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COMMON EIDERS AND OTHER WATERBIRDS

DURING THE BREEDING SEASON

NORTHWESTERN ALASKA

2006 – 2009

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AERIAL POPULATION SURVEYS OF COMMON EIDERS AND OTHER WATERBIRDS DURING THE BREEDING SEASON – NORTHWESTERN ALASKA, 2006–2009

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ABSTRACT Aerial surveys of Pacific common eiders (*Somateria mollissima v-nigrum*) and other waterbirds during the breeding season were conducted from 2006 through 2009 along the northwestern coast of Alaska from Point Romanof to Omalik Lagoon, a distance of approximately 2729 km of coastline. The survey design was tested in 2006 for only the southern part of the area. In 2007, only the northern coastline area and lagoons of the Seward Peninsula were flown. Survey design was standardized for the 2008 and 2009 surveys. Although this survey was designed specifically for common eiders, observers counted all species of birds, except small passerines. Observations of all large land and sea mammals were also recorded. The survey area consisted of coastal habitats, including inlets, bays, barrier islands, coastal lagoons, and all other near-coastal waters. Total numbers of common eiders averaged 4326 birds and indicated pairs averaged 1426 for 2008-2009. Distribution was similar between years. This survey, together with the Yukon-Kuskokwim Delta Waterbird Survey and the Arctic Coastal Plain Common Eider Survey, provide continuous survey coverage of the breeding range of common eiders along the coast of Alaska from the Yukon Delta north and east to the Canadian border. Recommendations are made for a final design of the Northwestern Alaska Common Eider Survey.

Key Words Common Eider, *Somateria mollissima v-nigrum* , aerial survey, waterfowl, Northwestern Alaska, Western Alaska, Chukchi Sea, Northwestern Alaska Common Eider Survey.

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INTRODUCTION

Although there has been no systematic effort to census the entire population of Pacific common eiders (*Somateria mollissima v-nigrum*), the U.S. Fish and Wildlife Service (USFWS) estimated the population to be 115,000-170,000 birds in 2008 (USFWS 2008). Available data indicate sharp declines from the 1950's to the 1990's on the northern Alaska, western Alaska, and Canadian breeding grounds (Woodby and Divoky 1982, Hodges et al. 1996, USFWS 1999, Suydam et al. 2000). Based on migration counts at Point Barrow, Suydam et al. (2000) estimated that the population declined 53% from 156,081 birds in 1976 to 72,606 birds in 1996. The U.S. Fish and Wildlife Service (USFWS) classified the Pacific common eider as one of the 412 "Birds of Management Concern" as described in the Service's Migratory Bird Program Strategic Plan 2004-2014 (USFWS 2005). The USFWS Migratory Bird Management (MBM) Program further refined this list down to 139 focal species that were to receive heightened attention. Strategies were to be developed that detailed explicit, strategic, and adaptive sets of

conservation actions that would be required to return the species to healthy and sustainable levels. Because of its sharply declining population trend, the Pacific common eider was among the first nine focal species identified.

The conservation strategy identified in the Service's Common Eider Focal Species Action Plan stated that establishment of population objectives was contingent upon two information needs (USFWS 2008). These needs were identified as: (i) "an assessment of distribution and relative abundance", and (ii) "defining appropriate management units". One of the specific management actions identified to address the first need was the effort "to design and implement a more precise survey to evaluate status of common eiders on the Seward Peninsula". This management action was the impetus for the survey described in this report.

The breeding range of the Pacific subspecies of common eiders extends from the Queen Maud Gulf area of western Canada westward across Alaska into eastern Russia (Bellrose 1976, Gabrielson and Lincoln 1959, Palmer 1976). In Alaska, the Pacific common eider breeding range extends almost continuously from the western tip of the Aleutian Islands, east along the Alaska Peninsula and Kodiak Archipelago, north along the Yukon Delta and Seward Peninsula, and east along the Arctic Coastal Plain to the Canadian border.

Estimates of abundance and trends already exist for two breeding areas in Alaska, the Yukon-Kuskokwim Delta (YKD, Platte and Stehn 2011) and the Arctic Coastal Plain (Dau and Bollinger 2009). The YKD has been surveyed for 23 years (1988-2010), and the Arctic Coastal Plain for 11 years (1999-2009). A northwestern Alaska survey, as proposed in this project, would fill the existing void in coverage between these two long-term survey areas. Using the same protocol as the Arctic Coastal Plain Survey, this study would essentially extend that survey's coverage south along Alaska's northwestern coast from Point Lay to Point Romanof at the northern extent of the YKD. Thus, these three surveys would provide continuous coverage from the YKD to the Canadian border, which is essentially the entire breeding range of the Pacific common eider in Alaska, with the exception of the Alaska Peninsula and Aleutian Islands. Thus, as mandated by the focal species action plan, data from these three surveys will provide a baseline for abundance and population trends to be used in establishing population objectives.

Little previous aerial waterfowl survey work has been conducted along coastal northwestern Alaska. Aerial surveys of this area were flown in the 1980's (King 1983, King and Eldridge 1985, King and Butler 1987) and in 1992 (Larned et al. 1992). The 1980's surveys recorded all waterfowl species, but were flown primarily to assess goose populations. However, these surveys were flown in mid- to late July, when most eiders had completed nesting and moved to coastal brood-rearing or molting areas. The 1992 survey, flown in mid-June, was designed specifically to assess and monitor the breeding populations of eiders

The objectives of this Northwestern Alaska Common Eider Survey were to:

1) Estimate a population index during the breeding season.
2) Determine distribution within the survey area.
3) Determine relative densities within the survey area.
4) Determine sex and age composition.
5) Estimate species composition, numbers, and distribution of other birds, primarily waterbirds.

The 2006 survey was a pilot study to assess survey design and the feasibility of obtaining population indices for common eiders during the breeding season along the coastal habitat of northwestern Alaska. It was designed to survey both the coastline and onshore wetland habitats. Coverage of the coastline habitat followed the same protocol as the Arctic Coastal Plain Common Eider Survey (Dau and Bollinger 2009). Adjacent onshore wetland habitats were to be sampled by flying transects parallel to and no farther inland than 1.6 km from the coastline. In 2007, this survey covered only the northern coastline area and lagoons of the Seward Peninsula. In 2008-2009, the survey area, timing, and protocols were standardized.

This report summarizes the results from our aerial fixed-wing surveys along the northwestern coast of Alaska from 2006-2009.

STUDY AREA AND METHODS

Survey Area

The survey area extended along the coastline of northwestern Alaska from Point Romanof to Omalik Lagoon, a straight-line coastal distance of approximately 1811 km (Fig. 1). However, total coastline distance, including Stuart Island, Golovin Lagoon, Port Clarence, Eschscholtz Bay, and Hotham Inlet, measured 2729 km. The coastline was divided into 33 segments (Figs. 2 and 3, Table 1) to enable comparisons between years, even with varying survey effort. Major geographic features and place names mentioned in this report can be referenced on the maps in Appendices 1a and 1b.

Survey Design

The survey was designed to provide complete coverage of all coastal breeding habitats, including nearby onshore wetlands. This ‘census’ type design would meet the objective of obtaining a population index during the breeding season. Common eider breeding sites are primarily confined to exposed coastal wetlands and sparsely or un-vegetated barrier beaches and islands. Geographic habitat areas identified within the survey boundaries were: (i) coastline, including peninsulas, islands, islets, barrier islands, inlets, and bays; (ii) lagoon habitat; and (iii) onshore wetlands, including estuaries adjacent to the coast. The coastline survey protocol generally entailed a meandering flight path flown 100-200 m offshore, with slight deviations being made when necessary, to confirm species identification and numbers. Emphasis was placed on potential common eider breeding locations including exposed shorelines, sand and gravel spits, barrier islands, lagoon inlets, and estuary inlets. Flight tracks varied among years, however,

mainly because of variable ice conditions (i.e., shore-fast ice, open leads, polynyas, and location of the sea ice edge). Where open water existed, consistent visual coverage extended up to 1.6 km seaward of the coastline; and deviations farther offshore (i.e.,≤ 3 km) were made if birds were detected. Complete coverage of all lagoon habitats was also flown during these surveys. Rather than using set transect lines within a lagoon, the flight track of a particular lagoon was modified among years to account for existing conditions including glare, water surface conditions, ice, and bird distribution.

The 2006 survey protocol for onshore wetlands differed from that of both the coastline and lagoon habitats. All areas of onshore wetlands, (i.e., wetland habitat depicted on USGS 1:250,000 topographic maps), were delineated along the coastline of the survey area. For these adjacent estuaries, we opportunistically flew transect lines that ran parallel to and within 1.6 km of the coastline. This 1.6 km inland boundary was established because common eiders are closely tied to marine habitats and exhibit a clear coastal gradient distribution with densities decreasing rapidly from the coast inland. Unlike the coastal and lagoon survey protocol, only observations within 200 m of each side of the aircraft were recorded. In order for the data to be comparable among years, the observations from these inland parallel transects are presented separately from the coastal and lagoon data. These transect data were not adjusted by a visibility correction factor and were not expanded to the total habitat area of the onshore wetlands. The extensive time and expense taken to survey these onshore wetlands and the small number of eiders observed justified deleting these survey lines and coverage of this habitat in subsequent surveys, 2007-2009. However, because Kessel (1989) reported the greatest density of breeding birds on the Seward Peninsula to be at Cape Espenberg, we continued to conduct these parallel onshore flight lines in the Cape Espenberg area during 2007-2009 surveys. These onshore flight lines were flown opportunistically, however, during ferry flights to and from coastal lagoons on the northern Seward Peninsula; and so did not entail any additional flight time.

Survey coverage varied in 2006 and 2007 (Fig. 4). In 2006, the survey only extended from Point Romanof as far north as Port Clarence (i.e., Segments 1-14; Fig. 2; Bollinger 2012a) due to logistical and time constraints. In 2007, due to limited funding, only the northern coastal lagoon area of the Seward Peninsula and the Nugnugaluktuk River Delta area were flown (i.e., Segments 16-22; Fig. 2; Bollinger 2012b). 2007 data included in this report are from the 15 June survey covering the northern Seward Peninsula from Cape Espenberg westward to mid-Lopp Lagoon and the 23 June survey covering the Nugnugaluktuk River Delta area. In 2008, survey coverage was complete except for the most northern coastline of Cape Lisburne eastward to Omalik Lagoon (i.e., partial Segments 32 and 33; Figs. 3 and 4; Bollinger 2012c). In 2009, coverage was complete for the entire survey area (Fig. 4; Bollinger et al. 2012).

Data Collection and Analyses

All surveys were flown during the interval from 15 June to 01 July (Table 2). Survey timing was intended to coincide with egg laying and early incubation while pair bonds are still intact and prior to the dispersal of males to molting sites (Johnson and Herter 1989; Kessel 1989). Surveys were initiated from Bethel and then staged from Unalakleet, Nome, and Kotzebue as the survey continued north. The survey was primarily based out of Kotzebue. Survey flight times including transects and flying to/from transects varied from 15.8 hrs (2007) to 54.8 hrs (2008; Table 2). Survey times for the complete coverage years of 2008 (54.8 hrs) and 2009 (43.5 hrs) varied

primarily due to inclement weather (i.e., coastal fog) affecting the order in which sequential transects were flown. An amphibious Cessna 206 airplane (N234JB) was used as the survey platform during all four years. The primary author served as pilot/observer for all surveys; however, observers varied each year (Table 2).

Survey procedures were the same as those that had been established for the Arctic Coastal Plain Common Eider Survey (Dau and Bollinger 2009). Flight paths included all coastal habitats (i.e., island, islet, peninsula, bay, inlets), lagoon habitats, and near-coast waters. In 2006, onshore wetlands were also surveyed using transect lines. To help ensure complete coverage of the survey area, the flight path was periodically checked via an on-board laptop computer displaying real-time moving geographic maps. The aircraft was flown at an altitude of 30-60 m (100-200 ft) above ground level and at a ground speed of 85-110 knots (150-200 km/hr). Generally surveys were flown in light winds, and followed survey weather protocol by not beginning flight when winds were >13 knots (kts) and discontinuing flights if winds increased to >22 kts (USFWS and Canadian Wildlife Service [CWS] 1987). The pilot and right-seat observer each recorded observations by species or species group on their side of the aircraft. For transects flown over onshore wetland habitats, only observations within 200 m of the flight path were recorded. All birds (except small passerines) and large land and sea mammals were counted. Each observation was recorded vocally to a sound file (.wav format), linked with simultaneous GPS coordinates, and saved to separate on-board computers for each observer, via custom software developed by John I. Hodges (USFWS, MBM, Juneau, Alaska). After the flight, a transcription program, also developed by John Hodges, was used to replay the sound files and combine the transcribed observation data with the geographic coordinates to produce a text data file. The transcribed text files were then used for data analyses.

Observations of waterfowl were recorded according to established breeding pair survey protocol (USFWS and CWS 1987), except we also counted female eider ducks occurring as singles or in all female groups. Observations of single and flocked female ducks are not recorded as part of the standard USFWS-CWS breeding pair survey protocol (1987), because it is generally assumed that females are sitting on nests and therefore not observable or identifiable. In counting lone female eider ducks, we followed the same protocol as the Arctic Coastal Plain Common Eider Survey (Dau and Bollinger 2009) which demonstrated that single eider females are identifiable and regularly observed, accounting for approximately 10% of all single eiders observed. Duck observations were recorded as lone drakes, single eider hens, pairs, flocked drakes, flocked eider hens, juvenile eiders, and mixed-sex flocks (i.e., groups of five or more birds). Small mixed-sex groups (< five birds) observed were recorded as singles and pairs. For example, an observation of one hen and two drakes was recorded as a pair and a lone drake; and an observation of a hen and three drakes was recorded as a pair and two drakes. For eiders, an observation of three hens and a drake was recorded as a pair and two hens. Observations of all lone hens (i.e., singles and all same-sex grouped hens) were recorded for eider species, but single and same-sex grouped females were not recorded for other duck species because few were observed or identified. Identification of eider hens to species was based on female size and assumed same speciation as male eiders in close proximity. The sex and age composition of eider flocks was also recorded. Flocks that could be identified as assemblages of pairs were recorded as individual pairs; otherwise, the sex ratio was recorded for flocks. Geese, swans, loons, and cranes were recorded

as singles, pairs, or flocks. Other birds and mammals observed were recorded by number. We differentiated between adults and young for caribou, moose, muskoxen, and bears.

