

POPULATION CHANGE IN THREE SPECIES OF SEABIRDS AT KENT ISLAND, NEW BRUNSWICK

BY PETER F. CANNELL AND G. DAVID MADDOX

Questions associated with the population dynamics of colonial seabirds are of intrinsic interest to biologists. Amid continuing exploitation of marine resources, including offshore oil exploration, answers to basic questions about population levels and trends are particularly needed. We report here the results of a recent land-based census of breeding populations of Leach's Storm-Petrel (*Oceanodroma leucorhoa*), Common Eider (*Somateria mollissima*), and Herring Gull (*Larus argentatus*) at Kent Island, New Brunswick. Kent Island is a small (75 ha) island at the southern extremity of the Grand Manan archipelago in the rich waters of the Bay of Fundy. In an attempt to assess population change, we compare our results to numerous other censuses made at Kent Island since the 1930's.

METHODS

During the summers of 1979 and 1980, we used a stratified random sampling system (Christy 1976, Christy and Sharitz 1980) to establish quadrat locations throughout Kent Island. Every 100 m along the north-south axis of the island perpendicular east-west transects were laid. Within each 100 m segment of the east-west transects a randomly chosen 10 m segment served as the northern edge of a 100 m² quadrat. Quadrats located beyond the limit of shoreline vegetation were not included. By this means 72 quadrats were generated, representing approximately 1% of the island's 75.15 ha.

During the week of 21 July 1980 all quadrats were examined for active gull or eider nests and active petrel burrows. The number of nests found for each species expressed on a per-area basis and multiplied by the island's total area yields our estimate for the breeding population of that species (Table 1). As some Herring Gulls nest on the beaches beyond the vegetation, the estimate for this species was supplemented by a count of shoreline nests. No attempt was made during the census to discriminate between nests of Herring and Great Black-backed (*Larus marinus*) gulls. As only about 20 pairs of Great Black-backed Gulls nest on Kent Island (Lock 1983, pers. obs.), the gull estimate may be reasonably taken as the Herring Gull population.

We tested the accuracy of our estimates in 2 ways. First, we compared independent estimates of the forested area of land on Kent Island. One used the same methods as described above but was based on vegetation data gathered from our quadrats. The second was derived from a recent aerial photograph of known scale. The 2 areas, 35.1 ha and 35.7 ha respectively, are very close.

Second, we compared our estimate of the petrel population to an independent estimate made by Dr. C. E. Huntington based on a long-

TABLE 1. Number of nests found in the 72 quadrats on Kent Island, New Brunswick, and the population estimates of this study.

Species	Nests found in quadrats	Estimated breeding pairs
Leach's Storm-Petrel	22	2184
Common Eider	9	893
Herring Gull	49	4864 + 115 ¹ = 4979

¹ Shoreline count.

term average of the number of active burrows in his study areas and the proportion of the island's petrel population he believed to be included in these areas. His estimate (pers. comm.) of 2000 pairs of petrels was made without knowledge of our results and, again, compares favorably with our estimate of 2184 pairs.

RESULTS AND DISCUSSION

Several previous estimates are higher than our own (Tables 1 and 2), sometimes dramatically so. Do such differences indicate real population change, or have previous censuses overestimated the breeding populations, exaggerating the amount of apparent population change? Here we discuss the history and circumstances of each species on Kent Island, attempting to discern real change.

Leach's Petrel.—Two estimates of the Kent Island petrel population have been published, one as recently as 1969 (Table 2). Each is significantly higher than our own figure (Table 1). Although Gross (1935) said that the Kent Island petrels were "rapidly decreasing in numbers," Huntington (pers. comm.), based on longer and more continuous work, feels that the population may be stable or declining slowly.

The basis for Gross' (1935) estimate, repeated by Pettingill (1939), is unclear. The tremendous number of petrels calling at night during the breeding season might have influenced him. Aside from difficulties in making an estimate, we do not consider estimates of numbers of calling birds to be a valid indicator of the size of the breeding population. We lured petrels into mist nets at night by tape playback of the species' vocalization. Over 95% of several hundred individuals caught in this manner were non-breeders, lacking developed brood patches (Cannell, Cherry, and Maddox, unpubl. data).

