Biological Services Program

FWS/OBS-79/10
September 1979

Coastal Waterbird Colonies:
CAPE ELIZABETH, MAINE TO VIRGINIA

Fish and Wildlife Service
U.S. Department of the Interior

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COASTAL WATERBIRD COLONIES: CAPE ELIZABETH, MAINE TO VIRGINIA

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PREFACE

This report is one of several recounting the results of 1976-1977 surveys of nesting colonies of egrets, herons, gulls, terns, and their allies in coastal areas along portions of the U.S. Atlantic, the Great Lakes, and the northern Gulf of Mexico.

Publication of the results will aid resource managers. Moreover, the hope is that as citizens learn more about these wildlife resources, they will acquire a greater appreciation for the interrelationships among coastal processes and resources.

Any suggestions or questions regarding this report should be directed to:

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EXECUTIVE SUMMARY

This report describes colony distribution, species abundance, historical trends, nesting chronology, and census techniques for 28 species of seabirds and wading birds from Cape Elizabeth, Maine to the Virginia-North Carolina border. A parallel report has been prepared for the rocky, island bound coastal region of Maine north of Cape Elizabeth (Korschgen 1979). The location and composition of all colony sites in 1977 are depicted in an atlas (Erwin and Korschgen 1979).

From May to July, 1976 and 1977, surveys of nesting colonies were conducted by a number of teams of well-qualified field biologists. Fixed- and rotary-wing aircraft were used extensively to locate, photograph, and inventory colonies. In addition, surface (foot, boat) censuses of nests and/or adults were made at many colonies and compared with aerial estimates. Standardized data forms with census instructions were provided to all participants.

A total of 240,982 pairs of waterbirds was recorded at 512 colonies in 1977. Herring (75,709 pairs) and laughing gulls (64,662) and common terns (26,905), respectively, were the 3 most abundant of the 17 seabird species. The least abundant species were those at the limits of their breeding ranges (the nearctic black guillemots and common eiders, and southern sandwich and Caspian terns). The most abundant of the 11 wading bird species were snowy egrets (10,148 pairs), black-crowned night herons (9,009), and cattle egrets (6,515). Green herons and white ibises were the most rare.

For the 10 coastal States, Virginia (54,423 pairs), New Jersey (53,389), and Massachusetts (42,488) harbored the greatest numbers of nesting birds, respectively, while Connecticut (5,467) and New Hampshire (465) had the fewest. Relative abundance of waterbirds is positively correlated with wetland area, a crude measure of both feeding and nesting habitat. Most nesting colonies are located on barrier, marsh, or coastal islands. In the highly-developed coastal areas of New Jersey, Delaware, and Long Island, New York, a number of beach- and dune-nesting seabird species (herring gulls, terns, black skimmers) have shifted from their traditional beach habitat to marsh or dredged material islands in adjacent embayments.

Analysis of census techniques indicated that, in general, aerial methods are best for locating colonies, photography, and, under some conditions for estimating adults. Helicopters are considered to be more useful than fixed-wing aircraft because of their slow speed and ability to hover and land in small open areas. Cost factors, however, must be balanced with efficiency. A total nest count is the most accurate method of assessing populations, but may be disruptive to colonies and costly in terms of time and personnel. As an alternative, nest counts can be taken at a number of sample colonies and used to generate conversion factors to be applied to aerial estimates from other colonies. Regression analysis of adult estimates versus nest counts indicated both marked variation among species and among censuses for a given species. This variation is attributable mainly to colony differences in vegetation density, adult attendance (due to time, tidal and climatic influences), and observer. In general, aerial counts often underestimate gulls and wading birds.

Examination of historical nesting records (1900-1975) in each State revealed trends for many species. At the beginning of the century, breeding populations of many species had been reduced or extirpated in many coastal regions because of the millinery trade and egg collecting. With the protection of Federal laws, most species have recovered all of their former breeding range. Herring and great black-backed gulls have not only recovered, but have expanded their ranges into the Carolinas. There is some evidence of recent herring gull declines in New England, but numbers are rapidly increasing from New Jersey south. Numbers of Arctic, roseate, and common terns are decreasing in New England, with the latter two species also showing a recent reduction on Long Island. Where human encroachment has altered barrier island dunes and beaches most tern, gull, and black skimmer colonies have moved to marsh and dredge deposition islands. Despite this human pressure on beaches, the least tern appears to be stable in most areas, except Rhode Island. Cormorants are increasing throughout New England after years of persecution by fishermen. On Penikese Island, Leach's storm-petrels persist (the only colony in the study area) and common eiders recently have nested following introduction. Information on wading birds is limited but in general, all species have increased and expanded their ranges northward over the past 10-20 years. Numbers of snowy and cattle egrets and glossy ibises have increased rapidly. Black-crowned night herons seem to have increased in some States after earlier declines associated with pesticide contamination. One pair of white ibises bred in Virginia in 1977, a new breeding record for the northeast. Although great blue herons nest inland from Maine to Virginia, the only major coastal colonies that remain from earlier years occur along the Chesapeake Bay (note: Coastal colonies are also numerous in Maine north of Portland).

For many species, nesting chronology varies from year to year and even from colony to colony. Most wading birds arrive in the northeast and nest earlier than seabirds. Great blue herons, black-crowned night herons, and great egrets initiate nesting often as early as late February and March. In contrast, cattle egrets are usually last with egg-laying often not occurring until June. The large gulls nest earlier than terns, sometimes usurping former tern nesting sites. Climatic influences such as cold, storms, floods, etc., often result in renesting which prolongs the nesting period and causes substantial yearly variation in both reproductive timing and success. In most years, May and June are the months of peak nesting activity for almost all waterbird species in the mid-Atlantic States.

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ABSTRACT

In 1976 and 1977, seabird and wading bird nesting colonies were inventoried along the northeast U.S. coast from Cape Elizabeth, Maine to the Virginia-North Carolina border as part of a study conducted by the Massachusetts Cooperative Wildlife Research Unit. A parallel study was conducted for the rocky, island bound coastal region of Maine north of Cape Elizabeth (Korschgen 1979). Colonies were surveyed and censused from March to July by teams of highly-qualified field biologists using aerial and ground-based methods.

A total of about 240,982 pairs of waterbirds (28 species) nested at 512 colonies in 1977. The most abundant species, in order, were herring gulls, laughing gulls, common terns, great black-backed gulls, snowy egrets, and black-crowned night herons. Virginia and New Jersey harbored the largest populations of waterbirds and also had the greatest area of coastal wetland habitat. Wading birds usually arrive on the breeding ground and begin nesting as early as late February and March, much earlier than most seabirds which usually arrive in April (gulls) or May (terns). Substantial colony and yearly variation exists in nesting chronology, but usually most waterbird young have fledged by August.

Evaluation of census techniques suggested that helicopters were the most useful way to inventory colonies over this large region but were costly on a per-hour basis. When aerial methods are employed, nest counts are required in a number of "sample" colonies to establish an adult-to-nest ratio. This ratio can then be applied to "correct" aerial estimates of adult numbers at other colonies. For some conspicuous species such as double-crested cormorants, great blue herons, great egrets, royal terns, and black skimmers, aerial photography can be effectively used to count nesting adults.

Historical nesting information indicated that most waterbird populations had recovered from near extirpation caused by hunting in the 1800's. While populations of cormorants, herring and great black-backed gulls, cattle and snowy egrets and glossy ibises are increasing, marked declines of Arctic, roseate, and common terns have been documented in New England and New York. Habitat alteration by oceanfront development, pollution, and competition with more aggressive gull species for suitable colony sites are probably causally related to this reduction.

Because many colonies are located on land which is vulnerable to recreation and development pressures, careful monitoring and protection of nesting waterbirds should be implemented.

In addition to this report, an atlas has been prepared to include location and nesting data for all waterbird colonies inventoried in 1977 from the Maine-Canada border to Virginia (Erwin and Korschgen 1979). The atlas is comprised of a series of maps showing individual colony sites and each map is accompanied by a set of Tables with details of the nesting species and characteristics of the colony sites.

KEY WORDS

Coastal
Nesting colonies
Seabirds
Wading birds
Waterbirds
Northeast
Maine
New Hampshire
Massachusetts
Rhode Island
Connecticut
New York
New Jersey
Delaware
Maryland
Virginia
Helicopter
Survey
Inventory
Census
Chronology
Populations
Habitat
Protection
Barrier islands
Cormorants
Gulls
Terns
Skimmers
Herons
Egrets
Ibises

INTRODUCTION

Colonial waterbirds are a conspicuous and significant part of the coastal environment. Even so, little effort has been made to evaluate present breeding waterbird populations on a regional level and to compare these with historical population levels. This report increases our knowledge about nesting chronology, present abundance, population trends, and colony distribution for 28 species of gulls, terns, skimmers, cormorants, herons, egrets, ibises, and eiders along the northeastern U.S. coast (Table 1). This report accompanies an atlas that includes locations of all colonies and Tables showing the results of the 1977 inventory (Erwin and Korschgen 1979).

The study objectives were to: 1) inventory nesting waterbird colonies in 1976 and 1977, 2) evaluate survey and census methods, 3) examine historical nesting records (1900 to present), 4) describe nesting chronology, 5) make management recommendations for the conservation and protection of nesting colonies.

Table 1. Colonial waterbirds nesting during 1976-1977, southern Maine to Virginia.

Common name	Scientific name
Leach's storm-petrel	Oceanodroma leucorhoa
Double-crested cormorant	Phalacrocorax auritus
Great blue heron	Ardea herodias
Green heron	Butorides striatus
Little blue heron	Florida caerulea
Cattle egret	Bubulcus ibis
Great egret	Casmerodius albus
Snowy egret	Egretta thula
Louisiana heron	Hydranassa tricolor
Black-crowned night heron	Nycticorax nycticorax
Yellow-crowned night heron	Nyctanassa violacea
Glossy ibis	Plegadis falcinellus
White ibis	Eudocimus albus
Common eider	Somateria mollissima
Great black-backed gull	Larus marinus
Herring gull	Larus argentatus
Laughing gull	Larus atricilla
Gull-billed tern	Gelochelidon nilotica
Forster's tern	Sterna forsteri
Common tern	Sterna hirundo
Arctic tern	Sterna paradisaea
Roseate tern	Sterna dougallii
Least tern	Sterna albifrons
Royal tern	Sterna maxima
Sandwich tern	Sterna sandvicensis
Caspian tern	Sterna caspia
Black skimmer	Rynchops niger
Black guillemot	Cepphus grylle

COLONIAL WATERBIRD INVENTORY RESULTS - 1977

BREEDING ABUNDANCE

The results from all aerial and ground inventories conducted in 1977 are summarized in Tables 2 through 13. Table 2 shows the order of abundance for all seabirds and wading birds for the entire study area (southern Maine to the Virginia-North Carolina border). Table 3 summarizes nesting populations of the two major waterbird groups in each of the 10 States. Subsequent tables show by State the species nesting in 1977, the numbers of colonies, total pairs, and mean colony sizes.

The three species of gulls rank 1, 2, and 4 in seabird abundance along the northeast coast (Table 2). This is somewhat expected considering their opportunistic feeding habits, physical dominance of smaller seabirds, and (at least for herring gulls), plasticity in nest and colony site selection (Burger 1977). The laughing gull is much more restricted to its nesting habitat than the other two gulls, and concentrates in the salt marshes of southern New Jersey and along the eastern shore of Virginia. Only at small, scattered colonies in Maine and Massachusetts does the laughing gull nest at upland sites. Their current northern populations are a mere remnant of those present in the 1800's in New York (Bent 1963a, Griscom 1923) and during the early 1900's in Massachusetts (Nisbet 1971a, b).

The small number of Arctic, gull-billed, sandwich, and Caspian terns, Leach's storm-petrels, black guillemots, and common eiders were found because they are near range limits, i.e., petrels, eiders, guillemots, and Arctic terns are nearctic species and are more abundant in northern Maine and Canada, while the other species are much more common along the Gulf of Mexico and/or South Atlantic coasts.

Snowy egrets and black-crowned night herons are the most abundant and widely-distributed of the wading birds. Interestingly, the two recent invading species (cattle egret and glossy ibis) are the next most numerous. Cattle egrets, however, are only common in colonies south of New York. Green herons are much more numerous than indicated in the Table, since only those pairs found in mixed-species heronries are reported. They often nest in small groups or as solitary pairs along the entire coast. The white ibis appears to be expanding its range northward and a pair nested for the first time at Fishermans Island, Virginia in 1977 (P. Frohring pers. comm.).

State totals of nesting seabirds and wading birds show that Virginia and New Jersey harbor the largest numbers (Table 3), but the relative numbers (density per unit of wetland) are greatest in Rhode Island, New York, and Massachusetts, respectively (Figure 1). Further study is required to determine if these density differences result from nesting habitat and/or food availability differences among States.

Wading birds comprise the larger proportion of waterbird abundance in the more southern States (Figure 1), probably because of the correlation between wading bird abundance and wetland area (Tables 14 and 15, Custer and Osborn 1977). Most wading birds feed predominantly in coastal marshes, pools, and tidal flats; thus, their density is expected to be more closely correlated

Table 2. Total nesting pairs and number of colonies of colonial waterbirds in 1977, southern Maine to Virginia.

Species	Number of nesting pairs	Colonies[a]
Seabirds		
Herring gull	75,709	212
Laughing gull	64,662	57
Common tern	26,905	186
Great black-backed gull	10,838	149
Least tern	7,616	118
Royal tern	4,734	3
Black skimmer	4,247	48
Double-crested cormorant	2,676	18
Roseate tern	2,278	24
Forster's tern	2,078	34
Gull-billed tern	124	6
Arctic tern	73	7
Leach's storm-petrel	20	1
Sandwich tern	5	1
Black guillemot	3	1
Caspian tern	1	1
Common eider	1	1
Wading birds		
Snowy egret	10,148	84
Black-crowned night heron	9,009	93
Cattle egret	6,515	25
Glossy ibis	5,491	62
Great blue heron	2,653	20
Great egret	2,474	59
Little blue heron	1,213	43
Louisiana heron	1,166	36
Yellow-crowned night heron	256	33
Green heron[b]	86	21
White ibis	1	1
Total	240,982	

[a] Includes all colonies at which no estimates were made.

[b] Incomplete census.

Table 3. Nesting populations of seabirds and wading birds, by States, 1977.

State	Seabirds	Wading birds	Total pairs
Virginia	46,731	7,692	54,423
New Jersey	44,676	8,713	53,389
Massachusetts	39,922	2,566	42,488
New York	33,619	4,247	37,866
Maryland	9,535	6,844	16,379
Maine[a]	14,097	202	14,299
Rhode Island	7,193	1,026	8,219
Delaware	771	7,216	7,987
Connecticut	4,961	506	5,467
New Hampshire	465	0	465
Totals	201,970	39,012	240,982

[a] From Cape Elizabeth, Maine south.

Table 4. Waterbird nesting populations in Maine (south of Cape Elizabeth), 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Double-crested cormorant	5	827	165	152
Little blue heron	2	4	2	2
Snowy egret	3	84	28	22
Louisiana heron	1	1	1	-
Black-crowned night heron	4	38	9	8
Glossy ibis	3	75	25	11
Great black-backed gull	16	3,280	205	296
Herring gull	17	9,751	574	633
Common tern	2	197	98	76
Roseate tern	1	25	25	-
Least tern	1	14	14	-
Black guillemot	1	3	3	-

Table 5. Waterbird nesting populations in New Hampshire, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Double-crested cormorant	1	24	24	0
Great black-backed gull	2	91	45	43
Herring gull	3[a]	350	175	71

[a]Includes one site at which species may breed but for which an estimate is not available.

Table 6. Waterbird nesting populations in Massachusetts, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Leach's storm-petrel[a]	1	20+	20	-
Double-crested cormorant	11	1,760	160	144
Green heron	1	1	1	-
Little blue heron	4	19	4	1
Cattle egret	1	10	10	-
Great egret	3	6	2	2
Snowy egret	12	459	38	60
Louisiana heron	1	1	1	-
Black-crowned night heron	14	1,958	140	169
Glossy ibis	3[b]	112	56	72
Common eider[c]	1	1+	1	-
Great black-backed gull	50	4,670	93	171
Herring gull	61	25,845	424	739
Laughing gull	1	200	200	-
Common tern	30	4,475	149	388
Arctic tern	7	73	10	13
Roseate tern	6	1,327	221	368
Least tern	32	1,551	48	63

[a] Based on previous years' estimates.

[b] Includes one colony site at which the species may breed but for which no estimate is available.

[c] Probably an introduced pair.

Table 7. Waterbird nesting populations in Rhode Island, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Green heron	2	2	1	0
Little blue heron	2[a]	35	35	-
Cattle egret	1	110	110	-
Great egret	2[a]	22	22	-
Snowy egret	2[a]	180	180	-
Black-crowned night heron	4	517	129	215
Glossy ibis	1	160	160	-
Great black-backed gull	14[b]	540	45	60
Herring gull	15	6,016	401	639
Common tern	22[b]	589	29	24
Roseate tern	5[c]	1	1	-
Least tern	4[a]	47	16	19

[a] Includes one colony site at which the species may breed but for which no estimate is available.

[b] Includes 2 colony sites at which the species may breed but for which no estimates are available.

[c] Includes 4 colony sites at which the species may breed but for which no estimates are available.

Table 8. Waterbird nesting populations in Connecticut, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Green heron	2	15	8	4
Little blue heron	1	1	1	-
Cattle egret	1	4	4	-
Great egret	1	20	20	-
Snowy egret	1	50	50	-
Black-crowned night heron	2	406	203	279
Yellow-crowned night heron	1[a]	-	-	-
Glossy ibis	1	10	10	-
Great black-backed gull	13	164	13	16
Herring gull	30	3,134	104	334
Common tern	11	1,479	134	322
Roseate tern	3	64	21	25
Least tern	4[a]	120	40	9

[a] Includes one colony site at which the species may breed but for which no estimate is available.

Table 9. Waterbird nesting populations in New York (Long Island), 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Double-crested cormorant	1	65	65	-
Green heron	3	3	1	0
Little blue heron	6[a]	13	3	2
Cattle egret	1	15	15	-
Great egret	14	317	22	36
Snowy egret	17	1,416	83	75
Louisiana heron	5[b]	10	2	1
Black-crowned night heron	19	1,534	81	51
Yellow-crowned night heron	5	22	4	4
Glossy ibis	15	917	61	94
Great black-backed gull	26	1,894	73	231
Herring gull	31	17,459	563	855
Common tern	38	10,014	263	500
Roseate tern	9	861	96	264
Least tern	36	2,884	80	139
Black skimmer	9	442	49	57

[a] Includes two colony sites at which the species may breed but for which no estimates are available.

[b] Includes one colony site at which the species may breed but for which no estimate is available.

Table 10. Waterbird nesting populations in New Jersey, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Great blue heron	1	3	3	-
Green heron	4	14	4	4
Little blue heron	17[a]	246	15	20
Cattle egret	7	565	81	84
Great egret	17[a]	488	30	68
Snowy egret	24	2,783	116	175
Louisiana heron	11	178	16	17
Black-crowned night heron	26	1,453	56	73
Yellow-crowned night heron	16[a]	139	9	11
Glossy ibis	19	2,844	149	263
Great black-backed gull	22	144	7	6
Herring gull	34	5,913	174	329
Laughing gull	25	30,940	1,238	2,273
Gull-billed tern	4	19	5	3
Forster's tern	6	463	77	86
Common tern	44	4,462	101	181
Least tern	19	1,786	94	95
Black skimmer	13	949	73	121

[a] Includes one colony site at which the species may breed but for which no estimate is available.

Table 11. Waterbird nesting populations in Delaware, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Great blue heron	3	174	58	74
Green heron	1	2	2	-
Little blue heron	1	600	600	-
Cattle egret	1	4,000	4,000	-
Great egret	1	250	250	-
Snowy egret	1	1,000	1,000	-
Louisiana heron	1	50	50	-
Black-crowned night heron	1	400	400	-
Yellow-crowned night heron	1	40	40	-
Glossy ibis	1	700	700	-
Herring gull	1	31	31	-
Laughing gull	1	96	96	-
Common tern	6	451	75	68
Least tern	4	166	41	35
Black skimmer	4	27	7	4

Table 12. Waterbird nesting populations in Maryland, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Great blue heron	14	1,883	135	130
Green heron	3	28	9	6
Little blue heron	2	102	51	8
Cattle egret	6	1,325	221	364
Great egret	12	830	69	96
Snowy egret	11	1,332	121	105
Louisiana heron	5	204	41	11
Black-crowned night heron	11	966	88	104
Yellow-crowned night heron	6	37	6	5
Glossy ibis	7	137	20	20
Great black-backed gull	4	33	8	11
Herring gull	10	4,586	459	997
Laughing gull	2	2,229	1,114	1,365
Forster's tern	7	520	74	70
Common tern	11	1,682	153	129
Least tern	2	209	104	64
Royal tern	2	134	67	75
Black skimmer	3	142	47	63

Table 13. Waterbird nesting populations in Virginia, 1977.

Species	No. colonies	Total breeding pairs	Mean colony size	Standard deviation
Great blue heron	2	593	296	175
Green heron	5	21	4	4
Little blue heron	8	193	24	17
Cattle egret	7	486	69	31
Great egret	10	541	54	48
Snowy egret	13	2,844	219	192
Louisiana heron	12[a]	722	66	58
Black-crowned night heron	12	1,737	145	262
Yellow-crowned night heron	4	18	4	1
Glossy ibis	12	536	45	37
White ibis	1	1	1	-
Great black-backed gull	2	22	11	7
Herring gull	10	2,624	262	428
Laughing gull	28	31,197	1,114	1,108
Gull-billed tern	2	105	52	53
Forster's tern	21	1,095	52	34
Common tern	22	3,556	162	176
Least tern	16	839	52	51
Royal tern	1	4,600	4,600	-
Sandwich tern	1	5	5	-
Caspian tern	1	1	1	-
Black skimmer	19	2,687	141	153

[a] Includes one colony site at which the species may breed but for which no estimate is available.

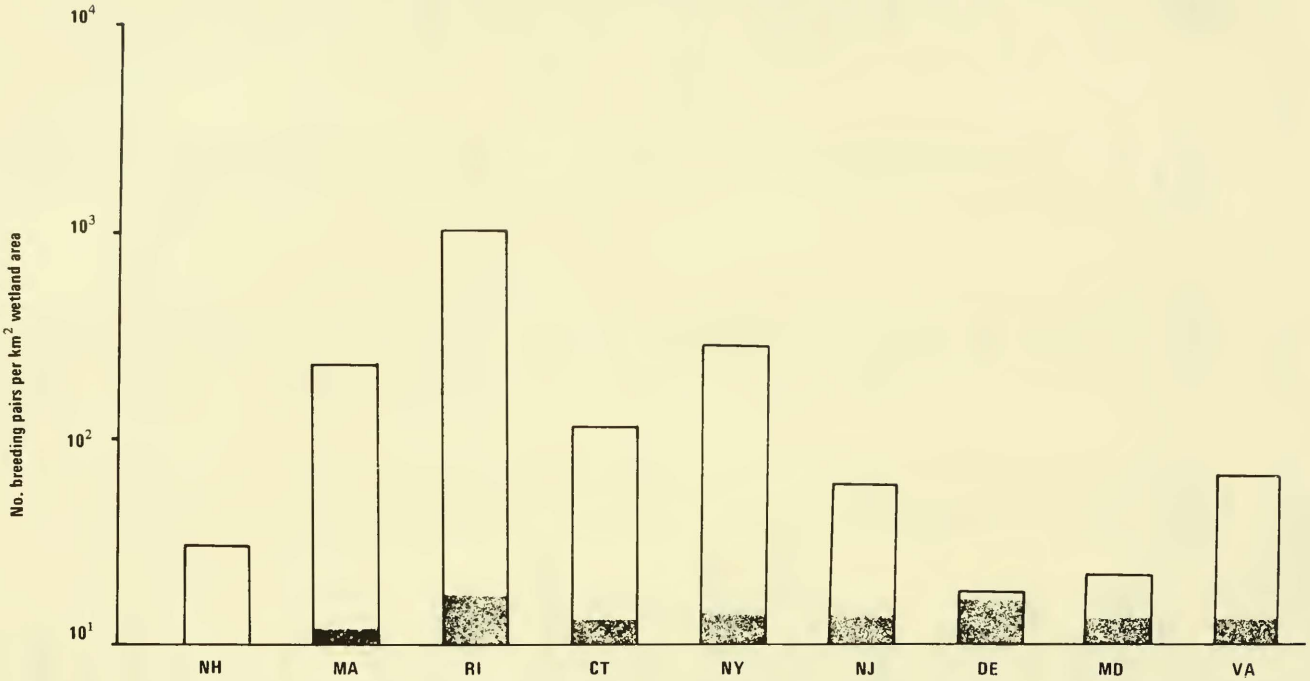

Figure 1. Nesting densities of waterbirds in nine northeastern States relative to wetland area. Open bars = seabirds; shaded areas = wading birds.

Table 14. Rank order of 10 northeast States in waterbird nesting population size, wetland area[a], and coastline length.

Rank in waterbird numbers	Rank in seabird numbers only	Rank in wader numbers only	Rank in wetland area[b] (Km^2)	Rank in coastline length[b] (Km)
1 VA	VA	NJ	NJ (873)	MD (3,088)
2 NJ	NJ	VA	VA (798)	MA (1,920)
3 MA	MA	DE	MD (744)	VA (1,600)
4 NY	NY	MD	DE (443)	NY (677)
5 MD	ME	NY	MA (181)	RI (544)
6 ME	MD	MA	NY (131)	CT (432)
7 RI	RI	RI	CT (47)	NJ (368)
8 DE	CT	CT	NH (15)	DE (170)
9 CT	DE	ME	RI (8)	NH (26)
10 NH	NH	NH		

[a] Data from Spinner 1969.

[b] Wetland area and coastline data not available for the southern section of Maine.

Table 15. Correlation measures[a] between nesting waterbird numbers, wetland area[b], and coastline length[c] in nine northeastern States (Maine excluded).

Species	Correlation	
	Numbers vs. wetland area	Numbers vs. coastline length
All species	r = 0.72*	r = 0.57
All seabirds	r = 0.67*	r = 0.60*
All wading birds	r = 0.93**	r = 0.32
Herring gull	r = -0.1	r = 0.57
Common tern	r = 0.43	r = 0.62*
Least tern	r = 0.63*	r = 0.45
Black skimmer[d]	r = 0.60	r = 0.20
Snowy egret	r = 0.85**	r = 0.33
Black-crowned night heron	r = 0.47	r = 0.75*

[a] All r values listed are from Spearman Rank tests, a non-parametric correlation method; * = $P < 0.05$, ** = $P < 0.01$.

[b] Wetland areas, in Km^2, from Spinner (1969).

[c] Coastal length in Km.

[d] Nesting occurred in only the five States from New York to Virginia.

with wetland area than is the density of seabirds which feed on land (gulls) and the pelagic zone in addition to marsh and bay areas. Nonetheless, waterbirds as a group show significant correlations between numerical abundance and wetland area. Coastline length, used as another index of "coastal space", was poorly correlated with waterbird abundance (Table 15).

Correlations of nesting abundance with wetland area and coastline were examined for six widely-distributed species of seabirds and wading birds (Table 15). An a posteriori prediction was that the abundance of the marsh-feeding species would show higher correlation with wetland area than the more "generalist" feeders. The expectation was only partly supported. Of the seabirds, only least terns showed a significant correlation between abundance and wetland area. This species is strictly an inshore-feeder, fishing mostly in inlets and marsh shallows (Erwin 1978). The other inshore-feeder, the black skimmer, did not show a significant correlation, although only five States were compared. Of the wading birds, snowy egret numbers were highly correlated with wetland area, but black-crowned night heron abundance only showed a correlation with coastline length. Snowy egrets seem to be more dependent upon marsh-dwelling aquatic organisms than black-crowns which prey upon birds, rodents, reptiles, etc. (Kushlan 1977). Similarly, Custer and Osborn (1977) found that the abundance of the three species which feed nearly exclusively in coastal salt marshes (great and snowy egrets, Louisiana herons) was significantly correlated with wetland area. The species which were less "specialized" or fed in fresh-water areas (black-crowns, cattle egrets, little blue herons) showed no correlation between abundance and wetland area per State. The herring gull showed the lowest correlation coefficient with wetland area. The herring gull's omnivorous and refuse-feeding habits have probably emancipated it from a dependence upon food produced in coastal wetlands.

To make the above comparisons more meaningful, it would be useful to have measures of nesting habitat availability and human disturbance. Although attempts to determine breeding habitat availability have been made (Burger and Lesser 1977), there is a problem in assessing "suitability" from a human as opposed to a bird perspective. "Wetland area" is a composite of feeding, nesting, and resting habitats and nesting abundance may be a complex function of these interdependent variables.

The locations of major waterbird colonies along the northeast coast are shown on State coastal maps (Figures 2-10). These maps indicate waterbird "hot spots" and may provide impetus and direction for further research and for local and regional protection and management.

Comparisons of mean colony sizes by States were made for several of the more widely-distributed species (Table 16). The mean colony size varies considerably for most species. Herring gulls nest in more widely-distributed, larger colonies in southern Maine, Massachusetts, and Rhode Island than in States from New Jersey south. However, this gull is still increasing south of New York and, in time, may show similar colony size distribution throughout its range. Common and least terns generally nest in many scattered colonies but, roseate terns nest at only a few locations. Therefore, local disturbance or environmental degradation could have a serious impact upon the roseate tern population as a whole. A species with many breeding populations, or demes, will be better buffered against extirpation than one which is confined to a few locations (Buckley and Buckley 1977).

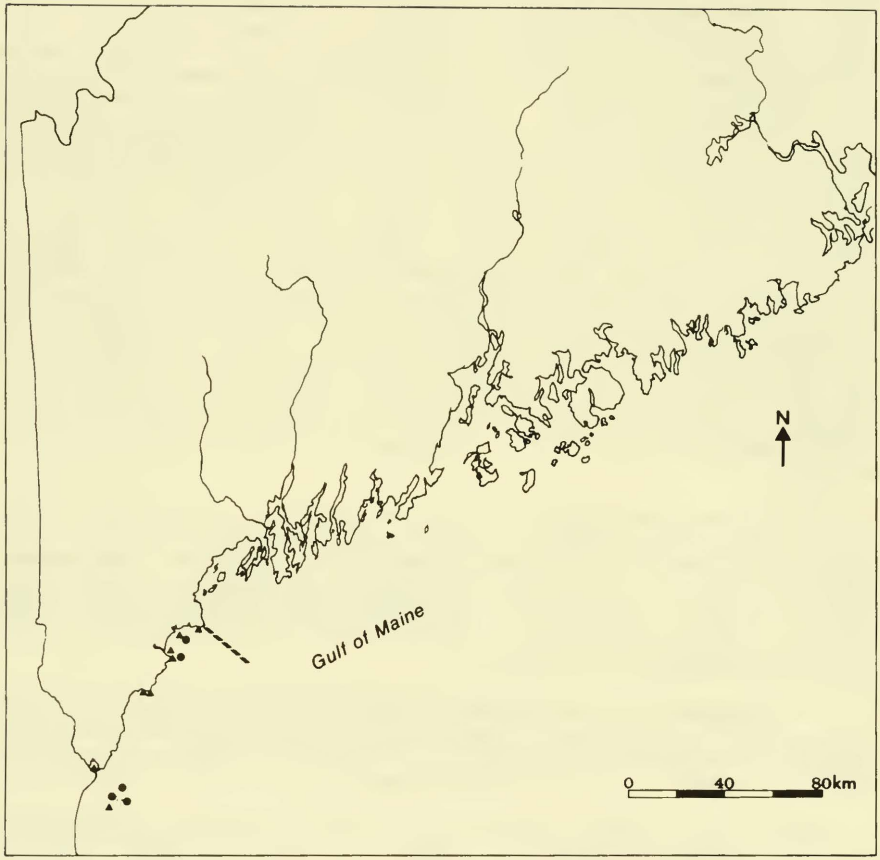

Figure 2. Location of major nesting colonies in southern Maine and New Hampshire, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

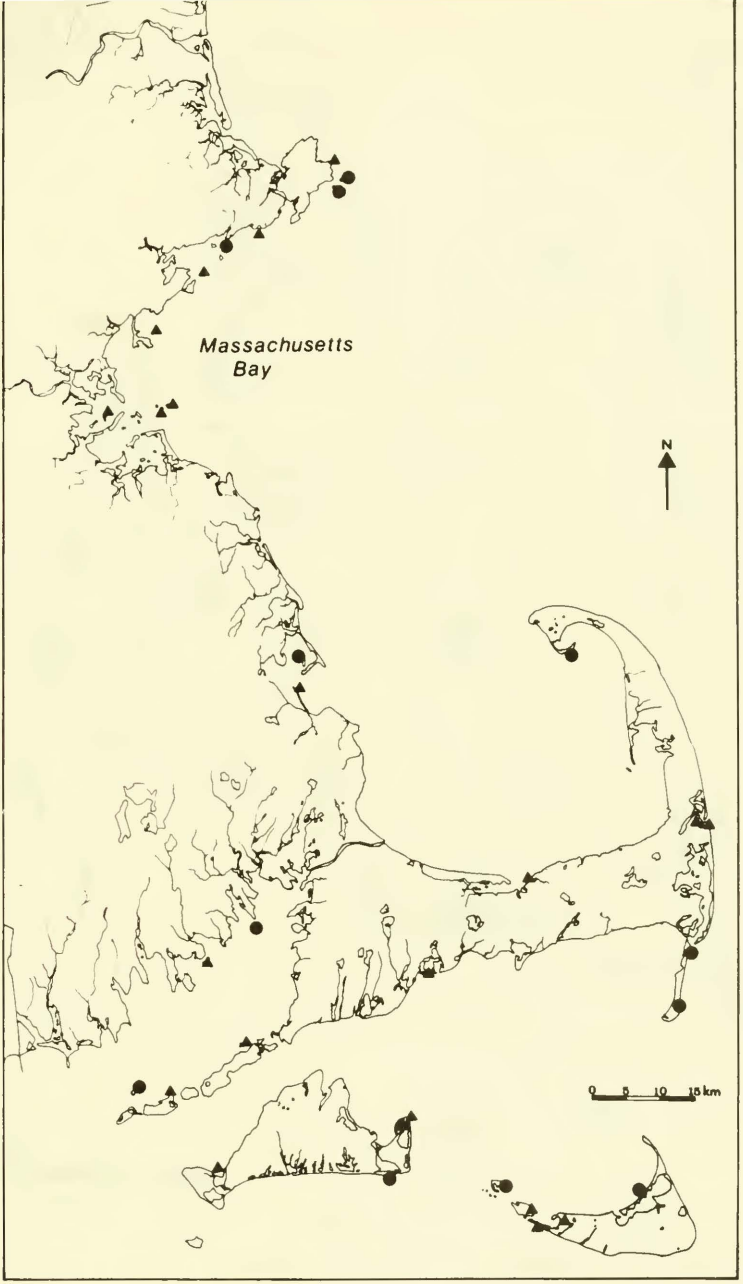

Figure 3. Location of major nesting colonies in Massachusetts, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

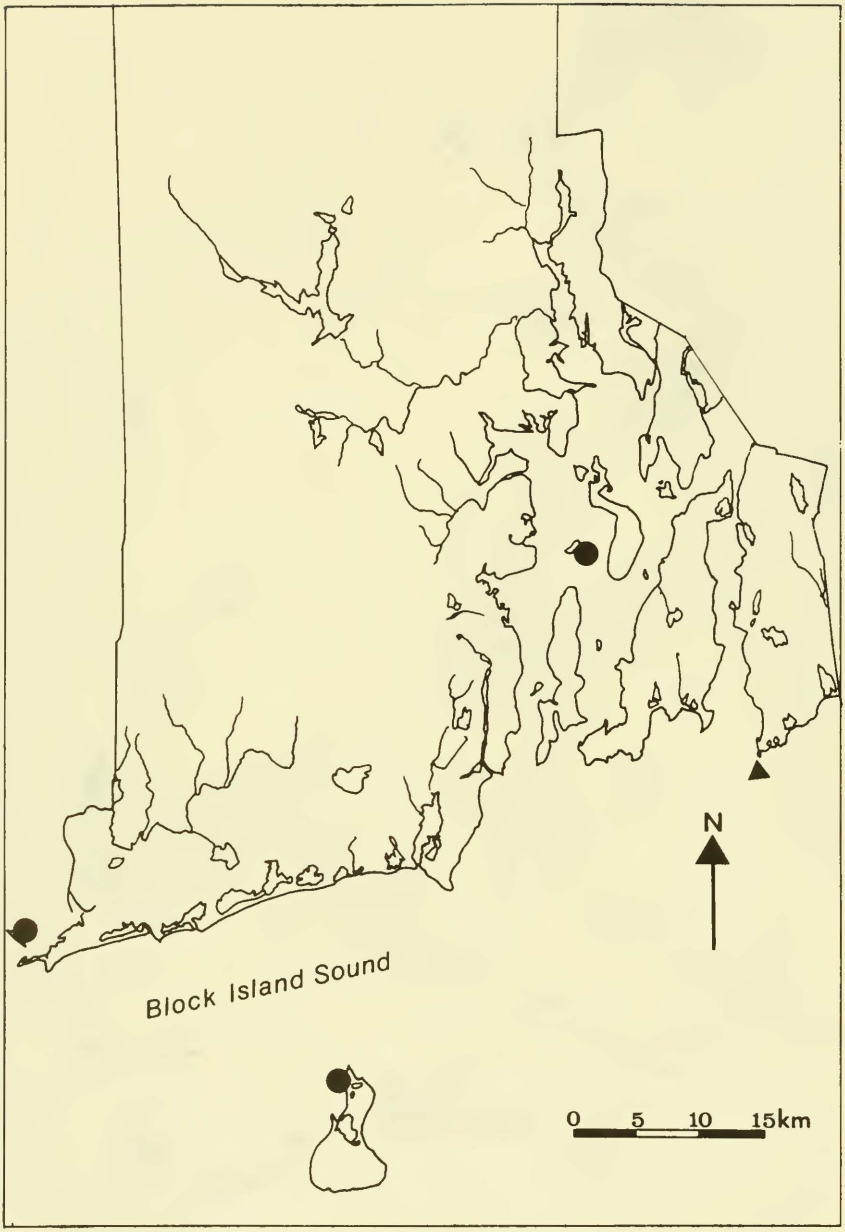

Figure 4. Location of major nesting colonies in Rhode Island, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

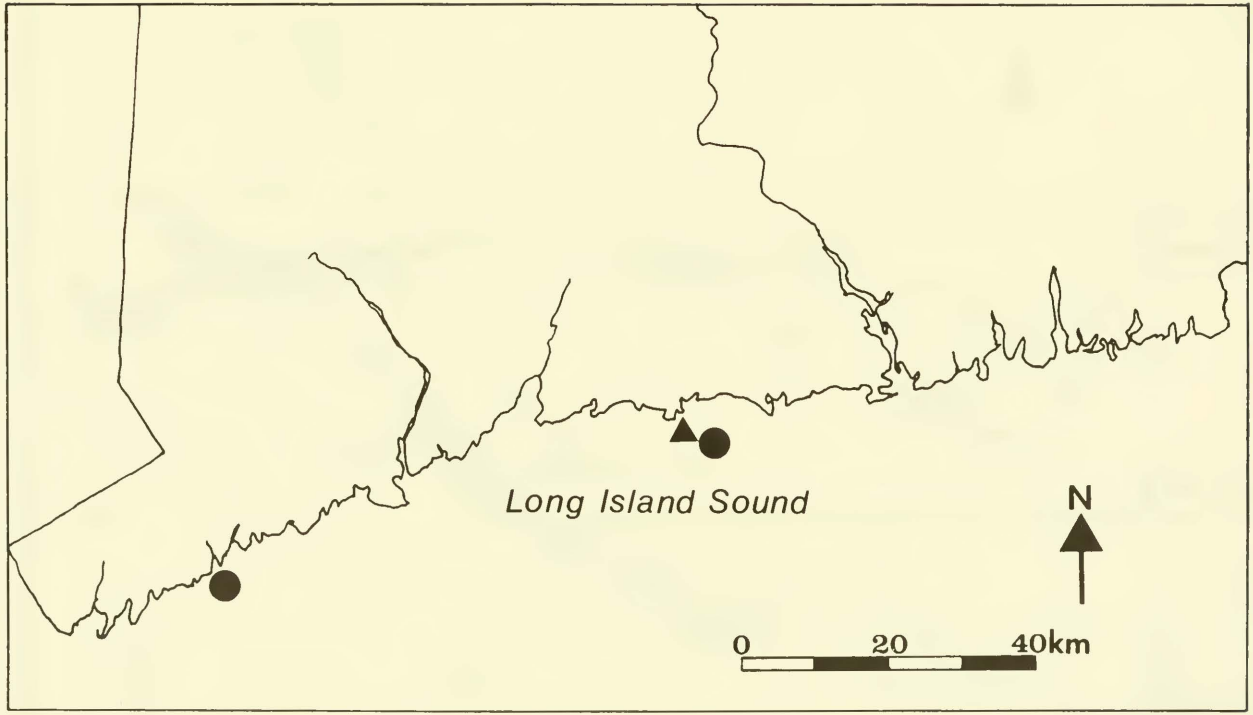

Figure 5. Location of major nesting colonies in Connecticut, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

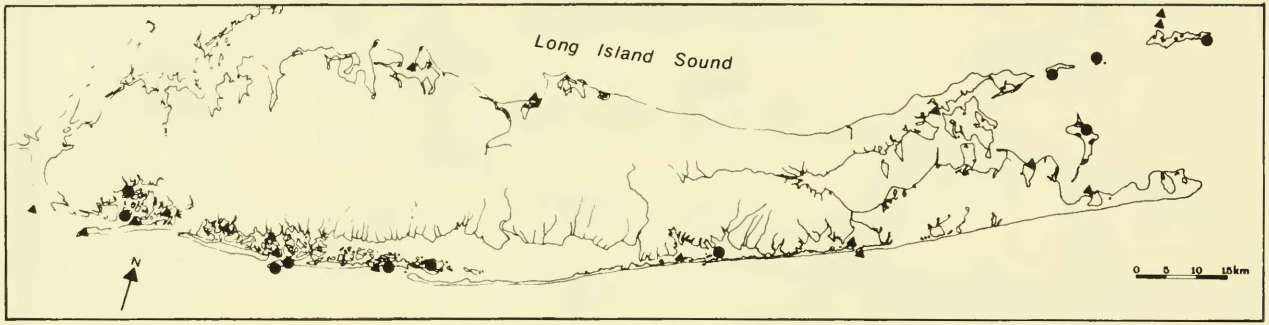

Figure 6. Location of major nesting colonies in Long Island, New York, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

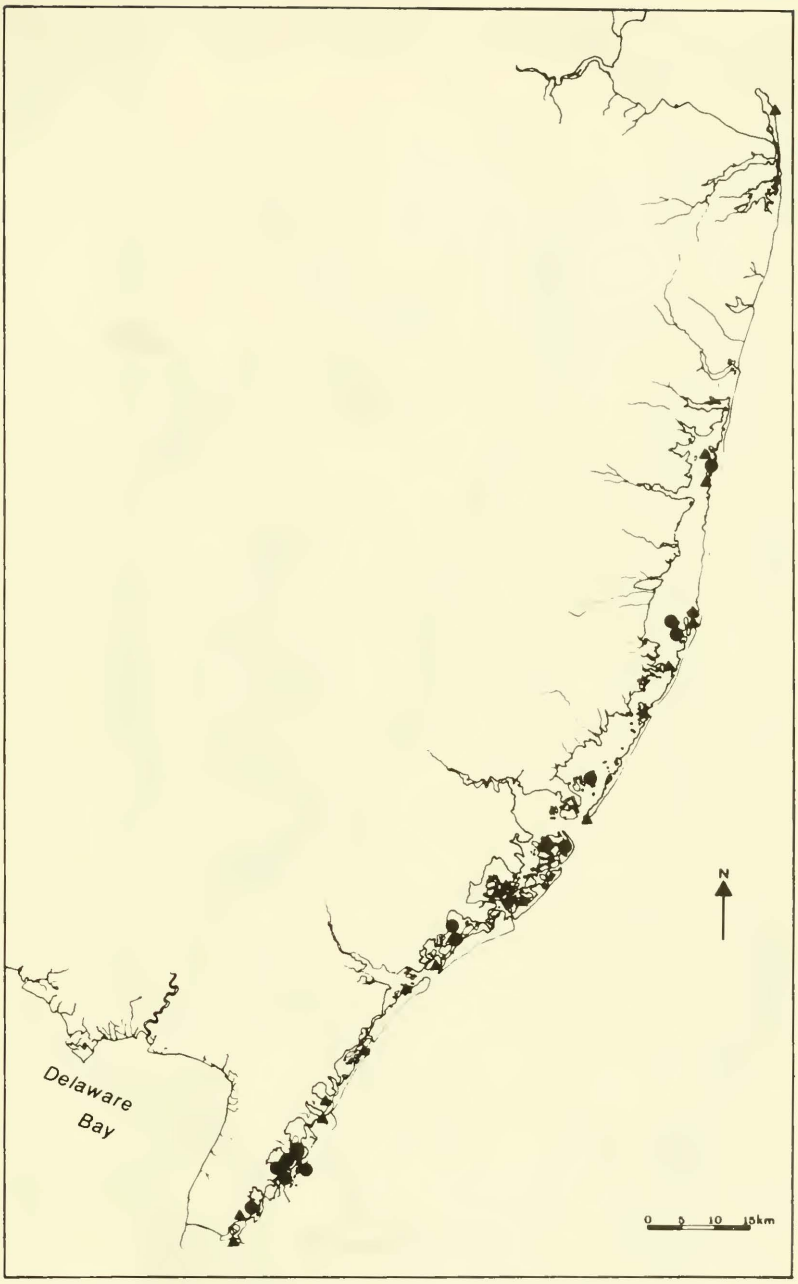

Figure 7. Location of major nesting colonies in New Jersey, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

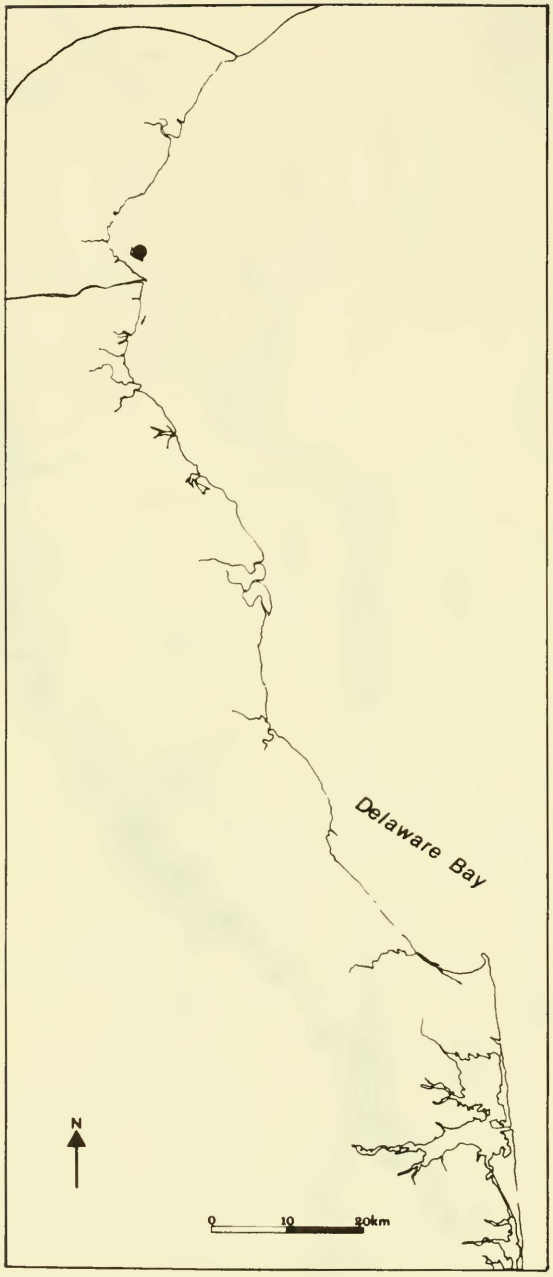

Figure 8. Location of major nesting colonies in Delaware, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

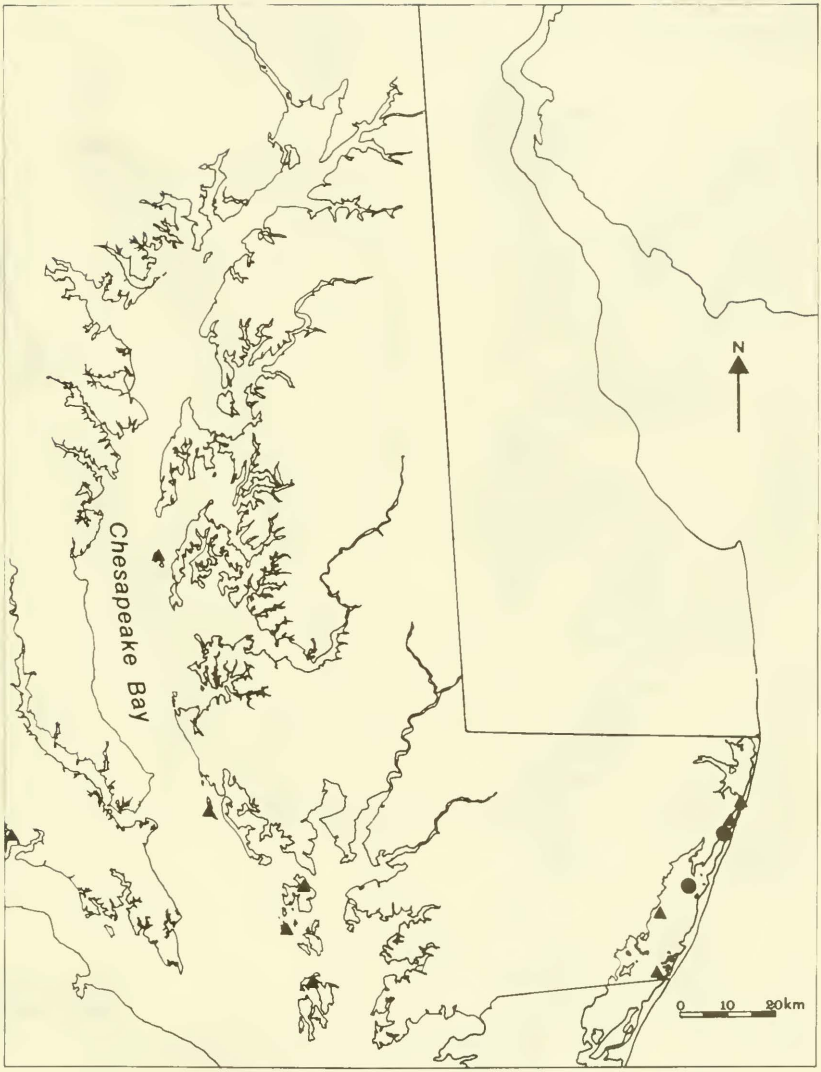

Figure 9. Location of major nesting colonies in Maryland, 1977. Triangles indicate 300-1,000 pairs, circles > 1,000 pairs.

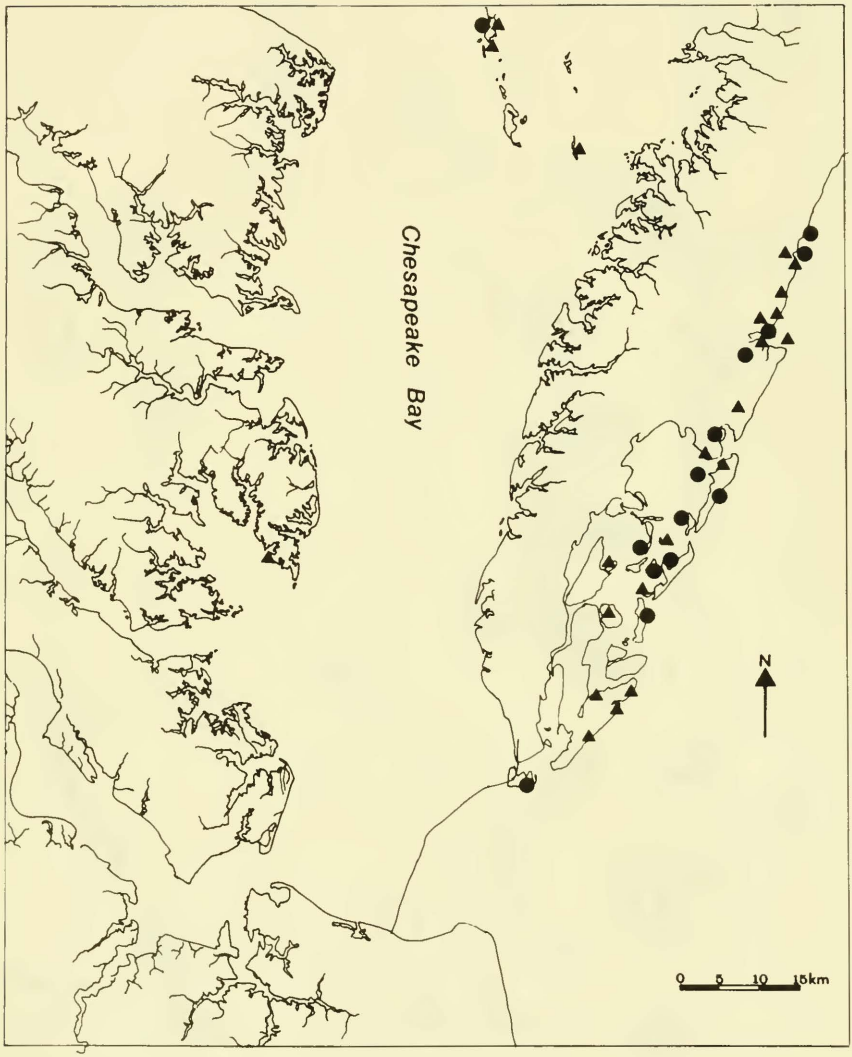

Figure 10. Location of major nesting colonies in Virginia, 1977. Triangles indicate 300-1,000 pairs circles > 1,000 pairs.

Table 16. Mean colony size (nesting pairs) of selected species in the 10 northeastern States

Species	ME	MA	RI	CT	NY	NJ	DE	MD	VA
Snowy egret	28	38	180	50	83	116	1,000	121	219
Black-crowned night heron	9	140	129	203	81	56	400	88	145
Herring gull	574	423	401	104	563	174	31	459	262
Laughing gull		200				1,238	96	1,114	1,114
Common tern	98	149	29	134	263	101	75	153	162
Roseate tern	25	221	1	21	96				
Least tern	14	48	16	40	80	94	41	104	52

Where laughing gulls nest abundantly (Virginia, Maryland, and New Jersey), their mean colony size is very uniform. Without data on available nesting habitat, marsh production, and feeding ecology of gulls in the two areas, any suggestion of causal factors influencing colony sizes would be mere speculation.

HABITAT UTILIZATION

Nesting habitats are categorized into two major types, mainland or island. Islands are further classified as barrier, marsh, or "coastal" (all those exclusive of the two former types); mainland habitats include contiguous marshes, beaches, or woodlands. Nesting commonly occurred on dredge deposition material at either marsh, barrier island, or mainland sites. Construction landfill was also used for nesting. In a few cases, artificial sites such as piers, buoys, and barges provided nesting substrate.

