A COOPERATIVE RESEARCH STRATEGY FOR KING AND COMMON EIDER DUCKS BREEDING IN NORTHERN CANADA

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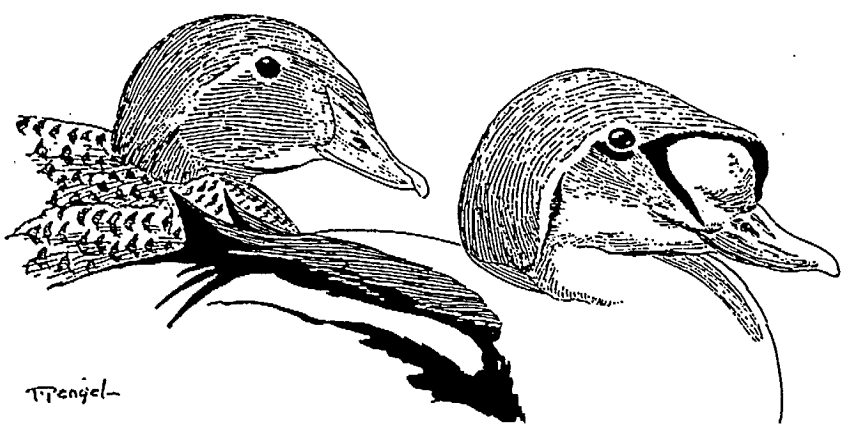

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PRAIRIE AND NORTHERN REGION
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INTRODUCTION

Conservation concerns

Canada supports internationally important populations of sea ducks. For example, approximately one-third of the world's king (*Somateria spectabilis*) and common eider (*Somateria mollissima*) duck populations breed in the Canadian Arctic (Gaston 1991). Information from a number of sources suggest that some eider populations are in decline in North America (Dickson et al. 1997; Suydam et al. 1997; Robertson and Gilchrist 1998), however the extent and causes of these declines are uncertain.

Several factors may contribute to the vulnerability of eider populations. Eiders are sensitive to disturbance, particularly on their nesting grounds. They are also vulnerable to oil spills because they tend to form large aggregations at sea. Recent studies also show that they bio-accumulate heavy metals, perhaps due to their diet of benthic organisms and longevity. Northern eider populations are harvested throughout much of their range during migration, breeding, and on their wintering grounds. These factors are all important to consider, because eiders are long-lived and have low annual production which make their populations vulnerable to factors that decrease adult survival.

Several other sea-duck species are also in decline (Goudie et al. 1994). This suggests that more global factors may be contributing to eider population declines. For example, changes in marine conditions such as prey abundance on shared wintering grounds may influence sea duck populations. The effects and interactions of these regional and global factors on eider populations are unknown.

Management needs

It is widely acknowledged that information regarding eider ecology and population dynamics is severely lacking. The logistical and financial difficulties associated with conducting research in remote areas where eiders breed, migrate, and over-winter has contributed to the lack of information. Co-operative research on eiders is complicated because unlike most waterfowl which migrate along north-south flyways, several eider populations migrate east-west between circumpolar countries. Thus, there is no network of agencies established to conduct co-operative eider studies in North America. Accordingly, the Prairie and Northern Region of the Canadian Wildlife Service has drafted this Eider Research Strategy. This Strategy identifies key information requirements and briefly outlines specific research programs for both king and common eiders. It is intended to focus human and financial resources on key issues, and to generate new research partnerships within Canada and between countries that share these eider populations.

BACKGROUND

EIDER DISTRIBUTIONS

King eider

King eiders (*Somateria spectabilis*) breed throughout Arctic Canada. Whereas the common eider tends to nest in colonies near marine waters, the king eider typically nests dispersed near inland lakes and ponds (but see, Kellet and Alisauskas 1997). The western Canadian Arctic population breeds primarily on Banks and Victoria islands, but also along the mainland from Tuktoyaktuk Peninsula eastward to Queen Maud Gulf (Figure 1). The males migrate westward in early July to molt in the Chukchi and Bering seas. Western Arctic king eiders winter in the Bering Sea and northern Pacific Ocean off the Alaska Peninsula, Aleutian Islands, Kamchatka Peninsula, Pribilof Islands, St. Lawrence Island and off the east and south coasts of Chukotski Peninsula. The eastern Arctic king eider winters along the coasts of Labrador, Newfoundland, and south west Greenland. The geographic delineation of the breeding grounds of the western and eastern populations of the king eider are still uncertain (Figure 1), as are their migration routes. The proportion of Canadian king eiders wintering in Greenland is also unknown.

Common eider

There are three recognised subspecies of common eiders (*Somateria mollissima*) breeding in northern Canada. The Pacific subspecies (*S. m. v-nigra*) breeds along the coasts of Alaska, northern Russia and northern Canada as far east as Queen Maud Gulf and Victoria Island (Figure 2). In July, many of the male eiders that breed in Canada migrate westward across the Beaufort Sea to molt in the Chukchi and Bering seas. The Pacific common eider winters around the islands and perimeter of the Bering Sea, as well as in the northern Pacific Ocean off the east coast of Kamchatka Peninsula and in the Gulf of Alaska.

The northern subspecies of the common eider (*S. m. borealis*) occurs in both the high and low eastern arctic. The range extends from the Boothia Peninsula to coastal Ellesmere Island and the west coast of Greenland. *Borealis* eiders also occur on Baffin Island (Figure 2), on Southampton Island, and also on small islands in Hudson Strait, around Foxe Basin, in coastal Ungava Bay and northern Quebec, and along the coasts of Labrador and Newfoundland. The *borealis* subspecies of common eider winters off the coasts of Newfoundland and Labrador, and off the south west coast of Greenland. However, the migration routes of the *borealis* subspecies are not well known.

The *sedentaria* subspecies of the common eider (*S. m. sedentaria*) breeds on the east and west coasts of Hudson and James Bay, and on the Belcher, Sleeper, and Ottawa Islands (Figure 2). Small numbers of *sedentaria* eiders breed allopatrically with *borealis* on Southampton Island in northern Hudson Bay (Gilchrist, unpubl. data). Eiders breeding within Hudson Bay winter in open water leads near the Belcher Islands and off the west coasts of Quebec, and possibly west of Southampton Island (i.e. the Roes Welcome Sound polynya).

EIDER POPULATION DECLINES

Western Arctic king and common eiders

There is growing evidence that eider populations in western arctic North America are in decline. The number of king and Pacific common eiders flying past Point Barrow, Alaska during spring migration declined by more than 50% between 1976 and 1994 (Suydam et al. 1997) (Table 1). A recent estimate of 200 000 to 250 000 king eiders breeding in the western and central Canadian Arctic (Dickson et al. 1997) suggests a 75% decline since 1960, when Barry (1960) estimated over 900 000 birds. Furthermore, there has been a three to four fold drop in Pacific common eiders in Russia since the 1970's (Goudie et al. 1994). The spectacled and Steller's eiders, which share similar wintering and molting areas in the Chukchi and Bering seas, have also declined (Ely et al. 1994; Kertell 1991; Stehn et al. 1993 US Fish and Wildlife Service 1996). Spectacled eider populations in Alaska have declined at a rate of 14% per year since the early 1970's (Stehn et al. 1993), and the Steller's eider is nearly extinct in one of the two areas in Alaska where it was once a regular breeder (Kertell 1991). It is unknown why the eiders of the North Pacific Rim are in decline.

