Species Status Summary and Information Needs

Sea Duck Joint Venture, September 2017

Common Eider, Northern Race (*Somateria mollissima borealis*)

<u>Population Size and Trends</u>: Northern Common Eiders breed in the eastern Canadian Arctic, northern Québec, Labrador, and west Greenland. It is logistically difficult and expensive to survey the breeding range for this subspecies, and thus population size and trend data are incomplete. Based on a combination of data sources from 1998-2003, Gilliland et al. (2009) estimated that there were approximately 305,400 female Northern Common Eiders breeding in Canada and 10,000-15,000 breeding in Greenland. More recently, the total West Greenland breeding population was estimated to be 50,000-63,000 breeding pairs (Burnham et al. 2012). In the Hudson Strait, Nunavut region, >32,500 nesting pairs were counted on 230 islands surveyed during 2010-2012 (Iverson et al. 2014). Aerial winter surveys during 1999-2007 provided estimates of 221,000 Northern Common Eiders wintering in Newfoundland and Québec and 463,000 in Greenland (Gilliland et al. 2008). Historical data for this subspecies is scarce, but the wintering abundance of Common Eiders (Northern and American combined) suggested there were two million in Newfoundland alone in the 1950s (Gilliland et al. 2009) and that there were >100,000 pairs breeding in Greenland in the mid-1800s (Merkel et al. 2006a).

Long-term, range-wide trend data are not available and localized studies show mixed results. Surveys of the mid-Labrador coast suggested that the numbers of adult male Common Eiders has increase ~2.5 times between 1980 and 2006 (Chaulk 2009). During the period from 1998-2003, there was an estimated annual increase of 13-22% in the number of nesting Common Eiders in coastal Labrador (Chaulk et al. 2005). Surveys of Northern Common Eider colonies in the Digges Sound region, Nunavut indicated a 4- to 5-fold increase from 1980-1983 to 1999 (Hipfner et al. 2002). Along the west coast of Ungava Bay in 2000, nest counts in some island groups were similar to counts from 1980, while dramatic increases occurred on a few islands and decreases on many islands; the authors speculated that apparent changes in abundance may actually have been due to redistribution (Falardeau et al. 2003). Numbers of nesting Northern Common Eiders on St. Helena and Devil islands, Nunavut appeared to have decreased from the 1980s to 2003-2007 (Black et al. 2012). Aerial surveys in 2002 and 2012 of 10 islands in Queens Channel, Nunavut (east of Bathurst Island), indicated a 43% increase in numbers of Common Eiders; three islands that had no eiders in 2002 had colonies present in 2012 (Maftei et al. 2015). At Nasaruvaalik Island, in the Queens Channel region, the number of nesting Northern Common Eiders increased during the period from 2007-2014, from less than 200 to over 700, but longer term data for High Arctic colonies is scarce (Pratte et al. 2016)

In West Greenland, surveys of Northern Common Eider breeding colonies indicated an 81% decline in number of nests during the period from 1960-1965 to 1998-2001 (Merkel 2004a). Of 51 colonies historically documented, 36 either did not exist anymore or had reduced numbers of nesting eiders while for the other 15 colonies historical data were insufficient to determine trends (Merkel 2004a). However, during 2000 to 2007, breeding numbers increased by 212%, possibly due to harvest reductions in Greenland that began in 2001 (Merkel 2010). Similarly, in

Avanersuaq District, northwest Greenland, the number of nesting Northern Common Eiders increased from an estimated 5,000 pairs in 1997-1998 to 25,000-30,000 pairs in 2009 (Burnham et al. 2012).

Priority Information Needs:

1. Continue the aerial winter count of males in Atlantic Canada and eastern Quebec conducted by Environment and Climate Change Canada (ECCC).
2. Periodically repeat surveys of eider breeding colonies where historical data exist (e.g. south Baffin Island, Ungava Bay, west Greenland).
3. Initiate new surveys to establish baseline data on abundance and breeding range. Locations include Frobisher Bay and Cumberland Sound, where large numbers of Common Eiders are thought to breed.
4. Develop new survey techniques (e.g. aerial spring count of drakes) and refine existing techniques.
5. Survey a sample of islands annually to quantify annual variation in colony size (e.g. non-breeding), long term response to perturbations (e.g. Polar Bear predation) and intra-colony movements within a region.

