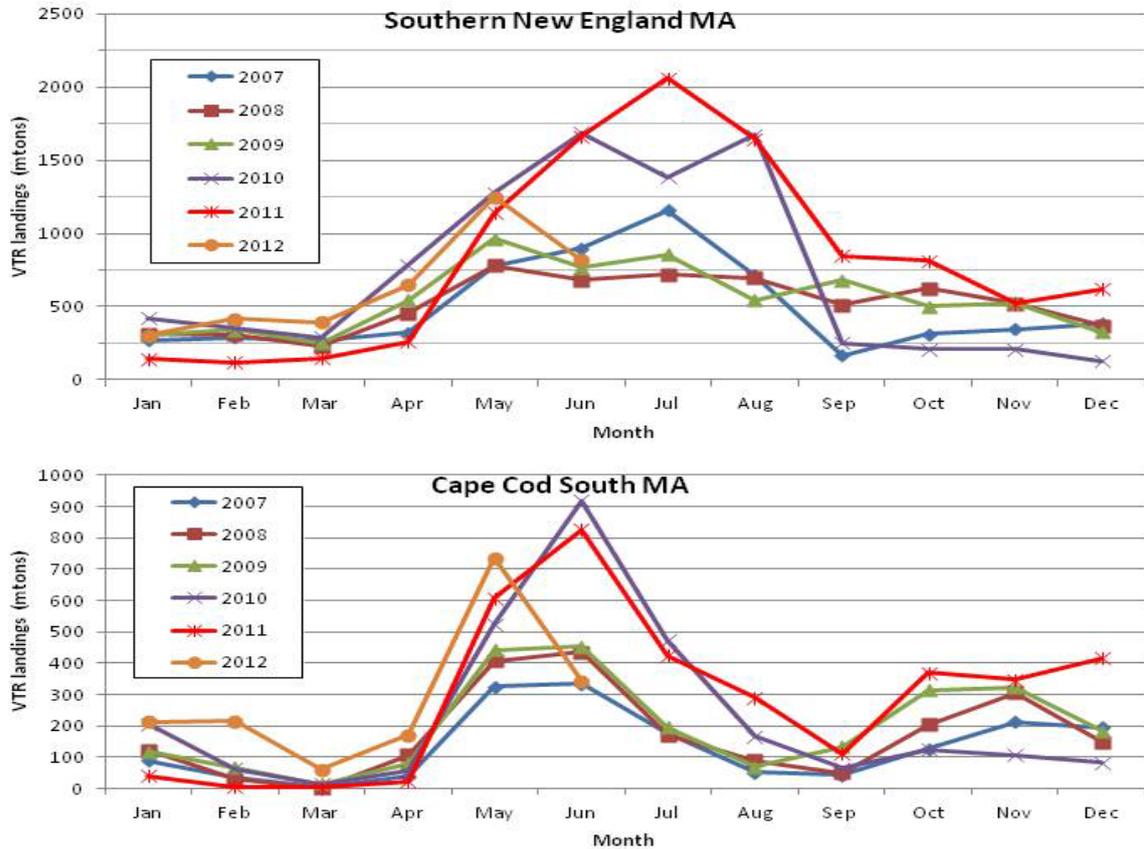


Figure 10 (cont). For each management area (MA), the amount of landings as recorded in the VTR by month and year (1 January 2007 – 31 May 2012). Note, range on y-axes differ.

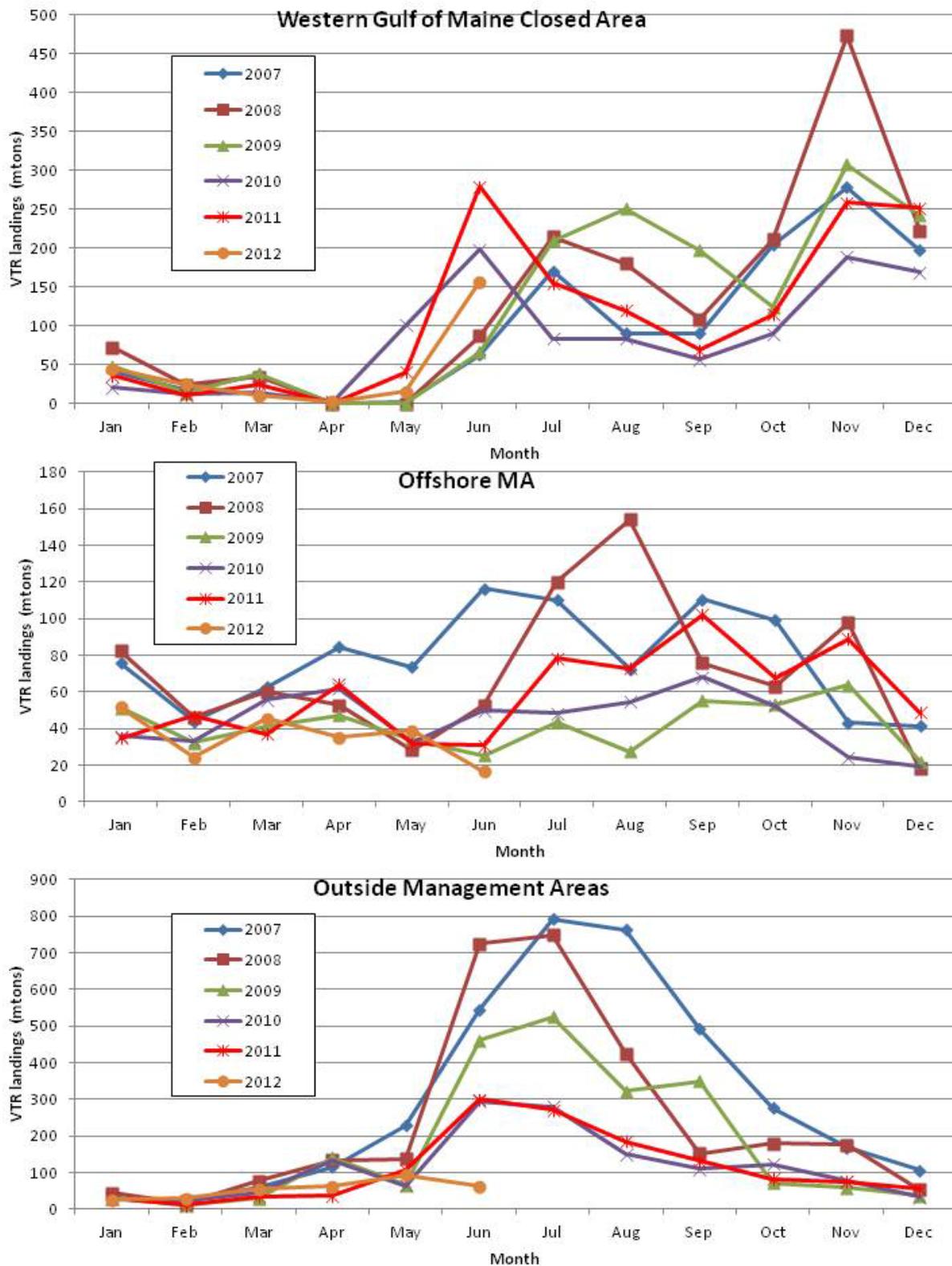


Figure 10 (cont). For each Consequence Closure Area (CAA), the amount of landings as recorded in the VTR by month and year (1 January 2007 – 31 May 2012). The Cape Cod South CCA and Eastern Cape Cod CCA are parts of the Southern New England MA, and the Coastal Gulf of Maine CCA overlaps parts or all of the Mid-Coast, Stellwagen Bank, and Massachusetts Bay MAs. Note, range on y-axes differ.

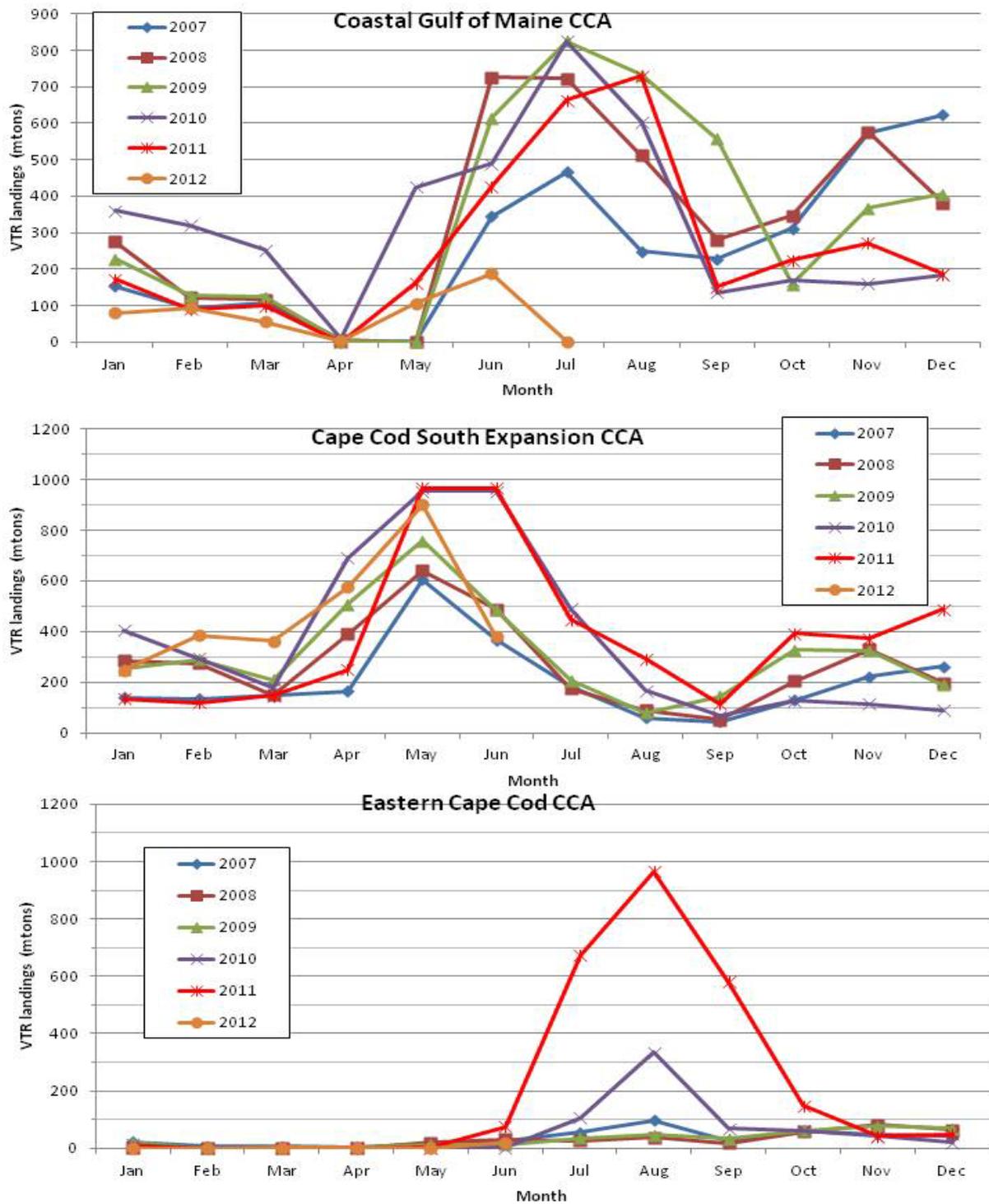
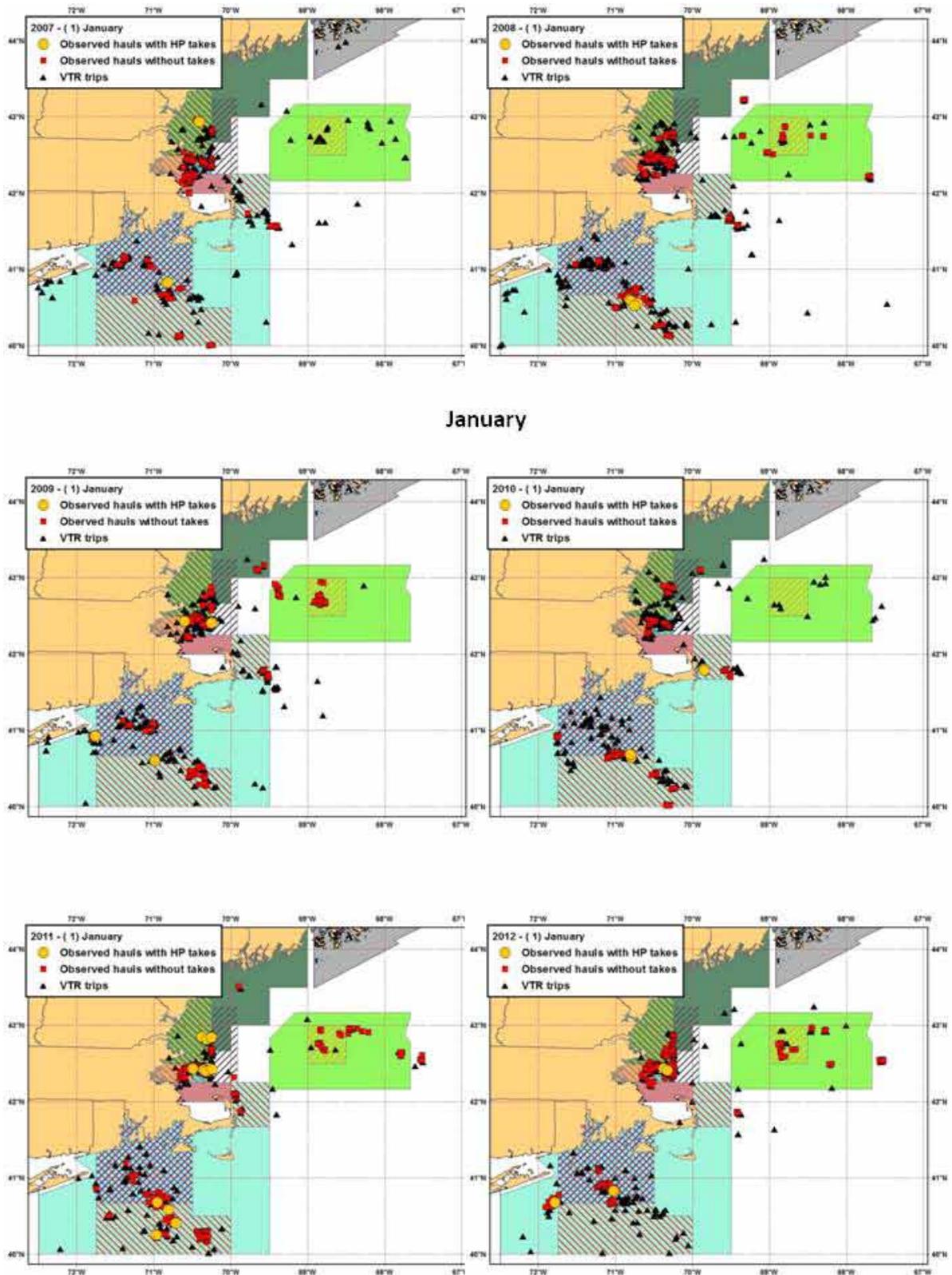


