Species Status Summary and Information Needs

Sea Duck Joint Venture, June 2015

King Eider *(Somateria spectabilis)*

Population Size and Trends: No reliable continental population estimate is available for King Eiders, and in particular there are no current trend or abundance data available for eastern arctic Canada. Roughly 400,000 King Eiders nest in western arctic Canada and northern Alaska and an additional 100,000 or more nest in Russia and winter in the Bering Sea and North Pacific. An aerial survey provides indices of population size on the Arctic coastal plain of Alaska; average indicated total birds was about 20,000 for 2005-2014; the population appears to be stable, with an average annual growth rate of 0.988 (90% CI: 0.970 - 1.007)(USFWS, unpubl. data). Sea Duck Joint Venture and Arctic Goose Joint Venture collaborated on aerial surveys intended to provide indices of King Eider breeding population size in the western and central arctic Canada, from 2002 to 2011 and those data are still being analyzed. Counts at Point Barrow, Alaska during spring migration indicated that the western Arctic population had declined by 56% from 1976 to 1996 (from 800,000 to 350,000); counts in 2003 and 2004 suggest that numbers have stabilized or increased since the 1990s (estimated 304,000 ± 76, 254 in 2003 and 592,000 ± 172,011 in 2004) (Suydam et al. 2000, 2008; Quakenbush et al. 2009). This survey was repeated in spring 2015 but data were not analyzed at time of this writing. Aerial surveys of western Victoria Island showed a 54% decline in the breeding population between 1992-1994 and 2004-2005 (from >70,000 to ~33,000 total indicated birds) (Raven and Dickson 2006). Decreases in numbers of King Eiders wintering and molting in Greenland (most of which breed in Canada) suggest declines in the eastern Canadian breeding population (Canadian Wildlife Service Waterfowl Committee 2013).

Priority Information Needs:

1. Continue breeding population surveys timed specifically for eiders on the Alaska arctic coastal plain, as a means of monitoring population trends in Alaska.
2. Continue to develop waterfowl breeding population surveys for western and central arctic Canada, possibly in cooperation with Arctic Goose Joint Venture, as a means of monitoring population trends of King Eiders in Canada.
3. Repeat eider count at Point Barrow during spring migration every 5-10 years. Determine whether the migratory pathway of eiders past Point Barrow varies among years, to assess whether the spring migration counts are a valid means of measuring population size and trends.
4. Survey molting or wintering birds in western and southern Greenland. Although interpretation of surveys would be confounded because it is unknown whether birds come from Canada or Greenland, these surveys may be the most efficient means of monitoring population trends of Atlantic-wintering King Eiders.

Population Definition/Delineation: Satellite telemetry, banding and stable isotope studies in Alaska and Canada indicate that there are two distinct wintering populations of King Eiders – Atlantic and Pacific. On breeding grounds, king eiders are largely separated into eastern and western breeding populations, although there is an undefined area of overlap in the central arctic.

King Eiders breeding in western Canada and Alaska migrate westward, wintering in three main areas – northern Bering Sea (southeast Chukotsk Peninsula), Alaska Peninsula (particularly Bristol Bay) and Kamchatka Peninsula (Oppel et al. 2008, Dickson 2012b). Stable isotope analysis of head feathers collected from adult King Eiders captured on breeding grounds on the Arctic Coastal Plain (Kuparuk oilfield and Teshekpuk Lake) indicated that 27% wintered in SW Alaska, 45% in northern Bering Sea and 27% along the coast of Kamchatka (Oppel and Powell 2008). The eastern Canadian population winters primarily along the west coast of Greenland, as well as in the Hudson Strait area (CWS Waterfowl Committee 2013; Gilchrist et al., unpubl. data). Boundaries between the Pacific and Atlantic wintering populations are likely the Taymyr Peninsula, Russia and the east side of Victoria Island, Canada (~100-104°W) (Dickson 2012b). However, in at least one location in central arctic Canada (i.e. Queen Maud Migratory Bird Sanctuary), breeding females migrate both east and west, with 66-73% wintering in the Bering Sea/North Pacific and 24-37% in the NW Atlantic/west Greenland (Mehl et al. 2004). Also, about 20% of the females likely switched wintering regions between years (Mehl et al. 2004). Furthermore, a recent genetics study indicates that there is no genetic distinction between King Eiders wintering in the Atlantic versus those wintering in the Bering Sea and North Pacific. However, this lack of genetic differentiation may be due to historical gene flow and rapid population expansion, and current exchange between eastern and western populations may be limited (Pearce et al. 2004). Within the western population, connections between breeding and wintering areas are diffuse; eiders breeding in western Canada and Alaska used all three major Pacific wintering regions in similar proportions, and males from each wintering region migrated to areas throughout the breeding range (Dickson 2012b). From breeding grounds in northern Alaska and Northwest Territories, most males and unsuccessful females molted along the Chukotsk Peninsula, with some individuals molting at St. Lawrence Island, in the Chukchi Sea, along the Russian and Alaskan coastlines of the Bering Sea, and on breeding areas (females only); some individuals remained at molting sites throughout the winter (Oppel et al. 2008; Dickson 2012b).