Population Delineation: The zone of contact between breeding populations of the Hudson Bay Eider and Northern Common Eider occurs in northern Hudson Bay and between the American Eider and Northern Common Eider in central Labrador. Genetic analysis indicated some gene flow between Northern Common Eider and American Eider as well as between Northern Common Eider and the nominate subspecies (*S. m. mollissima*) which breeds in Europe and Russia (Sonsthagen et al. 2011). Gene flow may be due to intermixing between subspecies in areas where wintering ranges overlap and/or occasional male dispersal among populations as mitochondrial DNA indicates that females have high natal and breeding site fidelity (Sonsthagen et al. 2011). The zone between the Pacific Common Eider (*v-nigrum*) and the Northern Common Eider is less clear, but may occur in the region between Victoria Island and the Boothia Peninsula, Nunavut (Sonsthagen et al. 2011). The Pacific Common Eider is the most genetically distinct of the subspecies, and there is likely little genetic exchange between these populations (Sonsthagen et al. 2011). Based on examination of Common Eiders collected from hunters and oiling events in Newfoundland, where the wintering ranges of Northern and American Common Eiders overlap, eiders in northern and eastern areas were mostly Northern or Northern-type intergrades while American Eiders were more common in southern areas, although still with a large proportion of intergrades (Gilliland and Robertson 2009, Robertson et al. 2014). Classification discrepancies depending on method were noted (visual inspection versus bill measurement key) and this uncertainty makes it challenging to determine zones of overlap in breeding and wintering ranges or the degree of interbreeding (Robertson et al. 2014). All Common Eiders wintering in the Gulf of St. Lawrence are thought to be Northern Common Eiders (J.-P. L. Savard, unpubl. data in Gilliland et al. 2009), except those overwintering in the Magdalen Islands; based on head examination from winter harvested birds there (n = 247), ~90% were part of the American subspecies, the rest being split between pure *borealis* and intergrades of both subspecies (CWS, unpubl. data).

From a Northern Common Eider colony on Mitivik Island, in East Bay, Southampton Island, Nunavut, 40% of birds marked with satellite transmitters migrated to wintering areas from Labrador to southern Newfoundland and the Gulf of St. Lawrence while 60% migrated to southwestern Greenland (Mosbech et al. 2006). Northern Common Eiders marked at a breeding colony in west Greenland all migrated to wintering areas on the Greenland coast and wintering eiders implanted near Nuuk, Greenland mostly migrated to Canada, breeding from Hudson Strait to northern Baffin Bay (Mosbech et al. 2006). In Greenland, there appeared to be some segregation during winter, with Greenlandic breeders wintering further north than Canadian breeders and differences in structural size related to wintering area indicated the possible existence of several subpopulations of Northern Common Eider (Mosbech et al. 2006). Based on re-sighting of marked birds at Mitivik Island, site fidelity for females was estimated at 0.98 ± 0.01 SE and males at 0.66 ± 0.07 SE. Return rates did not differ across years or in relation to avian cholera outbreak intensity (Iverson 2015). Northern Common Eiders breeding in Ungava Bay, Québec were marked with satellite transmitters and all molted in Ungava Bay, within 50 km of breeding colonies, and then 67% wintered in southwest Greenland and 33% in Canada (Newfoundland and Gulf of St. Lawrence) (Savard et al. 2011). Of the females that were tracked through the following spring, all returned to Ungava Bay (Savard et al. 2011).

Priority Information Needs:

1. With the use of ongoing satellite telemetry and banding programs, continue to determine affiliations between breeding, molting, and wintering areas in the Eastern Arctic, western Greenland and eastern Canada. In particular, information is needed on movements of birds from breeding areas along eastern Baffin Island and the north coast of Labrador, and from wintering areas in Quebec and Newfoundland and whether patterns of population movements change over time.
2. Conduct offshore aerial and boat-based surveys to define boundaries and level of use of coastal staging, molting, and wintering areas.
3. Monitor the sub-specific composition across their wintering range in eastern Canada where they are sympatric with *S. m. dresseri*. This information is important for estimating population size and apportioning harvest between subspecies.

Population Dynamics: Some recent information on annual productivity, survival, and recruitment is now available. Although a project is underway on Mitivik Island, additional work is required to concurrently measure these parameters at other breeding areas. The annual survival rate for adult females breeding in northern Hudson Bay estimated to be 0.80 during 1996-2005 (H. G. Gilchrist and E. Reed, unpubl. data in Gilliland et al. 2009) and a model-based estimate of 0.84 was generated for adult females wintering in west Greenland (Gilliland et al. 2009). Using data from the marked eider population at Mitivik Island, estimated apparent annual survival for adult females was 0.87-0.93 prior to an avian cholera outbreak and 0.53-0.76 during the peak of the epidemic; apparent survival post-epidemic but was still lower than pre-epidemic rates (Iverson 2015). Male apparent survival also decreased during the outbreak (Iverson 2015). Variations in survival estimates dependent on sex and on years since marking indicated that resident females were more negatively affected by cholera than newly banded birds, that there were transient males in the population, and that there was limited male recruitment into the population post-epidemic (Iverson 2015). True annual survival estimates for females were 0.90-0.95 pre-epidemic and 0.49-0.66 during the peak; true annual survival for males was estimated at 0.81-0.93 pre-epidemic and 0.70-0.75 during the peak (Iverson 2015). At the same study site, annual population growth was 1.17 during 2001-2006 (pre-epidemic), 0.66-0.93 during 2007-2009 (during epidemic) and 0.98-1.08 during 2010-2013 (post-epidemic) (Iverson 2015). Estimates of annual nest success ranged from 0.17-0.78 for early nesting females, 0.12-0.66 for median nesting, and 0.04-0.45 for late nesting (Iverson 2015). A large range in annual nest success was expected for this species, but the overall downward trend in nest success is basis for concern (Iverson 2015). Age ratios of Common Eiders harvested in the Canada and United States indicate an annual production rate of 0.18 fledged young females per adult female (Rothe et al. 2015).

