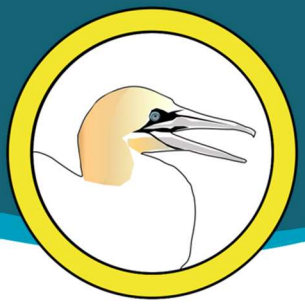
Monitoring the State of the
ST. LAWRENCE RIVER

Northern Gannet – A Sentinel Species for the Gulf, 4th edition



Northern Gannet
Status: moderate in 2019
Trend: slight improvement since 2012

Highlights

The size of the Northern Gannet population in Quebec is relatively stable and at a high level since 2010. However, the low and variable breeding success observed on Bonaventure Island should be monitored closely. In the 1960s and 1970s, certain contaminants were responsible for low reproduction rates, causing a decline in the population. This time, however, it is the availability of food in the Gulf of St. Lawrence that is affecting the species.

Problem

The Northern Gannet is an emblematic figure of the Gulf of St. Lawrence. Spectacular, it does not go unnoticed with its two-meter wingspan, its mostly immaculate white plumage, the way it dives to feed, and its gatherings for both feeding and nesting.

Quebec has a great responsibility of conservation towards this species. Indeed, there are only six nesting colonies in North America, and three of them are in Quebec (the other three being in Newfoundland). Moreover, three quarters of the continental population is concentrated at the two largest colonies in Quebec, located on Bonaventure Island and Bird Rocks (Figure 1).

The Northern Gannet is an excellent flyer that can travel hundreds of kilometers to feed on its favourite prey, such as mackerel, herring, capelin and sandlance. This makes it a good indicator of the health of the Gulf, particularly in terms of the abundance of forage fish on which it feeds, but also for the presence of contaminants in the ecosystem, being itself at the top of the food chain.

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It was in fact following the finding of the presence of pesticides in its eggs and their impact on its reproductive success (Chapdelaine et al 1987), that a quinquennial monitoring of the gannet population was undertaken (Rail et al 2013). Fortunately, the use of certain products was quickly banned in North America, and their concentration in the environment has decreased drastically since the late 1960s.

