Clutch, egg and body size variation among common eiders breeding in Hudson Bay, Canada

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The Hudson Bay common eider (*Somateria molissima sedentaria*) is a unique subspecies of eider that remains within the confines of Hudson Bay throughout the year. We compared clutch, egg and body size variation among populations of common eiders breeding in eastern and western Hudson Bay. Clutch size did not differ substantially among these populations. All eiders in Hudson Bay laid larger clutches than other subspecies in eastern North America. As Hudson Bay common eiders do not undergo extensive migrations, they may have more energy reserves available to them for egg production. Eiders nesting in eastern Hudson Bay laid larger eggs than eiders nesting in western Hudson Bay. Further, eiders in eastern Hudson Bay tended to be structurally larger, but had smaller bill processes. These differences may have a genetic basis. Smaller egg size and body size may arise in western Hudson Bay from mixing with the smaller *borealis* subspecies nesting to the north. Further work to resolve genetic affinities, determine levels of male and female dispersal, and examine variation in reproductive ecology are needed to resolve the sources of these differences.

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Many species of birds show variation in morphological, behavioural and/or life history characters across their ranges. This variation can be clinal or discrete (Rockwell & Barrowclough 1987), and populations showing discrete differences may be designated as subspecies. Alternatively, differences among populations may reflect differential phenotypic expression of traits in different environments. Documenting variation among populations has important implications for evolutionary, systematic and biogeographical studies and for conservation efforts (Avise & Hamrick 1996).

Among waterfowl, ducks tend to show less intraspecific variation than geese in morphological and life history traits across their range. Common eiders (*Somateria mollissima*) are one of the most variable ducks and have seven distinct subspecies (Palmer 1976; Cramp & Simmons 1977), which show morphological and life history trait differences. In this regard common eiders are similar to geese, which also tend to show considerable variation among populations and subspecies (Dunn & MacInnes 1987).

Clutch, egg and body size are all important life history/morphological traits. In particular, clutch size is an important component of reproductive output (Winkler & Walters 1983). Variation in clutch size among populations may reflect different selective regimes, environmental conditions, and/or age structure (Rohwer 1992). Factors governing egg size variation are less clear (Williams 1994). Variation in egg size among populations

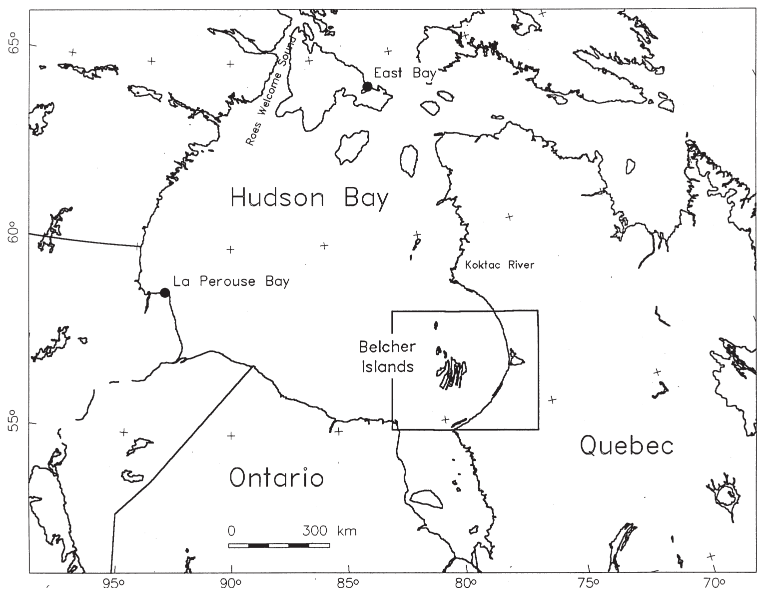

Fig. 1. Location and place names of common eider study areas in Hudson Bay.

may result from selection for different sized eggs in different environments, from genetic drift, different environmental conditions, and/or differences in age structure. Body size is heritable (Boag & van Noordwijk 1987; van Noordwijk et al. 1988), although environmental conditions, specifically food availability during growth, can influence final adult body size (Cooch et al. 1991; Leafloor et al. 1998). Therefore, differences in body size among populations may reflect different selective pressures, population isolation and genetic drift, or different environmental conditions.

