

Interactions between short-finned pilot whales (*Globicephala  
macrorhynchus*) and the Pelagic Longline Fishery  
in the Cape Hatteras Special Research Area

By

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# **Interactions between short-finned pilot whales (*Globicephala macrorhynchus*) and the Pelagic Longline Fishery in the Cape Hatteras Special Research Area (CHSRA)**

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## **Abstract**

Short-finned pilot whales have a long history of interactions with Pelagic Longline (PLL) fisheries along the east coast of the United States. These interactions represent a threat to both the PLL fisheries' economic interests and the whales themselves. The establishment of the Cape Hatteras Special Research Area (CHSRA) was enacted in the Pelagic Longline Take Reduction Plan in response to the high rate of interactions in this area. Through satellite-based tracking systems and PLL fisheries data, this study addressed the spatial overlap between fisheries and short-finned pilot whales by examining the distribution of the species, their relation to oceanographic variables, bycatch records, and fishing effort. Fishing effort and pilot whales overlap strongly in a large portion of the CHSRA. This study highlights the importance of the CHSRA and the need for continued protection in the future.

## **Introduction**

According to the Marine Mammal Commission of the U. S. Government, there have been two types of interactions between fishing activities and marine mammal populations historically, direct and indirect interactions (MMC, n.d.). On one side, marine mammal populations are directly affected by injuries or deaths caused by bycatch, while fishing activities reduce the availability of resources for the mammals. On the other hand, the Commission highlights the negative pressure that marine mammal populations exert on fisheries as they consume both bait and caught fish while potentially damaging the fishing gear used in these activities (MMC, n.d.).

The interactions that occur between marine mammals and fishing activities have impacts that can be mainly described by considering three different but complementary effects. First, fishing pressure may contribute to depletion of fish populations on which marine mammals prey (Bundy, Heymans, Morissette, & Savenkoff, 2009). Second, as a result of depleted prey, marine mammals may experience a reduction in the quality of their nutrient intake (Hlista, Sosik, Traykovski, Kenney, & Moore, 2009). And, third, if these mammals consume the fish targeted by fisheries, a strong competition for the fishing resources may arise, originating a negative relationship between the two parties (Trites, Christensen, & Pauly, 1997).

The Marine Mammal Protection Act (MMPA) was amended in 1994 to introduce a biological reference point that could measure impacts of fisheries removals (bycatch) on marine mammal populations (Lonergan, 2011). This stock-specific measurement is known as the Potential Biological Removal (PBR) and is defined as "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock

while allowing that stock to reach or maintain its optimum sustainable population” (NOAA NMFS, 2015).

Interactions between marine mammals and longline fisheries have been widely documented. Some examples include interactions between killer (*Orcinus orca*) and sperm whales (*Physeter microcephalus*) with longline fisheries in the Falkland Islands (Nolan, Liddle, & Elliot, 2000; Purves, Agnew, Balguerias, Moreno, & Watkins, 2004) and the depredation by orcas and false killer whales (*Pseudorca crassidens*) on the catch of this type of fisheries in Uruguay (Passadore, Domingo, & Secchi, 2015). At a more local scale, in the U.S. Atlantic Ocean, pilot whales and Risso’s dolphins interact frequently with pelagic longline fisheries areas (Garrison, 1992). To address these frequent and negative interactions, we need greater knowledge of the problem and the approaches taken by different actors.

The Atlantic Pelagic Longline fishery targets mainly tuna and swordfish, with a fishing gear that consists of a mainline, gangions and baited hooks. Depending on the targeted species, these longlines can contain different types of hooks and can also be set at any depth across the water column, where they can stay deployed for hours or even days (NOAA NMFS, n.d.). Historically, longline fishing gear has been used in multiple types of fisheries, ranging from small-scale operations to highly industrialized fishing fleets. Furthermore, these fisheries have permanently been a threat for marine megafauna, representing high risks for sea turtles and marine mammals, especially pilot whales and bottlenose and Risso’s dolphins (NOAA NMFS, n.d.).

The distribution of short-finned pilot whales (*Globicephala macrorhynchus*) overlaps with long-finned pilot whales (*Globicephala melas*) in the North Atlantic (NOAA NMFS, 2016). However, around Cape Hatteras most pilot whales have been determined to be the short-finned species (NOAA NMFS, 2016). The best estimates of this latter species are based on boat and aerial surveys carried out in 2011, and suggest a total of around 21,500 individuals in the western North Atlantic (NOAA NMFS, 2016). The species interacts frequently with pelagic longline (PLL) fisheries, with an estimated mean annual total of 148 serious injuries or mortality events between 2009 and 2013. All bycatch reported from PLL fisheries in the Atlantic has been assigned to short-finned pilot whales. This finding is derived from molecular and photo-id assessments conducted by the National Marine Fisheries Service, indicating the exclusive presence of the short-finned species in these interactions (NOAA NMFS, 2016).

As a response to these high levels of mortality and serious injuries, in 2009 the National Marine Fisheries Service (NMFS) implemented the Atlantic Pelagic Longline Take Reduction Plan (PLTRP). This Plan was created by the Take Reduction Team (TRT), a group of stakeholders convened by the NMFS consisting of representatives from the fishing industry, fishery management councils, state and Federal resource managers and conservation organizations (NOAA NMFS, 2016). Once a TRT is established, it is given a 6-months period to submit a draft Plan that is evaluated by the NMFS and that enters later to a phase of public comment on both the proposed regulations and the general plan. When the comment period ends, the NMFS has 60 days to publish the final plan and its implementation is monitored through periodic meetings of the TRT and NMFS (NOAA NMFS, 2016).

The plan included a set of “regulations to reduce serious injuries and mortality of pilot whales and Risso’s dolphins in the Atlantic pelagic longline fishery” (Department of Commerce, NMFS, & NOAA, 2009). The main components of the PLTRP included three regulatory measures: (1) the creation of the Cape Hatteras Special Research Area (CHSRA); (2) an upper limit of 20 nautical miles for every mainline deployed in the Mid Atlantic Bight (MAB); and (3) informational placards that must be placed in every vessel’s wheelhouse and working platforms. The CHSRA encompasses an area of 5927 square kilometers and was delimited based on historically high levels of fishing effort and pilot whale bycatch (Department of Commerce et al., 2009). The goal of establishing the CHSRA was to impose special requirements for fishermen operating in this area, including higher levels of observer coverage and a requirement for operators to cooperate with research initiatives when requested (Department of Commerce et al., 2009).

The objective of the current project is to provide an initial view on the occurrence of short-finned pilot whales in the CHSRA, their relation to oceanographic variables in the area; and to establish the density of pelagic longline fishing efforts that take place in the Area. Moreover, the project intends to establish the overlap that exists between short-finned pilot whales and longlines and generate an estimate of critical areas in which both high fishing effort and high densities of pilot whales co-occur.

## **Methods**

### *Bycatch data*

Bycatch events were recorded by observers working onboard PLL fishing vessels between 2000 and 2016. Data were filtered to select the period that best matched the whales’ telemetry data (see below). From the resulting dataset, non-targeted individuals were classified into broad categories, including finfish, sharks, cetaceans, rays, turtles, birds or unknown/unregistered and a total count for each of these categories was performed. The presence of pilot whales in the bycatch records was analyzed separately. Additionally, these records were evaluated based on the condition in which the animals were found and the condition in which they were released after the interaction with the fishing gear. These classifications were made for the whole period of the observer data set (2000 – 2016) and the period that best matched the whales’ satellite-based records (May 2014 through December 2016).

