

Calculating Food Production in the Subsistence Harvest of Birds and Eggs

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APPENDIX S1: Key respondent questionnaire to collect ethnographic information on subsistence harvesting and processing of birds and eggs in Alaska.

Key Respondent Survey of Current Subsistence Practices Related to Preparation of Birds for Human Consumption and Egg Harvests

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The objectives of this survey are:

- (a) To review and standardize methods used to calculate edible weight of birds harvested for subsistence uses based on live weight of birds. Reviewed methods will take into account responses to this survey and data from the literature on the average weight of bird body parts.*
- (b) To review and standardize methods used to convert eggs reported in harvest surveys as volume (e.g., 5-gallon bucket) to number of eggs harvested.*

Respondent's Region, Community: _____

Date completed: / 2015

Time at start of survey: : am pm
hour minutes (circle one)

- (1) Based on current practices, please briefly describe how birds are processed (cleaned) before cooking. Are there different practices for processing different kinds of birds? Please explain.

- (2) Some kinds of birds may be difficult to pluck. In your region, are there some kinds of birds that are usually skinned instead of plucked? Which ones?

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(7) How much fat (as proportion of the bird’s body weight) do you think these birds have in spring and fall?
 Indicate the closest proportion with an “X” for each kind of bird and season.
Leave blank if you do not know of if birds do not occur/not used in region.

| | Proportion of fat in Spring | | | | | | Proportion of fat in Fall | | | | | |
|-------------------------|-----------------------------|-----|-----|-----|-----|--------------------|---------------------------|-----|-----|-----|-----|--------------------|
| | 10% | 20% | 30% | 40% | 50% | Other % (describe) | 10% | 20% | 30% | 40% | 50% | Other % (describe) |
| Ducks | | | | | | | | | | | | |
| Geese | | | | | | | | | | | | |
| Swan | | | | | | | | | | | | |
| Crane | | | | | | | | | | | | |
| Gulls, murre, puffins | | | | | | | | | | | | |
| Loons | | | | | | | | | | | | |
| Snipe, godwit, whimbrel | | | | | | | | | | | | |
| Grouses, ptarmigans | | | | | | | | | | | | |

(8) Which containers are usually used to harvest bird eggs in your region?
 Please indicate with an “X” and describe other kinds of containers used and their volume.

- 5-gallon bucket
- 1-gallon bucket
- other (describe) _____
- other (describe) _____
- other (describe) _____
- other (describe) _____

(9.a) In your region, moss, grass, or other materials are usually used to protect eggs during transportation?
 Please indicate with an “X”.

- do not use moss, grass
- 1 out of 4 times
- 2 out of 4 times
- 3 out of 4 times
- every time

(9.b) Please explain other kinds of materials that may be used to protected eggs (if any).

(10.a) Even if eggs are plentiful, are containers usually only partially filled to avoid loss and damage of eggs during transportation?

Yes No

(10.b) Otherwise, if eggs are plentiful, are containers usually filled all the way to the brim?

Yes No

(10.c) If partially filling containers to protect eggs during transportation, how much are the containers usually filled? Please indicate with an "X".

| 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | | | | | | | | | |



1-gallon bucket about 60% filled with eggs and grass.



1-gallon bucket 100% filled with eggs and grass.

(11) How many eggs are usually packed in a 5-gallon bucket?

Leave blank if you do not know if birds/eggs do not occur/not used in region.

| Kind of egg | Number of eggs in a 5-gallon bucket, comments |
|--------------------|---|
| Murre | |
| Large gulls | |
| Small gulls | |
| Terns | |
| Ducks | |
| Geese | |
| Grouse, ptarmigans | |
| Swans | |
| Cranes | |

(12) Comments? Suggestions?

Time at end of survey: : am pm
 hour minutes (circle one)

Thank you very much!

Appendix S2. Notes to accompany Table 4 “Conversion factors to estimate food production in subsistence harvest of birds and eggs in Alaska.” Source for species distribution ranges was Dunn and Alderfer (2011) unless otherwise noted. Species distribution is referred to using the bird harvest management regions for Alaska (U.S. National Archives and Records Administration, 2015) (Fig. S1).

