

## BREVIa

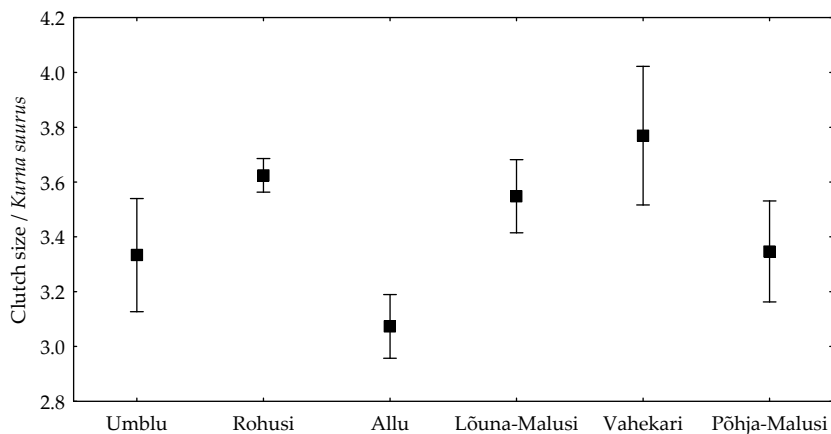
### Nest site selection and nest predation in Eider (*Somateria mollissima*) on Kolga Bay islands

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Eider (*Somateria mollissima*) is the species, breeding mainly on offshore islands. First reports about it's breeding in Estonia date back to around 1890, when it was seen on Vaika islands (Kumari 1954), and from then on Eider has spread in whole Estonian archipelago (Mänd 1994). The ornithological material collected from Kolga Bay islands has been previously published (Aua 1995) and analyzed (Aua 1991), but the breeding biology of Eider on these islands has not yet been covered. This article fills in the breeding of Eider at Kolga Bay.

According to census in 1991, ca 1300 pairs of Eiders were breeding on Kolga Bay islands. Data about 1219 of these are being used in following analyses. During the census, nests with eggs, nests with hatchlings, predated nests, and nests which the incubating female did not leave, when fieldworkers arrived, were fixated. Breeding habitat (shore, reed, meadow, junipers, shrubs and forest) was fixated as well. Mainly, we are using data collected from six islands – Umblu, Rohusi, Allu, Lõuna-Malusi, Vahekari and Põhja-Malusi. Data, collected from Koipse, are used only as additional information, for in 1991 this island was inhabited by a litter of foxes. As for Rammu and Pedassaare, only bird species that breed there were fixated, because of the size of these islands, and therefore they are not included in current analyze.

*Clutch size.* Clutch size was fixated in 790 Eider nests with the result of 3.50 eggs as an average. The overview of the clutch ( $n=772$ ) sizes on different islands is seen on Fig. 1. The size of island had significant influence on the clutch size (ANOVA  $F_{5, 766}=4.04$ ,  $p=0.001$ ). The average size of a clutch on Allu island was significantly smaller than the one on Rohusi (*Post-hoc*:  $p<0.001$ ), and tended to be smaller than on Lõuna-Malusi as well ( $p=0.08$ ).



**Figure 1.** Clutch size in Eider on Kolga bay islands in 1991. Whiskers denote SE.

*Joonis 1.* Kurna suurus hahkadel Kolga lahe saartel 1991. aastal. Vurrud on standardviga.

Cumulative data for clutch size and breeding density on islands is stated in Table 1. Clutches with 3 and 4 eggs predominated on all islands, making approximately 60% from total amount of clutches. Odd clutches (9 or more eggs in a single nest) were registered on 3 cases (on Umblu, Vahekari and Allu – one such on each island). All these clutches were discovered on smaller islands of Kolga archipelago. The average clutch size on Koipse island (33 ha) was 3.55 ( $n=20$ ), which is only a bit larger than archipelagos average (3.50). Quite an unconventional exception was Vahekari, with its average clutch size of 3.77 (Table 1).

**Table 1.** Number of nests and clutch size of Eider on Kolga bay islands. In addition area of islands (Loopmann 1996) and breeding densities are presented. Incubating females, nests with hatchlings, predated nests and odd nests were included into breeding density calculation.

