2012

Profile of the Offshore Bird Assemblage in Support for the Cape Charles Wind Project

M. D. Wilson
The Center for Conservation Biology

B. D. Watts
The Center for Conservation Biology, bdwatt@wm.edu

F. M. Smith
The Center for Conservation Biology, fmsmit@wm.edu

E S. Brinkley

Recommended Citation

Wilson, M. D., B. D. Watts, F. M. Smith, and E. S. Brinkley. 2012. Profile of the Offshore Bird Assemblage in Support for the Cape Charles Wind Project. CCBTR-12-06. Center for Conservation Biology Technical Report Series. College of William and Mary and Virginia Commonwealth University, Williamsburg, VA. 47 pp.

Profile of the Offshore Bird Assemblage in Support for the Cape Charles Wind Project

Prepared by

Center for Conservation Biology
College of William and Mary & Virginia Commonwealth University
Williamsburg, VA

The Center for Conservation Biology
The College of William and Mary
Virginia Commonwealth University

Profile of the Offshore Bird Assemblage in Support for the Cape Charles Wind Project

Michael D. Wilson
Bryan D. Watts
Fletcher M. Smith
Edward S. Brinkley

Center for Conservation Biology
College of William and Mary
&
Virginia Commonwealth University
Williamsburg, VA

Suggested Citation:

Wilson, M. D., B. D. Watts, F. M. Smith, and E. S. Brinkley. 2012. Profile of the Offshore Bird Assemblage in Support for the Cape Charles Wind Project. Center for Conservation Biology Technical Report Series, CCBTR-12-06. 47 pp.

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints

Table of Contents

Executive Summary

In recent years, near shore areas of the Atlantic Coast have been recognized in their ability to support significant wind resources. Offshore wind development has become one of the fastest growing energy sectors in the world and the focus of the clean energy movement of the United States. The growth of the wind industry will require the development of new technologies, and the construction of new infrastructures. Along the way will be the establishment of new government policies and guidelines to, among many issues, protect significant biological resources including migratory birds and birds of special conservation concern.

Minimizing population exposure to a potential hazard is a critical for reducing negative impacts to bird populations. For wind farms, selecting a location that is away from bird concentration areas can reduce the exposure of populations to direct collision mortality and indirect disturbances that reduce the carrying capacity of their habitats. This study provides a spatially explicit profile of an offshore bird concentration area at Cape Charles, VA that can be used to detail the distribution of expected impacts for this location. The specific objectives of this project were to collect information that 1) details the spatial distribution of birds in relation to height above the water and distance from the shoreline within the proposed construction area, 2) provide a relative estimate of abundance for species detected, and 3) provide a sampling of the diversity of species utilizing the proposed area.

Bird surveys were conducted on 75 days between 17 October 2011 and 15 May 2012 to encompass the fall, winter, and spring seasons. All surveys began at sunrise and lasted until 1400 EST. Birds were surveyed using a transect line that was oriented perpendicular to the shoreline and extended outward 5 km.

A total of 298,519 bird observations of 110 species were made across the three survey seasons (Appendix 1). The Northern Gannet was the numerically dominant species observed and accounted for 49% of all detections. This species was followed in rank order of abundance by the Red-throated Loon, Laughing Gull, and Surf Scoter (15.7, 5.3, and 3.4 % of all detections, respectively). The remaining observations were divided between 106 additional species that included various waterfowl (ducks and geese), waterbirds (gulls, terns, and skimmers), wading birds (herons, ibis), shorebirds (sandpipers, plovers), raptors, and landbirds.

We found that groups of species used the study area differently from one another. Some species were predominantly distributed within 1 km of the shoreline, some species were distributed relatively further away from shore, and other species utilized both near and far shore environments uniformly. Moreover, the overwhelming majority of birds were distributed within 30 m of the water surface and did not appear to shift their relative height use in relation to shoreline proximity.

Introduction

The Atlantic Flyway supports one of the largest near shore movement corridors of birds in the world including many declining species of conservation concern. The flyway supports hundreds of millions of birds annually including 164 species of waterbirds that include 33 seabirds, 36 waterfowl, 25 terns and gulls, 39 shorebirds, and others (Watts 2010). The greatest volume of birds utilizes the flyway as a movement corridor between breeding and wintering grounds. In addition, many species use portions of the Atlantic Coast as migratory staging areas, or exclusively breed or winter in the region.

The Chesapeake Bay is a prominent feature along the Atlantic Flyway. The Bay supports the largest estuary in the United States and one of the most biologically productive ecosystems in the world. The breadth of habitats and its position along the flyway make it particularly attractive to a diverse assemblage of avian species during the breeding, winter, and migration seasons. The Bay is semi-enclosed by the Delmarva Peninsula. The land mass of the Delmarva Peninsula narrows moving southward that acts like a funnel for concentrating migratory birds near its tip. In addition, birds become concentrated during all seasons along the along the Peninsula's shoreline and near shore environment in response to the unique and wide diversity of resources available along this margin.

In addition to the wealth of biological resources supported by the Bay region is an ever growing demand for utilizing its social and economic benefits. In recent years, near shore areas of the Atlantic Coast have been recognized in their ability to support significant wind resources. Offshore wind development has become one of the fastest growing energy sectors in the world and the focus of the clean energy movement of the United States. Wind power is expected to play an increasing role in meeting energy demands of burgeoning urban markets along the Atlantic Coast. The growth of the wind industry will require the development of new technologies, and the construction of new infrastructures. Along the way will be the establishment of new government policies and guidelines to, among many issues, protect significant biological resources including migratory birds and birds of special conservation concern.

Project Background

Gamesa Energy USA, LLC proposed installation of a prototype wind turbine generator approximately 3 miles southwest of Cape Charles Harbor, Virginia in the near shore waters of the lower Chesapeake Bay. The proposed project would involve installation of a 5 megawatt wind turbine mounted on a monopole tower. The center of the rotor hub would be attached to the nacelle at a height between 79 and 82 meters above mean sea level. Under this arrangement, the rotor swept zone would be approximately 128 m in diameter with a maximum height of 145 m above mean sea level and a minimum height of 16 m above mean sea level.

United States Federal and the Commonwealth of Virginia agency guidance pertaining to proposed wind facilities within the lower reach of the Chesapeake Bay recommend surveys of waterbirds during fall, winter, and spring seasons to document use for the purpose of assessing potential population-level impacts. Following a scoping meeting in the spring of 2011 including the United States Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries, ESS Group, Inc., and the Center for Conservation Biology, a field plan was developed to collect observation data to comply with agency recommendations.

The specific objectives of this project were to collect information that 1) details the spatial distribution of birds in relation to height above the water and distance from the shoreline within the proposed construction area, 2) provide a relative estimate of abundance for species detected, and 3) provide a sampling of the diversity of species utilizing the proposed area.

Methods

The fall observation period was conducted from 15 October through 15 December, 2011 and included 32 survey days. The fall study period was divided evenly into 8 rounds comprised of 4 survey days per round. The winter observation period was conducted from 3 January through 24 February, 2012. The winter study period was divided into 7 rounds of 1 survey day per round. The spring observation period was conducted from 1 March through 15 May, 2012 and included 36 survey days. The spring period was divided into 9 rounds of 4 survey days per round. All survey days began at sunrise and continued until 1400 EST. The general weather conditions were recorded hourly, including wind speed, direction, temperature, cloud cover, visibility, and precipitation. Days with extremely high winds or forecasted precipitation were not used for survey.

We used a modified line transect method to collect all bird data. Unlike most transect methods that record birds detected laterally away from a transect line; we only recorded birds that crossed over transect line that was oriented in a perpendicular direction from the shoreline. The length of the transect line was extended as far as what was visibly possible from the shoreline. On many days this distance was more than 5 km. In short, this technique creates an imaginary vertical plane along the transect line that requires a bird to cross over before it is collected as data.

Two observers were stationed on a 5-m platform on the shoreline located at 37.257193 Northing, -76.024717 Westing (decimal degrees). One observer was responsible for detecting birds over the Chesapeake Bay using a Leica 77 Telvid APO spotting scope by looking out over the perpendicular transect line. Another observer recorded the observations on field data sheets. Observers switched duties throughout the day to avoid eye strain.

The time of day, distance from shoreline, and height above water was estimated for every bird detected. Birds were placed in one of five distance classes from the shoreline as; 0-500meters, 501-1000, 1001-2000, 2001-3600 m, and greater than 3600 m. A line of marker floats were placed at 500 m, 1000 m, 2000 m, and a shipping can buoy at 3.6 km was used to help estimate distance from shoreline. The marker buoys were anchored with 100 pound weights to reduce movement in storms. At the time the first observation period began, Gamesa had not developed the dimensions of the proposed wind turbine generator. However, in order for collected bird data to help in assessing hazard risks in relation to both the monopole and rotor swept zone, we selected the best set of height classes based on designs of other wind turbines used in offshore locations. The height of every bird was placed in 1 of 5 classes as; 1) sitting on the water, 2) less than 10 meters above the water, 3) 11-30 meters above the water, 4) 31 to 220 meters above the water (potential Rotor Swept Zone), and 5) greater than 220 meters above the water. An average height category was used for birds in flocks. Actual heights of a subsample of birds were collected from birds flying through the nearest height class using a Leica 1500meter range finder to find distance and angle on the bird. This subsample will be used to assess observer error and train observers to make better height assignments by comparing rangefinder estimates to those estimated visually without such aids. Birds were also recorded as flying north, south, or in “no general direction” if feeding or loafing. Only birds passing through the line of marker buoys were recorded. All

birds were identified to the species level when possible and to a higher taxonomic order when not possible (i.e., unidentified duck species, loon species, and passerine species).

Data were summarized at various levels of distance and height classes for comparative purposes. Because distance classes were not uniform in length, bird detections were tallied as both raw totals and values standardized to 500 m of transect length (standardized totals hereafter) and described accordingly. Statistical comparisons were made with non-parametric techniques including Kruska-Wallas Analysis of Variance (KW Anova), and frequency tests because most statistics had large variances around mean values.

Results

A total of 298,519 bird observations of 110 species were made across the three survey seasons (Appendix 1). The Northern Gannet was the numerically dominant species observed and accounted for 49% of all detections (N = 146,740). The Northern Gannet was followed in rank order of abundance by the Red-throated Loon, Laughing Gull, and Surf Scoter (15.7, 5.3, and 3.4 % of all detections, respectively). The remaining observations were divided between the additional 106 species (N = 66,265, 22.4 % of all observations) and detections of birds unidentified to species-level but placed into general taxonomic categories (N = 12,453, 4.2 % of all observations). Observations of additional species spanned across taxa and included various waterfowl (ducks and geese), waterbirds (gulls, terns, skimmers), wading birds (herons, ibis), shorebirds (sandpipers, plovers), raptors, and landbirds (Table 1).

The number of birds detected varied somewhat between the three survey seasons but was not statistically distinguishable from one another when standardized to birds detected per hour (KW Anova, $H = 1.02$, $p > 0.50$) (Table 1). There was large day to day variation in bird movements in all seasons (Figure 1). The difference between the lowest and highest day's rate of birds passing varied over 10, 18, and 50 orders of magnitude in fall, winter, and spring, respectively (Table 2).

