

IS PARENTAL CARE A CONSTRAINT ON THE HABITAT USE OF COMMON EIDER FEMALES?¹

JAN OVE BUSTNES

Foundation for Nature Research and Cultural Heritage Research, Department of Arctic Ecology,
Storgata 25, N-9008 Tromsø, Norway

Abstract. The aim of this study was to investigate how parental care in Common Eider (*Somateria mollissima*) females affected their habitat selection. I compared the post-nesting behavior of brood-caring females and females without young. Females that cared for ducklings and females without young moved similar distances from the nesting colony to the feeding areas. However, throughout the brood rearing season, females without young undertook longer secondary movements than brood-caring females. The type of feeding habitat used and the feeding mode were similar among the different female categories, and all females that had attempted to nest foraged in the intertidal zone by dabbling. This study suggests that in a large sea duck like the Common Eider, with highly developed ducklings at hatching, parental care does not constrain habitat use very much compared to females without young.

Key words: *Common Eider*; *Somateria mollissima*; *parental care*; *habitat use*; *Norway*.

INTRODUCTION

An important feature of precocial birds is that they bring the young out of the nest shortly after hatching and move to sites where the young can feed. Some species of ducks may swim or walk distances of several kilometers from the nest to reach the brood-rearing areas (see Sedinger 1992 for a review). Ducklings depend on residual yolk material during the early days of life, thereby limiting the distance they can move without feeding (Sedinger 1992). This constraint could restrict the mobility of their mothers and determine how far they travel and what types of habitat they can use. The aim of this study was to investigate how brood-care influenced habitat selection of Common Eider *Somateria mollissima* females, by comparing the post-nesting behavior of those females caring for young with those without young.

The Common Eider is a sea duck that nests close to and rears its young in the marine environment. Females from large areas typically nest in colonies on islands. After nesting the females may disperse more than 20 km from the nesting islands to the brood rearing areas (Johnsgaard 1975, Gauthier and Bédard 1976, Cramp and Simmons 1977, Munro and Bédard 1977, Kaminsky and Weller 1992, Bustnes and Erikstad 1993).

In a recent review, Sedinger (1992) identified three aspects of the biology of duck broods that may constrain the habitat use by brood-caring females. Firstly, the limited distance that ducklings are able to move from the nest to the rearing area may lead to use of suboptimal habitats (Ball et al. 1975), a constraint that can be avoided by females not associated with broods. Secondly, vulnerability to predation and energetic needs of growing ducklings may make secondary brood movements (e.g., search for better habitats) risky. Adult birds without young may look for better feeding sites with little risk. Finally, ducklings may be unable to feed in the same habitat as adults, forcing mothers to use different habitats than other females. In the non-breeding season eiders usually feed by diving in the subtidal zone (e.g., Cramp and Simmons 1977, Player 1971, Guillemette et al. 1993), but when caring for young, females change their habitat and feed in the intertidal zone by dabbling (Pethon 1967, Cantin et al. 1974, Gauthier and Bédard 1976, Minot 1980, Bédard et al. 1986). If this change of habitat is caused by the needs of the young, there should be a general difference in feeding mode between brood-caring females and females without young. Females without parental duties would be expected to feed by diving in the subtidal zone.

STUDY AREA AND METHODS

The study was carried out near Tromsø (69°49'N, 18°50'E), northern Norway, between 1987 and

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1989. The study colony was on Grindøya, a small island (0.65 km²) where 400–500 pairs of Common Eiders breed annually. The vegetative cover on Grindøya consists of birch (*Betula pubescens*) woodland, heaths, bogs and fens. Common Eiders nest in all these habitats.

