Fall Photographic Survey of Pacific Brant at Izembek Lagoon, Alaska: 2025 Survey Update

U.S. Fish and Wildlife Service (USFWS) Alaska Region
Division of Migratory Bird Management

February 9, 2026

Background

In August 2024, the Pacific Flyway Council (Council) adopted a revised brant population objective and harvest strategy. Whereas prior harvest management decisions for brant were based on the 3-year running average of the Winter Brant Survey (WBS), the Council approved replacing the WBS with the fall photographic aerial survey, referred to as the Fall Brant Survey (FBS) at Izembek Lagoon, Alaska. Adoption of the FBS followed eight years of developing aerial photographic methods as an alternative to the WBS (Weiser et al. 2022) and provides statistically rigorous estimates of population abundance.

Methods

Brant in Izembek Lagoon use eelgrass (*Zostera marina*) beds primarily at low tide during autumn and retreat toward shorelines or barrier islands with increasing tides (Daniels et al. 2019). All surveys conducted since 2022 have attempted to photograph brant along transects across the lagoon at or around low tide when brant movement is at low levels. Weiser et al. (2022) provide details on the design and implementation of the 2017–2019 surveys, though estimates provided here will differ due to data treatment and the estimator used.

In 2022, brant in Izembek Lagoon were sampled with 5 replicate surveys. Each replicate was defined as a stationary set of 37 transects spaced approximately 1.30 km apart. Photographs were taken from a target altitude of 457 m (1500 ft) every 75 m by 2 Canon 5DS-R cameras fitted with Canon 200mm f/2.8L II USM lenses angled away from center approximately 5–6° in opposite directions. Photo coverage area was calculated for each image based on flight altitude and camera angle. Actual photo areas varied widely due to fluctuations in altitude caused by weather conditions such as wind and cloud cover.

Starting in 2023, the survey area was expanded (buffered) 500 m around the original survey area to include additional surrounding habitat. We established three sets of 40 transects across the expanded survey area, each set about 0.41 km apart. The transect spacing within each set was 1.25 km and contained two offset panels (e.g., A and B). Each panel consisted of every other transect in the set (20 transects, each 2.5 km apart; Figure 1). A replicate was defined as at least one panel (e.g., A) flown within a day. However, whenever weather, tide, and daylight allowed, both panels (e.g., A and B) within a set were flown sequentially on the same day making a replicate. Photographs were taken as in 2022, only using Nikon cameras fitted with Nikon lenses.

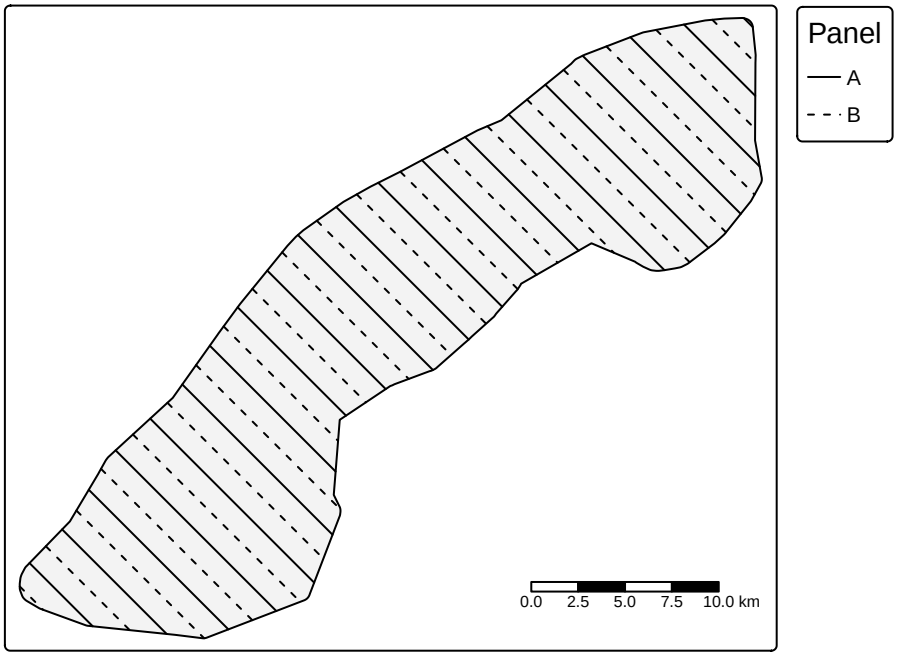

Figure 1: An example set of 40 transects (Panels A and B) spaced 1.25 km apart used to sample brant at Izembek Lagoon, Alaska, 2023–2025.