Eastern Arctic king and common eiders

In west Greenland, recent surveys of common eider (*S. m. borealis*) breeding colonies, and molting areas of king eiders suggest that dramatic declines have also occurred in eastern Arctic eider populations (Boertmann and Mosbech, 1996). Several common eider colonies which ranged in size from 1000 to 3000 breeding pairs in the 1930's have since been extirpated in Greenland. Similar declines in wintering and molting king eiders have apparently occurred, however a lack of historical information does not permit detailed analysis of population trends (Boertmann, *pers. com.*). These declines in Greenland have been attributed to high adult mortality due to eider harvest at breeding colonies and on wintering grounds (Boertmann and Mosbech, 1996). The effects of the Greenland winter harvest on king and common eiders (*S. m. borealis*) that originate in Canada is not known. Annual harvest estimates of king and common eiders in southwest Greenland range from 140-160 000 birds, and may not be sustainable (Merkel and Sand Frich, pers. com.).

Insufficient information exists to determine the population trends of northern eiders in the Canadian arctic. Recent surveys determined that the resident breeding population of the Hudson Bay eider (*S. m. sedentaria*) in the Belcher Islands has declined by 75% since the mid 1980s. This decline may have resulted when open water areas (polynyas and recurring leads) froze in the winter of 1990-91 resulting in a mass winter kill (Robertson and Gilchrist 1998).

INFORMATION NEEDED TO MANAGE EIDER POPULATIONS

Certain generic information such as population size and productivity is required to manage harvested waterfowl populations at sustainable levels. The adequacy of available information varies considerably among harvested species in North America. It is widely acknowledged that much of the information that exists on king and common eiders is insufficient or out of date to effectively manage eider populations (Reed and Erskine 1986; Seabird Working Group - Circumpolar Arctic Flora and Fauna Agreement, 1995).

The following Strategy outlines six questions which relate directly to the information needed to manage eider ducks. Each question is followed by a brief rationale, and then by specific research tasks designed to gain the required information. The eider species and subspecies studied by each research task are summarised in Table 2. The locations mentioned in the text are identified in Figures 3 and 4, and the locations of ongoing studies are identified in Figure 5. Finally, the status of each research task is defined as *ongoing*, *proposed*, or *not yet initiated* and the mailing addresses of key research contacts are identified (Appendix 1).

1 - WHAT ARE THE POPULATION ESTIMATES FOR EIDERS BREEDING IN ARCTIC CANADA?

Population estimates are required to determine if current levels of eider duck harvest are sustainable. Population estimates can be derived by counting eiders on their breeding grounds. They can also be derived by counting eiders during migration or on the wintering grounds when populations are often most concentrated. These types of studies, if repeated regularly, also provide baseline data to monitor population trends (see Population Trends below).

Census of western Arctic king and common eiders as they pass Point Barrow, Alaska

During spring migration both the western Arctic population of king eiders and the Pacific common eider (*S. m. v-nigra*) funnel past Point Barrow, Alaska on their way eastward to breed in northern Alaska and Canada (Figure 1, loc. 3). Thus, it is an ideal location to obtain both population estimates and population trends for these two populations. Counts of spring migrants were done in 1976 (Woodby and Divoky 1982), 1987, 1994 (Suydam et al. 1997), and 1996 (Suydam et al. in prep), and indicate that both populations are in decline (Table 1). These counts should be repeated on a regular basis. It is unknown what proportion of eiders pass Point Barrow either too far off shore or inland to be detected by the observers. Simultaneous monitoring of the migration by radar should clarify this. [STATUS: ongoing. CONTACT: Robert Suydam, North Slope Borough, Barrow, Alaska]

Census of western Arctic king eiders on the breeding grounds

Breeding pair surveys were conducted throughout approximately half of the breeding grounds of the western Arctic population of king eiders from 1991 to 1994. From these surveys, a population of 200 000 to 250 000 king eiders was estimated (Dickson et al. 1997). The accuracy of this estimate could be improved by extending the aerial surveys to areas not covered in 1991-94. In particular, surveys are needed on northern Banks Island and along the

mainland from Keats Point to Kent Peninsula (Figure 3 - Loc. 4, 5, 14). Further work is also required to determine an accurate Visibility Correction Factor for the king eider, as well as delineate the eastern limit of the breeding grounds (*see* Population Delineation below). [STATUS: not yet initiated]

Census of Pacific common eider in Queen Maud Gulf, Coronation Gulf and South east Dolphin and Union Strait, Northwest Territories

Surveys during spring migration in the 1980s suggested that >80% of the Pacific common eiders (*S. m. v-nigra*) that breed in Canada occur in this region of the central Arctic (Figure 3 - loc. 10, 11, 17). An aerial reconnaissance was done in 1995 to determine the concentration areas for nesting Pacific common eiders in the region. In 1996, we counted eider nests in the areas where breeding pairs were most abundant the previous year and obtained a breeding population estimate of over 36,000 eiders. A portion of the 1996 nest survey was repeated in 1997. About half as many eiders nested in 1997 as in 1996. These data concur with Coulson (1984) who found up to 65% of common eiders deferred nesting when conditions were unfavourable. This tendency not to nest in some years means caution must be used when using nests counts to monitor population trends [STATUS: completed 1999. CONTACT: Lynne Dickson, Canadian Wildlife Service]

Census of common eider breeding colonies in Hudson Strait, Baffin Island

The islands and shorelines of southern Baffin Island in Hudson Strait are important breeding areas for the *borealis* subspecies of common eider (Figure 4 - loc. 5). Over 24000 breeding pairs or 16% of this subspecies is thought to breed in this region based upon aerial surveys (Gaston and Cooch 1986) and limited ground surveys (Cooch 1986; Sirois and Kay 1993). Despite this, a detailed census of nesting islands in the region has not been completed. We initiated a three year survey in 1997-1999, and this will contribute to a more accurate estimate of the *borealis* population in the region. It will, also help identify key breeding and feeding areas along the coast of southern Baffin Island (*see* Key Habitat Sites below). [STATUS: ongoing 1997-99 CONTACT: Grant Gilchrist, Canadian Wildlife Service and David Kay, Ducks Unlimited Canada]

Census of wintering eastern Arctic king and common eiders in south west Greenland

The south west coast of Greenland is a key wintering area for both king eiders and the *borealis* subspecies of the common eider (Figure 4 - loc. 10). Winter and fall surveys in Greenland could provide estimates of population size and trends of Canadian breeding populations. This assumes that genetic and isotope studies will be able to determine what proportion of eiders wintering in Greenland breed in Canada. (*see* Population Delineation below). [STATUS: proposed 2000. CONTACT: Flemming Merkel, Greenland Institute of Natural Resources]

Census of breeding common eiders in Frobisher Bay and Cumberland Sound, Baffin Island

The community of Pangnirtung takes approximately 2000 eiders annually during the summer and fall which suggests that there is a substantial breeding and/or molting eider population in Cumberland Sound. A review of the topography and coastline of both Frobisher Bay and Cumberland Sound suggests that suitable breeding habitat exists, but the number of eiders breeding there is unknown (Figure 4 - loc. 8, 9). This warrants a census of both common and king eiders in the region. [STATUS: not yet initiated]

2 - WHAT ARE THE POPULATION TRENDS OF COMMON AND KING EIDERS IN CANADA?

In Canada, it is difficult to collect the quality of population data required to detect trends in eider numbers due to the remote locations and vast geographic range of eider breeding grounds. King eiders are particularly costly to census, because they are so thinly distributed throughout arctic Canada. Nonetheless, it should be possible to detect trends in eider populations by repeatedly sampling a portion of the breeding areas over time. Other research techniques include monitoring the number of birds passing by predictable sites during migration, and regularly counting eiders in wintering areas when their populations are most concentrated.

