Census of terns and gulls in Prince Edward Island - 2004

Andrew W. Boyne and Julie McKnight

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CENSUS OF TERNS AND GULLS IN PRINCE EDWARD ISLAND - 2004

ANDREW W. BOYNE and JULIE MCKNIGHT

Canadian Wildlife Service, 45 Alderney Drive, 16th Floor Queen Square, Dartmouth, Nova Scotia, B2Y 2N6

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Copies may be obtained from:

Andrew Boyne
Canadian Wildlife Service
45 Alderney Drive, 16th Floor Queen Square
Dartmouth, N.S. B2Y 2N6

Phone: 902-426-1900
Fax: 902-426-6434
e-mail: andrew.boyne@ec.gc.ca

SUMMARY

The coast of Prince Edward Island was surveyed for colonial nesting gulls and terns, in May and June 2004. The coastline was flown by fixed-wing aircraft and aerial visual estimates and photo estimates were made of gull colonies. Subsequently, each gull and tern colony was visited by ground. Surveys identified 10 Great Black-backed and Herring Gull colonies, 3 Ring-billed Gull colonies and 6 tern colonies. It was estimated that 1110 pairs of Great Black-backed Gulls, 1795 pairs of Herring Gulls, 691 pairs of Ring-billed Gulls, 737 pairs of Common Terns, and a single pair of Arctic Terns nested in the province in 2004.

Great Black-backed and Herring Gull populations have declined sharply since the mid-1980s, while Ring-billed Gulls continue to increase, albeit at a slower pace than in the past. Tern populations continue to exist at levels substantially lower than their peak in the early 1980s.

RÉSUMÉ

Un dénombrement des populations de goélands et de sternes qui nichent en colonie a été effectué en mai et en juin 2004 le long de la côte de l'Île-du-Prince-Édouard. Des estimations visuelles aériennes ainsi que des estimations photographiques des colonies de goélands ont été faites au moyen d'un aéronef à voilure fixe. Par la suite, chaque colonie de goélands et de sternes a été visitée à terre. Les enquêtes ont permis de recenser dix colonies de goélands marins et de goélands argentés, trois colonies de goélands à bec cerclé et six colonies de sternes. Il a été estimé que 1 110 paires de goélands marins, 1 795 paires de goélands argentés, 691 paires de goélands à bec cerclé, 737 paires de sternes pierregarins et une seule paire de sternes arctiques nichaient dans la province en 2004.

Les populations de goélands marins et de goélands argentés ont connu un important déclin depuis le milieu des années 1980, tandis que les populations de goélands à bec cerclé continuent de croître, bien que le rythme de croissance ait quelque peu ralenti ces dernières années. On dénombre encore quelques populations de sternes, mais leur nombre est sensiblement moins élevé que celui recensé lors du sommet démographique atteint au début des années 1980.

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INTRODUCTION

In 1999, the Canadian Wildlife Service (CWS) initiated an on-going program to census tern colonies in Atlantic Canada. It was recognized that many tern colonies in Atlantic Canada had not been surveyed in a decade and some had not been surveyed in almost 30 years. Each of the four Atlantic Provinces was to be surveyed every 4-5 years in rotation. Prince Edward Island (PEI) was first surveyed under this program in 1999 (Boyne et al. 2001). There have been several other efforts to survey seabird colonies in PEI over the last 40 years (Vass 1965; Pigot 1967; MacDougall 1985; Lock 1987; Northcott and Creamer 1987; Lock 1988).

In 1999, we surveyed Great Blue Heron (*Ardea herodias*) and cormorant colonies. We did not include them in the census in 2004 because the PEI Department of Environment and Energy surveys Double-crested Cormorants (*Phalacrocorax auritus*) and Great Cormorants (*P. carbo*) annually (R. Dibblee, personal communication), and Great Blue Heron colonies were surveyed in 2003 as part of a different study (R. Curley, personal communication). We did survey Great Black-backed Gull (*Larus marinus*), Herring Gull (*L. argentatus*), and Ring-billed Gull (*L. delawarensis*) colonies.

This report outlines the results of the tern and gull census conducted on Prince Edward Island in 2004.

METHODS

Aerial survey – The coast of PEI was surveyed by fixed-wing aircraft on 24 May, 2004 (Cessna 172 with floats; Tartan Air, Murray Harbour; pilot: Mark Coffin) (Figure 1). The aerial survey was timed to occur during the third week of incubation for Great Black-backed Gulls. This corresponded to the first or second week of incubation for Herring Gulls which was earlier than ideal for Herring Gulls (Johnson and Krohn 2001). Terns had not started to nest at this point but they were present at colony sites and we expected to observe them during aerial surveys.

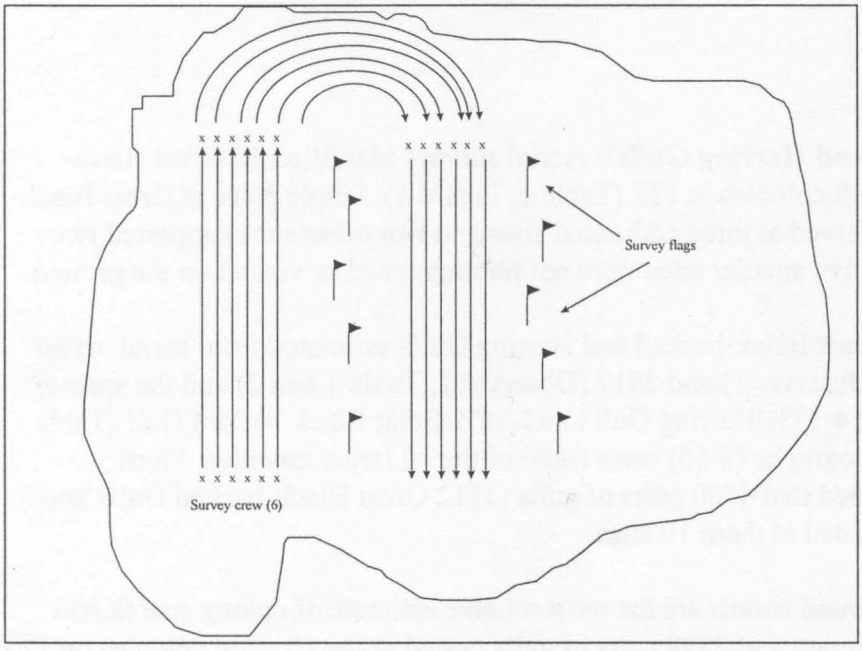
The aerial survey was conducted 50 m offshore at an altitude of approximately 150 m with two observers; A. W. Boyne and J. McKnight. Observer 1 (AWB) sat in the front left-hand seat and Observer 2 (JM) in the rear left-hand seat. The coastline of PEI was flown counter-clockwise starting and finishing in Murray Harbour (N 46.030°, W 62.528°). The total flight time was 7.1 hours and the total survey time was 6.75 hours. The actual survey occurred from 8:20-12:25 and from 13:30-16:10. A 45 minute refuelling stop was made at Alberton Harbour (N 46.795°, W 64.059°).

Tern and gull colonies were identified from the air, and their location marked on 1:50,000 topographic maps. Only the location of tern colonies was noted because the survey was too early for an accurate count and we planned to visit each tern colony on the ground. A visual estimate of the number of gulls at each colony was made by each observer. On

islands with small gull colonies, total counts of individual gulls were performed; but at larger colonies, birds were counted in clusters of 5, 10 or 25. The two observers jointly estimated the species ratio for colonies with both Great Black-backed Gulls and Herring Gulls. Ring-billed Gulls were counted separately. Birds that were obviously loafing, on the edge of the colony, or in the intertidal zone were not counted; however, the location and number of gulls in roosting flocks away from colonies was recorded according to Canadian Wildlife Service Coastal Survey Block (Lock et al. 1996; Figure 2).

In addition to visual estimates, aerial photographs were taken of gull colonies from the opened left front window of the plane at an altitude of 150-200 m. The angle of photographs varied depending on island size and the height of the aircraft. Photos were taken with a Pentax 645 medium format camera with Kodak Professional Portra 400VC colour negative film.

Aerial photographs of gull colonies were interpreted digitally (Chardine 2000). Films were scanned to compact disc at a resolution of 5452 x 4142 pixels (Appleby Color Lab Ltd., Fredericton, N.B.) and analyses were performed using Adobe Photoshop 5.5. For islands too large to be captured on one photograph, multiple overlapping photos were taken. Those sections of photographs that overlapped adjacent photographs were marked and only the image that best represented the overlapped area was counted. In Photoshop, a layer was added for each species and a square, with a known number of pixels, was placed using the pencil tool on each *apparently occupied territory* for gulls. Individual gulls or pairs on the interior of the colony that were spaced regularly were assumed to be on territories. Gulls that were obviously loafing, on the edge of the colony, or in the intertidal zone were not included in the count. The number of *apparently occupied territories* was determined using the HISTOGRAM function in Photoshop. This produced a histogram with the number of pixels of each colour on a layer. To determine the total number of squares or *apparently occupied territories* for each species, the total number of pixels was divided by the number of



Box 1. Pattern of ground surveys for gulls and terns in PEI, 2004.

pixels per square. A*pparently occupied territories* were deemed to be equivalent to nesting pairs.

Ground Survey – Ground surveys were conducted 4-7 June for gulls, except for Cherry Island and Little Courtin Island which were surveyed on 16 and 17 June, respectively and were conducted by the PEI Department of Environment and Energy (Brad Potter, personal communication). Ground surveys for terns were conducted on 15 June.