Study area

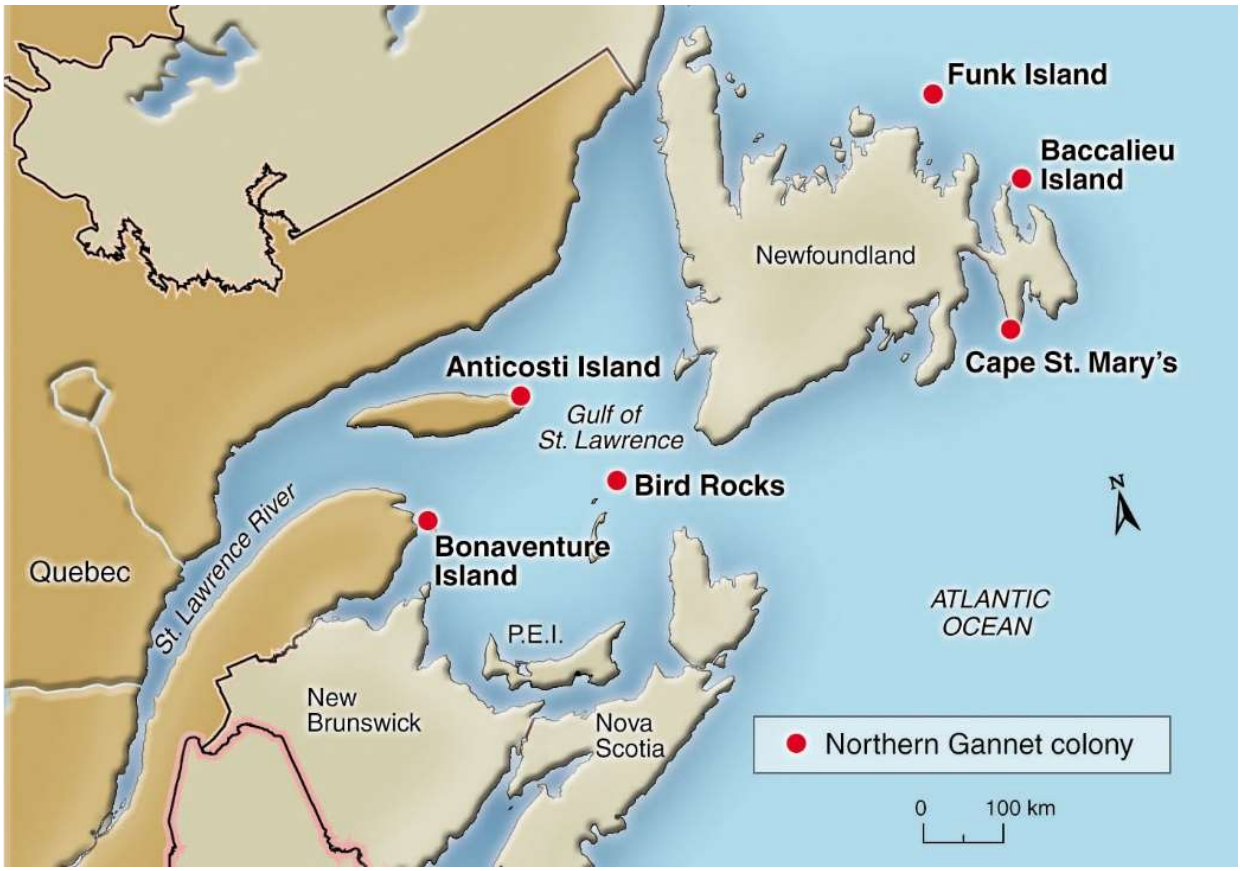

Figure 1. Location of Northern Gannet colonies in North America

Key measures

The overall status of the indicator takes into account several parameters. First, the size of the breeding population of Northern Gannet in Quebec: the status of this indicator is considered good when there are more than 60,000 pairs, and poor if there are less than 40,000 pairs. Breeding success on Bonaventure Island is also examined, assessed in terms of the percentage of breeding pairs that successfully raise a chick to fledging. Reproductive success is considered poor when it is less than 60%, and good when it is over 70%. Subsequently, the recent trend in population size (over 10 years) is assessed, as well as the recent trend (over the last 5 years) in breeding success. In both cases, a variation of less than 25% is considered a relatively stable trend (the indicator is then moderate), while the indicator is good for an increase of more than 25%, and poor with a decrease of more than 25%.
The last parameter concerns contaminants in eggs: if the analysis shows levels of contamination that can potentially affect the health of gannets, this indicator is moderate, and it becomes poor if there is evidence of negative effects.
For each parameter, a rating of 0 is assigned if the indicator is good, 1 if it is moderate, and 2 if it is poor. The sum of the five ratings defines the overall status of the indicator (0-1=good; 2-3=moderate-good; 4=moderate; 5-6=moderate-poor; 7 and +=poor).

Status and trends

In the 1950s and 1960s, DDT and Dieldrin were widely used in North America, including in the Gaspé Peninsula and New Brunswick, to control insect pests in forests and in agriculture. Unfortunately, these contaminants ended up in the marine ecosystem, and high concentrations were found in Northern Gannets, particularly in their eggs. At these high levels, these toxic substances affected the formation of eggshells, which were then thinned and tended to break under the weight of the adult during incubation. As a result, by the late 1960s, fewer than one in three gannet pairs on Bonaventure Island were breeding successfully, and the population began to decline.

A stabilized, large population

Following measures to curb the use of these pesticides, the population decline was reversed. And for about thirty years, from the end of the 1970s until 2009, the population showed a constant growth, reaching a maximum of nearly 90,000 breeding pairs in Quebec. However, suddenly, this growth was replaced by a stabilization of the numbers. For the last ten years, the population size has oscillated around 75,000-80,000 pairs. Thus, the status of the population size indicator is considered good, while the population trend indicator (over 10 years) is rather moderate.

Note that the size of the Bird Rocks colony followed a very similar trend to that of Bonaventure Island (Figure 2), which suggests that both colonies were affected by common factors. You may also note that the monitoring of the population size, as well as the reproductive success (see next paragraph), has been annual rather than five-yearly since 2009. Initially, we wanted to monitor the potential long-term impacts of a major oil spill (the DeepWater Horizon explosion) that occurred in the Gulf of Mexico in April 2010, knowing that many of our gannets frequent this area in winter as well as during their first year of life. However, even though breeding adults had already migrated toward the colonies during the April 10, 2010 spill, their numbers at the colonies declined by 17% that year. By examining their reproductive success the following year, it became clear by 2011 that our birds were facing problems while breeding, and that those were not necessarily related to the Gulf of Mexico incident. These findings and the uncertain future warranted continued close monitoring of the species to try to identify the factors involved.