Figure 11. January locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2012.



January

Figure 12. February locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2012.

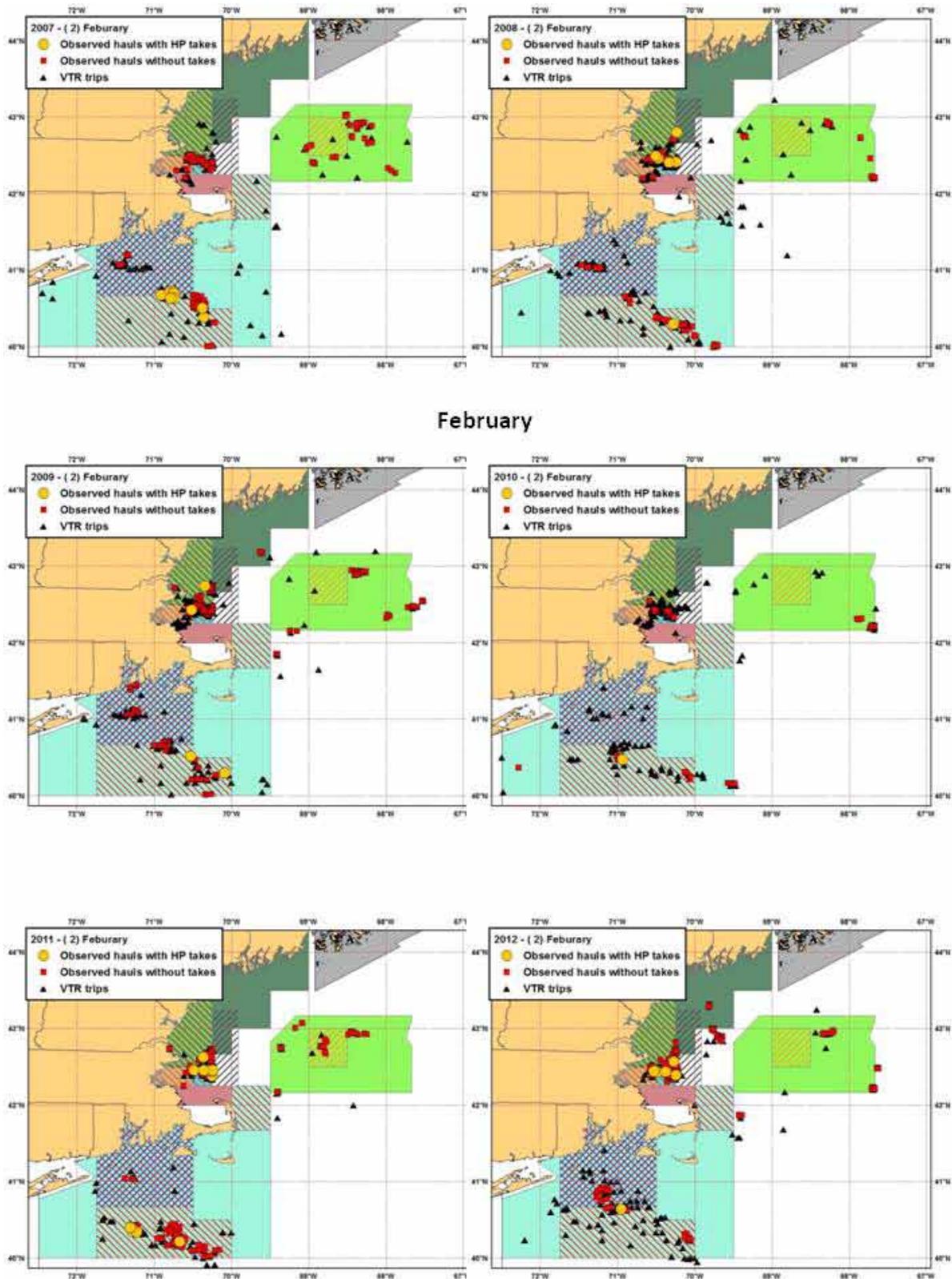


Figure 13. March locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2012.

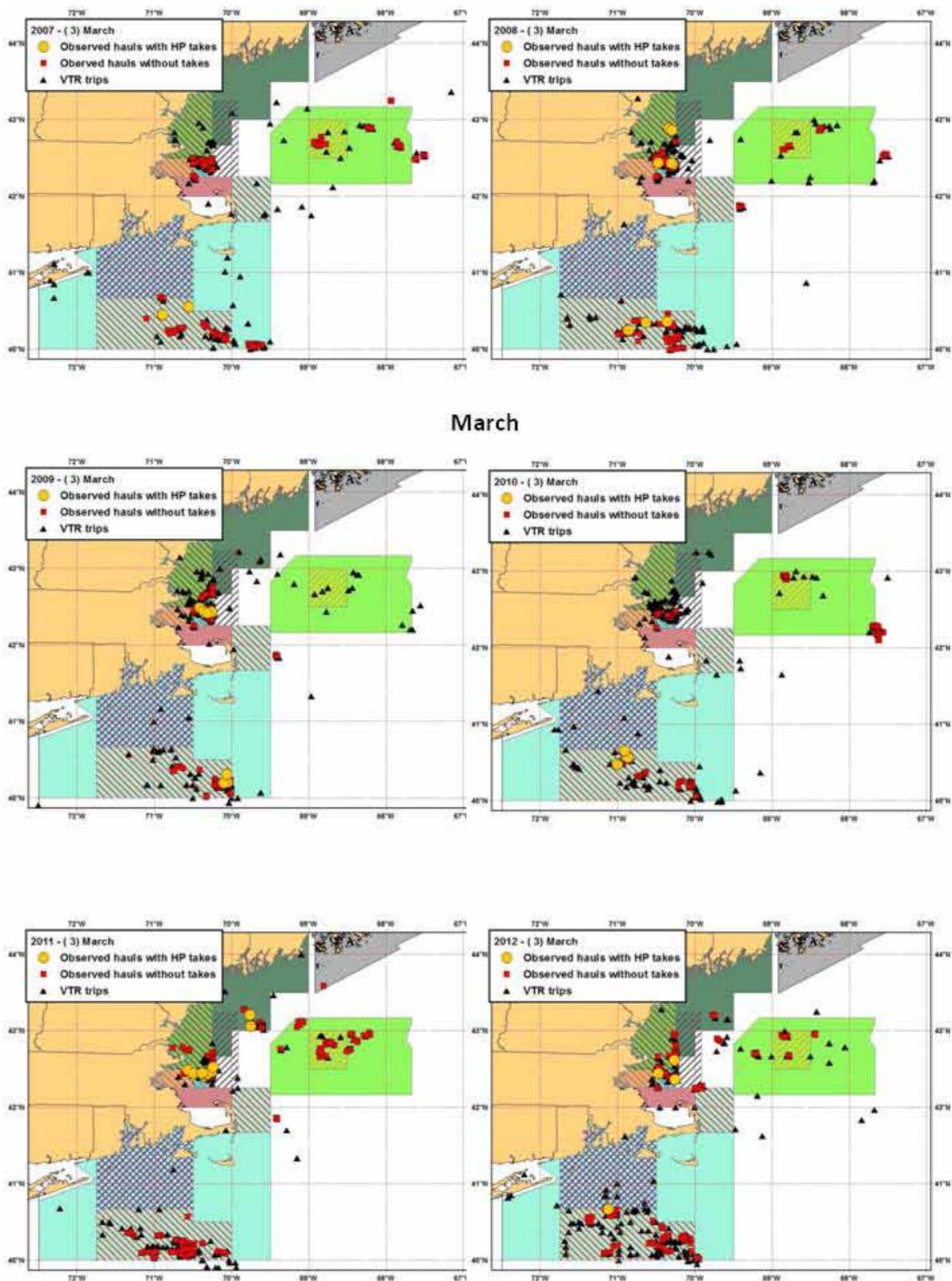
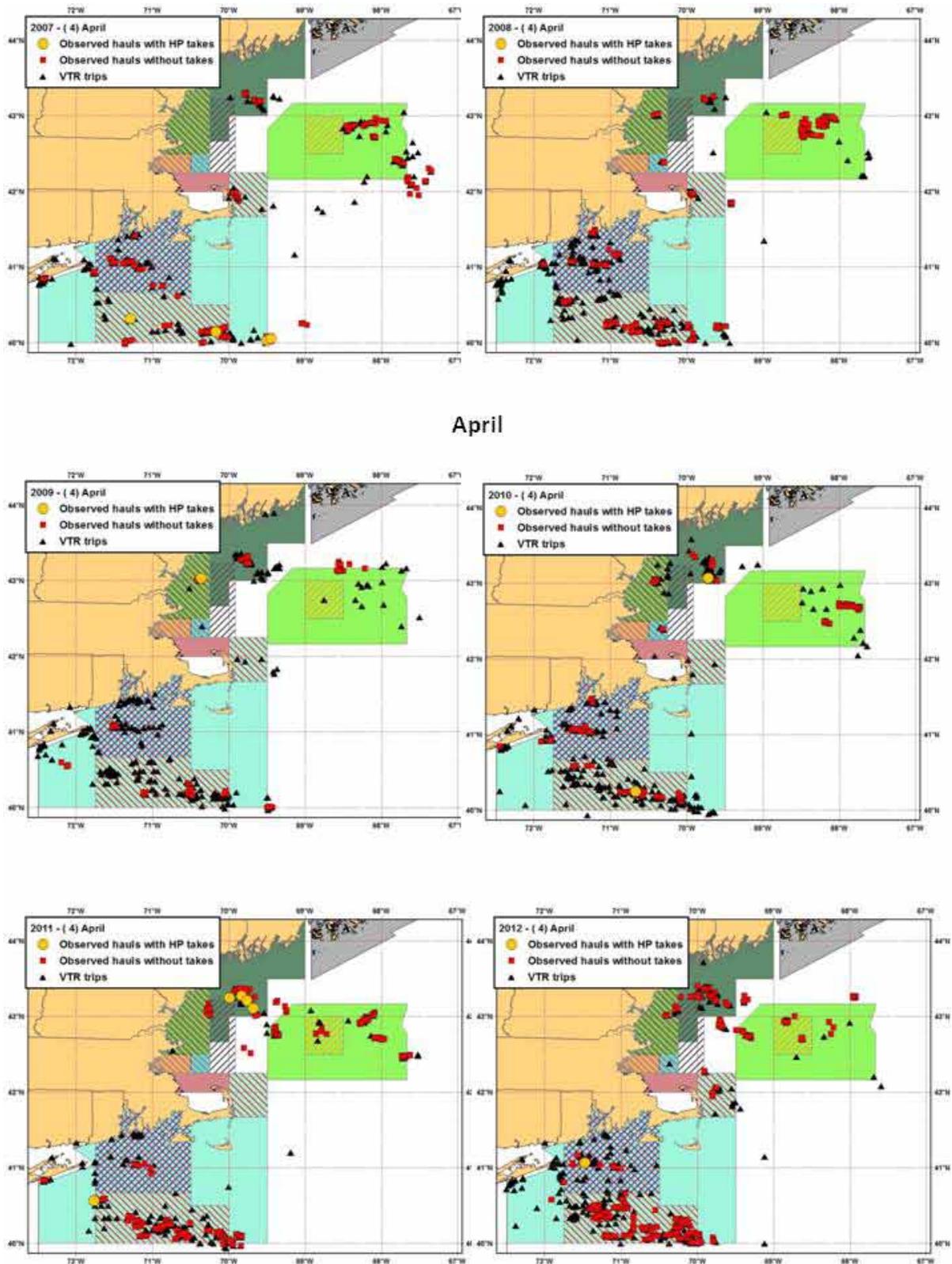


