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SHORT REPORT

# Cooperative incubation behaviour in a super dense Common Eider *Somateria mollissima* colony

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**Capsule** Common Eiders at Rif in west Iceland commonly show joint nest attendance, which may be an exaggerated behavioural response to the visual stimulus of many nests so close to their own nest. This represents a new insight into incubation behaviour in colonies with extremely high nest densities.

Most bird nests are attended by the incubating parents, either in pairs or as individuals (Cockburn 2006). In waterfowl (Anatidae), females incubate alone and males are either present and do not incubate (swans and geese) or are absent (ducks). In the Anatidae, exceptions that have biparental incubation are the Magpie Goose *Anseranas semipalmata*, Black Swan *Cygnus atratus* and the eight species of whistling ducks (Dendrocygninae) (Afton & Paulus 1992). The female Common Eider *Somateria mollissima* (hereafter eider) is generally considered a typical duck, i.e. the female incubates her eggs (Ashcroft 1976). In Iceland, the average clutch size is between three and five eggs, whereas six eggs or more is rare (Skarphéðinsson 1993, Snæbjörnsson 1998, D'Alba 2007, Kristjánsson 2008) and clutches of seven eggs or larger are probably due to parasitic nesting behaviour (Robertson *et al.* 1992, Öst *et al.* 2005).

The eider has one of the highest incubation constancies reported among birds, staying on the nest for 90–99% of the incubation period (Bolduc & Guillemette 2003, Kristjánsson & Jónsson 2011). Such incubation constancy requires energy expenditure from stored body fat, causing eiders to lose 25–45% of their body weight during the 24–27-day incubation period (Korschgen 1977, Parker & Holm 1990, Skarphéðinsson 1993, Harðardóttir *et al.* 1997, Jaatinen *et al.* 2012). Generally, studies have shown that incubation recesses last for 4–17 min (Mehlum 1991, Criscuolo *et al.* 2000, Bolduc & Guillemette 2003, Bottitta *et al.* 2003) but studies from Iceland report a longer average recess duration of 45 min (Kristjánsson & Jónsson 2011). Incubating eiders take 0–5 incubation recesses per 24 hours (Swennen *et al.* 1993, Kristjánsson & Jónsson 2011). In West Europe, recesses occur during the night and eiders use these recesses to preen, bathe and drink freshwater (Swennen *et al.* 1993, Bolduc & Guillemette 2003). In Iceland, eiders are equally likely to take recesses during daytime and night-time; this difference is probably explained by relatively longer daylight time in Iceland during the summer, allowing avian predators to be active for 24 hours (Kristjánsson 2008).

The behaviour of incubating eiders is well studied across its range (Scotland: Milne 1972, Greenland: Christensen & Falk 2001, Labrador: Chaulk *et al.* 2005 and Iceland: Kristjánsson 2008) where density in colonies is typically 0.8–250 nests/ha. The eider colony at Rif in west Iceland has one of the highest reported nest densities in the world, with over 2000 nests/ha (Jónsson & Lúðvíksson 2013). Such dense nesting may facilitate social cooperation in the incubating birds. During our previous research at Rif, we noted that female Common Eiders apparently tended other nests while the owner went on an incubation recess. Here, we assessed whether individually marked eiders attended more than one nest during incubation and if other, unmarked eiders tended the marked eider's nests during their recesses.

We captured 26 female eiders incubating at Rif on 25–26 May and 1–2 June 2011 with a noose-pole and individually marked them with a red plastic leg-ring with a white engraving (Pro-Touch, Canada). The eiders were also marked with nose markers (Juno

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Minnesota, USA) of different colour and shape for identification when incubating on the nest. Nose markers had the shapes: round, box, triangle, star and oval, and the colours: yellow, red, white, purple, brown and pink. Eiders were leg-marked and nose marked with two markers, one on the left and other one on the right. Each nose marker had two holes which we used to tie the markers together with a nylon seam (Biosyn) through the nostrils of the bird. We added a drop of super glue to strengthen the knot on the nasal marker. The nylon seam was UV light sensitive and ruptured within a few weeks, so the eiders lost the nasal markers after incubation. No females were observed with nasal markers upon return to the colony in 2012.