Surveys were conducted with 2-5 researchers walking parallel transects about arms length apart. The outside line of each transect was marked with forestry survey flags, which were picked up on the following transect (see Box 1). The number of eggs and chicks was recorded for each nest. The species attending each nest was determined by a combination of egg size, nest location, direct observation of incubating birds, and hatching chronology. On islands where chicks were old enough to have wandered sufficiently far that it was not possible to associate them with particular nests, the total number of nests, eggs, and chicks were recorded separately. This permitted a rough estimate of percent hatch but did not permit the determination of clutch sizes.

Results from this survey are archived in the Atlantic Region Seabird Colony Database, Canadian Wildlife Service, Sackville, New Brunswick.

RESULTS

Great Black-backed and Herring Gulls – Aerial surveys identified 10 Great Black-backed and Herring Gull colonies in PEI (Table 1; Figure 3). Single pairs of Great Black-backed Gulls were observed at three additional sites and two other sites supported two pairs (Table 2). These five smaller sites were not photographed or visited on the ground.

The total number of Great Black-backed and Herring Gulls estimated from aerial visual estimates were 3282 (Observer 1) and 2917 (Observer 2; Table 1 and 2) and the species ratio was estimated at 54-57% Herring Gull to 43-46% Great Black-backed Gull (Table 1). Multiple aerial photographs (2-15) were taken of the 10 larger colonies. From photographs we estimated that 4800 pairs of gulls (1712 Great Black-backed Gulls and 3088 Herring Gulls) nested at these 10 sites.

However, assuming ground counts are the most reliable estimate of colony size (Kress and Hall 2004), we estimate that 2898 pairs of gulls nested at the 10 main colonies on PEI in 2004. Of these, 1103 were Great Black-backed Gulls and 1795 were Herring Gulls.

The ground survey of Indian Point Sand Hills West was not completed because the falling tide would have prevented the field crew from getting off the island. Two fixed objects, large enough to be visible from the air, were identified and all birds west of the line connecting these points were counted from the ground. Aerial photographs were used to

estimate ground counts for Great Black-backed and Herring Gull numbers east of this line (see Table 1).

In order to determine the usefulness of aerial visual estimates and photo estimates we developed correction factors using the ground estimates as the true count. The aerial visual estimates of both observers were more accurate than the photo estimates ($1.36_{[obs\ 1]}$ and $1.32_{[obs\ 2]}$ individuals $_{[visual]}$/ nest $_{[ground]}$ compared to 1.80 territories $_{[photo]}$/ nest $_{[ground]}$) and the precision of the estimates (standard deviation) were similar (Table 1). The colony at Cascumpec Sandhills was not included in the correction factors. The ground survey only identified two gull nests despite quite a few adults in the vicinity of the colony site. There were signs of fox suggesting that this colony may have suffered from predation.

Great Black-backed Gulls were nesting at nine of the ten sites surveyed. Advanced age of chicks complicated identification of nest origin at all sites but one: Bird Island which only had four nests (1 nest with 2 eggs and 3 nests with 3 eggs). Percent hatch at the other sites was 74% (Table 3). Herring Gulls nested at eight of the ten sites surveyed. Clutch size was calculated for the six sites surveyed on 4-7 June: 2.51 ± 0.69 eggs per nest (Table 4). The percent hatch at these sites was 16%. Percent hatch at the other two sites surveyed on 16-17 June was 40% so it was not possible to determine clutch size (Table 4).

Ground surveys at Cherry Island and Little Courtin Island were conducted almost two weeks later than those at the other colonies. As a result, a far larger proportion of the Herring Gull eggs had hatched and the chicks were older, making them more difficult to differentiate from Great Black-baked Gull chicks. On Cherry Island, at least 67% of the gull eggs had hatched while on Little Courtin Island, at least 54% of the eggs had hatched. These would be underestimates because eggs that have not hatched are easier to detect than chicks because the chicks are mobile and able to hide. The ratio of Herring Gulls on Cherry Island was much higher (90%) than for the aerial visual estimate (60%) and photo estimate (73%). It is likely that the number of Great Black-backed Gulls on Cherry Island was underestimated during the ground survey. The species' ratio on Little Courtin Island from the ground survey (64%) was similar to those calculated from the aerial visual estimate (70%) and photo estimate (62%). The counts at these two colonies are not expected to be as accurate as those at the other colonies, although after the chicks have left the nest it is still possible to identify those nests that were active.

A total of 3481 roosting gulls were observed away from colonies during the aerial surveys (Table 5). This is a further decline from numbers observed in 1999, however it was expected that more gulls were away from colonies in 1999 because the survey was conducted later in the breeding period than in 2004. Regardless, the numbers of gulls away from colonies was substantially smaller than in 1986 (Lock 1987) when over 12000 roosting gulls were counted. The biggest declines appear to be on the western portion of the north shore.

Ring-billed Gulls – Ring-billed Gulls were observed nesting at three sites on PEI in 2004 (Table 6; Figure 4). Two of these sites supported two sub-colonies (Table 6). Ground

surveys identified 691 nests at the three sites. The north sub-colony at Poverty Beach was small and the nest density was low. It was not observed during the aerial survey nor was it detected on the aerial photographs. The sub-colony was discovered on 15 June during the survey for terns so it is possible that it was not present during the flight on 24 May. This was the only site where Ring-billed Gull chicks were not seen, suggesting that this sub-colony was established later than the others. The west sub-colony at Indian Point Sandhills West was inadvertently not photographed.

The correction factors suggested that the visual estimate of observer 2 was the most accurate but the precision of the photo estimate was better (Table 6). The differences were minimal implying that the additional costs of aerial photography may not have been worth the added precision they provided.

Percent hatch was greater than 50% for three of the five Ring-billed Gull nesting (sub-) colonies. At the south sub-colony at Poverty Beach, the chicks were young enough that they were still in the nest bowl which allowed the determination of clutch size. To reduce disturbance at the two sub-colonies on Indian Point Sand Hills West, only nests were counted. The average clutch size at the other three (sub-) colonies was 2.54 ± 0.76 eggs per nest (Table 7).

Terns – Surveys confirmed nesting terns at Poverty Beach, Indian Point Sand Hills West, Covehead Harbour and Hillsborough Bridge (Table 8; Figure 5), and an additional two sites in PEI National Park were identified by Piping Plover guardians. A total of 738 nests were counted at the six sites. All nests were attributed to Common Terns except for a single Arctic Tern nest at Covehead Bridge. The mean clutch size for the three colonies where eggs were counted was 2.43 ± 0.73 eggs per nest (Table 9): Indian Point Sand Hills West, Covehead Harbour and Poverty Beach. Several chicks were present at the Hillsborough Bridge site.

Incidental observations conducted by Piping Plover guardians in PEI National Park identified three Common Tern nests at Robinson's Island (Rustico Island Sandspit; N 46.443°, W 63.265°) and one nest at Blooming Point (N 46.415°, W 63.016°). Two of the nests at Robinson's Island were depredated and one nest hatched on 29 July but the fate of the chicks was not known. The nest on Blooming Point had two eggs and was found on 8 July it was still there when the plover season ended so it is likely that this nest was abandoned (Rick Hawkins, PEINP, personal communication). There were unconfirmed reports of another tern colony at Maximeville sandspit (N 46.444°, W 64.123°; J. Waddell, Island Nature Trust, personal communication).

DISCUSSION

This is the second survey of Prince Edward Island conducted by the Canadian Wildlife Service since 1999 when it implemented a program to survey terns and associated coastal

colonial waterbirds in Atlantic Canada. The results from this survey provide insight into recent trends in the abundance and distribution of terns and gulls in PEI.

Great Black-backed and Herring Gulls – Results from the 1999 survey of PEI suggested that Great Black-backed and Herring Gull populations had declined considerably since 1986 (Boyne et al. 2001; Table 10, Figure 6). However, in 1999, the survey was timed specifically for terns. As a result aerial estimates of gull colonies would have occurred after mean hatch for both species and no ground surveys were conducted. Furthermore, the aerial photos were of poor quality and it was not possible to differentiate between Great Black-backed Gulls and Herring Gulls. Therefore, the results in 1999 were problematic and the slight increase that appears to have occurred between 1999 and 2004 is questionable. However, our results in 2004 confirm the large decline in both species since 1986 (Lock 1987; Table 10, Figure 6). The decline of these large gulls is consistent with trends observed elsewhere in Eastern Canada (Nova Scotia – Boyne and Beukens 2004; Newfoundland – Robertson et al. 2001; New Brunswick – Boyne and Hudson 2002; Quebec – Chapdelaine 1995). These declines have been attributed to a decrease in food availability from artificial sources such as dumps and landfills, and discards from the fishing industry.

Ring-billed Gulls – Ring-billed Gulls were first detected nesting in PEI in 1974 when a single pair was observed on an island in Murray Harbour (Lock 1988). The following year five pairs were observed at this site (Lock 1988). The population increased 46.8% per year through to the mid-1980s (234 pair in 1984 and 230 pair in 1986; Figure 7). This was higher than the 21% annual increase Lock (1988) estimated for the Atlantic Canadian population between 1972 and 1986. This is likely due to the recent arrival and subsequent increase of the species in PEI. Ring-billed Gulls were recorded nesting in northern New Brunswick a decade earlier than in PEI and their historic range includes Newfoundland and southern Labrador. Since the mid-1980s the rate of population growth has declined in PEI with a mean annual increase of 5.6% between the mid-1980s and 1999 and 6.8% between 1999 and 2004. The overall mean population growth from 1975 until 2004 has been 18.5%.

