Local movements, home ranges and body condition of Common Eiders *Somateria mollissima* wintering in Southwest Greenland

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We examined local movements, home ranges and body condition of wintering Northern Common Eiders *Somateria mollissima borealis* in Southwest Greenland from late winter until spring migration in 2000 and 2001. At key marine habitats at coastal areas and in the inner fjord system of Nuuk, we implanted 33 Eiders with satellite transmitters and collected Eider carcasses for body condition analyses. Most Eiders exhibited strong site fidelity during the study period with a mean 95% home range size of 67.8 km² and a mean core area (50%) of 8.1 km². Diurnal movements peaked at dawn and dusk when birds presumably moved between feeding areas and roosting sites. Roosting occurred near daytime activity centres, on average 1.7 km apart. Among birds marked at coastal habitats only between 8% and 29% also used the inner fjord habitats, despite high levels of hunting at the coastal area. Birds that did move to the inner fjord system did not return to the coastal area. These findings accentuate the need for managing wintering Common Eiders in Southwest Greenland also at a local scale, taking site fidelity into account. The body condition of adult fjord birds was either equal or superior to that of coastal birds. However, within-years and between-years-variation in body condition were larger for fjord birds, suggesting they were challenged by a higher unpredictability at the local scale. Observations indicate that differences in habitat characteristics and the behaviour of avian predators may limit the exchange of Eiders between the coastal area and the inner fjord system. Our study suggests that often Eiders build up body reserves for the breeding season elsewhere; in three of four cases adult body condition declined from late winter to early spring.

Key words: satellite telemetry, home range, movements, body condition, Northern Common Eider, site fidelity, Southwest Greenland, winter

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INTRODUCTION

Migratory arctic birds spend most of their annual cycle away from breeding areas; consequently, the availability and suitability of non-breeding areas and their management strongly influence their population dynamics (Scott 1998). During the non-breeding period, birds must restore body reserves lost during the breeding season and must maintain sufficient reserves to buffer against severe weather and short photoperiods (King & Murphy 1985, Blem 1990). Among some large migratory arctic birds, body condition at the end of the wintering season has been shown to positively correlate with aspects of breeding performance (Ankney & MacInnes 1978, Ebbing & Spaans 1995, Bêty et al. 2003). To optimise individual winter survival, birds should select the habitat that provides the highest net gain of energy per time unit (Werner et al. 1981, Abrahams & Dill 1989). However, factors other than food availability and quality may influence habitat selection in winter, such as predation risk, human activity, site fidelity and social interactions (Greenwood 1980, Guillemette et al. 1993, Madsen & Fox 1995). A high degree of site fidelity, for whatever reason, will make birds more sensitive to local environmental conditions, including human activities.

We sampled body condition and used satellite telemetry to examine local movements of Northern Common Eiders Somateria mollissima borealis wintering in Southwest Greenland. These Eiders breed in eastern Arctic Canada and western Greenland and migrate to the Southwest Greenland open water area when Baffin Bay and north and west parts of Davis Strait become ice-covered (Merkel et al. 2002, Lyngs 2003). We focused on the degree of site fidelity from late winter until spring migration when Eiders have traditionally been most intensively harvested in Southwest Greenland. Winter habitats were utilized for approximately five months before the study period, making food depletion a possibility during late winter. Thus, we assumed that the risk of birds encountering poor feeding conditions and hunting disturbances would be highest during late winter and spring, making the Eiders more prone to search for alternative habitats. We aimed to (1) determine the home ranges of Common Eiders and validate the temporal importance of wintering areas previously identified as high density areas through aerial surveys (Merkel et al. 2002), (2) quantify the degree of interchange between coastal and fjord habitats, and (3) to clarify if body condition of Eiders differed significantly between these two distinct habitats. Coastal and fjord habitats are less than 100 km apart, however, hunting intensity and habitat characteristics differ distinctively between these two areas. We predicted that the less disturbed inner fjord system would act as a buffer region, to which Eiders would resort when conditions became unfavourable at coastal habitats. Common Eiders are considered to be particularly sensitive to disturbance (Bell & Owen 1990). Results are discussed in relation to available information about Common Eider distribution and behaviour in the study area and in relation to management perspectives.

