

## Note

### Conspecific nest attendance behaviour of Common Eider (*Somateria mollissima*) in response to Polar Bear (*Ursus maritimus*) foraging activity: error or intent?

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#### Abstract

Common Eider (*Somateria mollissima*) is a colonial nesting sea duck with extremely high nest attendance rates. Although individuals take few recess breaks away from their nest to feed or preen, previous research has shown that some female eiders in dense nesting assemblages engage in conspecific nest attendance, spending short amounts of time incubating nests of other females. However, to the best of our knowledge, most observations of these behaviours occur during regular recess events, as opposed to instances where females flush from their nest in response to a foraging predator. Using drone videography on East Bay Island, northern Hudson Bay, Nunavut, Canada, we observed conspecific nest attendance behaviours in 11 eiders that flushed in response to a foraging Polar Bear (*Ursus maritimus*). Of the 11 birds attending to other nests, only two predation events were observed at the focal bird's nest (i.e., two attenders' own nests were predated). Of the nine nests that were attended to, we also only observed two predation events. Motivations behind these behaviours are unclear, but conspecific nest attendance may serve as a type of distraction display, whereby activity at another female's nest leads the predator away from the focal bird's nest. However, given that, on East Bay Island, eiders are known to nest in proximity to kin, distraction displays at nests of related individuals would incur fitness costs. General confusion on nest location or the concealment of closely related eggs are more likely explanations for these behaviours.

Key words: Conspecific nest attendance; Common Eider; *Somateria mollissima*; Polar Bear; *Ursus maritimus*; incubation behaviour; distraction displays; drones

Common Eider (*Somateria mollissima*) is a large-bodied sea duck that typically nests in colonies on islands (Waltho and Coulson 2015). Eggs are incubated by females alone, which remain on their nest nearly constantly throughout the 21–24-day incubation period (Bolduc and Guillemette 2003; Bottitta *et al.* 2003). Eiders in Arctic populations fast throughout incubation, but may leave the nest occasionally to preen or drink water (Crisuolo *et al.* 2000); these recess events are typically short (median 401.5 s and 431.0 s before and after snow melt periods, respectively; Crisuolo *et al.* 2000) as unattended nests are vulnerable to predators such as Arctic Fox (*Vulpes lagopus*) and gulls (*Larus* spp.; Laurila 1989; Waltho

and Coulson 2015). Apart from self-maintenance or rehydrating, behavioural activities away from the nest should be infrequent, as females are expected to reduce the time their eggs are exposed. However, Kristjansson and Jónsson (2015) report observations of females leaving their nests (recess events) to attend unoccupied nests of other females in the same colony. They report that in 10 out of 39 recess events in their study, focal females left their nest for an incubation recess and were observed to cover other unattended nests with insulating down feathers or even sit on a nest that did not belong to them. Similarly, during 31 of those 39 recess events, non-focal individuals attended the focal nest in the absence of the focal

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females. Although eiders may entirely usurp nests of conspecifics (Waldeck and Andersson 2006; Waldeck *et al.* 2011) or other species (Pratte *et al.* 2016), the phenomenon of temporarily attending to the nests of other eiders has not been rigorously examined (Waltho and Coulson 2015).

To the best of our knowledge, all the recess events reported in Kristjánsson and Jónsson (2015) were true recess events, whereby females left their nest for an incubation break as opposed to flushing in response to a predator(s). Kay and Gilchrist (1998) report conspecific nest attendance by a single female eider during researcher activities at the East Bay Island, Nunavut, Canada, colony, but no other observations of these behaviours following predator-induced flushes have been reported in peer-reviewed literature. Waltho and Coulson (2015) report conspecific nest attendance in eiders during disturbance events, but they provide few details, which may reflect the logistic challenges associated with monitoring unmarked individual birds in dense nesting assemblages. Fortunately, the advent of drone technology (Chapman 2014) is providing unique visual perspectives on wildlife behaviour (e.g., Fortune *et al.* 2017; Jagielski *et al.* 2021b) and allows us to carefully parse out interactions between multiple individuals.