High daily variation in counts can be attributed to changes in bird migratory activity or use of the study area. Sequential high and low counts often represent the episodic nature of transient birds migrating into the area or the sudden appearance of winter species utilizing the study area as new space within the Chesapeake Bay vicinity. Time series analysis used to investigate the large range daily variation revealed different patterns between spring and fall. In fall, autocorrelation coefficients between sequential survey days were low and not statistically significant ($-0.08 < r < 0.20$ among all lag values, all p values > 0.20). In other words, bird passage rates for survey dates conducted sequentially were no more alike than for survey dates separated by greater amount of time. This lack of serial dependency in the survey data indicates a pattern of individual, random pulses of birds through time. In spring, autocorrelation coefficients between survey days were strongly related and statistically significant ($r > 0.47$ for lags of 1-3 survey days, all p values < 0.05). Basically, there was the tendency of counts earlier in the season to be more alike compared to that counted later in the season. This result was due to an abrupt decline trend in daily counts between early and late parts of the spring period. During spring, bird counts for the period of 1 March through 23 March averaged 1,325.7 ± 922.58 birds per hour but then quickly declined to an average of 286.3 ± 270.21 bird per hour from 24 March through 12 May.

Table 1. Abundance and species richness of general taxonomic groups detected during the study period.

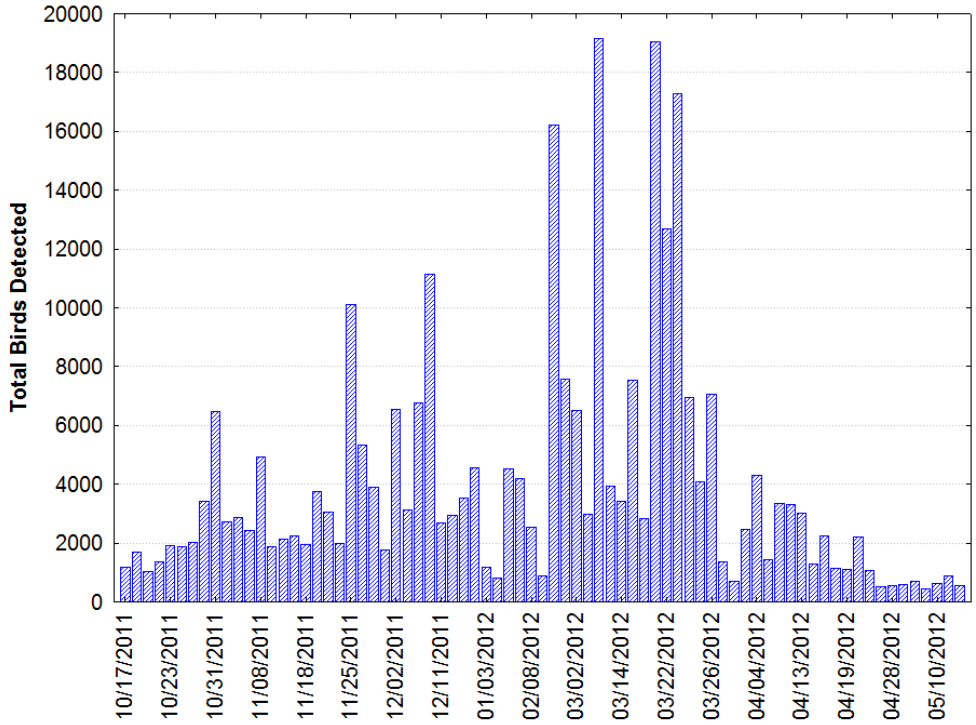
General Taxonomic Categories	Number of Species	Total Detected
Waterfowl (ducks, geese, swans)	30	84,142
Unidentified Waterfowl	-	7,806
Pelagic (Gannets, Jaegers)	5	146,766
Gulls, Terns, Skimmers & Cormorants	15	49,798
Unidentified Gulls andTerns	-	4,132
Shorebirds (sandpipers, plovers)	21	4,236
Unidentified Shorebirds	-	484
Wading birds (herons, ibises)	7	213
Raptors (eagles, hawks, osprey) and Vultures	9	360
Landbirds (crows, songbirds)	28	1,580

Table 2. Summary statistics for Chesapeake Bay offshore bird surveys.

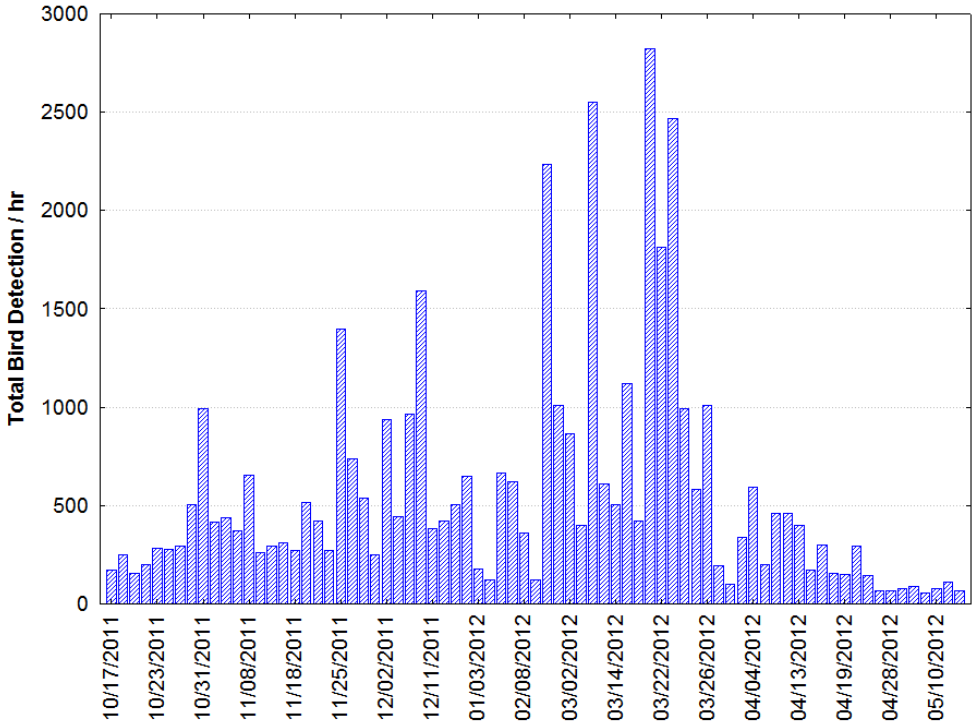
Season	N (Survey Days)	Survey Hours	Birds per hour ($\overline{x}$ ± SD)	Birds per hour (daily range)	Total bird observations
Fall	32	223.00	505.9 ± 342.14	153.0 - 1,592.7	113,259
Winter	7	48.25	615.7 ± 749.00	121.5 – 2,234.8	30,331
Spring	36	264.25	603.9 ± 727.34	53.5 – 2,824.7	154,929
Total	**75**	**535.50**	**563.2 ± 589.26**	**53.5 – 2,824.7**	**298,519**

Figure 1. A) Total birds detections by date during the fall (10/17/2011 – 12/14/2011), winter (1/03/2012 – 2/24/2012), and spring (3/01/2012 – 5/12/2012) survey seasons. B) Number of bird detections per hour during the fall, winter, and spring survey seasons.

A)



B)



Within a survey day, the rate of bird detection was highest in the first three hours then declined throughout the morning and into the afternoon. This pattern was consistent in all seasons of survey. Overall, bird detections within the first three hours of surveys accounted for 71 % of all detections and each 1-hr block of survey time after that did not constitute more than 10 % of the total detections (Figure 2).

Proximity to Shoreline

Birds were detected in large numbers across all distance from shoreline classes (Table 3). However, birds were shown to be unevenly distributed within each class after observations were standardized to birds /500 m length of transect, (χ^2 = 23,468, df = 4, $p < 0.05$). Bird detections within the first 1000 m of the shoreline occurred with a greater frequency than expected if birds were evenly distributed across distance classes. By comparison, the number of birds detected > 1000 m from the shoreline occurred with a lower frequency than that expected if birds were evenly distributed across the distance classes. Bird detections within 1000m of the shoreline accounted for 57% of all observations and the remaining 43 % of observations being detected > 1000 m.

Table 3. Total birds detected and standardized counts of birds detected/500m of transect length

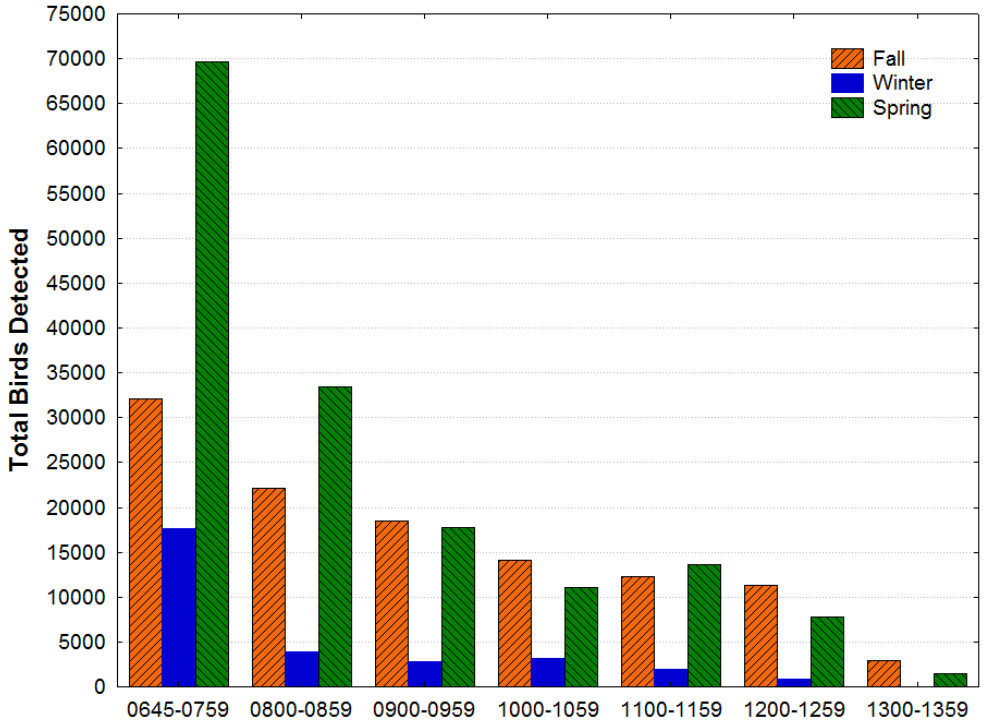
Distance from Shoreline (m)	Total birds detected	Transect segment length (m)	Birds detected per 500m of transect (birds/500m)
0-500	38,760	500	38,760.0
501-1000	53,356	500	53,356.0
1001-2000	56,653	1000	28,326.5
2001-3600	70,534	1600	22,041.9
3600+	78,839	2000	19,709.8

across 5 distance from shoreline classes.

The overall skewed distribution of bird detections to within 1000 m of the shoreline remained somewhat consistent in all seasons (Figure 3). Statistically significant departures from expected even distributions occurred across all distance classes in fall (χ^2 = 3,730.3, df = 4, $p < 0.05$), winter (χ^2 = 8,776.3, df = 4, $p < 0.05$) and spring (χ^2 = 28,880.8, df = 4, $p < 0.05$). However, in fall only 46 % of the detections were made within the first 100m from the shoreline. By comparison, 56 % of the observations were within the first 1000 m in winter, and 62 % of the observations were within 1000 m in spring. In every season, birds were detected with greater frequency than expected within either the 0-500m or the 501-1000m distant class when compared to an even distribution across all classes. Conversely, birds detected in all distance classes > 1000m were detected with a lower frequency relative to the same expectations.

Figure 2. A) Total birds passing in each 1-hr time block of survey for fall, winter, and spring. B) Birds passing per survey day in each 1-hr time block for fall, winter, and spring.

