

Progress Update: Arctic Goose Joint Venture Project 103

Pacific Black Brant Colony Photographic Survey

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Introduction

Historical data suggested that Pacific black brant productivity on the Yukon-Kuskokwim Delta (YKD) was the single most important factor responsible for the health of the Pacific brant breeding population; accounting for greater than 70% of total Pacific brant production (Sedinger et al. 1993). During the mid-1980's, declining numbers of nesting Pacific black brant on the YKD generated interest in developing an efficient method to estimate the number of individuals nesting in large colonies (Sedinger et al. 1993). As an alternative to labor intensive ground-plots and visual counts from aircraft (which were considered too impractical or imprecise for colonies), aerial videographic surveys were initiated in 1992 and conducted annually thereafter at the five major brant nesting colonies on the YKD (Anthony et al. 1995, Anthony 1992-2003, Wilson 2007-2010; Fig. 1). In 2004, the survey changed from videography (i.e., using a digital camcorder) to its current configuration: aerial still-frame, digital photography (Anthony 2004-2006, Wilson 2007-2010).

Since the outset, the goal of the brant colony photo survey has been to maintain a YKD colony index to help guide population harvest management for Pacific black brant (Pacific Flyway Council 2004). Population estimates for colonial nesting Pacific black brant (*Branta bernicla nigricans*) on the Yukon-Kuskokwim Delta (YKD), Alaska, are critical for assessing potential productivity, status, and population abundance and trends. These estimates are one of two primary indices used by the Pacific Flyway in setting annual harvest management regulations for Pacific black brant. Current flyway prescriptions for Pacific black brant mandate harvest closure if: a) the 3-yr average of the midwinter survey is <90,000, and b) the YKD-wide colony nest population estimate declines by 50% relative to the 1993-2000 average of 19,863 nests (Pacific Flyway Council 2004). Additionally, data generated from the survey is used in guiding Alaska subsistence harvest regulations on the YKD (Federal Register 2006), and played a key role in cooperative efforts to develop colony-specific management plans and aid in decisions regarding local arctic fox control on the YKD (Yukon Delta National Wildlife Refuge 2010). Data collected from the photographic survey also provides annual information on human use and disturbance of colony areas, nest densities of other species (e.g., cackling goose; *Branta hutchinsii minima*), and continues to be used to assess various measures of habitat change (Person et al. 1998, Lake et al. 2006, Wilson 2010, Schmutz 2015). The survey is conducted on an annual basis in order to provide annual population estimates and most rapidly detect trends.

With the support of the AGJV, an annual nesting population estimate for the YKD Pacific brant breeding colonies has continued from 1992 to the present. The following interim progress report summarizes the Pacific brant photographic colony index in Alaska and emphasizes the need for continuation of this survey in light of its role in the Pacific Flyway Brant Management Plan, the Alaska Migratory Bird Co- Management Council's subsistence planning, and on-going habitat, disturbance, and climate change studies.

Three AGJV information needs are directly addressed in this project: 1) Population status and assessment, 2) Population dynamics, and 3) Population biology and/or ecology, all of which depend upon estimates of nesting YKD brant generated by the survey to examine broader population questions. Additionally, a fourth AGJV information need: habitat concerns, is also addressed in the project via collaborative research utilizing the survey's population data and imagery to study changes in forage and habitat availability relative to nesting goose population dynamics.

Methods

The aerial photographic survey is conducted annually, in early June (mid-incubation), and covers the five primary brant nesting colonies on the YKD, Alaska (Fig. 1). Surveys are flown (1-2 days) to collect images at each of the colonies, after which images are processed (i.e., nesting brant are counted in images) on computers and data is analyzed to produce annual population estimates and trends for each colony (considering detection probabilities), from which an annual report is generated.

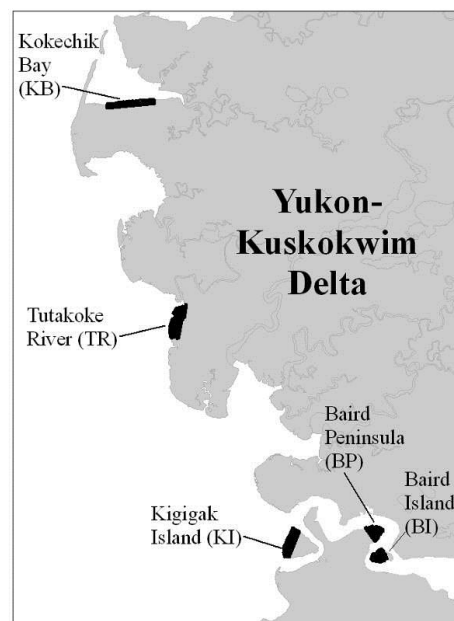


Figure 1. Photographic survey areas of the five primary Pacific black brant nesting colonies on the Yukon-Kuskokwim Delta.