METHODS

Study area
The study area comprised the coastal waters and fjords surrounding Nuuk, the capital city of Greenland (Fig. 1). This is part of the Greenland Open Water Area, which is internationally important for wintering seabirds (Boertmann et al. 2004) and a key wintering area for Common Eiders, with c. 25 000 birds in the coastal area and 32 000 in adjoining fjord systems based on 1999 aerial surveys (Merkel et al. 2002). The coastal area is an extensive archipelago including extensive areas of shallow waters, whereas the fjords to the east are lined with steep cliffs with little shallow water. AVHRR satellite images showed the innermost fjord system was ice covered throughout February, March, and part of April. At peak, in mid-March 2000, c. 53 km (c. 14%) of the inmost fjord sections was frozen. In general, less ice occurred in 2001 when in mid-March only c. 25 km of the innermost sections was frozen. Mean
temperatures in Nuuk in February, March and April were \(-9.6^\circ\), \(-8.4^\circ\) and \(-0.3^\circ\)C in 2000 and \(-7.8^\circ\), \(-5.6^\circ\) and \(-1.9^\circ\)C in 2001, respectively. From autumn to spring, commercial and recreational hunters in Nuuk shot on average 11 579 ± 1071 Eiders (1993–2001, Dept. of Fishing and Hunting, Greenland Home Rule), of which estimated 70% were Common Eiders; the remainder King Eiders *Somateria spectabilis* (Frich & Falk 1997, Merkel 2004). Typically, Eider hunting occurs in the coastal zone within 30 km of Nuuk, so hunting deep in the fjords is rare (Merkel 2004). Up until 2002 the hunting season was open from 1 October until 31 May.

**Capture and marking**

Eiders were captured in mist nets, 21 m long and 3.2 m high (D235/70, mesh size 70x70 mm, Ecotone) supported on aluminium stakes fixed into wooden floats. Three or four mist nets were connected end to end, extending 63–84 m from anchorage points on shore and deployed with plastic Eider decoys. Eiders were also captured at night by means of dazzling. A large and highly elastic net was set up at the stem of the research vessel, and at the base a horizontal mist net was placed to catch and entangle birds sliding down from the vertical frontline net. When approached during low visibility (snowfall or dense fog) Eiders were likely to orientate towards the vessel searchlight.

We implanted birds with Satellite Platform Transmitting Terminals (50 g Microwave Telemetry Inc. PTT 100). Transmitters were programmed to operate at various duty cycles: 4 PTTs transmitted 3 h every 7 h, 4 PTTs 4 h every 9 h, 6 PTTs 4 h every 14 h, 13 PTTs 4 h every 34 h, and 6 PTTs transmitted 6 h every 66 h. We marked 21 females and 12 males between 23 February and 6 March in 2000 and 2001 in the Nuuk study area (Fig. 1), 25 adults, 7 subadults (2nd or 3rd winter), and one juvenile (Baker 1993). External aging of subadult Common Eiders is, however, not accurate (F.R. Merkel, K. Falk, and S.E. Jamieson, unpubl.), and it is likely that some of these subadults were adults.

We implanted 28 of the 33 transmitters in the abdomen (Korschgen *et al.* 1996a) and 5 transmitters were subcutaneously deployed (Korschgen *et al.* 1996b). We avoided heat loss on re-exposure to seawater by avoiding removal of feathers from the abdominal surgery site by aligning feathers to each side of the midline and by making the incision along the *linea alba* (Mosbech *et al.*., unpubl.). Inert eye ointment (80% Vaselin, 20% paraffin oil) was used for cornea protection during anaesthesia. Postoperatively, an injection of enrofloxacin (15–25 mg intramuscularly) was given (Baytril, 50 mg ml\(^{-1}\), Bayer) and 0.02 mg of butorphanol (Torbugesic, 10 mg ml\(^{-1}\), Forte Dodge) for analgesia. Birds were kept in boxes and released two hours after surgery.