It is not clear what factors have affected the growth of Ring-billed Gull populations in Atlantic Canada. Increases in the Great Lakes were attributed to the protection provided by the Migratory Birds Convention Act, introduction and spread of rainbow smelt (*Osmerus mordax*) and alewives (*Alosa pseudoharengus*), and creation of nesting islands during a low water cycle (Ludwig 1974). It is not clear whether population declines of larger gulls or increases in food from human activities have contributed to these increases.

Terns – The tern population in PEI is well below historic highs recorded in the 1980s. In 1984, over 3000 pairs of terns nested at 10 colonies (Table 8; Figure 8). In 1999, fewer than 300 pairs of terns were found in the province. In 2001, 831 pairs were counted, however this was in large part to the appearance of a large colony at Poverty Beach which supported 611 of the 831 pairs. This site was not occupied in 1999. In 2004 we found 738

pairs at six sites. Across the three years, 1999, 2001 and 2004 only three sites supported nesting terns in each year; Indian Point Sandhills, Hillsborough Bridge and Covehead Harbour. Rustico Island Sandspit also supported terns in all three years but in 1999 and 2004 it only supported a single pair.

The number of terns nesting in the province has decreased and so have the number of colonies. In 1966, terns bred at 29 sites whereas in 2004, terns only nested at six. The decline in numbers and nesting sites, the fact that only a few sites support terns on an annual basis, and work that suggests that the productivity of terns is very poor (McLellan 2004) are all indications that terns in the province are under pressure.

Reduced habitat availability, as a result of human encroachment along the coast and competition for nest sites with the larger and more aggressive gulls is a major concern, as is predation from mammals such as foxes and coyotes. Efforts are required to protect terns at the three sites that currently support the majority of the PEI tern population; Indian Point Sandhills, Hillsborough Bridge and Poverty Beach. Gull populations are declining which in the long run should be beneficial for tern populations, however predation pressures from coyotes and foxes may be increasing and will require novel approaches to protect the colonies. Electric fencing has been used on the Magdalen Islands to protect tern colonies from foxes (F. Shaffer, Canadian Wildlife Service, personal communication), however the on-going effort necessary to maintain these structures requires long-term commitment from a local group or government. The Hillsborough Bridge piers are collapsing, reducing the nesting area for terns at that site. Local groups intend to use artificial nesting rafts to provide additional nesting sites for this colony. These efforts combined with appropriate land-use practices along the coast should benefit the long-term survival of tern populations on PEI.

Correction factors – We made an effort to produce visual aerial estimates, photo estimates, and ground counts for every gull colony in PEI. This was done at least partly to evaluate the necessity for aerial photography. Aerial photography is costly because of the extra time required during flights and because of the costs of having negatives scanned digitally for analyses (although with improvements in digital technology, it will be possible in the future to use a digital camera, thereby removing the costs associated with scanning).

For comparison purposes we assumed that ground counts produced the most accurate estimate. Thus, aerial visual estimates and aerial photo estimates were compared in relation to ground counts. Based on our results, the aerial visual estimates for Great Black-backed and Herring Gulls were more accurate and precise than the aerial photo estimate (see Table 1). For Ring-billed Gulls, aerial photo estimates and aerial visual estimates were comparable (see Table 6). These results suggest that assuming you have trained observers, the added benefit of aerial photography may not be worth the costs. However, there are discrepancies between surveys. In 2002, during a survey for gulls in Nova Scotia (Boyne and Beukens 2004), aerial estimates underestimated ground counts, while in this survey our aerial estimates overestimated ground counts. It is difficult to

interpret this discrepancy as one of the observers was the same in both surveys and the techniques were similar. Kadlec and Drury (1968) produced correction factors that are often quoted for aerial gull surveys. They found that aerial estimates from a helicopter underestimated the population slightly when compared to nest counts. Because of these discrepancies, we are not prepared at this time to recommend that aerial photography is not worth the added costs, however we will continue to collect data in such a way that the utility of aerial photographs can be further examined.

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Table 1. Aerial visual (individuals), aerial photo (territories), and ground (nests) estimates of Great Black-backed and Herring Gulls at colonies in Prince Edward Island, 2004 (see Appendix for topographic maps of selected colonies).

Location	Latitude	Longitude		Aerial visual (individuals)		Photo (territories)	Ground (nests)	Correction factors		
				Obs. 1	Obs. 2			Obs 1/ ground	Obs 2/ ground	Photo/ ground
Cherry Island	46.034	-62.503	Total Gulls	190	225	244	196	0.97	1.15	1.24
			% HERG	60%	60%	73%	90%			
			GBBG	76	90	66	19			
			HERG	114	135	178	177			
Poverty Beach	46.037	-62.482	Total Gulls	630	625	1035	774	0.81	0.81	1.34
			% HERG	30%	30%	44%	44%			
			GBBG	441	438	583	435			
			HERG	189	188	452	339			
Little Courtin Island	46.509	-63.760	Total Gulls	760	750	796	464	1.64	1.62	1.72
			% HERG	70%	70%	62%	64%			
			GBBG	228	225	306	168			
			HERG	532	525	490	296			
Bird Island	46.597	-63.822	Total Gulls	275	210	361	122	2.25	1.72	2.96
			% HERG	100%	100%	97%	97%			
			GBBG	0	0	10	4			
			HERG	275	210	351	118			
Cascumpec Sand Hills	46.780	-64.028	Total Gulls	60	60	86	2	-	-	-
			% HERG	100%	100%	94%	100%			
			GBBG	0	0	5	0			
			HERG	60	60	81	2			
Tern Island	46.807	-64.043	Total Gulls	110	130	132	75	1.47	1.73	1.76
			% HERG	0%	0%	1%	0%			
			GBBG	110	130	131	75			
			HERG	0	0	1	0			
Gillis Island	46.809	-64.038	Total Gulls	40	40	46	29	1.38	1.38	1.59
			% HERG	0%	0%	0%	0%			
			GBBG	40	40	46	29			
			HERG	0	0	0	0			
Wagners Island	46.813	-64.037	Total Gulls	140	150	169	65	2.15	2.31	2.60
			% HERG	0%	0%	11%	6%			
			GBBG	140	150	151	61			
			HERG	0	0	18	4			
Bernards Island	46.815	-64.039	Total Gulls	70	70	151	118	0.59	0.59	1.28
			% HERG	0%	0%	9%	3%			
			GBBG	70	70	137	114			
			HERG	0	0	14	4			
Indian Point Sand Hills	46.626	-64.287	Total Gulls	1000	650	1780	855 [1053]*	0.95	0.62	1.69
West			% HERG	70%	70%	84%	78%			
			GBBG	300	195	277	186 [198]*			
			HERG	700	455	1503	669 [855]*			
		Totals	Total Gulls	3275	2910	4800	2898			
			GBBG	1405	1337	1712	1103			
			HERG	1870	1573	3088	1795			
							Mean	1.36	1.32	1.80
							SD	0.58	0.58	0.60

* Incomplete ground count. Number in bracket is an overall estimate of colony size calculated using correction factor of photo estimate from the section of the colony for which there was a ground survey (1445 photo estimate/ 855 ground estimate = 1.69) and dividing the number of missed nests from aerial photo (1780-1445=335) by 1.69 (198) and adding that to the 855 nests that were surveyed on the ground. All other calculations are made using the corrected total of 1053 nests.

Table 2. Sites identified during aerial surveys that supported two or fewer Great Black-Backed Gulls in Prince Edward Island, 24 May 2004.

Location	Latitude	Longitude	Pairs of GBBG
Unnamed, East of Poverty Beach (mouth of Murray Harbour)	46.036	-62.484	1
Panmure Island	46.147	-62.489	2
Sturgeon Bay	46.130	-62.535	1
Thornton Point	46.146	-62.536	2
MacPhee Beach Island	46.202	-62.520	1

Table 3. Number of nests, eggs and chicks of Great Black-backed Gulls at colonies in Prince Edward Island, 2004.

Location	Latitude	Longitude	Date	Eggs	Chicks	Total chicks and eggs	Nests	Percent hatch
Indian Point Sand Hills West	46.626	-64.287	4 June	196	263	459	186*	57%
Tern Island	46.807	-64.043	5 June	34	128	162	75	79%
Gillis Island	46.809	-64.038	5 June	9	70	79	29	89%
Wagners Island	46.813	-64.037	5 June	31	86	117	61	74%
Bernards Island	46.815	-64.039	5 June	70	206	276	114	75%
Bird Island	46.597	-63.822	6 June	6	5	11	4	45%
Poverty Beach	46.037	-62.482	7 June	145	643	788	435	82%
Cherry Island	46.034	-62.503	16 June	-	-	-	19	-
Little Courtin Island	46.509	-63.760	17 June	-	-	-	168	-
			Totals	491	1401	1892	1091	74%

* Partial survey (see Table 1)

Table 4. Clutch size and nest counts of Herring Gulls at colonies visited in Prince Edward Island, 2004.