Census king and common eiders as they migrate past Point Barrow, Alaska

(see section on Population Estimates above)

Monitor the number of king eiders nesting in the Kagloryuak River valley, Northwest Territories

The Kagloryuak River valley on Victoria Island has one of the highest densities of nesting king eiders in the western Canadian Arctic, based on waterfowl breeding population surveys conducted throughout much of the western Canadian Arctic from 1992 to 1994 (1.3 to 1.86 birds per km^2) (Dickson et al. 1997). Due to the high densities of eiders and presence of three years of baseline data, this would be a suitable area to repeat surveys to help determine the population trend of western arctic king eiders. The monitoring data could also serve as early warning if eiders were being over-harvested at Holman, Northwest Territories (Figure 3 - loc. 9). [STATUS: proposed for 2002 CONTACT: Lynne Dickson, Canadian Wildlife Service]

Monitor the number of Pacific common eiders nesting in Prince Albert Sound

Although the harvest of Pacific common eiders (*S. m. v-nigra*) at Holman is small (about 200 birds plus an unreported number of eggs), the subpopulation is also small. Surveys for nesting common eiders in Prince Albert Sound in 1992 and 1993 indicate that the breeding population might be as few as 2200 birds (Cornish and Dickson, 1997). Such a small subpopulation could be easily over-harvested. To ensure a sustainable harvest at Holman, the islands in Prince Albert Sound should be periodically surveyed for breeding common eiders (Figure 3 - loc. 8). [STATUS: not yet initiated]

Repeat census of Pacific common eider breeding colonies in Dease Strait, Elu Inlet, Melville Sound and the mouth of Bathurst Inlet

Results of surveys in 1995 and 1996 revealed that this area of the central Arctic contains over 20% of Canada's nesting Pacific common eiders (Figure 3 - loc. 12, 13, 15). This is a logical site to monitor the population trend of the Pacific common eider, since nesting concentrations are high, there are already two years of baseline data and it is a relatively inexpensive site logistically due to its proximity to Cambridge Bay. Also, a sound knowledge of eider usage of the area will help biologists design strategies to mitigate the effects of increased ship traffic resulting from the future opening of several mines. [STATUS: not yet initiated]

Repeat census of king eiders in Queen Maud Gulf Migratory Bird Sanctuary

An estimated 20 000 king eiders were found nesting in the Queen Maud Gulf Migratory Bird Sanctuary during surveys conducted from 1990 to 1992. These surveys should be repeated in ten years to determine the population status of king eiders in the Sanctuary. [STATUS: not yet initiated. CONTACT: Ray Alisauskas, Canadian Wildlife Service]

Repeat census of common eider breeding colonies in Ungava Bay

An estimated 48 700 pairs (possibly as much as 32 % of the *borealis* subspecies of common eider nesting in Canada) were found on islands in Ungava Bay during surveys in 1978 and 1980 (Chapdelaine et al. 1986) (Figure 4 - loc. 6). This information can be used as baseline data to compare current population estimates in the region. Such a comparison would help determine the population trend of the *borealis* subspecies of the common eider in the eastern low Arctic. This is one of the only locations in the Canadian Arctic where sound historical survey data exists, and population trend estimates could be generated for the *borealis* subspecies. This study has been identified as one of the top priorities by biologists in eastern Canada who are concerned with the status of eiders wintering in Newfoundland [STATUS: proposed for 2000. CONTACT: Gilles Chapdelaine, Canadian Wildlife Service]

Repeat census of common eider breeding colonies in the Belcher and Sleeper Islands

The breeding population of common eiders (*S. m. sedentaria*) in the Belcher and Sleeper Islands was estimated in 1989 based upon ground surveys for nesting eiders (Flemming 1989) (Figure 4 - loc. 1). A repeat of this census permitted comparisons with these population estimates, and determined that the population of *sedentaria* eiders breeding in the Belcher Islands had declined by over 70% (Robertson and Gilchrist 1998). The declines apparently occurred due to a mass winter kill that occurred in 1991 when polynyas in the area froze over. [STATUS: completed 1997. CONTACT: Grant Gilchrist and Greg Robertson, Canadian Wildlife Service]

Repeat census of common eider breeding colonies in Hells Gate - Cardigan Strait

The breeding population of common eider (*S. m. borealis*) was estimated in this region in 1980-81 based upon detailed ground surveys (Prach et al. 1986) (Figure 4 - loc. 13). These previous studies provide baseline data that can be compared to current population estimates if these studies are repeated. Such a comparison would help determine the population trend of the *borealis* subspecies of the common eider in the eastern high Arctic. [STATUS: not yet initiated]

Monitor molt-migration of King Eiders at Clyde Inlet, Baffin Island

A large molt-migration of male king eiders is believed to occur from Foxe Basin overland across Baffin Island to Clyde Inlet on eastern Baffin Island in early July (Figure 4 - loc. 11). If this molt-migration does occur at Clyde Inlet, there is potential to develop an annual population index for eastern king eiders by monitoring eider numbers passing through the inlet each summer. The methods for this study would be similar to the fall and spring surveys conducted at Point Barrow, Alaska for the western king and Pacific common eiders (discussed above). As a first step in developing a molt-migration monitoring program at Clyde Inlet, the timing and extent of the migration should be quantified. [STATUS: not yet initiated]

Annual population census of wintering King and Common Eiders in West Greenland

(see section on Population Estimates above)

3 - WHAT IS THE GEOGRAPHIC DELINEATION OF VARIOUS EIDER POPULATIONS?

In order to assess factors affecting eiders and the ability of sub-populations to withstand them (e.g. harvest, disturbance, habitat loss), it is important to study where populations delineate geographically and how they differ ecologically (*also see* Annual Survival and Productivity below).

The eastern and western populations of the king eider differ in their migration pathways, the timing and location of moult, location of wintering areas, and annual levels of hunting mortality. However, the geographic locations where these populations separate on their breeding grounds is still uncertain. Similar uncertainties exist for the delineation of the *sedentaria* and *borealis* subspecies of common eider in northern Hudson Bay, as well as the *v-nigra* and *borealis* subspecies in the Central Arctic. Furthermore, within the northern *borealis* subspecies, it is still unknown where components of the population over-winter (e.g. Greenland vs. Newfoundland/Labrador).

Stable Isotope Analysis of king and common eiders

Birds carry distinct Stable Isotope Ratios that often reflect their diet and feeding locations (Hobson et al. 1994). Stable Isotope Ratios differ between the Bering Sea and waters west of Greenland. Thus, we attempted to use this technique to delineate the boundary between the breeding grounds of the eastern and western Arctic populations of

king eider. Preliminary results suggest this technique will not work, because the eiders that molt in the Bering Sea have a very large range in isotope ratio values. Further work is needed to determine if stable isotopes can be used to identify which common eider populations over-winter off Greenland versus Newfoundland. All that is required for stable isotope analysis is feathers, blood, and/or tissue which can be collected from live birds during banding, or from birds collected from hunters. [STATUS: ongoing. CONTACT: Keith Hobson, Canadian Wildlife Service]

Genetic analysis of king and common eiders in Canada, Alaska, and Greenland

Recent advances in population genetics have developed methods based on DNA markers found in animal tissue that can identify distinct populations if they exist. Genetic analysis of eiders sampled from breeding areas across the Arctic could help identify and delineate the boundaries of the breeding populations (e.g. eastern and western Arctic king eider populations). Genetic techniques also have the potential to identify the origin of eiders that are harvested in wintering areas (e.g. northern Greenland vs. the Canadian low arctic). This information would contribute greatly to assessing the impact of harvest on Arctic king and common eider populations (see Levels and Affects of Harvest). The methods and potential applications of genetic techniques should be investigated further. [STATUS: ongoing CONTACT: Kim Scribner, Arctic Science Centre and Michigan State University]