**Movements and home range analyses**

Data were received via Argos (DIAG format, Argos User’s Manual, http://www.cls.fr/manuel). We retained all location quality codes of classes 3, 2, and 1, rejecting positions greater than 5 km from

![Figure 1. The Nuuk study area in Southwest Greenland. Numbers show locations at which Common Eider carcasses were collected (1–9) and satellite transmitters deployed (1–8).](image-url)
other locations obtained over short time intervals, using the PC-SAS Argos Filter (Douglas 2003). Altogether, we rejected 38% of locations and from the time of deployment until the start of spring migration 1977 locations were used in the analysis. The onset of spring migration was determined as the date when birds started to cross the Davis Strait between Greenland and Canada. For individual birds this date ranged from 18 April to 23 May (median date 30 April, \( n = 5 \)).

To delineate the area used by each individual, we used a probabilistic home range technique to estimate the 50% home range (or core areas) and 95% home ranges based on the fixed kernel home range estimator (Worton 1989), and applied least squares cross-validation to determine the smoothing parameters. This method is less biased compared to other home range estimators (Seaman & Powell 1996, Hooge et al. 2004). We used the ArcView GIS extension ‘Animal Movements’ for home range calculation (Hooge et al. 1999). For some Eiders, we calculated the seasonal home range area (from late winter until spring migration) as the sum of multiple local area estimates, corresponding to the sum of all wintering areas used, each separated in time and space. Home ranges were split into multiple wintering areas whenever a bird moved more than 5 km from the mean activity centre (arithmetic mean point) on a permanent basis (i.e. the bird did not return within 5 km of the former activity centre). Locations received en route between such successive wintering areas were excluded from kernel home range estimation. Birds with <20 locations were excluded from the analysis.

Home range sizes were log-transformed to meet the assumptions of both normality and homogeneity of variances. Home range sizes were compared using t-tests. We analysed movements in relation to the time of day, using mean distances between consecutive locations separated in time by less than one hour. We tested the distributions of these distances between consecutive locations using a non-parametric Mann-Whitney test. Tests for serial autocorrelation among consecutive locations were not conducted. Studies have shown that aims to create independent data, by including only locations with a certain minimum time interval, are likely to produce a greater bias than that caused by autocorrelation (Andersen & Rongstad 1989, Reynolds & Laundre 1990).

**Body condition analysis**

Common Eider carcasses from the study area were obtained from the legal subsistence harvest. Birds were either shot or retrieved (unintentionally drowned) from fishing nets. We analysed 141 adult birds from 2000 and 2001 during the tracking period from late February until 18 April, when migration was first initiated. Nine birds were excluded from the final analysis because of damage sustained during collection that prevented measurements from being taken. Juvenile and immature carcasses were not analysed because of lack of these age classes during some periods.

Eiders were dissected, sexed and aged after (Merkel et al. 2006). We estimated body condition as total carcass lipids (TCL) from an equation which explained 93% of variation in total carcass lipids of Common Eiders in our study area (Jamieson et al. 2006). We analysed the influence of sex, habitat (coast or fjord) and period (late winter = 19 February – 18 March; early spring = 19 March – 18 April) on body condition using analyses of covariance (ANCOVA). For significant interactions between independent variables, we used least square means for multiple comparisons with the Tukey-Kramer test, which accounts for unequal sample size (Day & Quinn 1989, Zar 1999). We analysed 2000 and 2001 separately because of a significant three-way interaction between year, period, and habitat. PC1, from a principle component analysis on the length of head-bill, tarsus bone, and keel, was used in all ANCOVAs as a covariate to adjust for body size. The variables had similar factor loadings (0.56–0.60) on the first principal component (PC1) and explained 72% of the total variance. We included the covariate because of a weak, but highly significant, correlation between PC1 and TCL (Pearson, \( r = 0.24, P = 0.005 \)). The ANCOVA assumption of homogenous slopes was met, i.e.
there were no significant interaction terms that included the covariate and any of the independent variables. We used a significance level of 0.05 for all statistical tests. Throughout the paper we report values as means ± SE.