An automated object detection algorithm (YOLO v5) was trained on annotated aerial photos of brant from 2017–2019 and applied to each year and replicate combination during 2022–2025 to estimate the count and density of brant in each photo. We validated counts by subsampling 1–2% of photos split approximately equally between empty photos and photos containing brant to determine the frequency of false positive (incorrectly counted as brant) and false negative (missed brant) occurrences in automated counts. We assumed our visual counts of brant in each subsampled photo were without error, and subsequent counts were used to estimate a replicate-specific correction factor with variance approximated using bootstrap simulation. We derived a population estimate for the survey area by extrapolating the density of brant from the photos to the survey area using a ratio estimator and adjusted for algorithm error using

the correction factor.

Different individuals validated subsampled photos in 2017–2019, 2022, and 2023–25. No surveys were conducted in 2020 or 2021 due to COVID. Starting in 2025, due to variability in sampling effort among replicates within a year, we implemented an effort-based weighting for calculating the annual mean population estimate. This was applied to estimates from 2022 to present. This had little effect on the 2022–2024 population estimates since effort among replicates within a year was very similar (i.e., similar numbers of transects per replicate). However, in 2025, three replicates consisted of both panels of transects (~40 transects) and three consisted of one panel of transects (~20 transects), resulting in approximately half the sampled area. Using an effort-based weighting to calculate mean population estimates will result in those replicates with lower effort (one panel) contributing approximately half of the influence on the annual mean as the replicates with full effort (two panels).

Results

Replicate-specific corrected population estimates in 2025 were similar to the prior 2 years where sampling effort and methodology have been relatively consistent (Table 1, Figure 2). Correction factors varied by replicate (Table 1).

The effort-weighted mean corrected population estimate over 6 replicates in 2025 (Table 2) was 196,159 brant (95% CI 136,865–255,453). The YOLO algorithm tends to slightly overestimate the number of brant in photos and misses very few brant if they are present in a photo. Manual validation found 1.69 false positive brant and 0.14 false negative (missed) brant per photo where the YOLO algorithm indicated 1 or more brant present (n = 459 photos). There were no additional false positive or false negative cases during manual validation in photos where YOLO detected 0 brant (n = 441 photos), suggesting non-detection of the algorithm and false detections of the validator are low. The average of the most recent 3 annual estimates for 2023–2025 (the most recent 3-year average) is 209,944 (95% CI 173,201–246,687).

Results presented in this memo are subject to change, especially in the case of a change in estimation method. The process outlined here has not undergone rigorous outside review nor has it been evaluated through simulation and thus should be treated as the best available estimate at this time.

Replicate-specific population estimates and this report can be found on ScienceBase at https://doi.org/10.7944/f0qw-qm58.

Table 1: A summary of replicate-specific corrected population estimates and correction factors for a transect-based aerial photographic survey of Pacific brant in Izembek Lagoon in southwest Alaska, October 2025. Means and confidence intervals were determined through bootstrap simulation.

Replicate	Mean Population Estimate	Lower 95% CI	Upper 95% CI	Mean Correction Factor	Lower 95% CI	Upper 95% CI	Transects
1	226,025	98,018	377,171	0.94	0.90	0.96	20
2	224,613	89,250	402,536	0.95	0.88	1.00	39
3	245,877	139,855	365,058	0.96	0.94	0.97	39
4	133,160	72,946	200,430	0.83	0.61	0.92	40
5	230,785	77,338	447,685	0.97	0.95	0.97	20
6	105,232	39,623	188,867	0.94	0.90	0.96	20

Table 2: A summary of replicate-level means for a transect-based aerial photographic survey of Pacific brant in Izembek Lagoon in southwest Alaska, 2017–2025. An effort-based weighted mean was used for annual estimates from 2022 to present due to variability in sampling effort among replicates. No surveys were flown in 2020–2021 due to COVID.

