Species Status Summary and Information Needs

Sea Duck Joint Venture, July 2016

Steller's Eider (*Polysticta stelleri*)

Population Size and Trends: The current global population of Steller's Eider is estimated at 110,000-125,000 and is classified as vulnerable by the International Union for the Conservation of Nature (BirdLife International 2016, 2015). In 2006, the global population estimate was 200,000-220,000 and in the 1960s was 400,000-500,000 (reviewed in Zydelis et al. 2006). There are two wintering populations – an Atlantic wintering population that breeds in western arctic Russia and a Pacific wintering population that breeds mainly in eastern arctic Russia with a small proportion (~1%) breeding in Alaska (USFWS 2015). In Russia, the Steller's Eider is considered rare and is recorded in the Red Book, although an extensive survey of the Russian Far East indicated over 100,000 birds in the Pacific breeding population (Hodges and Eldridge 2001). The eastern Atlantic wintering population was estimated at 30,000-50,000 during 1990-1995 but in 2006 was estimated at 10,000-15,000 (>50% decline in 10 years) (Zydelis et al. 2006).

For Pacific wintering Steller's Eiders, a spring aerial survey conducted in southwest Alaska in most years from 1992 to 2012 provided an annual index to population size while birds migrated northward along coastal habitats. Steller's Eiders are also counted during spring and fall Emperor Goose surveys along the Alaska Peninsula. These three surveys show high annual variation but very similar population trends (ranging from -4.2 to -2.4% per year from 1992-2012;(Wilson et al. 2013a). The spring eider survey data from 1992-2012 provided an average annual index of 81,453 birds (range: 54,888-137,904) and there was a 2.4% per year decline during that period (Larned 2012). The Steller's Eider count from the 2014 spring Emperor Goose survey of the Alaska Peninsula was 15,212; the long-term average from 1981-2012 was 48,652; the low count in 2014 may have been due to mild spring conditions and early migration (Wilson and Dau 2014). The Steller's Eider count from the 2013 fall Emperor Goose survey (southwest Alaska) was 47,321; the average from 1979-2012 was 59,612 with 0.4%/year increase during 1979-2013 (Dau and Wilson 2013).

The precision of the spring Steller's Eider Pacific population survey was very dependent on weather, ice conditions, etc, so attempts have been made to develop a more reliable monitoring method (Larned 2012). The feasibility of a fall molt survey in Alaska has been tested in recent years starting in 2012 (Wilson et al. 2013a); this photographic survey of molting areas along the north side of the Alaska Peninsula in late August has reduced complexity, improved safety, and is more cost-effective than the spring survey (Wilson et al. 2013a). Preliminary estimates indicate about 70,000 molting birds are present within the surveyed area in late August. About 99% of birds observed were near the Seal Islands and at Nelson and Izembek lagoons (Anderson and Bowman 2015). Numbers molting at Izembek Lagoon appear to have decreased substantially since 1970s; the average count during 1977-1985 was 40, 464 and 2012 counts were 4,148 and 5,076, suggesting a decline of 5.6% per year in numbers of birds present in that

lagoon from 1977-2012 (C. Dau pers. comm. in Wilson et al. 2013a, Anderson and Bowman 2015).

The Alaska-breeding population was listed as a threatened species in 1997 under authority of the U. S. Endangered Species Act based on a substantial decrease in the species range and vulnerability of the remaining Alaska-breeding population to extirpation. Steller's Eiders have essentially disappeared as a breeding species from the Yukon-Kuskokwim Delta where they were once numerous. The breeding population on the Arctic Coastal Plain (ACP) is highly variable but has been estimated at 576-680 individuals, with highest densities around the Barrow area (Stehn and Platte 2009, Stehn et al. 2013).

Three surveys have been used to monitor the breeding population in northern Alaska – the ACP Waterfowl Survey, North Slope Eider (NSE) Survey and Barrow Triangle (ABR) Survey; there is wide variation among the surveys and much uncertainty in the estimates (Stehn and Platte 2009). The Standard ACP Survey was conducted from 1986-2006 in late June-early July, which was too late in the season to accurately capture numbers of breeding eiders; the North Slope Eider (NSE) Survey ran from 1992-2006 and was well-synchronized with eider breeding chronology but covered a smaller geographic area; beginning in 2007, the two surveys were combined, with an area similar to the 1986 ACP survey but timing as in the 1992-2006 NSE Survey (Larned et al. 2012). The ABR Survey, initiated in 1999, covers a much smaller area near Barrow. Steller's Eiders nest at very low densities throughout much of the ACP (e.g., in 2011 only one pair was observed on the ACP survey) and the density in the Barrow area is ~7 times greater than in the entire north coastal stratum of the survey (Larned et al. 2012).