The proportion of nesting seabirds and wading birds in each habitat type, by State, is shown in Table 17. The among-State differences observed resulted from two major factors: coastal physiography and development. The coastal shores in New England are predominantly steep and uneven with large numbers of rocky islands. In contrast, extensive embayments and marshes bounded by long barrier islands characterize the coast from Long Island, New York to Virginia (Clark 1974). Because of this major physiographic difference only a small percentage of colonial waterbirds in New England nest on barrier islands or in marshes. The majority of colonial birds from Cape Cod, Massachusetts north nest on small, rocky islands.

Urbanization and recreational activity along the coast appears to have a marked influence on colony distribution. A comparison of the five States (New York to Virginia) with similar coastal topography reveals major nesting pattern differences which parallel human activity levels. In Virginia, along the Eastern Shore, about 80% of the barrier island coastline is owned by the Nature Conservancy, a private conservation organization dedicated to protecting the natural environment (R. Hennessey pers. comm.). In contrast, fewer sections of outer coast are protected either from public or private recreation access in New York, New Jersey, Delaware, and Maryland. However, a rank correlation analysis of barrier island use by seabirds (Table 17) and bathing beach access (Table 18) did not yield a significant relationship (Spearman r_s = 0.22, $P > 0.05$). Although barrier island use by nesting seabirds is much higher (as expected) in Virginia where the ocean front is protected (Table 17), Long Island, New York ranks second in seabird use despite the fact that major stretches of beach are <u>not</u> protected. However, long-established colony sites of terns and skimmers are protected by signs on the south shore beaches of Long Island. Also, herring gulls have habituated to automobile traffic to such an extent that one of the largest colonies in the State occupies several loops of a parkway along Jones Beach.

Wading birds use nesting habitat more similarly in the different States than do seabirds (Table 17). Even in New Jersey and New York, significant numbers (37% and 26%, respectively) nest on barrier islands. Perhaps because they nest in dense, inaccessible shrubs or trees away from bathing beaches, they are much less vulnerable to human intrusion than are seabirds which nest

Table 17. Habitat use by nesting seabirds (S) and wading birds (W) in the 10 northeastern States. Numbers represent % of nesting in each habitat category.

State		Island				Mainland			
		Coastal	Barrier	Marsh	Dredge/fill[a]	Beach	Marsh	Woodland	Other[b]
ME	S	>99				<1			
	W	100							
NH	S	100							
	W								
MA	S	57	33	1	1	6	2		1
	W	58	19	2		1	20		
RI	S	42	28	1		26	1		1
	W	95				5			
CT	S	98		<1	2	<1			
	W	97					2	1	
NY	S	34	16	22	10	14	3		1
	W	14	26	44	8		2	3	3
NJ	S		3	63	19	<1	15		<1
	W	4	37	21	36	1	<1	<1	
DE	S	1		64	17	18			
	W	98						2	
MD	S			33	65	2			
	W	19		38	24			19	
VA	S	<1	33	53	10	1	2		
	W	7	35	21	31		1	5	

[a] Both dredge material deposition and fill are included together.
[b] Includes man-made structures such as old piers, barges, channel markers, etc.

Table 18. Recreational use along oceanfront beaches, Long Island, New York, to the eastern shore of Virginia. Percentages of total oceanfront are listed in parentheses.

State	Length of oceanfront (in Km)		
	Beaches under vehicular restriction[a]	Bathing beaches - public and private	Total
New York[b]	0	173 (100)	173
New Jersey	24 (13)	171 (90)	190
Delaware	18 (46)	37 (96)	38
Maryland	8 (16)	42 (84)	50
Virginia	107 (79)	19 (14)	126

[a]Either excluding all vehicles or limited to security or maintenance vehicles.
[b]South shore of Long Island only.

on overwashed, sandy beaches or dunes. In Virginia, with little disturbance on the beaches, wading birds and seabirds are equally abundant on barrier islands (Table 17). Also significant is the use of dredge material in New Jersey, Maryland, and Virginia. In most cases, dredge deposition material has been placed on marshes, making it difficult to determine if the dredge material *per se* or particular marshes provide the proximal cues in attracting nesting colonies. Records of colony location before dredging activities would help address this question. Dredge material deposited on low *Spartina alterniflora* marsh islands raises the elevation of the marsh and allows subsequent encroachment of woody vegetation (Soots and Parnell 1975). On those islands, there is little doubt that new heron nesting habitat becomes available.

METHODS OF ASSESSING BREEDING POPULATION SIZE

A first requirement of most population studies is to obtain a precise count or an estimate of the number of organisms in the study area. This presents little difficulty when the organisms are large, sedentary, conspicuous, diurnal, and live in homogeneous, open habitats. However, such conditions seldom hold for a given species. Waterbirds, in general, are relatively large and conspicuous, and are primarily diurnal except for night herons, petrels, and perhaps black skimmers. Their mobility while feeding and their tendency to nest in very dense, patchy vegetation (e.g. herons, egrets) or in holes or crevices (petrels, guillemots), however, presents problems for censusing. In addition, the large size of many waterbird breeding colonies makes accurate estimating extremely difficult.

The problems of locating and censusing waterbird colonies have been the subject of a number of publications (for example, Belopol'skii 1957,Kartaschew 1963, Kadlec and Drury 1968a,b, Drury 1973, Nisbet 1973, Drury 1974, Nettleship 1976, Buckley and Buckley 1976). In general, the most appropriate census methods will be dictated by the size of the geographic region to be surveyed, the species involved, the number of qualified personnel available, and funds available. At one extreme, censusing only a few colonies of cryptic-nesting species under conditions of limited support demands a ground count of nests; while, at the other extreme, a regional census with substantial funding would probably best be conducted using a combination of aerial censusing and photography with nest counts. A point which receives recurrent emphasis from experienced census workers is the need for replicability and standardization of procedures and reporting. For best results, censusing should be conducted (1) by the same individual(s) each year, (2) using the same, pre-tested techniques each time, (3) at comparable times (of day and of nesting phase). This should minimize the variance in the numbers estimated and allow more rigorous statistical evaluation of the "true" variance, i.e., the variability due to biological processes independent of sampling biases.

Natural variation of adult numbers in a colony results from several sources. Feeding conditions vary during the day depending upon tide cycle, wind conditions, weather, etc., all of which influence the number of foraging birds (Dunn 1973, Nisbet 1973, Custer 1977). The stage of nesting also influences colony attendance. Incubation requires at least one adult at the nest at all times but, after hatching, both members of the pair may need to forage simultaneously to meet the demands of the brood. Other factors affecting numbers at a colony are distances between nesting and feeding grounds, the number of "surplus" (nonbreeding) adults in attendance (Kadlec and Drury 1968a), and disturbances by predators (Nisbet 1975, Robert and Ralph 1975).

Because this study covered the entire northeastern U.S. coast, regional (large-scale) inventorying using rotary- and fixed-wing aircraft was employed in both 1976 and 1977. At selected colonies in each State, ground counts were made to provide a basis for assessing the accuracy of aerial data. Because conditions under which nest counts of the different species are taken vary so greatly, the accuracy of small-scale, "within-colony" sampling was tested in several colonies. These two levels of assessing census methods are treated separately below.

SAMPLING METHODS "WITHIN COLONY"

When only a few colonies in an area require censusing, the researcher needs to know which of several methods to employ for a given species (or group) under certain habitat conditions. Usually the expense of aircraft will demand some type of ground method (boat or on foot).

Of all ground methods, a total nest count using a marking method to prevent duplication is the most accurate. However, the accuracy of such "total" nest counts may be misleading (Drury 1973) unless a second count is made and a correction factor is applied, such as the Lincoln (mark-recapture) Index (Overton 1971). The accuracy of a one-search "total" count was compared to the "true-total" derived from a two-search count using the Lincoln Index (Table 19). Eight sample plots ranging from 0.06 to 1.10 ha were selected in various densities of vegetation in seven gull colonies. In each plot, all nests found on the first search were marked. A second search was then made, and a separate count of marked and unmarked nests was made. A qualitative assessment of nest dispersion (uniform, patchy) was also recorded.

The error range of 4-22% is large considering the relatively small sample plots. Vegetation density rather than plot size seems to be the more important factor in determining error rates. The "light"-vegetated plots had 4, 7, and 9% errors, while those in "moderate-dense" plots ranged from 7-22% (mean 15%). In summary, the accuracy of alleged "total" nest counts may be more apparent than real unless a second count is made, admittedly a very time-consuming process. However, the benefit one gains in achieving greater accuracy may be offset by causing greater disturbance, especially in large, dense colonies where several hours may be required to mark every nest.

An alternative to a total nest count is a sample count, using the sample to derive a total population estimate. This approach is especially valuable where the habitat density or colony size renders a total count impractical. In general, two types of sampling schemes may be employed in the field: plot (area) and plotless (distance) methods (Pielou 1969). Plot methods include quadrat, strip, or belt transect sampling, where (ideally) random "plots" are sampled and used to extrapolate the "true" population. Plotless methods commonly used are nearest-neighbor distance (Clark and Evans 1954, Lloyd 1967), point-centered quarter, and line-intercept (Smith 1966). With these methods, distances are measured and converted to aerial measures. A disadvantage of all except the belt transect method is that the total colony areas to be censused must be calculated. Surveying or measuring from aerial photographs can be expensive and time-consuming. Both plot (belt transect) and plotless (point-centered quarter) methods were tested in gull and heron-egret colonies to test the efficacy of these sampling methods under different regimes of habitat and nest dispersion pattern (Appendix A). Gull and heron colonies were chosen because their size and inaccessibility (especially in the case of herons) often preclude total count methods. In the largest colonies, a large sample plot was used.

Both sampling methods yielded highly variable population estimates, depending on vegetation and nest dispersion patterns (Table 20). The point-centered quarter method was reliable only when nests were uniformly distributed and vegetation was light (except at Eagle Island).

Table 19. Total nest count accuracy in selected Massachusetts gull colonies.

Colony	Vegetation density	Nest dispersion	Sample plot size (hectares)	Nests found on 1st search	Corrected[a] total	% error
1976						
Coatue	light	uniform	0.45	25	27	7
Sarson I., Martha's Vineyard	medium	uniform	0.06	52	56	7
Cape Poge, Martha's Vineyard	medium	uniform	0.14	25	29	14
Milk I., Rockport	medium	uniform	0.14	39	50	22
1977						
Cape Poge	medium	uniform	0.55	82	93	12
Nortons Neck, Martha's Vineyard[b]	light	uniform	0.73	183	190	4
Clarks I., Plymouth	dense	patchy	1.10	343	442	22
Long Pt., Provincetown	light	patchy	0.53	180	198	9

[a]Based on Lincoln Index, where $\frac{Xt}{Nm} = \frac{Nt}{Nm'}$, Xt = total no. nests, Nm = no. nests marked in 1st search, Nt = total nests found in 2nd search, and Nm'= total nests found in 2nd search that are marked.

[b]Based on sample taken by K. Caldwell, Manomet Bird Observatory.

Table 20. Comparison of two sampling techniques for estimating total nests in selected gull and heron colonies in Massachusetts and Rhode Island.[a]

Colony	Vegetation density	Nest dispersion	Sampling Method: Point-centered quarter (plotless) Estimated/actual	% error	Sampling Method: Belt transect (area) Estimated/actual	% error
Gulls						
Long Pt.[b]	light	uniform	192/198	3	250/198	26
Thacher I.	dense	medium clumped	3,675/1,873	98	1,667/1,082 (south portion only)	54
Milk I.						
Vegetation	medium	medium clumped	690/852	19	947/852	11
Rock	none	uniform	2,075/1,828	14	1,626/1,828	11
Eagle I.	light	uniform	867/213	400	------	
Kettle I.[b]	dense		-----		534/221	142
Penikese I.[b]	light	uniform	97/92	5	82/92	11
Herons						
Sampsons I.[b]	dense	medium uniform	80/115	30	-----	
House I.[b]	dense	medium uniform	122/223	45	256/223	10
Hope I.	dense	highly clumped	15/76	80	78/76	3

[a] 'Actual' count based on total number of nests marked; estimate based on pooled samples of marked nests.
[b] Sample plot used

Similar results were found by Soots and Parnell (1976) at laughing gull colonies in North Carolina. The quarter method was ineffective at the heronries we tested. A possible bias in our results may have arisen from the manner in which the sampling lines were selected. In most cases, diagonals were used within the sample plot instead of randomly-selected lines. The need to randomly select line orientations and to measure the colony area limit the utility of this method under most conditions.

The belt transect sampling method provided more accurate estimates in all but two colonies (Long Point and Penikese I.) than did the point-centered quarter method. Although only two colony samples were taken, the method seemed well-suited for use in heronries. Portnoy (1977) used the method effectively in large mangrove heronries along the Gulf of Mexico. An advantage of this method is that only the total length of the transect needs to be measured, not the entire colony area. Counting all nests in 2-m wide belts that completely cross the colony at random points along the transect bearing line enhances the probability that an unbiased sample of the total colony is taken. Some problems inherent in belt transect methods are discussed by McIntyre (1953), Eberhard (1968), and Anderson and Pospahala (1970). One bias that we became aware of during the sampling was a tendency to "steer" the belt transect toward nests seen in front of the observer even though compass orientation was supposedly being followed. This would result in an overestimation of the population, the opposite effect to that found by Anderson and Pospahala (1970) where hidden waterfowl nests are often missed on the edges of the transect (however, their transects were much wider than our 2-m belts).

In summary, sampling techniques such as quadrat, belt transect, or point-centered quarter can be useful for estimating nest numbers if the level of accuracy needed is within 10 to 20% of the true population size. Sample size should be increased however, where highly patchy nest distributions are encountered or where high vegetation density precludes obtaining a good sample of the colony.

LARGE-SCALE, "AMONG COLONY" METHODS OF ASSESSING POPULATION SIZE

Due to the large geographic area to be covered and the short nesting season, separate teams of field observers were selected to inventory different sections of the coast for this study (Table 21). A coastal survey was taken in late May 1976 using a U.S. Fish & Wildlife Service float-equipped De Havilland Beaver. Emphasis was placed on locating colonies along the coast. Parts of Long Island and Connecticut were ground censused by volunteers. The Connecticut census was incomplete. Field censuses were performed primarily using ground (boat, foot) methods, except in New York, parts of Massachusetts (helicopter), and Maryland-Virginia (fixed-wing in many areas). Based on the 1976 experience, all areas were covered during early June using helicopters in 1977 (supplemented with fixed-wing aircraft in Virginia). Subsequent ground checks were made at selected colonies throughout June and in some cases in July. As a result, the 1977 inventory information is more complete than in 1976, especially in Connecticut and New Jersey. As in 1976, a fixed-wing aircraft survey was flown in June 1977 to obtain aerial photographs.

Table 21. Field investigators, 1976-1977.

State	Year	Investigators
Maine, New Hampshire	1976-1977	R.M. Bollengier, Jr.; A.C. Borror; P.A. McGill
Massachusetts	1976-1977	R.M. Erwin; E.R. Ladd; J.J. Hatch; J. Portnoy; P. Trull; I.C.T. Nisbet; D. Minsky; S. Whiting; B. Blodget
Rhode Island	1976-1977	R.L. Ferren; J. Myers
Connecticut	1976	D.C. Duffy
	1977	F. Sibley; N. Proctor; D.C. Duffy; S. Satter
New York	1976	P.A. and F.G. Buckley; D.C. Duffy; P. Spitzer; E. Horning; P. Stoutenberg; M. Gochfeld; A. Lauro
	1977	P.A. and F.G. Buckley; D.C. Duffy
New Jersey	1976	R. Kane; R. Farrar; D. Smith; W. Clark; R. Lloyd; D. Kunkle; J. Burger
	1977	R. Kane; R. Farrar; F. Buckley; D. Smith; W. Wander; J. Sherman; M. Pokras; J. Rokita; P. Dunne; C. Curtis; J. Peterson; W. Jasionowske; D. Ward; M. Glaspey
Delaware	1976	M.A. Byrd; B. Williams; M. Barnhill; J. Wiese; E.J. Fisk
	1977	M.A. Byrd; J. Wiese; P. Jahn; W. McCoy
Maryland-Virginia	1976-1977	M.A. Byrd; W. Akers; B. Williams; P. Frohring; B. Warren; H. Armistead; F. Scott

Efficiency of Aerial and Ground Methods

Since inventories were conducted by both fixed-wing and rotary-wing aircraft as well as by ground (boat, foot) methods, the opportunity arose to compare the efficiency of the three methods. During the spring of 1976, colonies in Massachusetts and eastern Rhode Island were censused using all three methods. Accurate records of time and travel expenses were kept, allowing relative costs of each method to be determined. The census accuracy could not be statistically compared because the three methods could not be conducted simultaneously and independently for obvious logistical reasons.

The results of the cost comparison are shown in Table 22. Fixed-wing aircraft provide a fast, inexpensive method of censusing while ground methods are the most costly because of the time required (nearly 3 weeks). Helicopters are the most expensive per day, but the time saving renders them more efficient than ground methods.

Despite the low cost of the fixed-wing methods, there were a number of drawbacks: (1) Federal aviation regulations prohibit flying censuses near metropolitan airports; (2) the high airspeed, restricted vision, and often dense vegetation resulted in missing colonies of the smaller birds such as least terns or cryptic herons; (3) "ground-truthing" by nest counting in sample areas is usually not possible because of landing limitations.

Helicopters provide efficiency and flexibility by combining the time-saving advantages of aerial methods with the ability to land and make ground counts for improved census accuracy. Usually one hour of "free" ground time is allowed for each "air hour" so that the two methods can be combined without added cost.

Surveys are best performed for most species by helicopters. When conducting ground surveys, there is a tendency to restrict one's coverage to areas where previous nesting occurred because of the time involved in traversing large expanses of beach, marsh, and water. With helicopters, all rocks, points, and beach areas can be examined in a brief time. Low-flying helicopters may be the only way to flush and locate the more cryptic herons when they nest in dense, inaccessible swamp, marsh, or mangrove colonies (Buckley and Buckley 1976).

Other advantages in using helicopters are (1) good quality photographs can be taken from a variety of altitudes and angles; (2) weather and sea conditions can limit boat use to islands much more than helicopters; (3) landing can be achieved easily in a small (ca. 15 m^2) area.

One of the major unknowns in census methodology is the relative degree of disturbance involved. There are few good, controlled field studies of disturbance effects on breeding colonies (Kury and Gochfeld 1975, Robert and Ralph 1975). Results are often equivocal. Of the human activities at an oil well drilling site in Canada, helicopters were felt to be the most disturbing factor, but the results were qualitative (Barry and Spencer 1976). There are probably regional differences based on the history of disturbance factors at the colony. Least terns on Long Island remain on nests when a helicopter hovers less than 30 m above (M. Gochfeld pers. comm.) but in Florida, least terns seem to be more sensitive because of less exposure to air traffic (E. J. Fisk pers. comm.). In general, the more remote the observer, the less disturbance will result.

Table 22. Cost analysis of fixed-wing aircraft, helicopter, and ground (boat-foot) censusing of waterbird colonies.[a]

	Fixed-wing[b]	Helicopter[c]	Boat-foot
No. days	1	3	18
Man-hours	21	48	288
Salary	$210	$480	$2,880
per diem	$99	$198	$1,188
Transportation (vehicle, tolls, fees)	$174	$1,800	$146
Total	$490	$2,478	$4,214
per day	$490	$826	$234
Relative time-cost factor	1.0	5.1	8.6

[a]Based on expenses of two professional wildlife biologists at (salary) $10/hour, per diem $33/day, 8-hour working day.

[b]Fixed-wing (De Havilland Beaver) @ $22/hr., pilot $11/hr.

[c]Bell 47G5A @ $100/hr.

The cost comparison shown in Table 22 is based upon using trained professionals. It would reduce expenses by depending upon qualified volunteer workers, an approach the British have employed in "Operation Seafarer" (Cramp et al. 1974). However, this approach requires extensive coordination and standardization of technique to insure that, over large geographic areas, all volunteers can achieve 100% coverage.

Based on experience in 1976 and after consultation with others (P. A. and F. G. Buckley and others), it was decided that helicopters would be used for the coastal study area in 1977.

Aerial-Ground Comparisons

Because population estimates in 1977 were made from helicopters, "ground-truthing" was performed at selected colonies to establish the numerical relationship between the number of adult birds and the number of active nests found in the colony. Kadlec and Drury (1968b) suggested that, for herring gull colonies, proper interpretation requires photographing several (5-10) islands with known numbers of nests to establish the gull/nest ratio (correction factor) for that particular census. Aerial photography was used with limited success in both 1976 and 1977 using small, medium, and large format cameras (see Aerial Photography). Instead of deriving bird/nest ratios from photos, I compared numbers visually estimated to nest numbers in colonies (or marked sample plots in colonies) and used the slope of the linear regression equation as the correction factor. In using this measure, one must be aware that the variability observed is additive, partly due to errors in estimation and partly due to actual variation in bird attendance at the colony.

Because of the logistics involved, sufficient samples of colonies of all species could not be ground counted. Instead, comparisons were made for the most common species and those most difficult to census were treated. For some species, adult-to-nest ratios were derived from other sources (discussed below).

The aerial censuses were flown using small, 3-person Bell or Enstram helicopters, except in New York where a 5-person Bell jet "Ranger" was used. Censuses in each State required from 1-4 days during the period 31 May to 10 June. During the flight, two observers recorded species composition and numbers of adults present. After the flights, ground verification and censusing were performed in selected colonies. The ground (nest) counts were usually made within 10 days after the aerial census. In most cases, one-search nest counts were made. In Massachusetts, a two-search, "mark-recapture" method was used.

The results of the aerial estimate-nest count regressions are shown for several species in Table 23. The aerial estimates used were usually composite "best estimates" if there was more than one observer. Not only does the bird/nest ratio (b value in Table) vary "among species" as expected, but also "within species" for different censuses. Black-crowned night herons are grossly underestimated in aerial counts. Four nests were found for every adult flushed from the colony by helicopter (b = 0.24). Considering the very dense colony shrubbery obscuring the observer's view and the heron's propensity to remain on nests during disturbances (Portnoy pers. comm., P. A. and F. G. Buckley pers. comm.), this result is not surprising.

Table 23. Regression analysis of aerial estimates of adults versus nest counts in selected waterbird colonies.

Species	Location	N (colonies)	Colony size range (pairs)	b (regession coefficient) (=adults/nest)	S.E.	r^2
Herons						
Black-crowned Night	Mass., Md., Va.,	10	6-600	0.24	0.02	0.93
Gulls						
Herring, Gr. Black-backed	Mass.	11	26-2,760	0.54	0.05	0.93
	Maine	9	124-4,500	1.70	0.08	0.99
	New England	29	26-4,500	1.03	0.23	0.76
Terns						
Common, Roseate, Arctic	Maine Mass., R.I.	17	14-400	1.49	0.14	0.88

The differences in adult-to-nest ratios led me to consider the sources of variation. Much of the variation between States may be due to observer bias differences or to changes in habitat resulting in visibility differences. To test observer error, aerial estimates of gull colonies were compared using estimates made by two experienced wildlife biologists (Observers 1 and 2) during a 1-day census in southern Maine on 31 May (Figure 11). Estimates of Observer 2 were then compared with those of another, Observer 3, for all Massachusetts colonies obtained on 1 and 6 June (Figure 12). Since Observer 2 censused both States, the results reveal both inter-observer differences and State differences. The difference between estimates by Observers 2 and 3 are slight compared to those between Observers 1 and 2. The two regressions for Observer 2 are only slightly different (b = 0.35 vs. 0.30).

These results might be interpreted as follows: (1) there is little difference in adult/nest ratios between gull colonies in Maine and those in Massachusetts, (2) there can be a major difference in estimates by different observers. Without verification of the "true" number present (e.g. using photographs), it is impossible to say which observer is more accurate. However, a minimum of one bird per nest should be present because of incubation or brooding duties. The slopes and y-intercepts can be better understood if the raw data are examined (Tables 24 & 25). At the large colonies, Observers 2 and 3 usually underestimate the number of birds by a large factor. Observer 1, however, probably overestimates the larger colonies.

Major habitat differences permitted a comparison of the adult-to-nest count relationship among a number of gull colonies in New England. Eleven colonies in Rhode Island, Connecticut, and Massachusetts, with light to moderate cover of beach grass or on bare rock, were contrasted with six Massachusetts colonies in dense herbaceous or shrub vegetation. Regression analysis indicated that about 25% more gulls per nest are estimated when the colony occupies a lightly-vegetated island (slope, b = 0.67) rather than a densely-vegetated one (slope, b = 0.53). On many islands in Boston Harbor and on the north shore of Massachusetts, a large percentage of gulls nest under dense vegetation and are easily missed during an aerial inventory. This contributes significantly to bird-to-nest ratios (Figures 11 & 12) being much lower than the $\geq$ 1.0 value expected if at least one adult is always in attendance at a nest.

Species Correction Factors (Aerial-Ground)

Comparing adults estimated from the air with nests counted at certain colonies provided the basis for many of the correction factors used in determining the number of breeding pairs for colonies at which nests were not counted (Table 26). Laughing gull nest counts were only obtained at three colonies so regression analysis was not used to obtain a correction factor. The factor obtained for common terns was applied to other similar terns. Aerial photographs of colonies of black skimmers, royal, and sandwich terns showed that incubating and non-incubating birds (mates) could be distinguished. Portnoy (1977) found that both members of a black skimmer pair often attend the nest during incubation so a bird-to-nest ratio of 0.5 was used. Most often, only one adult attends the nest in royal-sandwich tern colonies so a 1.0 factor was applied.

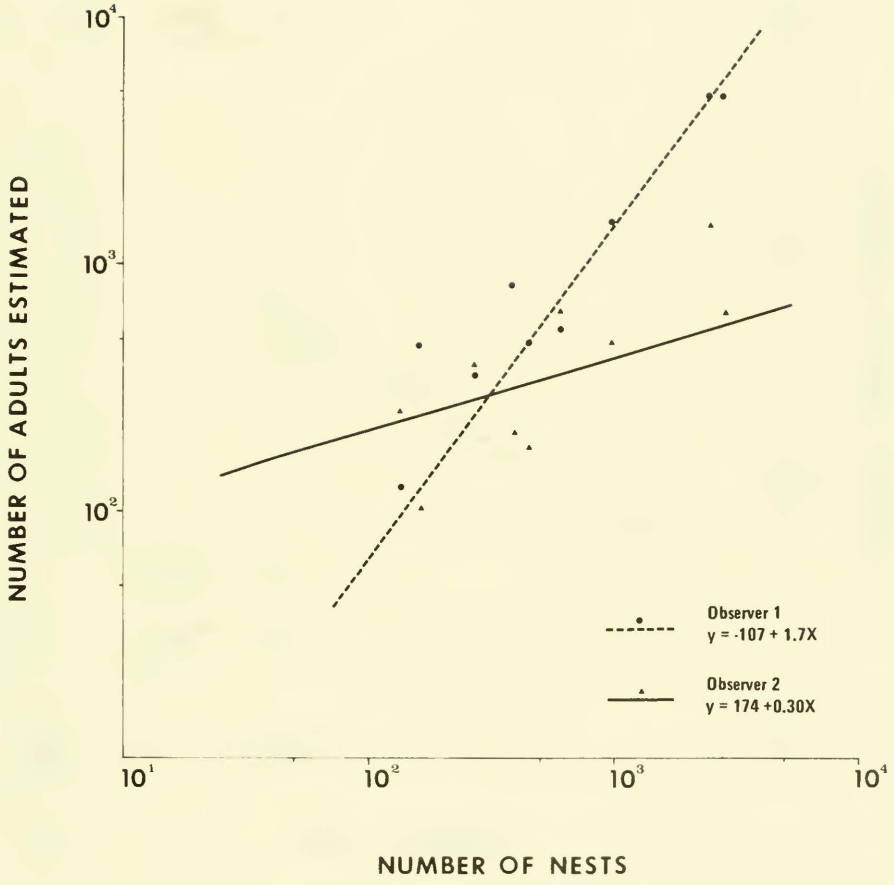

Figure 11. Aerial estimation of adults vs. nest counts at nine Maine gull colonies, 31 May 1977. Least squares regression equations are given for each of two observers.

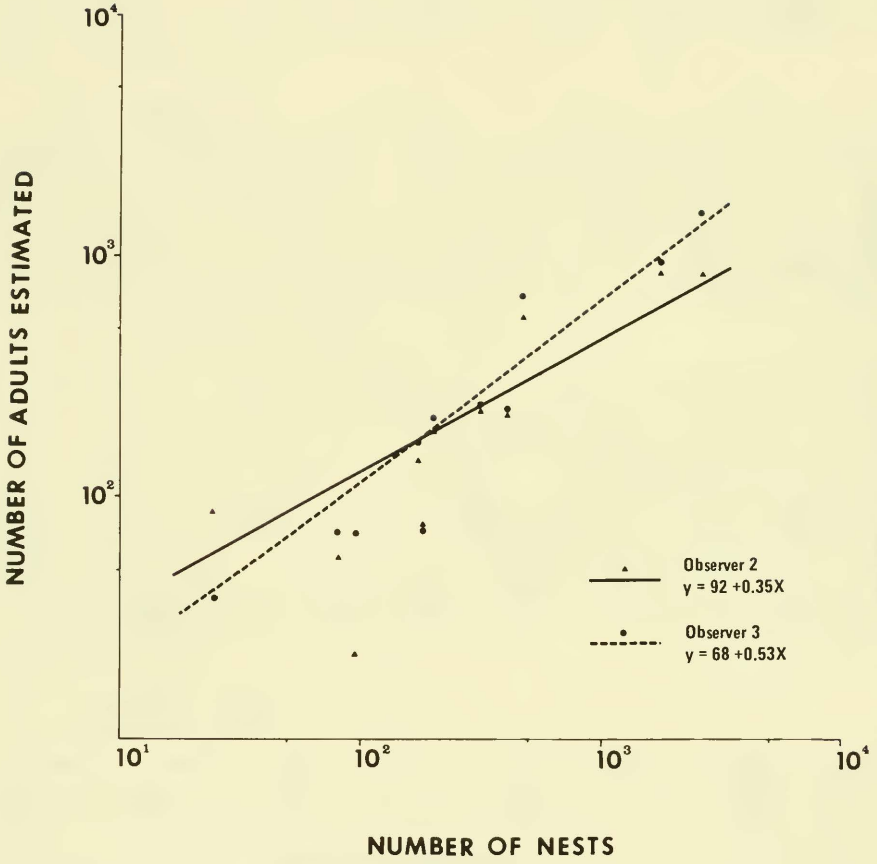

Figure 12. Aerial estimation of adults vs. nest counts at 11 Massachusetts colonies, 1 and 6 June 1977.

Least squares regression equations are given for each of two observers.

Table 24. Comparisons of observer estimates of adults versus nest counts at nine Maine gull colonies, 31 May 1977.

Colony	Nest count	Adult estimate	
		Observer 1	Observer 2
1	140	124	225
2	169	450	100
3	275	317	340
4	367	785	185
5	423	475	150
6	585	525	630
7	980	1,500	480
8	2,600	4,500	1,270
9	2,760	4,500	680

Table 25. Comparisons of observer estimates of adults versus nest counts at 11 gull colonies in Massachusetts, June 1977.

Colony	Nest count	Adult estimate	
		Observer 2	Observer 3
1	26	80	35
2	79	54	70
3	93[a]	23	70
4	180	145	185
5	190[a]	78	70
6	213	180	205
7	313	220	225
8	398[a]	200	210
9	491	530	650
10	1,873	910	1,000
11	2,680	880	1,480

[a] Counts based on marked, sample quadrats in colonies.

Table 26. Factors used to convert aerial estimates of adults into numbers of breeding pairs (nests) in a colony.

Species	Location	Correction factor[a] (adult-to-nest)	Basis for factor
Herons			
Blk.-cr. night	All	x 2.5	Conservative estimate of regression
All other herons	All	x 1.0	Field observations
Egrets			
Great	All	x 1.0	Aerial photo
Snowy	All	x 1.0	Adult/nest ratio in several colonies
Ibises			
Glossy	All	x 1.0	Field observations
Gulls			
Herring and Gr. black-backed	Maine, New Hampshire	x 0.6	Regression
	All other	x 1.0	Regression
Laughing	All	X 1.0	Adult/nest ratio in 3 colonies
Terns			
Common, Roseate, Arctic	All	x 0.66	Regression
Forster's Gull-billed	All	x 0.66	Assumed to be similar to above
Least	All	x 1.0	Regression
Royal, Sandwich	All	x 1.0	Aerial photo
Black skimmer	All	x 0.5	Aerial photo
Other			
Dbl.-cr. cormorant	All	x 1.7	Regression (8 colonies)

[a]Factor is the reciprocal of the regression coefficient (b) when based on linear regression. Factor converts adult estimate to nest number.

Eight comparisons of adult/nest ratios were made at Massachusetts double-crested cormorant colonies over a 2-year period. Adults were often underestimated (Table 26). This finding is surprising considering that cormorants are one of the most conspicuous species included in the survey.

Accurate nest counts were difficult to obtain at wading bird colonies. Great egrets and great blue herons required no correction factor since their tree- (or shrub-) top nesting habit enabled direct nest counts to be obtained either from aerial photographs or visual counts. At 10 colonies in Massachusetts, Maryland, and Virginia, the black-crowned night heron adult-to-nest ratio was only 0.24 (i.e., For every adult seen from the helicopter, four active nests were actually found in the colony.). A combination of dense vegetation, cryptic nests and plumage, and the tendency to "sit tight" when disturbed all resulted in gross underestimation of numbers (Portnoy 1977, Buckley pers. comm.). A conservative correction factor of 2.5, rather than 4.0, was applied since in a number of colonies multiple adult counts were made. These counts showed that differences between maximum and minimum estimates (both air and ground) were not great enough to warrant applying a 4x correction factor to the aerial estimates. When censuses were made by flushing birds on the ground, a factor of 1.0 was used.

A factor of 1.0 was applied to all other herons, egrets, and ibises. This factor has been applied elsewhere (Custer and Osborn 1976, P. A. and F. G. Buckley pers. comm.) even though its validity has not been established. Limited data at snowy egret and glossy ibis colonies in Virginia and Maryland indicate that adult estimates underestimate nest counts. Glossy ibises often nest near or on the ground in dense Phragmites in the mid-Atlantic region. The 1:1 adult-to-nest factor is probably very conservative. All the dark-bodied herons (Louisiana, little blue, and green) are probably underestimated because of their inconspicuousness.

Aerial Photography

In 1976 and 1977, aerial photographs were taken with hand-held 35 mm (55 mm lens) and 70 mm (105 mm lens) format single lens reflex cameras from both fixed-and rotary-wing aircraft. Fine-grained (VPS) color and Ektachrome film were used. Most photos were taken from altitudes of 100-200 m. In 1977, a Cessna 172 fixed-wing aircraft was used with bottom-mounted K17 (9' format) and Hasselblad (70 mm) cameras. Kodak Plus X aerographic film was used. Colonies of all species were photographed to assess the feasibility of obtaining accurate census data from prints.

Photography proved to be of limited value in censusing waterbird colonies. Among the 28 species included in the survey, only double-crested cormorants, great blue herons, great egrets, and royal and sandwich terns could be counted from either contact or enlarged prints (Figures 13 & 14). In some beach colonies, black skimmers and herring and great black-backed gulls can also be counted. For other species, either the small size (most terns), concealed nests (eiders, petrels, guillemots), or dense vegetation (herons, egrets, ibises, gulls) limited the usefulness of photography. Photographs can be valuable, however, in documenting the nesting habitat and the colony area used by the birds which could provide a baseline for comparison with photos taken during subsequent years.

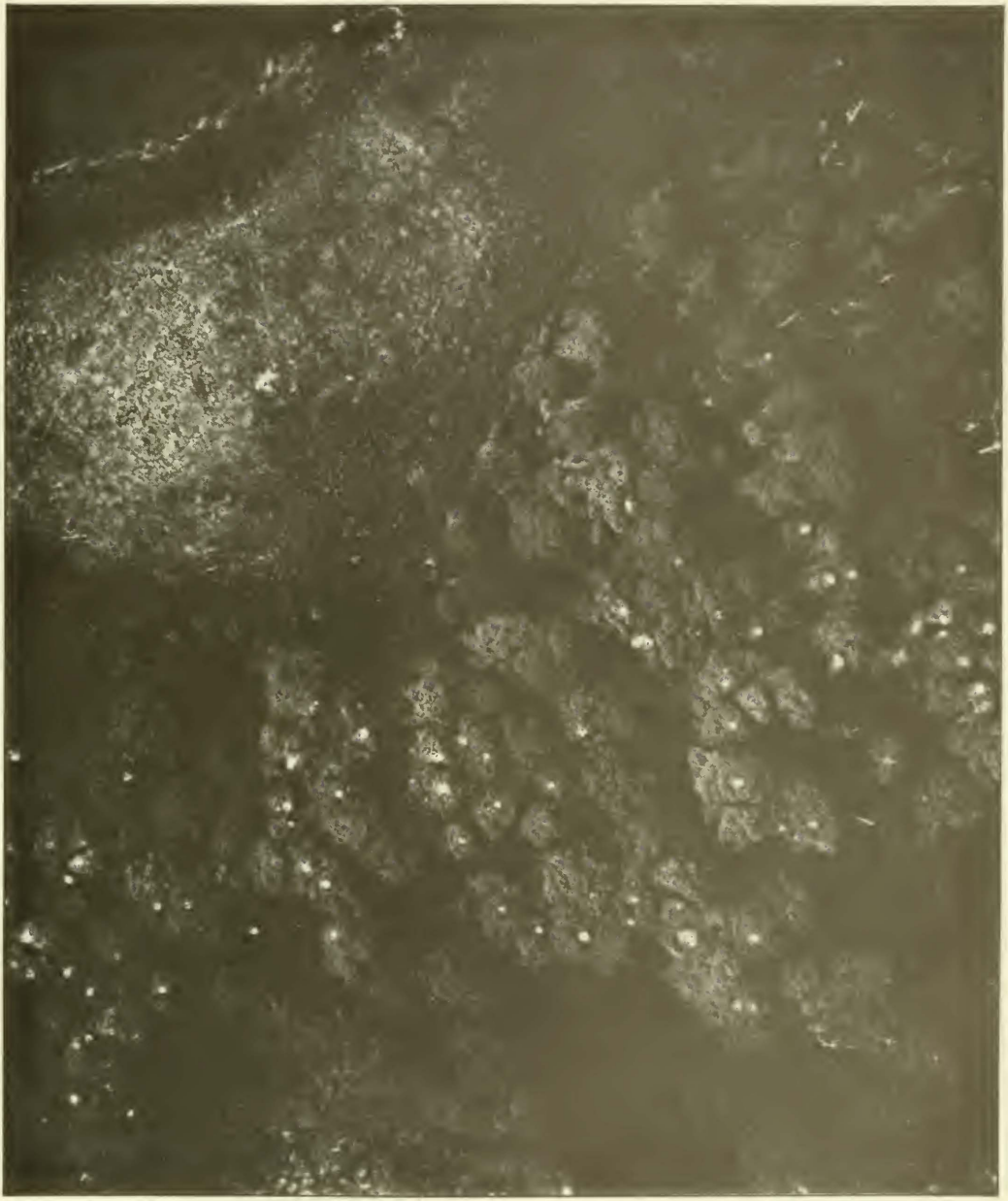

Figure 13. Aerial photograph of great blue heron colony at Poplar Island, Chesapeake Bay, Maryland, 22 June 1977. Note young in the guano-rimmed stick nests.

Figure 14. Aerial photograph of double-crested cormorant colony at rock south of Cat Island, Marblehead, Massachusetts, 24 June 1977.

POPULATION TRENDS OF WATERBIRDS, 1900-1977

In this section, historical nesting records of each species are summarized for each State. An extensive data supplement on microfiche at the back of this report lists all breeding records with number of pairs, location of colony, date, and reference. These data are also available on magnetic tape from the U. S. Fish and Wildlife Service. All records from 1900 to 1975 are included. Regional (State) totals, where available, are presented in tabular form for both historical data and the 1976-1977 inventory data.

Certain published and unpublished records were useful in summarizing historical trends by State or region. For instance, Drury (1973, 1974) reported trends of seabirds for New England and Long Island. Similarly, Nisbet (1973) described trends for terns in Massachusetts with reference to other northeast populations. R. L. Ferren and N. Proctor provided manuscripts and notes summarizing records for all seabirds and waders in Rhode Island and Connecticut, respectively. Each is preparing a text describing bird distribution and abundance for their respective States. P. A. and F. G. Buckley provided 1974-1977 census estimates from helicopter surveys of the Long Island coastline. For New Jersey waterbirds, F. G. Buckley (1977) recently compiled an historical account of nesting from the early 1800's. In Maryland, many records were obtained from the nest record card program of the Maryland Ornitho logical Society. R. Clapp kindly provided an unpublished annotated bibliography of seabird records for the eastern shore of Virginia.

Because nesting records were usually obtained from field notes sections in ornithological journals, many journal references are abbreviated in the text as follows: RNEB = Records of New England Birds, AFN/AB = Audubon Field Notes/ American Birds, LNL = Linnaean News-letter, KB = Kingbird, NJA = New Jersey Audubon, DO = DelMarVa Ornithologist, MB = Maryland Birdlife, MOS = Maryland Ornithological Society (nest records), BNWR = Blackwater National Wildlife Refuge records, AN = Atlantic Naturalist, R = The Raven, UOC = Urner Ornithological Club.

When estimates of current population abundance were compared with historical records, the incompleteness of earlier reports became very apparent. In most cases, only a few traditional colonies were visited on a regular basis and often no systematic counts were attempted. Early accounts of "declines" may simply have been the result of colonies shifting to new locations.

During the early 1900's, when migratory bird protection was initiated, some attempts were made to survey nesting colonies along the coast. W. Dutcher (1901, 1902, 1903) attempted to assess seabird nesting status along the entire Atlantic Coast. In the 1950's, R. P. Allen initiated a National Audubon Society wading bird survey of the entire U. S., but a final report was never published.

Because documentation of historical nesting was more complete in some States (Massachusetts, New York, Rhode Island) than in others (New Jersey, Delaware, Maryland, and Virginia), there is no reliable way of depicting trends for any given species over large geographical areas such as the northeastern U. S. The following accounts provide a general summary of long-term trends for each species and concentrate on the more complete data collected during this study.

MAINE (CAPE ELIZABETH TO KITTERY, EXCLUDING THE ISLES OF SHOALS)

Seabirds

Black guillemots have apparently never been abundant (Gross unpubl. notes) but their cryptic nesting habits make them very difficult to census (Table 27). Only 14 pairs were seen by Drury (1973) in the early 1970's. No nesting was confirmed in southern Maine in 1976-77, except at the Isles of Shoals.

In Saco Bay, populations of the great black-backed gull have expanded very rapidly since the 1940's (Drury 1973) and they continue to increase. Somewhat earlier, in the 1920's, the herring gull showed a similar explosion (Allan 1931, Jackson and Allan 1932, Wright 1937, A. O. Gross unpubl. notes). Kadlec and Drury (1968a) estimated that the population was doubling every 12-15 years. It apparently continues to increase although the rate may have declined. The laughing gull, at the northern edge of its range, nests only at a few widely-separated colonies in Maine and Massachusetts. The former Stratton Island colony has dwindled and no nesting occurred in 1976 or 1977. A few small colonies are still active north of Portland (Korschgen 1979).

Arctic terns were very abundant in southern Maine in the early part of the century (Norton 1907, 1914), but have declined substantially in recent years (Drury 1973). No colonies were found south of Cape Elizabeth in either 1976 or 1977. Common tern populations increased from the beginning of the century (Brownson 1906, 1907) and peaked about 1940 (Palmer 1949, Drury 1973). Recently, the population has been reduced to two breeding locations (Beach Island and West Goose Rocks). Because of the problems in censusing them, least terns have never been reported in significant numbers until concerted efforts were made by Mrs. E. J. Fisk in 1973 and 1974. They have never been abundant in Maine and only 20-50 pairs have nested at one or two colonies from 1969 to 1977 (AFN, RNEB, P. Grace pers. comm.). Roseate terns, nesting associates of common terns, seemed to disappear, with only one record of a large colony in 1931 (Palmer 1949). However, a 1977 report of about 25 pairs at Beach Island (P. Cannell pers. comm.) provides some encouragement for their reestablishment.

Double-crested cormorants have been controlled in the past because of their alleged predation on stocked salmon smolts. They were most abundant in southern Maine in the late 1940's and early 1950's (A. Gross unpubl. notes), declined in the 1960's (Drury 1973), but now have increased and breed at four locations.

Common eiders were reported by Drury as nesting in southern Maine but most of his records were based on counts of breeding-plumaged adults on the water near islands, not on nest counts. Bluff Island in Saco Bay is the only confirmed nesting location (Jones 1906, Drury 1973). No nesting was reported in 1976 or 1977 (R. Bollengier pers. comm.).

Wading Birds

Glossy ibises first nested in southern Maine at Stratton Island in 1972 (AFN/AB). In 1977, 45 pairs were recorded at Stratton and Wood islands, the only nesting sites north of the Isles of Shoals. An estimate of 247 pairs at Wood Island in 1975 (Custer and Osborn 1976, 1977) seems unlikely.

Table 27. Population trends of colonial birds in Maine (Cape Elizabeth, south) exclusive of the Isles of Shoals, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Double-crested cormorant	Several hundred (3 cols.[a])('44), ca. 600('48), 800+('52), 170+('65-72),		248('76)3 cols., 427('77)
Green heron	no census estimates		
Little blue heron			3-4('77)
Cattle egret			possible('76), 0('77)
Snowy egret		1('63), 111('75), 55('76),	34('77)
Louisiana heron			1-2?('76), 1('77)
Blk.-cr. night heron	2 large cols. ('14-15)	155('51),	101('75), 37('76), 28('77)
Glossy ibis		few('72), 247?('75). 88('76),	45('77)
Great black-backed gull[b]		ca.10('41), <100('50), ca. 500?('65), 500+('76),	1,000('77)
Herring gull[b]	<100('21), <1,000('31),	1,300('65), 1,200('72), 3,637('76),	3,300('77)
Laughing gull[b]		160('51), 150('65),	0('76), 0('77)
Common tern	400('00), 70('30), 800('31-5), 1,700('40),	2,300('45-8), 250('72),	100+('76), 197('77)
Arctic tern	"large nos."('07-14),	75('65-8),	0('76), 0('77)
Roseate tern	275('31),		25?('77)
Least tern		3('65), 40-50('69-71),	14('77)
Black guillemot		18 (65), 14('70-72) 2 cols.[a],	few('75),?('77)

[a] Col. (or cols.) refers to "colony" in Tables 27-38.

[b] Saco Bay area only

Snowy egrets seem to have increased rapidly from 1963 (AFN/AB) to 1975 (Custer and Osborn 1977) but decreased in 1976 and 1977. However, the census in 1975 was performed by different observers than in 1976 and 1977. Seven adult cattle egrets were seen at Stratton Island in 1976 (R. Bollengier pers. comm.) but nesting was not confirmed. In 1977, incipient nest-building was observed, but no nests or young were found (Vickery 1977).

Black-crowned night herons always have nested commonly in southern Maine, but only at one or two locations (Norton 1915, Gross 1951b, RNEB). A reduction occurred from 1975 to 1977, primarily at the Wood Island colony. A pair of Louisiana herons were found at Stratton Island for the first time in 1976 (R. Bollengier pers. comm.) and again in 1977 (Vickery 1977), constituting the northern-most site for this species. Four pairs of little blue herons nested at Stratton Island in 1977 (Vickery 1977), also representing a northern range expansion. Green herons, which usually nest solitarily or in small, loose colonies, probably have bred at scattered locations for many years even though they have seldom been reported. None were found in mixed heronries in 1976 or 1977. Great blue herons nest inland and on coastal islands further north.

ISLES OF SHOALS (MAINE-NEW HAMPSHIRE)

Seabirds

Great black-backed gulls maintained very low breeding numbers from 1930 to the mid-1940's, but have increased rapidly since 1950 (Drury 1973) (Table 28). Herring gull numbers increased rapidly in the 1920's and 1930's, fluctuated from 1945 to 1972 (Kadlec and Drury 1968a, Drury 1973), and have decreased recently.

Roseate terns nested fairly commonly about 1930 (Jackson and Allan 1931), but colony abandonment occurred by 1955 (Taber 1955). Common terns were very abundant in the early part of the century, peaking in 1940 (Wright 1937, Palmer 1938, 1949, Drury 1973). They were apparently driven away in the 1950's when the gull population erupted (Drury 1973). In 1977, none nested.

Double-crested cormorants increased from the 1940's to the mid-1960's (A. Gross and W. Drury unpubl. notes, Taber 1955) and have stabilized since then at 300 to 400 pairs. Only two or three pairs of black guillemots nest at this southernmost location (Drury 1973 unpubl. notes, A. Borror pers. comm.).

Wading Birds

Since 1975, 25 to 38 pairs of glossy ibises have nested at Appledore Island (Custer and Osborn 1977, A. Borror pers. comm.).

Black-crowned night herons increased on Appledore from 1934 until 1965 (AFN, RNEB) but dwindled to only 10 pairs by 1977. After 30 pairs nested in 1971 (new record) at Appledore Island, little blue herons were not seen in either 1975 or 1976, but one pair nested in 1977 (A. Borror pers. comm.). Snowy egret numbers increased from 1961 to 1975 (AFN) but dropped to only 50-60 pairs in 1976 and 1977.

Table 28. Population trends of colonial birds at the Isles of Shoals (Maine-New Hampshire), 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Double-crested cormorant		18('43), 100('45), 400('65), 325('72), 350('76), 400('77)	
Little blue heron		30('71)	0('76), 1('77)
Snowy egret		3('61), 10('67-9), 50('72), 110('75), 60('76), 50('77)	
Blk.-cr. night heron		Yes('34), 25('58), 210('65), 35('70), 60('72-5), 35('76), 10('77)	
Glossy ibis		38('75), 25('76), 30('77)	
Great black-backed gull	3('30), 16('41), 60('43), 120('50), 725('65), 1,150('72), 1,874('76), 2,136('77)		
Herring gull	500('21), 2,700('31), 2,350('35), 3,750('41), 5,000('45), 4,900('51), 3,800('62), 4,400('64), 5,850('65), 7,100('72), 4,250('76), 4,300('77)		
Common tern	1,000('28), 650('31-5), 1,700('40), 650('45-8),	0('72),	0('76), 0('77)
Roseate tern	10+('29), 15-20('30), 55('38),	0('55),	0('76), 0('77)
Black guillemot		2('45),	2('70-2), 3('76), 3('77)

MASSACHUSETTS

Seabirds

As in northern New England, both great black-backed and herring gull populations expanded very rapidly from the 1940's through the 1960's (Kadlec and Drury 1968a, Drury 1973) (Table 29). Recently, there appears to have been a reduction from population levels found in the 1965 to 1972 period for herring gulls but not for black-backs. Local population shifts also are occurring. Some Boston Harbor colonies are decreasing while others are increasing (J. Hatch unpubl. notes). Although the large Muskeget Island population has declined, the Coatue, Nantucket and Monomoy colonies have expanded considerably. Causes of these population shifts require investigation.

Laughing gull numbers expanded rapidly on Muskeget Island from the early 1900's to a peak of 20,000 pairs in 1940 (Nisbet 1971a, b, Wetherbee et al. 1972). Since then, the colony moved to Monomoy Island and numbers dwindled until 1972 when only 135 pairs remained (I. Nisbet pers. comm.). In 1977, they had increased to 200 pairs, providing some optimism for the future of this species in the State. In Massachusetts, they nest near terns in upland vegetation rather than in salt marsh (Spartina) as they do in New Jersey (Burger 1977) and further south.

Arctic terns, at the southern limit of their nesting range, have declined by nearly 50% since 1972 (Nisbet 1973, 1976b). Major declines were found at Plymouth Beach, Nomans Land Island, and Tern Island during the 1970's with only modest increases at Nauset Beach and along the north shore (Nisbet 1973 pers. comm.). This species usually nest with common and roseate terns.

Common tern populations also decreased by about 40% between 1972 and 1977 (Nisbet 1973 pers. comm.). Major shifts have occurred in colony location during the 1970's. Dramatic reductions have occurred in the past 6 or 7 years at the formerly large colonies at Nomans Land, Ram Island, Grays Beach, Plymouth Beach, Monomoy and Snake Island. Increases have been found at Bird Island and New Island, Nauset, but these increases have not compensated for the reductions at the major colonies.

Roseate tern populations have decreased by about 70% over the past 25 years (Nisbet 1973 pers. comm.). Major declines have occurred at six of the seven colonies. The two large colonies at Grays Beach and Nomans Land have nearly vanished. More than 95% of the breeding population is concentrated at only two colonies. This species is faring badly in New York as well and warrants consideration for "threatened" or even "endangered" status.

Least terns are faring better than any of the other terns in the State (Nisbet 1973 pers. comm., Blodget 1978). Thorough censusing in 1977 revealed a population at least equal to the "peaks" of about 1,500 pairs during the late 1940's (Nisbet 1973). Because of its asynchronous nesting pattern, small colony size, and tendency to shift colony sites, the least tern is probably underestimated in most censuses. Its population stability (or even increase) in recent years is particularly surprising considering the degree of disturbance along the beaches by vehicles and other types of human recreation (Blodget 1978).

Table 29. Population trends of colonial birds in Massachusetts, 1900-1977

Species	1900	Nesting pairs (and year)	1977
Leach's storm-petrel	some ('32)	90('41)	2-6('70-3), >20('76-77)
Double-crested cormorant	54('40), 43('43), 495('45), 715('50), 125('65),	500('72), 1,130('76),	1,760('77)
Little blue heron		1('40-1), 5('75), 10('76),	19('77)
Cattle egret			10('76), 10('77)
Great egret		1st record, 1('56), 3('75) 6('76)	6('77)
Snowy egret		1st record, 1('55), 1('62), 45('68), 478('75), 600('76),	459('77)
Louisiana heron			3('76), 1('77)
Blk-cr. night heron	3,000+ ('15-20)3 col., 3,300-3,600('55)10 col., 1,894('75), 1,500+('76)15 col.,		1,958('77)
Glossy ibis			96('75), 75('76), 110+('77)
Great black-backed gull		2('30), 9('41), 51('43), 60('50), 2,575('65), 3,175('72),	4,670('77)
Herring gull		300('31), 1,500('35), 5,900('41), 9,000('45), 24,800('51), 33,500('62), 36,600('65), 36,250('72),	25,845('77)
Laughing gull	45('00), 650('10), 2,000('20), 1,500('30), 20,000('40), 5,000('51), 400('60), 700('65), 200('70), 135('72), 180('76),		200('77)
Common tern	11,500('00), 30,200('31-5),	15,700('52), 7,500('72), 5,350('76),	4,475('77)
Arctic tern	35('01), 230('31),	240('52) 85('65-8), 105('72), 66('76),	73('77)
Roseate tern	3,500('00), 4,800('31),	3,800('52), 1,480('68), 1,340('72), 1,390('76),	1,327('77)
Least tern	250('10), 950('34-5),	1,500('45-52), 950('72), 1,470('76),	1,551('77)
Black skimmer		1('39), 2('46), 2('56-60), 1-2('67-72), 1('76),	0('77)

Black skimmers are at their northern breeding limit in Massachusetts, with only one or two pairs nesting in the Cape Cod area (Drury 1973). Double-crested cormorant numbers are increasing rapidly in Boston Harbor and Buzzard's Bay, more than tripling their population from 1972 (Drury 1973) to 1977. Leach's storm-petrels have nested on Penikese Island since at least the early 1930's. About 90 burrows were found in 1941 (Drury 1973), but only a few pairs were noted in the early 1970's. At least 20 pairs nested there in 1976 and 1977 (P. Stanton pers. comm.). Common eiders were introduced to Penikese Island and nested in 1976 (P. Stanton pers. comm.). In 1977, one eider brood was seen at Nashawena Island near Penikese (J. Hatch pers. comm.).