RESULTS

Location period and mortality
For 32 of 33 Common Eiders we received locations for 0.2 to 13.9 months (one transmitter failed before data collection began), compared to an expected 1.9–11.2 months battery life (depending on duty cycles). Of these 32 PTTs, 5 birds were caught accidentally in gillnets and 2 were shot, within 0.5–1.9 months after instrumentation. Seven birds apparently died 0.2 to 1.3 months after release according to PTT information, which indicated a decrease in body temperature. Five of these seven PTTs continued to transmit locations after the temperature had dropped. These Eiders may have been preyed by White-tailed Eagles Haliaeetus albicilla groenlandicus and carried to exposed mainland or island positions. One marked bird was caught in gillnets four years after PTT deployment.

Home ranges
Fifteen Eiders provided more than the minimum 20 locations for winter home range estimations around Nuuk. Mean 95% home range size was 67.8 ± 8.3 km$^2$ and the mean core area (50%) was 8.1 ± 1.3 km$^2$ (Table 1). Among all birds ($n = 32$), 72% used only one wintering area, the remainder used on average 2.1 sites. Among birds tracked from late February until spring migration initiation, two of seven birds (29%) used more than one wintering area. Eiders tracked for the full period had similar mean core areas (50%, $t = 0.58, df = 13, P = 0.57$) and 95% home ranges ($t = 0.32, df = 13, P = 0.76$) compared to birds that were tracked for a shorter period (Table 1). Birds using multiple wintering areas moved a median distance of 11.6 km (range: 5.1–71.9 km) between two areas and only two birds moved more than 30 km.

Diurnal movements and habitat use
Exchange between coastal and fjord habitats was seasonal and permanent, regular exchange was not observed. Two females marked in coastal habitats (Maluutu and Nepisat Sound, Fig. 1, location 3 and 4) moved to the inner Nuuk fjord system in early March and did not return to their original coastal habitat. One left the fjord system in late April to migrate towards Canada. The other one was caught in gillnets in early April, while still in the fjord. Remaining Eiders either stayed within the coastal area or within the inner fjord system, where initially marked, until spring migration or until we lost track of them. Exchange of birds from the coast to the inner fjord was 8%, based on all coast-marked Eiders (2/26). Assuming some birds may have moved into the fjord after we lost track of them, a less conservative estimate of exchange is 29% (2 of 7 birds from the coastal area, Fig. 2).

Table 1. Kernel Home Range (HR) sizes and maximum distances moved from the mean activity centre (AC) of a given HR for Common Eiders wintering in the Nuuk study area, Southwest Greenland.

<table>
<thead>
<tr>
<th>Period covered</th>
<th>Tracking period days</th>
<th>Birds</th>
<th>Locations</th>
<th>50% HR (km$^2$)</th>
<th>95% HR (km$^2$)</th>
<th>Max distance from AC (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>n</td>
<td>mean ± SE</td>
<td>median</td>
<td>range</td>
</tr>
<tr>
<td>&lt; Full$^b$</td>
<td>18 (15–25)</td>
<td>8</td>
<td>93 (42–178)</td>
<td>7.8 ±2.0</td>
<td>6.1</td>
<td>3.2–20.9</td>
</tr>
<tr>
<td>= Full$^b$</td>
<td>64 (30–89)</td>
<td>7</td>
<td>158 (26–445)</td>
<td>8.6 ±1.9</td>
<td>7.9</td>
<td>4.0–19.3</td>
</tr>
<tr>
<td>Pooled</td>
<td>39 (15–89)</td>
<td>15</td>
<td>123 (26–445)</td>
<td>8.1 ±1.3</td>
<td>7.1</td>
<td>3.2–20.9</td>
</tr>
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</table>

$^a$Transmissions stopped before spring migration.
$^b$Followed throughout the study period from late January or early February until spring migration.
A small fjord south of Nuuk (sampling site 5, Fig. 1), disconnected from the main fjord system, was the only site where birds used both coastal and fjord areas on a daily basis. For two females, daytime activity was centred at the mouth of the fjord, while night time activity centres were located 1.7 km and 3.1 km into the fjord.