Wilbur's (1969) estimate (Table 2) was based on the assumption that petrels nest uniformly throughout the habitats which they occupy. He sampled each habitat for petrels and extrapolated density to the habitat's total area, determined from color aerial photographs. We found petrels more or less limited to spruce-fir woods, and to be extremely patchy within that habitat depending on microhabitat features. We feel that Wilbur's methods, being insensitive to patchiness, led him to a considerable overestimation of the petrel population. We feel, therefore, that

TABLE 2. Estimates of the number of breeding pairs of Leach's Storm-Petrel, Common Eider, and Herring Gull on Kent Island.

Date	No. pairs	Method	Reference
Leach's Storm-Petrel			
1935	10,000	not stated	Gross 1935
1966	15,000	quadrat	Wilbur 1969
Common Eider			
1873	"in abundance"	not stated	Herrick 1873
1923	"nearly gone"	not stated	Townsend 1923
1930	30 ¹	not stated	Huntington 1956
1932	178	nest count	Gross 1938
1937	300+	nest count	Gross 1938
1947	1000	not stated	Gross 1947
1948	750	not stated	Paynter 1951
1955	1000-3000	not stated	Huntington 1956
Herring Gull			
1935-1937	20,000 ¹	not stated	Pettingill 1939
1940	11,672	nest count	Crystal 1941
1940	16,000	nest count + est.	Crystal 1941
1945	25,000	not stated	Cameron 1945
1947	30,000	not stated	Gross 1947
1948	20,500	count?	Boyer 1948
1949	12,000-15,000	not stated	Paynter 1949
1949	17,000	sample plots	Pimlott 1952
1963	10,000	air estimate	Drury, pers. comm.
1965	7500	air estimate	Drury, pers. comm.
1967	8347	nest count + est.	Ainley 1967
1972	8000	air estimate	Drury, pers. comm.
1973	4000	surface estimate	Drury, pers. comm.
1979	4560	quadrats + est.	Lock 1983

¹ Estimate includes 2 smaller nearby islands, Hay and Sheep, as well as Kent Island.

there is no firm basis for the apparent dramatic population decline indicated by a comparison of these figures with ours.

A slow decline of the petrel population at Kent Island may, in fact, be taking place, due to local factors. Petrels are restricted to wooded areas for nesting, presumably because of gull predation which takes place in open areas (Gross 1936, pers. obs.). Yet the forests of Kent Island are retreating (Gross 1947, pers. obs.), due, no doubt, to the combined effects of Herring Gulls, muskrats (*Ondatra zibethica*), and snowshoe hares (*Lepus americanus*).

Both Palmer (1949) and Drury (1973) have described adjacent Maine petrel populations as steadily declining. Certainly the sum population in this area has decreased with the loss of entire colonies due to local introduction of sheep or rodents. But the status of individual extant colonies is hard to assess. Estimation of petrel populations is difficult, with ground survey of active burrows the only possible method. The only other study of a colony in this region is for Matinicus Rock, where

Morse and Buchheister (1977) conclude that the petrel population there has been stable since 1955.

Our conclusion that the petrel population on Kent Island is stable or slowly declining rests primarily on the work of Huntington (pers. comm.). The results of our census may be used in the future to test this conclusion.

Common Eider.—Kent Island was originally purchased by Sterling Rockefeller as a preserve for the declining eider populations of the 1930's, and played a role in their recovery (Huntington 1956). Protected from human predation, eiders presently nest throughout the island in raspberry thickets, shoreline grasses, and thick spruce-fir woods. They nest closely with Herring Gulls without apparent interference during incubation, although both gull species represent a significant cause of mortality for downy eider young. The dramatic increase of the eider population at Kent Island after 1930 and apparent stabilization since the late 1940's (Tables 1 and 2) are undoubtedly real. A correlated increase along the Maine coast is also well-documented (Gross 1944, Palmer 1949).

Herring Gull.—The Kent Island gull colony has been called "the largest colony of Herring Gulls on the Atlantic seaboard if not in America" (Gross 1940:129), with a high estimate of 30,000 pairs (Gross 1947). Our own estimate of 5000 pairs presents a sharp contrast—still a large colony, but by no means unique.