Year	Replicates	Mean Population Estimate	Standard Error
2017	3	377,029	55,773
2018	3	227,450	21,651
2019	2	272,468	40,659
2020	0	NA	NA
2021	0	NA	NA
2022	5	201,576	24,042
2023	3	245,093	40,249
2024	4	188,580	25,053
2025	6	196,159	30,252

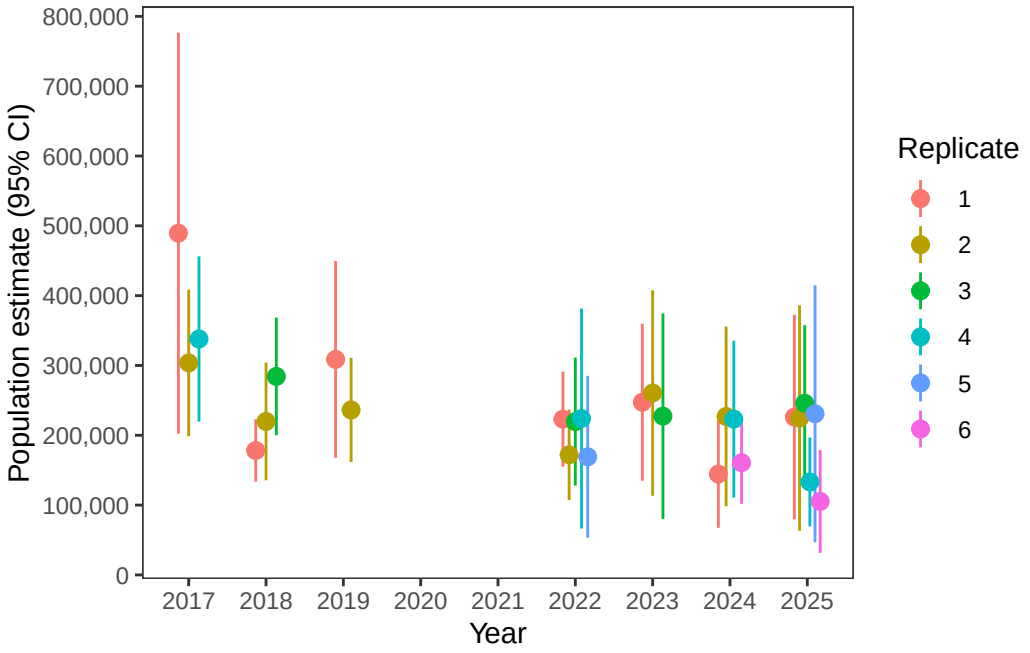

Figure 2: Pacific brant population estimates (95% CI) in Izembek Lagoon, Alaska, 2017–2025 derived from systematic aerial photography and automated object detection algorithms. Replicate 1 in 2017 included 7 consecutive validated photos with over 1,000 brant per photo, resulting in the higher and highly uncertain estimate. Only 2 other photos between 2018–2025 were over 1,000 brant (both in 2019).

References

Weiser, E. L., P. L. Flint, D. K. Marks, B. S. Shults, H. M. Wilson, S. J. Thompson, and J. B. Fischer. 2022. Optimizing surveys of fall-staging geese using aerial imagery and automated counting. Wildlife Society Bulletin 47:e1407. https://doi.org/10.1002/wsb.1407

Daniels, B. L, D. H. Ward, and J. M. Black. 2019. Activity budgets, daily energy expenditure and energetic model of Black Brant *Branta bernicla nigricans* during winter and spring along the Lower Alaska Peninsula. Wildfowl 69: 134-159.