Wading Birds

Glossy ibis numbers increased slightly from 1975 to 1977. A count of 107 nests was made at House Island, Manchester in May 1977. Two other colonies also were active.

Snowy egrets first nested in the State at Quivet Neck in 1955 (Hill 1965) and nested in small numbers at Martha's Vineyard beginning in 1962 (AFN, RNEB). During the past 5 years, their numbers have increased markedly. Great egrets first nested in the State in 1954 at South Hanson, an inland site. The first coastal nesting was in 1956 at House Island (AFN). They now nest at three locations in small numbers. Cattle egrets nested in small numbers at House Island in 1976 and 1977, their only colony site.

With the disappearance of the major Quivet Neck-Sandy Neck (Cape Cod) colonies (Gross 1923, Church et al. 1955, Hill 1965), the black-crowned night heron population declined markedly during the 1960's but has increased again in recent years. The State's population now is distributed among a larger number of small colonies than during the 1950's. Only a few yellow-crowned night herons have been reported from three locations in the 1940's and 1950's (AFN, RNEB). Little blue herons nest in small numbers at four locations and Louisiana herons colonized House Island in 1976 (Forster 1976), a new State record. Green herons have seldom been reported in large numbers at coastal colonies, but in 1965, Keith and Chalif (1968) reported 30 pairs at Little Neck, Martha's Vineyard.

RHODE ISLAND

Seabirds

Populations of both great black-backed and herring gulls have increased rapidly in Rhode Island (Drury 1973) (Table 30). Reversing the Massachusetts pattern, the Rhode Island population of herring gulls continues to increase, while great black-backed gulls may be declining.

Common tern numbers have fluctuated since the early part of the century but appear to have been relatively stable since the 1960's (Clement and Woodruff 1962). They generally nest in small colonies on rocks in Narragansett Bay (Ferren in prep.).

Roseate tern numbers dwindled during the 1940's and disappeared after 1951, probably due to the expansion of the gull population (Ferren in prep.). In 1977, only one pair was found. They may nest at four other sites.

Least terns appear to be in jeopardy in the State, having declined to only 13 pairs in 1976, the lowest figure since 1929 (Ferren in prep.). In 1977, there was a modest rebound.

Wading Birds

Glossy ibises first nested in the State in 1972 at Gould Island and increased to 160 pairs after moving to Hope Island.

Great egrets have increased slowly since they first began nesting in 1965 (Ferren in prep.). Snowy egret numbers have fluctuated since their initial nesting in 1965, but reached a peak of 180 pairs in 1977 at Hope Island. Similarly, cattle egrets increased from 1964 to 1974, declined in 1975 and 1976, but reached a record 110 pairs in 1977 (Ferren in prep.). Small numbers of little blue herons have nested in the State since 1967 (Ferren in prep.) and increased at Hope Island in 1977. Black-crowned night herons were abundant in the early part of the century, declined during the 1950's and 1960's but are increasing now (Ferren in prep., Drury pers. comm.). Yellow-crowned night herons have never been common. Only one to three pairs have been reported at Gould or Block Island (AFN, Ferren in prep.). Green herons are more abundant than their numbers suggest because their nesting habits make them difficult to census. In 1977, one pair was found nesting at each of two sites.

Table 30. Population trends of colonial birds in Rhode Island, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Green heron		4+('54), 3('72), 8('76), 2('77)	
Little blue heron		5('67), 3('68), 8('71), 12('72), 10('73), 18('74), 3('76), 35('77)	
Cattle egret		1('64), 10('65), 6('66), 10('67), 3('68), 25('71), 60('72), 25('73), 60('74), 0('75), 1('76), 110('77)	
Great egret		1('65), 1('68), 7('69), 5('71), 6('72), 5('73), 12('74), 18('75), 24('76), 22('77)	
Snowy egret		15('65), 12('66), 20('67), 15('68), 30('71), 50('72), 25('73), 80('74), 3('75), 7('76), 180('77)	
Black-cr. night heron	<300('00), 400('37), 450('40), 300+('47), 200+('50), 100('68), 100('71), 375('75), 413('76), 517('77)		
Yellow-cr. night heron		1('65), 1('72), 3-4('74), 0('75),	0('77)
Glossy ibis		1('72), 12('74), 0('75), 20('76),	160('77)
Great black-backed gull	1('44), 2('46), 2('51), 15('61). 60('62), 165+('71-2), 715('76),		540('77)
Herring gull	1('27), 10('38), 50('40), 144('41), 300('46), 1,300('51-2), 2,000('53), 2,300('61), 2,600+('62-3), 5,400('71-2), 5,200('76),		6,016('77)
Common tern	100-200('00), 120-150('35-40), 200+('46), 150+('50), 400('61), 200-250('72), 350('76),		589('77)
Roseate tern	First record ('29), 30('37), 40-60('41), 2-3('46), 10('51) -- disappeared --		1('77)
Least tern	few('29), 30-40('36-8), 60-70('44), 150('46), 75('50-5), 100-125('61), 50('65), 30-50('72), 13('76),		47('77)

CONNECTICUT

Seabirds

Both of the large gull species are increasing as in the rest of New England (Drury 1973), with herring gulls expanding much more rapidly than great blackbacked gulls (MacKenzie 1961, Drury 1973) (Table 31).

Common tern populations have fluctuated considerably since 1900, with large gaps of years between censuses (MacKenzie 1961, Bull 1964, Nisbet 1973). The large Falkner Island colony comprised 70% of the State population in 1976 and 1977 (D. Duffy pers. comm.). Only three of all the colonies along the coast contained more than 50 pairs in 1977. This species appears to be as abundant today as it ever was in the State, but the future of the large Falkner Island colony is uncertain (D. Duffy pers. comm.) because of ownership settlement.

Roseate terns, nesting associates of common terns, have not nested in large numbers in the State since the late 1800's when as many as 500 were reported (Dutcher 1901). Since 1900, numbers peaked in the period 1945 to 1952 (MacKenzie 1961, Nisbet 1973) but later declined apparently due to competition with gulls. In the past 5 years, only 40-60 pairs have been found (Duffy 1977, unpubl. notes).

Least tern numbers may have increased recently but concern for its population status (Arbib 1976) has probably resulted in more complete censusing. In 1976, seven colonies were located, but in 1977 the entire population was concentrated at only three sites (Duffy unpubl. notes, N. Proctor pers. comm.).

Wading Birds

Comprehensive censuses have been conducted infrequently in this State (Dater 1969). Glossy ibises are slowly increasing in the Chimon Island colony after their initial nesting in 1971 (AFN). Great blue herons have disappeared from coastal Connecticut. Great egret numbers increased from 5 pairs in 1976 to 20 pairs in 1977, equaling the previous high count in 1961 (Bull 1964). Similarly, the snowy egret population showed a gain, with 50 pairs nesting at Chimon Island in 1977 (N. Proctor pers. comm.). Cattle egrets are still marginal breeders in the State after their initial nesting in 1971 (AFN). Black-crowns appear to have increased along the coast since 1965 but in 1977 almost the entire population nested at Chimon Island (N. Proctor in prep.). Yellow-crowned night herons nest in very small numbers (AFN, RNEB, N. Proctor in prep.), usually in colonies with other species. One pair of Louisiana herons nested at Chimon Island in 1976 (Finch 1976) but was not recorded in 1977. A single pair of little blue herons nested at Chimon Island in 1968 (Dater 1969), 1971 (AFN), and again in 1977 (N. Proctor pers. comm.). Green herons are widely-distributed in small (5 pairs) numbers along the coast at 15 to 20 locations, but records are scarce (N. Proctor in prep.). More nest inland. The rocky shoreline and lack of extensive salt marsh feeding habitat probably explain the very small wading bird population in Connecticut.

Table 31. Population trends of colonial birds in Connecticut, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Great blue heron		7('47)	0('77)
Green heron		--scattered groups -- 50-75(1970's),	15('77)
Little blue heron		1('68), 1('71), possible('75),	1('77)
Cattle egret		1('71), 2?('76),	4('77)
Great egret		1('41) 20('61) 5('76),	20('77)
Snowy egret		8('61), 3('62) 23('76),	50('77)
Black-cr. night heron	20-25('03)[a] 1 col.,	30-40('65-66)[a] 3 col., 100-150('75)8 col.,	406('77) 2 col.
Yellow-cr. night heron	6?('47), 1st def. record,	2('53), few ('54)[a] 2 col., 2+('75) 1? possible	('77)
Glossy ibis		3('71), 2('76),	10('77)
Great black-backed gull		15('72), 50+('75),	164('77)
Herring gull		250('62), 1,500('72),	3,134('77)
Common tern	75('00),	700('47), 900('52), 450('72), 110('74), 1,035+('75), 975('76),	1,479('77)
Roseate tern		30('31), 125('47-51), 100('52), 40-65('72), 51('75), 38('76),	64('77)
Least tern		27('72), 55('73), 107('74), 120('75), 105('76),	120('77)

[a] Partial State count.

NEW YORK

A complete Long Island helicopter inventory of colonial waterbird colonies was conducted during early June each year from 1974 to 1977 by P. A. and F. G. Buckley (Buckley and Buckley in prep.). In most cases, the species totals given (Table 32) are based on their censuses except where more precise nest counts were made. Because the Buckleys used different correction factors than those derived in this study, the totals in Table 32 will differ somewhat from their published figures.

Seabirds

As in northern areas, great black-backed and herring gull numbers have exploded at the east end and along the south shore of Long Island since the 1960's and 1940's, respectively (Bull 1964, Kadlec and Drury 1968a, Drury 1973). There is some indication of a herring gull decline since 1975 (P. and F. Buckley pers. comm.), perhaps due to changing urban refuse policy. Curiously, laughing gulls have not nested on Long Island since the late 1800's, but nest in States both north and south.

Two pairs of gull-billed terns nested for the first time in the State at North Line Island in 1975 (Buckley et al. 1975) but nesting was not confirmed subsequently. Common terns are very abundant today, perhaps more than ever before (Nisbet 1973, Drury 1973). However, before 1973, census coverage was not comparable to that achieved by helicopter surveys of the entire coastline (Buckley and Davis 1973, Buckley and Buckley in prep.). Many small colonies probably were missed in earlier years. Colonies are becoming concentrated into fewer, larger assemblages with some shift in habitats from beaches to bay islands (Buckley and Buckley 1976).

The roseate tern population has declined markedly; a greater than 50% reduction occurred from 1975 to 1976 (Buckley and Buckley pers. comm.). On Long Island, nearly all birds now nest in one colony at Great Gull Island. Formerly large south shore colonies have decreased precipitously during the past few years (P. and F. Buckley pers. comm.).

Least terns may be more abundant in New York now than earlier in the century but, as noted above, comparing recent aerial surveys with earlier censuses may lead to spurious conclusions. The Eaton's Neck colony may be the largest colony on the northeast coast, but nesting numbers fluctuate considerably from year to year (LNL, KB, Fisk 1974, Duffy 1977).

Black skimmers have increased steadily along the southern beaches of Long Island since the 1930's (Bull 1964, 1974, Drury 1973, KB, L. Wilcox unpubl. notes). As with terns, the traditional beach nesting sites have been usurped by man, apparently resulting in a shift to dredge deposition islands in bays (Buckley and Buckley 1976).

In recent years, small numbers of double-crested cormorants have nested on rocks near Fisher's Island in eastern Long Island (Drury 1973). In 1977, 65 pairs nested at Hungry Point.

Table 32. Population trends of colonial birds in New York (Long Island), 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Green heron		50('62-6)[a] 7 col., ca. 10('73-4)[a] 4 col.,	3('77)
Little blue heron		1st bred ('58), 8('62), 10('67), 34('74), 20('75), 10('76), 13('77)	
Cattle egret		1st record('70), 16('74), 14('75), 21('76), 15('77)	
Great egret		1st bred('53), 30-60('56-'60)3 col., 300('74), 400('75), 300('76), 317('77)	
Snowy egret		1st bred ('51), 145-160('60-'61)3 col., 730('74), 930('75), 1,400('76), 1,416('77)	
Louisiana heron		1st bred ('55), 7+('73), 13('74), 13('75), 14('76), 10('77)	
Black-crowned[b] night heron		3,500('35-7) 20 col., 1,140('74), 1,290('75), 1,080('76)18 col.,	1,534('77)
Yellow-crowned night heron		ca. 30('60-3)a 8 col., 93('74), 6('75), 17('76),	22('77)
Glossy ibis		3('61), 7('63), 31('65), 115('67), 166('69), 428('74), 644('75), 741('76),	917('77)
Great black-backed gull		1('43), 4('50), 257('65), 320('72), 1,850('74), 1,400('75), 1,250('76),	1,894('77)
Herring gull		23('31), 475('41), 1,000('42), 2,250('45), 5,475('51), 8,800('62), 11,575('65), 13,400('72), 16,750('74), 21,200('75), 15,900('76),	17,459('77)
Common tern	2,500('00), 7,150('31-5),	400+[a]('55-58)15 col., 11,000-12,000('68-'72), 10,800('74), 11,760('75), 12,500('76),	10,014('77)
Roseate tern	0('00)	500('31) 2,100('72), 2,340('74), 2,053('75), 980('76),	861('77)
Least tern		1st breeding ('26), 300+('42)[a], 300+('54-8)[a] 8 col., 1,500+('72), 1,675('74), 2,450('75), 2,300('76),	2,884('77)
Black skimmer		1('34), 40('42), 250('48-'54), 300('61), 250+('71), 350('74), 450('75), 500('76),	442('77)

[a] Partial State count

[b] A 2.5 correction factor applied to Buckley's aerial estimates, 1974-1977

Wading Birds

Glossy ibises first nested in the State in 1961 (Post et al. 1970, Bull 1964) and by 1969 had increased to about 175 pairs at five locations (Post et al. 1970). In 1977 it ranked third in wading bird abundance on Long Island.

Great and snowy egrets proliferated after initial nesting in the 1950's. Great egrets increased quickly during the 1960's (KB, AFN, Bull 1964, 1970), but the population has remained fairly stable since 1974 (Buckley and Buckley in prep.). Snowy egrets are still rapidly increasing, nearly doubling their population from 1974 to 1976 (Buckley and Buckley in prep.). The growth rate of the cattle egret population, a recent invader of North America, is much more moderate on Long Island than in New Jersey, Delaware, and Maryland. It first nested in the State in 1970 (KB, Bull 1974), but after 7 years has increased to just 15 pairs (P. and F. Buckley pers. comm.).

The black-crowned night heron was essentially the only abundant breeding wading bird species throughout the first half of the century, with six colonies of 300 pairs or more in the 1930's (Allen 1937c). Habitat destruction and pesticides probably contributed to a reduction in their numbers today to less than half of those in 1935-37 (Allen 1937c, Bull 1964) but they seem to be increasing again. The recent (1974-1977) totals were derived by extrapolating the Buckleys' counts, using a 2.5 (nests per adult) factor rather than the 1.0 they used. Yellow-crowned night herons have declined in recent years but were never very abundant (Bull 1964, 1974). Little blue herons nested for the first time in 1958 (Post 1961, Bull 1964) and have maintained low numbers, decreasing between 1974 and 1976. Louisiana herons, after first nesting in New York City in 1955 (Meyerriecks 1957), maintain low numbers at four colonies (KB, AFN, P. and F. Buckley pers. comm.). Green herons, a semi-coastal species, might be declining but there are no accurate censuses.

NEW JERSEY

Seabirds

Great black-backed gulls first nested in 1966 (Miller 1966) and have increased gradually since then (Table 33). In 1977, only two colonies contained more than 10 pairs (Kane and Farrar 1977). Herring gulls have increased much more rapidly and have begun nesting in large numbers on salt marsh (Spartina alterniflora) islands (Burger 1977). As a result, intense nest site competition is occurring between this dominant gull and the smaller laughing gull and common tern (Burger 1977, Burger and Shisler 1977). Although laughing gulls appear to be increasing, earlier censusing was inadequate. Fables (1955) listed them as abundant but local in the southern coastal area. The largest colonies are in the marshes near Stone Harbor and Brigantine Refuge. The well-documented usurpation of laughing gull sites on Muskeget Island, Massachusetts may be repeated as herring gulls continue to expand their range southward.

Gull-billed terns have never nested in large numbers in the State. Usually only a few pairs are found at Avalon (Graven's Island) and at one or two other locations (AFN/AB, NJA, Fables 1955), but the total of 19 pairs in 1977 may indicate a genuine increase (Kane and Farrar 1977).

Forster's tern, at its northern coastal limit in New Jersey, probably has been more numerous in the past than early records indicated (McMullen unpubl. notes, Fables 1959). Its tendency to nest in small marsh colonies makes censusing difficult and it may be confused with common terns.

Common terns have nested abundantly in New Jersey since the 1920's (Stone 1937, Fables 1955, Nisbet 1973, Buckley 1977). The apparent increases in New Jersey and Long Island may in part balance reductions in New England (Nisbet 1973). Some common terns have shifted colonies from beach to salt marsh habitats (Burger and Lesser 1977). Drury's (1973) figures, which showed high fluctuations since 1900, may have resulted from incomplete surveys.

Roseate terns have nested infrequently in small numbers with common terns in the past. By 1937, they had returned as a breeding species but probably were overlooked among the numerous common terns (Stone 1937, Buckley 1977). Never more than five pairs have been reported. None were reported in 1977 (Kane and Farrar 1977).

Least terns, despite the human pressure on barrier beaches, seem to be increasing in the State, contrary to the dire predictions made by Downing (1973) and Fisk (1974). Caution must be used in comparing earlier censuses with recent ones because of the increased interest in the threatened status of the species (Arbib 1976, Galli pers. comm.). Nearly half of all breeding least terns in the State nested at artificial landfill or dredge deposition sites (Kane and Farrar 1977). The New Jersey Division of Fish, Game, and Shellfisheries has recommended that this species be placed on the State's Endangered Species list (J. Galli pers. comm.). There are very few nesting colonies that are not vulnerable to human disruption.

Table 33. Population trends of colonial birds in New Jersey, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Great blue heron	100-200('20-25) 6 col.,	150-175('50-55) 7 col.	6('76) 1 col. 3('77)
Green heron	-- from 1-36 pr. reported in diff. years from 17 locations--		60('75), 6('76), 14('77)
Little blue heron		135-220('45-51), 6 col.	ca. 250('58), 240('75), 10 col. 165('76), 246('77)
Cattle egret		1st record ('58), 13('59),	36('75)[a], ca. 125('76), 7 col. 565('77) 7 col.
Great egret	1('28), ca. 50('34-40) 5 col.,	300-400('57-8) 7 col.,	500[a]('75), 240[a]('76), 488('77)
Snowy egret		1st record ('39), 3 col.	800-1,200('59), 2,700[a]('75), 1,100[a]('76), 18 col. 2,783('77)
Louisiana heron		1('48)	ca. 220('57-59) 6 col., ca. 280('75), 88[a]('76), 178('77)
Black-cr. night heron	120+('20-25) 4 col.[a],	110-150('47-53) 6 col.[a],	ca. 1,500('75)[a], 600('76)a, 11 col. 16 col. 1,453('77) 26 col.
Yellow-cr. night heron			15-20('50-55) 6 col.[a], 70('75) 6 col., 43('76), 139('77)
Glossy ibis			1st record('55), 65('55-8) 6 col., 2,000-2,500('75-6)[a], 16 col. 2,844('77) 19 col.
Great black-backed gull			2('66), 8('70), 50-75('76), 144('77)
Herring gull			1('46), 15('59), 80('64)2 col., 4,400('76), 5,913('77)34 cols.
Laughing gull	2,500-3,000('26)2 col.only[a],	5,000+(mid-1950's)[a]5 col.,	10-15,000('76)[a]18 cols., 30,940('77)
Gull-billed tern	-- from 1-10 pr. reported occasionally from 1925-1970, 13('71), 4('76), 19('77) 4 col.		
Forster's tern	Yes('00)3 cols.[a] (no data) -- misc. reports of 1-40 pr. -- ca. 200('76), 463('77)6 col.		
Common tern	50('00), 900-1,200('25-31)13 col.[a],	300('31-5),	2,200-3,000('50-5)[a] 6 col., 750[a]('72), 4,000-4,300('76), 4,462('77)44 col.
Least tern	ca.300('25-30)8 col.[a],	ca. 175('45-50)6 col.[a],	300('75)[a], ca. 1,400('76), 1,786('77)19 col.
Black skimmer	350-400('25-30)9 col.[a],	400-650('45-50)5 col.[a],	1,000-1,500('74-5), 1,100('76), 949('77)

[a] Partial count only.

Black skimmers maintain a fairly large, stable breeding population in the State with major colonies on the protected beaches at Brigantine National Wildlife Refuge (Little Beach and Holgate). However, only three colonies make up 90% of the total breeding population. There is a large traditional colony at Avalon (AFN, NJA) located on a dredge deposition area. An early report (AFN) of 4,000 adults at Tuckerton in 1953 is probably erroneous since McMullen (unpubl. field notes) estimated only 200. Endangered Species status has been recommended to the New Jersey Division of Fish, Game, and Shellfisheries for this species (J. Galli pers. comm.). Two of the three largest colonies contain more than 50% of the population and are vulnerable to human disturbance (Kane and Farrar 1977).

Wading Birds

Glossy ibises first nested in the State in 1955 (McMullen unpubl. notes, UOC, Buckley 1977) and by 1976 was one of the more abundant wading birds (Kane and Farrar 1976). In 1977 it was equal in abundance to the snowy egret (Kane and Farrar 1977). It often nests on the ground in dense reed (Phragmites communis) on dredge deposition sites, frequently with black-crowned night herons. Its early arrival on the nesting ground may confer some advantage over native herons in New Jersey (Buckley 1977).

Coastal colonies of great blue herons have declined drastically since the early 1900's (Miller 1943, Buckley 1977). There have been no recent reports concerning the formerly large rookeries at several Delaware Bay locations. In 1977, only the Sandy Hook colony definitely had nesting birds.

After years of absence, great egrets nested again in 1928 and steadily increased through the 1950's (Stone 1937, Seibert 1951, Allen 1957, McMullen unpubl. notes). They may have peaked in recent years. Snowy egrets first nested in southern New Jersey in 1939 (McDonald et al. 1940) and have increased ever since, ranking now as one of the most abundant wading birds in the State (Kane and Farrar 1977). Cattle egrets also are increasing, possibly at the expense of other small herons such as the Louisiana and little blue (Burger 1978). From one pair in 1958 (Fables 1959), cattle egrets increased to 565 pairs at seven colonies in 1977 (Kane and Farrar 1977). The two recent invaders from the south, cattle egret and glossy ibis, now rank among the four most abundant wading bird species in New Jersey.

Little blue herons first nested in 1935 and began increasing in Cape May County in the 1940's (McMullen unpubl. notes, NJA). Bull (1964), Fables (1955), and Cruickshank (1942) considered the species an abundant nester. Clapp (1975) suggested that numbers might have decreased from peak counts in the 1950-60 period, but the 1977 totals equal the former peak. Like other dark-bodied cryptic herons, it probably has been underestimated in past censuses. Louisiana herons increased rapidly in the decade following their initial nesting in 1948 (Post 1961, UOC), but have remained at about 200 pairs since the late 1950's (H. Mills unpubl. notes, NJA). The 1975 estimate of 280 pairs is questionable due to the late (July) census date at which time counts may have included individuals dispersed from southern locations. Green herons have never nested in large numbers at any coastal location (Stone 1937, Fables 1955) except possibly during the 1890's (Burns 1929). As many as 36 pairs have been reported at Ocean City (Seibert 1951) and 58 by Custer and Osborn (1976) in 1975. In 1977 only 14 pairs were reported at four mixed colonies.

Black-crowned night herons have increased during the century by a substantial amount (Stone 1937, Fables 1955). Although its population probably decreased because of pesticides in the 1950's and 1960's, it is presently the third most abundant wader in the State (Kane and Farrar 1977). Yellow-crowns are difficult to census. Total estimates never exceeded 75 pairs until 1977 when 139 pairs were reported (Kane and Farrar 1977). Fables (1955) listed it as "rare" in southern New Jersey.

DELAWARE

Delaware information was the most incomplete of any of the 10 coastal States due to inadequate published records (Table 34).

Seabirds

No records of herring gulls nesting in the State prior to 1976 were found. Small numbers of herring gulls nesting on marsh islands (as in New Jersey and Maryland) may have been overlooked. Nesting by laughing gulls also was not recorded until 1976 (M. A. Byrd pers. comm.). Black skimmers have decreased from a peak of 100-125 pairs in 1967 (W. Wayne pers. comm., DO) to only 27 pairs at four sites in 1977. Three of the four locations are marsh islands. The once large, traditional tern and skimmer colony at Cape Henlopen State Park, used by skimmers during the 1960's, had been abandoned for several years but was reoccupied in 1977. Common terns peaked in 1967 (AFN, DO) at about 1,675 pairs at two colonies, but have declined in recent years. Most of the 451 pairs in 1977 nested on marsh islands in Rehoboth Bay. Least tern colonies persist at four locations along the oceanfront and the Cape Henlopen colonies appear to be returning to former sizes of 150-170 pairs found in the early 1970's (Downing 1973, Fisk 1974). Human intrusion and raccoon predation probably have caused reductions in some years. In 1976, the largest least tern colony ever found in the State (est. 400 pairs) was reported at Delaware Beaches State Park (M. Barnhill pers. comm.). With adequate protection, the terns and skimmers should be able to maintain present populations despite coastal development. The Rehoboth Bay-Indian River estuary appears to have high secondary productivity and in 1967, 1,300 pairs of terns and skimmers nested at one dredge deposition island near the inlet.

Wading Birds

Most of the recent information on wader abundance is based upon J. Wiese's observations at Pea Patch Island.

Glossy ibises increased rapidly from 1964 to 1968, reached a peak in 1975, but declined sharply in 1976 and 1977 at Pea Patch Island (Wiese and Smith-Kenneally 1977, Wiese pers. comm.). Great blue herons were the most abundant wading bird in 1915 (Miller 1943) but numbers have decreased since then while other species have increased. Their numbers appear to have stabilized since 1975. Many still nest at two woodland sites but the Pea Patch Island colony was nearly deserted in 1977 (Wiese and Smith-Kenneally 1977). In 1977 great egret numbers increased at Pea Patch to 250 pairs (Stone 1937, AFN, Wiese and Smith-Kenneally 1977) after a reduction from a peak of 600 pairs in 1974 to 175 pairs in 1975-76. Snowy egret populations have fluctuated also, with a peak of 1,000 pairs in 1977 at Pea Patch Island (Wiese pers. comm., Wiese and Smith-Kenneally 1977). Louisiana heron numbers appear to be fairly stable. Cattle egrets have expanded in number to become the most abundant wading bird in Delaware (Wiese and Smith-Kenneally 1977). Only two pairs of green herons were found in 1977 but many others probably nest inland and in small numbers along the coastal bays. Yellow-crowned night heron numbers doubled from 1975 to 1976 at Pea Patch (Wiese and Smith-Kenneally 1977).

Table 34. Population trends of colonial birds in Delaware 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Gr. blue heron	60-65('06)2 col., 735('15)1 col. ---- abandoned('36)		132('75), 164('76), 174('77) 2 col. 3 col.
Little blue heron		10('36)	35('75), 400('76), 600('77)
Cattle egret		125; 1st State record('64)1 col., 450('68)1 col., 600('73)1 col.,	4,500('75), 4,500('76), 4,000+('77)
Great egret		41('36), 400('68), 600('74), 175('75), 175('76), 250('77)	
Snowy egret		100('68), 900('74), 250('75), 900('76), 1,000('77)	
Louisiana heron			50('75), 40('76), 50('77)
Black-cr. night heron		150('36) 300('68), 500('74), 400('75), 400('76), 400('77)	
Yellow-cr. night heron			20('75), 40('76), 40('77)
Glossy ibis	20-30; 1st State record('64)1 col., 450('68)1 col., 400('73)1 col., 1,500('75),		600('76), 700('77)
Herring gull			ca. 20('76), 31('77)
Laughing gull			60('76), 96('77)
Common tern		130-150('64-66)1 col., 1,675('67), 750-800('69), 350-400('76), 451('77)	
Least tern		100('71)[a] 1 col., 170('74)[a] 1 col., ca. 450('76), 166('77)	
Black skimmer		30('65)1 col., 100-125('67)2 col., ca. 150[a]('76), 27('77)	

[a] Partial State count

MARYLAND (ATLANTIC COAST/CHESAPEAKE BAY)

Because of the interposition of a large land mass (the Delmarva peninsula) between the Chesapeake Bay and the Atlantic coast of the State, nesting populations of waterbirds for each region are treated separately in this report (Tables 35 and 36).

Seabirds

Great black-backed and herring gull populations have increased much more rapidly at Smith Island in the Chesapeake Bay than they have along the Atlantic coast (MOS, MB, M. Byrd unpubl. notes). In 1977, herring gull numbers had increased at six coastal sites. Laughing gulls nest primarily at one coastal colony, but none nest on the Bay.

Forster's terns, primarily coastal marsh nesters, are probably as abundant today as ever. A reduction along the coast in 1977 was offset by an increase at four Chesapeake Bay colonies. Gull-billed terns have nearly disappeared in the past 25 years in the State. They were not recorded as a breeding species in 1976 or 1977. The previous peak was only about 35 pairs in 1951 (AFN, MOS).

Common terns are equally abundant on both Atlantic and Chesapeake Bay coasts. Populations have been quite stable along the coast (MOS, Stewart and Robbins 1958) and may be increasing along the Bay although earlier reports were incomplete (MB). Virtually all of the coastal beaches are disturbed heavily by humans which apparently forces the terns to nest on small marsh islands.

Roseate terns nested on Assateague Island in 1933 (Stewart and Robbins 1958) but, with one exception, have not nested since. The royal tern is at its northern range limit in Maryland and numbers have fluctuated quite widely since the early 1950's (Stewart and Robbins 1958, Bridge and Weske 1961, MOS). The birds apparently shift between one or two sites in Maryland and the larger Virginia colonies nearby (J. Weske pers. comm.). A few sandwich terns recently have nested (J. Weske pers. comm.) in royal tern colonies but are also at their northern range limit in Maryland. The black skimmer appears to have declined since the 1950's. Only about half as many nests were found in 1976 and 1977 (M. Byrd pers. comm.) as in 1951 (Stewart and Robbins 1958).

Least terns have declined sharply along the coast. Stewart and Robbins (1958) reported that 285 pairs bred north of Ocean City in 1948. None were found in 1977 (M. Byrd pers. comm.). In the Chesapeake Bay, total numbers have remained fairly stable but the number of colonies has declined from more than 20 in the late 1940's and early 1950's to only 2 in 1977. They persist in some urbanized areas (New Jersey, Long Island) because of their propensity for nesting on newly-created sites such as landfills. In Maryland perhaps no alternative sites are available.

Wading birds

After a rapid expansion during the early 1970's (MB, MOS), the glossy ibis population recently has declined along both Chesapeake and Atlantic coasts (M. Byrd unpubl. notes) Great blue herons are thriving at 13 Bay colonies with an increase in the past 10-12 years. The harsh winter of 1976-1977 may have accounted for the 1977 decline (C. Robbins pers. comm.).

Table 35. Population trends of colonial birds along the Atlantic coast of Maryland, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Green heron		35-40('57)[a], 100+('60)[a] 4 col., 32('75), 10('76), 0('77)	
Little blue heron		125('46)1 col., 50('56), 50('65), 100-130('75-6)1 col., 57('77)	
Cattle egret		1('57), 12('58), 60('60), 7('65), 600('73), 300('75), 900('76), 960('77)	
Great egret		40('53) 15('60), 35('66), 53('75), 50('76), 177('77)	
Snowy egret		50('46), 100('56), 150('63), 500('73), 400('75), 275('76) 4 col., 500('77)	
Louisiana heron		9('53), 50('57), 33('60), 34('65), 230('75), 100('76), 73('77)	
Blk.-cr. night heron		50('46), 100('58), 70('75), 100('76)5 col., 189('77) 3 col.	
Glossy ibis		2('56), 25-30('58), 50('66), 500('71), 310('75), 140('76), 63('77)	
Great black-backed gull		1('72), 5('75), 1('76), 9('77)	
Herring gull		1st record('58), 3('65), 43('71), 100-150('76)4 col., 525('77)	
Laughing gull		<100('51)[a], 210('57)[a], 1,700('75)[a], ca. 3,000('76), 2,230('77)	
		2 col. 2 col. 5 col. 2 col.	
Gull-billed tern		25('51)[a], ca. 30('54)[a], 1('75), 0('76)	
Forster's tern		few('00-10), 713('51)[a], 135('55-56)[a], 360('75)[a], ca. 600('76), 336('77)	
		1 col. 4 col. 7 col. 3 col.	
Common tern	600('35-40)[a] 1 col.,	400-600('53-8)[a] 4 col., 300[a]('76) 3 col., 759('77)	
Roseate tern	ca. 50('33)	1('63), 0('75-7)	
Least tern		200('45)[a] 1 col., 285a('48), 50('53-8)[a] 4 col., 48('75), 100('76), 0(77)	
Royal tern		2('50), 250('54), 15('56), 300('58), 475-600('75), 1,150('76), 134('77)	
Sandwich tern		2('74) 0('76-77)	
Black skimmer		ca. 250('51)[a], 200-300('53-60), 80('70)[a], 100-130('75-6), 142('77)	
		4 col.	

[a] Partial State count

Table 36. Population trends of colonial birds in the Chesapeake Bay of Maryland, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Great blue heron	Only 2 col. reported before 1950,	1,300-1,400('63-4)[a] 6 col., 1,560('75), 2,070('76)13 col.,	1,883('77)
Green heron		330-400('63-9)8 col., 60('75), 12('76)[c],	28('77)
Little blue heron		100('60), 110-150('60-5)[a], 135('75), 15('76)[c],	45('77)
		1 col. 4 col. 6 col.	1 col.
Cattle egret		20('64), 200('69-71), 215('75), 65('76)[c],	365('77)
		2 col.	5 col.
Great egret		few('54-6) 2 col., 140-300('63-7), 335('75), 650('76),	650('77)
Snowy egret		100-125('63-7)5 col., 500('75)6 col., 125('76)[c],	835('77)
Louisiana heron		40('63-4)[a] 2 col., 140('75)6 col., 50('76)[c],	131('77)
Black-cr. night heron		300-350('60-63)[a], 350('75), 130('76)[c],	777('77)
		4 col. 7 col. 3 col.	8 col.
Yellow-crowned night heron		130('75)7 col., 20('76)[c] 2 col.,	37('77)
Glossy ibis		400-450('70-3)9 col., 180('75)5 col., 60('76)[c] 2 col.,	74('77)
Great black-backed gull		possible('73), 5-10('75), 5-10('76),	24('77)
Herring gull	1st State record ('55),	6('56), 50('62), 543('73), 1,600-1,800('75-76),	4,050('77)
		1 col.	4 col.
Laughing gull	small nos. ('36-'54)	possible ('75),	0('76-77)
Forster's tern		83('73)[a] 1 col., few('76),	184('77)
Common tern	only 2 reports ('19-20),	300+('54)[a] 2 col., 50-100 ('55-57)[a] 3 col.,	290('75), ca. 350('76) 5 col., 923('77)
Least tern	50-100('19-25)[a] 4 col.,	200-225('50-57)[b] 10 col., ca. 125('75), 50-100('76),	210('77)

[a] Partial State total

[b] Stewart and Robbins (1958) show 27 colony locations (Fig. 27, p.166) but all were not censused for any 1 year.

[c] Excludes Martin National Wildlife Refuge which was not censused

Great egrets have increased at nine colonies in the Chesapeake Bay and increased greatly at the major Chincoteague Bay colony on the Atlantic coast in the past year (MOS, BNWR, M. Byrd unpubl. notes). Snowy egrets also have shown marked population gain in both coastal areas during the 1960's and the early 1970's (MOS, BNWR). They continue to expand at seven Chesapeake Bay colony sites (M. Byrd unpubl. notes). After their initial nesting in the late 1950's and early 1960's (Valentine 1958, Miller 1959, MOS), cattle egrets have increased both along the Chesapeake and Atlantic coasts (one colony only). Along the Chesapeake Bay, the number of colonies also has increased from two in 1975 (Custer and Osborn 1976) to five in 1977 (M. Byrd unpubl. notes).

In the past 2 years, little blue herons have declined in the Bay from six colonies in 1975 to only one in 1977 (M. Byrd unpubl. notes). Also, only one Atlantic coast colony was active in 1977. Louisiana herons increased dramatically from the early 1960's to 1975 in both coastal regions (MOS, MB, AFN). Atlantic coast colonies declined from 1975 to 1977.

Black-crowned night heron numbers have been stable along the coast for the past 20 years and have increased from one to three colonies (Sprunt et al. 1976, MOS, AFN). In the Bay, there may have been an increase, but earlier records were incomplete prior to 1977. Also, reports of "total" numbers are usually underestimates. Yellow-crowned night herons nest commonly along the Chesapeake Bay (MB) but seldom are reported along the coast.

VIRGINIA (ATLANTIC COAST/CHESAPEAKE BAY)

Atlantic and Chesapeake Bay populations are treated separately in Virginia (Tables 37, 38). As in other States very few regional surveys were ever attempted. Most interest was focused at a few traditional colonies such as Cobb and Wreck. Historical comparisons, as a result, should be considered incomplete.

Seabirds

A few pairs of great black-backed gulls have nested at Fishermans Island since 1970 (AFN). Others have nested at one colony in Chesapeake Bay in 1976 and 1977 (M. Byrd unpubl. notes). Herring gulls have been increasing at a much faster rate along the coast, with a marked increase in both number of colonies and colony size from 1975 to 1977 (M. Byrd pers. comm.). Only a few have nested recently in the Virginia portion of Chesapeake Bay. Laughing gulls have never been censused systematically in the State prior to this survey (R. Clapp unpubl. notes, C. Robbins unpubl. notes). The "high" count in 1977 probably represents a population that has been very large and stable for a number of years rather than a sudden increase. There are no Chesapeake Bay colonies. The persecution that occurred before Federal protection apparently was not as detrimental to this species as to some others (Bent 1963a).

Gull-billed terns were more numerous in 1976 than previous counts had indicated but declined markedly in 1977. They nest with common terns and black skimmers which probably have caused them to be overlooked in previous surveys. In many cases, counts were made with no species distinction for terns.

Royal terns are abundant, but nested only at Fishermans Island in 1977. The large increase from 1976 to 1977 may explain the corresponding reduction in the Maryland population. Much colony shifting occurs in this species. Peak numbers nested in Virginia in the late 1960's (Buckley and Buckley 1972). Caspian and sandwich terns are near their northern limit in Virginia and have never been abundant (R. Clapp unpubl. notes). Forster's terns probably have been more abundant in the past than was realized. In 1976 and 1977, all marsh areas were examined carefully to locate major colonies. In 1977, a small colony was discovered at Great Fox Island in Chesapeake Bay. Common terns have been one of the most abundant seabirds in Virginia. However, only small numbers nest in the southern Chesapeake Bay. In the past, roseate terns have nested sporadically in small numbers in Virginia (Bales 1920, Kuerzi 1929, Worth 1929) but have not been found in recent years. Least terns nest abundantly in both coastal and Chesapeake Bay locations. A reduction along the Atlantic coast in 1977 was offset by an increase in the Chesapeake Bay colonies. Caution must be exercised in comparing earlier censuses to 1975-1977 counts. There probably has been a decline from populations in the 1800's, when 1,200 were killed in a single day (Austin 1932, Bent 1963a). Apparently, the least tern suffered more from hunting than either the common, Forster's, or royal tern. Least tern colonies shift readily from year to year (Erwin 1977a).

Until the early 1970's, black skimmer censusing occurred only at a few colonies, such as Cobb and Wreck Islands (AFN, AN, R, Austin 1932, R. Clapp

Table 37. Population trends of colonial birds along the Atlantic coast of Virginia, 1900-1977.

Species	1900	Nesting pairs (and year)	1977
Green heron	6 cols.(1930-50), 100-150('56-9)[a] 5 col.,	22('75), 20('76)5 col.,	18('77)
Little blue heron	100-150(1950's)[a] 2 col.,	330('75), 265('76)8 col.,	187('77)
Cattle egret	1('61) 100+('63)[a] 2 col.,	670('75), 320('76)6 col.,	340('77)
Great egret	10('56),	270('75), 305('76)7 col.,	400('77)
Snowy egret	no data before 1940 550-750('57-9)[a] 3 col.,	2,500('75), 2,100('76), 10 col.	2,480('77)
Louisiana heron		1,900('75), 1,170('76)10 col.,	663('77)
Blk.-cr. night heron	only 3 small col. reported (1960's),	1,300('75), 1,700('76),	1,660('77)
Yellow-crowned night heron	---- no data ----	100+('73)[a] 2 col., 57('75), 62('76)6 col.,	8('77)
Glossy ibis	1st State record ('56) 70+('61-3)[a] 3 col.	2,100('75), 1,400('76),9 col.,	465('77)
Great black-backed gull	3 col.	2('70), 3('76),	16('77)
Herring gull	3('29), 1('48), 2('58)	39+('66), 660('75), 1,300('76), 4 col. 2 col. 9 col.	2,625('77)
Laughing gull	min. 7,000('00-02)[a] 8 col., "thousands"('25-30)[a] 6 large cols., ca. 10,000('75)[a],	ca. 14,000('76)24 col.,	30,600('77)
Gull-billed tern	500('00) 30('10)[a] 3 col., ca. 100(1950's)[a] 4 col.,	800-900('75-6)13 col.,	105('77)
Forster's tern	min. several hundred ('00-10)[a] 7 col.,	ca. 1,000('76)18 col.,	1,085('77)
Common tern	4,000+('00-10)[a] 8 col.,	3,000+('76)15 col.,	3,470('77)
Roseate tern	8('20), 5('27),	1('63),	0('76-77)
Least tern	"large numbers"('00)[a] 5 col., 160('1930's)[a] 3 col.,	75('45-55)[a] 5 col., 400-500('76)13 col.,	165('77)
Royal tern	0('00-10)	2,100('65)[a], 5,400('67), 4,700('73), 3,150('76), 2 col. 3 col. 3 col.	4,600('77) 1 col.
Sandwich tern	---- occasional breeder ----	15('67)[a] 1 col., 70('73), 15('76),	5('77)
Caspian tern	-- prob. never more than 1-2 pr. in State,		1('75), 1('76), 1('77)
Black skimmer	3,500-3,700('00-10)[a] 5 col.,	prob. 2,000-3,000('65-70)6 col., 2,700-3,000('75-6),	2,650('77)

[a] Partial State total.

Table 38. Population trends of colonial birds on the Chesapeake Bay of Virginia, 1900-1977

Species	1900	Nesting pairs (and year)	1977
Great blue heron			533('75), 590('76)4 col., 593('77)
Green heron		15('55)	13('75), 0('76), 3('77)
Little blue heron		200('55)	25('75), 15('76), 6('77)
Cattle egret			87('75), 40('76), 147('77)
Great egret		300('55)	94('75), 24('76), 144('77)
Snowy egret		few('55-7)	320('75), 150('76), 365('77)
Louisiana heron			85('75), 38('76), 59('77)
Blk.-cr. night heron		105('57),	135('75), 33('76), 78('77)
Yellow-cr. night heron		one traditional col. (1960's)	25('75), 23('76), 10('77)
Glossy ibis			24('75), 15('76), 71('77)
Great black-backed gull			10('76), 6('77)
Herring gull			25('76), 32('77)
Gull-billed tern		1('64),	0('76), 0('77)
Forster's tern			10('77)
Common tern			145('75), 45('76), 86('77)
Least tern		50-200('63-73)[a]	1 col., 305('75), 290('76), 675('77)
Black skimmer		3('64),	0('76), 47('77)

[a] Partial total

unpubl. notes). However, they are one of the most abundant waterbird species in Virginia (Austin 1932, Murray 1955, AN, Clapp unpubl. notes). There may have been some reduction from numbers recorded near the turn of the century (Dutcher 1901, 1902, 1903). Because of its black plumage, the skimmer was not sought by millinery traders. In 1977, small numbers nested at three locations in the lower Chesapeake Bay.

Wading Birds

In Virginia, wading bird numbers have not been documented as well as those of seabirds. One pair of white ibises nested for the first time in Virginia in 1977 at Fishermans Island (P. Frohring pers. comm.). Glossy ibis numbers peaked along the Atlantic coast in 1975 (Custer and Osborn 1976, 1977) but declined markedly in 1976 and 1977. They have increased slightly along the Chesapeake Bay. Great blue herons, strictly confined to the Chesapeake Bay and bordering woodland swamps, are the most abundant wading birds in the lower Bay (M. Byrd pers. comm.). Little is known about their abundance in earlier years. Great egret numbers have fluctuated along the Chesapeake Bay since the demise of the large Hollis Marsh colony in the 1950's (Sprunt et al. 1976). They continue to increase along the Atlantic coast. Snowy egrets have shown the most dramatic recovery from the plume trade decimation in the 1800's. They increased rapidly from the 1950's to 1977 in both regions (AFN, R, Sprunt et al. 1976, M. Byrd unpubl. notes). Numbers seem to be stable at present. Cattle egrets, after an initial exponential growth in the 1960's (AFN, R), declined from 1975 to 1976 in both Atlantic and Chesapeake Bay areas. In 1977, there was a large increase along the Chesapeake Bay. Perhaps some of the recent growth of the Maryland population is from adults emigrating from Virginia colonies. Louisiana and little blue herons nested in moderate numbers in the 1950's at only two or three colonies (R, AFN, Sprunt et al. 1976, F. Scott pers. comm.). The past three years have shown a rapid decline in their numbers, especially on the Atlantic coast (Custer and Osborn 1976, 1977, M. Byrd unpubl. notes). On Chesapeake Bay, only six pairs of little blue herons were found in 1977. Green herons breed in small numbers on the Bay. A decline seems to have occurred in coastal locations in the past 20 years (R, AFN), similar to trends in Maryland. Black-crowned night herons probably always have been underestimated. The population has been fairly stable in the past 3 years at both Atlantic and Chesapeake Bay locations (Custer and Osborn 1976, 1977). Ten Atlantic coast colonies were found in 1976, while only three had been reported in the 1960's. Yellow-crowned night herons have never been very abundant either on Chesapeake Bay or along the Atlantic coast. The Mockhorn Island colony has decreased in size recently (AFN, M. Byrd unpubl. notes). In 1977, a reduction occurred in both regions.

NESTING CHRONOLOGY

The sequence of reproductive activities from spring arrival until departure from the breeding grounds is described in this section. The information was extracted from 33 major sources of both published and unpublished reports. Data from the 1976-1977 survey were incorporated also. For most of the 28 species, a figure was prepared showing the peaks of adults arriving in the spring (A), the major egg-laying period (E), the hatching peak (H), and the average departure dates (D). Where references in the literature included exceptionally "early" or "late" dates of arrival, departure, etc., they were omitted in an attempt to document the modal periods of arrival, egg-laying, hatching, and departure. Inclusion of extreme dates would have greatly extended the primary nesting period for many species. Since references from the early 1900's to the present were included, a number of changes in breeding status and nesting periods were found. Some species which were formerly only breeding populations are now year-round residents. Also, because of Federal protection laws in 1918, almost all of the seabird and wading bird species made a major recovery from near extirpation, expanding their breeding ranges. Their status, then, in many States has changed from visitor or wintering to breeding or permanent resident.

To present the chronology in a concise fashion, each species is treated separately in three geographic areas along the coast: southern New England, New York-New Jersey, and the Delaware-Maryland-Virginia (hereafter "DelMarVa") coast and Chesapeake Bay region. There were only very slight differences among States within regions. For many species, no data were available from certain States. The bar graphs show the major activity, relative to periods early (week 1), in the middle (weeks 2-3), and at the end (week 4) of the month (at the top of the figure). If a species did not breed in a given region, that section on the figure was left blank. Source code numbers are shown on the upper right of each bar and are referenced in Table 39. A brief summary for each species follows:

SEABIRDS

Leach's Storm-Petrel

Nesting chronology data are unknown for the single colony at Penikese Island, Massachusetts.

Double-crested Cormorant

This species shares many of its colonies with herring and great black-backed gulls and is fairly synchronous in egg-laying and hatching with them (Fig. 15). Narrow bands reflect few data points.

Common Eider

Since only introduced birds nested at Penikese Island, eiders are not included in this section.

Table 39. Reference codes for nesting chronology data

Code	Reference
1	Bent 1963a, b
2	Erwin (unpubl observ.)
3	Maryland Birdlife notes
4	Kirkwood 1895
5	Stewart and Robbins 1958
6	MacKenzie 1961
7	Bailey 1913
8	Stone 1937
9	Shriner 1896
10	Leck 1975
11	Griscom 1923
12	Bull 1964
13	Howe and Sturtevant 1899
14	Samuels 1895
15	Forbush 1929
16	Howe and Allen 1901
17	Knight 1908
18	Ferren (in prep.)
19	Bull 1974
20	Hill 1965
21	Allen 1903
22	Palmer 1949
23	Pennock 1908
24	Manomet Bird Observatory records
25	Smith-Kenneally (pers. comm.)
26	Byrd (pers. comm.)
27	Sage et al. 1913
28	Griscom and Folger 1948
29	Patuxent Wading Bird Survey, 1975 (U.S. Fish and Wildlife Service)
30	Maine Field Naturalist, 1965-1971
31	Murray 1952
32	Weske (pers. comm.)
33	1976-1977 Colonial Sea and Wading Bird Survey (U.S. Fish and Wildlife Service)

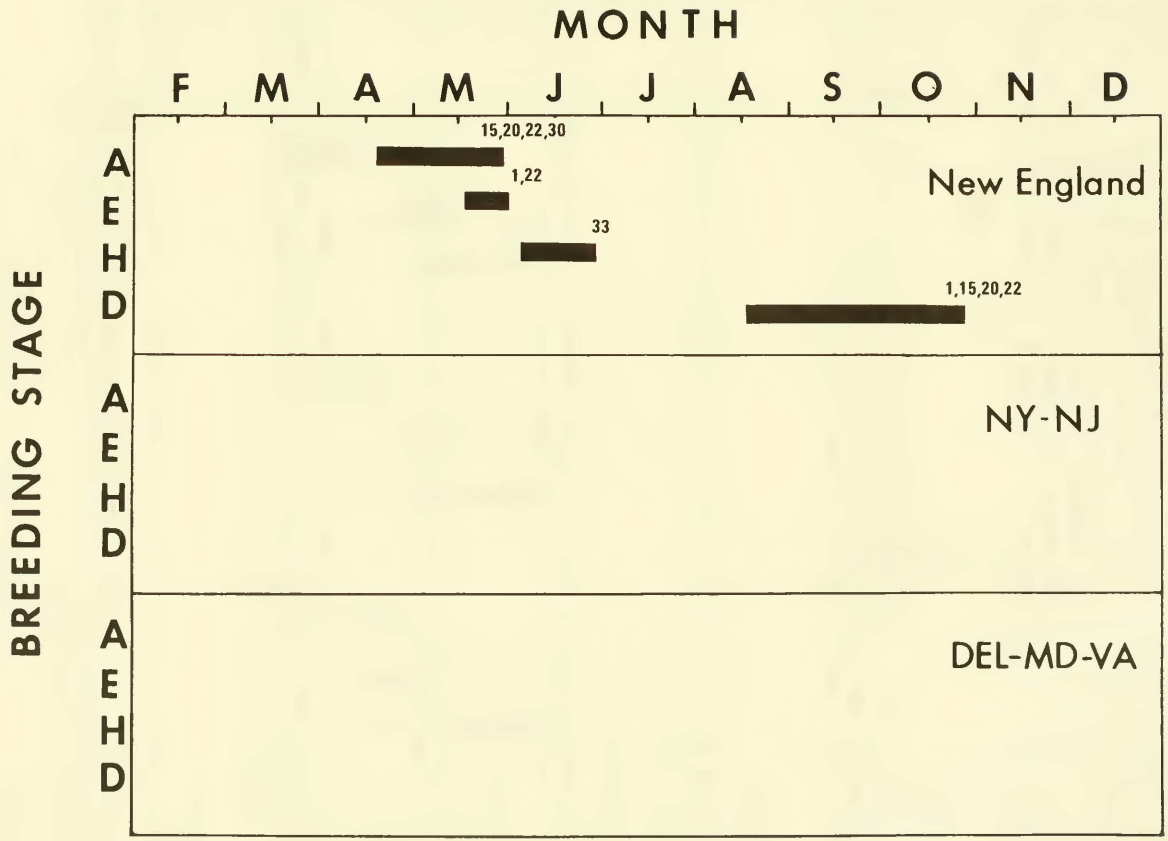

Figure 15. Nesting chronology of the double-crested cormorant. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

Great Black-backed Gull

In the early 1900's this gull was a scarce winter resident (Howe and Allen 1901, Knight 1908) but rapidly increased with protection (Kadlec and Drury 1968a) so that it is now a permanent resident, although part of the population migrates south to the imd-Atlantic area (Fig. 16). The later arrival of this gull in the DelMarVa region relative to the more northern areas is an artifact of differences in numbers of observations. The great black-backed gull is the earliest of the gulls and terns to arrive on the breeding ground.

Herring Gull

This gull has also become reestablished as a permanent resident in the northeast (Fig. 17). Relatively few observations of this species in the DelMarVa region resulted from the recent southern expansion into this area. The herring gull usually nests 1-2 weeks later than the great black-backed gull.

Laughing Gull

Laughing gulls nest only locally in New England today (Massachusetts and Maine) (Fig. 18). Its nesting chronology overlaps the herring gull, although it begins slightly later.

Gull-billed Tern

This southern tern is similar to the common tern with regard to nesting chronology and often nests with it in mixed species colonies (Fig. 19).

Forster's Tern

Nesting chronology of this marsh-nesting tern is similar to that of the common tern even though it is more southern in distribution (Fig. 20).

Common Tern

In New England this species generally arrives 1-2 weeks after the Arctic tern (Fig. 21). Mid-Atlantic populations are advanced in breeding by about 2 weeks. The protracted period of nesting in the DelMarVa region is probably due to renesting attempts after storm washouts.

Arctic Tern

Arctic terns are the first of the northern terns (common, Arctic, roseate) to return in spring, but egg-laying activity occurs at about the same time as for the other species (Fig. 22). It is also one of the first to depart from breeding sites in late summer.

Roseate Tern

Nesting of this species is more extended than for the common or Arctic tern (Nisbet 1973) (Fig. 23). The New York observations are primarily from one major colony (Great Gull Island).

