4.0 SUPPLEMENTAL AVIAN OFFSHORE AND ONSHORE SURVEYS

Supplemental shipboard avian surveys were conducted during December 2008 and from August through December 2009. Three types of supplemental surveys were conducted: shoal/station surveys, ship sawtooth transects, and land-based migration counts associated with shipboard transects. The objective of the shoal/station surveys was to help determine whether high densities of waterbirds occur in association with shoals. The objective of the shipboard sawtooth transect surveys was to determine whether increased survey effort would cause changes in abundance estimates of avian species. While the primary goal of the land-based counts and seawatch transect surveys was to determine the passage rates (number of birds/unit time) of migrating waterbirds relative to distance from shore.

4.1 FIELD SURVEY METHODOLOGY

4.1.1 Shoal Surveys

The USFWS identified the need to gather data on avian foraging locations, avian use of fishing locations, and the feeding and roosting locations of Northern Gannets. The station count method (Gould and Forsell 1989) was modified from a “snapshot” technique to continuous data collection to survey shoal areas. The survey area consisted of two concentric circles with the observer as the center of the circle. The radius of the first circle (A) ranged from 0 to 300 m (984 ft) and the radius of the second circle (B) ranged from 301 to 600 m (988 to 1969 ft).

A shoal-area map (**Section 2.3.3.1: Figure 2-8**) was generated via GIS, with shoals numbered sequentially from north to south. Shoal size varies in the Study Area (**Section 2.3.3.1: Figure 2-8**) and small shoals may require only one station, while larger shoals may have numerous stations. All shoal stations were located a minimum of 1 km (1.9 NM) apart. All other survey methodology and data-recording techniques remained consistent with those of the shipboard avian surveys (**Section 2.1.2; Appendix A**).

4.1.2 Ship Sawtooth Transect Surveys

Survey methodology was identical to that of the shipboard avian surveys (**Section 2.1.2**).

4.1.3 Seawatch: Land-based Counts/Shipboard Transect Surveys

This supplemental project was designed to determine abundance of fall-migrating waterbirds relative to distance from shore within the Study Area. It is important to stress that in this aspect of the study, <u>only</u> southbound waterbird migrants were counted; in all other aspects of the study, all birds were noted. Land-based surveys were conducted from Barnegat Light (39°45'30.21"N, 74°05'42.08"W) and from the north end of Avalon (39°06'35.13"N, 74°42'29.78"W). These sites were chosen for the ease of detecting southbound waterbird migration, as they project into the paths of these birds. The Avalon site has been used as a long-term waterbird migration count site by Cape May Bird Observatory and New Jersey Audubon Society[2] since before 1995. The seawatch land-based counts and shipboard transect surveys were conducted concurrently so that the migrant-passage rate along the coast could be determined to be ongoing or to have ceased, even during those times when the ship was out of sight of land.

Land-based survey methods at both sites were mirrored on those used by Cape May Bird Observatory[2] for its Avalon Seawatch waterbird migration count site in order to maintain consistency and comparability of methods. A single observer used a high-quality binocular and a high-quality spotting scope to locate migrating birds and flocks of birds over the Atlantic Ocean. At Barnegat Inlet, an assistant recorded data; however, the observer recorded the data at Avalon. Southbound birds were detected by scanning all airspace above the ocean surface in the entire arc visible from the count site (approximately 180° at Barnegat Inlet and approximately 135° at Avalon), with all detections recorded in 15-minute (min) increments. Parameters recorded included species (to lowest identifiable taxon), flock size and composition, and distance from shore (within or outside 2 km [1.1 NM] using known locations of buoys as distance markers).

Shipboard strip-transect surveys were conducted simultaneously with each seawatch survey along three 37.04-km (20-NM) transect lines spaced 2.78 km (1.5 NM) apart at their coastal origins and running perpendicularly from the coast to the offshore boundary of the project area (**Figure 4-1**). All three transects at each location were conducted on a given survey date and were considered replicates of a single sample. Start points were varied across sampling dates. Surveys were conducted from the north-facing side of the vessel and the single observer scanned the northerly 180° of view (stern to bow) for flying birds. As southbound flight is seasonally expected for fall migrants, all southbound birds crossing the transect line were recorded. Field methods were those of regular shipboard surveys (**Section 2.1.2**), except that only southbound flying birds detected in the northerly-facing 180° arc were recorded.