In this study we investigated patterns of clutch, egg and body size variation among populations of the Hudson Bay subspecies of the common eider (*Somateria mollissima sedentaria*). As a subspecies, Hudson Bay common eiders are poorly defined and not well studied (Snyder 1941; Freeman 1970; Mendall 1980, 1986). The entire population of Hudson Bay common eiders is assumed to spend the whole year within the icy confines of Hudson Bay (Snyder 1941; Freeman 1970), unlike other subspecies of northern breeding eiders, which migrate to southern waters. In this paper, we compare clutch, egg and body size among populations of common eiders at three spatial scales: 1) among populations of common eiders breeding on the east coast of Hudson Bay, 2) between common eiders breeding in eastern and western Hudson Bay, and 3) between the Hudson Bay subspecies and the other two subspecies of common eiders breeding in eastern North America.

Methods

Fieldwork for this study was conducted in two general areas within Hudson Bay. The first site was a large area along the coast of south-eastern Hudson Bay and the Belcher Islands (Figs. 1 and 2). Data on egg size and clutch size in this region were collected during two intensive surveys of nesting eiders, one from 1985 to 1988, the other in 1997. Nine nesting regions were visited in 1985-88, while only four regions in the Belcher Island archipelago were surveyed in 1997. Clutch size data for these sites were extracted from Fleming & McDonald (1987), Nakashima & Murray (1988), McDonald & Fleming (1990) and Robertson & Gilchrist (1998). This population was estimated at 83 000 breeding pairs in the mid-1980s (Nakashima & Murray 1988), but has declined to an estimated 20 000 pairs by 1997 (Robertson & Gilchrist 1998).

The other study area was at La Pérouse Bay, on the west coast of Hudson Bay, 30 km east of Churchill, Manitoba (Fig. 1). Data from this site were collected as part of an intensive study on the breeding biology of common eiders in 1991–93. The colony consists of approximately 400 female eiders nesting on the small freshwater islands of

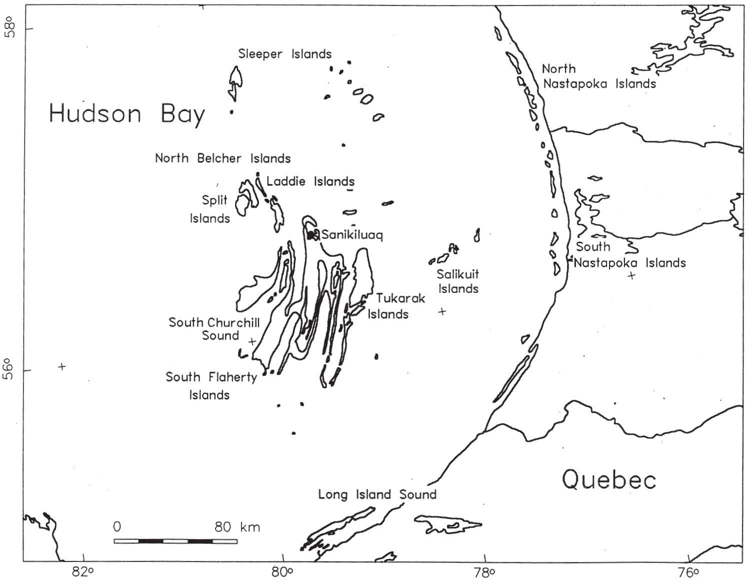

Fig 2. Location and place names of common eider study areas in south-eastern Hudson Bay.

the Mast River Delta (Schmutz et al. 1983; Robertson 1995a). Egg and clutch size data for this site have been presented in Robertson & Cooke (1993) and Robertson (1995b); the data presented in this paper have been reanalysed to keep the analyses between the two study areas consistent. Because the colony at the Mast River is small, it is likely that clutch size and egg size for a few females were measured in more than one year. This potential problem will artificially inflate sample sizes, but will not bias estimates of means. Information for other subspecies (*borealis* and *dresseri*) was extracted from the literature and unpublished data provided by researchers.