Based on pooled analyses of the ACP and NSE survey data, the average population growth rate from 1989-2014 was 0.983, 90% CI: 0.913-1.058) and from 2005-2014 was 0.981 (90% CI: 0.768-1.253; Stehn et al. USFWS unpublished). However, due to low densities and high interannual variability in nesting, sampling error is high and population trends are imprecise (Stehn et al. 2013). Using just the ACP survey data, the mean population growth rate from 1992-2011 was 0.990 (90% CI: 0.904-1.084) and from 2002-2011 was 0.966 (90% CI: 0.776-1.201) (Larned et al. 2012). The ABR Survey in 2015 estimated 56 Steller's Eiders; estimated totals (uncorrected for detection rate) for the Barrow Triangle survey have ranged from 0 (in 2009) to 240 (in 2014; Obritschkewitsch and Ritchie 2016).

Priority Information Needs:

1. Determine the feasibility of re-establishing the Western Alaska-breeding subpopulation by releasing Steller's Eiders to the Yukon-Kuskokwim Delta using eggs or ducklings from the captive flock held at the Alaska SeaLife Center in Seward, Alaska (USFWS 2015).
2. Estimate population size and trend for the Alaska-breeding and Pacific populations. Continue aerial surveys including the intensive surveys near Barrow (Barrow Triangle Survey) and the extensive Arctic Coastal Plain survey. Continue to evaluate and improve the Alaska Peninsula fall molting survey.
3. Continue standardized ground-based breeding pair and nest surveys at Barrow.
4. Update Population Viability Analysis.

5. Develop visibility correction factor for aerial surveys of Steller's Eiders on the breeding grounds.

Population Delineation: There are two geographical populations of Steller's Eiders with separate breeding and winter distributions. The Atlantic population winters in the Barents and Baltic Seas and nests in western Siberia. The Pacific population winters primarily in Alaska in the Bering Sea, and mainly breeds on the maritime tundra of northeast Siberia. The boundary between the Atlantic and Pacific populations may be around the Taymyr Peninsula, Russia but this may be an emerging and/or ephemeral border (Pearce et al. 2005). A smaller subpopulation breeds at low densities across the Arctic Coastal Plain of Alaska, with highest densities near Barrow. The Alaska breeding range may once have encompassed an area extending from the eastern Aleutian Islands along the western and northern Alaskan coasts to the Canadian border, but was likely not continuous through this area. The Yukon-Kuskokwim Delta was an important breeding area and nesting also occurred on St. Lawrence Island in the Bering Sea and other islands near the Alaskan mainland (Fay and Cade 1959, Fredrickson 2001).

Steller's Eiders implanted with satellite transmitters on breeding grounds near Barrow were distributed during winter along the Alaska Peninsula; there was no evidence of segregation from the Russian-breeding population (Martin et al. 2015). During molt migration many stopped along the Chukotka coast in Russia, particularly males; however, Alaska-breeding birds appeared to use Kuskokwim Shoals with a much higher frequency than Russian breeders, so there may be some behavioral separation (Martin et al. 2015). Four individuals were tracked in the following spring – three males migrated to Russia and one female returned to the breeding area in Alaska (Martin et al. 2015). Of 24 Steller's Eiders captured during winter at Kodiak Island, Alaska, 16 individuals migrated to breeding areas along the Russian Arctic coast from the Chukotka Peninsula to Taymyr Peninsula (particularly the Indigirka –Yana lowlands); five (assumed to be non-breeding) were located in nearshore waters of Russia and Alaska; and three died/transmitters failed (Rosenberg et al. 2014). Thirteen individuals were tracked through the summer to molt and sites were broadly distributed along the coast of Alaska; 12 of these 13 returned to Kodiak Island to winter (Rosenberg et al. 2014). Of eight nesting females captured near Barrow in 2012, two had been previously marked, and their 2012 nest sites were ~3 km from the original nests (Safine 2013). From the mid-1990s to 2014, eight hens banded near Barrow had been recaptured in subsequent years; the time between captures ranged from 1-12 years and the distance between nests from 0.1-6.3 km (USFWS 2015).