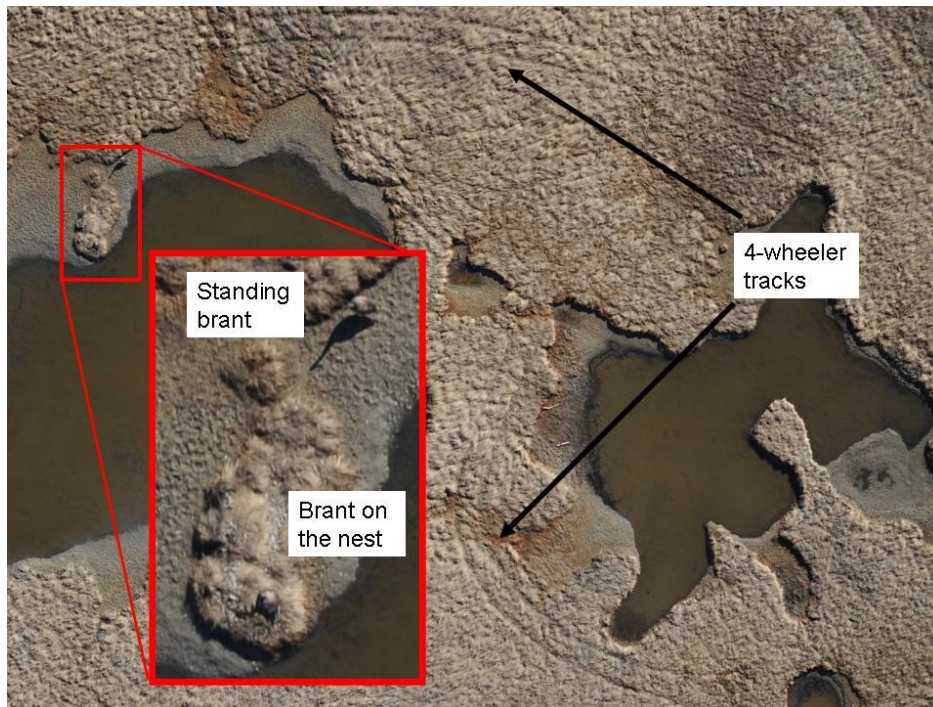


Figure 2. Example of a high-resolution digital image (Nikon D700 SLR camera) including nesting and standing brant, surrounded by 4-wheeler tracks at Kokechik Bay in 2010. This photo shows both nesting brant (upon which, population estimates are based), as well as evidence of human-use (in this case, 4-wheeler tracks). 2010 marked the highest recorded index of 4-wheeler, snowmachine, and human footprint tracks at the Kokechik Bay colony in the history of the survey.

Results

Approximately 4,500 images are analyzed each year across the five colonies, representing 7-16% coverage of the composite colony area. Although annual change nest population estimates for individual colonies are highly variable (range: -40 to +60% change from the previous year), the composite trend in annual YKD estimates of brant nests indicates a decidedly negative ($\lambda = 0.963$; 1992-2014, Fig. 3) and sustained population decline. Over the past seven years (2008-2014), the long-term trends at the two largest colonies (Tutakoke River and Kokechik Bay) have experienced continued negative departures from the long-term composite colony trend (e.g., ~5.3% annual declines at Tutakoke River and Kokechik Bay versus ~3.6% annual decline for all colonies), suggesting that most of the overall long term decline can be attributed to reductions at these historically productive colonies. In 2014, the YKD colony nest population estimate fell below the productivity benchmark outlined by the Pacific Flyway (>50% below the 1993-2000 average of 19,683 nests) and the annual estimate was 40% lower than the long term average (15,273; 1992-2013).

Overall, the long-term growth rate for brant nests in the primary colonies as estimated by photography ($\lambda = 0.963$, 1993-2014, Fig. 3) continues to be substantially lower than that estimated for brant nests across the YKD (from the nest plot survey, $\lambda = 0.995$, 1985-2014; Fischer et al. 2015), and lower than that for indicated breeding birds from aerial counts ($\lambda = 1.049$, 1985-2014, Platte et al. 2014). This suggests that brant nesting in the historical colonies are in a significant long-term decline, while brant nesting elsewhere on the YKD are experiencing

a much slower rate of decline, and in some cases, may be approaching stability (also see Stehn et al. 2011).