### *Pilot whale telemetry*

Wildlife Computer SPOT5 tags were deployed with the LIMPET configuration on short-finned pilot whales found off the coast of Cape Hatteras between 2014 and 2017. Satellite tag data were collected under NMFS Permit No. 17086 and No. 20605 issued to R.W. Baird/Cascadia Research. The raw ARGOS database retrieved from satellite tags deployed on short-finned pilot whales was processed and filtered using Microsoft Access. Through this filter, information corresponding to tag ID, individual ID, date, ARGOS quality score, latitude and longitude was retrieved. Furthermore, each ARGOS location estimate has a quality score that ranges from zero to three, with three being the most precise estimate and zero the lowest quality estimate. Based on this quality score, these positions were refined to

obtain the most reliable locations for each of the periods an individual was tracked. To this end, a single record was chosen for each tagged individual for each day it was tracked, based on the ARGOS quality score. For cases in which more than one location per individual had the same quality for a specific day, the first position was chosen. The final best-quality filtered locations were used to create a shapefile to map the records using ArcMap 10.5.1.

Values of depth, slope and Chlorophyll-a were assigned to each pilot whale location using ArcGIS model builders. Rasters with the bathymetry data for the Western Atlantic Ocean were obtained from the Global Bathymetric Chart of the Oceans (GEBCO) publicly available online datasets and consisted of a 30 arc-second grid of the ocean elevation profile and published in 2014 as the GEBCO\_2014 Grid. This dataset was also implemented in the creation of a raster layer with the slope values of the seafloor of the area using the Slope tool on ArcMap 10.5.1. Both rasters were interpolated to each of the points previously generated. Chlorophyll-a values were assigned through the implementation of the “Interpolate NASA OceanColor” tool developed by Duke’s Marine Geospatial Ecology Lab (MGEL) (Roberts et al., 2010). The tool was set to use the Aqua sensor with a spatial resolution of 9km and was initially set to implement daily productivity values based on the telemetry locations’ recorded dates. Given the very high proportion of missing productivity values obtained due to the sensors’ limitations to overcome cloud cover, the tool’s settings were modified to make use of weekly average productivity values.

Each of the three datasets obtained based on the three main ARGOS quality scores (3 through 1) were analyzed separately and contrasted with the obtained depth and slope rasters, as well as with Chlorophyll-a values. Bathymetric and slope values of each pilot whale point were used to generate frequency distributions of these parameters. Furthermore, descriptive statistics of mean, maximum and minimum values of the three oceanographic variables of interest were obtained, for each location quality class.

Finally, the recorded positions of pilot whales with the highest quality scores (3) were used to generate a Kernel density raster, using as the population field the presence and aggregation of the point locations. The Kernel density raster was later reclassified making use of quantiles as the break values and differentiating the density data into five different categories, assigning a value of 5 to the areas of the highest presence and a value of 1 to the areas where whale density was lowest.

### *Fisheries data analysis*

Fisheries data were provided by the Southeast Fisheries Science Center (SEFSC) and consisted of logbook records with temporal and spatial distribution of pelagic longline fishing activities between April 2000 and November of 2017. Logbooks consist of records of the fishing activities that must be reported by operators of commercial fisheries for each trip (NOAA SFSC, n.d.) and include information on gear locations, catch and effort, among others (NOAA NMFS-WCR, n.d.). The datasets included descriptive variables such as lengths of the mainline, number of hooks per mainline and between floats, target species of the operation and types of bait, among others. The data was initially processed to convert the latitude and longitude values from degrees-minutes format to decimal degrees to facilitate its display in ArcGIS. The fishing operations were processed based on the logbook data

provided, generating a single point for each of the fishing operations records included in the logbook data based on the initial location of each set.

The logbook data were selected to match the dates for which whales' telemetry information was available. Once the point features were created, they were implemented to generate a Kernel density raster making use of the number of hooks deployed per set as the population value, the variable that is distributed across the extent of the area of interest to generate the continuous raster surface. Other parameters such as cell size and area unit scale factor were set as default so that they matched the raster datasets used in the other procedures. As performed with the whales' presence density raster, the fishing effort density raster was reclassified using quantiles, breaking the raster values into five categories being 5 and 1 the highest and lowest densities, respectively.

### *Spatial overlap analysis*

Once both whales' and fisheries' density rasters were reclassified, they were added through a raster calculator to generate a compiled raster surface. The compiled raster surface was later processed through equal intervals into three different categories depending on the degree of co-occurrence between both established densities. The overlap between the pilot whales and PLL fishing activities was categorized into three different intensities: medium or high.

The raster surface depicting the intensity of the overlap was converted into polygons with the purpose of obtaining delimited spatial areas assigned to each of these different levels of interactions. The obtained areas were contrasted with the Cape Hatteras Special Research Area boundaries to establish the zones within the area in which the interactions are more likely to occur. For each of the labeled overlap regions, the area was obtained and their percentages as portions of the CHSRA were calculated.

## **Results**

### *Incidence of short-finned pilot whale bycatch*

The bycatch records retrieved from the observer data that best fit the time range of the study occurred between May of 2014 and December of 2016. During this period a total of 60431 non-targeted individuals were recorded (Table 1). Finfish accounted for about three quarters of the total recorded bycatch, followed by sharks (22.39%) and rays (2.62%), with cetaceans accounting for only 0.18% of the non-targeted individuals caught (Figure 1). Regarding the specific presence of pilot whales, between 2014 and 2016 a total of 81 individuals were reported as bycatch, making up approximately 76% of the recorded cetaceans and about 0.1% of the total bycatch for that period (Table 2). Additionally, for the whole period for which the observer data was obtained between 2000 and 2016, a total of 225 pilot whales were reported as bycatch, comprising 0.096% of the full set of bycatch records.

Of special consideration is the status in which these pilot whales were found and the conditions in which they were released from the pelagic longline fishing gear. Most of the

81 pilot whales caught between 2014 and 2016 were found alive (Figure 2). However, the condition in which these individuals were released is not entirely clear given that the individual was reported as lost at surface for at least one fifth of the cases (Figure 2). Regarding the whole period for which the observer data was available between 2000 and 2016 only five pilot whales were found dead, a small percentage of the total of animals caught (Figure 3). Moreover, a high proportion of the caught individuals were still alive when released, although a considerable proportion were also reported as lost at surface and as a consequence, their status when released is unknown (Figure 3).