Figure 14. April locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2012.



April

Figure 15. May locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2012.

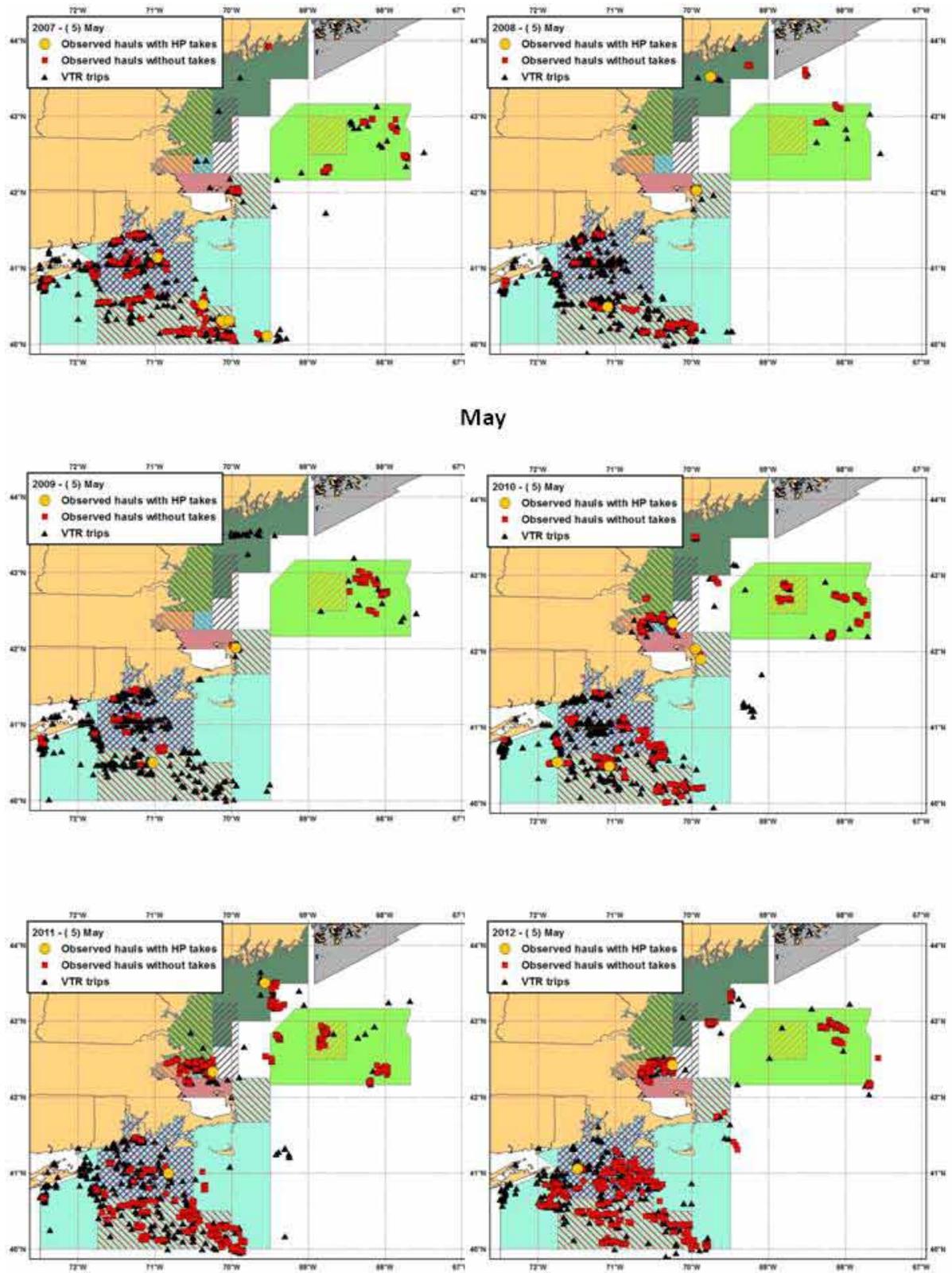


Figure 16. June locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.