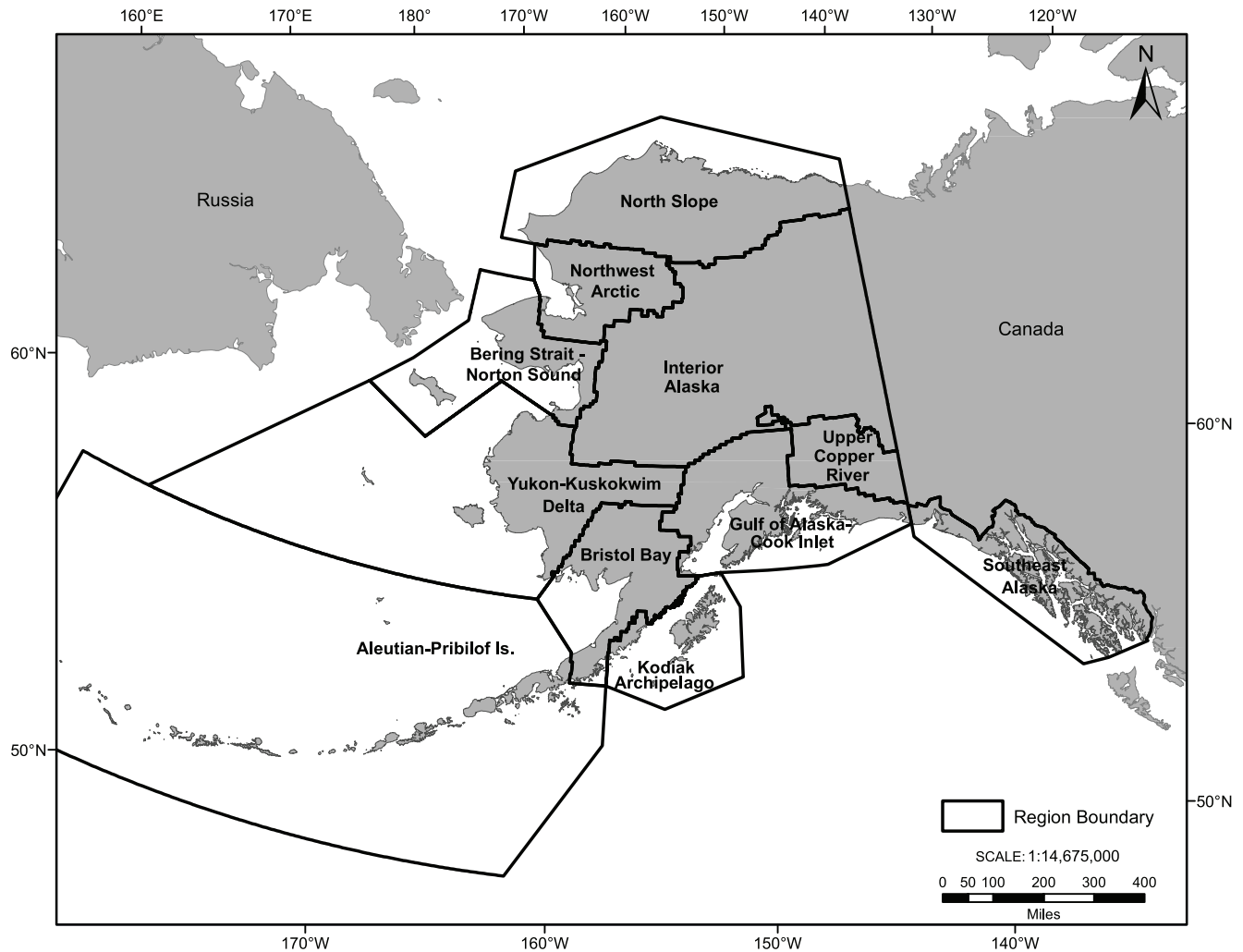


FIG. S1. Alaska regions used as reference for geographic distribution of bird species and regional conversion factors for bird and egg harvest.