Priority Information Needs:

1. Initiate other studies of survival, productivity, and recruitment at a few other major nesting areas in Ungava Bay and the low eastern Canadian Arctic, perhaps in Frobisher Bay or along the south coast of Baffin Island where, (a) a study would be logistically feasible, (b) some baseline data already exist, and (c) where significant proportions of the Northern Common Eider ducks nest.
2. Expand surveys in summer to detect the prevalence and locations of cholera outbreaks, perhaps with the assistance of northern Inuit residents

<u>Population Ecology</u>: As in other long-lived species with high adult survival, Northern Common Eider population growth rates are most sensitive to variation in adult survival. However, like other subspecies of Common Eider, there is probably little variation in adult survival (excepting harvest mortality) and variable reproductive success is more likely to actually affect population trends. A long term data set from Common Eiders breeding in Iceland (1900-2007) indicated that adult survival was generally high and probably only affected in years of particularly bad weather but that breeding propensity and duckling production responded more to annual weather conditions (Jónsson et al. 2013). At Mitivik Island, female eiders possibly use local temperature during the pre-laying period as a cue to initiate nesting so that hatch is optimally timed to coincide with ice-free conditions for ducklings (Love et al. 2010). Warmer spring temperatures corresponded with earlier mean laying dates and earlier ice-free conditions and ducklings that hatched just prior to ice-free conditions had the highest survival probability (Love et al. 2010). Pre-laying body mass of females at Mitivik Island varied in perfect opposition to the winter North Atlantic Oscillation (NAO) index, indicating that body condition was lower following winters with unfavorable weather condition (i.e., higher storm activity and lower air temperatures) (Descamps et al. 2010). Clutch size, breeding success and offspring survival are linked to female body condition, so there are likely links between the NAO and eider population dynamics (Descamps et al. 2010). Early-arriving females initiated nests earlier and produced larger clutches, and females in good condition laid earlier (Descamps et al. 2011a). On the Labrador coast, greater ice extent around Common Eider nesting islands was correlated with later nest initiation dates and later nest initiation was linked to smaller clutch sizes (Chaulk and Mahoney 2012). Increasing water salinity was negatively correlated with growth rate and survival of Northern Common Eider ducklings (DeVink et al. 2005). At a High Arctic nesting colony on Nasaruvaalik Island, Northern Common Eiders nesting in areas with higher nest densities had greater nest success and lower total clutch predation (Pratte et al. 2016).

The incidence of Polar Bears on bird colonies in the Hudson Strait-Northern Hudson Bay region was seven times greater in 2010-2012 than during 1980s and polar bear activity was detected in 34% of Northern Common Eider colonies surveyed during 2010-2012 (Iverson et al. 2014). Eider nest success was greatly reduced on islands with signs of Polar Bear presence and observed levels of nest predation could lead to local extirpation of colonies if continued (Iverson et al. 2014). However, islands with few eiders, or closer to shore and/or villages were less likely to experience Polar Bear predation, so shifts in density and distribution of nesting eiders could moderate the effects of Polar Bear egg predation (Iverson et al. 2014). The increased predation by Polar Bears on Northern Common Eider nests was related to earlier date of ice breakup, and models predict that eider nests will become more dispersed in the landscape, with fewer large colonies (Dey et al. 2016). They are also expected to nest closer to the mainland, on average, which could possibly increase exposure to land-based predators such as Arctic Foxes (Dey et al. 2016).