Location	Latitude	Longitude	Date	Clutch size					Nests	Total eggs	Hatched chicks	Percent hatch	Clutch size	
				0	1	2	3	4					Mean	SD
Indian Point Sand Hills West	46.626	-64.287	4 June	0	77	194	397	1	669	1660	249	15%	2.48	0.70
Wagners Island	46.813	-64.037	5 June	0	0	2	2	0	4	10	0	0%	2.50	0.58
Bernards Island	46.815	-64.039	5 June	0	1	1	2	0	4	9	0	0%	2.25	0.96
Cascumpec Sand Hills	46.780	-64.028	5 June	91*	2	0	0	0	2	2	0	0%	1.00	0
Bird Island	46.597	-63.822	6 June	0	6	24	88	0	118	318	1	0%	2.69	0.56
Poverty Beach	46.037	-62.482	7 June	0	39	87	213	0	339	852	283	33%	2.51	0.69
Cherry Island	46.034	-62.503	16 June	-	-	-	-	-	177	-	-	-	-	-
Little Courtin Island	46.509	-63.760	17 June	-	-	-	-	-	296	-	-	-	-	-
			Totals	91	125	308	702	1	1609	2851	533	16%	2.51	0.69

* not included in totals

Table 5. Roosting gulls surveyed in Prince Edward Island away from colonies, recorded by Canadian Wildlife Service Coastal Survey Blocks, 1986-2004.

	1986					1999						2004				
Block	GBBG	HERG	RBGU	Immature	Total	GBBG	HERG	BOGU	Immature	Unknown	Total	GBBG	HERG	Immature	Unknown	Total
381	301	1271		235	1807					360	360	25	30	25	275	355
382	327	935		227	1489					365	365		10	90	202	302
383					ns					75	75	25	99	49	282	455
384					ns						0	8	12	10	20	50
385	59	699		26	784						0	5	30	35		70
386	42	691		800	1533					550	550	45	130	100	190	465
387	55	611		1095	1761					521	521	15	45	30		90
388	110	319		375	804					45	45	8	17			25
389	12	13		25	50		+				+					0
390	30	180		199	409		350				350	5	20			25
393	74	281	20	125	500	18	84		30		132	2	8	3	12	25
394	7	90	10	60	167				55	323	378	9	58	36		103
395	7	11	3	2	23	38	2				40					0
396	16	57		44	117						0					0
397		77		55	132				55	100	155	1	40	24		65
398		64		22	86	2	363	100	44	140	649		62	10		72
402	93	100		55	248		80		40	135	255	17	63	87		167
403	36	80		31	147	2	28		42		72	27	95	50		172
404	56	46		3	105	6	54				60		42			42
405		5			5				22		22					0
406		34			34	4	95		40		139	5	70		40	115
407	2	32			34		35				35	10	15		142	167
408					0	10	90				100					0
409	6				6						ns					0
411	5	413		7	425				70		70	1			205	206
412	66	165		78	309				50		50	3	2		45	50
413		109		4	113	3	79		12	55	149				30	30
414	145	159		61	365		230			2	232	5	5		295	305
415	7	37		16	60		90			28	118					0
416	49	155			204					12	12	3			22	25
417	24	85		2	111						0					0
418	116	747		27	890					550	550	10	18	12	60	100
Total	1645	7466	33	3574	12718	83	1580	100	460	3261	5484	229	871	561	1820	3481

Headings are GBBG = Great Black-backed Gull; HERG = Herring Gull; RBGU = Ring-billed Gull and BOGU = Bonaparte's Gull.
+ gulls present but not counted
ns not surveyed

Table 6. Aerial visual (individuals), aerial photo (territories), and ground (nests) estimates of Ring-billed Gulls at colonies in Prince Edward Island, 2004.

Location	Latitude	Longitude	Aerial visual		Photo	Ground	Correction factors		
			Obs. 1	Obs. 2			Obs. 1/ ground	Obs. 2/ ground	Photo/ ground
Indian Point Sand Hills West	46.626	-64.287							
West colony			350	210	-	292	1.20	0.72	-
East colony			200	175	214	230	0.87	0.76	0.93
Bird Island	46.597	-63.822	75	70	78	69	1.09	1.01	1.13
Poverty Beach	46.037	-62.482							
South colony			150	150	130	83	1.81	1.81	1.57
North colony			0	0	0	17	-	-	-
		Totals	775	605	422	691			
						Mean	1.24	1.08	1.21
						SD	0.35	0.44	0.27

Table 7. Clutch size and nest counts of Ring-billed Gulls at colonies visited in Prince Edward Island, 2004.

Location	Latitude	Longitude	Date	Clutch size						Nests	Eggs	Chicks	Total chicks & eggs	Percent hatch	Clutch size	
				1	2	3	4	5	6						Mean	SD
Indian Point Sand Hills West	46.626	-64.287	4 June													
West colony										292						
East colony										230						
Bird Island	46.597	-63.822	6 June	11	13	41	3	0	1	69	178	8	186	4%	2.58	0.91
Poverty Beach	46.037	-62.482														
South colony			7 June	4	33	46	0	0	0	83	-	-	208	>50%	2.51	0.59
North colony			15 June	4	7	6	0	0	0	17	36	0	36	0%	2.12	0.78
			Totals	19	53	93	3	0	1	691	422		430		2.54	0.76

Table 8. Surveys of tern nests in Prince Edward Island, 1966-2004. A '-' indicates a colony was not surveyed, and a blank cell indicates that it was not possible to determine whether an island was surveyed.

Colony	1966 [1]	1975 [2]	1984 [3]	1986 [4]	1987 [5]	1999 [6]	2001 [7]	2004
Alberton Harbour Islands	410	100	474	18	0	0		0
Boughton Island			-	0	12	0		0
Cascumpec Sandhills		100	983	136	155	0	2	0
Charlottetown Harbour	80		-	0	-	0		0
Conway Sandhills		0	1189	0	57	0		0
Darnley Island		50	-	0	-	0		0
Duck Creek Point							2	-
Eglington Cove			-	0	-	15	3	0
Gascoigne Cove							4	0
Hillsborough Bridge	80	125	-	234	231	17	69	66
Indian Point Sandhills			355	0	178	54	61	254
Little Courtin Island	541	70	0	0	-	0		0
Malpeque Sandhills, Hog Island			161	0	33	0	7	0
Mossy Point			3	0	-	0		0
Murray Harbour Islands	90	200	-	0	0	0		0
PEINP, Blooming Point			0	0	-	1		3
PEINP, Cavendish Sandspit		12	161	0	-	68	2	0
PEINP, Covehead Harbour		56	5	0	-	12	8	19
PEINP, Rustico Causeway			62	0	-	0	2	0
PEINP, Rustico Island Sandspit	1		5	0	-	1	60	1
Pownal Bay	98	35	-	21	81	113		0
Poverty Beach		50	-	21	81	0	611	395
Savage Harbour	1		-	0	1	0		0
South Lake			-	0	2	6		0
St. Peter's Bay			-	2	0	0		0
St. Peter's Lake	24		-	0	-	0		0
Wood Island	1	75	-	4	61	0		0
Additional colonies	40*							
Total	1326	873	3398	436	892	287	831	738
Number of Colonies	29	11	10	7	11	9	12	6

[1]B.C. Pigot, Maritimes Nest Record Scheme, Canadian Widlife Service, Sackville, NB; [2]G. Hogan, PEI Fish and Wildlife Division, MNRS; [3]MacDougall 1985; [4]Lock 1987; [5]Northcott and Creamer 1987; [6] Boyne et al. 2001; [7] R. Curley, unpublished data and L. Thomas unpublished data

* 40 nests observed at 19 additional sites

Table 9. Clutch size and nest counts of Common Terns at colonies visited in Prince Edward Island, 2004.

Location	Latitude	Longitude	Date	Nests	Number of eggs				Eggs	Clutch size	
					1	2	3	4		Mean	SD
Indian Point Sandhills West	46.626	-64.287	15 June	254	50	63	140	1	600	2.36	0.80
Covehead Harbour	46.430	-63.149	15 June	19	3	6†	10	0	45	2.37	0.76
Hillsborough Bridge	46.237	-63.108	15 June	66							
Poverty Beach	46.037	-62.482	15 June	395	41	127	226	1	977	2.47	0.68
			Totals	734	94	196	376	2	1622	2.43	0.73

† One Arctic Tern nest (2 eggs)

Table 10. Numbers of Great Black-backed Gull, Herring Gull and Ring-billed Gull nests surveyed at colonies in Prince Edward Island, 1975-2004.

