Diet of Guillemots *Uria aalge* in the central Baltic Sea

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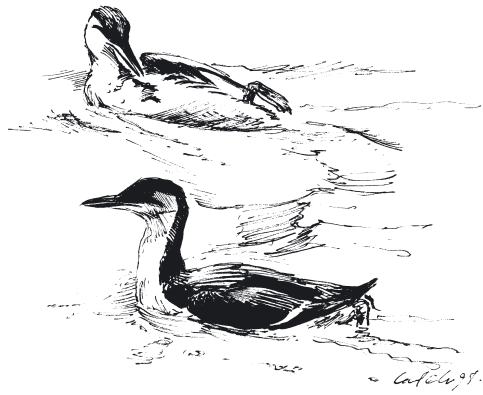
(Med et dansk resumé: Lomviens Uria aalge *fødevalg i den centrale del af Østersøen)*

Introduction

The food choice of the Baltic Guillemot *Uria aalge* is poorly known. Chick diet has been studied at Stora Karlsö off Gotland (Hedgren 1976), but information on the diet of full-grown Guillemots has been lacking. This paper presents the first description of the food of Guillemots from the offshore parts of the Baltic Sea. Baltic Guillemots are largely sedentary (Stolt et al. 1991, Lyngs & Kampp 1996), and since our sampling stations were within the main wintering area (Durinck et al. 1994), the results presented here are likely to be generally valid for the food choice of Guillemots in the central Baltic Sea.



Material and methods

The stomachs of 64 Guillemots drowned in fishing nets in the central Baltic Sea (Fig. 1) during 1990-96 were obtained from fishermen living on the island of Christiansø, Denmark (55°19'N, 15°12'E). Nine birds were caught in gill nets set for cod *Gadus morhua* at depths of 20-75 m near the Guillemot breeding colony Græsholmen, Christiansø, during March-June in 1990-1996 (sampling station A). The remaining birds were caught during September-November in salmon *Salmo salar* drift nets north of Christiansø (stations B and C, 25 in 1990 and 13 in 1994) and south of Gotland (station D, 10 in 1990 and 7 in 1994). The drift nets are surface nets (depth up to 2.5 m) operating during hours of darkness. Some salmon fishermen eat the drowned Guillemots during the week-long trips, so from 34 birds we only got the stomachs while the other 30 (including the birds from station A) were intact when received by us. The latter were sexed and aged: 20 immatures (A 2, B+C 4, D 14) and 10 adults (A 7, B+C 0, D 3); and 8 males (A 3, D 5) and 14 females (A 5, D 9). All stomachs were kept frozen until examination.

Stomach contents were determined to the lowest possible taxon, mainly from fish otoliths (Härkönen 1986) and (Clupeidae) from prootic/pterotic bullae (Svetovidov 1952). Fish weight and length was estimated from otoliths using equations given by Härkönen (l.c.). Such estimates are accurate to within 5-10% when based on fresh otoliths, but degradation in bird stomachs may lead to an underestimation of fish size (Barrett et al. 1990).

Results

One of the 64 stomachs was completely empty, one contained only pebbles while the rest contained fish or remains of fish. Pebbles with a mean length of 6.4 mm (4-9 mm, SD 1.5, n= 14) were found in 8 stomachs (13%). Remains of 313 fish were identified as follows: 305 sprats *Sprattus sprattus* (Clupeidae; as no herring *Clupea harengus* remains were identified, all prootic/pterotic bullae were assumed to have been from sprats), 2 sandeels *Ammodytes* sp. (Ammodytidae), 2 unidentified gadids (Gadidae), and 4 unidentified fish. Sandeels were only found at station A. A total of 57 birds (89%) had eaten sprats, 2 had eaten sandeels, 2 had eaten gadids, and one had only unidentifiable fish remains. To assess the proportion of the total wet weight contributed by each prey species, we assigned a mass of 63 g to each of the 2 gadids, which was the average

Fig. 1. Map of the central Baltic Sea showing the sampling stations for the Guillemots included in the analysis. Station A is centred over Christiansø.
Kort over den centrale Østersø med angivelse af indsamlingsstederne; Christiansø ligger under A.

weight of the largest ingested gadids measured by Durinck et al. (1991). The proportion of wet weight made up by gadids was 6%, sandeel 1% and sprat 93%. Sprats were dominant in all subgroups of birds irrespective of sampling station, sampling period, sex or age.