Female King Eiders breeding in Alaska and western Canada show strong fidelity to breeding areas; in satellite telemetry studies, all females returned to the same areas in consecutive years, usually within 1-2 km (maximum 16 km) (Oppel and Powell 2010; Dickson 2012a, 2012b). Conversely, males captured in one Alaska breeding location were scattered across the breeding range in the following year, from Lena River Delta, Russia to Victoria Island, Canada, with the average distance between sites >1000 km (Dickson 2012b). Both males and females show high return rates to molt sites, with individuals molting within 2-44 km of sites used in the previous year (Dickson 2012a); another study found distances between molt sites in consecutive years averaged 6.2 km for males and ~50 km for females (Phillips and Powell 2006). Stable isotope analysis of primary feathers has also shown inter-annual fidelity to molt sites (Knoche et al. 2007). However, there were low return rates to winter sites, with many individuals also making large movements during winter (Oppel et al. 2008).

Migratory patterns of western King Eiders are relatively well studied, with much less known about the eastern breeding population, although satellite telemetry studies have been done and indicate that a substantial portion of Canadian breeding King Eiders winter in Greenland; further analyses are underway (G. Gilchrist, pers. Comms).

It may be prudent to monitor and consider managing King Eiders in North America as two populations (Atlantic and Pacific) based on wintering area. To do so on breeding populations would require more information on location and extent of overlap of breeding ranges in arctic Canada for king eiders that winter on opposite coasts.

Priority Information Needs:

1. Continue using satellite telemetry, banding, and stable isotopes to determine molting and wintering areas of King Eiders from central arctic Canada to better define the extent and area of overlap of eastern and western populations on the breeding grounds.

<u>Population Dynamics</u>: Recent studies on the Alaska Coastal Plain and at Karrak Lake, NU have provided information on productivity, survival and recruitment. A study using data from two sites (Teshekpuk and Kuparuk) on the Alaska Coastal Plain estimated high annual adult survival (0.94; 95% CI: 0.86-0.97) and a decreasing population (λ=0.981, 95% CI: 0.978-0.985) (Bentzen and Powell 2012). Population growth was most sensitive to changes in adult female survival, but retrospective analysis indicated that variation in duckling survival accounted for 66% of variation in λ (Bentzen and Powell 2012). While duckling survival was generally low, duckling and nest survival may be more responsive to management actions than would adult survival (Bentzen and Powell 2012). Nest survival was estimated at 0.21 to 0.57, and varied across sites and years (Bentzen et al. 2008). At Kuparuk, complete brood loss occurred in 80% of tracked broods, with most mortality within the first 10 days after hatch (Phillips and Powell 2009). Average brood size was 4.2 ducklings; daily survival estimate for broods was 0.855 ± 0.026 and estimated survival to 30 days was 10.3% (95% CI: 2.0-49.3) (Phillips and Powell 2009). At Karrak Lake, complete loss of broods accounted for 84% of all duckling mortality and most brood loss occurred within the first two days after hatch (Mehl and Alisauskas 2007). Estimated apparent duckling survival to 24 days was 0.10 (95% CI: 0.05-0.015) and apparent brood survival was 0.31 (95% CI: 0.13-0.50) (Mehl and Alisauskas 2007). Pre-fledging King Eiders implanted with satellite transmitters had estimated annual survival of 0.67 (95% CI: 0.48-0.80) during the first year and no mortality events were recorded during second year (n = 21) (Oppel and Powell 2010At the age of 2 years, 88% of females returned to their natal areas (within 25 km) but based on timing of movements did not appear to breed and males remained at sea (Oppel and Powell 2010).