As per the Arctic Coastal Plain Common Eider Survey protocol (Dau and Bollinger 2009), we calculated for common eiders:

'total observed birds' = summation of

i) singles, both males and females ($n = \leq 4$)
ii) 2*pairs
iii) all grouped birds ≥ 5 birds.

However, we also calculated for all ducks, including common eiders:

'total indicated birds' = summation of

i) 2*drakes ($n \leq 4$), except for scaup, ring-necked ducks, and redheads
ii) 2*pairs
iii) all grouped birds ≥ 5 birds.

'Total indicated birds' is the standard breeding pair protocol formula (USFWS and CWS 1987) for calculating total birds, because single males (i.e., 1-4 birds) are assumed to represent a breeding pair with the female sitting on the nest and not observable to be counted. Drakes are not doubled for scaup, ring-necked ducks, and redheads, however, because of the disproportionate sex ratio in favor of males that exists for these species; it is assumed therefore, that a single male does not reliably indicate an unseen female. The difference in calculating 'total indicated birds' versus 'total observed birds' is that single males (≤ 4) are doubled for 'total indicated' versus single females (i.e., lone and grouped females) are counted and single males are not doubled for 'total observed'. The Arctic Coastal Plain Common Eider Survey (Dau and Bollinger 2009) has reported observations of eiders as 'total observed birds' for all years of the survey (1999-2009). However, the YKD Waterbird Survey (Platte and Stehn 2011) and the 1992 Northwestern Alaska Eider Survey (Larned et al. 1992) calculated observations of eiders as 'total indicated birds'. Their final estimates of population size were derived by multiplication of the 'total indicated birds' by both an expansion factor to the total habitat area and a coastal tundra visibility correction factor (Conant et al. 1991, Lensink 1968). For this survey, we report common eider observations as both 'total observed birds' and 'total indicated birds'. However, we intend to use 'total observed birds' when comparing this survey's data to that of the Arctic Coastal Common Eider Survey (Dau and Bollinger 2009). Survey design for the two Alaska coastal eider surveys (Arctic Coastal Plain and this Northwestern Alaska Survey) is a coastline survey (census); while the survey design for both the YKD Waterbird Survey and the 1992 Northwestern Eider Alaska Survey is based on transect sampling. These latter two surveys observed few lone female eiders.

Number of 'indicated breeding pairs' for ducks, including common eiders, were calculated per standard breeding pair survey protocol (USFWS and CWS 1987), however.

'Total indicated pairs' = summation of

i) single males ($n = \leq 4$)
ii) pairs

We also doubled single observations (n = ≤ 4) for all geese species except snow geese (i.e., Canada, white-fronted, and emperor geese, and brant).

RESULTS

Spring phenology and survey timing

We accessed satellite images of sea ice conditions (NASA MODIS Rapid Response System website http://rapidfire.sci/gsfc.nasa.gov) for each of the survey years on dates within the survey interval. These images were dated 16 June 2006, 14 June 2007, 21 June 2008, and 20 June 2009 (Figs. 5-8, respectively). Based on these images, 2007 appeared to be most delayed; 2009, the most advanced; and 2006 and 2008, intermediate in spring ice phenology. Extensive shore-fast ice was present along the northern Seward Peninsula coastline (Segments 16-22) for survey years 2006-08; cloud cover prevented views of this area for 2009. Differences were seen on inland thaw lake conditions, however, with these being mostly frozen in 2007, and a mix of frozen and open in 2006 and 2008. Comparison of the coastline from Kotzebue northward to Cape Lisburne (Segments 29-33), which was surveyed in 2008-2009 only, showed almost solid ice coverage in 2008 and little ice coverage in 2009. However, coastlines that are free of shore-fast ice can have floating brash or broken ice, either sparsely or more solidly packed together (see Fig. 8). These ice conditions could temporarily restrict migration of birds along the coastline as presence or absence of brash ice is often dictated by wind direction and can change on a daily basis depending on whether an onshore wind blows the ice up against the shore or an offshore wind causes the ice to move out from the shore. We do not believe that ice conditions affected common eider spring migration during our survey years, 2006-2009, however, because distribution (i.e., numbers by segment) was similar among years, except for Segment 13.

Survey results

Total observed common eiders during the 2006-2009 surveys were 1016, 1285, 4438, and 4214 birds, respectively (Table 3). Indicated pairs, (calculated as pairs + single males≤ 4 birds) numbered 458, 668, 1661, and 1192 pairs, respectively for 2006-2009. However, comparisons are only made between 2008 and 2009, the two years of the survey when coverage was similar. Although total numbers were similar, indicated pairs totaled 40% more in 2008 as compared to 2009. Percentages for singles and single-sexed flocks (15 – 17%) were similar both years. Percentages of paired birds and mixed-sex flocked birds differed between years. Paired birds made up 50% of the total count in 2008, but only 36% in 2009. Mixed-sex flocked birds made up only 15% of the total count in 2008, but 33% of the total count in 2009. The sex ratios of flocks reversed from 2008 to 2009. In 2008, females comprised 63% of the mixed-sex flocks; while in 2009, males comprised 64%.

Common eider observations were summarized by segment for each year of the survey (Tables 4 and 5). Observations by segment are presented as totals and percentages (Table 4), and by subtotals showing females (not in pairs or mixed-sex flocks) and juveniles (Table 5). Common eider observations are also mapped for each survey year (Fig. 9). Common eiders were observed along a relatively large percentage of the coastline covered in the survey, but there were some sections of coastline that had relatively few birds. Distribution and higher density areas of eiders along the coastline of northwest Alaska were relatively consistent between 2008 and 2009. One

segment (Nome, Segment 13), however, did show major differences in the number of common eiders observed among years. Counts for the years 2006, 2008, and 2009 for this segment were 69, 597, and 68, respectively (Tables 4 and 5). Many of the 597 birds counted on 23 June 2008 in Segment 13 were observed in the areas of Feather and Tisuk lagoons between Cape Woolley and Cape Douglas. Seventy percent of these birds were in flocks and the composition of these flocks was 82% females, 13% males, and 5% juveniles.

'Total indicated birds' for common eiders was calculated and compared to numbers calculated as 'total birds observed' (Table 6). 'Total indicated birds' numbered 13.6%, 14.6%, 0.2%, and 0.8% greater than 'total birds observed' for survey years 2006-2009, respectively.

Densities of common eiders and rankings of survey segments

Shoreline distances for the survey area were measured by segment for both the outer coastline, including large bays and inlets, and for lagoon shorelines (Table 7). Density of common eiders was then calculated by segment for number of birds per outer coastline distance and for number of birds per total shoreline distance (i.e., both outer coastline plus lagoon shoreline distances).

We then determined rankings of each survey segment as to their importance to common eiders for the years 2008-2009. We calculated an average ranking for each segment by summing the individual ranks for: (i) the percentage of birds, (ii) number of birds per length of outer coastline distance, and (iii) number of birds per length of both outer coastline and lagoon shoreline distance, and then dividing by 3 (Tables 8a and 8b, Figs. 10 and 11). The three highest ranking segments were Lopp Lagoon (Segment 16), Nugnugaluktuk River Delta (Segment 22), and St. Michael Bay (Segment 3). For the years 2008 and 2009, 17% and 21% of common eiders observed were found in Lopp Lagoon, respectively (Table 4). The percentage of birds observed in the Nugnugaluktuk River Delta and St. Michael Bay in 2008 and 2009 ranged from 4.3 to 9.2%. The next highest ranking segments in order were Shishmaref Inlet-East (Segment 20), Reindeer Hills Peninsula (Segment 5), Kwiniuk Inlet (Segment 7), Kiwalik Lagoon (Segment 24), and Stuart Island (Segment 2). Relatively few or no common eiders were observed in the following segments: Elim (Segment 8), Golovin Bay (Segment 9), Rocky Point (Segment 11), Tin City (Segment 15), Baldwin Peninsula-West (Segment 26), Hotham Inlet (Segment 27), and Cape Thompson (Segment 30). These segments each had less than 0.5% of the common eiders observed in either 2008 or 2009. Also few to no common eiders were observed in Grantley Harbor (which is a part of Port Clarence (Segment 14).

Other species

Observations of 24 other species/species groups of waterfowl, 22 species/species groups of other birds, and 8 mammal species were made during the 2006-2009 surveys (Tables 9a and 9b). Northern pintail was the most abundant waterfowl species observed, followed by greater scaup, tundra swans, and then common eiders. Overall, gull and kittiwake species were the most numerous birds observed throughout the survey area. Observations of murre species represent minimal numbers as this survey is not an appropriate design for seabirds that nest in high density colonies in cliff habitats and observers were inconsistent in efforts to estimate murre numbers.

DISCUSSION

Northwestern Alaska population estimate during the breeding season and comparison to other surveys

This survey represents the first effort dedicated to obtaining a population estimate of common eiders for the northwestern coast of Alaska during the breeding season. Our 2-year average estimate of 4,326 birds for 2008-2009 is well below that of the 10,000 to 20,000 individuals that the Pacific Common Eider Action Plan estimated for the Seward Peninsula (USFWS 2008).

The Pacific Common Eider Action Plan cites two previous estimates for birds on the Seward Peninsula during the breeding season. However, we believe that only one of these is valid for comparison with our estimate. The first estimate referenced was that of King and Lensink (1971). They estimated 4900 breeding eiders (species undifferentiated) based on the average of the 1957-1970 adjusted annual estimates obtained from the Waterfowl Breeding Population and Habitat Survey (WBPHS) for the Seward Peninsula stratum. Although similar to our estimate, we do not believe that their estimate represents a valid comparison to ours because the Seward Peninsula stratum is based on only 3 inland transects.

We do believe, however, that a valid comparison can be made between our estimate and the second estimate referenced by the Pacific Common Eider Action Plan. This 1992 survey (Larned et al. 1992) was flown specifically to obtain a population estimate for eiders along the coast from Point Romanof to Point Hope during the interval 12-18 June. During that survey, consisting of systematic strip transects within wetland polygons, they sampled 4.8% of 8173 km^2 of coastal wetlands. Their estimate of 24,459 common eiders (95% CI = 4386–44,532) was calculated by expanding the total indicated birds observed (329) to the total habitat area (20.77 expansion factor) and applying a visibility correction factor of 3.58 (Conant et al. 1991, Lensink 1968). They observed 46 singles, 81 pairs, and 75 grouped birds in 136 observations. Since we did not apply a visibility correction factor to our estimate, we deducted the visibility correction factor from their estimate in order to make these two estimates comparable. When doing this, we find Larned's estimate to be 6833 birds, which is 58% higher than our estimate of 4326.

One of the 1980's aerial goose surveys, flown during the brood-rearing and molt period along the northwestern Alaska coast, also recorded high numbers of eiders. From 11-19 July 1986, King and Butler (1987) flew a survey of all intertidal habitats along the northwestern coast of Alaska from Point Hope to Scammon Bay. Although the objective of this survey was to assess goose habitat, they also recorded eider ducks, but not to species. They counted a total of 7085 eiders and 77 eider broods near Cape Espenberg during this brood-rearing and molt period. Their estimate, which also includes ducklings, exceeded our estimate of 4326 by 64%. The other two coastal goose surveys flown along the northwestern Alaska coast during the brood-rearing and molting period recorded fewer than 100 eiders (King 1983, King and Eldridge 1985).

The population of common eiders in northwestern Alaska during the breeding season appears to be greater than that along the Arctic coast, but those estimates have been variable, averaging 2524 birds (1999-2009) with a range from 1353 (1999) to 4449 (2002) individuals. For 2007-2009, estimates were 1936, 1774, and 1931 individuals (Dau and Bollinger 2009).

In this report, we present our population estimates as 'total birds observed' which equates to presentation of the field observations without interpretation (i.e., recording lone females and not doubling lone males). For comparison, however, we also calculated population estimates on the basis of 'total indicated birds' (i.e., 2*drakes and not recording lone females) which is the standard protocol for breeding pair surveys (USFWS and CWS 1987). Because we found relatively small differences between these two methods, we believe our population estimates (i.e., based on 'total birds observed') to be valid and can be compared to those common eider surveys whose population estimates are based on expansion of 'total indicated birds' (i.e., Larned et al. 1992, Platte and Stehn 2011). The transect survey design of these other common eider surveys usually resulted in few, if any, single female observations.

Northwestern Alaska common eider distribution and areas of high concentration

The distribution of common eiders and areas of high concentration that we found during this survey correlated well with what King and Butler (1987), Kessel (1989), and Larned et al. (1992) reported. Over 81% (5800) of the eiders observed by King and Butler (1987) were found in the lagoon at Cape Espenberg (Segment 21), followed by 9% (630) in Shishmaref Inlet East (Segment 20) and another 4% (250) in Kiwalik Lagoon (Segment 24). Most of Larned et al.'s (1992) observations were made in the Nugnugaluktuk River Delta (Segment 22) and all along the coastal lagoons of the northern Seward Peninsula (Segments 16-21).

Kessel (1989) stated the following on distribution of common eiders for the Seward Peninsula:

"The greatest density of breeding birds occurs at Cape Espenberg, but they are also a common breeder in the Nugnugaluktuk River estuary and locally along the northwest coast of the Peninsula on the outer fringes of Lopp and Arctic lagoons. It also breeds in lesser numbers on the outer islands of the Buckland River estuary and along the Norton Sound coastline, including Safety Sound and the wetlands west of Koyuk Inlet. It is absent from the enclosed waters of Imuruk Basin, but nests in small numbers in the wetlands that stretch from the mouth of the Serpentine River to the mouth of the Arctic River, within Shishmaref Inlet."