Measurements of 109 otoliths yielded an almost normal length distribution of the ingested sprats (mean 120 mm, median 126 mm, SD 35.7 mm). The mean and median length of six whole sprats found in two birds from station C was 125 mm and 128 mm (107-135 mm, SD 10.5 mm). Mean wet weight of ingested sprats was 19 g (SD 16.6), median 15 g.

Discussion

The general food of Guillemots is small pelagic fish such as herring, sandeel, sprat and capelin *Mallotus villosus* (Swennen & Duiven 1977, Glutz & Bauer 1982, Cramp 1985, Bradstreet & Brown 1985, Barrett et al. 1997). Madsen (1957) found the main food of 14 Guillemots caught in the Kattegat and the Danish Straits to be herring, followed by gobies (Gobiidae) and sticklebacks *Gasterosteus* sp. (Gasterosteidae). In a study of Guillemot food in the Skagerrak Durinck et al. (1991) estimated that two-thirds of the wet weight consisted of herring and sprat. A subsequent study in the Skagerrak found the at sea distribution of Guillemots to be positively correlated with the distribution of young herring (Skov et al. 1992). Other studies of Guillemot food have documented that sprat, herring, sandeel and horsemackerel *Trachurus trachurus* (Carangidae) are important prey species in the North Sea (Blake 1984, Camphuysen 1990, Geertsma 1992).

Our sample from the Baltic Sea showed a very strong dominance of sprats (97% by numbers). Chick diet at Stora Karlsö was likewise dominated by sprats (92%), with small herrings (5%) and sandeels (2%) as minor constituents (Hedgren 1976). Sandeels are common locally in coastal areas of the Baltic Sea but seem to be scarce in the open sea (H. Jensen & H. Sparholt, pers. comm.), and are probably not generally accessible for Guillemots when offshore. The mean total stock biomass of sprat in the central Baltic Sea is roughly 2-5 times higher than the biomass of young herring (Anon. 1997a, Anon. 1997b), but despite some spatial and temporal differences of the distribution of these two species (Grzebielec et al. 1995, Anon. 1997c), both appear to be abundant in the areas where Hedgren's (1976) and our samples were taken. So the dominance of sprats might, to some extent, indicate that the Guillemots were feeding selectively on them. Sprats generally have a higher calorific value than young herrings (Hislop et al. 1991), and Marsault (1975) found indications that Guillemots were able even to distinguish between sprats of high and low fat content.

The calorific value of sprats varies between 6 and 9 kJ/g, depending on fish size and season (Hislop et al. 1991). Assuming a daily energy expenditure of Guillemots of 2200 kJ/d (Gabrielsen 1996), 93% of which is taken as sprat, and an assi-

milation efficiency of Guillemots of 80%, the total Baltic population (40 000 birds, Lyngs 1992) would consume about 5000 tons per year. The mean annual stock biomass in the central Baltic Sea is estimated to be 1.6 million tons (1985-95), of which 119 000 tons are landed by the commercial fisheries and 147 000 tons are eaten by other fish, mainly cod (data from Anon. 1997a). Compared with these figures the consumption of the Guillemots is insignificant.