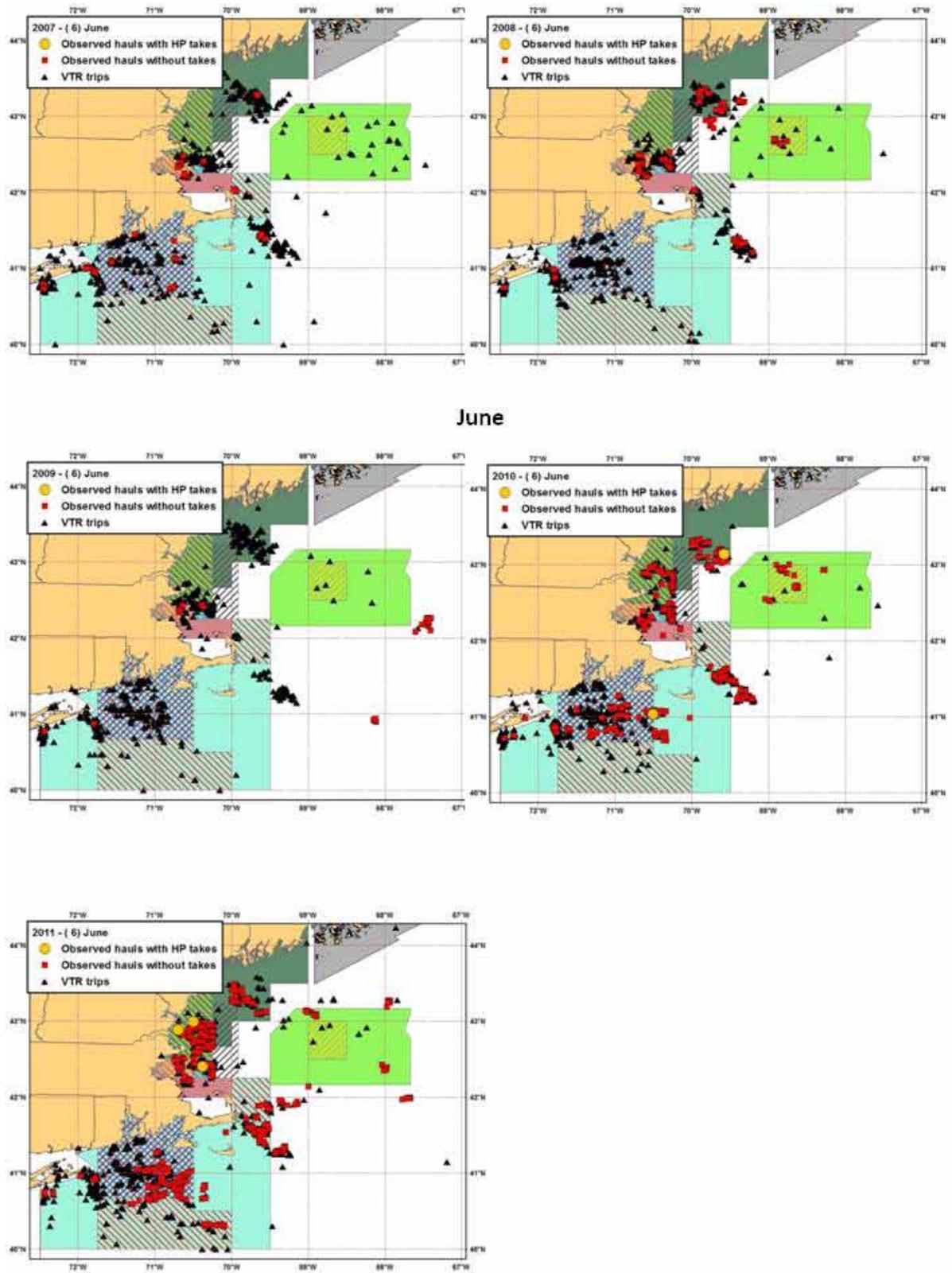
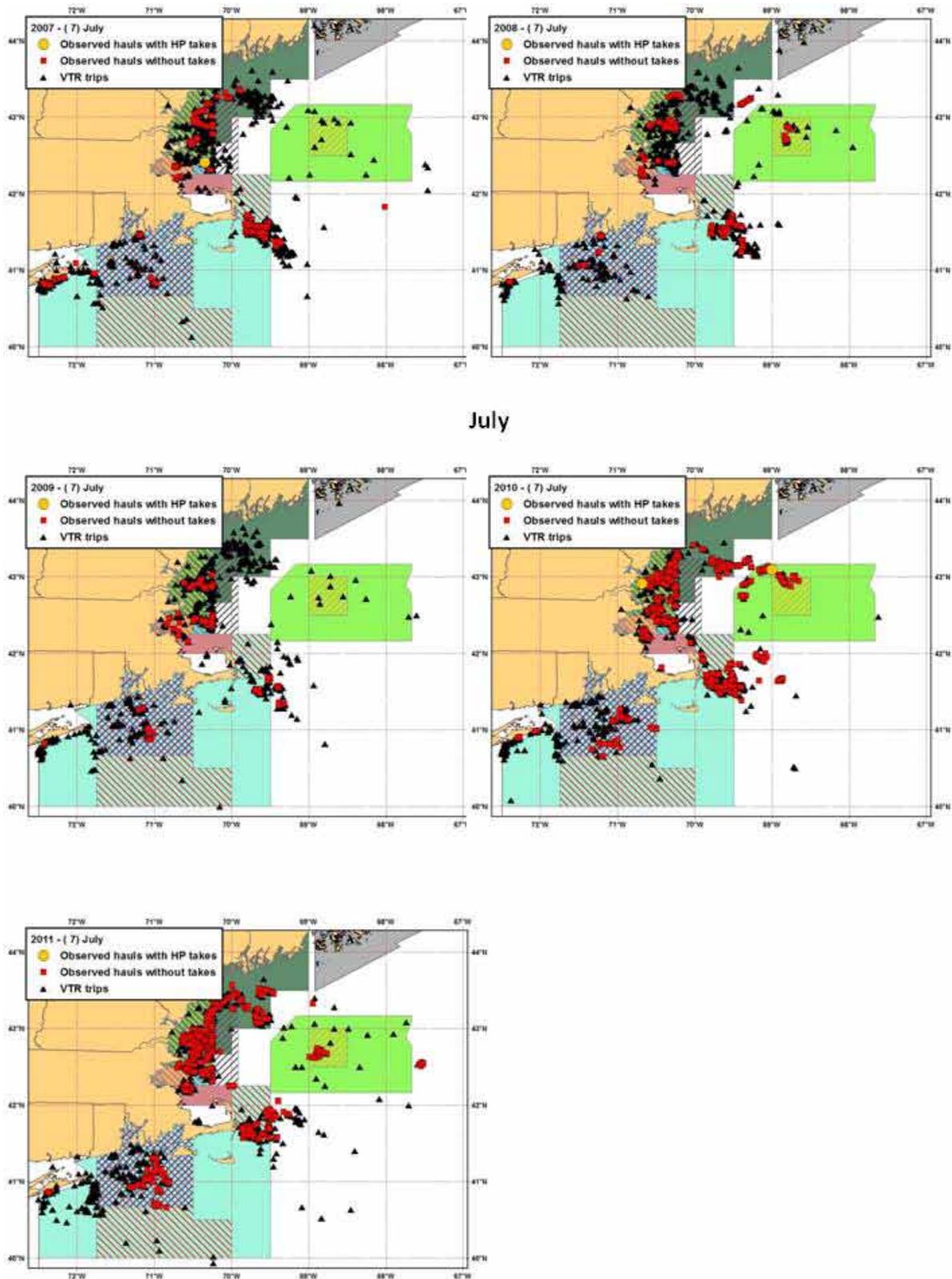
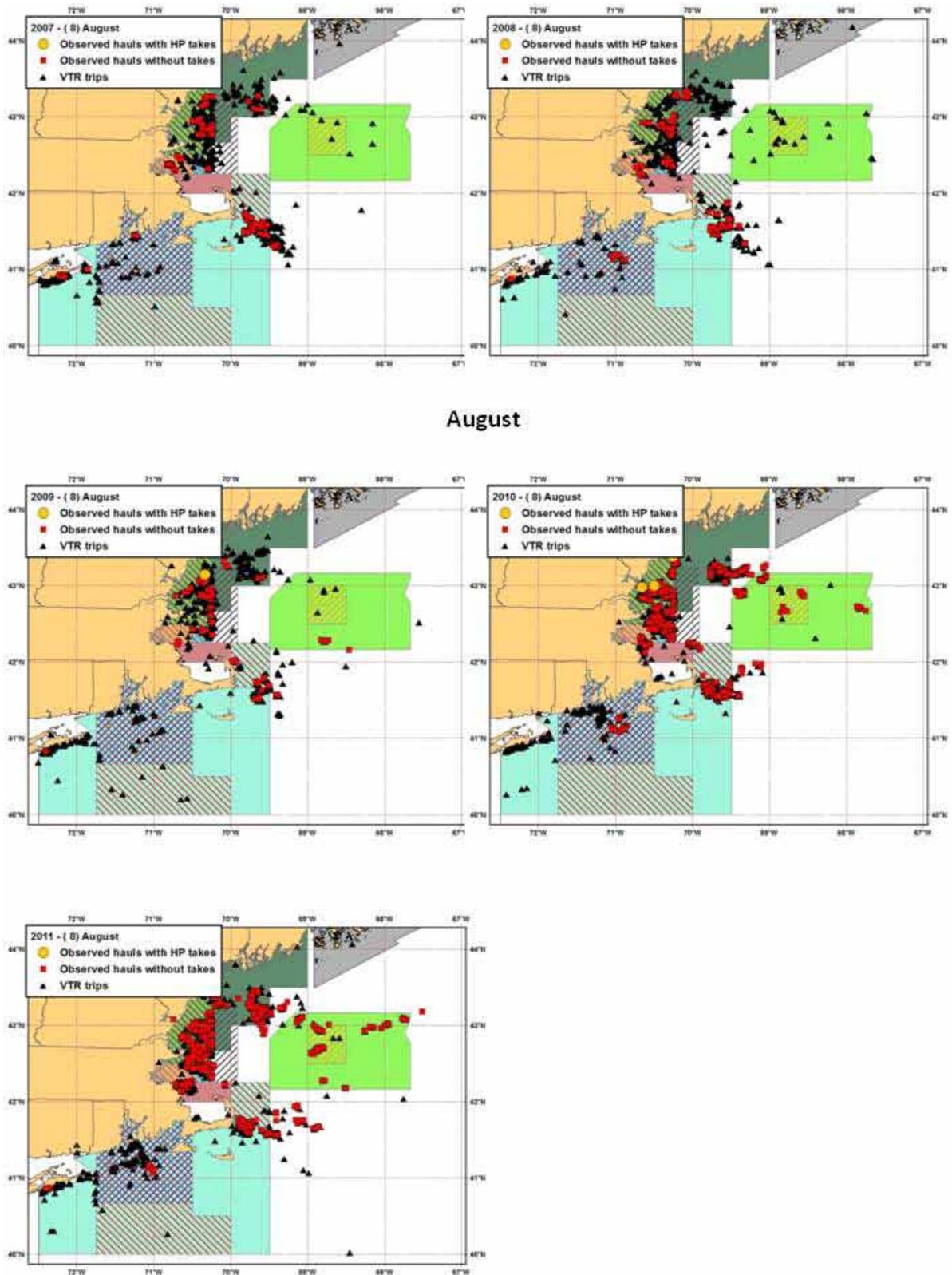


Figure 17. July locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.



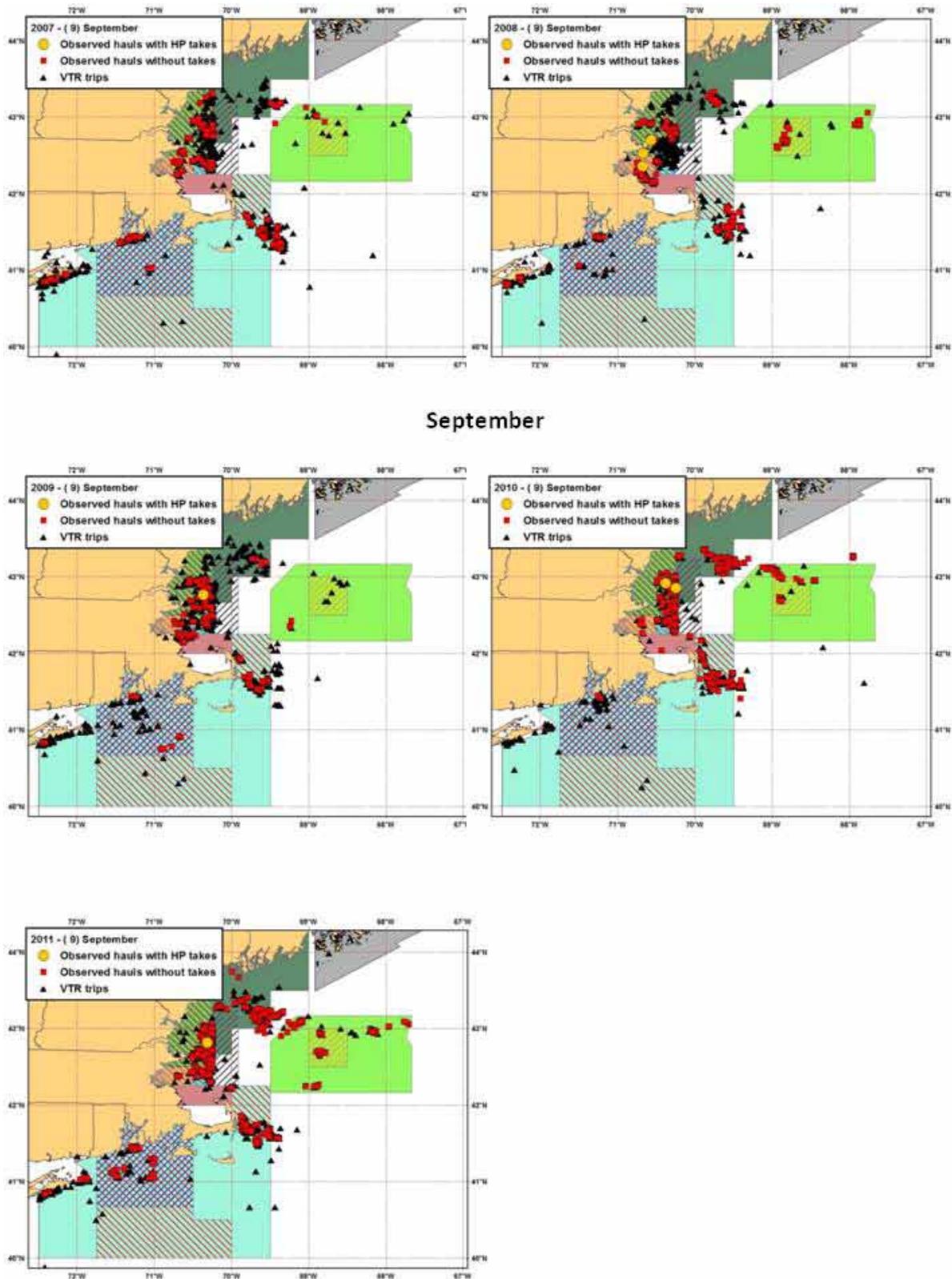
July

Figure 18. August locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.



August

Figure 19. September locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.



September

Figure 20. October locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.