A)



B)

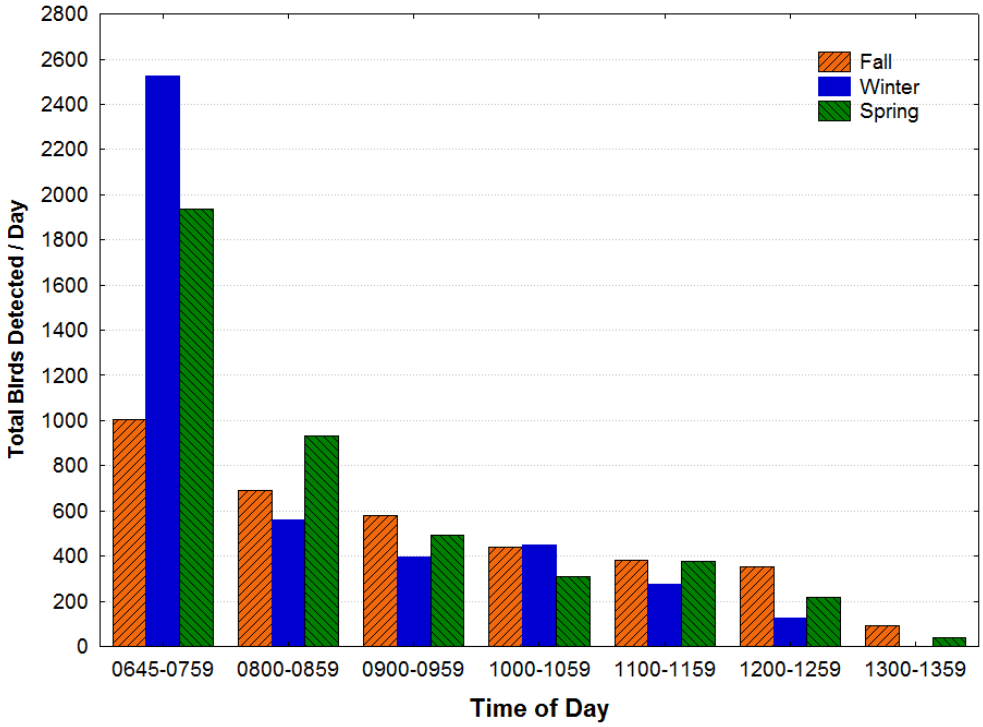
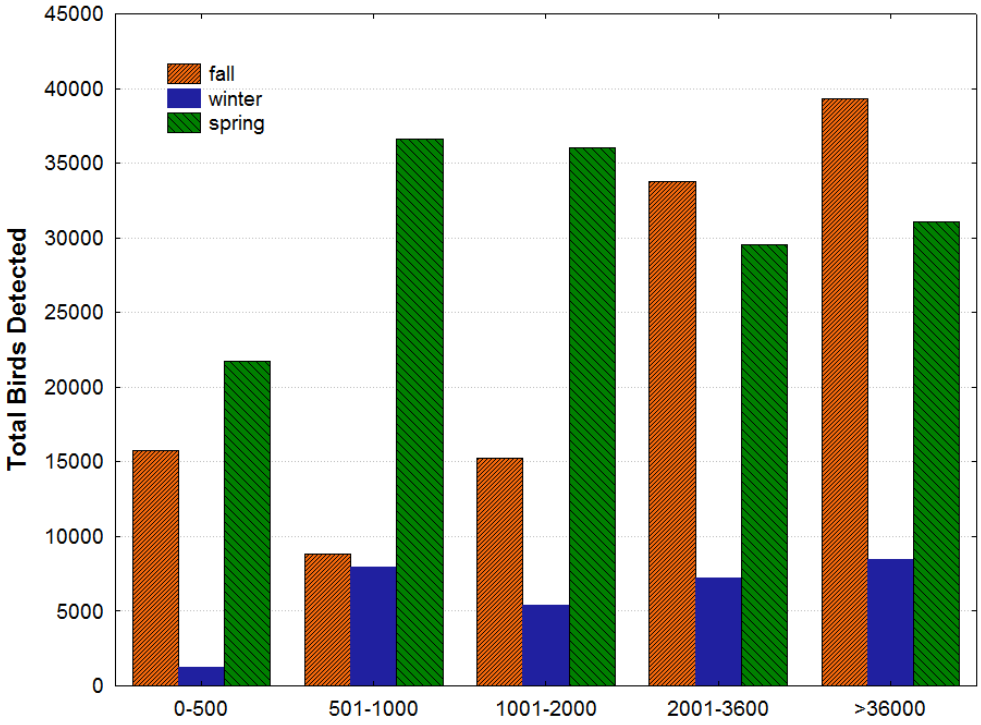
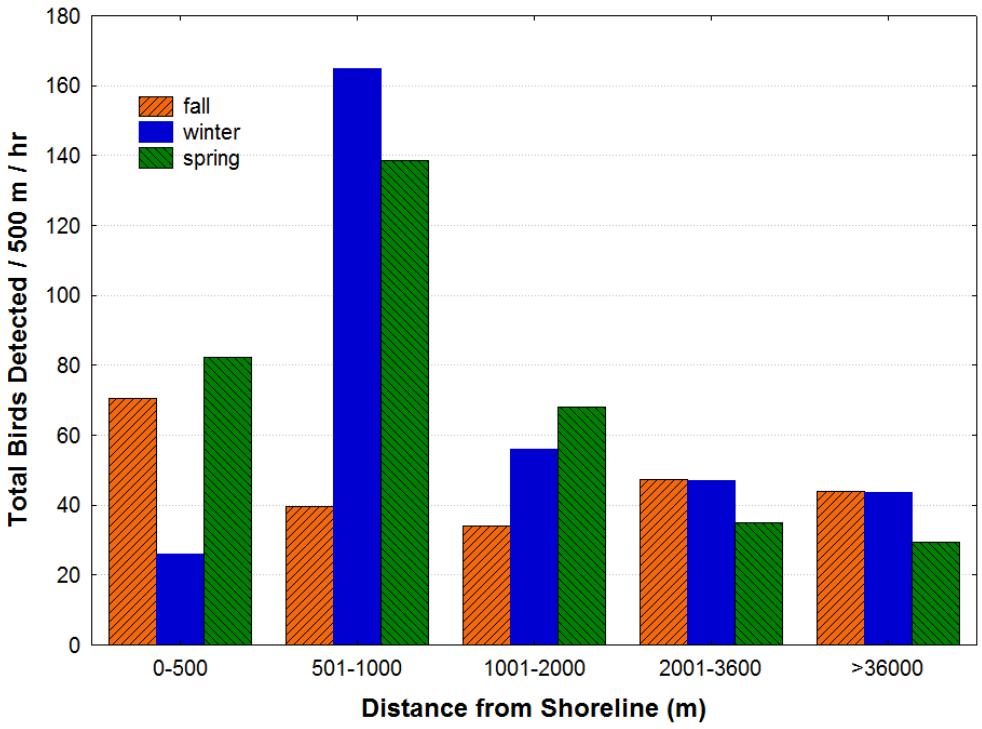


Figure 3. The proximity of birds passing in relation to the shoreline for A) total birds passing over all surveys and B) Standardized counts of birds passing per 500m distance from the shoreline per hour.

A)



B)



Height Above Water

There was an overwhelming preponderance of birds detected 30 m above the water or lower. Over 92 % of the birds detected were found on the water surface or were flying below the 30 m height mark with most of those below 10 m(Table 4). This pattern remained relatively consistent across all seasons (Table 4) and at all distances from the shoreline (Table 5).

Table 4. Vertical profiles of toal bird detections and number of birds detected per hour within 5 height above water classes. Percentages are calculated individually for each season.

Height above water	Total Birds Detected and (% of total)	Birds detected/hr
All Seasons		
On water	3,299 (1.1 %)	6.2
1-10 m	230,357 (77.3 %)	430.2
11-30 m	41,607 (13.9 %)	77.7
31-220 m	22,679 (7.6 %)	42.4
> 220 m	180 (.06 %)	0.3
Fall Season		
On water	1,359 (1.2 %)	6.1
1-10 m	81,721 (72.4 %)	366.5
11-30 m	18,153 (16.1 %)	81.4
31-220 m	11,486 (10.1 %)	51.5
> 220 m	148 (0.1 %)	0.67
Winter Season		
On water	66 (0.2%)	1.4
1-10 m	25,799 (85.0 %)	534.7
11-30 m	3,611 (11.9 %)	74.8
31-220 m	852 (2.8 %)	17.7
> 220 m	0 (0.05%)	0
Spring Season		
On water	1,874 (1.2 %)	7.1
1-10 m	122,837 (79.3 %)	464.9
11-30 m	19,843 (12.8 %)	75.1
31-220 m	10,341 (6.6 %)	39.1
> 220 m	32 (< 0.1%)	0.1

Table 5. Vertical and horizontal profiles for bird detections across fall, winter, and spring survey seasons. Values indicate the total number of birds detected in combinations of height above water classes and distance from shoreline classes. Values in parentheses are calculated for each distance class to represent the percentage of detections attributed by height.

	Distance from shoreline (m)				
Height above water	**0-500**	**500-1000**	**1001-2000**	**2001-3,600**	**> 3,600**
On water	732 (1.8)	409 (0.8)	443 (0.8)	1,684 (2.3)	67 (<0.1)
1-10 m	28,899 (77.1)	4,2032 (78.7)	49,055 (78.2)	56,522 (80.1)	52,837 (67.0)
11-30 m	5,420 (13.9)	8,920 (16.7)	4,684 (8.3)	9,062 (12.8)	13,499 (17.1)
31-220 m	2,701 (6.9)	1,863 (3.5)	2,441 (4.3)	3,292 (4.7)	12,380 (15.7)
> 220 m	7 (< 0.1)	132 (0.2)	0 (0.0)	8 (< 0.1)	33 (<0.1)

Individual Species Patterns

Northern Gannet

The Northern Gannet was the most numerically dominant species and accounted for 49 % of all bird observations. The Chesapeake Bay is an important migratory corridor and winter foraging area for this species. Northern Gannets were abundant in all survey seasons but had the greatest rate of detections in spring (421.7 birds/hour), followed by winter (388.8 birds/hour), then fall (74.2 birds per hour).

Northern Gannets were detected in all distance from shoreline classes (Table 6). In general, Northern Gannets were mostly distributed > 500 m from the shoreline. Standardized detections indicated that Northern Gannets were detected in greatest density within the 501-1000 m class. This distance class contained 26 and 46 % of the raw total and standardized detections, respectively. However, there were still a large number of birds detected beyond 1000 m. At least 43 % of the raw total and 35 % of the standardized total were detected > 1000 m from the shoreline. Northern Gannets were also detected in all height classes but had 90 % of all detections contained below 30 m and another 9 % of the detections between 31 and 220 m.

Table 6. Vertical and horizontal profiles of bird detections for selected species across height above water and distance from shoreline classes. The first row value indicates the total number detected during the entire study period. The second row value indicates birds detected/500 m of transect length. The third row value indicates a rate of detection as birds/500 m transect / hr.