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Resumé

Lomviens *Uria aalge* fødevalg i den centrale del af Østersøen

I denne artikel bringes den første analyse af Lomviens *Uria aalge* fødevalg i de centrale dele af Østersøen. Fra 1990 til 1996 blev 64 lomviemaver indsamlet af fiskere på Christiansø i områder (Fig. 1), der ligger indenfor de baltiske Lomviers hovedudbredelse. Da de baltiske Lomvier overvejende er standfugle, kan resultatet betragtes som en generel indikation af deres fødevalg i Østersøens centrale dele.

Af de 64 maver indeholdt 62 fiskerester, mens én var tom og én kun indeholdt småsten. Småsten af en gennemsnitlig længde på 6,4 mm blev i øvrigt fundet i 8 maver. I alt 57 fugle (89%) havde spist brisling *Sprattus sprattus*, 2 havde spist tobis *Ammodytes* sp., 2 havde spist ubestemte torskefisk, og 1 rummede kun ubestemmelige fiskerester. Der blev i alt fundet 313 genkendelige fiskerester, heraf 305 (97%) fra brisling, 2 fra tobis, 2 fra torskefisk og 4 fra ubestemte fisk. Begge de fugle, der havde ædt tobis, var taget om foråret ved Christiansø. Ud fra ørestenenes bredde skønnedes de fortærede brislinger at have en gennemsnitlig længde på 120 mm og en vådvægt på 19 g (n=109). I et forsøg på at opgøre fødens fordeling i våd vægt lod vi de to torskefisk repræsentere en masse på 63 g, svarende til de største torskefisk fundet i et studium af Lomviens føde i Skagerrak. Torskefiskenes andel af fødens vådvægt var 6%, tobis 1% og brisling 93%.

I en undersøgelse over hvad Lomvierne på Stora Karlsö ved Gotland fodrede deres unger med, udgjorde brisling 92% af byttedyrene, sild 5% og tobis 2%. Brisling udgør således den altovejende del af de baltiske Lomviers fødegrundlag. Tobis er lokalt almindelig nær Østersøens kyster, men tilsyneladende fåtallig på det åbne hav. Unge sild er talrige i Østersøen, selv om biomassen af brisling antagelig er 4-5 gange så stor. Energiindholdet i brisling er højere end i ungsild, og den totale dominans af brisling afspejler formentlig, at Lomvierne foretrækker denne art.

I midten af 1980erne talte den baltiske lomviebestand omkring 40 000 individer. Hvis vi antager, at en Lomvie dagligt behøver 2200 kJ, og at energiindholdet i brisling er 7-9 kJ/g hvoraf 80% assimileres, bliver bestandens årlige konsumption ca 5000 tons. Den gennemsnitlige biomasse af brisling i den centrale del af Østersøen er omkring 1,6 mio. tons, hvoraf 119 000 tons tages af fiskeriet og 147 000 tons ædes af andre fisk (især torsk). Sammenlignet med disse tal er Lomviernes forbrug beskedent.

References

Anon. 1997a: Report of the study group on multispecies model implementation in the Baltic. – ICES CM 1997 Assess/J:2, Copenhagen.

Anon. 1997b: Report of the Baltic fisheries assessment working group. – ICES CM 1997/ Assess:12, Copenhagen.

Anon. 1997c: Report of the Baltic international fish survey working group. – ICES CM 1997 Assess/J:4, Copenhagen.

Barrett, R. T., N. Røv, J. Loen & W. A. Montevecchi 1990: Diets of Shags *Phalacrocorax aristotelis* and Cormorants *P. carbo* in Norway and implications for gadoid stock recruitment. – Mar. Ecol. Prog. Ser. 66: 205-218.

Barrett, R.T., M. Asheim & V. Bakken 1997: Ecological relationships between two sympatric congeneric species, Common Murres and Thick-billed Murres, *Uria aalge* and *U. lomvia*, breeding in the Barents Sea. – Can. J. Zool. 75: 618-631.

Blake, B. F. 1984: Diet and fish stock availability as possible factors in the mass death of auks in the North Sea. – J. Exp. Mar. Biol. Ecol. 76: 89-103.

