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Introduction

The Goldeneye *(Bucephala clangula)* is a non-breeding visitor to Denmark throughout the year. Moulting birds have been recorded in many areas in summer, mostly in fresh- and brackish-water habitats, and during 1966–72 the annual total Danish moulting population was estimated to be at least 12–14,000 birds (JEPSEN & JOENSEN 1973). The greatest concentrations moult in the Limfjord region, where Hjarbæk Fjord is the most important area. The occurrence of this species and the sequence of its moult in that area have been previously described by JEPSEN (1973).

The moulting period of the whole population extends from late July until early October, culminating in the first half of August. For different categories, the moult sequence during this period is as follows: 1 – juvenile males late June–late August, 2 – adult males early July–mid-September, 3 – juvenile females and possibly non-breeding females mid-July–late September, and 4 – adult females early August–mid-October (JEPSEN 1973).

The present paper concerns the local distribution of Goldeneye in Hjarbæk Fjord, and its food preference during the wing-feather moult. It is based on an analysis of the stomach contents of 119 individuals caught and drowned accidentally in fishing gear. The quantitative and qualitative composition of the diet in relation to the food resources available is also considered, on the basis of benthic fauna samples collected in August–September in 1968 and 1971. The Danish Institute for Fishery and Marine Research very kindly provided data concerning trawl samples collected in Hjarbæk Fjord in 1969, 1970, 1972 and 1973.

The author is indebted to several people for help with this investigation. Mr. CARLO F. JENSEN and Cand. scient. HANS HEIDEMANN LASSEN, both of the Zoological Institute, Århus University, determined the contents of benthic samples from 1968 and 1971 respectively. Mr. OLE PREUSS, Mr. JEPPE EBDRUP, and Miss ISA and Mr. ASGER UHD JEPSEN all helped to sort and count items in benthic samples and stomach contents. Cand. scient. GRETHE JØRGENSEN determined seeds and other vegetative matter from stomach contents. While fish and invertebrates in stomach contents were determined by the author, the identifications were confirmed by Cand. scient. GORM RASMUSSEN for fish, and Dr. JON FJELDSÅ for invertebrates. To the latter, special thanks are due for critical reading of the manuscript. Dr. OLE BAGGE of The Danish Institute for Fishery and Marine Research kindly provided data on fish populations in Hjarbæk Fjord, and Mr. SIGVALD JØRGENSEN, a fisherman at Hjarbæk Fjord, is to be thanked for assistance with fieldwork in the study area. The manuscript was translated into English by Dr. ROBERT RUSSEL, and the Russian summary was translated by Mr. AXEL MORTENSEN.

Material and methods

THE STUDY AREA

Hjarbæk Fjord (56° 32′ N, 09° 14′ E) is a fiord arm of the south-easterly part of the Limfjord. The area, including a 100 m wide margin along its coast, was made a game reserve in 1967. Regulations for the reserve include prohibition of waterfowl-shooting and a speed limit of 8 knots while sailing with motorpropelled craft. The area of the fiord is approximately 24 km^2; the deepest section of the fiord is 5–7 m, while the major part is shallow (Fig. 1). In the deeper central part the bottom consists of sand or sand mixed with clay, and no macrophytes are found here (MUUS 1967). In the shallow areas, the bottom consists of sand or sand mixed with clay and stones. Off the outlets of streams, and especially in Kvols Vig and certain places in the deeper part of the fiord, there are deposits of detritus which vary in depth, of up to 50 cm.

In 1966, Hjarbæk Fjord was separated off from the rest of the Limfjord by a road-bearing dam at Virksund. The sluices allow excess water from Hjarbæk Fjord to pass out, but close automatically against the inflow of water from the north. As a result, the average surface salinity of the water fell from between 14 and 19 ‰ in northern parts of the fiord and from between 7 and 13 ‰ in eastern parts (as measured before establishment of the dam (MUUS 1967)) to approximately 0.7 ‰ on average for the whole fiord in October 1969, 0.4 ‰ in October 1972, and 0.6 ‰ in October 1974. The change from a mesohaline to a freshwater habitat has brought about marked changes in the marginal and benthic vegetation and in the invertebrate fauna. Changes in the distribution of the benthic vegetation and its species composition from 1967 to 1969 have been described by JEPSEN (1970).