Genetic analysis of samples collected from five locations in Alaska, Russia and Norway, during breeding, molt and winter indicated low levels of population differentiation within Atlantic and Pacific nesting areas (Pearce et al. 2005). There were higher levels of differentiation between Atlantic (Russian breeders) and Pacific (Russian and Alaskan breeders) regions, but only for mtDNA, which suggests female-biased philopatry (Pearce et al. 2005). Microsatellite data indicated no sub-population structure despite evidence of multiple breeding areas based on band-recovery data; insufficient time since historical population expansion may account for absence of genetic spatial structure but contemporary behaviors (e.g. periodic non-breeding) may also contribute to genetic homogeneity (Pearce et al. 2005).

A captive flock of Steller's Eiders has been established at the Alaska Sea Life Center (ASLC), with individuals hatched from eggs collected from nests on the Arctic Coastal Plain near Barrow in 2005-2006 (USFWS 2012).

Priority Information Needs:

1. Better document linkages between breeding, molting, wintering and staging areas.
2. Understand how eiders using Kuskokwim Shoals relate to the listed population.
3. Acquire more genetic samples opportunistically from Russia and Alaska.
4. Estimate breeding site fidelity of adult females and natal philopatry. Examine site fidelity and philopatry through genetic and mark-recapture methods.
5. Estimate site fidelity and the shifts in distribution among molting areas.

Population Dynamics: In a mark-recapture study, conducted at key molting sites on the Alaska Peninsula during 1993-2006, average annual survival was estimated at 0.86 (SE = 0.030) for females and 0.87 (SE = 0.018) for males and the average annual population growth since 1998 was approximately 1.0 for both sexes (Frost et al. 2013). From 1991-2012, average Mayfield nest success in the Barrow area was 0.35 (SE = 0.07) and in 2012, daily brood survival rate was estimated at 0.984 ± 0.008 and brood survival probability (to 36 days) was 0.57 (95% CI: 0.22-0.81; Safine 2013).

Priority Information Needs:

1. Key demographic parameters for population modeling. Continue nest and brood monitoring at Barrow.
2. Update and evaluate Population Viability Analysis with the most recent survey and demographic data.
3. Determine female breeding area fidelity by capturing, marking and re-sighting hens at Barrow.

Population Ecology: Studies of nesting ecology in Alaska have demonstrated high annual variation in nesting propensity, and that nesting is positively related to high lemming numbers (probably related to prey-switching by predators). During years in which there is little or no nesting in the Barrow area, it is unknown whether individuals forego nesting entirely or if they nest elsewhere on the Arctic Coastal Plain of Alaska or Russia in those years. During 1999-2012, ground surveys in the Barrow study area found that pair density ranged from 0.09-0.98 males/km^2 in years when nests were found and and 0-0.16 in years when nests were not found near Barrow (Safine 2013). Control of arctic fox (an important nest predator) in the Barrow area appears to increase nest survival rates; prior to fox control efforts, mean nest survival was 0.23 ± 0.09 during 1991-2000 but was 0.47 ± 0.08 during 2005-2012 (Safine 2013, Gilsdorf and Rossi 2008 in Engeman et al. 2009). Prior to fox control, there were nesting efforts in half the years (7 of 14 years; 1991-2004) while during fox control (2005-2015) there were nests found in all but one year (10 of 11 years; Graff 2016). Video monitoring of sea duck nests near Barrow revealed predation by jaegers (Parasitic and Pomarine), Glaucous Gulls, Snowy Owls and Arctic Fox (Safine 2013, 2015). Video monitoring also demonstrated that it can be very difficult to correctly identify predators based on evidence left at nests (Rojek et al. 2006).

Priority Information Needs:

1. Determine the feasibility of using non-lethal methods to reduce avian nest predation.
2. Examine the efficacy of the fox control program at Barrow. Is the program effective at increasing nest survival of Steller's Eiders?
3. Confirm identity of predator species causing egg/young loss.
4. Monitor changes in distribution and abundance of predators at Barrow.
5. Determine the number and causes of infertile and inviable eggs in the Barrow breeding population.

Habitat Requirements: Breeding, molting and winter habitat needs of Steller's Eiders are not well studied, although the locations of many key areas have been documented. Critical habitat for the Alaska-breeding population has been designated at breeding areas of the Yukon-Kuskokwim Delta, and several molting and staging areas along the Alaska Peninsula and nearshore waters of western Alaska. However, the nesting area around Barrow has not been included in the designated critical habitat.

During the early breeding season near Barrow, Steller's Eiders were most commonly observed in *Arctophila* ponds and most nests were near permanent waterbodies, primarily *Carex* and *Arctophila* ponds (Safine 2013, Rojek 2008). Ducklings mainly used shallow *Carex* and *Arctophila* ponds (on average, <200 m long, ~20 cm deep, with 40% coverage of emergent vegetation and salinity <0.5 ppt; Safine 2013). Broods and adult females sometimes used nearby marine areas in the Chukchi and Beaufort seas after fledging (USFWS 2015; Safine 2013).

