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POPULATION DECLINES OF KING AND COMMON EIDERS OF THE BEAUFORT SEA¹

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Abstract. King (*Somateria spectabilis*) and Common Eiders (*S. mollissima v-nigra*) wintering off western North America migrate past Point Barrow, Alaska and across the Beaufort Sea to nest in northern Alaska and northwestern Canada. Migration counts were conducted by various researchers at Point Barrow during 1953, 1970, 1976, 1987, 1994, and 1996. We examined population trends by standardizing the analysis of the migration counts in all years. Based on this stan-

dardized procedure, the King Eider population appeared to remain stable between 1953 and 1976 but declined by 56% (or 3.9% year⁻¹) from approximately 802,556 birds in 1976 to about 350,835 in 1996. The Common Eider population declined by 53% (or 3.6% year⁻¹) from approximately 156,081 birds in 1976 to about 72,606 in 1996. Reasons for the declines are unknown.

Key words: *Beaufort Sea, Common Eider, King Eider, mortality, population trend, Somateria mollissima v-nigra, Somateria spectabilis.*

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King (*Somateria spectabilis*) and Common Eiders (*S. mollissima v-nigra*) wintering in the Bering Sea and north Pacific Ocean migrate north to nesting areas in Russia, Alaska, and northwestern Canada. Most of the eiders that nest in Alaska and Canada migrate past Point Barrow, Alaska and across the Beaufort Sea.

During the molt and fall migrations, eiders again pass close to Point Barrow as they head west and south to the Chukchi and Bering Seas. An account of the spectacular migrations of eiders past Point Barrow was first published more than 100 years ago (Murdoch 1885), although systematic efforts to estimate the magnitude of the passage did not occur until much later (Thompson and Person 1963, Woodby and Divoky 1982, Suydam et al. 1997).

King and Common Eider populations are not routinely monitored; there are few data on the sizes or trends of the populations. Two studies in the early 1990s suggested that the King Eider population of the Beaufort Sea had declined markedly over the previous 20 years (Dickson et al. 1997, Suydam et al. 1997). The objective of this paper is to examine the available data on population trends of the King and Common Eiders of the Beaufort Sea.

METHODS

We compared estimates of the number of King and Common Eiders migrating past Point Barrow in 1953 (Thompson and Person 1963), 1970 (Johnson 1971), 1976 (Woodby and Divoky 1982), 1987, 1994 (Suydam et al. 1997), and 1996 (Suydam and Quakenbush, unpubl. data). The duration of the migration counts varied among the studies, thus we standardized our analysis procedures to include data collected only between 1 May to 4 June for spring migration and 13 July and 7 September for summer/fall migration. The standardized periods contained mostly adult eiders. Few immature King Eiders migrate past Point Barrow (Suydam and Quakenbush, unpubl. data). During the fall, the young-of-the-year do not first appear at Point Barrow until the very end of August or the first week of September (Johnson 1971, Timson 1976), thus few young are included in the standardized summer/fall time period.

We conducted simple linear regression analysis on point estimates of eider numbers (Norusis 1993). Because the King Eider population appeared stable at least through 1976, we conducted regression analysis only on 1976 to 1996 estimates, both spring and summer/fall counts. Because estimates were obtained for both spring and summer/fall migrations in 1994 and 1996, point estimates for each of these years are an average of the two counts. For Common Eiders, we only used the spring migration data for trend analysis. Whereas fall migration of most adult King Eiders past Point Barrow occurs in July and August, many adult Common Eiders remain east of Point Barrow until late September or October (Barry 1986, Suydam et al. 1997). Counts during 1953 and 1970 ended in early September well before the conclusion of the migration of adult Common Eiders (Thompson and Person 1963, Johnson 1971). Therefore, the fall counts could not be compared with the spring counts that appear to contain most of the Beaufort Sea breeding eiders.

RESULTS

The estimated numbers of King and Common Eiders passing by Point Barrow during the standardized periods are presented in Table 1. The number of King Eiders appeared to be stable between 1953 and 1976 at approximately 800,000 birds. By 1996, the King

TABLE 1. Estimated passage and 95% confidence intervals (CI) for the number of King and Common Eiders migrating past Point Barrow during a standardized period in the spring (1 May to 4 June) and fall (13 July to 7 September).