Table 1. Count of recorded individuals registered as bycatch by observers onboard PLL vessels between 2014 and 2016

Type	Registered individuals (2014 - 2016)
Fish	44920
Shark	13529
Ray	1582
Unknown	169
Turtle	116
Cetacean	106
Bird	9
<b>Total</b>	<b>60431</b>

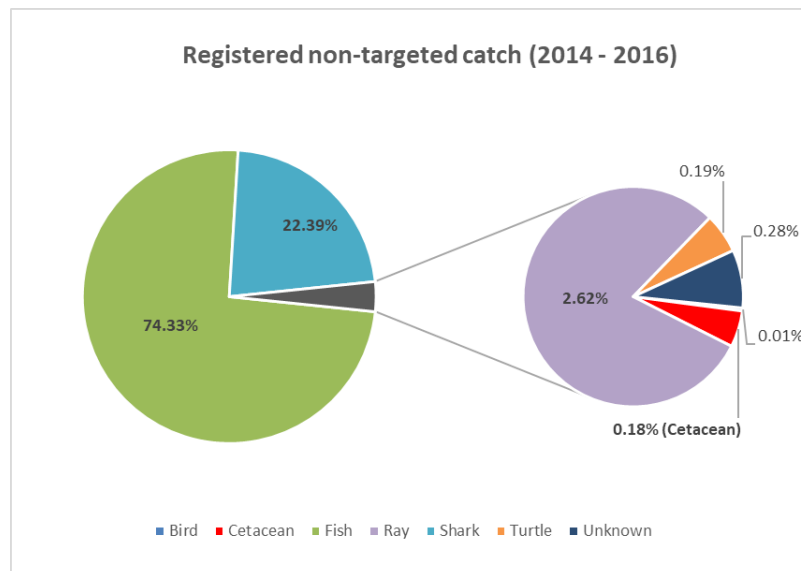


Figure 1. Plot depicting registered non-targeted catch in PLL fisheries with subplot showing the percentage of cetaceans as part of this bycatch data between 2014 and 2016

Table 2. Incidence of short-finned pilot whales as part of the bycatch reported for the PLL fisheries between 2014 and 2016.

Type	Registered individuals	Percentages (2014-2016)	
Cetacean	106	0.1754	
Pilot Whales	81	Of Cetaceans	Of Total
		76.4151	0.1340

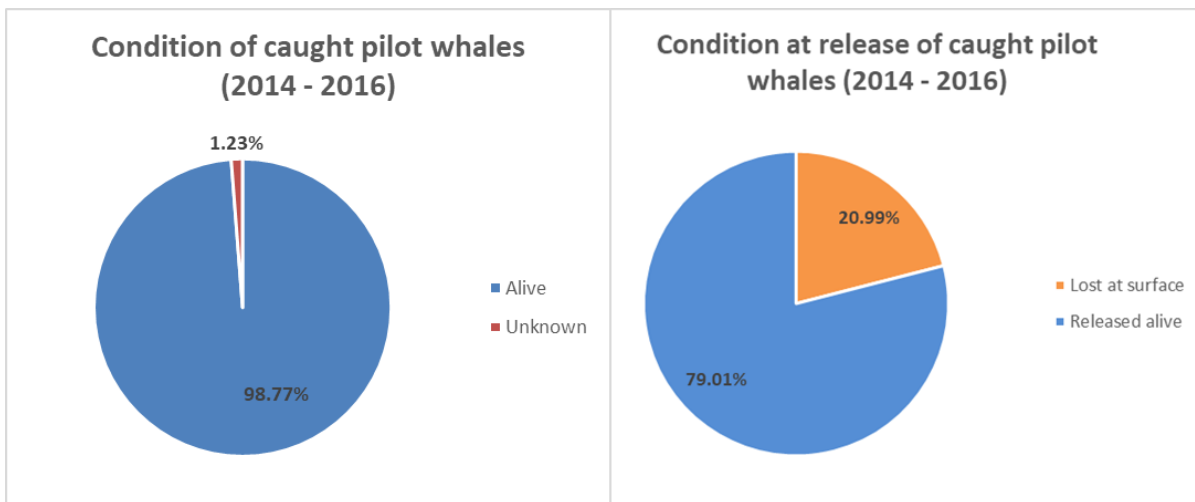


Figure 2. Condition when caught and at release of short-finned pilot whales reported as bycatch for the PLL fisheries between 2014 and 2016.

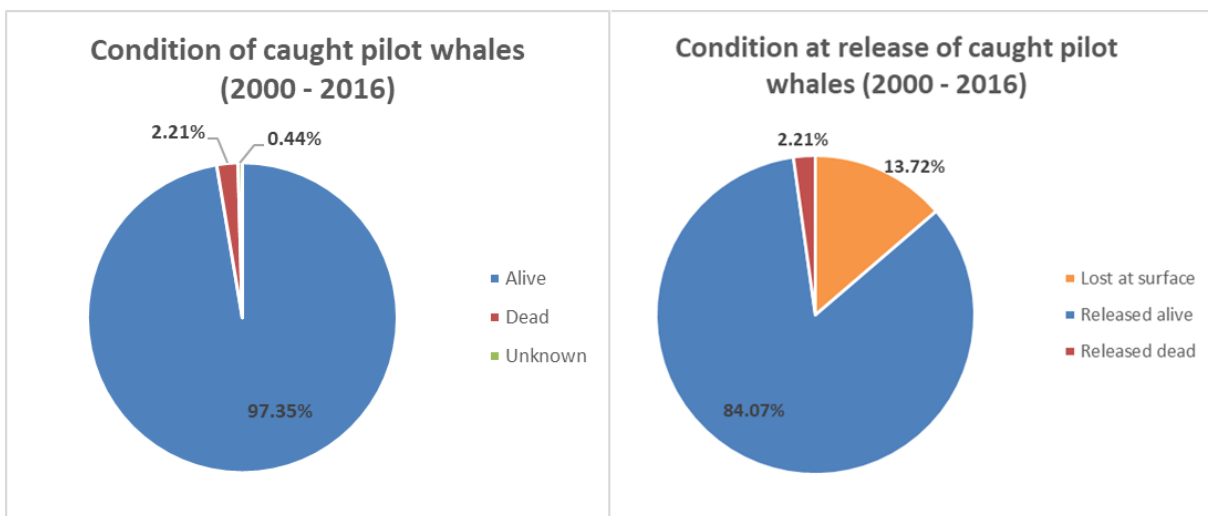


Figure 3. Condition when caught and at release of short-finned pilot whales reported as bycatch for the PLL fisheries between 2000 and 2016.



### *Relation of pilot whales and PLL fishing vessels to oceanographic variables*

The Cape Hatteras Special Research Area was delimited based on the geographic coordinates established in the PLTRP, corresponding to the rectangular boundaries formed by 35° N. lat., 75°W. long., 36° 25' N. lat., and 74° 35' W. long and later created as a shapefile. ARGOS data were retrieved from a total of 57 short-finned pilot whales, with a grand total of 21411 records. The dates for which the whales' telemetry data was available started in May of 2014 and went through September of 2017. The data retrieved from the satellite tags was filtered for the best-quality locations accounted for a total of 2483 records. Of this total, 1183 were recorded within the boundaries of the CHSRA, representing the 47.64% of the records. The differentiation based on the different quality scores resulted in 462 lc3 records (high quality; Figure 4), 527 lc2 records (medium quality; Figure 5), 147 lc1 records (low quality; Figure 6) and 47 lc0 records; with the latter excluded from further analyses.