Priority Information Needs:

1. Determine breeding propensity, reproductive success, recruitment and age-specific survival of King Eiders in several nesting areas (to estimate variation among breeding areas, dispersed versus colonial nesters, etc).
2. Once key population parameters have been obtained, develop a population model for King Eiders.
3. Investigate feasibility of using regular winter surveys to determine age and sex ratios in populations.

4. Investigate feasibility of using fall migration counts at Barrow, Alaska as an index of annual productivity of the Pacific-wintering population.

Population Ecology: There have been only a few localized studies of nesting ecology, and very little is known about factors affecting the survival of King Eiders at sea during molt, winter and migration. Absence of open water in the Beaufort Sea during spring migration has caused the death of up to 100,000 King Eiders. It is not known whether this also occurs on wintering areas. At Karrak Lake, predation was the main cause of nest failure, and nest success was higher on islands (30-89%) than at mainland locations (Kellett et al. 2003). Conversely, at Kuparuk and Teshekpuk, nest site seclusion (i.e. on islands) and increased incubation constancy did not increase nest survival, and nest survival was negatively affected by nest visitations by researchers (Bentzen et al. 2008). Nest survival was higher after foxes were removed from the breeding area, suggesting that predator control could be used to increase breeding success in this area (Bentzen et al. 2008). Avian predators may also impact nest success; researchers observed successful predation by Glaucous Gull and predation attempts by Parasitic Jaeger, and speculated that the abundance of predators may be higher around communities near oilfields than in undeveloped areas (Phillips and Powell 2009). An extreme decline in the breeding population near Holman, Victoria Island (92% from 1992-1994 to 2004-2005) was concurrent with growing numbers of Glaucous Gulls, which prey on both eggs and ducklings (Raven and Dickson 2006). A larger human population in Holman, with increased availability of anthropogenic food sources may be supporting higher numbers of Glaucous Gulls and other predators, such as Common Raven and Arctic Fox (Raven and Dickson 2006). Phillips and Powell (2009) found that females that joined creches were the only ones that successfully raised ducklings to 30 days while at Karrak Lake, larger females with earlier hatch dates raised more ducklings and survival was higher for ducklings on smaller ponds away from a central nesting area (Mehl and Alisauskas 2007).

Priority Information Needs:

1. Study nesting ecology of King Eiders at several locations across the arctic.
2. Study winter ecology (could compare survival of King Eiders in polynia in the northern Bering Sea to their survival in areas south of the ice-edge).
3. Determine important factors (weather, predators, food, etc.) affecting survival and fitness of the species throughout its range during the molting period.
4. Study feeding ecology on spring staging areas in Chukchi Sea and in southeastern Beaufort Sea to assess importance of area as an energy source for survival and productivity.

Habitat requirements: Recent satellite telemetry has contributed information on at-sea locations of King Eiders during migration, molt and winter, thus providing new information on habitat requirements at a broad scale. King Eiders breeding in Alaska wintered in three distinct areas – northern Bering Sea (Cape Chukotskiy, Russia), southwestern Alaska (inner Bristol Bay) and Kamchatka Peninsula (Oppel et al. 2008). Other satellite telemetry studies have identified key marine areas for western King Eiders in the southeastern Beaufort Sea, west coast of Banks Island, eastern Chukchi Sea, Bristol Bay, Bering Sea of the southeast Chukotsk Peninsula and Anadyr Bay (Dickson 2012b). Important fall staging areas were in southern Bering Sea east of St. Lawrence Island, in Kuskokwim Bay, and along the Russian coastline from Gulf of Anadyr to

Olyutorskiy Bay (Oppel et al. 2008). Of 190 King Eiders marked with satellite transmitters, 74% used the eastern Chukchi Sea during southward migration (late June to early November) and during spring migration, all birds migrating to breeding grounds in western North America (n = 62) and 6 of 11 males migrating to breeding grounds in Siberia used this area for ≥ 1 week (Oppel et al. 2009); Ledyard Bay, AK was a particularly heavily used site (Oppel et al. 2008; Dickson and Smith 2013). King Eiders are present in Bristol Bay, Alaska throughout the annual cycle and are broadly distributed throughout the bay; on average, they were found in water depths of 6.3 m and were 10.6 km from shore (Schamber et al. 2010).