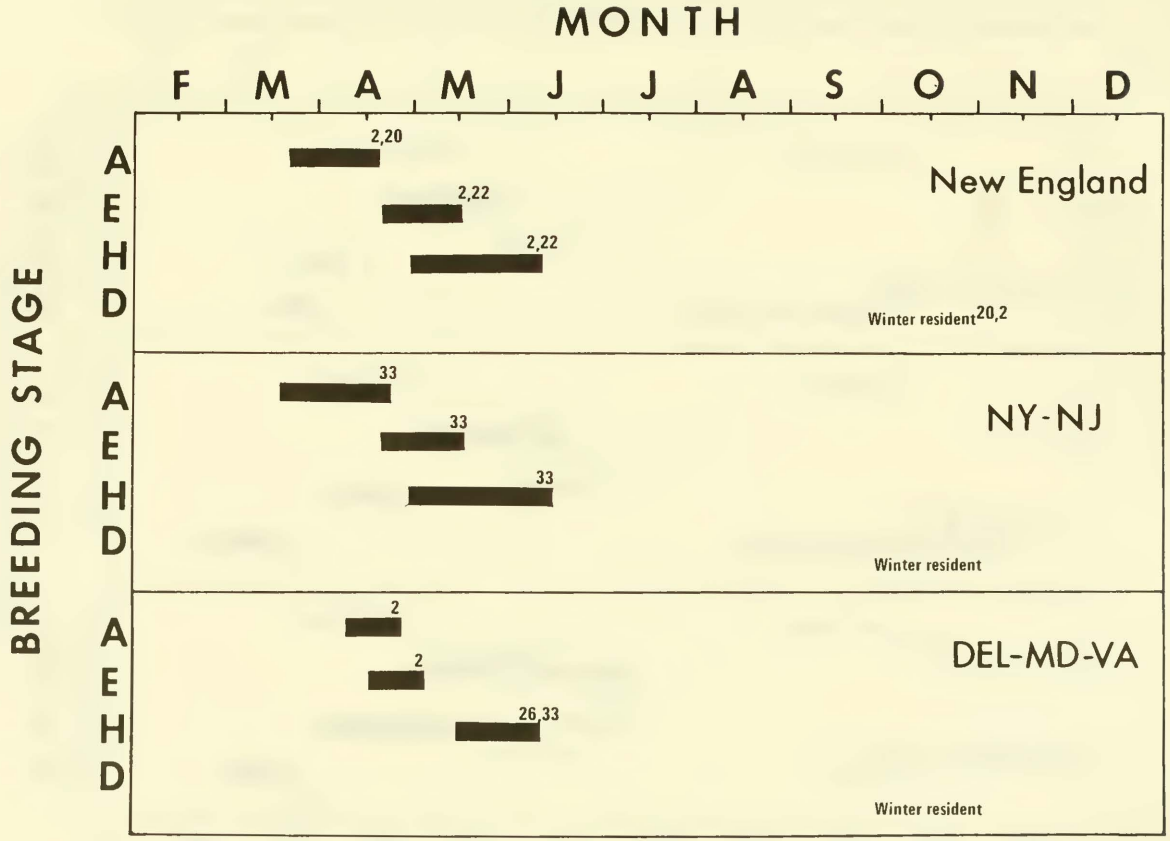

Figure 16. Nesting chronology of the great black-backed gull. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

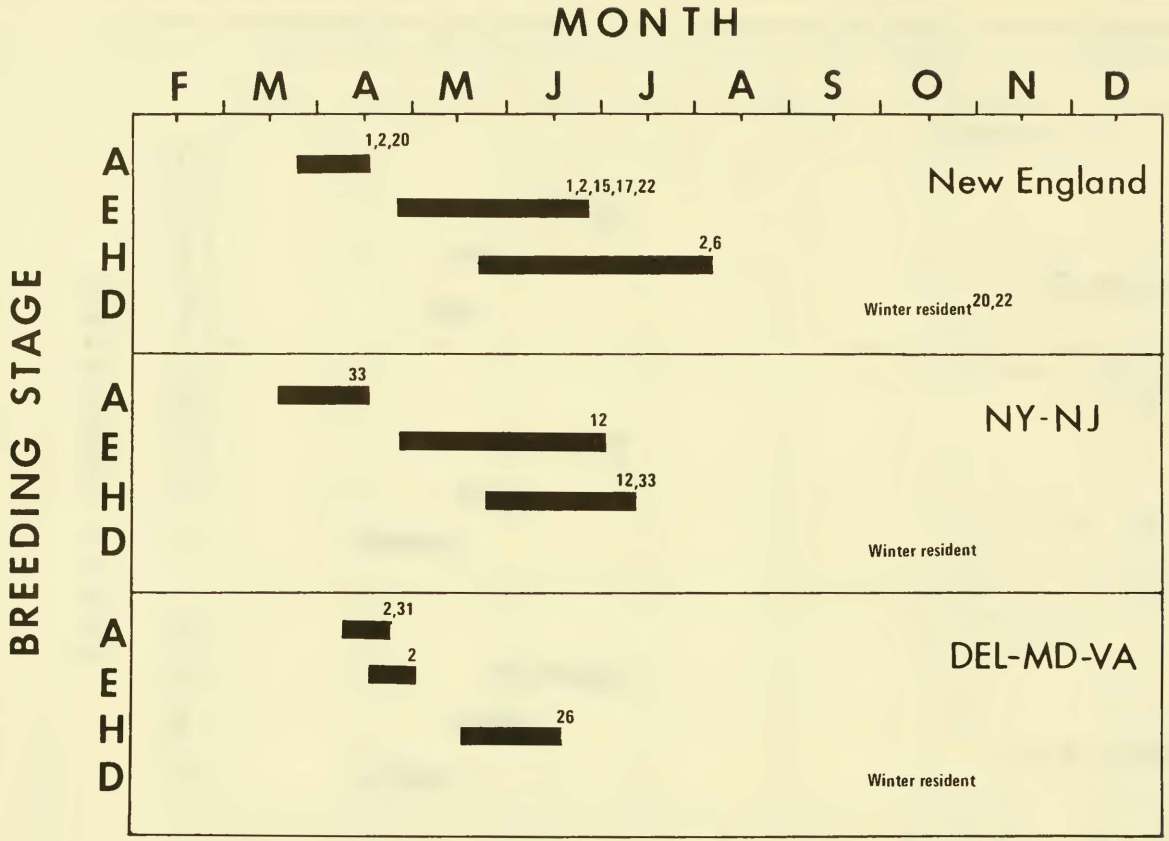

Figure 17. Nesting chronology of the herring gull. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

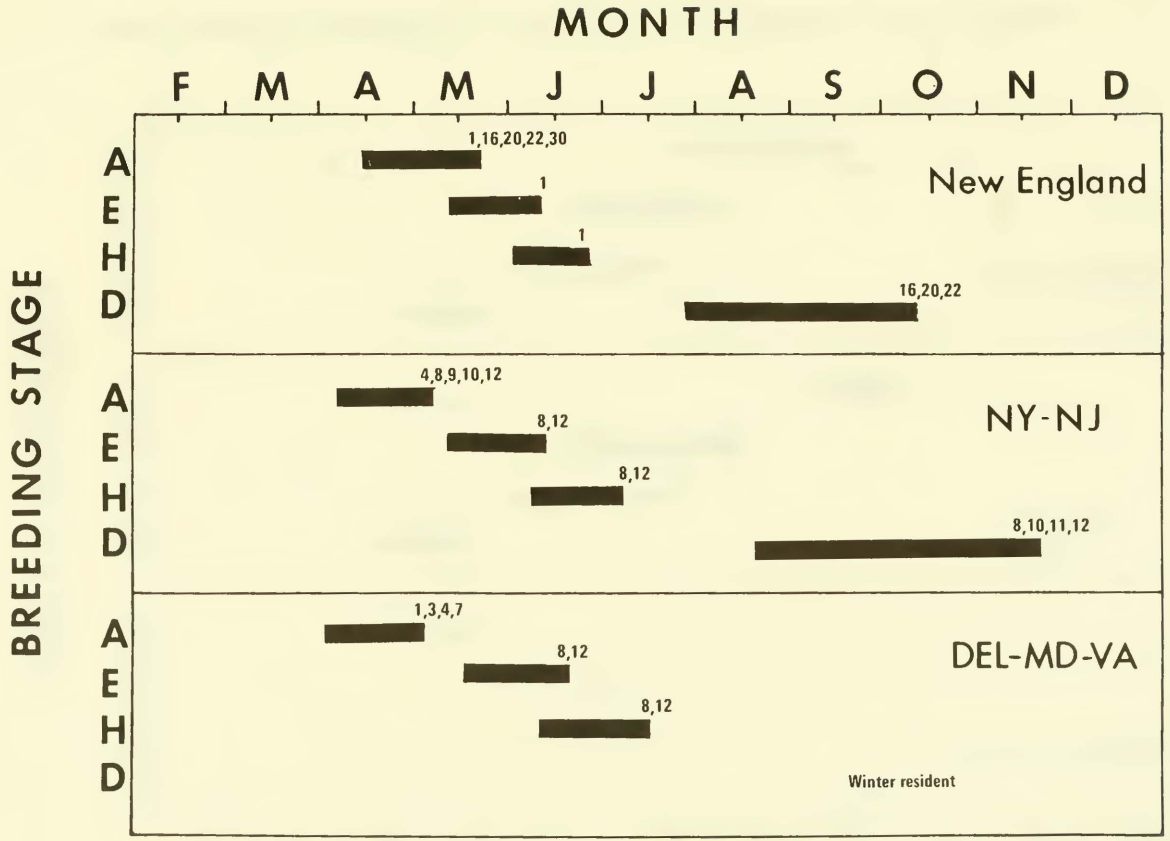

Figure 18. Nesting chronology of the laughing gull. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

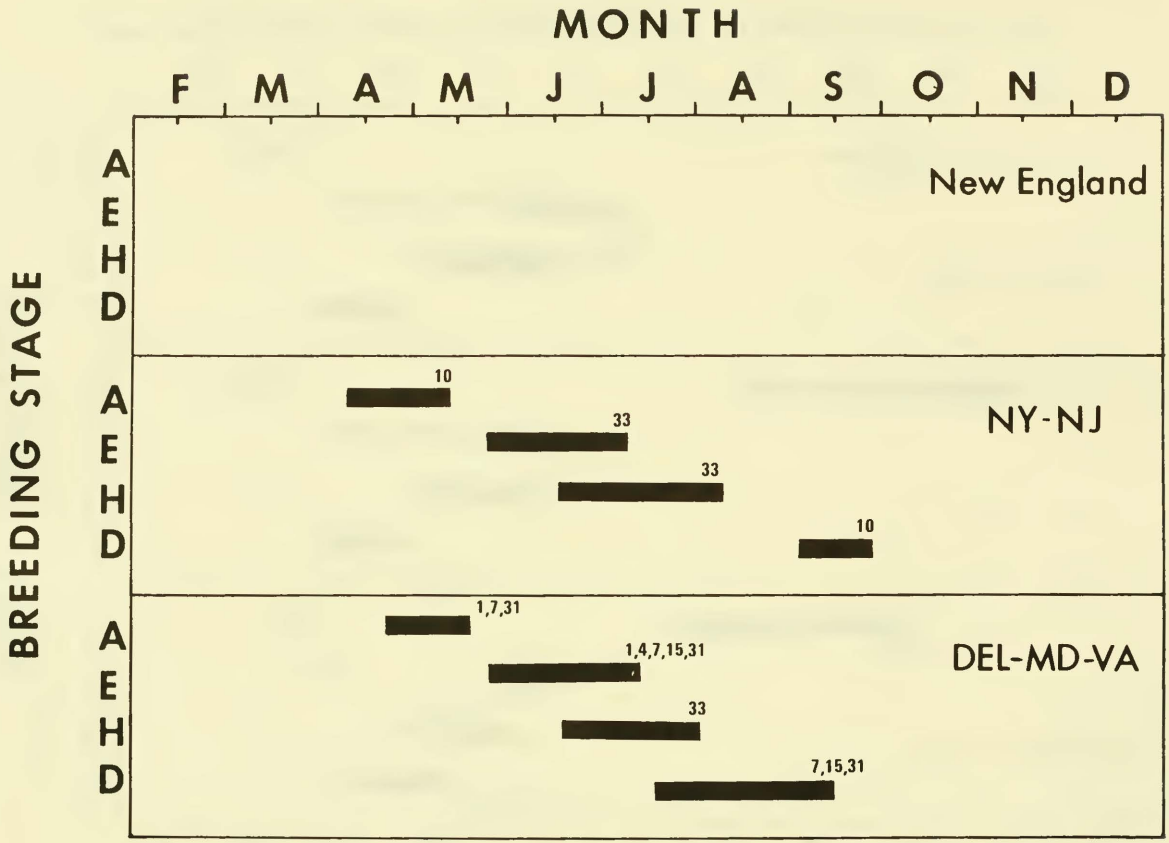

Figure 19. Nesting chronology of the gull-billed tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

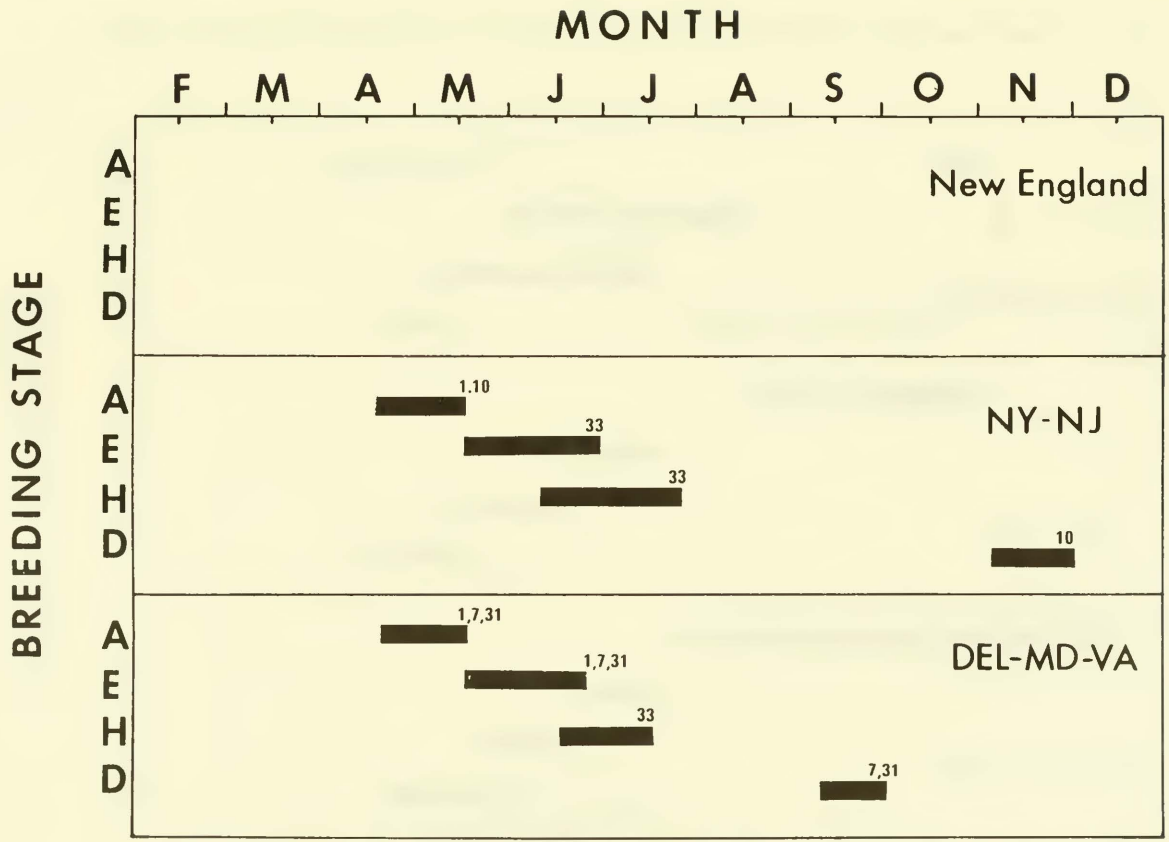

Figure 20. Nesting chronology of the Forster's tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

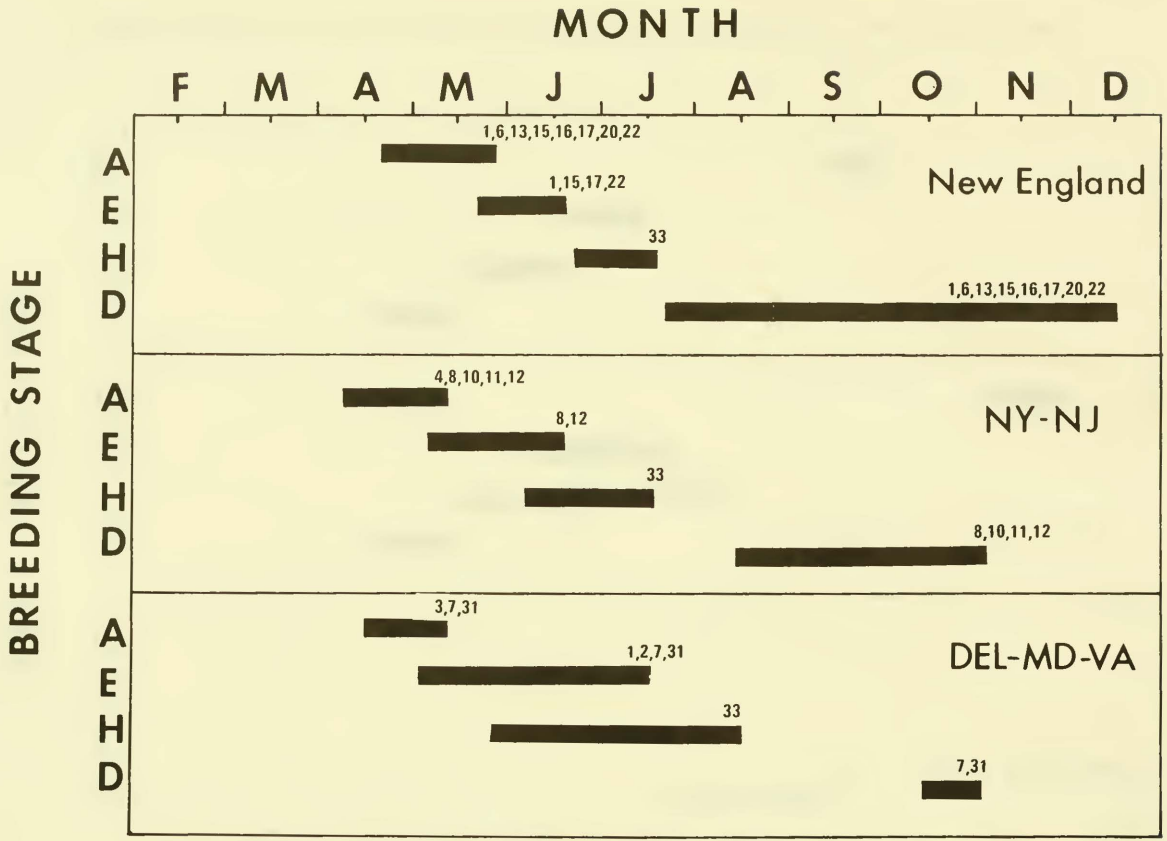

Figure 21. Nesting chronology of the common tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

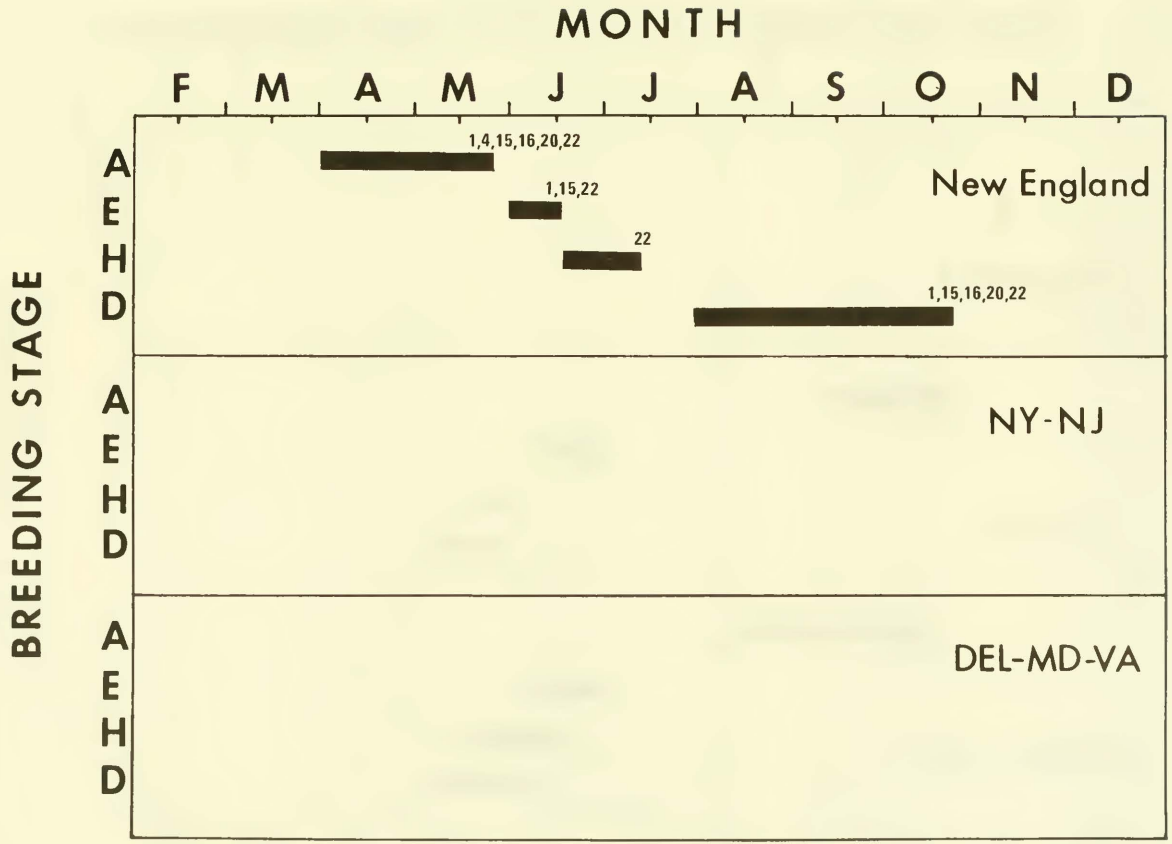

Figure 22. Nesting chronology of the Arctic tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

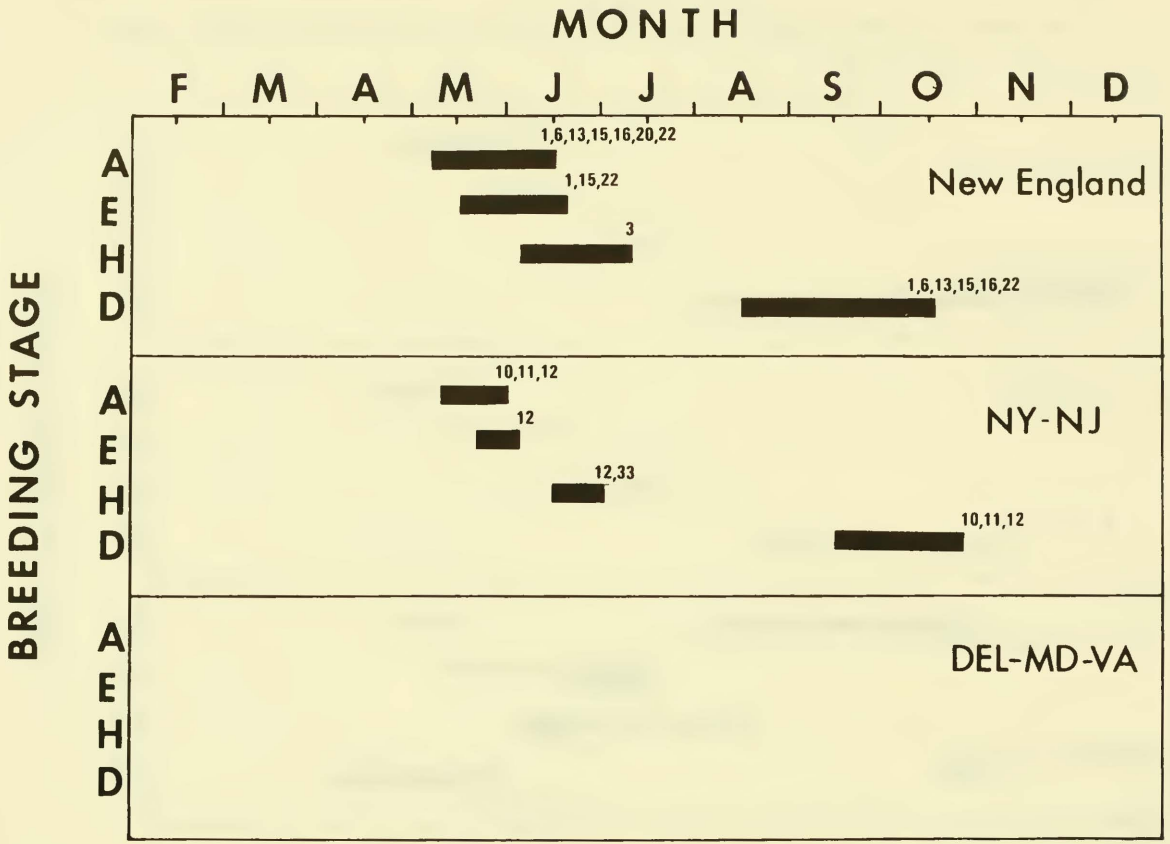

Figure 23. Nesting chronology of the roseate tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

Least Tern

Least terns arrive later than the other small terns (Fig. 24). Time of egg-laying is quite variable both within and between regions. Its egg-laying can be very protracted because of disturbances and other factors, so often no distinct "peak" is observed. Renesting makes assessment of nesting chronology difficult. Fewer observations in the DelMarVa region result in narrow bars on the Figure. Departure is a few weeks earlier in the northern part of its range.

Royal Tern

Royal terns are one of the earliest terns to arrive, but egg-laying dates vary (Fig. 25). At one colony (Fishermans Island, Virginia) egg-laying occurred almost a month earlier one year than the previous year (Erwin 1975). Usually, egg-laying peaks at the end of May with hatching occurring 4 weeks later. Renesting may occur in late June or early July, but will not extend as late into the season as with the common or least tern (J. Weske pers. comm.).

Sandwich Tern

This southern crested tern nests within royal tern colonies and its nesting chronology is essentially identical with its larger congener (Fig. 26).

Caspian Tern

Caspian terns nest throughout the interior lake regions of the U.S.; but along the east coast, it is at its northern limit in Virginia with very few records available (Fig. 27). It usually nests later than its close relative, the royal tern, in coastal areas south of Virginia (J. Weske pers. comm.).

Black Skimmer

Only one or two pairs nest in Massachusetts annually so the New England section was excluded (Fig. 28). Skimmers usually nest about 1 week later than their nesting associate, the common tern, in Virginia (Erwin 1977b) and New York (Gochfeld 1977). This species probably has a longer breeding season than any of the gulls or terns in the northeast. Eggs may be laid as late as August in both Virginia (Erwin 1977b) and New York (Gochfeld 1977) if predation or storms destroy earlier clutches.

Black Guillemot

This northern alcid arrives very early, but lays eggs relatively late in the season (Fig. 29). It remains in north Atlantic waters throughout the winter.

WADING BIRDS

Great Blue Heron

This species is the earliest to begin nesting, as early as February in Virginia (M. Byrd pers. comm.) (Fig. 30). It frequently winters as far north as southern New England.

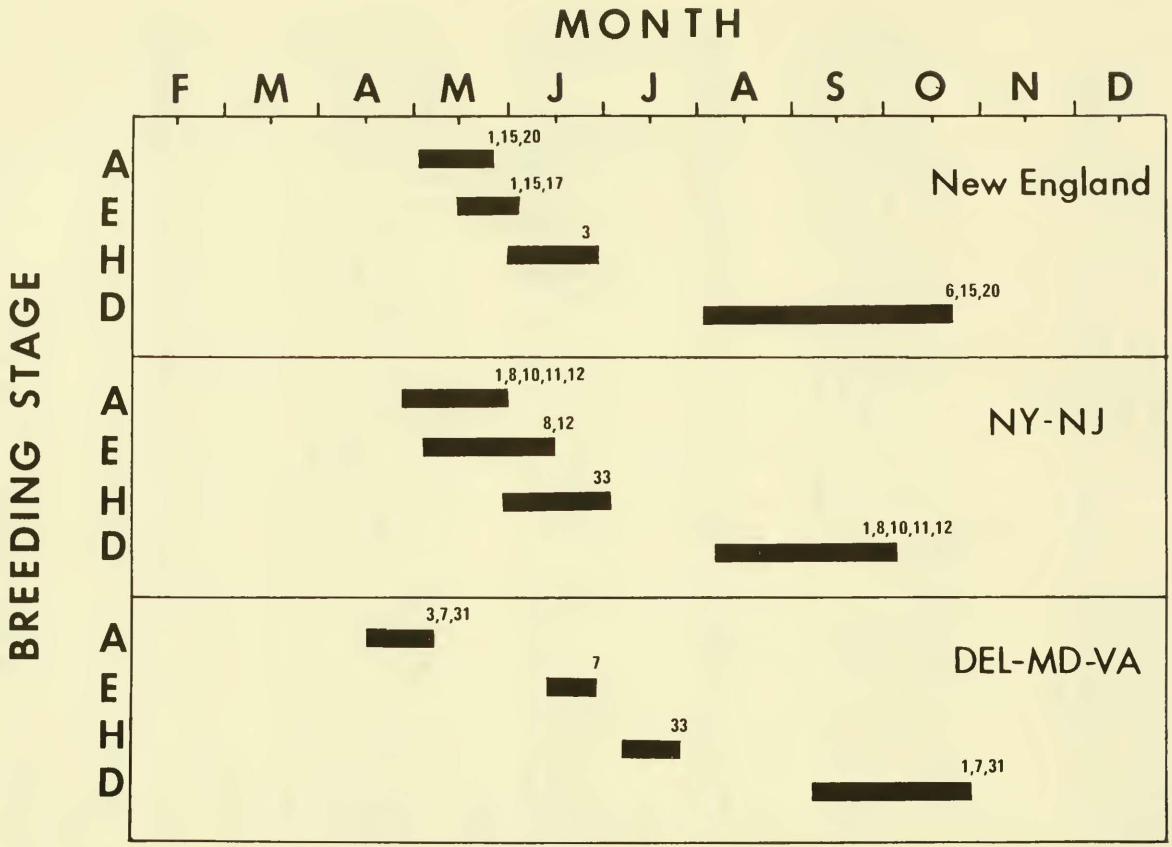

Figure 24. Nesting chronology of the least tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

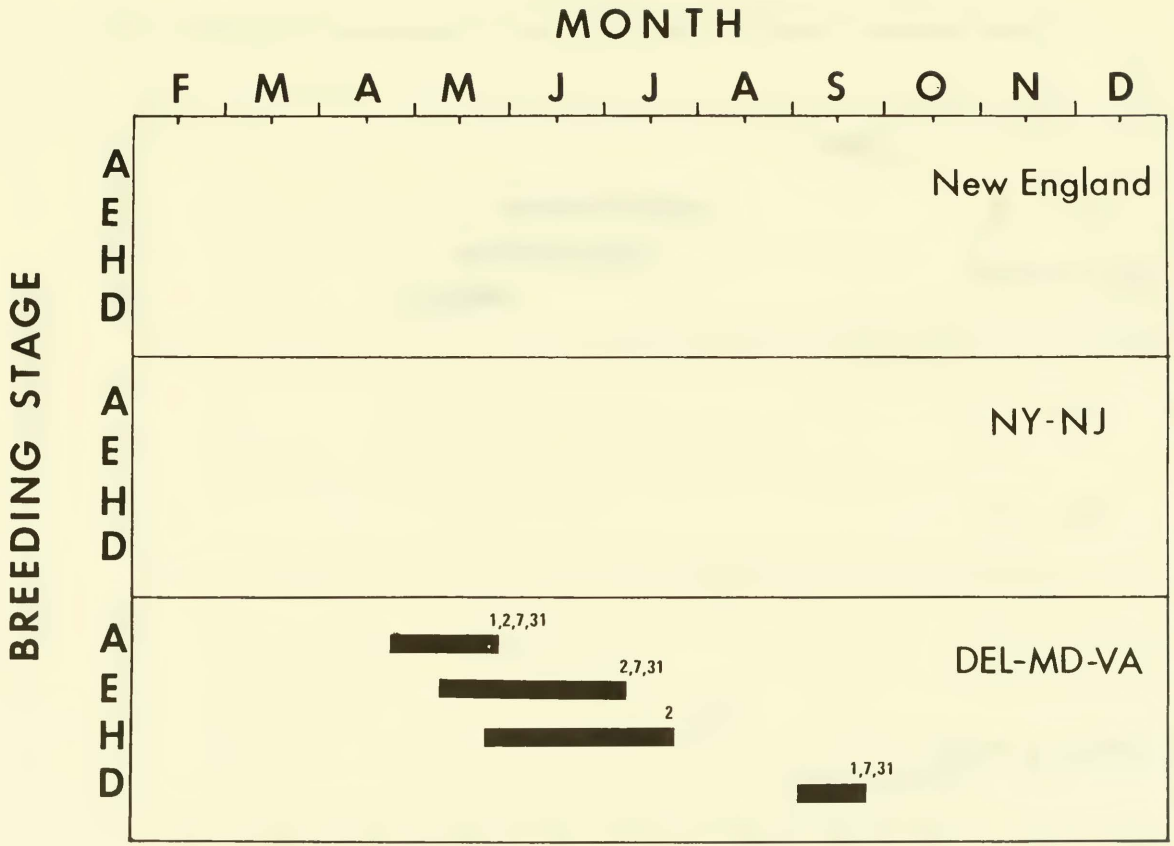

Figure 25. Nesting chronology of the royal tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

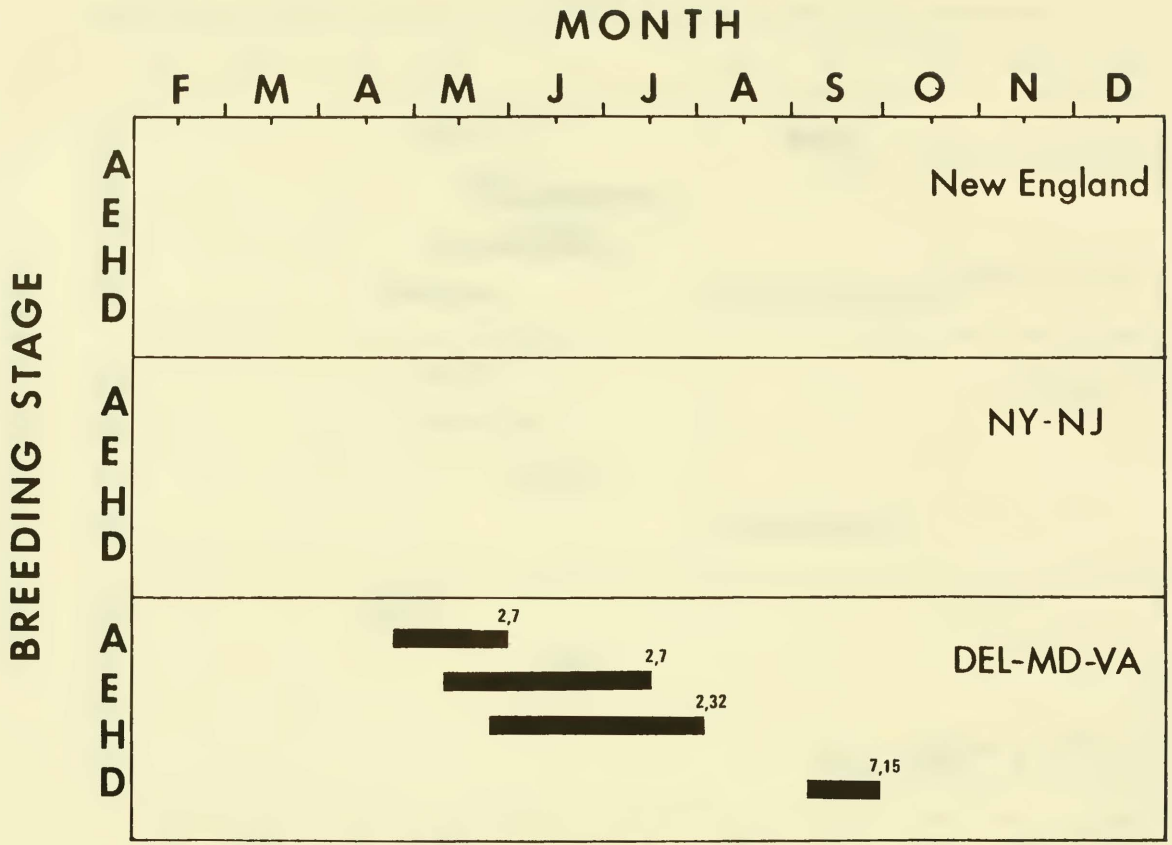

Figure 26. Nesting chronology of the sandwich tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

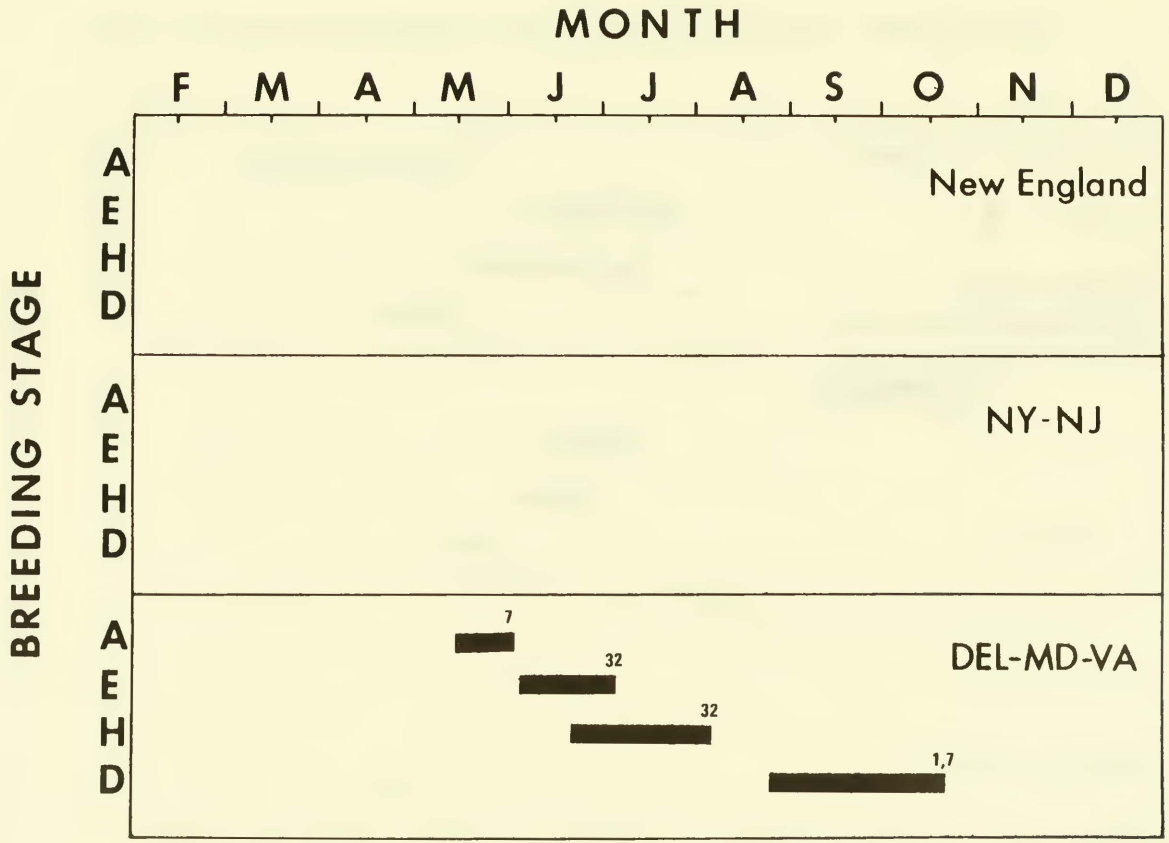

Figure 27. Nesting chronology of the Caspian tern. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

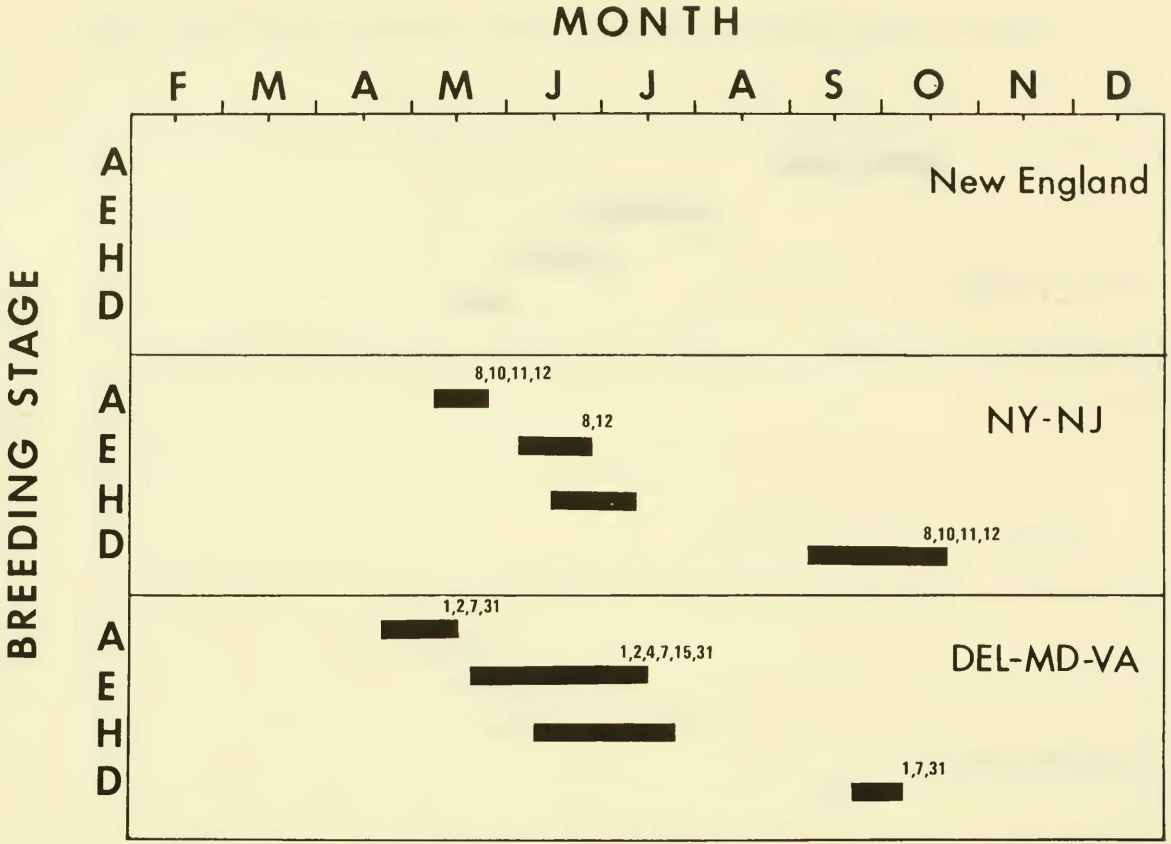

Figure 28. Nesting chronology of the black skimmer. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

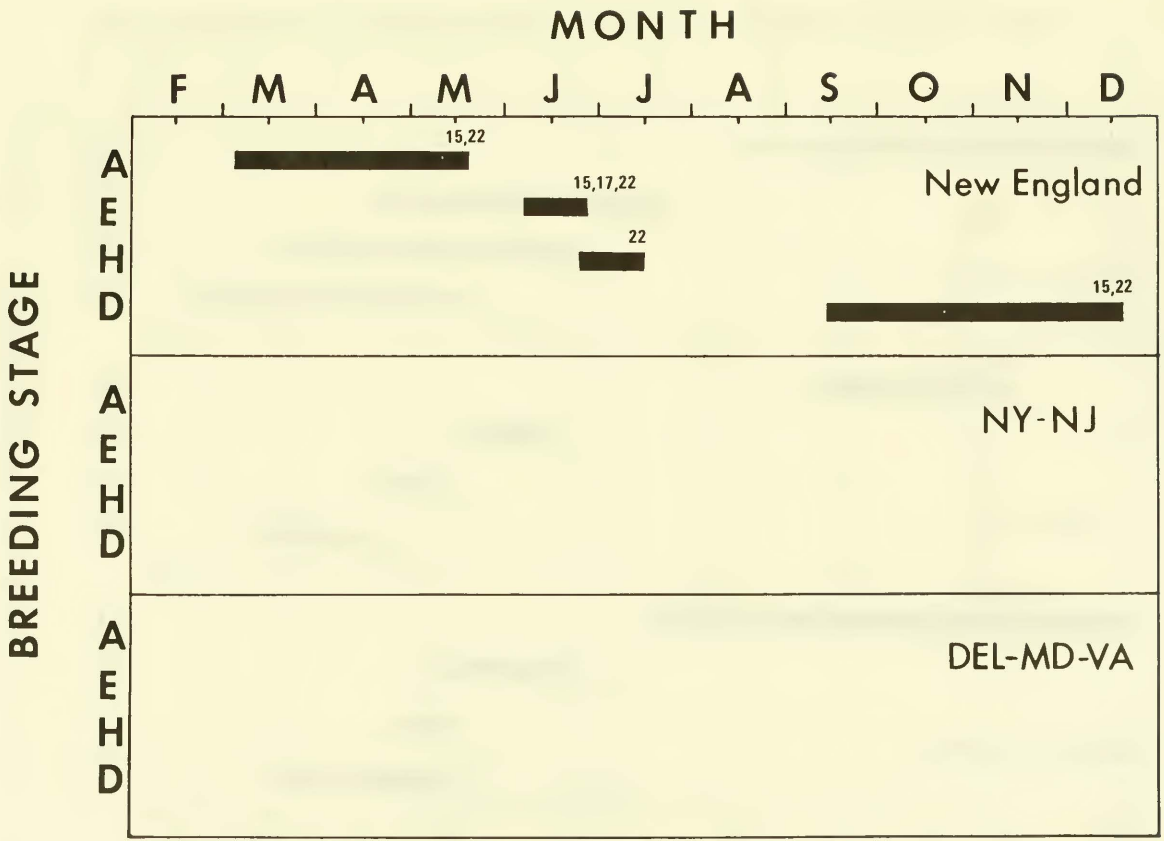

Figure 29. Nesting chronology of the black guillemot. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

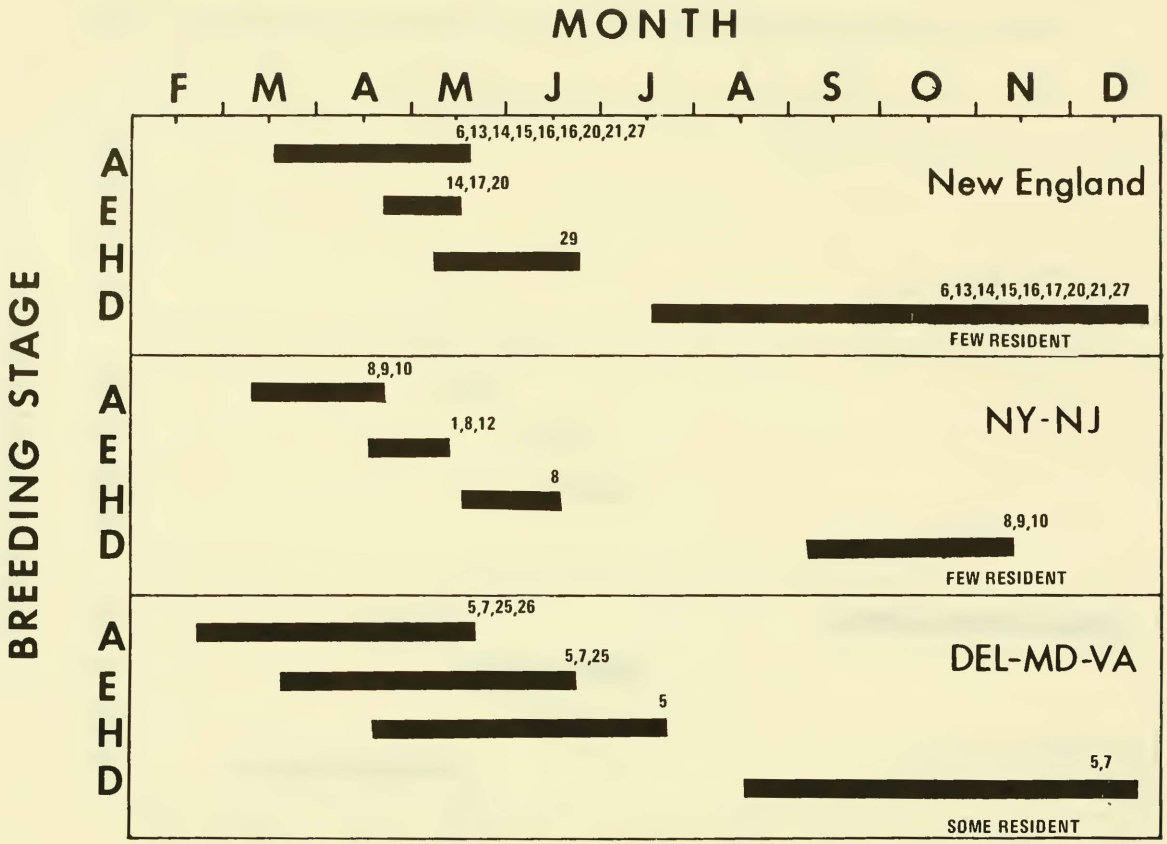

Figure 30. Nesting chronology of the great blue heron. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

Green Heron

The nesting period of this semi-colonial bird is intermediate between the night herons and the other day herons (Fig. 31). It departs fairly early in late summer and early fall.

Little Blue Heron

This species, along with snowy egrets and Louisiana herons, begins nesting activity in late April and early May (Fig. 32). Southern populations lay eggs earlier than northern populations.

Cattle Egret

Cattle egrets often are the last to nest (Fig. 33). They may not arrive until May, with egg-laying often extending into June.

Great Egret

This species, the largest egret, is among the earliest to nest (Fig. 34). In southern locations, egg-laying peaks in mid-April.

Snowy Egret

This species generally begins nesting in late April-early May, at the same time as Louisiana and little blue herons (Fig. 35). Additional data in New York and New Jersey probably would reveal a nesting pattern similar to that in the other two regions.

Louisiana Heron

Louisiana herons only recently have been recorded as a breeding species in New England and, therefore, are not included in that region (Fig. 36). Few data are available from other areas.

Black-crowned Night Heron

Next to the great blue, this heron is the earliest to nest, even laying eggs in March in New England (J. Hatch pers. comm.) (Fig. 37). A great deal of variability occurs among colonies, even within the same State. For example, in 1976, most birds at a Martha's Vineyard colony were incubating in early June, while at House Island, Massachusetts young were already quite large by mid-June. Most of the population leaves New England in winter. Recently, greater numbers are remaining through the winter in New Jersey and New York (R. Kane pers. comm.).

Yellow-crowned Night Heron

Insufficient data are available on this species to adequately describe nesting chronology.