The mean linear distance moved between consecutive locations of all marked birds was $3.5 \pm 0.1$ km (range 0.1–72.3 km, 96% less than 10 km). The median distance moved did not differ between males and females ($Z = 0.36; n_1, n_2 = 484, 1493; P = 0.72$). Within each home range or wintering area (when home range consisted of multiple wintering area), the maximum distance moved from the mean centre of activity ranged from 6.2 to 32.2 km (Table 1). On a daily basis, mean linear distance between consecutive locations (<1 h time intervals) peaked in the hour after sunrise and two hours around sunset (Fig. 3). The median linear distance moved within these three hours was significantly larger than for the

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**Figure 2.** Winter home range areas (95% and 50% utilization distribution) for individual Common Eiders (distinguished by different shading) tracked by satellite telemetry in Southwest Greenland from late February until spring migration (2000 and 2001). Only birds marked at the coastal area off Nuuk are shown, and among these only birds for which it is known if they moved to the inner fjord system within the full study period ($n = 7$).
remaining hours (Fig. 3, $Z = 2.66$; $n_1, n_2 = 122, 1343; P = 0.008$). For individual Eiders, the mean centre of daytime activity was located near the mean centre of night time activity: on average $1.7 \pm 0.3$ km, ranging from 0.6 to 3.1 km ($n = 8$, all from coastal habitats). The mean centre of activity at night was closer to the coast than by day, often within sheltered bay areas.

**Body condition**

In both years, sex and interactions between sex and other variables did not significantly contribute to any the variation in Eider body condition (ANCOVA, all: $P > 0.38$), so sex was excluded from the final model. Adjusted for body size (PC1), we found a significant interaction between habitat and period in 2000 and 2001 (ANCOVA: $F_{1.56} = 6.23$, $P = 0.02$ and $F_{1.66} = 8.77$, $P = 0.004$, respectively). *Post hoc* comparisons showed that the body condition of fjord birds decreased significantly from late winter to early spring in 2000, while the opposite was the case in 2001 (2000: $T = -4.7$, $P = 0.0001$, 2001: $T = 3.4$, $P = 0.006$, Fig. 4). Body condition of coastal birds varied less between periods and changed in the same direction in both years (Fig. 4). Pooled over years, there was a significant fall in body condition from late winter to early spring ($F_{1.57} = 5.77$, $P = 0.02$). In two of four periods, fjord birds were superior in body condition compared to coastal birds (2000, late winter: $T = 3.9$, $P = 0.002$; 2001, early spring: $T = 2.6$, $P = 0.06$), but at other times fjord and coastal birds did equally well (2000, early spring: $T = 1.3$, $P = 0.60$; 2001, late winter: $T = -1.8$, $P = 0.27$) (Fig. 4).

**DISCUSSION**

**Home ranges**

The Eiders tracked in the present study were marked at locations previously identified as high-density wintering areas for Common Eiders (Merkel et al. 2002, Merkel 2004). From late winter until spring migration, wintering Common Eiders around Nuuk showed strong site fidelity to these areas, with mean core areas of c. 8 km² and 95% home ranges around 68 km². These areas...
(sampling sites 1–5, Fig. 1) constitute the major hunting areas for Common Eiders, King Eiders *S. spectabilis* and Brünnich’s Guillemots *Uria lomvia* (Merkel 2004). Despite this, most Common Eiders (71%) remained within a single small wintering area throughout our study period. Recent satellite telemetry on King Eiders indicates that small winter home range areas, like those detected in our study, are not always the case for that species. In Southwest Greenland large numbers of King Eiders winter over offshore shallow banks (Mosbech & Johnson 1999, Mosbech *et al.* 2001), where individual kernel home ranges range from c. 50 km² (50%) to 600 km² (95%) (Mosbech *et al.*, unpubl.). Diurnal movements

Nuuk hunters consider that Eiders use coastal habitats for feeding during daylight hours and the inner fjord system to roost at night, but our study did not support this theory. Distances travelled between roosting and feeding areas were generally a few kilometres and there was no general regular pattern of Eiders movement towards the inner fjord at night. Visual observations from the coastal area have since confirmed the proximity of feeding areas and roosting areas. At Nepiset Sound (sampling site 3, Fig. 1) birds fed during daylight hours and swam to and from the roost in a small sheltered bay, c. 3 km away (Merkel and Mosbech, unpubl.), consistent with the satellite tracking (Fig. 3). Contrary to our findings, Goudie *et al.* (2000) reported that Common Eiders wintering in Newfoundland, Canada, moved offshore at night to drift in compact flocks on ocean currents and flew 50–100 km inshore in early morning to feed. Clearly, daily movement patterns of Common Eiders are highly site specific.