The bathymetry records for the best locations (L3) showed a mean depth of 691 meters, with maximum and minimum depths of 2811 and 56 meters, respectively and with a steady decrease when compared to medium and low-quality depth records (Table 3). Regarding the slope values assigned to the point locations, despite slope values being as high as 54 in some areas of the CHSRA, the best records showed a mean of 5.8 degrees with a maximum slope of 12.38°; not showing much variation when compared to the other location class records (Table 3). Chlorophyll-a generally evidenced mean values in the lower spectrum for all the classified records, with maximum productivity below 2 milligrams per cubic meter (mg/m<sup>3</sup>) (Table 3). The frequency distribution analyzes performed on depth and slope records for each of the quality datasets (Figures 4 through 6) demonstrate depth records with a tendency towards lower values (shallower waters) with increased record quality, while slope records strongly tend towards middle values as record quality increases.

The analysis of the records obtained from the fisheries' logbooks showed that longline vessels set their gear across the entire Special Research Area (Figure 7). Moreover, the frequency distributions for depth and slope records followed trends very similar to those obtained for the whales (Figure 7). Oceanographic variables for the fisheries' locations showed mean values closely related to the whales' records, with a mean slope of 6.38 degrees and mean productivity of 0.39. Nonetheless, fishing activities occurred in waters slightly deeper than that used by the pilot whales, with a mean depth of approximately one thousand meters (Table 4).

### *Spatial overlap between pilot whales and PLL fishing activities*

The results from the initial Kernel density analysis of the fishing effort based on the number of hooks deployed per longline set evidence a clear pattern in which the highest density of pelagic longline fishing operations occurred along the continental shelf break (Figure 8). When specifically considering the CHSRA, the fishing density raster created showed a high proportion of the delimited area characterized by intense fishing effort, with a slight decrease towards the southern limit of the Area. Regarding the Kernel density surface obtained for the presence of pilot whales, the CHSRA included the highest density values within its boundaries, with a clear hotspot located in the core region of the area (Figure 8).

Table 3. Descriptive statistics of the considered oceanographic variables for the records classified at each quality score within the CHSRA (L3 – High, L2 – Medium, L1 – Low).

Cape Hatteras Special Research Area									
	L3			L2			L1		
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
<b>Depth (m)</b>	2811	56	691	2069	38	749.1	1974	60	761
<b>Slope</b>	12.38	0.12	5.8	12.82	0.0034	5.66	12.64	0.13	6.06
<b>Productivity</b>	1.69	0	0.58	1.84	0	0.53	1.66	0	0.55

Table 4. Descriptive statistics of the considered oceanographic variables for the longline vessels records within the CHSRA

PLL fisheries in the CHSRA			
	Max	Min	Mean
<b>Depth (m)</b>	2938	38	1009
<b>Slope (°)</b>	14.42	0.012	6.38
<b>Productivity (mg/m3)</b>	3.1	0.04	0.39

Table 5. Portions of the Cape Hatteras Special Research Area classified based on the overlap that exists between whales’ presence and fishing operations.

CHSRA	Co-occurrence	Area (sqKm)	% Within CHSRA
5902.78 sqKm	Low	314.47	5.33
	Medium	1566.57	26.54
	High	4021.74	68.13

Density results obtained from the occurrence of pilot whales and fishing effort showed that the CHSRA was characterized by the highest values for both aspects, with large portions of the Area resulting in values between 3 and 5 (Figure 9). Once the aggregate co-occurrence was determined, the pattern of the highest values taking place within the boundaries of the Area continued, with extensive regions ranked at the maximum co-occurrence level of 10 (Figure 9). Approximately 70% of the Cape Hatteras Special Research Area was classified as an area of high overlap, corresponding to a total of 4021 square kilometers (Table 5; Figure 10). Furthermore, only a small section of approximately 5% (314.47 square kilometers) of the CHSRA was categorized as low overlap (Table 5; Figure 10).

### Locations of tagged short-finned pilot whales and corresponding oceanographic variables in the Cape Hatteras Special Research Area (CHSRA)

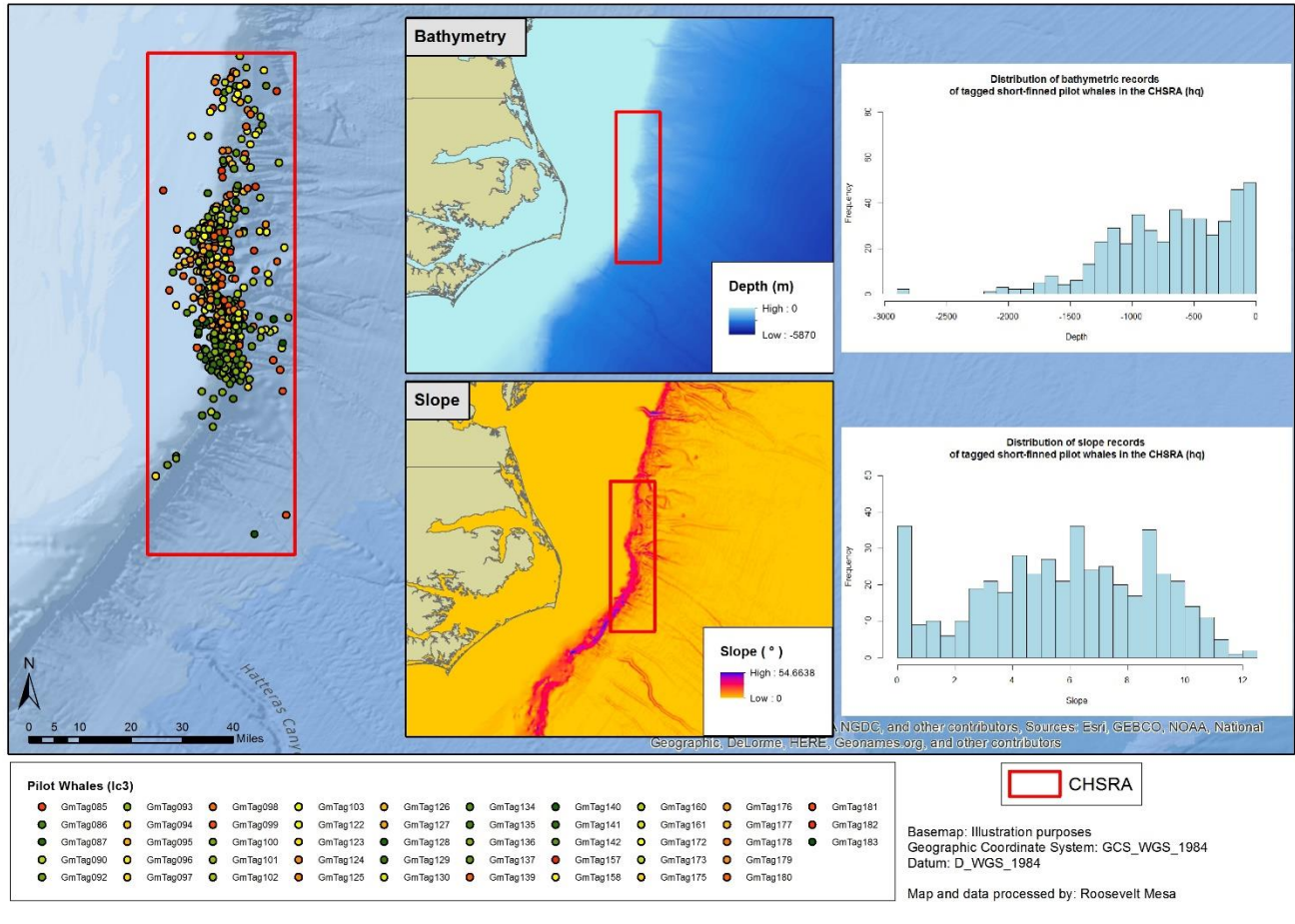


Figure 4. Location and corresponding depth and slope frequency distributions of the pilot whales' records classified as high quality (1c3)