Within the Seward Peninsula defined area, our data agrees with most of Kessel's summation. Both studies found Cape Espenberg (Segment 21), Nugnugaluktuk River Estuary (Segment 22), Lopp Lagoon (Segment 16), and Arctic Lagoon (Segment 18) to be important areas for breeding common eiders. Both studies were also in agreement concerning wetlands west of Koyuk Inlet (Kwiniuk Inlet, Segment 7), Safety Sound (Segment 12), and river mouths within Shishmaref Inlet (Segment 19). We did not survey Imuruk Basin, (inland from Grantley Harbor, Segment 14), an area which Kessel stated was absent of common eiders. Areas that we found to have relatively high numbers that Kessel did not mention were Brevig Lagoon (a part of Port Clarence, Segment 14) and Kiwalik Lagoon (Segment 24). We did count birds in the Buckland River Estuary, but not as many as Kessel found. Other areas outside of the Seward Peninsula where we also found relatively high numbers were: Stuart Island (Segment 2); St. Michael Bay (Segment 3); Beeson Slough, Shaktoolik Bay, Malikfik Bay, Sineak River Mouth (within Reindeer Hills Peninsula, Segment 5); and Point Hope (Segment 31).

We did find numbers of common eiders observed in the Nome area (Segment 13) to differ between years. They numbered 69 and 68 in 2006 and 2009, as compared to almost 600 in 2008, with most being found near Cape Woolley. Kessel stated that beginning in July, post-breeding

males join the flocks of nonbreeders in 'Inshore Waters' (i.e., exposed coastal waters of Norton and Kotzebue sounds); and she cited Woodby and Divoky (1983), who found non- and post-breeding eiders most common near exposed rocky outcrops such as Cape Nome and Cape Woolley. Flocks that we sighted on 23 June were mostly females and juveniles, however (i.e., 87% of 300 birds in flocks were either females or juveniles). Perhaps these birds were non-breeders or possibly late spring migrants that fit the description of an extended migration given by Palmer (1976). He stated that extended migration passage is the result of some sex and age segregation, with adult males leading the migration, followed by some mated pairs, and then an increasing proportion of females and immature birds.

Segment rankings – as to the importance of common eiders

There are limitations to the rankings developed in this report. These rankings are dependent on how the segments were selected and on the lengths of coastline within those segments. For example, St. Michael Bay (Segment 3), Kwiniuk Inlet (Segment 7), Nugnugaluktuk River Delta (Segment 22), and Kiwalik Lagoon (Segment 24) are relatively short in length and mainly encompass high common eider density areas. On the other hand, Reindeer Hills Peninsula (Segment 5) and Port Clarence (Segment 14) were relatively long in length and encompassed areas of both lower and higher common eider density. Many of the birds observed in Reindeer Hills Peninsula (Segment 5) were in the areas of Beeson Slough, Shaktoolik Bay, Malikfik Bay, and Sineak River mouth; and many of the birds observed in Port Clarence (Segment 14) were located in Brevig Lagoon. However, despite this limitation, we still believe that the rankings are valid and relevant for determining the importance of areas to common eiders and serving as the basis for determining a final survey design.

Spring phenology, migration phenology, and survey timing

Both spring phenology and migration phenology of common eiders influence when nesting occurs. Survey timing can be better optimized when current or prior knowledge of both these phenologies can be accessed.

This survey area covers a large geographic area over a large latitudinal distance from north to south (i.e., 63°-69° latitude) resulting in considerable variation in seasonal phenomena, both temporal and geographic. Annual variation in spring climatic conditions, that affect the timing of breakup of both sea ice and freshwater rivers, ponds, and lakes, and that affect the timing of snow melt and the availability of nest sites, play a significant role in determining arrival times of spring migrants and subsequent nesting chronologies. These events may vary annually by one to two weeks. Generally, breakup in the Bering Strait region and along the Chukchi Sea coast is about two weeks later than in Norton Sound and Eschscholtz Bay (Kessel 1989). Ice, which surrounds the Seward Peninsula during winter, starts to become less compact during late March and April; while rivers begin break-up in May, with the earliest being at the base of the Seward Peninsula (Kessel 1989). Rivers break out and clear the ice away from the mouths and adjacent shorelines, making available critical habitat for migrant waterbirds (Kessel 1989).

As far as migrational phenology, most Pacific common eiders winter from the Bering Sea pack ice south to the Aleutian Islands (Byrd 1992, Kessel 1989) and migrate up the coast of western Alaska in spring (Petersen and Flint 2002). However, because a portion of the population winters as far north as there is open water, it becomes difficult to distinguish the earliest spring

migrants from overwintering birds (Kessel 1989). Petersen and Flint (2002) found that satellite-marked female common eiders from the YKD and Beaufort Sea coast breeding populations wintered in the closest available ice-free habitat to their breeding grounds. Numerous studies have shown that the extent and distribution of ice cover and offshore leads likely affect common eider migratory phenology (Divoky 1979, Johnson and Herter 1989, Petersen and Flint 2002, Petersen 2009). Kessel (1989) stated that the common eider spring movement northward varies considerably with annual differences in ice conditions, but that the main movement on the Seward Peninsula begins in early May and it peaks, depending on weather, between about 20 May and mid-June. Other studies indicate that migration of common eiders bound for just the Seward Peninsula and not farther north may not commence until early June. Eldridge (1983) flew coastal surveys from Shishmaref to Kivalina at weekly intervals during May 1982. He found little indication of movement in his survey area (i.e., one flock totaling 10 birds on 20 May between Krusenstern and Kivalina lagoons), although he noted that migration of eiders was heavy at Point Hope on 15 May. The 06 June 2007 survey along the northern Seward Peninsula, (Bollinger 2007b) observed only 149 common eiders (all but three in pairs) mostly concentrated in the relatively few open water areas. These data would tend to suggest that common eiders migrating past the Seward Peninsula earlier than June were probably following the lead ice further offshore and were bound for the Alaska Arctic Coastal Plain or western Canada.

Our objective is to time our surveys to coincide with egg-laying and early incubation while pair bonds are intact and prior to the dispersal of males to molting sites (Johnson and Herter 1989, Kessel 1989). The commencement of nesting is closely associated with ice melt in the vicinity of nest sites. Thus, nesting may vary annually by a week or more and may also vary geographically along our survey route from south to north. Breeding males usually only remain with their females until the beginning of incubation. Beginning in July, they join flocks of nonbreeders to molt in small groups along the coast (Kessel 1989). Therefore, difference in survey timing relative to egg laying and early incubation would affect number of pairs versus flocked birds observed. Thayer (1951) reported that males were seldom seen with females after June 26 in the Serpentine River mouth of Shishmaref Inlet. Schamel et al. (1978) reported that numbers on transects on Cape Espenberg peaked in late June/early July. This peak in numbers corresponded primarily with the peak of incubation and the flocking of non-nesting and/or failed-nesting eiders. Kessel reported egg laying dates for Cape Espenberg to be 10 June-11 July in 1976 and 4 June–4 July in 1977. We flew our surveys within these intervals.

Our attempts to optimize timing of the survey were dependent on prior access to information on both sea ice conditions at a gross level and on spring phenology in the immediate vicinity of nest sites on a finer scale. Sea ice conditions would affect migrational phenology of common eiders while nest site habitat conditions would influence nest initiation. We have access to satellite images for monitoring sea ice conditions, but we currently do not have any means to assess immediate nest site conditions. Analysis of weather data obtained from nearby villages (R. Stehn pers. commun., USFWS, MBM, Anchorage, Alaska) is currently being used to aid in determining optimal survey timing for the YKD Waterbird Survey. Development of a similar analysis might help in determining optimal survey timing for the northwest coastal area.

However, comparison of the 2008 and 2009 data implies that the precision of timing for this survey is not critical to obtaining a reliable population estimate. The total number of common

eiders observed in 2008 and 2009 was remarkably close, despite the difference in spring phenology when these surveys were flown. The 2008 and 2009 surveys were flown on the same dates (20-28 June and 20 June – 01 July, respectively), even though spring phenology was earlier in 2009 compared to 2008 (i.e., sea ice conditions). Comparison of percentages of birds found in pairs and mixed-sex flocks between 2008 and 2009 suggests that nesting phenology was also earlier in 2009 as compared to 2008. In 2008, 50% of the birds were observed in pairs and only 15%, in mixed-sex flocks. In 2009, only 36% of the birds were observed in pairs and 33%, in mixed-sex flocks. This implies that in 2009, more males had already abandoned incubating females and were joining flocks to begin molt, as compared to the same time period in 2008. The high ratio of males (64%) in the mixed-sex flocks in 2009 also suggests that spring phenology was earlier in 2009. Based on this, we would recommend that, during years of average spring phenology, this survey be flown during the third week of June. However, exact timing is not necessarily critical to obtaining reliable population indexes.

We also believe that survey timing for the breeding population of common eiders in northwestern Alaska is less critical than for that on the Arctic Coastal Plain. Many common eiders overwinter as far north as open water allows which would result in relatively short spring migrations for birds nesting on the Seward Peninsula. When this survey is flown the third week of June, there is little likelihood that birds from the Beaufort Sea and western Canadian breeding populations are still migrating through our survey area. Furthermore, no extensive molt migration of post-breeding males has been recorded passing through the Bering Strait (Kessel 1989). This is in sharp contrast to the large numbers of post-breeding males and failed breeders from the western Canadian Arctic and the Beaufort Sea coastline of Alaska that migrate back west to molt in the coastal waters of the Chukchi Sea between Point Lay and Peard Bay beginning in late June and early July (Johnson and Herter 1989, Kessel 1989) . Therefore, on the Arctic Coastal Plain, there is the possibility that a survey flown too early might include migrants eastbound still enroute to Canada, and that a survey flown too late might include post-breeding males westbound enroute to molting areas in the Chukchi Sea.

RECOMMENDATIONS

Northwestern Alaska Common Eider Survey Design

The following recommendations are made as to the final survey design:

1) Continue to survey the same coastline area from Point Romanof to Omalik Lagoon.
2) Continue with meandering coastline survey design (i.e., census survey).
3) Initially plan to fly the survey starting the third week of June and make timing adjustments on the basis of current sea ice satellite images.
4) Delete Grantley Harbor (part of Segment 14, Port Clarence) from the survey design.
5) Delete all but the northern part of Hotham Inlet (Segment 27) from the survey design.
6) Consider deleting Golovin Lagoon (Segment 10) if numbers of other waterfowl are not deemed to be important.
7) Minimize survey efforts in areas of the main coastline that have few common eiders by adjustments in survey speeds and how closely the coastline shore is followed.

Deletion of Grantley Harbor and Hotham Inlet can be accomplished because these coastlines are peripheral to the continuity of the main outer coastline. Overall, both of these areas have relatively few observations of any waterfowl species. However, it is recommended that the long narrow sand spit at the mouth of Grantley Harbor and the barrier islands across the mouth of Ekichuk Lake (northern end of Hotham Inlet) and the northern shore of Hotham Inlet continue to be flown. Both areas have high numbers of waterfowl and other waterbirds.

It is recommended that Golovin Lagoon continue to be surveyed even though relatively few common eiders were counted there. The marsh area of the lagoon at the north end has an abundance of waterfowl, and continuity of this data might prove valuable in the future. The Golovin Lagoon coastline is peripheral to the main outer coastline and could easily be bypassed, however.

It is recommended that other areas that have relatively few common eiders continue to be surveyed for two reasons: (i) these areas are part of the main outer coastline and, for the most part, it is necessary for these areas to be transited anyway in order to get to the next segment. These segments include Koyuk (Segment 6), Elim (Segment 8), Golovin Bay (Segment 9), Rocky Point (Segment 11), Tin City (Segment 15), Baldwin Peninsula – west side (Segment 26), and Cape Thompson (Segment 30); (ii) they represent areas of high density for other waterfowl species. These segments include Eschscholtz Bay (Segment 25), Noatak / Krusenstern (Segment 28), and Kivalina (Segment 29). Eschscholtz Bay's coastline is also mostly peripheral to the main coastline and could be easily bypassed.

These recommendations for the Northwestern Alaska Common Eider Survey include priorities and list potential options. This allows for flexibility in survey coverage from year to year in order to accommodate variables such as funding, logistics, and time constraints.

''The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the U.S. Fish and Wildlife Service.''

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Table 1. Aerial survey segment names and descriptions for the northwestern Alaska common eider survey, 2006-2009.