During molt migration, Alaskan breeding Steller's eiders stop and rest in areas of the Alaska Chukchi Sea, often in nearshore waters (within 2 km or 1 nmi of shore) near Ledyard Bay and Icy Cape (BOEM 2010, Martin et al. 2015). There is less use at more northerly locations near Wainwright and Peard Bay. Over 50% of individuals marked with satellite transmitters on breeding grounds near Barrow used Kuskokwim Shoals during molt (Martin et al. 2015) and a previously unknown molting area, used by a minimum of 2,500 Steller's Eiders annually, was recently located in Kamishak Bay, Cook Inlet, Alaska (Rosenberg et al. 2014).

Kuskokwim Shoals is also an important spring staging area, used for 3-5 weeks, despite the presence of open water further north (Martin et al. 2015). Steller's Eiders likely use spring leads in sea ice for feeding and resting during northward migration, but there is little information on habitat use during this time (USFWS 2015). Wintering individuals marked with satellite transmitters on breeding grounds near Barrow were distributed throughout the coastline of the Alaska Peninsula, but individuals used small areas (5-40 km in width) within the winter range (Martin et al. 2015). Locations during winter documented frequent nighttime use of deeper water habitats (up to 30 m) during December to April, these habitats may be used for resting and/or predation on zooplankton species such as euphausiids (Martin et al. 2015). Steller's Eiders tracked by VHF transmitters near Dutch Harbor, Alaska foraged for only 2.7 ± 0.6 hours/day, indicating high food availability which may be linked to eutrophication causing increased populations of invertebrate prey (Reed and Flint 2007). Mean winter range size was

5.1 ± 1.3 km^2, and predation risk from Bald Eagles may have caused ducks to move offshore when not foraging (Reed and Flint 2007).

Based on data from molting adults at Izembek Lagoon, the lowest estimates of annual survival coincided with a brief warming event in the Pacific Decadal Oscillation (1997-98) after which higher and increasing estimates of annual survival occurred when cooler conditions returned in the Bering Sea (Frost et al. 2013). Potential breeding habitat availability in 2040 was modeled under differing climate projections and oil and gas development scenarios on the Arctic Coastal Plain (Fuller et al. 2008). Oil and gas development was predicted to cause decreased habitat availability while the effect of climate change was variable, depending on the degree of warming, with a possible southward shift in the breeding area (Fuller et al. 2008). Oil and gas exploration and development in the Chukchi Sea could have negative impacts, including mortality caused by disturbance, collision, and oil/toxic pollution (BOEM 2010).

Priority Information Needs:

1. Identify and protect important non-breeding habitats of the listed population, especially in the Chukchi Sea.
2. Investigate effects of climate change on marine and terrestrial habitats and foraging ecology.
3. Continue education at Barrow, including Eider Journey, Barrow Bird and Cultural Camp, Migratory Bird Calendar contest and North Slope Outreach Team meetings for Barrow residents to reduce disturbance of nests and ducklings.

Harvest Assessment: There is no legal harvest of Steller's Eiders in Alaska, as the hunting season was closed statewide in 1991, after a petition was filed for listing under the Endangered Species Act (Rothe et al. 2015). A few are taken incidentally and illegally by subsistence hunters. Since 1965, Steller's Eiders wings have only been recorded in 10 years of the wing survey and since 1991 an annual average of 0.1 wings have been submitted to the survey (Rothe et al. 2015). Based on the wing survey data, harvest estimates were <100/year and since 1991the total statewide estimated harvest was 3.7 birds/year; however, a lack of data makes it challenging to estimate harvest accurately (Rothe et al. 2015). The estimated total subsistence harvest in Alaska was 229 birds/year, mostly in the Northwest Arctic, Bering Strait-Norton Sound and Yukon-Kuskokwim regions with 65% of harvest in fall-winter and 24% in spring (Rothe et al. 2015).

