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Eighteenth census of seabirds breeding in the sanctuaries of the North Shore of the Gulf of St. Lawrence, 2015

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Abstract

In 1925, ten migratory bird sanctuaries were created on the North Shore of the Gulf of St. Lawrence, and their breeding seabird populations have been censused every five years since. Between 2010 and 2015, only three alcid species exhibited positive population trends (Razorbill [*Alca torda*], Common Murre [*Uria aalge*], and Atlantic Puffin [*Fratercula arctica*]), while the remaining 13 species showed declining trends. Leach's Storm-Petrel (*Hydrobates leucorhous*) and Caspian Tern (*Hydroprogne caspia*) are on the verge of disappearing from the sanctuaries, and the prolonged and rapid decline in Black-legged Kittiwake (*Rissa tridactyla*) is worrisome. Based on historical records since 1925, it appears that seabird communities are faring well in some sanctuaries (e.g., Baie de Brador, Îles aux Perroquets, and Îles Sainte-Marie), while numbers are at low levels in others (e.g., Île à la Brume, Baie des Loups, and Saint-Augustin). Human disturbance, harvest of seabirds (eggs and birds), and predation are among the issues potentially most affecting seabird populations on the North Shore of the Gulf of St. Lawrence.

Key words: Seabirds; populations; North Shore; sanctuaries; Gulf of St. Lawrence; larids; alcids

Résumé

En 1925, dix refuges d'oiseaux migrateurs ont été créés sur la Côte-Nord du golfe Saint-Laurent, et depuis les populations d'oiseaux marins qui y nichent ont été recensées à tous les cinq ans. De 2010 à 2015, seulement trois espèces d'alcidés ont montré des tendances positives (le Petit Pingouin [*Alca torda*], le Guillemot marmette [*Uria aalge*], et le Macareux moine [*Fratercula arctica*]), tandis que les treize autres espèces présentaient des déclins à divers degrés. L'Océanite cul-blanc (*Hydrobates leucorhous*) et la Sterne caspienne (*Hydroprogne caspia*) sont à risque de disparaître des refuges, alors que le déclin prolongé et rapide de la Mouette tridactyle (*Rissa tridactyla*) est inquiétant. En comparant avec les données historiques depuis 1925, il apparaît que les communautés d'oiseaux de mer sont en assez bonne santé dans certains refuges (ceux de Baie de Brador, des Îles aux Perroquets et des Îles Sainte-Marie), tandis qu'ils sont à de bas niveaux à d'autres (i.e., ceux de l'Île à la Brume, Baie des Loups et Saint-Augustin). Le dérangement, la consommation (d'œufs et d'oiseaux) par l'homme, ainsi que la prédation, sont parmi les problématiques qui affectent potentiellement le plus la conservation des oiseaux marins de la Côte-Nord du golfe du Saint-Laurent.

Mots clefs: Oiseaux marins; populations; Côte-Nord; refuges; golfe du Saint-Laurent; laridés; alcidés

Introduction

In 1925, when Harrison Flint Lewis succeeded in creating ten migratory bird sanctuaries (MBSs) along the North Shore of the Gulf of St. Lawrence, he also conducted a census of all seabird colonies in those sanctuaries (Lewis 1925). An ornithologist and true pioneer in wildlife conservation, Lewis was a chief migratory bird officer for Ontario and Quebec, and later became the first chief of the Canadian Wildlife Service. His duties were broad: educating local residents about the new conservation laws (i.e., the *Migratory Bird Convention Act*), patrolling the North Shore and charging poachers, investigating potential sites for bird sanctuaries, and issuing scientific and aviculture permits, among other things (Burnett 1999).

Lewis returned in 1930, 1935, and 1940 to monitor seabird populations in the North Shore MBSs and published his findings in *The Canadian Field-Naturalist* (Lewis 1931, 1937, 1942). Many other naturalists continued Lewis' legacy by censusing the seabirds in the MBSs at intervals of approximately five years (Hewitt 1950; Tener 1951; Lemieux 1956; Moisan 1962; Moisan and Fyfe 1967; Nettleship and Lock 1973; Chapdelaine 1980, 1995; Chapdelaine and Brousseau 1984, 1991; Rail and Chapdelaine

2004; Rail and Cotter 2007, 2015). In doing so, they contributed to what would become one of the longest continuous data sets for seabirds in North America (Burnett 1999) and a most precious one for tracking the status and trends of seabirds in Quebec.

Ninety-five years later, three sanctuaries have been abandoned and three others created. Although threats to seabirds may seem less obvious than in the early 20th century, when commercial egging and hunting were flourishing, the purpose and importance of the North Shore sanctuaries remain. Seabirds benefit from the protection afforded by the MBSs, where they find some of the best quality habitat for reproduction along the huge North Shore coastline. For many species, the concentrated breeding populations found in those sanctuaries represent a significant proportion of the provincial or even Canadian populations (Rail and Cotter 2015).

Thus, observations and results from the quinquennial censuses provide useful information regarding the management and conservation of our seabirds. This article details the updated population estimates in each of the sanctuaries on the North Shore of the Gulf of St. Lawrence in 2015 (Figure 1), summarizes the current status for each species and sanctuary, and highlights some conservation issues.