## Locations of tagged short-finned pilot whales and corresponding oceanographic variables in the Cape Hatteras Special Research Area (CHSRA)

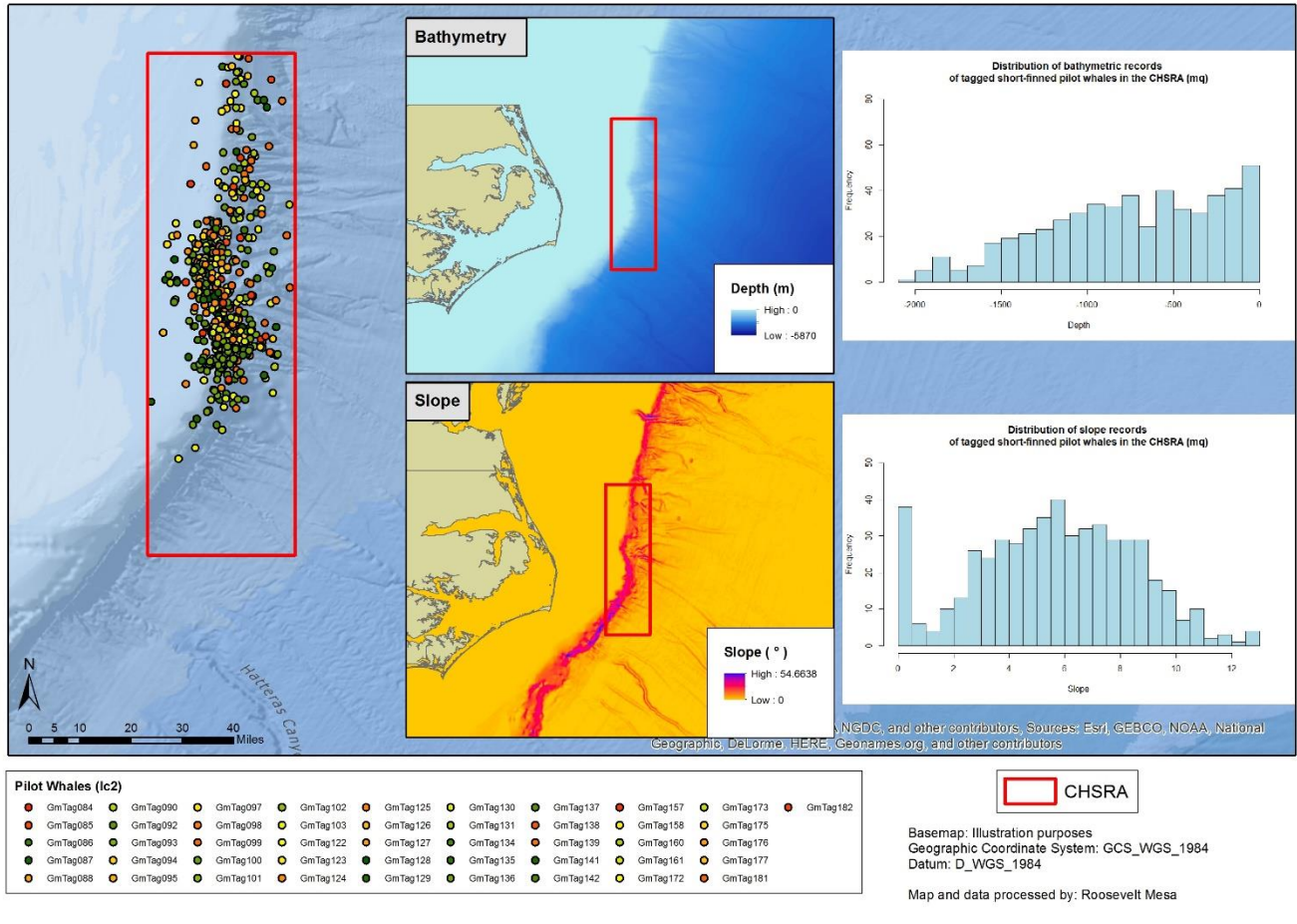
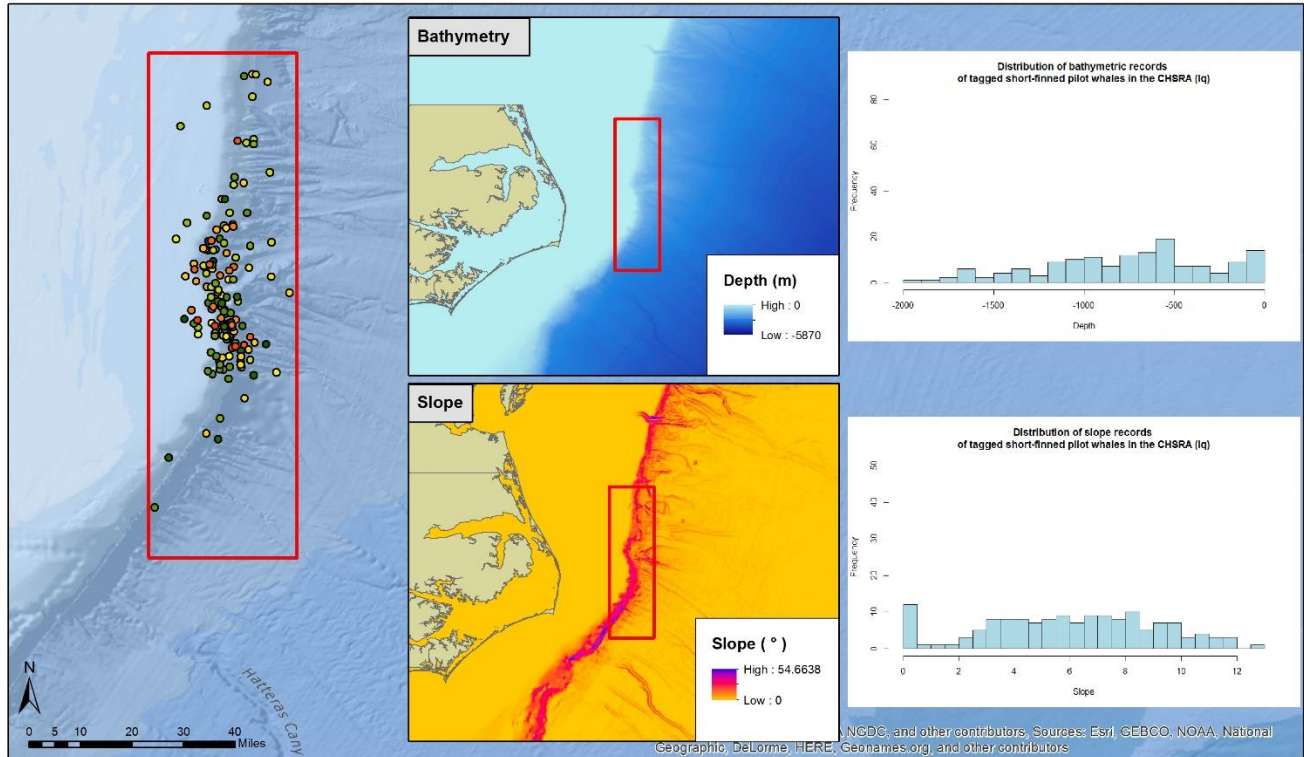