Species	Height Class	Distance from shoreline (m) 0-500	500-1000	1001-2000	2001-3,600	> 3,600
Northern Gannet						
	On water	145	26	5	610	45
		145.0	26.0	2.5	190.63	11.25
		0.27	0.04	0.01	0.36	0.02
	1-10 m	11,748	32,947	31,850	17,119	16,144
		11,748.0	32,947.0	15,925.0	5,349.68	4,036.0
		21.94	61.53	29.74	9.99	7.54
	11-30 m	2,407	5,295	1,981	3,689	8,208
		2,407.0	5,295.0	990.5	1,152.8	2,052
		4.49	11.06	1.84	2.15	3.83
	31-220 m	233	1,130	1,109	1,326	10,032
		233.0	1,130.0	554.5	414.4	2,508.0
		0.45	2.11	1.03	0.77	4.68
	> 220 m	0	0	0	3	33
		-	-	-	0.9	8.3
		-	-	-	<0.01	0.02
Red-throated Loon						
	On water	7	8	4	6	2
		7.0	8.0	2.0	1.9	0.5
		0.01	0.01	<0.01	<0.01	<0.01
	1-10 m	35	175	4,020	18,295	21,955
		35.0	175.0	2010.0	5,717.8	5488.8
		0.07	0.33	3.75	10.67	10.24
	11-30 m	2	31	157	937	859
		2.0	31.0	78.5	292.8	214.75
		< 0.01	0.06	0.15	0.55	0.40
	31-220 m	4	13	138	224	57
		4.0	13.0	69.0	70.0	14.25
		<0.01	0.02	0.13	0.13	0.03
	> 220 m	0	0	0	0	0
		-	-	-	-	-
		-	-	-	-	-

Table 6 continued		Distance from shoreline (m)				
Species	**Height Class**	**0-500**	**500-1000**	**1001-2000**	**2001-3,600**	**> 3,600**
Laughing Gull						
		259	28	9	3	0
	On water	259.0	28.0	4.5	0.9	-
		0.48	0.05	<0.01	<0.01	-
		6,014	2,397	1,483	1,412	250
	1-10 m	6,014.0	2,397.0	741.5	441.25	62.5
		11.23	4.47	1.38	0.82	0.12
		936	817	402	322	67
	11-30 m	936.0	817.0	201.0	100.6	16.8
		1.74	1.52	0.38	0.18	0.03
		902	175	119	81	15
	31-220 m	902.0	175.0	59.5	23.3	3.75
		1.68	0.33	0.11	0.04	<0.01
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-
Surf Scoter						
		1	11	102	174	0
	On water	1.0	11.0	51.0	54.4	-
		<0.01	0.02	0.09	0.10	-
		79	770	4,087	3,779	512
	1-10 m	79.0	770.0	2043.5	1180.9	128.0
		0.14	1.44	3.18	2.20	0.24
		8	87	208	253	62
	11-30 m	8.0	87.0	104.0	79.1	15.5
		0.01	0.16	0.19	0.14	0.02
		0	5	29	32	15
	31-220 m	-	5.0	14.5	10.0	3.8
		-	<0.01	0.02	0.02	<0.01
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-

Table 6 continued		Distance from shoreline (m)				
Species	**Height Class**	**0-500**	**500-1000**	**1001-2000**	**2001-3,600**	**> 3,600**
Dark-winged Scoter (Black and Surf scoters not identified to species)						
		0	0	1	8	0
	On water	-	-	0.5	2.5	-
		-	-	<0.01	<0.01	-
		18	25	416	3,534	2,933
	1-10 m	18.0	25.0	208.0	1,104.4	733.3
		0.03	0.04	0.39	2.06	1.37
		0	7	61	370	453
	11-30 m	-	7.0	30.5	115.6	113.2
		-	0.01	0.06	0.22	0.21
		0	0	25	74	48
	31-220 m	-	-	12.5	23.1	12.0
		-	-	0.02	0.04	0.02
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-
Common Loon						
		87	238	213	754	0
	On water	87.0	238.0	106.5	235.6	-
		0.16	0.44	0.19	0.44	-
		190	347	1,014	1,640	1,283
	1-10 m	190.0	347.0	507.0	512.50	320.75
		0.35	0.65	0.95	0.96	0.59
		50	75	245	264	310
	11-30 m	50.0	75.0	122.5	82.5	77.5
		0.09	0.14	0.23	0.15	0.14
		86	54	216	513	1,016
	31-220 m	86.0	54.0	108.0	160.3	254.0
		0.16	0.10	0.20	0.29	0.47
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-

Table 6 continued		Distance from shoreline (m)				
Species	**Height Class**	**0-500**	**500-1000**	**1001-2000**	**2001-3600**	**> 3,600**
Brown Pelican						
		22	6	2	5	1
	On water	22.0	6.0	1.0	1.6	0.25
		0.04	0.01	<0.01	<0.001	<0.01
		1,692	1,208	1,023	1,154	814
	1-10 m	1,692.0	1,208.0	511.5	360.3	203.5
		3.16	2.26	0.95	0.67	0.38
		148	279	285	299	236
	11-30 m	148.0	279.0	142.5	93.5	59.0
		0.28	0.52	0.27	0.17	0.11
		40	52	97	116	140
	31-220 m	40.0	52.0	48.5	36.25	35.0
		0.07	0.09	0.09	0.07	0.06
		2	0	0	3	0
	> 220 m	2.0	-	-	0.9	-
		<0.01	-	-	<0.01	-
Forster's Tern						
		0	0	0	0	0
	On water	-	-	-	-	-
		-	-	-	-	-
		1,219	550	891	1,295	677
	1-10 m	1,219.0	550.0	445.5	404.7	169.3
		2.28	1.02	0.89	0.76	0.32
		169	396	544	1,559	131
	11-30 m	169.0	396.0	272.0	487.2	32.8
		0.31	0.74	0.51	0.91	0.06
		1	26	51	44	0
	31-220 m	1.0	26.0	25.5	13.8	-
		<0.01	0.05	0.05	0.03	-
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-

Table 6 continued		Distance from shoreline (m)				
Species	**Height Class**	**0-500**	**500-1000**	**1001-2000**	**2001-3,600**	**> 3,600**
Double-crested Cormorant						
		19	16	0	0	0
	On water	19.0	16.0	-	-	-
		0.03	0.03	-	-	-
		2,342	801	221	282	323
	1-10 m	2,342.0	801.0	110.5	88.1	80.8
		4.37	1.49	0.21	0.16	0.15
		497	193	97	87	188
	11-30 m	497.0	193.0	48.5	27.2	47.0
		0.98	0.36	0.09	0.05	0.09
		423	143	233	257	517
	31-220 m	423.0	143.0	116.5	80.3	129.3
		0.79	0.27	0.22	0.15	0.24
		0	0	0	1	0
	> 220 m	-	-	-	0.3	-
		-	-	-	<0.01	-
Bonaparte's Gull						
		5	0	0	25	0
	On water	5.0	-	-	7.8	-
		<0.01	-	-	0.01	-
		769	426	697	1,986	1,464
	1-10 m	769.0	426.0	348.5	620.6	366.0
		1.43	0.79	0.65	1.15	0.68
		1	134	137	296	30
	11-30 m	1.0	134.0	68.5	92.5	7.5
		<0.01	0.25	0.13	0.17	0.01
		0	25	29	85	1
	31-220 m	-	25.0	14.5	26.6	0.25
		-	0.04	0.03	0.05	<0.01
		0	0	0	0	0
	> 220 m	-	-	-	-	-
		-	-	-	-	-

Table 6 continued		Distance from shoreline (m)				
Species	**Height Class**	**0-500**	**500-1000**	**1001-2000**	**2001-3600**	**> 3,600**
Bald Eagle						
		0	0	0	0	0
	On water	-	-	-	-	-
		-	-	-	-	-
		23	8	2	1	0
	1-10 m	23.0	8.0	1.0	0.3	-
		0.04	0.02	<0.01	<0.01	-
		48	9	4	2	1
	11-30 m	48.0	9.0	2.0	0.6	0.25
		0.09	0.02	<0.01	<0.01	<0.01
		43	21	8	6	0
	31-220 m	43.0	21.0	4.0	1.9	-
		0.08	0.04	0.04	<0.03	-
		3	0	0	0	0
	> 220 m	3.0	-	-	-	-
		<0.01	-	-	-	-

Red –throated Loon

The Red-throated Loon was ranked second in overall abundance during surveys and accounted for 16% of the total bird observations. Red-throated Loons were observed in all three survey seasons and were detected with greater rates during fall (125.6 birds/hr), and winter (107.3 birds/hr) compared to spring (52.0 birds/hr).

Red-throated Loons were primarily distributed > 2000 m from the shoreline. Eight-nine percent of the raw total and 82 % of the standardized total of detections were found > 2000m from the shoreline (Table 6). There were a moderate number of detections from 1001-2000 m that accounted for 9 % of the raw total and 15 % of standardized detections. Detections within 1000 m of the shoreline accounted for less than 1 % of all detections.

Red-throated Loons were observed in height classes below 220 m but were overwhelmingly distributed in the 1-10 and 11-30 m classes where 99 % of their detections were recorded. This height profile appeared to remain consistent at all distances from the shoreline.

Laughing Gull

The Laughing Gull was ranked third in overall abundance over the course of surveys and accounted for 5.3 % of the total birds detected. Laughing Gulls were detected most frequently in fall (62.9 birds/hour), at much lower frequency in spring (6.9 birds/hr), and not detected in winter. The absence of this species during winter is not surprising since Virginia is at the northern edge of an expanding winter range. The bulk of the Atlantic Coast population would have migrated to the south of the study area during the winter survey season.

The majority of Laughing Gull observations occurred within 1000 m of the shoreline. Fifty-two percent of the raw total of detections and 62% of the standardized detections were within 500 m of the shoreline (Table 6). An additional 22 and 26 % of the raw total and standardized total were respectively found 501-1000 m away from the shoreline. The remaining 26% of the raw totals and 12 % of the standardized totals were distributed > 1000 m from the shoreline. Laughing Gulls were found at all height classes below 220 m. Laughing Gulls were mostly observed near the water with 90 % of the detections occurring between 1 – 30 m above the water and 8 % found from 31-220 m. The use of height classes remained consistent at all distances from the shoreline.

Surf Scoter and "Dark-winged" Scoter

The Surf Scoter was ranked fourth in overall abundance during surveys and accounted for 3.4 % of all bird detections. Surf Scoters were most frequently detected in the fall (33.8 birds/hr), followed by winter (25.0 birds/hr), and spring (5.5 birds/hr). The Dark-winged Scoter is a mixed species category that includes both Surf Scoters and Black Scoters . These two species are difficult to distinguish from one another at far distances so any detections of birds that could not be identified to these two species were aggregated into this special category. Dark-winged Scoters accounted for 2.7 % of the total bird detections and were more frequently detected n fall (26.2 birds/hr) and winter 32.4 birds/hr) than in spring (2.2 birds/hr).

The majority of detections for the Surf Scoter were observed between distances of 501 – 3,600 m from the shoreline (Table 6). Observations in this range of distance accounted for 96 % of the raw total of detections for this species and 93 % of the standardized totals. Within this range, the raw totals were nearly equally divided between distances of 1001-2000 and 2001-3,600 from the shoreline (84 and 75 % of the raw and standardized totals, respectively). Ninety percent of detections for Surf Scoters occurred 1-10 m above the water at all distance classes from the shoreline. Spatial patterns for the Dark-winged Scoter grouped remained consistent with those observed for Surf Scoters.

Common Loon

The Common Loon was ranked fifth in overall abundance and accounted for 2.9 % of all bird detections. Although this species was detected across all three survey seasons, it was more frequently detected during fall (14.4 birds/hr) and spring (20.3 birds/hr) than in winter (0.8 birds/hr).

