Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy

Summer and Fall 2016 Semi-Annual Report

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NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

APEM

Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy

Summer and Fall 2016 Semi-Annual Report

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Abstract

In support of New York State's commitment to incorporating offshore wind into its energy portfolio, the New York State Energy Research and Development Authority (NYSERDA) embarked on a multi-year ultrahigh-resolution aerial digital survey of marine resources in a 12,650 square nautical mile offshore planning area (OPA) in 2016. The OPA encompasses the waters of the New York Bight from Long Island southeast to the continental shelf break. Surveys are conducted on a quarterly basis, timed to coincide with periods of abundance of avian and marine species vulnerable to impacts from offshore wind activities. This report summarizes the results of the first two surveys conducted in July–August and November 2016. Each survey collected images covering at least 7% of the OPA.

Of the more than 700,000 images collected within the survey area during these two surveys, 3.8% (27,135 images) contained organisms, including 38 bird, 17 fish, 5 whales, 7 dolphin, 1 seal, and 4 sea turtle species. Some seasonal patterns were evident. During the summer survey, the vast majority of the organisms observed were rays (8,388 images) or birds (1,893 images). During the fall survey, birds predominated (12,352 images). Shearwaters, storm-petrels, and terns were substantially more abundant in the summer while ducks, gannets, gulls and phalaropes were substantially more abundant in the fall. Turtles, sharks, and large bony fishes were all most abundant in the summer, though present in the fall. Number of images with marine mammals was similar in both surveys.

Spatial patterns were apparent in some taxonomic groups. A number of species tended to occur in nearshore waters including large gulls and least, royal and Sterna terns. Turtles typically occurred inshore of the 70 m isobath. Audubon's, sooty, and Cory's shearwaters clustered in the northeast corner of the OPA. Whales, Audubon's shearwaters, and black-capped petrels were most common near the shelf break. While sharks exhibited no clear patterns, rays showed some tendency to cluster off the mouth of New York Harbor. Large bony fishes typically occurred in deeper waters.

Results from the surveys will be incorporated into efforts to identify suitable areas for development of offshore wind projects.

Acknowledgments

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Acronyms and Abbreviations

ESA	Endangered Species Act
FAA	Federal Aviation Administration
GSD	Ground Sampling Distance
Normandeau	Normandeau Associates, Inc.
NYSERDA	New York State Energy Research and Development Authority
OPA	Offshore Planning Area
OSW	Offshore Wind Energy
WEA	Wind Energy Area

Summary

The New York State Energy Research and Development Authority (NYSERDA) contracted with Normandeau Associates, Inc., and teaming partner APEM Inc. to use high resolution aerial digital imagery to collect data on birds, marine mammals, sea turtles, cartilaginous fish, and other taxa encountered in the New York Offshore Planning Area. Additional data were collected on bony fish, fish shoals, and commercial and recreational boat activity. This report summarizes the results of the first two surveys conducted in July–August and November 2016. Each survey collected images covering at least 7% of the OPA.

More than 700,000 images were collected within the survey area during these two surveys. Of these 3.8% (27,135 images) contained organisms, including 38 bird, 17 fish, 5 whales, 7 dolphin, 1 seal, and 4 sea turtle species. Some seasonal patterns were evident. During the summer survey, the vast majority of the organisms observed were rays (8,388 images) or birds (1,893 images). During the fall survey, birds predominated (12,352 images). Shearwaters, storm-petrels and terns were substantially more abundant in the summer while ducks, gannets, gulls and phalaropes were substantially more abundant in the fall. Turtles, sharks, and large bony fishes were all most abundant in the summer, though present in the fall. Number of images with marine mammals was similar in both surveys.

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Introduction

There is growing interest in developing offshore wind energy (OSW) in New York and elsewhere in the country. However, it is still unclear what impacts OSW development will have on wildlife, including corals, birds, bats, sea turtles, fish, and marine mammals. Data gaps interfere with federal and state regulator efforts to avoid or minimize potential negative impacts on wildlife from OSW development. There have been several efforts in New York and elsewhere along the Atlantic coast to identify and fill these gaps in recent years, but many research needs are still unmet. One of the most pressing research needs is baseline data on potential wildlife exposure. Knowledge about species presence and absence in development areas helps regulators form appropriate site-specific questions to be addressed by developers. Regional-scale baseline information on wildlife distributions, abundance, and movements by season can inform the relative biodiversity of development sites. These types of surveys can also provide a better understanding of the potential effects of individual projects, as well as any potential cumulative effects of multiple projects.

The New York State Energy Research and Development Authority (NYSERDA) contracted with Normandeau Associates Inc. (Normandeau) and teaming partner APEM Inc. (APEM) to use high resolution aerial digital imagery to collect data on birds, marine mammals, sea turtles, cartilaginous fish, and other taxa encountered offshore. Surveys are conducted four times a year over three years. The surveys have been designed in light of available historical data and use the latest digital and sensor technology to provide high identification success.

Survey results are presented in semiannual reports, which will cumulatively provide insight into interseasonal and interannual variation in species composition, densities, and distributions. This report is the first semiannual report, providing the results of the first and second surveys (Summer 2016 and Fall 2016).

This report draws on information presented in documents prepared on behalf of NYSERDA by Normandeau and available at https://remote.normandeau.com/nys_docs.php

Reports used in the preparation of this document:

- Summer 2016 Survey 1 Summary Report.
- Summer 2016 Target Extraction Summary Report.
- Summer 2016 Taxonomic Analysis Summary Report.
- Fall 2016 Survey 2 Summary Report.
- Fall 2016 Target Extraction Summary Report.
- Fall 2016 Taxonomic Analysis Summary Report.

Methods

Data Collection

The New York Offshore Planning Area (OPA) including a 300-m buffer covers 43,745.20 km^2, and the New York Wind Energy Area (WEA) including a 4-km buffer covers 850.92 km^2. The Summer 2016 survey of the OPA and WEA began on 26 July 2016 and was completed 9 August 2016. The Fall 2016 survey began on 5 November 2016 and was completed 27 November 2016. Two different camera systems were used for the surveys. The Shearwater II camera system was used during the Summer 2016 survey and the new Shearwater III camera system was used during the Fall 2016 survey. Both systems collected

data at 1.5-cm ground sampling distance (GSD) and both surveys used a Piper Aztec twin engine aircraft. In addition, during the Summer survey data were collected at 0.75 cm GSD on near shore sample lines, which were flown at the lower altitude of >500 ft to accommodate restrictions imposed in controlled airspace around JFK. Flight altitude for the remaining survey lines of the Summer survey was at 1,020 ft, and data were captured at 1,360 ft for all of the Fall survey.

The survey team was based out of MacArthur Airport in Long Island, New York, for the duration of surveys. Because there are a number of local airfields on Long Island, the Federal Aviation Administration (FAA) imposes varying altitude restrictions that survey aircraft must obey. These are designated according to distance from the airfield. Flights parallel to the shoreline within the restricted zone ensure that the survey aircraft can maintain constant altitude over a complete transect, thus ensuring consistency in image resolution and areal coverage along the transect. For both surveys, nearshore transects were flown parallel to the shoreline, and for the Fall survey these were split into east and west segments (Figure 1 and Figure 2). FAA controlled altitude restrictions cease to be an issue several miles offshore. At this point transects were orientated perpendicular to the shoreline and consequently to the bathymetry, providing optimal orientation for expected clines in the distribution of target species (Figure 3). The WEA was surveyed using a grid pattern sampled from flown lines depicted in Figure 4.

Daily survey time maximized crew hours and avoided mid-day when glare/glint was most prevalent, and surveys were not conducted when sea state was 4 or above, cloud base <1,400 ft, visibility <5 km, or wind speed >30 knots. The onboard camera technician continuously monitored the images collected and if they ceased to be of sufficient quality, image acquisition stopped until suitable conditions returned. Extra imagery was collected to replace any glint-affected images. At each capture point, surplus images are collected to allow for replacement of any image found unsuitable for analysis. Data collected for the OPA included a 300-m buffer. Data collected for the WEA included a 4-km buffer. All data capture points located within the 300-m buffer of the OPA are included for analysis. The shape of the survey area sometimes means that a small part of the very large image might be outside of the 300-m buffer. Following each daily survey, sample imagery was evaluated to make sure it was of good quality for analysis. Data was backed up daily and prepared to be shipped for analysis.

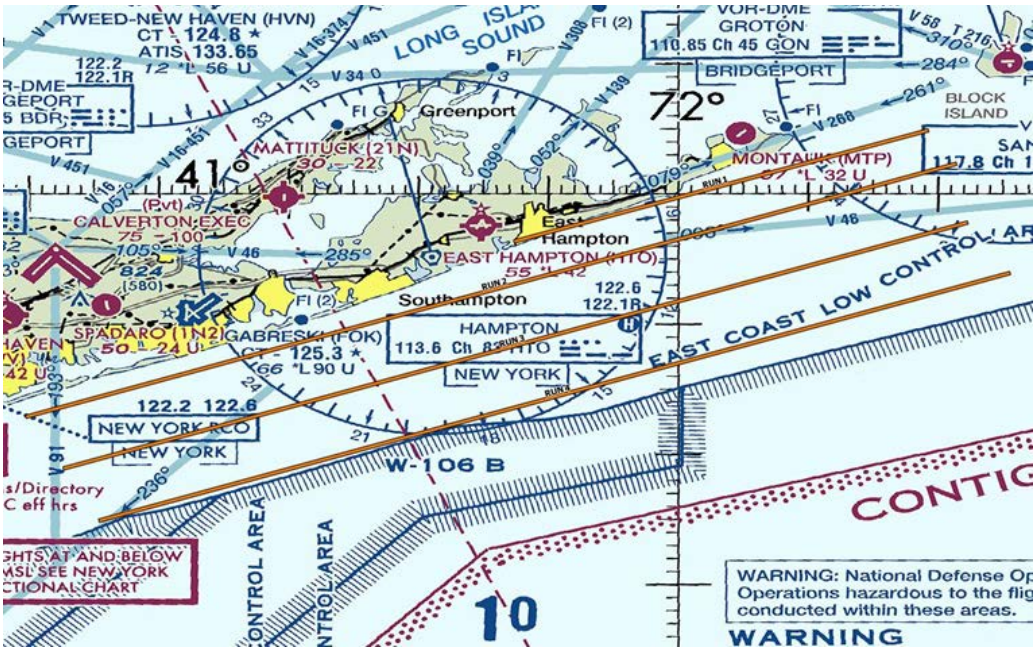

Figure 1. Flight plan used for Near Shore East.

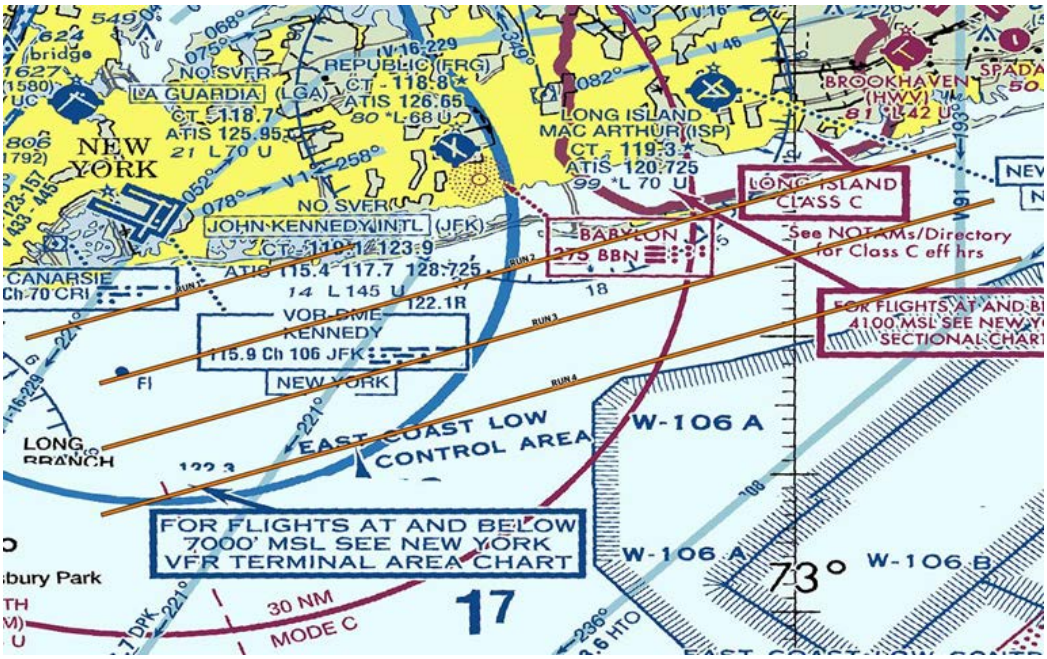

Figure 2. Flight plan used for Near Shore West.

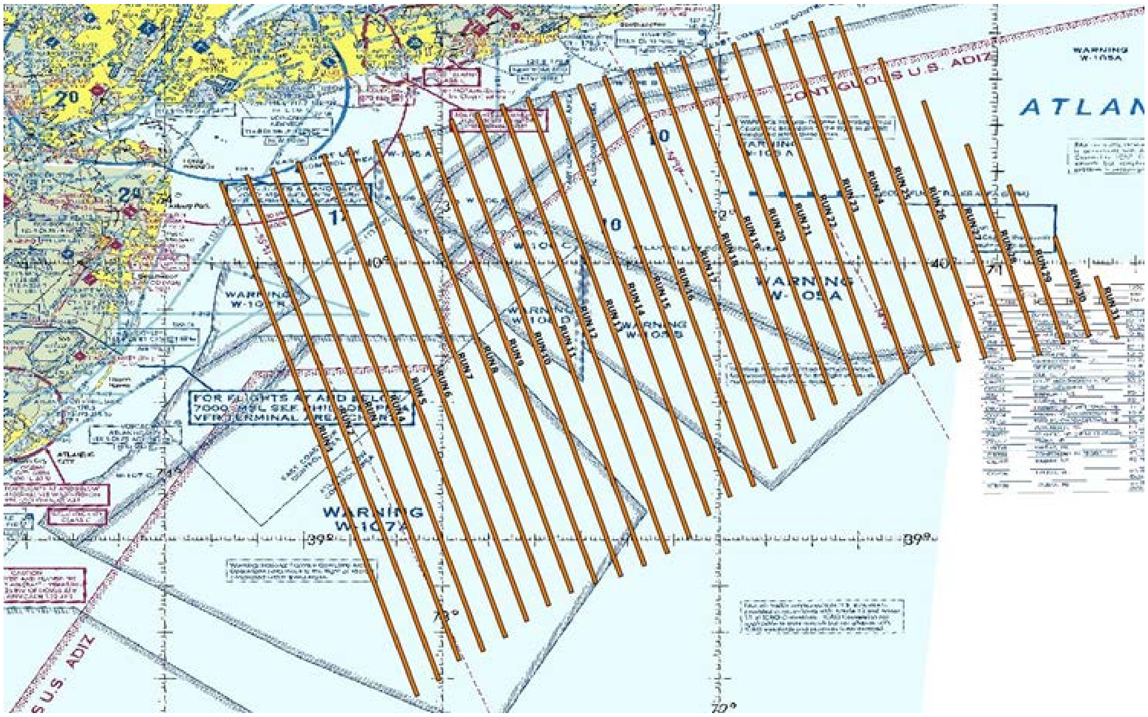

Figure 3. Flight plan used for the Offshore Planning Area.

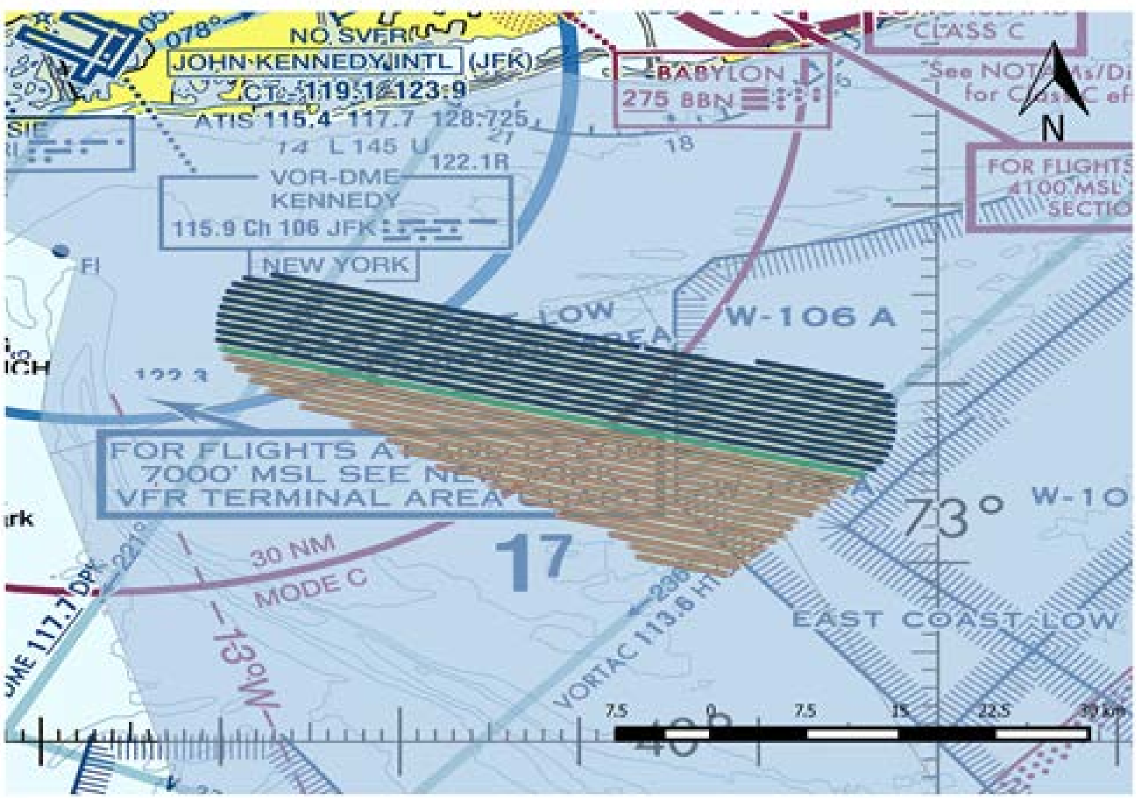

Figure 4. Flight plan used for the Wind Energy Area using image captures for grid survey.

During the Summer survey using Shearwater II, 299,980 images were collected for analysis. During the Summer survey, 3,204.02 km^2 of imagery data were collected in the OPA, providing an overall coverage of 7.32%. In the WEA, 107.59 km^2 of imagery data were collected, providing an overall coverage of 12.64% (Table 1). During the Fall survey using Shearwater III, 407,075 images were collected over an area of 3,890.58 km^2 in the OPA, providing an overall coverage of 8.89%. In the WEA, 94 km^2 of data were collected, providing an overall coverage of 11.14% (Table 1).

Table 1. Data Collected in the Summer and Fall Surveys 2016

Area	Total Area (km²)	Collection Area			Survey Area	
		Area (km²)	Percent Coverage [b]	Number of Images	Area (km²)	Number of Images
Summer 2016						
WEA [a]	850.92	107.59	12.64%	11,146	103.21	10,587
OPA	43,745.20	3,204.02	7.32%	289,393	3,204.02	289,393
Total	**44,596.12**	**3,311.61**	**7.43%**	**300,539**	**3,307.23**	**299,980**
Fall 2016						
WEA [a]	850.92	94.83	11.14%	10,996	94.83	10,996
OPA	43,745.20	3,890.58	8.89%	396,079	3,890.58	396,079
Total	**44,596.12**	**3,985.41**	**8.94%**	**407,075**	**3,985.41**	**407,075**

[a] This table only represents the imagery that was processed and analysed per the scope of work. An additional 10% coverage was collected for the WEA but is being stored if needed for future processing and analysis.

[b] Percent coverage of the entire OPA including the WEA imagery.

Target Extraction and Quality Control

Target extraction for the first Summer survey for the OPA and WEA was started in August 2016. All target extraction and quality control of target extraction was completed by 26 October 2016. The vast majority of the images collected contained no evidence of living organisms, vessels, or structures. More than 96% of the images from the WEA were blank as were more than 98% of the images from the OPA (Table 2). Target extraction for the Fall survey for the OPA and WEA was started in December 2016. All target extraction and quality control of target extraction was completed by 27 February 2017. Again, the vast majority of images collected contained no evidence of living organisms, vessels, or structures. More than 99% of the images from the WEA were blank as were more than 98% of the images from the OPA (Table 2).

To continue monitoring the success of the automated and manual target extraction and ensure that data are not lost during the extraction process, approximately 10.4% of the Summer blank images went through independent review for quality control (n=30,789) (Table 2), and 74 were determined to contain targets that had been missed in the initial target extraction (Table 3). The overall quality rate of the initial extraction was 99.76%, well within the quality control criteria established for the project (Table 3). Images found to contain organisms were transmitted to taxonomists for identification (Table 4). Approximately 10.1% of the Fall blank images went through independent review for quality control (n=40,598) (Table 2). Of these, 28 were determined to contain targets (living organisms) that had been missed in the initial target extraction (Table 3). The overall quality rate of the initial extraction was

99.93%, well within the quality control criteria established for the project (Table 3). Images found to contain organisms were transmitted to taxonomists for identification (Table 4).

Table 2. Number of Images Collected, Number of Blank Images Detected, and Number Sent for Quality Control Review for the 2016 Summer and Fall Surveys

Area	Number of Images in Survey Area	Blank Images			
		Number	Percent	Number QC'd	Percent QC'd
Summer 2016					
WEA	10,587	10,166	96.02	1,100	10.82
OPA	289,393	285,818	98.76	29,689	10.39
Total	**299,980**	**295,984**	**98.67**	**30,789**	**10.40**
Fall 2016					
WEA	10,996	10,944	99.53	1,262	11.53
OPA	396,079	391,474	98.84	39,336	10.05
Total	**407,075**	**402,418**	**98.86**	**40,598**	**10.09**

Table 3. Number of Blank Images sent for Quality Control Review, Number Found to be Blank/Not Blank, and Percent Agreement Reached for the 2016 Summer and Fall Surveys

Survey	Number of Images			% Agreement Reached
	For QC	QC'd as Blank	QC'd Not Blank	
Summer 2016	30,789	30,715	74	99.76%
Fall 2016	40,598	40,570	28	99.93%

Table 4. Number of Individuals within Taxonomic Groups Found During QC Process for the 2016 Summer and Fall Surveys

Order Found in Image	Number of Individuals in Blank QC	
	Summer 2016	Fall 2016
Birds	10	23
Fish	40	3
Marine Mammals	3	2
Turtles	21	0
TOTAL	**74**	**28**

Target Classification and Identification

Targets could be categorized into ten groups representing avian (birds), bats, turtles, marine mammals, rays, sharks, large bony fish, fish shoals, vessels, and fixed structures. Most of these were then accessed

for identification by biologists highly experienced in their taxonomic group, and identifications of species listed as "Endangered" or "Threatened" by the state or under the Endangered Species Act (ESA) were flagged. The identification of large bony fish was added later to the scope of work, with initial review of the group identifying only ocean sunfish. Vessels were also a group that was not initially classified.

Identification Quality Control

A minimum of 20% of all images identified were reviewed by a second taxonomic expert and taxonomic agreement had to meet a minimum of 90% concurrence. Failure to reach this would trigger a review of 100% of identifications made by the initial taxonomist. The 20% review included quality control review of 100% of ESA and State-listed species, and for endangered species a 100% agreement had to be reached on identifications. Additional experts in the species concerned were called in to arbitrate identifications when concurrence could not be reached.

Results

Identification Success

All identifications that went through quality control review reached and exceeded their targeted percent agreement (Table 5, Table 6) (see Appendix A for a list of species included in taxonomic groups).

Table 5. Number of Images by Taxonomic Group, Number Reviewed, and Percent Identification Agreement Reached

Taxonomic Group	Number of Images		Number of Images for QC		% Agreement Reached	
	Summer	Fall	Summer	Fall	Summer	Fall
Avian	1,893	12,352	472	2,457	100	99
Turtles	578	40	578	40	100	100
Marine Mammals	929	1,118	132	241	96	100
Rays	8,388	4	1,401	0	100	—
Sharks	917	4	105	1	100	100
Large Bony Fish	727	185	0	0	—	—
TOTAL	**13,432**	**13,703**	**2,688**	**2,739**	**99**	**100**

Table 6. Number of Images of Threatened and Endangered Species by Taxonomic Group, Number Reviewed, and Percent Identification Agreement Reached

Taxonomic Group	Number of Images		% Agreement Reached
	Summer 2016	Fall 2016	
Avian	152	0	100
Turtles	578	40	100
Marine Mammals	11	9	100
Sharks	143	1	100
TOTAL	**884**	**50**	**100**

Identification success varied by taxonomic groups and by depth of subsurface animals. All identifications had a level of certainty ascribed to them (e.g., possible, probable, and definite). Some animals were identified as "possible" when a number of conspecifics had already been identified within that group (see (Figure 5 for an example) and there was no evidence in literature that the animal moved in mixed species groups. A number of rays fell into this category. The certainty level "probable" was ascribed to species with the combination of physical characters available in the imagery and a high probability of a specific species presence in the area strongly suggested that identification. The certainty level "definite" was ascribed when all characters were present and the taxonomist was confident in the identification.

Subsurface animals were ranked as "breaching," "near surface," and "significantly submerged" (see Figure 5 for an example). The reason for this was to be able to evaluate whether image quality, angle of the animal at point of capture, or depth in the water impacts the ability to identify animals to species. Digital imagery captured from downward-pointing sensors "sees" through the water column more effectively than angled sensors, and more animals are "observed." Visual surveyors from boats and digital imagery captured by angled lenses will "see" fewer animals to a greater or lesser degree because subsurface animals are hidden by the water column. However, this improvement in reporting animal presence by downward facing lenses sometimes is at a cost of species identification because of the depth of the animal.

Figure 5. Example of image showing difficulty of identification of more deeply submerged animals. Deeply submerged animals would be ascribed a certainty of "possible" and ranked as "significantly submerged."

Avian Species

Over the two surveys, all avian identifications were classified to taxonomic group (n=14,245) (Appendix B). Avian species level identifications varied by taxonomic groups depending on size and coloration. The largest and most distinct bird species found was northern gannet and 100% of these (n=2,953) were identified to species. All cormorants (n=73), 50% of auks (n=39), 100% of sea duck (n=1,714), 89% of gulls (n=4,962), >99% of loons (n=280), 74% of petrels (n=14), 100% of storm-petrels (n=792), 100% of raptors (n=2), and 83% of shearwaters (n=768) were identified to species (Appendix B). Of other shorebirds (n=60), only 6 (10%) were identified to species. Of terns (n=209), 73% (n=152) were identified to the group "*Sterna*," which consists of common tern, Forster's tern, arctic tern, and roseate tern. Another 22% (n=46) were identified to species. Only 5% (n=11) of terns were unidentified to species or genus. The Fall survey found large numbers of phalaropes (n=1,558) of which 61% (n=949) were identified to species (Appendix B).