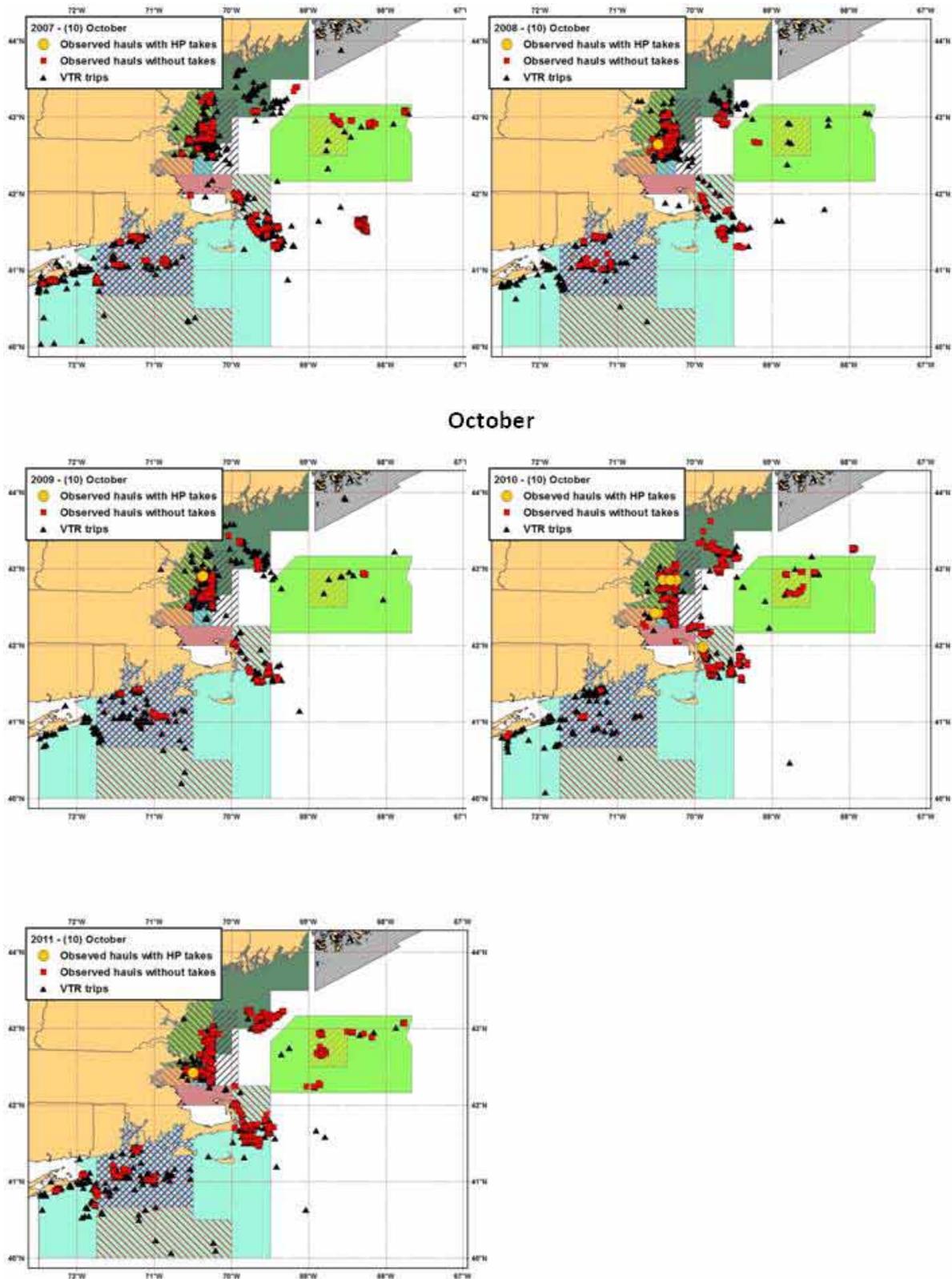


Figure 21. November locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.

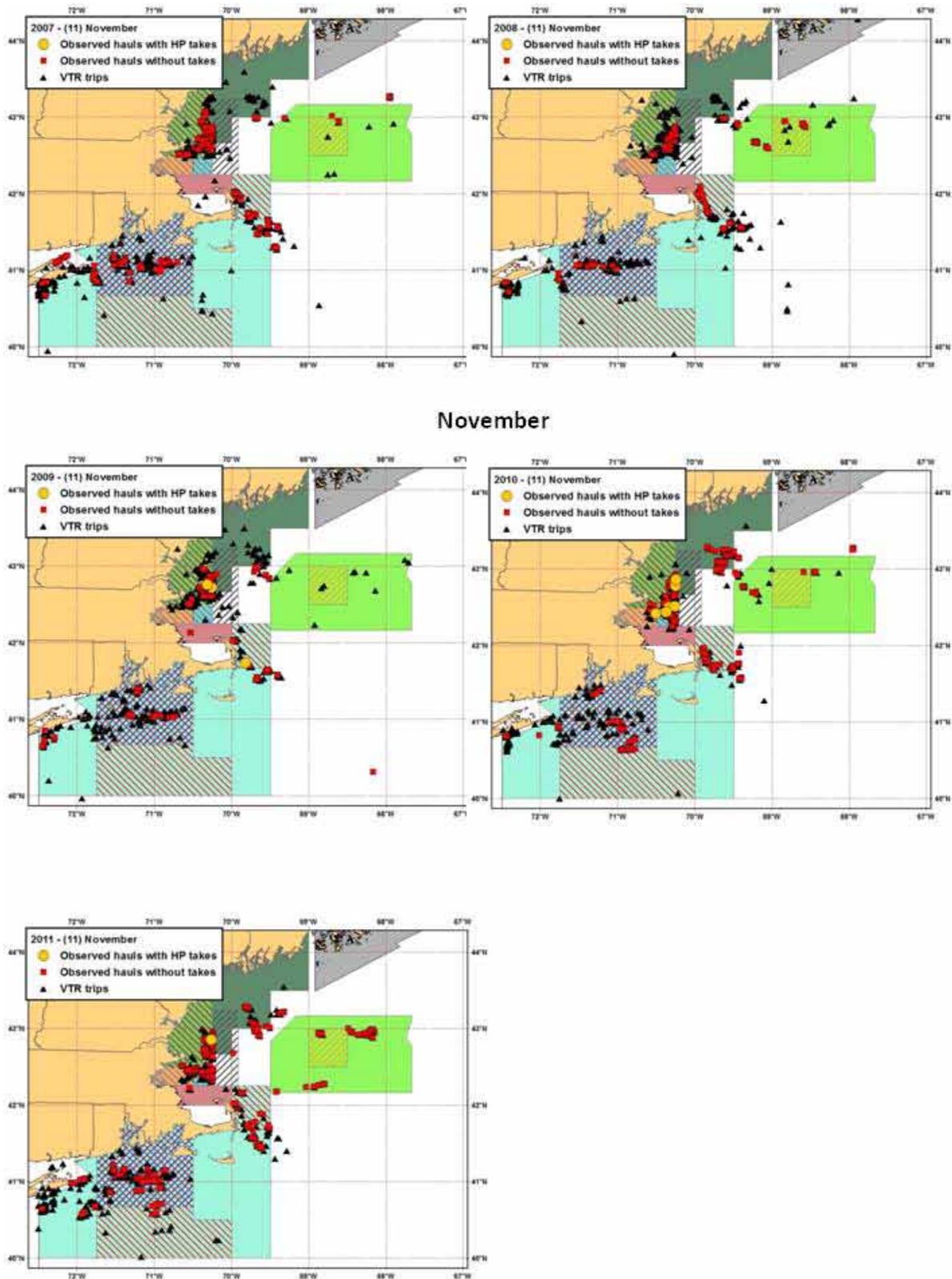


Figure 22. December locations of observed hauls (NEFOP and ASM) with and without harbor porpoise takes, and locations of trips as reported in the VTR database for each year 2007 to 2011.

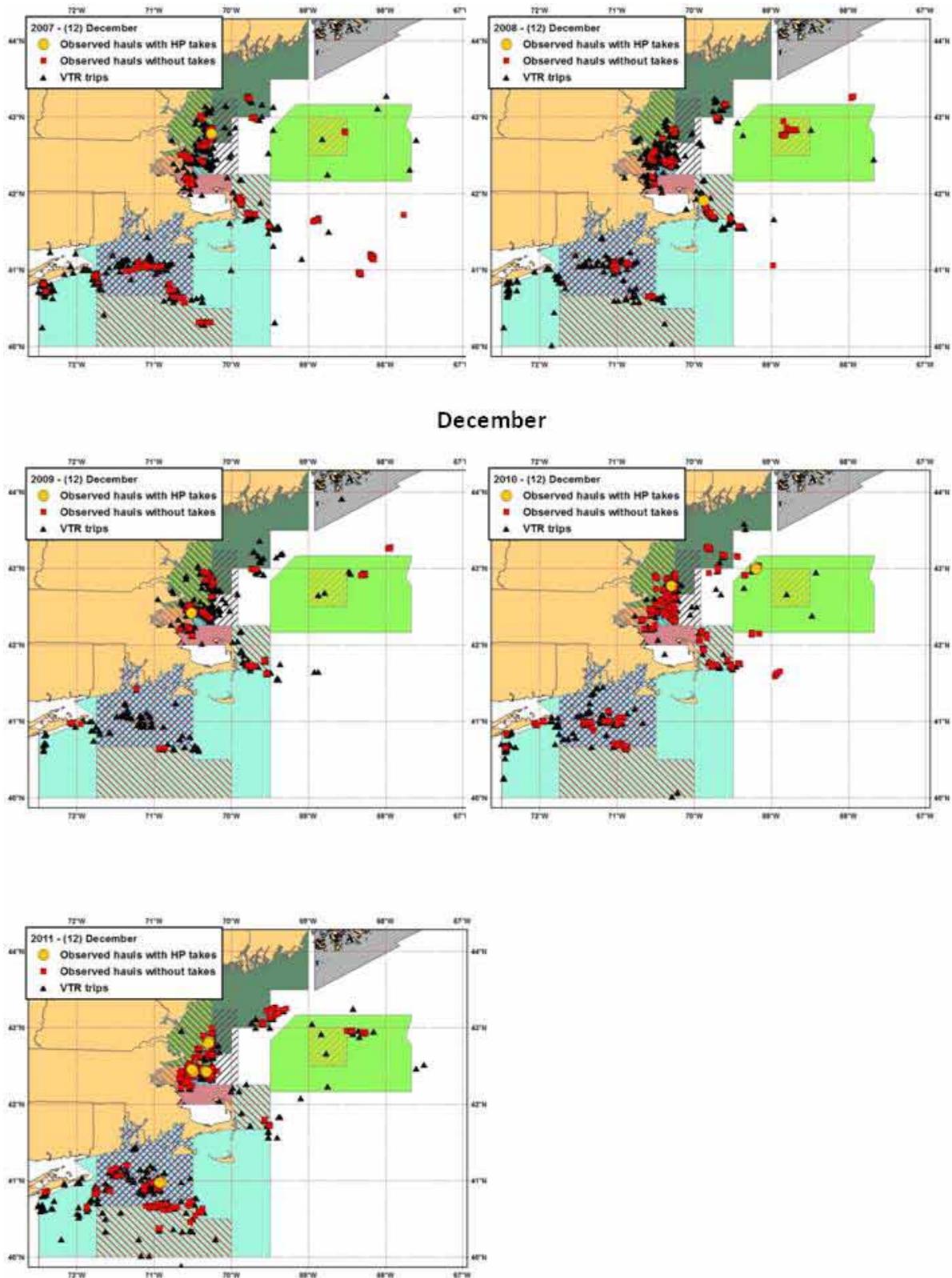


Figure 23. Distribution of total numbers of observed harbor porpoise takes by management area (MA) and month when under the 1998 harbor porpoise take reduction plan (HPTRP) starting 1 January 2007. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, 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. Note, range on y-axes differ.