Season/ year	King Eider		Common Eider	
	Passage ^a	CI ^b	Passage ^a	CI ^b
1953 ^c	759,999 ^d	NA ^e		
1970 ^c	760,199	NA		
1976 ^f	802,556	NA	156,081	NA
1987 ^f	555,870	103,229	95,069	28,261
1994 ^f	345,489	147,877	74,651	22,317
1994 ^c	288,362	46,229		
1996 ^f	371,452	107,697	72,606	13,606
1996 ^c	330,218	70,725		

^a Projected passage of eiders for 1953 (Thompson and Person 1963), 1970 (Johnson 1971), 1976 (Woodby and Divoky 1982), 1987 and 1994 (Suydam et al. 1997), and 1996 (Suydam and Quakenbush, unpubl. data).

^b Confidence intervals were calculated using a stratified sampling procedure (Thompson 1992) with days being used as the strata.

^c Fall migration.

^d Estimated passage was not divided between King and Common Eiders by Thompson and Person (1963), thus we used the percentage of King and Common Eiders observed in the migration during 1970 by Johnson (1971).

^e NA = Not available.

^f Spring migration.

Eider population had declined (1976 to 1996, $F_{1,2} = 74.9$, $P = 0.01$) by 56% (or 3.9% year⁻¹) to approximately 350,835. The number of Common Eiders passing Point Barrow during the spring declined by 53% (or 3.6% year⁻¹) from 156,081 in 1976 to 72,606 in 1996 ($F_{1,2} = 58.0$, $P < 0.02$).

DISCUSSION

Standardized analysis of results from migration counts of eiders at Point Barrow provide evidence that the number of King and Common Eiders of the Beaufort Sea may have declined markedly from 1976 to 1996. A change in the number of migrating eiders, however, could reflect a change or shift in the migration route. There are no scientific data available to evaluate changes in migration routes, although Eskimo hunters indicate that there has been no change (C. D. N. Brower, pers. comm.).

The data indicating a decline in eider populations are compelling but need to be viewed with some caution. Suydam et al. (1997) pointed out some of the difficulties associated with comparing eider migration counts, including: (1) differences in watch effort and duration of the counts, (2) fall counts miss some females that migrate late in the season and may contain some young-of-the-year birds, (3) lack of variance estimates for early counts, (4) interannual variation in timing of the migration, and (5) potential differences in counting techniques or abilities among observers. We have tried to minimize the effects of the first two factors by standardizing the counts across years. Too few data exist to sufficiently evaluate the latter three factors. By standardizing the results among all years, we minimized, but did not eliminate, potential effects of these factors.

In 1976, Woodby and Divoky (1982) observed huge numbers of eiders in a short period of time—360,000

in 10 hours. During other years, such tremendous passages were not observed but still large numbers were seen in relatively short periods of time. An observed decline in the number of King Eiders could result if earlier counts (1953 to 1976) were biased upwards relative to later counts (1987 to 1996). This probably did not occur because Woodby and Divoky (1982) were experienced observers and Johnson (1971) used photographs to correct his estimates. During later counts, observers were trained to estimate flock sizes using photographs of large flocks of eiders and estimates were calibrated among observers (Suydam et al. 1997).

The results of breeding-pair surveys in the western Canadian Arctic corroborate a decline in numbers of King Eiders, but also need to be viewed with caution. From 1991 to 1994, systematic aerial surveys estimated 200,000 to 250,000 King Eiders (Dickson et al. 1997). Dickson et al. (1997) suspected their estimate was biased downward because the visibility correction factor was minimal and because of difficulties in correctly timing the surveys with peak numbers of male eiders. This recent estimate is considerably lower than Barry's (1960) estimate of 900,000 for the same area in 1960, but the 1960 estimate was based on an aerial reconnaissance and coverage was limited.

There is currently no information indicating a decline in the number of King Eiders breeding in Alaska. Aerial surveys for breeding pairs of waterfowl show no clear trend for King Eiders from 1986 to present (R. King, pers. comm.; 1992–present, W. Larned, pers. comm.).