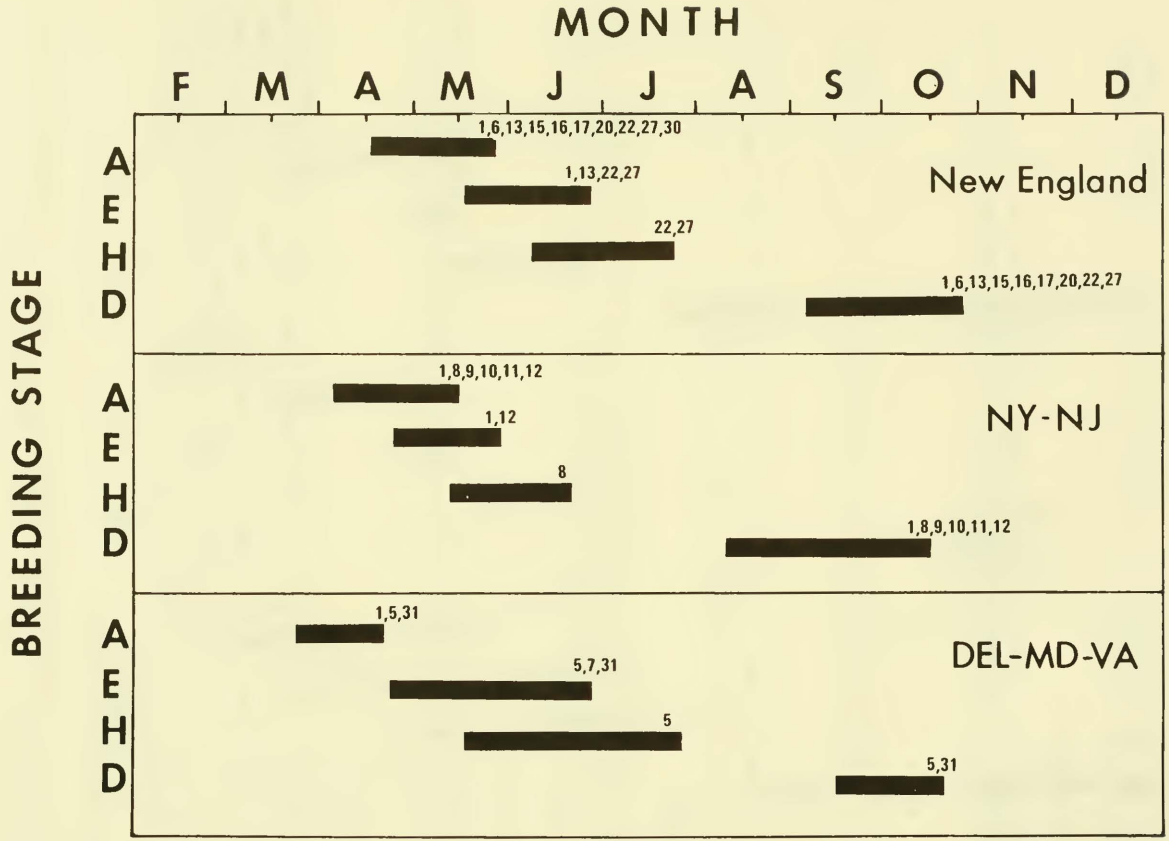

Figure 31. Nesting chronology of the green heron. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

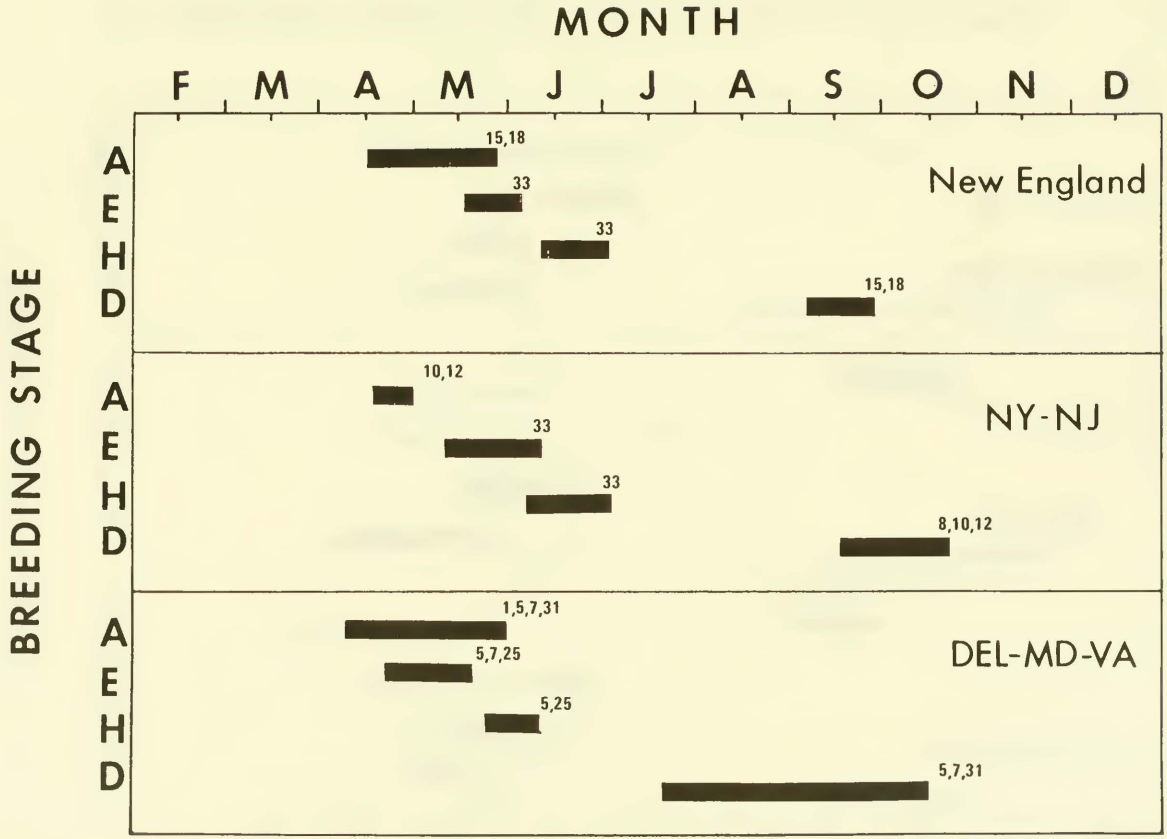

Figure 32. Nesting chronology of the little blue heron. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

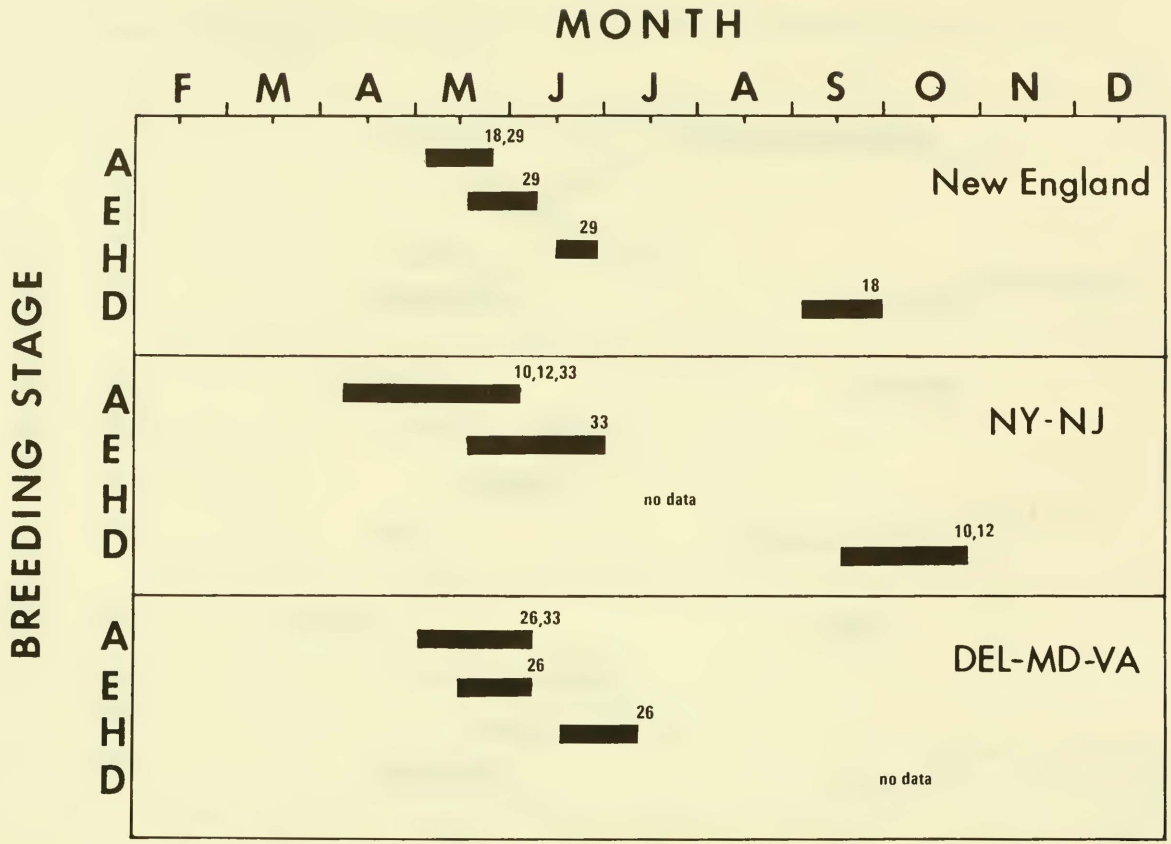

Figure 33. Nesting chronology of the cattle egret. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

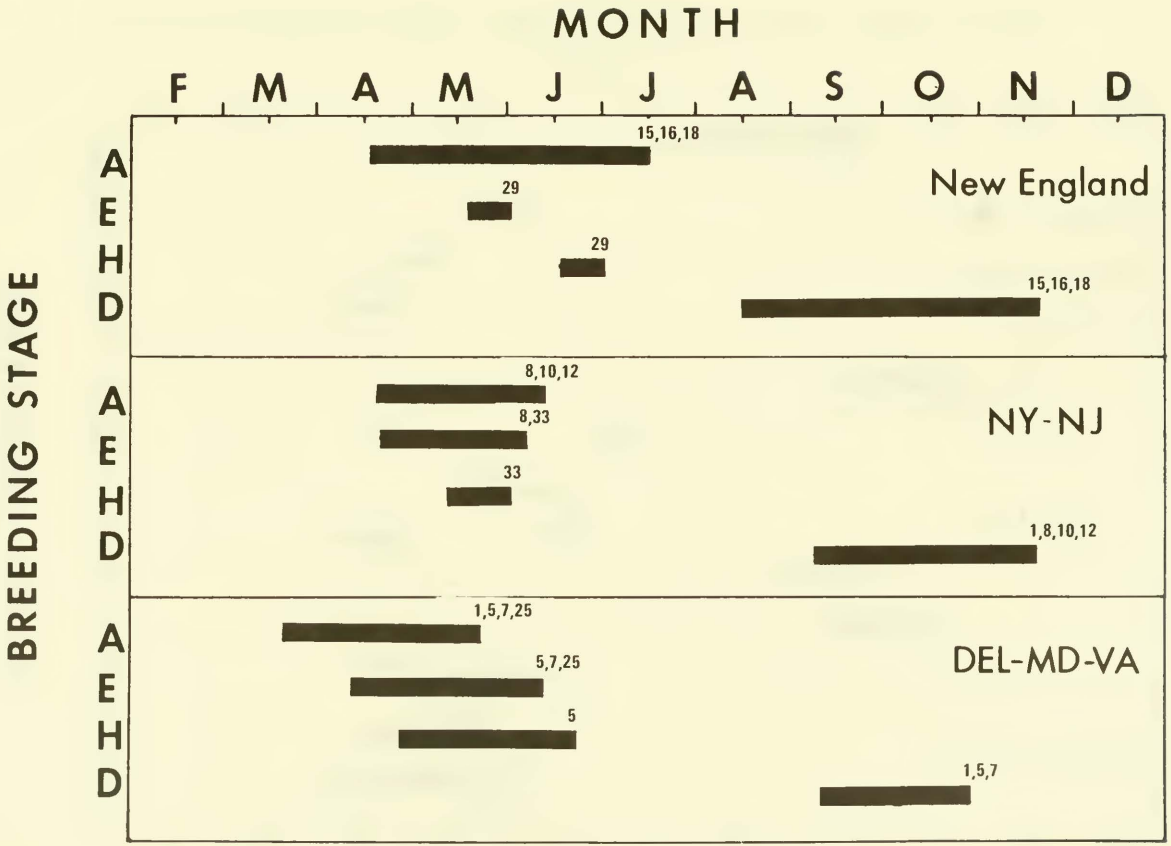

Figure 34. Nesting chronology of the great egret. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

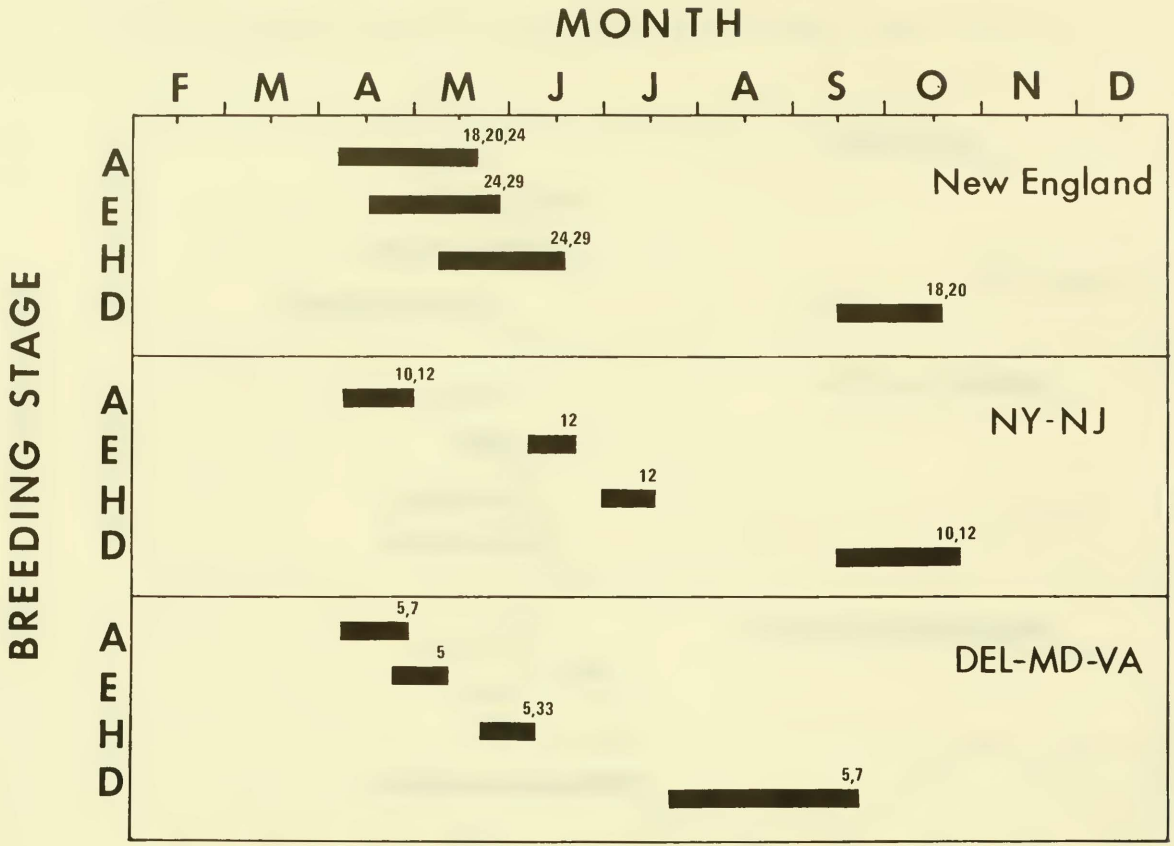

Figure 35. Nesting chronology of the snowy egret. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

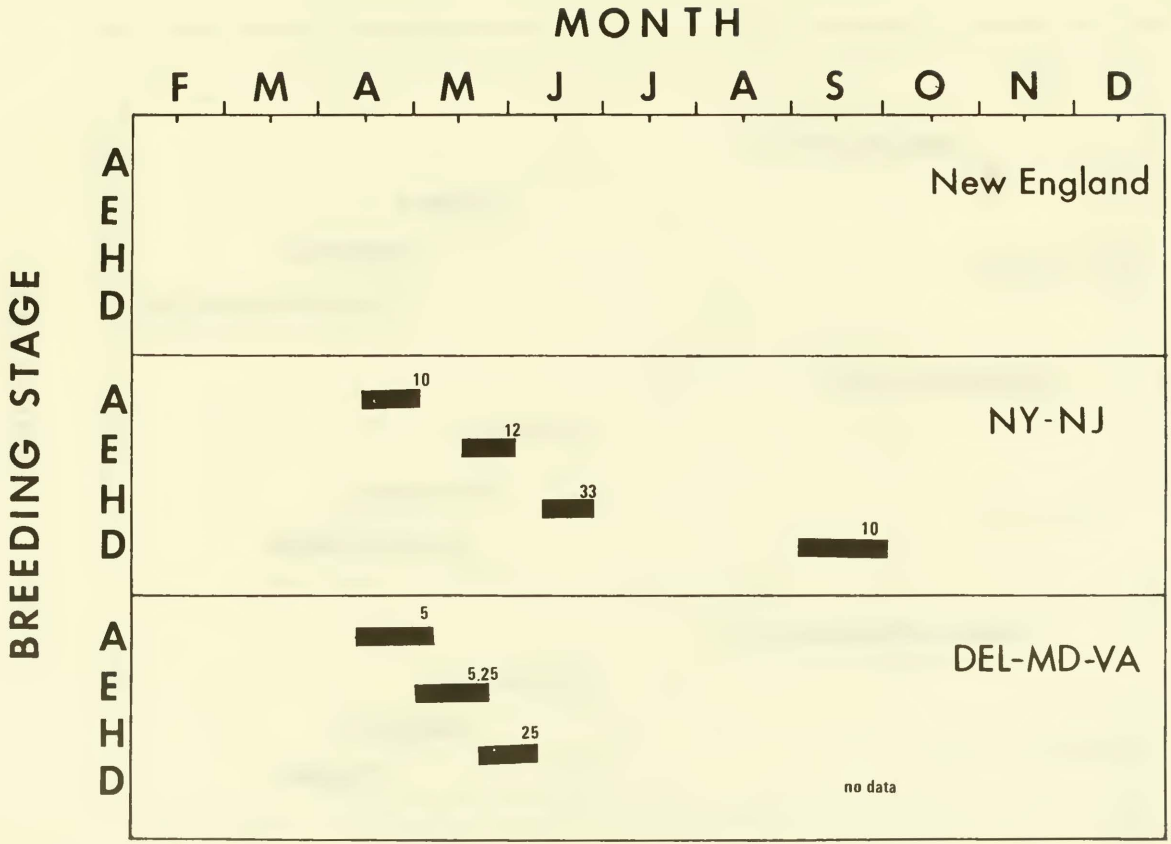

Figure 36. Nesting chronology of the Louisiana heron. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

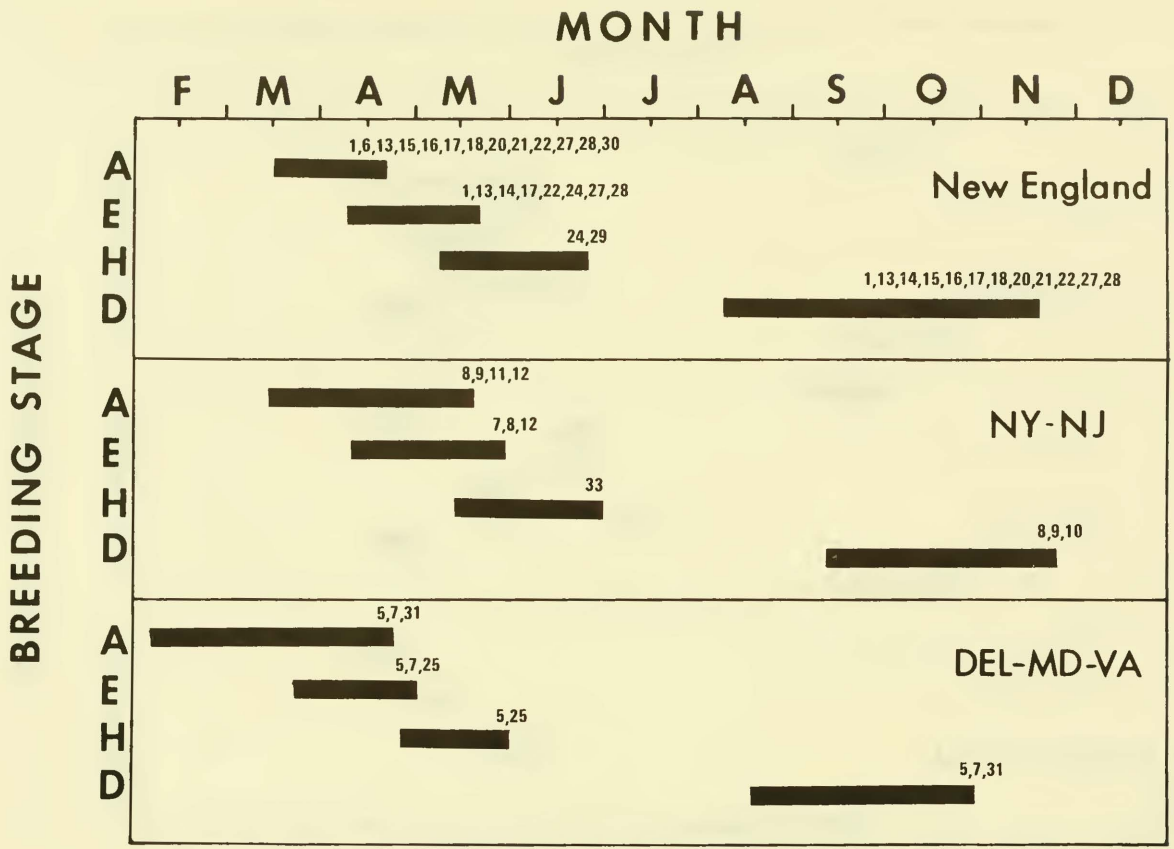

Figure 37. Nesting chronology of the black-crowned night heron. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

Glossy Ibis

The glossy ibis is one of the earlier nesters among the wading birds (Fig. 38). More data are required for this species especially in the mid-Atlantic region.

White Ibis

Only one pair nested in Virginia in 1977.

SUMMARY

The nesting chronology of seabirds and waders is quite variable throughout the north Atlantic both geographically and from year to year. Latitudinal differences are not large for most species. At a given colony, differences of 2 months in peak egg-laying between consecutive years are quite common in gulls, terns, and herons. Even colonies which are located close together may be quite different in chronology. The factors involved in the timing of reproduction are unclear. For terns, food supply probably influences egg-laying timing more than other environmental factors (I. Nisbet pers. comm.). Food abundance may act as a cue in signalling the optimum time for onset of egg production or it may be the nutritional bottleneck for egg formation in females. For example, in some terns a scarce food supply may delay egg-laying and clutches may be smaller. In addition to environmental factors, demographic aspects may also affect nesting chronology among colonies. In large, traditional gull colonies, a large proportion of breeders will be older, experienced birds; while at small, new colonies, young birds will often predominate (Kadlec and Drury 1968a). Older birds generally arrive and initiate egg-laying earlier than young birds (Coulson and White 1960).

With some exceptions, wading birds arrive and begin nesting activity somewhat earlier than seabirds, but the overlap is great. Most waterbird nesting activity begins in early May and concludes by mid to late July by which time the majority of young have fledged. Renesting may occur after initial nesting has failed so that for some species, young do not fledge until August or September. The May to July period is the most important period for nesting waterbirds and protection of nesting areas is most valuable at this time.

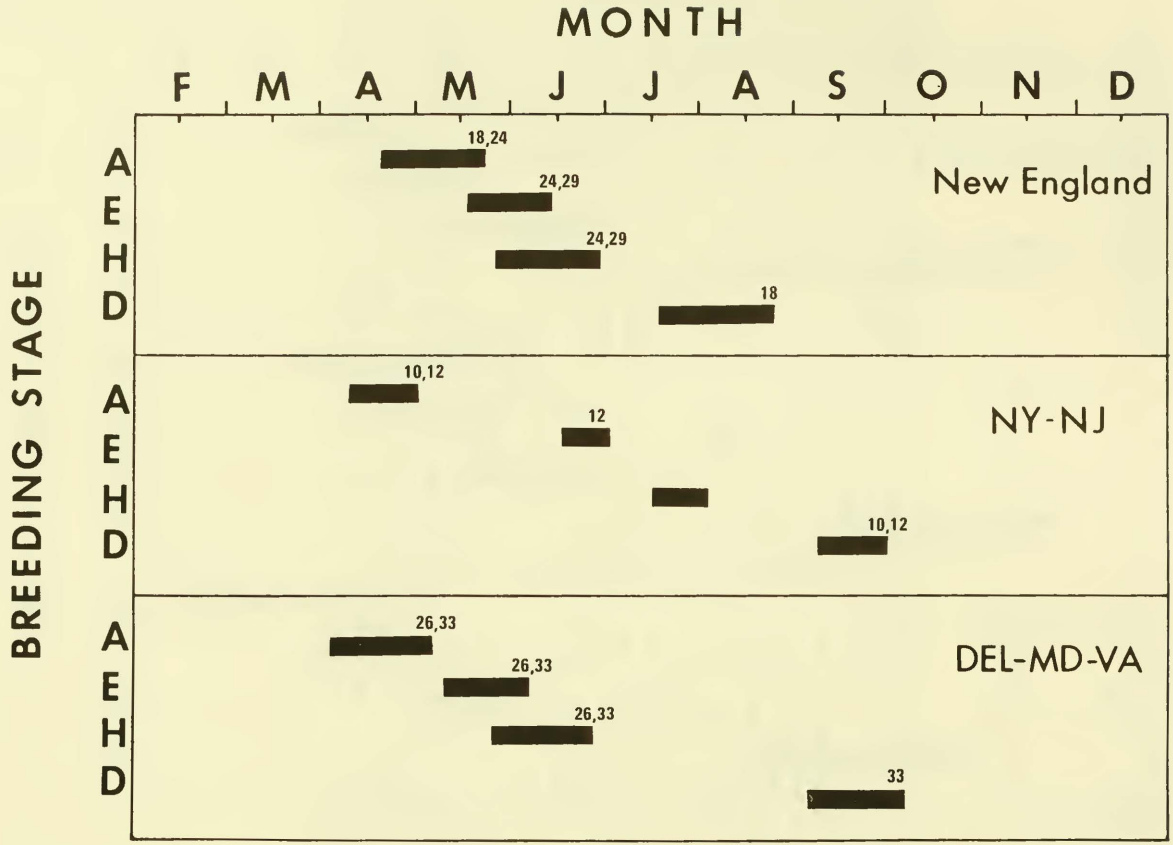

Figure 38. Nesting chronology of the glossy ibis. A = arrival; E = peak egg-laying; H = peak hatching; D = departure from breeding area.

MANAGEMENT RECOMMENDATIONS

POPULATION EVALUATION

The 2-year colonial waterbird breeding inventory has been a necessary first step in establishing a data baseline along the northeast coast. Impending offshore drilling activity provided the impetus for the study but recreational and urban pressures continue to grow in the coastal zone mandating accurate assessment of important natural resources.

A major shortcoming in this study was the lack of adequate historical nesting data for comparison to current population estimates. This flaw underscores the necessity of implementing long-term monitoring projects (Gorham 1977). Only with long-range, systematic data collection can population dynamics be related to both short- and long-term perturbations (Lewontin 1969, May 1973). An updated baseline should be maintained by conducting inventories on a 3 year interval basis, even though some information will be lost by missing years (Diamond and May 1977, Erwin 1977a). Most waterbirds are relatively long-lived so that this interval will provide a two or three point sample for an average breeding adult based on estimates of longevity by Austin (1945), Tinbergen (1953) and Bent (1963a, b). Important biological regions along the coast should be identified for more intensive inventorying. The more productive estuaries harboring significant numbers of breeding birds should receive higher priority for protection and management than areas with low productivity caused by factors such as poor water quality or industrialization. Yearly colony shifts by nesting adults requires that fairly large geographic regions be treated as breeding population units (Kadlec and Drury 1968a). Concentrating only on the largest colonies may provide misleading results. Areas such as the Chesapeake Bay, lower eastern shore of Virginia, Brigantine and Wildwood regions in New Jersey, northeastern tip of Long Island, and Cape Cod and southern islands in Massachusetts should receive the greatest survey and management attention.

Population estimation should be performed over large areas. Experienced biologists familiar with the area to be studied should conduct the inventories at standard times of the day, year (early to mid June), and breeding cycle in the region, if possible. Training sessions in estimation techniques can improve both accuracy and precision. Standard data forms should be used to conform with other inventories (National Audubon Society, Canadian Wildlife Service, etc.). Photography may be used to provide a basis for assessing habitat changes, both natural and man-induced.

FEEDING HABITAT

Identifying areas where waterbirds concentrate for feeding should provide a valuable index to higher order productivity in estuarine and marine environments. Monitoring seasonal use patterns of coastal feeding sites over several annual cycles should indicate whether important fish and invertebrate populations are relatively uniform or highly clumped in distribution. Biological "production hot-spots" might then be identified for protection and further research.

HABITAT PRESERVATION AND MANAGEMENT

Natural, undisturbed habitat is rapidly declining along the northeast coast. Identification of the habitat requirements of nesting waterbirds is essential to preserve at least some of the natural resources still remaining. The U.S. Fish and Wildlife Service should work jointly with States and private organizations to set aside certain islands or large parcels of land during the nesting period (primarily April to July) for protection. Special attention should be given to those species which are declining (at State, regional, or national levels) and/ or those with very specific habitat requirements. Posting and/or fencing, are probably necessary as a minimum measure of management.

Efforts should also be made to preserve certain man-created habitats, such as dredge deposition islands (Soots and Parnell 1975), old piers, and buildings because of their extensive use by waterbirds in highly-urbanized areas. These colony sites probably serve as secondary habitats because the natural sites are usurped by development.

In some States (e.g. North Carolina, Delaware), islands created by dredging are State-owned. State Fish and Wildlife agencies should be encouraged (by Federal matching funds, etc.) to acquire and manage such sites. Periodic burning and clearing is an effective management method for providing nesting habitat for terns, black skimmers, oystercatchers, and plovers (Soots and Parnell 1975).

Federal, State, and local agencies responsible for managing seashore areas should be encouraged to provide protected areas for nesting birds. Information about the natural history and ecology of colonial nesting waterbirds should be made available by the Fish and Wildlife Service to land management agencies and the public. Short brochures describing tern and skimmer nesting activities have been distributed at a number of State, County, and private parks in the northeast with good results.

Federal agency cooperation should also extend to the military. A number of ordnance testing grounds are used by nesting waterbirds. Agreements should be negotiated to reduce or eliminate testing during the period from April to July.

To facilitate planning and communication among responsible agencies, all data concerning waterbirds and other wildlife resources should be disseminated to all Federal, State, and local resource and planning agencies.

REFERENCES

Allan, P.F. 1931. Studies in bird ecology at the Isles of Shoals. M.S. Thesis. Univ. of New Hampshire, Durham. 103 pp.

Allen, G.M. 1903. A list of the birds of New Hampshire. Nature Study Press, Manchester.

Allen, R.P. 1937a. Thirty-six years after. Bird-Lore 39:92-94.

Allen, R.P. 1937b. Report on the cooperative herring gull project. Bird-Banding 8:173.

Allen, R.P. 1937c. Black-crowned night heron colonies on Long Island. Proc. Linnaean Soc. N. Y. 49:43-54.

Allen, R. 1957. An urgent appeal for information on the wading birds. Audubon Field Notes 11:458-460.

Anderson, D.R., and R.S. Pospahala. 1970. Correction of bias in belt transect studies of immotile objects. J. Wildl. Manage. 34:1087-1096.

Arbib, R. 1976. The blue list for 1977. Amer. Birds 30:1031-1039.

Austin, O.L. 1945. The role of longevity in successful breeding by the common tern. Bird-Banding 16:21-28.

Austin, O. L., Jr. 1932. Cobb Island. Bird-Banding 3:12-25.

Bailey, H.H. 1913. The birds of Virginia. J.P. Bell Co., Inc. Lynchburg. 362 pp.

Bales, B. 1920. Roseate tern (Sterna dougallii) breeding in Virginia. Auk 37:579.

Barry, T.W., and R. Spencer. 1976. Wildlife response to oil well drilling. Canadian Wildl. Serv. Progress Notes 67:1-75.

Belopol'skii, L.O. 1957. Ecology of sea colony birds of the Barents Sea. Israel Prog. Sci. Transl., Jerusalem. 346 pp.

Bent, A.C. 1963a. Life histories of North American gulls and terns. Dover Publications, Inc. N.Y. 337 pp.

Bent, A.C. 1963b. Life histories of North American marsh birds. Dover Publications, Inc. N.Y. 392 pp.

Blodget, B. 1978. The effect of off-road vehicles on least terns and other shorebirds. M.S. Thesis. Univ. of Massachusetts, Amherst. 76 pp.

Bridge, D., and J. Weske. 1961. Breeding birds on Maryland's coastal island. Maryland Birdlife 17:3-6.

Brownson, W. 1906. Birds in and around Portland in 1906. J. Maine Ornithol. Soc. 8:84-87.

Brownson, W. 1907. Visit to a colony of laughing gulls. J. Maine Ornithol. Soc. 9:27.

Buckley, F.G. 1977. A study of the use of dredged material islands by colonial seabirds and wading birds (A historical perspective). Phase II Interim Rep. U.S. Army Corps of Engineers, Waterways Exp. Sta. Vicksburg, MS. 231 pp.

Buckley, F.G., and P.A. Buckley. 1972. The breeding ecology of royal terns, Sterna (Thalasseus) maxima maxima. Ibis 114:344-359.

Buckley, P.A., and F.G. Buckley. 1976. Guidelines for the protection and management of colonially-nesting waterbirds. National Park Service Report. 54 pp.

Buckley, P.A., and F.G. Buckley. 1977. Human encroachment on barrier beaches of the Northeastern U.S. and its impact on coastal birds. Pages 68-76 in A Symposium on Coastal Recreation Resources in an Urbanizing Environment. Massachusetts Coop. Extension Serv. Monogr. University of Massachusetts, Amherst.

Buckley, P.A., and F. G. Buckley. in prep. Colonial waterbirds of Long Island, New York, 1974-1977. I. Atlas. II. Habitat selection. III. Protection and management.

Buckley, P.A., and T.H. Davis. 1973. Hudson-St. Lawrence region. Am. Birds 27:845-852.

Buckley, P.A., F.G. Buckley, and M. Gochfeld. 1975. Gull-billed tern: New York State's newest breeding species. Kingbird 25:178-183.

Bull, J. 1964. Birds of the New York City area. Harper and Rowe, New York. 540 pp.

Bull, J. 1970. Supplement to the birds of the New York City area. Proc. Linnaean Soc. N.Y. 71:1-54.

Bull, J. 1974. Birds of New York State. Doubleday/Natural Hist. Press, Garden City. 655 pp.

Burger, J. 1977. Nesting behavior of herring gulls: Invasion into Spartina saltmarsh areas of New Jersey. Condor 79:162-169.

Burger, J. 1978. The pattern and mechanism of nesting in mixed-species heronries. Pages 45-60 in A. Sprunt IV., J. Ogden and S. Winckler eds. Wading birds. Res. rep: 7, National Audubon Society, N. Y.

Burger, J., and F. Lesser. 1977. Determinants of colony site selection in common terns (Sterna hirundo). Pages 118-127 in W.E. Southern ed. Proc. 1977 Conf. Colonial Waterbird Group. Dekalb, Illinois.

Burger, J., and J. Shisler. 1978. The effects of ditching a salt marsh on colony and nest site selection by herring gulls, Larus argentatus. Am. Midl. Natur. in press.

Burns, F. 1929. The vanished glory of Great Egg Harbor Bay region, New Jersey. Oologist 46:33-39.

Church, E., B. Shaub, and M. Shaub. 1955. The Quivett Neck heronry. Bull. Massachusetts Aud. Soc. 39:267-271.

Clapp, R.B. 1975. Unpublished notes on the New York Bight area. National Fish and Wildlife Lab., Natl. Mus. Natur. Hist., Washington.

Clark, J. 1974. Coastal ecosystems: Ecological considerations for management of the coastal zone. The Conservation Foundation, Washington D.C. 178 pp.

Clark, P.I., and F.C. Evans. 1954. Distance to nearest neighbor as a measure of spatial relationships in populations. Ecology 35:445-453.

Clement, R., and R. Woodruff. 1962. A history of nesting gulls and terns of Rhode Island, 1889-1961. Narragansett Naturalist 5:68-73, 103-111, 125-128.

Coulson, J., and E. White. 1960. The effect of age on the breeding biology of the kittiwake, Rissa tridactyla. Ibis 102:71-86.

Cramp, S., W.R.P. Bourne, and D. Saunders. 1974. The seabirds of Britain and Ireland. Collins, London. 207 pp.

Cruickshank, A. 1942. Birds around New York City. American Mus. Natur. History, N. Y.

Custer, T.W. 1977. The use of feeding habitat by a colony of herons, egrets, and ibises near Beaufort, North Carolina (Abstract). Page 154 in W.E. Southern ed. Proc. 1977 Conference of the Colonial Waterbird Group. DeKalb, Illinois.

Custer, T.W., and R.G. Osborn. 1976. Wading birds of the Atlantic coast: 1975. Office of Biol. Serv., U.S. Fish & Wildl. Serv. Interim Rep. 151 pp.

Custer, T.W., and R.G. Osborn. 1977. Wading birds as biological indicators: 1975 colony survey. U.S. Fish & Wildl. Serv. Spec. Sci. Rep.-Wildl. 206: 28 pp.

Dater, C. 1969. Status survey of rails and wading birds in Connecticut: June to September 1968. Connecticut Audubon Council, Harwinton.

Dayton, P. K. 1973. Two cases of resource partitioning in an intertidal community: Making the right prediction for the wrong reason. Amer. Natur. 107:662-670.

Diamond, J. and R. May. 1977. Species turnover rates on islands: Dependence on census interval. Science 179:266-270.

Downing, R.L. 1973. Preliminary nesting survey of least terns and black skimmers in the East. Am. Birds 27:946-949.

Drury, W.H. 1963a. Results of a study of herring gull populations and movements in Southeastern New England. Pages 207-217 in Colloque: Le Probleme des Oiseaux sur les Aerodromes. Nice, France.

Drury, W.H. 1963b. Herring gull populations and movements in Southeastern New England. Massachusetts Audubon Soc. Rep.

Drury, W.H. 1973. Population changes in New England seabirds. Bird-Banding 44:267-313.

Drury, W.H. 1974. Population changes in New England seabirds (continued). Bird-Banding 45:1-15.

Duffy, D. 1977. Breeding populations of terns and skimmers on Long Island Sound and Eastern Long Island, 1972-1975. Proc. Linnaean Soc. N. Y. 73:1-48.

Dunn, E.K. 1973. Changes in fishing ability of terns associated with wind speed and sea surface conditions. Nature 244:520-521.

Dutcher, W. 1901. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 18:76-103, 183-190.

Dutcher, W. 1902. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 19:34-63.

Dutcher, W. 1903. Report of the A.O.U. Committee on the protection of North American birds. Auk 20:101-159.

Eberhard, L. 1968. A preliminary appraisal of line transects. J.Wildl.Manage. 32:82-88.

Erwin, R.M. 1975. Comparative foraging and breeding strategies of three seabird species, the royal tern, Sterna maxima, common tern, S. hirundo, and black skimmer, Rynchops niger. Ph.D. Thesis. Univ. of Maryland, College Park. 111 pp.

Erwin, R.M. 1977a. Population and colony site dynamics in selected Massachusetts waterbirds. Pages 19-25 in W.E. Southern ed. Proc. 1977 conference of the Colonial Waterbird Group. DeKalb, Illinois.

Erwin, R.M. 1977b. Black skimmer breeding ecology and behavior. Auk 94:709-717.

Erwin, R.M. 1978. Coloniality in terns: The role of social feeding. Condor 80:211-215.

Erwin, R. M. and, C. Korschgen. 1979. Coastal waterbird colonies: Maine to Virginia, 1977. FWS/OBS-79/08. U.S. Fish and Wildlife Service, Office of Biological Services.

Fables, D. 1955. Annotated list of New Jersey birds. Urner Ornithol. Club, Newark. 95 pp.

Fables, D. 1959. First supplement to the annotated list of New Jersey birds. Urner Ornithol. Club, Newark.

Ferren, R.L. in prep. The birds of Rhode Island.

Finch, D. 1976. Northeastern maritime region (nesting summary). Am. Birds 30:926-930.

Fisk, E.J. 1974. Atlantic coast least tern survey 1974. Unpubl.report, National Audubon Society.

Forbush, E.H. 1929. Birds of Massachusetts and other New England states. Vol. I. Massachusetts Dept. Agric. Norwood Press, Norwood. 484 pp.

Forster, R. 1976. Field notes--new nesting records. Massachusetts Audubon News-letter 16:16.

Fretwell, S. 1972. Populations in seasonal environments. Princeton Univ. Press, Princeton. 217 pp.

Gochfeld, M. 1977. Colony and nest site selection by black skimmers. Pages 78-90 in W.E. Southern ed. Proc. 1977 Conference of the Colonial Waterbird Group. DeKalb, Illinois.

Gorham, E. 1977. Routine environmental monitoring--an unexploited opportunity. Bull. Ecol. Soc. Amer. 58:7.

Griscom, L. 1923. Birds of the New York City region. Amer. Mus. Natur. Hist., New York. 400 pp.

Griscom, L., and E. Folger. 1948. The birds of Nantucket. Harvard Univ. Press, Cambridge.

Gross, A.O. 1923. The black-crowned night heron (Nycticorax nycticorax naevius) of Sandy Neck. Auk 40:1-30.

Gross, A.O. 1951a. The herring gull-cormorant control project. Proc. 10th Int. Ornithol. Congr. 535-536.

Gross, A.O. 1951b. Laughing gulls nesting at Stratton Island. Maine Aud. Soc. 7:52-54.

Hill, N.P. 1965. The birds of Cape Cod, Massachusetts. W. Morrow, New York.

Howe, R.H. Jr., and G.M. Allen. 1901. The birds of Massachusetts. Cambridge. 154 pp.

Howe, R.H. Jr., and E. Sturtevant. 1899. The birds of Rhode Island. Private publisher. 111 pp.

Jackson, C.F., and P.F. Allen. 1932. Additional notes on the breeding in Maine of the great black-backed gull. Auk 49:349-350.

Jones, L. 1906. A contribution to the life history of the common (Sterna hirundo) and roseate (S. dougallii) terns. Wilson Bull. 18:35-47.

Kadlec, J.A., and W.H. Drury. 1968a. Structure of the New England herring gull population. Ecology 49:644-676.

Kadlec, J.A., and W.H. Drury. 1968b. Aerial estimation of the size of gull breeding colonies. J. Wildl. Manage. 32:287-293.

Kane, R.,and R. Farrar. 1976. 1976 coastal colonial bird survey of New Jersey. New Jersey Audubon Occas. Paper 125:7-14.

Kane, R.,and R. Farrar. 1977. 1977 coastal colonial bird survey of New Jersey. New Jersey Audubon Occas. Paper 131:187-194.

Kartaschew, N.N. 1963. Review of methods of censusing Laridae and Alcidae. Pages 105-116 in A. Formozov and Y. Isakov eds. Organization and Methods of Censusing Birds and Harmful Rodents. Israel Prog. Sci. Transl.,Jerusalem.

Keith, A., and E. Shalif. 1968. A supplemental list of Martha's Vineyard birds. Massachusetts Audubon Soc.

Kirkwood, F.C. 1895. A list of the birds of Maryland. Trans. Maryland Acad. Sci. 2:241-382.

Knight, O.W. 1908. The birds of Maine. C.H. Glass and Co., Bangor. 693 pp.

Korschgen, C. 1979. Maine coastal waterbird colonies--1977. U.S. Fish and Wildlife Service, Biol. Services Program, FWS/OBS-79/09. 83 pp.

Kuerzi, J. 1929. Notes on the birds of Cobb's Island, Virginia. Auk 46:14-20.

Kury, C., and M. Gochfeld. 1975. Human interference and gull predation in cormorant colonies. Biol. Conserv. 8:23-24.

Kushlan, J. 1977. Feeding ecology of wading birds. Pages 249-297 in A. Sprunt IV., J.C. Ogden, and S. Winckler eds. Wading birds. Res. Rep. 7, National Audubon Society, N. Y.

Leck, C. 1975. Birds of New Jersey, their habits and habitats. Rutgers Univ. Press, New Brunswick. 190 pp.

Lewontin, R.C. 1969. The meaning of stability. Pages 13-24 in Symposium on Diversity and Stability in Ecological Systems. Brookhaven Symp. Biol. 22. Nat. Bur. Standards, U.S. Department of Commerce.

Lloyd, M. 1967. Mean crowding. J. Anim Ecol. 36:1-30.

MacKenzie, L. 1961. The birds of Guilford, Connecticut. Peabody Mus. Natur. Hist., Yale Univ., New Haven. 110 pp.

May, R.M. 1973. Stability and complexity in model ecosystems. Princeton Univ. Press, Princeton. 265 pp.

McDonald, N., S. Daly, and J. Gillespie. 1940. Snowy egret nesting in New Jersey. Auk 57:106.

McIntyre, G.A. 1953. Estimation of plant density using line transects. J. Ecol. 41:319-330.

McMullen, T.E. MS. unpublished field notes, 1909-1962. MS. Coll. No. 773, Philadelphia Acad. Natur. Sci.

Meyerriecks, A. 1957. Louisiana heron breeds in New York City. Wilson Bull. 69:184-185.

Miller, G.E. 1959. First nesting of the cattle egret in Maryland. Maryland Birdlife 15:22.

Miller,J.C. 1966. Great black-backed gull nesting in New Jersey and additional notes on nesting herring gulls. Cassinia 49:31.

Miller, R. 1943. The great blue heron. Cassinia 33:1-23.

Murray, J.J. 1952. Eastern shore field trip. Raven 23:70-71.

Murray,J.J. 1955. A checklist of the birds of Virginia. Virginia Soc.Ornithol., Richmond (with 5 supplements). 113 pp.

Nettleship, D.N. 1976. Census techniques for seabirds of Arctic and eastern Canada. Canadian Wildl. Serv. Occas. Paper 25:1-33.

Nisbet, I.C.T. 1971a. Laughing gull colonies in the Northeast. Massachusetts Audubon 55:2-10.

Nisbet, I.C.T. 1971b. The laughing gull in the Northeast. Am.Birds 25:677-683.

Nisbet, I.C.T. 1973. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44:27-55.

Nisbet, I.C.T. 1975. Selective effects of predation in a tern colony. Condor 77:221-226.

Nisbet, I.C.T. 1976a. Colonization of Monomoy by laughing gulls. Cape Natur. 5:4-8.

Nisbet, I.C.T. 1976b. Returns from terns. Massachusetts Audubon News-letter. 15:3-5.

Nisbet, I.C.T., and W.H. Drury. 1972. Measuring breeding success in common and roseate terns. Bird-Banding 43:97-106.

Norton, A.H. 1907. Report of Arthur H. Norton on colonies of birds in Maine receiving special protection in 1907. Bird-Lore 9:319-327.

Norton, A.H. 1914. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 16:489-492.

Norton, A.H. 1915. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 17:501-502.

Overton, W.S. 1971. Estimating the numbers of animals in wildlife populations. In R. Giles, Jr. ed. Wildlife Management Techniques. The Wildlife Society, Washington, D.C.

Palmer, R.S. 1938. Tern mortality along the Maine coast. Bird-Banding 9:117-123.

Palmer, R.S. 1949. Maine birds. Bull. Mus. Comp. Zool. 102 pp.

Pennock, C.J. 1908. Birds of Delaware--additional notes. Auk 25:282-288.

Pielou, E.C. 1969. An introduction to mathematical ecology. Wiley-Interscience, N. Y. 286 pp.

Portnoy, J. 1977. Nesting colonies of seabirds and wading birds--coastal Louisiana, Mississippi, and Alabama. U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS-77/07. 126 pp.

Post, W. 1961. Range extensions of herons in the northeastern United States. Wilson Bull. 73:390-393.

Post, W., F. Enders, and T. Davis, Jr. 1970. The breeding status of the glossy ibis in New York. Kingbird 20:3-8.

Proctor, N. in prep. The birds of Connecticut.

Robert, H.C., and C.J. Ralph. 1975. Effects of human disturbance on breeding success in gulls. Condor 77:495-499.

Sage, J.H., L.B. Bishop, and R.B. Bliss. 1913. Birds of Connecticut. Printed for the State Geological and Natural History Survey, Hartford. 370 pp.

Samuels, E.A. 1895. The birds of New England and adjacent states. Noyes, Holmes and Co., Boston. 591 pp.

Seibert, H. 1951. Light intensity and roosting flight of herons in New Jersey. Auk 68:63-74.

Shriner, C.A. 1896. The birds of New Jersey. Fish and Game Comm. Trenton. 212 pp.

Smith, R.L. 1966. Ecology and field ecology. Harper and Row, New York. 678 pp.

Soots, R.F. Jr., and J.F. Parnell. 1975. Ecological succession of breeding birds in relation to plant succession on dredge islands in North Carolina estuaries. Univ. North Carolina Sea Grant Publ. UNC-56-75-27.

Soots, R.F. Jr., and J.F. Parnell. 1976. Analysis of the use of the point-center quarter method in estimating colonial seabird nesting populations. 94th meeting Amer. Ornith. Union (abstract), Haverford, Pennsylvania.

Spinner, G. 1969. Serial atlas of the marine environment. Folio 18. The wildlife wetlands and shellfish areas of the Atlantic coastal zone. Amer. Geographic Soc.

Sprunt, A. IV, J. Odgen, D. McCrimmon, and E. Weinstein. 1976. Historical data (1900-1963) for east coast sea and wading bird colonies. Natl. Aud. Soc. Rep. to the U.S. Fish and Wildlife Service. Unpublished.

Stewart, R.E., and C.S. Robbins. 1958. Birds of Maryland and the District of Columbia. North Amer. Fauna 62.

Stone, W. 1937. Bird studies at Old Cape May. Delaware Valley Ornith. Club. Vols I-II. 941 pp.

Taber, W. 1955. The Isles of Shoals. Bull. Maine Audubon Soc. 9:58-66.

Tinbergen, N. 1953. The herring gull's world. Doubleday, Garden City, N. Y.

Valentine, J. 1958. Cattle egrets nesting in Maryland. Maryland Birdlife 14:49.

Vickery, P. 1977. Northeastern maritime region (the nesting season). Am. Birds 31:1110-1116.

Wiese, J. and T. Smith-Kenneally. 1977. A heron colony called Pea Patch. Delaware Conserv. 21:8-15.

Wetherbee, D., R. Coppinger, and R. Walsh. 1972. Time-lapse ecology, Muskeget Island, Nantucket, Massachusetts. MSS Educ. Pub. Co., New York. 173 pp.

Wilson, E.O. 1975. Sociobiology: The new synthesis. Belknap Press, Cambridge. 697 pp.

Worth, C.B. 1929. Notes from Cobb's Island, Virginia. Auk 46:558-559.

Wright, P.L. 1937. The birds of the Isles of Shoals. M.S. Thesis. Univ. of New Hampshire, Durham. 46 pp.

APPENDIX A

PROCEDURES FOR USING SAMPLING METHODS IN DETERMINING NEST DENSITIES

POINT-CENTER QUARTER

1. A line should be selected (randomly, haphazardly, etc.) within the study area and followed using compass orientation or markers along the line at fixed intervals.

2. At a predetermined constant interval along the line, points are selected. At each point, an imaginary circle is circumscribed with the point at the center. The circle is divided into four quadrats. Within each quadrat, the nearest nest to the point is measured (in feet) and recorded. This is repeated for each point along the line, measuring four distances for each point.

3. An average nearest nest-to-point distance is then computed by summing all distance measurements and dividing by 4 x no. points used.

4. This value then is converted into an aerial measure by squaring it.

5. The squared value, divided into 43,560 (no. $ft.^2$/acre), represents the number of nests per acre. To get the total number of nests in the study area, the total area (in acres) needs to be calculated.

BELT TRANSECTS

The procedure outlined below was adopted from a study conducted in salt marsh heronries along the north Gulf coast by Portnoy (1977).

1. A transect line is established along the longest axis of the colony.

2. Either a 10% or 20% sample of the colony area is taken, using 2-m wide belts as sampling units (approximately an arm's length on each side of the observer while walking the belt). The sampling transects are run perpendicular to the long axis of the colony. To obtain a 10% sample by maintaining a 20 m mean distance between 2-m wide transects, only random numbers between 2 and 40 are accepted (rationale: a 100% sample would have a mean inter-transect distance of 50 since the range of random numbers is 0 to 100. Hence, a 20 m distance (40% of the 50 m distance) requires that only 40% of all random numbers should be used.)

3. At each of the randomly-selected points along the transect line, the observer follows a compass bearing perpendicular to the line and crosses the entire width of the colony area, counting all nests within 1 m of each side. This can be accomplished expeditiously when several observers are used, since several belts can be sampled simultaneously. Separate counts are kept for each belt transect.

4. The exact percent sample is determined next by dividing the entire length of the long axis into the cumulative width of all 2 m width transects. The total nest estimate of the entire colony then is extrapolated by dividing the total number of nests in all belt transects by the percent sample taken.

5. If density (number of nests/unit area) is required, the colony area can be determined either by surveying, measuring from aerial photographs (see Portnoy 1977), or, as a gross approximation, by multiplying the total length of the colony by the average of all belt transect lengths.

6. To provide a measure of sampling accuracy, the individual belt transect densities can be calculated and used to derive confidence limits in each colony (Portnoy 1977).

APPENDIX B

LISTING OF COLONY NESTING DATA, 1900-1977

The purpose of this supplement is to provide the reader with ready access to detailed breeding data on all colonial waterbirds from southern Maine to Virginia for the period 1900-1977. These data have already been summarized and are presented, by State and species, in tabular form in Section III of this report.

All information concerning nesting numbers at specified locations in each of the 10 northeastern States is presented. References to State or regional totals are not recorded here, but are integrated into Section III.

DATA SOURCES

Both published and unpublished reports of breeding numbers were extracted from a number of sources. All major ornithological periodicals were carefully reviewed, especially the field notes sections (Table B1). In most cases, all issues in the journal series were available. Museum, research center, and national wildlife refuge files provided a second major source of information (Table B2). Also, data were requested from each of the State's Audubon societies. In most cases, this information was already available from other sources. Lastly, a significant amount of data were obtained from unpublished field notes and records of a number of professional and amateur ornithologists (Table B2).

Concerted efforts were made to contact as many active ornithologists and waterbird banders as possible in an attempt to collect all nesting records. In some cases, the data were not made available; however, the following compilation represents the vast majority of waterbird nesting data.

A bibliography of all data sources is included (Appendix C). The majority of the literature survey was completed by December 1975, but important additional journal references from 1976 and 1977 are also listed.

DATA ORGANIZATION

The data are organized by States. All data were recorded on computer cards. Because of the nature of the data and the computer storage systems used, four record types are included: 1) colony location, 2) 1977 field data, 3) 1976 field data, and 4) historical (1900-1975) data.

The information for each record type is presented on microfiche at the end of this report. Data entries are explained below:

COLONY LOCATION DATA

All colony locations, both present and past, are listed. In most cases, U.S.G.S. map names are used. If no official name was available, the colony was named after a major geographical feature (water body, etc.) nearby. Location is given by latitude and longitude, judged to the nearest degree. The "map ID" refers to the code number on the approximate U.S.G.S. 1:250,000 scale map (these code numbers are now superceded by a map name). Ownership is listed but more detailed information is given in the atlas. The six-digit

Table B1. Major source journals of historical breeding data and their geographical scope.

Scope	Name
Northeast (regionwide)	Bird-Lore
	Audubon (Field Notes)
	American Birds
	Oologist
	Bird-Banding
	Auk
	Condor
	Wilson Bulletin
	Eastern Bird-Banding Assoc. Bulletin
New England	Bull. New England Birdlife
	Records of New England Birds
	Bull. Nuttall Ornithol. Club
	Man and Nature
Middle Atlantic	Atlantic Naturalist
	DelMarVa Ornithologist
Maine	J. Maine Ornithol. Soc.
	Bull. Maine Audubon Soc.
	Maine Field Naturalist
New Hampshire	New Hampshire Audubon Quarterly
	Audubon Society of New Hampshire Bulletin
Massachusetts	Bull. Massachusetts Audubon Society
	Massachusetts Audubon (and News-letter)
	Bull. Essex County Ornithological Club
Rhode Island	News of Rhode Island Ornithology
	Narragansett Naturalist
New York	Proc. Linnaean Society of New York
	Linnaean News-letter
	Kingbird
New Jersey	New Jersey Audubon Bulletin
	Audubon News-letter
	New Jersey Nature News
	New Jersey Audubon
	Cassinia

(Continued)

Table B1 (Concluded)

Scope	Name
Delaware	Delaware Conservationist
	DelMarVa Ornithologist
Maryland	Wood Thrush
	Maryland Birdlife
Virginia	Raven
	Wood Thrush

Table B2. Institutional and private sources of unpublished breeding data.

Museum	U.S. Fish & Wildlife Service office	Private (or public) manuscripts and notes
Comparative Zoology (Harvard University)	Migratory Bird & Habitat Lab, Laurel MD (C.S. Robbins)	C. Andrews (MA)
Peabody (Yale University)	Back Bay NWR	H. Armistead (MD)
American (Ornithology Dept.)	Black Water NWR	J. Buckalew (MD)
Philadelphia Academy of Natural Science	Brigantine NWR	R. Clapp (VA)
Maryland Society of Natural History	Chincoteague NWR	W. Drury (MA, ME)
National (Bird & Mammal Lab. viz. R. Clapp)	Plum Island NWR	R. Ferren (RI)
Newark (NJ)	Target Rock NWR	E. Fisk (MA, NJ)
Delaware[a]		J. Hatch (MA)
		T. McMullen (NJ)
		H. Mills (NJ)
		N. Proctor (CT)
		C. Urner (NJ)
		J. Weske (MD, VA)
		S. Whiting (MA)
		L. Wilcox (NY)

[a]Curator contacted, but not visited.

number in the last column gives the atlas identification number (1977 data). A "0" means that the colony was not occupied in 1977.

1977 FIELD DATA

All 1977 nesting data are listed by species and colony for each State. The third column gives the date of the inventory (month, day, year). The fourth column lists the number of nesting pairs estimated. A code of "800000" indicates "possible" nesting. The fifth column indicates the inventory method: "AD-EST" (adult estimate - air or ground); "NEST-CT" (nest count); "NEST-ES-SP" (nest estimate from sample count); "PHOTO-CT" (count from photographs); etc. "Other" refers to a combination of methods. The last column lists the major observer for each inventory. Whereas the atlas lists only the "best estimate" for each species at a colony, this listing includes all the estimates made.

1976 FIELD DATA

The 1976 data is ordered first by colony, listing all species and corresponding nesting pair estimates. Habitat and nest site substrate are listed in abbreviated form and census date is given as before. The census (inventory) techniques are coded differently from 1977; "TOT-CT-ADU" (=total count of adults) corresponds to "AD-EST" in 1977. "F-W-AIR-ES" (air estimate with fixed-wing aircraft) corresponds to "AD-EST-AIR in 1977. In 1977, both fixed-wing and helicopter aerial estimates are combined. The remainder are self-explanatory. Lastly, time and observers are listed.

HISTORICAL DATA

The historical (1900-1975) data are ordered by species (in A.O.U. number order) and year, beginning with the earliest records. When species in mixed colonies were not estimated separately, the general categories "terns", "gulls", and "herons" are used. When a range of years is given (e.g. 1940-1950) by an author, a "1999" year code is given, and the year range is given under the "observation" column. Nesting pair estimates are given. A code of "800000" indicates "possible" nesting; "900000" means definite nesting, but no numbers are provided. Much confusion arises in the literature in differentiating "pairs" and "bird" estimates. If only adult totals were given, the following factors were used to convert adult numbers to breeding pairs: X 1.0 for all gulls, cormorants, and wading birds; X 0.80 for terns; X 0.50 for black skimmers. When reference to a "few" pairs of a species was made, an entry of five pairs was used. The "observation" column simply lists additional pertinent information about the species or inventory methods used at that colony. At least one reference for each data entry is shown. Limited space precluded all references from being listed. Since much of the data was derived from the field notes sections of various ornithological journals, only the journal name is given, not the name of the editor or year. Abbreviations are used throughout and are shown in Table B3.

In Maryland and Virginia, the historical data is separated into two regions, Chesapeake Bay and the Atlantic coast (eastern shore).