Figure 5. Location and corresponding depth and slope frequency distributions of the pilot whales' records classified as medium quality (lc2)

### Locations of tagged short-finned pilot whales and corresponding oceanographic variables in the Cape Hatteras Special Research Area (CHSRA)



**Pilot Whales (lc1)**

GmTag084	GmTag088	GmTag094	GmTag099	GmTag124	GmTag129	GmTag135	GmTag142	GmTag161
GmTag085	GmTag090	GmTag095	GmTag101	GmTag125	GmTag130	GmTag136	GmTag157	GmTag173
GmTag086	GmTag092	GmTag097	GmTag103	GmTag126	GmTag131	GmTag137	GmTag158	GmTag176
GmTag087	GmTag093	GmTag098	GmTag122	GmTag128	GmTag134	GmTag141	GmTag160	GmTag182

Basemap: Illustration purposes  
 Geographic Coordinate System: GCS\_WGS\_1984  
 Datum: D\_WGS\_1984

Map and data processed by: Roosevelt Mesa

Figure 6. Location and corresponding depth and slope frequency distributions of the pilot whales' records classified as low quality (lc1)

## Density of pelagic longline fishing vessels and corresponding oceanographic variables in the Cape Hatteras Special Research Area (CHSRA)

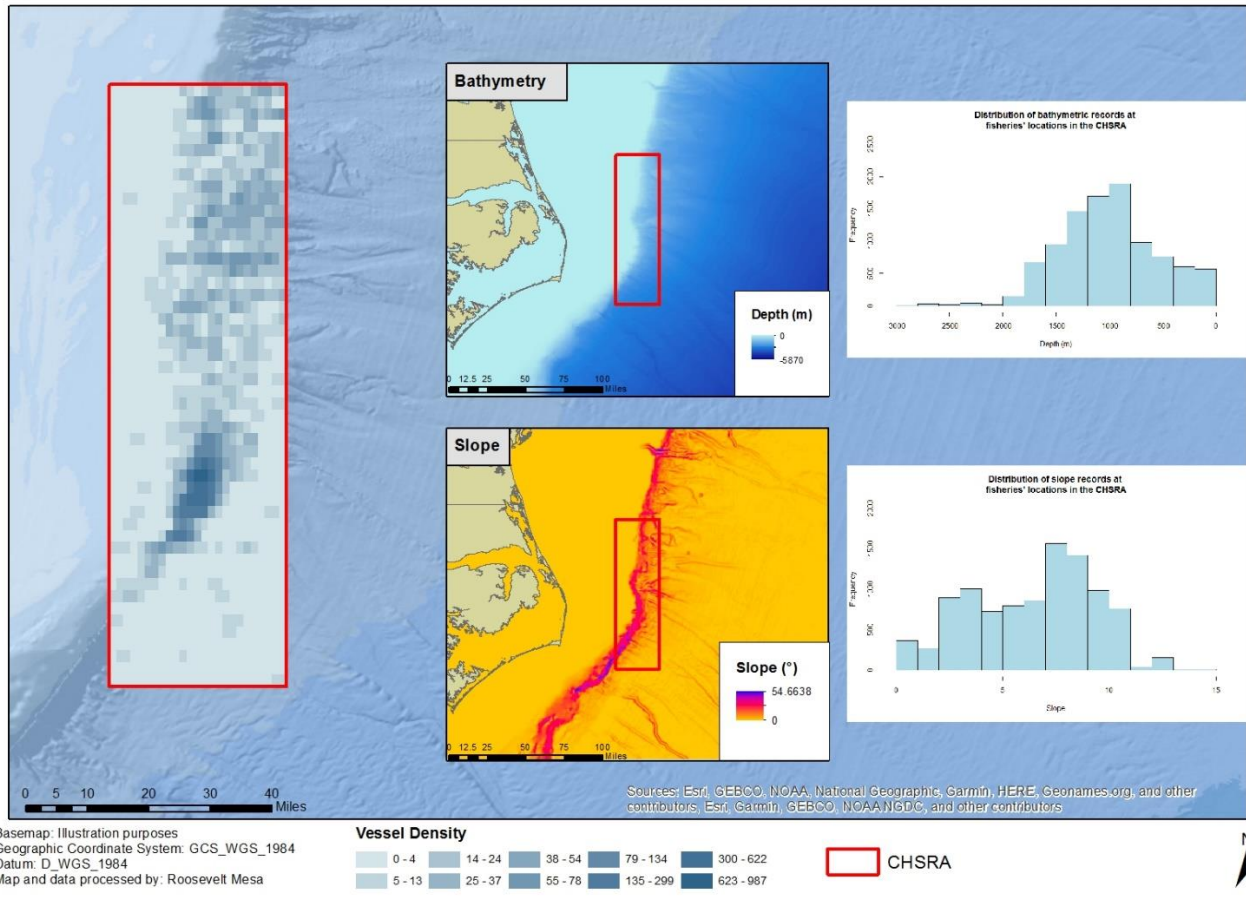


Figure 7. Location and corresponding depth and slope frequency distributions of PLL fishing vessels' records within the CHSRA

## Density analysis of fishing effort and pilot whale occurrences along the East Coast of the United States (2014 - 2017)