4.2 SURVEY EFFORT

4.2.1 Shoal Surveys

Shoal surveys were conducted 22-23 January 2009 for 12.33 hrs and covered seven shoals, once each, in the southern half of the Study Area

4.2.2 Ship Sawtooth Transect Surveys

Inclement weather limited survey efforts throughout fall 2009. Though 1-2 survey dates were scheduled for each available week of fall 2009, ship sawtooth transect surveys were conducted 14 times between 17 August and 08 December 2009, inclusive. Transects covered 1,398.28 km (755.01 NM; **Figure 4-2**) in 71.85 hrs.

4.2.3 Seawatch: Land-based Counts/Shipboard Transect Surveys

Six concurrent land-based seawatch and strip-transect surveys were conducted between 20 October and 04 December 2009, four at Avalon (22 October, 09 November, and 02 and 04 December) and two at Barnegat Light (20 October and 10 November). On 04 December at Avalon, one of the three transects was not conducted due to deteriorating weather conditions. Transects covered 635.44 km (343.11 NM) in 32.65 hrs, while the land-based survey effort totaled 36.75 hrs. Effort varied between the two survey types to ensure that all shipboard transect time was matched with land-based survey effort. The variation in effort had three causes: 1) start and/or end times could not be coordinated between ship and land, thus start and end times of the land-based survey effort were designed to encompass all shipboard transect time by starting earlier and/or ending later; 2) land-based survey efforts continued even when the ship was transiting between transects and not surveying; and 3) land-based counts were taken in mandatory 15-min intervals, even when the shipboard transects had been completed, therefore, ending after the shipboard transects. Seawatch transect-survey data were analyzed relative to distance from shore, in bands of 1.866 km (1.007 NM).

4.3 SURVEY RESULTS

4.3.1 Shoal Surveys

Although a very low survey effort did limit the amount of data collected, this supplemental survey effort did help to validate the importance of shoals as feeding areas for birds in general and for Northern Gannets in particular. Of the 928 birds recorded in-zone, over 70% (614) were Northern Gannets. The five most abundant species recorded during the shoal/station counts are presented in **Table 4-1**. The use of shoals was also verified during analysis of avian shipboard and coastal survey data (**Section 2.3.3.1; Chapter 8.0**), and various species accounts in **Appendices C** and **F**.