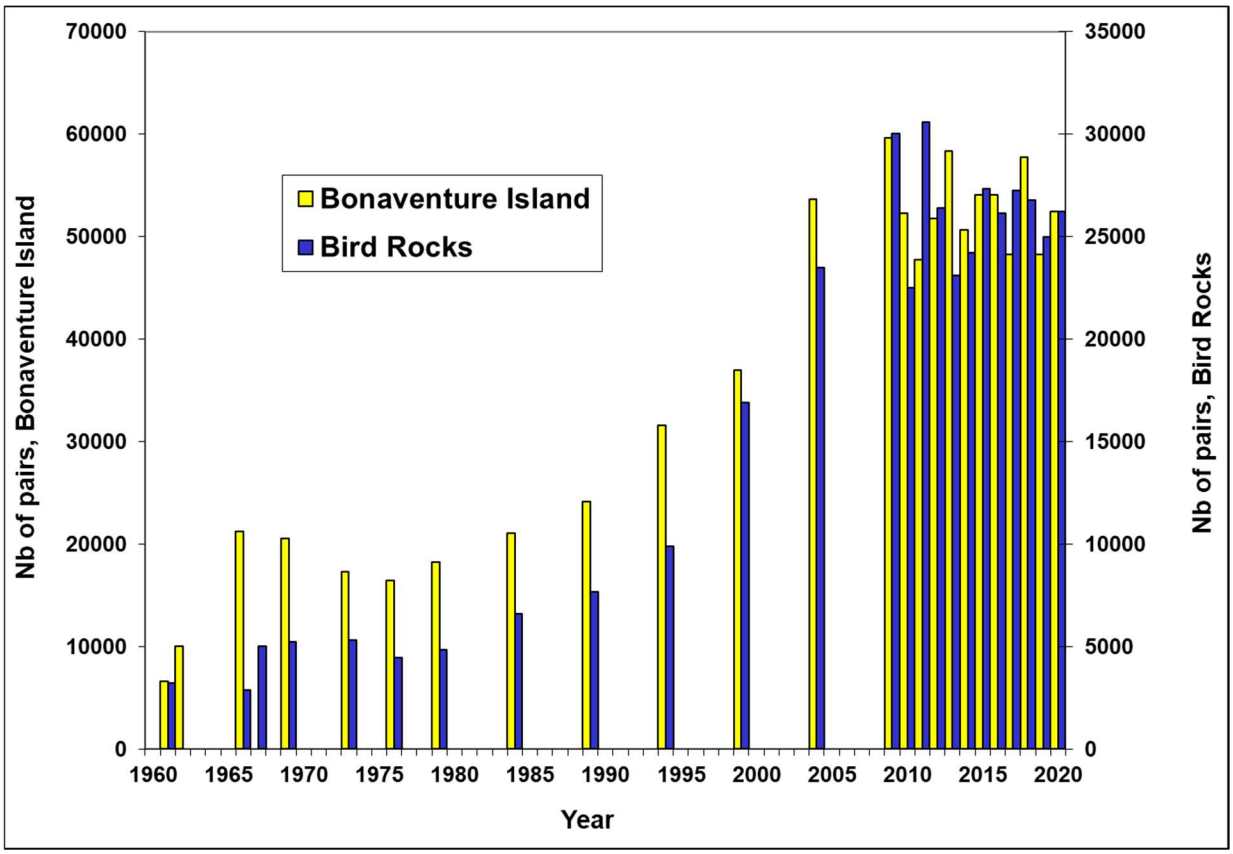

Figure 2. Northern Gannet population trend at the colonies of Bonaventure Island and Bird Rocks, from 1960 to 2020.

Reproductive success remains low and variable

As Figure 3 shows, with DDT, the concentration of banned chemicals in Northern Gannet eggs has declined dramatically, and in response, breeding success has increased (in just ten years) from 31% to 77%. Thereafter, between 1979 and 2004, this reproductive rate remained high (above 70%). It is during this same period that the population experienced a nice growth. We can also see that by 2009, the reproductive success (50%) had already decreased significantly (Figure 3), while the breeding population size was reaching its peak (Figure 2). It is important to understand that a change in reproductive success should only have an effect on the number of breeders after a delay of 5 or 6 years, because it is only at this age that the Northern Gannet starts to reproduce.