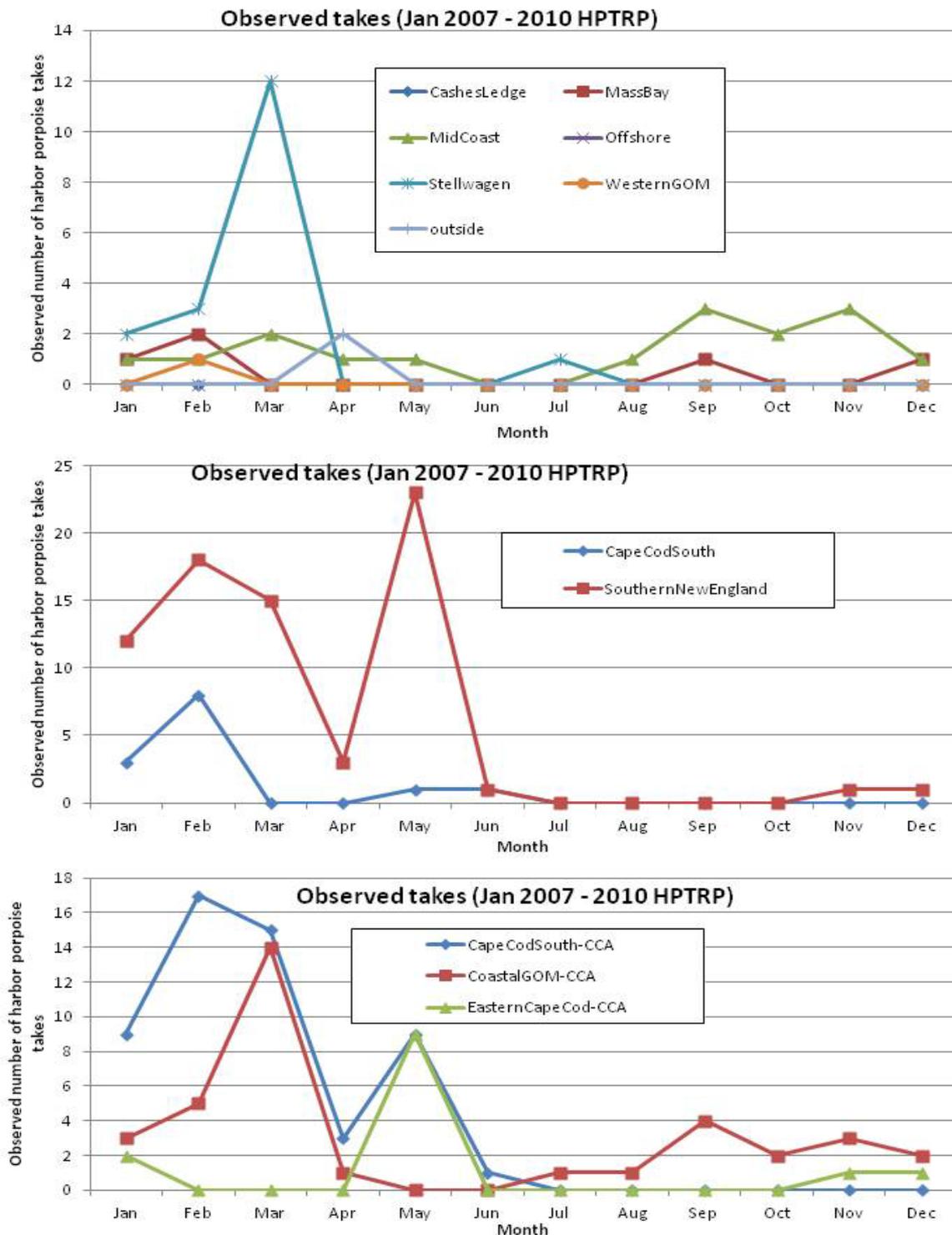


Figure 24. Distribution of total number of observed harbor porpoise takes by management area and month when under the 2012 harbor porpoise take reduction plan (HPTRP) ending 31 May 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South 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. Note, range on y-axes differ.

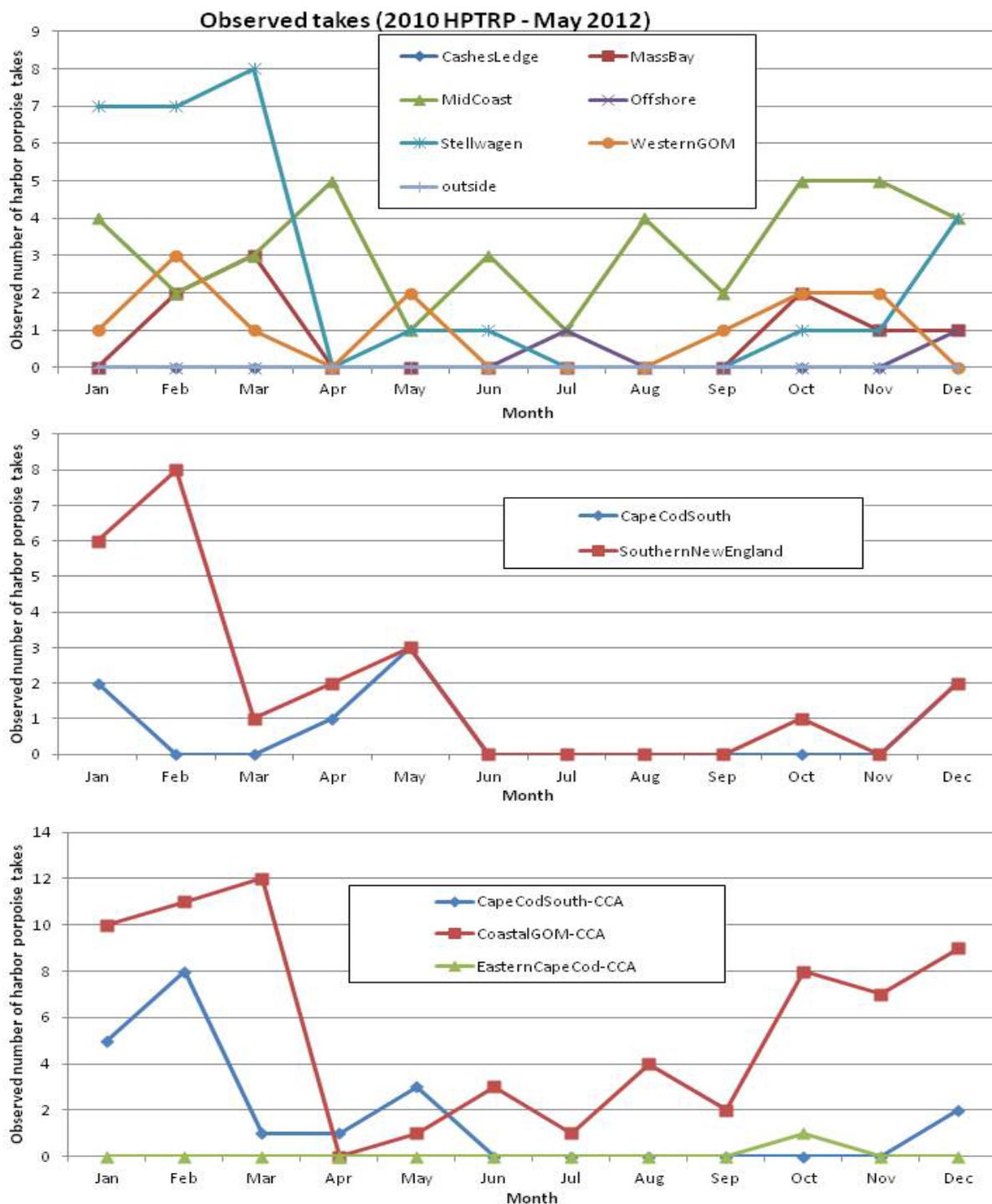


Figure 25. Approximate average total bycatch estimates of harbor porpoises by management area (MA) and month under the 1998 harbor porpoise take reduction plan starting 1 January 2007. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South 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. Note, range on y-axes differ.

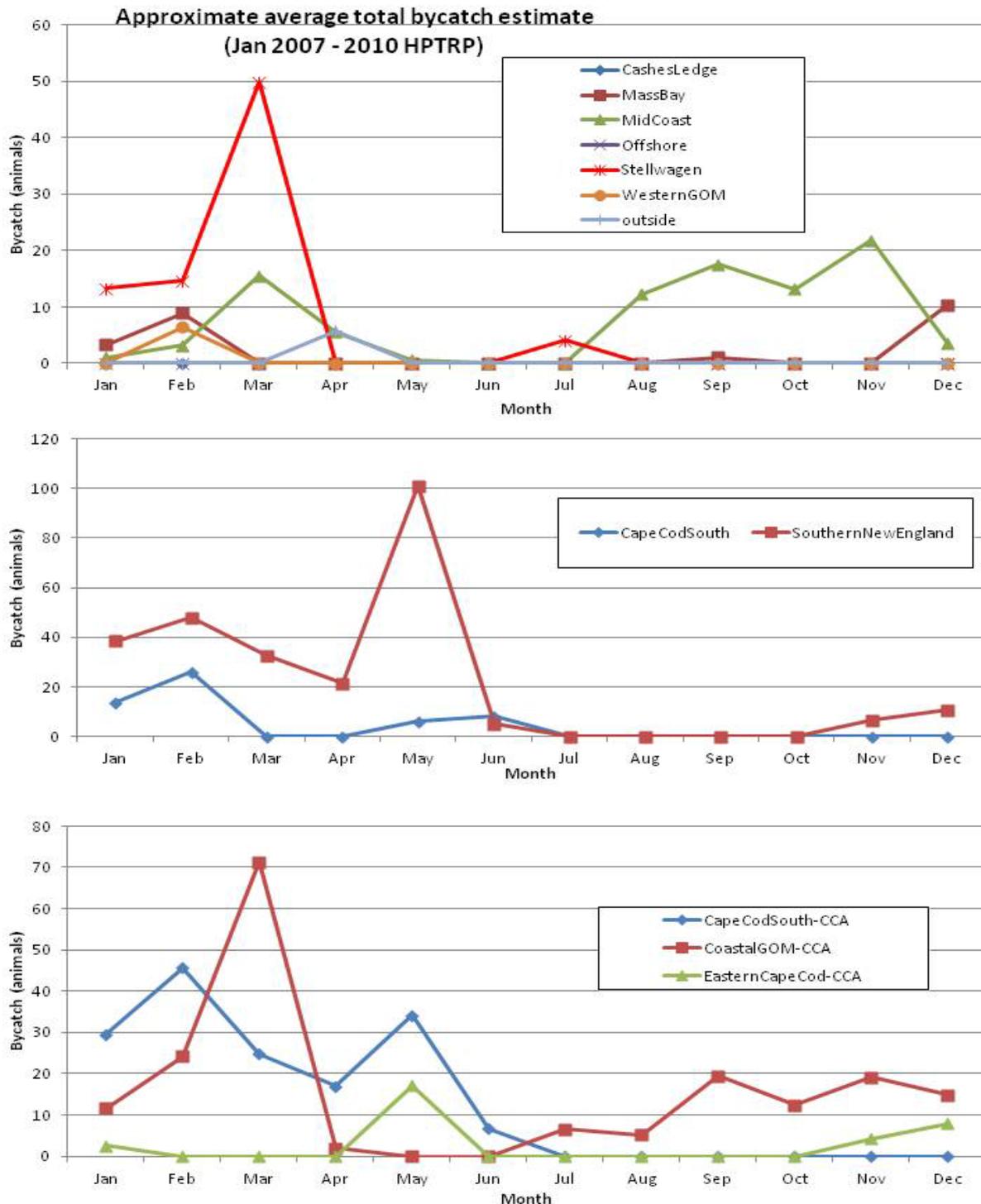


Figure 26. Approximate average total bycatch estimates of harbor porpoises by management area (MA) and month under the 2010 harbor porpoise take reduction plan ending 31 May 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South 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. Note, range on y-axes differ.