Methods

The fieldwork required to obtain the population estimates was considerable: it involved 30 participants visiting ~130 remote islands over five consecutive weeks. Sixteen species of seabirds were censused simultaneously by counting nests and birds from boats or on foot, using binoculars, telescopes, or photographs. Moreover, various extrapolation methods were used, as the total terrestrial area of the ten sanctuaries exceeds 20 km^2. Methods for estimating the number of breeding birds varied depending on the species and habitats. These have been previously described in detail by Rail and Chapdelaine (2002) for the 1998–1999 census and have been followed consistently over time. Here is a short summary of the methods used in 2015.

Whenever possible, complete nest counts (multiplied by two to get the number of breeding individuals) were used to estimate population sizes of all species, except for alcids, but there were some particularities in methods used and species coverage. For

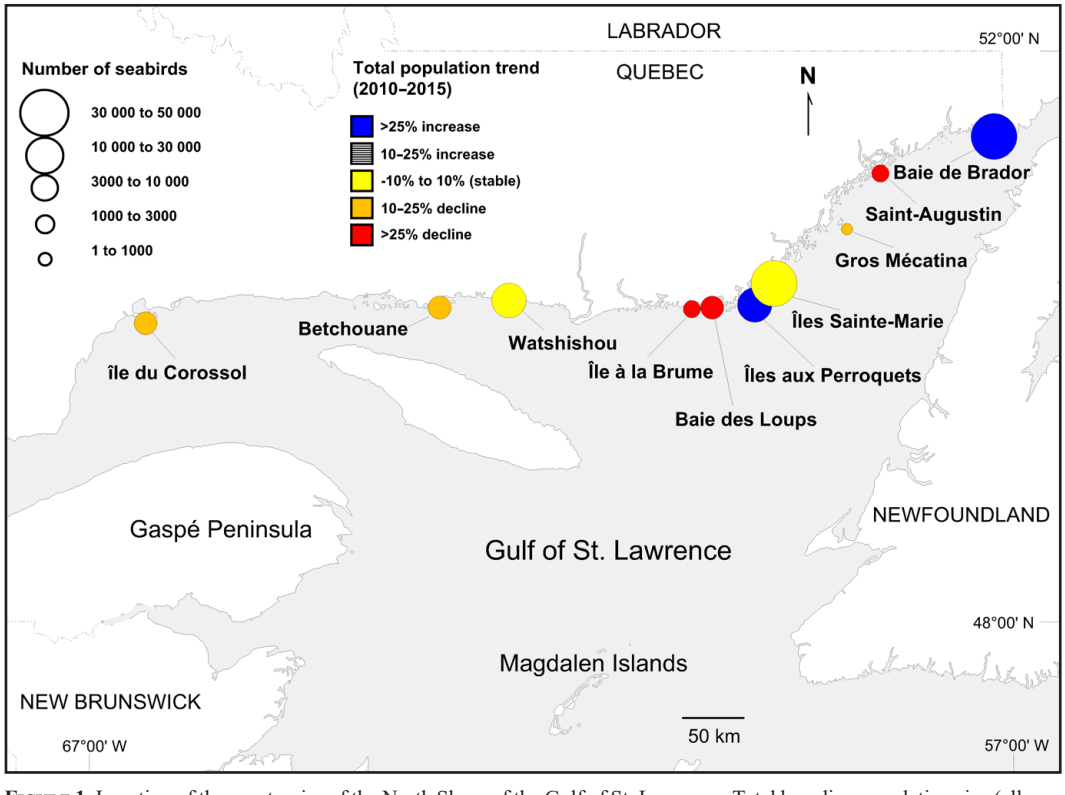

FIGURE 1. Location of the sanctuaries of the North Shore of the Gulf of St. Lawrence. Total breeding population size (all seabird species combined) and recent trend are also indicated for each sanctuary.

example, we looked for Red-throated Loon (*Gavia stellata*) nests by walking around ponds in suitable open habitat. For Leach's Storm-Petrel (*Hydrobates leucorhous*), we searched for apparently occupied burrows in areas known to have been used by the species in past censuses. Evidence of burrow occupation included freshly excavated soil, feathers, and typical musky petrel odour at the burrow entrance.

For Common Eider (*Somateria mollissima*), so ubiquitous in its breeding habitat, different sampling and extrapolation methods were used. In Île du Corossol MBS, five quadrats of 3600 m^2 were used (14% coverage) and mean nest density was extrapolated over the rest of the suitable habitat. In the Betchouane MBS, six 16-m wide transects were used on the main part of Île Innu (where mean nest density was extrapolated), while the rest of the entire sanctuary was searched (total of 45% area coverage). In the Watshishou MBS, mean nest density from a sample of 20 islands visited (representing 12% of the potential habitat of the 201 islands; see Brousseau and Chapdelaine 1990) was extrapolated to the rest of the sanctuary. In Île à la Brume, Baie des Loups, Îles aux Perroquets, and Îles Sainte-Marie MBSs, some of the islands (representing, respectively, 23%, 26%, 19%, and 59% of total land area) was thoroughly searched, and mean nest density was extrapolated to the rest of the sanctuary's area. In the Saint-Augustin MBS, we counted the number of female eiders flushing from the smaller islands (where we did not land), and carried out nest counts on the larger islands.

Because Common and Arctic Terns (*Sterna hirundo* and *Sterna paradisaea*) are physically very similar and often nest in mixed colonies, it would have been time consuming to determine the precise species ratio at each tern colony. Thus, as in previous censuses, we grouped the two species and present the estimated numbers and population trends for "tern spp.". Also, because these species tend to initiate nesting a bit later than other seabirds, we counted individuals when territorial terns were present on an island, even if we found only a few or no nests.