One reason for the discrepancy is easy to identify. Crystal (1941) censused the Kent Island gull population in 1940, counting nests in roped-off quadrats in the dense nesting colony. He counted 11,672 nests, but felt that many nests had been overlooked and added a "corrective" 3000 nests to his count. He, therefore, reported "a total number of nests on the southern end of the island of 15,000 or approximately 30,000 birds." He estimated that 1000 pairs nested on the uncensused north end of Kent Island. Gross (1947), citing Crystal as a reference, refers to 30,000 pairs of Herring Gulls, inadvertently doubling Crystal's figure.

Even so, estimates of up to 25,000 pairs exist (Table 2). The basis for several of these is unknown. If counts of birds at the colony site were used, figures may be high. Kadlec and Drury (1968) found that 15–30% of adult-plumaged Herring Gulls at New England colonies were not breeders. Buckley and Buckley (1980) found up to 70% non-breeding adults at some Long Island colonies in 1977 and 1978.

Pimlott (1952) counted nests in sample plots within "distinct vegetation type areas" and, like Wilbur (1969), extrapolated to the total amount of each vegetation type on the island. This method may be reasonable for gulls, although our method of a larger number of smaller quadrats chosen regardless of vegetation type seems better. Boyer (1948) has indicated that 20% of the nesting gull population is not represented by nests at any one time, suggesting that Pimlott's count, as well as ours, may actually be an underestimate. We feel that both counts would in-

clude gulls nesting previous to the census date, and doubt that many gulls initiate breeding, including nest construction, after this time.

Of previous high counts, those of Crystal and Pimlott seem reliable, and, with our figure, document a significant decline in the Kent Island Herring Gull population. The independent recent estimates by Ainley (1967), Lock (1983), and Drury (pers. comm.) reinforce confidence in a decline, with the suggestion that much of the decrease may have taken place between 1950 and 1965.

There are no obvious local factors which might have caused such a decline, as may be true for the petrels. In this case the regional view may be more helpful. Drury and Kadlec (1974) suggested that New England and Maritime populations of Herring Gulls were stabilizing, perhaps even declining, in the 1950's and 1960's, with the center of population growth moving south to New York, New Jersey, and farther. For example, the breeding population at Muskeget Island, off Nantucket, Massachusetts, showed a gradual decline in numbers during this period (Drury, pers. comm.). Work along coastal New York (Buckley and Buckley 1980) has shown a definite decline in gull populations. Data "for the entire Long Island area reveal a peak population in 1975, with marked drops in 1976, 1977, and 1978 . . . the decline is general and real" and of a "precipitous nature." Whether our findings and those of Buckley and Buckley (1980) and Drury and Kadlec (1974) are related is not known, but the coincidence of 3 studies documenting stabilization and decline after a century of increase (Kadlec and Drury 1968) warrants further examination. Drury and Kadlec (1974) and Buckley and Buckley (1980) suggest a variety of possible explanations for a regional decline in Herring Gull populations. We are not in a position to assess nor add to these.

SUMMARY

We present the results of a recent census of 3 species of breeding seabirds at Kent Island, New Brunswick, and have used these, in comparison with previous estimates, to draw conclusions about population trends of these species. We suggest that the Kent Island petrel population has undergone a slow decline due to local factors. The eider population appears to have increased and stabilized since a low point in the 1930s. A dramatic decline in the Herring Gull population is indicated, and may be part of a regional change in the demography of the species. This point deserves more detailed attention. We hope that our census may be used to assess future population changes at Kent Island, testing our conclusions, and recommend periodic accurate censuses at other locations.

ACKNOWLEDGMENTS

We owe special thanks to Bowdoin College, Dr. C. E. Huntington, and Myrhone Tate for help and support during the field season. The

assistance of Kass Hogan, Amanda Cannell, and others who helped in the field is also gratefully acknowledged. John Pinder advised us on sampling methods. We are pleased to thank Paul Buckley, Peter B. Cannell, Joe DiCostanzo, William Drury, Helen Hays, Jerry Jackson, C. E. Huntington, and an anonymous reviewer for helpful comments on drafts of this paper. This is contribution number 51 of the Bowdoin Scientific Station, Kent Island, New Brunswick.