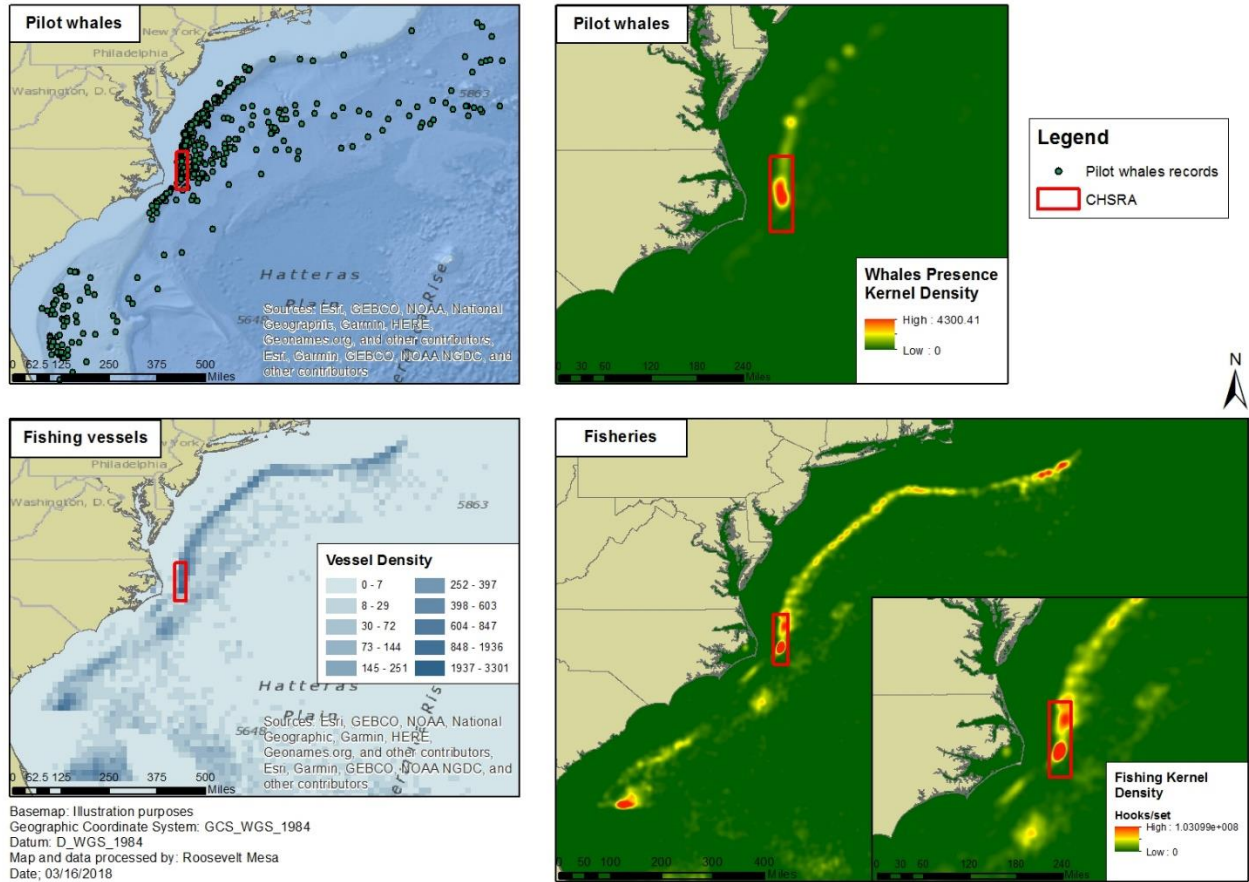
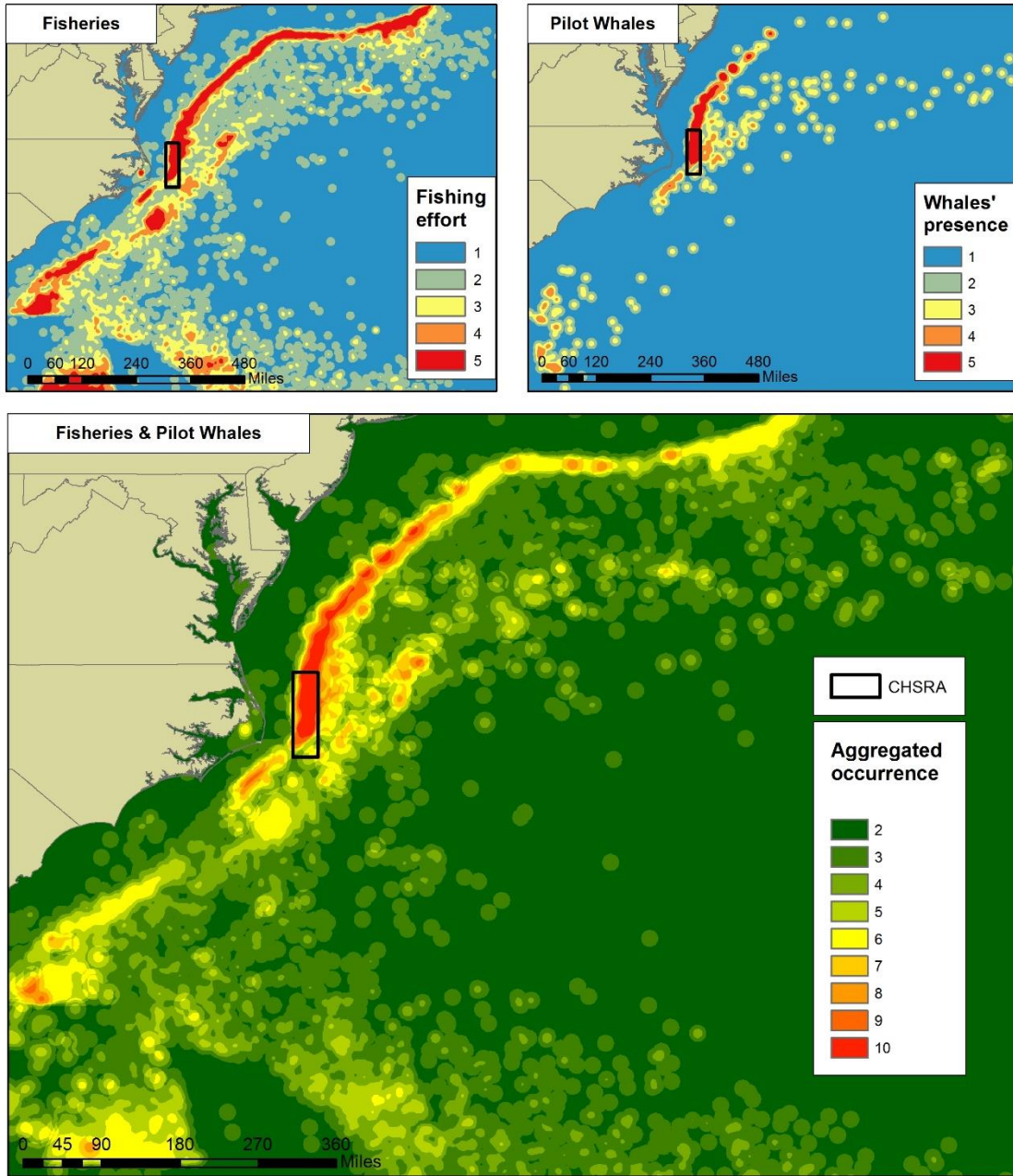


Figure 8. Kernel density analysis of the presence of pilot whales and the fishing effort (measured as hooks/set) in the U.S. East Coast and the CHSRA