Turtle Species

Over the Summer and Fall 2016 surveys, 618 turtles were identified in imagery (Appendix C). Of these, 24% (n=151) were not ascribed to species, 132 of which were rated as significantly submerged. Ten turtles were categorized as "loggerhead/Kemp's ridley" species group and of these 6 were significantly submerged. Overall species identification success for turtles reached 76% (n=467).

Marine Mammal Species

Identification rates between marine mammal taxonomic groups varied (Appendix D). There were 2,047 marine mammals identified in the imagery across the Summer and Fall 2016 surveys, and of these 98% (n=2000) were dolphins of which 49% (n=986) were ascribed either to species (n=875) or "pilot whale (unid.)" (n=111). Of the 1,014 dolphins not ascribed to species or as "pilot whale (unid.)," 73% (n=739) were rated as significantly submerged.

Thirteen seals were found in imagery (Appendix D), of which one (8%) was identified to species. Four of the remaining 12 were rated as significantly submerged.

Identification rates for whale species reached 94% (Appendix D), of which 12 (36%) were categorized as "beaked whale (unid.)." Only 1 of the 34 whales were not ascribed to a species.

Ray and Shark Species

There were 8,392 rays found in the imagery; 86% (n= 7,214) were ascribed to species (n=3,696) or "cownose/bullnose ray" (n=3,518) (Appendix E). Of the cownose/bullnose ray group, 63% (n=2,228) were rated as significantly submerged as were 69% (n=812) of the 1,178 unknown ray species. Removing cownose/bullnose ray as an identification, the resulting overall ray species-specific identification success was 44%.

The identification success for sharks varied between taxonomic groups (Appendix E). Of the 921 sharks found over the Summer and Fall 2016 surveys, 191 (21%) were identified as "Carcharhinidae (unid.)," 125 (14%) as "hammerhead (unid.)," and 548 (60%) as species unknown. Although species-specific identification success was therefore 5%, many of these species are difficult to distinguish at even very close quarters. By including individuals ascribed to taxonomic group, this success rate would increase to 40% (Appendix E).

The identification success for large bony fish varied by taxonomic group. Of 907 large bony fish found over the Summer and Fall 2016 surveys, all but 122 (13%) were identified to species or taxonomic group. Of the 314 sunfish species 32 (10%) remained as "sunfish (unid)" and out of 181 tuna, 21 (12%)

remained as "tuna (unid)." Eleven of the 907 large bony fish (1%) were identified as "billfish (unid)" (Appendix F).

Treatment of Unidentified Animals Closely Resembling Listed Species

The categorization of ESA or State-listed species was conservative, incorporating "*Sterna* tern" (possibly representing roseate tern), "hammerhead shark (unid.)" (possibly representing scalloped hammerhead), and "whale species unknown" (possibly representing blue, fin, sperm, or north Atlantic right whale). Inability to identify the "*Sterna* tern" group to individual species was usually a result of the angle of the bird and an inability to see the bird's head and bill. With hammerhead sharks and unidentified whale, the angle of the animal or depth of the animal in the water column obscured characters required to differentiate great hammerhead from scalloped hammerhead, or in the Fall survey the whale from potentially being a small juvenile sperm whale.

Relative Abundance of Animals

The relative abundance of taxonomic groups differed between seasons. In the Summer survey, ray encounters were the most frequent, with 8,388 animals (62%) found in imagery (Table 7, Figure 6). During the Fall survey only 4 rays (<1%) were found, and the most common taxonomic group encountered was birds with over 12,000 encountered (90%) (Figure 6). The Summer survey encountered just under 2,000 birds representing 14% of the sample (Table 7, Figure 6). The other notable difference was in sharks with over 900 (7%) found in the Summer survey and only 4 (<1%) found in the Fall survey (Table 7, Figure 6). For both surveys marine mammals represented approximately 8% of the sample (Figure 6). No bats were found in imagery.

Table 7. Total Number of Individuals (OPA and WEA combined) in Group by Season

Group	Summer 2016	Fall 2016
Avian	1,893	12,352
Bats	0	0
Turtles	578	40
Marine Mammals	929	1,118
Rays	8,388	4
Sharks	917	4
Large Bony Fish	727	185
Subtotal	***13,432***	***13,703***
Fish Shoals	6,674	84
Vessels	16	16
Fixed Structures	1	3
Subtotal	***6,691***	***103***
TOTAL	**20,123**	**13,805**

Relative abundance within each animal group varied between seasons. With avian species, the shift in species seasonal representation was marked, with avian species richness slightly lower in the Summer survey than in the Fall survey (see Appendix A for a list of species included in taxonomic groups). Nine

taxonomic groups were present in the Summer and 15 in the Fall (Appendix B); this with the caveat that we do not include phalaropes in the group "shorebird."

During the Summer survey, 42% of encounters were with storm-petrels and 39% with shearwaters (Figure 7). In the Fall, 44% of encounters were with gulls and 24% with gannets; only 2% were with shearwaters and <1% with storm-petrels (Figure 7). During the Summer, 11% of encounters were with terns, while in the Fall survey < 1% of encounters were with terns, and 13% were with phalaropes, a species absent in the Summer survey (Figure 7). These differences highlight the seasonal nature of avian activity.

Within each taxonomic group, seasonal abundance for some species also varied. In the Summer survey, four species of gulls were present, of which great black-backed gull followed by herring gull were most abundant (Figure 8). In the Fall survey eight species of gulls were present, of which herring gull followed by Bonaparte's gull were most abundant (Figure 8). Relative abundance within shearwaters remained pretty static, with Cory's shearwater being the most frequently encountered (Figure 9). The Fall survey encountered many ducks and it will be interesting to see if the winter season relative abundance changes for that taxonomic group (Figure 10).

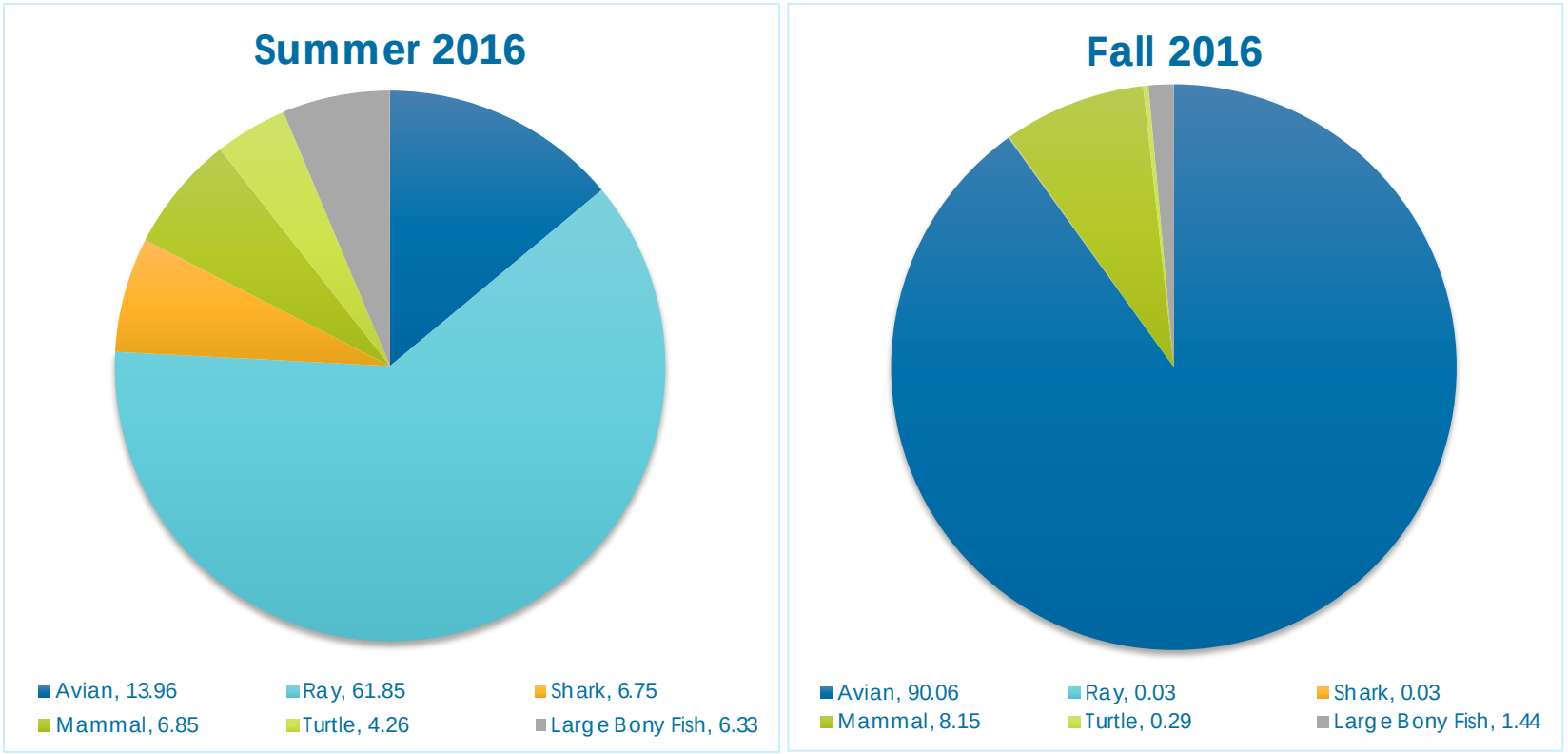

Figure 6. Relative abundance of taxonomic groups for the Summer and Fall 2016 surveys.

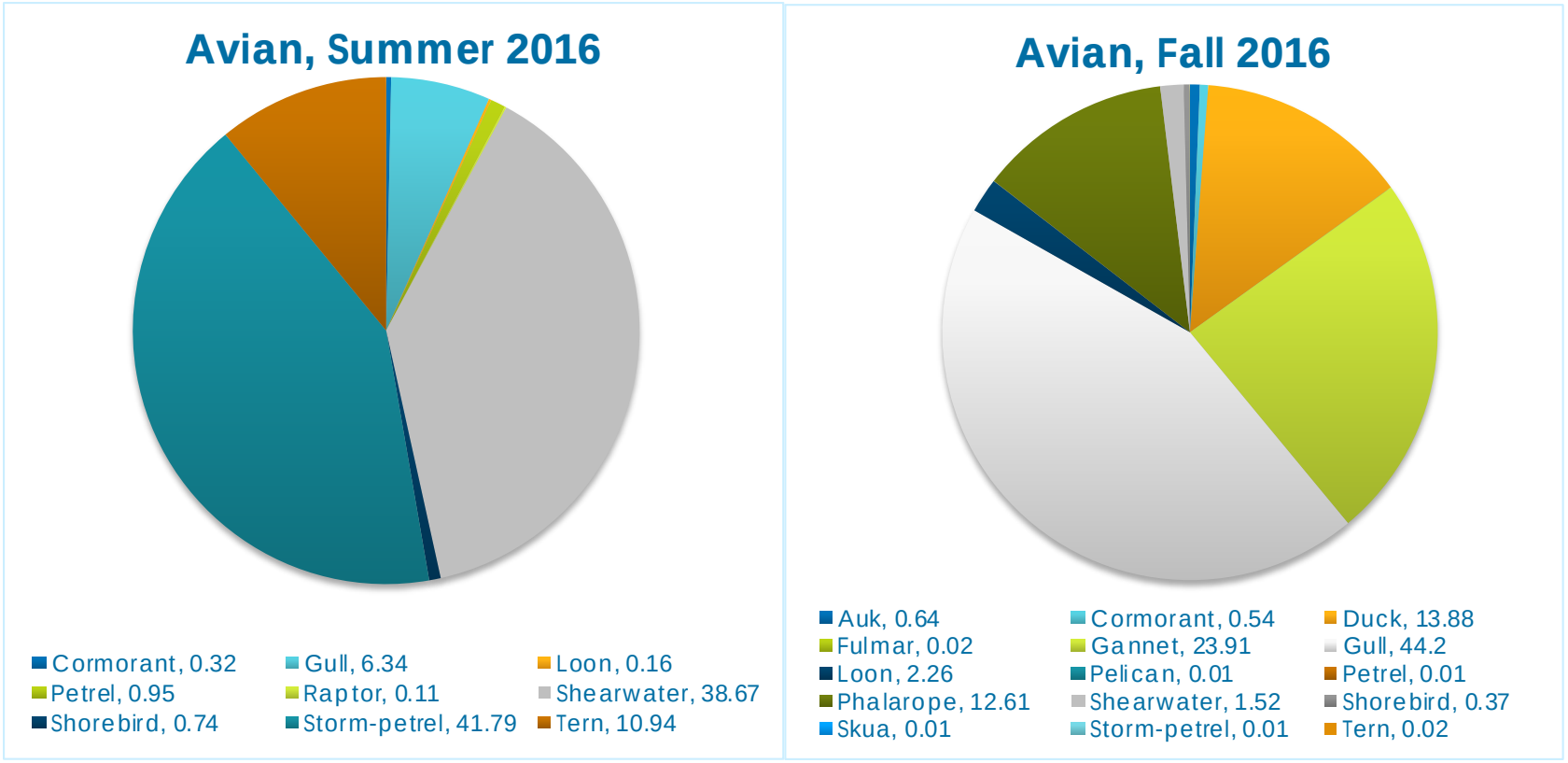

Figure 7. Relative abundance of avian taxonomic groups by survey.

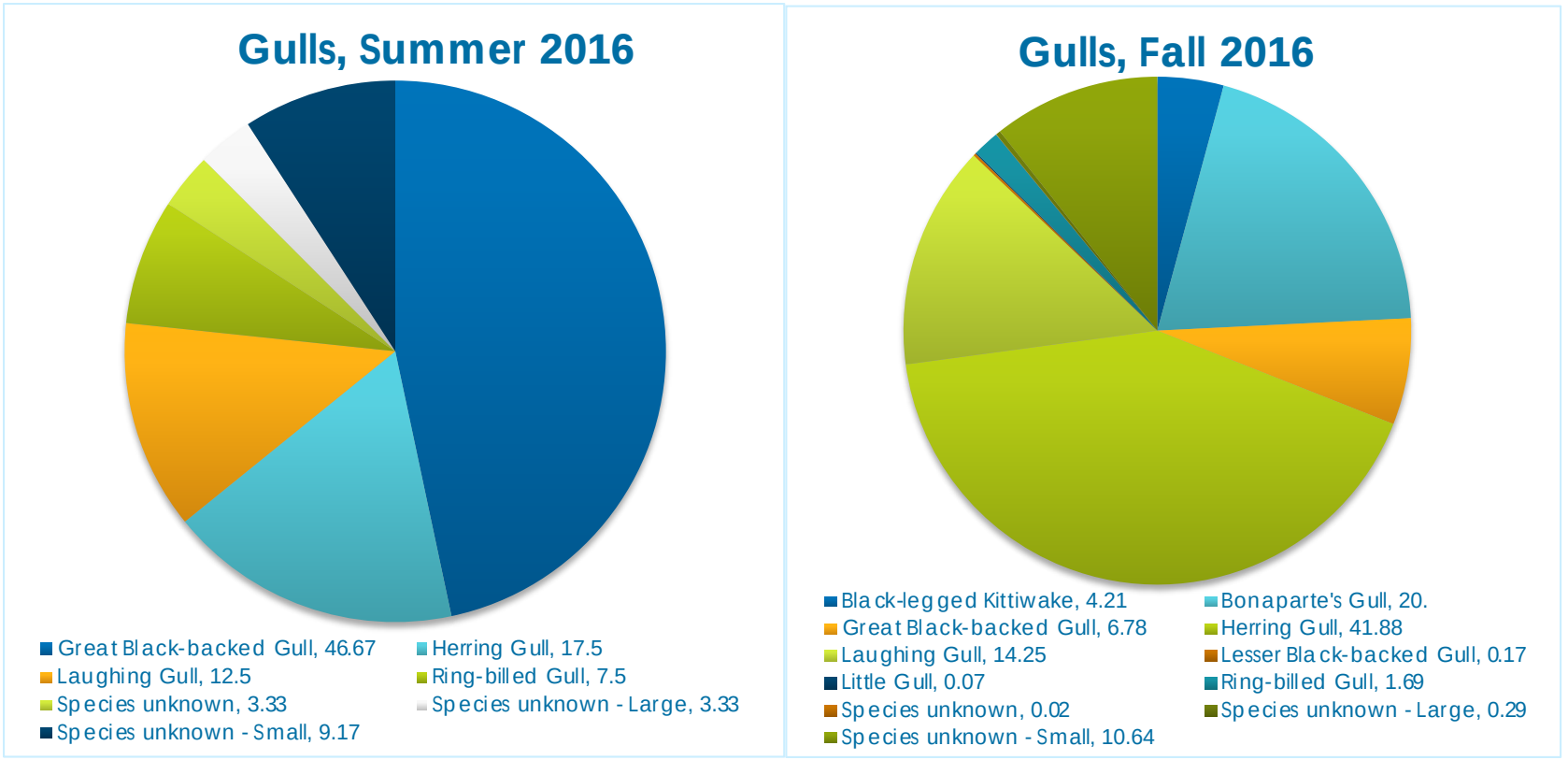

Figure 8. Relative abundance of gull species by survey.

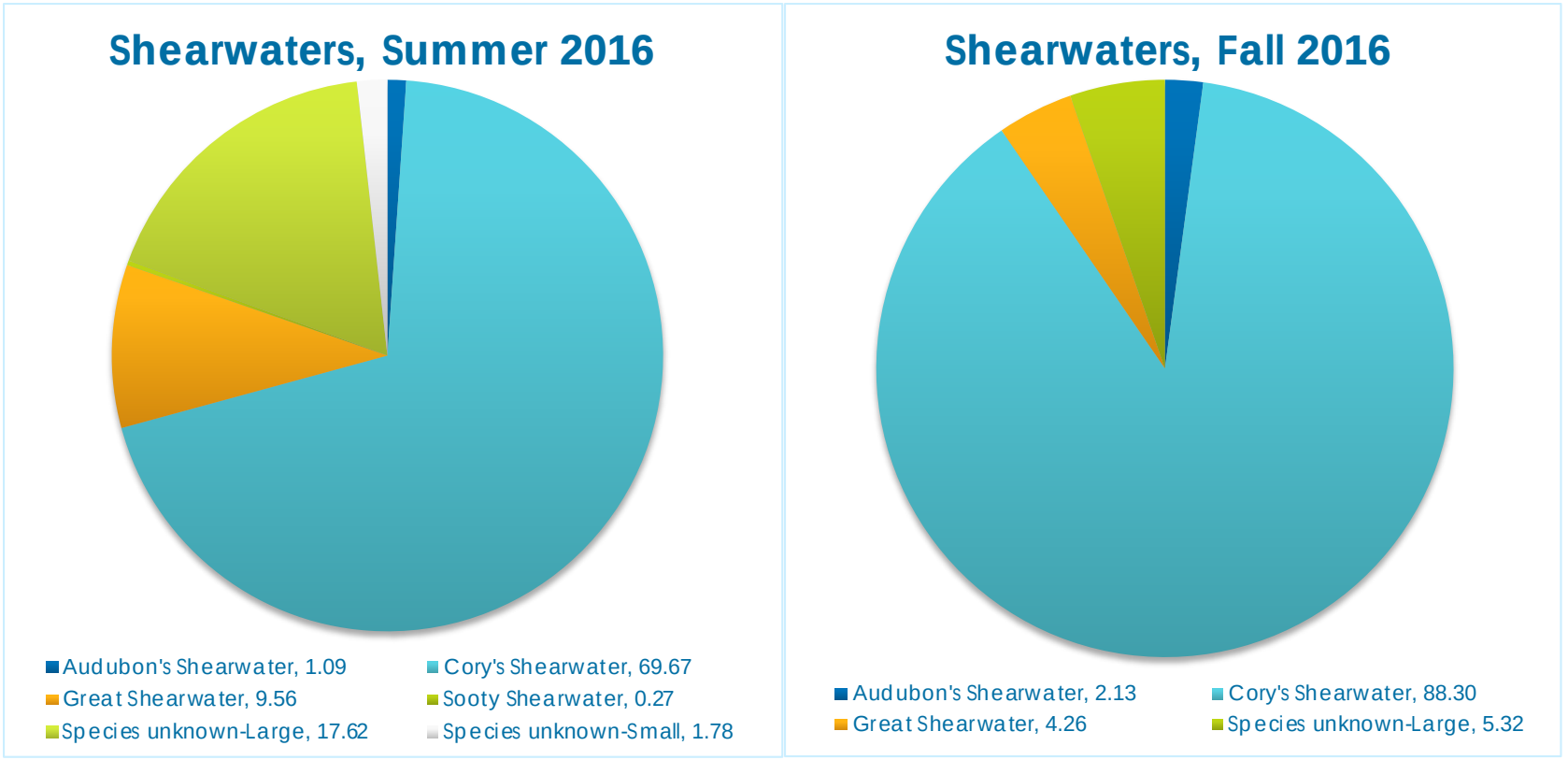

Figure 9. Relative abundance of shearwater species by survey.

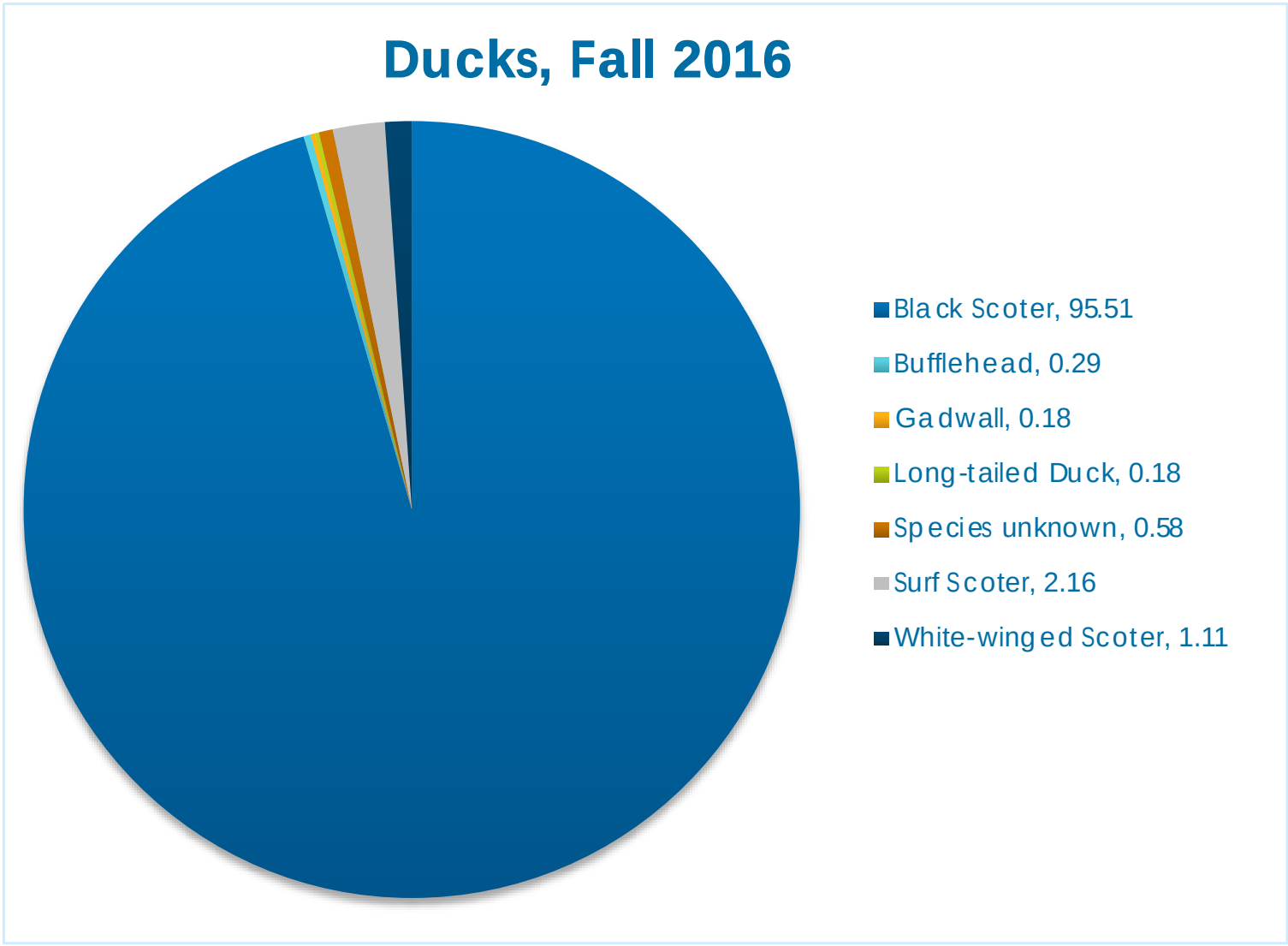

Figure 10. Relative abundance of ducks in the Fall 2016 survey.

Species Presence

Avian Species

During the Summer survey, 1,893 birds were recorded (Appendix B), of which 1,556 were identified as 17 different species (Table 8). The remaining 337 were identified to taxonomic group and of these 152 were identified as *Sterna* tern. Wilson's storm-petrel (n=791) was the most frequently encountered species, followed by Cory's shearwater (n=510). Encounter rates with remaining species in order of frequency were primarily gulls and terns, black-bellied plover, and double-crested cormorant (Figure 11).

During the Fall survey, 12,352 birds were recorded (Appendix B) with 11,037 (89%) identified as 33 different species (Table 8). The remaining 1,315 were identified within one of 7 taxonomic groups. Northern gannet (n=2,953) was the most frequently encountered species, closely followed by herring gull (n=2,286) and black scoter (n=1,637) (Figure 12). Bonaparte's gull, red phalarope, and laughing gull were also recorded in good numbers, followed by great black-backed gull, black-legged kittiwake, red-throated loon, and Cory's shearwater. Eight species had between 10 and 100 individuals reported and 15 species had less than 10 individuals reported (Table 8, Figure 12).