Teal (unidentified): In Alaska, the Green-winged Teal (805 000 birds) is more broadly distributed and abundant than the Blue-winged Teal (2100 birds) (Mallek and Groves, 2011). We based bird conversion factor (CF) for teal (unidentified) on Green-winged Teal body mass. We based egg CF for teal (unidentified) on the Blue-winged Teal egg mass because egg mass data were unavailable for Green-winged Teal and these teals had similar body mass.

Goldeneye (unidentified): Distributions of goldeneye species in Alaska overlap. Population size data were unavailable. Body mass was similar for all goldeneyes. We based CF for goldeneye (unidentified) on the mean bird mass and egg mass of Common and Barrow’s Goldeneyes.

Scaup (unidentified): Distributions of scaup species in Alaska overlap. Population size data were unavailable, but the Greater Scaup was the predominant species in the Yukon-Kuskokwim Delta, where most subsistence harvests occur (Naves, 2015; Platte and Stehn, 2015). We based CF for scaup (unidentified) on bird and egg mass of Greater Scaup.

Common Eider, King Eider, Steller’s Eider, Spectacled Eider, and Long-tailed Duck: Mean body mass included data from Johnson (1971).

Merganser (unidentified): Distributions of merganser species overlap in Alaska, except that Common Mergansers do not occur on the North Slope. Population size data were unavailable.

- a) *Alaska-wide and all individual regions, except North Slope*. We recommend CF for merganser (unidentified), which was calculated from the mean bird mass and egg mass of the two merganser species.
- b) *North Slope*. We recommend CF based on Red-breasted Merganser bird mass and egg mass.

Canada/Cackling Goose (unidentified): In Alaska, there are two species and six subspecies of Canada/Cackling geese. Variation within species and subspecies in morphology, size, and plumage makes their identification difficult (Pearce and Bollinger, 2003; Sibley, 2007). It is unknown whether local ethnotaxonomies differentiate among species and subspecies or between large-bodied (*Branta c. parvipes*, *B. c. occidentalis*, *B. c. fulva*) and small-bodied (*Branta h. taverneri*, *B. h. leucopareia*, *B. h. minima*) geese. In some cases, assignment of harvest data to smaller taxonomic categories based on distribution ranges may be possible. Breeding (summer) ranges do not overlap for some subspecies, but ranges overlap during migration and molt (spring and fall, when most harvest occurs). Population data available did not allow us to assess the relative abundance of subspecies (U.S. Fish and Wildlife Service, 2015). For geographic scales smaller than Alaska-wide, we recommend CF based on the mean bird mass and egg mass of subspecies likely to be available.

- a) *Alaska-wide*. We recommend CF for Canada/Cackling Goose (unidentified), which was based on the mean bird mass and egg mass of *B. h. taverneri* and *B. h. minima* because most harvest occurs in their breeding ranges in the Yukon-Kuskokwim Delta and Bering Strait-Norton Sound (Naves, 2015).
- b) *North Slope, Bering Strait-Norton Sound, and Northwest Arctic*. Harvest in all seasons is likely composed of *B. h. taverneri*.
- c) *Aleutian-Pribilof Islands*. Harvest in all seasons is likely composed of *B. h. leucopareia*.
- d) *Gulf of Alaska-Cook Inlet*. Harvest is likely composed of *B. c. occidentalis* and *B. c. parvipes* in summer, but may include other subspecies in spring and fall.
- e) *Yukon-Kuskokwim Delta*. Harvest in all seasons is likely composed of *B. h. minima* and *B. h. taverneri*. In coastal areas, 90% of all Canada/Cackling geese in summer are *B. h. minima* (U.S. Fish and Wildlife Service, 2015).
- f) *Bristol Bay*. Harvest is likely composed of *B. c. parvipes* in summer, but may include *B. h. minima* and *B. h. taverneri* in spring and fall.
- g) *Interior Alaska and Upper Copper River*. Harvest is likely composed of *B. c. parvipes* in summer, but may include *B. h. taverneri* in spring and fall.
- h) *Southeast Alaska*. Harvest is likely composed of *B. c. fulva* in summer, but may include most other subspecies in spring and fall.

Greater White-fronted Goose: Data on the relative abundance of three subspecies occurring in Alaska were unavailable (U.S. Fish and Wildlife Service, 2015).