Segment			Description	Beginning Point	Ending Point	Beginning		Ending	
No.		Name				Lat	Long	Lat	Long
1		Point Romanof	Point Romanof to Cape Stephens	Point Romanof	Cape Stephens	63 12 11	162 49 44	63 32 29	162 18 51
2		Stuart Island	Stuart Island shoreline: Lat-Long SW Corner of Island			63 33 06	162 20 34		
3		St Michael Bay	St Michaels Bay and adjoining shoreline	Cape Stephens	Wood Point	63 32 29	162 18 51	63 28 00	161 40 39
4		Unalakleet	NortonSound shoreline - Unalakleet	Wood Point	Beeson Slough	63 28 00	161 40 39	64 12 02	160 56 58
5		Reindeer Hills Peninsula	Reindeer Hills Peninsula and marsh areas	Beeson Slough	Ungalik - North	64 12 02	160 56 58	64 36 18	160 49 08
6		Koyuk	Norton Bay - centered on Koyuk Inlet	Ungalik-North	BaldHead	64 36 18	160 49 08	64 44 38	161 32 57
7		Kwiniuk Inlet	Kwik & Kwiniuk River mouths & delta areas	BaldHead	Moses Point-West	64 44 38	161 32 57	64 39 41	162 12 22
8		Elim	Norton Bay - centered on Elim	Moses Point-West	Cape Darby	64 39 41	162 12 22	64 19 29	162 47 22
9		Golovin Bay	Golovin Bay - east shoreline	Cape Darby	Golovin Village Pt	64 19 29	162 47 22	64 32 25	163 02 42
10		Golovin Lagoon	Golovin Lagoon	Golovin Village Pt	South Spit	64 32 25	163 02 42	64 31 15	163 02 00
9		Golovin Bay	Golovin Bay - west shoreline	South Spit	Rocky Point	64 31 15	163 02 00	64 23 52	163 09 00
11		Rocky Point	Norton Sound - Rocky Point to Topkok Head	Rocky Point	Topkok Head	64 23 52	163 09 00	64 33 07	163 58 38
12		Safety Sound	Safety Sound & coastline east	Topkok Head	Cape NomeE	64 33 07	163 58 38	64 26 31	164 58 08
13		Nome	Bering Sea coastline - centered on Nome	Cape NomeE	Cape Douglas	64 26 31	164 58 08	64 59 58	166 42 04
14		Port Clarence	Port Clarence(bay)-including GrantleyHarbor	CapeDouglas	BrevigLag-NW	64 59 58	166 42 04	65 22 12	166 56 27
15		Tin City	Bering Sea coastline - Tin City	BrevigLag-NW	CapePrinceOfWalesN	65 22 12	166 56 27	65 35 59	168 05 12
16		Lopp Lagoon	Northern Seward Peninsula - Lopp Lagoon	CapePrinceOfWalesN	Mitletukeruk-East	65 35 59	168 05 12	65 49 45	167 30 10
17		Ikpek Lagoon	Northern Seward Peninsula - Ikpek Lagoon	Mitletukeruk-East	ArcticLag-WestEnd	65 49 45	167 30 10	65 59 12	167 00 49
18		Arctic Lagoon	Northern Seward Peninsula - Arctic Lagoon	ArcticLag-WestEnd	Shishmaref-WestEnd	65 59 12	167 00 49	66 12 00	166 16 49
19		Shishmaref Inlet	Northern Seward Peninsula-ShishmarefInlet	Shishmaref-WestEnd	Shishmaref Narrows	66 12 00	166 16 49	66 19 49	165 47 02
20		Shishmaref Inlet - East	Northern Seward Pen-ShishmarefIn-EastArea	Shishmaref Narrows	Singeak	66 19 49	165 47 02	66 32 44	164 40 48
21		Cape Espenberg	Northern Seward Peninsula-Cape Espenberg	Singeak	NugnugaluktukRiv-N	66 32 44	164 40 48	66 12 52	163 56 34
22		Nugnugaluktuk River Delta	Nugnugaluktuk River Delta	Nug River-N Inlet Pt	Nug River-S Inlet Pt	66 12 52	163 56 34	66 11 06	163 53 35
23		Deering	Kotzebue Sound: GoodhopeBay - Willow Bay	Nugnugaluktuk Riv-S	MotherwoodPt	66 11 06	163 53 35	66 04 40	162 08 09
24		Kiwalik Lagoon	Spafarief Bay: Kiwalik Lagoon	MotherwoodPt	Church Rock	66 04 40	162 08 09	66 10 43	161 37 02
25		Eschscholtz Bay	Eschscholtz Bay: ChurchRock-ChamissoIsland	ChurchRock	BaldwinPen - SWTip	66 10 43	161 37 02	66 20 39	161 55 35
26		Baldwin Peninsula - West Side	KotzebueSound-Baldwin Pen-West Shoreline	BaldwinPen - SWTip	Pipe Spit	66 20 39	161 55 20	66 56 55	162 20 07
27		Hotham Inlet	Hotham Inlet - East Side Baldwin Peninsula	Pipe Spit	NoatakRiver-EastEnd	66 56 55	162 20 07	67 01 08	162 08 50
28	a	Noatak River Delta	NoatakRiver Delta -Sheshalik Spit	NoatakRiv-EastEnd	SheshalikSpit-Point	67 01 08	162 08 50	66 59 37	162 49 29
28	b	Krusenstern Lagoon	Krusenstern and Aukulak Lagoons	SheshalikSpit-Point	Tasaychek - N End	66 59 37	162 49 29	67 18 12	163 47 33
29		Kivalina & other Lagoons	Chukchi Sea - Lagoons to CapeThompson	Krusenstern -N End	Cape Thompson - S	67 18 12	163 47 33	68 03 45	165 30 40
30		Cape Thompson	Chukchi Sea -Cape Thompson - Cliff Area	Cape Thompson - S	Ipnot	68 03 45	165 30 40	68 10 33	166 00 30
31		Point Hope	Chukchi Sea-Tigara Peninsula-LagoonsMarsh	Ipnot	Kilikralik Point	68 10 33	166 00 30	68 31 02	166 18 12
32		Cape Lisburne	Chukchi Sea - CapeLisburne - Cliff Area	Kilikralik Point	Cape Lisburne - East	68 31 02	166 18 12	68 51 50	165 53 53
33		Cape Sabine	Chukchi Sea - CapeLisburne - OmalikLagoon	Cape Lisburne - East	Omalik Lagoon	68 51 50	165 53 53	69 08 30	163 31 55

Table 2. Survey timing, aircraft platform, and survey crews for northwestern Alaska common eider survey, 2006-2009.

Year	Date	Aircraft [a]	Pilot/Observer	Observer	Flight Hours
2006	16-17 June	C-206	Karen S Bollinger [b] Edward J Mallek [b c]	Edward J Mallek [b c] Karen S Bollinger [b]	21.7 hrs [i]
2007	06, 15, 23 June	C-206	Karen S Bollinger	Tina L Moran [d] Dennis Marks [e]	15.8 hrs
2008	20 - 28 June	C-206	Karen S Bollinger	Tamara Zeller [f]	54.8 hrs [j]
2009	20 June - 01 July	C-206	Karen S Bollinger	William D Eldridge [g] Christian P Dau [h]	43.5 hrs

[a] Survey aircraft N234JB - a fixed wing Cessna 206 amphibian aircraft

[b] Pilot and Observer duties were shared. Ed flew as pilot/observer on 16 June and Karen, on 17 June.

[c] Ed Mallek, USFWS, Migratory Bird Management, Waterfowl Branch, Fairbanks, Alaska

[d] Tina Moran, USFWS, Selawik National Wildlife Refuge, Kotzebue, Alaska

[e] Dennis Marks, USFWS, Migratory Bird Management, Waterfowl Branch, Anchorage, Alaska

[e] Tamara Zeller, USFWS, Migratory Bird Management, Anchorage, Alaska

[g] William D Eldridge, USFWS, Migratory Bird Managemt, Waterfowl Branch, Anchorage, Alaska, retired

[h] Christian P Dau, USFWS, Migratory Bird Management, Waterfowl Branch, Anchorage, Alaska

[i] Flight hours include 4.5 hrs ferry time from Nome to Fairbanks at end of survey.

[j] Flight hours include 3.5 hrs ferry time from Kotzebue to Fairbanks at end of survey.

Table 3. Common eider sex and age composition and totals for the common eider aerial survey, northwestern Alaska, 2006-2009.
Counts are only comparable between years 2008 and 2009 when survey coverage was similar.

Year	Singles (in groups of ≤ 4 birds)		Single-sex Flocked Birds (≥ 5 birds) [a]		Juv	No. of Pairs	# Birds in Pairs	Mixed-sex Flocked	Ratio [b] Male:	Total	Indicated
	Males	Females	Males	Females	Males	Observed	Observed	Birds [a]	DarkBirds	No Birds [c]	Pairs [d]
2006	Segments 1 -14										
coastline	171	43	128 (5-20) n=10	11 (5-6) n=2	3	294	588	72 (12-40) n=3	unk	1016	465
inland	57	10	33 (6-20) n=3	0	0	40	80	0	- -	180	97
2007	Segments 16 - 22										
	226	19	89 (5-36) n=9	20 (5-10) n=3	0	452	904	27 (5-12) n=3	unk	1285	678
2008	Segments 1 - 14 and 16 - 31										
	553	221	458 (5-24) n=52	279 (5-50) n=25	44	1114	2228	655 (10-100) n=13	190:320	4438	1667
2009	Segments 1- 33										
	440	227	444 (5-150) n=29	178 (5-15) n=23	1	757	1514	1410 (8-120) n=43	903:507	4214	1197

[a] Ranges of flock size and number of flocks observed are given for flocked groups, both single-sex and mixed-sex flocks.
For example, "(5-40) n=14", under single-sex flocked males, denotes 14 flocks were observed and numbers in each flock ranged from 5 to 40 birds.
[b] Ratios of males:dark birds in flocks of mixed-sex common eiders. Dark birds = females and subadults.
[c] Total number observed = males + females + flocks. Single males were not doubled.
[d] Indicated total pairs = single males (in groups of ≤ 4 birds) + pairs.

Table 4. Summary of total common eider observations and percentages by segment, for the northwestern Alaska coastal survey, 2006-2009.

Segment	2006 Coastal		2006 Inland [a]		2007 [b]		2008		2009	
Number	#	%	#	%	#	%	#	%	#	%
1	16	1.6	11	6.1	- -	- -	17	0.4	8	0.2
2	93	9.2	- -	- -	- -	- -	220	5.0	92	2.2
3	309	30.4	- -	- -	- -	- -	189	4.3	366	8.7
4	112	11.0	- -	- -	- -	- -	121	2.7	62	1.5
5	128	12.6	71	39.4	- -	- -	345	7.8	275	6.5
6	19	1.9	1	0.6	- -	- -	20	0.5	15	0.4
7	160	15.8	83	46.1	- -	- -	144	3.2	212	5.0
8	4	0.4	- -	- -	- -	- -	8	0.2	4	0.1
9	0	0.0	- -	- -	- -	- -	0	0.0	1	0.0
10	2	0.2	7	3.9	- -	- -	16	0.4	23	0.5
11	0	0.0	- -	- -	- -	- -	0	0.0	6	0.1
12	96	9.4	0	0.0	- -	- -	115	2.6	96	2.3
13	69	6.8	3	1.7	- -	- -	597	13.5	68	1.6
14	8 [c]	0.8	4 [c]	2.2	- -	- -	259	5.8	249	5.9
15	- -	- -	- -	- -	- -	- -	0	0.0	8	0.2
16	- -	- -	- -	- -	173 [d]	13.46	757	17.1	883	21.0
17	- -	- -	- -	- -	34	2.646	88	2.0	82	1.9
18	- -	- -	- -	- -	62	4.825	95	2.1	33	0.8
19	- -	- -	- -	- -	229	17.82	48	1.1	45	1.1
20	- -	- -	- -	- -	445	34.63	234	5.3	299	7.1
21	- -	- -	- -	- -	179	13.93	145	3.3	150	3.6
22	- -	- -	- -	- -	163	12.68	407	9.2	266	6.3
23	- -	- -	- -	- -	- -	- -	194	4.4	189	4.5
24	- -	- -	- -	- -	- -	- -	123	2.8	252	6.0
25	- -	- -	- -	- -	- -	- -	30	0.7	40	0.9
26	- -	- -	- -	- -	- -	- -	16	0.4	6	0.1
27	- -	- -	- -	- -	- -	- -	0	0.0	0	0.0
28	- -	- -	- -	- -	- -	- -	90	2.0	114	2.7
29	- -	- -	- -	- -	- -	- -	57	1.3	36	0.9
30	- -	- -	- -	- -	- -	- -	0	0.0	1	0.2
31	- -	- -	- -	- -	- -	- -	103	2.3	164	3.9
32	- -	- -	- -	- -	- -	- -	- - [e]	- - [e]	56	1.3
33	- -	- -	- -	- -	- -	- -	- - [e]	- - [e]	113	2.7
Total 1-14	1016		180				2051		1477	
Total 16-22					1285		1774		1758	
Total 1-33							4438		4214	

[a] Inland transects only flown in Segments 1, 5, 6, 7, 10, 12, 13, and 14.

[b] Numbers include observations made on 15 and 23 June 2007.

[c] Coverage of Segment 14, Port Clarence, only extended to the western one-third due to fog.

[d] Coverage of Segment 16, Lopp Lagoon, only extended to the eastern one-third due to fog.

[e] Coverage in these segments was minimal due to weather / fog.

Table 5. Summary of common eider observations by segment, northwestern Alaska, 2006-2009. Segment subtotals show observations for females not in pairs or mixed-sex flocks (COEIH) and juveniles (COEIJ) separately.

