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Diet of the Common Scoter *Melanitta nigra* and Velvet Scoter *Melanitta fusca* wintering in the North Sea

Jan Durinck, Kim Diget Christensen, Henrik Skov & Finn Danielsen

Durinck, J., Christensen, K. D., Skov, H. & Danielsen, F., Ornis Consult Ltd, Vesterbrogade 140, DK-1620 Copenhagen V. Denmark

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Introduction

The Danish marine areas are among the richest waterbird areas in the Western Palearctic. Counts from land and aeroplane, and studies of beached oiled seabirds indicate that these waters are among the main wintering areas for a number of seaduck species, including Common Scoters *Melanitta nigra* and Velvet Scoters *Melanitta fusca* (Joensen 1974, Danielsen et al. 1986a, Laursen 1989). Up to 200 000 Common Scoters have been counted during winter west of the Danish Wadden Sea area (Rost et al. 1989) and up to 100 000 in the Jammerbugt, in northwest Denmark (Danielsen et al. 1986b).

The only detailed study on the feeding ecology of Common and Velvet Scoter in Danish waters is that of Madsen (1954), made on birds from the Kattegat area. In Common Scoters, he found that molluscs constituted 77% of the diet, 66% of these being bivalves, and the main species being *Mytilus edulis* and *Cardium edule*. In Velvet Scoters, he found that molluscs constituted 83% of the diet, 53% of these being the bivalves *Mytilus edulis*, *Cardium edule* and *Nassa reticulata*, which were consumed in about equal quantities.

Considering the importance of the Danish marine areas to these bird species, it is desirable to expand our knowledge of their habitat, food choice and condition. The present study is intended as a contribution in this direction.

Materials and methods

During one night, in March 1987, 340 Common and Velvet Scoters drowned in fishing nets placed near Hanstholm in the Danish sector of the North Sea (57°03′N, 8°29′E). The water at the site was about 10 m deep and the distance from land was about 1500 m. Local fishermen had reported "several thousand black ducks" in the area at that time, and informed us that 120 ground nets of 30 m had been in use when the ducks were drowned. The nets stand out overnight and the catch is collected the following morning. The marine environment in the area is dominated by the Jutland Current, with salinities between 26‰ and 32‰ (Hermann 1979).

A sample of 179 birds chosen at random from the drowned birds comprised 144 Common and 35 Velvet Scoters. All the birds were examined according to the instructions given in Jones et al. (1982). Their physical condition was studied using fat deposits as an index. The amount of subcutaneous fat on the breast (1), abdomen (2) and

the distal parts of the intestine (3) was estimated and each deposit ranked from 0 to 3 (Jones et al. 1982). These fat rankings were then summed to give a fat score between 0 and 9 for each individual. We dissected the 144 Common Scoter stomachs and 35 Velvet Scoter stomachs to examine the food composition.

Whole mussels were gently removed from the oesophagus and gizzard, identified, and measured along the greatest length. We did not treat the food from the oesophagus and gizzard independently. All the measurements of food items were made by the same person (JD) in order to reduce inter-personal variation (see Barrett et al. 1989).

Results

We sexed and aged 141 Common Scoters and found 59% adult males and 30% adult females. Only 11% of the birds were immature, consisting of 1 male and 14 females. We sexed and aged 35 Velvet Scoters and found 49% adult males and 49% adult females. Only one immature bird was found — a male.

The mean weights were high, indicating good general condition: Common Scoter ♂♂ 1294 g, ♀♀ 1249 g, Velvet Scoter ♂♂ 1785 g and ♀♀ 1618 g (Table 1). The fat scores also indicated that few birds were in poor condition (Table 1) and 61% Common Scoters and 74% Velvet Scoters were in very good condition (scores >5). The fat scores for Common Scoter ♀♀ were significantly higher than those for ♂♂ ($P = 0.0001$, Mann-Whitney U-test). The fat scores for Velvet Scoter ♀♀ were also significantly higher than those for ♂♂ ($P = 0.0028$, Mann-Whitney U-test). Other differences in fat scores were not significant.