For estimating tern and gull populations in large MBSs (e.g., Watshishou, Baie des Loups, Saint-Augustin), we combined nest counts on larger islands with bird counts on the smaller islands where we did not land. Because nests of Great Black-backed Gull (*Larus marinus*) and Herring Gull (*Larus argentatus*) are difficult to identify to species, after counting the nests of large gulls in a given colony, nests were attributed to each species using the observed species ratio of adults on site.

Population estimates for alcids, namely Common Murre (*Uria aalge*), Razorbill (*Alca torda*), Black Guillemot (*Cepphus grylle*), and Atlantic Puffin (*Fratercula arctica*), were made by counting adult birds visible around the colonies to minimize observer disturbance in large and vulnerable colonies and also because nests are often inaccessible (e.g., in cliffs, under large boulders) or well concealed (e.g., Black Guillemots). In rare circumstances, nest counts were also used: a few Razorbill eggs were found in the Watshishou and Île à la Brume MBSs, and apparently occupied puffin burrows were systematically counted on Île à Calculot (Betchouane MBS). Finally, at Île aux Perroquets (Baie de Brador MBS), a system of transects and quadrats was used to estimate the area of the puffin colony and its mean burrow density (see Rail and Chapdelaine 2002).

Because our alcid breeding population estimates are derived, in large part, from direct counts of individuals, they are probably underestimates. Indeed, a proportion of breeding individuals is usually not visible during a colony census, as they may be hidden at the nest or away from the colony. Thus, correction factors are sometimes used to convert the number of individuals observed into more realistic estimates of the number of breeding pairs (e.g., see Cairns 1979; Harris *et al.* 2015). However, correction factors (k = number of breeding pairs/number of individuals observed) are subject to considerable variation depending on species, site, time of day, breeding phenology, and weather conditions (Rail and Chapdelaine 2002) and, ideally, require field validation. Because we did not have time to obtain such values and our results are mainly used to monitor population trends, we chose not to apply any correction factors to the raw number of individuals counted for the alcids.

Results and Discussion

In 2015, an estimated 146 729 seabirds were breeding in the North Shore sanctuaries. This represents a 13% increase compared with the 2010 total of 130 407 individuals. However, despite this apparent positive overall result, upward population trends were observed for only three alcid species (Razorbill, Common Murre, and Atlantic Puffin), while the remaining 13 species showed various degrees of decline (Table 1). Furthermore, one species was absent in 2015: we could not find any active Leach's Storm-Petrel burrows. Populations showed highly variable trends depending on the species and sanctuary. Below is a short description of the main results for each sanctuary, from west to east, followed by an assessment of the overall situation for each species, from least to highest concern. Trends are based on the data in Table 1.

Sanctuaries (from west to east)

Île du Corossol MBS (visited 30 May to 1 June 2015)—As in 2005, Leach's Storm-Petrel was absent

TABLE 1. Census of seabirds (number of individuals) in the bird sanctuaries of the North Shore of the Gulf of St. Lawrence in 2010 and 2015.

Species	Île du Corossol		Betchouane		Watshishou		Île à la Brume		Baie des Loups	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Common Eider *Somateria mollissima*	1504	1014	6006	3274	12 958†	14 192†	1610	1208	3436	2302
Red-throated Loon *Gavia stellata*							4	8	12	6
Leach's Storm-Petrel *Hydrobates leucorhous*	72	0								
Double-crested Cormorant *Phalacrocorax auritus*	316	308			1888	1766			40	408
Great Cormorant *Phalacrocorax carbo*										
Ring-billed Gull *Larus delawarensis*					414	12	174	2	128	0
Herring Gull *Larus argentatus*	1040	920	828	464	598	664	422	220	379	230
Great Black-backed Gull *Larus marinus*	420	282	74	26	168	232	82	48	96	91
Black-legged Kittiwake *Rissa tridactyla*	1342	448	58	252						
Caspian Tern Hydroprogne caspia							3	2		
Common and Arctic Terns *Sterna hirundo, Sterna paradisaea*			0	12	220	63	35	46	12	14
Common Murre *Uria aalge*	1662	1898	116	724					256	393
Razorbill *Alca torda*	2799	3068	346	1323	0	6	10	8	2984	2329
Black Guillemot *Cepphus grylle*	401	119			1	7	20	49	15	4
Atlantic Puffin‡ *Fratercula arctica*	3	2	540	468					4028	1688
Total	9559	8059	7968	6543	16 247	16 942	2360	1591	11 386	7465

*Totals for 2005 included for comparison purposes.
†The method used to calculate the eider population in Watshishou likely produced a significant overestimation (possibly as much as two to four times; but see Rail and Chapdelaine 2002). However, this method had been used in previous censuses and, thus, allowed better historical comparisons.

in 2015, as we could not find any active burrows (36 had been found in 2010). In addition, Black Guillemot declined sharply (−70%) between 2010 and 2015, as did Black-legged Kittiwake (*Rissa tridactyla*; −66%). The current most abundant species in the sanctuary, Razorbills and Common Murres, increased only marginally (+14% and +10%, respectively). Overall, the estimated number of breeding seabirds decreased by 16% from 2010 to 2015.