Segment	2006 [a]			2007 [b]			2008			2009		
Number	COEI	COEIH	COEIJ	COEI	COEIH	COEIJ	COEI	COEIH	COEIJ	COEI	COEIH	COEIJ
1	9	7	0	--	--	--	16	1	0	8	0	0
2	87	6	0	--	--	--	210	10	0	90	2	0
3	296	11	2	--	--	--	177	12	0	364	2	0
4	108	4	0	--	--	--	120	1	0	62	0	0
5	122	5	1	--	--	--	333	12	0	256	19	0
6	19	0	0	--	--	--	16	4	0	12	3	0
7	152	8	0	--	--	--	141	3	0	207	5	0
8	3	1	0	--	--	--	6	2	0	4	0	0
9	0	0	0	--	--	--	0	0	0	1	0	0
10	0	2	0	--	--	--	16	0	0	13	10	0
11	0	0	0	--	--	--	0	0	0	6	0	0
12	86	10	0	--	--	--	91	24	0	85	11	0
13	69	0	0	--	--	--	529	55	13	61	7	0
14	8 [c]	0 [c]	0 [c]	--	--	--	245	12	2	237	12	0
15	--	--	--	--	--	--	0	0	0	8	0	0
16	--	--	--	170 [d]	3 [d]	0 [d]	668	89	0	864	19	0
17	--	--	--	29	5	0	82	6	0	79	3	0
18	--	--	--	62	0	0	92	3	0	22	11	0
19	--	--	--	228	1	0	45	3	0	32	13	0
20	--	--	--	441	4	0	166	48	20	209	90	0
21	--	--	--	159	20	0	99	46	0	130	20	0
22	--	--	--	157	6	0	338	69	0	249	17	0
23	--	--	--	--	--	--	188	6	0	176	13	0
24	--	--	--	--	--	--	111	12	0	212	40	0
25	--	--	--	--	--	--	25	5	0	36	4	0
26	--	--	--	--	--	--	15	1	0	6	0	0
27	--	--	--	--	--	--	0	0	0	0	0	0
28	--	--	--	--	--	--	63	23	4	113	1	0
29	--	--	--	--	--	--	20	32	5	2	33	1
30	--	--	--	--	--	--	0	0	0	0	1	0
31	--	--	--	--	--	--	82	21	0	102	62	0
32	--	--	--	--	--	--	-- [e]	-- [e]	-- [e]	50	6	0
33	--	--	--	--	--	--	-- [e]	-- [e]	-- [e]	112	1	0
Total 1-14	959	54	3				1900	136	15	1406	71	0
Total 16-22				1246	39	0	1490	264	20	1585	173	0
Total 1-33							3894	500	44	3808	405	1

[a] Numbers include only observations from coastline habitat, not inland transects flown in 2006.

[b] Numbers include observations made on 15 and 23 June 2007.

[c] Coverage of Segment 14, Port Clarence, only extended to the western one-third due to fog.

[d] Coverage of Segment 16, Lopp Lagoon, only extended to the eastern one-third due to fog.

[e] Coverage in these segments was minimal due to weather / fog.

Table 6. Comparison of total common eider observed (including hens) and total indicated common eiders (hens not counted, single drakes doubled) for the northwestern Alaska coastal survey, 2006-2009.

Segment	2006		2007		2008		2009	
Number	Total Obs [a]	Total Indicated [b]	Total Obs [a]	Total Indicated [b]	Total Obs [a]	Total Indicated [b]	Total Obs [a]	Total Indicated [b]
1	16	10	- -	- -	17	16	8	10
2	93	108	- -	- -	220	241	92	96
3	309	352	- -	- -	189	210	366	380
4	112	134	- -	- -	121	146	62	73
5	128	136	- -	- -	345	384	275	292
6	19	22	- -	- -	20	20	15	14
7	160	174	- -	- -	144	159	212	242
8	4	4	- -	- -	8	6	4	4
9	0	0	- -	- -	0	0	1	2
10	2	0	- -	- -	16	16	23	19
11	0	0	- -	- -	0	0	6	12
12	96	110	- -	- -	115	114	96	96
13	69	72	- -	- -	597	539	68	62
14	8	8	- -	- -	259	280	249	271
15	- -	- -	- -	- -	0	0	8	8
16	- -	- -	173	194	757	758	883	916
17	- -	- -	34	32	88	84	82	92
18	- -	- -	62	82	95	112	33	28
19	- -	- -	229	258	48	54	45	44
20	- -	- -	445	513	234	200	299	244
21	- -	- -	179	193	145	120	150	153
22	- -	- -	163	200	407	394	266	300
23	- -	- -	- -	- -	194	229	189	219
24	- -	- -	- -	- -	123	127	252	226
25	- -	- -	- -	- -	30	30	40	43
26	- -	- -	- -	- -	16	16	6	12
27	- -	- -	- -	- -	0	0	0	0
28	- -	- -	- -	- -	90	70	114	117
29	- -	- -	- -	- -	57	26	36	2
30	- -	- -	- -	- -	0	0	1	0
31	- -	- -	- -	- -	103	96	164	106
32	- -	- -	- -	- -	0	0	56	51
33	- -	- -	- -	- -	0	0	113	114
Total 1-14	1016	1130			2051	2131	1477	1573
Total 16-22			1285	1472	1774	1722	1758	1777
Total 1-33					4438	4447	4214	4248
% Difference	Seg 1-14	11.2%	Seg 16-22	14.6%	Seg 1-33	0.2%	Seg 1-33	0.8%

[a] Total observations are counts as presented in this report and equals summation of all birds observed, including hens.

[b] Total indicated are counts based on breeding pair survey protocol [i.e., single females are not counted and males (n=1-4 birds) are doubled].

Table 7. Length (km) of shorelines and linear density of common eiders by segment for the outer coast and lagoons along the northwestern Alaska coast from Point Romanof to Omalik Lagoon, 2008-2009.

Segment		Outer Coast	Lagoon	Total	2008 Number of COEI /		2009 Number of COEI /	
No.	Name	Shoreline-km	Shoreline-km	Shoreline-km	Outer Coast	Total Shoreline	OuterCoast	Total Shoreline
1	Point Romanof	51	0	51	0.33	0.33	0.16	0.16
2	Stuart Island	71	0	71	3.11	3.11	1.30	1.30
3	St. Michael Bay	69	0	69	2.73	2.73	5.29	5.29
4	Unalakleet	159	0	159	0.76	0.76	0.39	0.39
5	Reindeer Hills Peninsula	122	0	122	2.82	2.82	2.25	2.25
6	Koyuk	82	0	82	0.24	0.24	0.18	0.18
7	Kwiniuk Inlet	56	0	56	2.56	2.56	3.76	3.76
8	Elim	48	0	48	0.17	0.17	0.08	0.08
9	Golovin Bay	60	0	60	0.00	0.00	0.02	0.02
10	Golovin Lagoon	60	0	60	0.27	0.27	0.39	0.39
11	Rocky Point	50	0	50	0.00	0.00	0.12	0.12
12	Safety Sound	56	108	164	2.04	0.70	1.70	0.58
13	Nome	121	42	163	4.95	3.67	0.56	0.42
14	Port Clarence	185	48	233	1.40	1.11	1.35	1.07
15	Tin City	48	0	48	0.00	0.00	0.17	0.17
16	Lopp Lagoon	42	122	164	18.09	4.61	21.10	5.38
17	Ikpek Lagoon	29	58	87	3.04	1.01	2.83	0.94
18	Arctic Lagoon	42	109	151	2.27	0.63	0.79	0.22
19	Shishmaref Inlet	27	109	137	1.75	0.35	1.64	0.33
20	Shishmaref Inlet-East	56	132	188	4.15	1.24	5.31	1.59
21	Cape Espenberg	119	0	119	1.22	1.22	1.26	1.26
22	NugnugaluktukRiverDelta	35	0	35	11.50	11.50	7.51	7.51
23	Deering	130	0	130	1.49	1.49	1.45	1.45
24	Kiwalik Lagoon	64	0	64	1.91	1.91	3.91	3.91
25	Eschscholtz Bay	142	0	142	0.21	0.21	0.28	0.28
26	BaldwinPen-W	109	0	109	0.15	0.15	0.05	0.05
27	Hotham Inlet	209	39	248	0.00	0.00	0.00	0.00
28	Noatak/Krusenstern	151	45	196	0.59	0.46	0.75	0.58
29	Kivalina	111	163	274	0.51	0.21	0.32	0.13
30	Cape Thompson	27	0	27	0.00	0.00	0.04	0.04
31	Point Hope	76	122	198	1.36	0.52	2.17	0.83
32	Cape Lisburne	61	0	61	- -	- -	0.92	0.92
33	Cape Sabine	60	18	77	- -	- -	1.90	1.46
	TOTAL	2729	1115	3844				

Table 8a. Ranking of survey segments in order of segments for common eiders on the basis of percentage of total birds and numbers of birds per shoreline distance for the northwestern Alaska common eider survey, 2008-2009.

Segment		Rank						Summation		Overall
		2008			2009			of	Average	Total
No.	Name	% of Total Birds	Birds / Outer Coast	Birds / Total Coast	% of Total Birds	Birds / Outer Coast	Birds / Total Coast	Ranks	Rank	Rank
1	Point Romanof	23-25	21	20	26-28	27	26	145.0	24.2	26
2	Stuart Islan	7	5	4	15	15	10	56.0	9.3	8
3	St. Michael Bay	9	8	6	2	4	3	32.0	5.3	3
4	Unalakleet	13	18	14	18	21	19	103.0	17.2	18-19
5	Reindeer Hills Peninsula	4	7	5	4	8	6	34.0	5.7	5
6	Koyuk	22	23	22	25	24	24	140.0	23.3	25
7	Kwiniuk Inlet	11	9	7	8	6	5	46.0	7.7	6
8	Elim	26	25	25	29-31	29	29	164.0	27.3	27
9	Golovin Bay	27-31	27-31	27-31	32-33	32	32	184.0	30.7	32
10	Golovin Lagoon	23-25	22	21	24	22	20	133.0	22.2	22
11	Rocky Point	27-31	27-31	27-31	29-31	28	28	173.0	28.8	30
12	Safety Sound	14	11	15	14	11	16	81.0	13.5	15
13	Nome	2	3	3	17	20	18	63.0	10.5	11
14	Port Clarence	5	15	12	7	14	12	65.0	10.8	12
15	Tin City	27-31	27-31	27-31	26-28	26	25	165.0	27.5	28
16	Lopp Lagoon	1	1	2	1	1	2	8.0	1.3	1
17	Ikpek Lagoon	17-18	6	13	16	7	13	72.5	12.1	13
18	Arctic Lagoon	16	10	16	23	18	23	106.0	17.7	21
19	Shishmaref Inlet	20	13	19	20	12	21	105.0	17.5	20
20	Shishmaref Inlet-East	6	4	10	3	3	7	33.0	5.5	4
21	Cape Espenberg	10	17	11	11	16	11	76.0	12.7	14
22	NugnugaluktukRiverDelta	3	2	1	5	2	1	14.0	2.3	2
23	Deering	8	14	9	9	13	9	62.0	10.3	10
24	Kiwalik Lagoon	12	12	8	6	5	4	47.0	7.8	7
25	Eschscholtz Bay	21	24	23-24	21-22	25	22	137.0	22.8	24
26	BaldwinPen-W	23-25	26	26	29-31	30	30	166.0	27.7	29
27	Hotham Inlet	27-31	27-31	27-31	32-33	33	33	185.5	30.9	33
28	Noatak/Krusenstern	17-18	19	18	12-13	19	17	103.0	17.2	18-19
29	Kivalina	19	20	23-24	21-22	23	27	134.0	22.3	23
30	Cape Thompson	27-31	27-31	27-31	26-28	31	31	176.0	29.3	31
31	Point Hope	15	16	17	10	9	15	82.0	13.7	16
32	Cape Lisburne	--	--	--	19	17	14	50.0	16.7	17
33	Cape Sabine	--	--	--	12-13	10	8	30.5	10.2	9

Table 8b. Ranking of survey segments in order of rank for common eiders on the basis of percentage of total birds and numbers of birds per shoreline distance for the northwestern Alaska common eider survey, 2008-2009.

Segment		Rank						Summation		Overall
		2008			2009			of	Average	Total
No.	Name	% of Total Birds	Birds / Outer Coast	Birds / Total Coast	% of Total Birds	Birds / Outer Coast	Birds / Total Coast	Ranks	Rank	Rank
16	Lopp Lagoon	1	1	2	1	1	2	8.0	1.3	1
22	NugnugaluktukRiverDelta	3	2	1	5	2	1	14.0	2.3	2
3	St. Michael Bay	9	8	6	2	4	3	32.0	5.3	3
20	Shishmaref Inlet-East	6	4	10	3	3	7	33.0	5.5	4
5	Reindeer Hills Peninsula	4	7	5	4	8	6	34.0	5.7	5
7	Kwiniuk Inlet	11	9	7	8	6	5	46.0	7.7	6
24	Kiwalik Lagoon	12	12	8	6	5	4	47.0	7.8	7
2	Stuart Islar	7	5	4	15	15	10	56.0	9.3	8
33	Cape Sabine	--	--	--	12-13	10	8	30.5	10.2	9
23	Deering	8	14	9	9	13	9	62.0	10.3	10
13	Nome	2	3	3	17	20	18	63.0	10.5	11
14	Port Clarence	5	15	12	7	14	12	65.0	10.8	12
17	Ikpek Lagoon	17-18	6	13	16	7	13	72.5	12.1	13
21	Cape Espenberg	10	17	11	11	16	11	76.0	12.7	14
12	Safety Sound	14	11	15	14	11	16	81.0	13.5	15
31	Point Hope	15	16	17	10	9	15	82.0	13.7	16
32	Cape Lisburne	--	--	--	19	17	14	50.0	16.7	17
4	Unalakleet	13	18	14	18	21	19	103.0	17.2	18-19
28	Noatak/Krusenstern	17-18	19	18	12-13	19	17	103.0	17.2	18-19
19	Shishmaref Inlet	20	13	19	20	12	21	105.0	17.5	20
18	Arctic Lagoon	16	10	16	23	18	23	106.0	17.7	21
10	Golovin Lagoon	23-25	22	21	24	22	20	133.0	22.2	22
29	Kivalina	19	20	23-24	21-22	23	27	134.0	22.3	23
25	Eschscholtz Bay	21	24	23-24	21-22	25	22	137.0	22.8	24
6	Koyuk	22	23	22	25	24	24	140.0	23.3	25
1	Point Romanof	23-25	21	20	26-28	27	26	145.0	24.2	26
8	Elim	26	25	25	29-31	29	29	164.0	27.3	27
15	Tin City	27-31	27-31	27-31	26-28	26	25	165.0	27.5	28
26	BaldwinPen-W	23-25	26	26	29-31	30	30	166.0	27.7	29
11	Rocky Point	27-31	27-31	27-31	29-31	28	28	173.0	28.8	30
30	Cape Thompson	27-31	27-31	27-31	26-28	31	31	176.0	29.3	31
9	Golovin Bay	27-31	27-31	27-31	32-33	32	32	184.0	30.7	32
27	Hotham Inlet	27-31	27-31	27-31	32-33	33	33	185.5	30.9	33

Table 9a. Total counts of waterfowl species by year observed during the common eider survey, along the northwestern Alaska coast, 2006-2009. Counts are only comparable between years 2008 and 2009 when survey coverage was similar.