Table 8. Avian Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Gadwall				3	3	
Surf Scoter				37	37	
White-winged Scoter				19	19	
Black Scoter				1,637	1,603	34
Long-tailed Duck				3	3	
Bufflehead				5	5	
Red-throated Loon				227	222	5
Common Loon	3	3		50	48	2
Northern Fulmar				3	3	
Black-capped Petrel	13	13		1	1	
Cory's Shearwater	510	510		166	146	20
Great Shearwater	70	70		8	8	
Sooty Shearwater	2	2				
Audubon's Shearwater	8	8		4		4
Wilson's Storm-Petrel	791	791		1	1	
Northern Gannet				2,953	2,939	14
Double-crested Cormorant	6	6		67	67	
Brown Pelican				1	1	
Osprey	1	1				
Bald Eagle	1	1				
Black-bellied Plover	6	6				
Red-necked Phalarope				69	69	

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Red Phalarope				880	873	7
Pomarine Jaeger				1	1	
Dovekie				3	3	
Common Murre				11	11	
Razorbill				24	24	
Black Guillemot				1	1	
Black-legged Kittiwake				230	230	
Bonaparte's Gull				1,092	1,081	11
Little Gull				4	4	
Laughing Gull	15	15		778	778	
Ring-billed Gull	9	9		92	91	1
Herring Gull	21	21		2,286	2,277	9
Lesser Black-backed Gull				9	9	
Great Black-backed Gull	56	56		370	370	
Least Tern	36	36				
Royal Tern	8	8		2	2	
TOTAL	**1,556**	**1,556**	**0**	**11,037**	**10,930**	**107**

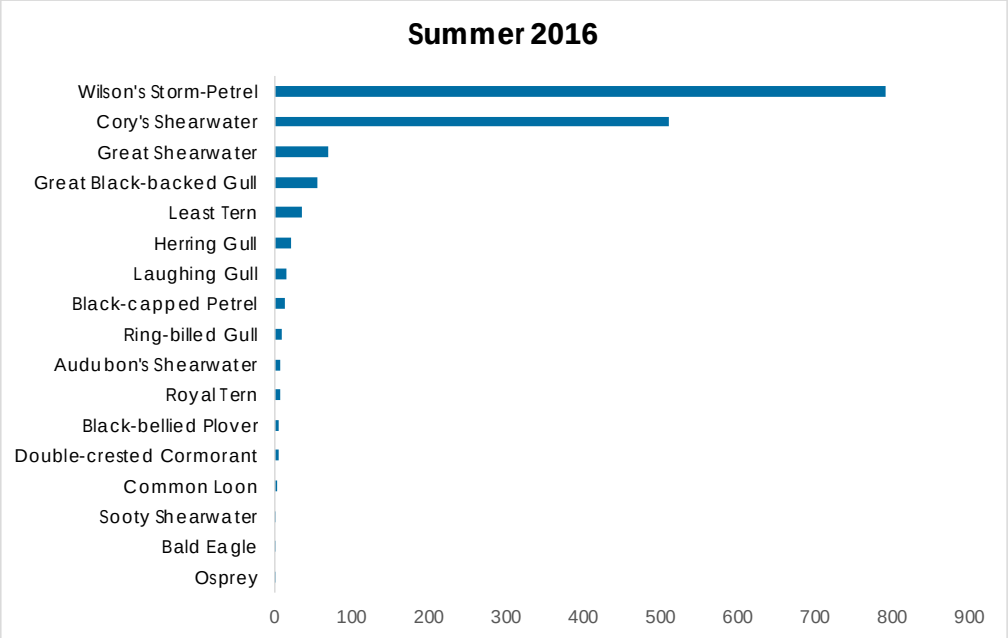

Figure 11. Number of individuals for each avian species identified during the Summer 2016 Survey.

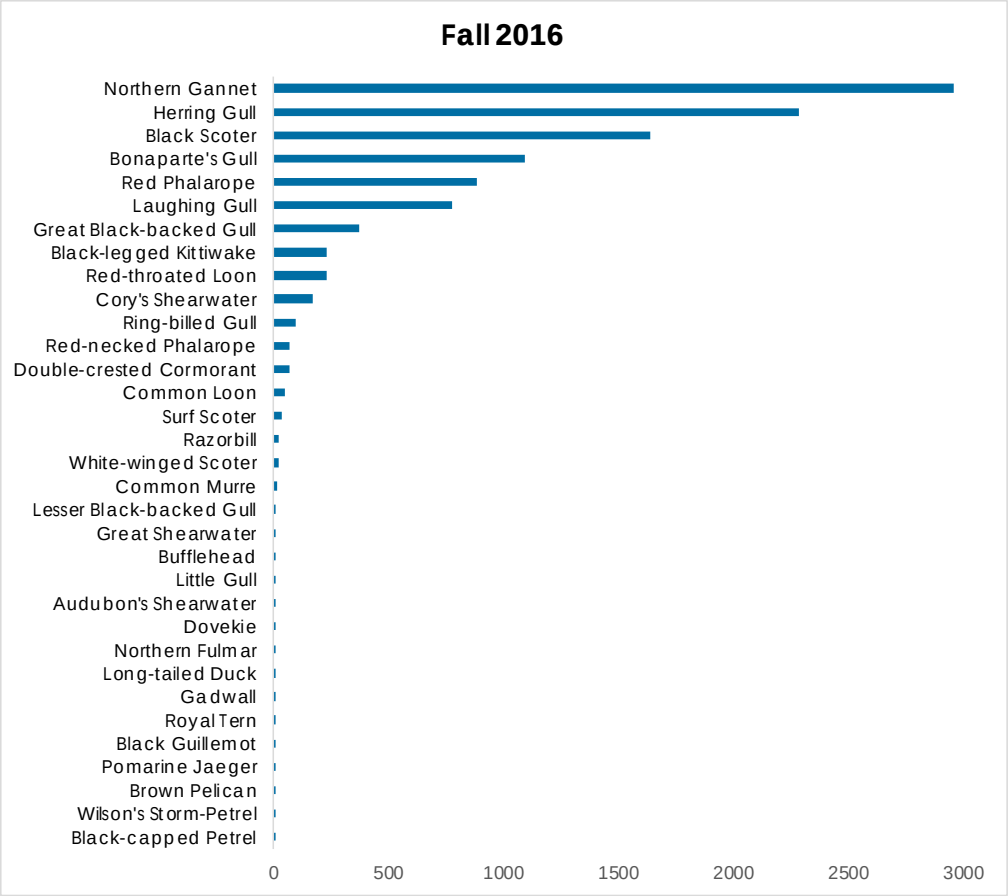

Figure 12. Number of individuals for each avian species identified during the Fall 2016 Survey.

Sitting and Flying Birds

All birds found in the Summer and Fall surveys were identified as sitting or flying. During the Summer survey, 17 species and 9 taxonomic groups were identified (Table 9, Appendix B). Of these, 10 species and 6 taxonomic groups had sitting birds identified and 16 species and 9 taxonomic groups had flying birds identified (Table 9).

During the Fall survey, 33 species and 9 taxonomic groups were identified (Table 10). Of these, 21 species and 9 taxonomic groups had sitting birds identified and 30 species and 6 taxonomic groups had flying birds identified (Table 10).

Flight heights were calculated for 11 species during the Summer survey (Table 11) and 26 species and 1 taxonomic group during the Fall survey (Table 12). The mean, maximum, and minimum flight heights for each species are presented in Table 11 and Table 12 for each survey, respectively.

Table 9. Number of Sitting and Flying Birds (in Taxonomic Order) Observed during the Summer 2016 Survey

Species	Total Number of Individuals	Sitting Birds		Flying Birds	
		Number	Percent of Total	Number	Percent of Total
Common Loon	3	3	100.00		0.00
Black-capped Petrel	13	2	15.38	11	84.62
Cory's Shearwater	510	264	51.76	246	48.24
Great Shearwater	70	7	10.00	63	90.00
Sooty Shearwater	2		0.00	2	100.00
Audubon's Shearwater	8	5	62.50	3	37.50
Wilson's Storm-Petrel	791	113	14.29	678	85.71
Double-crested Cormorant	6		0.00	6	100.00
Osprey	1		0.00	1	100.00
Bald Eagle	1		0.00	1	100.00
Black-bellied Plover	6		0.00	6	100.00
Laughing Gull	15	8	53.33	7	46.67
Ring-billed Gull	9	5	55.56	4	44.44
Herring Gull	21	13	61.90	8	38.10
Great Black-backed Gull	56	22	39.29	34	60.71
Least Tern	36		0.00	36	100.00
Royal Tern	8		0.00	8	100.00
Gull-species unknown	4	2	50.00	2	50.00
Gull-species unknown - Large	4	3	75.00	1	25.00
Gull-species unknown - Small	11	6	54.55	5	45.45
Petrel-species unknown	5		0.00	5	100.00
Shearwater-species unknown-Large	129	107	82.95	22	17.05
Shearwater-species unknown-Small	13	2	15.38	11	84.62
Shorebird-species unknown	8		0.00	8	100.00
Sterna Tern	152	14	9.21	138	90.79
Tern-species unknown	11		0.00	11	100.00
TOTAL	**1,893**	**576**	**30.43**	**1,317**	**69.57**

Table 10. Number of Sitting and Flying Birds (in Taxonomic Order) Observed during the Fall 2016 Survey

Species	Total Number of Individuals	Sitting Birds		Flying Birds	
		Number	Percent of Total	Number	Percent of Total
Gadwall	3		0.00	3	100.00
Surf Scoter	37	7	18.92	30	81.08
White-winged Scoter	19		0.00	19	100.00
Black Scoter	1,637	1,161	70.92	476	29.08
Long-tailed Duck	3		0.00	3	100.00
Bufflehead	5	2	40.00	3	60.00
Red-throated Loon	227	102	44.93	125	55.07
Common Loon	50	11	22.00	39	78.00
Northern Fulmar	3		0.00	3	100.00
Black-capped Petrel	1		0.00	1	100.00
Cory's Shearwater	166	82	49.40	84	50.60
Great Shearwater	8	3	37.50	5	62.50
Audubon's Shearwater	4	4	100.00		0.00
Wilson's Storm-Petrel	1		0.00	1	100.00
Northern Gannet	2,953	2,088	70.71	865	29.29
Double-crested Cormorant	67		0.00	67	100.00
Brown Pelican	1		0.00	1	100.00
Red-necked Phalarope	69	56	81.16	13	18.84
Red Phalarope	880	520	59.09	360	40.91
Pomarine Jaeger	1		0.00	1	100.00
Dovekie	3	3	100.00		0.00
Common Murre	11	11	100.00		0.00
Razorbill	24	20	83.33	4	16.67
Black Guillemot	1		0.00	1	100.00
Black-legged Kittiwake	230	53	23.04	177	76.96
Bonaparte's Gull	1,092	653	59.80	439	40.20
Little Gull	4		0.00	4	100.00
Laughing Gull	778	615	79.05	163	20.95
Ring-billed Gull	92	38	41.30	54	58.70
Herring Gull	2,286	1,386	60.63	900	39.37
Lesser Black-backed Gull	9	4	44.44	5	55.56
Great Black-backed Gull	370	220	59.46	150	40.54

Species	Total Number of Individuals	Sitting Birds		Flying Birds	
		Number	Percent of Total	Number	Percent of Total
Royal Tern	2		0.00	2	100.00
Auk-species unknown	40	40	100.00		0.00
Duck-species unknown	10	10	100.00		0.00
Gull-species unknown	1	1	100.00		0.00
Gull-species unknown–Large	16	11	68.75	5	31.25
Gull-species unknown–Small	581	570	98.11	11	1.89
Loon-species unknown	2	1	50.00	1	50.00
Phalarope-species unknown	609	394	64.70	215	35.30
Shearwater-species unknown–Large	10	1	10.00	9	90.00
Shorebird-species unknown	46	43	93.48	3	6.52
TOTAL	**12,352**	**8,110**	**65.66**	**4,242**	**34.34**

Table 11. Mean, Maximum, and Minimum Flight Heights for Flying Birds (in Taxonomic Order) Observed during the Summer 2016 Survey

Species	Number of Individuals	Flight Height (m)		
		Mean	Max	Min
Cory's Shearwater	154	2.35	20.00	0.50
Great Shearwater	32	1.78	9.60	1.00
Audubon's Shearwater	2	1.50	2.00	1.00
Wilson's Storm-Petrel	184	0.68	3.00	0.50
Double-crested Cormorant	6	2.00	2.00	2.00
Laughing Gull	4	31.70	50.30	6.50
Ring-billed Gull	3	43.07	73.00	5.00
Herring Gull	6	51.38	98.00	10.00
Great Black-backed Gull	31	58.05	99.40	7.92
Least Tern	13	6.61	11.30	1.60
Royal Tern	4	17.82	25.48	6.00
TOTAL	**439**	**7.02**	**99.40**	**0.50**

Table 12. Mean, Maximum, and Minimum Flight Heights for Flying Birds (in Taxonomic Order) Observed during the Fall 2016 Survey

Species	Number of Individuals	Flight Height (m)		
		Mean	Max	Min
Gadwall	3	12.23	13.20	10.50
Surf Scoter	29	12.67	48.00	3.00
White-winged Scoter	3	44.53	104.20	11.40
Black Scoter	388	21.63	65.80	4.00
Long-tailed Duck	3	28.97	35.00	17.70
Bufflehead	3	10.20	12.30	8.60
Red-throated Loon	119	98.38	201.40	1.80
Common Loon	37	92.50	334.90	5.00
Northern Fulmar	1	56.50	56.50	56.50
Black-capped Petrel	1	29.30	29.30	29.30
Cory's Shearwater	66	5.87	29.80	0.40
Great Shearwater	3	22.17	28.50	12.40
Wilson's Storm-Petrel	1	2.30	2.30	2.30
Northern Gannet	704	52.23	166.70	0.10
Double-crested Cormorant	67	20.81	50.00	7.00
Red Phalarope	64	11.93	114.90	0.20
Phalarope-species unknown	42	3.05	4.00	2.00
Pomarine Jaeger	1	85.50	85.50	85.50
Razorbill	2	6.60	6.60	6.60
Black-legged Kittiwake	96	35.44	102.80	0.40
Bonaparte's Gull	390	46.00	162.50	0.70
Laughing Gull	136	45.99	173.20	0.30
Ring-billed Gull	45	61.51	164.30	0.80
Herring Gull	709	54.03	319.40	0.10
Lesser Black-backed Gull	4	37.18	108.90	2.50
Great Black-backed Gull	106	52.96	265.60	0.70
Royal Tern	1	18.50	18.50	18.50
TOTAL	**3,024**	**45.74**	**334.90**	**0.10**

Turtle Species

There were 618 turtles found during the Summer and Fall surveys: 578 during the Summer and 40 during the Fall (Appendix C). Of the 578 turtles in the Summer, 431 (75%) were identified to species and the remaining 147 (25%) were identified to taxonomic group only, primarily because they were significantly submerged (Table 13). Loggerhead turtles were the most abundant species during the Summer with 392 (68%) individuals recorded (Figure 13). During the Fall survey, 36 (90%) of the 40 turtles found were

identified to species (Table 13). Leatherback turtles were the most abundant during the Fall with 29 (73%) individuals being recorded (Figure 14).

Table 13. Turtle Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Green Turtle	1	1	0			
Kemp's Ridley Turtle	19	18	1	1	1	0
Leatherback Turtle	9	9	0	29	28	1
Loggerhead Turtle	392	388	4	6	6	0
Loggerhead/Kemp's Turtle	10	10	0			
Species unknown	147	139	8	4	4	0
TOTAL	**578**	**565**	**13**	**40**	**39**	**1**

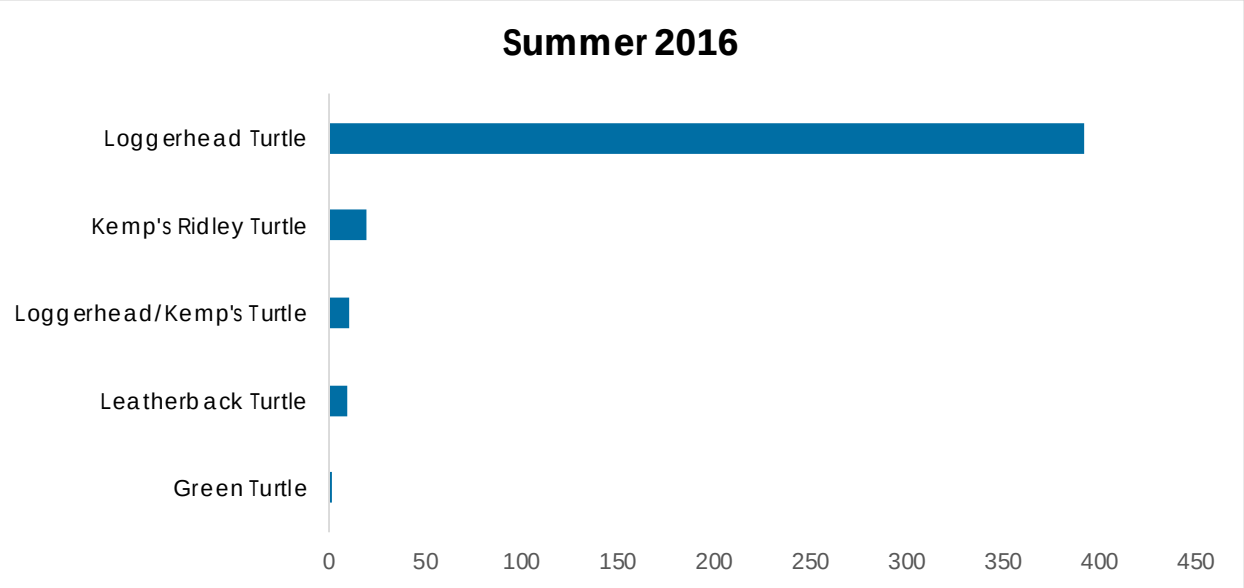

Figure 13. Number of individuals for each turtle species identified during the Summer 2016 Survey.

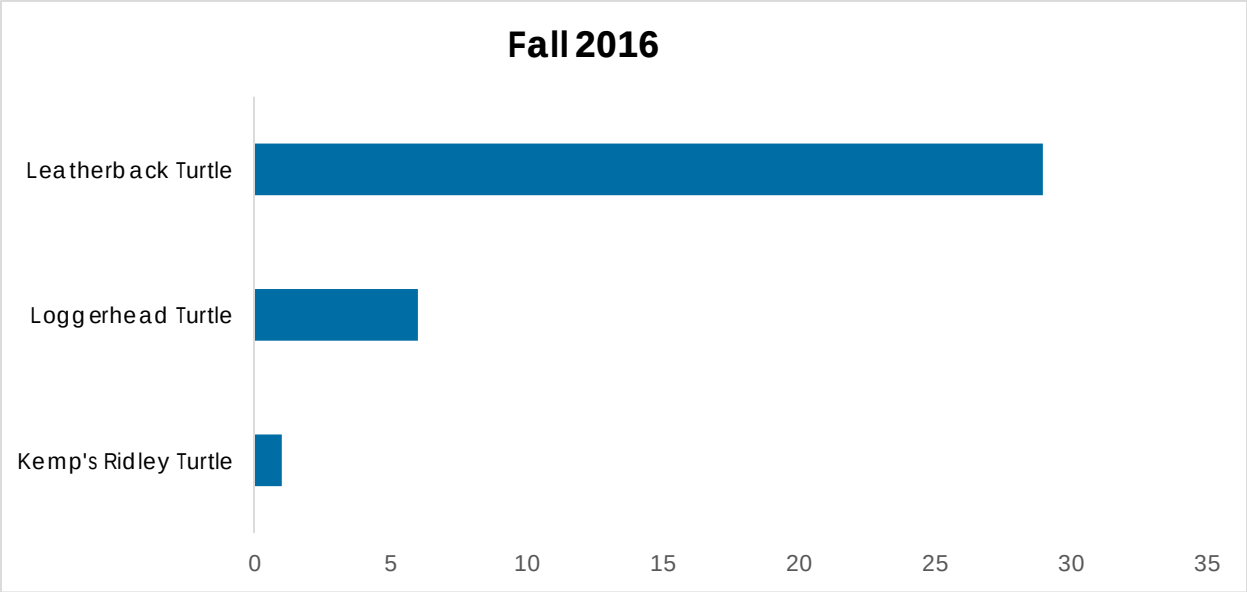

Figure 14. Number of individuals for each turtle species identified during the Fall 2016 Survey.

Marine Mammal Species

There were 2,046 marine mammals found during the Summer and Fall surveys: 929 during the Summer and 1,118 during the Fall (Appendix D). Of the 929 mammals recorded in the Summer, 908 (98%) were dolphins and 21 (2%) were whales (Table 14). Of the 1,118 mammals recorded during the Fall, 1,092 (98%) were dolphins, 13 (1%) were seals, and 13 (1%) were whales.

During the Summer survey, 320 (35%) dolphins were identified to species and the remaining 588 (65%) were identified to taxonomic group, 102 (17%) of which were classed as "pilot whale (unid.)." Risso's dolphin was the most abundant species (n=166) followed by common bottlenose dolphin (n=98) and short-beaked common dolphin (n=56) (Table 14, Figure 15). During the Fall survey, 555 (51%) dolphins were identified to species and 537 (49%) were identified to taxonomic group only, 9 of which were classified as "pilot whale (unid.)" (Table 14). Short-beaked common dolphin (n=223) was the most frequently recorded species following by Risso's dolphin (n=124) and striped dolphin (n=75) (Table 14, Figure 16). The majority of individuals not identified to species were significantly submerged.

No seals were recorded during the Summer survey; however, 13 were recorded during the Fall (Table 14). Of the 13 seals, 12 (92%) were identified to taxonomic group only. The remaining seal was identified as gray seal.

Among the whales for the Summer survey, 12 (57%) were identified to species with the remaining 9 individuals were identified to taxonomic group only, 8 of which were classed as "beaked whale (unid.)" (Table 14). The most abundant species was fin whale (n=10) followed by 1 individual each of common minke whale and humpback whale (Table 14, Figure 17). During the Fall survey, 9 (69%) individuals were identified to species with the remaining 4 identified to taxonomic group, all of which were classed as "beaked whale (unid.)" (Table 14). The most abundant species during Fall was the fin whale (n=5) followed by 2 sperm whales and 1 individual each of blue whale and humpback whale (Table 14, Figure 18).

Table 14. Marine Mammal Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Dolphin	**908**	**906**	**2**	**1,092**	**1,092**	**0**
Atlantic Spotted Dolphin				54	54	0
Atlantic White-sided Dolphin				16	16	0
Common Bottlenose Dolphin	98	98	0	59	59	0
Harbor Porpoise				4	4	0
Risso's Dolphin	166	166	0	124	124	0
Short-beaked Common Dolphin	56	56	0	223	223	0
Striped Dolphin				75	75	0
Pilot Whale (unid.)	102	102	0	9	9	0
Dolphin species unknown	486	484	2	528	528	0
Seal	**0**	**0**	**0**	**13**	**13**	**0**
Gray Seal				1	1	0
Seal species unknown				12	12	0
Whale	**21**	**21**	**0**	**13**	**13**	**0**
Beaked Whale (unid.)	8	8	0	4	4	0
Common Minke Whale	1	1	0			
Blue Whale*[a]				1	1	0
Fin Whale*[a]	10	10	0	5	5	0
Humpback Whale[a]	1	1	0	1	1	0
Sperm Whale*				2	2	0
Whale species unknown	1	1	0	0	0	0
TOTAL	**929**	**927**	**2**	**1,118**	**1,118**	**0**

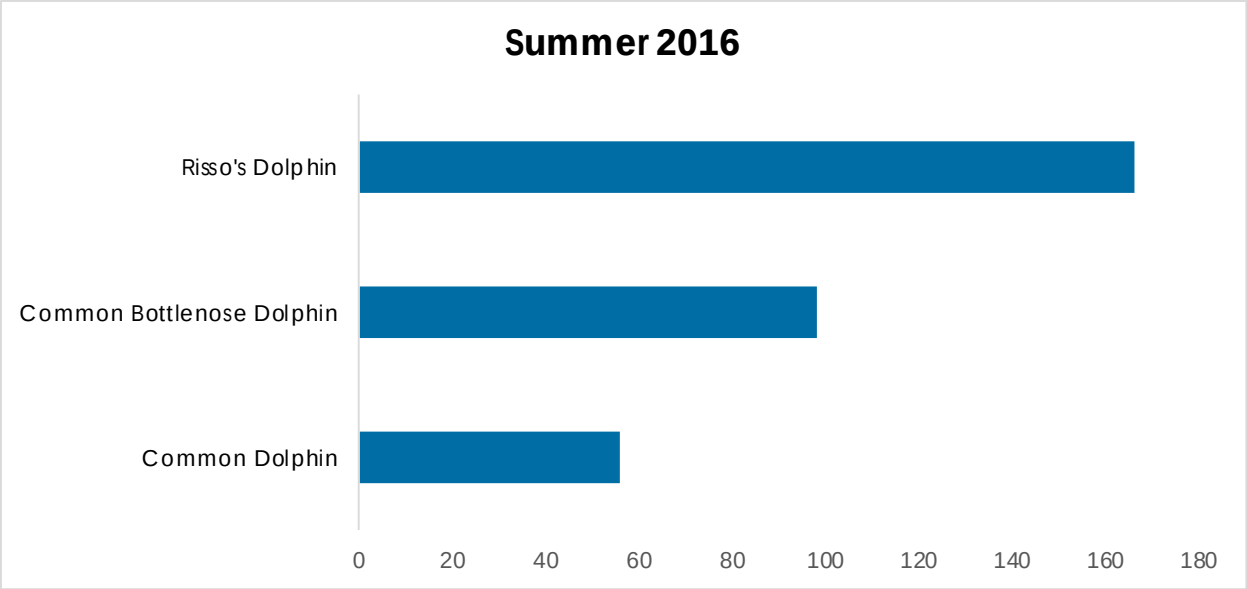

Figure 15. Number of individuals for each dolphin species identified during the Summer 2016 Survey.

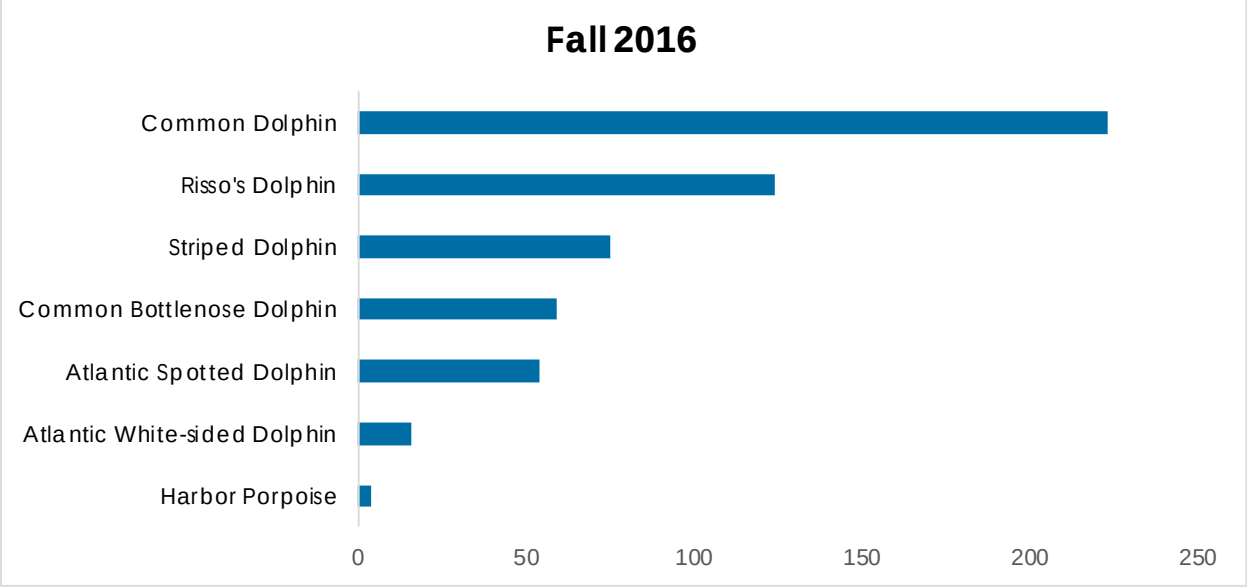

Figure 16. Number of individuals for each dolphin species identified during the Fall 2016 Survey.