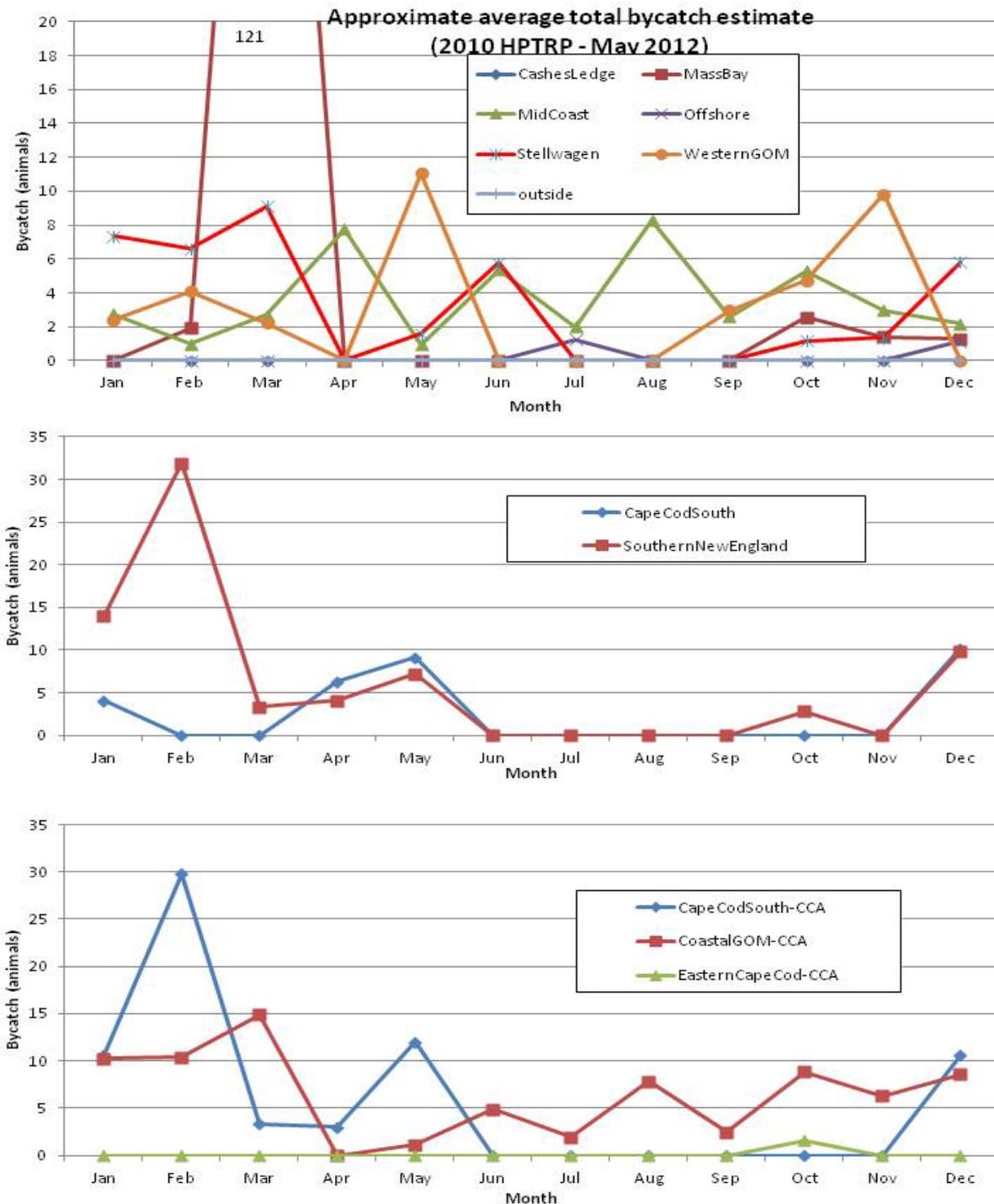


Figure 27. Approximate total bycatch estimates of harbor porpoises by management area (MA), year and month during 2007 – 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern Cape Cod CCA are parts of the Southern New England MA, and the Coastal Gulf of Maine CCA overlaps parts or all of the Mid-Coast, Stellwagen Bank, and Massachusetts Bay MAs. Note, range on y-axes differ.

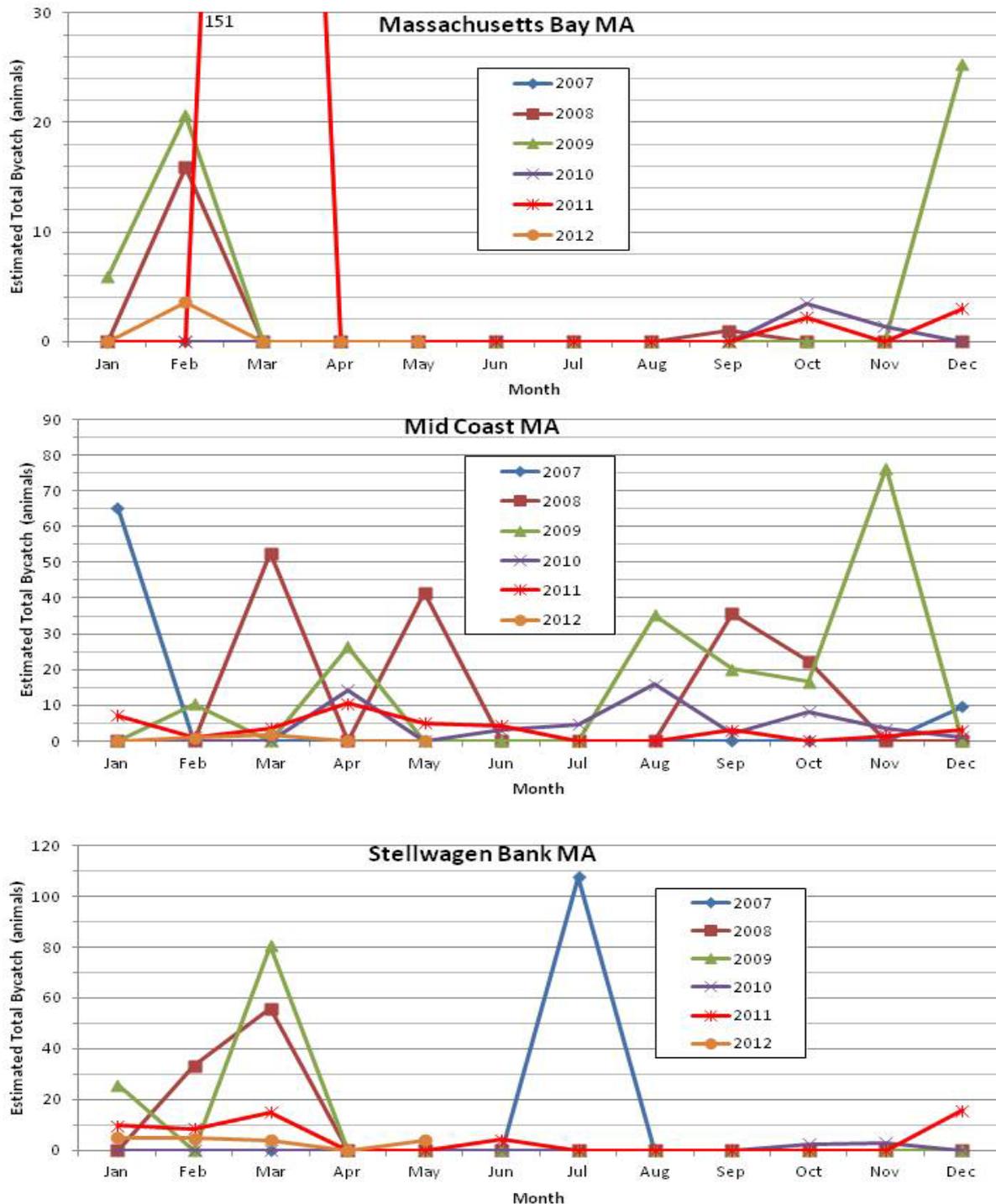


Figure 27 (cont). Approximate total bycatch estimates of harbor porpoises by management area (MA), year and month during 2007 – 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern Cape Cod CCA are parts of the 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. Note, range on y-axes differ.

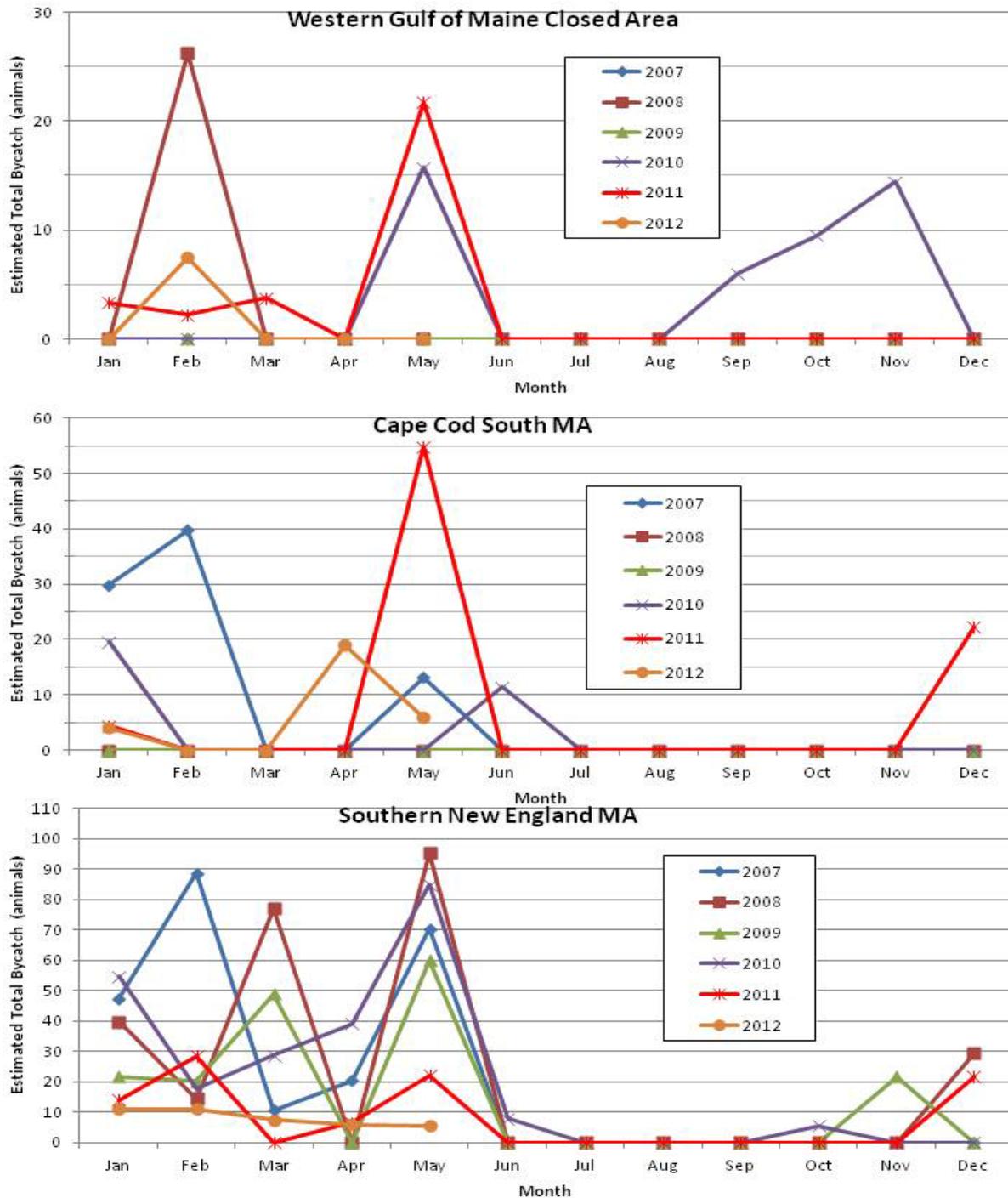


Figure 27 (cont). Approximate total bycatch estimates of harbor porpoises by management area (MA), year and month during 2007 – 2012. The Cape Cod South MA is part of the Southern New England MA, Cashes Ledge MA is part of the Offshore MA, Cape Cod South CCA and Eastern Cape Cod CCA are parts of the 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. Note, range on y-axes differ.