Only clutches that were complete and being incubated were included in the analyses. Egg volume (cm^3) was calculated from measurements of egg length and maximum egg breadth using the equation found in Guild (1974) and Robertson & Cooke (1993): vol. = $0.000515*\text{length}*\text{breadth}^2$.

Two analysis methods were used, recognizing that the size of eggs within a clutch are not independent samples. For data collected in eastern Hudson Bay in 1985-88 and the western Hudson Bay data, a mean egg size for the clutch was calculated and used in all analyses. During the 1997 survey in eastern Hudson Bay only one egg was measured from each clutch to reduce time spent on nesting islands. The egg that was measured was chosen at random (the egg closest to the north-east corner of the nest). Both methods estimate mean egg size without bias and effectively control for the non-independence of the size of eggs within a clutch. The only difference is that by selecting one egg at random, both intra- and inter-clutch variance are estimated, whereas using mean egg size, only inter-clutch egg size variance is estimated (i.e. the variance will be overestimated with the random eggs, making statistical tests more conservative).

Body size measurements were collected by the senior author at all locations. Measurements, taken with vernier calipers (± 0.1 mm), were collected from eiders trapped for ringing (western Hudson Bay) or from birds shot by local Inuit field assistants (eastern Hudson Bay). Birds collected in eastern Hudson Bay where shot on the breeding grounds (in some cases directly off the nests) and so were representative breeders. Head length, culmen 1 (culmen midline) and culmen 2 (total bill length), nostril extension, and total tarsus were taken according to Mendall (1980, 1986) and Dzubin & Cooch (1992).

Results

Clutch size

There were some differences in the clutch sizes among regions in eastern Hudson Bay (Table 1). Eiders at the most northerly and southerly sites laid larger clutches. Clutch size from sites in the middle of the study area did not differ (4.0 - 4.4). Clutch sizes laid in western Hudson Bay were in the middle of the range of clutch sizes laid in eastern Hudson Bay (Table 1).

Egg size

Within eastern Hudson Bay, there were significant differences among mean egg volumes measured at the different locations in 1985-86 (ANOVA, F= 2.55, df = 7, 199, p = 0.016). Egg volumes were larger in Long Island Sound than all other regions (Table 2); the sample size for this region was very small and may not be representative. No differences in mean egg volume were detected among the four regions of eastern Hudson Bay studied in 1997 (F = 1.43, df = 3, 224, p = 0.24).

Mean egg volumes for clutches from western Hudson Bay (Table 2) were significantly smaller than clutches laid in eastern Hudson Bay (pooled mean 104.2 cm^3 ± 7.2, n = 435) (t-test with unequal variances, t = 20.8, df = 754.7, p = 0.0001).

Body size

In general, female common eiders in eastern Hudson Bay had longer tarsi and head lengths, and shorter nostril extensions than females in western Hudson Bay (Table 3). Similarly, males from eastern Hudson Bay had longer tarsi and head lengths and shorter nostril extensions and culmen 2 (total bill length) than males from western Hudson Bay (Table 3).

Differences among subspecies

Clutch sizes were largest among *sedentaria* females. Some populations of *dresseri* laid similar sized clutches (Table 4), but some laid smaller ones. To the north, *borealis* females tended to lay smaller clutches. Egg sizes were smaller in *borealis* than in *sedentaria* in eastern Hudson Bay, but not western Hudson Bay (Table 4). Only limited information is available for *dresseri*, but this subspecies lays similar or larger sized eggs than *sedentaria* (Table 4).

Table 1. Mean clutch size (± 1 s.d.) for Hudson Bay common eiders (*Somateria mollissima sedentaria*) across their range (see Figs. 1 and 2 for locations). Letters represent means not significantly different from one another (Student-Neuman-Keuls post-hoc means test, ANOVA, F = 34.4, df = 12, 10165, p = 0.0001).