Banding of breeding king and common eiders in Canada

Bands that are returned by harvesters could help identify the wintering areas and migration pathways of specific eider sub-populations. Potential banding sites for common eiders include colonies on Southampton Island (*sedentaria* and *borealis*), in Hudson Strait (*borealis*), in Cardigan Strait (*borealis*), in Prince Albert Sound (*v-nigra*) and in Bathurst Inlet (*v-nigra*). Potential banding sites for king eiders are Southampton Island (eastern population), the Kagloryuak River mouth (females and young of western population), and Karrak Lake (unknown western or eastern populations). Bands could be returned by harvesters as part of ongoing eider harvest studies in Canada, Greenland, and Alaska (*see* Levels of Annual Harvest below). Banding programs could also contribute to needed studies of eider survival rates, reproductive ecology, and philopatry to breeding areas (see Survival and Productivity below). [STATUS: Southampton Island and Hudson Strait, ongoing, CONTACT: Grant Gilchrist, Canadian Wildlife Service; STATUS: Karrak Lake, ongoing, CONTACT: Ray Alisauskas, Canadian Wildlife Service; STATUS: Kagloryuak River mouth, not yet initiated]

Physical examination of birds retrieved by hunters

One way to improve our knowledge of the breeding range boundaries of the various subspecies of common eiders would be to physically examine birds shot at communities thought to be along the boundary. For example, Pacific common eider males have a v-shaped black marking on their white throat which is rarely found in the other

subspecies. Examination of birds shot at communities such as Gjoa Haven and Taloyoak for this marking would help determine how far east the breeding range of the Pacific common eider extends. [STATUS: not yet initiated]

4 - WHAT ARE THE LEVELS AND AFFECTS OF HARVEST ON KING AND COMMON EIDERS?

To determine whether harvest levels are sustainable, several characteristics of a population must be known. These include the size of the population, adult survival, annual productivity, and the annual level of harvest. Studies that assess levels of harvest and their impact on eider populations are complicated by the fact that eiders are shot in breeding areas, during migration, and on wintering grounds. Thus, harvest studies must involve other countries including Alaska, Russia, and Greenland, as well as several regions within Canada.

Inuvialuit Harvest Study

The harvest of king and common eiders in the western Arctic has been monitored by the Inuvialuit Harvest Study since 1988. This study should be continued, and expanded to include data on the annual harvest of common eider eggs and down. [STATUS: ongoing. CONTACT: Sheila Nasogaluak, Inuvialuit Joint Secretariat]

Nunavut Harvest Study

The harvest of king and common eiders in the eastern arctic should be monitored using data collected by the Nunavut Harvest Study which was initiated in 1996. This study will collect data on the timing and extent of adult harvest, as well as the collection of eggs and down. Data is gathered at a community level and collated by the Nunavut Harvest Study. The results of the Harvest Study may also provide information on the extent of the breeding range of the various subspecies of common eider. For example, it is unknown how far east the Pacific common eider nests. Examination of birds shot at communities such as Gjoa Haven and Taloyoak would help determine these breeding range boundaries. [STATUS: ongoing. CONTACT: John MacPherson, Nunavut Wildlife Management Board]

Greenland Harvest Study

The harvest of king and common eiders should be monitored in southwest Greenland during the winter. The number of eiders which are taken should be categorised by species, subspecies, sex and age where possible. Specimens are also collected from hunters in Greenland for genetic and isotope analysis to potentially quantify the numbers of eiders that breed in Canada which are harvested annually in Greenland. [STATUS: ongoing CONTACT: Flemming Merkel, Greenland Institute of Natural Resources]

Effects of down collection and disturbance at common eider colonies in the Belcher Islands.

The community of Sanikiluaq has established a commercial eider down industry (*S. m. sedentaria*) in the Belcher Islands in Hudson Bay. The community has taken an active role in monitoring eider populations and ensuring a sustainable harvest. The weather and ice conditions in the Belcher Islands makes the timing of down collection unpredictable. Studies which examine the effects of down collection and disturbance at various times of the breeding season are required to ensure that detrimental affects of down collection are minimised. [STATUS: not yet initiated]

Quantify non-retrieved kill and crippling loss of common and king eiders during harvest in all regions.

Eiders are fast-flying, large ducks which are often hunted in poor weather conditions. During the spring hunt, there is often a mixture of ice and open water making travel difficult. These factors likely contribute to high numbers of birds that are wounded or killed, but which are not retrieved by hunters. Studies which quantify the extent of non-retrieved kill, as well as the factors which contribute to it, are required to assess and manage eider harvest. These studies should be conducted at a number of communities in the Canadian Arctic, Newfoundland, Greenland, and Alaska. [STATUS: Holman, completed 1999. CONTACT: Lynne Dickson, Canadian Wildlife Service. STATUS: Belcher Islands, ongoing. CONTACT: Grant Gilchrist and Greg Robertson, Canadian Wildlife Service]

Determine size of western Arctic sub-population of king and common eiders harvested near Holman

Nearly all (99%) of the harvest of western Arctic eiders within Canada occurs near Holman on Victoria Island (Fabijan et al. 1997) (Figure 3, loc. 7). The purpose of this study was to further our understanding of the impact of the Holman hunt on that area's eider subpopulation. It also tested the usefulness of an eider migration count at Holman as a means of monitoring the proportion of the eider subpoplation being harvested. More specifically, data were collected each spring for three years on the number of eiders that migrated past Holman, timing of the migration, the number of eiders harvested including crippling losses, and the sex, age and body condition of harvested birds.[STATUS: completed in 1999 CONTACT: Lynne Dickson, Canadian Wildlife Service and Tim Byers, Byers Environmental Studies]

5 - WHAT IS THE ANNUAL SURVIVAL AND PRODUCTIVITY OF EIDERS BREEDING IN CANADA?

To determine whether harvest levels are sustainable, the size of the population, levels of harvest, adult survival rates, life span, age of first breeding, and annual production must be known. Furthermore, to assess the impact of harvest, it is also important to study how populations differ ecologically. Therefore, effective population studies also include ecological studies such as determining the affect of age on reproductive success, the degree of philopatry of eiders to specific breeding areas, sources of adult mortality and reproductive failure, and the impact of weather and ice conditions on foraging and reproduction.

Ecological studies of the Pacific common eider at the mouth of Bathurst Inlet

Several nesting colonies of Pacific common eiders occur at the mouth of Bathurst Inlet (Figure 3 - loc. 12). Numbers are sufficient to permit banding, the study of adult survival, philopatry and reproductive ecology of the Pacific common eider on the Central Arctic. [STATUS: not yet initiated]

Ecological studies of king eiders at Karrak Lake, Queen Maude Gulf Bird Sanctuary

The reproductive and population biology of king eiders nesting on islands is being examined in Karrak Lake in the central Canadian Arctic (Kellett and Alisauskas, 1997). There were 41 nests distributed among 10 islands which could be reached by boat. Such a concentration of eider nests, as well as the presence of a nearby field camp originally established for goose studies, makes this a suitable place to conduct further ecological studies of eiders. Ongoing studies include banding, annual survival, philopatry, and reproductive ecology (Figure 3 - loc. 20). [STATUS: ongoing. CONTACT: Ray Alisauskas, Canadian Wildlife Service]

Ecological studies of common and king eiders at East Bay, Southampton Island

East Bay, Southampton Island is an important nesting area for common (both *sedentaria* and *borealis* subspecies) and king eiders (Abraham and Ankney 1986) (Figure 4 - loc. 2). High nesting densities permit banding and the study of adult survival and reproductive ecology of three low Arctic eider populations which are nesting allopatrically. [STATUS: ongoing. CONTACT: Grant Gilchrist, Canadian Wildlife Service]

Ecological studies of common eiders at Cardigan Strait, Devon Island

Cardigan Strait - Hells Gate is a key nesting area for common eiders (*S. m. borealis*) in the high arctic (Figure 4 - loc. 13). Eiders nest in sufficient density there to permit banding and ecological studies of a high Arctic population. The colonies can only be reached by helicopter due to their remote location and the ice conditions and strong tidal currents around the islands. [STATUS: not yet initiated]

Ecological study of common and king eiders in the Belcher Island polynyas during winter

The polynyas and recurring leads that occur in the Belcher Islands during winter support thousands of eider ducks. In rare winters, these open waters freeze over resulting in mass winter kills (Robertson and Gilchrist, 1998). Clearly, over-winter mortality is a key population parameter of eider ducks in Hudson Bay. Studies were initiated in 1997 to examine how dynamic ice conditions influence the movements, diet, energetics, and over-winter survival of eider ducks in the Belcher Islands. [STATUS: ongoing. CONTACT: Grant Gilchrist and Greg Robertson, Canadian Wildlife Service].

