

## SHORT COMMUNICATION

Conservation genetics of high-arctic Gull species at risk: I. Diversity in the mtDNA control region of circumpolar populations of the Endangered Ivory Gull (*Pagophila eburnea*)

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## Abstract

The high-arctic Ivory Gull (*Pagophila eburnea*) has recently undergone a sharp decline in numbers, and in Canada it is listed as "Endangered" under the Species-At-Risk Act. To test for circumpolar genetic distinctiveness, we examined 264 bp of the mtDNA Control Region Domain I from 127 museum specimens collected during the breeding season from northern Canada, Greenland, and Norway, and during the non-breeding season from adjacent overwintering grounds in Canada, Greenland, and a disjunct area in Alaska adjacent to the Bering Sea. Partition of genetic variance according to various phylogeographic and breeding ground models indicates no strong population structure, except that Alaska birds are consistently differentiated from other locations, and there are significant temporal shifts in haplotype frequencies. The evidence suggests that Ivory Gulls in Canada, Greenland, and Norway are a single genetic entity, in contrast to Alaska birds, which may represent a distinctive Siberian population.

## Keywords

Conservation genetics, COSEWIC, endangered species, ivory gull, mtDNA

## History

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*The cold coast of Greenland is barren and bare  
No seedtime, no harvest are ever known there.  
And the birds here sing sweetly in mountain and dale  
But there's no bird in Greenland to sing to the whale*  
-Farewell to Tarwathie, trad

## Introduction

The Canadian breeding population of Ivory Gulls, *Pagophila eburnea* (Phipps, 1774), underwent a precipitous decline from an estimated 1200 pairs in the 1980s to as few as 250 pairs in 2005 (Gilchrist & Mallory, 2005; Haney & McDonald, 1995; Renaud & McLaren, 1982), and they now breed only in northern Nunavut (Figure 1). Based on a projected decline to 200 birds by 2015, the species has been assessed as "Endangered" under the Species-At-Risk Act (SARA) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2006). Another high arctic gull species, Ross's Gull (*Rhodostethia rosea*), has been assessed as "Threatened", recognizing it as a rare species in Canada with small numbers of birds breeding at a few newly established colonies (Royston & Carr, 2015).

The global population of this circumpolar and high-arctic species appears also to be in decline from the previous estimate of 10,000 breeding birds by Vuilleumier (1995). The best estimate for northern and eastern Greenland showed 1800 birds, with

decline in the south (Gilg et al., 2009). It is classified as Declining at Svalbard in Norway (Anker-Nilssen et al., 2000), and rare in the islands of the Kara Sea of Siberia (Zubakin, 1984). Colonies documented in the late nineteenth and early twentieth centuries at Franz Josef Land and Spitsbergen have either disappeared or been severely reduced (Bateson & Plowright, 1959; Birkenmajer, 1969; de Korte & Volkov, 1993; Haney & McDonald, 1995; Krajick, 2003; MacDonald, 1976; Volkov & de Korte, 1996).

Declines in Ivory Gull abundance have been attributed to several factors (Gilchrist & Mallory, 2005). Although now protected under SARA, they were formerly shot for food in Nunavut and off the northeast coast of Newfoundland, and bands recovered from shot birds show that they remain vulnerable to hunting pressure during migration to and from breeding grounds (Stenhouse et al., 2004). Intense and unregulated hunting still occurs in Greenland, and on the coast of eastern Siberia adjacent to the Bering Sea wintering grounds (Greg Robertson, personal communication). The species is strongly dependent on the sea ice: reduced ice on the breeding grounds is associated with lower reproductive success (Dalgety, 1932), whereas increased sea ice at the wintering grounds appears to have a negative impact on food availability (Krajick, 2003). Gilg et al. (2009) suggest that it may well become the first bird species to become extinct as a result of anthropogenic global warming.

We consider here the circumpolar population genetic structure of Ivory gulls, in particular those on their summer breeding grounds in high-arctic Canada and northern and eastern Greenland and adjacent wintering areas, as well as the Norway breeding grounds and the disjunct Alaska wintering ground. The species' geographic remoteness and conservation status preclude

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