Location	Latitude	Mean clutch size		
		Eastern Hudson Bay		Western Hudson Bay
		1985-88[a]	1997[b]	1991-93[c]
Koktac River	59°15’	4.8 ± 1.3 B (612)		
La Pérouse Bay, MB	58°45’			4.3 ± 1.0 CD (323)
Sleeper Islands	57°30’	4.3 ± 1.4 CD (2557)	4.4 ± 1.1 C (412)	
Nastapoka Islands	57°00’	4.1 ± 1.4 DE (925)		
N. Belcher Islands	56°45’	4.0 ± 1.3 E (1140)	4.0 ± 1.1 E (206)	
Salikuit Islands	56°15’	4.2 ± 1.4 CDE (649)		
S. Churchill Sound	56°00’	4.1 ± 1.4 DE (876)	4.4 ± 1.2 C (275)	
S. Flaherty Islands	55°45’	4.0 ± 1.1 DE (1980)	4.4 ± 1.0 C (419)	
Long Island Sound	54°45’	5.6 ± 1.0 A (113)		

[a] Data from Fleming & McDonald (1987), Nakashima & Murray (1988), McDonald & Fleming (1990).

[b] Data from Robertson & Gilchrist (1998).

[c] Data from Robertson (1995b).

Discussion

Clutch size

Comparisons of clutch sizes across studies are confounded by many factors that can influence measurements of clutch size. The timing of when clutch size is surveyed is important as partial clutches may be counted if the survey is too early. Further, eiders, along with many other bird species, show significant annual variation in clutch sizes laid by individuals and populations (Coulson 1999). A component of this annual variation is correlated with laying date (Rohwer 1992). To minimize these sources of variation, at all sites in this study clutch size was measured during early to mid-incubation. Although it is difficult to control for annual differences, we were fortunate in most years of this study because nesting was usually early and conditions were generally favourable (Nakashima & Murray 1988; Robertson 1995b; Robertson & Gilchrist 1998). Predation can greatly impact measures of clutch size, as many eggs are taken during the egg-laying stage (Robertson & Cooke 1993), especially by avian predators. Differences in predation rates may be reflected in differences in clutch sizes among populations and among years.

In spite of the fact that different sites were examined in different years, within Hudson Bay there was no clear pattern of clutch size variation among populations of common eiders. Clutch sizes consistently averaged between 4 and 4.5 eggs. We are not sure why clutch sizes laid in Long Island Sound were so large in 1985 at 5.6 eggs. Intraspecific nest parasitism may have resulted in abnormally large clutches being incubated at this site (Robertson et al. 1992; Bjørn & Erikstad 1994), and sample sizes were not large.

In general, *sedentaria* laid slightly larger clutches then *dresseri* to the south and larger clutches than *borealis* to the north. Other waterfowl species show a similar trend: clutch size tends to decrease in the northern portions of their range (Dunn & MacInnes 1987; Rohwer 1992). Individuals and populations that lay later in the season tend to lay smaller clutches (Rohwer 1992). However, the relative timing of egg laying cannot explain the variation in clutch size laid between these subspecies of common eiders. In good to normal years, eiders nesting near the Belcher Islands do not begin egg-laying until mid- to late June (Nakashima & Murray 1988; Robertson & Gilchrist 1998), similar to *borealis* eiders

Table 2. Mean egg volumes (± 1 s.d.) of Hudson Bay common eiders (*Somateria mollissima sedentaria*) across their range (see Figs. 1 and 2 for locations). Letters represent means not significantly different from one another (Student-Neuman-Keuls post-hoc means test).

Location	Latitude	Mean egg volume of clutch (cm^3)		
		Eastern Hudson Bay		Western Hudson Bay
		1985-86	1997	1991-93
Koktac River	59°15’	103.4 ± 5.8 B (72)		
La Pérouse Bay, MB	58°45’			94.5 ± 5.5 C (323)
Sleeper Islands	57°30’	104.3 ± 4.7 B (14)	103.2 ± 8.1 B (61)	
N. Nastapoka Islands	57°15’	102.2 ± 7.0 B (41)		
S. Nastapoka Islands	56°45’	105.9 ± 5.7 B (10)		
N. Belcher Islands	56°45’	103.0 ± 7.1 B (20)	105.4 ± 7.0 B (38)	
Salikuit Islands	56°15’	105.5 ± 8.1 B (16)		
S. Churchill Sound	56°00’		104.5 ± 7.5 B (74).	
S. Flaherty Islands	55°45’	102.7 ± 5.2 B (25)	105.9 ± 7.9 B (55)	
Long Island Sound	54°45’	110.9 ± 8.0 A (9)		

in good nesting years far to the north (Cooch 1965; Prach et al. 1986; HGG unpubl. data). This is months later than *dresseri* nesting in New England and Maritime Canada, which begins in April for many populations. Therefore, common eiders nesting in Hudson Bay tend to lay large clutches in spite of their late timing of breeding.