Betchouane MBS (visited 6–7 June 2015)—Between 2010 and 2015, numbers of the most abundant and representative species in this sanctuary, Common Eider, decreased by nearly half (−45%). Herring Gull (−44%) and Great Black-backed Gull (−65%) also showed substantial declines. Conversely, the relatively small numbers of Common Murre, Black-legged Kittiwake, and Razorbill increased over sixfold (+524%), fourfold (+334%), and nearly fourfold (+282%), respectively, from 2010 to 2015. The total number of seabirds showed an 18% decline.

Watshishou MBS (visited 3–5 June 2015)—The populations of the most abundant species locally, Common Eider, Double-crested Cormorant (*Phalacrocorax auritus*), and Herring Gull, remained quite stable between 2010 and 2015, as did the total number of breeding seabirds. Razorbill made a small but notable reappearance (three eggs found on one island), after not being detected in the sanctuary during the

Îles aux Perroquets		Îles Sainte-Marie		Gros Mécatina		Saint-Augustin		Baie de Brador		Total		
2010	2015	2010	2015	2010	2015	2010	2015	2010	2015	2005*	2010	2015
986	824	1152	1940	4	14	94	192			25 716	27 750	24 960
30	34	52	44	4	4		2			92	102	98
										0	72	0
		3245	286							3346	5489	2768
0	34	156	30	78	32					48	234	96
0	28	2	0			216	178			1893	934	220
204	167	154	89	93	71	1793	1240	558	543	5914	6069	4608
71	95	182	214	81	51	123	112	348	386	1956	1645	1537
		820	644							3994	2220	1344
										3	3	2
91	48	12	0	8	0	645	220			3311	1023	403
2811	7898	20 078	20 821	12	34			1402	2170	14 877	26 337	33 938
6864	14 945	16 547	20 396	280	401			6283	9305	22 472	36 113	51 781
90	36	103	157	192	37	6	3	3	15	928	831	427
400	391	837	2126	59	29			15 718	19 843	25 335	21 585	24 547
11 547	24 500	43 340	46 747	811	673	28 77	1947	24 312	32 262	109 885	130 407	146 729

‡In 2005, the use of a burrow probe at a few sites at Baie des Loups, Îles aux Perroquets, and Baie de Brador verified that apparently occupied burrows were actually used at a fairly constant rate of 71–76%. Therefore, the puffin population estimates presented here for these sanctuaries, as well as for the Betchouane and Îles Sainte-Marie Sanctuaries, are overestimates because apparently occupied burrow counts were used. We did not apply a correction factor to these estimates to allow better comparison with data from previous censuses.

2005 and 2010 censuses. The declines in Ring-billed Gull (*Larus delawarensis*; −97%) and Common and Arctic Terns (−71%) seem severe, but may be mainly caused by colonies moving outside the sanctuary, rather than an overall population decline. Colonies of those species on the North Shore rarely persist from one census to another and, consequently, numbers have been extremely variable in the past.

Île à la Brume MBS (visited 14–15 June 2015)—Six of the nine breeding species here declined, including the three most abundant species in 2010: Common Eider (−25%), Herring Gull (−49%), and Ring-billed Gull (−99%; only one pair found in 2015). Overall, the sanctuary lost a third (−33%) of its breeding seabirds, and seabird density (579/km^2 of land) is the second lowest among the North Shore sanctuaries. A significant increase (+145%) in the number of Black Guillemot observed is perhaps the only positive trend here, along with the four nests of Red-throated Loon (compared with two in 2010). The sighting of a pair of Caspian Tern (*Hydroprogne caspia*) and their nest confirmed that there is still a breeding population, although a small one.

Baie des Loups MBS (visited 15, 17, and 20 June 2015)—Overall, populations of eight of the 11 breeding species declined between 2010 and 2015, and the total number of seabirds decreased by a third (−34%). Common Eider, one of the most abundant species at

this site, declined by 33% from 2010 to 2015. Furthermore, local populations of Atlantic Puffin, Black Guillemot, and Great Black-backed and Herring Gulls, reached their lowest levels observed since 1925–1930. On the positive side, the small number of Double-crested Cormorant grew ten-fold in five years, and the small Common Murre population increased notably (+54%).

Îles aux Perroquets MBS (visited 18–20 June 2015)—Razorbill and Common Murre, by far the two most abundant species in this sanctuary, showed spectacular increases between 2010 and 2015 (+118% and +181%, respectively). The increase in these two species is responsible for the more than doubling (+112%) of the overall number of seabirds in the sanctuary. The density of breeding seabirds here (25 868/km^2 of land) is now the second highest among the North Shore sanctuaries. Also worthy of note is the reappearance of two breeding species, Great Cormorant (*Phalacrocorax carbo*, 17 pairs) and Ring-billed Gull (14 pairs). Other species' numbers remained relatively stable, except for Black Guillemot (60% decline).

Îles Sainte-Marie MBS (visited 16, 21, and 22 June 2015)—In contrast with the adjacent Îles aux Perroquets MBS, the populations of Razorbill and Common Murre here remained stable between the last two censuses (increases of 23% and 4%, respectively). The other alcids (Black Guillemot, +52%; Atlantic Puffin, +154%) fared well from 2010 to 2015, as did Common Eider (+68%). One striking result is the 91% decline in Double-crested Cormorant, resulting from the near abandonment of the large colony on Île de l'Est (1290 nests in 2010), because of the presence of Red Fox (*Vulpes vulpes*). The size of the Great Cormorant colony (on Île Cliff) also declined severely (−81%). Furthermore, for the first time since 1950, no breeding terns were found. Overall, the total number of breeding seabirds remained quite stable (+8%).

