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TITLE: **Abundance and Distribution of Harlequin Ducks Molting in Eastern Canada**

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ABUNDANCE AND DISTRIBUTION OF HARLEQUIN DUCKS MOLTING IN EASTERN CANADA

ABSTRACT. - Until recently, very little was known about the basic ecology of the Harlequin Duck (*Histrionicus histrionicus*) in eastern North America, including molting locations. A combination of aerial, ground and boat surveys were initiated in 1989 (Québec) and 1994 (Newfoundland and Labrador), and continued through 1999, to locate their molting areas. Molting Harlequin Ducks were found in Labrador, Newfoundland and the Gaspé Peninsula and Anticosti Island, Québec. Coastal areas of southern Labrador, Grey Islands, northern Newfoundland, and Bonaventure and Anticosti Islands, southern Québec, were the most important sites. The tip of northern Labrador and possibly sites along the Québec North Shore and Greenland are the most likely sites where the rest of the eastern population molts. Molting chronology for the ducks in Québec is similar to those on the east and west coast of North America. Now that these sites are known, monitoring and, if necessary, protection of these sites can be considered.

INTRODUCTION

The eastern North American population of Harlequin Ducks (*Histrionicus histrionicus*) was thought to be small (<1,000 individuals; Vickery 1988, Goudie 1991), declining in size (Goudie 1991), geographically disjunct from Harlequin Ducks breeding in Greenland and in western North America (Palmer 1976), and winter along the Atlantic Coast of North America (Robertson and Goudie 1999). This population of Harlequin Ducks was listed as endangered in Canada in 1990, but at that time, almost nothing was known about this population (Vickery 1988, Goudie 1989).

In most species of sea ducks (tribe: Mergini), males undergo an extensive migration after breeding to molt in remote locations (Salomonsen 1968). For some species, the location of these molting areas is well documented, but for others it is not (Palmer 1976). The few historical data suggested that Harlequin Ducks molted in coastal Labrador (seven collected by Cartwright in St. Peter's Bay in 1770; Todd 1963) and Hudson Bay (one collected near the Belcher Islands in 1927; Todd 1963). By the late 1980s, molting sites had been confirmed at Tumbledown Dick Island and the Gannet Islands, Labrador (Goudie *et al.* 1994). An understanding of molting locations is important in the management of waterfowl species. Many undergo extensive migrations to reach these areas, so it is likely that molting sites meet specific biological requirements. For sea ducks, locations with few predators and appropriate foraging habitat are likely features that make suitable molting sites (Hohman *et al.* 1992, Cooke *et al.* 1997). Habitat degradation or disturbance at this time may hamper the ability of birds to complete their molt into a quality plumage and in a timely fashion, which may affect their future survival (Hohman *et al.* 1992). Indeed, food stressed birds are known to molt into a poorer quality plumage (Pehrsson 1987). A key component for the conservation of Harlequin Ducks in eastern North America is identifying, and, if necessary protecting, molting sites (Montevecchi *et al.* 1995).

The objective of this paper is to document Harlequin Duck molting concentrations recently discovered in eastern North America. Further, we provide data on sex and age ratios at some sites where data were available. Finally, we provide data on the molt chronology at a southern molting site and compare with previous work on the west coast of North America and in Labrador.

METHODS

General survey methods. - We searched coastal areas using aircrafts, boats and on foot to find aggregations of Harlequin Ducks. Aircraft were used primarily to search large geographic regions and to access remote areas. We used a survey crew of two

to three observers, and two types of fixed-wing aircraft (a C-206 Cessna on amphibious landing gear, a P86c Partenavia on wheels) and one helicopter for surveys, and (a BO-105). Surveys were flown at an altitude of 15 to 40 m above sea level and at speeds between 100 - 200 km/hr, depending on the aircraft. We searched all shorelines including most offshore islands and shoals during the pre-molt period along the coast of Labrador (June and early July), and during late July, August, or early September when we expected male Harlequin Ducks to be flightless (Robertson and Goudie 1999, Adams *et al.* 2000). The approximate location and counts of Harlequin Ducks were recorded on 1:250,000 scale topographic maps. We counted individual birds in flocks of less than 15 and estimated the number of birds in larger flocks.

Most potential molt sites identified from the air were subsequently visited by boat. As in the aerial surveys, it was difficult to count individual birds in large aggregations from the boat, and flocks of more than 15 birds were estimated. When possible, we also counted Harlequin Ducks from the ground. Ground counts were generally more accurate and often yielded the age and sex composition of the flocks.