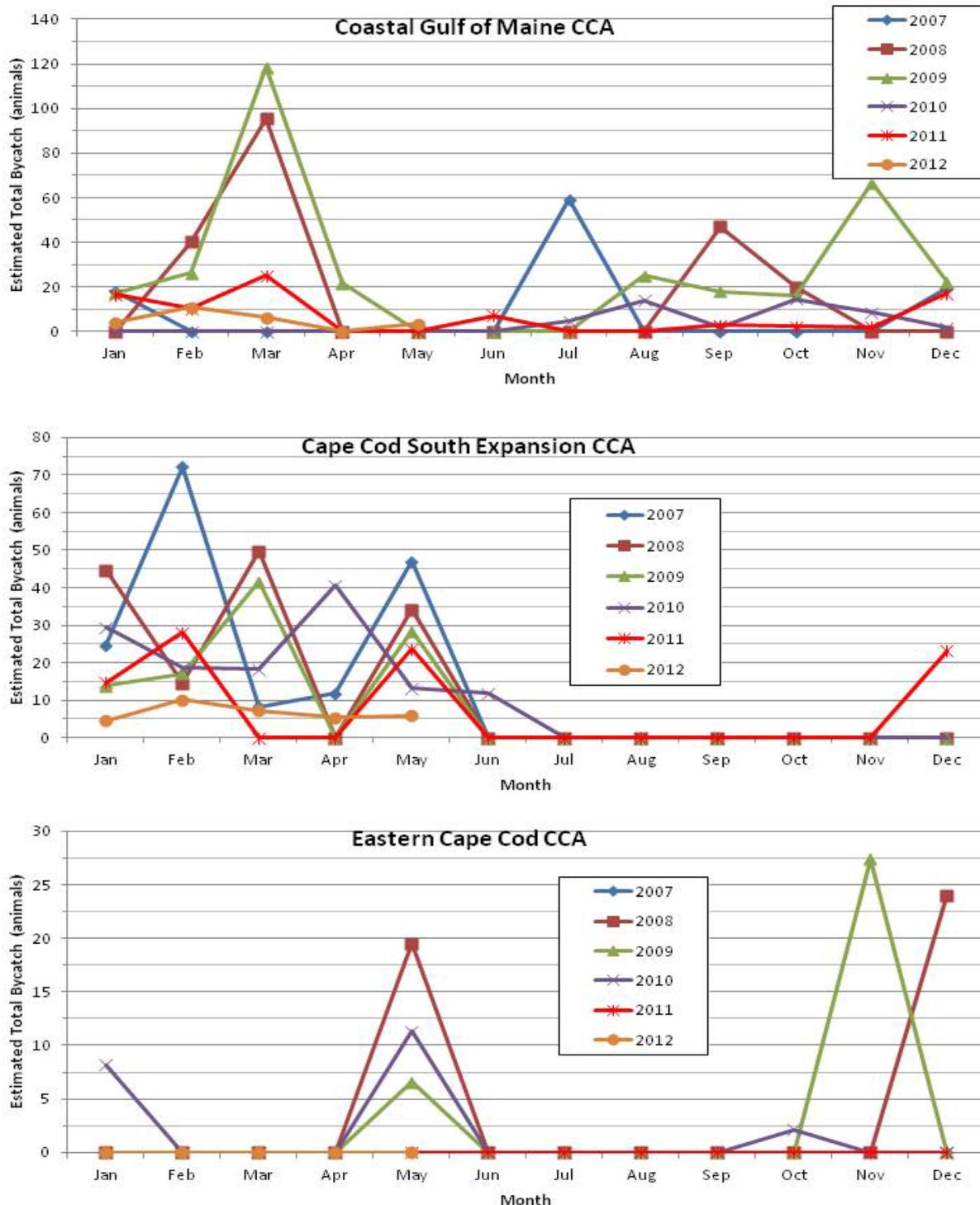


Figure 28. Comparison of bycatch rates (takes/mtons landed) and approximate total bycatch estimates in the Coastal Gulf of Maine Consequence Closure Area during the October-November time period as compared to the February-March time period.

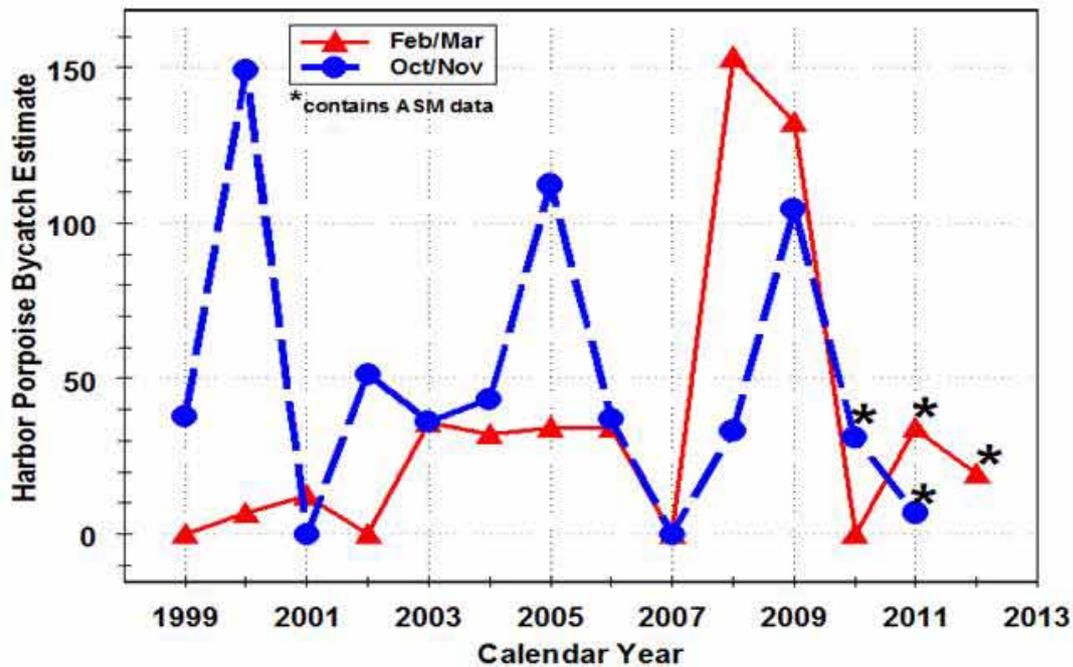
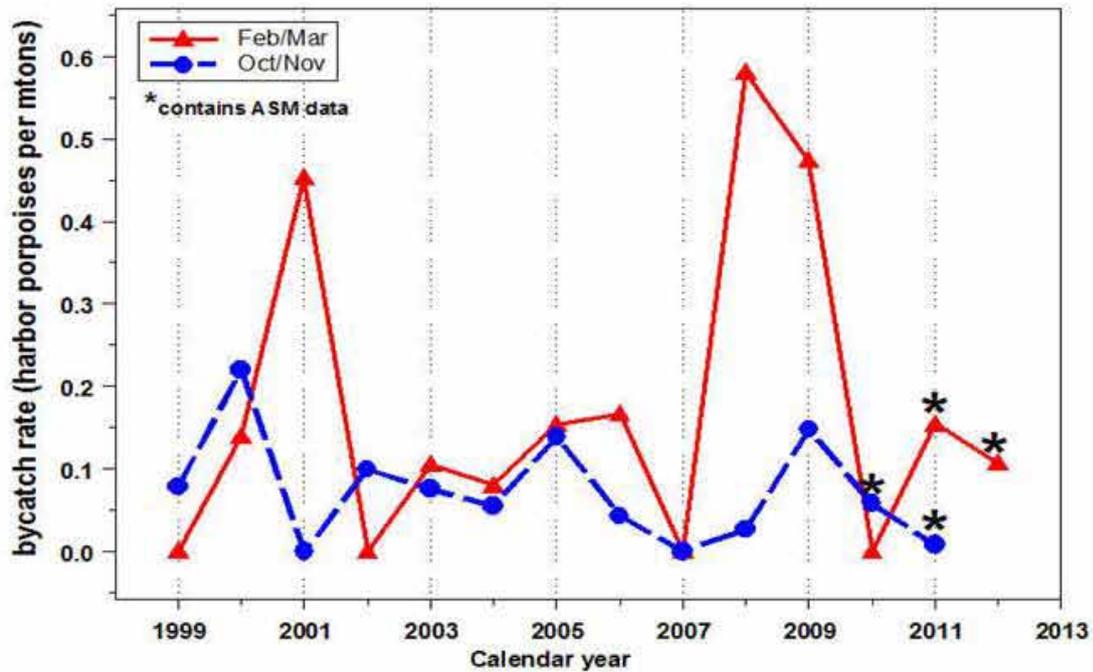


Figure 29. Results of a Generalized Additive Model of harbor porpoise bycatch rates (takes/(mtons landed + 0.0001)) using only the NEFOP observer data from 1 January 2007 – 31 May 2012.

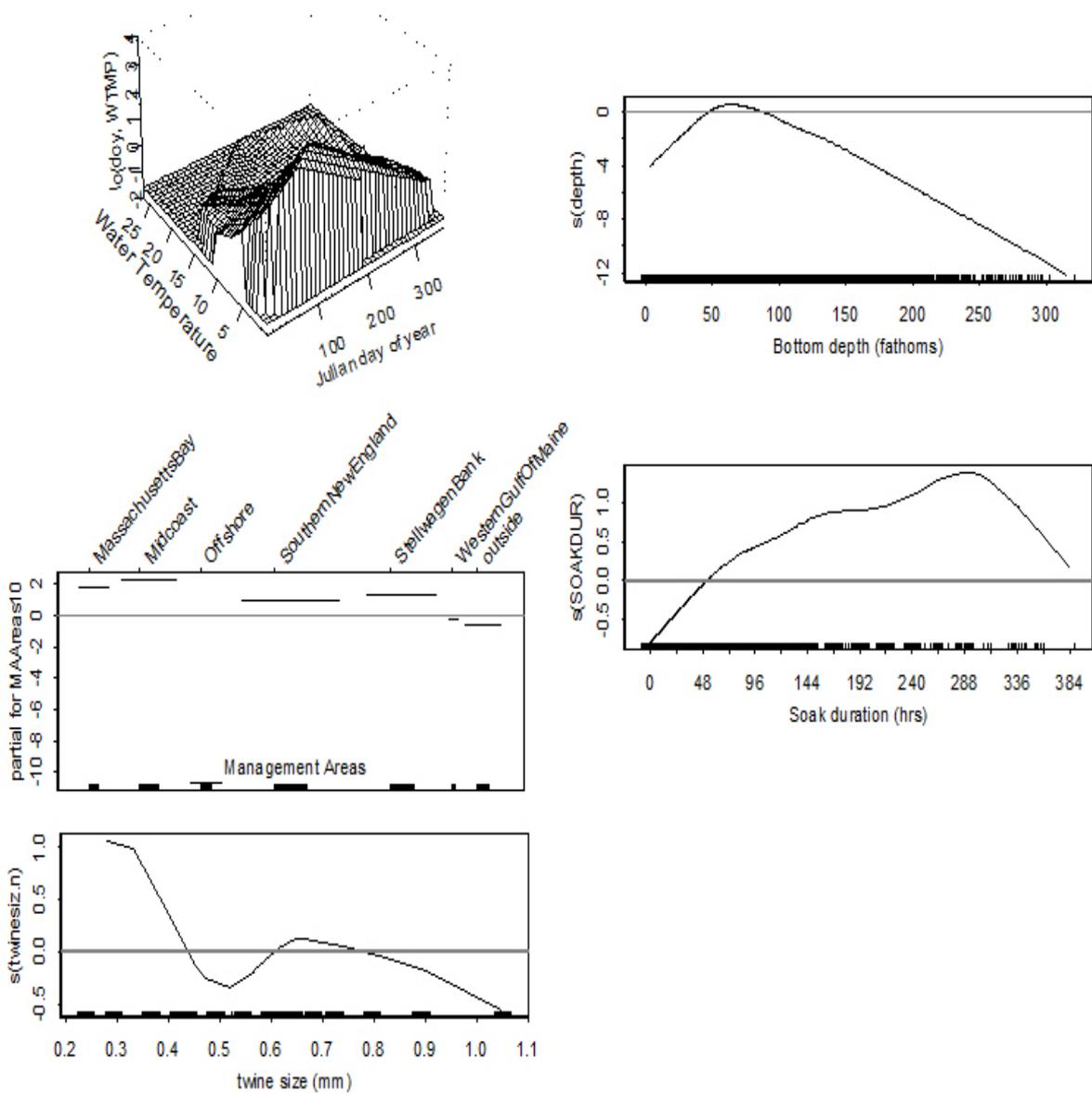


Figure 30. Results of a Generalized Additive Model of harbor porpoise bycatch rates (takes/(mtons landed + 0.0001)) using only the NEFOP observer data from 1 January 2007 – 31 May 2012 that were in times and areas that required pingers.