In the shallow areas along the western coast of the fiord, the dominant vegetation is now *Ruppia spp.*, and *Potamogeton pectinatus* is common in the eastern part of the fiord. In and off stream outlets are rich growths of *Potamogeton* spp., *Elodea canadensis* and *Spirogyra* spp. Taller marginal vegetation is uncommon, although it does occur in certain places, especially in and off stream outlets. A certain amount of overgrowth has occurred along most coastal stretches in recent years, *Scirpus tabernaemontani, Phragmites communis* and several other plants having spread further. Over many years,

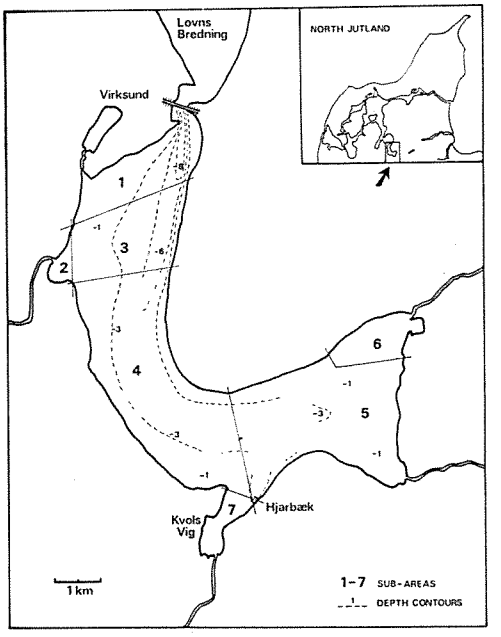

Fig. 1. Map of Hjarbæk Fjord showing depth contours in metres and division into sub-areas. Locality names mentioned in the text are included.

and particularly since the establishment of the dam at Virksund in 1966, the fiord has been subject to increasing eutrophication. The streams which empty into the fiord drain approximately 1,200 km^2 of agricultural land, and in this way the fiord gains mineral nutrients and large amounts of plant material which originate from the trimming of stream banks. In late summer the transparency of the fiord water is very low, at times being only a few centimetres.

INVESTIGATION OF THE FIORD AREA

During the period of study, salinity analyses were performed approximately once each month from October 1967 until the end of 1974, along with the general studies on waterfowl. The analyses were carried out as chloride titrations at the Botanical Institute, Århus University.

The quantitative and qualitative composition of the benthic fauna was studied at 39 stations in August 1968 and September 1971. The position of the stations was on a co-ordinate basis, such that they could be found in the field using landmarks and compass directions. Benthic samples were collected using an Ekman-Birge dredge with an aperture of 225 cm^2 and height 17 cm. Samples were sieved through a 1.0 mm mesh plankton net and preserved in a 4 % formalin solution until identification. JON FJELDSÅ informs (pers. comm.) that some *Chironomidae* larvae will pass through a plankton net with mesh 1.0 mm. After this the samples were transferred to 70 % alcohol, and they are now stored permanently at the Game Biology Station. In analysing the samples, the macrofauna were removed and their occurrence expressed as individuals/m^2. However, the study only provides an approximate idea of the composition of the benthic fauna and is by no means representative, as for example no net samples were taken in order to identify the larger free-swimming animals.

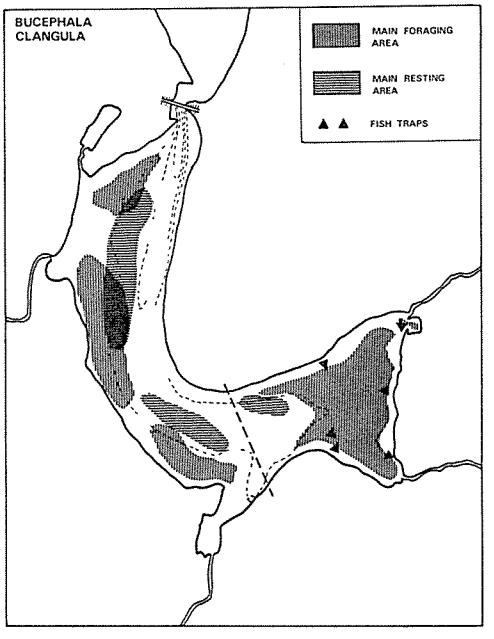

Fig. 2. Map of Hjarbæk Fjord showing the most important foraging and resting areas of the Goldeneye. The position of fish traps is also indicated. The food preference of the Goldeneye was only determined from specimens collected in the area east of the heavy broken line.

STUDIES OF THE MOULTING POPULATION OF GOLDENEYE

Data on the number of Goldeneye in Hjarbæk Fjord have been collected since April 1967 together with records of other waterfowl, by counts performed 1–3 times per month. Estimates of the sex- and age-composition have been made based on random samples of at least 10 % and at times up to 100 % of the Goldeneye population since October 1969 (JEPSEN 1973). During the moult period, the local distribution of Goldeneye in the fiord was recorded.