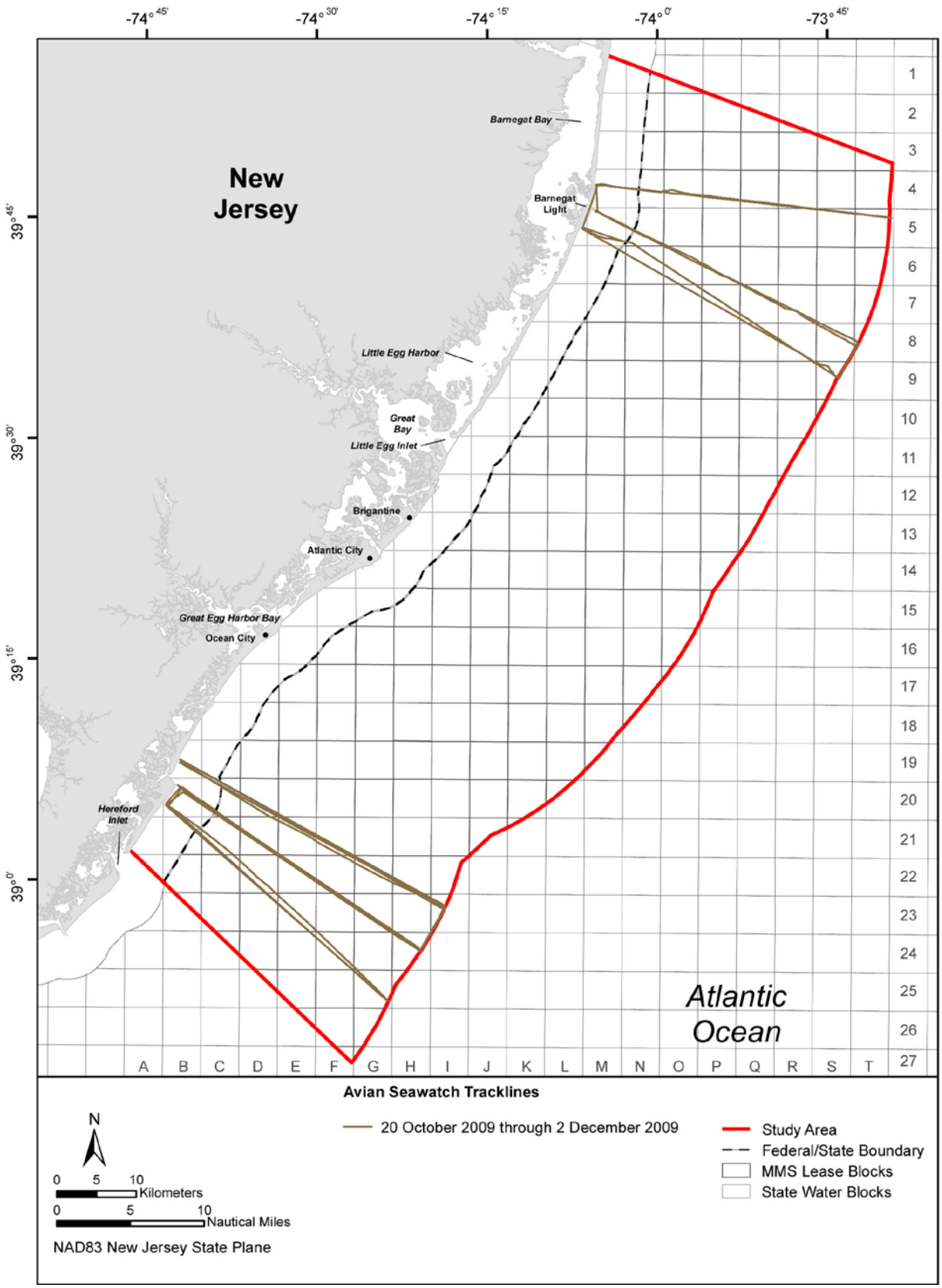

Figure 4-1. Seawatch shipboard transect tracklines, October-December 2009.