The subsistence harvest on the Yukon-Kuskokwim Delta was estimated to be 16/year in1990-1994, 51/year in 1995-2000, and 40/year in 2001-2005 (Wentworth 2007a). The subsistence harvest in Bristol Bay, Alaska was estimated at 48/year from 1995-2000 and 9/year from 2001-2005 (Wentworth 2007b). The Alaska Migratory Bird Subsistence Harvest Estimates for 2009 were 40 birds and 66 eggs in the Yukon-Kuskokwim Delta; 36 birds and 36 eggs in Bering Strait-Norton Sound; and none on the North Slope (Naves 2011). Egg harvest has also been estimated at 50/year in Bering Strait-Norton Sound and Yukon-Kuskokwim combined (Rothe et al. 2015). The 2007 Barrow Subsistence Survey reported harvest of 36 individuals, which would be 6.3% of the total estimated Alaskan population (Baldassare 2014). However, Rothe et al. suggest that most of the Alaskan harvest could actually be composed of birds that breed in Russia. Harvest appears to have decreased since 1980s-90s, which could be due to

outreach/communication, law enforcement efforts, reduced reporting (because of law enforcement), and/or reduced availability (Rothe et al. 2015).

There are no reliable comprehensive estimates of harvest in Russia. Subsistence harvest surveys in 22 villages in northeastern Russia during1999, 2002-2005 estimated an annual average harvest of 4,435/year (70% male, 30% female) which was extrapolated to estimate an annual total harvest of 13,000 in eastern Russia (Syroechkovski and Klokov 2009 in Baldassare 2014). Another study estimated an annual harvest of 15,000-18,000 in eastern Russia (~8-11% of Pacific population) and indicated that illegal harvest occurred in western Russia (Solovieva et al. 1998 in Baldassare 2014). More intensive harvesting may occur in some areas, as it was estimated that 3,000-4,500 were harvested annually in just four Russian villages during the 1990s (Syroechkovski and Zockler 1997 in Baldassare 2014). Further assessment of Russian subsistence harvest is underway (Baldassare 2014).

While harvest may not have caused the decline in Steller's Eider numbers, it may be affecting the species' recovery (Baldassare 2014).

Priority Information Needs:

1. Gather and summarize information on harvest levels in Alaska.
2. Assess harvest levels in Russia.

Parasites, Disease, Contaminants: Little is known about parasites, disease, and contaminants in Steller's Eider. Steller's Eiders captured at Dutch Harbor, Alaska (industrialized site) had 16% prevalence of *E. coli* in fecal samples while prevalence was 2% of individuals captured at Izembek Lagoon (reference site); genetic profiling of *E. coli* strains from water samples indicated that transmission from nearshore habitats was possible (Hollmen et al. 2011). Avian pathogenic *E. coli* (APEC) strains were detected and individuals carrying APEC strains had lower serum total protein and albumin concentrations (Hollmen et al. 2011). The avian influenza virus seroprevalence rate was ~80% in Steller's Eiders in Alaska, but only ~5% were infectious (i.e., shedding AI virus; Wilson et al. 2013b). However, Ip et al. (2008) found that only 1% of Steller's Eiders in Alaska tested positive for avian influenza virus (Ip et al. 2008). Molting Steller's Eiders were captured at Nelson and Izembek lagoons and samples collected by cloacal swab were tested for avian influenza virus, with a prevalence rate of 0.2% at Izembek and 3.9% at Nelson (Ramey et al. 2011). Phylogenetic analysis indicated a Eurasian origin for 4.9% of genes, suggesting transport of AIV genes between continents through long-distance migratory movements (Ramey et al. 2011). Evidence has been found of reovirus exposure and *Sarcocystis* sp., and *Leucocytozoon* sp. infections but population-level effects unknown (Hollmen and Franson 2015).

Recent studies have identified lead poisoning as an important source of mortality for breeding Spectacled Eiders on the Yukon-Kuskokwim Delta (Flint et al. 2016) where Steller's Eiders historically and currently nest in reduced densities. High levels of lead have also been found in breeding Steller's Eiders on the Alaska Arctic Coastal Plain. Of 30 Steller's Eiders captured at Kodiak, Alaska, only two individuals had blood lead levels above background exposure and these individuals showed no signs of lead toxicity (Brown et al. 2006). Hepatic EROD activity (an indicator of exposure to polycyclic aromatic hydrocarbons [PAHs]) was higher in Steller's

Eiders and PAH levels were higher in blue mussels (*Mytilus trossilus*) at industrialized sites rather than non-industrialized sites in the Aleutian Islands, Alaska (Miles et al. 2007). However, levels of organochlorine compounds were low in prey species and there was no relationship between polychlorinated biphenyl (PCB) levels and EROD activity (Miles et al. 2007).

Priority Information Needs:

1. Continue studies on prevalence and effects of disease and causes of mortality.
2. Screen/monitor for lead exposure throughout the range of the listed population.
3. Examine whether existing outreach and law enforcement programs are effective in reducing lead shot use by waterfowl hunters in Western and Northern Alaska.
4. Determine physiological and reproductive effects of selenium, cadmium and other contaminants.

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