Common Loons were detected in all distance classes and when birds when standardized to 500 m transect length they appeared to be distributed rather uniformly. The percent of standardized

detections was 11, 19, 23, 27, and 18 % moving across distance classes from near shoreline to far shoreline, respectively (Table 6). The Common Loon was observed at all height classes below 220 m. This species was detected in the water relatively more frequently than other common species. Sixty-seven percent of all observations were within 10 m of the water surface that is subdivided between on water (15 % of all detections) and within 1 – 10 m (52 % of all detections). An additional 10 % of detections were observed from 11- 30 above the water and 22 % of detections occurred from 31 – 220 m above the water.

Brown Pelican

The Brown Pelican was ranked sixth in overall abundance and accounted for 2.5 % of all bird detections. Brown Pelicans were more frequently detected in fall (18.5 birds/hr) and spring (13.2 birds/hr) compared to winter (0.4 birds/hr).

Brown Pelicans were detected across all distance from shoreline classes and appeared to use all areas uniformly. The percent of total detections ranged from 15 – 25 % across all distant classes (Table 6). Brown Pelicans are known for their low flights and we observed the majority of all detections (77 %) within 1 - 10 m above the water and an additional 16 % located 11 – 30 m above the water. Relative height use remained consistent at increasing distances from the shoreline.

Forster's Tern

Forster's Tern was ranked seventh in overall abundance and accounted for 2.5 % of the total bird detections. This species was detected more frequently in fall (31.0 birds/hr) compared to winter (0.16 birds/hr) and spring (2.5 birds/hr).

Forster's Terns were spread relatively evenly to distances < 3,600 m from the shoreline. Thirty-three percent of the standardized totals were within 500 m of the shoreline while other classes between 501 and < 3,600 m supported 18 – 23 % of the standardized observations (Table 6). Observations at distances > 3,600 m from the shoreline only accounted for 11 % of the raw total and 4.8 % of the standardized totals. Forster's Tern was predominantly lower than 30 m above the water. Sixty-one percent of all detections were within 1-10 m of the water and 37 % from 11 – 30 m above the water. The remaining 2 % of observations were contained between 31-220 m and no birds were detected in the water or above 220 m.

Double-crested Cormorant

The Double-crested Cormorant was ranked eighth in overall abundance and accounted for 2.2 % of the total birds detected. Detections of this species were similar in fall and spring (13.5 and 13.2 birds/hr, respectively) and relatively much lower in winter (3.6 birds/hr).

Double-crested Cormorants were primarily distributed within 1000 m of the shoreline (Table 6). This species had the highest percentage of it detections within 500 m (49 % of total detections and 63 % of standardized detections) followed secondarily by the 501- 1000 m class (17 % of total detections and 22 % of standardized detections). Detections were made from all height classes < 220 with 60 % of

observations occurring 1 – 10 m above the water, 16 % occurring 11 – 30 m, and 24 % occurring 31 – 220 m (24 %). Height use for this species remained relatively consistent at all distances from the shoreline.

Bonaparte's Gull

The Bonaparte's Gull was ranked ninth in overall abundance and accounted for 2.0 % of the total birds detected. Bonaparte's Gull was detected more frequently in fall (24.0 birds/hr) than in winter (4.14 birds/hr) or spring (2.1 birds/hr).

The Bonaparte's Gull was observed with a relatively uniform distribution moving away from the shoreline. The percentage of standardized detections ranged from 14 – 26 % among all shoreline distance classes (Table 6). This species was detected at all height classes < 220 m but was predominantly observed 1- 10 above the water (87 % of all detections). Nine percent of the detections occurred between 11-30 m with the remaining 2 % being observed from 31 – 220 m. Height distribution remained consistent at all distances from the shoreline.

Bald Eagle

The Bald Eagle was detected in relatively low numbers but is exclusively summarized in this report because of it high conservation concern as a state threatened species in Virginia and its regulatory protection by the United States Bald Eagle and Golden Eagle Protection Act.

A total of 179 observations for the Bald Eagle were made across all seasons (93, 15, and 64 detections for fall, winter, and spring, respectively). The rate of detection was relatively even in each season with 0.4 birds/hr detected in fall, 0.3 birds/hr in winter, and 0.2 birds/hr in spring.

Bald Eagles were typically associated with the near shoreline from 0 – 1000 m (Table 6). Sixty-five percent of the total observations occurred within 500 m of the shoreline and 21 % from 500 – 1000 m away. Another 8 % of the detections occurred from 1001 – 2000 m and 5 % from 2001 – 3600 m away from the shoreline. The percentage of total detections increased with height above the water. Nineteen percent of all observations occurred between a height of 1-10 m, 35 % occurred from 11 – 30 m, 45 % occurred between 31 – 220 m, and 1 % of observations occurred above 220 m.

Other Species of Regulatory Concern

In addition to the Bald Eagle, three other avian species including the Piping Plover, Roseate Tern, and Red Knot were recommended for risk assessment to be included in this report. Among these three species, only the Red Knot was detected during surveys. A total of 6 Red Knots were detected during spring surveys. The first detection was of one individual at a height of 11-30 m above the water and within 500 m of the shoreline. The second occurrence was of a small flock of 5 birds flying within 10 m of the water surface at a distance of 1000-2000 m from the shoreline.

Sources of Survey Error

There are several potential errors associated with the survey technique used for this study. The most important sources for error to be recognized are those that influence the detectability of birds for

an observer. In turn, these errors bias the estimates of bird abundance or distribution. Distance and weather are two factors known to influence bird detection rates. The general belief is that the ability to detect a bird decreases the further it is located away from the observer. Distance sampling is a commonly used technique to estimate the number of birds that may have been missed by calculating a correction factor for estimates of birds detected at greater distances. However, this technique assumes there is a constant availability of birds at all distances away from the observer such that any variation in the abundance estimated over distance is associated with an observer's perception and not associated with the bird's actual use of space. In this study, we have demonstrated species that have declined in abundance with distance from the shoreline as well as birds that have increased in abundance moving away from the shoreline. Because of this, we decided not to apply a correction factor that could mask space use patterns and so rely on direct observations to explain bird abundance and distribution patterns.

Long-range visibility can also influence the detectability of birds during shoreline observations and may particularly bias bird abundance estimates at greater distances. Using individual hours of surveys as replicates, visibility (in terms observable distance) in this this study was weakly, but negatively, correlated with the numbers of birds estimated (Table 7). This relationship remained consistent across all distance classes. The number of hours that visibility was less than 5 km was low and accounted for only 4 % of the 535 hours of observation. Periods of low visibility occurred during the early morning hours and were spread across different days. We did not incorporate the influence on visibility on detection patterns for birds and do not know its numerical effect on abundance estimates. In general, bird abundance was always greater in the morning versus the afternoon so its affect may be small.

Table 7. Spearman rank correlation coefficients for the comparison of weather related factors with abundance estimates for total birds and distance classes from the shoreline. Abundance estimate

Abundance Estimate	Wind Speed	Visibility	Cloud Cover
Total Count	0.19*	-0.07	0.10*
0-500m	-0.09	0.05	-0.00
501-1000m	0.12*	-0.00	-0.00
1001-2000m	0.24*	-0.05	0.02
2001-3600m	0.16*	-0.09*	0.09*
>3600m	0.14*	-0.02	0.12*

Finally, the assignment of birds into height classes based on observer estimation is associated with some unknown level of error. Observers trained themselves to make the best estimates using a laser range finder but there is an expected, but unknown quantity of overlap between adjacently positioned height classes.

Key Findings

- This study provides a spatially explicit profile on space use of an offshore bird concentration area at Cape Charles, VA that could aid strategies at minimizing population exposure to potential hazards.

- The offshore region of Cape Charles, VA provides habitat for a diverse assemblage of waterbirds, waterfowl, shorebirds, and others species. Many of these species are restricted to using very narrow portions of offshore habitats because they contain specific combinations of resources that are not found elsewhere.

- The Northern Gannet was the numerically dominant species accounting for 49 % of the 298,519 total bird detections. Other commonly detected species include the Red Throated Loon, Surf Scoter, Common Loon, and Brown Pelican

- Several species within this offshore bird assemblage are of conservation concern because of low or declining populations or because a significant portion of their regional or continental population is supported within the Chesapeake Bay region during their non-breeding season.

- We found that species use the study area differently from one another. Some species were predominantly distributed within 1 km of the shoreline, some species were distributed relatively further away from shore, and other species utilized both near and far shore environments uniformly. Taken together, this result suggests that the birds are distributed in large numbers across all distances from the shoreline.

- The Northern Gannet, Laughing Gull, Double-crested Cormorant, and Bald Eagle were detected with greater frequency within 1000 m of the shore. Red-throated Loons were more frequently found > 2000 m away from the shoreline and Surf Scoters detected with greater abundance from 500-3600m compared to nearshore areas. The Common Loon, Brown Pelican, Forster's Tern and Bonapartes Gull were distributed evenly in near (< 1000 m)and far (1000 m to > 3,600 m)shoreline zones.

- The overwhelming majority of birds were distributed within 30 m of the water surface. This included 78 % of all detections being within < 10 m above the water surface. Individual bird species did not shift height use between near and far distances from the shoreline.

- The Piping Plover and Roseate Tern were not detected during surveys. Only 6 Red Knots were detected during the spring migration season.

Acknowledgements

We thank Gamesa Energy USA and Dan Renshaw of Gamesa for providing the funding support for this effort, Erica Lawler and Jane Lopez of the William and Mary Sponsored Programs Office for administrative oversight throughout the entire project. We also thank Steve Wood and Jennifer Latour for additional administrative oversight from ESS and Lyle Varnell for support at the Virginia Institute of Marine Science

Literature Cited

Watts, B. D. 2010. Wind and waterbirds: establishing sustainable mortality limits within the Atlantic Flyway. Center for Conservation Biology Technical Report Series, CCBTR-10-05. College of William and Mary & Virginia Commonwealth University, Williamsburg, VA. 43 pp.