**Table 1.** Pesade arv ja kurna keskmine suurus Kolga lahe saartel. Lisatud on saare pindala (Loopmann 1996) ja haha asustustihedus saarel. Asustustiheduse arvutamisel on arvestatud ka haudivoaid emalinde, poegadega pesi, liitkurnasid ja rüüstatud pesi.

	Umblu	Rohusi	Allu	L-Malusi	Vahekari	P-Malusi
Area / Pindala (ha)	1.6	11.2	0.7	8.2	1.4	2.5
No. of clutches (breeding pairs)	39 (51)	442 (703)	123 (166)	93 (173)	26 (39)	49 (61)
Kurnade arv (pesitsevaid paare)						
Clutch size ( $\pm$ SD)	3.33	3.62	3.07	3.55	3.77	3.35
Keskmine kurn ( $\pm$ SD)	( $\pm 1.49$ )	( $\pm 1.20$ )	( $\pm 1.36$ )	( $\pm 1.36$ )	( $\pm 1.58$ )	( $\pm 1.42$ )
Breeding density (pair/ha)	31.9	62.8	237.1	21.1	27.9	24.4
Asustustihedus (paari/ha)						

Correlation between area and the average clutch size is not relevant ( $r_s=0.43$ ,  $n=6$ ,  $p=0.40$ ). Similarly to Southern Sweden (Gerell 1985), there is no correlation between breeding density and the average clutch size ( $r_s=-0.09$ ,  $n=6$ ,  $p=0.87$ ). There was also no correlation between breeding density and size of the island ( $r_s=-0.37$ ,  $n=6$ ,  $p=0.47$ ), however the trend of the correlation was expected – the larger is island, the smaller is the breeding density. The same was noted by Gerell (1985) about Bräkne-Hoby archipelago in Sweden – the breeding density of Eider is bigger in small islands than in large forested islands.

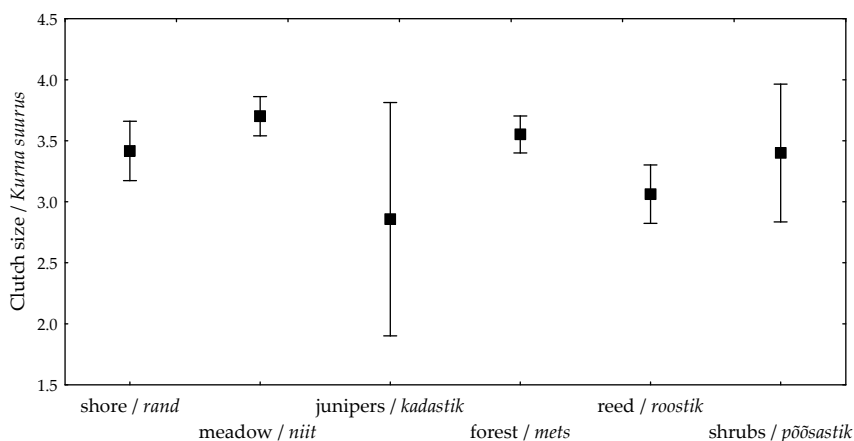
Whereas Eider is a species, breeding mostly on islands, one might presume marine islands to be preferred to offshore islands, for the number of unsuccessful breeding attempts on these islands is much higher (Gerell 1985). While better nest sites are occupied by older, stronger and more experienced individuals, who lay more eggs, the average clutch should be larger on the farther islands. However, there was no positive correlation between clutch size and the distance of island from the mainland ( $r_s=-0.14$ ,  $n=6$ ,  $p=0.79$ ). In 1991, the situation on Kolga Bay islands was rather reverse ( $r_s=-0.60$ ,  $n=6$ ,  $p=0.21$ ) – breeding density of Eider was higher on islands closer to the mainland, and this became a motive to examine the occurrence or absence of various breeding habitat on the islands. There is no doubt, that for correlations the sampling size is too small, and therefore, the occurrence of statistically relevant correlations is rather unlikely (power of the tests stay in between 0.05–0.27).