Assess heavy metal contaminants in king and common eiders in the Canadian arctic

This study examines heavy metal levels in eider tissues at different locations in the arctic. We will determine if geographic variation occurs in levels of these contaminants and if there are sublethal effects in the birds associated with exposure to contaminants. By examining ducks collected from Holman (NWT), Southampton Island (Nunavut), and the Belcher Islands (Nunavut), we will also identify areas where populations have high contaminants levels and possibly pinpoint the origin of some contaminants. [STATUS: ongoing. CONTACT: Mark Wayland, Canadian Wildlife Service]

6 - WHERE DO KEY HABITAT SITES FOR EIDERS OCCUR?

Because eiders tend to form large aggregations, they are vulnerable to pollution, disturbance and habitat loss caused by human activity. King eiders are particularly susceptible during spring migration, molt and on their wintering grounds. Common eiders are susceptible at all times of the year, especially during the nesting and brood-rearing periods. Thus, in any given place and time, a large proportion of an entire population can be affected by a single natural or man-caused change in the environment. For example, an oil spill in the Bathurst polynya in the Beaufort Sea could affect one-third of the North American population of Pacific common eiders on a given day during spring migration (Alexander et al. 1997). To effectively conserve and protect eider populations, it is important to know where they congregate in large numbers. Despite this, many of the key staging, brood-rearing, moulting and wintering areas of both eider species have not been identified.

Satellite tracking of king and common eiders

Satellite transmitters placed on king and common eiders during the breeding season would help identify migration routes, and moulting and wintering areas in the Canadian Arctic, Greenland, Chukchi Sea and Bering Sea (Petersen et al. 1995). Satellite tracking is a particularly effective tool when coupled with aerial surveys. Once a bird has arrived on the moulting or wintering ground, aerial surveys in its vicinity could locate many other eiders. More specifically, satellite data are needed: to determine the importance of the Greenland coast as a wintering area for eiders breeding in Canada; to identify where in the Chukchi and Bering seas eiders that breed in Canada molt and winter; and to identify the differences in migratory movements and habitat use of both king and common eider species. [STATUS: ongoing for western Arctic king eiders. CONTACT: Lynne Dickson, Canadian Wildlife Service. STATUS: not yet initiated for eastern Arctic eiders]

Location and importance of staging areas in the south-eastern Beaufort Sea to king eiders during moult migration

Results of satellite telemetry show that male king eiders stage in the western Canadian Arctic for about a month prior to moult migration in late July. Systematic aerial surveys are needed to determine the boundaries of the staging

areas and to determine the importance of each site. [STATUS: proposed for 2001. CONTACT: Lynne Dickson, Canadian Wildlife Service]

Aerial surveys to determine the location of key brood-rearing and molting areas

Counts of post-breeding Pacific common eiders (*S. m. v-nigra*) at Point Barrow, Alaska indicate that a second wave of males migrate past after the moult (Suydam et al. 1997). This, along with reports by hunters and a survey in north west Prince Albert Sound in mid-summer of 1992 (Cotter et al. 1997), all suggest that concentrations of male Pacific common eiders remain in Canadian waters to moult. Surveys during the moult in Prince Albert Sound, south eastern Dolphin and Union Strait, Coronation Gulf and Queen Maud Gulf would determine the location and importance of these moulting areas (Figure 3). Common Eiders tend to rear their young in the same location each year (Bustnes and Erikstad 1993). To date, we have very little information on where these brood-rearing areas are (see Cornish and Dickson 1997 for a summary of available data). Aerial surveys near the nesting colonies during brood-rearing are needed to determine their location. [STATUS: not yet initiated]

Surveys in late September and October to determine key fall staging areas for western Arctic eider populations

Very few surveys have been conducted during the fall to identify key staging areas. Yet females and young eiders have been seen migrating past Johnson Point on the west side of Banks Island as late as 20 October (Barry et al. 1981). Aerial surveys of coastal areas of the western Canadian Arctic are needed to identify key areas late in the open water season. [STATUS: not yet initiated]

Importance of the polynya in south eastern Dolphin and Union Strait to Pacific common eiders during spring migration

As many as 65 000 Pacific common eiders (>80% of the North American population of Pacific common eiders) use the polynya in south eastern Dolphin and Union Strait during spring migration (Alexander et al. 1994) (Figure 3 - loc. 10). In future, there will likely be ship traffic through the Strait to service mining operations in Canada. At the Strait's shallowest point, the two-mile wide corridor is only 13 m deep. Thus, dredging will likely be necessary which could change the ecology of the Strait, including the abundance and availability of the benthic prey organisms of eiders. Prior to nesting, common eiders must accumulate enough energy reserves not only to produce eggs, but also to survive the 28 day incubation period. A study is required to assess the importance of the Dolphin and Union Strait polynya as a source of energy for reproduction by the Pacific common eider. [STATUS: not yet initiated]

Winter aerial and ground surveys at the Belcher Islands Polynyas

A large proportion of the Hudson Bay eider population (*S. m. sedentaria*) over-winters in polynyas and leads near the Belcher Islands and along the south west coast of Hudson Bay (Figure 4 - loc. 1). However, the distribution and

number of eiders in this area is still poorly known (Abraham and Finney 1986). Aerial and ground surveys could help identify key over-wintering habitats and also contribute to estimating population size and trends of the *sedentaria* subspecies (*see also* Population Trends). [STATUS: ground surveys ongoing. CONTACT: Grant Gilchrist and Greg Robertson, Canadian Wildlife Service]

Winter aerial and boat surveys in south west Greenland

The south west coast of Greenland is a key wintering area for both king eiders and the *borealis* subspecies of the common eider (Figure 4 - loc. 10). Winter aerial and boat surveys could identify specific feeding and staging locations important for wintering eiders, and also contribute to estimates of population size (*see* Population Trends above). [STATUS: proposed]

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Table 1. Number of eiders passing Point Barrow, Alaska during spring migration.

Year	Pacific Common Eider	King Eider
1976[a]	153 000	802 000
1987[b]	95 000	556 000
1994[b]	71 000	373 000

[a] Woodby and Divoky 1982.

[b] Suydam et al. 1997.

Table 2. Eider research projects in relation to status, race, and species. Circles identify species and/or race of eider populations targeted by specific projects (solid circles refer to ongoing projects; open circles refer to proposed projects).