Common eiders rely exclusively on nutrients gathered and stored before laying for egg production and incubation (Korschgen 1977; Parker & Holm 1990). Eiders nesting in Hudson Bay may have more nutrient reserves during egg production because they do not undertake an extensive migration to the breeding grounds (Freeman 1970; Guild 1974). Migrating individuals can utilize considerable nutrient reserves (Berthold 1993). Most populations of *dresseri* do not make extensive migrations either, and clutch sizes tend to be larger than *borealis* populations, which migrate from south-west Greenland, Newfoundland and the Gulf of St. Lawrence to the eastern Canadian Arctic (Palmer 1976). Populations of common eiders nesting in Europe (*S. m. mollissima*) that do not undergo extensive migrations also show relatively large clutch sizes (means ranging from 4.2 to 5.0 eggs; Scotland [Milne 1974], the Netherlands [Swennen 1983], Sweden [Götmark & Åhlund 1988], Finland [Hario & Selin 1988], Norway [Erikstad et al. 1993]). Similar to North America, *borealis* breeding on remote islands north of Europe lay much smaller clutches (3.0 to 3.2, Spitsbergen, Ahlén & Andersson [1970]; Bjørn & Erikstad [1994]). These populations undergo substantial migrations, wintering off the south coast of Greenland, eastern North America or the Barents Sea (Dement'ev & Gladkov 1952). These comparisons must be made cautiously, however, as other factors, such as high incidents of nest parasitism in Hudson Bay among common eiders, may artificially inflate measures of clutch size, or high levels of partial clutch depredation in *borealis* may lower clutch size.

Table 3. Morphometrics (mm, ± 1 s.d.) of common eiders in eastern and western Hudson Bay. Culmen 1 (Dzubin & Cooch 1992) corresponds to Mendall's (1980, 1986) culmen midline and culmen 2 corresponds to total bill length. Tarsus length is total tarsus (Dzubin & Cooch 1992).

	Eastern Hudson Bay[a]	Western Hudson Bay	*t*	p
Females (n)	30	79		
Culmen 1	51.6 ± 2.6	52.0 ± 3.0	0.59	0.5552
Culmen 2	71.4 ± 2.8	71.0 ± 2.4	0.75	0.4527
Nostril extension	34.0 ± 2.0	35.9 ± 1.6	5.16	0.0001
Head length	121.1 ± 2.3	118.6 ± 2.6	4.60	0.0001
Tarsus length	66.4 ± 2.0	62.8 ± 2.0	8.38	0.0001
Males (n)	10	9		
Culmen 1	55.8 ± 2.9	58.1 ± 3.5	1.59	0.1305
Culmen 2	79.7 ± 3.3	82.8 ± 2.3	2.29	0.0353
Nostril extension	40.5 ± 2.7	45.3 ± 2.2	4.20	0.0006
Head length	128.8 ± 2.6	125.9 ± 2.5	2.35	0.0327
Tarsus length	68.6 ± 1.3	66.2 ± 2.0	3.20	0.0053

[a] Only 28 female and 8 male head measurements available for eastern Hudson Bay.

Egg size

Eiders nesting in western Hudson Bay laid smaller eggs. Interestingly, there is no correlation between egg size and female body size or condition (Laurila & Hario 1988; Swennen & van der Meer 1992), so differences in body condition or size would not explain egg size differences among populations. One environmental component has been identified that explains some variation in egg size: Robertson (1995b) showed that eiders laid smaller eggs when temperatures were cold during egg-laying. However, the average mean egg size difference between a very warm year and a very cold year was only 3% (Robertson 1995b). The mean difference between east and west coast Hudson Bay common eiders was three times larger at 9%. Nesting conditions were generally favourable in most years included in this study, so different annual environmental conditions were not likely to be a major source of variation in egg size between sites. Egg size is highly repeatable in common eiders (Laurila 1988; Swennen & van der Meer 1992) and likely to be highly heritable (Rohwer 1992). Therefore, we suggest that egg size differences among populations may reflect mostly genetic differences, although some portion of the variation (up to 3%) could be explained by the fact that eiders nesting on the east coast of Hudson Bay enjoy warmer temperatures at nesting.