Labrador and Newfoundland surveys (see Fig. 1). - Between 17 June and 8 July 1994, we surveyed the entire coast of Labrador by plane covering the area from Blanc-Sablon (51° 25'N, 57° 12'W), Québec, north to Cape Chidley (60° 23'N, 64° 26'W), Labrador. We did not survey the shorelines around large seabird colonies to minimise disturbance to breeding birds. Between 22 June and 9 July 1995, we searched approximately 150 km of the Labrador coast line by boat, from Cape Greep (53° 36'N, 56° 11'W) in Table Bay to the Indian Islands (54° 14'N, 57° 33'W) on the south-side of Groswater Bay. The primary purpose of the 1995 survey was to search for Common Eider (*Somateria mollissima*) colonies; however, we also recorded all Harlequin Ducks and specifically searched any areas where Harlequin Ducks had been observed during aerial surveys in 1994. In 1998 (26 July to 3 August and 11 to 12 August) and 1999 (16 August), we returned to conduct aerial surveys of the southern Labrador coast from St. Peter's Bay (52° 05'N, 55° 47'W) north to the outlet of Port Manvers Run (56° 52'N, 61° 38'W). These aerial surveys were focused on specific sites where pre-molting aggregations of Harlequin Ducks had been located. We intensively searched thirty-eight areas by circling several times at low altitude (25 m). The aerial surveys confirmed that Harlequin Ducks molted at 17 sites, which were further searched again by boat or from the ground to accurately count birds and determine their age and sex composition.

Boat and ground surveys were conducted in August at the Gannet Islands in 1996 (53° 56'N, 56° 32'W), North and South Stag Islands (54° 05'N, 57° 10'W), Tumbledown Dick Islands (54° 09'N, 57° 09'W), Gannet Islands and Cape St. Mary's (46°

17'N, 54° 12'W) in 1998, and North Stag Island, Gannet Islands, Grey Islands (50° 57'N, 55° 36'W) and Cape St. Mary's in 1999 (Figs. 1 and 2).

Québec surveys (see Fig. 2). - From 5-8 September 1995, we conducted surveys for Harlequin Ducks using a helicopter along the Québec North Shore. This survey ran from the mouth of the Saguenay River (48° 09'N, 69° 43'W) to Blanc-Sablon, as well as around Anticosti Island (49° 30'N, 63° 00'W), and a section of the Gaspé Peninsula, between Newport (48° 14'N, 64° 45'W) and Port-Daniel (48° 07'N, 64° 59'W). A boat survey was conducted on 7 September 1989, which covered Bonaventure Island (48° 30'N, 64° 10'W) and the area between Newport and Port-Daniel. A second boat survey conducted on 26 August 1990, covered the area from Newport to Port-Daniel. On 10-11 September 1996, a boat survey was conducted that covered Forillon National Park (48° 54'N, 64° 21'W; hereafter Forillon), Bonaventure Island, and nearby Rocher Percé (48° 31'N, 64° 12'W). Two boat surveys, on 13 August and 9 September 1999, covered Forillon and Bonaventure Island.

In summer and autumn 1999, we also conducted regular (usually 3-4 times a month) ground surveys along the Gaspé Peninsula at Forillon (from 6 July to 6 November; N = 18 surveys), Bonaventure Island (from 27 June to 29 September; N = 11 surveys), and Port-Daniel (from 19 July to 6 October; N = 7 surveys) to document the molt status of Harlequin Ducks. During each survey, birds were classified in four categories based on the status of their primaries and rectrices: 1) with old feathers present (faded and tinged with light brown), 2) with no new feathers visible, 3) with new feathers visible but not fully grown and 4) with new, and full grown feathers (dark brown and shiny).

Age and sex structure. - Detailed observations at the Gannet Islands allowed an assessment of sex and age ratios in the summer of 1998. Five boat surveys of all six islands in the Gannet Island cluster were undertaken from 10 July to 27 August. All individuals were sexed. Ages of males (second year or older) were recorded on the first two surveys (10 and 12 July), after that time they were undergoing the pre-basic molt and it was not possible to classify males by age (Smith *et al.* 1998). It is not possible to age females visually.