Eiders from Grindøya disperse in most directions and over 72 km of shoreline (Bustnes and Erikstad 1991) within the enclosed fjord system surrounding Tromsø. Birds included in this study were found along 61.5 km of shoreline, of which 14 km were mudflats. Mudflats had a substrate of soft mud and a low density of intertidal rocks. Forty-seven point five kilometers were classified as *rocky shorelines*, consisting of areas with rock substrate, densely covered with boulders and smaller stones. Within the rocky areas there were occasionally bedrock ledges extending down into the water. There were no sandy beaches of any significance in the study area. The algae vegetation on the stones both on the mudflats and along the rocky shorelines was dominated by seaweed (*Fucus* spp. and *Ascophyllum* spp.), among which most Common Eider broods and crèches feed.

Grindøya was searched for nests from the start of egg laying in mid May, and each nest was plotted on a map. During late incubation, females were caught on their nests and marked with steel leg bands and patagial tags (Anderson 1963, Bustnes and Erikstad 1990) in 1987 and 1988, and nasal disks (Sugden and Poston 1968) in 1989. The date when eggs hatched or were lost was noted for each female. Observations of ducklings and females in the rearing areas were carried out weekly from mid June until late July.

Observations made during the first four days after a female left the colony were excluded from the analyses, because females with ducklings may still have been moving to the rearing site that was farthest away from Grindøya (21 km). On two occasions marked females with young were observed at this site four days after leaving the nest. I therefore assumed that in my study area, females needed no more than four days to reach their post-nesting site. Only females that were observed more than once were included in the study.

All distances in post-nesting areas were measured on a map using the shortest possible distance on water. To compare the distances that females with and females without young moved from the colony, I used females that left the col-

TABLE 1. The mean distance (km) moved from the nesting colony by Common Eider females after nesting attempts. Data from Tromsø, northern Norway.

| Year | Distance (km) moved from the colony | | |
|-----------|-------------------------------------|------|----------|
| | \bar{x} | SE | <i>n</i> |
| 1987 | 8.85 | 1.35 | 8 |
| 1988 | 9.76 | 0.62 | 68 |
| 1989 | 8.30 | 0.58 | 54 |
| All years | 9.10 | 0.42 | 131 |

ony with young and which subsequently were recovered with young (brood-caring) to females that failed during nesting. The farthest distance moved by each female was used. For comparison of secondary movements of different categories of females (brood-caring females, females losing young between observations, females hatching but not caring for young, and failed nesters) the farthest distance that each bird moved from the first observation was used.

To find out whether brood-care influenced the selection of feeding habitat, the habitat type (intertidal vs. subtidal zone) and feeding mode (diving or dabbling) of different female categories were recorded. At the start of each observation the behavior of adults was classified as feeding or other activities.

Observations were conducted using a 10 × 40 binocular and a 20–60 × spotting scope. Statistical tests were carried out using Statview SE+ and were corrected for ties.

RESULTS

During the 3 years of the study, 131 marked Common Eider females were observed a total of 384 times.

Mean distance moved from the nesting colony by all females was 9.1 km (range 1.5 to 21.5 km), and there were no significant differences between years ($df = 2$, $H = 2.15$, $P = 0.34$, Kruskal-Wallis test, $n = 131$) (Table 1). No differences were found within the brood-caring category ($df = 2$, $H = 1.71$, $P = 0.42$, $n = 58$), or within the failed nester category ($df = 2$, $H = 2.87$, $P = 0.24$, $n = 34$), between the years (Table 2). These two female categories moved similar distances from Grindøya (all years pooled, $P = 0.66$), even if failed nesters tended to move farther away than brood-caring females in 1989 (10.2 vs. 7.9, $P = 0.10$) (Table 2).

The mean distance moved by females after the

TABLE 2. Distances (km) moved from the nesting colony by Common Eider females leaving with young and subsequently recovered with young (brood-caring females), vs. females leaving without young (failed nesters).

| Year | Distance (km) moved from the colony | | | | | | <i>P</i> * |
|-----------|-------------------------------------|------|----------|----------------|------|----------|------------|
| | Brood-caring females | | | Failed nesters | | | |
| | \bar{x} | SE | <i>n</i> | \bar{x} | SE | <i>n</i> | |
| 1987 | 7.74 | 2.36 | 5 | 10.28 | 1.09 | 3 | 0.75 |
| 1988 | 9.52 | 0.98 | 29 | 8.77 | 1.29 | 19 | 0.36 |
| 1989 | 7.92 | 0.79 | 24 | 10.19 | 1.20 | 12 | 0.10 |
| All years | 8.70 | 0.62 | 58 | 9.40 | 0.84 | 34 | 0.66 |