Nineteen of the stomachs from Common Scoters and 5 from Velvet Scoters were empty and these have been excluded from Table 2. A total of 2418 food items were identified to species.

All Common Scoter stomachs with food contained *S. subtruncata* and about 11% contained *Cardium edule* (Table 2). Two species of prey were found in the stomachs of Velvet Scoters but *S. subtruncata* dominated (Table 2).

There was no significant difference in the length of the prey eaten by Common and Velvet Scoters or in the prey taken by the two sexes of either species (Tables 3 and 4).

Table 1. Mean weight of whole birds plus mean sum of fat rankings with standard deviations and range.

	Common Scoter		Velvet Scoter	
	Weight	Fat	Weight	Fat
♂♂	1294±86 (1150–1490, n=47)	5.8±1.2 (3–9, n=83)	1785±114 (1600–2070, n=16)	5.9±0.9 (5–7, n=17)
♀♀	1249±73 (1110–1360, n=22)	6.8±1.6 (5–9, n=43)	1618±86 (1510–1780, n=16)	7.4±1.5 (5–9, n=17)
♀	1199±72 (1090–1290, n=7)	6.1±1.0 (5–8, n=14)		

Table 2. Frequency of food items and percentage occurrence of food items from 125 Common Scoters and 30 Velvet Scoters drowned in March 1987 in the North Sea.

Prey species	Common Scoter Frequency		Common Scoter Percentage occurrence	Velvet Scoter Frequency		Velvet Scoter Percentage occurrence
Spisula subtruncata	97.0	(1770)	100.0	93.8	(557)	100.0
Cardium edule	3.0	(52)	11.2	6.2	(37)	12.8
Solenidae sp.	–	(1)	0.8		(0)	0.0
Pectinaria sp.	–	(1)	0.8		(0)	0.0
Total	100	(1824)		100	(594)	

Discussion

Velvet Scoters are generally scarce along the Danish west coast, while more than 100 000 birds winter in the Kattegat, generally using waters less than 20 m deep (Joensen 1974). Common Scoters are numerous along the west coast, but they appear irregularly and in strongly fluctuating numbers (Danielsen et al. 1986b). In the area of this study, Common Scoters appear irregularly and Velvet Scoters are rare.

The two species of scoters fed on identical prey and the main food of both scoters was *S. subtruncata*. We do not know the composition of the benthic fauna at the site where the birds were drowned but stomach contents from plaice *Pleuronectes platessa* indicated that *S. subtruncata* was their main food in the area and can hence perhaps be regarded as superabundant. *S. subtruncata* is widely distributed in Danish waters less than about 20 meters deep, forming part of the "Venus-community" (Thorson 1979). *S. subtruncata* is one of the most rapidly growing and productive mussels, reaching densities of 8000 individuals per m^2 in rich areas, such as those found along the west coast of Denmark. It is a 2-year species, reaching a length of 12–14 mm after one year, and it lives near the surface of the substrate. The specimens found in this study were then about one year old.

Madsen (1954) found that bivalves were the most important items in the diet of the Common Scoter, occurring in 95% of the stomachs; the most important species were *Mytilus edulis* and *C. edule*. The preferred size of molluscs was 10–20 mm. Madsen also reported bivalves to be important to Velvet Scoters, and found them in 82.6% of the stomachs, the most important being *M. edulis*, *C. edule* and Gastropods. The food items were smaller than 30 mm and the measured *Spisula* spp. were 10–12 mm. The preferred food size in this study seems to correspond well to Madsen's findings. Madsen's material came from game dealers, so he did not know the exact locations from which his specimens originated. The observed interspecific differences in diet may be due to differences in sampling location. Indeed, Madsen himself ascribed the differences in food to the observation that the two species of scoters generally feed at different distances from the coast. In the Gulf of Gdànsk in Poland, Stempniewicz (1986) found that *Mya arenaria*, *Macoma baltica* and *Cardium lamarckii* were the most important items for both scoters. The studies by Madsen (1952) and Stempniewicz (1986) demonstrate that scoters have specialized on mussels, their diets generally reflecting the benthic communities of their haunts (Thorson 1979). Our results also indicate that overwintering

Table 3. Length of food items (mm), standard deviation and analysis for difference in food choice between species and sex.