During pre- and post-breeding migration, male and female King Eiders used the Alaskan Beaufort Sea; pre-breeding females were on average farther from shore (26.5 km) and in deeper water (28.8 m) than males (12.0 km from shore, 11.1 m water depth) (Phillips et al. 2007). However, during post-breeding migration, females were closer to shore (12.8 km) and in shallower water (11.7 m) than males (14.8 km from shore, 12.6 m water depth) (Phillips et al. 2007). Pre-breeding locations were scattered from Point Barrow to the Canadian border, with >40% of locations >20 km from shore. Post-breeding males were widely dispersed, from Oliktok Point to Point Barrow and up to 40 km offshore while females were concentrated in Harrison Bay and upper Smith Bay (Phillips et al. 2007). King Eiders breeding in western Canada used the southeastern Beaufort Sea for spring staging for 3-4 weeks (Dickson 2012), with key areas near Komakuk, Yukon, Tuktoyaktuk Peninsula, and west coast of Banks Island and they avoided areas near the mouth of the Mackenzie River, where the water is very turbid (Dickson and Smith 2013). During spring staging, they mainly used habitat within the flaw lead, with open water or scattered ice, and then further selected habitat based on variables such as water depth, proximity to ice edge; about 1/3 also used habitat within the pack ice (Dickson and Smith 2013). Relative to available habitat, they selected shallower water depths (mostly 20-40 m), narrower portions of the flaw lead, and were more likely to be within 2 km of the flaw lead edge; very few used landfast ice or solid ice habitats and none were observed in near-shore waters (Dickson and Smith 2013). King Eiders were in deeper water, farther from shore and farther from the landfast ice edge than Common Eiders in the same general area; furthermore, King Eiders were in deeper water than typical for this species and were not using the shallowest water available, so perhaps they were choosing areas based on benthic food availability (Dickson and Smith 2013). On average, they were located in water depths of 30m, 48 km from shore, 31 km from pack ice edge, 17 km from landfast ice edge, with a flaw lead with of 36 km (Dickson and Smith 2013). This study also found a high degree of overlap of core use areas and potential oil and gas development (Dickson and Smith 2013). Habitat association modeling of King Eider breeding distributions in Queen Maud Gulf and Rasmussen Lowlands, Nunavut fpredicted higher probability of encounter at low elevations distributed parallel to the coast (Conkin and Alisauskas 2013). Wet sedge meadow was the principal determinant of encounter, but they were also associated with marine ice and meltwater, hummock graminoid tundra and lichen-heath tundra, and were absent in areas of exposed peat (Conkin and Alisauskas 2013). However, the model performance was relatively poor, especially for Rasmussen Lowlands, and perhaps habitat selection occurred at a finer scale than was measured (Conkin and Alisauskas 2013). On the Arctic Coastal Plain, they selected nest sites close to water, on islands and in areas with high willow cover, but not near conspecifics or Glaucous Gull nests (Bentzen et al. 2009). The most common prey items in ponds where King Eiders foraged were chironomid larvae and worms, ranging from 1-30 mm in length (Oppel et al. 2011).

Many King Eiders marked with satellite transmitters wintered on or near molting areas, and some individuals also moved large distances during winter, with only 32% of marked birds remaining at one site all winter (Oppel et al. 2008). Winter movement patterns were highlly variable among individuals, but individuals wintering at lower latitudes moved more; there were more movements later in winter, and sea ice concentration increased at sites after individuals departed (Oppel et al. 2009). Mean winter home range size for western King Eiders was 6905 ± 11 523 km^2 , but varied greatly, ranging from 13 to 66,722 km^2 (Oppel et al. 2008). During molt and winter in the Bering Sea, King Eiders were located closer to shore, in shallower water, with lower salinity than random locations; during winter, they were also in areas with lower ice concentrations (Phillips et al. 2006).

Priority Information Needs:

1. Identify and quantify characteristics of habitats used for staging in the Beaufort Sea during spring and molt/fall migration.
2. Characterize habitats at molting and wintering sites.
3. Collect data on King Eider food habits on nesting, brood-rearing, molting and wintering areas. These data will be useful in evaluating other information needs including contaminant loads and may provide insights into limiting factors.
4. Quantify the characteristics of habitats used for nesting and brood-rearing.