* Mann-Whitney *U*-test.

first observation (secondary movements) was 2.3 km (Table 3), and there were no differences between years ($df = 2$, $H = 1.31$, $P = 0.51$, $n = 131$). There were significant differences among the four female categories ($df = 3$, $H = 13.13$, $P = 0.0044$, $n = 131$, Table 3). While brood-caring females on average moved 0.96 km, failed nesters moved 4.10 km ($P = 0.0004$, Mann-Whitney *U*-test, Table 3).

The length of secondary movements among the female categories was different with marginal significance both in 1988 ($df = 3$, $H = 7.12$, $P = 0.07$, $n = 68$), and in 1989 ($df = 3$, $H = 6.77$, $P = 0.08$, $n = 53$, Table 4). No separate test could be carried out for 1987 because of small sample size.

During all observations of feeding ($n = 174$), all females, independent of female category, fed in the intertidal zone by dabbling (Table 5).

DISCUSSION

Habitat selection in brood-caring diving ducks must to some extent be influenced by the fact that ducklings are unable to dive very deep.

TABLE 3. Secondary movements (mean distance moved from first observation) of different categories of females nesting on Grindøya, 1987–89.

| Female category | Number of females | Distance moved (km) | |
|------------------------------------|-------------------|---------------------|-------|
| | | \bar{x} | SE |
| Females hatching young: | | | |
| Brood caring | 38 | 0.96 | 0.38 |
| Loosing young between observations | 20 | 1.97 | 0.72* |
| Not observed tending young | 39 | 2.30 | 0.62 |
| Failed nesters | 34 | 4.10 | 0.81 |
| All categories | 131 | 2.33 | 0.33 |

* All movements took place after loss of young.

However, this study suggests that in the Common Eider, the differences between brood-caring females and females without young, is rather small, and there were no overall differences between the two categories in distance moved from the colony. Because Common Eiders nest in colonies, females without parental care could in theory fly to good habitats that would be impossible to reach by mothers from the same colony. Such movements would allow these females to avoid competition for food that may occur in crowded brood-rearing areas closer to the nesting area. Cantin et al. (1974) showed that in such areas up to 30% of the intertidal invertebrates could be removed by eider ducklings and the females accompanying them.

It has been found that most brood-caring Common Eider females go directly from the nesting area to a specific feeding area, which is reached within a few days (Gauthier and Bédard 1976, Munro and Bédard 1977). Munro and Bédard (1977) found that ducklings crossed up to 14 km of open water only hours after leaving the nest. Thus, Common Eider ducklings are apparently able to undertake long movements with little food. Potential for such movements has been attributed to the relatively large size of ducklings, resulting in a low mass specific metabolic rate, combined with large absolute hatching energy reserves (Sedinger 1992). However, in my study area the ducklings often swam along shorelines, enabling them to find some food as they were moving toward their specific site.

There may be several reasons why females without young stay as close to the colony as females accompanying ducklings. Firstly, if all females search for the same type of habitats, e.g., with high food abundance, few predators and little environmental exposure (Cantin et al. 1974, Minot 1980), they will probably go to the same areas. However, in areas with very long distances

TABLE 4. Secondary movements (mean distance moved from first observation) of different categories of Common Eider females nesting on Grindøya.