RESEARCH TASKS	STATUS	KING EIDER		COMMON EIDER		
		western	eastern	*v-nigra*	*sedentaria*	*borealis*
1 - POPULATION ESTIMATES						
Repeat census of migrants, Point Barrow, Alaska	ongoing	●		●		
Census breeders, Banks Island and Mainland	--	○				
Census breeders, Queen Maud and Coronation Gulf	completed			●		
Census breeders, colonies in Hudson Strait	ongoing					●
Census breeders, Frobisher Bay and Cumberland Sound	--					○
Census wintering grounds, southwest Greenland	ongoing		●			●
Census wintering grounds, Belcher Islands	ongoing				●	
2 - POPULATION TRENDS						
Repeat census of migrants, Point Barrow, Alaska	ongoing	●		●		
Repeat census, breeders in Kagloryuak River Valley	proposed	○				
Repeat census, breeders in Prince Albert Sound	--			○		
Repeat census, breeders in Dease Strait and Melville Sound	--			○		
Repeat census, breeders in Belcher Islands	completed				●	
Repeat census, breeders in Ungava Bay, Quebec	proposed					○
Repeat census, breeders in Hells Gate and Cardigan Strait	--					○
Monitor molt migration, Clyde Inlet, Baffin Island	--		○			○
Monitor molt migration, Newfoundland/Labrador	proposed		○			○
3 - GEOGRAPHIC DELINEATION OF EIDER POPULATIONS						
Stable Isotope Analysis	ongoing	●	●	●	●	●
Population Genetic Analysis	ongoing	●	●	●	●	●
Banding of breeding eiders	ongoing	●	●	○	●	●
Physical analysis of harvested eiders	ongoing	○	○	○	○	●

Table 2. Continued

RESEARCH TASKS	STATUS	KING EIDER		COMMON EIDER		
		western	eastern	*v-nigra*	*sedentaria*	*borealis*
4 - LEVELS AND EFFECTS OF EIDER HARVEST						
Inuvialuit harvest study	ongoing	●		●		
Nunavut harvest study	ongoing	●	●	●	●	●
Greenland harvest study	ongoing		●			●
Effects of down collection, Belcher Islands	--				○	
Effects of down collection, Newfoundland/Labrador	ongoing					●
Quantify size of eider subpopulations hunted at Holman, NT	completed	●		●		
Quantify imbedded shot in eiders	ongoing		●		●	●
Quantify non-retrieved kill	ongoing	●	●	●	●	○
5 - ANNUAL SURVIVAL AND PRODUCTIVITY						
Ecological studies, Bathurst Inlet	--			○		
Ecological studies, Karrak Lake	ongoing	●(?)	●(?)			
Ecological studies, Southampton Island	ongoing		●		●	●
Ecological studies, Cardigan Strait, Devon Island	--					○
Ecological studies in winter, Belcher Islands	ongoing				●	
Ecological studies in winter, Newfoundland/Labrador	proposed					○
6 - IDENTIFYING KEY HABITAT SITES						
Satellite tracking, eastern, central and western Canadian Arctic, Greenland	ongoing	●	○	○	○	○
Early summer staging areas, Beaufort Sea	proposed	○				
Integration of Aboriginal Ecological Knowledge	ongoing	●	●	●	●	●
Brood rearing and molting areas	--	○		○	○	○
Fall staging, western and central Arctic	--			○		
Spring staging, Dolphin and Union Strait polynyas	--			○		
Wintering areas, Belcher Islands polynyas and leads (ground work)	ongoing				●	
Aerial surveys, winter, Belcher Islands	proposed				○	
Aerial surveys, winter, south west Greenland	ongoing		○			○

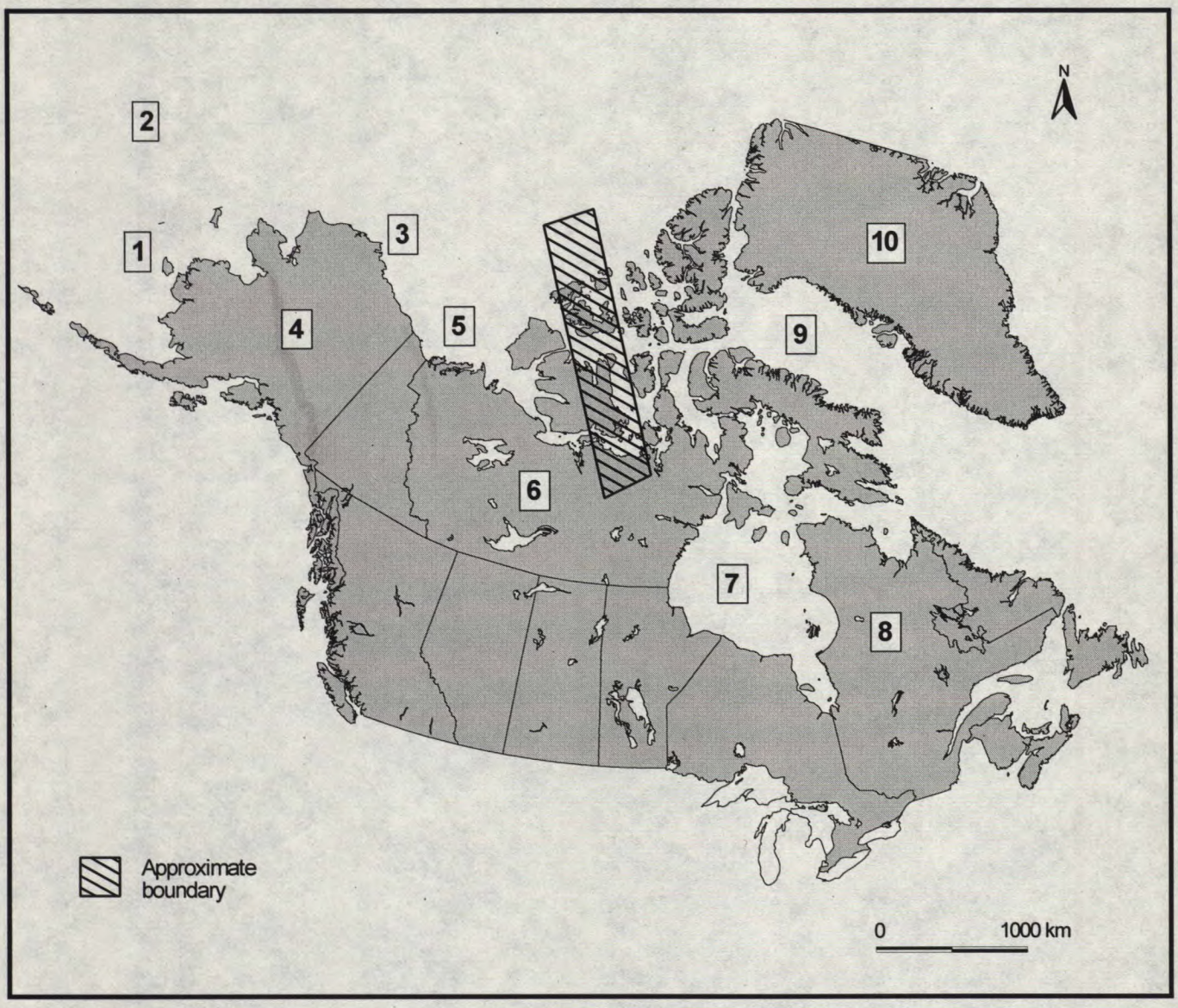

Figure 1. Breeding distribution of eastern and western populations of king eiders in Canada.

LEGEND

1 Bering Sea
2 Chukchi Sea
3 Point Barrow, Alaska
4 Alaska, United States
5 Beaufort Sea
6 Northwest Territories, Canada
7 Hudson Bay
8 Quebec, Canada
9 Baffin Bay
10 Greenland