Species	Year			
	2006 [a]	2007 [b]	2008 [c]	2009 [d]
Tundra Swan	3478	886	6729	7176
Tundra Swan Nest	not recorded	16	26	16
Canada Goose	1357	666	1288	2005
Black Brant	140	288	3916	2584
Gr White-fronted Goose	16	367	724	518
Emperor Goose	0	1112	125	137
Snow Goose	5	11	43	11
Mallard	306	24	118	80
Northern Pintail	2989	5021	14,359	14,488
American Wigeon	178	45	2046	3380
Am Green-winged Teal	2	0	2	6
Northern Shoveler	10	0	74	23
Canvasback	0	101	1518	2168
Redhead	8	0	0	0
Greater Scaup	568	1060	4468	9791
Common Eider	**1016**	**1285**	**4438**	**4214**
King Eider	0	0	20	152
Harlequin Duck	218	0	104	94
Long-tailed Duck	111	487	1830	2062
Black Scoter	562	686	1360	2526
Surf Scoter	37	85	2438	517
White-winged Scoter	53	2	438	55
Common Goldeneye	0	0	12	24
Bufflehead	2	0	6	2
Mergansers	1003	219	2735	2805

[a] 2006 survey coverage included Segments 1 - 14 coastline habitat; only covered western one-third of Segment 14.

[b] 2007 survey coverage included Segments 16 - 22; only covered eastern one-third of Segment 16.

[c] 2008 survey coverage included Segments 1 - 31.

[d] 2009 survey coverage included all 33 segments in the survey area; only covered southern half of Segment 13.

Table 9b. Total counts of other bird species and large mammals by year observed during the common eider survey along the northwestern Alaska coast, 2006-2009. Counts are only comparable between the years 2008 and 2009 when survey coverage was similar.

Species	Year			
	2006 [a]	2007 [b]	2008 [c]	2009 [d]
Red-throated Loon	160	242	674	463
Pacific Loon	61	110	193	282
Common Loon	0	0	16	7
Yellow-billed Loon	0	9	42	36
Murre species [f]	5152	0	28,025	7978
Red-necked Grebe	2	0	12	8
Pelagic Cormorant	73	3	137	1011
Glaucous (large) Gull	6989	5991 [e]	18,709	49,329
Mew (small) Gull	1003	- -	2688	564
Black-legged Kittiwake	3772	- -	28,019	25,229
Sabine's Gull	3	39	113	317
Arctic Tern	328	583	1199	2448
Jaeger species	43	49	142	457
Sandhill Crane	65	215	336	278
Large Shorebirds	0	82	0	48 (whimbrel)
Meium Shorebirds	0	0	0	100
Small Shorebirds	300	1448	575	370
Ptarmigan species	0	0	0	0
Common Raven	60	6	223	188
Bald Eagle	1	1	4	0
Golden Eagle	0	0	0	3
Other Raptors	0	0	0	2
Muskox Adult	37	78	0	282
Muskox Calf	0	7	0	25
Caribou Adult	0	30	0	16
Caribou Calf	0	5	0	2
Moose Adult	0	0	0	4
Moose Calf	0	0	0	1
Red Fox	0	0	0	1
Brown Bear Adult	2	0	0	2
Brown Bear Cub	2	0	0	5
Brown Bear Yearling	2	0	0	0
Pacific Walrus-headless	4	0	0	2
Seal	1	2	0	7
Sea Otter	1	0	0	0

[a] 2006 survey coverage included Segments 1 - 14 coastline habitat; only covered western one-third of Segment 14.

[b] 2007 survey coverage included Segments 16 - 22; only covered eastern one-third of Segment 16.

[c] 2008 survey coverage included Segments 1 - 31.

[d] 2009 survey coverage included all 33 segments in the survey area; only covered southern half of Segment 13.

[e] In 2007, gulls and kittiwakes were not differentiated, except for Sabine's gulls.

[f] Counts of murre species are minimal and not comparable among years due to inappropriate survey design.

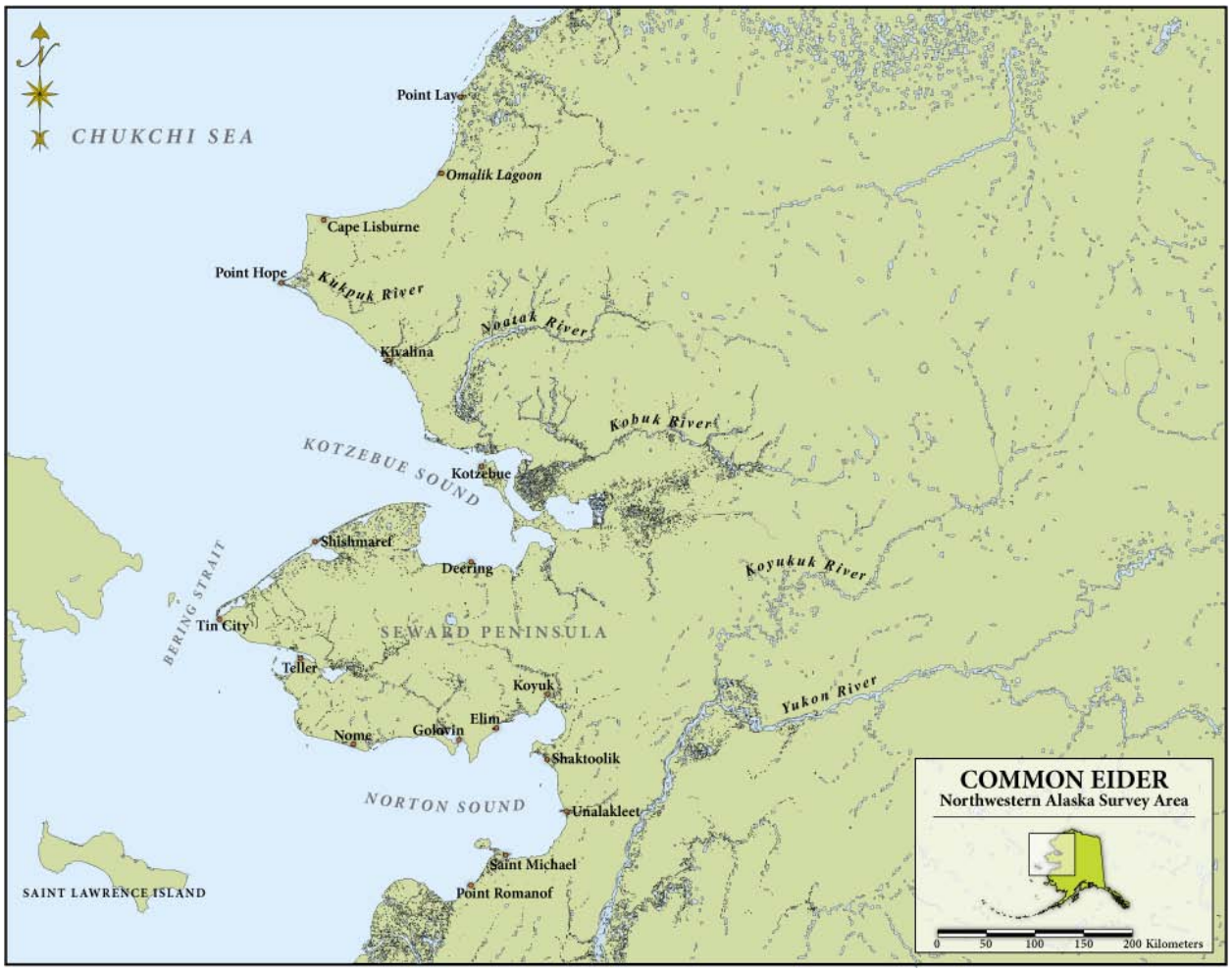

Figure 1. Survey area for common eiders along the northwestern Alaska coast from Point Romanof to Omalik Lagoon, 2006–2009.

Figure 2. Aerial survey segments (south segments) for the common eider survey along the northwestern Alaska coast, 2006–2009.

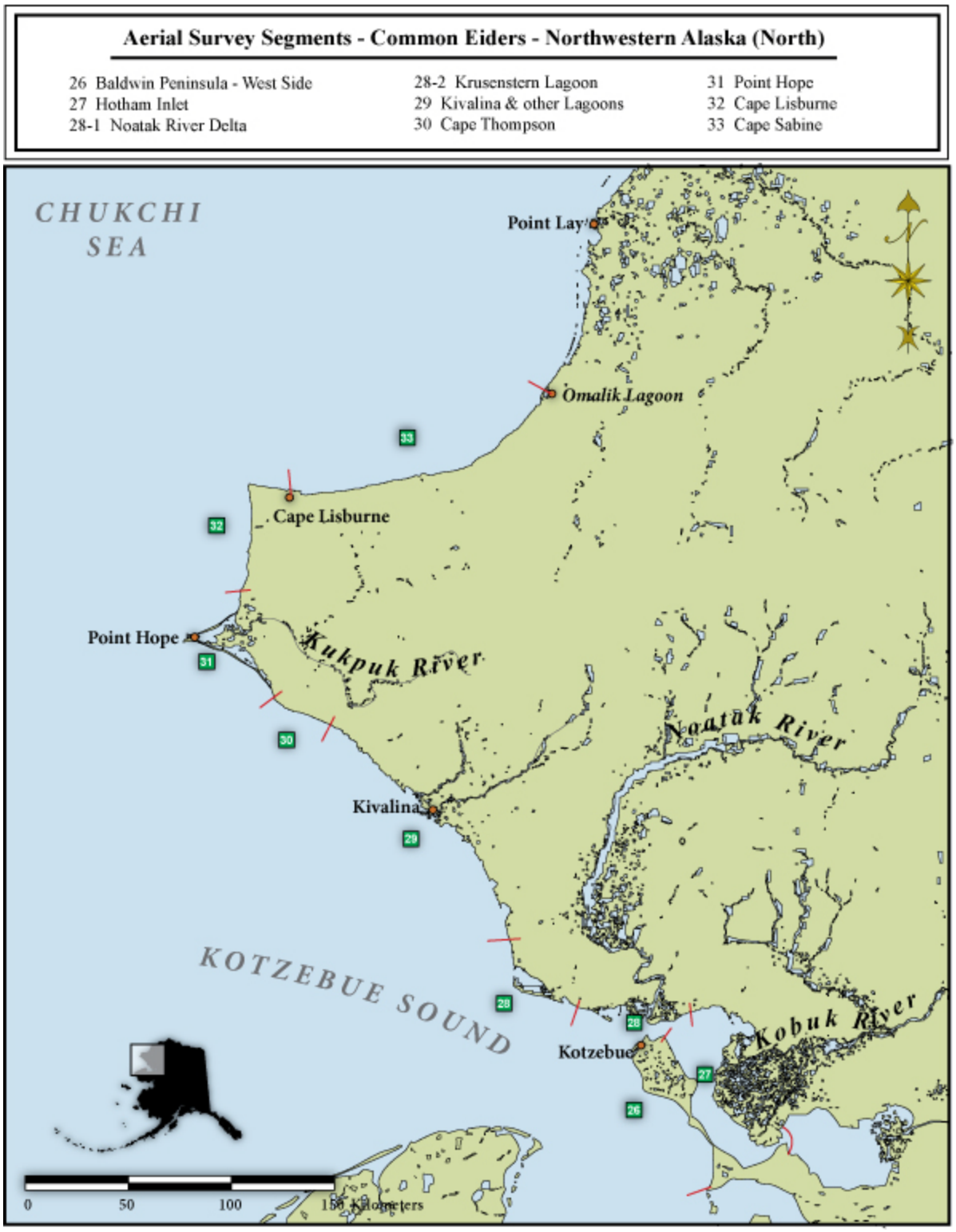

Figure 3. Aerial survey segments (north segments) for the common eider survey along the northwestern Alaska coast, 2006–2009.

Figure 4. Aerial survey flight paths for the common eider survey along the northwestern Alaska coast, 2006–2009. Land mass is indicated by gray shading and ocean, by white shading.