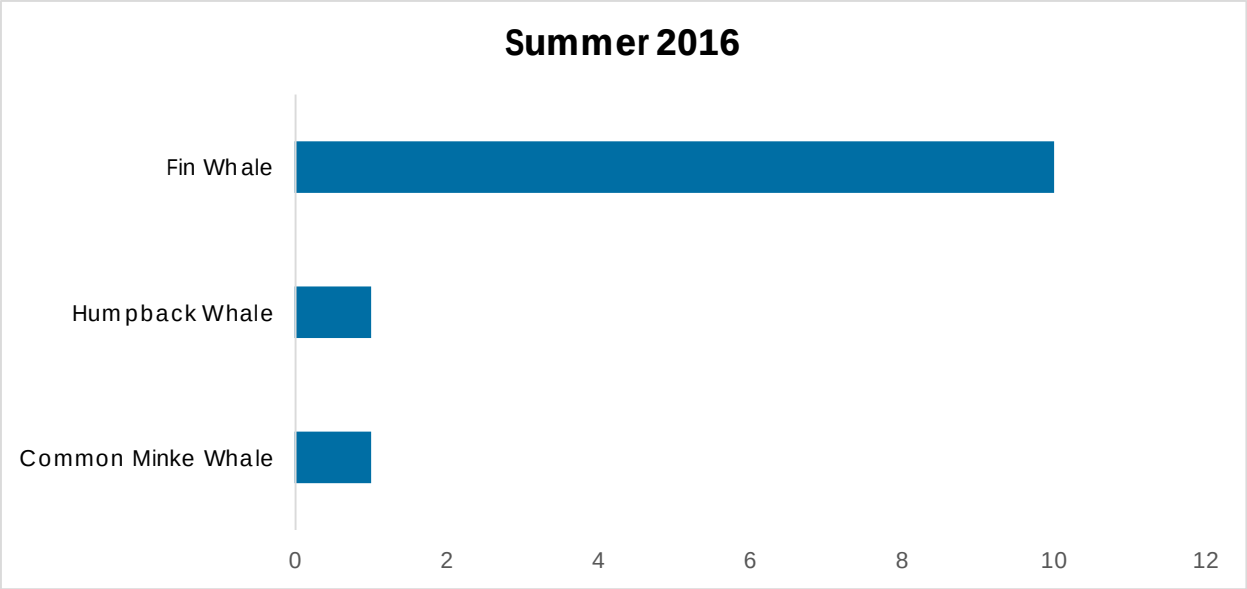

Figure 17. Number of individuals for each whale species identified during the Summer 2016 Survey.

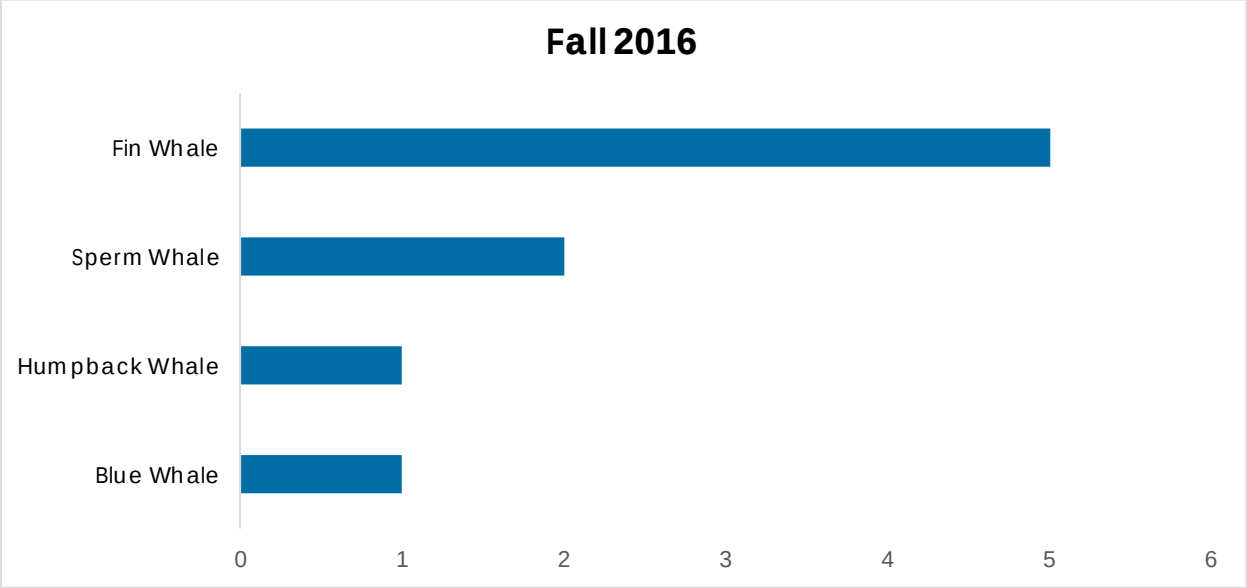

Figure 18. Number of individuals for each whale species identified during the Fall 2016 Survey.

Ray and Shark Species

There were 8,392 rays found during the Summer and Fall surveys: 8,388 during the Summer and 4 during the Fall (Appendix E). Of the 8,388 rays recorded in the Summer, 3,318 (39.6%) were cownose rays, 3,517 (41.9%) were identified as “cownose/bullnose” rays, and 375 (4.5%) were giant manta rays. A single bluntnose stingray and a single bullnose ray were also identified (Figure 19). The remaining rays (n=1,176) were not ascribed to species or species group and many of these (n=812) were significantly submerged (Table 15). Of the four rays recorded during the Fall, one “cownose/bullnose” ray was identified, one giant manta ray identified, and two rays were not ascribed to species or species group.

Table 15. Ray Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Bluntnose Stingray	1	1	0			
Bullnose Ray	1	1	0			
Cownose Ray	3,318	3,297	21			
Cownose/Bullnose Ray	3,517	3,479	38	1	1	0
Giant Manta Ray	375	375	0	1	1	0
Ray species unknown	1,176	1,005	171	2	2	0
TOTAL	**8,388**	**8,158**	**230**	**4**	**4**	**0**

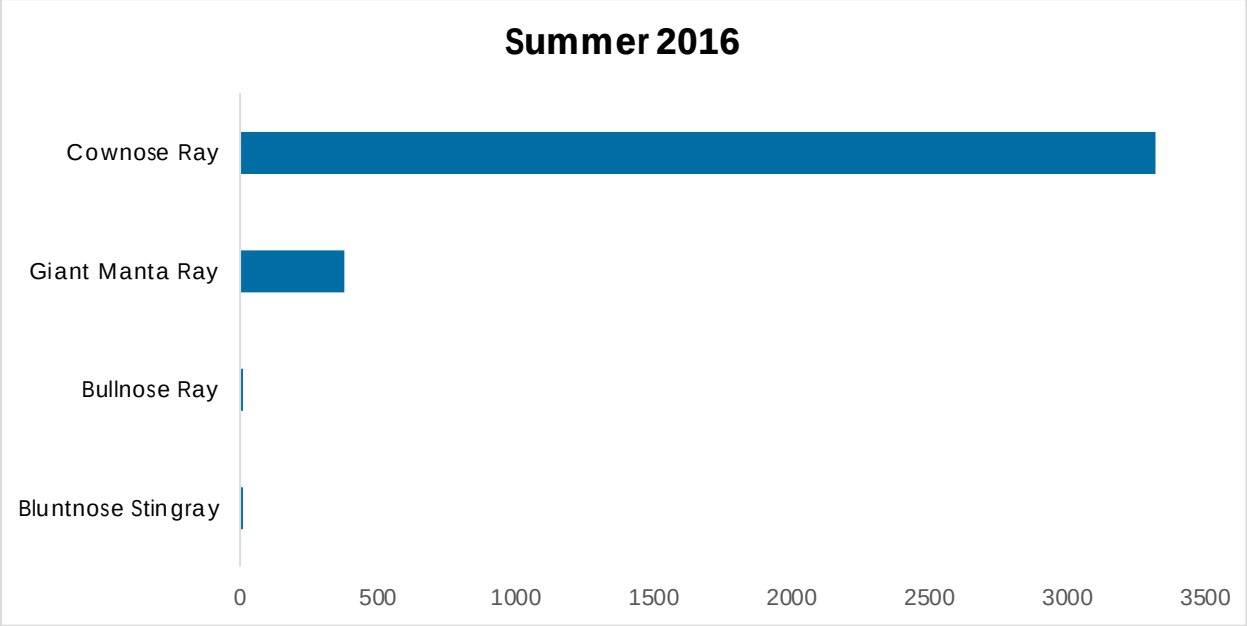

Figure 19. Number of individuals for each ray species identified during the Summer 2016 Survey.

There were 921 sharks found during the Summer and Fall surveys: 917 during the Summer and 4 during the Fall. Of the 917 sharks recorded in the Summer, 204 (22%) were Carcharhinidae (requiem sharks) and 160 (17%) were Sphyrnidae (hammerheads) (Table 16). Of the 4 sharks recorded during the Fall, 2 were Carcharhinidae, one was a Sphyrnidae, and one was unknown.

During the Summer survey, 55 individuals of 14 shark species were identified, 315 were identified to taxonomic group, and 547 remained unidentified. Scalloped hammerhead was the most abundant identified species (n=19) followed by smooth hammerhead (n=9), great hammerhead (n=8), blue (n=5), tiger (n=4), and thresher (n=2). Single individuals were identified of basking, bull, dusky, great white, oceanic whitetip, sandbar, shortfin mako, and whale shark (Table 16, Figure 20). During the Fall survey, 2 blue sharks were identified, with one hammerhead (unid.) and one unidentified (Table 16).

Table 16. Shark Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Family	Species	Summer 2016			Fall 2016		
		Total	OPA	WEA	Total	OPA	WEA
Alopiidae	Thresher Shark	2	2	0			
Carcharhinidae	Blue Shark	5	5	0	2	2	0
	Bull Shark	1	1	0			
	Carcharhinidae (unid.)	191	173	18			
	Dusky Shark	1	1	0			
	Oceanic Whitetip Shark	1	1	0			
	Sandbar Shark	1	1	0			
	Tiger Shark	4	4	0			
Cetorhinidae	Basking Shark	1	1	0			
Lamnidae	Great White Shark	1	1	0			
	Shortfin Mako	1	1	0			
Rhincodontidae	Whale Shark	1	1	0			
Sphyrnidae	Great Hammerhead	8	8	0			
	Hammerhead (unid.)	124	123	1	1	1	0
	Scalloped Hammerhead*	19	19	0			
	Smooth Hammerhead	9	9	0			
	Shark species unknown	547	402	145	1	1	0
TOTAL		**917**	**753**	**164**	**4**	**4**	**0**

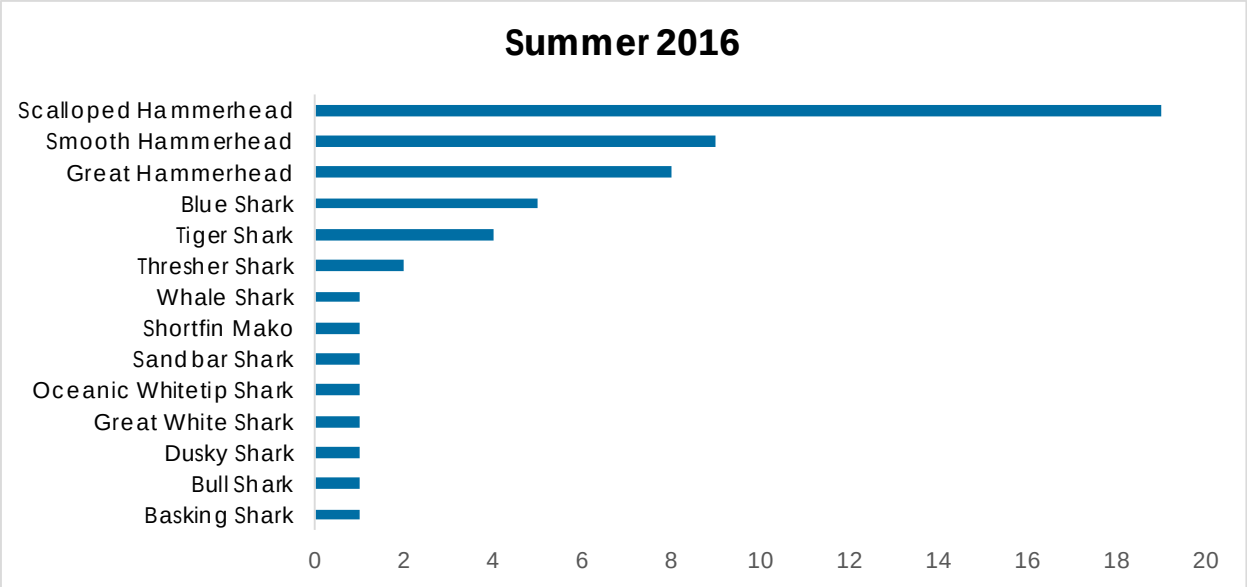

Figure 20. Number of individuals for each shark species identified during the Summer 2016 Survey.

Large Bony Fish

There were 907 large bony fish found during the Summer and Fall surveys: 722 during the Summer and 185 during the Fall (Appendix F). Of the 722 large bony fish recorded during the Summer survey, 618 were identified to species or species group. Of those, 181 (25%) were tuna, 147 (20.4%) were sunfish, 145 (20%) were cobia, 134 (18.6%) were mahi-mahi, and 11 (1.5%) were identified as billfish. The remaining 104 (14.4%) were unidentified (Table 17). Of the 185 large bony fish recorded during the Fall, 167 (90.3%) were sunfish and the remaining 18 (9.7%) were unidentified fish (Table 17).

During the Summer survey, 5 species of large bony fish were identified (Figure 21). Atlantic bluefin tuna had the highest density (n=160), followed by cobia (n=145), mahi-mahi (n=134), ocean sunfish (n=115), and sharptail sunfish (n=2). During the Fall survey, 2 species of large bony fish were identified (Figure 22). Of 167 sunfish, 164 were ocean sunfish and one was a sharptail sunfish (Table 17).

Table 17. Large Bony Species Identified and Number of Individuals by Project Area from the Summer and Fall 2016 Surveys

Species	Summer 2016			Fall 2016		
	Total	OPA	WEA	Total	OPA	WEA
Billfish species unknown	11	11				
Cobia	145	6	139			
Mahi-Mahi	134	133	1			
Ocean Sunfish	115	115		164	160	4
Sharptail Sunfish	2	2		1	0	1
Sunfish species unknown	30	30		2	2	
Atlantic bluefin tuna	160	160				
Tuna species unknown	21	21				
Unidentified species	104	102	2	18	9	9
TOTAL	**722**	**580**	**142**	**185**	**171**	**14**

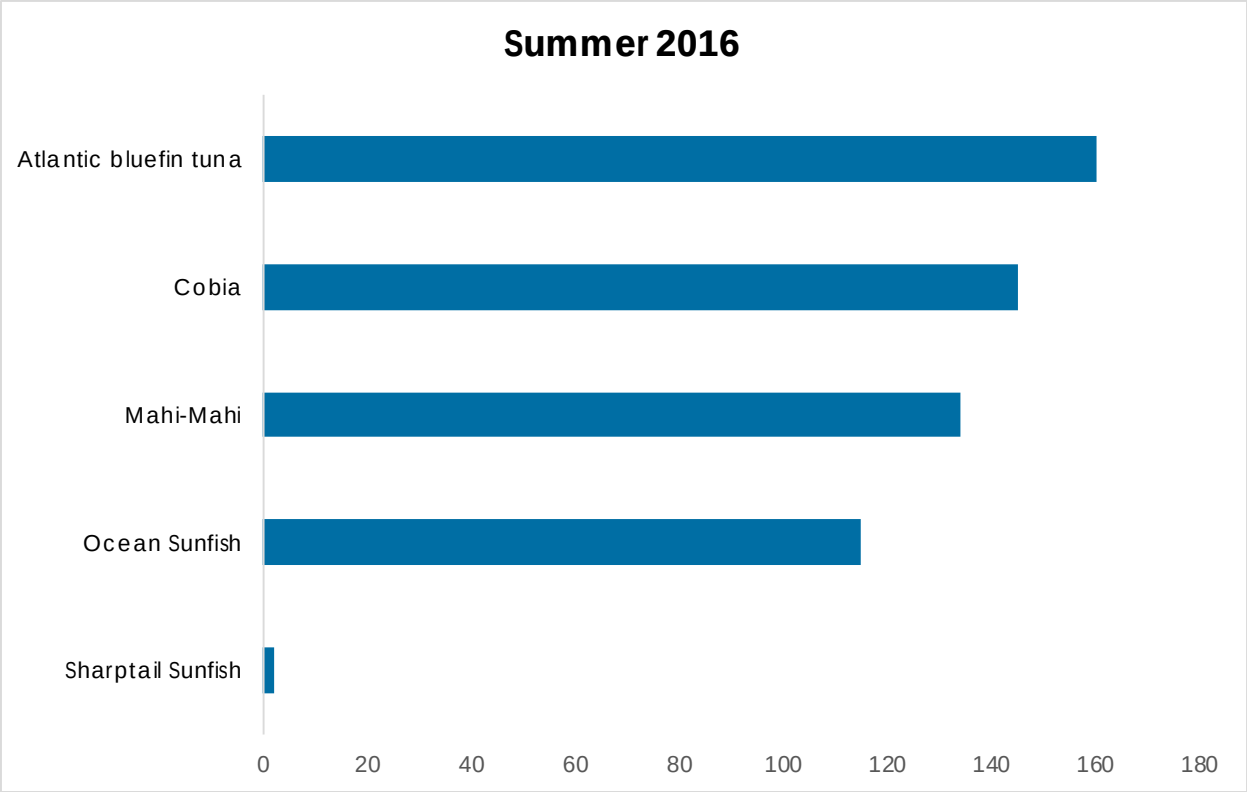

Figure 21. Number of individuals for each large bony fish species identified during the Summer 2016 Survey.

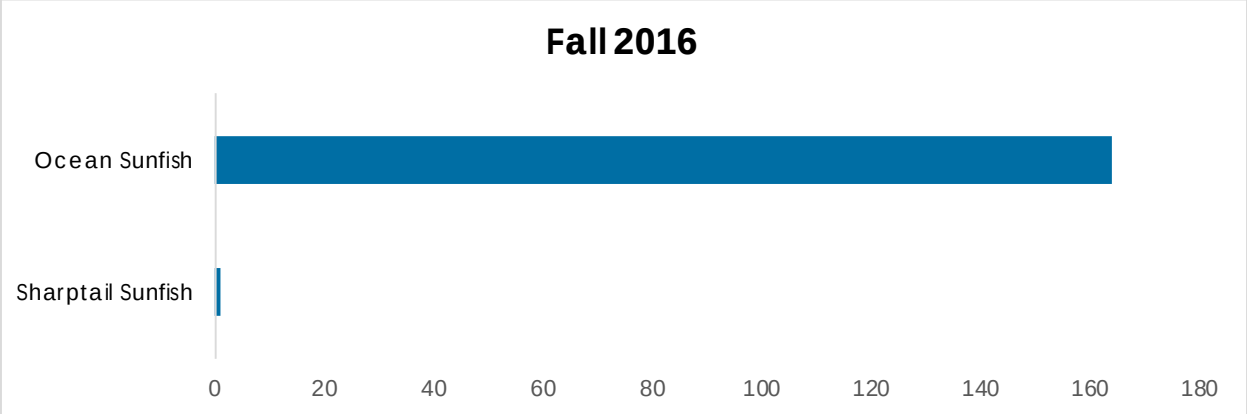

Figure 22. Number of individuals for each large bony fish species identified during the Fall 2016 Survey.

Threatened and Endangered Species

The categorization of ESA or State-listed species was conservative, incorporating "*Sterna* tern" (possibly representing roseate tern), "hammerhead shark (unid.)" (possibly representing scalloped hammerhead) and "whale species unknown" (one possibly representing juvenile sperm whale, the other possibly a fin whale) (Table 18). A total of 934 animals found over both surveys were categorized into ESA or State-

listed species, of which 884 were found in the Summer survey and 50 in the Fall survey (Table 18). Most of these were turtles (n=618), with most being present in the Summer survey (n=578). The second highest group was sharks (n=144) of which 143 were present in the Summer survey. Nineteen were definitely identified as scalloped hammerhead with a further 124 identified as "hammerhead (unid.)" (Table 18).

Table 18. Number of ESA and State Listed Species found during the 2016 Summer and Fall Surveys

Name	Total	OPA			WEA		
		Summer and Fall 2016	Summer 2016	Fall 2016	Summer and Fall 2016	Summer 2016	Fall 2016
Avian	**152**	**152**	**152**	**0**	**0**	**0**	**0**
Tern	152	152	152	0	0	0	0
Sterna Tern	152	152	152	0	0	0	0
Sharks	**144**	**143**	**142**	**1**	**1**	**1**	**0**
Hammerhead (unid.)	125	124	123	1	1	1	0
Scalloped Hammerhead	19	19	19	0	0	0	0
Marine Mammals (Whale)	**20**	**20**	**11**	**9**	**0**	**0**	**0**
Blue	1	1	0	1	0	0	0
Fin	15	15	10	5	0	0	0
Humpback	2	2	1	1	0	0	0
Sperm	2	2	0	2	0	0	0
Turtles	**618**	**604**	**565**	**39**	**14**	**13**	**1**
Green Turtle	1	1	1	0	0	0	0
Kemp's Ridley	20	19	18	1	1	1	0
Leatherback	38	37	9	28	1	0	1
Loggerhead	398	394	388	6	4	4	0
Loggerhead/Kemp's	10	10	10	0	0	0	0
Species unknown	151	143	139	4	8	8	0
TOTAL	**934**	**919**	**870**	**49**	**15**	**14**	**1**

Spatial Distributions within the Offshore Planning Area

Avian Species

Black-capped petrel and Audubon's shearwater did not show any substantial differences in distribution between the Summer and Fall surveys. Both species clustered both on the shelf break and in the northeast corner of the OPA (Figure 23). Sooty shearwater was only found during the Summer survey, located in the northeast corner of the OPA (Figure 23). Cory's shearwaters also showed a tendency to cluster in the northeast corner, with no apparent shift in distribution between the Summer and Fall surveys (Figure 24). Great shearwaters and unidentified shearwaters were more evenly distributed across the OPA (Figure 24), as were northern gannet, which were only recorded during the Fall survey (Figure 25).

There were fewer small gull species recorded during the Summer 2016 survey than during the Fall 2016 survey, and no general or interseasonal spatial patterns are in evidence for this group (Figure 26). Large gulls were recorded during both Summer 2016 and Fall 2016 surveys. Most large gulls tended to show greater nearshore tendencies in the Summer than in the Fall, possibly correlated with breeding activity. Species showing this pattern were great back-backed, herring, laughing, and ring-billed gull (Figure 27, Figure 28). Nearshore tendencies for least and royal terns were also evident in the Summer. Interseasonal patterns were not in evidence as few of these terns were recorded in the Fall survey (Figure 29). Sterna terns were also found nearer shore with no sterna terns recorded in the Fall 2016 survey (Figure 30).

Sea ducks such as scoter species and long-tailed duck were recorded only in the Fall 2016 survey. Most of these duck with only a few exceptions were found nearer shore (Figure 31).

Loons were mainly recorded during the Fall 2016 survey, with only a few common loons recorded during the Summer survey. Although some loons showed nearshore occupancy, many were also distributed across a wide bathymetric gradient (Figure 32).

Phalaropes were not recorded in the Summer survey, and during the Fall survey were generally found beyond the -60 meter mark (Figure 33).

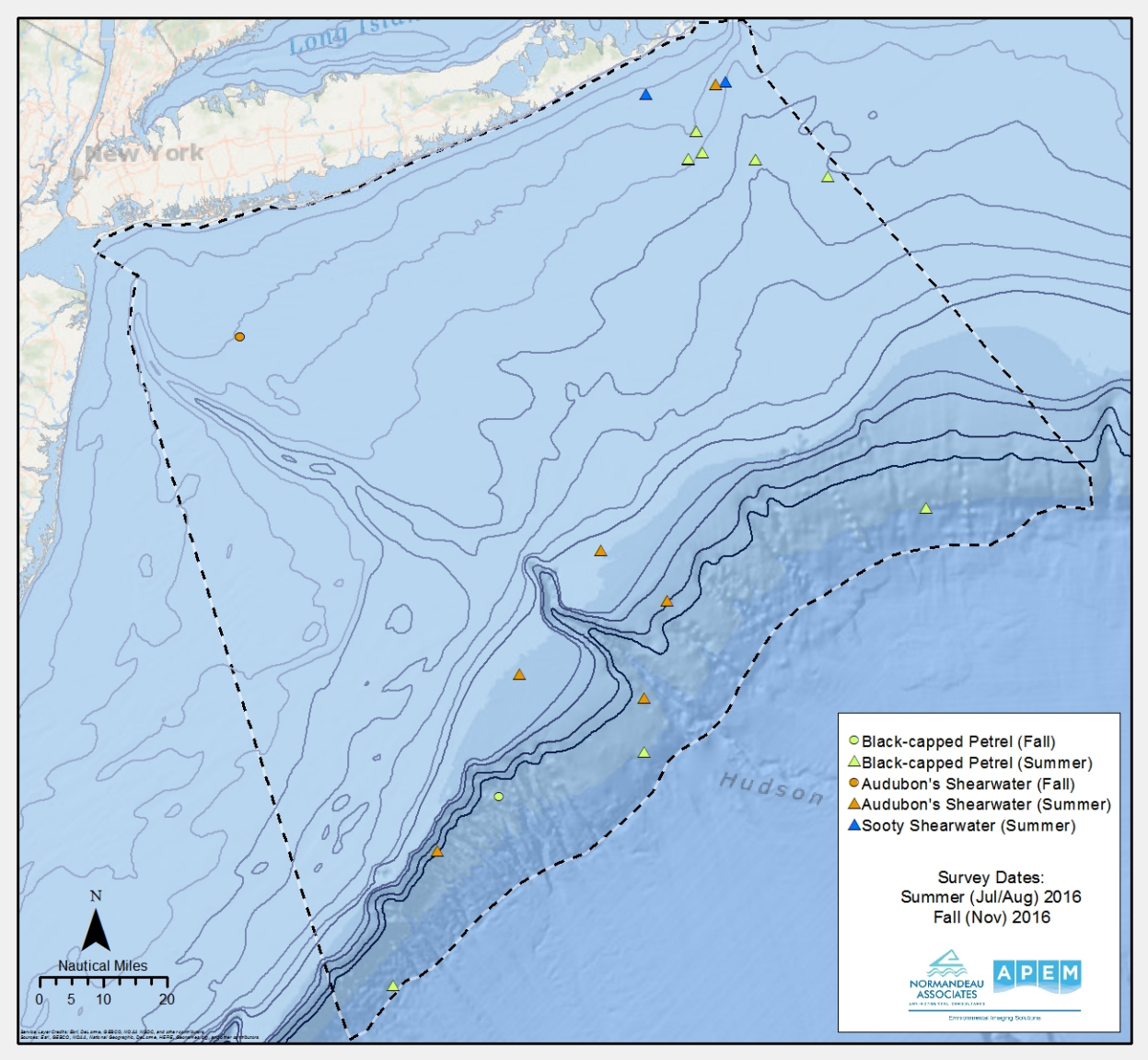

Figure 23. Distribution of black-capped petrel and Audubon's shearwaters during the Summer and Fall 2016 surveys. Sooty shearwater was only recorded during the Summer 2016 survey.