Appendix I

List of all species observed and ranked by their total detections

Species	Latin Name	Total Detected
Northern Gannet	*Morus bassanus*	146740
Red-throated Loon	*Gavia stellata*	46947
Laughing Gull	*Larus atricilla*	15897
Surf Scoter	*Melanitta perspicillata*	10218
Common Loon	*Gavia immer*	8603
Dark-winged Scoter	*Melanitta perspicillata or nigra*	7973
Brown Pelican	*Pelecanus occidentalis*	7628
Forster's Tern	*Sterna forsteri*	7607
Double-crested Cormorant	*Phalacrocorax auritus*	6656
Bonaparte's Gull	*Larus philadelphia*	6110
Horned Grebe	*Podiceps auritus*	4616
Unidentified Loon	*Gavia sp.*	4460
Unidentified Gull	*Gull sp.*	3906
Unidentified Duck	*Duck sp.*	2891
Red-breasted Merganser	*Mergus serrator*	2186
Great Black-backed Gull	*Larus marinus*	1723
Bufflehead	*Bucephala albeola*	1697
Sanderling	*Calidris alba*	1433
Dunlin	*Calidris alpina*	1343
Herring Gull	*Larus argentatus*	1098
Tree Swallow	*Tachycineta bicolor*	1029
Ring-billed Gull	*Larus delawarensis*	958
Royal Tern	*Sterna maxima*	489
Tundra Swan	*Cygnus columbianus*	487
Black Scoter	*Melanitta nigra*	485
Unidentified Shorebird	*Shorebird sp.*	484
Unidentified Scaup	*Scaup sp.*	455
Black-bellied Plover	*Pluvialis squatarola*	398
Great Cormorant	*Phalacrocorax carbo*	349
Ruddy Turnstone	*Arenaria interpres*	280

Species	Latin Name	Total Detected
American Oystercatcher	*Haematopus palliatus*	280
Long-tailed Duck	*Clangula hyemalis*	263
Unidentified Tern	*Tern sp.*	226
Purple Sandpiper	*Calidris maritima*	194
Bald Eagle	*Haliaeetus leucocephalus*	179
Common Grackle	*Quiscalus quiscula*	149
Osprey	*Pandion haliaetus*	139
Canada Goose	*Branta canadensis*	134
Semipalmated Sandpiper	*Calidris pusilla*	134
White-winged Scoter	*Melanitta fusca*	123
American Wigeon	*Anas americana*	113
Caspian Tern	*Sterna caspia*	102
Great Blue Heron	*Ardea herodias*	80
Common Tern	*Sterna hirundo*	69
Atlantic Brant	*Branta bernicla*	61
Glossy Ibis	*Plegadis falcinellus*	61
Unidentified Cormorant	*Phalacrocorax auritus or carbo*	60
Lesser Yellowlegs	*Tringa flavipes*	49
Sandwich Tern	*Sterna sandvicensis*	45
Greater Yellowlegs	*Tringa melanoleuca*	45
Barn Swallow	*Hirundo rustica*	45
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	44
Snowy Egret	*Egretta thula*	43
American Pipit	*Anthus rubescens*	42
Red-winged Blackbird	*Agelaius phoeniceus*	41
American Goldfinch	*Carduelis tristis*	39
Lesser Scaup	*Aythya affinis*	37
Greater Scaup	*Aythya marila*	36
Belted Kingfisher	*Ceryle alcyon*	32
American Crow	*Corvus brachyrhynchos*	28
Redhead	*Aythya americana*	27
Great Egret	*Ardea alba*	26
Gadwall	*Anas strepera*	25
Northern Pintail	*Anas acuta*	22
Mallard	*Anas platyrhynchos*	21
Least Tern	*Sterna antillarum*	20
Horned Lark	*Eremophila alpestris*	20
Purple Martin	*Progne subis*	18
Unidentified Passerine	*Passerine sp.*	17
Fish Crow	*Corvus ossifragus*	17
European Starling	*Sturnus vulgaris*	17

Species	Latin Name	Total Detected
Spotted Sandpiper	*Actitis macularius*	17
Hooded Merganser	*Lophodytes cucullatus*	15
Sharp-shinned Hawk	*Accipiter striatus*	14
American Green-winged Teal	*Anas crecca*	14
American Black Duck	*Anas rubripes*	13
Short-billed Dowitcher	*Limnodromus griseus*	13
Turkey Vulture	*Cathartes aura*	12
Razorbill	*Alca torda*	10
Chimney Swift	*Chaetura pelagica*	9
Parasitic Jaeger	*Stercorarius parasiticus*	9
Red-necked Grebe	*Podiceps grisegena*	9
Myrtle Warbler	*Dendroica coronata*	7
Pectoral Sandpiper	*Calidris melanotos*	7
Black Skimmer	*Rynchops niger*	7
Unidentified Jaeger	*Stercorarius sp.*	6
Wood Duck	*Aix sponsa*	6
Red Knot	*Calidris canutus*	6
Common Goldeneye	*Bucephala clangula*	5
Semipalmated Plover	*Charadrius semipalmatus*	5
American Kestrel	*Falco sparverius*	4
Unidentified Warbler	*Warbler sp.*	4
Cedar Waxwing	*Bombycilla cedrorum*	4
Northern Harrier	*Circus cyaneus*	4
Killdeer	*Charadrius vociferus*	4
Peregrine Falcon	*Falco peregrinus*	3
Cooper's Hawk	*Accipiter cooperii*	3
Blackpoll Warbler	*Dendroica striata*	3
Unidentified Swallow	*Swallow sp.*	3
Brown-headed Cowbird	*Molothrus ater*	3
Merlin	*Falco columbarius*	2
Eurasian Wigeon	*Anas penelope*	2
King Eider	*Somateria spectabilis*	2
Pomarine Jaeger	*Stercorarius pomarinus*	2
Marbled Godwit	*Limosa fedoa*	2
Western Sandpiper	*Calidris mauri*	2
Willet	*Catoptrophorus semipalmatus*	2
House Finch	*Carpodacus mexicanus*	2
Northern Cardinal	*Cardinalis cardinalis*	2
Pied-billed Grebe	*Podilymbus podiceps*	1
American Coot	*Fulica americana*	1

Species	Latin Name	Total Detected
Yellow Palm Warbler	*Dendroica palmarum*	1
Unidentified Sparrow	*Sparrow sp.*	1
Little Blue Heron	*Egretta caerulea*	1
Eared Grebe	*Podiceps nigricollis*	1
Green Heron	*Butorides virescens*	1
Dovekie	*Alle alle*	1
American Robin	*Turdus migratorius*	1
Tricolored Heron	*Egretta tricolor*	1
Red-necked Phalarope	*Phalaropus lobatus*	1
Whimbrel	*Numenius phaeopus*	1
Eastern Kingbird	*Tyrannus tyrannus*	1

Appendix II

The percent of total detections for a species within combinations of distance from shoreline and height above water classes.

Species	Distance from Shoreline									
	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
American Black Duck	0.00%	0.00%	0.00%	23.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Coot	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
American Crow	0.00%	14.29%	60.71%	21.43%	0.00%	0.00%	3.57%	0.00%	0.00%	0.00%
American Goldfinch	0.00%	0.00%	15.38%	84.62%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Green-winged Teal	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%	50.00%	25.00%	0.00%	0.00%
American Oystercatcher	0.00%	83.64%	5.09%	1.09%	0.00%	0.00%	6.55%	2.55%	0.00%	0.00%
American Pipit	0.00%	9.52%	47.62%	9.52%	0.00%	0.00%	26.19%	0.00%	0.00%	0.00%
American Robin	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Wigeon	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.44%	34.51%	0.00%	0.00%
Atlantic Brant	0.00%	11.48%	0.00%	0.00%	0.00%	0.00%	6.56%	0.00%	0.00%	0.00%
Bald Eagle	0.00%	12.85%	26.82%	24.02%	1.68%	0.00%	4.47%	5.03%	11.73%	0.00%
Barn Swallow	0.00%	35.56%	17.78%	0.00%	0.00%	0.00%	26.67%	2.22%	0.00%	0.00%
Belted Kingfisher	0.00%	93.75%	3.13%	3.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Black-bellied Plover	0.00%	83.92%	6.78%	0.50%	0.00%	0.00%	3.52%	5.03%	0.00%	0.00%
Black Scoter	0.00%	5.10%	0.00%	0.00%	0.00%	0.00%	10.44%	0.46%	0.00%	0.00%
Black Skimmer	0.00%	85.71%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
Species	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Blackpoll Warbler	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bonaparte's Gull	0.08%	12.59%	0.02%	0.00%	0.00%	0.00%	6.97%	2.19%	0.41%	0.00%
Brown-headed Cowbird	0.00%	33.33%	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Brown Pelican	0.29%	22.19%	1.94%	0.52%	0.03%	0.08%	15.84%	3.66%	0.68%	0.00%
Bufflehead	2.78%	35.14%	1.48%	0.00%	0.00%	0.59%	20.67%	1.54%	0.47%	0.00%
Canada Goose	0.00%	47.76%	13.43%	23.13%	0.00%	0.00%	5.22%	5.97%	0.00%	0.00%
Caspian Tern	0.00%	4.90%	1.96%	0.00%	0.00%	0.00%	3.92%	7.84%	0.00%	0.00%
Cedar Waxwing	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chimney Swift	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Goldeneye	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%
Common Grackle	0.00%	0.67%	16.78%	2.01%	0.00%	0.00%	0.00%	0.00%	0.00%	80.54%
Common Loon	1.01%	2.21%	0.58%	1.00%	0.00%	2.77%	4.04%	0.87%	0.63%	0.00%
Common Tern	0.00%	21.74%	1.45%	0.00%	0.00%	0.00%	13.04%	23.19%	0.00%	0.00%
Cooper's Hawk	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Dark-winged Scoter	0.00%	0.23%	0.00%	0.00%	0.00%	0.00%	0.31%	0.09%	0.00%	0.00%
Double-crested Cormorant	0.29%	35.25%	7.48%	6.37%	0.00%	0.24%	12.06%	2.90%	2.15%	0.00%
Dovekie	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dunlin	0.00%	57.41%	3.87%	1.86%	0.00%	0.00%	30.38%	5.21%	0.00%	0.00%
Eared Grebe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Eastern Kingbird	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eurasian Wigeon	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	0.00%	76.47%	23.53%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fish Crow	0.00%	41.18%	35.29%	0.00%	0.00%	0.00%	23.53%	0.00%	0.00%	0.00%
Forster's Tern	0.00%	16.14%	2.24%	0.01%	0.00%	0.00%	7.28%	5.24%	0.34%	0.00%

Appendix II continued	Distance from Shoreline									
Species	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Gadwall	0.00%	0.00%	36.00%	20.00%	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%
Glossy Ibis	0.00%	40.98%	0.00%	42.62%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Black-backed Gull	1.10%	18.18%	14.00%	12.43%	0.00%	0.93%	8.59%	4.99%	2.03%	0.00%
Great Blue Heron	0.00%	36.25%	3.75%	15.00%	0.00%	0.00%	0.00%	1.25%	2.50%	0.00%
Great Cormorant	0.57%	12.03%	1.15%	0.57%	0.00%	1.43%	16.05%	0.57%	0.00%	0.00%
Great Egret	0.00%	15.38%	7.69%	0.00%	0.00%	0.00%	19.23%	0.00%	3.85%	0.00%
Greater Scaup	0.00%	5.56%	0.00%	8.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Greater Yellowlegs	0.00%	20.00%	13.33%	0.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%
Green Heron	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Herring Gull	3.38%	22.85%	15.81%	7.13%	0.18%	0.27%	6.67%	3.66%	1.46%	0.09%
Hooded Merganser	0.00%	0.00%	0.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Grebe	0.41%	0.93%	0.22%	0.00%	0.00%	0.39%	4.09%	0.00%	0.00%	0.00%
Horned Lark	0.00%	35.00%	15.00%	5.00%	0.00%	0.00%	10.00%	20.00%	0.00%	0.00%
House Finch	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	0.00%	50.00%	25.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%
King Eider	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%
Laughing Gull	1.65%	38.33%	5.97%	5.75%	0.00%	0.18%	15.28%	5.21%	1.12%	0.00%
Least Tern	0.00%	55.00%	25.00%	0.00%	0.00%	0.00%	15.00%	5.00%	0.00%	0.00%
Lesser Scaup	0.00%	0.00%	0.00%	16.22%	0.00%	0.00%	24.32%	13.51%	0.00%	0.00%
Lesser Yellowlegs	0.00%	8.16%	0.00%	0.00%	0.00%	0.00%	42.86%	16.33%	0.00%	0.00%
Little Blue Heron	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Long-tailed Duck	1.14%	6.46%	0.00%	0.00%	0.00%	1.52%	10.27%	0.00%	0.38%	0.00%
Mallard	0.00%	9.52%	9.52%	9.52%	0.00%	0.00%	33.33%	9.52%	0.00%	0.00%
Marbled Godwit	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
Species	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Merlin	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Myrtle Warbler	0.00%	14.29%	0.00%	85.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Cardinal	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Gannet	0.10%	8.01%	1.64%	0.16%	0.00%	0.02%	22.46%	4.04%	0.77%	0.00%
Northern Harrier	0.00%	25.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Pintail	0.00%	0.00%	0.00%	4.55%	0.00%	0.00%	9.09%	45.45%	0.00%	0.00%
Northern Rough-winged Swallow	0.00%	81.82%	15.91%	0.00%	0.00%	0.00%	2.27%	0.00%	0.00%	0.00%
Osprey	0.00%	14.39%	30.22%	23.02%	0.00%	0.00%	7.19%	7.91%	4.32%	0.00%
Parasitic Jaeger	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Pectoral Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Peregrine Falcon	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%
Pied-billed Grebe	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pomarine Jaeger	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Purple Martin	0.00%	11.11%	44.44%	0.00%	0.00%	0.00%	11.11%	0.00%	11.11%	0.00%
Purple Sandpiper	0.00%	10.82%	0.00%	0.00%	0.00%	0.00%	57.22%	0.00%	0.00%	0.00%
Razorbill	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-breasted Merganser	0.82%	32.30%	3.57%	2.52%	0.00%	0.14%	9.15%	6.04%	1.74%	0.00%
Red-necked Grebe	22.22%	22.22%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%
Red-necked Phalarope	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Red-throated Loon	0.01%	0.07%	0.00%	0.01%	0.00%	0.02%	0.37%	0.07%	0.03%	0.00%
Red-winged Blackbird	0.00%	2.44%	4.88%	2.44%	0.00%	0.00%	90.24%	0.00%	0.00%	0.00%
Red Knot	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Redhead	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.81%	0.00%	0.00%	0.00%
Ring-billed Gull	4.08%	21.97%	11.30%	1.99%	0.00%	1.67%	20.40%	4.81%	0.21%	0.00%