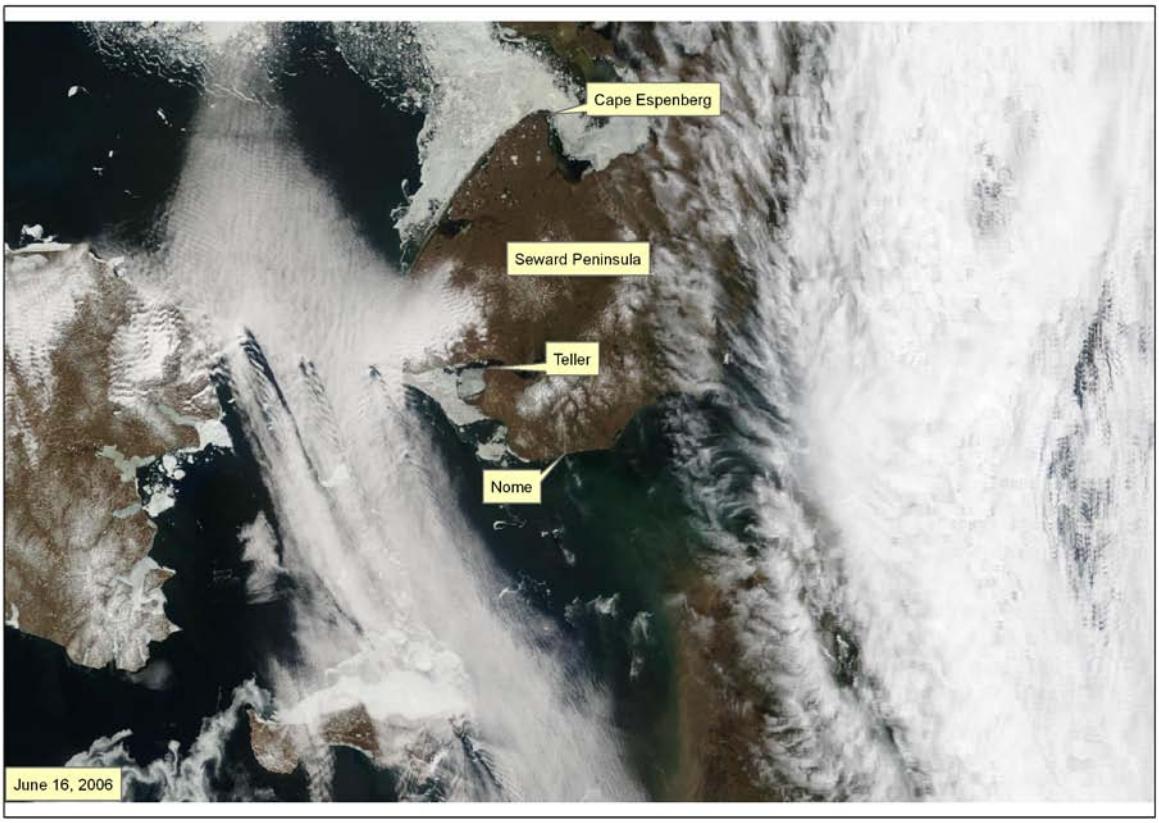

Figure 5. Satellite image of sea ice distribution in the Bering and Chukchi Sea area of northwest Alaska that was taken on 16 June 2006. Image is from the NASA MODIS Rapid Response System website http://rapidfire.sci/gsfc.nasa.gov/.

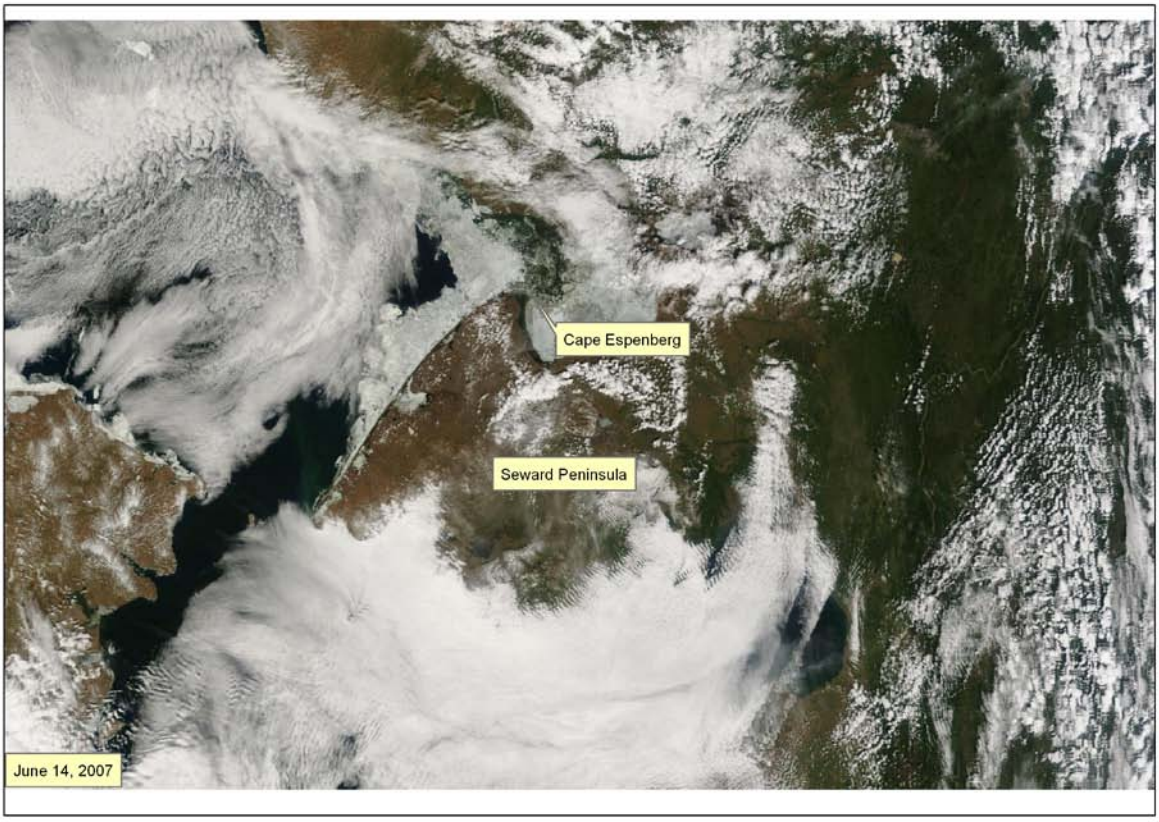

Figure 6. Satellite image of sea ice distribution in the Bering and Chukchi Sea area of northwest Alaska that was taken on 14 June 2007. Image is from the NASA MODIS Rapid Response System website http://rapidfire.sci/gsfc.nasa.gov/.

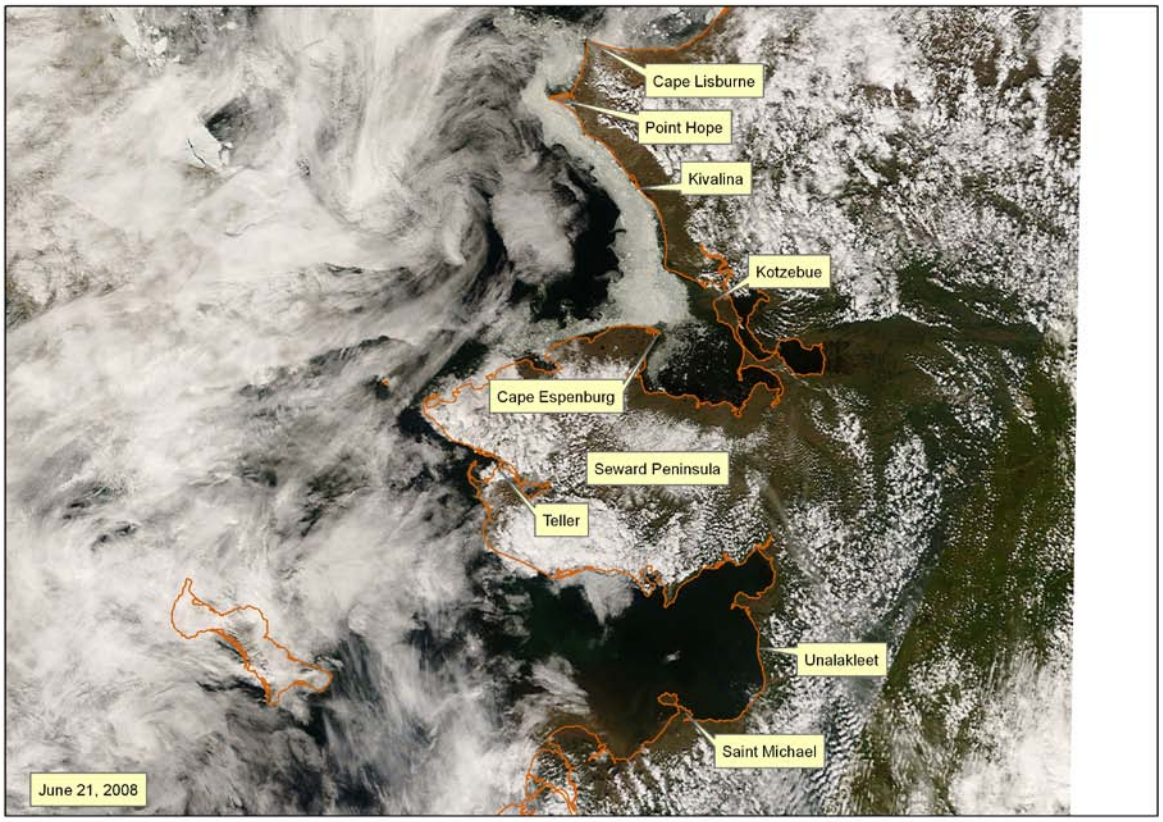

Figure 7. Satellite image of sea ice distribution in the Bering and Chukchi Sea area of northwest Alaska that was taken on 21 June 2008. Image is from the NASA MODIS Rapid Response System website http://rapidfire.sci/gsfc.nasa.gov/.

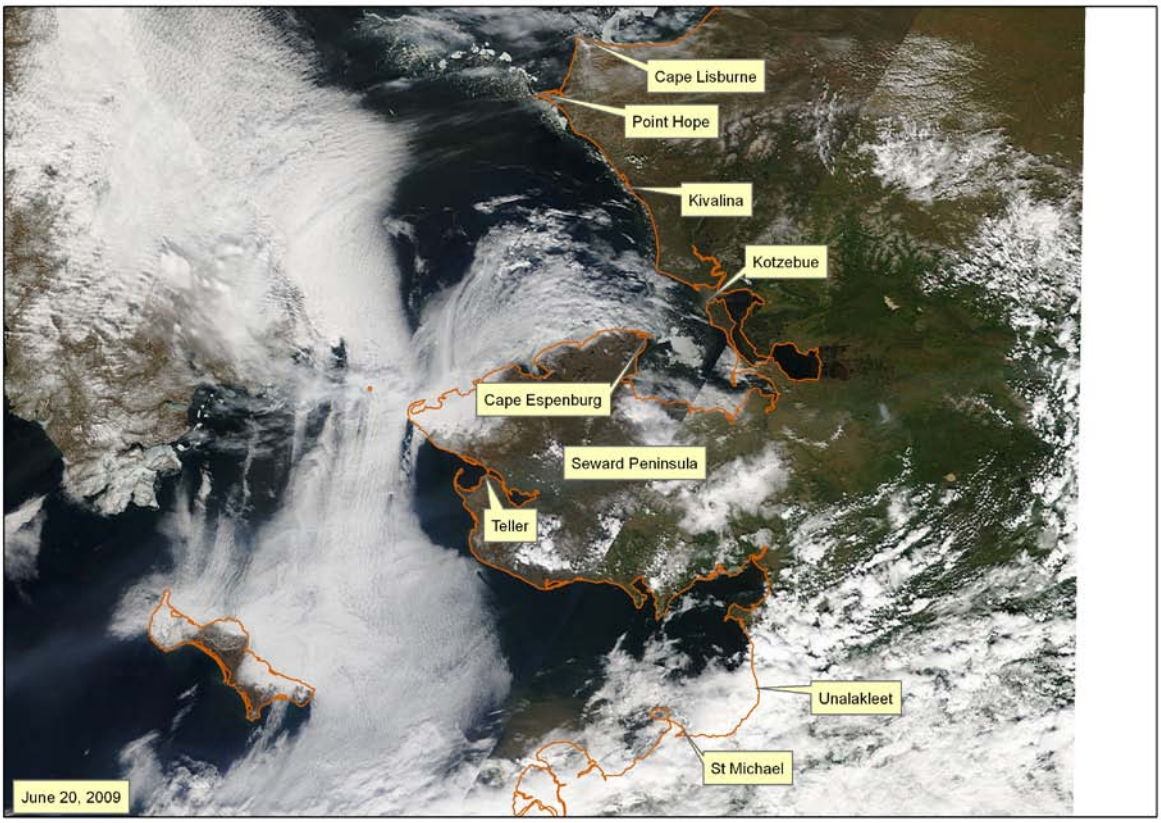

Figure 8. Satellite image of sea ice distribution in the Bering and Chukchi Sea area of northwest Alaska that was taken on 20 June 2009. Image is from the NASA MODIS Rapid Response System website http://rapidfire.sci/gsfc.nasa.gov/.

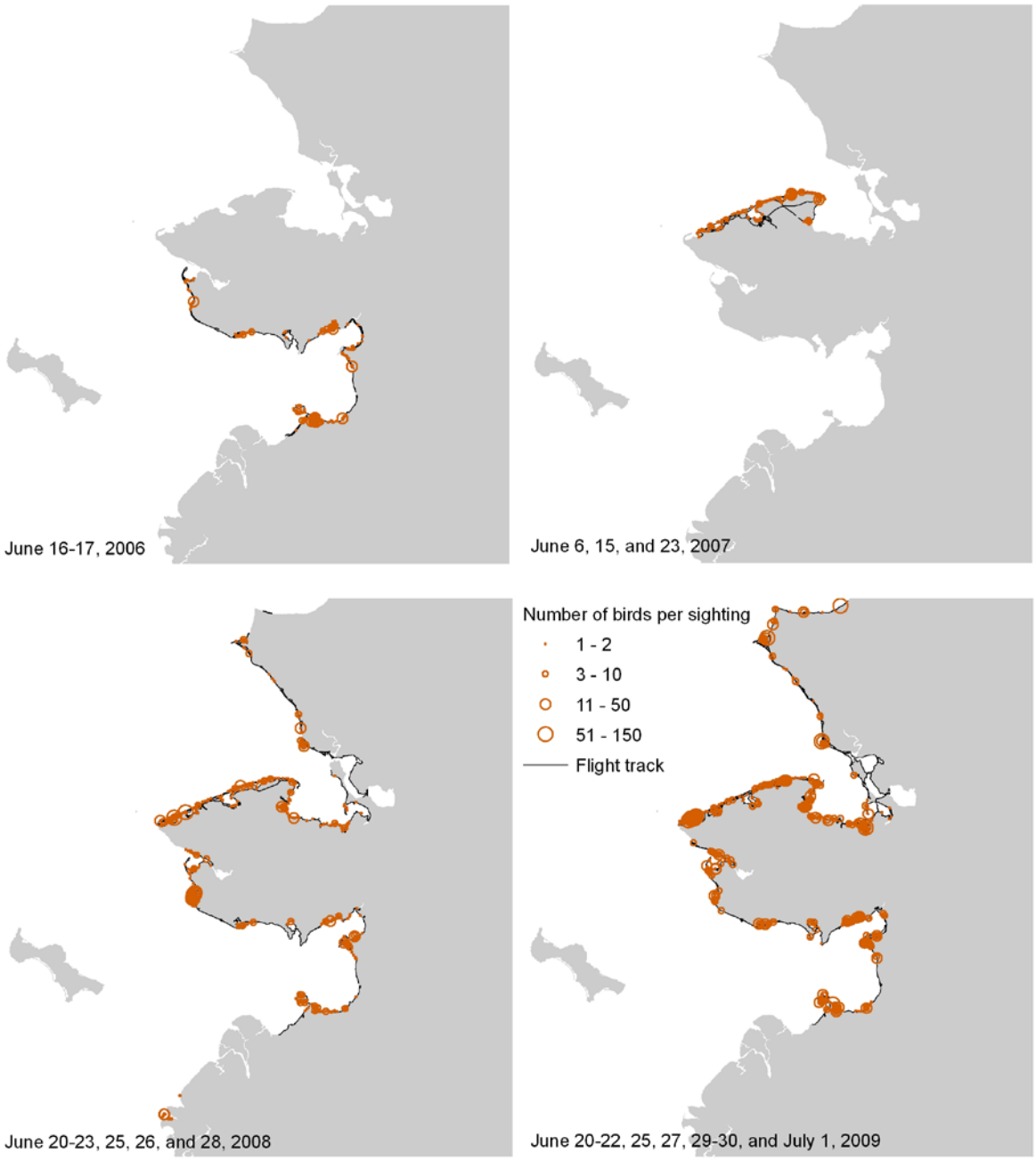

Figure 9. Common eider observations plotted along the coastal northwestern Alaska survey route, 2006–2009. Land mass is indicated by gray shading and ocean, by white shading.