Female eiders show natal philopatry to their breeding grounds (Wakeley & Mendall 1976; Swennen 1990), so breeding populations of eiders are expected to show some genetic isolation (Anderson et al. 1992; Avise et al. 1992). Indeed, Tiedemann et al. (1999) found high levels of differentiation between colonies in maternally inherited mtDNA sequences. However, male common eiders in Europe disperse widely (Swennen 1990). Genetic isolation among breeding populations of common eiders in Hudson Bay could be maintained if male dispersal is restricted. Suitable wintering habitat in the form of open water leads and polynyas is mostly restricted to south-eastern Hudson Bay, where large numbers of *sedentaria* common eiders are known to winter (Freeman 1970; Gilchrist & Robertson 2000). It is assumed that these eiders breed in eastern Hudson Bay (Freeman 1970). Although they may winter in the Belcher Islands, common eiders from western Hudson Bay are suspected to winter off the landfast ice edge of the western coast, or in a large recurring polynya in Roes Welcome Sound (Abraham & Finney 1986). Potentially, eastern and western Hudson Bay common eiders are isolated from each other during winter, the time when pair bonds and, therefore, gene flow occurs.

Even if there is extensive nuclear gene flow among eiders breeding in Hudson Bay due to male dispersal, genetic isolation could be maintained if additive genetic variance for egg size is maintained on mitochondrial genes or the heterogametic chromosome. Williams et al. (1994) suggested that there may be a genetic correlation between egg size and physiological and/or metabolic processes. If the genetic variance in egg size and covariance of egg size with other metabolic traits are occurring within the mitochondrial DNA of females, then egg size will be solely maternally inherited. In this case, male dispersal will not result in exchange of genes influencing egg size, and genetic population structure for egg size would be solely influenced by female dispersal patterns (Avise et al. 1992).

Body size

As with egg size, eiders in eastern Hudson Bay

Table 4. Volumes of eggs and clutch sizes laid by common eiders in eastern North America. Mean ± 1 s.d. (or range) with sample sizes in parentheses below.

Subspecies Location	Mean egg volume (cm^3)	Mean clutch size	Source
borealis			
Devon Island	94.6 ± 7.7 (158)	3.3 ± 1.0 (544)	Prach et al. (1986)
Southampton Island	90.2 ± 6.6 (262)	3.6 ± 1.2 (262)	H. G. Gilchrist, unpubl data
Cape Dorset		3.4 ± 1.0 (1598)	Cooch (1965)
Ungava Bay	94.7 ± 6.2 (33)	3.6 ± 1.1 (2387)	Chapdelaine et al. (1986)
sedentaria			
La Pérouse Bay	94.5 ± 5.5 (323)	4.3 ± 1.0 (323)	this study
La Pérouse Bay	96.1 (298)	4.1 ± 1.2 (175)	Guild (1974)
Eastern Hudson Bay	104.2 ± 7.2 (435)	4.2 ± 1.3 (9855)	this study
S. Belcher Islands	116 (97 - 139) (84)	4.5 ± 1.4 (290)	Freeman (1970)
dresseri			
St. Lawrence Estuary	112.8 ± 7.4 (72)	3.7 ± 1.4 (1521)	Milne & Reed (1974)
Gulf of St.Lawrence		4.3 ± 1.2 (315)	Guignion (1968)
Gulf of St.Lawrence		4.0 ± 1.0 (1131)	Lewis (1939)
New Brunswick		3.6 ± 1.2 (134)	Paynter (1951)
New Brunswick	116.4 ± 10.2 (45)	4.4 (2-7) (100)	Gross (1938)
New Brunswick	106.3 ± 7.2 (642)	4.0 ± 1.1 (1921)	K. Mawhinney, unpubl. data
Maine	107.4 ± 8.2 (736)	3.9 ± 1.7 (395)	K. Mawhinney, unpubl. data