- a) *Alaska-wide and all individual regions, except Gulf of Alaska-Cook Inlet and Southeast Alaska*. We recommend CF for Greater White-fronted Goose (no subspecies defined), which was based on bird mass and egg mass of *A. a. gambelli* and *A. a. sponsa* because these subspecies occur in the areas of most harvest (Naves, 2015).
- b) *Gulf of Alaska-Cook Inlet*. CF based on bird mass of *A. a. elgasi* (Banks, 2011) and egg mass of *A. a. gambelli* (egg mass data for *A. a. elgasi* were unavailable).
- c) *Southeast Alaska*. CF based on bird mass and egg mass of *A. a. sponsa*, which is the subspecies likely to be available for harvest in this region (based on band recovery data, Jason Schamber, Alaska Department of Fish and Game, Division of Wildlife Conservation, pers. comm. 2017).

Swan (unidentified): Trumpeter Swan and Tundra Swan ranges overlap in Alaska. Most subsistence harvest of swans occurs in the Yukon-Kuskokwim Delta (Naves, 2015), where Trumpeter Swans do not occur. In Alaska, the Tundra Swan is represented by the eastern population (nesting in the North Slope region) and the western population (nesting in western Alaska) (U.S. Fish and Wildlife Service, 2015). Body mass was similar in the two populations (Christian Dau and Craig Ely, pers. comm. 2015).

- a) *Interior Alaska, Upper Copper River, and Gulf of Alaska-Cook Inlet*. CF for swan (unidentified) based on mean bird mass and egg mass of Tundra and Trumpeter swans weighted by population sizes (Tundra Swan: 139 900 birds, Trumpeter Swan: 25 347 birds) (Mallek and Groves, 2011; Groves, 2012).
- b) *Alaska-wide and all other individual regions*. CF for Tundra Swan (no population defined) was based on the mean body mass of the two populations.

Sandhill Crane:

- a) *Alaska-wide*. CF for Sandhill Crane (no subspecies defined) based on the mean bird mass and egg mass of the two subspecies weighted by population sizes (*G. c. canadensis*: 44 100 birds, *G. c. rowani*: 3700 birds) (Mallek and Groves, 2011).
- b) *Interior Alaska*. CF based on bird and egg mass of *G. c. rowani*.
- c) *All other Alaska regions, except Interior Alaska*. CF based on bird mass and egg mass of *G. c. canadensis*.

Ptarmigan (unidentified): Willow Ptarmigan is the most ubiquitous ptarmigan species in Alaska, occurs at lower elevations, and is likely more accessible to harvest than White-tailed and Rock Ptarmigan, which occur in alpine habitats. Data on relative species abundance were unavailable. We based CF for ptarmigan (unidentified) on the bird and egg mass of Willow Ptarmigan.

Mean body mass for White-tailed, Rock, and Willow Ptarmigan was based on Weeden (1979).

Grouse (unidentified): The Sooty Grouse occurs only in Southeast Alaska, where harvest data indicate low grouse harvest (CSIS, 2016b). Distribution ranges of other grouse species in Alaska overlap. Data on population sizes were unavailable. We based CF for grouse (unidentified) on the mean bird and egg mass of Ruffed, Spruce, and Sharp-tailed Grouse. Mean body mass for Ruffed, Spruce, and Sharp-tailed Grouse was based on Taylor (2013).

Short-tailed Shearwater: This species does not breed in Alaska, thus eggs are not available for harvest (NA). Mean body mass was based on Hunt et al. (2002).

Cormorant (unidentified): Cormorants harvested in the Bering Strait-Norton Sound region are likely Pelagic Cormorant (Stephensen et al., 1998) and this region accounts for most cormorant harvest in Alaska (Naves, unpubl. data). Cormorants harvested in other regions may include Red-faced and Double-crested Cormorants.

- a) *Alaska-wide and Bering Strait-Norton Sound.* CF based on bird mass and egg mass of Pelagic Cormorant.
- b) *All Alaska regions, except Bering Strait-Norton Sound.* CF for cormorant (unidentified) based on the mean body mass of individual species weighted by population sizes (Pelagic Cormorant: 44 000 birds, Red-faced Cormorant: 20 000 birds, Double-crested Cormorant: 6100 birds) (U.S. Fish and Wildlife Service, 2009).