How individuals interact when living in large groups is of key interest to behavioural ecologists (Kopachena 1991). Eiders in brood rearing amalgamations are known to exploit social information and the vigilance of conspecifics (Bustnes 1993; Öst and Tierala 2011), but can also perform complex behaviours to avoid predation (McNair 1981; Kay and Gilchrist 1998). Eiders in several regions are facing increasing predation from Polar Bear (*Ursus maritimus*; Iverson *et al.* 2014; Prop *et al.* 2015; Barnas *et al.* 2020; Jagielski *et al.* 2021b), and little attention has been paid to the behavioural mechanisms by which eiders can avoid predation by bears (but see Dey *et al.* 2017). Understanding how the behaviours of individuals translate to population level effects can inform conservation practices (Bro-Jørgensen *et al.* 2019). Because eiders are a culturally and ecologically important species in the Arctic (Henri *et al.* 2018; Clyde *et al.* 2021), investigations into the behaviours of individuals are warranted.

Here, we describe observations of conspecific nest attendance by female eiders that flushed in response to Polar Bear foraging on East Bay Island (64°1'47.0"N, 81°47'16.7"W), in the Qaqsauqtuuq (East Bay) Migratory Bird Sanctuary, northern Hudson Bay, Nunavut, Canada. Eiders were observed between 10 and 20 July 2017 as a part of ongoing Polar Bear and eider behaviour monitoring using drone video from DJI Phantom 3 and 4 Professional

quadcopters (Dà-Jiāng Innovations, Nanshan, Shenzhen, China). We reviewed video recorded at ~30 m above ground during Polar Bear foraging events. The use of drones is thought to reduce behavioural impacts on both Polar Bears (Barnas *et al.* 2018; Jagielski *et al.* 2022) and nesting eiders (Ellis-Felege *et al.* 2021) and, as such, we are confident that our method did not influence their behaviours. Additional details on the drone used and general methodology of video collection are in Jagielski *et al.* (2021b).

During the original review of video, we recorded flush responses from 193 birds, but noted conspecific nest attendance behaviours in 11 individuals (two birds attended a single nest in one of the 10 observations). In some cases, these interactions involved multiple individuals attending to the same nest, so we describe these behaviours from the perspective of the eider exhibiting the conspecific attendance behaviours. All field observations and eider flushes, summarized in Table 1 and described in detail in Appendix S1, are assumed to occur in response to a foraging Polar Bear (unless otherwise stated), because of the close proximity of the bear to focal nests (i.e., 3–10 m).

Although conspecific nest attendance in eiders was observed in only 11 individuals across a relatively short timespan, these observations contribute to the growing database of Arctic bird responses to foraging Polar Bears (Gaston and Elliott 2013; Iverson *et al.* 2014). Conspecific nest attendance following disturbance events (source of disturbance unclear) has been reported in eiders by Waltho and Coulson (2015). However, our observations are only the second record of such behaviours for the East Bay Island eider colony since the single instance reported by Kay and Gilchrist (1998) and the first involving multiple non-focal females attending to the same nest (Table 1; Appendix S1: observations 2, 3, and 5). Because the East Bay colony is well studied (see Love *et al.* 2010; Descamps *et al.* 2011; Hennin *et al.* 2016; Jean-Gagnon *et al.* 2018), we would expect more reporting of this phenomenon. But, it seems that conspecific nest attendance behaviours are either somewhat rare (although potentially common as we documented 10 instances within 10 days) or difficult to discern by observers, and/or are unreported in the literature. Although the paucity of observations prevents an understanding of the role of these behaviours in determining nest fate or fitness consequences, we can briefly hypothesize evolutionary origins and suggest future research needs.

Kristjánsson and Jónsson (2015) proposed four possible explanations for the conspecific nest attendance behaviours they observed in eiders. First, individuals may get confused in dense colonies during disturbance events, lose awareness of their nest

**TABLE 1.** Summary of conspecific attendance observations involving nesting Common Eider (*Somateria mollissima*) and foraging Polar Bear (*Ursus maritimus*), East Bay Island, Nunavut, Canada captured using drone videos in July 2017. Each event involved a single bear.