Table B3. Abbreviations of journal and source names in the historical data section.

Title	Abbreviation
Bulletin of New England Birdlife	BNEBL
Record of New England Birds	RNEB
Bulletin of the Nuttall Ornithological Club	BNOC
Bulletin of the Essex County Ornithological Club	BECOC
Audubon Field Notes (later American Birds)	AFN/AB
Patuxent Wading Bird Survey (See Custer and Osborn 1977)	Patuxent WBS
New Jersey Nature News	NJNN
Maryland Ornithol. Society's Nest Record Card File	MOS NRC
Atlantic Naturalist	AN

The computer program summed all breeding pair estimates and listed "totals" for each species. These figures should be ignored since they simply represent cumulative counts over a series of years and colonies.

In addition to the microfiche, the data are presently stored on a limited number of magnetic tapes. A copy of the tape may be made available by contacting the Coastal Ecosystems Regional Activity Leader, Region 5, U.S. Fish and Wildlife Service, 1 Gateway Center, Newton Corner, MA.

APPENDIX C

SELECTED BIBLIOGRAPHY OF NESTING RECORDS OF
COLONIAL WATERBIRDS
PORTLAND, MAINE TO BACK BAY, VIRGINIA

Abbott, C.G. 1907. Summer bird-life of the Newark, New Jersey marshes. Auk 24:1-11.

Adams, B., and J. Miller. 1975. The Absecon Bay heron colony. EBBA News 38: 103-108.

Alexander, G. 1923. Summer birds of Cape Cod compared with those of Missouri. Wilson Bull. 35:73-79.

Allan, P.F. 1931. Studies in bird ecology at the Isles of Shoals. M.S. Thesis. Univ. of New Hampshire, Durham. 103 pp.

Allen, G.M. 1903. A list of the birds of New Hampshire. Nature Study Press, Manchester, New Hampshire.

Allen, G.M. 1909. List of Aves (of New England). Occas. Pap. Boston Soc. Natur. Hist. 7:230 pp.

Allen, R.P. 1931. Report of Robert P. Allen on inspection of bird colonies along the Atlantic coast. Bird-Lore 33:481-483.

Allen, R.P. 1933. Breeding range of herring gull extended. Auk 50:433-434.

Allen, R.P. 1937a. Thirty-six years after. Bird-lore 39:92-94.

Allen, R.P. 1937b. Report on the cooperative herring gull project. Bird-Banding 8:173.

Allen, R.P. 1937c. Black-crowned night heron colonies on Long Island. Proc. Linnaean Soc. N. Y. 49:43-54.

Allen, R.P., and A.H. Norton. 1931. An inspection of the colonies of sea birds on the coast of Maine by the National Assoc. of Audubon Societies, June 23 to July 14, 1931, and a comparison of present conditions with those existing in 1900 and subsequent years of the Association's protection. Manuscript.

Alperin, I.M. 1954. Wither the herring gull. Linnaean News-letter 8:1-2.

Alperin, I.M. 1955. Common terns reestablish along on Great Gull Island. Linnaean News-letter 9.

Anderson, K.S. 1958. History of the Plymouth tern colony. Bull. Mass. Audubon Soc. 42:238-242.

Anon. 1905. State reports (Mass.). Bird-Lore 7:88-90.

Anon. 1905. State reports (Mass.). Bird-Lore 7:327-329.

Anon. 1931. Seabirds of the Maine coast. Mass. Audubon 15:12.

Anon. 1966. Survey of Hog Island. Atlantic Naturalist 66:186.

Anon. 1972. Sand city tern project - summer 1972. Target Rock National Wildlife Refuge unpubl. report. 12 pp.

Anon. 1974. Tern nesting and resting areas. New York Audubon Society.

Anon. 1975. Quarks, croaks and gurgles. Maine Audubon News 4-5.

Armistead, H.T. 1974. Lower Chesapeake heronries of Maryland - Smith I. to Barren I. Maryland Birdlife 30:9-27.

Armistead, H.T. 1974. Iceland gulls, Forsters' terns nests and breeding herons in Dorchester Co., summer, 1974. Maryland Birdlife 30:128-132.

Austin, O.L. Unpublished notebooks, 1927-1957, at Mass. Audubon Soc., Lincoln, Mass.

Austin,O.L. 1932. The status of Cape Cod terns in 1932. Bird-Banding 3:143-156.

Austin,O.L. 1934. The status of Cape Cod terns in 1934. Bird-Banding 5:155-171.

Austin,O.L. 1938. Some results of adult tern trapping in the Cape Cod colonies. Bird-Banding 9:12-25.

Austin, O.L. 1940. Some aspects of individual distribution within Cape Cod tern colonies. Bird-Banding 11:155-169.

Austin, O.L. 1941. Status of the Cape Cod terns in 1941 from the standpoint of conservation. Bull. Mass. Audubon Soc. 25:175-182.

Austin, O.L. 1942. The life span of the common tern (Sterna hirundo). Bird-Banding 13:159-176.

Austin, O.L. 1942. Terns on Cape have good season. Bull. Mass. Audubon Soc. 26:167.

Austin, O.L. 1944. The status of Tern Island and the Cape Cod terns in 1943. Bird-Banding 15:133-139.

Austin, O.L. 1945. The role of longevity in successful breeding by the common tern (Sterna hirundo). Bird-Banding 16:21-28.

Austin, O.L. 1946a. The status of Cape Cod terns in 1944: A behavior study. Bird-Banding 17:10-27.

Austin, O.L. 1946b. The status of Cape Cod terns in 1946. Bull. Mass. Audubon Soc. 30:245.

Austin, O.L. 1947. A study of the mating of common terns (Sterna hirundo). Bird-Banding 18:1-16.

Austin, O.L. 1948. The status of the Cape Cod terns in 1947. Bull. Mass. Audubon Soc. 32:137-138.

Austin, O.L. 1949. Site tenacity, a behavior trait of the common tern (Sterna hirundo). Bird-Banding 20:1-39.

Austin, O.L. 1951a. Group adherence in the common tern. Bird-Banding 22:1-15.

Austin, O.L. 1951b. Tern Island. Bull Mass. Audubon Soc. 35:295.

Austin, O.L. 1953. The migration of the common tern (Sterna hirundo) in the western hemisphere. Bird-Banding 24:39-55.

Austin, O.L., and O.L. Austin, Jr. 1956. Some demographic aspects of the Cape Cod population of common terns (Sterna hirundo). Bird-Banding 27:55-66.

Austin,O.L.,Jr. 1929. Contributions to the knowledge of the Cape Cod Sterninae. Bull. Northeastern Bird-Banding Assoc. 5:123-140.

Austin, O.L., Jr. 1932a. Further contributions to the knowledge of the Cape Cod Sterninae. Bird-Banding 3:123-139.

Austin, O.L., Jr. 1932b. Cobb Island. Bird-Banding 3:12-25.

Austin, O.L., Jr. 1933. The status of the Cape Cod terns in 1933. Bird-Banding 4:190-198.

Bailey, H.H. 1913. The birds of Virginia. J.P. Bell Co., Inc., Lynchburg, Va. 362 pp.

Bailey, S.W. 1915. The Plum Island night herons. Auk 32:424-441.

Bailey, W.L. 1899. Three Cobb's Island pictures. Bird-Lore 1:81-82.

Bailey, W. 1955. Birds of Massachusetts: How and where to find them. The College Press, South Lancaster, Mass.

Baird, S.F., T.M. Brewer, and R. Ridgway. 1884. The water birds of North America. II: 144-166. Mem. Mus. Comp. Zool. Harvard College No. 13.

Bales, B.R. 1919. Twenty-four hours in a black skimmer colony. Wilson Bull. 31:83-87.

Bales, B.R. 1920. Roseate tern (Sterna dougallii) breeding in Virginia. Auk 37:579.

Barnes, I.R. 1947. A field trip to Cobb's Island. Wood Thrush 3:3.

Barnett, M.L. 1958. A trip to Turk's Head. Bull. Mass. Audubon Soc. 42:59-64.

Bent, A.C. 1907. Report of A.C. Bent, on condition of bird colonies on Cobb's Island, Virginia, in 1907. Bird-Lore 9:16-17.

Bent, A.C. 1963. Life histories of North American gulls and terns. Dover Publ. Inc., New York. 337 pp.

Bent, A.C. 1963. Life history of North American marsh birds. Dover Publ. Inc., New York. 385 pp.

Bock, W., and J. Terborgh. 1957. Breeding of the glossy ibis in Virginia. Bird-Banding 28:98.

Bongiorno, F., and J. Swinebroad. 1969. Increase in herring gull colony in Cape May, New Jersey. Wilson Bull. 81:99-100.

Bowdish, B.S. 1909. Ornithological miscellany from Audubon wardens. Auk 26: 116-128.

Boyajian, N.R. 1967. Hudson - St. Lawrence region. Audubon Field Notes 21: 550-552.

Boyajian, N.R. 1968. Hudson - St. Lawrence region. Audubon Field Notes 22: 590-593.

Boyajian, N.R. 1969. Hudson - St. Lawrence region. Audubon Field Notes 23: 643-646.

Boyajian, N.R. 1972. Hudson - St. Lawrence region. Am. Birds 26:838-841.

Braislin, W.C. 1904-1907. A list of birds of Long Island, New York. Proc. of Linnaean Soc. N. Y. (abst.) No. 17-19.

Braislin, W.C. 1905. Notes concerning certain birds of Long Island, New York. Auk 22:167-170.

Bridge, D. 1959. Nesting summary for 1959. Maryland Birdlife 15:89-96.

Bridge, D., and J.S. Weske. 1961. Breeding birds on Maryland's coastal islands. Maryland Birdlife 17:3-6.

Brownson, W.H. 1906. Birds in and around Portland in 1906. J. Maine Ornithol. Soc. 8:84-87.

Brownson, W.H. 1907. Visit to a colony of laughing gulls. J. Maine Ornithol. Soc. 9:27.

Brownson, W.H. 1908. Portland bird notes. J. Maine Ornithol. Soc. 10:119-120.

Bruen, F. 1905. A trip to Gardiner's Island. Wilson Bull. 17:14-18.

Buckalew, H. 1933. American egret nesting in Delaware. Auk 50:206.

Buckalew, J.H. 1948. Surveys of Virginia's eastern shore. Wood Thrush 48: 22, 42-45.

Buckalew, J.H. 1949. The eastern glossy ibis in Delaware. Auk 66:196-197.

Buckalew, J.H. 1950. Records from the Delaware-Maryland-Virginia peninsula. Auk 67:250-252.

Buckley, P.A., and F.G. Buckley. 1975. The significance of dredge spoil islands to colonially nesting waterbirds in certain national parks. Pages 35-45 in Parnell, J.F., and R.F. Soots, eds. Proc. Conf. Manage. Dredge Islands in North Carolina Estuaries. Univ.of North Carolina Sea Grant Publ.UNC-SG-75-01.

Buckley, P.A., and F.G. Buckley. 1977. Human encroachment on barrier beaches of the northeastern U.S. and its impact on coastal birds. Pages 68-76 in Symp. on Coastal Recreation Resources in an Urbanizing nEvironment. Massachusetts Coop. Ext. Serv. Monogr. Univ. of Massachusetts, Amherst.

Buckley, P.A., and F.G. Buckley. in prep. Colonially nesting waterbirds of Long Island, New York: Parts I, II, III.

Buckley, P.A., and T.H. Davis. 1973. Hudson - St. Lawrence region. Am. Birds 27:845-852.

Buckley, P.A., and F.G. Buckley, and M. Gochfeld. 1975. Gull-billed tern: New York State's newest breeding species. Kingbird 25:178-183.

Buckley, P.A., R.O. Paxton, and D.A. Cutler. 1975. The Hudson-Delaware region: nesting season, 1975. Am. Birds 29:947-954.

Buckley, P.A., R.O. Paxton, and D. Cutler. 1976. Hudson - Delaware region. Am. Birds 30:932-938.

Bull, J. 1959. The changing season--a summary of the nesting season. Audubon Field Notes 13:408-413.

Bull, J. 1964. Birds of the New York City area. Harper and Rowe, N.Y. 540 pp.

Bull, J. 1970. Supplement to birds of the New York City area. Proc. Linnaean Soc. N. Y. 71:1-54.

Bull, J. 1974. Birds of New York State. Doubleday/Natur. Hist. Press, Garden City, N.Y. 655 pp.

Bull, J.L. 1975. Ornithological year 1974 for the New York City region. Proc. Linnaean Soc. N. Y.

Burger, J. 1977. Nesting behavior of herring gulls: Invasion into Spartina salt marsh areas of New Jersey. Condor 79:162-169.

Burger, J., and C. Hahn. 1977. Crow predation on black-crowned night heron eggs. Wilson Bull. 89:350-351.

Burger, J., and F. Lesser. 1977. Determinants of colony site selection in common terns (Sterna hirundo). Pages 118-127 in W. Southern ed. Proc. 1977 Conf. Colonial Waterbird Group. DeKalb, Illinois.

Burger, J., and J. Shisler. 1978. The effects of ditching a salt marsh on colony and nest site selection in herring gulls, Larus argentatus. Am. Midl. Natur. in press.

Burnett, F.L. 1942. Double-crested cormorant. Bull. New England Birdlife. 6:45.

Burnett, F.L. 1943. Double-crested cormorant. Bull. New England Birdlife. 7:57.

Burnett, F.L. 1944. Double-crested cormorant. Bull. New England Birdlife. 8:68.

Burnett, F.L. 1945. Double-crested cormorant nest off Manchester, Massachusetts. Bull. Mass. Audubon Soc. 29:205-207.

Burroughs,R.C. 1966.A study of the breeding biology of least terns on Nantucket Island. M.S. Thesis. University of Massachusetts, Amherst.

Bystrak, D. 1969. Nest record card summary for 1968. Maryland Birdlife 25: 43-49.

Bystrak, D. 1970. Maryland nest summary for 1969. Maryland Birdlife 26:30-34.

Bystrak, D. 1971. Twenty second annual nest card summary, 1970. Maryland Birdlife 27:173-181.

Bystrak, D. 1973. Twenty third annual nest card summary, 1971. Maryland Birdlife 29:14-19.

Cahn, A.R. 1916. The terns of Weepecket Island, Massachusetts. Wilson Bull. 28:11-18.

Carleton, G. 1961. Hudson - St. Lawrence region. Audubon Field Notes 15: 453-455.

Carleton, G. 1962. Hudson - St. Lawrence region. Audubon Field Notes 16: 461-463.

Carleton, G. 1963. Hudson - St. Lawrence region. Audubon Field Notes 17: 449-452.

Carleton, G. 1964. Hudson - St. Lawrence region. Audubon Field Notes 18: 499-500.

Chamberlain, S. 1953. Cape Ann through the seasons. Hastings House, New York.

Chapman, F.C. 1903. The bird life of Cobb's Island. Bird-Lore 5:109-114.

Choate, E.A. (ed.). 1959. Region No. 5. New Jersey Nature News 14:19.

Choate, E.A. (ed.). 1966. Region No. 5. New Jersey Nature News 21:187-189.

Choate, E.A. (ed.). 1968. Region No. 5. New Jersey Nature News 23:154-155.

Choate, E.A. (ed.). 1969a. Region No. 5. New Jersey Nature News 24:134-136.

Choate, E.A. (ed.). 1969b. Region No. 5. New Jersey Nature News 24:178-181.

Choate, E.A. (ed.). 1970a. Region No. 5. New Jersey Nature News 25:126-128.

Choate, E.A. (ed.). 1970b. Region No. 5. New Jersey Nature News 25:165-166.

Choate, E.A. (ed.). 1971. Region No. 5. New Jersey Nature News 26:123-126.

Church, E.B., C.E. Goodwin, and M.S. Shaub. 1951. The Elizabeth Islands revisited July 17-20, 1951. Bull. Mass. Audubon Soc. 37:17-22.

Church, E.B., and M.S. Shaub. 1953. Muskeget Island - July 1952. Bull. Mass. Audubon Soc. 37:47-50.

Church, E.B., B.M. Shaub, and M.S. Shaub. 1954. Muskeget Island - its gulls and terns. Bull. Mass. Audubon Soc. 38:193-199.

Church, E.B., B.M. Shaub, and M.S. Shaub. 1955. The Quivett Neck heronry. Bull. Mass. Audubon Soc. 39:267-271.

Cleaves, H.H. 1911. Report of Howard H. Cleaves on Virginia coast colonies. Bird-Lore 13:355-358.

Cleaves, H.H. 1967. Gulls and bridges. Kingbird 17:14-15.

Clement, R.C., and R.E. Woodruff. 1962. A history of nesting gulls and terns of Rhode Island 1889-1961. Narragansett Natur. 5:68-73, 103-111, 125-128.

Cooper, D.M., H. Hays, and C. Pessino.1970. Breeding of the common and roseate terns on Great Gull Island. Proc. Linnaean Soc. N.Y. 71:83-104.

Cottrell, G.W., Jr. 1949. The southern heron flight of 1948. Bull. Mass. Audubon Soc. 33:155-160.

Coues, E.B. 1879. Occurrence of the Caspian tern (Sterna caspia) upon the coast of Virginia. Bull. Nuttall Ornithol. Club 4:243-244.

Court, E.J. 1936. Four rare nesting records for Maryland. Auk 53:95-96.

Cowger, J. 1975. The Leach's storm petrel in Maine. Maine critical areas program. Unpubl. rep.

Cowger, J. 1975. Alcids nesting on the Maine coast. Maine critical areas program. Unpubl. Rep.

Crawford, E. 1964. A review of the fish and wildlife resources in Cape May County. New Jersey Nature News 19:98-103.

Crispin, W.B. 1905. Great blue heron collecting in Salem Co., N.J. Oologist 22:101.

Crosbie, L.M. 1944. Field notes - Exeter. Audubon Soc. New Hampshire 16:27-28.

Crowell, E.M. 1932. Two common tern returns and a roseate tern recovery. Bird-Banding 3:33-34.

Crowell, E.M., and S.Crowell. 1946. The displacement of terns by herring gulls at the Weepecket Islands. Bird-Banding 17:1-10.

Cruickshank, A.D. 1936. The ornithological year 1935 for the New York City region. Proc. Linnaean Soc. N. Y. (abst.) 48:66-95.

Cruickshank, A.D. 1942. Birds around New York City. American Mus. Natur. Hist., N. Y. 489 pp.

Darden, C.W. 1947. Nest of yellow-crowned night heron. Raven 18:25-26.

Darlington, E.J. 1908. Great blue heron. Oologist 25:54.

Dater, C. 1969. Status survey of rails and wading birds in Connecticut: June to September 1968. Connecticut Audubon Council, Harwinton.

Davis, D.C. 1960. The spread of the cattle egret in the United States. Auk 77:421-424.

Davis, M. 1945. Black-crowned night heron in Washington, D.C. Auk 62:458.

Davis, T.H. 1973. "Jones strip" bird colonies: Summary-1973. Linnaean Newsletter 27:1.

Davis, T.H. 1976. The birds of Jamaica Bay Wildlife Refuge. Kingbird 26:11-22.

Davis, T.H., and F. Heath. 1965. Region 10 - marine (for June-August 1965). Kingbird 15:253-256.

Davis, T.H., and F. Heath. 1966. Region 10 - marine (for June-August 1966). Kingbird 16:242-243.

Davis, T.H., and F. Heath. 1967. Region 10 - marine (for June-August 1967). Kingbird 17:243-245.

Davis, T.H., and L. Morgan. 1968. Region 10 - marine (for June-August 1968). Kingbird 18:227-230.

Davis, T.H., and L. Morgan. 1969. Region 10 - marine (for June-August 1969). Kingbird 19:239-242.

Davis, T.H., and L. Morgan. 1970. Region 10 - marine (for June-July 1970). Kingbird 20:204-207.

Davis, T.H., and L. Morgan. 1971. Region 10 - marine (for June-July 1971). Kingbird 21:244-246.

Davis, T.H., and L. Morgan. 1972. Region 10 - marine (for June-July 1972). Kingbird 22:190-193.

Dexter, R.W. 1976. Marine banding and nesting studies at Cape Ann, Massachusetts. North Amer. Bird Bander 1:165-166.

Donaldson, G. 1969. Roseate tern in unusual plumage. Bird-Banding 40:255.

Dow, R.L. 1953. The herring gull-cormorant control program. State of Maine. Gen. Bull. No. 1. Dept. Sea and Shore Fisheries. 26 pp.

Downing, R.L. 1973. A preliminary nesting survey of least terns and black skimmers in the east. Am. Birds 27:946-949.

Drury,W.H. 1963a. Results of a study of herring gull populations and movements in southeastern New England. Pages 207-217 in Collogue: le Probleme des Oiseaux sur les Aerodromes (Nice, 1963). Paris, Inst. Natur. Rech. Agron.

Drury, W.H. 1963b. Herring gull populations and movements in southeastern New England. Mass. Audubon Soc. Unpubl. Rep. Lincoln. 68 pp.

Drury, W.H. 1965. Gulls vs. terns; clash of coastal nesters. Mass. Audubon-Summer.

Drury, W.H. 1973. Population changes in New England seabirds. Bird-Banding 44:267-313.

Drury, W.H. 1974. Population changes in New England seabirds (cont'd.). Bird-Banding 45:1-15.

Drury, W.H., and I.C.T. Nisbet. 1973. The importance of movements in the biology of herring gulls in New England. Pages 173-212 in Population Ecology of Migratory Birds: A symposium. Wildl. Res. Rep. 2:U.S. Dept of Interior.

Drury, W.H., and J.A. Kadlec. 1974. The current status of the herring gull population in the northeastern United States. Bird-Banding 45:297-306.

Duffy, D. 1970. Observations on Great Gull Island - summer 1969. Kingbird 20:169-170.

Duffy, D. 1977. Population of terns and skimmers on Long Island Sound and eastern Long Island, 1972-1975. Proc. Linnaean Soc. N.Y. 73:1-48.

Duffy, D.C., and A. Poole. 1973. The status of the least tern on eastern Long Island in 1972. Linnaean News-letter 27:1-2.

Dusi, J. 1967. Migration in the little blue heron. Wilson Bull. 79:223-235.

Dutcher, W. 1901. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 18:76-103, 183-190.

Dutcher, W. 1902. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 19:34-63.

Dutcher, W. 1903. Report of the A.O.U. committee on the protection of North American birds. Auk 20:101-159.

Dutcher, W., and W.B. Bailey. 1903. A contribution to the life history of the herring gull (Larus argentatus) in the United States. Auk 20:417-431.

Dutcher, W. 1904. Report of the A.O.U. committee on the protection of North American birds for the year 1903. Auk 21(suppl.):97-208.

Dutcher, W. 1905a. State reports: Maine. Bird-Lore 7:90-94.

Dutcher, W. 1905b. Maine (report to Natl.Assoc.Aud.Soc.). Bird-Lore 7:322-327.

Eaton, R.J. 1931. Great black-backed gull (Larus marinus) breeding in Essex County, Mass. Auk 48:588-589.

Eike, J.W. 1967. The 1967 Wachapreague field trip. Raven 38:66-67.

Eliot, S.A., Jr. 1933. Notes from the coast of Connecticut. Auk 50:444-445.

Elkins, F.T. 1946. The Audubon check lists for 1946. Bull. Mass. Audubon Soc. 31:99-111.

Elliott, J.J. 1953. Region 8 - Long Island. (for nesting season, 1953). Kingbird 3:77-78.

Elliott, J.J. 1954. Region 10 - Long Island. (for breeding season, 1954). Kingbird 4:85-86.

Elliott, J.J. 1955. Region 10 - marine. (for breeding season, 1955). Kingbird 5:91-92.

Elliott, J.J. 1956. Region 10 - marine. (for breeding season, 1956). Kingbird 6:102-104.

Elliott, J.J. 1957. Jones Beach - barrier to the Atlantic. Kingbird 7:102-104.

Elliott, J.J. 1958. Region 10 - marine. (for June-August 1958). Kingbird 8:94-96.

Elliott, J.J. 1959. Region 10 - marine. (for June-August 1959). Kingbird 9:138-140.

Elliott, J.J. 1960. Region 10 - marine. (for June-August 1960). Kingbird 10:118-120.

Elliott, J.J. 1961. Region 10 - marine. (for June-August 1961). Kingbird 11:175-177.

Elliott, J.J. 1962. Region 10 - marine. (for June-August 1962). Kingbird 12:164-165.

Elliott, J.J. 1963a. Region 10 - marine. (for August-November 1962). Kingbird 13:52-54.

Elliott,J.J.1963b. Region 10 - marine.(for April-May 1963).Kingbird 13:183-184.

Elliott, J., and C. Nichols. 1949. First New York "white heron". Audubon Field Notes 3:229.

Ellis, K.R., and M. Gross. 1974a. Census of Sarcen's (sic) Island in Sengekontacket Pond. Report to Trustees of Reservations. 3 pp.

Ellis, K.R., and M. Gross. 1974b. Census of colonial birds. Report to Trustees of Reservations.

Emery, R.P. 1955. Field Notes. Bull. Mass. Audubon Soc. 39:343.

Emery, R.P. 1956. Field Notes. Bull. Mass. Audubon Soc. 40:391-392.

Emery, R.P. 1960. Field Notes. Bull. Mass. Audubon Soc. 45:34-35.

Erwin, R.M. 1971. Breeding success of two sympatric gulls, the herring gull and the great black-backed gull. Wilson Bull. 83:152-158.

Erwin, R.M. 1975. Comparative foraging and breeding strategies among three seabird species, the royal tern, Sterna maxima, the common tern, S. hirunda, and the black skimmer, Rynchops niger. Ph.D. Thesis. University of Maryland, College Park. 111 pp.

Erwin, R.M. 1977. Black skimmer breeding behavior and ecology. Auk 94:709-717.

Fables,D. 1955. Annotated list of New Jersey birds. Urner Ornith. Club. Newark Museum, Newark, New Jersey.

Fables, D. 1959. First supplement to the annotated list of New Jersey birds. Urner Ornithol. Club. Newark Museum, Newark, New Jersey.

Ferren, R. in prep. The birds of Rhode Island. Manuscript.

Finch, D. 1970. Northeastern maritime region. Am. Birds 24:659-670.

Finch, D. 1971. Northeastern maritime region. Am. Birds 25:830-836.

Finch, D. 1972. Northeastern maritime region. Am. Birds 26:832-837.

Finch, D. 1975. Northeastern maritime region. Am. Birds 29:745-750.

Finch, D. 1976. Northeastern maritime region. Am. Birds 30:926-930.

Fisk, E.J. 1972. A search for nesting least terns. Cornell Lab. Ornithol. Newsletter 66:3-4.

Fisk, E.J. 1973. The 1973 tern season: Addenda. Cape Naturalist 2:3.

Fisk, E.J. 1974a. The 1973 tern season on Cape Cod, Massachusetts. Am. Birds 28:871-873.

Fisk, E.J. 1974b. Atlantic coast least tern survey 1974. Natl. Audubon Soc. Rep. 29 pp.

Fisk, E.J. 1975. Atlantic coast least tern survey 1975. Natl. Audubon Soc. Rep. 14 pp.

Fletcher, A.J. 1959. Maryland nest summary, 1958. Maryland Birdlife 15:5-12.

Floyd, C.B. 1925. Six days in a Massachusetts tern colony. Bull. Northeastern Bird-Banding Assoc. 1:58-60.

Floyd, C.B. 1926a. The fourth banding expedition to the Sandy Neck black-crowned night heron colony. Northeastern Bird-Banding Assoc. 2:3-6.

Floyd, C.B. 1926b. Additional experiences in banding terns at Tern Island, Chatham, Massachusetts. Bull. Northeastern Bird-Banding Assoc. 2:68-72.

Floyd, C.B. 1928. Notes on banding terns at Chatham, Massachusetts for 1928. Bull. Northeastern Bird-Banding Assoc. 4:125-132.

Floyd, C.B. 1929. Notes on banding terns at Chatham, Massachusetts for 1929. Bull. Northeastern Bird-Banding Assoc. 5:144-148.

Floyd, C.B. 1930. Further banding notes from Tern Island, Massachusetts. Bird-Banding 1:181-184.

Floyd, C.B. 1932a. Strange disappearance of nesting Penikese Island terns. Bird-Banding 3:173-174.

Floyd, C.B. 1932b. Report of tern banding on Cape Cod during 1931. Bird-Banding 3:63-65.

Floyd, C.B. 1938. Terns and tractors. Bull. Mass. Audubon Soc. 22:2-4.

Forbush, E.H. 1905. The decrease of certain birds in New England.Auk 22:25-31.

Forbush, E.H. 1908. Massachusetts notes. Bird-Lore 10:227-228.

Forbush, E.H. 1917. Report of Edward Howe Forbush, field agent for New England (for the year 1917). Bird-Lore 19:407-410.

Forbush, E.H. 1921. Report of Edward Howe Forbush, field agent for New England (for the year 1921). Bird-Lore 23:345-349.

Forbush, E.H. 1922. Report of Edward Howe Forbush, field agent for New England (for the year 1922). Bird-Lore 24:403-405.

Forbush, E.H. 1925. Birds of Massachusetts and other New England states. Vol. I. Mass. Dept. Agric., Boston.

Forbush, E.H. 1929. Birds of Massachusetts and other New England states. Vol. II. Mass. Dept. Agric., Boston.

Forster, R. 1976. Field Notes - New nesting records. Mass. Audubon News-letter 16:16.

Frohling, R.C. 1965. American oystercatcher and black skimmer nesting on salt marsh. Wilson Bull. 77:193-194.

Frohling,R.C. 1966. A social flight of laughing gulls. Bird-Banding 37:206-207.

Fry, V. 1948. Another common tern nest with seven eggs. Auk 65:604-605.

Galli, J. 1975. Least tern management program. Rec. New Jersey Birds 1:10.

Gemperle, M., and F. Preston. 1955. Variation of shape in the eggs of the common tern in their clutch sequence. Auk 72:184-198.

Gill, G. 1953. An unusual nest of the common tern (Sterna hirundo). Auk 70:89.

Gillespie, J.A. 1931. Rynchops nigra, the black skimmer: some returns and recoveries. Bird-Banding 2:52-58.

Gochfeld, M. 1966. Mortality among the common terns of the Short Beach, Long Island colony. Linnaean News-letter 19:3.

Gochfeld, M. 1973a. Least tern colonies on Jones Beach and Western Fire Island in 1972. Linnaean News-letter 27:2.

Gochfeld, M. 1973b. Recent status of the least tern (S. albifrons) on the south shore of western Long Island. Engelhartia 6:1-9.

Gochfeld, M. 1976. Sewage outfall threatens Cedar Beach tern colony. Linnaean News-letter 30.

Gochfeld, M., and D. Ford. 1974. Reproductive success in common tern colonies near Jones Beach, Long Island, New York, in 1972: A hurricane year. Proc. Linnaean Soc. N. Y. 72:63-76.

Grey, J.H., Jr. 1938. Notes on birds of Princess Anne County, Virginia, July-August 1938. Raven 9:101-102.

Grey, J.H., Jr. 1939. Notes on some of the rarer coastal birds of Virginia and North Carolina. Raven 12:1-13.

Grey, J.H., Jr. 1950. Birds of the Cape Henry Region. Raven 20:66-111.

Griffin, D.R. 1943. Homing experiments with herring gulls and common terns. Bird-banding 14:7-33.

Griffin, J. 1975. Unpublished report for Gateway National Recreation Area, Sandy Hook.

Griscom, L. 1923. Birds of the New York City Region. American Mus.Natur.Hist., N.Y. 400 pp.

Griscom, L. 1927. The ornithological year 1926 in the New York City region. Proc. Linnaean Soc. N.Y. (abst.) No. 40.

Griscom, L. 1937. Black skimmers in New England. Auk 54:206-207.

Griscom, L. 1938. Decrease and increase of Massachusetts birds. Bull. Mass. Audubon Soc. 22:10-14.

Griscom, L. 1949. The birds of Concord: a study in population trends. Harvard Univ. Press, Cambridge.

Griscom, L., and W. Eaton. 1928. The ornithological year 1927 in the New York City region. Proc. Linnaean Soc. N. Y. (abst.) No. 40.

Griscom, L., and E.V. Folger. 1948. The birds of Nantucket, Massachusetts. Harvard Press, Cambridge. 156 pp.

Griscom, L., and D.E. Snyder.1955. The birds of Massachusetts. Peabody Museum, Salem. 295 pp.

Griscom, L., and G. Emerson. 1959. Birds of Martha's Vineyard. Martha's Vineyard, Massachusetts, privately printed.

Gross, A.O. 1923.The black-crowned night heron (Nycticorax nycticorax naevius) of Sandy Neck. Auk 40:1-30.

Gross, A.O. MS. unpubl. journals 1938-1952 at Bowdoin College, Brunswick, Maine.

Gross, A.O. 1943. The double-crested cormorant on the coast of Maine. Bull. Mass. Audubon Soc. 27:227-231.

Gross, A.O. 1944a-1952a. The herring gull-cormorant control project. Annual reports (unpubl.): U.S. Fish and Wildl. Serv.

Gross, A.O.1944b. The present status of the american eider on the Maine coast. Wilson Bull. 56:15-26.

Gross, A.O. 1944c. The present status of the double-crested cormorant on the coast of Maine. Auk 61:513-537.

Gross, A.O. 1945a. The present status of the great black-backed gull on the coast of Maine. Auk 62:241-256.

Gross, A.O. 1945b. The laughing gull on the coast of Maine. Bird-Banding 16:55-58.

Gross, A.O. 1948a. Gulls of Muskeget Island. Bull. Mass. Audubon Soc. 32:43-46.

Gross, A.O. 1948b. Egrets in Maine. Bull. Maine Audubon Soc. 5:66-68.

Gross, A.O. 1951a. The herring gull-cormorant control project. Proc. 10th Int. Ornithol. Congr. 535-536.

Gross, A.O. 1951b. Laughing gulls nesting at Stratton Island. Bull. Maine Audubon Soc. 7:52-54.

Gross, A.O. 1951c. Eider duck extends its nesting range. Bull. Maine Audubon Soc. 7:56.

Gross, A.O. 1952b. Eider duck. Bull. Maine Audubon Soc. 8:62.

Gross, A.O. 1952c. Western Egg Rock bird sanctuary. Bull. Maine Audubon Soc. 8:2-4.

Gross, A.O.1955. Changes in certain seabirds populations along the New England coast of North America. Act. XI Congr. Int. Ornithol. 446-449.

Gross, A.O. 1961. Herring gull control. Bull. Mass. Audubon Soc. 45:183-185.

Gusey, W. 1976. The fish and wildlife resources of the Middle Atlantic Bight. Shell Oil Co., Houston. 582 pp.

Hacker, C.W. 1970. V.S.O. field trip. Raven 42:51-52.

Hagar, J.A. 1937. Least tern studies - 1935 and 1936. Bull. Mass. Audubon Soc. 21:5-8.

Hagar, J.A. 1941a. Double-crested comorant nesting in Massachusetts. Auk 58:567-568.

Hagar, J.A. 1941b. Little blue heron nesting in Massachusetts. Auk 58:568-569.

Hagar, J.A. 1946. Black skimmer breeding in Massachusetts. Auk 63:594-595.

Hailman, J.P.1963. Herring gull extends breeding range south to North Carolina. Auk 80:375-376.

Hampe, I.E., and H. Kolb. 1947. A preliminary list of the birds of Maryland and the District of Columbia. Natur. Hist. Soc. Maryland, Baltimore. 80 pp.

Harper, F. 1912. Observations in a laughing gull colony. Bird-Lore 14:204-209.

Harris, M.P. 1964. Aspects of the breeding biology of the gulls Larus argentatus, L. fuscus and L. marinus. Ibis 106:432-456.

Harris, M.P. 1965. Food of some Larus gulls. Ibis 107:43-53.

Hatch, J.J. 1970. Predators and piracy by gulls at a ternery in Maine. Auk 87:244-254.

Hathaway, H.S. 1913. Notes on the occurrence and nesting of certain birds in Rhode Island. Auk 30:545.

Hawksley, O. 1957. Ecology of a breeding population of Arctic terns. Bird-Banding 28:57-92.

Hawksley, O., and J. Hawksley. 1949. Laughing gulls nesting off the coast of Maine. Bull. Maine Audubon Soc. 5:77.

Hays, H. 1965. Division and multiplication of the glossy ibis. Linnaean News-letter 19:1-3.

Hays, H. 1966a. Activity in some of the heron rookeries in the New York area. Linnaean News-letter 19:1-2.

Hays, H. 1966b. Night heron scatology. Linnaean News-letter 19:1-2.

Hays, H.1969. Second nesting record of the Louisiana heron for New York State. Kingbird 19:93-94.

Hays, H. 1970. Great Gull Island report on nesting species, 1967-1968. Proc. Linnaean Soc. N.Y. 71:105-118.

Hays, H., and R.W. Risebrough.1972. Pollutant concentrations in abnormal young terns from Long Island Sound. Auk 89:19-35.

Heilbrun, L.H. 1970. Great Gull Island, its history and biology. Proc.Linnaean Soc. N.Y. 71:55-79.

Hetzel, C., and N. Niosi. 1960 Breeding bird census of Brigantine National Wildlife Refuge. Unpubl. Report. pp. 5-7.

Hiatt, B.C. 1927. A study of great horned owls in the Delaware City heronry. Cassinia 27:1-7.

Hiatt, B.C., and C.B. Doak. 1927. Yellow-crowned night heron nesting in New Jersey. Auk 44:560.

Hickey, J.J. 1935. The ornithological year 1934 for the New York City region. Proc. Linnaean Soc. N.Y. (abst.) 47:100-131.

Hickey, J.J., and L. Wilcox. 1936. On the nesting of the black skimmer in New York State. Proc. Linnaean Soc. N.Y. 48:98-99.

Hill, N.P. 1965. The birds of Cape Cod, Massachusetts. William Morrow, New York. 364 pp.

Hilliard, P. 1926. Weekly itinerary report. Game Warden, Pleasantville, New Jersey.

Howard, D.V. 1968. Do New England terns have a future? Bull. Mass. Audubon Soc. 53:2-9.

Howe, R.H., Jr. and E.Sturtevant. 1899. The birds of Rhode Island. (no publisher).

Howe, R.H., Jr., and G.M. Allen. 1901. The birds of Massachusetts. Cambridge, Massachusetts. 154 pp.

Howell, A.B.1911. A comparative study of Cobb Island, Virginia. Auk 28:449-453.

Hunt, G.L. 1973. Influence of food distribution and human disturbance on the reproductive success of herring gulls. Ecology 53:1051-1061.

Hunter, M.L.1975. Least tern breeding range extension in Maine.Auk 92:143-145.

Huntington, C. 1956. Maine bird notes, summer 1956. Bull.Maine Audubon Soc.12.

Imsick, R.C., and R. Imsick.1944. Reviewing a year's bird log at Nahant. Bull. Mass. Audubon Soc. 28:85-87.

Jackson, C.F. 1947. Notes on the bird population of the Isles of Shoals. Audubon Soc. New Hampshire Bull. 18:49-64, 93-99.

Jackson, C.F., and P.F. Allan. 1931. Experiment in the recolonization of the common tern (Sterna hirundo). Auk 48:17-21.

Jackson, C.F., and P.F. Allan. 1932. Additional notes on the breeding in Maine of the great black-backed gull. Auk 49:349-350.

Jones, C.M. Field notes on Connecticut birds. Univ. of Iowa Studies in Natural History 13:5-40 (year unknown).

Jones, L. 1903. The terns of Weepecket Island, Massachusetts. Wilson Bull. 15:94-104.

Jones, L. 1904. July fourth censo-horizons. Wilson Bull. 17:76-80.

Jones, L. 1906. A contribution to the life history of the common (Sterna hirundo) and roseate (S. dougallii) terns. Wilson Bull. 18:35-47.

Kadlec, J.A. 1976. A re-evaluation of mortality rates in adult herring gulls. Bird-Banding 47:8-12.

Kadlec, J.A., and W.H. Drury. 1968a. Structure of the New England herring gull population. Ecology 49:644-676.

Kadlec, J.A., and W.H. Drury. 1968b. Aerial estimation of the size of gull breeding colonies. J. Wildl. Manage. 32:287-293.

Kane, R. 1974. Birds of the Hackensack Meadows, 1970-1973. New Jersey Nature News 29:83-88.

Kane, R., and R. Farrar.1976. 1976 coastal colonial bird survey of New Jersey. New Jersey Audubon Occas. Paper 125:8-14.

Keith, A., and E.L. Shalif. 1968. A supplemental list of Martha's Vineyard birds. Mass. Audubon Society.

Keniston, A. 1927. Gull-banding at Muskeget Island. Bull. Northeastern Bird-Banding Assoc. 3:105-107.

Keniston, A. 1928.(Letter to editor) Northeastern Bird-Banding Assoc.4:155-157.

Kirkwood, F.C. 1895. A list of the birds of Maryland. Trans. Maryland Acad. Sci. 2:241-382.

Knight, O.W. 1908. The birds of Maine. C.H. Glass & Co., Bangor. 693 pp.

Kohler, L.S. 1910. Green heron in New Jersey. Wilson Bull. 22:202.

Kramer, E. 1948. Oystercatcher breeding in New Jersey. Auk 65:460.

Kuerzi, J.F. 1929a. Notes on the birds of Cobbs Island, Virginia. Auk 46:14-20.

Kuerzi, J.F. 1929b. The ornithological year in the New York City region. Proc. of Linnaean Soc. N.Y. (abst.) No. 41.

Kuerzi, J., R. Kuerzi, and P. Kesski. 1925. Black skimmer and golden plover in Bronx County. Auk 42:125-126.

Kury, C.R. 1969. Pesticide residues in a marine population of double-crested cormorants. J. Wildl. Manage. 33:91-95.

Latham, R. 1915. Terns at Orient, L.I. after twenty-five years absence and notes on the piping plover. Bird-Lore 17:207.

Lawson, R. 1926. Herring gulls nesting in Salem Bay. Bull. Essex Co. Ornithol. Club, 1926:52.

Lazell, J.D., Jr., and I.C.T. Nisbet.1972. Snake eating terns. Man and Nature, June:27-29.

Leck, C. 1975. Birds of New Jersey: their habits and habitats. Rutgers Univ. Press, New Brunswick. 190 pp.

MacKay, G.H. 1892. Habits of the american herring gull (Larus argentatus smithsonianus) in New England. Auk 9:221-229.

MacKay, G.H. 1895. The terns of Muskeget I., Massachusetts. Auk 12:32-48, 178.

MacKay, G.H. 1896. The terns of Muskeget I., Massachusetts. Pt.2.Auk 13:47-55.

MacKay, G.H. 1897a. Report on Muskeget Island to the Committee on Bird Protection. Auk 14:21-22.

Mackay, G.H. 1897b. The terns of Penikese I., Massachusetts. Auk 14:278-284.

MacKay, G.H. 1897c. The terns of Muskeget I., Massachusetts. Part III. Auk 14:383-390.

MacKay, G.H. 1898. The terns of Muskeget I., Massachusetts. Part IV. Auk 15:168-172.

MacKay, G.H. 1899. The terns of Muskeget and Penikese Islands, Massachusetts. Auk 16:259-266.

MacKay, G.H. 1925. Breeding of the herring gull in Massachusetts. Auk 42:517-518.

MacKenzie, L. 1961. The birds of Guilford, Connecticut. Yale Peabody Museum of Natur. Hist. New Haven. 110 pp.

Marks, R.J., Jr. 1975. Coskata-coatue Wildlife Refuge--Report of activities and wildlife observations. Trustees of Reservations report, Milton, Massachusetts.

Mason, C.R. 1944. Summer birds of Nantucket. Bull. Mass. Audubon Soc. 28:217-220.

Mason, C.R. 1953. Tern Island. Bull. Mass. Audubon Soc. 37:32.

McDonald, N.J., S.Daly, and J.A. Gillespie. 1940. Snowy egret nesting in New Jersey. Auk 57:106.

McGuinness, H.D. 1975. Region 10 - marine (for June-July 1974). Kingbird 25:60-62.

McIlwaine, W.B., Jr. 1939. A visit to Cobb's Island. Raven 10:1-4.

McIlwaine, W.B., Jr. 1941. Headed for Cobb's Island. Raven 12:51-52.

McKeever, C. 1940. The breeding of the herring gull on Long Island in 1939. Proc. Linnaean Soc. N.Y. 50-51:32-33.

McKeever, C.1946. Data on some of the seabird colonies of eastern Long Island. Proc. Linnaean Soc. N.Y. 54-57:44-47.

McMullen, T.E. 1938. Southern New Jersey nesting birds. Oologist 56:119-120.

McMullen, T.E. 1947. Nesting of herring gull in New Jersey. Auk 64:321.

Meanley, C.B. 1975. Birds and marshes of the Chesapeake Bay country. Tidewater Publ. Cambridge, Maryland. 157 pp.

Means, W.G., and R.J. Eaton. 1941. Great black-backed gulls breeding in Essex Co., Massachusetts. Auk 13:4-6.

Mendall, H.L. 1934. The relationship of certain seabirds to the fishing industry of the state of Maine. Report to the Commissioner of Sea and Shore Fish.

Mendall, H.L. 1936. The home-life and economic status of the double-crested cormorant, Phalacrocorax auritus auritus (Lesson). Univ. of Maine Studies, Sec. Ser. 38: 150 pp.

Meritt, J.K. 1972. Field Notes - 1971. Cassinia 53:55-58.

Meyerriecks, A.J. 1957. Louisiana heron breeds in New York City. Wilson Bull. 69:184.

Miller, G.E. 1958. Nesting herring gulls on Maryland coast. Maryland Birdlife 14:92-93.

Miller, G.E. 1959. First nesting of the cattle egret in Maryland. Maryland Birdlife 15:22.

Miller, J.C. 1966a. Herring gulls nesting at Stone Harbor, New Jersey. Cassinia 49:31.

Miller, J.C. 1966b. The great black-backed gull nesting in New Jersey and additional notes on nesting herring gulls. Cassinia 49:31.

Miller, J.C. 1973. Second nesting of herons, egrets and ibis. Cassinia 54:29.

Miller, L.D. 1953. Bird islands of Hog Island Bay. Raven 24:87-88.

Miller, R.F. 1914. Summer residents of the Pennsauken Creek, New Jersey. Oologist 31:123-128.

Miller, R.F. 1918. Pennsylvania and New Jersey nesting dates for 1915. Oologist 35:122-123.

Miller, R.F. 1924. Pennsylvania and New Jersey nesting dates for 1924. Oologist 41:124-126.

Miller, R.F.1925. Pennsylvania and New Jersey nesting dates for 1925. Oologist 42:156-157.

Miller, R.F.1926. Pennsylvania and New Jersey nesting dates for 1926. Oologist 43:162-164.

Miller, R.F. 1928. Pennsylvania and New Jersey 1927 nesting dates. Oologist 45:14-16, 18.

Miller, R.F.1928a. Pennsylvania and New Jersey nesting dates for 1928. Oologist 45:125-126.

Miller, R.F.1930. Pennsylvania and New Jersey nesting dates for 1929. Oologist 47:5,7-8.

Miller, R.F. 1931. Pennsylvania and New Jersey nesting records for 1930. Oologist 48:17-19.

Miller, R.F.1932. Pennsylvania and New Jersey nesting dates for 1931. Oologist 49:14-16.

Miller, R.F.1933. Pennsylvania and New Jersey nesting dates for 1932. Oologist 50:40-41.

Miller, R.F.1934. Pennsylvania and New Jersey nesting dates for 1933. Oologist 51:2-4.

Miller, R.F.1935. Pennsylvania and New Jersey nesting dates for 1935. Oologist 52:137-139.

Miller, R.F.1937. Pennsylvania and New Jersey nesting dates for 1936. Oologist 54:21-23.

Miller, R.F.1939. Pennsylvania and New Jersey nesting dates for 1938. Oologist 56:4-6.

Miller, R.F. 1940a. Yellow-crowned night heron nesting in Salem Co., New Jersey. Auk 57:561.

Miller, R.F. 1940b. Pennsylvania and New Jersey dates for 1939. Oologist 57:33-36.

Miller, R.F.1941a. Pennsylvania and New Jersey dates for 1940. Oologist 58:6-8.

Miller, R.F. 1941b. Richard F. Miller's annual report of the Pennsylvania and New Jersey nesting record for 1941. Oologist 58:133-136.

Miller, R.F. 1943. The great blue heron. The breeding birds of the Philadelphia Region (Part II). Cassinia 33:1-23.

Montagna, W.,and W.A. Winsatt.1942. Bird records from Virginia.Auk 59:434-436.

Morse, L. 1903. Birds of New Jersey. Ann.Rept. N.J. State Museum. Camden, N.J.

Murphy, L.W. 1972. Least tern colony at Sandy Point State Park. Maryland Birdlife 28:91-93.

Murphy, R.C. 1915. The Atlantic range of the Leach's storm petrel (Oceanodroma leuchorhoa vieillot). Auk 32:170-173.

Murray, J.J.1933. Additions to the Virginia avifauna since 1890. Auk 50: 190-200.

Murray, J.J. 1937. June days on Cobb's Island. Raven 8:39-43.

Murray, J.J. 1949. Summer season-1949. Raven 20:62-65.

Murray, J.J. 1952. Eastern shore field trip. Raven 23:70-71.

Murray, J.J. 1955. A check-list of the birds of Virginia. Virginia Soc. Ornithol. Richmond. 113 pp. (with 5 suppl.).

Murray, J.J. 1957. News and notes. Raven 28:55-56.

Murray, J.J. 1958. News and notes. Raven 29:65.

Nash, N.C., IV. 1948. A review of the 1947 check-lists. Bull. Mass. Audubon Soc. 32:83-92.

Nichols, C.K. 1953. Hudson-St. Lawrence region. Audubon Field Notes 7:298-302.

Nichols, C.K. 1954. Hudson-St. Lawrence region. Audubon Field Notes 8:334-337.

Nichols, C.K. 1955. Hudson-St. Lawrence region. Audubon Field Notes 9:366-370.

Nichols, C.K. 1956. Hudson-St.Lawrence region. Audubon Field Notes 10:371-375.

Nichols, C.K. 1958. Hudson-St. Lawrence region. Audubon Field Notes 12:397-402.

Nichols, C.K. 1959. Hudson-St.Lawrence region. Audubon Field Notes 13:419-422.

Nichols, C.K. 1960. Hudson-St.Lawrence region. Audubon Field Notes 14:437-439.

Nisbet, I.C.T. 1971a. Laughing gull colonies in the northeast. Massachusetts Audubon 55:2-10.

Nisbet, I.C.T.1971b. The laughing gull in the northeast. Am. Birds 25:677-683.

Nisbet, I.C.T. 1971c. Downward turn for terns? Mass. Audubon News-letter 10.

Nisbet, I.C.T. 1972. Disaster year for terns. Man & Nature 1:16-21.

Nisbet, I.C.T. 1973. Terns in Massachusetts: Present numbers and historical changes. Bird-Banding 44:27-55.

Nisbet, I.C.T. 1976a. Colonization of Monomoy by laughing gulls. Cape Naturalist 5:4-8.

Nisbet, I.C.T. 1976b. Returns from terns. Mass. Audubon News-letter 15:3-5.

Nisbet, I.C.T., and W.H. Drury. 1972a. Measuring breeding success in common and roseate terns. Bird-Banding 43:97-106.

Nisbet, I.C.T.,and W.H. Drury. 1972b. Post-fledgling survival in herring gulls in relation to brood size and date of hatching. Bird-Banding 43:161-172.

Noble, G., and D. Lehrman. 1940. Egg recognition by the laughing gull. Auk 57:22-43.

Noble, G.K., and M. Wurm. 1943. The social behavior of the laughing gull. Ann. New York Acad. Sci. 45:179-200.

Norton, A.H. 1907. Report of Arthur H. Norton on colonies of birds in Maine receiving special protection in 1907. Bird-Lore 9:319-327.

Norton, A.H. 1913. Birds new or rare to Maine. Auk 30:574-576.

Norton, A.H. 1914. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 16:489-492.

Norton, A.H. 1915. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 17:501-502.

Norton, A.H. 1916. Notes on some Maine birds. Auk 33:376-383.

Norton, A.H. 1918. Report of Authur H. Norton, field agent for Maine. Bird-Lore 20:465-467.

Norton, A.H. 1921. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 23:355-357.

Norton, A.H. 1922. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 24:410-412.

Norton, A.H. 1925. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 27:472.

Norton, A.H. 1926. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 28:464-465.

Norton, A.H. 1928. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 30:455.

Norton, A.H. 1929. Report of Arthur H. Norton, field agent for Maine. Bird-Lore 31:469.

Norton, A.H. 1934. The breeding habits and breeding range of Leach's storm petrel. Auk 51:75-76.

Norton, A.H., and P.F. Allan. 1932. Leach's storm petrel on the coast of Maine. Auk 49:340-341.

Norton, A.H., and R.P. Allen. 1931. Breeding of the great black-backed gull and double-crested cormorant in Maine. Auk 48:589-592.

Norton, A.H., and R.P. Allen. 1955. Additional notes on breeding in Maine of the great black-back. Auk 49:349-350.

Packard, W. 1924. Terns and some ants. Bull. Mass. Audubon Soc. 8:5-6.

Palmer, R.S.1938.Tern mortality along the Maine coast. Bird-Banding 9:117-123.

Palmer, R.S. 1949. Maine Birds. Bull. Mus. Comp. Zool. Cambridge, Massachusetts. 656 pp.

Paynter, R.A. 1963. North American herring gull nesting on a building. Wilson Bull. 75:88.

Pearson, T.G. 1912. Night heron colonies. Bird-Lore 14:70.

Pearson, T.G. 1919. A New Jersey heron colony. Bird-Lore 21:271.

Pennock, C.J. 1908. Birds of Delaware - Additional notes. Auk 25:282-288.

Pennock, C.J. 1930. Little blue heron breeding in Delaware. Auk 47:555-556.

Pessino, C. 1965. Great Gull Island, 1964. Linnaean News-letter 18:1.

Pessino, C.M. 1968. Red-winged blackbird destroys eggs of common and roseate terns. Auk 85:513.

Pessino, C. 1970. Great Gull Island visits 1962-1966. Proc. Linnaean Soc. N.Y. 71:80-82.

Pettingill, O.L., Jr. 1937. Behavior of black skimmers at Cardwell Island, Virginia. Auk 54:237-244.

Pettingill,O.L.,Jr. 1939. History of 100 nests of Arctic terns. Auk 56:420-428.

Phillips, J.C. 1939. Changes in status of Essex County birds. Bull. Essex Co. Ornithol. Club 1937-1938:4-21.

Pokras, M.A., and M.L. Pokras. 1974. Ecological studies in the bays and other waterways near Little Egg inlet and in the ocean in the vicinity of the proposed site for the Atlantic generating station. New Jersey Terrestrial Study. Progress report Jan-Dec 1973. Icthyol. Assoc., Inc.

Poole, E.J. 1922. Notes on early summer birds of the Virginia coast. Auk 39:271-272.

Poole, F.G. 1972. A list of birds of Caroline County, Maryland. Bull. Natur. Hist. Soc. of Maryland 12:51-58.

Poor, H. 1941. Visits to gull colonies in New York State. Proc. Linnaean Soc. N.Y. 132-134.

Poor, H. 1945. Breeding of the herring gull in Connecticut. Proc. Linnaean Soc. N.Y. 43-44.

Post, P.W. 1961. Range extension of herons in the northeastern United States. Wilson Bull. 73:390-393.

Post, P.W. 1962. Glossy ibis breeding in New York. Auk 79:120-121.

Post, P.W. 1972. A new glossy ibis colony at Cedar beach, New York. Kingbird 22:19-22.

Post, P.W., F. Enders, and T. Davis, Jr. 1970. The breeding status of the glossy ibis in New York. Kingbird 20:3-8.