At some colonies in the Hudson Strait-Northern Hudson Bay region, adult survival and reproductive success of Northern Common Eiders has been negatively affected by outbreaks of avian cholera (Descamps et al. 2009, Iverson 2015). For adult survival rates related to avian cholera outbreaks, see Population Dynamics section, above. Prior to the cholera outbreak at Mitivik Island, clutch size was not related to survival rate, but during the peak of the epidemic, larger clutch sizes were correlated with reduced survival rates and an increase of one egg in the clutch corresponded to an estimated average 15% decrease in survival (Descamps et al. 2009). Similarly, females with higher levels of plasma triglycerides (indicator of rate of condition gain) were more likely to breed and had earlier laying dates, but also had a higher risk of mortality (Hennin et al. 2013). In the presence of a highly virulent disease, increased investment in reproduction may come at the cost of survival. During the outbreak, duckling survival was reduced by 90%, leading to almost zero recruitment (Descamps et al. 2011b). Duckling mortality may have been caused by direct cholera infection, by maternal death from cholera infection, and/or from increased predation by gulls that had been attracted to the island by the presence of adult eider carcasses (Descamps et al. 2011b). Before the epidemic, duckling survival was related to hatching date and hatching mass (ducklings that hatched very early or very late had lower survival rates and survival increased with duckling mass) but during the outbreak, duckling mortality was so high that selection on hatch characteristics lost significance (Descamps et al. 2011b).

In southwest Greenland, wintering eiders spent less time feeding when disturbed by human activity and attempted to compensate by rescheduling feeding activity to times that were typically less profitable (e.g., during high tide and midday); high levels of disturbance may negatively affect their ability to maintain a positive energy budget (Merkel et al. 2009). However, carcass composition analysis of Northern Common Eiders wintering in Greenland indicated no relation between body condition and hunting disturbance, photoperiod or temperature (Jamieson et al. 2006). Protein levels were fairly constant within and between years and there was little seasonal variation in lipid levels, suggesting that there were no prolonged energetic shortfalls and eiders likely had access to reliable food resources, although juvenile eiders were more prone to nutritional stress (Jamieson et al. 2006).

Concentration of corticosterone (CORT) in flight feathers is an indicator of the magnitude or extent of stress during molt when feathers are grown. Feather CORT in Northern Common Eiders had high interannual variability and was not affected by prior reproductive investment nor pre-breeding body condition but CORT levels were higher when late summer air temperatures were higher (Legagneux et al. 2013). Levels of feather CORT were found to have carry-over effects to the subsequent breeding season, with higher CORT directly related to later arrival date and lower body condition (Harms et al. 2015). Furthermore indirect relationships, led to a decrease of ~0.25 standard deviations from the mean of reproductive success and annual survival with an increase of 1 standard deviation from the mean of feather CORT (Harms et al. 2015).

Priority Information Needs:

1. Continue to study factors affecting breeding ecology and survival of Northern Common Eiders at East Bay, Southampton Island, Nunavut. These include predation, diseases, weather, ice conditions, contaminants, parasitology, nest site selection, and body condition of hens.
2. Establish other research studies at a few other major nesting areas in Ungava Bay and the low eastern Canadian Arctic, perhaps in Frobisher Bay or along the south coast of Baffin Island where, (a) a study would be logistically feasible, (b) some baseline data already exist, and (c) where significant proportions of the Northern Common Eider ducks nest.
3. Initiate a study of winter ecology in southwest Greenland. Compare diet, survival, habitat use, and body condition across years, in different habitats, and among other Arctic eider populations.

Habitat Requirements: During nesting, molting, brood rearing, and at over-wintering sites, Northern Common Eiders are vulnerable to disturbance and potentially, food shortages. On the coast of Labrador, abundance of breeding Common Eiders was not found to be related to density of intertidal resources (mussel, periwinkle, knotted wrack) and was negatively related to the number of islands within a 104 km^2 area (Chaulk et al. 2007). The authors speculated that clusters of islands could trap sea ice reducing food availability and/or allowing mammalian predators to access islands (Chaulk et al. 2007). In the Hudson Strait-Northern Hudson Bay region, colonies were mainly on small (0.1-5.0 km^2) islands that were close to shore (< 5km) (Iverson et al. 2014). Freshwater sources in brood-rearing areas are essential for duckling growth and survival (DeVink et al. 2005). Winter distributions and flock sizes of Northern Common Eiders varied according to local ice conditions and the greatest concentrations were found in ice-free areas along the north coast of Gulf of St. Lawrence, northeast coast of Newfoundland and southwest coast of Greenland (Gilliland et al. 2008).

Climate change may make the Arctic more accessible to shipping. Large concentrations of eiders can exist for several weeks at a single location, and these sites must be identified with the long-term view of formal marine habitat protection under the Oceans Act and the revised Canadian Wildlife Act. Research methods include boat-based and aerial surveys, and satellite telemetry. The latter technique has great potential, particularly in the Canadian Arctic and Greenland, where constrained logistics and extreme weather conditions often prohibit surveys.

Priority Information Needs:

1. Identify key molting, brood-rearing, and wintering areas in Arctic and eastern Canada, and west Greenland. Quantify the key environmental and habitat factors that influence habitat selection and annual variation in habitat use.
2. Identify key nesting areas in Northern Canada and west Greenland. Quantify key environmental and habitat factors that influence nest site selection, colony size, and annual variation in habitat use (e.g. island size, proximity to a mainland, and frequency of Polar Bear predation).3. Characterize, in terms of number of birds and habitat characteristics, the staging area located with satellite telemetry at the northern tip of Labrador.
3. Keep abreast of any plans for expanding shipping in the Arctic and assess risks to eiders along shipping routes.