| Female category | 1988 Distance moved (km) | | | 1989 Distance moved (km) | | |
|------------------------------------|-----------------------------|------|----------|-----------------------------|------|----------|
| | \bar{x} | SE | <i>n</i> | \bar{x} | SE | <i>n</i> |
| Females hatching young: | | | | | | |
| Brood caring | 1.10 | 0.46 | 25 | 0 | 0 | 8 |
| Loosing young between observations | 3.50 | 2.41 | 4 | 1.59 | 0.70 | 16 |
| Not observed tending young | 2.94 | 0.98 | 20 | 1.72 | 0.77 | 18 |
| Failed nesters | 3.90 | 1.01 | 19 | 4.77 | 1.65 | 12 |
| All categories | 2.56 | 0.47 | 68 | 2.15 | 0.53 | 54 |

between the nesting colony and good feeding areas, a difference between females with broods and those without might be expected. In such areas, brood-caring females may be forced to use suboptimal habitats. Females from Grindøya disperse over a 72 km shoreline (Bustnes and Erikstad 1991), which appears to have enough good habitats to sustain the population of the colony. The whole area seems to be well within the range of small ducklings. Secondly, Common Eider females often show site-fidelity towards their post-nesting sites between years (Gauthier and Bédard 1976, Bustnes and Erikstad 1993), and the similar distance moved by different female categories may be a result of birds returning to their preferred site.

Secondary brood movements, that is broods moving between different rearing sites, are common among ducks (Ringelman and Longcore 1982, Pehrsson and Nyström 1988, Sedinger 1992), but such movements seem to be rare in Common Eiders (Gauthier and Bédard 1976, Munro and Bédard 1977). Munro and Bédard (1977) found that most groups containing young stayed at the same specific site for most of the

rearing period (9–10 weeks). The reason for this site stability is not known, but growing eider ducklings are very susceptible to food shortage, and their survival may be severely affected (Swennen 1989). Since females often show site-fidelity between years, they may know exactly where to find food at a specific site after a few years. This may reduce the profitability of moving to new, unknown areas. Movements may become advantageous, however, if the food abundance in an area declines to a very low level. Movements in response to declining food abundance have been shown in some duck species (Talent et al. 1982, Gauthier 1987, Pehrsson and Nyström 1988).

The chances of finding good feeding sites are probably independent of reproductive status of the females. Why then do females without young move more often than brood-caring females? Since there is depletion of food as a result of predation by eider females and ducklings (Cantin et al. 1974), some competition for food is likely to occur in crowded areas. Females with young tend to be dominant and can displace subordinate females in aggressive encounters (Munro

TABLE 5. Number of observations of feeding and total number of observations, by different categories of Common Eider females, in the post-nesting period (mid June to late July). All feeding birds were found in the intertidal zone.

| Female category | 1987 | | 1988 | | 1989 | | Total | |
|-------------------------|------|------|------|------|------|------|-------|------|
| | Obs. | Feed | Obs. | Feed | Obs. | Feed | Obs. | Feed |
| Females hatching young: | | | | | | | | |
| Brood-caring | 12 | 7 | 96 | 60 | 37 | 27 | 145 | 94 |
| After loosing young | 2 | 0 | 69 | 26 | 65 | 20 | 136 | 46 |
| Failed nesters | 8 | 2 | 68 | 20 | 27 | 12 | 103 | 34 |
| Total | 22 | 9 | 233 | 106 | 129 | 59 | 384 | 174 |

and Bédard, pers. observ.). This may reduce their ability to compete for food, and searching for better sites may be advantageous.

There was no difference in the type of habitats used (intertidal vs. subtidal zones) and feeding mode among females with parental care and those without. All birds were feeding in the intertidal by dabbling. In contrast, Cantin et al. (1974) argued that Common Eider females that played no part in the rearing of the young dispersed "seaward." Gauthier and Bédard (1976) found that females not caring for young scattered along the same shores as broods/crèches, but were less restricted by factors like weather and distance. Even though some Common Eiders feed by diving in the summer (Cantin et al. 1974, pers. observ.), this study suggests that Common Eider females use a different habitat after nesting than they use in winter. Clearly, small ducklings cannot feed in deep water, but from my observations of females without young, parental care is not the only cause of the differences between winter and summer habitat use.

In a sea duck like the Common Eider, with ducklings that are highly developed at hatching, parental care seems to impose few restrictions on their mothers.

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