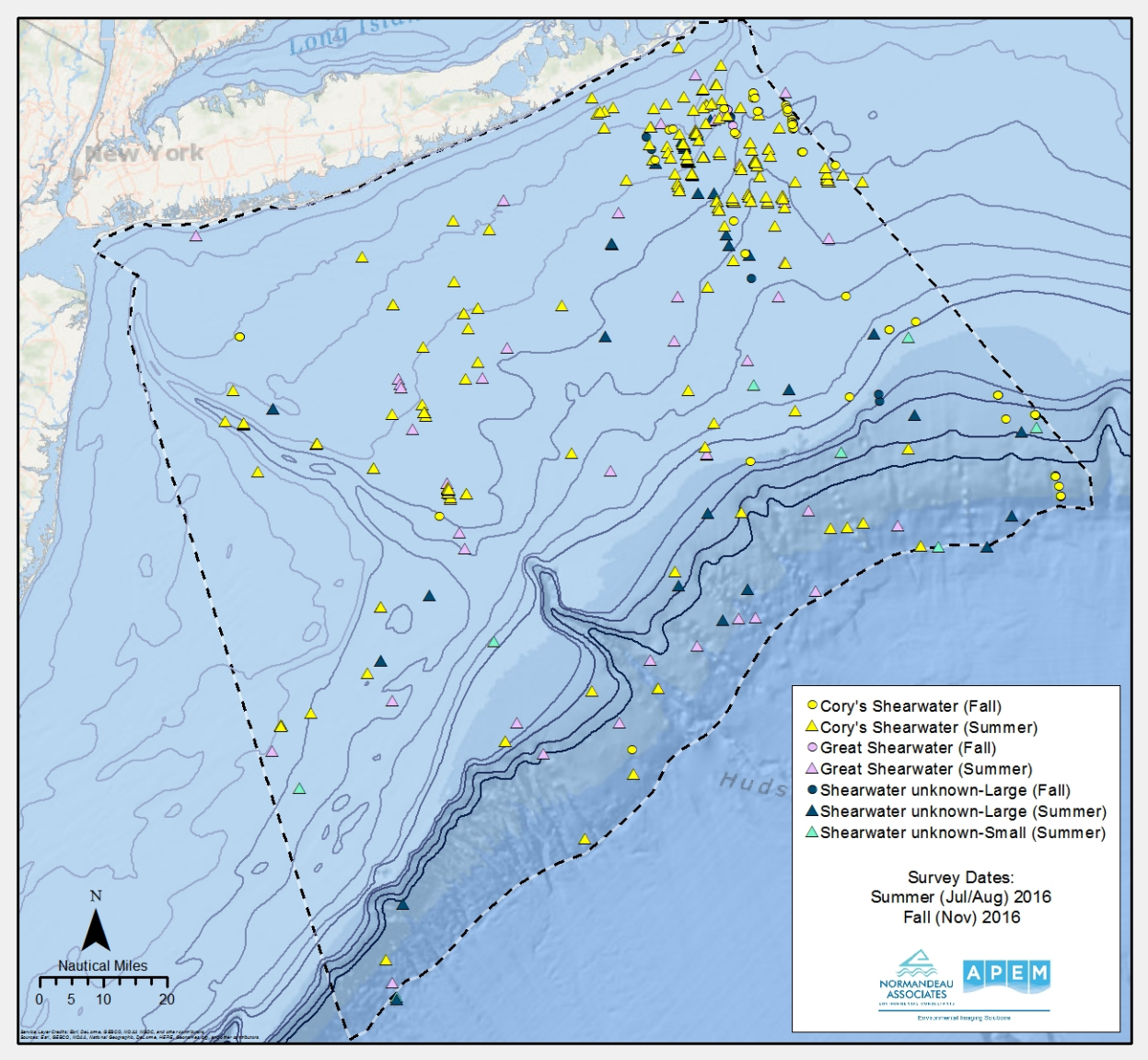

Figure 24. Distribution of Cory's, great, and unidentified shearwaters during the Summer and Fall 2016 surveys.

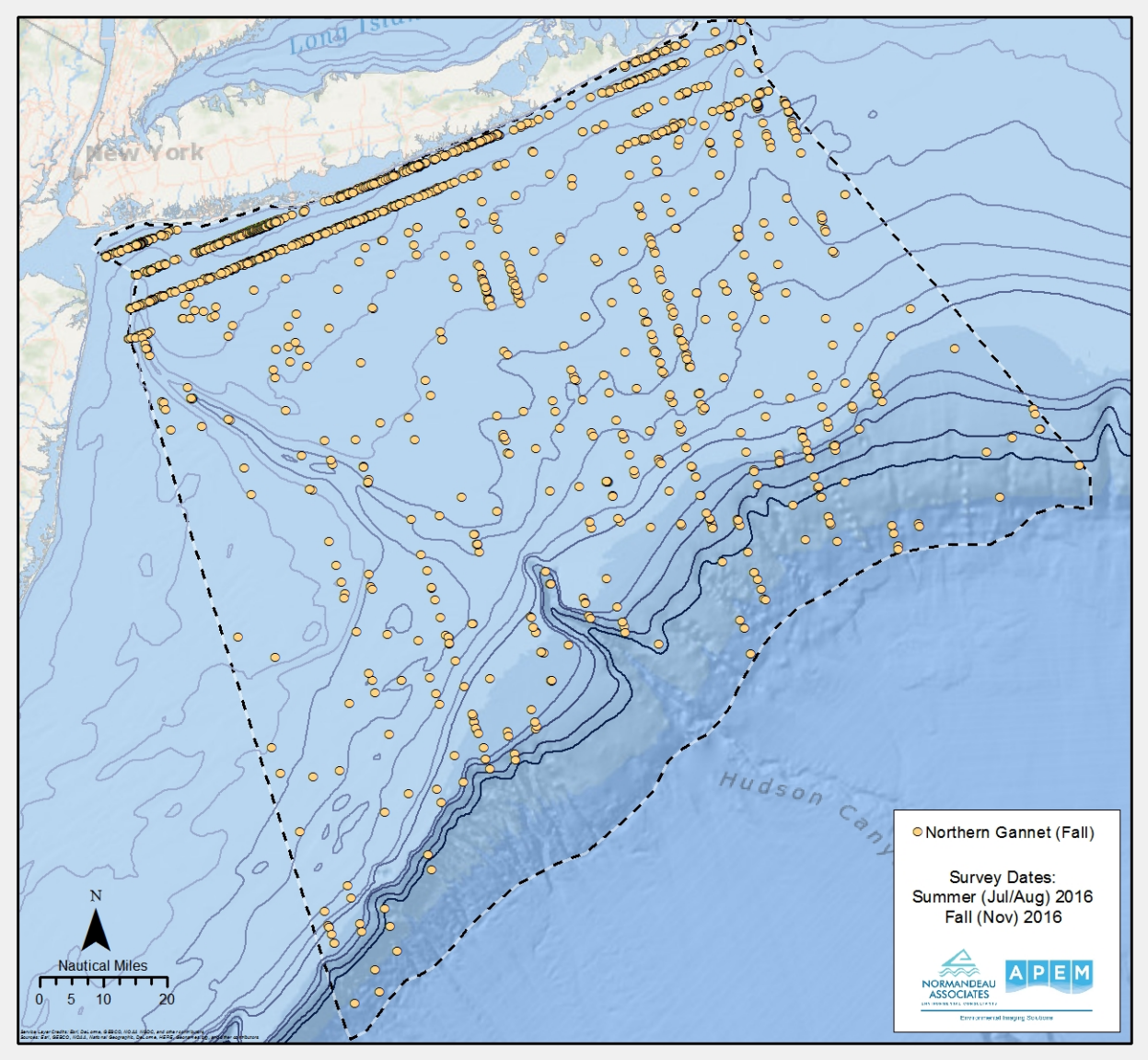

Figure 25. Distribution of northern gannet during the Fall 2016 survey.

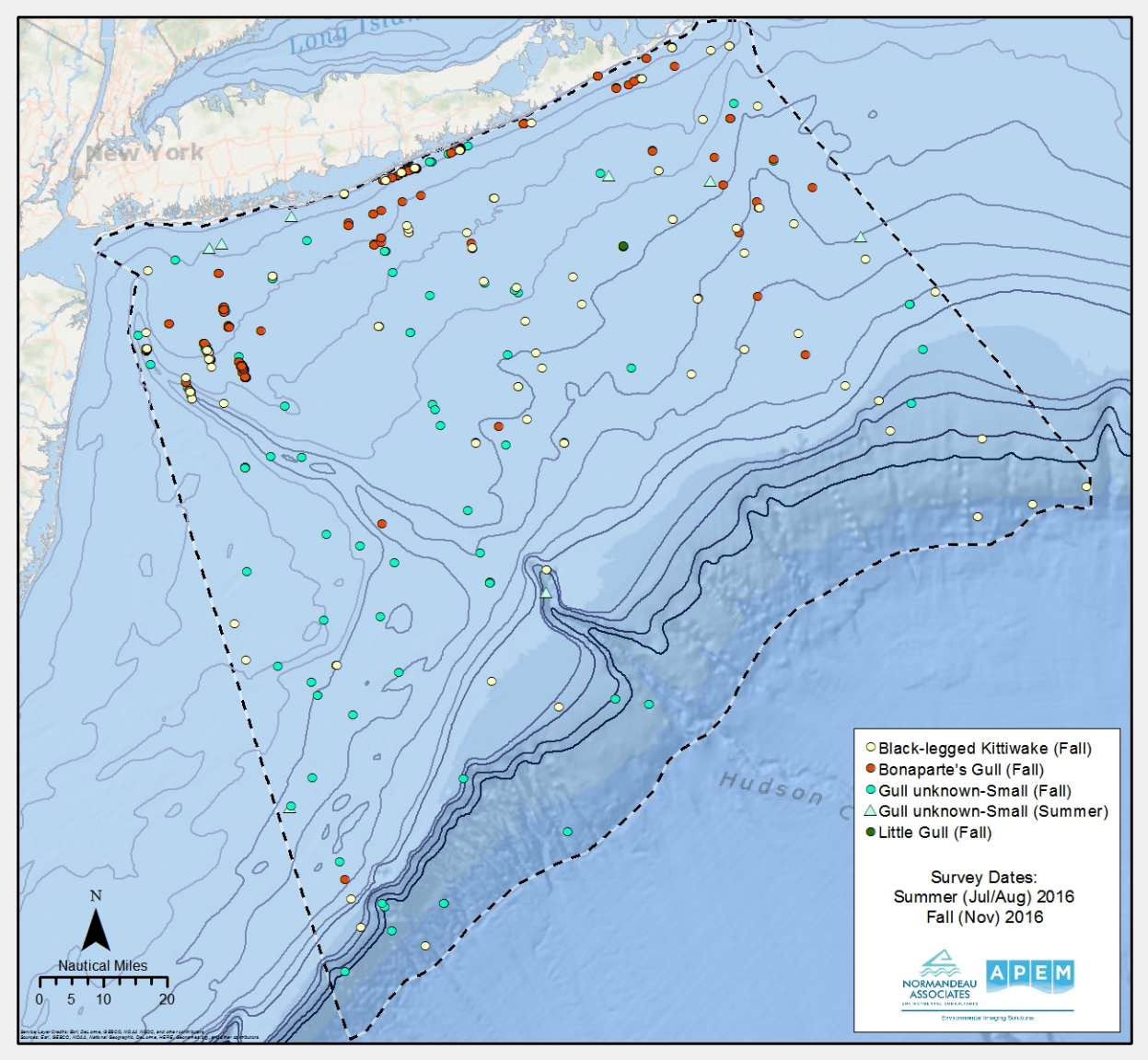

Figure 26. Distribution of black-legged kittiwake, Bonaparte's gull, and little gull during the Fall 2016 survey and unidentified small gulls during the Spring and Fall 2016 surveys.

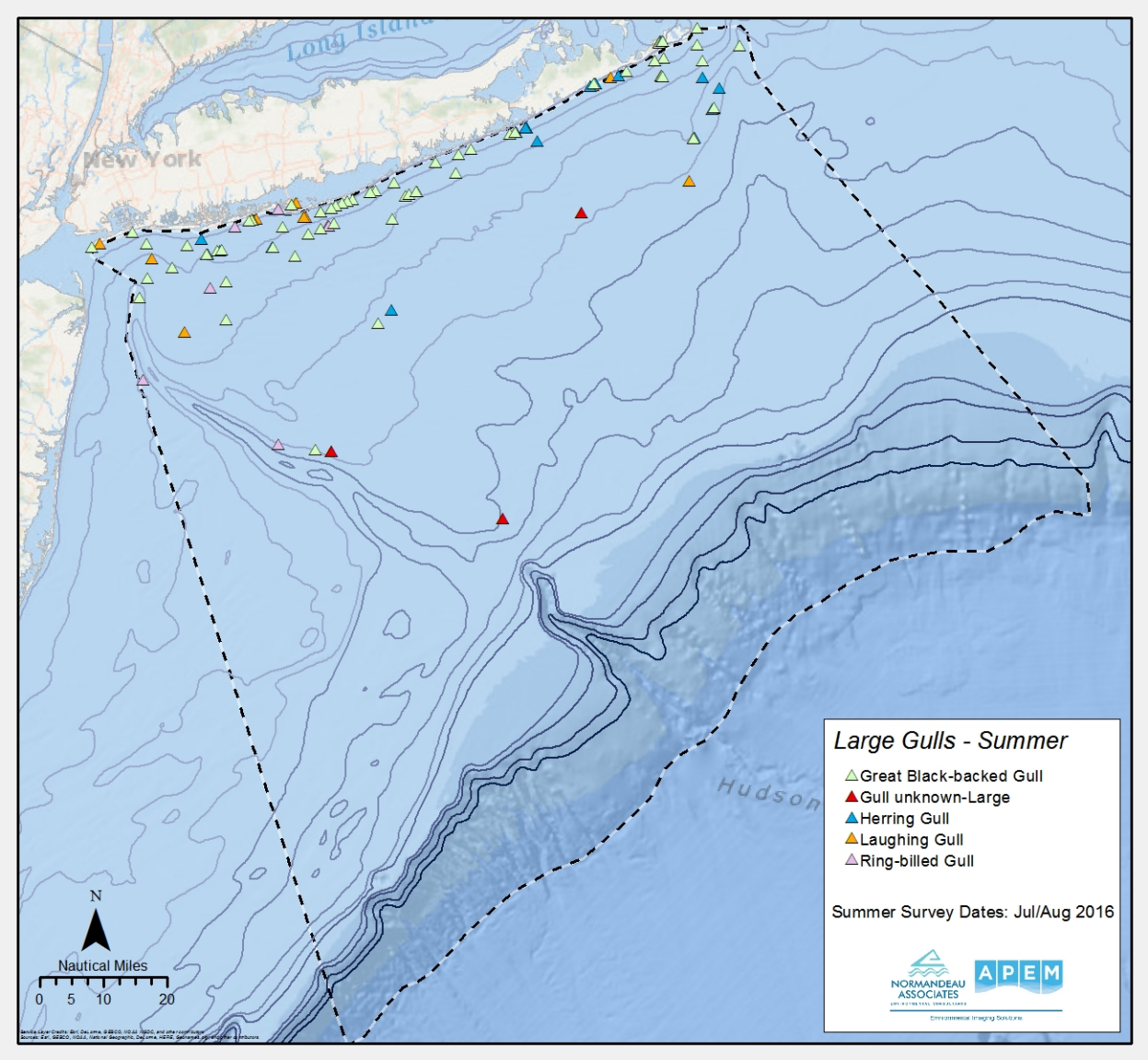

Figure 27. Distribution of large gulls including great black-backed gull, herring gull, lesser black-backed gull, laughing gull, and ring-billed gull during the Summer 2016 survey.

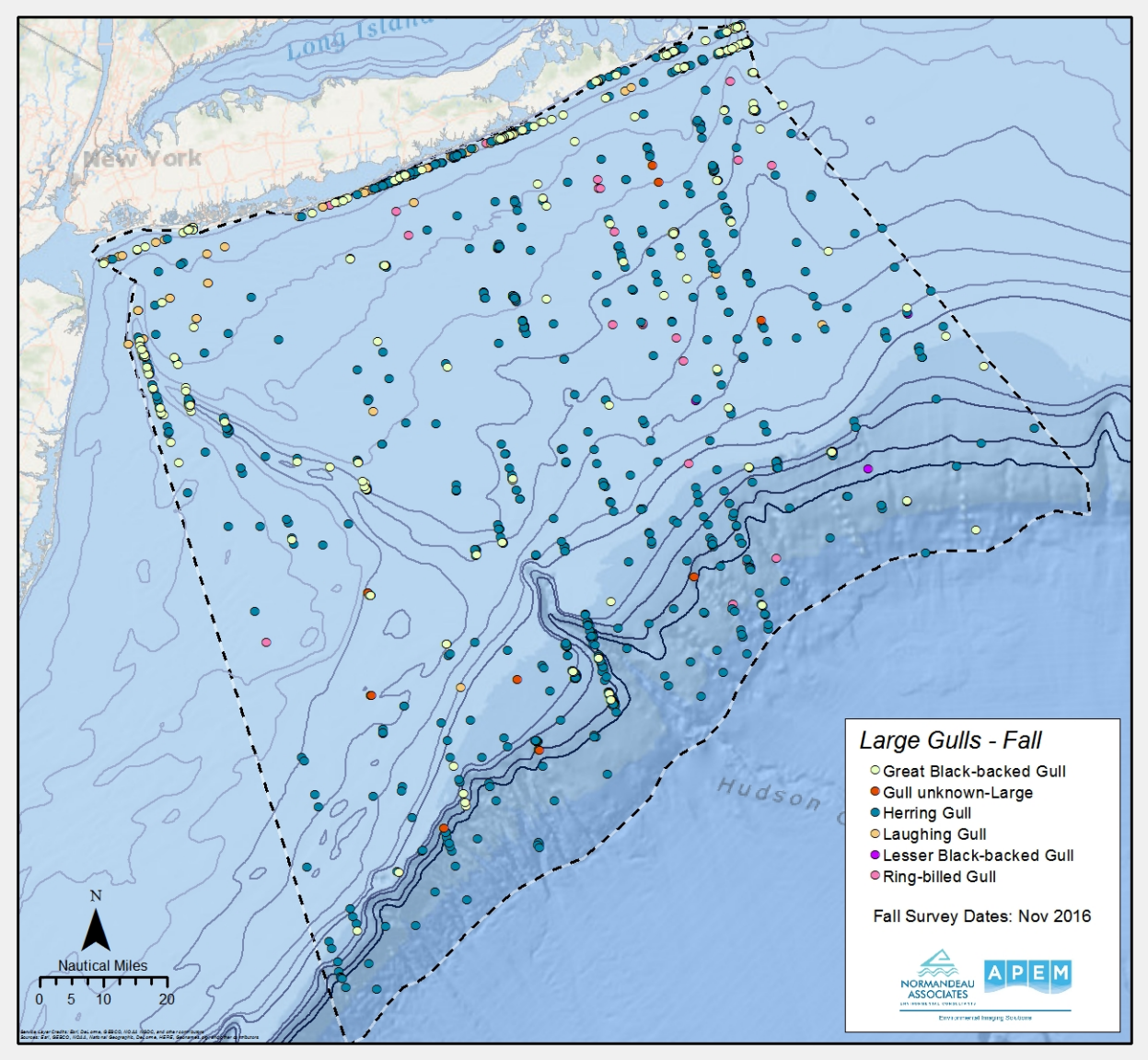

Figure 28. Distribution of large gulls including great black-backed gull, herring gull, lesser black-backed gull, laughing gull, and ring-billed gull during the Fall 2016 survey.

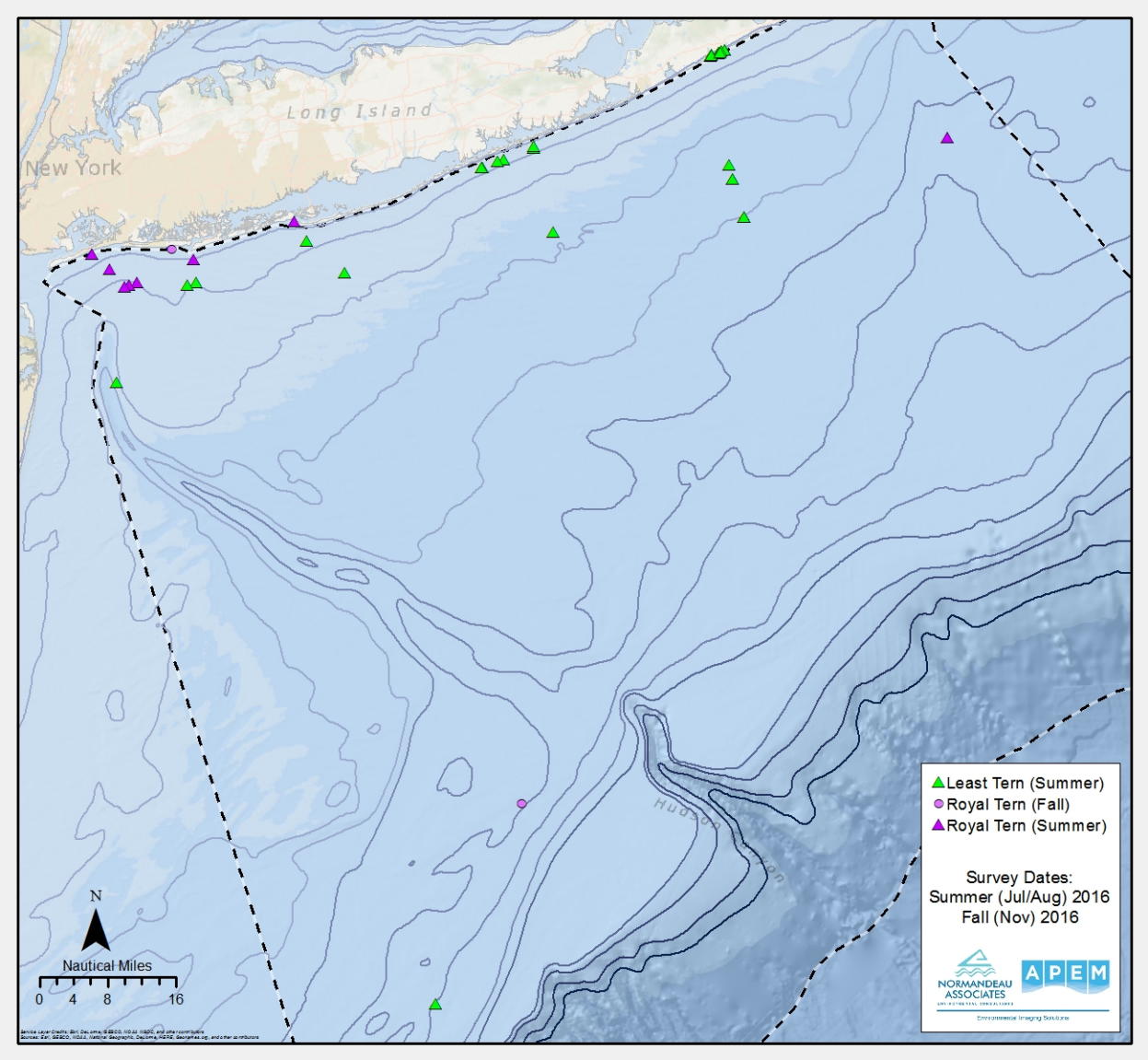

Figure 29. Distribution of least and royal terns during the Summer and Fall 2016 surveys.

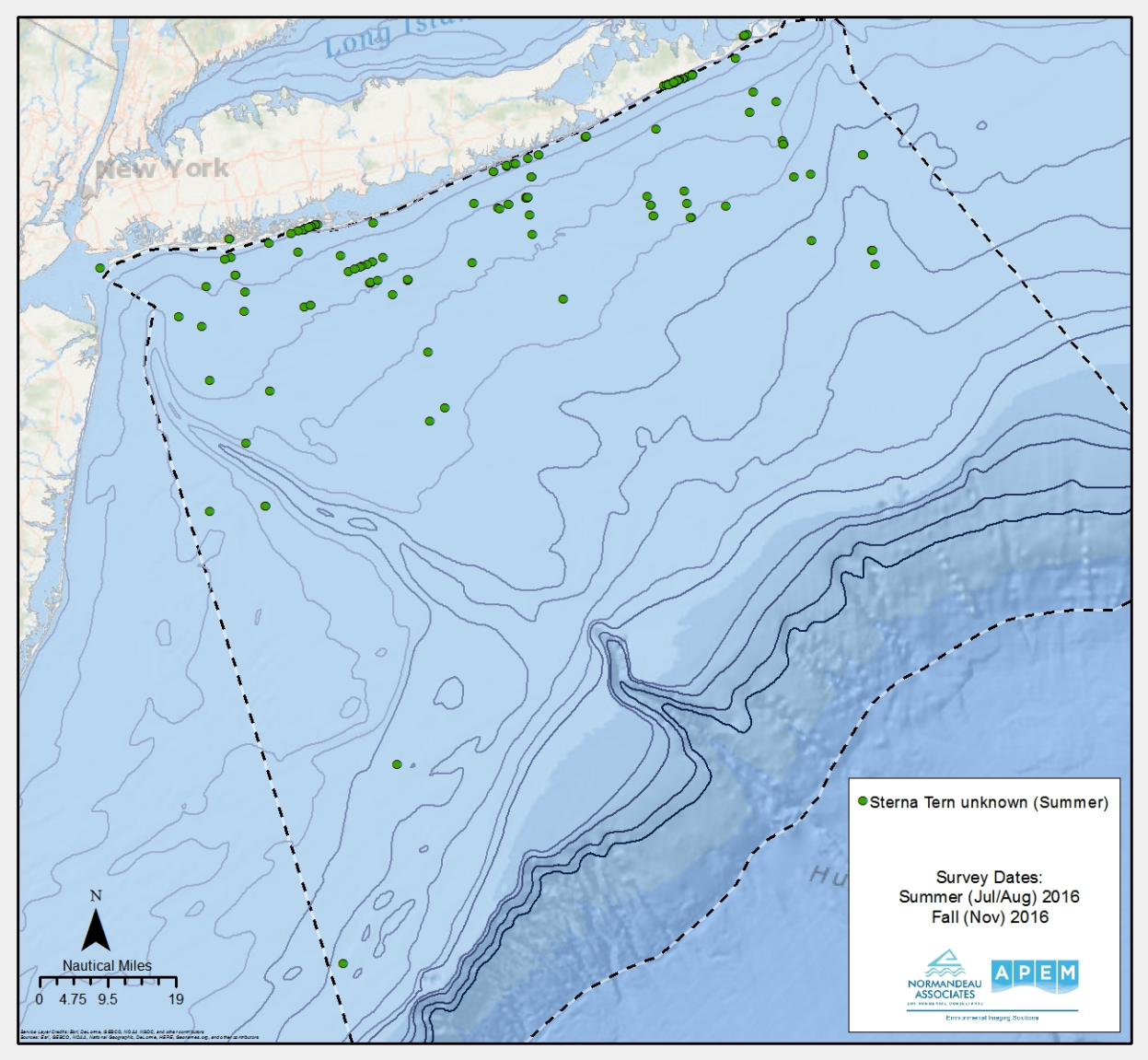

Figure 30. Distribution of *Sterna* terns during the Summer and Fall 2016 surveys.