*Selection of breeding habitat.* In 1991, six major breeding habitats for Eider were defined on Kolga Bay islands. Detailed survey of clutch sizes in various breeding habitats on islands is stated in Table 2. Clutch size depended on breeding habitat ( $F_{5,766}=4.35$ ,  $p<0.001$ , Fig. 2). Birds, breeding in junipers (only on Rohusi island), had the smallest clutches. However, differences were nonsignificant due to small sampling size (see Table 2). But Eiders, breeding in reeds had considerably smaller clutches, than those who had their nests on meadow (Post-hoc:  $p<0.001$ ) and in forest ( $p=0.009$ ).

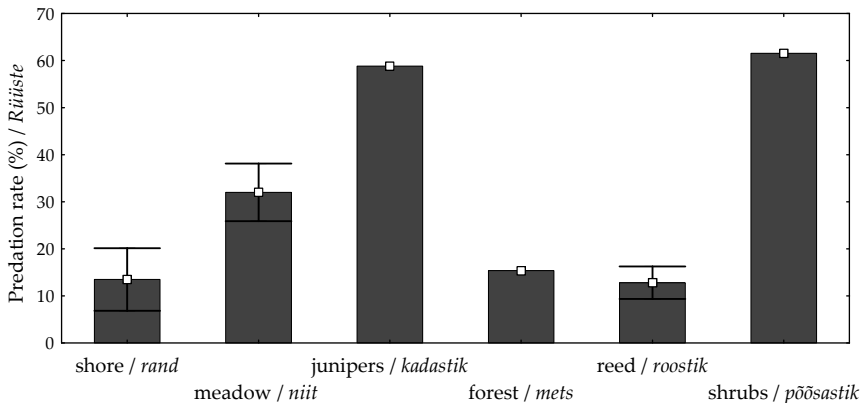
Rather interesting is the fact, that no Eider nests were found on the shingle shore of Lõuna-Malus. 71% of Eiders in the archipelago was breeding on meadows and in the forest on Rohusi Island. Remaining 29% shared (probably) less suitable shores – reeds, junipers and shrubs.

**Table 2.** Breeding habitat and clutch size of Eider on islands of Kolga bay in 1991.*Tabel 2. Pesitsusbiotoop ja kurna suurus hahal Kolga lahe saartel 1991. aastal.*

Island	Habitat	Found nests	No. of clutches	Clutch size ( $\pm$ SD)
Saar	Biotoop	Leitud pesi	Kurnade arv	Kurna suurus ( $\pm$ SD)
Umblu	shore	37	32	3.25 ( $\pm$ 1.44)
	meadow	14	7	3.71 ( $\pm$ 1.80)
Rohusi	shore	45	34	3.53 ( $\pm$ 1.44)
	meadow	164	124	3.85 ( $\pm$ 1.16)
	junipers	17	7	2.85 ( $\pm$ 1.35)
	forest	475	277	3.55 ( $\pm$ 1.71)
Allu	reeds	118	86	3.04 ( $\pm$ 1.38)
	meadow	48	37	3.14 ( $\pm$ 1.32)
Lõuna-Malusi	shore	0	0	0
	reeds	32	26	3.12 ( $\pm$ 1.24)
	meadow	89	47	3.85 ( $\pm$ 1.37)
	shrubs	52	20	3.40 ( $\pm$ 1.35)
Vahekari	shore	39	26	3.77 ( $\pm$ 1.58)
Põhja-Malusi	shore	16	16	2.94 ( $\pm$ 1.06)
	meadow	45	33	3.54 ( $\pm$ 1.54)

**Figure 2.** Clutch size in Eider on Kolga bay islands in 1991. Whiskers denote 95% confidence intervals.*Joonis 2. Kurna suurus ja 95% usalduspiirid hahal erinevates biotoopides Kolga lahe saartel 1991. aastal*