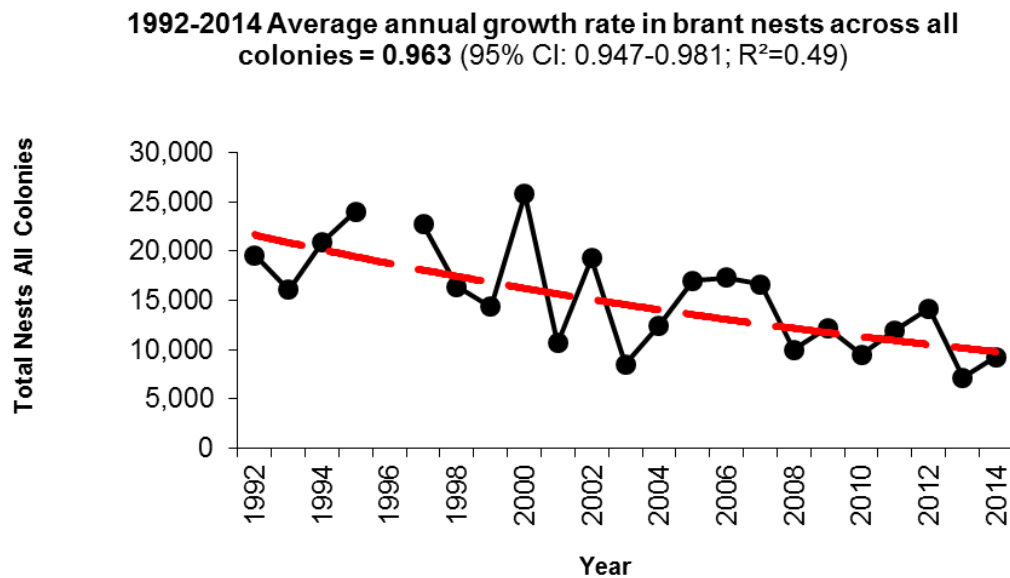


Figure 3. Trend in annual estimates of brant nests (red dashed line) from photographic surveys across all brant colonies on the Yukon-Kuskokwim Delta (1992-2014).

Based on aerial imagery from 2011-2014, human activity (quantified as the number of photos with footprints and vehicle tracks at locations without researchers) appears to have stabilized at some colonies (e.g., Kokechik Bay), while markedly increasing at others (e.g., Baird Inlet). Unfortunately, notably increase in human disturbance is often coupled with an annual decline in total brant nests at the effected colony. However, human disturbance at colonies, as indicated by the brant imagery survey, has also prompted local grassroots efforts to identify and reduce disturbance of nesting colonies and associated habitat.

Trends for ancillary species in the colonies (2009-2014) indicate precipitous declines for eiders ($\lambda = 0.67$ SE: 0.10), moderate declines for cackling geese ($\lambda = 0.95$ SE: 0.07), and increasing trends for emperor ($\lambda = 1.05$ SE: 0.04), and greater white-fronted geese ($\lambda = 1.05$ SE =0.17). Notably, eider nests in the colonies reached historic lows in 2014 and have been precipitously declining since 2005 ($\lambda = 0.67$ SE: 0.10). Common eiders nest sympatrically with brant and likely benefit from associated predator swamping, or conversely suffer as brant colonies decline.

Management Implications

Since its inception, the brant colony imagery survey has produced a YKD-colony index to help guide population harvest management for Pacific black brant (Pacific Flyway Council 2004). Population estimates and trends from this annual survey have become one of two primary indices used by the Pacific Flyway in setting harvest management regulations for Pacific black brant, and current flyway prescriptions for Pacific black brant mandate harvest closure if: a) the 3-yr average of the midwinter survey is <90,000, and b) the YKD-wide colony nest population estimate declines by 50% relative to the 1993-2000 average estimate (Pacific Flyway Council 2004). On the Yukon Delta National Wildlife Refuge (in coordination with Migratory Bird

Management and the USGS Alaska Science Center), a YKD brant management plan has been under development in which individual colony trends (based on population estimates of nesting brant from this survey) would be used to trigger fox control at individual colonies. Fox control would be initiated when the three-year running averages of nesting brant have fallen below stated population goals. Moreover, the Alaska Migratory Bird Co-Management Council continues to depend on annual data from the brant colony photo survey to help gauge productivity, disturbance, and overall health of the brant population on Alaskan nesting grounds. Finally, images from the historic brant colony imagery survey have been used to assess goose grazing lawn abundance (Person et al 1998, Lake et al. 2006) and are currently being used to explore climate-related habitat change, loss of coastal nesting areas (Wilson 2010), and in monitoring changes in grazing-lawn abundance and distribution (Schmutz 2015). Such changes may have profound impacts on multiple species of arctic nesting geese that utilize the YKD and the brant colony imagery continues to provide one of the most extensive photographic records of habitat change available for the region.

The Alaska Region of USFWS will continue its commitment to the brant colony imagery survey by providing personnel and logistics support for the banding program. However, due to Service-wide budget cuts, increased overhead costs, and redirected funding, operational funding (\$10K/yr) is critically needed to maintain the brant colony imagery survey.

Literature Cited

**PDFs of the following publications (those marked with asterisk and pertinent to this proposal) have been included in a separate email to familiarize reviewers with previous work accomplished and track-record of the PI (relative to the project).*

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