Colony	Great Black-backed Gull					Herring Gull					Ring-billed Gulls				
	1975 [1]	1984 [2]	1986 [3]	1999*	2004	1975 [1]	1984 [2]	1986 [3]	1999*	2004	1975 [1]	1984 [2]	1986 [3]	1999*	2004
Alberton Harbour Islands	50														
Bernards Island		136	149		114				44	4					
Tern Islands		2	11		75				30	0					
Wagners Island		35	30		61				53	4					
Gillis Island		1			29					0					
Gull Island (Sandy Is.)		111	90		0										
Murray Harbour															
Cherry Island	40		327		19	70		766	63	177					
Gordons Island								2		0					
Poverty Beach			531		435			2200	455	339			114	92	100
Sable Point Island	200				0	250				0	5				0
Bird Island			6		4		17*			118					69
Cascumpec Sand Hills			157		0		1341*	1412	384	93		159			0
Pownal Bay	20		1		0					0					
Conway Sand Hills			2		0		108*	46		0					
Hillsborough Bridge			2	2	0										
Indian Point Sandhills		617	146		186**		616	1263	605	669**		75	116	405	522
Malpeque Bay															
Little Courtin Island	200		571		168	300	200*	1430	128	296					
Ram Island	100		300		0	200	325*	25	115	0					
Nail Pond			1		0					0					
Totals	610	902	2324	2	1091	820	4408	7144	1877	1700	5	234	230	497	691

[1]G. Hogan, PEI Fish and Wildlife Division, Maritime Nest Record Scheme, Canadian Wildlife Service, Sackville, NB; [2]MacDougall 1985; [3]Lock 1987

* Includes Great Black-backed Gulls

** partial ground survey

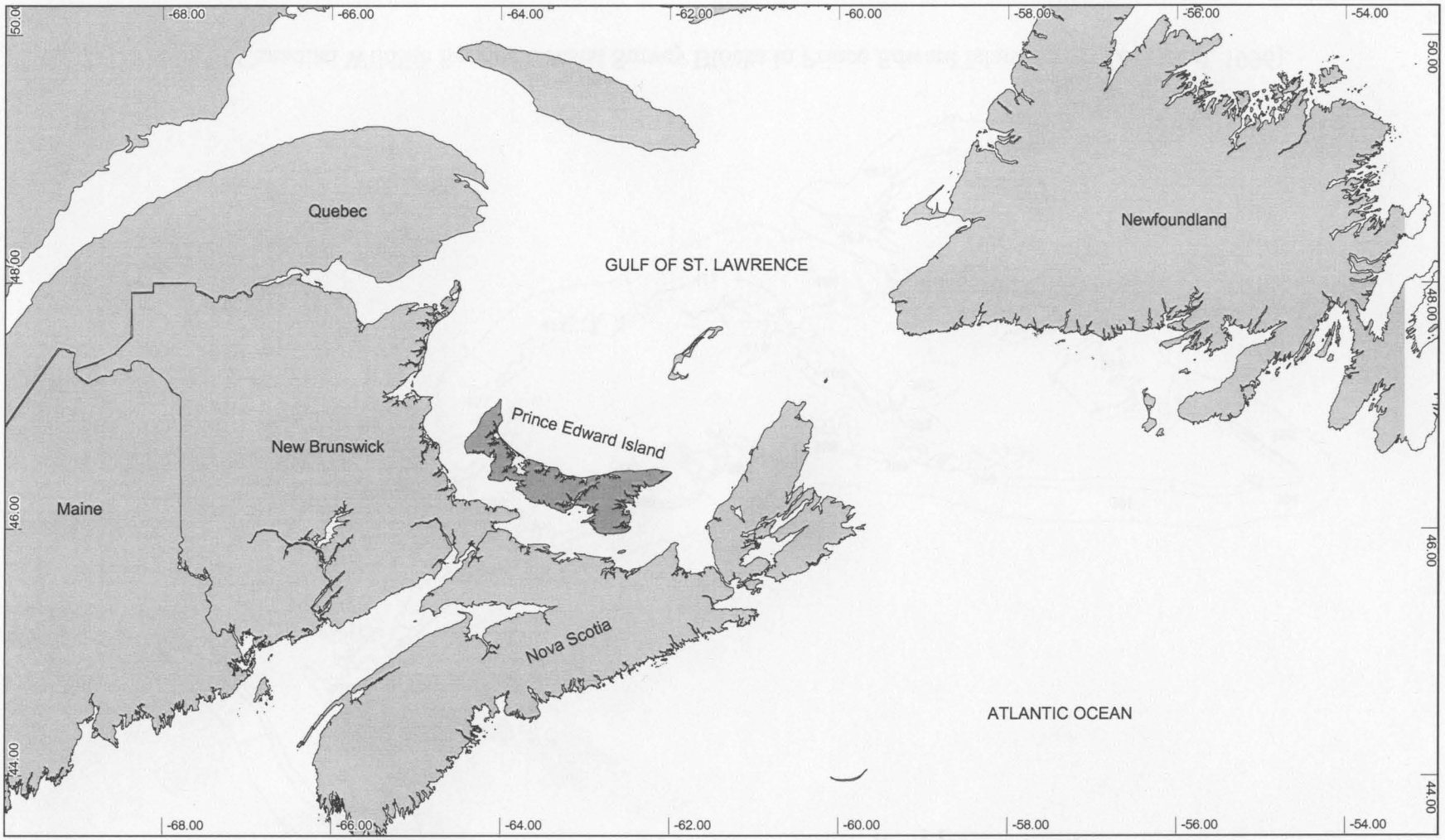


Figure 1. Location of Prince Edward Island, Canada.

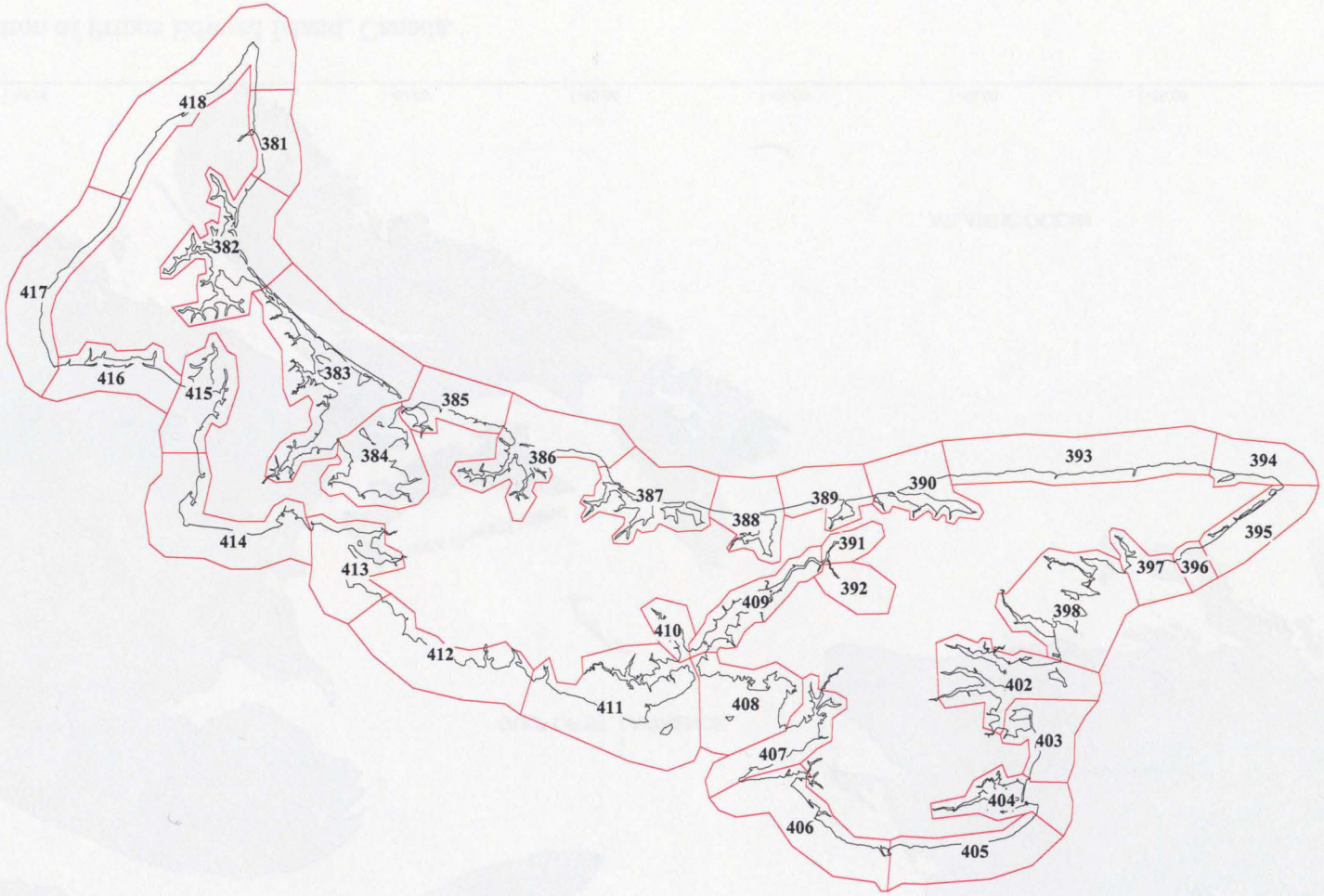


Figure 2. Location of Canadian Wildlife Service Coastal Survey Blocks in Prince Edward Island (from Lock et al. 1996).