Harvest Assessment: Northern Common Eiders are one of the most heavily hunted sea ducks in Canada and large harvests also occur in Greenland. Most of the Common Eider harvest in Canada is of Northern Common Eiders, although some American Eiders are shot in southern parts of the country (Rothe et al. 2015). Concerns have been expressed regarding Common Eider harvest in the Atlantic Flyway, due to fluctuating populations, high harvest pressure and presence of two subspecies (Rothe et al. 2015). The Migratory Bird Convention of 1916 prohibited any hunting of eiders in Canada and the U.S. as American Eiders had been almost extirpated (Rothe et al. 2015). However, the Migratory Bird Convention Act did not apply in Newfoundland and Labrador, which was still a British Colony so eider hunting continued there and in the Canadian North despite the ban (Rothe et al. 2015). The prohibition on eider hunting in the rest of Canada and the United States was lifted in 1932 (Rothe et al. 2015). The Northern Common Eider harvest occurs in Greenland, Canada and, to a much lesser extent, St. Pierre et Miquelon, France, as the subspecies' range does not extend into the U.S. Harvest statistics are quite uncertain, due to the occurrence of breeding and wintering range overlap with Hudson Bay and American Eiders and subsistence harvests. Unlike the sport hunt for most other migratory game birds in North America, eider harvests by non-aboriginal people in parts of Atlantic Canada and Greenland may be for subsistence purposes, although they are classified as part of the 'sport' harvest under standard harvest survey methodology (Gilliland et al. 2009, Rothe et al. 2015). Furthermore, in Greenland, commercial hunting is permitted, with eiders being one of the most common types of birds taken.

In the past few decades, estimates of annual eider sport harvest levels have declined but the Common Eider harvest in Newfoundland and Labrador appeared to have been increasing since 2005, with unusually high levels in 2007 and 2008 (CWS Waterfowl Committee 2013). National harvest surveys during 1988-1991 estimated that 20,000 eiders (all species) were taken annually in Atlantic Canada, with 43% in Newfoundland and Labrador, 41% in Nova Scotia, 12% in Québec and 3% in New Brunswick (Chardine et al. 2008). The Canadian sport harvest of Northern Common Eiders averaged 20,000 annually during 1992-2001 (SDJV 2007) and 13,000 annually during 1996-2001 (Gilliland et al. 2009). During 2004-2013, the average annual Canadian sport harvest of Common Eiders (all subspecies) was ~19,000 but harvest in 2014 and 2015 was under 10,000 annually (Gendron and Smith 2016). During 2005-2013, ~55-80% of the Canadian Common Eider sport harvest occurred in Newfoundland (Gendron and Smith 2016).

However, as with other sea duck species, harvest estimates are quite uncertain. The estimated harvest of Northern Common Eiders in Atlantic Canada is considered sustainable, but some conditions could lead to slow population decline (Gilliland et al. 2009). And if the Canadian harvest is underestimated (as suspected) or if breeding success declined, harvest levels could be unsustainable (Gilliland et al. 2009).

Common Eiders are the most commonly harvested marine bird in the Canadian Arctic, and there is widespread interest, knowledge and concern regarding this species (Chardine et al. 2008). The estimated harvest of ~12,000 Common Eiders in Arctic Canada is considered sustainable although some colonies close to communities may have been extirpated (Chardine et al. 2008). The average annual subsistence harvest of Northern Common Eiders reported in Nunavut during 1999-2001 was 2,400 (Gilliland et al. 2009). The Nunavut Wildlife Harvest Survey of 1996-2001, indicated an average annual harvest of 6,000 eiders (mostly Common Eiders, including Northern and Hudson Bay, and a small proportion of King Eiders) but harvest estimates from 1982 reported 554 eiders in the High Arctic, 8,067 eiders in the Low Arctic and 6,000 eiders in Belcher Islands (Hudson Bay Eiders) (Rothe et al. 2015). A 2007 survey of Inuit households in Nunatsiavut, Labrador estimated an annual harvest of 2,608 Common Eiders and in Nunavik, Québec the annual eider harvest during 1973-1980 was estimated at 10,246 (James Bay and Northern Quebec Native Harvesting Research Committee 1988). In 1980, an estimated 30,000 eiders (probably almost all Common) were harvested on Labrador coast alone; many hunters in this region were not required to buy hunting permits because of aboriginal status (Chardine et al. 2008). The total Canadian subsistence harvest was estimated at ~7,000 Northern Common Eiders, 2/3 of which were assumed to be from the Canadian wintering population and 1/3 from the Greenland wintering population (SDJV 2007).