Event, observation	Bird exhibiting conspecific nest attendance	Behaviours		Fate of nest
		Flushing	Conspecific nest attendance	
1,1	138	138 flushed from her nest by the bear	138 attended nest of 142 which had also been flushed by the bear and covered and sat on eggs in nest of 142 a couple of times, after 138 was chased off nest by 142 (see obs. 3)	Eggs in nest of 138 consumed by the bear
1,2	136	136 flushed from her nest by the bear in obs. 1	136 chased neighbour 135 off nest and sat on nest of 135 then departed	Neither nest visited by predators (bear or gulls)
1,3	142	142 flushed by bear in obs. 1	142 sat on nest of 135 after 136 departed in obs. 2	Neither nest visited by predators
1,4	148	148 and 145 flushed from their nests by bear eating eggs of 138 in obs. 1	148 visited nest of 145 and covered the eggs; did not return to her own nest	Neither nest visited by predators
1,5	Unknown 1 Unknown 2	141 flushed by approaching bear	Unknown 1 partially sat on nest of 141 then left, gull pecked at eggs, gull chased off by unknown 2 which then sat on nest of 141	Unable to assess damage to eggs or fate of nest
1,6	Unknown 3	152 flushed by approaching bear	Unknown 3 sat on nest of 152, then departed, 152 returned and sat on nest	Nest not visited by predators
2,7	126	126 flushed off her nest and walked behind bear while the bear consumed eggs of 124	126 performed broken wing display after bear began approaching her nest, redirecting the bear from the nest, scattering her ducklings, one of which was consumed by a gull, another of which fell into the unattended nest of 124 which 126 then sat on	No further predation by gulls or the bear
3,8	188	Both 188 and 189 flushed off their nests by a bear	188 sat on nest of 189, both then flushed again by approaching bear	Neither nest visited by predators
4,9	088	Both 088 and 086 flushed off their nests by a bear	088 sat on the nest of 086	Neither nest visited by predators
5,10	Unknown 4	While a bear consumed eggs from another nest, unknown 4 approached nest of 129 and removed 129	Both birds fought, unknown 4 left, 129 sat on her nest	Nest not visited by predators

Note: obs. = observation.

location, and submit to the strong visual stimulus to cover an unattended clutch of eggs (even those not their own). While other Arctic birds such as Common Murre (*Uria aalge*) and Thick-billed Murre (*Uria lomvia*) can recognize their own eggs (Gaston *et al.* 1993), high rates of conspecific nest parasitism in eider colonies (Waldeck and Andersson 2006; Hervey

*et al.* 2019) suggest that they are poor at egg recognition. The combination of disturbance induced by a large predator and the inability to recognize their own nest suggests that general confusion is a highly likely explanation for conspecific nest attendance in eiders, but other explanations deserve consideration.

Second, sitting on unattended eggs may reduce

heat loss of eider hens from their bare brood patch (although this is not satisfactory to explain the covering of eggs with insulating down feathers). Eiders do not feed during incubation, instead they exhibit a mass-loss incubation strategy (Moreno 1989; Criscuolo *et al.* 2000; Bolduc and Guillemette 2003). The restricted energy budget of eiders during incubation suggests that behaviours that retain heat should be favoured, but conspecific nest attendance bouts were short (e.g., 12 s) and likely did not provide ample heat transfer.

Third, the focal eider has a reproductive investment in other unattended nests because she has laid parasitic eggs in them (Hervey *et al.* 2019), and fourth, the focal eider is genetically related to the female of the unattended nest (McKinnon *et al.* 2006) and, therefore, gains direct fitness benefits from concealing the exposed eggs of relatives. Both of these hypotheses are plausible as high rates of conspecific nest parasitism (Waldeck and Andersson 2006; Hervey *et al.* 2019) and kin-grouping (McKinnon *et al.* 2006) occur in eider colonies. These hypotheses are intriguing and require further investigation. One caveat is that if eiders do nest close in proximity to relatives and simply attend nearby nests at random (as in the general confusion hypothesis), this may appear to be kin-based selection of conspecific nest attendance, when no such recognition of nests is actually required.

We examine a fifth possible explanation in more detail (originally postulated by Kay and Gilchrist 1998 as “nest betrayal behaviour”) based on the conspecific nest attendance behaviours we observed in the context of predator foraging. Increased activity at bird nests in the presence of predators is hypothesized to attract predator attention (Skutch 1949; Martin *et al.* 2000) and, by attending other nests nearby, female eiders breeding in a dense colony may enhance their own nest survival by drawing bears to nests other than their own (Kay and Gilchrist 1998). Polar Bears rely heavily on olfactory senses to locate prey (Derocher 2012; Togunov *et al.* 2017), but recent work also suggests that bears may use visual cues to locate eider nests (Gomezano *et al.* 2017). On East Bay Island, Polar Bears located more eider nests when responding to the visual cues of flushing birds, although this strategy was not consistently used by all bears (Jagielski *et al.* 2021a). It is possible that the activity of a female eider near another nest could draw attention away from the focal bird’s nest and direct the bear to consume eggs from another nest not their own. However, we observed only a single clear instance of a bear changing its presumed route to chase a distracting female eider (Table 1; Appendix S1: bird 126 in observation 7), which resulted in at least one of the