Gros Mécatina MBS (visited 23 June 2015)—We did not observe any breeding terns in this sanctuary in 2015. Trends in the small populations of the other species varied considerably, but, overall, the number of breeding seabirds declined only slightly (−17%). Numbers of Common Murre almost tripled (+183%), those of Razorbill increased (+43%), while those of Black Guillemot and Atlantic Puffin declined (−81% and −51%, respectively). Only 16 nests remained in the colony of Great Cormorants on Île aux Trois Collines (−59%).

Saint-Augustin MBS (visited 1 July 2015)—Compared with the other North Shore sanctuaries, Saint-Augustin MBS has the largest land area, but, again in 2015, the density of seabirds was lowest (354/km^2). In fact, the sanctuary lost a third (−32%) of its seabirds, as its most abundant species underwent serious declines between 2010 and 2015 (−31% for the Herring Gull and −66% for the Common and Arctic Terns). On the positive side, the Red-throated Loon nest found in 2015 represents the first breeding record of the species here since 1977. The number of eider nests found in 2015 (96) was double that of 2010 (+104%).

Baie de Brador MBS (visited 27–29 June 2015)—Between 2010 and 2015, marked increases were noted in the numbers of all breeding alcids, namely Common Murre (+55%), Razorbill (+48%), Atlantic Puffin (+26%), and even Black Guillemot (from three to 15 individuals). Meanwhile, populations of Herring Gull and Great Black-backed Gull remained stable (−3% and +11%, respectively). With its total number of seabirds growing 33% since 2010, this MBS now has the highest density of seabirds by far (31 754/km^2). The Atlantic Puffin population has rebounded to about 20 000 individuals (following a 22% decline between 2005 and 2010) and is particularly important for the conservation of the species in Quebec, as this colony holds over 70% of the puffins in the province.

Species accounts (from least to highest concern)

Razorbill—Once again, this species comes first on our list (Rail and Cotter 2015). The population has been growing steadily since 1977 (Figure 2a) and the 43% increase in numbers between 2010 and 2015 (over 7% annually) is still high for a bird laying a single egg. Razorbill is now, by far, the most numerous seabird in the North Shore sanctuaries, and its situation appears positive throughout its range in Quebec (Cotter and Rail 2007; Rail 2009, 2018) and North America (Chapdelaine *et al.* 2001; Lavers *et al.* 2020).

Common Murre—The population increased 29% between 2010 and 2015, reaching its highest level on record (Figure 2b). Numbers rose everywhere, but especially rapidly in recently established colonies, such as those in Betchouane and Baie de Brador MBSs (Table 1). This seabird ranks second in abundance in North Shore sanctuaries. It has been generally increasing and expanding in the province for the past 20 years (Rail 2009, 2018; Canadian Wildlife Service unpubl. data), as well as in most of its global range (BirdLife International 2018a).

Common Eider—With little variation in total numbers observed over the last three censuses (+8% between 2005 and 2010; −10% from 2010 to 2015), the population seems to have stabilized around its highest level on record (Figure 2c). Declines were noted in five MBSs and increases in four (Table 1). The situation of Common Eider on the North Shore (see also Troutet and Samson 2015) contrasts with the significant declining trend (−5%/year) observed in the St. Lawrence Estuary since 2003 (Lepage 2019).

Red-throated Loon—The total number of breeding

pairs levelled off close to the high count in 2010 (−4% between 2010 and 2015; Figure 2d). When the presence of Red Fox prevented loons from breeding on an island in the Îles Sainte-Marie MBS, pairs appeared to relocate to adjacent islands. Most nests (80%) are concentrated in the Îles Sainte-Marie and Îles aux Perroquets MBSs. From 1935 to 1955, fairly large numbers (24–70 individuals) of Red-throated Loon were also found in the Mécatina MBS, which was abolished in 1974.

Double-crested Cormorant—The 50% decrease from 2010 to 2015 may seem striking; however, Double-crested Cormorant numbers in the MBSs may vary considerably between quinquennial censuses, and the actual population is still relatively large compared with historical levels since 1925 (Figure 2e). Note also that the recent decline (−93% from 2010 to 2015) is a result of the near abandonment of the largest colony (1290 nests in 2010) on Île de l'Est (Îles Sainte-Marie MBS; Table 1). This in turn is likely the consequence of Red Fox repeatedly accessing the island; as cormorant nests there are built in low krummolz bushes or directly on the ground, they are vulnerable to mammalian predation.

Great Black-backed Gull—A population decline was observed for the third consecutive census. However, the recent decrease is rather marginal (−7% from 2010 to 2015), and numbers rose at four MBSs and fell at six others (Table 1). The actual population size is very close to the average number of Great Black-backed Gulls observed in the sanctuaries since 1925 (Figure 2f). Since the end of the 1980s, however, populations have shown major declines in most parts of southeastern Canada (Wilhelm *et al.* 2016). These declines have been associated with reduced groundfish fisheries, which had been providing abundant discards for gulls in the preceding decades (Wilhelm *et al.* 2016).