Habitat selection

Most coastal Common Eiders showed high site fidelity despite intensive hunting and gillnet activity (Merkel 2004). There was little support for the suggestion that the inner fjord system acted as a buffer, to which Eiders resorted when conditions became unfavourable in coastal habitats. Our results indicate that exchange of Eiders between coastal and fjord habitats was not common. This may suggest that disturbance levels were not critically high within the coastal area, that less disturbed alternative habitats were poorer in quality, or that some other factor favoured site fidelity (e.g. social behaviour). Birds using coastal habitats fed mainly by day, while birds wintering in the inner fjord fed only at night; presumably an anti-predator strategy resulting from White-tailed Eagle activity (Merkel and Mosbech unpubl.). Lack of shallow waters constrains Eiders to feed very close to land in the fjord, exposing them to Eagle predation during the day. Coastal habitats support larger shallow water areas, where Eiders can feed at safe distances from land. Familiarity of specific areas (for breeding, staging or wintering) is believed to be one of the most important factors responsible for establishing site fidelity (Robertson & Cooke 1999). The juxtaposition of feeding areas and roosting areas is also advantageous in terms of costs incurred by travelling. Flight is energetically very expensive (King 1974), and those birds that can survive the non-breeding period without regular relocation flights presumably can allocate more energy to daily maintenance and stores.

Body condition

Only the fjord Eiders accumulated body fat (in 2001) in our study area prior to the migration period (Fig. 4). This agrees with information on body condition of Common Eiders collected in eastern Canada in late spring (Jamieson 2003) and information from satellite telemetry on migrating birds from Southwest Greenland (Mosbech *et al.* 2006), which indicate that most accumulation of stores for the breeding season takes place subsequent to arrival in Eastern Canada.

In both 2000 and 2001 Eiders from the coastal area lost body fat from late winter to early spring (Fig. 4) as predicted if body reserves were influenced by day length and weather. Fat levels often increase in relation to decreasing daylength (Nolan & Ketterson 1983, Blem 1990), increasing latitude (Blem 1976, Rogers *et al.* 1993), and decreasing
ambient temperature (King 1972, Lima 1986, Gaston 1991), and reflects the need to store additional reserves for periods when foraging conditions are sub-optimal. For fjord birds, body condition reflected ambient temperature. High fat levels carried by the fjord birds in late winter 2000 (Fig. 4) coincided with below average February and March temperatures when the inmost fjord system was ice covered. The strategy to carry more fat during sub-optimal wintering conditions does, however, presume that birds are capable of increasing foraging efficiency. It is unknown whether this was the case in our study area. It is clear, however, that variation in body condition, both within and between years, was relatively large for Eiders amongst fjord compared to coastal birds (Fig. 4). This may have been caused by greater unpredictability in the local fjord environment: perhaps because feeding accessibility varied according to ice conditions, and/or was perhaps related to the presence/absence of White-tailed Eagles. Fjord habitats may therefore represent a more profitable foraging area in winter, but unpredictability and/or predation pressure may favour wintering on the coast.