distracting female’s ducklings escaping predation. Although in observation 7 it is more likely that bird 126 was initially defending her duckling that fell into the nest of bird 124 rather than engaging in conspecific nest attendance, but given that she chose to remain on the nest, we felt it important to include. Of the 11 birds attending to other nests, only two predation events were observed at the focal bird’s nest (i.e., two attenders’ own nests were predated, bird 138 in observation 1 and bird 126 in observation 7). Of the nine nests that were attended to, we also only observed two predation events (bird 141 in observation 5, bird 124 in observation 7). As such, there is insufficient evidence to support the “nest betrayal” hypothesis, and there are several possible explanations for why this behavioural strategy is not observed at East Bay.

Eiders have been known to engage in “distraction displays” (McNair 1981; Kay and Gilchrist 1998), which are common in cryptic nesting birds, but less likely to evolve in colonial nesting species (Gochfeld 1984; Humphreys and Ruxton 2020). The rarity of these behaviours observed in eiders may reflect the negative fitness consequences of leading predators to nests of closely related individuals, as eiders often nest close to relatives (McKinnon *et al.* 2006; Hervey *et al.* 2019). At East Bay Island, eiders form kin-based social groups when arriving at the colony, during nest site selection, and when departing the colony (McKinnon *et al.* 2006). Because all conspecific nest attendance behaviours involving individuals with known nest locations occurred between neighbours less than 5 m apart (Appendix S1), true “nest betrayal” is not likely widespread at the East Bay Island colony as bears would be led to nearby nests. The conditions under which “nest betrayal” behavioural strategies could occur in a nesting colony of closely related individuals warrants future investigation.

Polar Bear foraging activity on eider nesting colonies has been reported more frequently in recent years, likely because of reductions in the extent of spring sea ice (Iverson *et al.* 2014; Prop *et al.* 2015; Barnas *et al.* 2020). At the landscape level, some predict that Polar Bear foraging will lead to increasingly dispersed nesting strategies as a means to avoid bear predation (Dey *et al.* 2017, 2018), but this has not yet been observed at large spatial scales (Dey *et al.* 2020). The behaviour of individual eiders in response to Polar Bears is less understood, and here we have shown that at least some birds may engage in conspecific nest attendance as a result. Future research should examine whether eiders performing conspecific nest attendance behaviours are more or less likely to lose their nest in the presence of foraging predators and how these behaviours impact nest success of neighbouring individuals.

The motivation behind these behaviours remains unknown, as are the potential fitness benefits, if any. Accurately estimating fitness consequences of these behaviours will require that birds of known relatedness are observed and demonstrate a change in predation risk for each nest (i.e., nest fate) as a result of these behaviours.

### Author Contributions

Writing – Original Draft: C.A.B.S. and A.F.B.; Writing – Review & Editing: C.A.B.S., E.A.G., O.P.L., H.G.G., C.A.D.S., and A.F.B.; Conceptualization – C.A.B.S., E.A.G., C.A.D.S., and A.F.B.; Methodology – C.A.B.S., O.P.L., H.G.G., C.A.D.S., and A.F.B.; Funding Acquisition – O.P.L., H.G.G., and C.A.D.S.

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#### SUPPLEMENTARY MATERIALS:

**APPENDIX S1.** Detailed field observations of conspecific nest attendance behaviours of Common Eider (*Somateria mollissima*) in response to Polar Bear (*Ursus maritimus*) foraging activity, East Bay Island, Nunavut, Canada.

**FIGURE S1.** Screenshots from observation 7 drone footage of Common Eider (*Somateria mollissima*) flushing in response to a foraging Polar Bear (*Ursus maritimus*), East Bay Island, northern Hudson Bay, Nunavut, Canada.

**FIGURE S2.** Screenshots from observation 8 drone footage of Common Eider (*Somateria mollissima*) flushing in response to a foraging Polar Bear (*Ursus maritimus*), East Bay Island, northern Hudson Bay, Nunavut, Canada.