Nests were identified by a plastic pole with a nest number next to the nests of marked eiders. Behaviour of the birds was observed with a LEICA telescope (20–60×). We investigated behaviour of the 26 incubating females for 2–3 hours for 5 days (31 May; 6, 8, 11 and 16 June 2012). Nesting success of these 26 marked eiders was high, 81% of the birds hatched at least 1 duckling. We: (1) documented all incubation recesses and noted if the marked birds attended to nests other than their own on their way to or from the pond and (2) documented all approaches and activities by other eiders, female or male, towards a marked female's identified nest.

A total of 39 incubation recesses were documented among the 26 marked females. In 10 of 39 incubation recesses (26%), the marked females themselves attended to other nests on their way to and from incubation recesses. When a marked eider left her own nest, she stopped for a few moments and covered other clutches with nest down during 8% of recesses (3 of 39 occasions). Marked eiders were also seen sitting on other nests during 15% of recesses (6 of 39 occasions). In 3% of recesses (1 occasion), marked eiders were seen both covering other nests and sitting on other nests. During recesses, marked eiders were also seen drinking water from the pond, bathing and preening.

In 31 of 39 incubation recesses (79%), other eiders attended the focal marked nests. Unmarked eiders covered a focal nest during 26% of recesses (10 of 39 occasions) and sat on focal nests during 44% of recesses (17 of 39 occasions). In 10% of recesses (4 of 39 occasions) unmarked eiders were seen both covering and sitting on a focal nest (Table 1). Included here are one occasion where a male was seen sitting on a focal nest and three occasions where males covered a focal nest.

When a marked eider returned back to its nest after a recess, the unmarked eider on the nest usually fled or was already gone. In five recesses, the unmarked bird was aggressively chased away by the owner, which then resumed incubating her clutch. Sometimes a returning marked female sat on another unguarded nest for a short period or covered the eggs there before returning to her own nest.

In most eider colonies, males leave at the start of incubation but at Rif, males stay among the incubating females until mid-June, when males leave the colony to moult at sea. We saw male eiders both covering unguarded nests and sitting on nests while females took a recess. The males were even seen rotating the eggs while incubating for a short period. In a study in Önundarfjörður, male eiders stayed with the female during the whole incubation in only 4–7% of nests and were never seen sitting on the nests (Skarphéðinsson 1993).

Why eiders show this incubation behaviour towards other nests is not known and has not been reported before. Nevertheless, our findings may be applicable to other eider colonies with similar extremely high nest

**Table 1.** Behaviour of 26 marked incubating female Common Eider *S. mollissima* during the 2011 nesting season (31 May; 6, 8, 11 and 16 June 2011, with total numbers in bold) at Rif, Snæfellsnes, Iceland, during incubation recesses and (1) the frequency which they attended to nests other than their own and (2) the frequency that other birds attended at the marked focal nests.

| | 31 May | 6 June | 8 June | 11 June | 16 June | **Total** | % |
|---|---|---|---|---|---|---|---|
| Marked birds incubation recess | 2 | 9 | 2 | 22 | 4 | **39** | |
| Marked bird covers another nest | 0 | 2 | 0 | 1 | 0 | **3** | 8 |
| Marked birds sits on another nest | 1 | 2 | 1 | 1 | 1 | **6** | 15 |
| Marked bird does both | 1 | 0 | 0 | 0 | 0 | **1** | 3 |
| Unmarked bird covers a focal nest | 0 | 2 | 0 | 6 | 2 | **10** | 26 |
| Unmarked bird sits on a focal nest | 0 | 5 | 0 | 12 | 0 | **17** | 44 |
| Unmarked bird does both | 0 | 0 | 2 | 2 | 0 | **4** | 10 |

densities. There are at least four possible explanations for our observations that merit further investigation:

Eiders may be confused in this super dense colony and 'mistake' other female nests as their own when returning from recesses. There is probably a strong visual stimulus for an incubating female to attend an unguarded nest as she walks by. The density at Rif is so high that every eider passes many other nests during incubation recesses. In most eider colonies in Iceland, the nest density is closer to 20–250 nests/ha and there is more vegetation available for shelter than at Rif (2000 nests/ha), so females do not pass other nests as often.

Eiders are on a tight energy budget during incubation and it could be that sitting on an unguarded clutch when they have been disturbed from their own nest (i.e. by the eiderdown collectors) is a strategy to minimize heat loss from the brood patch on the bird (Schmidt *et al.* 2006).

Eiders may egg dump, so incubation in other nests may reflect differential investment in care of their own offspring. Parasitic nesting within species has been documented in 234 bird species and is widespread among *Anseriformes* and *Passeriformes* (Yom-Tov 2001). Large clutches indicative of egg dumping were present in our study colony. At Rif, clutch size was high in most years and nests with seven eggs or more were common. We do not have clutch size data for 2011 but in 2012, parasitic clutches (7 eggs or more) were 22% of all nests (Fig. 1), compared to 5.7% reported by Coulson (1999) at Coquet Island, England. We saw incubated unmarked nests with as many as 18 eggs. Eiders were also seen hatching and fledging up to 9 young from a single nest at Rif. Nest parasitism is known among eiders (Robertson *et al.* 1992, Waldeck & Andersson 2006) but is often related to poor body condition of the parasitizing female which then does not help the incubating eider hatch the young (Öst *et al.* 2005). It is hard, however, to distinguish between egg dumping into random nests and egg dumping into the nests of relatives (a kin selection strategy), because relatedness of the offspring is unclear without using molecular methods for determining kinship relations (Waldeck & Andersson 2006).

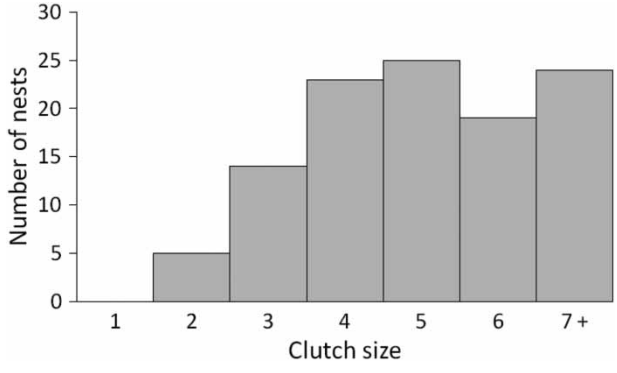


**Figure 1.** Eider clutch size at Rif, west Iceland in the year 2012.

Eiders at Rif are probably closely related to one another and might help related kin in the passing of genetic material to the next generation, when individual parents are not capable of incurring the costs of raising offspring all by themselves (Waldeck and Andersson 2006). Eiders are able to recognize kin but may not choose to associate with kin over unrelated individuals, or be relatively more likely to associate with kin in some years (Tiedemann *et al.* 2011, Jaatinen *et al.* 2012). At Rif, more than one female could possibly attend the same nest and all may be incubating at least some of their own eggs within the shared nest. This would then be cooperative incubation rather than wholly parasitic behaviour. However, relatedness may not be required for nest sharing: females cooperate when clutches hatch simultaneously and these are not necessarily related (Öst *et al.* 2005, Tiedemann *et al.* 2011, Jaatinen *et al.* 2012). Future research should investigate whether the females helping to temporarily incubate the nests have indeed laid some eggs in those nests themselves. A study of relatedness of incubating birds within the colony and eggs in the nests is needed to assess this possibility and should be a future research topic.

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