RESULTS

Labrador and Newfoundland surveys. - We counted Harlequin Ducks along the Labrador coast in June and July of 1994, before wing molt had begun (Fig. 1). Relatively large aggregations of birds were observed at St. Peter's Bay, and the Stag and Tumbledown Dick Islands in southern Labrador. Small flocks of Harlequin Ducks were scattered along the south and north sides of Groswater Bay and around an extensive

system of offshore islands and shoals to the east of Nain. Most birds observed (~60%) were near the northern tip of Labrador above Nachvak Fiord. In addition, 42 birds were identified at the North Stag Islands and three birds at the south Stag Island during boat surveys in 1995 (Table 1); we did not find any birds using sites along the south coast of Groswater Bay during this survey.

During our aerial surveys of the Labrador coast in August 1998 and 1999, we searched areas where aggregations of Harlequin Ducks had been observed prior to molt (Fig. 1). We found no large aggregations of birds in the region between Groswater Bay and Port Manvers Run. The few birds that were found were females still capable of flight. South of Groswater Bay we found Harlequin Ducks off the Tumbledown Dick Islands, Stag Islands, St. Peter's Bay in Labrador, and the Grey Islands in Newfoundland. All sites except St. Peter's Bay were visited subsequently by boat or on foot, when flightlessness was confirmed and more detailed counts were obtained (Table 1).

We did not visit all sites in the same year, so the following numbers are based on the most recent estimate (1999) or the most reliable estimate i.e., ground surveys before boat surveys before aerial surveys. Aerial surveys that did not detect any molting birds are not included, as it is possible to miss birds from an aeroplane. In these cases, the most recent boat or ground survey was used. In 1998-1999, in Newfoundland and Labrador, the number of molting birds observed was six at Cape St. Mary's (1999), 18 at Stearin Island (W. Montevecchi, pers. comm.; 1998), 159 at the Grey Islands (1999), 30 at St. Peter's Bay (1999), 166 at the Gannet Islands (1999), 43 at the North Stag Island (1999), 56 at Tumbledown Dick Island (1998), giving a total of 478 birds. Molting Harlequin Ducks have been seen at South Stag Island and Little Tumbledown Dick Island, but not in 1998 or 1999; birds molting at these sites may also use North Stag Island and Tumbledown Dick Island, respectively. Locations of these sites are presented in Figure 2.

Québec surveys. - We counted 60 Harlequin Ducks during a helicopter survey conducted 5 - 8 September 1995, at Pointe du Sud-Ouest (49° 23'N, 63° 36'W), on the south shore of Anticosti Island. No Harlequin Ducks were seen along the north shore of the St. Lawrence River Estuary. Strong winds and poor light conditions prevailed during the Gaspé Peninsula part of the helicopter survey and only eight individuals were detected, all at Port-Daniel. On 7 September 1989, however, 204 Harlequin Ducks were counted along the Gaspé Peninsula: 118 at Bonaventure Island and 86 between Newport and Port-Daniel. On 26 August 1990, 54 individuals were distributed between Newport and Port-Daniel. On 10 - 11 September 1996, 93 individuals were surveyed at Bonaventure Island, 32 at Rocher Percé, and 25 at Forillon. On 13 August and 9

September 1999, 40 and 47 Harlequin Ducks were at Forillon, while 25 and 70 were at Bonaventure Island, respectively.

It is more difficult to combine the estimates for Québec as some areas have not been surveyed since 1989. Combing the count of 60 at Anticosti Island in 1995 with the count of 150 on the Gaspé Peninsula in 1996 totals about 200 birds. However the area between Port-Daniel and Newport are not included (86 in 1989 and 54 in 1990). We tentatively estimate that 200 - 300 Harlequin Ducks molted annually in Québec in the mid-1990s.

Timing of molt. - We conducted 36 ground surveys around the Gaspé Peninsula in 1999, which yielded a maximum of 40 individuals (on 16 October) at Forillon, 35 (on 26 August) at Bonaventure Island, and 23 (on 23 September) at Port-Daniel. At Forillon and Bonaventure Island, the first flightless birds were seen on 9 and 10 August, respectively, and there were still birds with primaries visible but not fully grown on 20 October (18%) and 29 September (75%), respectively. On 31 October, all birds seen at Forillon had new and full grown primaries and rectrices. In each area, the first birds without rectrices were seen later than the ones without primaries i.e., on 8 September at Forillon and 26 August at Bonaventure Island. At Port-Daniel no birds were flightless on 19 July, but 92% and 50.% of them had no primaries or their new primaries were not fully grown on 29 August and 6 October, respectively. On 29 August, 85% also had no rectrices or their new rectrices were not fully grown.