Harvest Assessment: The sport harvest of King Eiders is very low; the mean annual harvest from 2000 to 2011 was 124 birds in Canada (all from eastern Canada) and 135 birds in the US (majority on east coast, some in Alaska) (Rothe et al. 2015). The Canadian estimate may be biased slightly low, as approximately 10% of the thousands of eiders harvested in Newfoundland were King Eiders, mostly juveniles, which may be overlooked in the harvest statistics (Gilliland and Robertson 2009; Rothe et al. 2015). During 2004-2012, the Alaska subsistence harvest averaged 16,024 birds/year, mostly on the North Slope and Yukon-Kuskokwim Delta (Rothe et al. 2015). The egg harvest was estimated at 925 eggs/year, mostly from the North Slope and Northwest Arctic, but also from Bering Strait-Norton Sound, which is outside of the known breeding range – it is unclear whether eggs were misidentified or if the breeding range extends further south than previously thought (Rothe et al. 2015). In western arctic Canada, the annual eider harvest was around 3,500 birds/year (1988-1994), with the majority being King Eiders, while in Nunavut the annual eider harvest was estimated at ~6,000 birds per year (1996-2001), but most were Common Eiders (Rothe et al. 2015). Subsistence hunters at Holman on Victoria Island were estimated to take 4-7% of the regional subpopulation; these rates were thought to be sustainable but there is some concern about a localized negative impact (Byers and Dickson 2001; CWS Waterfowl Committee 2013). A large proportion of the western North American breeding population winters along the Russian coast where the level of harvest is unknown, but may be relatively high (Syroechkovski and Klokov in Rothe et al. 2015). In Greenland, 10,000 to 20,000 King Eiders are harvested by commercial and subsistence hunters, and many of these may belong to the eastern Canadian breeding population. In Newfoundland, the sex ratio of harvested King Eiders was not significantly different from 1:1 (54.7% male), and 85% of harvested male King Eiders were immatures (Gilliland and Robertson 2009).

Priority Information Needs:

1. Update and improve estimates of King Eider harvest in Alaska and Canada.
2. Determine the level of harvest of North American breeding populations of King Eiders in both Russia and Greenland.
3. Determine harvest composition (i.e. adults, immatures, or juveniles; males or females) and seasonal timing of harvests. Model the populations (eastern separately from western) to determine the impact of various harvest levels on eider population size.

Parasites, Disease, Contaminants: There is general concern about contamination of benthic foods in northern areas. Some data has been obtained on levels of trace elements in King Eiders. Selenium and zinc levels tend to be high in King Eiders in the western arctic, while cadmium levels are high in the eastern arctic (Wayland et al. 2008). For adult females captured at Karrak Lake, a weak negative relationship between blood mercury levels and annual survival was found, mercury levels were generally low and blood samples may not adequately represent long-term mercury exposure, so results should be interpreted cautiously (Wayland et al. 2008). There was no relationship between survival and levels of cadmium, lead or selenium, or any effects on recapture probability, a surrogate measure for breeding effort (Wayland et al. 2008). Repeated measures of blood contaminant levels in multiple years showed moderate to strong evidence of correlation of cadmium, selenium and lead levels in individuals over time, but not mercury; this could indicate year-to-year fidelity to wintering and/or staging areas with differential exposure to contaminants; individual prey preferences; or individual variation in metabolism and excretion of metals (Wayland et al. 2007). For King Eiders captured at Prudhoe Bay, arsenic was detected in 13% of sampled birds, barium in 47%, cadmium in 33%, and mercury in 87%; none had blood lead levels above the subclinical toxicity threshold (0.2 µg/g); all had selenium levels higher than the accepted background level (0.4 µg/g); and overall concentrations of arsenic, barium, cadmium and mercury were not at levels associated with toxic effects (Wilson et al. 2003). On Alaska's North Slope, a health assessment intended to provide baseline data for healthy individuals during the breeding season found that individuals of both sexes were in excellent body condition, and that total protein, calcium, alkaline phosphatase, amylase and globulin levels were higher in females than males, likely because of differences in reproductive physiology (Scott et al. 2010). Levels of organochlorines and other potentially harmful materials in four species of eiders were below what are considered to be harmful toxic thresholds (Stout et al. 2002). Avian influenza viruses were isolate in 1.4% of King Eiders sampled in Alaska during 2006-2007 (Ip et al. 2008) and low pathogenic avian influenza virus was detected in King Eiders sampled on St. Lawrence Island (Ramey et al. 2010), but generally, little is known about parasites and disease in King Eiders.

Priority Information Needs:

1. Examine exposure to avian cholera, avian influenza and other communicable diseases.
2. Determine prevalence and effects of parasite loads.
3. Determine physiological effects of selenium, cadmium and other contaminants on King Eiders.
4. Opportunistically sample King Eiders for contaminants, disease and parasites.

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