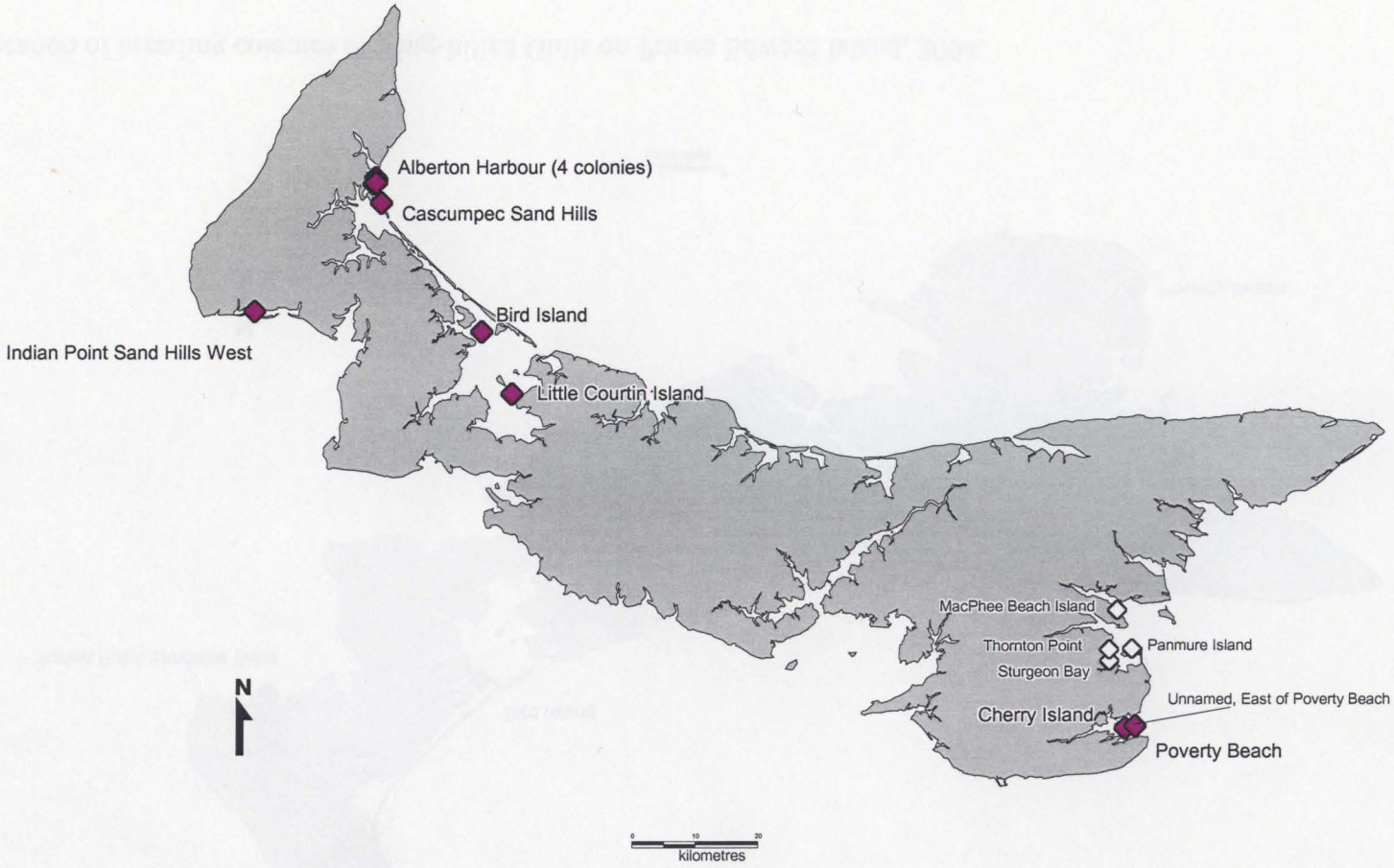


Figure 3. Location of breeding colonies of Herring and Great Black-backed Gulls on Prince Edward Island, 2004. Colonies with two or fewer pairs are marked with open points and smaller font.

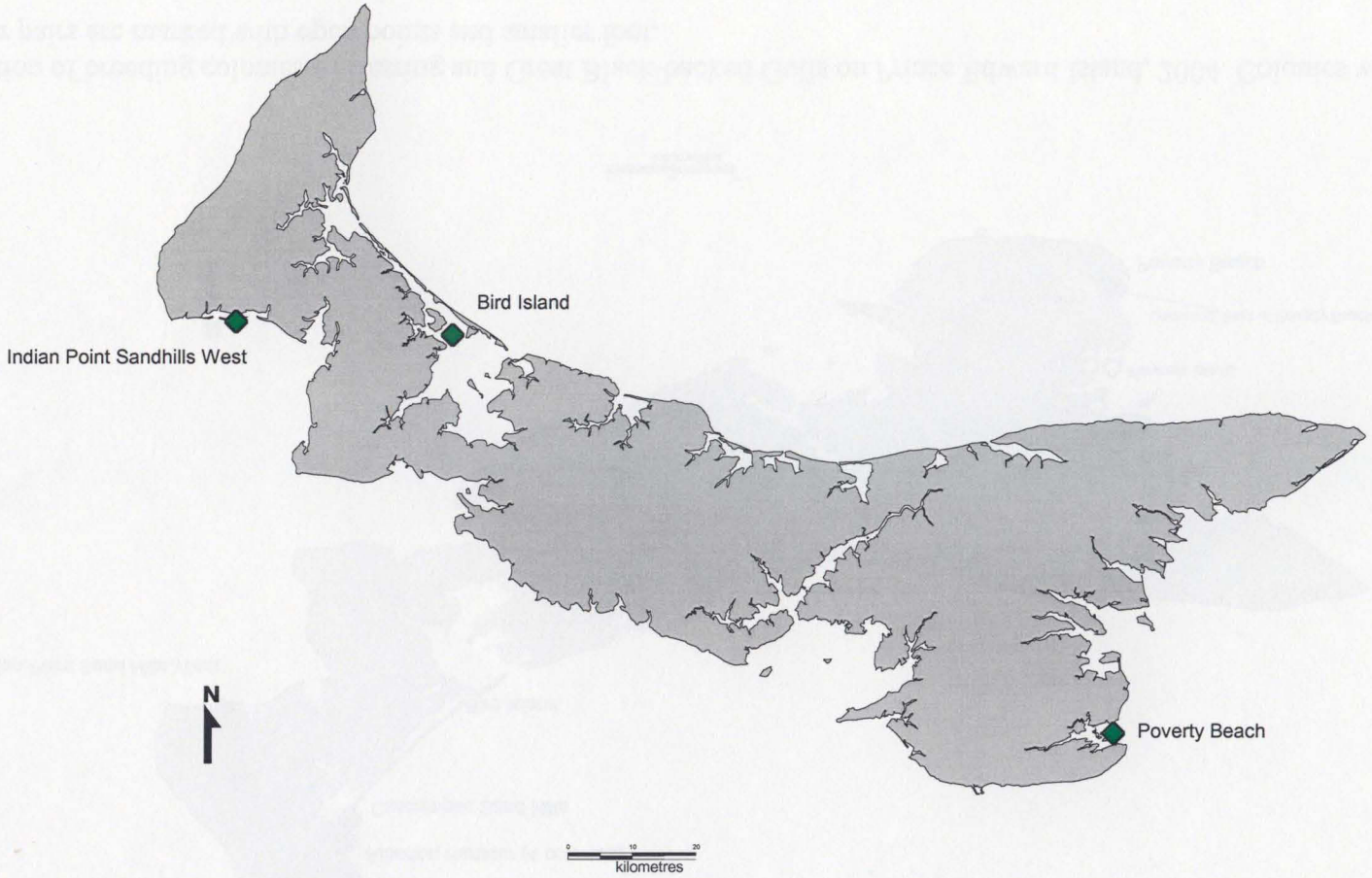


Figure 4. Location of breeding colonies of Ring-billed Gulls on Prince Edward Island, 2004.