Age and sex structure. - In 1998 between 9-15% of the molting birds at the Gannet Islands were female birds. On 10 July 1998, 84% of surveyed Harlequin Ducks were identified as adult males, 5% as second year males, and 11% as females (n = 127). Two days later on 12 July, 77% were identified as adult males, 14% as second year males, and 9% as females. On 12 August 1999, we visited the Stag Islands and counted 43 Harlequin Ducks, of which 8 (19%) were females.

DISCUSSION

In the mid to late 1990s, 650-800 molting Harlequin Ducks (450-500 in Newfoundland and Labrador and 200-300 in Québec) were seen in eastern North America. Because of the logistical difficulty of surveying many of these sites, we had to pool data from different years to obtain the total Harlequin Ducks molting at all of these sites. Our estimate could be biased if birds moved between molting sites, either within or between years. Harlequin Ducks are highly philopatric to their molting sites, both within and across years (Breault and Savard 1999, Robertson *et al.* 1999, 2000, P. W. Thomas, unpubl. data), so we believe that double counting was unlikely. However, two of eight

birds tracked with satellite radio-tags in 1997 molted at different sites in subsequent years (Brodeur *et al.* 1999). So there may be some movement between molting sites.

Based on counts of Harlequin Ducks at known wintering sites in February, about 1500 individuals were present in the eastern North America during the mid-1990s and local trend data suggest that the numbers has increased slightly through the 1990s (see Thomas and Roberts 2001). Assuming that all males and yearling females should be at these sites during the early molting period (July, August, and early September) we would expect around 800-900 molting birds, (based on a 1:1 sex ratio and 9-19% of the molting birds found were young females). Our surveys account for 650-800 individuals, suggesting we have documented most of the molting sites for this population. The three most important molting areas are the Grey Islands, in northern Newfoundland, the Gannet Islands, in southern Labrador, and Bonaventure Island, in southern Québec; these sites accounted for over half of the birds sighted during our surveys. The Stag and Tumbledown Dick Islands, in southern Labrador, as well as Anticosti Island, in Québec, are also important molting sites with more than 50 individuals at each of these locations.

Groswater Bay, Labrador, may have a few important molting sites despite the fact that we did not find any molting birds in the 1998 or 1999 aerial survey. Brodeur *et al.* (1998) found that a male implanted with a satellite transmitter in 1997 at the Gaspé Peninsula molted in the Herring Islands, at the mouth of Groswater Bay. So, there is likely to be a molting birds at the Herring Islands and possibly other nearby islands. Another area which may support molting birds, is the northern tip of Labrador. Large concentrations of Harlequin Ducks were found in this area before molt in June. Based on satellite telemetry, some of the males caught along the Gaspé Peninsula in spring moved to northern Labrador to molt, while others caught in breeding areas in northern Québec and northern Labrador stage in this area before moving to Greenland to molt and winter (Brodeur *et al.* 1998, 1999). However, one of the males tracked by Brodeur *et al.* (1999) molted in northern Labrador before moving to Greenland. Indeed, the relative proportion of Harlequin Ducks that use this site to molt and subsequently winter in eastern North America or winter in Greenland has yet to be determined. Coastal areas around Nain supported a substantial population of Harlequin Ducks in June, however, further surveys did not find any molting individuals. Yet, it is possible that a few birds may molt at this site as there are many islands, suitable habitat, and sighting Harlequin Ducks molting in large seabird colonies can be difficult. The south coast of Newfoundland has not been surveyed for molting Harlequin Ducks and 4 were sighted in August at Grey River Rocks in the mid 1990s (T. Northcott, pers. obs.). Finally, a few Harlequin Ducks may also molt on the north shore of the Gulf of St. Lawrence, as 9 individuals have been sighted at

Blanc-Sablon on 31 July 1981 (ÉPOQ database, unpubl. data) and one individual molted in Mingan Archipelago (50° 13'N, 63°35'W) in July 1998.

Timing of molt. - Results are crude for the Gaspé Peninsula due to the low frequency of surveys. But, they suggest that the flightless period begins in late July or early August and extends into early October. If patterns are similar to those observed for populations on the west coast of North America, individuals molting early will be mostly males and a few pre-breeding (yearling) females (Robertson *et al.* 1997). A similar chronology was found in the Gannet Islands, Labrador, for molting males and females in July and August (Adams *et al.* 2000). Individuals molting in September and into October were post-breeding females (Robertson *et al.* 1997). The molting locations of females are still not well known in eastern North America, but the presence of molting individuals in the Gaspé Peninsula in September and October suggest that adult females also molt at this site.