The Nunavut Wildlife Harvest Survey reported an average annual harvest of 7,909 eider eggs/year during 1996-2001, the Nunatsiavut 2007 harvest survey indicated 4,019 Common Eider eggs/year and in Nunavik 35,421 duck eggs (probably almost entirely Common Eider) were gathered annually (Rothe et al. 2015). Egg collection was probably widespread in Labrador, but has likely diminished in recent decades (Chardine et al. 2008). Collection of down from eider nests is common in the Hudson Strait area, and the harvest is in transition from traditional use to more intense commercial harvest in some areas. In Nunavut and Nunavik, recent conflicts over harvesting rights in shared land claim settlement areas indicate importance of this resource (Savard and Gilchrist 2006). In Nunavik, it is estimated that down is collected from 75,000-125,000 eider nests, mainly in Hudson Strait and Ungava Bay (Bédard et al. 2006). During 1998-2004, an average of 3,300 kg of raw down was collected annually, with 5,000 kg collected in 2004 (Bédard et al. 2006).

The majority of the Greenlandic wintering population of Northern Common Eiders breeds in Canada, and the annual winter harvest of 55,000-70,000 reported in Greenland in 1993-2000 was likely not sustainable (Gilliland et al. 2009). It was recommended that the Greenland harvest be reduced by at least 40% of the 1993-2000 levels and new regulations were introduced in 2002-2004 (Gilliland et al. 2009). Harvests in West Greenland have declined substantially since then, from ~70,000 in 1998 to ~50,000 in 2001 and a mean of 20,583 ± 1,088 SE during 2002-2006 (Merkel 2010). In addition to hunting pressure, it was reported that in March and April of 2001 and 2002, 52% of eiders being sold in the market in Nuuk, Greenland were actually obtained as bycatch in gillnet fisheries; while not hunting *per se*, this may still constitute an important source of mortality (Merkel 2004b).

Poaching and illegal hunting of Common Eiders is likely widespread, but the magnitude is unknown (Chardine et al. 2008). Similarly, the illegal sale of harvested Common Eiders has regularly occurred in Newfoundland, but the current extent is unknown (Chardine et al. 2008). Data from the Maryland Department Natural Resources indicated that hunters were unable to retrieve about 28% of downed sea ducks (eiders, scoters and Long-tailed Ducks) (Rothe et al. 2015). Given their large size, fast flight, and often dense flocks, crippling loss is likely an important parameter in harvest assessment. Approximately 26% of female Common Eiders breeding in Hudson Strait and Foxe Basin and 54% in Labrador carry embedded shot (Hicklin and Barrow 2004). However, embedded shot negatively affected body condition of juvenile Common Eiders but did not seem to have long term effects on subadults or adults (Merkel et al. 2006b) whereas Madsen and Noer (1996) suggest that survival of Pink-footed Geese was lower for birds carrying shot. Mortality due to wounding remains unknown (Rothe et al. 2015).

In Newfoundland, Common Eiders hunted in winter were mainly Northern Common Eiders (including birds classified as intergrades between Northern and American) in the northeast part of the province and American Eiders along the southern coast (Gilliland and Robertson 2009). The relative proportions of the two subspecies varied by region and time of year which should be considered when drafting hunting regulations, as the population size and productivity of the subspecies differ (Gilliland and Robertson 2009). The sex ratio of harvested birds did not differ significantly from 1:1 and 60% of harvested males were immature (hatch-year or second-year) (Gilliland and Robertson 2009). For Common Eiders (all subspecies) harvested during 2002-2011, the adult sex ratio (males:females) was 0.94 in Canada and 2.24 in U.S. and the age ratio (immature of both sexes:adult females) was 1.65 in Canada and 0.63 in U.S (Rothe et al. 2015). Ratios in Canada were probably a more accurate reflection of the population as sea duck hunters in the U.S. target adult male eiders (Rothe et al. 2015).

Harvest in late winter and spring/summer will likely have proportionally greater negative impact on population trajectories, as abundance is already reduced by natural mortality during the winter and relatively higher numbers of adult, breeding birds will be taken (Gilliland et al. 2009). Harvest mortality appears to be additive to disease (avian cholera) mortality (Iverson 2015). Based on recent data from Greenland, Common Eiders appear capable of relatively rapid population growth when harvest levels are reduced (Merkel 2010). As it is not feasible to collect the data necessary to annually adjust Northern Common Eider harvest levels experts recommend repeated population modeling with more recent data and parameter estimates (Gilliland et al. 2009).

Priority Information Needs:

1. Continue to monitor the subsistence and sport harvests of Northern Common Eider in Nunavut, Nunavik, Newfoundland, Labrador, and west Greenland.
2. Improve harvest estimates for sea ducks in eastern Canada.
3. Assess sources and degree of bias in harvest reporting from each area, and establish correction factors to refine harvest estimates.
4. Assess crippling loss of eiders under various harvest scenarios (e.g. shot over pack ice, solid ice, from shore over open water, from boats, etc.).