Post, P.W., and E.J. Restivo. 1961. A mid-summer visit to Canarsie Pol. Linnaean News-letter 14.

Post, P.W., and G.A. Tudor. 1963. Region 10 - marine (for June-August 1963). Kingbird 13:228-232.

Post, P.W., and G.A. Tudor. 1964. Region 10 - marine (for June-August 1964). Kingbird 14:239-242.

Potter,J.K.1922. A season's study of some of our waterbirds. Cassinia 25:10-20.

Potter,J.K.1926. Yellow-crowned night heron in New Jersey in June. Auk 43:538.

Potter, J.K. 1959. Region No. 5. New Jersey Nature News. 14:92-93.

Potter, J.K., and J.J. Murray. 1948. Mid-Atlantic region. Audubon Field Notes 2:200-201.

Potter, J.K., and J.J. Murray. 1952. Mid-Atlantic region. Audubon Field Notes 6:10.

Potter, J.K., and J.J. Murray. 1953. Middle Atlantic coast region. Audubon Field Notes 7:302-303.

Potter, J.K., and J.J. Murray. 1955. Middle Atlantic coast region. Audubon Field Notes 9:370-371.

Potter, J.K., and J.J. Murray. 1956. Middle Atlantic coast region. Audubon Field Notes 10:375-376.

Potter, J.K., and J.J. Murray. 1957. Middle Atlantic coast region. Audubon Field Notes 11:394-396.

Pratt, E.E. 1947. Field notes. Bull. Mass. Audubon Soc. 31:265.

Prior, G. 1966. Eastern shore field trip. 1966. Raven 37:85.

Puleston, D. 1970. First recorded nesting of the cattle egret in New York State. Kingbird 20:177.

Rapp, W.F., Jr. 1940. A heronry in northern New Jersey. Auk 57:106.

Raynor, G.S. 1972. Overland feeding flights by the common tern on Long Island. Kingbird 22:63-71.

Reed, A.C. 1938. Notes from the coast. Raven 9:48-50.

Reed, A.C. 1939. Along the coast. Raven 10:3.

Rhoads, S.N., and C.J. Pennock. 1905. Birds of Delaware: a preliminary list. Auk 22:194-205.

Richards, T. 1954. A list of birds of New Hampshire. New Hampshire Bird News 7:3-10, 13-21.

Richards, T. 1958. A list of birds of New Hampshire. Audubon Soc. of New Hampshire, Concord.

Rives, W.C. 1890. A catalog of the birds of the Virginias. Proc. Newport Hist. Soc., 1889-90. Doc. VII, Newport Natur. Hist. Soc., Newport, R.I.

Robbins, C.S. 1973. The season. Maryland Birdlife 29:114-124.

Rogers, C.H. 1961. Increases in numbers in New Jersey's coastal birds in fifty years. New Jersey Nature News 16:124-134.

Rogers, C.H.1965. Herring gull nesting colony in Barnegat Bay. Cassinia 48:38.

Rowlett, R. 1973. Status of the sandwich tern in Maryland. Maryland Birdlife 29:81-82.

Sage, J.H., L.B. Bishop, and P.B. Bliss. 1913. Birds of Connecticut. Printed for the State Geological and Natural History Survey. Hartford. 370 pp.

Savell, W.E. 1972. Gull-billed terns in New Jersey. Cassinia 53:47-48.

Scott, F.R. 1951. Nesting season. Raven 22:29-30.

Scott, F.R. 1953. V.S.O. field trip. Raven 23:87-88.

Scott, F.R. 1954a. The 1953 summer season in Virginia. Raven 25:97-98.

Scott, F.R. 1954b. The eastern shore of Virginia. Raven 25:70-77.

Scott, F.R. 1956. V.S.O. summer field trip to Wachapreague. Raven 27:60-61.

Scott, F.R. 1960. Mid-Atlantic region. Audubon Field Notes 14:439-440.

Scott, F.R. 1965. Mid-Atlantic region. Audubon Field Notes 19:530-532.

Scott, F.R. 1967. Mid-Atlantic region. Audubon Field Notes 21:493, 553-554.

Scott, F.R.1969. Middle Atlantic coast region. Audubon Field Notes 23:647-648.

Scott, F.R. 1972. Middle Atlantic coast region. Am. Birds 26:842-843.

Scott, F. R. 1976. Middle Atlantic coast region. Am. Birds 30:938-942.

Scott, F.R., and J.K. Potter.1958. Middle Atlantic coast region. Audubon Field Notes 12:402-403.

Scott, F.R., and J.K. Potter. 1959. Middle Atlantic coast region. Audubon Field Notes 13:422-424.

Scott, F.R., and D.A. Cutler. 1961. Middle Atlantic coast region. Audubon Field Notes 15:455-458.

Scott, F.R., and D.A. Cutler. 1963. Middle Atlantic coast region. Audubon Field Notes 17:452-454.

Scott, F.R., and D.A. Cutler. 1964. Middle Atlantic coast region. Audubon Field Notes 18:500-503.

Scott, F.R., and D.A. Cutler. 1966. Middle Atlantic coast region. Audubon Field Notes 20:556-559.

Scott, F.R., and D.A. Cutler. 1968. Middle Atlantic coast region. Audubon Field Notes 22:594-597, 511-513.

Scott, F.R., and D.A. Cutler. 1970. Middle Atlantic coast region. Audubon Field Notes 24:668-670.

Scott, F.R., and D.A. Cutler. 1971. Middle Atlantic coast region. Am. Birds 25:840-843, 716-718.

Scott, F.R., and D.A. Cutler. 1973. Middle Atlantic coast region. Am. Birds 27:853-856.

Scott, F.R., and D.A. Cutler. 1974. Middle Atlantic coast region. Am. Birds 28:885-889.

Scott, W.E.D. 1903. The story of a bird lover. The Outlook Co., N. Y.

Sedwitz, W. 1937. The ornithological year 1937 for the New York City region. Proc. Linnaean Soc. N.Y. 41-59.

Segre, A., R. Noble, and J. Hailman. 1966. A five egg herring gull nest. Bird-Banding 37:290.

Seibert, H.C. 1951. Light intensity and roosting flight of herons in New Jersey. Auk 68:63-74.

Shelley, L.O. 1932a. Least tern on the New Hampshire coast in July. Auk 49:477-478.

Shelley, L.O. 1932b. Gulling along the New Hampshire coast. Audubon Soc. New Hampshire 11:23-25.

Shelley, L.O. 1934. Gull notes from the New Hampshire and Maine coast. Auk 51:83.

Smith, H.M. 1902. A supposed new colony of least terns on Martha's vineyard. Auk 19:76.

Smith, P.W., Jr. 1972. Region No. 5. New Jersey Nature News 27:135-140.

Smith, P.W., Jr. 1973a. Region No. 5. New Jersey Nature News 28:235-238.

Smith, P.W., Jr. 1973b. Region No. 5. New Jersey Nature News 28:170-174.

Smith, P.W., Jr. 1974. Region No. 5. New Jersey Nature News 29:187-190.

Smith, P.W., Jr. 1975. Region No. 5. Summer season field notes June-August 1975. New Jersey Audubon 1:8.

Snyder, D.E. 1943. A June diary of Cape Cod birds. Bull. Mass. Audubon Soc. 27:161-164.

Snyder, D.E. 1945. Field notes. Bull. Mass. Audubon Soc. 29:229.

Sprunt, A., Jr. 1949. Status of roseate tern as a breeding species in southern United States. Auk 66:206-207.

Sprunt, A., IV, J. Ogden, D. McCrimmon, and E. Weinstein. 1976. Historical data (1900-1963) for east coast sea and wading bird colonies. Natl. Audubon Soc. Rep. to U.S. Fish and Wildlife Service.

Steirly, C.C. 1954. Nesting studies on Wreck Island. Raven 25:99-101.

Steirly, C.C. 1959. V.S.O. field trip. Raven 29:61-62.

Stewart, R.E. 1957. Eastern glossy ibis nesting in southeastern Maryland. Auk 74:509.

Stewart, R.E., and C.S. Robbins. 1958. Birds of Maryland and the District of Columbia. North Amer. Fauna No. 62.

Stone, W. 1909. The birds of New Jersey. Ann. Report New Jersey State Mus. 13-347.

Stone, W. 1934. American egrets nesting in New Jersey. Auk 51:368-369.

Stone, W. 1937. Bird studies at old Cape May. Delaware Valley Ornithol. Club Vols. I & II. 941 pp.

Strong, R. M. 1901. Notes on terns. Sterna hirundo, S. dougallii and S. antillarum. Wilson Bull. 36:69.

Taber, W. 1947. Northward extension of the breeding range of the least tern. Auk 64:629-30.

Taber, W. 1955. The Isles of Shoals. Bull. Maine Audubon Soc. 9:58-66.

Taber, W. 1960. The Isles of Shoals. New Hampshire Bird News 13:85-90.

Terborgh, J. 1956. First breeding record of the glossy ibis for Virginia. Raven 28:21.

Tibbets, R. 1975. Tern study report. Trustees of Reservation report. Milton, Massachusetts.

Townsend, C.W. 1905. The birds of Essex County, Mass. Mem. Nuttall Ornithol. Club No. III. Cambridge, Massachusetts.

Townsend, C.W. 1920. Supplement to the birds of Essex County, Mass. Mem. Nuttall Ornithol. Club No. V. Cambridge, Massachusetts.

Townsend, C.W. 1921. The terns of our coast. Bull. Essex Co. Ornithol. Club 3:34-37.

Townsend, C.W. 1930. Another yellow-crowned night heron (Nyctanassa violacea) at Ipswich, Massachusetts. Auk 47:75.

Townsend, C.W. 1934. An estimate by means of ands and the number of terns on Penikese Island, Massachusetts in 1933. Bird-Banding 5:44-45.

Townsend, C.W., and F.H. Allen. 1933. Leach's storm petrel (Oceanodroma leucorhoa leucorhoa) breeding in Massachusetts. Auk 50:426.

Tudor, G. 1974a. The 1974 Captree June count. Linnaean News-letter 28:3.

Tudor, G. 1974b. Captree June count. Linnaean News-letter 28:2.

Tyler, H. 1975. Common terns, Arctic terns, and roseate terns in Maine. Maine Critical Areas Program. State Planning Office, Augusta.

Tyler, W.M. 1929. Recollections of a bird-banding trip. Bull. Northeastern Bird-Banding Assoc. 5:148-150.

Urner, C.A. 1924. Records for North Beach, Barnegat Bay, New Jersey. Auk 41:167.

Urner, C.A. 1926. Black skimmer (Rynchops nigra) nesting in Ocean County, New Jersey. Auk 43:532.

Urner, C.A. 1931. The eel grass blight on the New Jersey Coast. Proc. Linnaean Soc. N.Y. No. 43-44:1-37.

Valentine, J.M. 1958. Cattle egrets nesting in Maryland. Maryland Birdlife 14:49.

Valentine, J.M. 1958. The cattle egret of Chincoteague, Virginia. Raven 29:67-96.

Van Velzen, W.T. 1968. The status and dispersal of Virginia royal terns. Raven 39:55-60.

Varza, D. 1975. The neglected tern. Underwater Natur. 9:12-14, 32.

Very, N.T. 1937. Behavior of young herring gulls. Bird-Banding 8:77-78.

Vogt, W. 1934a. Black skimmer (Rynchops nigra) breeding in New York. Auk 51:521.

Vogt, W. 1934b. The ornithological year 1933 of the New York City region. Proc. Linnaean Soc. N.Y. (abst.) 46:74-100.

Vogt, W. 1938. Birding down Long Island. Bird-Lore 40:331-340.

Voous, K.H. 1963. Tern colonies in Aruba, Curacao and Bonaire, South Caribbean Sea. Proc. XIII Int. Ornithol. Congr:1212-1216.

Wachenfeld, A.W. 1962. V.S.O. Wachapreague field trip. Raven 33:3-10.

Walsh, L.L. 1936. Coastal notes. Raven 7:7-8.

Weaver, D.K., and J.A. Kadlec. 1970. A method for trapping breeding adult gulls. Bird-Banding 40:28-31.

Weske, J.S. 1974. Summary of population estimates for colonial nesting birds on the oceanside of the Virginia and Maryland eastern shore. Unpubl. rep. Bird and Mammal Lab., U.S. Natl. Mus. Natur. Hist., Washington, D.C.

Weske, J.S., and H. Fessenden. 1963. Glossy ibis nesting in tidewater Maryland away from the ocean. Bird-Banding 34:161.

Wetherbee, D.K., R.P. Coppinger, and R.E. Walsh. 1972. Time-lapse ecology, Muskeget Island, Nantucket, Mass. MSS Educ. Publ. Co., New York. 173 pp.

White, F.B. 1927. Common and Arctic terns at Seabrook. Audubon Soc. New Hampshire Bull. 6:42-43.

White, F.B. 1929. Marsh beach and ledge. Audubon Soc. New Hampshire Bull. 8:3-5.

White, F.B. 1931. Notes on birds at Seabrook in 1930. Audubon Soc. New Hampshire Bull. 10:29-30.

White, F.B. 1932. Notes from Seabrook beach 1931. Audubon Soc. New Hampshire Bull. 11:7.

White, F.B. 1935. Notes from Concord and Seabrook. Audubon Soc. New Hampshire Bull. 14:11-12.

Wiese, J., and T. Smith-Kenneally. 1977. A heron colony called Pea Patch. Delaware Conserv. 21:8-15.

Wilbur, H.M. 1969. The breeding biology of Leach's storm petrel, Oceanodroma leucorhoa leucorhoa. Auk 86:433-442.

Wilcox, L. 1938. Colonial birds on Long Island. Proc. Linnaean Soc. N.Y. 49:71-72.

Wilcox, L. 1944. Great black-backed gull breeding in New York Auk 61:653-654.

Wolk, R.G., and J. Bull. 1967. Differential nesting schedules of herring gulls on Long Island, New York. Kingbird 17:5-6.

Worth, C.B. 1929. Notes from Cobb's Island, Virginia. Auk 46:558-559.

Worth, C.B. 1941. Snowy egret again nesting in Cape May County, New Jersey. Auk 58:252-253.

Wright, J.K. 1955. 1954 breeding bird population studies. Atlantic Natur. 10:150-151.

Wright, P.L. 1937. The birds of the Isles of Shoals. M.S. Thesis. Univ. of New Hampshire, Durham. 46 pp.

Yrizarry, J.C. 1956. Observing birds in the New Haven region. New Haven Bird Club.

Zinn, D.J., and J.S. Rankin, Jr. 1952. Fauna of Penikese Island, 1947. Kendall Printing Co., Falmouth.

APPENDIX D

Table D1. Colony Site Listing: Maine (Cape Elizabeth, South) - Virginia, 1977

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
MAINE (CAPE ELIZABETH, SOUTH)				
Appledore Island	324 001	4259 N	7037 W	Isles of Shoals
Beach Island, Biddeford	296 047	4326 N	7020 W	Biddeford Pool
Bluff Island	296 038	4331 N	7019 W	Prout's Neck
Bumpkin Island	296 050	4321 N	7027 W	Kennebunkport
Cedar Island	324 003	4259 N	7036 W	Isles of Shoals
Clarks Island	296 051	4305 N	7043 W	Kittery
Duck Island	296 052	4300 N	7036 W	Isles of Shoals
Eagle Island	296 041	4329 N	7022 W	Biddeford Pool
Folly Island	296 048	4321 N	7026 W	Kennebunkport
Gooseberry Island	296 046	4327 N	7020 W	Biddeford Pool
Goose Rocks Beach	296 040	4323 N	7025 W	Biddeford
Green Island	296 049	4321 N	7026 W	Kennebunkport
Negro Island	296 045	4327 N	7021 W	Biddeford Pool
Ram Island	296 036	4333 N	7016 W	Prout's Neck
Ram Island	296 042	4328 N	7022 W	Biddeford Pool
Smuttynose Island	324 002	4259 N	7036 W	Isles of Shoals
Stage Island	296 044	4328 N	7021 W	Biddeford Pool
Stratton Island	296 037	4331 N	7019 W	Prout's Neck
West Goose Rocks	296 039	4323 N	7025 W	Biddeford
Wood Island	296 043	4328 N	7020 W	Biddeford Pool
NEW HAMPSHIRE				
Lunging Island - Square Rock	324 005	4258 N	7038 W	Isle of Shoals
Star Island	324 004	4258 N	7036 W	Isle of Shoals
White Island	324 006	4258 N	7038 W	Isle of Shoals
MASSACHUSETTS				
Acoaxet	352 048	4130 N	7106 W	Westport
Bakers Island	324 027	4232 N	7047 W	Marblehead North
Barneys Joy, Allens Neck	352 046	4131 N	7059 W	Westport
Big Ram Island, Westport	352 047	4131 N	7104 W	Westport
Bird Island	352 045	4140 N	7043 W	Onset
Black Point Pond, Martha's Vineyard	352 037	4121 N	7040 W	Tisbury Great Pond
Black Rocks	324 054	4216 N	7049 W	Nantasket Beach
Brush Island	324 055	4215 N	7048 W	Nantasket Beach

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
MASSACHUSETTS (continued)				
Calf Island	324 045	4221 N	7054 W	Hull
Cape Poge Elbow, Martha's Vineyard	352 030	4124 N	7028 W	Edgartown
Cape Poge Light, Martha's Vineyard	352 029	4125 N	7027 W	Edgartown
Cat Island	324 035	4231 N	7049 W	Marblehead North
Chubb Island	324 024	4233 N	7048 W	Marblehead North
Clarks Island	324 059	4200 N	7039 W	Duxbury
Coatue, Nantucket	352 021	4119 N	7003 W	Siasconset
Coney Island	324 028	4232 N	7050 W	Marblehead North
Craigville, East Bay	352 004	4138 N	7022 W	Hyannis
Crane Beach	324 011	4241 N	7045 W	Ipswich
Dead Neck-Sampson Island	352 017	4137 N	7025 W	Cotuit
Dry Salvages	324 017	4240 N	7034 W	Rockport
Dunbar Point, Lewis Bay	352 005	4138 N	7016 W	Hyannis
Duxbury Beach	324 058	4201 N	7037 W	Duxbury
Eagle Island	324 031	4232 N	7049 W	Marblehead North
Egg Rock	324 040	4226 N	7054 W	Lynn
Esther Island	352 026	4117 N	7014 W	Tuckernuck
Fish Island, Buzzards Bay	352 044	4135 N	7052 W	Sconticut Neck
Gallops Island	324 050	4219 N	7056 W	Hull
Graves Island	324 015	4234 N	7045 W	Gloucester
Grays Beach, Yarmouth	352 007	4143 N	7015 W	Dennis
Grays Rock	324 034	4231 N	7050 W	Marblehead North
Great Brewster Island	324 048	4220 N	7054 W	Hull
Great Egg Rock	324 016	4234 N	7044 W	Gloucester
Great Haste Island	324 030	4232 N	7051 W	Marblehead North
Great Misery Island	324 025	4233 N	7048 W	Marblehead North
Great Point, Nantucket	352 020	4123 N	7002 W	Great Point
Green Island	324 043	4221 N	7054 W	Hull
Gull Island	324 056	4215 N	7046 W	Nantasket Beach
Harding Beach	352 014	4140 N	7000 W	Chatham
High Head	324 063	4203 N	7007 W	North Truro
Hog Island Pier	324 053	4218 N	7054 W	Hull
House Island	324 023	4233 N	7046 W	Marblehead North
Island South of Cat Island	324 036	4231 N	7049 W	Marblehead North
Jericho Creek	324 008	4247 N	7049 W	Newburyport East
Kettle Island	324 014	4234 N	7043 W	Gloucester
Little Calf Island	324 044	4221 N	7054 W	Hull
Little Misery Island	324 026	4233 N	7048 W	Marblehead North
Little Neck, Martha's Vineyard	352 031	4124 N	7027 W	Edgartown
Lobsterville, Martha's Vineyard	352 038	4121 N	7047 W	Squibnocket
Long Point-Wood End	324 060	4201 N	7012 W	Provincetown
Madaket, Nantucket	352 025	4117 N	7011 W	Nantucket
Marblehead Rock	324 037	4230 N	7049 W	Marblehead North
Marconi Beach	352 012	4157 N	6959 W	Wellfleet
Middle Brewster Island	324 047	4221 N	7053 W	Hull

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
MASSACHUSETTS (continued)				
Milk Island	324 020	4238 N	7035 W	Rockport
Monomoy Island	352 016	4136 N	6059 W	Monomoy Point
Monomoy North	352 015	4138 N	6958 W	Chatham
Muskeget Island	352 028	4120 N	7018 W	Tuckernuck
Nashawena Island	352 041	4126 N	7052 W	Cuttyhunk
Nauset - Chatham	352 013	4139 N	6957 W	Chatham
Nauset - Eastham	352 011	4149 N	6956 W	Orleans
Nauset - New Island	352 010	4149 N	6956 W	Orleans
Nauset - Orleans	352 009	4148 N	6956 W	Orleans
Nomans Land, Martha's Vineyard	352 039	4115 N	7049 W	Squibnocket
Normans Woe	324 013	4235 N	7042 W	Gloucester
North Gooseberry Island	324 032	4231 N	7048 W	Marblehead North
North Sandwich	352 002	4146 N	7029 W	Sandwich
Norton Neck, Martha's Vineyard	352 033	4121 N	7029 W	Edgartown
Outer Brewster Island	324 046	4221 N	7053 W	Hull
Peddocks Island	324 052	4217 N	7057 W	Hull
Penikese Island	352 042	4127 N	7056 W	Cuttyhunk
Pleasure Bay	324 041	4220 N	7101 W	Boston South
Plum Island	324 009	4245 N	7046 W	Newburyport East
Plymouth Beach	352 001	4158 N	7039 W	Plymouth
Pope Head	324 029	4231 N	7048 W	Marblehead North
Quaise, Nantucket	352 024	4118 N	7001 W	Siasconset
Quidnet, Nantucket	352 022	4118 N	6959 W	Siasconset
Race Point Coast Guard Station	324 062	4204 N	7013 W	Provincetown
Race Point Light	324 061	4204 N	7014 W	Provincetown
Ram Island	324 039	4229 N	7052 W	Marblehead South
Ram Island, Buzzards Bay	352 043	4137 N	7048 W	Sconticut Neck
Ram Islands	324 022	4233 N	7047 W	Marblehead North
Rock Dundy	324 021	4234 N	7046 W	Marblehead North
Roger Island	324 010	4243 N	7049 W	Ipswich
Sandy Neck	352 006	4144 N	7017 W	Hyannis
Sarson Island, Martha's Vineyard	352 034	4125 N	7033 W	Edgartown
Scituate	324 057	4211 N	7043 W	Scituate
Scorton Creek	352 003	4145 N	7026 W	Sandwich
Shag Rocks	324 049	4221 N	7052 W	Hull
Siasconset, Nantucket	352 023	4116 N	6958 W	Siasconset
Snake Island	324 042	4222 N	7059 W	Hull
South Cape Beach - Waquoit	352 018	4133 N	7031 W	Falmouth
South Gooseberry Island	324 033	4231 N	7048 W	Marblehead North
Spectacle Island	324 051	4219 N	7059 W	Hull
Straitsmouth Island	324 018	4240 N	7035 W	Rockport
Sylvia Beach, Martha's Vineyeard	352 035	4125 N	7033 W	Edgartown
Tashmoo, Martha's Vineyard	352 040	4128 N	7038 W	Vineyard Haven
Tenpound Island	324 012	4236 N	7046 W	Gloucester

(Continued)

Table D1. (Continued)

Colony name name	Colony site no.	Latitude	Longitude	Quadrangle
MASSACHUSETTS (continued)				
Thacher Island	324 019	4238 N	7035 W	Rockport
Tinkers Island	324 038	4229 N	7050 W	Marblehead South
Tuckernuck Island	352 027	4117 N	7015 W	Tuckernuck
Wasque Point, Martha's Vineyard	352 032	4121 N	7028 W	Edgartown
Watcha Pond, Martha's Vineyard	352 036	4121 N	7037 W	Tisbury Great Pond
Weepecket Islands	352 019	4131 N	7044 W	Woods Hole
West Dennis	352 008	4139 N	7010 W	Dennis
Woodbridge Island	324 007	4248 N	7050 W	Newburyport East
CONNECTICUT				
Barn Island	352 087	4119 N	7154 W	Mystic
Belden Island	351 020	4115 N	7245 W	Branford
Betts Island	351 038	4104 N	7323 W	Norwalk South
Big Mermaid Rock	351 029	4116 N	7249 W	Branford
Black Rock, Avery Point	351 005	4119 N	7204 W	New London
Burr Island	351 021	4115 N	7245 W	Branford
Calf Pasture Island	351 041	4105 N	7323 W	Norwalk South
Cedar Island	351 026	4115 N	7245 W	Branford
Chimon Island	351 040	4104 N	7324 W	Norwalk South
Copps Island	351 036	4104 N	7323 W	Norwalk South
Crow Island	351 037	4103 N	7323 W	Norwalk South
East White Rock	351 035	4105 N	7322 W	Norwalk South
Falkner Island	351 014	4113 N	7239 W	Guilford
Foot Rocks	351 024	4115 N	7247 W	Branford
Frisbie Island	351 018	4115 N	7245 W	Branford
Gates Island	352 091	4119 N	7159 W	Mystic
Goose Island	351 015	4113 N	7240 W	Guilford
Goose Island	351 034	4104 N	7322 W	Sherwood Point
Grassy Island	351 039	4104 N	7323 W	Norwalk South
Green Island	351 023	4115 N	7247 W	Branford
Gull Rock	351 013	4116 N	7236 W	Clinton
Lewis Island	351 019	4115 N	7245 W	Branford
Long Beach	351 033	4109 N	7309 W	Bridgeport
Long Beach Island	351 043	4104 N	7325 W	Norwalk South
Long Ledge	351 009	4117 N	7213 W	Niantic
Long Rock, Black Point	351 010	4118 N	7213 W	Niantic
Lordship	351 031	4109 N	7306 W	Milford
Lyddy Island	352 088	4120 N	7157 W	Mystic
Menunketesuck Island	351 012	4116 N	7228 W	Essex
Middle Rock	351 028	4116 N	7246 W	Branford
Milford Point	351 030	4110 N	7306 W	Milford
Narrows Island	351 017	4115 N	7243 W	Guilford
North Brother	351 011	4118 N	7215 W	Niantic
Point No Point	351 032	4109 N	7307 W	Bridgeport

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
CONNECTICUT (continued)				
Ram Island	352 092	4118 N	7159 W	Mystic
Sheffield Island	351 042	4102 N	7325 W	Norwalk South
Shore Rock, Ocean Point	351 006	4118 N	7206 W	New London
Smith Island	351 016	4115 N	7244 W	Guilford
Spectacle	351 025	4115 N	7248 W	Branford
St. Helena Island	351 022	4115 N	7246 W	Branford
Waterford Island	351 007	4118 N	7210 W	Niantic
Whaleback Rock	352 090	4119 N	7159 W	Mystic
Whale Rock	352 089	4118 N	7159 W	Mystic
White Top Rock	351 027	4116 N	7246 W	Branford
Wigwam Rock	351 008	4119 N	7211 W	Niantic
RHODE ISLAND				
Allen Harbor	352 073	4137 N	7125 W	East Greenich
Baileys Beach Rock	352 068	4127 N	7119 W	Newport
Bills Island	352 081	4120 N	7143 W	Quonochontaug
Block Island, North End	352 086	4114 N	7135 W	Block Island
Briggs Beach - Marsh	352 050	4127 N	7111 W	Sakonnet Point
Cormorant Rock	352 053	4128 N	7115 W	Sakonnet Point
Despair Island	352 057	4136 N	7122 W	Prudence Island
Dyer Island	352 061	4135 N	7118 W	Prudence Island
East Matunuck	352 078	4123 N	7133 W	Kingston
East Price Neck	352 070	4127 N	7120 W	Newport
East Providence	352 072	4148 N	7123 W	Providence
Ft. Wetherill	352 066	4129 N	7121 W	Newport
Gooseberry Island	352 059	4136 N	7122 W	Prudence Island
Gooseberry Island	352 069	4127 N	7120 W	Newport
Gould Island	352 055	4137 N	7113 W	Tiverton
Gould Island	352 062	4133 N	7120 W	Prudence Island
Gull Rock	352 067	4127 N	7118 W	Newport
Gull Rocks	352 063	4130 N	7121 W	Prudence Island
Hog Island	352 056	4138 N	7117 W	Bristol
Hope Island	352 060	4136 N	7122 W	Prudence Island
Horace Island	352 085	4120 N	7151 W	Watchhill
Island Rocks, Sachuest	352 052	4129 N	7115 W	Sakonnet Point
Island West of Price Neck	352 071	4127 N	7120 W	Newport
Long Pond	352 049	4128 N	7111 W	Sakonnet Point
Mackeral Cove	352 076	4129 N	7124 W	Narragansett Pier
Misquamicut	352 083	4119 N	7149 W	Watchhill
Ninigret	352 080	4121 N	7140 W	Quonochontaug
Potters Pond	352 077	4123 N	7133 W	Kingston
Quonochontaug Pond	352 082	4120 N	7143 W	Quonochontaug
Quonset Point	352 074	4135 N	7124 W	Wickford
Rose Island	352 064	4130 N	7121 W	Newport
Round Rock	352 058	4136 N	7122 W	Prudence Island
Sakonnet Point	352 051	4127 N	7112 W	Sakonnet Point
Sandy Point - Napatree Point	352 084	4121 N	7153 W	Watchhill

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
RHODE ISLAND (continued)				
Spar Island	352 054	4141 N	7114 W	Fall River
The Dumplings	352 065	4129 N	7121 W	Newport
Trustom Pond	352 079	4122 N	7135 W	Kingston
Wickford Harbor	352 075	4134 N	7126 W	Wickford
NEW YORK				
Acabonack Harbor	351 054	4101 N	7208 W	Gardiner's Island West
Alder Island	378 049	4036 N	7335 W	Jones Inlet
Birch Creek	378 010	4054 N	7235 W	Mattituck
Breezy Point, Rockaway	378 064	4033 N	7357 W	Coney Island
Bullhead Bay	378 014	4055 N	7227 W	Southampton
Canarsie Pol, Jamaica Bay	378 063	4038 N	7352 W	Far Rockaway
Captree Island	378 031	4039 N	7316 W	Bayshore West
Cedar Beach	378 033	4038 N	7320 W	Bayshore West
Cedar Beach Point	351 049	4102 N	7223 W	Southhold
Cedar Point	351 050	4102 N	7215 W	Greenport
Conkling Point/Greenport	351 047	4105 N	7222 W	Southhold
Cuba Island	378 041	4037 N	7332 W	Freeport
East Crow Island	378 042	4037 N	7332 W	Jones Inlet
East End, Fishers Island	352 093	4117 N	7155 W	Mystic
East Fire Island	378 028	4039 N	7311 W	Bayshore East
East High Meadow, Jamaica Bay	378 057	4037 N	7348 W	Far Rockaway
Flat Hammock	351 004	4117 N	7201 W	New London
Gardiners Island	351 055	4106 N	7207 W	Gardiner's Island East
Gardiners Point	351 046	4108 N	7209 W	Plum Island
Garrett Marsh	378 053	4036 N	7338 W	Lawrence
Georgica Pond	378 017	4056 N	7214 W	East Hampton
Gilgo Beach and State Park	378 034	4037 N	7324 W	Bayshore West
Gilgo Island	378 036	4037 N	7325 W	West Gilgo Beach
Goose Creek Point	378 011	4055 N	7236 W	Mattituck
Great Gull Island	351 044	4112 N	7207 W	Plum Island
Hay Harbor	351 001	4116 N	7201 W	New London
Hicks Island	351 056	4101 N	7204 W	Gardiner's Island East
Hoffman Island	377 004	4034 N	7403 W	The Narrows
Huckleberry Island	378 001	4053 N	7346 W	Mount Vernon
Hungry Point, Fishers Island	352 094	4417 N	7157 W	Mystic
Island 1.3 Miles NE Tobay Tower	378 037	4037 N	7326 W	West Gilgo Beach
Islip Spoil Island	378 030	4039 N	7315 W	Bayshore East
Jo Co Marsh, Jamaica Bay	378 058	4037 N	7348 W	Far Rockaway
Jones Beach, Lot 1 - Meadowbrook	378 044	4035 N	7334 W	Jones Inlet
Jones Beach, Lot 3 - Storehouse	378 043	4036 N	7332 W	Jones Inlet
Jones Island (Toll Booth)	378 047	4037 N	7333 W	Jones Inlet

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
NEW YORK (continued)				
Lawrence	378 056	4036 N	7342 W	Lawrence
Little Egg Marsh	378 061	4035 N	7350 W	Far Rockaway
Lloyd Neck, Target Rock	378 003	4055 N	7325 W	Lloyd Harbor
Loop Causeway	378 048	4037 N	7334 W	Jones Inlet
Meadowbrook Causeway	378 046	4036 N	7333 W	Jones Inlet
Mecox Inlet	378 018	4054 N	7220 W	Sag Harbor
Middle Farms Pond, Fishers Island	352 095	4117 N	7158 W	Mystic
Middle Line Island	378 038	4037 N	7329 W	West Gilgo Beach
Middle Pond, Shinnecock	378 016	4053 N	7227 W	Southampton
Mill Creek	378 009	4100 N	7221 W	Mattituck
Moriches Inlet	378 024	4047 N	7245 W	East Port
New Made Island	378 025	4045 N	7248 W	Moriches
New Suffolk - Cutchogue	378 015	4059 N	7229 W	Southampton
Nissequogue	378 005	4055 N	7314 W	Saint James
North Cinder Island	378 052	4036 N	7337 W	Jones Inlet
North Dumpling	351 002	4117 N	7201 W	New London
North Sea Harbor	378 012	4057 N	7225 W	Southampton
Northwest Harbor - Barcelona Neck	351 051	4101 N	7215 W	Greenport
Pearsalls Hassock	378 054	4037 N	7340 W	Lawrence
Plum Island	351 045	4111 N	7212 W	Plum Island
Port Jefferson	378 006	4057 N	7304 W	Port Jefferson
Red Cedar Point	378 008	4055 N	7234 W	Mattituck
Red Creek Pond	378 007	4055 N	7233 W	Mattituck
Robins Island	378 013	4058 N	7228 W	Southampton
Ruffle Bar, Jamaica Bay	378 062	4036 N	7352 W	Far Rockaway
Sand City, Eatons Neck	378 002	4057 N	7320 W	Lloyd Harbor
Sandy Hook North	377 006	4029 N	7401 W	Sandy Hook
Sedge Island	378 023	4049 N	7233 W	Quoque
Seganus Thatch	378 032	4039 N	7317 W	Bayshore West
Sexton Island	378 029	4039 N	7314 W	Bayshore East
Shelter Island	351 052	4104 N	7220 W	Greenport
Shinnecock Inlet - Bridge	378 019	4051 N	7229 W	Shinnecock Inlet
Short Beach	378 045	4036 N	7333 W	Jones Inlet
Silver Hole Marsh, Jamaica Bay	378 059	4036 N	7348 W	Far Rockaway
Smith Meadow	378 051	4037 N	7335 W	Jones Inlet
Smith Point County Park	378 026	4044 N	7252 W	Pattersquash
South Dumpling	351 003	4117 N	7201 W	New London
South Green Sedge Island	378 055	4036 N	7341 W	Lawrence
Southhold, Port of Egypt	351 048	4103 N	7225 W	Southhold
South Pine Marsh	378 050	4037 N	7334 W	Jones Inlet
Stoneybrook Harbor	378 004	4055 N	7311 W	Saint James
Subway Island, Jamaica Bay	378 060	4038 N	7349 W	Far Rockaway
Swinburne Island	377 005	4034 N	7403 W	The Narrows
Tiana Beach	378 022	4049 N	7231 W	Quoque
Tiana Neck - Lanes Island	378 021	4050 N	7231 W	Quoque
Threemile Harbor	351 053	4102 N	7211 W	Gardiner's Island West

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
NEW YORK (continued)				
Tobay Sanctuary and Beach	378 039	4036 N	7329 W	West Gilgo Beach
Wansers Island	378 035	4038 N	7325 W	Amityville
Wantagh Causeway	378 040	4038 N	7330 W	Freeport
Warner Islands	378 020	4051 N	7230 W	Shinnecock Inlet
Watch Hill, Fire Island	378 027	4042 N	7259 W	Howell's Point
NEW JERSEY				
Absecon Boulevard	403 051	3923 N	7429 W	Oceanville
Absecon Inlet	403 050	3923 N	7424 W	Oceanville
Alex Island	403 053	3922 N	7431 W	Ocean City
Avalon and Causeway	403 070	3907 N	7443 W	Avalon
Barnegat Head	403 006	3946 N	7407 W	Barnegat Light
Barnegat Inlet	403 005	3946 N	7406 W	Barnegat Light
Barrel Island	403 024	3933 N	7417 W	Tuckerton
Big Heron Island	403 043	3924 N	7426 W	Oceanville
Black Point, Brigantine Refuge	403 039	3936 N	7424 W	Oceanville
Broad Creek Marsh	403 048	3923 N	7425 W	Oceanville
Bunting Sedge	403 025	3933 N	7417 W	Tuckerton
Cape May Inlet	428 004	3857 N	7452 W	Wildwood
Carvel Island	403 013	3941 N	7410 W	Ship Bottom
Cedar Bonnet	403 015	3939 N	7411 W	Ship Bottom
Chadwick Marsh	403 001	4000 N	7405 W	Seaside Park
Clam Island	403 007	3946 N	7408 W	Forked River
Corson Inlet	403 064	3913 N	7439 W	Sea Isle City
Cowpens Island	403 061	3917 N	7435 W	Ocean City
Dead Thorofare	403 079	3902 N	7448 W	Stone Harbor
Egg Island	403 017	3938 N	7413 W	Ship Bottom
Elder Island - Brigantine Channel	403 036	3926 N	7421 W	Brigantine Inlet
Expressway	403 052	3922 N	7427 W	Atlantic City
Flat Creek	403 066	3911 N	7441 W	Sea Isle City
Flat Island	403 016	3938 N	7412 W	Ship Bottom
Gateway - Sandy Hook	378 065	4028 N	7401 W	Sandy Hook
Goodluck Sedge	403 030	3933 N	7418 W	Tuckerton
Goosebar Sedge	403 031	3932 N	7417 W	Tuckerton
Great Flat	403 075	3903 N	7448 W	Stone Harbor
Great Thorofare, Brigantine Refuge	403 035	3929 N	7421 W	Brigantine Inlet
Gulf Island	403 010	3944 N	7410 W	Ship Bottom
Gull Island	403 071	3905 N	7446 W	Stone Harbor
Gull Island, Ludlam Thorofare	403 068	3903 N	7443 W	Sea Isle City
Ham Island	403 018	3936 N	7413 W	Beach Haven
Hammock Cove Island, Brigantine Refuge	403 037	3928 N	7424 W	Oceanville
Hither Island	403 028	3934 N	7417 W	Tuckerton

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
NEW JERSEY (continued)				
Holgate Beach, Brigantine Refuge	403 033	3931 N	7417 W	Tuckerton
Islajo Island	403 042	3925 N	7426 W	Oceanville
Jarvis Sound - Wildwood Crest	428 006	3858 N	7451 W	Cape May
Kearney	377 001	4046 N	7405 W	Weehawken
Lavallette	403 002	3959 N	7405 W	Seaside Park
Little Beach Island, Brigantine Refuge	403 034	3928 N	7419 W	Brigantine Inlet
Little Island	403 021	3935 N	7416 W	Tuckerton
Log Creek	403 014	3941 N	7411 W	Ship Bottom
Longport	403 059	3918 N	7433 W	Ocean City
Loop Sedge	403 011	3944 N	7409 W	Ship Bottom
Low Water Thorofare	403 046	3924 N	7426 W	Oceanville
Ludlam Beach	403 067	3910 N	7441 W	Sea Isle City
Margate	403 058	3920 N	7431 W	Ocean City
Marshelder Island	403 019	3935 N	7414 W	Beach Haven
Mid Buster	403 004	3948 N	7406 W	Barnegat Light
Middle Island	403 027	3934 N	7417 W	Tuckerton
Middle Sedge	403 023	3934 N	7417 W	Tuckerton
Mordecai Island	403 022	3933 N	7415 W	Tuckerton
Muddy Hole	403 073	3904 N	7446 W	Stone Harbor
Mulberry	403 056	3920 N	7432 W	Ocean City
Nummy Island	403 076	3902 N	7448 W	Stone Harbor
Obes Thorofare	403 040	3925 N	7422 W	Oceanville
Ortley Beach Marsh	403 003	3957 N	7405 W	Seaside Park
Oyster Thorofare	403 041	3926 N	7424 W	Oceanville
Parker Island	403 020	3934 N	7415 W	Beach Haven
Peck Bay	403 062	3916 N	7437 W	Ocean City
Perch Cove, Brigantine Refuge	403 038	3928 N	7423 W	Oceanville
Peter Beach	403 049	3924 N	7426 W	Oceanville
Point Bar Thorofare	403 047	3924 N	7427 W	Oceanville
Port Newark	377 002	4042 N	7408 W	Elizabeth
Ring Island	403 074	3903 N	7447 W	Stone Harbor
Risley Channel	403 057	3920 N	7433 W	Ocean City
Sandy Hook North	377 006	4029 N	7401 W	Sandy Hook
Sandy Island	403 012	3942 N	7409 W	Ship Bottom
Seven Islands	403 032	3931 N	7420 W	Tuckerton
Shooters Island	377 003	4038 N	7409 W	Elizabeth
Somers Bay - Wading Thorofare	403 045	3925 N	7424 W	Oceanville
Somers Point	403 060	3918 N	7436 W	Ocean City
South Barrel Island	403 026	3933 N	7417 W	Tuckerton
South Cape May Beach	428 007	3850 N	7450 W	Cape May
South Clam Island	403 008	3945 N	7408 W	Forked River
Stake Thorofare, Brigantine Refuge	403 044	3924 N	7425 W	Oceanville
Stingaree/Shaw Cutoff	428 001	3859 N	7451 W	Wildwood

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
NEW JERSEY (continued)				
Stites Creek	428 002	3859 N	7451 W	Wildwood
Stone Harbor	403 077	3902 N	7446 W	Stone Harbor
Stone Harbor - Lower 7 Mile Beach	403 078	3903 N	7445 W	Stone Harbor
Story Island	403 029	3934 N	7418 W	Tuckerton
Strathmere Marsh	403 065	3911 N	7440 W	Sea Isle City
Sturgeon Island	403 072	3905 N	7446 W	Stone Harbor
Swain Channel	428 003	3858 N	7452 W	Wildwood
Taugh Creek	403 080	3901 N	7449 W	Stone Harbor
Townsends Inlet Marsh	403 069	3908 N	7443 W	Sea Isle City
Ventor Beach	403 055	3921 N	7430 W	Ocean City
Vol Sedge	403 009	3945 N	7407 W	Long Beach
Weakfish Creek	403 063	3913 N	7439 W	Sea Isle City
Whirlpool Island	403 054	3921 N	7431 W	Ocean City
Wildwood - 2 Mile Beach	428 005	3859 N	7449 W	Wildwood
DELAWARE				
Big Piney Island	428 012	3840 N	7507 W	Rehoboth Beach
Big Reedy Island	428 013	3838 N	7505 W	Rehoboth Beach
Broadkill Beach	428 008	3849 N	7512 W	Lewes
Bush Island	428 014	3838 N	7505 W	Rehoboth Beach
Cape Henlopen State Park	428 010	3848 N	7506 W	Cape Henlopen
Delaware Beaches State Park	428 015	3841 N	7504 W	Rehoboth Beach
Delaware City - Augustine Creek	403 082	3930 N	7537 W	Delaware City
Indian River Yacht Club	428 017	3836 N	7504 W	Bethany Beach
Marsh Island	428 011	3840 N	7507 W	Fairmount
Milton	428 009	3848 N	7516 W	Milton
Pea Patch Island	403 081	3935 N	7534 W	Delaware City
Rack Turn Point Island	428 018	3836 N	7504 W	Bethany Beach
Sand Island	428 016	3836 N	7506 W	Bethany Beach
MARYLAND				
Adam Island	427 009	3808 N	7605 W	Bloodsworth Island
Bloodsworth Island	427 008	3809 N	7603 W	Bloodsworth Island
Cabin John Creek	403 083	3927 N	7557 W	Earlville
Canoe Neck Creek	427 003	3815 N	7644 W	Leonardtown
Cedar Islands	428 032	3802 N	7517 W	Boxiron
Deal Island Wildlife Management Area	428 036	3810 N	7553 W	Deal Island
Eastern Neck	402 002	3901 N	7612 W	Langford Creek
Ewell	452 005	3759 N	7602 W	Ewell
Fish Island	428 035	3808 N	7552 W	Deal Island
Hog Neck	452 004	3757 N	7602 W	Ewell

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
MARYLAND (continued)				
Holland Island	427 010	3807 N	7605 W	Kedges Straits
Horsehead Tump	428 031	3803 N	7517 W	Boxiron
Islands Near Buoy 13	428 022	3817 N	7507 W	Ocean City
Islands South of South Point	428 023	3812 N	7512 W	Tingles Island
Isle of Wight Bay	428 019	3821 N	7505 W	Ocean City
Lumber Marsh	428 024	3811 N	7509 W	Tingles Island
Martin Refuge - Northwest	427 012	3802 N	7602 W	Kedges Straits
Martin Refuge - Terrapin Sand Point	428 038	3801 N	7559 W	Terrapin Sand Point
Middle Hooper Island	427 007	3814 N	7609 W	Richland Point
Mink Tump	428 029	3804 N	7519 W	Boxiron
Nelson Island	427 002	3842 N	7617 W	Tilghman
Ocean City - Fenwick Island	428 020	3820 N	7505 W	Ocean City
Outward Tump	428 025	3811 N	7512 W	Tingles Island
Piney Island	428 039	3806 N	7555 W	Terrapin Sand Point
Piney Point	427 004	3909 N	7630 W	Piney Point
Pirate Islands	428 027	3806 N	7514 W	Whittington Point
Pooles Island	402 001	3916 N	7616 W	Gunpowder Neck
Poplar Island	427 001	3846 N	7523 W	Claiborne
Ready Cove Tump	428 028	3805 N	7518 W	Boxiron
Robins Marsh	428 026	3809 N	7514 W	Tingles Island
Sand Point, Barren Island	427 006	3819 N	7615 W	Barren Island
Smith Island 4	452 002	3758 N	7602 W	Ewell
South Marsh Island	427 011	3806 N	7601 W	Kedges Straits
Spoil Buoy 11	428 021	3817 N	7507 W	Ocean City
St. Pierre Island	428 037	3808 N	7551 W	Monie
Striking Marsh	428 030	3803 N	7516 W	Boxiron
Tar Bay	427 005	3822 N	7616 W	Barren Island
Tylerton/Kelly Island	452 003	3758 N	7601 W	Ewell
VIRGINIA				
Big Easter Marsh	453 037	3720 N	7547 W	Cobb Island
Burtons Bay (So.) Marsh	453 018	3736 N	7538 W	Wachapreague
Calfpen Island	428 034	3800 N	7518 W	Boxiron
Cedar Island	453 013	3740 N	7535 W	Metomkin Inlet
Cedar Island - South	453 015	3735 N	7537 W	Wachapreague
Chesconessex	453 058	3746 N	7546 W	Chesconessex
Chimney Pole Marsh	453 027	3728 N	7542 W	Quinby Inlet
Clubhouse Point	453 020	3735 N	7538 W	Wachapreague
Coards Marshes	453 001	3759 N	7519 W	Chincoteague East
Cobb Island	453 043	3719 N	7545 W	Great Machipongo Inlet
Crisfield	453 056	3754 N	7546 W	Crisfield

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
VIRGINIA (continued)				
Dawson Shoals	453 019	3735 N	7536 W	Wachapreague
Dutchman Point	452 006	3720 N	7619 W	New Point Comfort
Eckichy Marsh	453 038	3719 N	7552 W	Cobb Island
Egging Marsh	453 025	3727 N	7543 W	Quinby Inlet
Fishermans Island	453 051	3706 N	7558 W	Fishermans Island
Folly Creek	453 012	3741 N	7535 W	Metomkin Inlet
Gargathy Beach	453 008	3746 N	7532 W	Bloxom
Grand View	452 009	3706 N	7617 W	Hampton
Great Channel	453 014	3737 N	7538 W	Accomac
Great Fox Island	453 057	3754 N	7554 W	Great Fox Island
Great Gut Cove	453 017	3737 N	7536 W	Wachapreague
Gull Marsh 1	453 033	3723 N	7548 W	Nassawadox
Gull Marsh 2	453 034	3721 N	7547 W	Cobb Island
Halfmoon Island	453 059	3749 N	7545 W	Parksley
Hampton	452 010	3700 N	7621 W	Hampton
Herring Island	452 001	3754 N	7601 W	Ewell
High Shoal Marsh	453 029	3726 N	7544 W	Quinby Inlet
Hodges Narrows	453 026	3726 N	7542 W	Quinby Inlet
Hog Island	453 030	3725 N	7542 W	Quinby Inlet
Hog Island Bay 1	453 028	3726 N	7544 W	Quinby Inlet
Hummock Channel	453 016	3737 N	7539 W	Wachapreague
Jamesville 1	453 060	3736 N	7555 W	Jamesville
Jamesville 2	453 061	3736 N	7555 W	Jamesville
Jamesville 3	453 062	3735 N	7555 W	Jamesville
Jamesville 4	453 063	3733 N	7557 W	Jamesville
Little Cobb Island	453 039	3718 N	7547 W	Cobb Island
Little Easter Marsh	453 036	3720 N	7546 W	Cobb Island
Little Fox Island	453 053	3752 N	7554 W	Tangier Island
Man and Boy Marsh	453 041	3717 N	7550 W	Cobb Island
Metomkin Island - North	453 009	3745 N	7532 W	Metomkin Inlet
Metomkin Island - South	453 010	3741 N	7534 W	Metomkin Inlet
Metomkin Island, South Marsh	453 011	3741 N	7535 W	Metomkin Inlet
Millstone Creek Marsh	453 021	3735 N	7540 W	Wachapreague
Myrtle Island Beach	453 046	3712 N	7549 W	Ship Shoal Inlet
Nandua Creek	453 064	3738 N	7554 W	Nandua Creek
New Point Comfort	452 007	3718 N	7616 W	New Point Comfort
Parchaby Tump	453 035	3722 N	7546 W	Cobb Island
Parramore Island	453 024	3729 N	7539 W	Quinby Inlet
Queen Sound Channel	453 003	3756 N	7525 W	Chincoteague West
Rapesian Tump	453 040	3718 N	7550 W	Cobb Island
Ramshorn Bay	453 032	3723 N	7551 W	Nassawadox
Red Drum Marsh	453 045	3714 N	7549 W	Ship Shoal Inlet
Rogue Island	453 031	3723 N	7544 W	Quinby Inlet
Sandy Island Marsh	453 023	3729 N	7543 W	Wachapreague
Shelly Bay	453 004	3755 N	7526 W	Chincoteague West

(Continued)

Table D1. (Continued)

Colony site name	Colony site no.	Latitude	Longitude	Quadrangle
VIRGINIA (continued)				
Ship Shoal Channel Marsh	453 047	3711 N	7534 W	Ship Shoal Inlet
Ship Shoal Island	453 044	3714 N	7548 W	Ship Shoal Inlet
Skidmore Island	453 052	3708 N	7555 W	Townsend
Smith Island Beach - Middle	453 049	3709 N	7552 W	Ship Shoal Inlet
Smith Island Beach - North	453 048	3710 N	7550 W	Ship Shoal Inlet
Smith Island Beach - South	453 050	3707 N	7554 W	Fishermans Island
Swash Bay - Major Hole Marsh	453 022	3731 N	7541 W	Wachapreague
Tangier Island	453 055	3748 N	7559 W	Tangier Island
Thurf Marsh Island	453 002	3758 N	7519 W	Chincoteague East
Toby Island	428 033	3801 N	7517 W	Boxiron
Urbanna	452 008	3743 N	7638 W	Urbanna
Walker Marsh	453 006	3754 N	7527 W	Chincoteague West
Wallops Island	453 007	3752 N	7526 W	Chincoteague West
Watts Island	453 054	3749 N	7554 W	Tangier Island
Willis Marsh	453 005	3754 N	7526 W	Chincoteague West
Wreck Island	453 042	3716 N	7548 W	Cobb Island

APPENDIX E

Table E1. Breeding Species in Maine (Cape Elizabeth-South), 1977

Species	Colony site no.	Colony site no.	Nesting pairs
Double-crested Cormorant			
	296 052	Duck Island	400
	296 041	Eagle Island	196
	296 050	Bumpkin Island	171
	296 036	Ram Island	43
	296 038	Bluff Island	17
Little Blue Heron			
	296 037	Stratton Island	3
	324 001	Appledore Island	1
Snowy Egret			
	324 001	Appledore Island	50
	296 043	Wood Island	28
	296 037	Stratton Island	6
Louisiana Heron			
	296 037	Stratton Island	1
Black-crowned Night Heron			
	296 043	Wood Island	21
	324 001	Appledore Island	10
	296 037	Stratton Island	5
	296 049	Green Island	2
Glossy Ibis			
	296 043	Wood Island	33
	324 001	Appledore Island	30
	296 037	Stratton Island	12
Great Black-backed Gull			
	324 002	Smuttynose Island	960
	296 052	Duck Island	800
	324 001	Appledore Island	366
	296 038	Bluff Island	360
	296 043	Wood Island	300
	296 041	Eagle Island	210
	296 037	Stratton Island	150

(Continued)

Table E1. (Concluded)

Species	Colony site no.	Colony site no.	Nesting pairs
Great Black-backed Gull (continued)			
	296 036	Ram Island	43
	296 050	Bumpkin Island	32
	296 046	Gooseberry Island	16
	296 048	Folly Island	11
	324 003	Cedar Island	10
	296 044	Stage Island	8
	296 045	Negro Island	6
	296 051	Clarks Island	6
	296 042	Ram Island	2
Herring Gull			
	324 001	Appledore Island	2,274
	324 002	Smuttynose Island	1,800
	296 037	Stratton Island	1,200
	296 043	Wood Island	900
	296 051	Clarks Island	579
	296 038	Bluff Island	540
	296 044	Stage Island	385
	296 036	Ram Island	380
	296 048	Folly Island	356
	296 050	Bumpkin Island	285
	296 049	Green Island	283
	296 041	Eagle Island	240
	296 052	Duck Island	180
	296 046	Gooseberry Island	169
	296 045	Negro Island	85
	324 003	Cedar Island	50
	296 042	Ram Island	45
Common Tern			
	296 047	Beach Island, Biddeford	152
	296 039	West Goose Rocks	45
Roseate Tern			
	296 047	Beach Island, Biddeford	25
Least Tern			
	296 040	Goose Rocks Beach	14
Black Guillemot			
	324 002	Smuttynose Island	3

APPENDIX F

Table F1. Breeding Species in New Hampshire, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Double-crested Cormorant	324 005	Lunging Island - Square Rock	24
Great Black-backed Gull	324 005	Lunging Island - Square Rock	76
	324 004	Star Island	15
Herring Gull	324 005	Lunging Island - Square Rock	225
	324 004	Star Island	125
	324 006	White Island	Possible