Atlantic Puffin—After a large decrease (−54%) between 1993 and 2010, the population now appears to have stabilized, as the recent slight increase in numbers (14% from 2010 to 2015) brought the population close to the level observed in 2005 (Figure 2g). Although the latest increase at the largest colony (+26% at Baie de Brador MBS from 2010 to 2015) may appear reassuring, over 80% of the puffins are now concentrated in this sanctuary, and numbers dwindled (−58%; Table 1) to a record low at Baie des Loups MBS, where the species used to be nearly as abundant. From 1925 to 1955, breeding puffins were twice as abundant as they now are in North Shore MBSs (Figure 2g). Globally, since 2015, the species has been listed as Vulnerable by the International Union for the Conservation of Nature (IUCN; BirdLife International 2018b) because of rapid declines across most of its European range. Factors affecting the species here are unknown, but Fayet *et al.* (2017) found that distance to wintering area was negatively linked with population productivity. Their study used geolocators, but unfortunately did not include birds from Quebec, and, as the species winters far offshore, little is known about its wintering range from banding data (Gaston *et al.* 2008).

Black Guillemot—Population trends were extremely variable among sanctuaries, but large declines were observed where the species was most abundant (−70% and −81% at Île du Corossol and Gros Mécatina MBSs, respectively), so that the total number of individuals in all sanctuaries was halved (−49%) between 2010 and 2015 (Table 1). Although we recognize that estimates from counts of individuals may be subject to substantial variations (e.g., daily, seasonally, weather related; see Cairns 1979), such large declines are nonetheless enigmatic. The species is known to be particularly vulnerable to mammalian predators (Butler *et al*. 2020) and may be outcompeted by increasing numbers of Razorbill and Common Murre at mixed colonies. The highest counts of Black Guillemot were recorded from 1940 to 1950 (Figure 2h), when about half of these birds (600–840) were found in the Mécatina MBS alone. However, seabird populations in this sanctuary declined so much afterwards that it was abolished in 1974.

Herring Gull—Marginal to moderate declines were observed in nine of the ten MBSs (Table 1). In 2015, the estimated total number of Herring Gulls breeding in the MBSs represents a 24% decrease from 2010. On the other hand, it is only 15% lower than the average estimate from the previous four censuses (1993 to 2010; Figure 2i). This still suggests a stabilization of the population, after the large-scale decline that occurred in the late 1980s to early 1990s on the North Shore (−70%; see Chapdelaine 1995; Chapdelaine and Rail 1997) and elsewhere in Atlantic Canada (Cotter *et al*. 2012; Wilhelm *et al.* 2016).

Great Cormorant—The two medium-sized colonies noted in 2010 (78 and 39 nests at the Îles Sainte-Marie and Gros Mécatina MBSs, respectively) were markedly smaller in 2015 (−81% and −59%, respectively). However, a new colony of 17 pairs was found at the Îles aux Perroquets MBS, for an overall decline of −59% between 2010 and 2015 (Table 1). The species was found breeding in three sanctuaries, but in such small numbers that its persistence in the North Shore MBSs now appears rather fragile. In 1930, it was found breeding in the Îles Sainte-Marie MBS, and the size of this colony peaked at 339 pairs in 1955 (Figure 2j).

Arctic and Common Terns and Ring-billed Gull—The total number of terns and Ring-billed Gulls in