Identifying molting sites and the times they are used is important to effectively manage waterfowl populations. Sea ducks, in particular, can undertake extensive migrations to molting locations (Salomonsen 1968). These sites are typically remote, such as many islands identified during this study, probably because sea ducks are vulnerable to predators while flightless. These sites may have sources of high-quality food. Harlequin Ducks spend most of their molting period resting and preening (Adams *et al.* 2000), so ensuring that these molting congregations are not disturbed is important. Chronic disturbance may compromise the ability of Harlequin Ducks to molt, as they alter their time-budgets by continually avoiding sources of disturbance. Many of the sites discovered already have some protective status, either as Seabird Ecological Reserves (Gannet Islands and Cape St. Mary's) or National (Forillon) and Provincial (Île Bonaventure and Rocher Percé) Parks. Future recovery efforts should focus on monitoring populations at existing sites, and possibly, evaluating the need to formally protect other molting areas.

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TABLE 1. Summary of molt sites of Harlequin Ducks identified from aerial, boat and ground surveys from 1980's to 1999 Newfoundland and southern Labrador.

Site	July 1982	July 1989	July 1992	June 1994	July 1995	Aug 1996	July 1998	Aug 1998	Aug 1999
Stearin Island	-		2[+]	-	-	-	-	18[*a]	-
Cape St. Mary's	-		-	-	5[+b]	-	5[+]	5[+]	6[+]
Grey Islands	-		-	-	-	1[c]	-	-	159[*]
St. Peter's Bay	-		-	50[‡]	-	-	-	-	30[‡]
Gannet Islands	150[d]		-	-	-	56[*]	-	131[*]	166[*]
Tumbledown Dick	30[e]	30[f]	-	0[‡]	-	-	30[‡]	56[*]	0[‡]
Little Tumbledown Dick	-		-	26[‡]	-	-	21[‡]	0[*]	0[‡]
North Stags	-		-	0[‡]	42[‡]	-	15[‡]	47[*]	43[*]
South Stag	-		-	27[‡]	3[*]	-	6[‡]	0[*]	0[‡]

Note: [+]ground count, * boat count or [‡]aerial count;

[a] W. Montevecchi pers. comm.

[b] P. Thomas pers. comm.

[c] based on satellite transmitter (Brodeur *et al.* 1998)

[d] W. Lidster and J. Piatt pers. comm.

[e] J. Brazil pers. comm.

[f] Goudie *et al.* (1994)