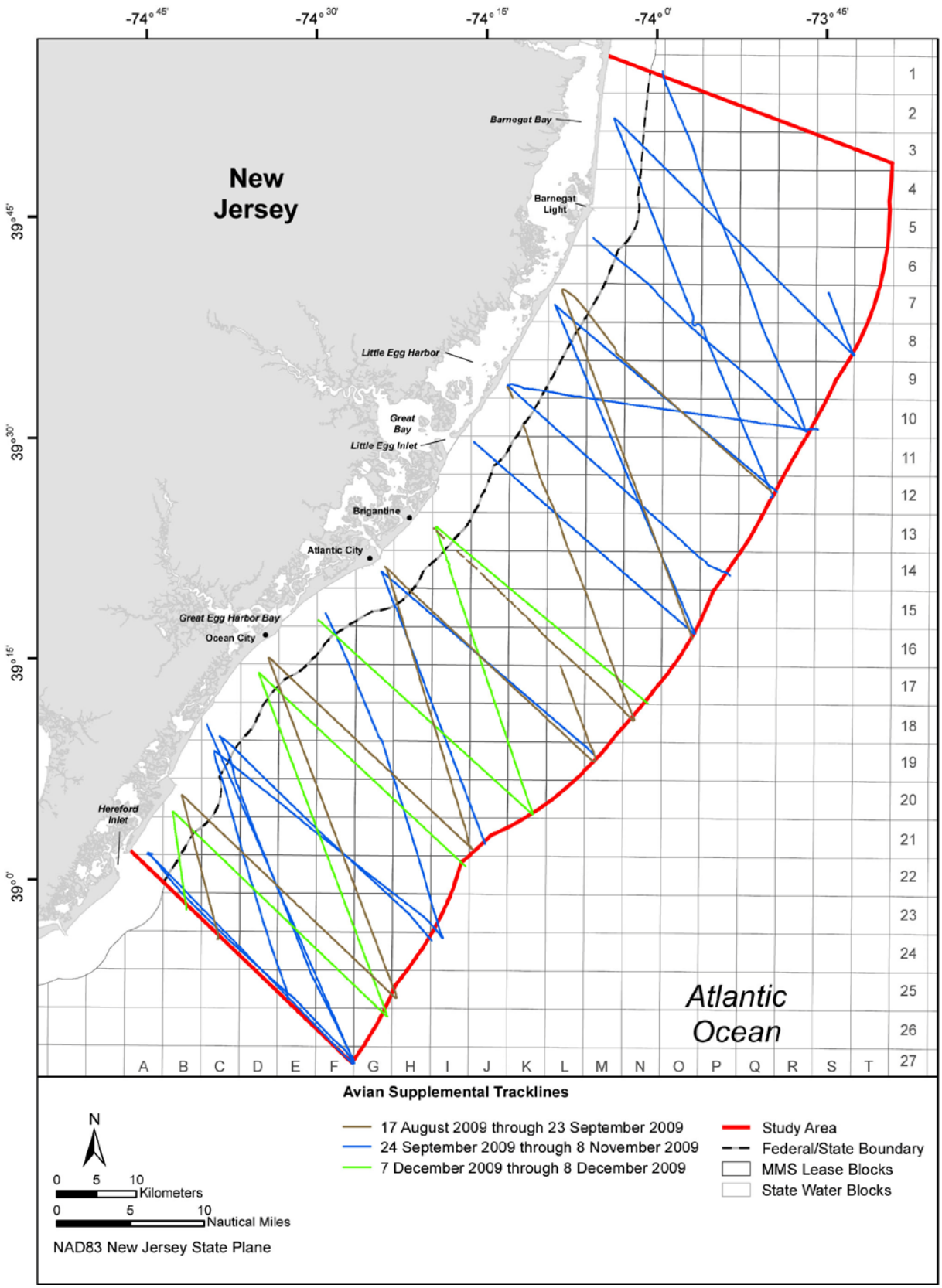

Figure 4-2. Supplemental sawtooth transect tracklines, August-December 2009.

Table 4-1. Five most numerous species, with overall total, detected on supplemental shoal and station surveys during January 2009.

Common Name	Number
Overall total (16 species)	**928**
Northern Gannet	614
Common Loon	99
Red-throated Loon	47
Black Scoter	35
White-winged Scoter	25

4.3.2 Ship Sawtooth Transect Surveys

The ten most abundant species recorded during the supplemental ship sawtooth transect surveys are presented in **Table 4-2**. For the most part, the additional survey effort conducted during this supplemental effort did not differ from the results of the regular shipboard transects during the same period; however, 237 Double-crested Cormorants were recorded during the supplemental surveys compared to only 17 during regular transects (**Appendix C: Table C-1**). This difference is due primarily to ship scheduling, as most regular transect effort in fall 2009 took place outside the period during which the bulk of Double-crested Cormorants migrate through the project area (Sibley 1997; see also **Section 4.3.2** concerning this species). Additionally, Laughing Gull comprised 19% of all birds detected on the supplemental transects and only 9% on the regular transects during the same period fall 2009 (**Appendix C: Table C-1**). These data suggest that the additional effort of offshore transects would have added materially to the understanding bird distribution and abundance, although at a finer temporal scale than intended by the scope of work.

Table 4-2. Ten most numerous species[1], with overall total and abundance, detected on supplemental sawtooth transects, August-December 2009, with standard shipboard offshore abundance for the same time period for comparison.