*Predation.* Gerell (1985), while examining Eiders breeding on Bräkne-Hoby archipelago, noticed that 75% of all nests lied outside the shrubs, yet on Kolga Bay islands even 94% of nests were set outside the shrubs. Percentages of predated nests varied between breeding habitats ( $F_{5,8}=4.42$ ,  $p=0.03$ , Fig. 3). As most of the Eiders nests are situated on islands densely populated by Herring Gulls (Umblu, Allu, Lõuna-Malusi, Vahekari and Põhja-Malusi), the depredation of Herring Gulls could be regarded as one of the main reasons for downfall of Eiders clutches. Interesting is the fact, that on those islands, where density of population of Herring Gulls was highest (Allu, Põhja-Malusi), the average size of Eider's clutch was smaller (respectively 3.07 and 3.35) than the average of the whole archipelago. Paradoxically, the safest breeding habitat for Eider seems to be islands' reeds (see Fig. 3) – size of the clutches found in reeds was the smallest, but breeding success appeared to be the greatest. It is known, that there is negative relation between the latency of nest and possibility for the adult bird to flee from the nest, and that older adults of higher quality are breeding on better territories (Öst & Steele 2010). Unfortunately, in this case we do not know whether it is not useful for Eider to spend much energy for lying in secure place, or whether the individuals breeding in reeds are just low quality. Junipers and shrubs (on Lõuna-Malusi, Rohusi) of Kolga Bay islands appear to be rather unsuitable breeding habitats for Eider, for despite the lowest average clutch size (2.86), 58.8% of nests had fallen victims of the predators. On Koipse island, that in 1991 was inhabited by a litter of foxes, as much as 73% of Eider's nests had been predated.



**Figure 3.** Predation rate of Eider's nests in different habitats on Kolga bay islands. Whiskers denote SE.

*Joonis 3.* Haha pesade riiüste ja selle standardviga erinevates biotoopides Kolga lahe saartel.

Studies, carried out in Southern Swedens Bräkne-Hoby archipelago in 1972–1974, showed that laying eggs starts earlier on larger islands, clutches layed earlier are bigger, and that early breeders, thus layers of the bigger clutches are older birds (Gerell 1985). The same tendency has been noticed on Eiders breeding on St. Lawrence Bay islands in Canada (Bolduc *et al.* 2005). Data collected on Kolga bay, show also that the average clutch on larger islands is somewhat larger than those on smaller ones. There may be several reasons for that. Bolduc (2005) suggests that when density of population of Gulls is low, nests are located farther from coast, on areas with lower vegetation. Breeders, residing on areas with lower vegetation appear to be more successful. They start breeding earlier and have larger clutches, although danger of getting their nests predated is higher, especially due to more exposed nests. Gerell (1985) also confirms that nests less hidden and closer to sea, are more successful, but also points out, that nests of young birds, that have arrived later, are also more exposed, but the average clutch size in these nests is considerably smaller. While Eider's selection of nest-site is based on trial and error method (Gerell 1985), it seems likely that better breeding areas (meadows and forest of Rohusi, where relatively small amount of nests had been predated, although the clutch sizes were above the average) are inhabited primarily by older birds. For example, while on Vahekari the vegetation is virtually absent, we may speculate, basing on the average clutch size and considering afore cited facts, that in 1991 this island was inhabited mainly by older Eiders. Effect of an island on the clutch size on Kolga bay islands was not affected by the area of the island; it's density of population, nor distance of the island from the mainland, but only by the breeding habitat. From this we may draw a conclusion, that in case of Eider, as not so conservative species when it comes to selecting the breeding site, one may proceed from the amount or absence of various breeding habitats, while estimating the effect of an island. As a conclusion, one may recognize, that indicators for population of Eider on Kolga bay, were explicable or similar to the tendencies observed by researchers on St. Lawrence Bay in Canada (Bolduc *et al.* 2005) and in Bräkne-Hoby archipelago in Sweden (Gerell 1985). However, there were some differences: 1) on Kolga Bay, the density of population of Eider was higher on islands closer to the mainland; 2) the number of breeding Eider's was high also on forested islands (Rohusi, Koipse); 3) clutch size was not affected considerably by the area of an island nor its distance from the mainland.

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