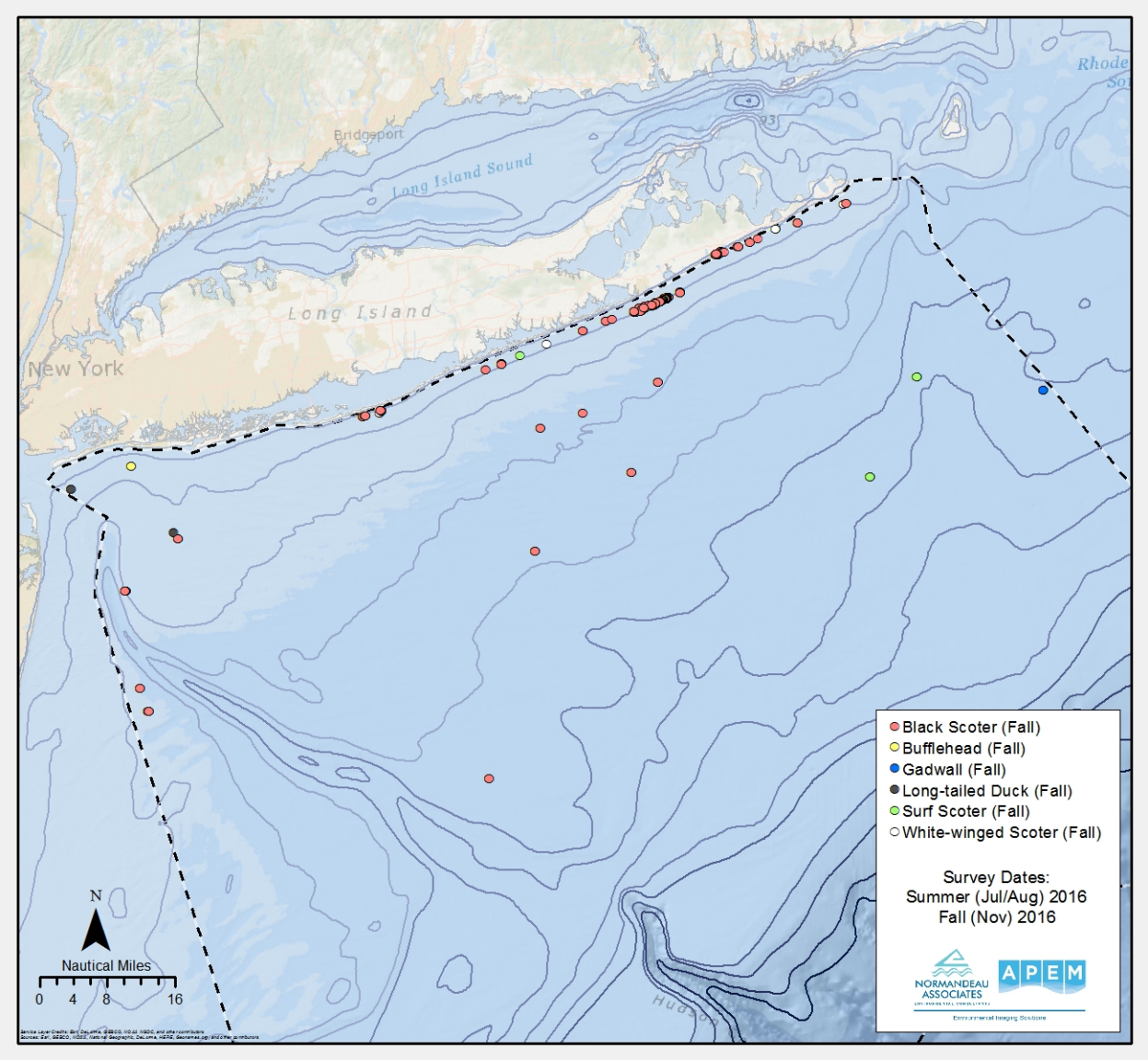

Figure 31. Distribution of sea ducks during the Fall 2016 survey. No sea duck were recorded during the Summer 2016 survey.

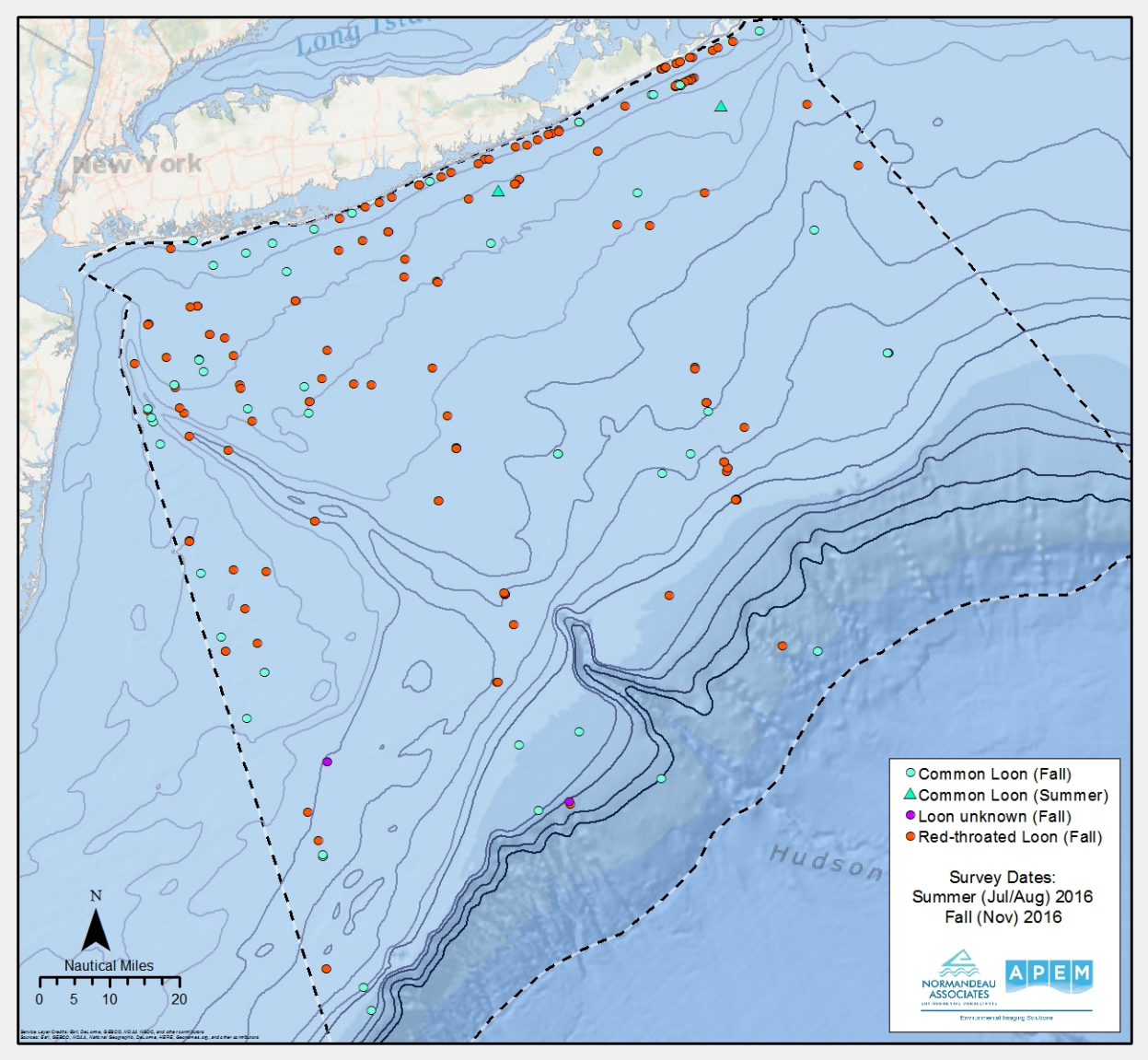

Figure 32. Distribution of common, red-throated, and unidentified loons during the Summer and Fall 2016 surveys.

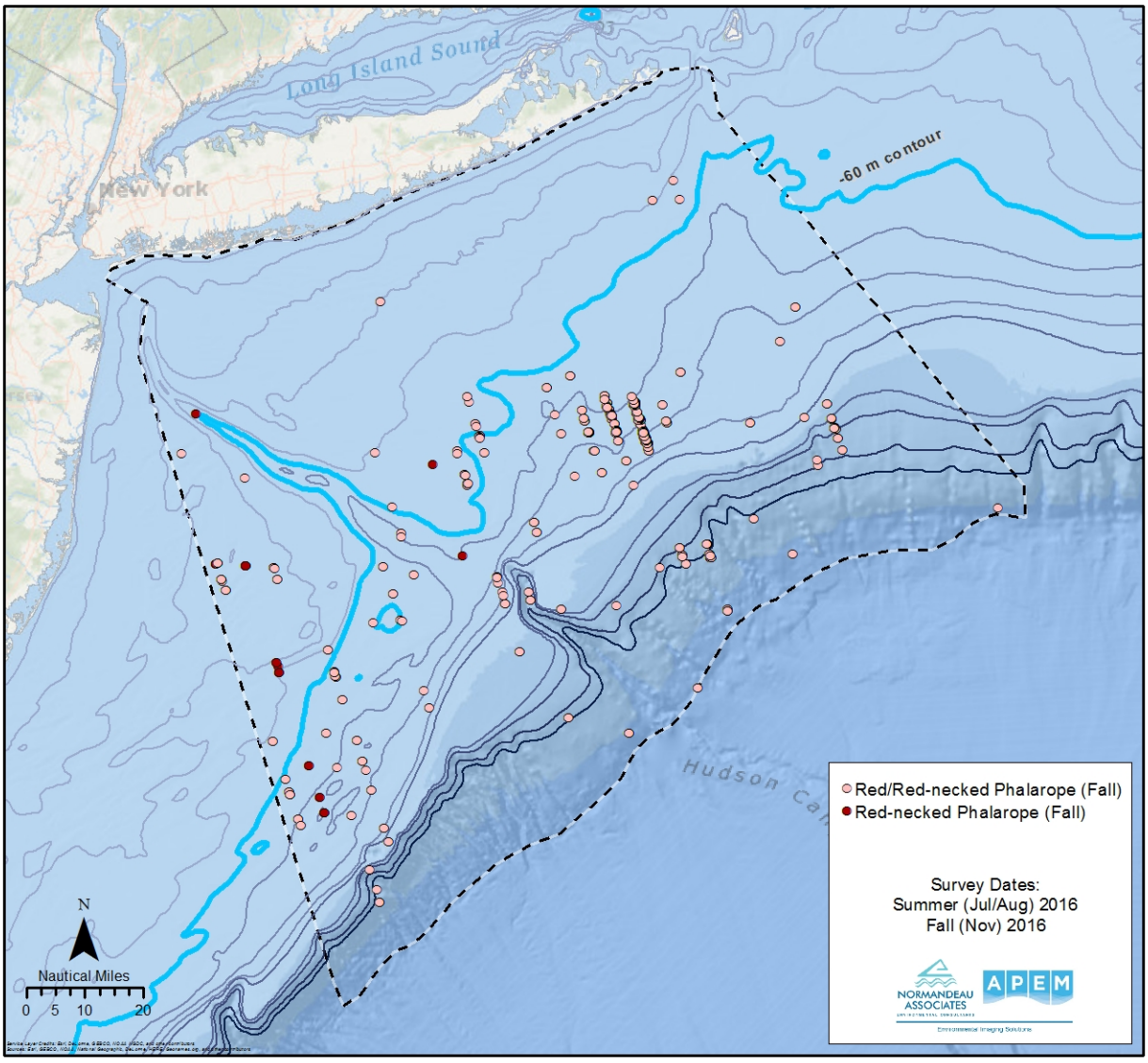

Figure 33. Distribution of phalaropes during the Summer and Fall 2016 surveys.

Turtle Species

There is an evident relationship between turtles during both Summer 2016 and Fall 2016 surveys staying in water shallower than -70 meters. This is the same for green, Kemp's ridley, and leatherback turtles (Figure 34), as well as loggerhead and all unidentified turtles (Figure 35); although, there were a few exceptions. There were no seasonal differences in this distribution pattern.

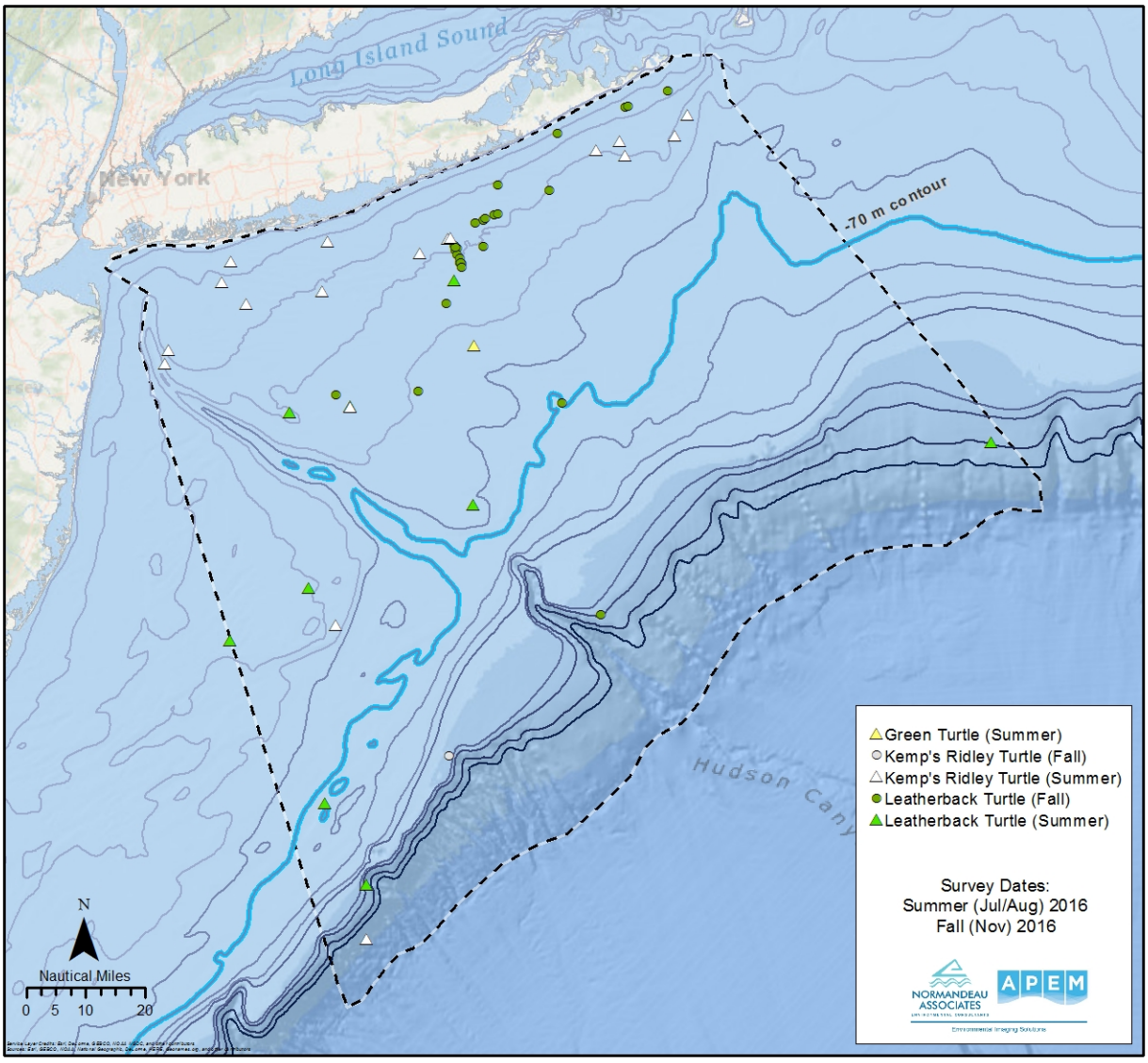

Figure 34. Distribution of green, Kemp's ridley, and leatherback turtles during the Summer and Fall 2016 surveys.

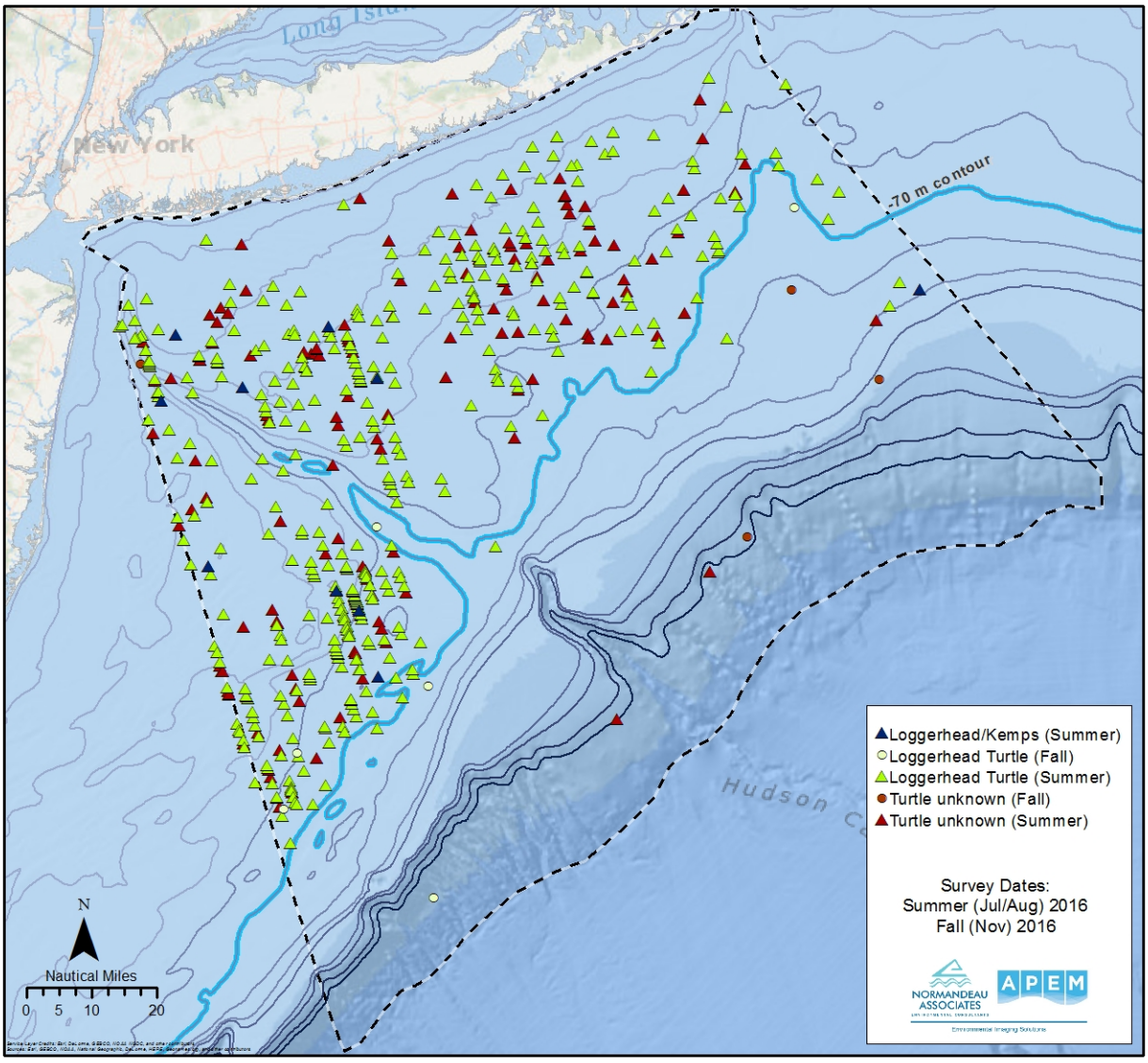

Figure 35. Distribution of loggerhead, loggerhead/Kemp's, and unidentified turtles during the Summer and Fall 2016 surveys.

Marine Mammal Species

Dolphins

In general, few of the dolphin species showed significant preference variation in spatial distributions. Distributions for some species were fairly widespread during both the Summer and Fall 2016 surveys (e.g., common and common bottlenose dolphins) (Figure 36). However pilot whale and Risso's dolphin show a definite preference for deeper water at the shelf break for both survey periods (Figure 37).

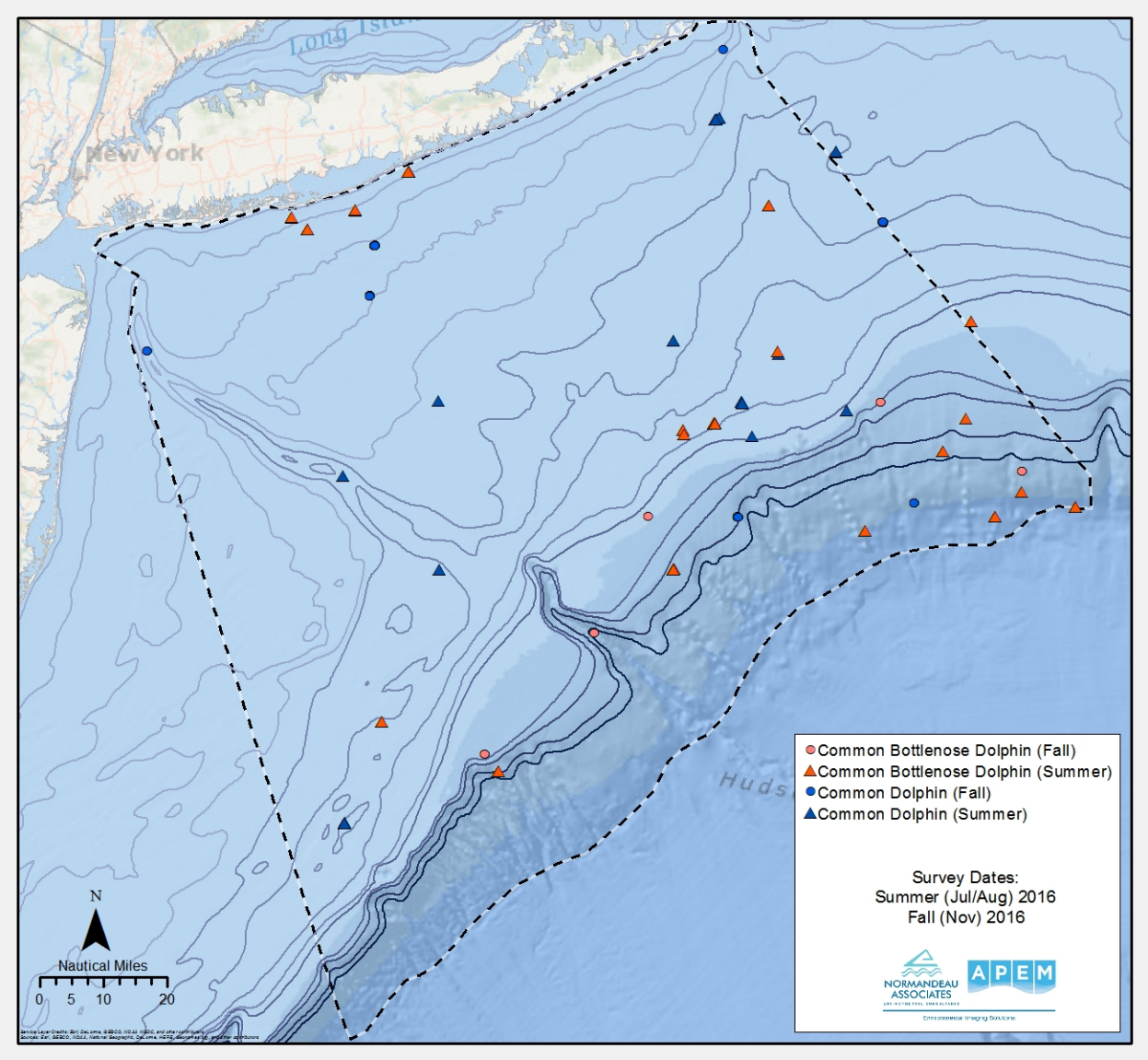

Figure 36. Distribution of common and common bottlenose dolphins during the Summer and Fall 2016 surveys.

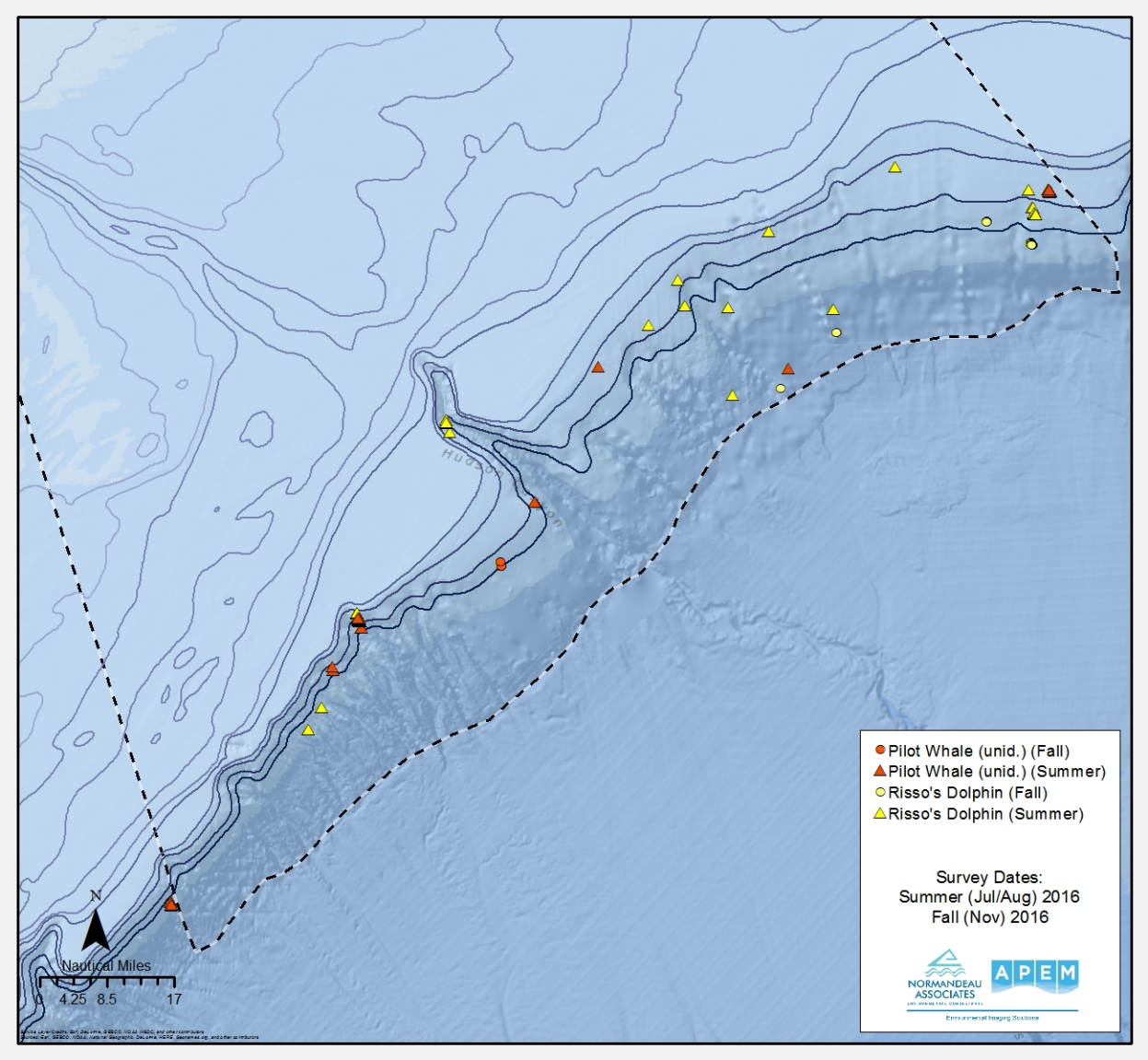

Figure 37. Distribution of pilot whale and Risso's dolphin during the Summer and Fall 2016 surveys.