Other than what we have presented, there are no data available to assess the population trend of Common Eiders of the Beaufort Sea. Conventional aerial surveys for breeding waterfowl do not include the offshore islands where Common Eiders tend to nest.

The biology of both King and Common Eiders of the Beaufort Sea is poorly known. Presumably, like most other sea ducks, King and Common Eiders have low annual productivity, late sexual maturity, and high annual adult survival. Given these life-history traits, it is likely that the stability of eider populations is dependent on adult survival. The only known consistent human caused mortality of adult eiders in the Beaufort Sea is hunting. The harvest of King Eiders in northwestern Canada and Alaska ranged from 2.5 to 5.5% of the total population during the period from 1976–1995 (Fabijan et al. 1997). During the same period, the harvest of Common Eiders was 1.6 to 3.5% of the population. Although little is known regarding sustainable harvest for eiders, the rates are within limits for other sea ducks (Goudie et al. 1994). Other sources of mortality may contribute to the decline of the populations, particularly periodic die-offs caused by extreme weather and ice conditions (Barry 1968, Fournier and Hines 1994) and oiling events in the Bering Sea (Fowler and Flint 1997). If recruitment since 1976 has equaled natural adult mortality, then hunting and other anthropogenic causes could have contributed to declines of King and Common Eider populations.

King and Common Eider numbers have declined concurrently with two closely related and sympatric species, Spectacled (*S. fischeri*) and Steller's (*Polysticta stelleri*) Eiders (Kertell 1991, Stehn et al. 1993). To

better understand possible declines, there is a need to determine survival and productivity rates, locations of staging, molting, and wintering areas, and sources of mortality and their impacts to eider populations.

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FAUNAL REMAINS IN CALIFORNIA CONDOR NEST CAVES¹

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Abstract: Studies of faunal remains in California Condor (*Gymnogyps californianus*) nests in the 1980s yielded bones and hair of a variety of small, medium-sized, and large mammals, and a near absence of avian and reptilian materials. A prevalence of small to medium-sized species may reflect ease of penetration of hides of such carrion and a relative abundance of ingestible bone from such species. Remains also included metal, plastic, and glass artifacts, likely mistaken for bone materials by condors. Size distributions of bone materials and percentage artifacts among hard remains suggest an overall absence of severe calcium-supply problems for condors.

Key words: calcium supplies, California Condor, carrion preferences, *Gymnogyps californianus*.

As an obligate scavenger, the California Condor (*Gymnogyps californianus*) has long been known to feed heavily on carcasses of large mammals. Recorded food items include cattle, horses, burros, mules, pigs, sheep, goats, domestic dogs, domestic cats, jackrabbits, deer, elk, coyotes, bobcats, mountain lions, grizzly bears, skunks, ground squirrels, kangaroo rats, whales, sea lions, and salmon (Koford 1953, Miller et al. 1965, Wilbur 1978). Yet despite the frequency of sight records of condors at large carcasses, such as those of

cattle, there have been some indications from choice situations that condors may prefer smaller carcasses, such as rabbits, when they are available (Miller et al. 1965). Such a preference is plausible because it is presumably relatively easy for the birds to penetrate the hides of small carcasses and easy for them to obtain needed bone material from such carcasses. Scott and Boshoff (1990) similarly reported a potential preference for small carcasses, especially light-colored small carcasses, in the condor-sized Cape Vulture (*Gyps coprotheres*) in Africa.

Because of a variety of factors, such as the ease of seeing condors in open rangeland habitats, historical sight records of feeding condors may be inherently biased toward large carcasses and may not be fully representative of overall diet of the species. One way to circumvent some of the observational biases in sight records is to examine remains of food found in condor nests, primarily bone material, but also hair and feathers. However, food remains in nests also are subject to biases (Errington 1932, Schipper 1973). Although they can yield useful qualitative data on breadth of diet, food remains, like sight records, cannot be assumed to give quantitatively accurate estimates of various diet components. Presumably, not all food items have the same probability of preservation as food remains in nests, and furthermore, the presence of food remains in condor nests is not absolute proof that they were brought in by the condors. Nevertheless, food remains in nests can give useful insights into condor food hab-

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