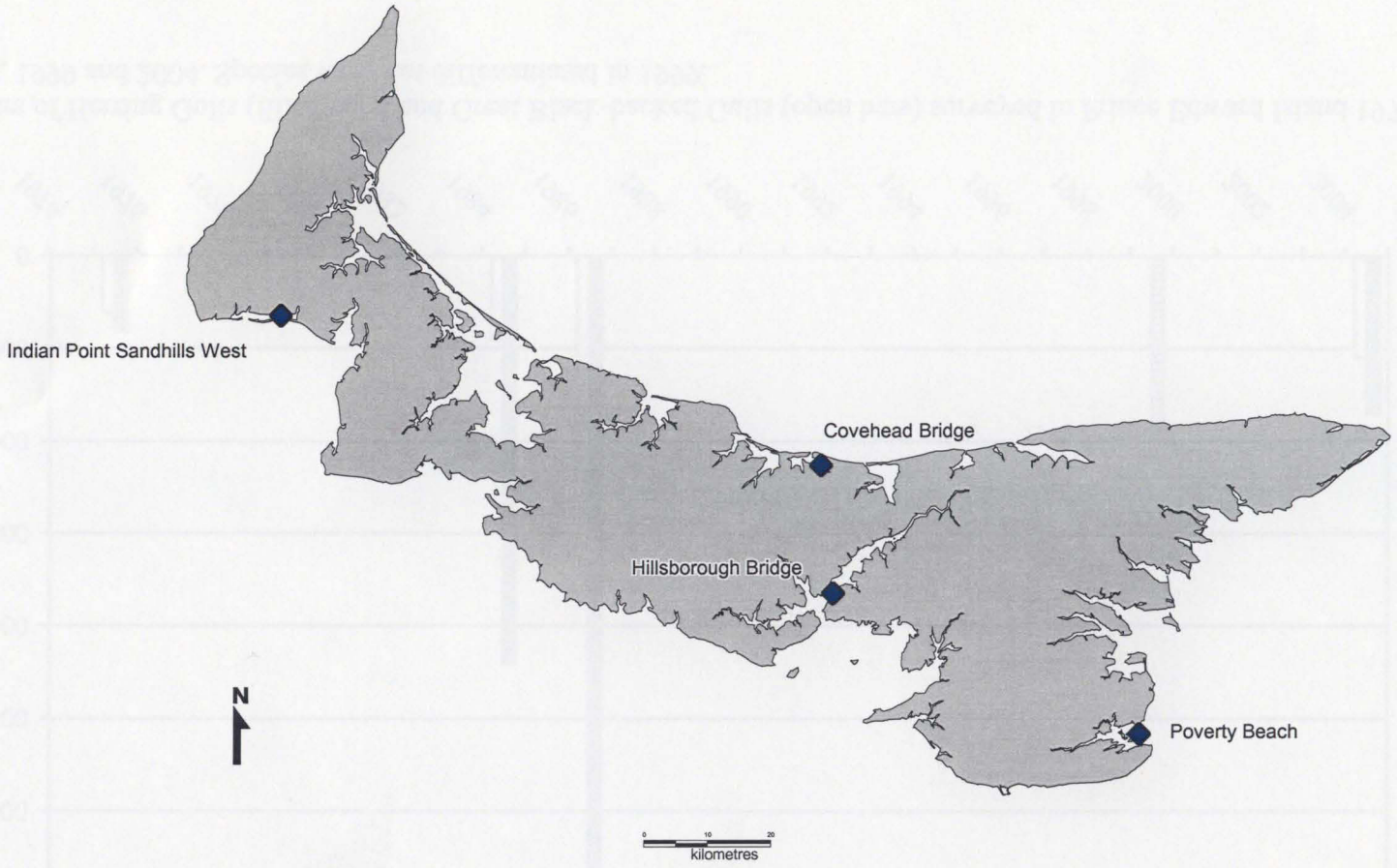


Figure 5. Location of breeding colonies of terns on Prince Edward Island, 2004.

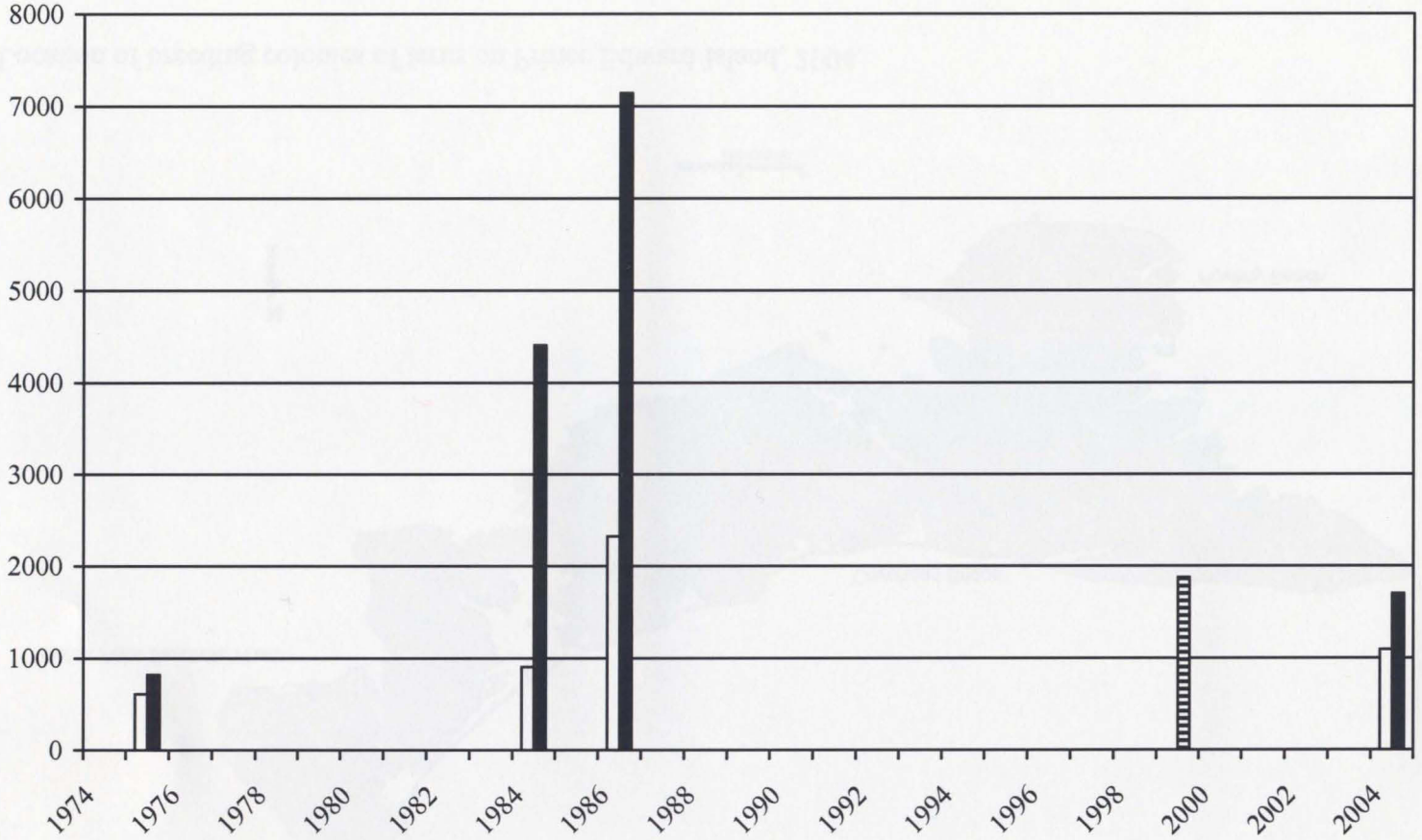


Figure 6. Pairs of Herring Gulls (filled bars) and Great Black-backed Gulls (open bars) surveyed in Prince Edward Island 1975, 1984, 1986, 1999 and 2004. Species were not differentiated in 1999.

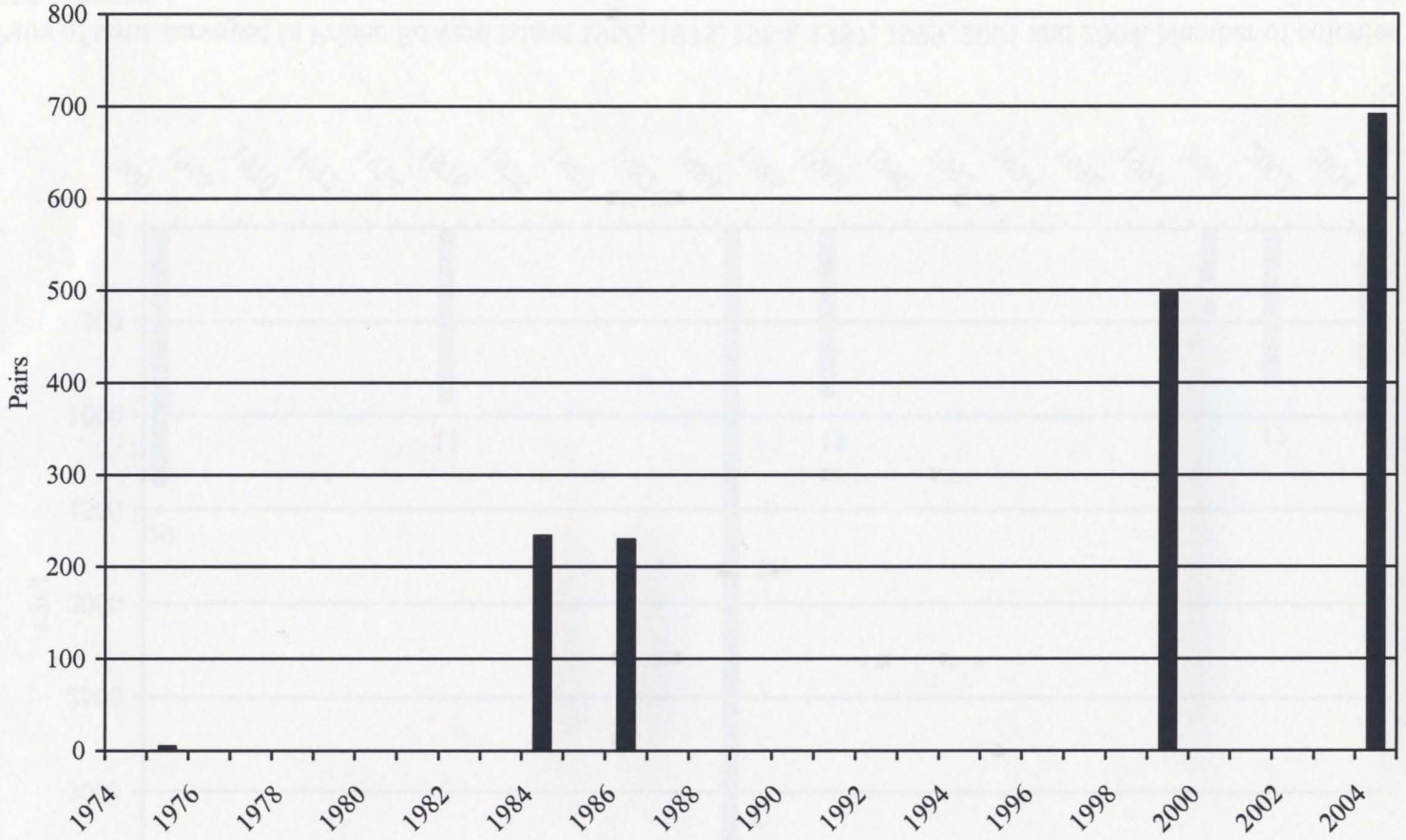


Figure 7. Pairs of Ring-billed Gulls surveyed in Prince Edward Island 1975, 1984, 1986, 1999 and 2004.