Chapdelaine et al. (1987) estimated, using a population model, that a reproductive success of about 67% was necessary to counter natural mortality and maintain the gannet population. Indeed, population growth was observed with nesting success above 70%. For this reason, it was determined that the reproductive success indicator would be considered moderate at values between 60 and 70% (corresponding to the grey area in Figure 3). After 2004, however, the gannets' breeding success declined unexpectedly and dramatically to a poor value of 8% in 2012. What followed was equally unpredictable; from 2013 to 2018, increasing values of 37% to 64% were recorded, the latter representing an encouraging "return to normality". Unfortunately, the following year (2019) was the second worst of all in terms of breeding success (14%) of gannets on Bonaventure Island.

Thus, considering the last five years for indicators related to reproduction, reproductive success remains poor (below 60%, except in 2018), and its recent trend must be qualified as variable, which corresponds to a moderate status.

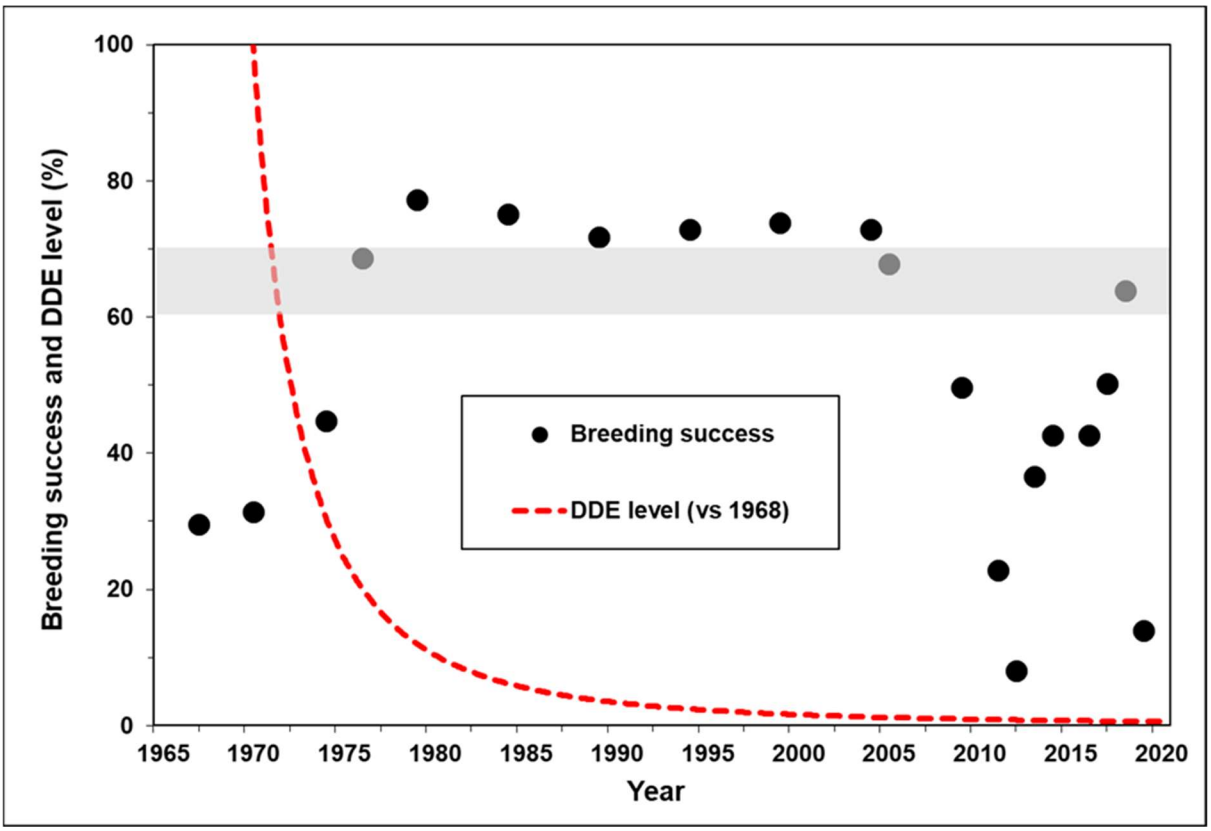

Figure 3. Trends in breeding success and DDE (DDT residue) levels in the eggs of Bonaventure Island Northern Gannets, from 1965 to 2020.

Contaminants do not appear to be involved

Based on results from analyses made on blood and feathers, Champoux et al. (2020) suggested that gannets that overwintered in the Gulf of Mexico may have had poorer quality diets, or exposure to environmental stresses or contaminants. However, this cannot explain the low and variable reproductive success seen in Bonaventure Island gannets in the past decade, especially since contaminant levels in their eggs are generally declining (Champoux et al. 2017).