			Difference of choice
S. subtruncata			
15.2 ± 1.44	(2327)	All Scoters	
15.3 ± 1.44	(1770)	Common Scoter	
15.2 ± 1.45	(557)	Velvet Scoter	(F = 0.35, P = 0.55, ANOVA)
15.3 ± 1.44	(1217)	Common Scoter ♂♂	
15.2 ± 1.45	(382)	Common Scoter ♀♀	(t = 1.67, df = 1597, P > 0.1)
15.2 ± 1.46	(351)	Velvet Scoter ♂♂	
15.2 ± 1.50	(206)	Velvet Scoter ♀♀	(t = 0.49, df = 555, P > 0.1)
Cardium edule			
11.5 ± 1.10	(89)	All scoters	
11.4 ± 1.29	(52)	Common Scoter	
11.6 ± 0.88	(37)	Velvet Scoter	(F = 0.49, P = 0.48, ANOVA)
11.3 ± 1.31	(34)	Common Scoter ♂♂	
11.7 ± 1.23	(13)	Common Scoter ♀♀	(t = 0.95, df = 45, P > 0.1)
11.6 ± 0.89	(36)	Velvet Scoter ♂♂	

Table 4. Percentage distribution by size classes of *Spisula subtruncata* and *Cardium edule* eaten by Common and Velvet Scoters in March 1987 in the North Sea.

Interval mm	*Spisula subtruncata* Common Scoter %	*Spisula subtruncata* Velvet Scoter %	*Cardium edule* Common Scoter %	*Cardium edule* Velvet Scoter %
8–9	0.0	0.0	2.0	0.0
9–10	0.1	0.0	13.7	8.1
10–11	0.5	0.4	17.6	18.9
11–12	1.1	0.7	29.4	40.5
12–13	4.2	4.8	27.5	27.0
13–14	13.5	16.0	7.8	5.4
14–15	24.8	26.4	2.0	0.0
15–16	28.1	23.2	0.0	0.0
16–17	17.1	17.8	0.0	0.0
17–18	8.7	9.0	0.0	0.0
18–19	1.9	1.8	0.0	0.0
Total	100.0	100.0	100.0	100.0
n	(1770)	(557)	(37)	(52)

Scoters are mussel specialists. Most of the food items found belong to species distributed in water less than 20 m deep. Madsen (1954) and Stempniewicz (1986) did not record *S. subtruncata* as a major part of the diet, but this mussel is far more common along the Danish west coast than in the eastern Danish waters (Thorson 1979). This mussel was also reported to be the main food of Common Scoters i Dutch coastal waters (Offringa 1991).

Thus, during winter Common and Velvet Scoters seem to aggregate in areas of superabundant food and their main food in the North Sea seems to be *S. subtruncata*, a very common, widespread and highly renewable food source. The high weights of the drowned Scoters compared to values reported earlier (Cramp et al. 1979) and their high fat scores indicate that they live well on this food.

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Selostus: **Pohjanmerellä talvehtivien mustalintujen ja pilkkasiipien ravinto**

Kirjoituksessa analysoitiin 144:n kalaverkkoihin hukkuneen mustalinnun ja 35 pilkkasiiven kuntoa ja ruoansulatuskanavan sisältöä. Linnut olivat hyväkuntoisia (Taulukko 1). Molemmat lajit söivät pieniä merenpohjassa eläviä simpukoita, pääasiassa *Spisula subtruncata* -lajia (Taulukot 2, 3 ja 4).

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