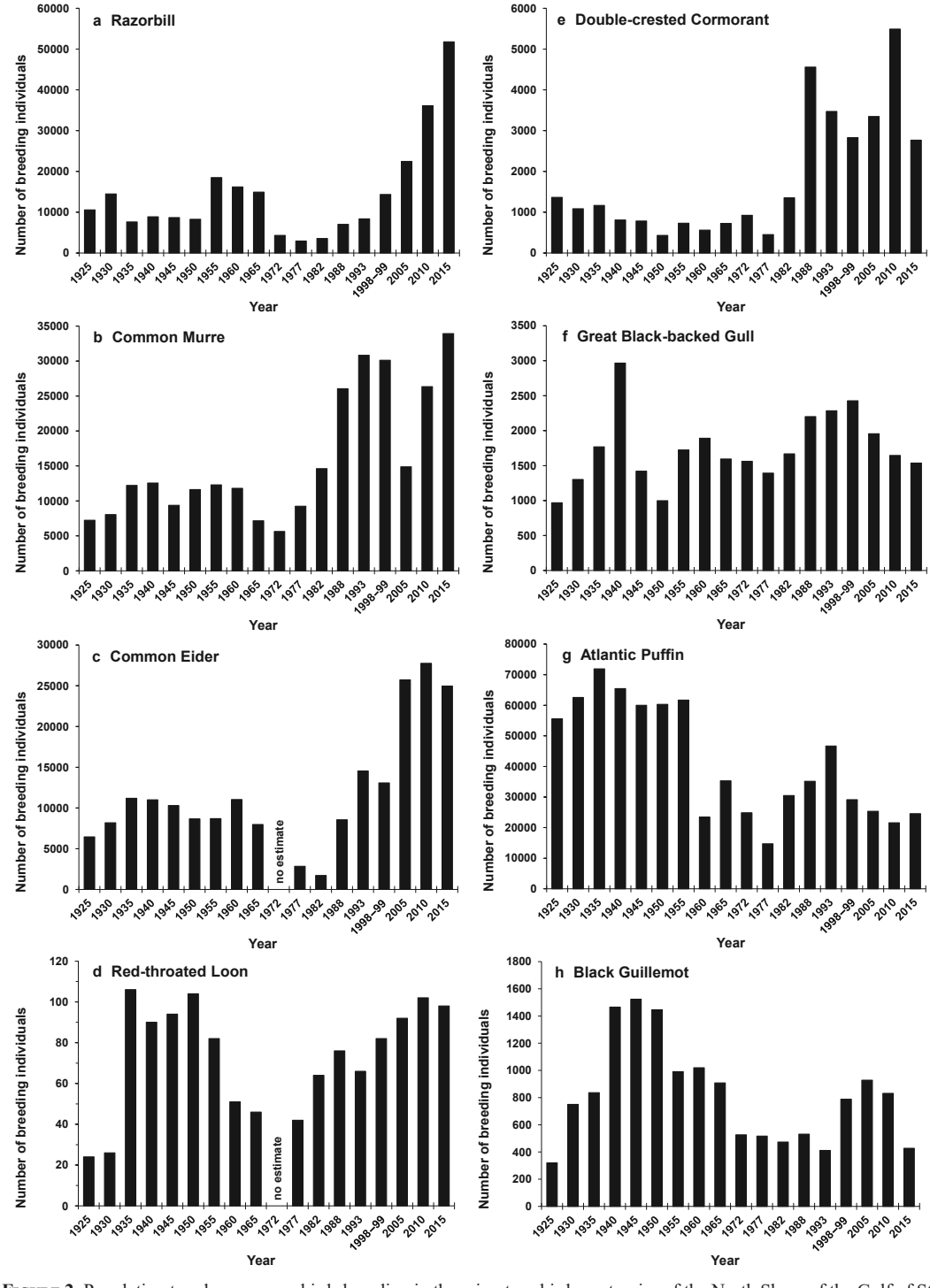

FIGURE 2. Population trends among seabirds breeding in the migratory bird sanctuaries of the North Shore of the Gulf of St. Lawrence, 1925–2015, in order from least to most concern.