Appendix II continued	Distance from Shoreline									
Species	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Royal Tern	0.00%	16.26%	20.16%	2.26%	0.00%	0.00%	8.23%	20.78%	1.65%	0.00%
Ruddy Turnstone	0.00%	65.36%	0.71%	0.00%	0.00%	0.00%	21.07%	0.00%	0.00%	0.00%
Sanderling	0.00%	90.37%	1.40%	0.00%	0.00%	0.00%	4.54%	0.00%	0.07%	0.00%
Sandwich Tern	0.00%	24.44%	26.67%	0.00%	0.00%	0.00%	17.78%	20.00%	0.00%	0.00%
Semipalmated Plover	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Semipalmated Sandpiper	0.00%	32.84%	5.22%	14.93%	0.00%	0.00%	2.24%	0.00%	0.00%	0.00%
Sharp-shinned Hawk	0.00%	28.57%	7.14%	21.43%	0.00%	0.00%	7.14%	0.00%	0.00%	0.00%
Short-billed Dowitcher	0.00%	61.54%	38.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snowy Egret	0.00%	62.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spotted Sandpiper	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Surf Scoter	0.01%	0.72%	0.08%	0.00%	0.00%	0.11%	7.54%	0.85%	0.05%	0.00%
Tree Swallow	0.00%	10.99%	1.36%	0.19%	0.00%	0.00%	7.39%	0.39%	0.00%	0.00%
Tricolored Heron	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Tundra Swan	0.00%	0.00%	0.00%	17.86%	0.00%	0.00%	0.00%	0.00%	18.48%	2.26%
Turkey Vulture	0.00%	0.00%	8.33%	83.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Cormorant	0.00%	0.00%	3.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Duck	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Gull	0.00%	0.03%	0.95%	5.25%	0.00%	0.00%	0.03%	0.00%	0.18%	0.00%
Unidentified Jaeger	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Loon	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%
Unidentified Passerine	0.00%	31.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.25%	0.00%
Unidentified Scaup	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.27%	3.08%	0.00%	0.00%
Unidentified Shorebird	0.00%	14.26%	2.48%	8.26%	0.00%	0.00%	1.65%	51.65%	0.00%	0.00%
Unidentified Sparrow	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
Species	0-500m					501-1000 m				
	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Unidentified Swallow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Tern	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.44%	11.06%	0.00%	0.00%
Unidentified Warbler	0.00%	75.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Sandpiper	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Whimbrel	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
White-winged Scoter	0.00%	8.13%	0.81%	0.00%	0.00%	0.00%	3.25%	2.44%	0.00%	0.00%
Willet	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wood Duck	0.00%	0.00%	16.67%	83.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Palm Warbler	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
American Black Duck	0.00%	7.69%	38.46%	0.00%	0.00%	0.00%	15.38%	15.38%	0.00%	0.00%
American Coot	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Crow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Goldfinch	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Green-winged Teal	0.00%	57.14%	28.57%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
American Kestrel	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Oystercatcher	0.00%	1.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Pipit	0.00%	7.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Robin	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Wigeon	0.00%	0.88%	0.00%	2.65%	0.00%	0.00%	11.50%	0.00%	0.00%	0.00%
Atlantic Brant	0.00%	1.64%	0.00%	4.92%	0.00%	0.00%	55.74%	0.00%	3.28%	0.00%
Bald Eagle	0.00%	1.12%	2.23%	4.47%	0.00%	0.00%	0.56%	1.12%	3.35%	0.00%
Barn Swallow	0.00%	6.67%	4.44%	2.22%	0.00%	0.00%	4.44%	0.00%	0.00%	0.00%
Belted Kingfisher	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Black-bellied Plover	0.00%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Black Scoter	0.23%	61.95%	4.18%	0.00%	0.00%	0.00%	17.17%	0.00%	0.00%	0.00%
Black Skimmer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blackpoll Warbler	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bonaparte's Gull	0.00%	11.41%	2.24%	0.47%	0.00%	0.41%	32.50%	4.84%	1.39%	0.00%
Brown-headed Cowbird	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Brown Pelican	0.03%	13.42%	3.74%	1.27%	0.00%	0.07%	15.14%	3.92%	1.52%	0.04%
Bufflehead	1.36%	25.46%	0.24%	0.35%	0.00%	0.00%	9.33%	0.12%	0.00%	0.00%
Canada Goose	0.00%	2.24%	2.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Caspian Tern	0.00%	0.00%	59.80%	0.98%	0.00%	0.00%	1.96%	12.75%	5.88%	0.00%
Cedar Waxwing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chimney Swift	0.00%	22.22%	0.00%	22.22%	0.00%	0.00%	0.00%	22.22%	33.33%	0.00%
Common Goldeneye	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%
Common Grackle	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Loon	2.48%	11.80%	2.85%	2.51%	0.00%	8.77%	19.08%	3.07%	5.97%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Common Tern	0.00%	15.94%	10.14%	0.00%	0.00%	0.00%	0.00%	14.49%	0.00%	0.00%
Cooper's Hawk	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dark-winged Scoter	0.01%	5.22%	0.77%	0.31%	0.00%	0.10%	44.32%	4.64%	0.93%	0.00%
Double-crested Cormorant	0.06%	3.33%	1.46%	3.51%	0.00%	0.00%	4.24%	1.31%	3.87%	0.02%
Dovekie	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dunlin	0.00%	1.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eared Grebe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eurasian Wigeon	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fish Crow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Forster's Tern	0.00%	11.80%	7.20%	0.68%	0.00%	0.00%	17.15%	20.64%	0.58%	0.00%
Gadwall	0.00%	0.00%	0.00%	24.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Glossy Ibis	0.00%	6.56%	4.92%	0.00%	0.00%	0.00%	0.00%	0.00%	4.92%	0.00%
Great Black-backed Gull	1.51%	4.53%	5.57%	3.02%	0.00%	0.58%	7.08%	4.99%	5.52%	0.06%
Great Blue Heron	0.00%	1.25%	0.00%	16.25%	0.00%	0.00%	3.75%	1.25%	0.00%	0.00%
Great Cormorant	0.00%	22.92%	1.43%	0.00%	0.00%	0.29%	33.24%	1.43%	0.86%	0.00%
Great Egret	0.00%	0.00%	0.00%	3.85%	0.00%	0.00%	15.38%	0.00%	11.54%	0.00%
Greater Scaup	0.00%	63.89%	5.56%	0.00%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%
Greater Yellowlegs	0.00%	6.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Green Heron	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Herring Gull	0.18%	5.03%	3.02%	2.01%	0.00%	0.00%	23.22%	1.65%	1.55%	0.00%
Hooded Merganser	0.00%	26.67%	53.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Grebe	0.97%	22.27%	0.06%	0.02%	0.00%	1.02%	54.83%	0.32%	0.04%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Horned Lark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.00%	0.00%	0.00%	0.00%
House Finch	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
King Eider	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%
Laughing Gull	0.06%	9.45%	2.56%	0.76%	0.00%	0.02%	9.00%	2.05%	0.52%	0.00%
Least Tern	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lesser Scaup	0.00%	32.43%	2.70%	0.00%	0.00%	0.00%	8.11%	2.70%	0.00%	0.00%
Lesser Yellowlegs	0.00%	32.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Little Blue Heron	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Long-tailed Duck	0.76%	48.29%	1.52%	0.00%	0.00%	0.00%	23.19%	0.00%	0.00%	0.00%
Mallard	0.00%	4.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	23.81%	0.00%
Marbled Godwit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Merlin	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Myrtle Warbler	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Cardinal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Gannet	0.00%	21.71%	1.35%	0.76%	0.00%	0.42%	11.67%	2.51%	0.90%	0.00%
Northern Harrier	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%
Northern Pintail	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	40.91%	0.00%	0.00%	0.00%
Northern Rough-winged Swallow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Osprey	0.00%	1.44%	0.00%	6.47%	0.00%	0.00%	2.16%	0.72%	2.16%	0.00%
Parasitic Jaeger	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%	11.11%	11.11%	11.11%	0.00%
Pectoral Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Peregrine Falcon	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pied-billed Grebe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Pomarine Jaeger	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%
Purple Martin	0.00%	5.56%	0.00%	0.00%	0.00%	0.00%	0.00%	16.67%	0.00%	0.00%
Purple Sandpiper	0.00%	31.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Razorbill	0.00%	30.00%	0.00%	0.00%	0.00%	0.00%	30.00%	0.00%	0.00%	0.00%
Red-breasted Merganser	0.00%	13.31%	5.63%	2.33%	0.00%	0.00%	14.91%	2.42%	2.01%	0.00%
Red-necked Grebe	0.00%	44.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-necked Phalarope	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red-throated Loon	0.01%	8.57%	0.33%	0.29%	0.00%	0.01%	38.98%	2.00%	0.48%	0.00%
Red-winged Blackbird	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Red Knot	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	83.33%	0.00%	0.00%	0.00%
Redhead	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	62.96%	0.00%	0.00%
Ring-billed Gull	0.42%	14.02%	2.72%	1.26%	0.00%	0.42%	8.47%	2.82%	0.31%	0.00%
Royal Tern	0.00%	5.56%	12.96%	2.26%	0.00%	0.00%	1.23%	4.32%	3.70%	0.00%
Ruddy Turnstone	0.00%	11.43%	0.00%	0.00%	0.00%	0.00%	1.43%	0.00%	0.00%	0.00%
Sanderling	0.00%	1.19%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%
Sandwich Tern	0.00%	2.22%	8.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Semipalmated Plover	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Semipalmated Sandpiper	0.00%	0.00%	0.00%	44.78%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sharp-shinned Hawk	0.00%	21.43%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	0.00%	0.00%
Short-billed Dowitcher	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snowy Egret	0.00%	0.00%	0.00%	2.33%	0.00%	0.00%	13.95%	0.00%	11.63%	0.00%
Spotted Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Surf Scoter	1.00%	40.04%	2.04%	0.28%	0.00%	1.70%	37.02%	2.48%	0.31%	0.00%
Tree Swallow	0.00%	33.27%	0.29%	0.00%	0.00%	0.00%	46.01%	0.10%	0.00%	0.00%
Tricolored Heron	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline									
	1001-2000 m					2000-3600 m				
Species	Height Above Water					Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m	On water	1-10 m	11-30 m	31-220 m	> 220 m
Tundra Swan	0.00%	0.00%	0.00%	12.32%	0.00%	0.00%	0.00%	3.90%	14.99%	0.00%
Turkey Vulture	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8.33%	0.00%	0.00%	0.00%
Unidentified Cormorant	0.00%	1.67%	0.00%	0.00%	0.00%	0.00%	10.00%	5.00%	16.67%	0.00%
Unidentified Duck	0.00%	1.53%	0.07%	1.99%	0.00%	0.00%	15.40%	4.70%	5.22%	0.00%
Unidentified Gull	0.00%	0.33%	0.28%	0.05%	0.00%	0.00%	20.23%	10.04%	0.92%	0.00%
Unidentified Jaeger	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Unidentified Loon	0.00%	0.36%	0.04%	0.04%	0.00%	0.00%	2.78%	0.87%	0.99%	0.00%
Unidentified Passerine	0.00%	31.25%	0.00%	6.25%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%
Unidentified Scaup	0.00%	17.80%	3.08%	1.98%	0.00%	0.00%	39.56%	8.35%	0.00%	0.00%
Unidentified Shorebird	0.00%	6.20%	3.72%	0.00%	0.00%	0.00%	9.30%	0.00%	0.00%	0.00%
Unidentified Sparrow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Swallow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	33.33%	0.00%
Unidentified Tern	0.00%	8.85%	15.93%	0.00%	0.00%	0.00%	22.12%	34.51%	0.00%	0.00%
Unidentified Warbler	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Whimbrel	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
White-winged Scoter	0.00%	26.02%	1.63%	0.81%	0.00%	0.81%	48.78%	0.00%	5.69%	0.00%
Willet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wood Duck	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Palm Warbler	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline				
	1001-2000 m				
Species	Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m
American Black Duck	0.00%	0.00%	1.18%	0.00%	0.00%
American Coot	0.00%	0.00%	0.00%	0.00%	0.00%
American Crow	0.00%	0.00%	0.00%	0.00%	0.00%
American Goldfinch	0.00%	0.00%	0.00%	0.00%	0.00%
American Green-winged Teal	0.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	0.00%	0.00%	0.00%	0.00%	0.00%
American Oystercatcher	0.00%	0.00%	0.00%	0.00%	0.00%
American Pipit	0.00%	0.00%	0.00%	0.00%	0.00%
American Robin	0.00%	0.00%	0.00%	0.00%	0.00%
American Wigeon	0.00%	0.00%	0.00%	0.00%	0.00%
Atlantic Brant	0.00%	16.39%	0.00%	0.00%	0.00%
Bald Eagle	0.00%	0.00%	0.01%	0.00%	0.00%
Barn Swallow	0.00%	0.00%	0.00%	0.00%	0.00%
Belted Kingfisher	0.00%	0.00%	0.00%	0.00%	0.00%
Black-bellied Plover	0.00%	0.00%	0.00%	0.00%	0.00%
Black Scoter	0.00%	0.46%	0.00%	0.00%	0.00%
Black Skimmer	0.00%	0.00%	0.00%	0.00%	0.00%
Blackpoll Warbler	0.00%	0.00%	0.00%	0.00%	0.00%
Bonaparte's Gull	0.00%	23.96%	0.00%	0.02%	0.00%
Brown-headed Cowbird	0.00%	0.00%	0.00%	0.00%	0.00%
Brown Pelican	0.01%	10.68%	0.00%	1.84%	0.00%