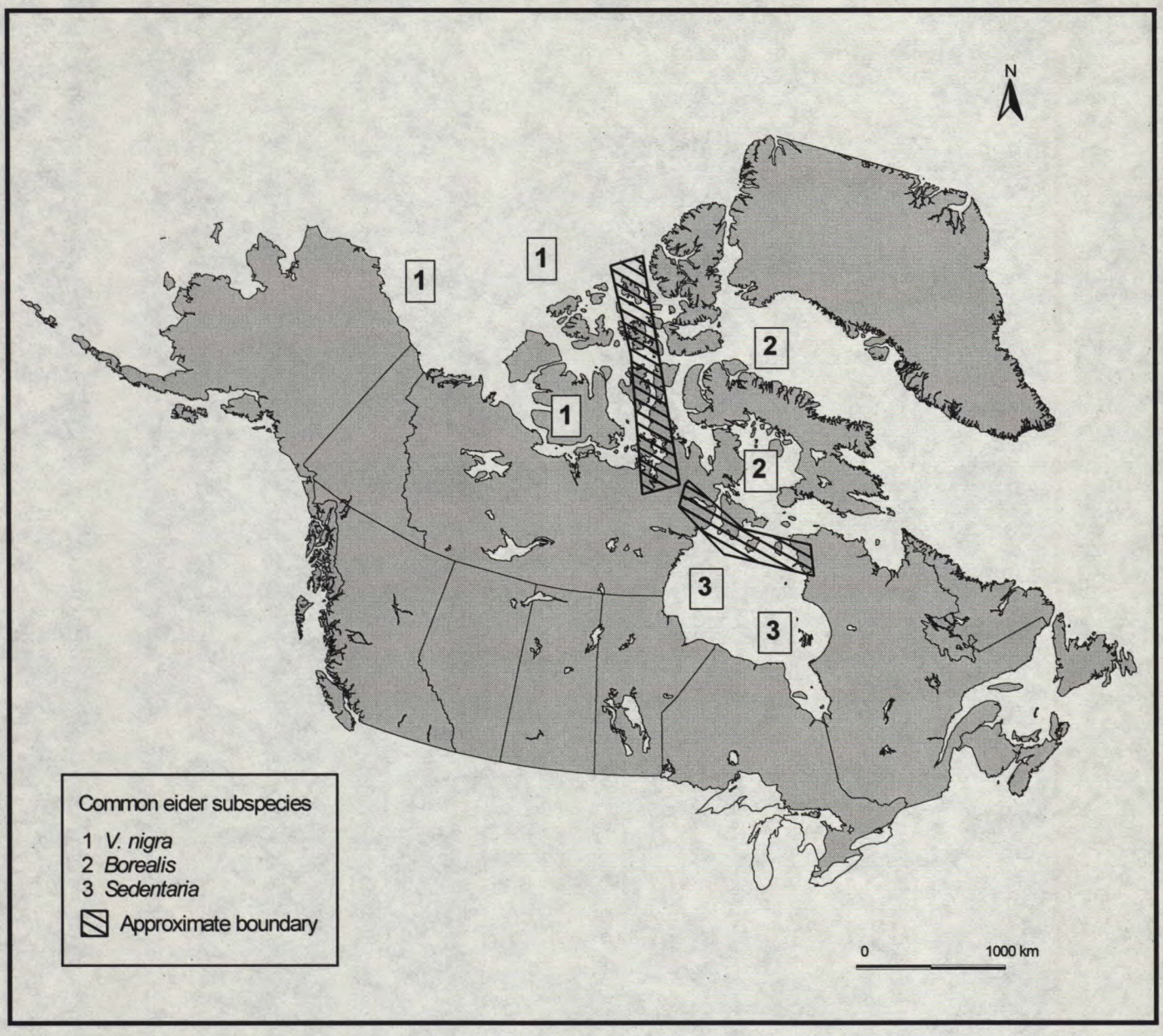

Figure 2. Breeding distribution of common eider subspecies in North America.

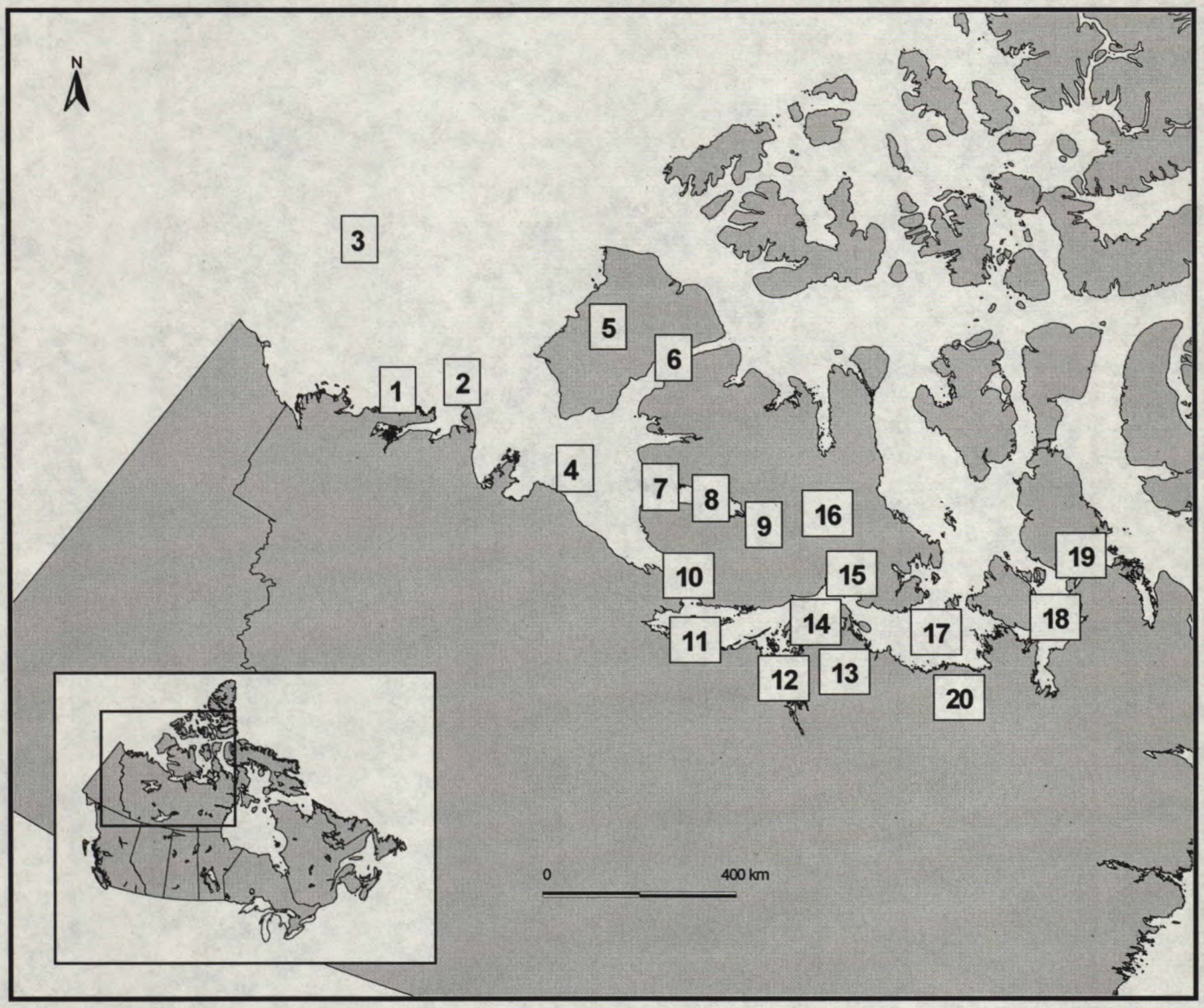

Figure 3. Place names in the western Arctic mentioned in the text.

LEGEND

1 Tuktoyaktuk Peninsula
2 Bathurst Polynya
3 Beaufort Sea
4 Keats Point
5 Banks Island
6 Johnson Point
7 Holman
8 Prince Albert Sound
9 Kagloryuak River
10 Dolphin and Union Strait Polynya
11 Coronation Gulf
12 Bathurst Inlet
13 Melville Sound / Elu Inlet
14 Kent Peninsula
15 Dease Strait
16 Victoria Island
17 Queen Maud Gulf
18 Gjoa Haven
19 Taloyoak
20 Karrak Lake