Common Name	Number	Supplemental Abundance[2]	Shipboard Abundance[2]
Overall total (32 species)	**2,934**	**2.10**	**1.33**
Northern Gannet	1,251	0.89	0.51
Laughing Gull	545	0.39	0.12
Double-crested Cormorant	236	0.17	0.01
Common Loon	150	0.11	0.05
Herring Gull	140	0.10	0.09
Great Black-backed Gull	123	0.09	0.07
Black Scoter	69	0.05	0.00
Scoter, dark-winged (unk.)	66	0.05	0.01
Red-throated Loon	54	0.04	0.02
Wilson's Storm-Petrel	53	0.04	0.19

[1] Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts
[2] Detected abundance = No. birds/km within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

4.3.3 Seawatch: Land-based Counts/Shipboard Transect Surveys

Land-based count efforts resulted in the detection of 31,169 migrating waterbirds of 38 species (**Table 4-3**). On shipboard transects, 3,925 migrating waterbirds of 30 species were detected. A combined total of 44 species was detected. Overall, shipboard-transect totals were only 12.6% of the land-based count totals (**Table 4-3**).

The four survey dates at Avalon spanned the time during which the bulk of the southbound waterbird migration passes the site (except for that of Double-crested Cormorant, noted above), but the two dates conducted at Barnegat Inlet both occurred after the main passage of Double-crested Cormorant and before the primary passage period of both Red-throated Loon and Northern Gannet (Sibley 1997). The three scoter species typically account for a large share of the waterbirds migrating past Avalon (Cape May Bird Observatory, unpubl. data) and, as a group, comprise the single largest portion of the annual Avalon count (Cape May Bird Observatory, unpubl. data). During our Avalon efforts, only the 09 November survey resulted in relatively high numbers of scoters; high single-day scoter counts at Avalon usually surpass 50,000 individuals (Cape May Bird Observatory, unpubl. data). Despite the relatively low numbers of scoters observed during these surveys, this group was still the most abundant, although the Northern Gannet total was the highest for a single species (**Table 4-3**). Scoters and Northern Gannet, together, accounted for nearly 68% of all birds counted at Barnegat Inlet and Avalon (**Table 4-3**).

More than 77% of all migrating individuals were within 9.26 km (5 NM) of shore; almost 61% were within 5.56 km (3 NM) of shore (**Tables 4-4** and **4-5**, **Figure 4-3**). The spike in abundance of total birds in the 11th bin is due to a single flock of 250 Double-crested Cormorants (of the 273 detected during the seawatch shipboard transect efforts). Although Double-crested Cormorant is one of the most abundant migrant waterbird species that passes through New Jersey in fall (Sibley 1997, Walsh et al. 1999), this project was scheduled to maximize species diversity. Thus, it was conducted outside the primary migration period of Double-crested Cormorant (September through mid-October (inferred from Sibley 1997), during which time few waterbird species are migrating.

Though nearly all species seen from the ship were detected throughout the width of the entire Study Area (shore to 37 km [20 NM] offshore), distribution and abundance is generally greater closer to shore and diminishes as distance from shore increased. The species or groups (scoters, Northern Gannet, Red-throated Loon, and gulls) highlighted in **Tables 4-4** and **4-5** were similar to that of all birds (**Figures 4-3** and **4-4**); however, the Common Loon's distribution and abundance was essentially even throughout the Study Area (**Figure 4-4**). The apparent peaks of abundance for Common Loon presented in **Figure 4-4** are due primarily to the combination of relatively low sample size and the occurrence of flocks of loons at nearly random locations. Its fall migration should be considered to be of a broad-front nature, rather than the coastal orientation of the migration routes of most waterbirds passing through New Jersey at that season.

Because the land-based counts and the shipboard transects were conducted concurrently, the much lower numbers of migrating waterbirds beyond 9.26 km (5 NM) relative to that inside 9.26 km can be shown to document actual occurrence. Overall, the land-based surveys yielded higher observations than offshore surveys.