5. Determine what proportion of Common Eiders harvested in Greenland breed in Canada.
6. Implement a monitoring program to document levels of eiderdown harvest and development guidelines for sustainable down harvesting and distribute this information widely in Nunavut and Northern Quebec.

Parasites, Disease, Contaminants: There has been a large volume of recent work on parasites, disease and contaminants in Northern Common Eiders, much of it from the Mitivik Island breeding colony. At Mitivik Island, if females were late arriving to the colony or in low body condition an anti-parasite treatment (to reduce gastrointestinal parasites) led to increased nesting propensity (Provencher et al. 2016a). However, the treatment had no effect on nest survival or clutch size and it did not affect re-sighting rates for females in subsequent years, indicating there were no carry-over effects on survival or reproduction (Provencher et al. 2016a). In male and female Northern Common Eiders collected near Cape Dorset, Nunavut during May, 2011 there was no evidence that body condition varied directly with either mercury concentrations or parasite load (Provencher et al. 2016b). However, males generally had a higher condition index than females, liver mass varied positively with condition and parasite intensity varied negatively with liver mass, so females did have higher parasitism rates and eiders feeding at higher trophic level had higher levels of parasites (Provencher et al. 2016b).

Mass-mortality outbreaks of avian cholera, caused by *Pasteurella multocida* infection, were first reported in Nunavik in 2004 and at Mitivik Island in 2005 (Harms 2012). Surveys of eider colonies along >1000 km of the Hudson Strait coastline during 2004-2013, detected mass-mortality events on at least 13 breeding colonies, with 1-43% mortality of nesting females, and >1,200 total mortalities recorded (Iverson 2015). The probability of an outbreak occurring was higher on islands with greater vegetative cover, with greater migratory connectivity to Atlantic Canada wintering areas (rather than Greenland), and on islands with many eiders and relatively few (but not zero) freshwater ponds (Iverson 2015). During surveys at Mitivik Island, almost all recovered eider carcasses were female but survival analysis of marked birds has indicated significant male mortality as well (Iverson 2015). Recurrent mortality due to cholera was reported in eight consecutive seasons at Mitivik Island (2005-2012), with 6194 direct eider mortalities observed and breeding pair abundance reduced by almost 56% relative to the pre-outbreak peak (Iverson et al. 2016). It was estimated that more than one severe outbreak (i.e., causing >30% mortality of breeding females) per decade would be unsustainable, likely leading to colony extinction within a century and that more than four outbreaks per decade could cause colony extinction within 20 years (Descamps et al. 2012). However, the epidemic appears to be gradually fading out as >4,000 breeding pairs remain in the population and avian cholera was not detected at the colony in 2013 (Iverson et al. 2016). Female eiders that tested positive for avian cholera have survived and returned to the colony, demonstrating that infection is not fatal in all cases (Harms 2015) and herd immunity likely mitigated the extent and duration of the epidemic (Iverson et al. 2016). Breeding pair numbers have remained fairly constant post-epidemic, and there is little evidence that the population is either recovering or declining (Iverson et al. 2016). Mortality rates during the outbreak were similar to estimates reported for outbreaks in other eider breeding colonies (Iverson et al. 2016).

Assays of cloacal and anal swabs indicated that apparently healthy wild birds serve as a reservoir of avian cholera (*P. multocida* was also detected in Lesser Snow Geese, Ross's Geese, King

Eiders and Herring Gulls), but it is unknown if one of these species served as a vector for avian cholera to reach the Canadian Arctic or if Northern Common Eiders were infected on wintering areas shared with American Eiders (Harms 2015). Transmission pathways for avian cholera are unclear; in addition to direct transfer between individual birds, *P. multocida* may be transmitted via freshwater ponds (Harms 2015). Samples from Mitivik Island were genetically distinct from *P. multocida* from eider colonies in the St. Lawrence Estuary but similar to samples from Nunavik and from a 2007 outbreak in pelagic gulls in Newfoundland, suggesting the possibility of transmission among colonies in the eastern Canadian Arctic (Harms 2015). Avian cholera has not been confirmed in Northern Common Eiders breeding on south Baffin Island, but eiders nesting and harvested near Cape Dorset tested positive for *P. multocida* and 45.5 % of ponds sampled near Cape Dorset tested positive for *P. multocida* DNA (Harms 2015).