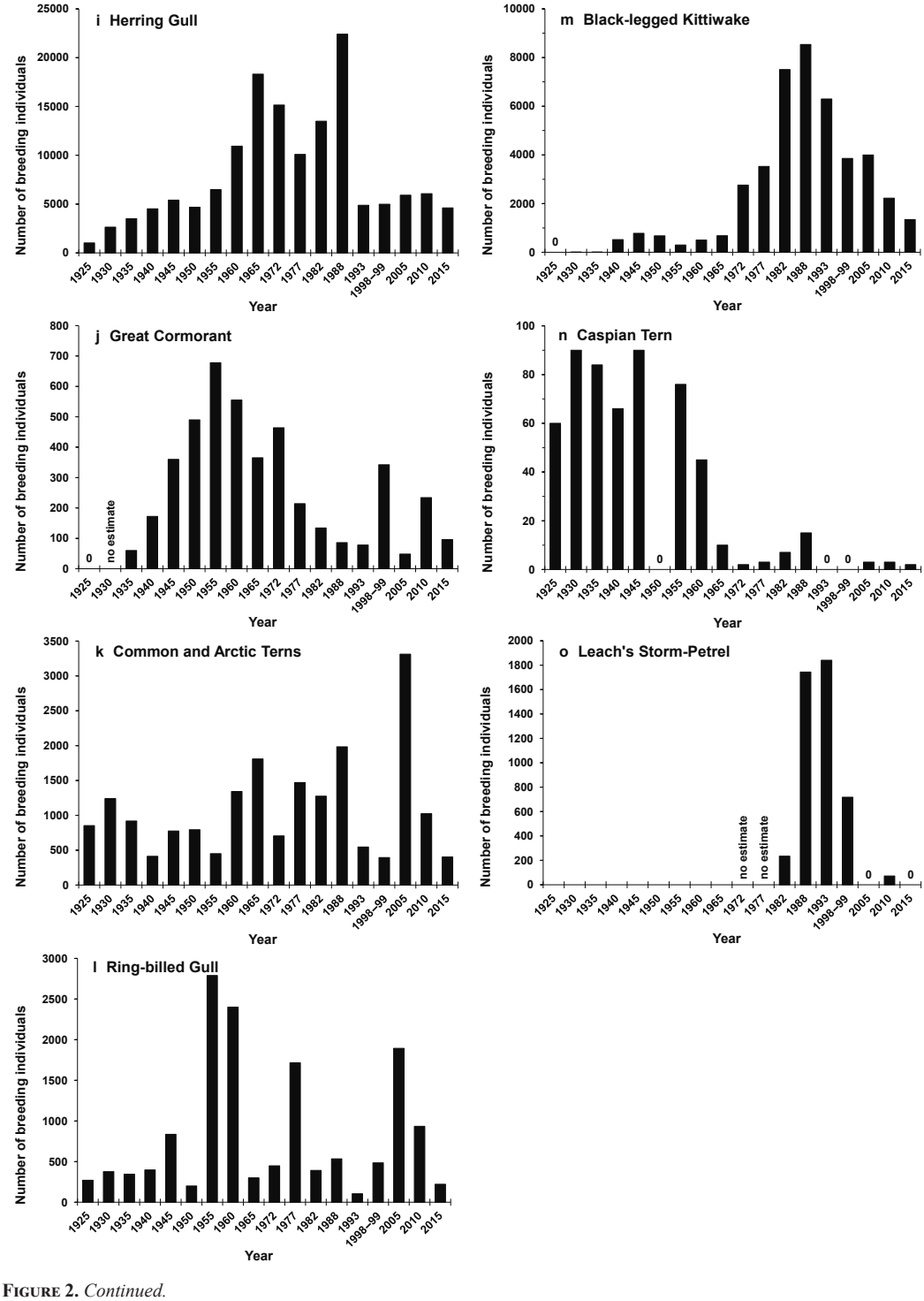

FIGURE 2. *Continued.*

the North Shore MBSs decreased by 61% and 76%, respectively, between 2010 and 2015 (Table 1). The abundance of these species is characterized by extreme fluctuations between censuses (Figure 2k–l), as colonies of all sizes move in and out of the MBSs and new colonies are found while others are abandoned. Thus, such small population levels as those of 2015 have been observed in the past and are not necessarily indicative of a longer-term decline. The Mingan Archipelago National Park Reserve, a much wider area that includes the Betchouane and Watshishou MBSs, stretches along 152 km of coastline and encompasses over 1000 islands; it provides the most representative results for terns on the North Shore of the Gulf of St. Lawrence. Yet, the park's large tern population remained quite stable from 2009 to 2019, at around 4500 pairs, and shows a 20% increase since 1999 (Abgrall and Langlois 2019).

Black-legged Kittiwake—The Île du Corossol MBS has always been the stronghold for Black-legged Kittiwake on the North Shore. However, with a fifth consecutive decrease (−67% between 2010 and 2015), for the first time since this MBS was created in 1937, it no longer holds the largest kittiwake colony. The only positive trend was observed in the Betchouane MBS where a small colony (126 pairs in 2015) is doing well (+334%; Table 1). The overall decline of 84% in the MBSs since 1988 is troubling, as there is no indication of it slowing down, and there are only a few hundred (n = 672) pairs left (Figure 2m). Long-term large-scale declines are also occurring elsewhere in the species' core breeding distribution in eastern Canada, i.e., Gaspé Peninsula (−52% between 1989 and 2018; Canadian Wildlife Service unpubl. data), Anticosti Island (−90% from 1985 to 2019; Canadian Wildlife Service unpubl. data), and Newfoundland (Cotter *et al.* 2012). The species, which has been listed as Vulnerable by the IUCN since 2017 (BirdLife International 2018c) because of continuing declines in large parts of its global range, appears affected by ocean warming rates and trophic shifts in the Atlantic (Descamps *et al.* 2017).

Caspian Tern—Two adults and one nest were found in 2015, confirming that the species still breeds, sporadically, at the Île à la Brume MBS. In 2005 and 2010, three birds, presumably breeders (but no nest), had been observed after no detection of the species in 1999 and 1993. The Îles à la Brume MBS is the only site where the species breeds regularly in Quebec. Between 1925 and 1945, 60–90 birds were observed during the quinquennial censuses (Figure 2n). This tiny and isolated colony appears fragile, especially as Caspian Terns are particularly vulnerable to human disturbance (Cuthbert and Wires 2020), and the site is probably visited by people from local communities. Moreover, as Caspian Terns often nest among Ring-billed Gulls, the near disappearance of the latter species on Île à la Brume MBS may represent a lost opportunity for Caspian Terns to breed.

Leach's Storm-Petrel—No active nests were found in 2015, as in 2005. However, given the small size of the entrance to this species' burrows, which can be easily missed in vegetation, it may still breed on Île du Corossol MBS, because 36 occupied burrows were counted there in 2010. However, the species is obviously less abundant now than in the 1980s and early 1990s, when with minimal effort, up to 900 active burrows were found in colonies at four MBSs: Île du Corossol, Baie des Loups, Îles aux Perroquets, and Îles Sainte-Marie. Burrows were noted in 1972 and their number first estimated in 1982 (Figure 2o), but breeding storm-petrels have probably been present since the sanctuaries were created. The species was globally listed as Vulnerable in 2018, because of worldwide declines (BirdLife International 2018d). In November 2020, the Atlantic population in Canada was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (SARA Registry 2021). It is known to be particularly vulnerable to mammalian predation, and American Mink (*Neovison vison*) and Red Fox have been seen for the first time on Île du Corossol in recent years. On a brighter note, audio recordings from Île aux Perroquets, in the Baie de Brador MBS, suggest that storm-petrels might breed there (e.g., 74 chatter calls [see Pollet *et al.* 2020] between 0100 and 0200 on 28 June 2015). There is no previous breeding record for this species there, but again, Leach's Storm-Petrel burrows may be difficult to detect and identify through the vegetation, especially among nearly 10 000 puffin burrows.

Conclusions

Our results highlight, once again, the precariousness of the status of Caspian Tern and Leach's Storm-Petrel breeding populations in North Shore MBSs. The main threats they potentially face (disturbance and egg harvest for the former, invading American Mink and Red Fox for the latter) should be addressed before these species vanish permanently from the sanctuaries. Black-legged Kittiwake is another species of concern, showing a fast and steady decline since 1988. Compared with historical levels since 1925, the seabird community appears generally healthy in some MBSs (e.g., Baie de Brador, Îles aux Perroquets, and Îles Sainte-Marie). However, seabird numbers are obviously declining and not recovering at others, particularly alcids at Île à la Brume and Baie des Loups MBSs, and Common Eider at Saint-Augustin MBS. We found some evidence and reported facts suggesting that human disturbance and

harvest of seabirds (eggs and birds) could still be the main limiting factors in these areas. Seabird population monitoring, wildlife law enforcement, and raising public awareness all remain important challenges to ensure the conservation of seabird populations in such a huge and remote area as the North Shore.

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