Bradstreet, M. S. W. & R. G. B. Brown 1985: Feeding ecology of the Atlantic Alcidae. Pp. 263-318 in: Nettleship, D. N. & T. R. Birkhead (eds): The Atlantic Alcidae. – Acad. Press.

Camphuysen, K. 1990: Dieet, leeftijd en geslacht van de Zeekoet *Uria aalge* in de Nederlandse Noordzee in het voorjaar. – Sula 4: 41-54.

Cramp, S. (ed.) 1985: The Birds of the Western Palearctic. Vol. 4. – Oxford University Press.

Durinck, J., H. Skov & F. Danielsen 1991: Winter food of Guillemots *Uria aalge* in the Skagerrak. – Dansk Orn. Foren. Tidsskr. 85: 145-150.

Durinck, J., H. Skov, F. P. Jensen & S. Pihl 1994: Important marine areas for wintering birds in the Baltic Sea. – Ornis Consult, Copenhagen.

Gabrielsen, G. W. 1996: Energy expenditure of breeding Common Murres. – Occ. Paper Can. Wildl. Serv. 91: 49-58.

Geertsma, M. 1992: Dieet van de Zeekoet *Uria aalge* op het Friese Front in het najaar van1989; een vergelijkend voedselonderzoek. – Unpubl. dissertation, R.U. Groningen.

Glutz von Blotzheim, U. N. & K. M. Bauer 1982: Handbuch der Vögel Mitteleuropas. Band 8. – Academi-

sche Verlagsgesellschaft, Frankfurt am Main.
Grzebielec, R., A. Paciorkowski, M.. Wyszynski & W. Grygiel 1995: Polish hydroacoustic assessment survey of herring, sprat and cod stocks in ICES subdivisions 25 and 26 of the Baltic conducted in October 1994. – ICES CM 1995/J:18, Copenhagen.
Hedgren, S. 1976: Om sillgrisslans *Uria aalge* föda vid Stora Karlsö. – Vår Fågelv. 35: 287-290.
Hislop, J. R. G., M. P. Harris & J. G. M.. Smith 1991: Variation in the calorific value and total energy contents of the lesser sandeel (*Ammodytes marinus*) and other fish preyed on by seabirds. – J. Zool., Lond. 224: 501-517.
Härkönen, T. 1986: Guide to the otoliths of the bony fishes of the Northeast Atlantic. – Danbiu ApS, Hellerup.
Lyngs, P. 1992: Ynglefuglene på Græsholmen, 1925-90. – Dansk Orn. Foren. Tidsskr. 86: 1-93.
Lyngs, P. & K. Kampp 1996. Ringing recoveries of Razorbills *Alca torda* and Guillemots *Uria aalge* in Danish waters. – Dansk Orn. Foren. Tidsskr. 90: 119-132.
Madsen, J. F. 1957: On the food habits of some fish-eating birds in Denmark. – Dan. Rev. Game Biol. 3(2): 19-83.
Marsault, B. M. 1975: Auks breeding in captivity. – Bird Study 22: 44-46.
Skov, H., Durinck J. & F. Danielsen 1992: The distribution and number of Guillemot *Uria aalge* in the Skagerrak during late summer. – Dansk. Orn. Foren. Tidsskr. 86: 169-176.
Stolt, B.-O., L. Ekström, T. Fransson, B. Malmgren, R. Staav, B. Sällström & U. B. Sällström 1991: Guillemot *Uria aalge*. – Pp. 9-15 in: Report on Swedish bird ringing for 1988, Stockholm.
Svetovidov, A. N. 1952: Fishes. Fauna SSSR vol. II no. 1, New Ser. 48. – Israel Progr. Sc. Transl., Jerusalem.
Swennen, C. & P. Duiven 1977: Size and food objects of three fish-eating species: *Uria aalge*, *Alca torda* and *Fratercula arctica* (Aves, Alcidae). – Neth. J. Sea Res. 11: 92-98.

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