APPENDIX G

Table G1. Breeding Species in Massachusetts, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Leach's Storm Petrel	352 042	Penikese Island	20
Double-crested Cormorant	352 019	Weepecket Islands	435
	324 044	Little Calf Island	301
	324 049	Shag Rocks	288
	324 020	Milk Island	246
	324 036	Island South of Cat Island	180
	324 040	Egg Rock	160
	324 016	Great Egg Rock	65
	324 037	Marblehead Rock	50
	324 017	Dry Salvages	18
	324 013	Normans Woe	11
	324 033	South Gooseberry Island	6
Green Heron	324 060	Long Point - Wood End	1
Little Blue Heron	352 047	Big Ram Island, Westport	6
	352 017	Dead Neck - Sampson Island	5
	324 023	House Island	5
	324 059	Clarks Island	3
Cattle Egret	324 023	House Island	10
Great Egret	324 059	Clarks Island	3
	352 017	Dead Neck - Sampson Island	2
	324 023	House Island	1
Snowy Egret	324 023	House Island	220
	324 059	Clarks Island	68
	352 031	Little Neck, Martha's Vineyard	36
	324 052	Peddocks Island	35
	352 017	Dead Neck - Sampson Island	30
	324 051	Spectacle Island	24
	352 024	Quaise, Nantucket	13
	352 047	Big Ram Island, Westport	11
	352 038	Lobsterville, Martha's Vineyard	10
	352 029	Cape Poge Light, Martha's Vineyard	10
	352 019	Weepecket Islands	1
	352 025	Madaket, Nantucket	1
Louisiana Heron	324 023	House Island	1

(Continued)

Table G1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Black-crowned Night Heron	324 023	House Island	600
	352 025	Madaket, Nantucket	400
	352 017	Dead Neck - Sampson Island	231
	324 052	Peddocks Island	150
	352 031	Little Neck, Martha's Vineyard	135
	352 038	Lobsterville, Martha's Vineyard	114
	352 024	Quaise, Nantucket	90
	324 059	Clarks Island	65
	352 047	Big Ram Island	40
	324 060	Long Point - Wood End	40
	352 029	Cape Poge Light, Martha's Vineyard	35
	352 041	Nashawena Island	25
	324 047	Middle Brewster Island	20
	324 051	Spectacle Island	13
Glossy Ibis	324 023	House Island	107
	324 059	Clarks Island	5
	324 052	Peddocks Island	Possible
Common Eider	352 041	Nashawena Island	1
Great Black-backed Gull	352 016	Monomoy Island	900
	324 020	Milk Island	600
	352 021	Coatue, Nantucket	550
	352 028	Muskeget Island	350
	352 042	Penikese Island, Martha's Vineyard	300
	324 019	Thacher Island	275
	352 027	Tuckernuck Island	100
	324 035	Cat Island	100
	324 018	Straitsmouth Island	90
	352 030	Cape Poge Elbow, Martha's Vineyard	86
	324 039	Ram Island	85
	324 059	Clarks Island	80
	352 026	Esther Island	70
	324 055	Brush Island	68
	352 029	Cape Poge Light, Martha's Vineyard	62
	324 015	Graves Island	60
	324 040	Egg Rock	60
	324 046	Outer Brewster Island	60
	324 014	Kettle Island	52
	324 023	House Island	50
	324 037	Marblehead Rock	50
	324 051	Spectacle Island	50
	324 060	Long Point - Wood End	50
	352 033	Norton Neck, Martha's Vineyard	50

(Continued)

Table G1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Great Black-backed Gull (continued)	324 047	Middle Brewster Island	48
	352 038	Lobsterville, Martha's Vineyard	45
	324 043	Green Island	40
	324 045	Calf Island	40
	324 031	Eagle Island	36
	324 054	Black Rocks	25
	352 019	Weepecket Islands	25
	324 033	South Gooseberry Island	20
	352 015	Monomoy - North	20
	352 043	Ram Island, Buzzards Bay	20
	324 048	Great Brewster Island	17
	352 017	Dead Neck - Sampson Island	17
	324 012	Tenpound Island	15
	324 022	Ram Islands	15
	324 032	North Gooseberry Island	15
	324 021	Rock Dundy	11
	324 025	Great Misery Island	10
	324 026	Little Misery Island	10
	352 039	Nomans Land, Martha's Vineyard	10
	324 036	Island South of Cat Island	9
	324 016	Great Egg Rock	5
	324 024	Chubb Island	5
	324 049	Shag Rocks	5
	352 002	North Sandwich	5
	324 028	Coney Island	2
	324 030	Great Haste Island	2
Herring Gull	352 016	Monomoy Island	4,900
	324 020	Milk Island	2,080
	352 042	Penikese Island	1,650
	324 019	Thacher Island	1,600
	324 060	Long Point - Wood End	1,250
	352 021	Coatue, Nantucket	1,250
	352 033	Norton Neck, Martha's Vineyard	1,000
	324 018	Straitsmouth Island	940
	352 028	Muskeget Island	900
	324 046	Outer Brewster Island	750
	324 059	Clarks Island	735
	352 041	Nashawena Island	675
	324 051	Spectacle Island	650
	352 027	Tuckernuck Island	650
	352 029	Cape Poge Light, Martha's Vineyard	556

(Continued)

Table G1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Herring Gull (continued)	324 047	Middle Brewster Island	535
	352 019	Weepecket Islands	450
	352 038	Lobsterville, Martha's Vineyard	400
	324 035	Cat Island	391
	324 023	House Island	350
	352 043	Ram Island, Buzzards Bay	350
	352 026	Esther Island	290
	324 014	Kettle Island	261
	352 017	Dead Neck - Sampson Island	220
	324 039	Ram Island	200
	324 031	Eagle Island	177
	324 040	Egg Rock	175
	352 015	Monomoy - North	175
	324 015	Graves Island	160
	324 054	Black Rocks	155
	352 002	North Sandwich	155
	324 043	Green Island	140
	324 016	Great Egg Rock	135
	324 048	Great Brewster Island	130
	352 034	Sarson Island, Martha's Vineyard	130
	324 013	Normans Woe	120
	324 045	Calf Island	100
	324 050	Gallops Island	85
	324 025	Great Misery Island	80
	324 037	Marblehead Rock	80
	352 030	Cape Poge Elbow, Martha's Vinyeard	75
	324 036	Island South of Cat Island	70
	324 026	Little Misery Island	60
	324 028	Coney Island	60
	352 039	Nomans Land, Martha's Vineyard	60
	324 030	Great Haste Island	50
	324 034	Grays Rock	50
	324 044	Little Calf Island	50
	324 021	Rock Dundy	48
	324 012	Tenpound Island	45
	324 022	Ram Islands	40
	324 032	North Gooseberry Island	40
	324 055	Brush Island	35
	324 009	Plum Island	29
	324 056	Gull Island	26
	324 049	Shag Rocks	25
	324 033	South Gooseberry Island	20
	324 029	Pope Head	16

(Continued)

Table G1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Herring Gull (continued)	324 024	Chubb Island	8
	324 007	Woodbridge Island	4
	324 027	Bakers Island	4
Laughing Gull	352 015	Monomoy - North	200
Common Tern	352 015	Monomoy - North	2,100
	352 045	Bird Island	400
	352 001	Plymouth Beach	375
	352 010	Nauset - New Island	350
	352 007	Grays Beach, Yarmouth	300
	324 007	Woodbridge Island	245
	324 041	Pleasure Bay	120
	324 038	Tinkers Island	111
	352 017	Dead Neck - Sampson Island	50
	352 008	West Dennis	45
	352 044	Fish Island, Buzzards Bay	44
	324 042	Snake Island	40
	352 039	Nomans Land, Martha's Vineyard	40
	352 041	Nashawena Island	40
	352 004	Craigville, East Bay	35
	324 053	Hog Island Pier	30
	352 035	Sylvia Beach, Martha's Vineyard	30
	352 006	Sandy Neck	20
	324 060	Long Point - Wood End	17
	324 008	Jericho Creek	15
	324 010	Roger Island	15
	352 009	Nauset - Orleans	11
	324 009	Plum Island	10
	352 002	North Sandwich	10
	352 031	Little Neck, Martha's Vineyard	7
	324 011	Crane Beach	4
	352 003	Scorton Creek	3
	352 020	Great Point, Nantucket	3
	352 030	Cape Poge Elbow, Martha's Vineyard	3
	352 048	Acoaxet	2
Arctic Tern	352 039	Nomans Land, Martha's Vineyard	40
	324 015	Monomoy - North	10
	324 038	Tinkers Island	7
	352 009	Nauset - Orleans	7
	352 001	Plymouth Beach	5
	352 010	Nauset - New Island	3
	352 007	Grays Beach, Vermouth	1

(Continued)

Table G1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Roseate Tern	352 045	Bird Island	900
	352 015	Monomoy - North	400
	352 001	Plymouth Beach	12
	352 007	Grays Beach, Yarmouth	7
	352 039	Nomans Land, Martha's Vineyard	5
	352 010	Nauset - New Island	3
Least Tern	352 009	Nauset - Orleans	330
	352 023	Siasconset, Nantucket	145
	352 020	Great Point, Nantucket	130
	352 018	South Cape Beach - Waquoit	110
	324 011	Crane Beach	75
	324 060	Long Point - Wood End	69
	324 058	Duxbury Beach	65
	352 032	Wasque Point, Martha's Vineyard	65
	352 003	Scorton Creek	60
	352 013	Nauset - Chatham	55
	352 040	Tashmoo, Martha's Vineyard	50
	324 063	High Head	41
	352 046	Barneys Joy, Allens Neck	36
	324 062	Race Point Coast Guard Station	33
	352 008	West Dennis	32
	352 005	Dunbar Point, Lewis Bay	30
	352 027	Tuckernuck Island	30
	352 002	North Sandwich	25
	352 041	Nashawena Island	25
	352 004	Craigville, East Bay	22
	352 038	Lobsterville, Martha's Vineyard	20
	352 035	Sylvia Beach, Martha's Vineyard	16
	352 036	Watcha Ponds, Martha's Vineyard	15
	352 001	Plymouth Beach	12
	352 014	Harding Beach	12
	324 061	Race Point Light	11
	324 057	Scituate	10
	352 037	Black Point Pond, Martha's Vineyard	9
	352 012	Marconi Beach	8
	352 022	Quidnet, Nantucket	5
	352 011	Nauset - Eastham	3
	352 017	Dead Neck - Sampson Island	2

APPENDIX H

Table H1. Breeding Species in Rhode Island, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Green Heron	352 055	Gould Island	1
	352 081	Bills Island	1
Little Blue Heron	352 060	Hope Island	35
	352 055	Gould Island	Possible
Cattle Egret	352 060	Hope Island	110
Great Egret	352 055	Gould Island	22
	352 060	Hope Island	Possible
Snowy Egret	352 060	Hope Island	180
	352 086	Block Island, North End	Possible
Black-crowned Night Heron	352 060	Hope Island	451
	352 086	Block Island, North End	50
	352 055	Gould Island	14
	352 081	Bills Island	2
Glossy Ibis	352 060	Hope Island	160
Great Black-backed Gull	352 051	Sakonnet Point	162
	352 084	Sandy Point-Napatree Point	150
	352 086	Block Island, North End	90
	352 060	Hope Island	70
	352 065	The Dumplings	39
	352 064	Rose Island	15
	352 061	Dyer Island	5
	352 059	Gooseberry Island	4
	352 071	Island West of Price Neck	2
	352 053	Cormorant Rock	1
	352 067	Gull Rock	1
	352 069	Gooseberry Island	1
	352 062	Gould Island	Possible
	352 066	Ft. Wetherill	Possible
Herring Gull	352 084	Sandy Point-Napatree Point	1,900
	352 086	Block Island, North End	1,750
	352 060	Hope Island	1,000
	352 051	Sakonnet Point	556
	352 061	Dyer Island	250

(Continued)

Table H1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Herring Gull (continued)	352 064	Rose Island	250
	352 069	Gooseberry Island	110
	352 065	The Dumplings	82
	352 071	Island West of Price Neck	62
	352 067	Gull Rock	43
	352 062	Gould Island	6
	352 063	Gull Rocks	3
	352 058	Round Rock	2
	352 053	Cormorant Rock	1
	352 055	Gould Island	1
Common Tern	352 075	Wickford Harbor	100
	352 056	Hog Island	55
	352 070	East Price Neck	50
	352 080	Nigiquet	48
	352 052	Island Rocks, Sachuest	44
	352 079	Trustom Pond	44
	352 077	Potters Pond	41
	352 068	Baileys Beach Rock	38
	352 085	Horace Island	37
	352 063	Gull Rocks	32
	352 050	Briggs Beach - Marsh	23
	352 076	Mackeral Cove	19
	352 066	Ft. Wetherill	15
	352 074	Quonset Point	13
	352 053	Cormorant Rock	12
	352 073	Allen Harbor	6
	352 054	Spar Island	5
	352 057	Despair Island	3
	352 082	Quonochontaug Pond	3
	352 061	Dyer Island	1
	352 049	Long Pond	Possible
	352 072	East Providence	Possible
Roseate Tern	352 085	Horace Island	1
	352 052	Island Rocks, Sachuest	Possible
	352 053	Cormorant Rock	Possible
	352 068	Baileys Beach Rock	Possible
	352 070	East Price Neck	Possible
Least Tern	352 078	East Matunuck	37
	352 083	Misquamicut	9
	352 050	Briggs Beach - Marsh	1
	352 074	Quonset Point	Possible

APPENDIX I

Table I1. Breeding Species in Connecticut, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Green Heron	352 087	Barn Island	10
	351 040	Chimon Island	5
Little Blue Heron	351 040	Chimon Island	1
Cattle Egret	351 040	Chimon Island	4
Great Egret	351 040	Chimon Island	20
Snowy Egret	351 040	Chimon Island	50
Black-crowned Night Heron	351 040	Chimon Island	400
	351 030	Milford Point	6
Yellow-crowned Night Heron	351 040	Chimon Island	Possible
Glossy Ibis	351 040	Chimon Island	10
Great Black-backed Gull	351 040	Chimon Island	60
	352 091	Gates Island	25
	351 039	Grassy Island	24
	351 009	Long Ledge	12
	351 025	Spectacle Island	10
	351 015	Goose Island	8
	352 092	Ram Island	8
	351 028	Middle Rock	6
	351 027	White Top Rock	4
	351 023	Green Island	2
	351 034	Goose Island	2
	352 090	Whaleback Rock	2
	351 016	Smith Island	1
Herring Gull	351 040	Chimon Island	1,850
	351 039	Grassy Island	240
	351 015	Goose Island	153
	351 009	Long Ledge	130
	351 025	Spectacle Island	120
	352 091	Gates Island	100

(Continued)

Table 11. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Herring Gull (continued)	352 092	Ram Island	80
	351 036	Copps Island	60
	352 090	Whaleback Rock	46
	351 035	East White Rock	44
	351 010	Long Rock, Black Point	42
	351 023	Green Island	38
	351 020	Belden Island	33
	351 027	White Top Rock	30
	351 038	Betts Island	30
	351 022	St. Helena Island	28
	351 041	Calf Pasture Island	28
	351 017	Narrows Island	18
	351 037	Crow Island	14
	351 028	Middle Rock	12
	352 089	Whale Rock	7
	351 024	Foot Rocks	6
	351 034	Goose Island	6
	351 042	Sheffield Island	6
	351 016	Smith Island	3
	351 019	Lewis Island	3
	351 021	Burr Island	2
	351 026	Cedar Island	2
	351 043	Long Beach Island	2
	351 011	North Brother	1
Common Tern	351 014	Falkner Island	1,100
	351 006	Shore Rock, Ocean Point	135
	351 007	Waterford Island	73
	351 011	North Brother	40
	351 018	Frisbie Island	32
	351 013	Gull Rock	28
	351 029	Big Mermaid Rock	26
	351 005	Black Rock, Avery Point	22
	352 088	Lyddy Island	17
	351 008	Wigwam Rock	3
	351 043	Long Beach Island	3
Roseate Tern	351 014	Falkner Island	50
	351 007	Waterford Island	11
	351 006	Shore Rock, Ocean Point	3
Least Tern	351 012	Menunketesuck Island	50
	351 033	Long Beach	36
	351 031	Lordship	34
	351 032	Point No Point	Possible

APPENDIX J

Table J1. Breeding Species in New York, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Double-crested Cormorant	352 094	Hungry Point, Fishers Island	65
Green Heron	378 001	Huckleberry Island	1
	378 034	Gilgo Beach and State Park	1
	378 054	Pearsalls Hassock	1
Little Blue Heron	378 034	Gilgo Beach and State Park	6
	352 093	East End, Fishers Island	4
	378 054	Pearsalls Hassock	2
	378 046	Meadowbrook Causeway	1
	351 045	Plum Island	Possible
	378 001	Huckleberry Island	Possible
Cattle Egret	378 062	Ruffle Bar, Jamaica Bay	15
Great Egret	378 043	Jones Beach, Lot 3 - Storehouse	140
	378 062	Ruffle Bar, Jamaica Bay	40
	378 039	Tobay Sanctuary and Beach	30
	378 054	Pearsalls Hassock	30
	378 034	Gilgo Beach and State Park	20
	378 001	Huckleberry Island	10
	378 032	Seganus Thatch	9
	378 046	Meadowbrook Causeway	9
	378 056	Lawrence	9
	378 051	Smith Meadow	6
	352 093	East End, Fishers Island	5
	378 004	Stoneybrook Harbor	4
	351 045	Plum Island	3
	378 050	South Pine Marsh	2
Snowy Egret	378 054	Pearsalls Hassock	227
	378 062	Ruffle Bar, Jamaica Bay	210
	378 051	Smith Meadow	165
	378 039	Tobay Sanctuary and Beach	160
	378 034	Gilgo Beach and State Park	136
	378 004	Stoneybrook Harbor	128
	378 046	Meadowbrook Causeway	115
	378 047	Jones Island (Toll Booth)	68

(Continued)

Table J1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Snowy Egret (continued)	378 063	Canarsie Pol, Jamaica Bay	35
	351 045	Plum Island	30
	378 001	Huckleberry Island	30
	378 032	Seganus Thatch	30
	378 056	Lawrence	30
	378 050	South Pine Marsh	25
	351 055	Gardiners Island	17
	352 093	East End, Fishers Island	8
	378 013	Robins Island	2
Louisiana Heron	378 051	Smith Meadow	4
	378 034	Gilgo Beach and State Park	2
	378 047	Jones Island (Toll Booth)	2
	378 056	Lawrence	2
	351 045	Plum Island	Possible
Black-crowned Night Heron	351 045	Plum Island	200
	378 004	Stoneybrook Harbor	160
	351 055	Gardiners Island	150
	378 062	Ruffle Bar, Jamaica Bay	130
	378 034	Gilgo Beach and State Park	125
	352 093	East End Fishers Island	109
	378 051	Smith Meadow	95
	378 013	Robins Island	80
	378 032	Seganus Thatch	60
	378 039	Tobay Sanctuary and Beach	55
	378 046	Meadowbrook Causeway	55
	378 001	Huckleberry Island	50
	378 028	East Fire Island	50
	378 047	Jones Island (Toll Booth)	50
	378 054	Pearsalls Hassock	50
	378 050	South Pine Marsh	35
	378 043	Jones Beach, Lot 3 - Storehouse	30
	378 056	Lawrence	25
	378 063	Canarsie Pol, Jamaica Bay	25
Yellow-crowned Night Heron	378 047	Jones Island (Toll Booth)	11
	378 051	Smith Meadow	4
	378 050	South Pine Marsh	3
	378 039	Tobay Sanctuary and Beach	2
	378 046	Meadowbrook Causeway	2
Glossy Ibis	378 062	Ruffle Bar, Jamaica Bay	310
	378 054	Pearsalls Hassock	260
	378 034	Gilgo Beach and State Park	77
	378 046	Meadowbrook Causeway	55

(Continued)

Table J1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Glossy Ibis (continued)	378 051	Smith Meadow	53
	378 047	Jones Island (Toll Booth)	48
	351 045	Plum Island	30
	378 039	Tobay Sanctuary and Beach	25
	378 032	Seganus Thatch	20
	378 056	Lawrence	16
	378 063	Canarsie Pol, Jamaica Bay	10
	378 050	South Pine Marsh	8
	351 055	Gardiners Island	2
	378 043	Jones Beach, Lot 3 - Storehouse	2
	352 093	East End, Fishers Island	1
Great Black-backed Gull	351 055	Gardiners Island	1,200
	351 056	Hicks Island	85
	378 063	Canarsie Pol, Jamaica Bay	85
	351 045	Plum Island	75
	378 062	Ruffle Bar, Jamaica Bay	55
	378 031	Captree Island	54
	378 019	Shinnecock Inlet - Bridge	46
	351 004	Flat Hammock	45
	351 003	South Dumpling	40
	352 093	East End, Fishers Island	33
	352 094	Hungry Point, Fishers Island	33
	378 020	Warner Islands	30
	378 024	Moriches Inlet	23
	378 043	Jones Beach, Lot 3 - Storehouse	20
	351 001	Hay Harbor	17
	351 002	North Dumpling	15
	377 005	Swinburne Island	7
	378 054	Pearsalls Hassock	7
	351 046	Cardiners Point	5
	378 049	Alder Island	5
	378 061	Little Egg Marsh	5
	378 029	Sexton Island	4
	378 030	Islip Spoil Island	2
	377 004	Hoffman Island	1
	378 001	Huckleberry Island	1
	378 028	East Fire Island	1
Herring Gull	351 055	Gardiners Island	4,000
	352 093	East End, Fishers Island	2,090
	378 063	Canarsie Pol, Jamaica Bay	2,050
	378 031	Captree Island	1,600
	378 043	Jones Beach, Lot 3 - Storehouse	1,000

(Continued)

Table J1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Herring Gull (continued)	378 062	Ruffle Bar, Jamaica Bay	1,000
	351 045	Plum Island	900
	377 005	Swinburne Island	620
	351 056	Hicks Island	500
	378 048	Loop Causeway	480
	378 024	Moriches Inlet	460
	351 003	South Dumpling	450
	378 054	Pearsalls Hassock	375
	378 061	Little Egg Marsh	330
	378 019	Shinnecock Inlet - Bridge	275
	351 002	North Dumpling	250
	377 004	Hoffman Island	210
	378 020	Warner Islands	200
	378 049	Alder Island	150
	351 001	Hay Harbor	110
	352 094	Hungry Point, Fishers Island	106
	378 028	East Fire Island	95
	378 029	Sexton Island	80
	378 060	Subway Island, Jamaica Bay	65
	378 030	Islip Spoil Island	22
	378 037	Island 1.3 miles NE Tobay Tower	12
	351 004	Flat Hammock	10
	378 001	Huckleberry Island	10
	378 042	East Crow Island	5
	351 046	Gardiners Point	3
	351 050	Cedar Point	1
Common Tern	351 044	Great Gull Island	2,000
	378 033	Cedar Beach	1,900
	378 045	Short Beach	1,523
	378 024	Moriches Inlet	890
	378 064	Breezy Point, Rockaway	620
	351 048	Southhold, Port of Egypt	575
	378 058	Jo Co Marsh, Jamaica Bay	320
	378 025	New Made Island	310
	351 055	Gardiners Island	248
	378 057	East High Meadow, Jamaica Bay	235
	378 021	Tiana Neck - Lanes Island	179
	378 059	Silver Hole Marsh, Jamaica Bay	175
	378 019	Shinnecock Inlet - Bridge	140
	378 052	North Cinder Island	120
	378 038	Middle Line Island	90
	351 053	Threemile Harbor	87
	351 056	Hicks Island	61
	378 020	Warner Islands	56
	378 037	Island 1.3 miles NE Tobay Tower	55

(Continued)

Table J1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Common Tern (continued)	378 055	South Green Sedge Island	55
	378 010	Birch Creek	50
	378 023	Sedge Island	50
	378 004	Stoneybrook Harbor	45
	351 046	Gardiners Point	29
	378 035	Wansers Island	24
	351 001	Hay Harbor	22
	378 036	Gilgo Island	21
	378 006	Port Jefferson	20
	378 053	Garrett Marsh	20
	378 002	Sand City, Eatons Neck	18
	378 031	Captree Island	17
	378 041	Cuba Island	17
	378 008	Red Cedar Point	13
	378 054	Pearsalls Hassock	13
	378 042	East Crow Island	6
	378 012	North Sea Harbor	5
	378 005	Nissequogue River	3
	378 011	Goose Creek Point	2
Roseate Tern	351 044	Great Gull Island	800
	378 033	Cedar Beach	25
	378 024	Moriches Inlet	19
	378 021	Tiana Neck - Lanes Island	5
	351 055	Gardiners Island	4
	351 048	Southhold, Port of Egypt	2
	351 056	Hicks Island	2
	378 019	Shinnecock Inlet - Bridge	2
	378 020	Warner Islands	2
Least Tern	378 002	Sand City, Eatons Neck	760
	378 034	Gilgo Beach and State Park	395
	378 008	Red Cedar Point	180
	378 027	Watch Hill, Fire Island	180
	378 004	Stoneybrook Harbor	167
	351 053	Threemile Harbor	163
	378 014	Bullhead Bay	100
	378 018	Mecox Inlet	81
	378 048	Loop Causeway	80
	378 040	Wantagh Causeway	70
	378 003	Lloyd Neck, Target Rock	69
	351 051	Northwest Harbor, Barcelona Neck	65
	351 055	Gardiners Island	57
	378 044	Jones Beach, Lot 1 - Meadowbrook	55
	378 064	Breezy Point, Rockaway	55
	378 006	Port Jefferson	53

(Continued)

Table J1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Least Tern (continued)	378 012	North Sea Harbor	40
	351 054	Acabonack Harbor	31
	378 022	Tiana Beach	31
	378 019	Shinnecock Inlet - Bridge	30
	378 009	Mill Creek	26
	378 021	Tiana Neck - Lanes Island	24
	351 050	Cedar Point	23
	352 095	Middle Farms Pond, Fishers Island	20
	378 016	Middle Pond, Shinnecock	20
	378 039	Tobay Sanctuary and Beach	20
	351 049	Cedar Beach Point	15
	378 026	Smith Point County Park	15
	351 052	Shelter Island	14
	378 015	New Suffolk - Cutchogue	12
	378 005	Nissequogue River	9
	351 047	Conkling Point/Greenport	8
	378 017	Georgica Pond	8
	378 007	Red Creek Pond	4
	351 056	Hicks Island	2
	378 010	Birch Creek	2
Black Skimmer	378 033	Cedar Beach	146
	378 045	Short Beach	138
	378 024	Moriches Inlet	75
	351 048	Southhold, Port of Egypt	26
	378 064	Breezy Point, Rockaway	20
	351 055	Cardiners Island	17
	378 021	Tiana Neck - Lanes Island	15
	378 019	Shinnecock Inlet - Bridge	3
	378 010	Birch Creek	2

APPENDIX K

Table K1. Breeding Species in New Jersey, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Great Blue Heron	377 006	Sandy Hook North	3
Green Heron	403 043	Big Heron Island	10
	428 004	Cape May Inlet	2
	403 006	Barnegat Head	1
	403 038	Broad Creek Marsh	1
Little Blue Heron	403 077	Stone Harbor	80
	403 043	Big Heron Island	40
	403 042	Islajo Island	21
	403 061	Cowpens Island	20
	403 069	Townsends Inlet Marsh	15
	403 006	Barnegat Head	14
	428 001	Stingaree/Shaw Cutoff	12
	403 044	Stake Thorofare, Brigantine Refuge	10
	403 024	Barrel Island	8
	403 031	Goosebar Sedge	6
	403 071	Gull Island	6
	403 055	Ventor Beach	4
	403 016	Flat Island	3
	428 004	Cape May Inlet	3
	403 045	Somers Bay - Wading Thorofare	2
	403 063	Weakfish Creek	2
	403 034	Little Beach Island, Brigantine Refuge	Possible
Cattle Egret	403 077	Stone Harbor	200
	428 001	Stingaree/Shaw Cutoff	200
	377 003	Shooters Island	70
	403 061	Cowpens Island	50
	403 071	Gull Island	20
	403 043	Big Heron Island	13
	403 042	Islajo Island	12
Great Egret	403 077	Stone Harbor	280
	403 034	Little Beach Island, Brigantine Refuge	56
	403 061	Cowpens Island	40
	403 043	Big Heron Island	23
	428 001	Stingaree/Shaw Cutoff	22

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Great Egret (continued)	403 027	Middle Island	18
	403 006	Barnegat Head	11
	403 016	Flat Island	11
	403 070	Avalon and Causeway	9
	403 032	Seven Islands	8
	428 004	Cape May Inlet	3
	403 042	Islajo Island	2
	403 069	Townsends Inlet Marsh	2
	377 003	Shooters Island	1
	403 045	Somers Bay - Wading Thorofare	1
	403 048	Broad Creek Marsh	1
	403 071	Gull Island	Possible
Snowy Egret	403 077	Stone Harbor	800
	403 042	Islajo Island	300
	403 061	Cowpens Island	300
	403 027	Middle Island	260
	403 069	Townsends Inlet Marsh	225
	428 001	Stingaree/Shaw Cutoff	200
	403 043	Big Heron Island	150
	403 071	Gull Island	110
	403 070	Avalon and Causeway	60
	403 034	Little Beach Island, Brigantine Refuge	57
	403 006	Barnegat Head	45
	403 024	Barrel Island	45
	403 016	Flat Island	35
	377 003	Shooters Island	30
	403 008	South Clam Island	30
	403 032	Seven Islands	30
	403 044	Stake Thorofare, Brigantine Refuge	30
	403 031	Goosebar Sedge	25
	403 063	Weakfish Creek	20
	403 045	Somers Bay - Wading Thorofare	10
	403 055	Ventor Beach	8
	403 037	Hammock Cove Island, Brigantine Refuge	7
	428 004	Cape May Inlet	5
	403 039	Black Point, Brigantine Refuge	1
Louisiana Heron	403 077	Stone Harbor	60
	403 043	Big Heron Island	30
	403 042	Islajo Island	17
	403 044	Stake Thorofare, Brigantine Refuge	17

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Louisiana Heron	403 069	Townsends Inlet Marsh	16
	403 027	Middle Island	14
	428 001	Stingaree/Shaw Cutoff	8
	403 032	Seven Islands	6
	403 061	Cowpens Island	6
	403 006	Barnegat Head	2
	403 071	Gull Island	2
Black-crowned Night Heron	403 077	Stone Harbor	375
	403 042	Islajo Island	135
	403 034	Little Beach Island, Brigantine Refuge	100
	428 004	Cape May Inlet	100
	403 031	Goosebar Sedge	90
	403 063	Weakfish Creek	65
	377 003	Shooters Island	50
	403 032	Seven Islands	50
	403 061	Cowpens Island	50
	403 070	Avalon and Causeway	50
	403 048	Broad Creek Marsh	45
	377 001	Kearney	40
	403 043	Big Heron Island	40
	403 055	Ventor Beach	40
	403 024	Barrel Island	35
	403 016	Flat Island	30
	403 037	Hammock Cove Island, Brigantine Refuge	30
	403 045	Somers Bay - Wading Thorofare	30
	428 001	Stingaree/Shaw Cutoff	30
	403 069	Townsends Inlet Marsh	20
	403 027	Middle Island	16
	403 038	Perch Cove, Brigantine Refuge	15
	403 006	Barnegat Head	8
	403 058	Margate	5
	403 039	Black Point, Brigantine Refuge	2
	403 071	Gull Island	2
Yellow-crowned Night Heron	403 077	Stone Harbor	40
	403 034	Little Beach Island, Brigantine Refuge	29
	403 061	Cowpens Island	15
	428 001	Stingaree/Shaw Cutoff	14
	403 048	Broad Creek Marsh	10
	403 055	Ventor Beach	8
	403 024	Barrel Island	6
	403 070	Avalon and Causeway	4
	428 004	Cape May Inlet	4

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Yellow-crowned Night Heron (continued)	403 027	Middle Island	3
	403 042	Islajo Island	2
	403 038	Perch Cove, Brigantine Refuge	1
	403 043	Big Heron Island	1
	403 058	Margate	1
	403 071	Gull Island	1
	403 069	Townsends Inlet Marsh	Possible
Glossy Ibis	428 001	Stingaree/Shaw Cutoff	900
	403 077	Stone Harbor	840
	403 061	Cowpens Island	250
	403 042	Islajo Island	240
	403 034	Little Beach Island, Brigantine Refuge	90
	428 004	Cape May Inlet	77
	403 071	Gull Island	70
	403 043	Big Heron Island	65
	403 016	Flat Island	40
	403 032	Seven Islands	40
	403 069	Townsends Inlet Marsh	40
	403 006	Barnegat Head	35
	403 045	Somers Bay - Wading Thorofare	31
	403 044	Stake Thorofare, Brigantine Refuge	30
	403 055	Ventor Beach	30
	403 070	Avalon and Causeway	25
	377 003	Shooters Island	21
	403 063	Weakfish Creek	15
	377 001	Kearney	5
Great Black-backed Gull	403 027	Middle Island	25
	403 076	Nummy Island	19
	403 053	Alex Island	11
	403 017	Egg Island	10
	403 075	Great Flat	10
	403 059	Longport	9
	403 007	Clam Island	8
	403 043	Big Heron Island	8
	403 057	Risley Channel	7
	403 013	Carvel Island	5
	403 061	Cowpens Island	5
	403 045	Somers Bay - Wading Thorofare	4
	403 011	Loop Sedge	3
	403 031	Goosebar Sedge	3
	403 036	Edler Island - Brigantine Channel	3
	403 044	Stake Thorofare; Brigantine Refuge	3

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Great Black-backed Gull (continued)	403 012	Sandy Island	2
	403 037	Hammock Cove Island, Brigantine Refuge	2
	403 042	Islajo Island	2
	403 046	Low Water Thorofare	2
	403 047	Point Bar Thorofare	2
	403 041	Oyster Thorofare	1
Herring Gull	403 027	Middle Island	1,700
	403 007	Clam Island	1,050
	403 043	Big Heron Island	375
	403 012	Sandy Island	310
	403 076	Nummy Island	290
	403 059	Longport	275
	403 044	Stake Thorofare, Brigantine Refuge	185
	403 013	Carvel Island	165
	403 047	Point Bar Thorofare	150
	403 057	Risley Channel	138
	403 011	Loop Sedge	130
	403 017	Egg Island	125
	403 061	Cowpens Island	125
	403 031	Goosebar Sedge	120
	403 042	Islajo Island	105
	403 075	Great Flat	105
	403 036	Elder Island - Brigantine Channel	75
	403 045	Somers Bay - Wading Thorofare	65
	403 026	South Barrel Island	60
	403 028	Hither Island	60
	403 072	Sturgeon Island	55
	403 069	Townsends Inlet Marsh	50
	403 034	Little Beach Island, Brigantine Refuge	47
	403 008	South Clam Island	32
	403 029	Story Island	30
	403 037	Hammock Cove Island, Brigantine Refuge	25
	403 009	Vol Sedge	15
	403 041	Oyster Thorofare	15
	403 023	Middle Sedge	12
	377 006	Sandy Hook North	9
	403 046	Low Water Thorofare	8
	403 073	Muddy Hole	4
	403 018	Ham Island	2
	428 006	Jarvis Sound - Wildwood Crest	1

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Laughing Gull	403 074	Ring Island	9,000
	403 035	Great Thorofare, Brigantine Refuge	5,730
	403 073	Muddy Hole	5,600
	403 008	South Clam Island	2,300
	403 075	Great Flat	2,100
	403 007	Clam Island	2,000
	403 054	Whirlpool Island	1,200
	403 053	Alex Island	950
	403 076	Nummy Island	950
	403 045	Somers Bay - Wading Thorofare	230
	428 002	Stites Creek	175
	403 046	Low Water Thorofare	100
	403 055	Ventor Beach	100
	403 068	Gull Island, Ludlam Thorofare	90
	428 003	Swain Channel	90
	403 059	Longport	85
	403 066	Flat Creek	55
	403 040	Obes Thorofare	40
	403 057	Risley Channel	39
	403 017	Egg Island	35
	403 062	Peck Bay	25
	403 023	Middle Sedge	14
	403 041	Oyster Thorofare	12
	403 072	Sturgeon Island	12
	403 080	Taugh Creek	8
Gull-billed Tern	403 036	Elder Island - Brigantine Channel	8
	403 001	Chadwick Marsh	5
	403 041	Oyster Thorofare	5
	428 006	Jarvis Sound - Wildwood Crest	1
Forster's Tern	428 003	Swain Channel	200
	403 035	Great Thorofare, Brigantine Refuge	175
	403 079	Dead Thorofare	35
	403 066	Flat Creek	25
	403 036	Elder Island - Brigantine Channel	17
	403 068	Gull Island, Ludlam Thorofare	11
Common Tern	403 002	Lavallette	900
	428 006	Jarvis Sound - Wildwood Crest	800
	403 001	Chadwick Marsh	340
	403 004	Mid Buster	300
	403 034	Little Beach Island, Brigantine Refuge	200

(Continued)

Table K1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Common Tern (continued)	403 040	Obes Thorofare	175
	403 056	Mulberry	150
	403 036	Elder Island - Brigantine Channel	130
	403 070	Avalon and Causeway	130
	403 080	Taugh Creek	110
	403 033	Holgate Beach, Brigantine Refuge	95
	403 062	Peck Bay	90
	403 014	Log Creek	70
	428 003	Swain Channel	70
	403 021	Little Island	65
	403 054	Whirlpool Island	65
	403 045	Somers Bay - Wading Thorofare	60
	403 010	Gulf Island	55
	403 057	Risley Channel	55
	403 065	Strathmere Marsh	55
	403 079	Dead Thorofare	55
	403 013	Carvel Island	50
	403 018	Ham Island	50
	403 024	Barrel Island	50
	403 059	Longport	40
	403 009	Vol Sedge	35
	403 041	Oyster Thorofare	35
	403 076	Nummy Island	35
	403 053	Alex Island	25
	403 022	Mordecai Island	24
	403 019	Marshelder Island	21
	403 023	Middle Sedge	20
	403 055	Ventor Beach	20
	403 025	Bunting Sedge	17
	403 042	Islajo Island	16
	403 058	Margate	15
	403 030	Goodluck Sedge	8
	377 006	Sandy Hook North	6
	403 003	Ortley Beach Marsh	6
	403 046	Low Water Thorofare	5
	403 026	South Barrel Island	4
	403 031	Goosebar Sedge	4
	428 007	South Cape May Beach	4
	403 017	Egg Island	2
Least Tern	403 003	Ortley Beach Marsh	316
	403 004	Mid Buster	300
	378 065	Gateway - Sandy Hook	200
	403 064	Corson Inlet	170
	403 049	Peter Beach	135

(Continued)

Table K1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Least Tern (continued)	403 033	Holgate Beach, Brigantine Refuge	130
	403 078	Stone Harbor - Lower 7 Mile Beach	100
	428 007	South Cape May Beach	100
	403 015	Cedar Bonnet	80
	403 050	Absecon Inlet	75
	403 052	Expressway	50
	403 051	Absecon Boulevard	36
	403 020	Parker Island	35
	403 059	Longport	25
	377 002	Port Newark	10
	428 005	Wildwood - 2 Mile Beach	10
	403 060	Somers Point	6
	403 055	Ventor Beach	4
	403 067	Ludlam Beach	4
Black Skimmer	403 065	Strathmere Marsh	315
	403 033	Holgate Beach, Brigantine Refuge	300
	403 070	Avalon and Causeway	230
	403 034	Little Beach Island, Brigantine Refuge	35
	403 014	Log Creek	30
	403 080	Taugh Creek	12
	403 018	Ham Island	8
	403 041	Oyster Thorofare	6
	403 022	Mordecai Island	5
	403 026	South Barrel Island	5
	403 010	Gulf Island	1
	403 059	Longport	1
	428 006	Jarvis Sound-Wildwood Crest	1

APPENDIX L

Table 1. Breeding Species in Delaware, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Great Blue Heron	403 082	Delaware City - Augustine Creek	142
	428 009	Milton	30
	403 081	Pea Patch Island	2
Green Heron	403 081	Pea Patch Island	2
Little Blue Heron	403 081	Pea Patch Island	600
Cattle Egret	403 081	Pea Patch Island	4,000
Great Egret	403 081	Pea Patch Island	250
Snowy Egret	403 081	Pea Patch Island	1,000
Louisiana Heron	403 081	Pea Patch Island	50
Black-crowned Night Heron	403 081	Pea Patch Island	400
Yellow-crowned Night Heron	403 081	Pea Patch Island	40
Glossy Ibis	403 081	Pea Patch Island	700
Herring Gull	428 013	Big Reedy Island	31
Laughing Gull	428 013	Big Reedy Island	96
Common Tern	428 014	Bush Island	200
	428 011	Marsh Island	100
	428 012	Big Piney Island	50
	428 018	Rock Turn Point Island	50
	428 016	Sand Island	40
	428 010	Cape Henlopen State Park	11
Least Tern	428 010	Cape Henlopen State Park	92
	428 017	Indian River Yacht Club	39
	428 008	Broadkill Beach	20
	428 015	Delware Beaches State Park	15
Black Skimmer	418 014	Bush Island	10
	428 010	Cape Henlopen State Park	8
	428 012	Big Piney Island	8
	428 011	Marsh Island	1

APPENDIX M

Table M1. Breeding Species in Maryland, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Great Blue Heron	427 006	Sand Point, Barren Island	390
	427 003	Canoe Neck Creek	350
	427 001	Poplar Island	327
	402 002	Eastern Neck	184
	403 083	Cabin John Creek	129
	402 001	Pooles Island	110
	427 008	Bloodsworth Island	101
	427 010	Holland Island	100
	427 012	Martin Refuge - Northeast	60
	428 036	Deal Island Wildlife Management Area	60
	428 038	Martin Refuge - Terrapin Sand Point	27
	427 007	Middle Hooper Island	23
	452 004	Hog Neck	12
	427 009	Adam Island	10
Green Heron	427 008	Bloodsworth Island	15
	427 010	Holland Island	10
	427 009	Adam Island	3
Little Blue Heron	428 023	Islands South of South Point	57
	427 010	Holland Island	45
Cattle Egret	428 023	Islands South of South Point	960
	427 012	Martin Refuge - Northeast	145
	427 010	Holland Island	80
	452 003	Tylerton/Kelly Island	61
	427 006	Sand Point, Barren Island	51
	427 001	Poplar Island	28
Great Egret	427 003	Canoe Neck Creek	300
	427 006	Sand Point, Barren Island	180
	428 023	Islands South of South Point	175
	427 010	Holland Island	55
	427 001	Poplar Island	51
	427 012	Martin Refuge - Northeast	25
	452 003	Tylerton/Kelly Island	16
	452 005	Ewell	14
	452 004	Hog Neck	9
	427 007	Middle Hooper Island	2
	428 022	Islands Near Buoy 13	2
	427 009	Adam Island	1

(Continued)

Table M1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Snowy Egret	428 023	Islands South of South Point	360
	452 003	Tylerton/Kelly Island	225
	427 010	Holland Island	200
	427 001	Poplar Island	158
	427 006	Sand Point, Barren Island	90
	427 012	Martin Refuge - Northeast	72
	452 005	Ewell	72
	428 022	Islands Near Buoy 13	55
	428 026	Robins Marsh	52
	428 028	Ready Cove Tump	30
	452 004	Hog Neck	18
Louisiana Heron	428 026	Robins Marsh	50
	452 003	Tylerton/Kelly Island	49
	427 010	Holland Island	45
	452 005	Ewell	37
	428 028	Ready Cove Tump	23
Black-crowned Night Heron	452 005	Ewell	350
	452 003	Tylerton/Kelly Island	160
	428 023	Islands South of South Point	150
	427 012	Martin Refuge - Northeast	110
	427 010	Holland Island	75
	452 004	Hog Neck	40
	428 028	Ready Cove Tump	35
	427 007	Middle Hooper Island	30
	427 009	Adam Island	7
	427 008	Bloodsworth Island	5
	428 022	Islands Near Buoy 13	4
Yellow-crowned Night Heron	427 010	Holland Island	15
	427 038	Martin Refuge - Terrapin Sand Point	9
	452 005	Ewell	6
	427 009	Adam Island	3
	427 012	Martin Refuge - Northeast	3
	427 008	Bloodsworth Island	1
Glossy Ibis	428 023	Islands South of South Point	58
	427 010	Holland Island	33
	452 003	Tylerton/Kelly Island	24
	452 005	Ewell	7
	427 006	Sand Point, Barren Island	6
	428 026	Robins Marsh	5
	427 001	Poplar Island	4

(Continued)

Table M1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Great Black-backed Gull	452 005	Ewell	24
	428 025	Outward Tump	4
	428 026	Robins Marsh	4
	428 030	Striking Marsh	1
Herring Gull	452 005	Ewell	3,200
	452 002	Smith Island 4	850
	428 025	Outward Tump	175
	428 032	Cedar Islands	160
	428 026	Robins Marsh	150
	428 022	Islands Near Buoy 13	16
	428 027	Pirate Islands	16
	428 024	Lumber Marsh	10
	427 010	Holland Island	5
	427 005	Tar Bay	4
Laughing Gull	428 022	Islands Near Buoy 13	2,080
	428 026	Robins Marsh	149
Forster's Tern	428 029	Mink Tump	200
	428 026	Robins Marsh	125
	428 039	Piney Island	80
	428 035	Fish Island	70
	428 037	St. Pierre Island	25
	428 030	Striking Marsh	11
	427 011	South Marsh Island	9
Common Tern	428 020	Ocean City - Fenwick Island	375
	428 039	Piney Island	375
	428 037	St. Pierre Island	200
	428 021	Spoil Buoy 11	180
	428 035	Fish Island	170
	427 002	Nelson Island	150
	428 032	Cedar Islands	100
	428 019	Isle of Wight Bay	90
	427 010	Holland Island	21
	428 031	Horsehead Tump	14
	427 005	Tar Bay	7
Least Tern	427 004	Piney Point	150
	427 005	Tar Bay	59
Royal Tern	428 032	Cedar Islands	120
	428 021	Spoil Buoy 11	14
Black Skimmer	428 021	Spoil Buoy 11	120
	428 031	Horsehead Tump	12
	428 032	Cedar Islands	10

APPENDIX N

Table N1. Breeding Species in Virginia, 1977

Species	Colony site no.	Colony site name	Nesting pairs
Great Blue Heron	452 006	Dutchman Point	420
	453 054	Watts Island	173
Green Heron	453 022	Swash Bay - Major Hole Marsh	12
	453 042	Wreck Island	3
	453 054	Watts Island	3
	453 020	Clubhouse Point	2
	453 012	Folly Creek	1
Little Blue Heron	453 051	Fishermans Island	52
	453 020	Clubhouse Point	43
	453 004	Shelly Bay	35
	453 001	Coards Marshes	20
	453 011	Metomkin Island, South Marsh	19
	453 030	Hog Island	12
	453 042	Wreck Island	6
	453 059	Halfmoon Island	6
Cattle Egret	453 042	Wreck Island	125
	453 059	Halfmoon Island	78
	453 001	Coards Marshes	75
	453 004	Shelly Bay	70
	453 054	Watts Island	69
	453 051	Fishermans Island	44
	453 011	Metomkin Island, South Marsh	25
Great Egret	453 059	Halfmoon Island	125
	453 004	Shelly Bay	115
	453 051	Fishermans Island	110
	453 030	Hog Island	75
	453 011	Metomkin Island, South Marsh	44
	453 001	Coards Marshes	22
	453 054	Watts Island	19
	453 031	Rogue Island	12
	453 006	Walker Marsh	10
	453 020	Clubhouse Point	9
Snowy Egret	453 004	Shelly Bay	750
	453 030	Hog Island	390
	453 042	Wreck Island	320

(Continued)

Table N1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Snowy Egret (continued)	453 022	Swash Bay - Major Hole Marsh	216
	453 020	Clubhouse Point	215
	453 051	Fishermans Island	206
	453 054	Watts Island	190
	453 011	Metomkin Island, South Marsh	175
	453 059	Halfmoon Island	175
	453 031	Rogue Island	89
	453 001	Coards Marshes	85
	453 006	Walker Marsh	25
	453 012	Folly Creek	8
Louisiana Heron	453 004	Shelly Bay	190
	453 020	Clubhouse Point	151
	453 022	Swash Bay - Major Hole Marsh	97
	453 030	Hog Island	70
	453 031	Rogue Island	47
	453 011	Metomkin Island, South Marsh	45
	453 051	Fishermans Island	41
	453 059	Halfmoon Island	41
	453 054	Watts Island	18
	453 012	Folly Creek	12
	453 042	Wreck Island	10
	453 001	Coards Marshes	Possible
Black-crowned Night Heron	453 051	Fishermans Island	825
	453 004	Shelly Bay	550
	453 030	Hog Island	100
	453 042	Wreck Island	85
	453 059	Halfmoon Island	55
	453 001	Coards Marshes	29
	453 054	Watts Island	23
	428 033	Toby Island	20
	453 006	Walker Marsh	20
	453 011	Metomkin Island, South Marsh	15
	453 012	Folly Creek	10
	453 020	Clubhouse Point	5
Yellow-crowned Night Heron	452 010	Hampton	5
	453 054	Watts Island	5
	453 030	Hog Island	4
	453 051	Fishermans Island	4
Glossy Ibis	453 030	Hog Island	140
	453 004	Shelly Bay	75
	453 001	Coards Marshes	71

(Continued)

Table N1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Glossy Ibis (continued)	453 051	Fishermans Island	55
	453 042	Wreck Island	42
	453 059	Halfmoon Island	37
	453 054	Watts Island	34
	453 020	Clubhouse Point	32
	453 012	Folly Creek	18
	453 006	Walker Marsh	15
	453 011	Metomkin Island, South Marsh	15
	453 022	Swash Bay - Major Hole Marsh	2
White Ibis	453 051	Fishermans Island	1
Great Black-backed Gull	453 051	Fishermans Island	16
	453 053	Little Fox Island	6
Herring Gull	453 051	Fishermans Island	1,250
	453 027	Chimney Pole Marsh	800
	453 011	Metomkin Island, South Marsh	325
	453 003	Queen Sound Channel	164
	453 053	Little Fox Island	32
	453 034	Gull Marsh 2	22
	453 042	Wreck Island	16
	428 034	Calfpen Island	7
	453 005	Willis Marsh	4
	453 037	Big Easter Marsh	4
Laughing Gull	453 003	Queen Sound Channel	4,530
	453 027	Chimney Pole Marsh	3,410
	453 037	Big Easter Marsh	2,865
	453 042	Wreck Island	2,845
	453 034	Gull Marsh 2	2,000
	453 036	Little Easter Marsh	1,770
	453 018	Burtons Bay (So.) Marsh	1,610
	453 029	High Shoal Marsh	1,360
	453 005	Willis Marsh	1,350
	453 017	Great Gut Cove	994
	453 021	Millstone Creek Marsh	939
	453 033	Gull Marsh 1	900
	453 016	Hummock Channel	784
	453 047	Ship Shoal Channel Marsh	650
	453 014	Great Channel	576
	453 051	Fishermans Island	575
	453 035	Parchaby Tump	560
	453 009	Metomkin Island - North	550
	453 026	Hodges Narrows	532
	453 041	Man and Boy Marsh	487
	453 013	Cedar Island	450
	453 025	Egging Marsh	350

(Continued)

Table N1. (Continued)

Species	Colony site no.	Colony site name	Nesting pairs
Laughing Gull (continued)	453 038	Eckichy Marsh	342
	453 022	Swash Bay - Major Hole Marsh	318
	453 040	Rapesian Tump	162
	453 023	Sandy Island Marsh	129
	453 001	Coards Marshes	101
	453 028	Hog Island Bay 1	58
Gull-billed Tern	453 010	Metomkin Island - South	90
	453 019	Dawson Shoals	15
Forster's Tern	453 045	Red Drum Marsh	130
	453 003	Queen Sound Channel	120
	453 033	Gull Marsh 1	87
	453 047	Ship Shoal Channel Marsh	84
	453 034	Gull Marsh 2	70
	453 018	Burtons Bay (So.) Marsh	65
	453 005	Willis Marsh	60
	453 010	Metomkin Island - South	60
	453 021	Millstone Creek Marsh	58
	453 027	Chimney Pole Marsh	58
	453 036	Little Easter Marsh	55
	453 022	Swash Bay - Major Hole Marsh	44
	453 037	Big Easter Marsh	41
	453 001	Coards Marshes	35
	453 002	Thurf Marsh Island	34
	453 026	Hodges Narrows	25
	453 038	Eckichy Marsh	21
	453 016	Hummock Channel	20
	453 035	Parchaby Tump	10
	453 057	Great Fox Island	10
	453 023	Sandy Island Marsh	8
Common Tern	453 048	Smith Island Beach - North	590
	453 039	Little Cobb Island	559
	453 051	Fishermans Island	425
	453 010	Metomkin Island - South	360
	453 046	Myrtle Island Beach	240
	453 049	Smith Island Beach - Middle	240
	453 030	Hog Island	225
	453 033	Gull Marsh 1	178
	453 009	Metomkin Island - North	100
	453 025	Egging Marsh	100
	453 019	Dawson Shoals	89
	453 043	Cobb Island	86
	453 044	Ship Shoal Island	85
	453 052	Skidmore Island	85
	453 057	Great Fox Island	49

(Continued)

Table N1. (Concluded)

Species	Colony site no.	Colony site name	Nesting pairs
Common Tern (continued)	453 024	Parramore Island	45
	453 042	Wreck Island	23
	453 027	Chimney Pole Marsh	20
	453 064	Nandua Creek	20
	452 001	Herring Island	17
	453 032	Ramshorn Bay	13
	453 015	Cedar Island - South	7
Least Tern	453 061	Jamesville 2	176
	452 009	Grand View	162
	453 063	Jamesville 4	85
	453 056	Crisfield	75
	453 059	Little Cobb Island	64
	452 008	Urbanna	46
	453 058	Chesconessex	42
	453 055	Tangier Island	37
	452 007	New Point Comfort	27
	453 024	Parramore Island	24
	453 008	Gargathy Beach	22
	453 013	Cedar Island	22
	453 007	Wallops Island	17
	453 050	Smith Island Beach - South	16
	453 060	Jamesville 1	12
	453 062	Jamesville 3	12
Royal Tern	453 051	Fishermans Island	4,600
Sandwich Tern	453 051	Fishermans Island	5
Caspian Tern	453 051	Fishermans Island	1
Black Skimmer	453 010	Metomkin Island - South	550
	453 009	Metomkin Island - North	360
	453 051	Fishermans Island	315
	453 039	Little Cobb Island	287
	453 048	Smith Island Beach - North	280
	453 019	Dawson Shoals	225
	453 030	Hog Island	120
	453 046	Myrtle Island Beach	120
	453 049	Smith Island Beach - Middle	110
	453 044	Ship Shoal Island	85
	453 015	Cedar Island - South	65
	453 033	Gull Marsh 1	54
	453 024	Parramore Island	35
	453 057	Great Fox Island	35
	453 043	Cobb Island	15
	453 042	Wreck Island	14
	453 063	Jamesville 4	7
	453 001	Coards Marshes	5
	453 064	Nandua Creek	5

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In 1976 and 1977, seabird and wading bird nesting colonies were inventoried along the northeast U.S. coast from Cape Elizabeth, Maine to the Virginia-North Carolina border. A parallel study was conducted for the rocky, island bound coastal region of Maine, north of Cape Elizabeth. Colonies were surveyed and censused from March to July by teams of biologists using aerial and ground-based methods.

Approximately 240,982 pairs of waterbirds (28 species) nested at 522 colonies in 1977. The most abundant species, in order, were herring gulls, laughing gulls, common terns, great black-backed gulls, snowy egrets, and black-crowned night herons. Virginia and New Jersey had the greatest area of coastal wetlands and harbored the largest populations of waterbirds. Wading birds usually begin nesting as early as late February and March; most seabirds arrive in April or May. Most waterbird young have fledged by August.

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COASTAL WATERBIRD COLONIES CAPE ELIZABETH, MAINE TO VIRGINIA
NESTING RECORDS SINCE 1900

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