Bonaparte's/Sabine's Gull: Distribution ranges of Bonaparte's and Sabine's Gulls overlap in most of Alaska, except that only Sabine's Gulls occur in northern Alaska. Population size data were unavailable. Considering that these species were similar in size, CF based on their mean bird mass and egg mass can be used across Alaska. Optionally, for the Bering Strait-Norton Sound, Northwest Arctic, and North Slope, CF can be based on Sabine's Gull bird mass and egg mass.

Mew Gull: Egg mass from Williams et al. (1982).

Large gull (unidentified): Data on the relative abundance of large gulls were unavailable. In Alaska, subsistence uses of large gulls refer more to egg harvest (22 847 eggs/year) than to bird harvest (1557 birds/year) (Naves, unpubl. data). We recommend CF based on mass of regionally occurring species.

- a) *Alaska-wide.* CF for large gull (unidentified) based on the mean bird mass and egg mass of the three large gull species (all seasons).
- b) *North Slope, Northwest Arctic, and Bering Strait-Norton Sound.* CF based on the bird mass and egg mass of Glaucous Gull (all seasons).

c) *Yukon-Kuskokwim Delta.* For summer harvest, CF based on the mean bird mass and egg mass of Glaucous-winged and Herring Gulls. For spring and fall harvest, CF based on the mean bird mass and egg mass of Glaucous-winged, Glaucous, and Herring Gulls.

d) *Bristol Bay, Kodiak Archipelago, Aleutian-Pribilof Islands, Gulf of Alaska-Cook Inlet, and Southeast Alaska.* For summer harvest, CF based on bird mass and egg mass of Glaucous-winged Gull. For spring and fall harvest, CF based on the mean bird mass and egg mass of Glaucous-winged, Glaucous, and Herring Gulls.

e) *Interior Alaska.* CF based on the bird mass and egg mass of Herring Gull (eggs and birds, all seasons).

Tern (unidentified): The distribution of Arctic and Aleutian terns overlap in most coastal areas in Alaska, but only the Arctic Tern occurs inland. Considering that body mass was similar for these species and that the Arctic tern is likely more abundant than the Aleutian tern (U.S. Fish and Wildlife Service, 2009), we recommend CF based on bird mass and egg mass of the Arctic Tern.

Murre (unidentified): Distributions of Common and Thick-billed Murres overlap in Alaska. Body mass was similar for these species. We based CF on the mean bird mass and egg mass of the two species.

Guillemot (unidentified): In Alaska, Black Guillemots breed only in the North Slope, and Pigeon Guillemots breed across coastal areas. These species overlap in the Bering Strait-Norton Sound region in fall-winter, when most harvest occurs (Naves, unpubl. data).

- a) *Alaska-wide, Northwest Arctic, and Bering Strait-Norton Sound.* CF for guillemot (unidentified) based on the mean body mass of the two species weighted by population sizes (Pigeon Guillemot: 49 000 birds, Black Guillemot: 700 birds) (U.S. Fish and Wildlife Service, 2009).
- b) *North Slope.* CF based on bird mass and egg mass of Black Guillemot.
- c) *All Alaska regions, except North Slope, Northwest Arctic, and Bering Strait-Norton Sound.* CF based on bird mass and egg mass of Pigeon Guillemot.

Auklet (unidentified):

- a) *Alaska-wide and St. Lawrence Island.* In Alaska, most auklet harvest occurs on St. Lawrence Island, at the Bering Strait Norton Sound region (Naves, unpubl. data). Considering the auklet species composition at this location (Stephensen, et al., 1998), the local harvest is likely composed of similar proportions of Least and Crested Auklets. For Alaska-wide and St. Lawrence Island harvest, we recommend CF for Least/Crested Auklet, which was calculated based on the mean bird mass and egg mass of these two species.

b) *All Alaska regions, except St. Lawrence Island.* We calculated CF for auklet (unidentified) from the mean bird mass and egg mass of the auklet species weighted by population sizes (Least Auklet: 7 250 000 birds, Crested Auklet: 3 000 000 birds, Parakeet Auklet: 1 000 000 birds, Cassin's Auklet: 473 000 birds, Rhinoceros Auklet: 180 000 birds, Whiskered Auklet: 116 000 birds) (U.S. Fish and Wildlife Service, 2009).