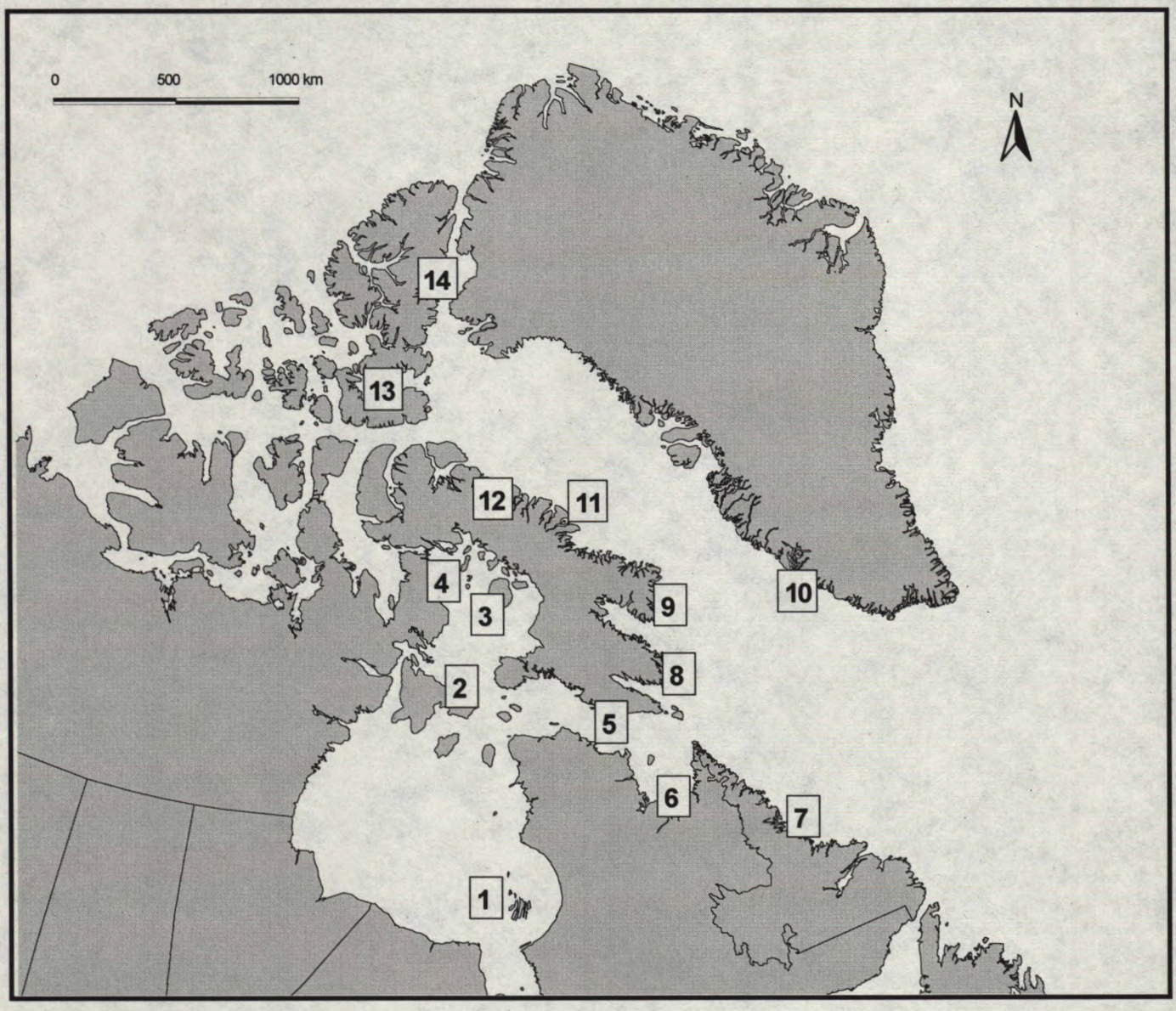

Figure 4. Place names in the eastern Arctic mentioned in the text.

LEGEND

1 Belcher Islands
2 East Bay, Southampton Island
3 Foxe Basin
4 Boothia Peninsula
5 Hudson Strait
6 Ungava Bay
7 Labrador Coast
8 Frobisher Bay
9 Cumberland Sound
10 Southwest Greenland Coast
11 Clyde Inlet
12 Baffin Island
13 Cardigan Strait / Hells Gate
14 Ellesmere Island

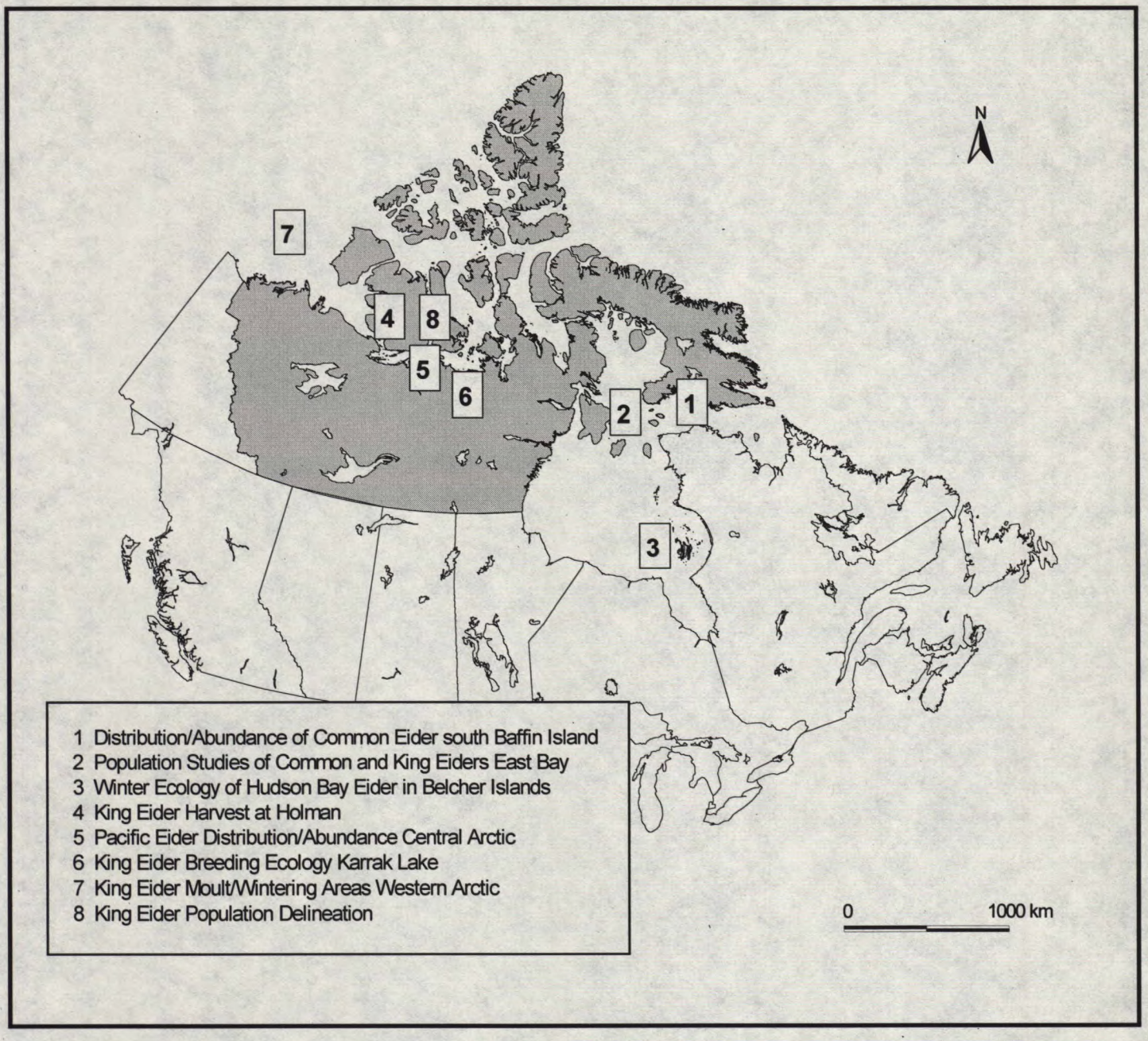

Figure 5. Location of sea duck studies currently being conducted in the Prairie and Northern Region. Numbers on the map correspond to the numbers assigned to each project in the text.

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A cooperative research strategy for King and Common eider ducks breeding in northern Canada