Appendix II continued	Distance from Shoreline				
	1001-2000 m				
Species	Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m
Bufflehead	0.00%	0.41%	0.00%	0.00%	0.00%
Canada Goose	0.00%	0.00%	0.00%	0.00%	0.00%
Caspian Tern	0.00%	0.00%	0.12%	0.00%	0.00%
Cedar Waxwing	0.00%	0.00%	0.00%	0.00%	0.00%
Chimney Swift	0.00%	0.00%	2.47%	0.00%	0.00%
Common Goldeneye	0.00%	0.00%	0.00%	0.00%	0.00%
Common Grackle	0.00%	0.00%	0.00%	0.00%	0.00%
Common Loon	0.00%	14.93%	0.00%	11.82%	0.00%
Common Tern	0.00%	0.00%	0.21%	0.00%	0.00%
Cooper's Hawk	0.00%	0.00%	0.00%	0.00%	0.00%
Dark-winged Scoter	0.00%	36.79%	0.00%	0.60%	0.00%
Double-crested Cormorant	0.00%	4.86%	0.00%	7.78%	0.00%
Dovekie	0.00%	0.00%	0.00%	0.00%	0.00%
Dunlin	0.00%	0.00%	0.00%	0.00%	0.00%
Eared Grebe	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	0.00%	0.00%	0.00%	0.00%	0.00%
Eurasian Wigeon	0.00%	0.00%	0.00%	0.00%	0.00%
European Starling	0.00%	0.00%	0.00%	0.00%	0.00%
Fish Crow	0.00%	0.00%	0.00%	0.00%	0.00%
Forster's Tern	0.00%	8.96%	0.00%	0.00%	0.00%
Gadwall	0.00%	0.00%	0.00%	0.00%	0.00%
Glossy Ibis	0.00%	0.00%	0.00%	0.00%	0.00%
Great Black-backed Gull	0.29%	1.51%	0.00%	2.21%	0.00%
Great Blue Heron	0.00%	0.00%	0.02%	18.75%	0.00%

Appendix II continued	Distance from Shoreline				
	1001-2000 m				
Species	Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m
Great Cormorant	0.86%	6.30%	0.00%	0.00%	0.00%
Great Egret	0.00%	23.08%	0.00%	0.00%	0.00%
Greater Scaup	0.00%	0.00%	0.00%	0.00%	0.00%
Greater Yellowlegs	0.00%	0.00%	0.00%	0.00%	0.00%
Green Heron	0.00%	0.00%	0.00%	0.00%	0.00%
Herring Gull	0.09%	1.01%	0.00%	0.37%	0.00%
Hooded Merganser	0.00%	0.00%	0.00%	0.00%	0.00%
Horned Grebe	0.00%	14.41%	0.00%	0.00%	0.00%
Horned Lark	0.00%	0.00%	0.00%	0.00%	0.00%
House Finch	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	0.00%	0.00%	0.00%	0.00%	0.00%
King Eider	0.00%	0.00%	25.00%	0.00%	0.00%
Laughing Gull	0.00%	1.59%	0.00%	0.10%	0.00%
Least Tern	0.00%	0.00%	0.00%	0.00%	0.00%
Lesser Scaup	0.00%	0.00%	0.07%	0.00%	0.00%
Lesser Yellowlegs	0.00%	0.00%	0.00%	0.00%	0.00%
Little Blue Heron	0.00%	0.00%	0.00%	0.00%	0.00%
Long-tailed Duck	0.00%	4.56%	0.00%	0.00%	0.00%
Mallard	0.00%	0.00%	0.00%	0.00%	0.00%
Marbled Godwit	0.00%	0.00%	0.00%	0.00%	0.00%
Merlin	0.00%	0.00%	0.00%	0.00%	0.00%
Myrtle Warbler	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Cardinal	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Gannet	0.03%	11.00%	0.00%	6.84%	0.02%

Appendix II continued	Distance from Shoreline				
	1001-2000 m				
Species	Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m
Northern Harrier	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Pintail	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Rough-winged Swallow	0.00%	0.00%	0.00%	0.00%	0.00%
Osprey	0.00%	0.00%	0.01%	0.00%	0.00%
Parasitic Jaeger	0.00%	22.22%	1.23%	0.00%	0.00%
Pectoral Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%
Peregrine Falcon	0.00%	0.00%	0.00%	0.00%	0.00%
Pied-billed Grebe	0.00%	0.00%	0.00%	0.00%	0.00%
Pomarine Jaeger	0.00%	50.00%	0.00%	0.00%	0.00%
Purple Martin	0.00%	0.00%	0.93%	0.00%	0.00%
Purple Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%
Razorbill	0.00%	40.00%	0.00%	0.00%	0.00%
Red-breasted Merganser	0.00%	1.14%	0.00%	0.82%	0.00%
Red-necked Grebe	0.00%	0.00%	0.00%	0.00%	0.00%
Red-necked Phalarope	0.00%	0.00%	0.00%	0.00%	0.00%
Red-throated Loon	0.00%	46.78%	0.00%	0.12%	0.00%
Red-winged Blackbird	0.00%	0.00%	0.00%	0.00%	0.00%
Red Knot	0.00%	0.00%	0.00%	0.00%	0.00%
Redhead	0.00%	0.00%	2.33%	0.00%	0.00%
Ring-billed Gull	0.00%	0.21%	0.00%	0.00%	0.00%
Royal Tern	0.00%	0.62%	0.01%	0.00%	0.00%
Ruddy Turnstone	0.00%	0.00%	0.00%	0.00%	0.00%
Sanderling	0.00%	2.37%	0.00%	0.00%	0.00%
Sandwich Tern	0.00%	0.00%	0.00%	0.00%	0.00%
Semipalmated Plover	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	Distance from Shoreline				
	1001-2000 m				
Species	Height Above Water				
	On water	1-10 m	11-30 m	31-220 m	> 220 m
Semipalmated Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%
Sharp-shinned Hawk	0.00%	0.00%	0.00%	0.00%	0.00%
Short-billed Dowitcher	0.00%	0.00%	0.00%	0.00%	0.00%
Snowy Egret	0.00%	9.30%	0.00%	0.00%	0.00%
Spotted Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%
Surf Scoter	0.00%	5.02%	0.00%	0.15%	0.00%
Tree Swallow	0.00%	0.00%	0.00%	0.00%	0.00%
Tricolored Heron	0.00%	100.00%	0.00%	0.00%	0.00%
Tundra Swan	0.00%	4.31%	0.01%	25.87%	0.00%
Turkey Vulture	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Cormorant	0.00%	60.00%	0.08%	3.33%	0.00%
Unidentified Duck	0.00%	54.89%	0.00%	3.97%	0.00%
Unidentified Gull	0.26%	34.56%	0.00%	3.43%	0.00%
Unidentified Jaeger	0.00%	50.00%	0.00%	0.00%	0.00%
Unidentified Loon	0.00%	57.44%	0.00%	1.88%	0.00%
Unidentified Passerine	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Scaup	0.00%	15.38%	0.02%	0.66%	0.00%
Unidentified Shorebird	0.00%	2.48%	0.00%	0.00%	0.00%
Unidentified Sparrow	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Swallow	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Tern	0.00%	6.64%	0.15%	0.44%	0.00%
Unidentified Warbler	0.00%	0.00%	0.00%	0.00%	0.00%
Western Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%
Whimbrel	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix II continued	**Distance from Shoreline**				
	1001-2000 m				
Species	**Height Above Water**				
	On water	**1-10 m**	**11-30 m**	**31-220 m**	**> 220 m**
White-winged Scoter	0.00%	0.00%	0.00%	0.00%	0.00%
Willet	0.00%	0.00%	0.00%	0.00%	0.00%
Wood Duck	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Palm Warbler	0.00%	0.00%	0.00%	0.00%	0.00%