Of nine species of Canadian Arctic marine birds monitored since the 1970s, Common Eiders had the lowest mean egg mercury concentrations (0.73 ± 0.25 µg/g dry weight) but however, hepatic mercury levels were relatively high 2.68 ± 0.69 to 4.16 ± 1.62 µg/g dry weight (Provencher et al. 2014a). Male eiders collected at Cape Dorset in May 2011 had significantly higher concentrations of mercury in breast muscle than females (0.69 ± 0.25 µg/g and 0.56 ± 0.20 µg/g, respectively) and individuals feeding at higher trophic levels (as indicated by $\delta^{15}N$ values) typically had higher mercury burdens (Provencher et al. 2016b). Levels of total and methylated mercury in feather were lower for Common Eiders collected near Cape Dorset than for five other species of Arctic marine birds (Mallory et al. 2015). Northern Common Eider eggs had higher mercury levels (0.857µg/g dry weight) at a High Arctic site than at a Low Arctic site (0.501 µg/g dry weight) (Akearok et al. 2010). Northern Common Eider eggs collected from St. Helena Island (High Arctic) had low levels of total mercury and total persistent organic pollutants (POPs) when compared to other marine bird species and PCBs, and polychlorinated biphenyls (PCBs) were the main contributor to total POPs (Peck et al. 2016). In breeding female Common Eiders collected at three sites in the eastern Canadian Arctic, hepatic concentrations of zinc and cadmium increased by ~300% during 1992 to 2008 and cause(s) remain unknown (Mallory et al. 2014). Levels reported for 2008 were high relative to other waterfowl and also to other marine birds sampled in the Canadian Arctic and may be approaching levels associated with adverse effects (Mallory et al. 2014). However, at one of these sites (Mitivik Island), Provencher et al. (2016c) found low blood cadmium levels in 2013 and 2014.

Female Northern Common Eiders captured at Mitivik Island in 2013 and 2014 had blood concentrations of cadmium, mercury, lead and selenium that were considered to be below established no-effect levels (Provencher et al. 2016c). However, blood lead levels were higher for birds that were later-arriving and in poorer condition, indicating that even though lead levels are low they may be having sub-lethal effects on reproductive investment (Provencher et al. 2016c). Mercury levels were positively correlated with condition (i.e., fatter birds had higher mercury burdens) but showed no significant relationship with return rates or reproductive parameters and there was no evidence of interaction effects between mercury burden and parasite load (Provencher et al. 2016a, c). Cadmium and selenium were detected in 95% and 100% of females, respectively, but concentrations were much lower than previously reported for this colony (Provencher et al. 2016c, Wayland et al. 2001). Comparison of mercury, selenium and cadmium concentrations to biomarkers (body condition, immune function, stress response, glycogen levels and vitamin A status) in female Northern Common Eiders did not indicate any adverse health effects due to exposure to metals (Wayland et al. 2002, 2003). Concentrations of mercury in liver and cadmium in kidneys were higher in lighter, nesting females than in heavier, pre-nesting females while the total hepatic content of selenium was lower in nesting females, emphasizing the importance of considering intra-annual variation when monitoring contaminant levels (Wayland et al. 2005).

Chronic marine oil pollution has been reported repeatedly around Newfoundland and has the potential to affect large numbers of Common Eiders, among other marine birds (Robertson et al. 2014). In two isolated incidents in 2005 and 2006, a minimum of 1400 and 337 eiders were oiled, respectively (Robertson et al. 2014). Most of the oiled eiders were adults, and if this mortality is in addition to hunting and natural mortality, it could be enough to cause population-level declines (Robertson et al. 2014). Observations of living oiled eiders for >1 month after the oiling event suggest that they are able to survive some degree of light oiling, but longer term viability of lightly oiled eiders is unknown and even if they survived, reproductive ability may have been compromised (Robertson et al. 2014). There were no notable inshore oiled bird events in Newfoundland from unknown sources between April 2006 and April 2014 so federal legislation enacted in 2005, along with additional surveillance, enforcement and education, may be successful in curtailing chronic ship-source pollution (Robertson et al. 2014).

Plastic ingestion frequency and intensity was low (1%) in Common Eiders collected in Nunavut and Greenland (Provencher et al. 2014b) and in 48 Common Eiders collected off northeastern Newfoundland during December-January, one piece of plastic debris and one piece of metal debris were found (English et al. 2015).

Priority Information Needs:

1. Compare levels of contaminants in recently collected Northern Common Eiders to museum specimens to determine if levels have increased over the past century.
2. Compare levels of contaminants found in Northern Common Eiders to other North American and eider populations. A recent pan-Arctic comparison suggests that the Northern Common Eider carries higher metal concentrations (e.g. cadmium) than either the Hudson Bay or Pacific subspecies, and among the highest concentrations of any sea duck. The effect of these levels on reproduction and survival are not known, and require further study.
3. Maintain a reporting network to detect and document extent of Avian Cholera outbreaks.
4. Continue studies to determine the impact of these mortality events on population dynamics of Northern Common Eiders.

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