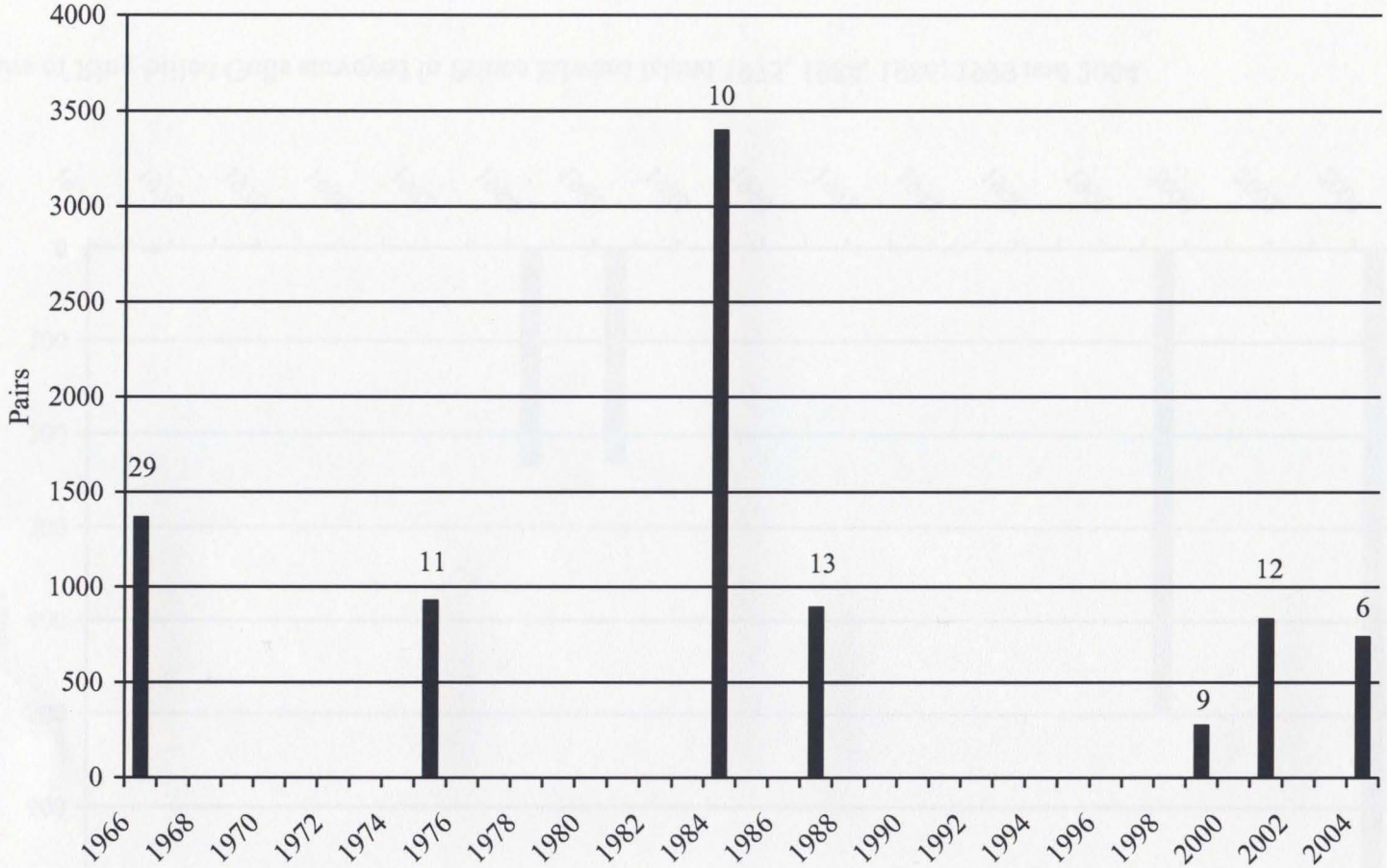
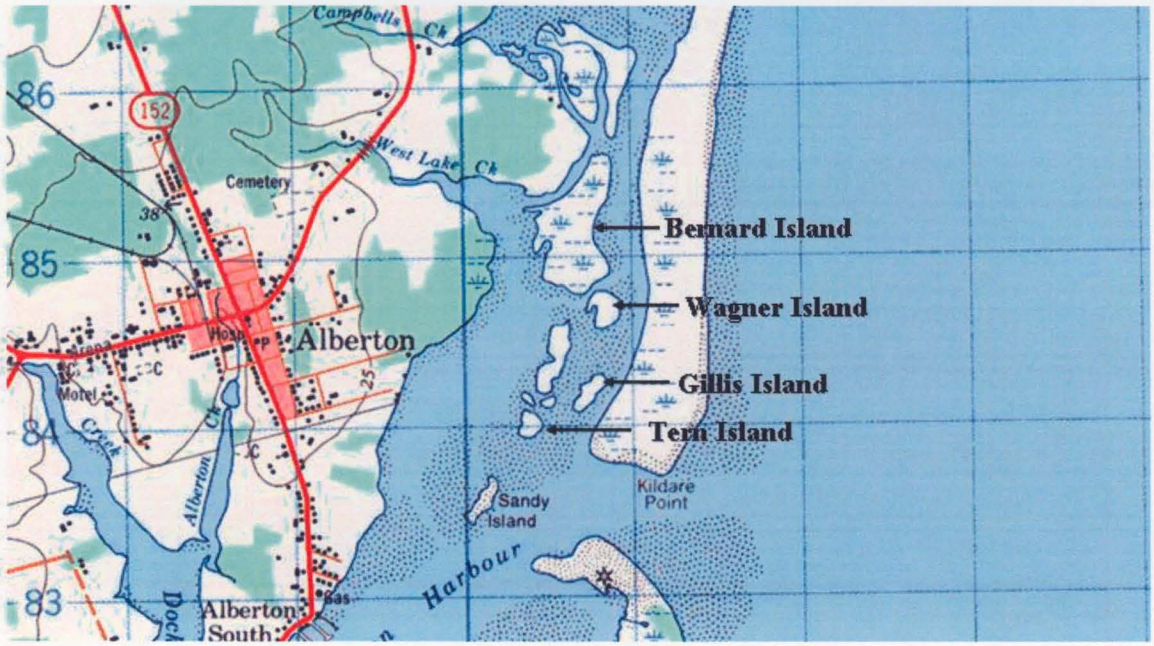


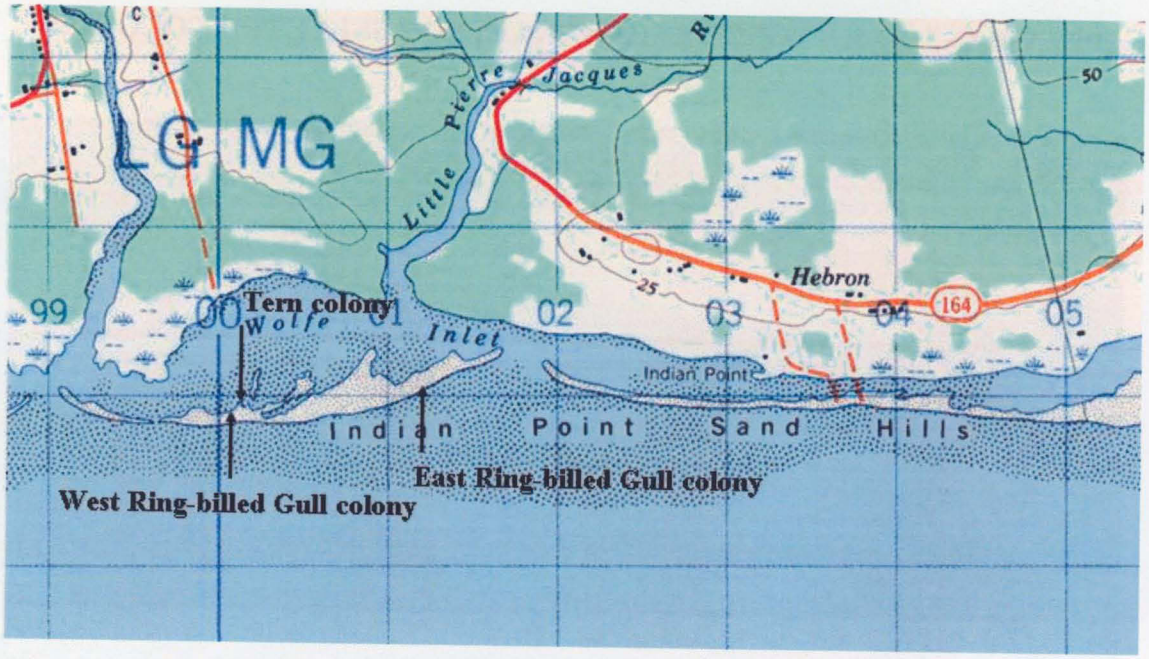
Figure 8. Pairs of terns surveyed in Prince Edward Island 1966, 1975, 1984, 1987, 1999, 2001 and 2004. Number of colonies is shown above columns.

APPENDIX - 1:50,000 TOPOGRAPHIC MAPS FOR SELECTED COLONIES

Poverty Beach



Murray Harbour Islands



Indian Point Sand Hills West

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post-consumer fiber.