Whales

Whales in general showed a preference for the shelf break, although fin and humpback whales were also found elsewhere in the OPA. No seasonal distribution patterns are in evidence (Figure 38).

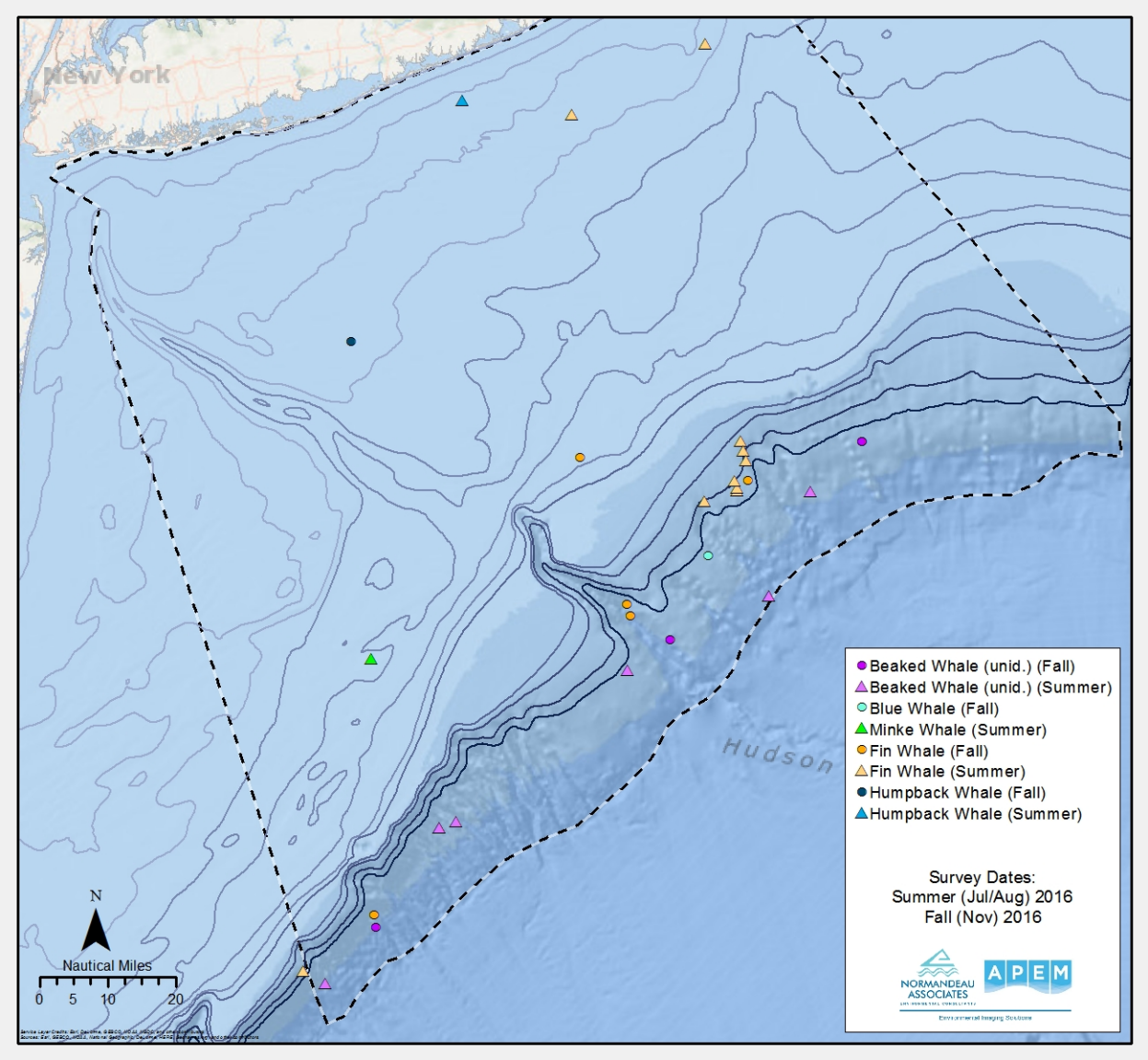

Figure 38. Distribution of beaked, blue, minke, fin, and humpback whales during the Summer and Fall 2016 surveys.

Ray and Shark Species

During the summer 2016 survey which recorded the most rays, patterns of clumped distribution were evident on the eastern edges of the OPA for cownose, bullnose and cownose/bullnose rays (Figure 39). When reviewing only unidentified rays, although species presence is more broadly distributed, the same clumped distributions are also evident, along with additional aggregations including at the shelf break (Figure 40). The shelf break aggregation of unidentified rays also correlates with aggregations of giant manta rays (Figure 41).

There were no clear distribution patterns among sharks, including scalloped hammerhead sharks and unidentified hammerhead sharks (Figure 42)

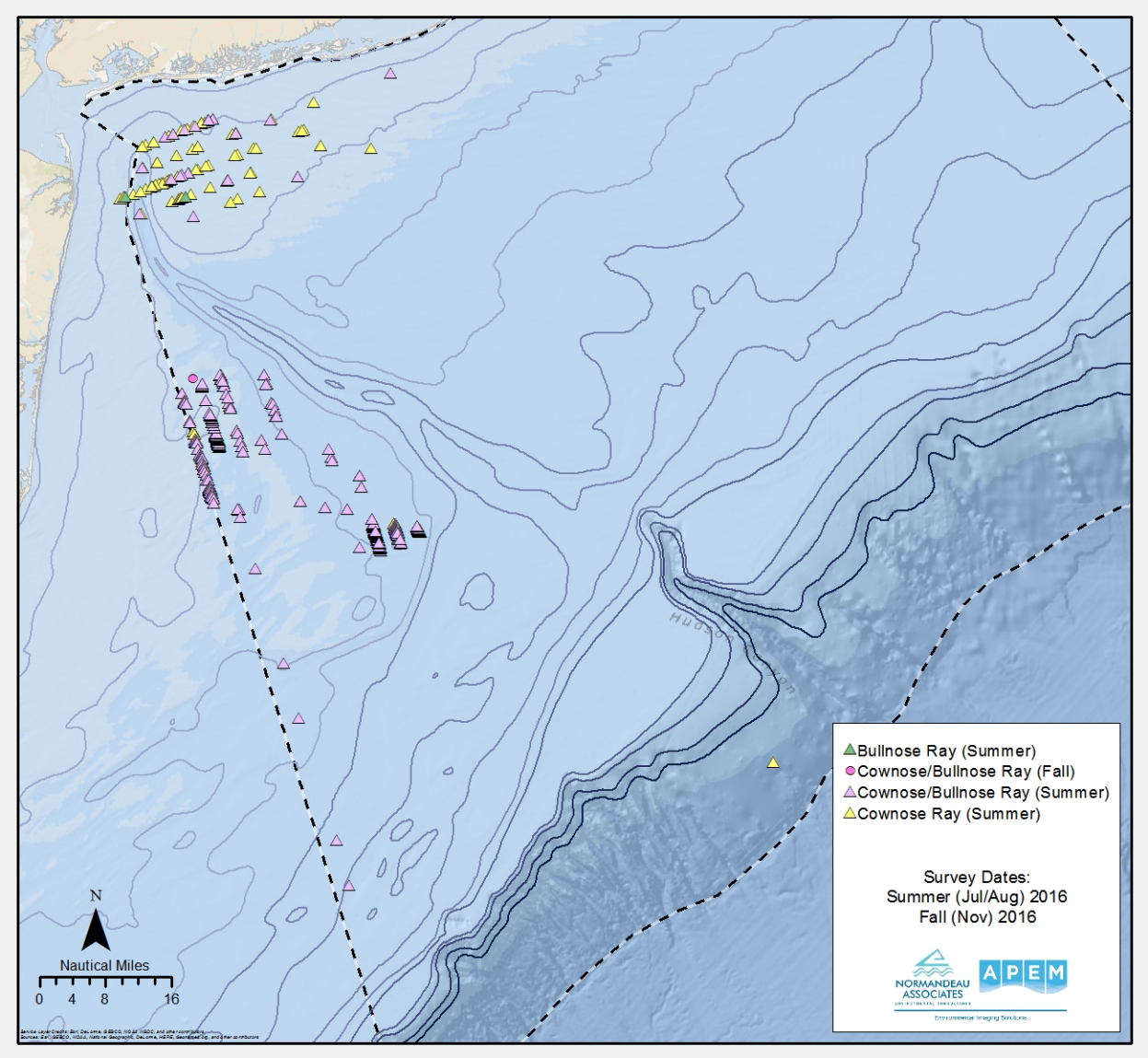

Figure 39. Distribution of bullnose and cownose/bullnose rays during the Summer and Fall 2016 surveys.

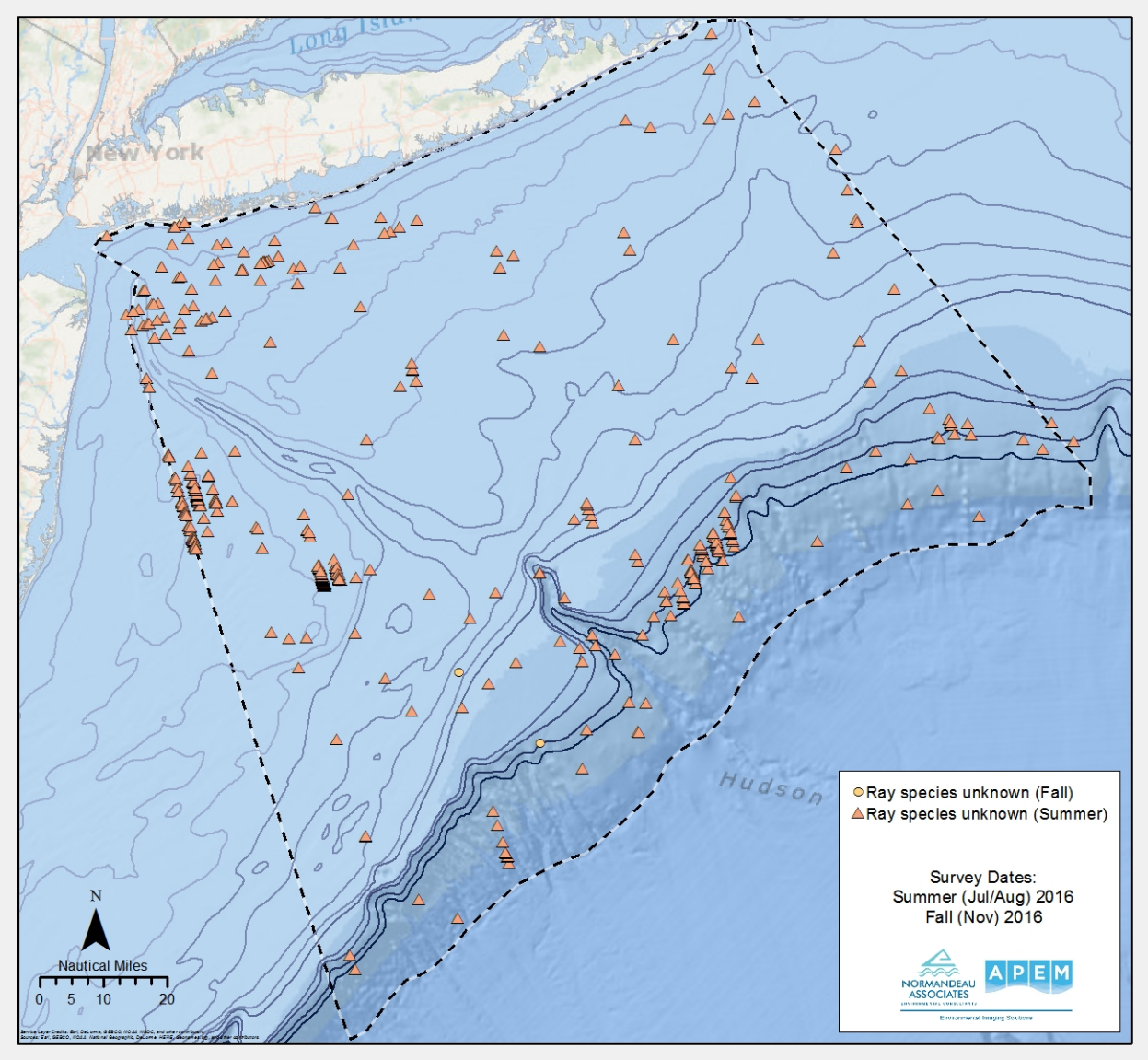

Figure 40. Distribution of unidentified rays during the Summer and Fall 2016 surveys.

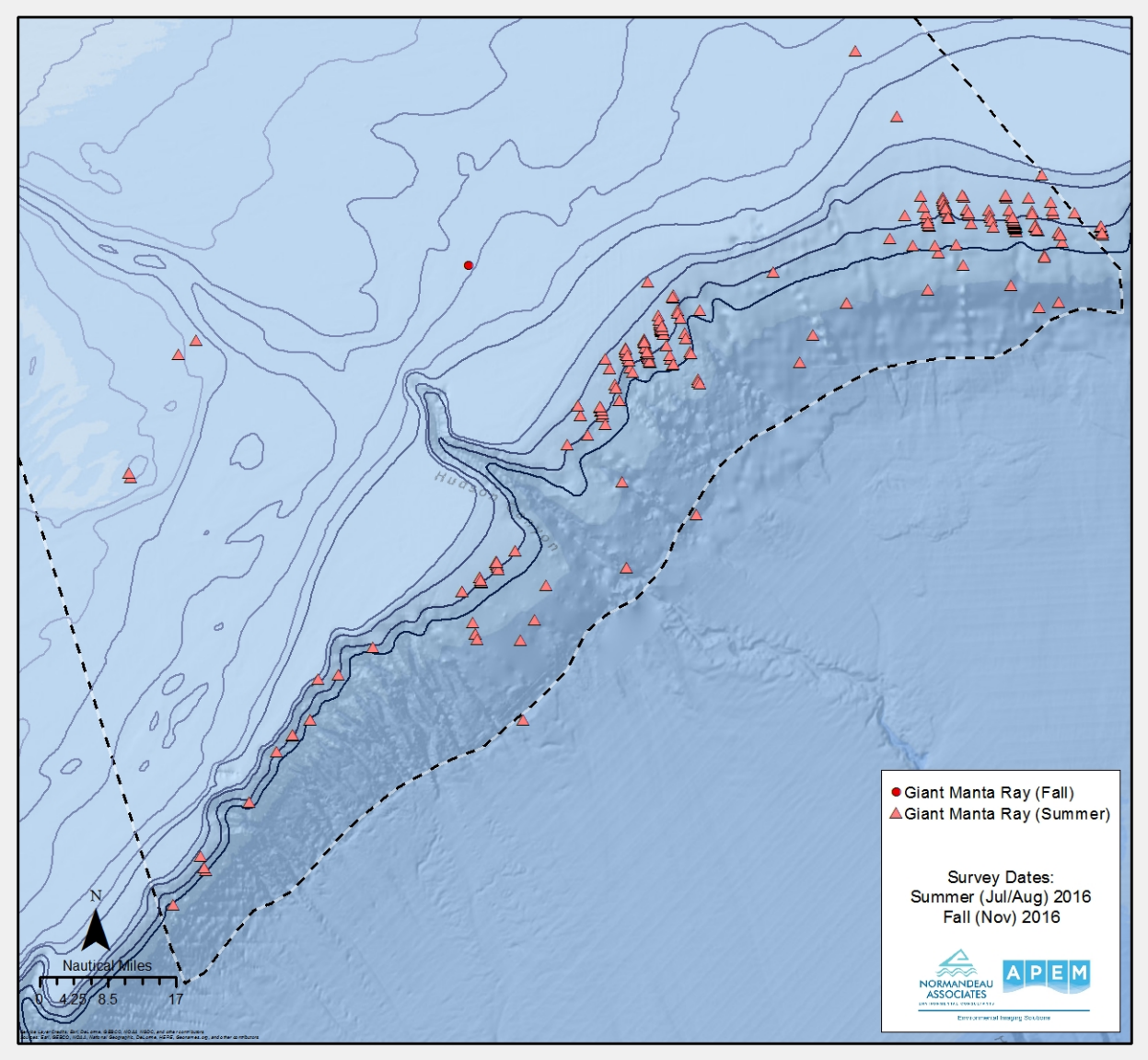

Figure 41. Distribution of giant manta rays during the Summer 2016 and Fall 2016 surveys.

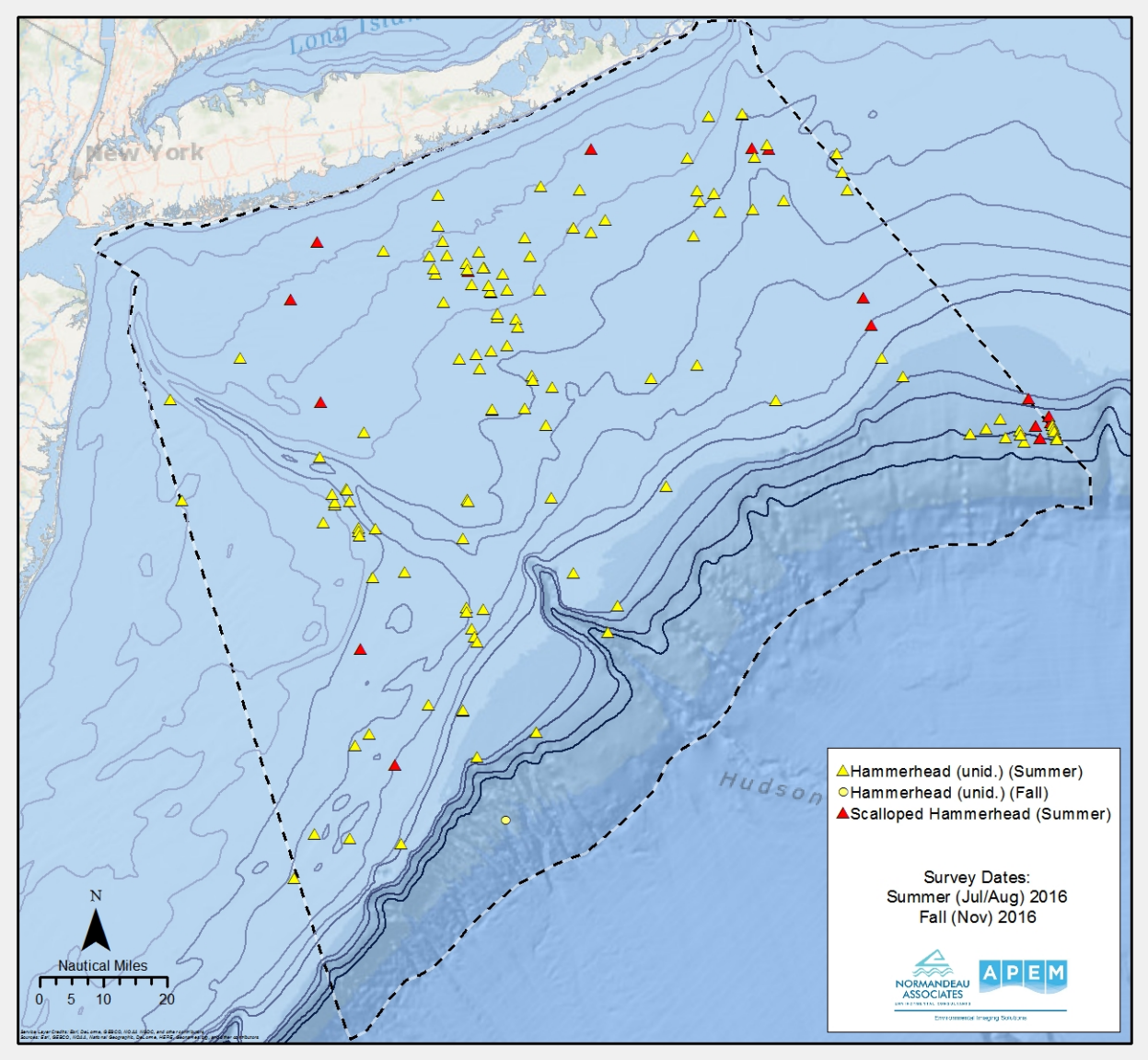

Figure 42. Distribution of hammerhead and scalloped hammerhead sharks during the Summer 2016 and Fall 2016 surveys.

Large Bony Fish

Of the large bony fish, preference for deeper water was shown by mahi-mahi (Figure 43), which were recorded only during the Summer survey, and sunfish species (Figure 44).

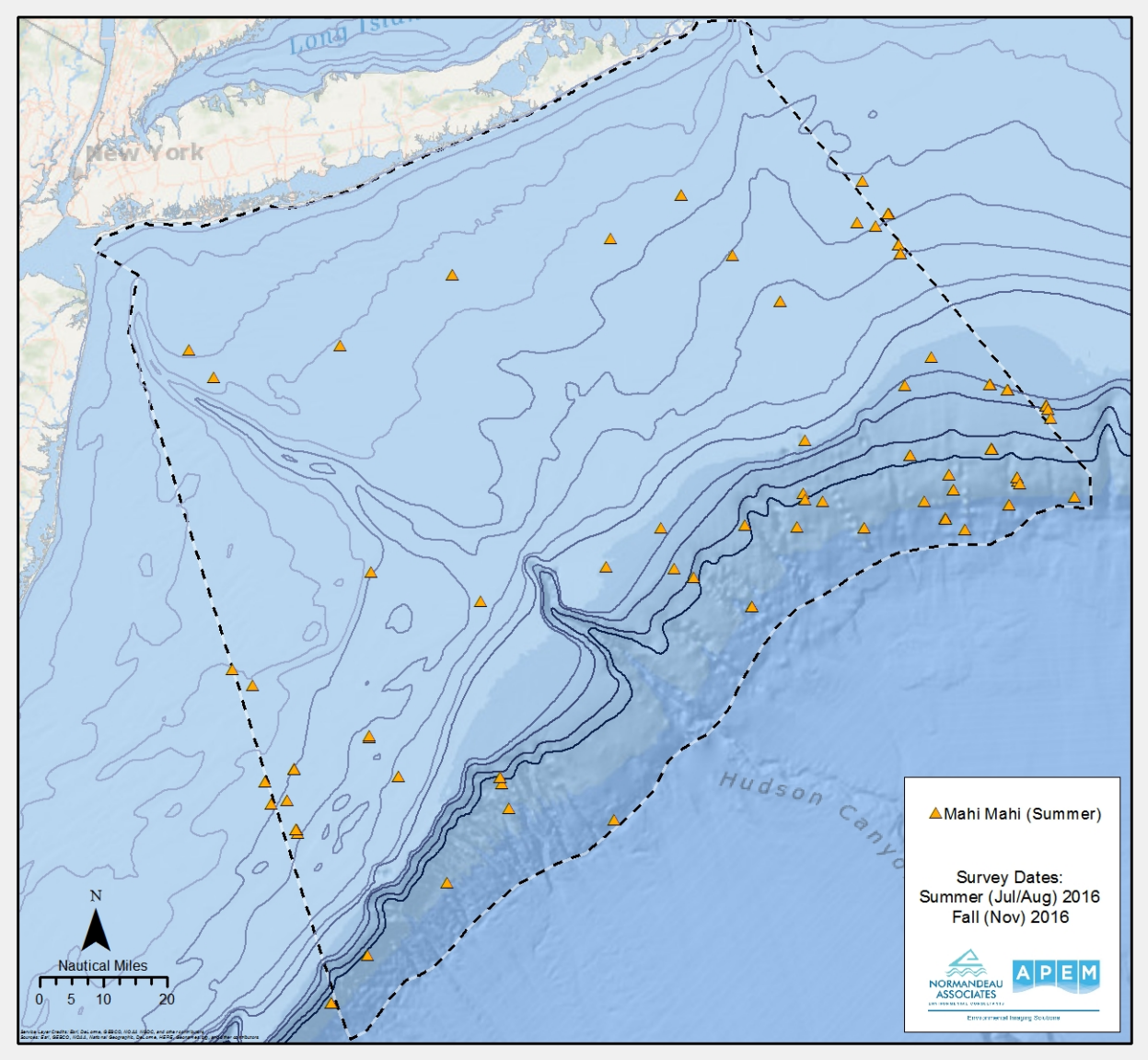

Figure 43. Distribution of mahi-mahi during the Summer 2016 survey.

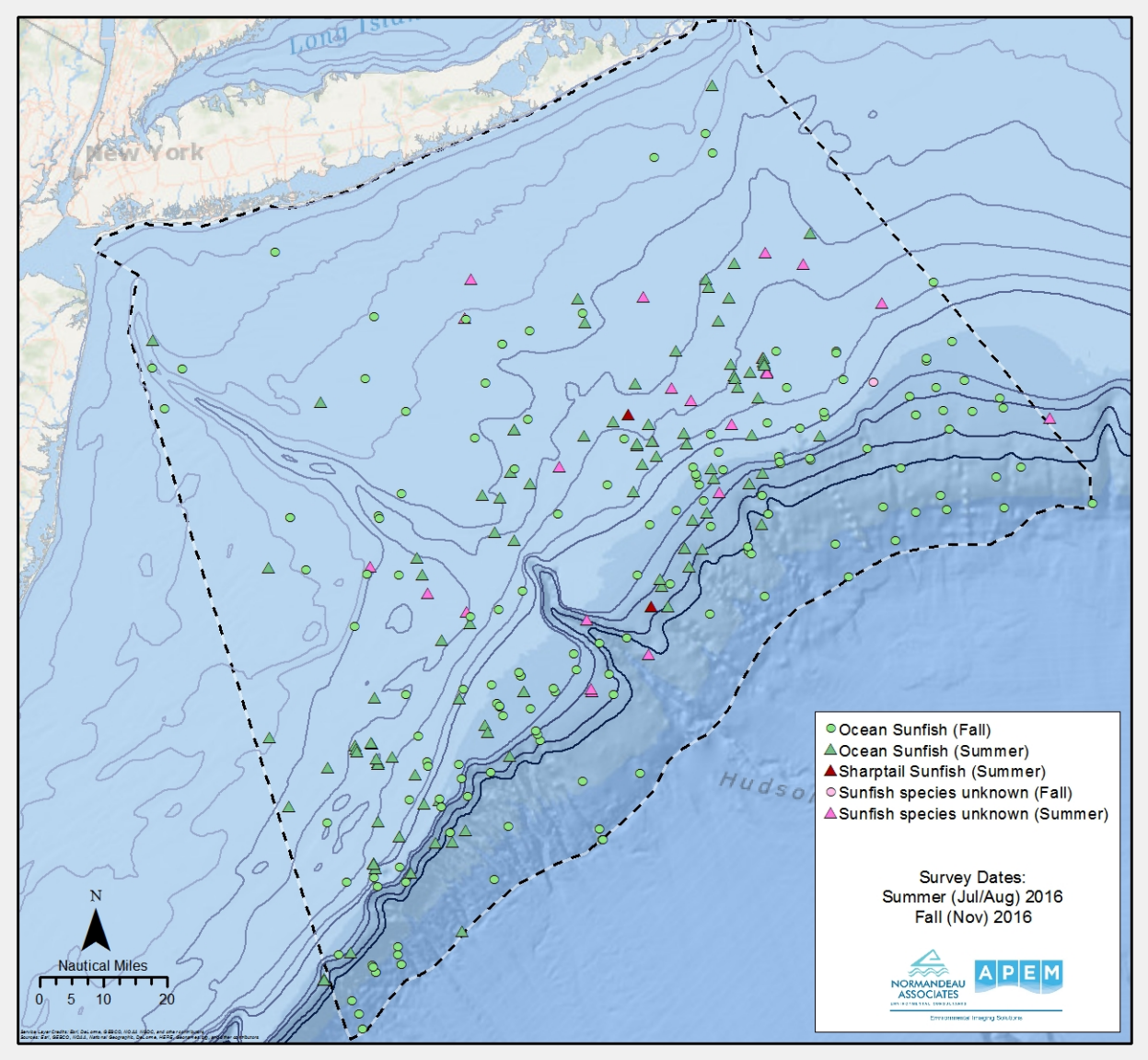

Figure 44. Distribution of sunfish during the Summer and Fall 2016 surveys.