## Aggregated occurrence of fishing effort and whales' presence along the US East Coast (2014 - 2017)



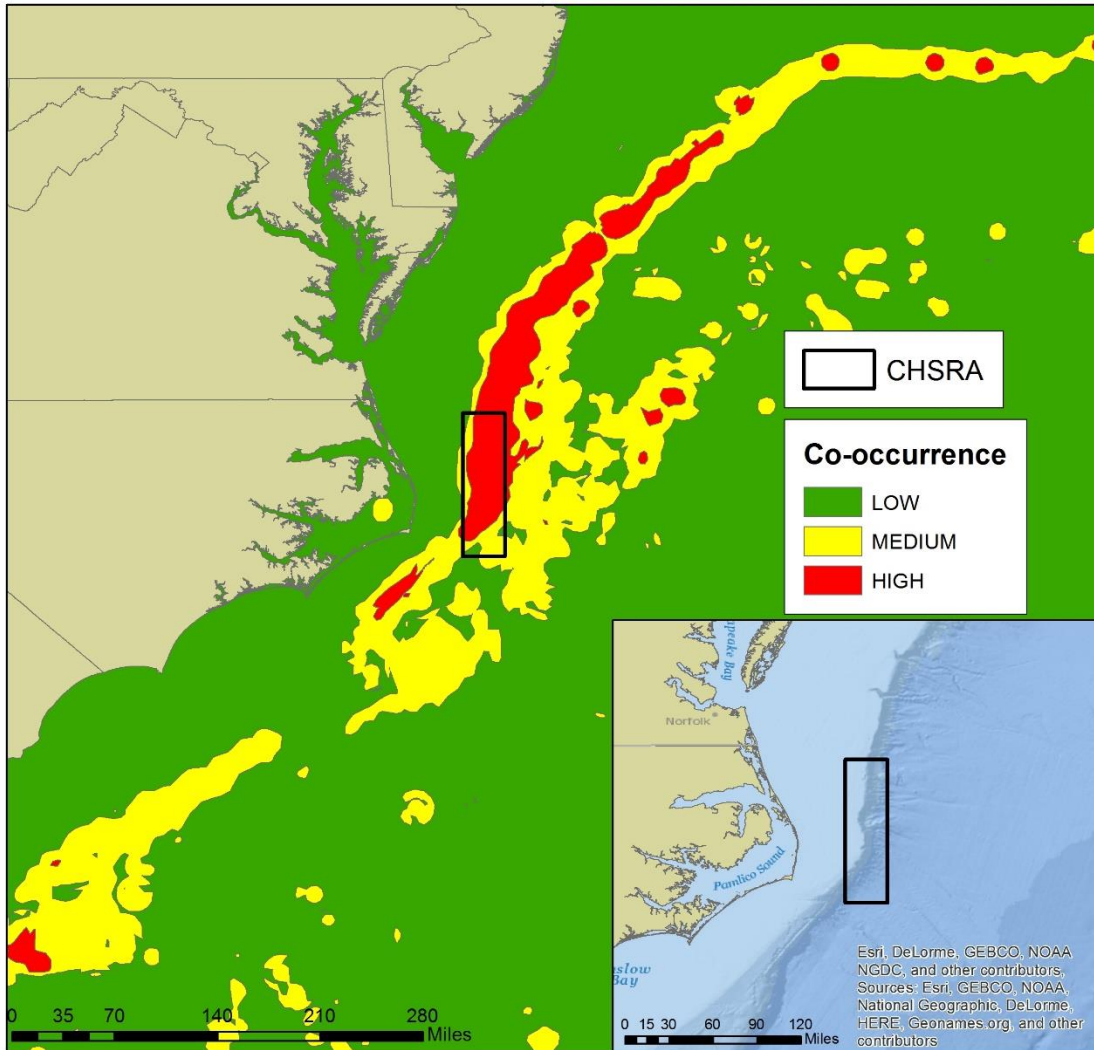
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 Map and data processed by: Roosevelt Mesa  
 Date: 03/16/2018



Figure 9. Reclassified and aggregated occurrence of pilot whales' presence and fishing effort in the U.S. East Coast and the CHSRA



## Overlap of fishing effort and pilot whale presence across the CHSRA (2014 - 2017)



CHSRA	Co-occurrence	Area (sqKm)	% Within CHSRA
5902.78 sqKm	Low	314.47	5.33
	Medium	1566.57	26.54
	High	4021.74	68.13

Basemap: Illustration purposes  
 Geographic Coordinate System: GCS\_WGS\_1984  
 Datum: D\_WGS\_1984  
 Map and data processed by: Roosevelt Mesa  
 Date: 03/16/2018



Figure 10. Ranked overlap between pilot whales' presence and fishing effort in the CHSRA

## **Discussion:**

Short-finned pilot whales constitute a very small percentage of the total records of bycatch for the PLL fisheries and might be considered as a rare event. However, a few incidents can have drastic effects on the species, and cetaceans in general, because of their life histories. Pilot whales have a long lifespan, delayed sexual maturity, and low fecundity, producing only a single calf at long intervals (Olson, 2009). Short-finned pilot whales have a lower growth rate compared to the long-finned species (Olson, 2009), making the short-finned species slightly more vulnerable to the effects of bycatch. Additional consideration must be given to the unknown conservation status of *G. macrorhynchus*, as the species is classified as Data Deficient (DD) by the IUCN (IUCN, 2009).

The potential biological removal (PBR) for short-finned pilot whales in the western North Atlantic has been established at 159 individuals (NOAA NMFS, 2017). Additionally, the population of *G. macrorhynchus* in the United States has been reported to suffer fishery-related mortality and serious injuries at levels higher than 10% of the PBR, exceeding the insignificance threshold (NOAA NMFS, 2017). Given the life traits mentioned, the lack of accurate information on the conservation status of the species, and the prevalence of incidents with fishing operations, it is of critical importance to reduce the uncertainty on the status of the pilot whales after the interaction with the fishing gear that characterizes bycatch records of PLL fisheries.

The highest occurrence of short-finned pilot whales has been reported at water depths between 1000 and 2500 meters. Depth, along with temperature and nutrient concentration, is one of the key parameters that characterize the regions used by the species in their foraging activities (Abecassis et al., 2015). The obtained mean values for the slope and water productivity variables considered for the pilot whales here closely resemble those obtained for the PLL fishery. Fishing effort occurred at mean depths slightly lower than the mean depths of the whales but longlines and pilot whales overlap extensively within the CHSRA. The bathymetry and slope frequency distributions of whales and longlines followed similar trends, further showing the resemblance in spatial use between fisheries and pilot whales. With such strong spatial overlap, along with the coincidences in the characteristic oceanographic variables between pilot whales and the PLL fishery, and considering the relatively small size of the CHSRA, the implementation of effective spatial management strategies would be difficult, if not impossible.

Between December 1<sup>st</sup> and 3<sup>rd</sup> 2015, the Pelagic Longline Take Reduction Team (PLTRT) convened in Virginia Beach to provide updates on the effectiveness of the PLTRP and to provide and refine new management alternatives (McCreary & Brooks, 2015). At the meeting, original mainline regulations were changed allowing a maximum of 30 nautical miles of gear deployed in a 24-hour period. Additionally, every active gear with a length exceeding 20 nautical miles was required to be separated from other active gear by at least one mile of mainline without any leaders or hooks with a maximum of 20 nautical miles of active gear that must be separated from other active gear by at least a mile without any leaders or hooks (McCreary & Brooks, 2015). As part of the discussion, the existence Cape Hatteras Special Research Area was questioned by members of the fishing industry, who requested the PLTRT consider the removal of the Area or at least the elimination of the call-in

requirements (McCreary & Brooks, 2015). The industry's representatives argued that the NMFS has not enforced the observers program at any extent since the call-in requirement was established. Furthermore, these members claimed that the pilot whales' distribution has moved northward and the interactions in the area are negligible; convening that "the CHSRA is no longer a useful hot spot for focused attention" (McCreary & Brooks, 2015). The results presented here demonstrate that this is not the case, and that pilot whales continue to use the CHSRA and overlap, to a significant degree, with fishing effort in this area.

### **Conclusion**

Short-finned pilot whales and pelagic longline fisheries share a long history of negative interactions. Management strategies implemented in recent years, such as the implementation of the Cape Hatteras Special Research Area, have encountered opposition from fishermen. The present research provides an initial baseline that demonstrates the presence of high densities of short-finned pilot whales and fishing effort within the boundaries of the Cape Hatteras Special Research Area. Moreover, it shows that this overlap extends over most of the CHSRA, increasing the probability of negative interactions. These results highlight the importance of the maintenance and stable management of the CHSRA, as it serves as a relevant tool for the conservation of the short-finned pilot whale.

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