Management implications
Hunting mortality and drowning in gillnets was frequent in the present study (22%) and confirms existing knowledge that the harvest level was high in the Nuuk area. Recent surveys of embedded shot loads among wintering Eiders in Southwest Greenland (Falk et al. 2006) substantiates high hunting levels along the Nuuk coast, with up to 35.0% of adults inflicted. The high site fidelity detected among Common Eiders in late winter, combined with the local hunting pressure requires greater vigilance regarding management and conservation of this population. Our results accentuate the need for a flexible conservation protocol, which will enable adaptive management of sub-unit winter populations according to local environmental conditions. Presently, wintering Common Eiders are managed in the same way throughout the open water area in Southwest Greenland, by open and closed seasons. This may, however, put excessive and unsustainable pressure on local fragments of the population. Unsustainable use, as a result of site fidelity and poor management of wintering grounds has been reported for goose species. In Ireland and Britain such factors lead to local extinctions of Greenland White-fronted Geese *Anser albifrons flavirostris* (Rutledge & Ogilvie 1979, Norriss & Wilson 1988). For Common Eiders wintering in Southwest Greenland, we recommend the use of non-hunting disturbance-free reserves as a supplemental conservation tool. Experiments with such a reserve network for migratory and wintering waterfowl in Denmark showed that bird numbers and diversity increased after establishment of reserves (Madsen et al. 1998, Madsen 1998). The experiment showed that reserves not only attract more birds to the core area, but also to adjacent areas. Hunters thereby gain some compensation for lost hunting areas through improved hunting opportunities in surrounding areas (Madsen et al. 1998). In our study area, sampling sites 1, 2, and 3 (Fig. 1) constitute good reserve candidates, based on human activities and Eider densities (Merkel et al. 2002, Merkel 2004). We suggest, that future reserves are designated at the centre of high-density wintering areas. The present study indicates that strong site fidelity constrains Eiders from finding alternative wintering sites. Common Eiders are generally site-faithful between years (Spurr and Milne 1976, Goudie et al. 2000), making such local management even more important. Our study also support this assumption: two of the three Eiders bearing transmitters, which continued to transmit during the next autumn, returned from Canada to their original catching sites in Nuuk. The third bird arrived in Greenland in mid-October c. 150 km south of Nuuk and had not returned to Nuuk when transmissions stopped in early November. A fourth Eider was recovered at the original sampling site (8, Fig. 1) four years after implantation (Mosbech et al., unpubl.).
ACKNOWLEDGEMENTS

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SAMENVATTING

In dit onderzoek worden de zwerfbewegingen, de grootte van het leefgebied en de lichaamscconditie van overwinterende Noordelijke Eiders Somateria mollissima borealis onderzocht bij Nuuk op Zuidwest-Groenland. Het onderzoek vond plaats aan het einde van de winters in 2000 en 2001. Hiertoe werden 33 Eiders voorzien van een satellietzender en werden dode Eiders verzameld. De meeste Eiders waren plaatstrouw met een gemiddelde ‘home range’ van 67,8 km², en een kerngebied van 8,1 km². Van de vogels die langs de kust waren gevangen, gebruikte


SAMENVATTING

In dit onderzoek worden de zwerfbewegingen, de grootte van het leefgebied en de lichaamscconditie van overwinterende Noordelijke Eiders Somateria mollissima borealis onderzocht bij Nuuk op Zuidwest-Groenland. Het onderzoek vond plaats aan het einde van de winters in 2000 en 2001. Hiertoe werden 33 Eiders voorzien van een satellietzender en werden dode Eiders verzameld. De meeste Eiders waren plaatstrouw met een gemiddelde 'home range' van 67,8 km², en een kerngebied van 8,1 km². De dagelijke trekbewegingen piekten tijdens de ochtend- en avondschemering, wanneer de vogels kennelijk tussen voedsel- en rustgebied pendelden. Er werd op gemiddeld 1,7 km afstand van de foerageerplek geslapen. Van de vogels die langs de kust waren gevangen, gebruikte
slechts 8–29% de binnenlandse fjorden, ondanks de hoge mate van verstoring langs de kust. De vogels die naar het binnenland waren getrokken, keerden echter niet naar de kust terug. De waarnemingen onderstregen het belang om bij het beheer van overwinterende Eiders in Zuidwest-Groenland rekening te houden met de sterke plaats trouw van de soort. De lichaamsconditie van volwassen vogels in de fjorden was gelijk aan, of beter dan, die van vogels langs de kust. De lichaamsgewichten vari eerden in de fjorden echter meer dan aan de kust, het geen erop duidt dat de voedselbronnen in de fjorden minder voorspelbaar zijn. Ondiep water, waar de Eiders voedsel zochten, was in de fjorden beperkt tot een strook vlak onder de wal waardoor ze bovendien gevoelig bleken voor predatie door Zeearenden Haliaeetus albicilla. De lichaamsconditie nam aan het eind van de winter af \( n = 4 \), hetgeen erop duidt dat lichaamsreserves voor de broedperiode elders werden verzameld.

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