were structurally larger. Body size, similar to egg size, is highly heritable (Boag & van Noordwijk 1987), suggesting that there some isolation among eider populations breeding in Hudson Bay might be possible. Head length and tarsus tend to be better indices of overall structural size than bill measurements (Rising & Somers 1989) and these were larger in eastern Hudson Bay. Mixing with the smaller *borealis* race to the north may explain the smaller body size (and possibly egg size) of eiders nesting in western Hudson Bay. In developing his key, Mendall (1980) tentatively identified some individuals collected from north-west Hudson Bay as *borealis–sedentaria* intergrades. A north—south cline along western Hudson Bay, with *sedentaria* to the south and *borealis* to the north is plausible. Further, that cline may extend south-east, with the largest eiders occurring at the south-east corner of Hudson Bay. Inuit hunters from the Belcher Islands mention that large brown eiders are found in the southern portion of the archipelago and smaller grey eiders are found at the northern portions of the Belchers Islands (Nakashima & Murray 1988).

This cline may be maintained by male dispersal. Genes for body size are known to be paternally inherited in waterfowl (Larsson & Forslund 1992; Cooke et al. 1995), and clines are usually maintained by limited dispersal. Movements of male eiders along the coast of Hudson Bay during winter are possible but probably restricted, to a degree, by ice and food availability. Alternatively, the cline could be maintained by mate choice, if mates choose partners from their natal colony more often (but not exclusively) than expected at random (Tiedemann et al. 1999). Notwithstanding potential genetic differences, body size differences between eastern and western Hudson Bay may be due to different environmental conditions, especially during duckling growth (Leafloor et al. 1998). The core of the breeding range of eiders in Hudson Bay is the south-eastern portion of the bay. Therefore the western portion of Hudson Bay may represent marginal habitat for eiders and may be responsible for their slower growth and subsequent smaller adult body size (and possibly egg size).

Unlike head and tarsus length, bill measurements tend to be larger in western Hudson Bay. These differences are not as easily explained by differences in conditions during duckling growth. Bill measurements are used in discriminating between the different subspecies of common eiders (Mendall 1980, 1986). In general, *dresseri* individuals have longer culmen 2 (total bill length) and nostril extension measurements, and larger frontal lobes than *sedentaria* or *borealis.* Interestingly, individuals, especially males, from western Hudson Bay had bill measurements like *dresseri* birds. In fact, using the keys provided in Mendall (1986), the average male from western Hudson Bay was classified as a *dresseri* male. The key was based on small samples sizes for male *sedentaria* (n = 11) and may be insufficient to discriminate the subspecific status of eiders in Hudson Bay (Mendall 1986).

Overall, common eiders breeding in Hudson Bay are large compared to other subspecies in eastern North America (Freeman 1970). Only *v-nigra*, which breeds and winters in the north Pacific, is larger (Palmer 1976). Common eiders in Hudson Bay may have been under selective pressure to become larger. Larger birds are better able to maintain homeothermy and they can survive longer during periods of stress (Calder 1974; Dunn & MacInnes 1987). During the cold, short days of winter at these latitudes, larger body size may be advantageous for common eiders that do not migrate to southern waters.

Conclusion

Clutch sizes were relatively large and similar among populations of common eiders breeding in eastern and western Hudson Bay. As any differences in environmental conditions would be most likely be seen as differences in clutch size, differences in egg and body size among these populations suggest that there is some genetic population structuring of common eiders breeding in Hudson Bay. The population structure seen in eiders may be due to female natal philopatry and/or a lack of dispersal by males because of restricted wintering habitat in the ice. Clearly, more work is needed to resolve the genetic relationships among eiders in Hudson Bay and studies are required to determine actual movements and breeding and wintering ground affinities of these populations. Eider populations in this region have declined dramatically in recent years (Robertson & Gilchrist 1998) and an understanding of the genetic structure, affinities and movements of these populations is certainly needed to guide management recommendations in the future.

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