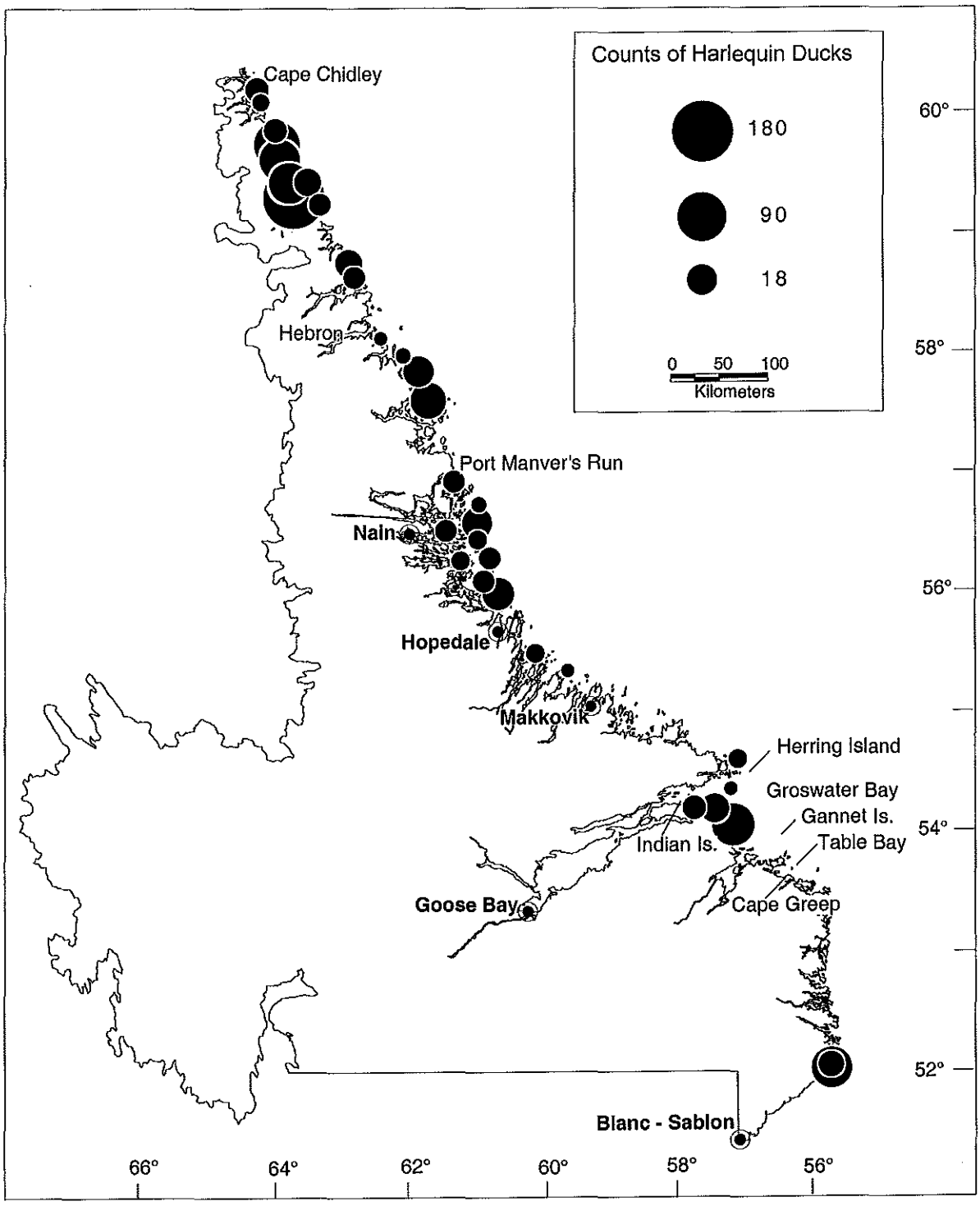

FIG. 1. Counts of Harlequin Ducks observed along the Labrador coast, June – July 1994.

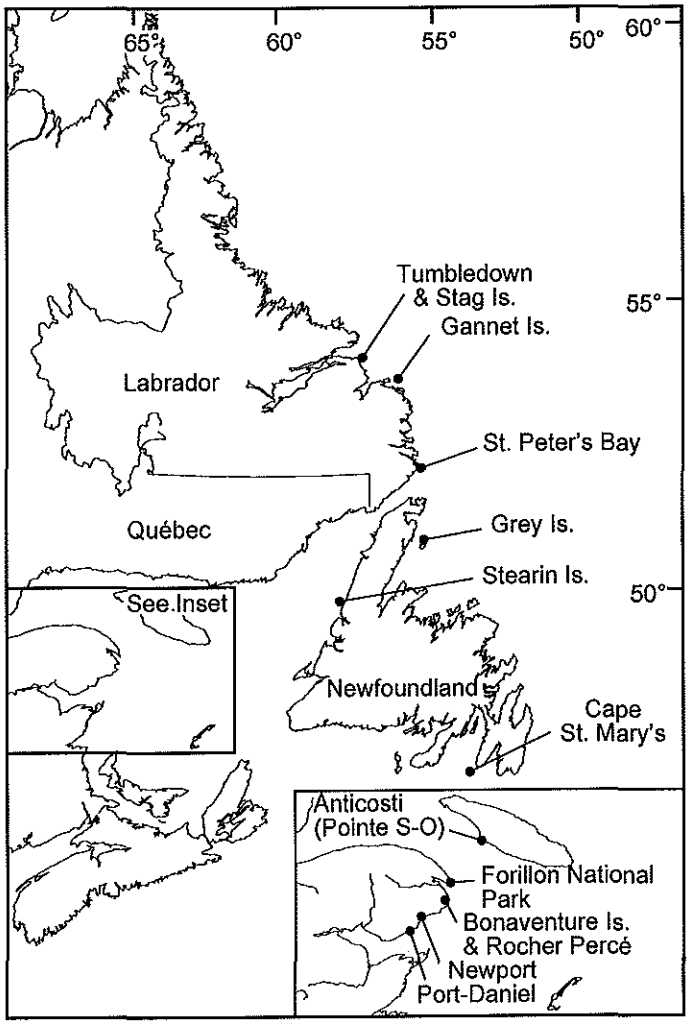

FIG. 2. Location of known molting sites of Harlequin Ducks in eastern North America.