Although these results are based on relatively few samples and, particularly, a small variety of seasonal and weather conditions, they do provide a clear pattern for southbound waterbird migration over New Jersey's marine waters: most fall-migrant waterbirds travel within sight distance of land. Thus, the long-running count of migrating waterbirds conducted at Avalon by the Cape May Bird Observatory and New Jersey Audubon Society is probably reasonably accurate in terms of the magnitude of the fall migration of waterbirds; however, caution is warranted, as distribution of migrating individuals of at least some species, such as Common Loon exhibit a more even dispersion in the Study Area. As the majority of individuals of such species pass Avalon out of sight of land, annual totals of actual migrants may be much larger than that provided by land-based counts. Further efforts to quantify abundance of migrant waterbirds relative to distance from land, with a larger variety of seasonal samples and of weather conditions, would allow for more accurate correlations of land-based migration counts to that of the actual magnitude of fall waterbird migration.

Table 4-3. Daily and total land-based seawatch counts in comparison with shipboard transect totals, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

	Barnegat Inlet				Avalon						Totals		
	Land-based			Shipboard Total	Land-based					Shipboard Total	Land Total	Shipboard Total	Ship % of land
Species	10/20/09	11/10/09	Total		10/22/09	11/9/09	12/2/09	12/4/09	Total				
Land-based totals	3057	9591	12648	1229	3278	9656	3730	1857	18521	2696	31169	3925	12.6%
Scoters	1456	1201	2657	236	247	6590	1007	240	8084	1599	10741	1835	17.1%
Red-throated Loon	0	128	128	5	12	755	1869	1120	3756	168	3884	173	4.5%
Common Loon	33	49	82	28	14	5	5	14	38	128	120	156	130.0%
Northern Gannet	1292	4966	6258	517	2323	1502	320	0	4145	501	10403	1018	9.8%
Gulls	0	3380	3380	142	438	433	258	221	1350	143	4730	285	6.0%

Table 4-4. Abundance of five study species/species groups relative to distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

Species/ group	All birds		Scoters		Red-throated Loon		Common Loon		Northern Gannet		Gulls	
NM from shore	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total
1	922	23.49	167	9.10	94	54.34	9	5.77	475	46.66	95	33.33
2	364	9.27	155	8.45	46	26.59	24	15.38	84	8.25	34	11.93
3	1106	28.18	934	50.90	6	3.47	6	3.85	112	11.00	35	12.28
4	459	11.69	373	20.33	8	4.62	2	1.28	50	4.91	15	5.26
5	196	4.99	98	5.34	4	2.31	7	4.49	46	4.52	21	7.37
6	55	1.40	12	0.65	3	1.73	4	2.56	31	3.05	5	1.75
7	23	0.59	0	0.00	0	0.00	7	4.49	7	0.69	6	2.11
8	33	0.84	0	0.00	0	0.00	15	9.62	10	0.98	5	1.75
9	73	1.86	28	1.53	0	0.00	5	3.21	27	2.65	8	2.81
10	56	1.43	22	1.20	5	2.89	8	5.13	15	1.47	3	1.05

Table 4-4 (*continued*). Abundance of five study species/species groups relative to distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

Species/ group	All birds		Scoters		Red-throated Loon		Common Loon		Northern Gannet		Gulls	
NM from shore	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total
11	325	8.28	33	1.80	1	0.58	5	3.21	4	0.39	9	3.16
12	39	0.99	7	0.38	0	0.00	5	3.21	20	1.96	5	1.75
13	68	1.73	0	0.00	2	1.16	11	7.05	49	4.81	5	1.75
14	23	0.59	0	0.00	0	0.00	7	4.49	8	0.79	2	0.70
15	25	0.64	0	0.00	1	0.58	17	10.90	4	0.39	3	1.05
16	21	0.54	0	0.00	0	0.00	5	3.21	13	1.28	1	0.35
17	31	0.79	1	0.05	1	0.58	7	4.49	15	1.47	7	2.46
18	34	0.87	0	0.00	0	0.00	8	5.13	14	1.38	11	3.86
19	37	0.94	0	0.00	0	0.00	2	1.28	10	0.98	13	4.56
20	35	0.89	5	0.27	2	1.16	2	1.28	24	2.36	2	0.70
Totals	**3925**	**100**	**1835**	**100**	**173**	**100**	**156**	**100**	**1018**	**100**	**285**	**100**