LITERATURE CITED

- AINLEY, D. 1967. Census of the breeding population of Herring Gulls on Kent Island, New Brunswick, Canada. Unpublished report to the Bowdoin Scientific Station. (A copy has been deposited in the Van Tyne Library, Univ. of Michigan, Ann Arbor.)
- BOYER, G. F. 1948. Report on the gull control project, the Grand Manan Archipelago, N.B. Canadian Wildlife Service, internal report #645. (A copy has been deposited in the Van Tyne Library, Univ. of Michigan, Ann Arbor.)
- BUCKLEY, P. A., AND F. G. BUCKLEY. 1980. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. *Trans. Linn. Soc. New York* 9:23-56.
- CAMERON, A. W. 1945. Report on the economic status of the Herring Gull in the Grand Manan (New Brunswick) Archipelago. Internal report of the Canadian Wildlife Service #361. (A copy has been deposited in the Van Tyne Library, Univ. of Michigan, Ann Arbor.)
- CHRISTY, E. J. 1976. Population dynamics of a swamp annual under temperature stress. Ms. Thesis, University of Georgia, Athens.
- CHRISTY, E. J., AND R. R. SHARITZ. 1980. Characteristics of three populations of a swamp annual under different temperature regimes. *Ecology* 61:454-460.
- CRYSTAL, F. H. 1941. Herring Gull census. Bowdoin Scientific Station Bull. 7:37-38.
- DRURY, W. H. 1973. Population changes in New England seabirds. *Bird-Banding* 44:267-313.
- , AND J. A. KADLEC. 1974. The current status of the Herring Gull population in the northeastern United States. *Bird-Banding* 45:297-306.
- GROSS, A. O. 1938. Eider Ducks of Kent Island. *Auk* 55:387-400.
- . 1940. The migration of Kent Island Herring Gulls. *Bird-Banding* 11:129-155.
- . 1944. The present status of the American Eider on the Maine coast. *Wilson Bull.* 56:15-26.
- . 1947. Recoveries of banded Leach's Petrels. *Bird-Banding* 18:117-126.
- GROSS, W. A. O. 1935. The life history cycle of the Leach's Petrel (*Oceanodroma leucorhoa leucorhoa*) on the outer sea islands of the Bay of Fundy. *Auk* 52:382-399.
- . 1936. Kent Island—outpost of science. *Natural History* 37:195-210.
- HERRICK, H. 1873. A partial catalogue of the birds of Grand Manan, N. B. *Bulletin of the Essex Institute* 5:28-41.
- HUNTINGTON, C. E. 1956. The Bowdoin Scientific Station. *Maine Field Nat.* 12:2-9.
- KADLEC, J. A., AND W. H. DRURY. 1968. Structure of the New England Herring Gull population. *Ecology* 49:644-676.
- LOCK, A. R. 1983. A survey of the sea-bird colonies in southern New Brunswick. Canadian Wildlife Service internal report.
- MORSE, D. E., AND C. W. BUCHHEISTER. 1977. Age and survival of breeding Leach's Petrel in Maine. *Bird-Banding* 48:314-349.
- PALMER, R. S. 1949. Maine birds. *Bull. Mus. Comp. Zool.* 102.
- PAYNTER, R. A., JR. 1949. Clutch-size and the egg and clutch mortality of Kent Island Herring Gulls. *Ecology* 30:146-166.
- . 1951. Clutch-size and egg mortality of Kent Island eiders. *Ecology* 32:497-507.
- PETTINGILL, O. S., JR. 1939. The bird life of the Grand Manan Archipelago. *Proc. Nova Scotian Institute of Science* 19:293-372.

- PIMLOTT, D. H. 1952. The economic status of the Herring Gulls of the Grand Manan Archipelago, New Brunswick, 1949. *Can. Wildl. Serv. Manage. Bull. Ser. 2, No. 5.*
- TOWNSEND, C. W. 1923. Notes on the birds of Grand Manan, New Brunswick. *Can. Field-Nat.* 37:141-144.
- WILBUR, H. M. 1969. The breeding biology of Leach's Petrel, *Oceanodroma leucorhoa*. *Auk* 86:433-442.

Ornithology Department, American Museum of Natural History, 79th Street and Central Park West, New York City, New York 10024; and Department of Entomology, Comstock Hall, Cornell University, Ithaca, New York 14853. Received 15 Apr. 1982; accepted 2 Sept. 1982.