Direction of Travel within the Offshore Planning Area

Not all groups were observed in each season, and graphs were only created for the season(s) with greater than 100 observations. The one exception is whales, in which case both seasons were graphed as a combined dataset. Overall, the predominant directions of all taxonomic groups were towards the North and WNW during the Fall season. There was no predominant direction overall during the Summer season.

During the Fall 2016 season, phalarope species were all observed flying predominately WNW and West (Figure 45). Red-throated loons were variable in their flight direction, but both the red-throated loon and common loon were most often observed flying WNW and W (Figure 45).

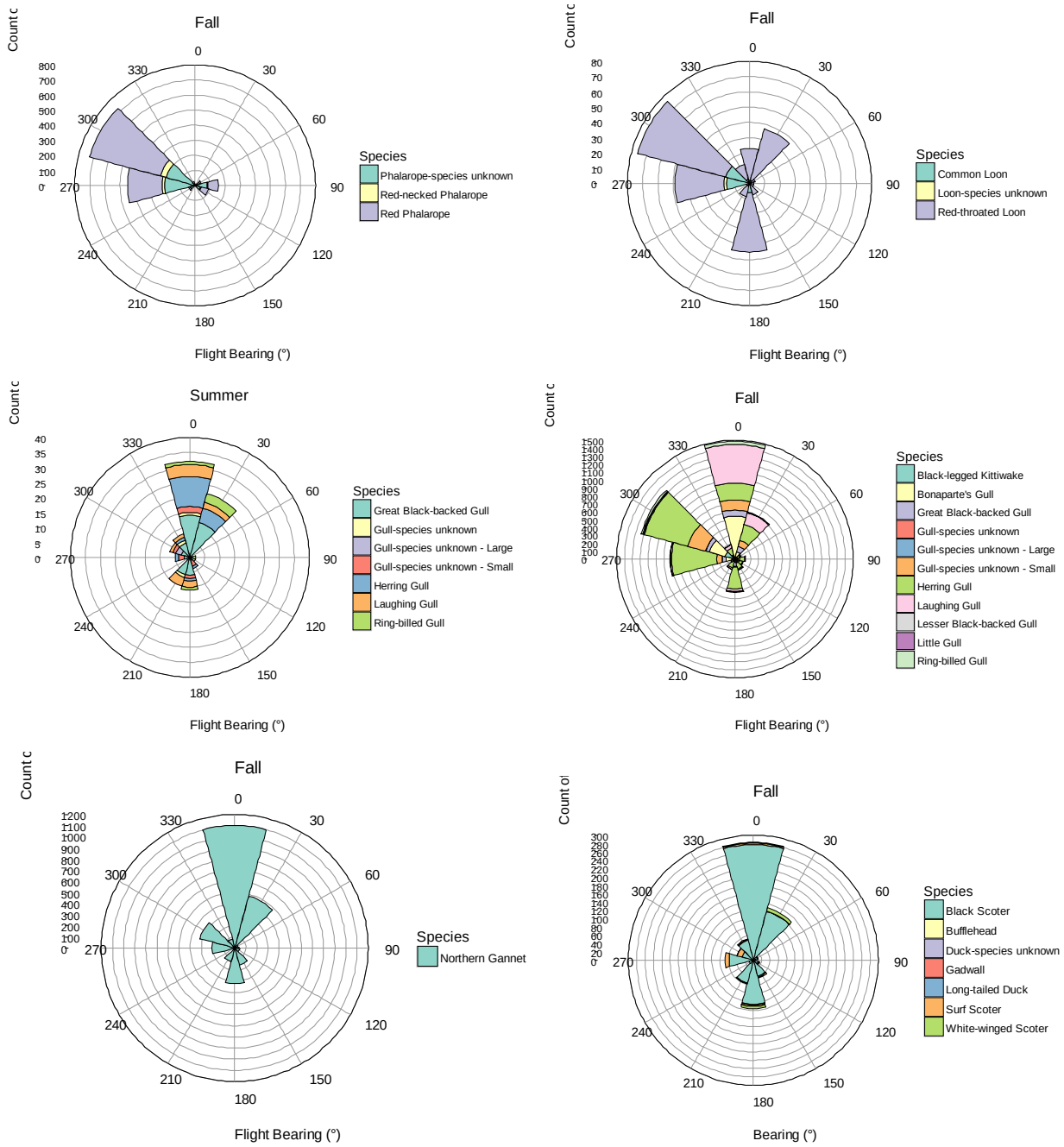

Figure 45. Direction of travel for phalaropes, loons, gulls, gannets, and ducks during the Summer and Fall 2016 surveys.

Flight directions for gulls were mapped separately for each season to facilitate different y axis ranges. During the Summer, the majority of gulls were observed flying North or NNE, with great black-backed gulls and herring gulls comprising the majority of the observations. During the Fall, most gulls were again observed flying North, but there was greater variation in flight headings and differences among species. Laughing gulls were mostly observed heading North or NNE, and Bonaparte's gulls were observed flying either North or WNW. Herring gulls were observed flying in all directions, but the majority of herring gulls were flying WNW and West (Figure 45).

During the Fall 2016 survey, Northern gannets were mostly observed flying North (Figure 45). Black scoters were the most frequently observed duck species and were most often observed flying North. With the exception of surf scoters, which headed roughly West and WNW, observations of all other duck species were too infrequent for discernable patterns (Figure 45).

Wilson's storm-petrel was the only species of storm-petrel observed during the Summer and it was most often observed heading roughly East–West or WNW–ESE (Figure 46). Shearwater species were generally headed West and WNW during both the Summer and Fall seasons. However, a large number were also observed heading East during the Summer (Figure 46).

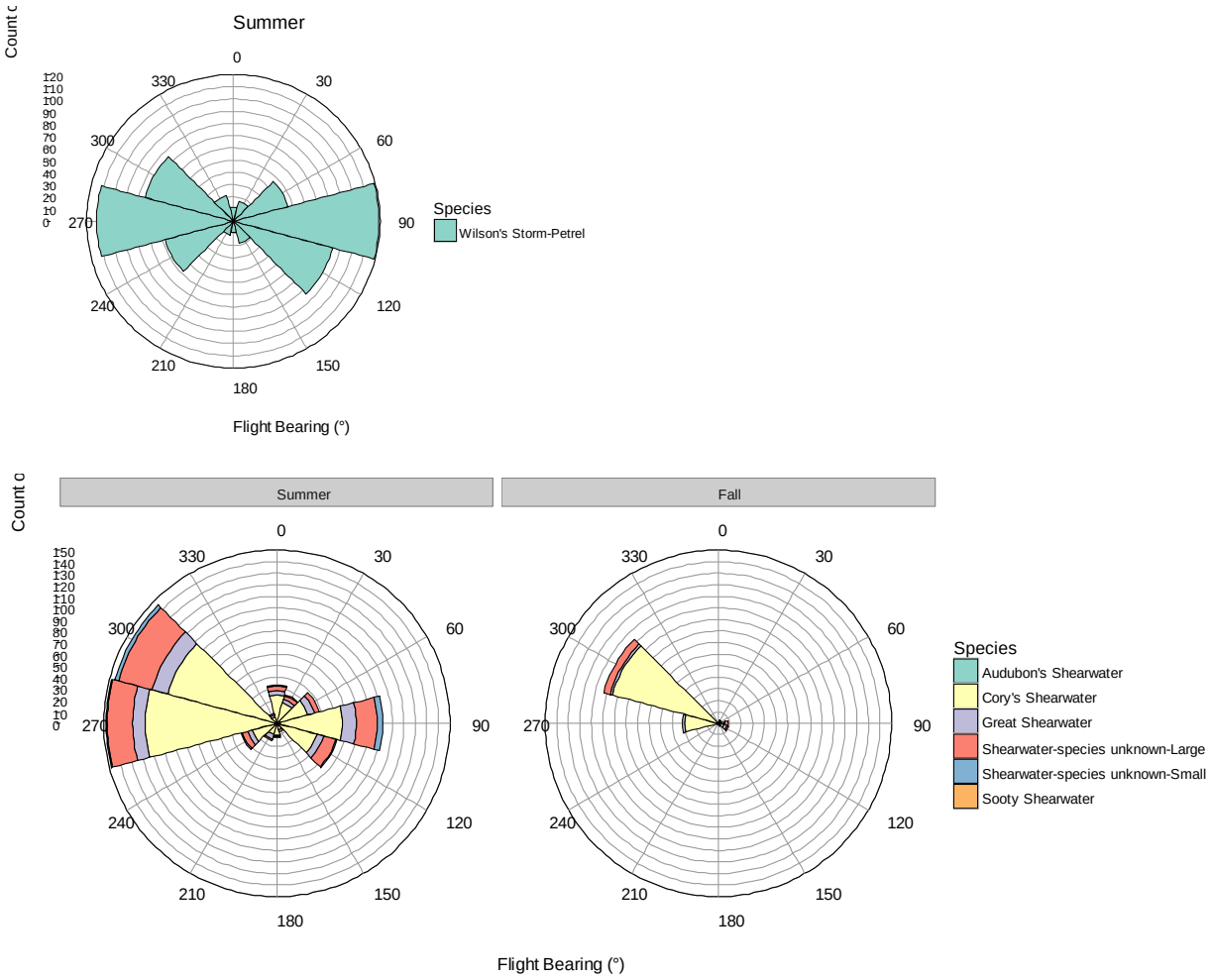

Figure 46. Direction of travel for storm-petrels and shearwaters during the Summer and Fall 2016 surveys.

For the Summer 2016 survey, turtles were mostly observed heading in WNW–ESE and West–East directions (Figure 47).

During both Summer and Fall, dolphins were observed swimming mainly East–West and WNW–ESE (Figure 48).

Whale observations were infrequent during both Summer and Fall, and sample sizes are likely too small to draw any conclusions from the direction of swimming. However, there may be a slight trend of whales traveling roughly East–West (Figure 49).

Overall, rays were generally observed heading East–West or WNW–ESE during the Summer (Figure 50). During the Summer, unidentified shark species made up the largest proportion of shark observations, including individuals that could only be identified to Carcharhinidae and Sphyrnidae. Overall, sharks were observed heading in all directions, but particularly South (Figure 51).

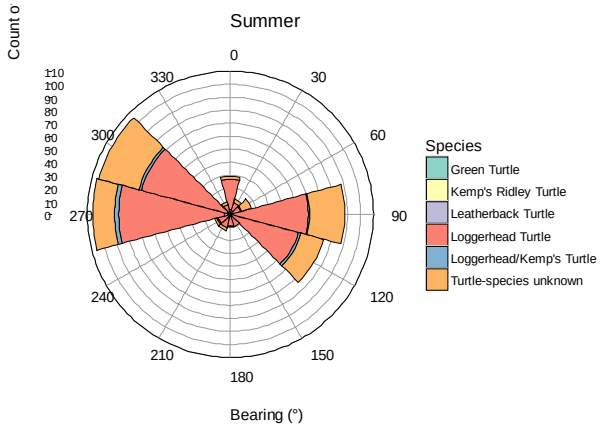

Figure 47. Direction of travel for turtles during the Summer 2016 survey.

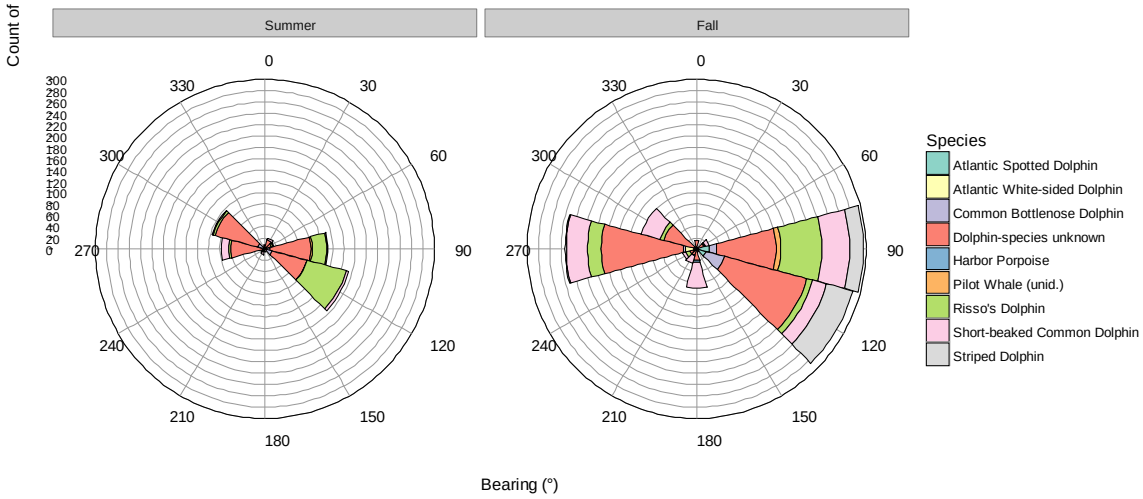

Figure 48. Direction of travel for dolphins during the Summer and Fall 2016 surveys.

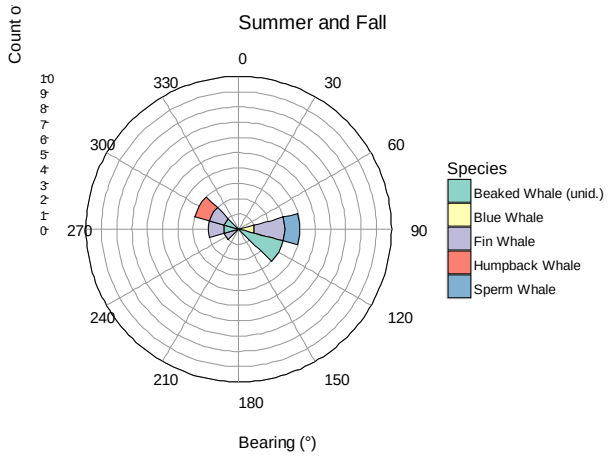

Figure 49. Direction of travel for whales during the Summer and Fall 2016 surveys.

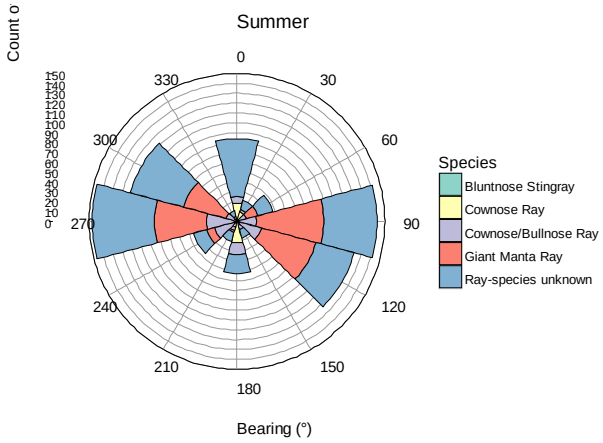

Figure 50. Direction of travel for rays during the Summer 2016 survey.

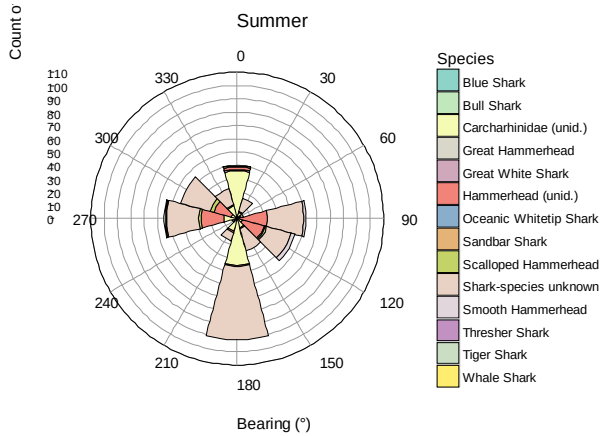

Figure 51. Direction of travel for sharks during the Summer 2016 survey.

Appendix A. Common and Scientific Names for Taxa Identified in the Summer and Fall Surveys 2016

Subtype: Common Name	Scientific Name
Ducks	
Gadwall	*Anas strepera*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta americana*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Loons	
Red-throated Loon	*Gavia stellata*
Common Loon	*Gavia immer*
Fulmars	
Northern Fulmar	*Fulmarus glacialis*
Petrels	
Black-capped Petrel	*Pterodroma hasitata*
Shearwaters	
Cory's Shearwater	*Calonectris diomedea*
Great Shearwater	*Ardenna gravis*
Sooty Shearwater	*Ardenna grisea*
Audubon's Shearwater	*Puffinus lherminieri*
Storm-Petrels	
Wilson's Storm-Petrel	*Oceanites oceanicus*
Gannets	
Northern Gannet	*Morus bassanus*
Cormorants	
Double-crested Cormorant	*Phalacrocorax auritus*
Pelicans	
Brown Pelican	*Pelecanus occidentalis*
Raptors	
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Shorebirds	
Black-bellied Plover	*Pluvialis squatarola*
Phalaropes	
Red-necked Phalarope	*Phalaropus lobatus*

Subtype: Common Name	Scientific Name
Red Phalarope	*Phalaropus fulicarius*
Skuas	
Pomarine Jaeger	*Stercorarius pomarinus*
Auks	
Dovekie	*Alle alle*
Common Murre	*Uria aalge*
Razorbill	*Alca torda*
Black Guillemot	*Cepphus grylle*
Gulls	
Black-legged Kittiwake	*Rissa tridactyla*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Little Gull	*Hydrocoloeus minutus*
Laughing Gull	*Leucophaeus atricilla*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Lesser Black-backed Gull	*Larus fuscus*
Great Black-backed Gull	*Larus marinus*
Terns	
Least Tern	*Sternula antillarum*
Royal Tern	*Thalasseus maximus*
Large Bony Fish	
Ocean Sunfish	*Mola mola*
Rays	
Bluntnose Stingray	*Dasyatis say*
Giant Manta Ray	*Manta birostris*
Bullnose Ray	*Myliobatis freminvillii*
Cownose Ray	*Rhinoptera bonasus*
Sharks	
Bull Shark	*Carcharhinus leucas*
Oceanic Whitetip Shark	*Carcharhinus longimanus*
Dusky Shark	*Carcharhinus obscurus*
Sandbar Shark	*Carcharhinus plumbeus*
Shortfin Mako	*Isurus oxyrinchus*
Tiger Shark	*Galeocerdo cuvier*
Blue Shark	*Prionace glauca*
Scalloped Hammerhead	*Sphyrna lewini*
Great Hammerhead	*Sphyrna mokarran*

Subtype: Common Name	Scientific Name
Smooth Hammerhead	*Sphyrna zygaena*
Basking Shark	*Cetorhinus maximus*
Great White Shark	*Carcharodon carcharias*
Whales	
Common Minke Whale	*Balaenoptera acutorostrata*
Blue Whale	*Balaenoptera musculus*
Fin Whale	*Balaenoptera physalus*
Humpback Whale	*Megaptera novaeangliae*
Sperm Whale	*Physeter macrocephalus*
Dolphins	
Short-beaked Common Dolphin	*Delphinus delphis*
Risso's Dolphin	*Grampus griseus*
Atlantic Spotted Dolphin	*Stenella frontalis*
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*
Common Bottlenose Dolphin	*Tursiops truncatus*
Striped Dolphin	*Stenella coeruleoalba*
Harbor Porpoise	*Phocoena phocoena*
Seals	
Gray Seal	*Halichoerus grypus*
Turtles	
Loggerhead Turtle	*Caretta caretta*
Green Turtle	*Chelonia mydas*
Kemp's Ridley Turtle	*Lepidochelys kempii*
Leatherback Turtle	*Dermochelys coriacea*

Appendix B. Avian Species Identified in the 2016 Summer and Fall Surveys

Name	Number in Taxonomic Group	Total Summer 2016	Total Fall 2016
Auk	**79**	**0**	**79**
Black Guillemot		0	1
Common Murre		0	11
Dovekie		0	3
Razorbill		0	24
Auk species unknown		0	40
Cormorant	**73**	**6**	**67**
Double-crested Cormorant		6	67
Duck	**1,714**	**0**	**1,714**
Black Scoter		0	1,637
Bufflehead		0	5
Gadwall		0	3
Long-tailed Duck		0	3
Species unknown		0	10
Surf Scoter		0	37
White-winged Scoter		0	19
Fulmar	**3**	**0**	**3**
Northern Fulmar		0	3
Gannet	**2,953**	**0**	**2,953**
Northern Gannet		0	2,953
Gull	**5,579**	**120**	**5,459**
Black-legged Kittiwake		0	230
Bonaparte's Gull		0	1,092
Great Black-backed Gull		56	370
Herring Gull		21	2,286
Laughing Gull		15	778
Lesser Black-backed Gull		0	9
Little Gull		0	4
Ring-billed Gull		9	92
Gull species unknown		4	1
Gull species unknown–Large		4	16
Gull species unknown–Small		11	581

Name	Number in Taxonomic Group	Total Summer 2016	Total Fall 2016
Loon	**282**	**3**	**279**
Common Loon[a]		3	50
Red-throated Loon		0	227
Loon species unknown		0	2
Pelican	**1**	**0**	**1**
Brown Pelican		0	1
Petrel	**19**	**18**	**1**
Black-capped Petrel		13	1
Petrel species unknown		5	0
Raptor	**2**	**2**	**0**
Bald Eagle		1	0
Osprey		1	0
Phalarope	**1,558**	**0**	**1,558**
Red Phalarope		0	880
Red-necked Phalarope		0	69
Phalarope species unknown		0	609
Shearwater	**920**	**732**	**188**
Audubon's Shearwater		8	4
Cory's Shearwater		510	166
Great Shearwater		70	8
Sooty Shearwater		2	0
Shearwater species unknown–Large		129	10
Shearwater species unknown–Small		13	0
Shorebird	**60**	**14**	**46**
Black-bellied Plover		6	0
Shorebird species unknown		8	46
Jaegers	**1**	**0**	**1**
Pomarine Jaeger		0	1
Storm-petrel	**792**	**791**	**1**
Wilson's Storm-Petrel		791	1
Tern	**209**	**207**	**2**
Least Tern[b]		36	0
Royal Tern		8	2
Sterna Tern		152	0
Tern species unknown		11	0
TOTAL	**14,245**	**1,893**	**12,352**

[a] Listed as species of concern by NYSDEC
[b] Listed as threatened by NYSDEC

Appendix C. Turtle Species Identified in the 2016 Summer and Fall Surveys

Species	Total Summer 2016	Total Fall 2016
Green Turtle*	1	0
Kemp's Ridley Turtle*	19	1
Leatherback Turtle*	9	29
Loggerhead Turtle*	392	6
Loggerhead/Kemp's Turtle*	10	0
Species unknown*	147	4
TOTAL	**578**	**40**

*Listed under the Endangered Species Act

Appendix D. Marine Mammals Identified in the 2016 Summer and Fall Surveys

Species	Number in Taxonomic Group	Total Summer 2016	Total Fall 2016
Dolphin	**2,000**	**908**	**1,092**
Atlantic Spotted Dolphin		0	54
Atlantic White-sided Dolphin		0	16
Common Bottlenose Dolphin		98	59
Harbor Porpoise		0	4
Risso's Dolphin		166	124
Short-beaked Common Dolphin		56	223
Striped Dolphin		0	75
Pilot Whale (unid.)		102	9
Dolphin species unknown		486	528
Seal	**13**	**0**	**13**
Gray Seal		0	1
Seal species unknown		0	12
Whale	**34**	**21**	**13**
Beaked Whale (unid.)		8	4
Common Minke Whale		1	0
Blue Whale*[a]		0	1
Fin Whale*[a]		10	5
Humpback Whale[a]		1	1
Sperm Whale*		0	2
Whale species unknown		1	0
TOTAL	**2,047**	**929**	**1,118**

* Listed under the Endangered Species Act

[a] Listed as threatened or endangered by NYSDEC

Appendix E. Rays and Sharks Identified in the 2016 Summer and Fall Surveys

Species	Number in Taxonomic Group	Total Summer 2016	Total Fall 2016
Rays	**8,392**	**8,388**	**4**
Bluntnose Stingray		1	0
Bullnose Ray		1	0
Cownose Ray		3,318	0
Cownose/Bullnose Ray		3,517	1
Giant Manta Ray		375	1
Ray species unknown		1,176	2
Sharks	**921**	**917**	**4**
Basking Shark		1	0
Blue Shark		5	2
Bull Shark		1	0
Carcharhinidae (unid.)		191	0
Dusky Shark		1	0
Great Hammerhead		8	0
Great White Shark		1	0
Hammerhead (unid.)		124	1
Oceanic Whitetip Shark		1	0
Sandbar Shark		1	0
Scalloped Hammerhead*		19	0
Shortfin Mako		1	0
Smooth Hammerhead		9	0
Shark species unknown		547	1
Thresher Shark		2	0
Tiger Shark		4	0
Whale Shark		1	0

*Listed under the Endangered Species Act

Appendix F. Fish Species Identified in the 2016 Summer and Fall Surveys

Species	Number in Taxonomic Group	Total Summer 2016	Total Fall 2016
Billfish	**11**	**11**	
Species unknown		11	
Cobia	**145**	**145**	
Cobia		145	
Mahi-Mahi	**134**	**134**	
Mahi-Mahi		134	
Sunfish	**314**	**147**	**167**
Ocean Sunfish		115	164
Sharptail Sunfish		2	1
Species unknown		30	2
Tuna	**181**	**181**	
Atlantic bluefin tuna		160	
Species unknown		21	
Unid. Fish	**122**	**104**	**18**
Species unknown		104	18