Puffin (unidentified): The distribution of Tufted and Horned Puffins overlaps in Alaska. We based CF on the mean bird mass and egg mass of the two species weighted by population sizes (Tufted Puffin: 2 300 000 birds, Horned Puffin: 921 000 birds) (U.S. Fish and Wildlife Service, 2009).

Whimbrel/Curlew: The breeding (summer) range of Bristle-thighed Curlews is a small area in the Yukon-Kuskokwim Delta and Bering Strait-Norton Sound regions, where Whimbrels also occur. These species' ranges also overlap in other seasons and most other regions. We based CF for Whimbrel/Curlew on the mean bird mass and egg mass of the two species weighted by population sizes (Whimbrel: 40 000 birds, Bristle-thighed Curlew: 10 000 birds) (Andres et al., 2012).

Godwit (unidentified): Distribution ranges of godwits overlap in Alaska. We based CF on the mean bird mass and egg mass of the three species weighted by population sizes (Bar-tailed Godwit: 90 000 birds, Hudsonian Godwit: 21 000 birds, Marbled Godwit: 2000 birds) (Andres et al., 2012).

Golden/Black-bellied Plover: Distribution ranges of Golden, Black-bellied, and American Golden-Plovers overlap in Alaska. We based CF on the mean bird mass and egg mass of the three species weighted by population sizes (American Golden-Plover: 500 000 birds, Black-bellied Plover: 262 700 birds, Pacific Plover: 42 500 birds) (Andres et al., 2012).

Turnstone (unidentified): Distribution ranges of turnstones overlap in Alaska. We based CF on the mean bird mass and egg mass of the two species weighted by population sizes (Black Turnstone: 95 000 birds, Ruddy Turnstone: 20 000 birds) (Andres et al., 2012).

Phalarope (unidentified): Red-necked Phalaropes breed across Alaska and Red Phalaropes breed only in the North Slope and Northwest Arctic.

a) *North Slope and Northwest Arctic.* CF for phalarope (unidentified), which was calculated from the mean bird mass and egg mass of the two phalarope species weighted by population sizes (Red-necked Phalarope: 2 500 000 birds, Red Phalarope: 1 620 000 birds) (Andres et al., 2012).

b) *Alaska-wide and all individual regions, except North Slope and Northwest Arctic.* For summer harvest, CF for Red-necked Phalarope. For spring and fall harvest, CF for phalarope (unidentified).

Small shorebird (unidentified): Shorebird species identification in harvest surveys is particularly challenging because species are difficult to tell apart. In harvest studies, about 20 species have been included under the category "small shorebird," including sandpipers (*Calidris* spp.), yellowlegs (*Tringa* spp.), and dowitchers (*Limnodromus* spp.) (Naves, 2015). We selected Western Sandpiper and Dunlin to represent species in this category because they are broadly distributed and are among the most abundant species of small shorebirds. We based CF for small shorebird (unidentified) on the mean bird mass and egg mass of these two species weighted by population sizes (Western Sandpiper: 3 500 000 birds, Dunlin: 1 050 000 birds) (Andres et al., 2012).

Loon (unidentified): Pacific Loons were about 90% of all loons occurring in the St. Lawrence Island, North Slope, and Yukon-Kuskokwim Delta (Naves and Zeller, 2013; Stehn et al., 2013; Platte and Stehn, 2015), these regions being those with highest loon harvest (Naves, unpubl. data). We based CF for loon (unidentified) on the mean bird mass and egg mass of loon species weighted by population sizes (Pacific Loon: 69 498 birds, Red-throated Loon: 15 360 birds, Common Loon: 8886 birds, and Yellow-billed Loon: 3500 birds) (Douglas and Sowl, 1993; Groves et al., 1996; U.S. Fish and Wildlife Service, 2014).

Grebe (unidentified): The Alaska distributions of Horned and Red-necked Grebes overlap. Data on relative species abundance were unavailable. We based CF on the mean body mass of grebe species.