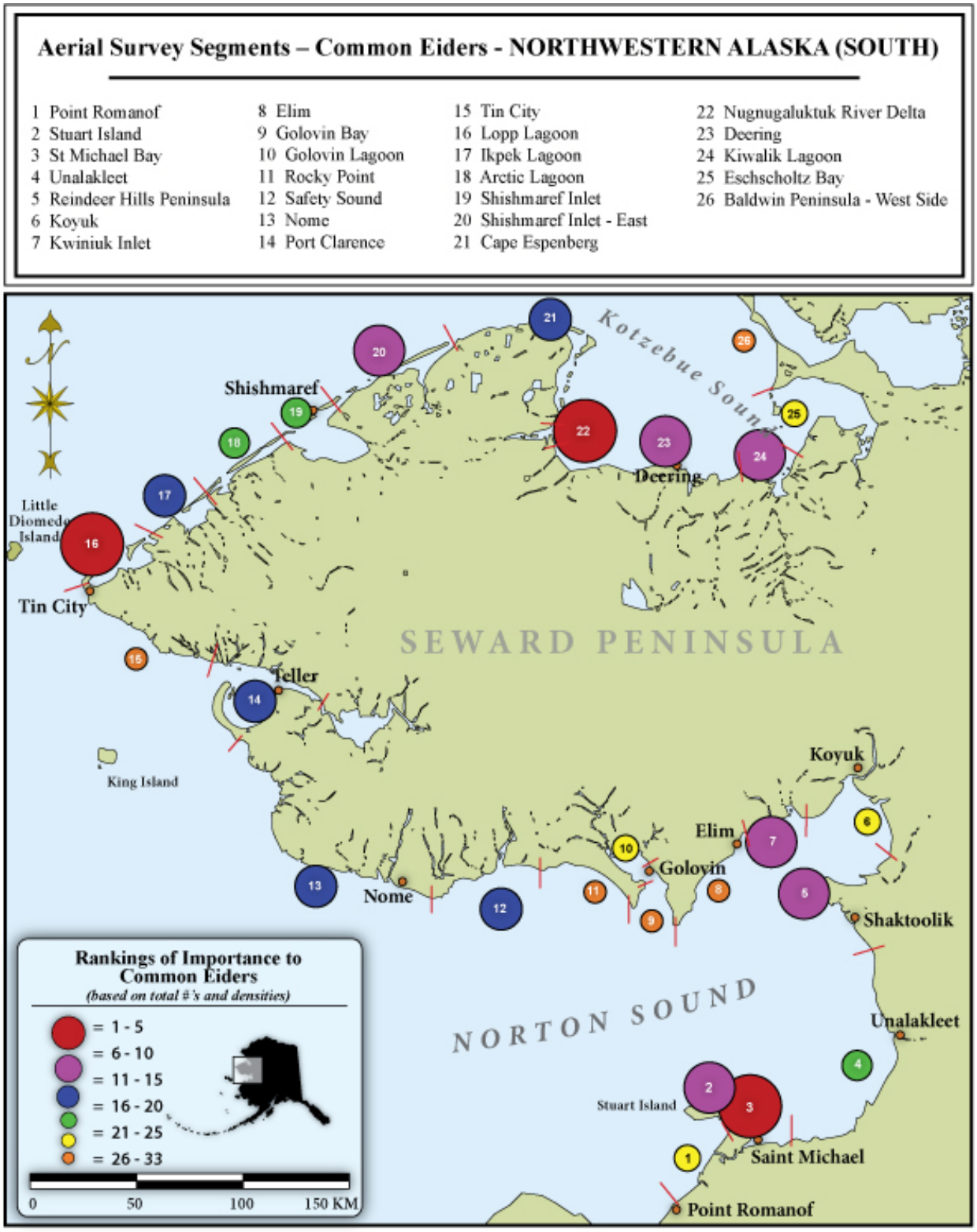

Figure 10. Rankings of survey segments (south segments) as to importance for common eiders based on the northwestern Alaska coastal surveys, 2006–2009. Ranking categories from highest to lowest are: 1) average rank value of 1-5 (3 segments); 2) average rank value of 6-10 (7 segments); 3) average rank value of 11-15 (6 segments); 4) average rank value of 16-20 (5 segments); 5) average rank value of 21-25 (5 segments); and 6) average rank value of 26-33 (7 segments).

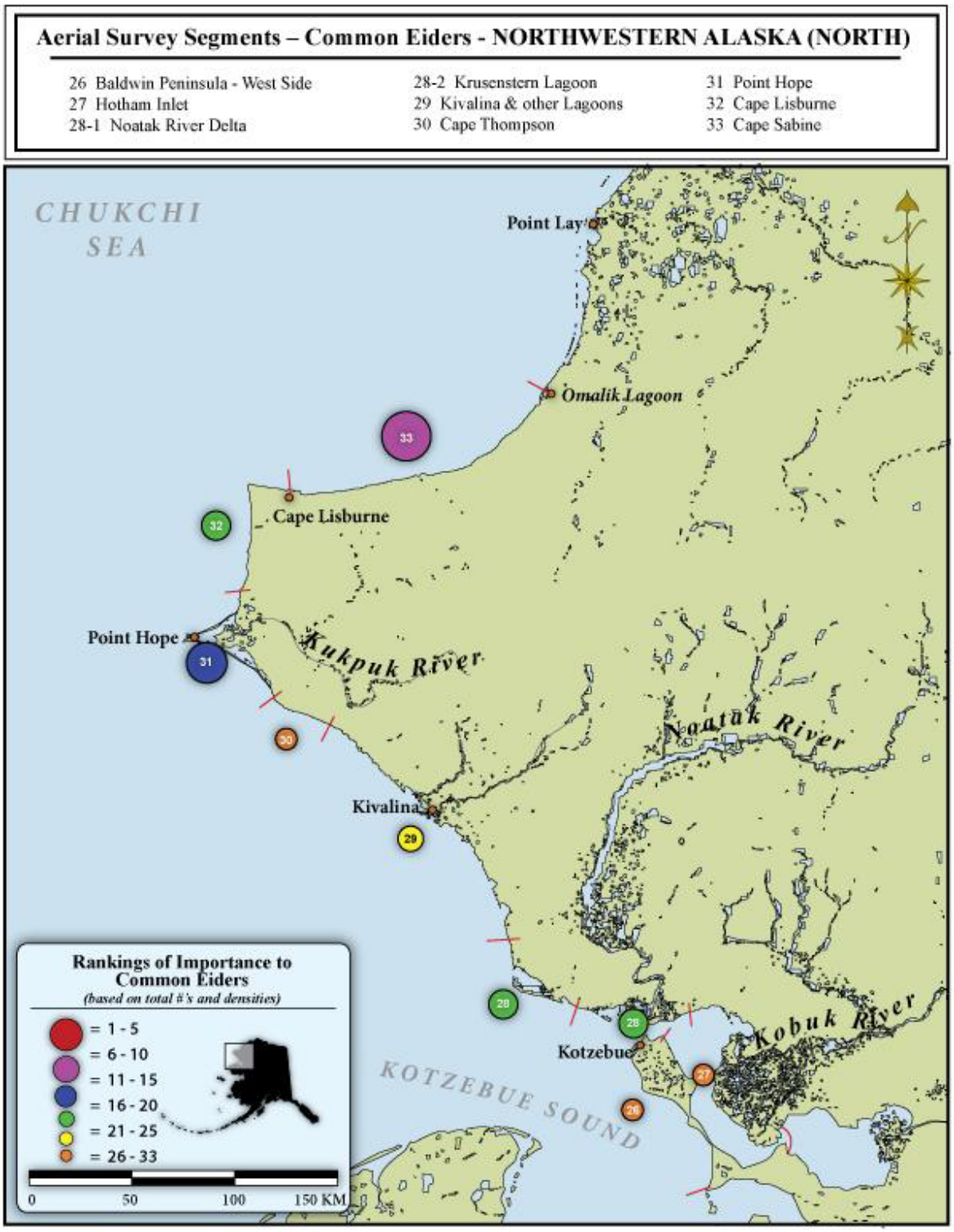

Figure 11. Rankings of survey segments (north segments) as to importance for common eiders based on the northwestern Alaska coastal surveys, 2006–2009. Ranking categories from highest to lowest are: 1) average rank value of 1-5 (3 segments); 2) average rank value of 6-10 (7 segments); 3) average rank value of 11-15 (6 segments); 4) average rank value of 16-20 (5 segments); 5) average rank value of 21-25 (5 segments); and 6) average rank value of 26-33 (7 segments).

APPENDIX 1a. Map of major geographic features and place names for the common eider aerial survey along the northwestern Alaska coast (south area), 2006-2009.

APPENDIX 1b. Map of major geographic features and place names for the common eider aerial survey along the northwestern Alaska coast (north area), 2006-2009.

APPENDIX 2. Common and scientific names of species referenced in this report, Northwestern Alaska Common Eider Survey, 2006-2009.

Family	Common name	Scientific name
Loons and grebes: (Families *Gaviidae*, *Podicipedidae*)		
	Pacific loon	*Gavia pacifica*
	Red-throated loon	*G. stellata*
	Common loon	*G. immer*
	Yellow-billed loon	*G. adamsii*
	Red-necked grebe	*Podiceps grisegena*
Cormorants: (Family *Phalacrocoracidae*)		
	Pelagic cormorant	*Phalacrocorax pelagicus*
Swans, geese, ducks: (Family *Anatidae*)		
	Tundra swan	*Cygnus columbianus*
	Canada goose	*Branta canadensis*
	Brant	*B. bernicla nigricans*
	Greater white-fronted goose	*Anser albifrons*
	Emperor goose	*Chen canagica*
	Snow goose	*C. caerulescens*
	Mallard	*Anas platyrhynchos*
	Northern pintail	*A. acuta*
	American wigeon	*A. americana*
	Northern shoveler	*A. clypeata*
	American green-winged teal	*A. crecca*
	Canvasback	*Aythya valisineria*
	Redhead	*A. americana*
	Greater scaup	*A. marila*
	Common eider	*Somateria mollissima*
	King eider	*S. spectabilis*
	Harlequin duck	*Histrionicus histrionicus*
	Long-tailed duck	*Clangula hyemalis*
	Surf scoter	*Melanitta perspicillata*
	Black scoter	*M. americana*
	White-winged scoter	*M. fusca*
	Common goldeneye	*Bucephala clangula*
	Bufflehead	*B. albeola*
	Common merganser	*Mergus merganser*
	Red-breasted merganser	*M. serrator*

APPENDIX 2 - continued. Common and scientific names of species referenced in this report, Northwestern Alaska Common Eider Survey, 2006-2009.

Family	Common name	Scientific name
Eagles: (Family *Accipitridae*)		
	Bald eagle	*Haliaeetus leucocephalus*
	Golden eagle	*Aquila chrysaetos*
Cranes: (Family *Gruidae*)		
	Sandhill crane	*Grus canadensis*
Shorebirds: (Family *Scolopacidae, Charadriidae, Haematopodidae*)		
	Whimbrel	*Numenius phaeopus*
Gulls: (Family *Laridae*)		
	Glaucous gull	*Larus hyperboreus*
	Mew gull	*L. canus*
	Slaty-backed gull	*L. schistisagus*
	Black-legged kittiwake	*Rissa tridactyla*
	Sabine's gull	*Xema sabini*
Alcids: (Family *Alcidae*)		
	Guillemots	*Cepphus spp.*
	Murres	*Uria aalge, U. lomvia*
	Puffins	*Fratercula cirrhata, F. corniculata*
Marine Mammals		
	Sea otter	*Enhydra lutris*
	Pacific walrus	*Odobenus rosmarus*
	Seal	*Phoca spp., esp. Phoca vitulina*
Land Mammals		
	Moose	*Alces alces*
	Caribou	*Rangifer tarandus*
	Muskox	*Ovibos moschatus*
	Red fox	*Vulpes vulpes*
	Brown bear	*Ursos arctos*