Table 4-5. Cumulative abundance distribution in selected spans of distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

Species/ group	All birds		Scoters		Northern Gannet		Red-throated Loon		Common Loon		Gulls	
NM from Shore	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total
1	922	23.49	167	9.10	475	46.66	94	54.34	9	5.77	95	33.33
2	1286	32.76	322	17.55	559	54.91	140	80.92	33	21.15	129	45.26
3	2392	60.94	1256	68.45	671	65.91	146	84.39	39	25.00	164	57.54
5	3047	77.63	1727	94.11	767	75.34	158	91.33	48	30.77	200	70.18
10	3287	83.75	1789	97.49	857	84.18	166	95.95	87	55.77	227	79.65
15	3767	95.97	1829	99.67	942	92.53	170	98.27	132	84.62	251	88.07
20	3925	100.00	1835	100.00	1018	100.00	173	100.00	156	100.00	285	100.00

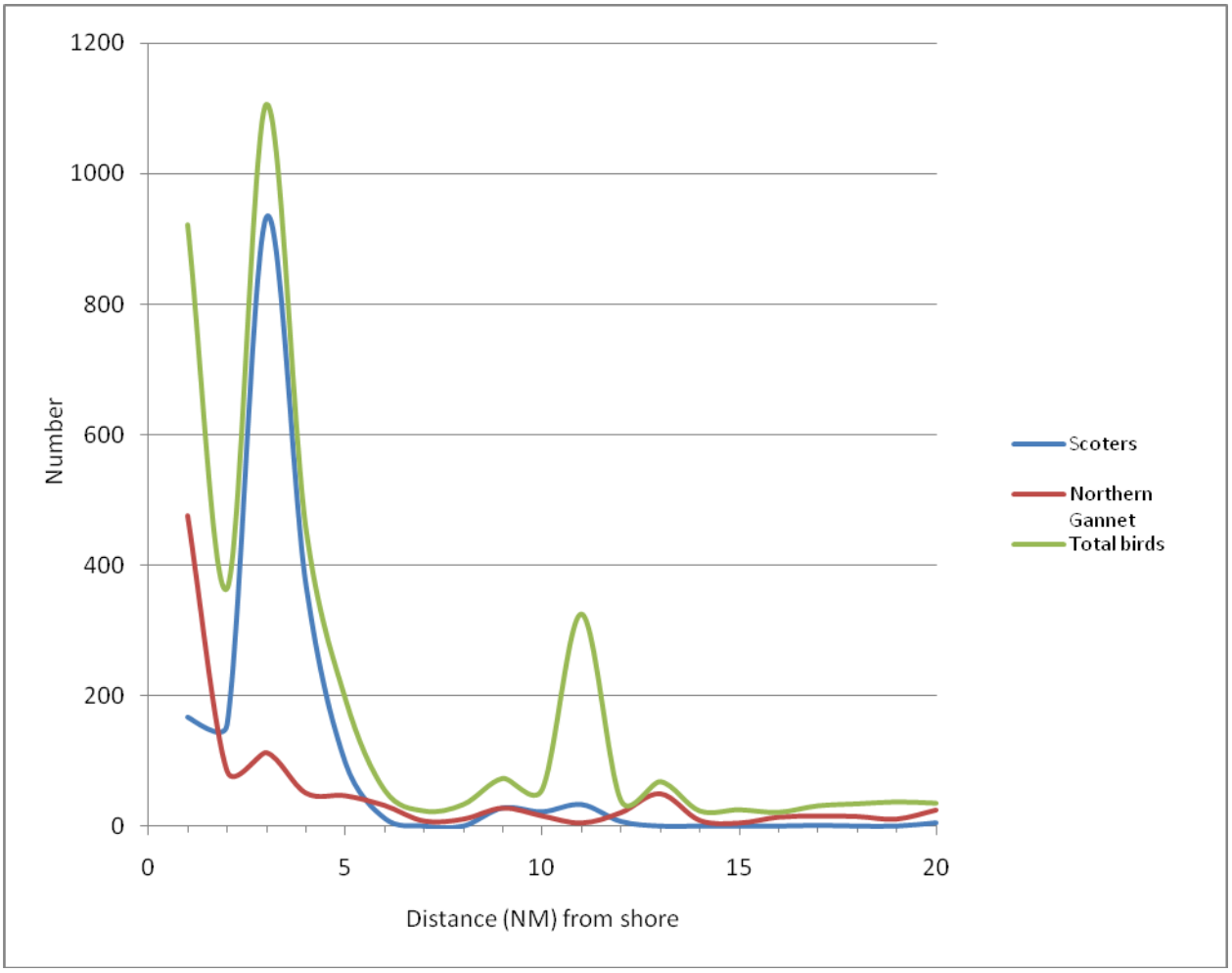

Figure 4-3. Number of individuals of all species and of scoters and Northern Gannet relative to distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

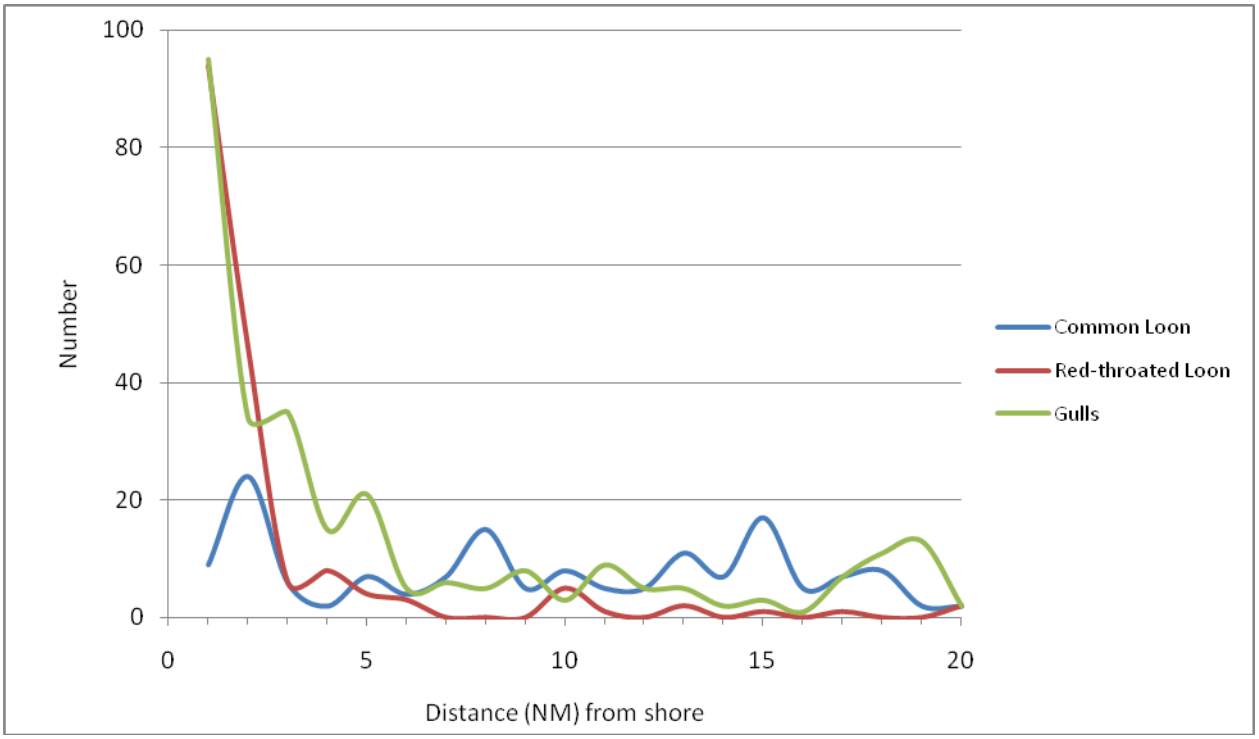

Figure 4-4. Number of individuals of Common Loon, Red-throated Loon, and all gulls relative to distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.