Other studies have found that gannets struggle to find food during nesting, and that this influences their reproductive success (Guillemette et al. 2018). Analysis of their movements showed that they traveled longer distances, and were absent from the colony longer. It was also found that Atlantic mackerel and Atlantic herring, once their main prey during chick rearing, were recently less present in their diet. The stocks of these two pelagic fish species have been at a critical level in the Gulf of St. Lawrence for several years. In addition, with global warming, prey is sometimes less available to gannets when ocean surface temperatures become too warm, as was the case in August 2012 (Montevecchi et al. 2021). That year, the many abandoned and starving chicks at the nest on Bonaventure Island were a sad sight.

Fortunately, the Northern Gannet is a resilient species capable of adjusting to global changes. If necessary, it can modify its diet to take advantage of the abundance of other fish species, such as capelin and sand lance. In 2020, it was even discovered that a large part of its diet was composed of Deepwater redfish (D. Pelletier, pers. comm.), a fish that has made a strong comeback and is now abundant in the Gulf of St. Lawrence.

Outlook

The combination of a large and stable population, a rather low and variable reproductive success, and non-preoccupying levels of contamination make the overall status for the Northern Gannet indicator "moderate". This represents a slight improvement from the ("moderate-poor") finding in 2012, when the population looked like it might start to decline, and reproductive success had just collapsed sharply to the lowest level ever observed on Bonaventure Island.

ECCC plans to continue its five-yearly monitoring program of the Northern Gannet, while leaving the door open for more frequent and comprehensive monitoring in the coming years. Among other things, there is the idea of developing a method using aerial photos to evaluate reproductive success, which would make it possible to monitor reproduction not only on Bonaventure Island, but also at Bird Rocks and the Newfoundland colonies.

For more information

List of references used in the sheet and relevant references.

Champoux, L., J.-F. Rail and R. Lavoie 2017. Polychlorinated dibenzo-p-dioxins, dibenzofurans, and flame retardants in northern gannet (Morus bassanus) eggs from Bonaventure Island, Gulf of St. Lawrence, 1994-2014. Environmental Pollution, vol. 222: 600-608.

Champoux, L., J.-F. Rail, M. Houde, M. Giraudo, E. Lacaze, C. Franci, G.D. Fairhurst, K.A. Hobson, P. Brousseau, M. Guillemette, D. Pelletier, W.A. Montevecchi, S. Lair, J. Verreault, and C. Soos 2020. An investigation of physiological effects of the Deepwater Horizon oil spill on a long-distance migratory seabird, the northern gannet. Marine Pollution Bulletin 153: 110953.

Chapdelaine, G., P. Laporte and D.N. Nettleship 1987. Population, productivity and DDT contamination trends of Northern Gannets (Sula bassanus) at Bonaventure Island, Quebec, 1976-1984. Canadian Journal of Zoology 65: 2922-2926.

Guillemette, M., F. Grégoire, D. Bouillet, J.-F. Rail, F. Bolduc, A. Caron and D. Pelletier. 2018. Breeding failure of seabirds in relation to fish depletion: is there one universal threshold of food abundance? Marine Ecology Progress Series 587: 235-245.

Montevecchi, W.A., P. Regular, J.-F. Rail, K. Power, C. Mooney, K.J.N. d'Entremont, S. Garthe, L. Guzzwell and S.I. Wilhelm 2021. Ocean heat wave induces breeding failure at southern breeding limit of the Northern Gannet Morus Bassanus. Marine Ornithology 49: 71-78.

Rail, J.-F., L. Champoux, R.A. Lavoie, and G. Chapdelaine. 2013. Monitoring the population and contamination of Northern Gannets in Quebec, 1966-2009. Technical Report Series No. 528. Canadian Wildlife Service, Quebec Region, Environment Canada, Quebec, ix + 77 pages + appendices.

State of the St. Lawrence Monitoring Program

Five government partners—Environment and Climate Change Canada; Fisheries and Oceans Canada; Parks Canada; the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques du Québec; and the Ministère des Forêts, de la Faune et des Parcs du Québec—and Stratégies Saint-Laurent, a non-governmental organization that works actively with riverside communities, are pooling their expertise and efforts to provide Canadians with information on the state of the St. Lawrence and the long-term trends affecting it.

For more information about the State of the St. Lawrence Monitoring Program, please consult our website: http://planstlaurent.qc.ca/en/state_monitoring.html.

Prepared by

Jean-François Rail
Canadian Wildlife Service
Environment and Climate Change Canada

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