The fiord was divided into seven sub-areas (Fig. 1). Population counts were mainly carried out from the land, and occasionally supplemented by counts from aircraft. Methods, coverage, and the influence of weather conditions on the results have been described by JOENSEN (1973 and 1974) and JEPSEN (1973).

The feeding ecology of the species during the wing-feather moult has not previously been described, but several studies exist concerning food preference during the autumn, winter and spring in both fresh-water and marine localities (MADSEN 1954, OLNEY & MILLS 1963, NILSSON 1972, and others). In addition BENGTSON (1971) has described the feeding ecology of the Barrows Goldeneye *(Bucephala islandica)* during the breeding season.

COLLECTION AND ANALYSIS OF STOMACH CONTENTS

The food preference of Goldeneye during the wing-feather moult is described on the basis of material collected from 110 birds in July, August and September during 1969–1973 (see Appendix 1). A total of 119 birds were collected, of which 9 had empty stomachs. The birds were accidentally caught and drowned in fishing gear positioned in the eastern part of Hjarbæk Fjord (Fig. 2). The Goldeneye collected were more or less evenly distributed amongst the six fish traps, and their drowning in the traps was presumably connected with the low transparency of the water, as they were mainly caught during periods of algal increase, especially of green algae. In particular birds in full moult were caught, probably due to their reduced manoeuvrability underwater while in this condition. In addition it is especially the birds in full moult, comprising 60–70 % of the moulting population (JEPSEN 1973), which seek their food in the very shallow water where the traps are situated. Apart from information on food preference, the birds collected provided data about body- and wing-feather moult (JEPSEN 1973). It was discovered that the drowned birds died while foraging just before the traps were emptied, as the birds were alarmed when a boat approached; those that were in between the arms of the trap became confused and were trapped in the enclosed part of the gear. Thus in most cases the stomach contents were quite fresh, and only slightly subjected to digestion. This, in addition, was confirmed by the fact that only about 10–15 % of the individuals contained larger food particles, especially of fish, in the muscular stomach. The main occurrence of food items was in the oesophagus and glandular stomach, which greatly facilitated identification and counting.

Immediately on removing the Goldeneye from the fish traps they were labelled with the date, placed in a plastic bag and stored in a deep-freeze. The digestive organs were later removed and while still

frozen transferred to a solution of 4 % formalin. After identification and counting the samples were placed in 70 % alcohol and stored permanently at the Game Biology Station. The importance of immediate preservation of stomach contents has been described by KOERSVELD (1950).

The total stomach contents and fish were weighed wet, and the weight of invertebrates subsequently calculated. Single food items were not weighed, but the percentage volume of each item was determined from its wet volume in a specimen tube.

Results

HABITAT SELECTION DURING THE MOULTING PERIOD

The moult migration of the Goldeneye to Hjarbæk Fjord and other localities, and the natural conditions at these localities, have been described by JEPSEN (1973). The actual moult migration to the fiord area begins in the latter half of May, the numbers of Goldeneye culminating between mid-July and mid-August (Fig. 3). Migration to the fiord is entirely over water from the remainder of the Limfjord, through the broads of Lovns Bredning and the narrows of Virksund.

The northern and to some extent the central section of Hjarbæk Fjord are used by the birds as a resting place after arrival, and gradually, as the moulting period approaches, they disperse to the south-western and eastern sections of the fiord. During the flightless period between 40–60 % of the population occur in the eastern part of the fiord (Fig. 4).

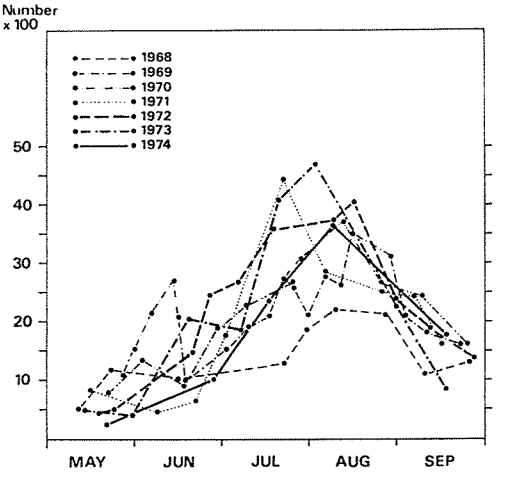

Fig. 3. Numbers of Goldeneye at Hjarbæk Fjord, May–September 1968 to 1974.

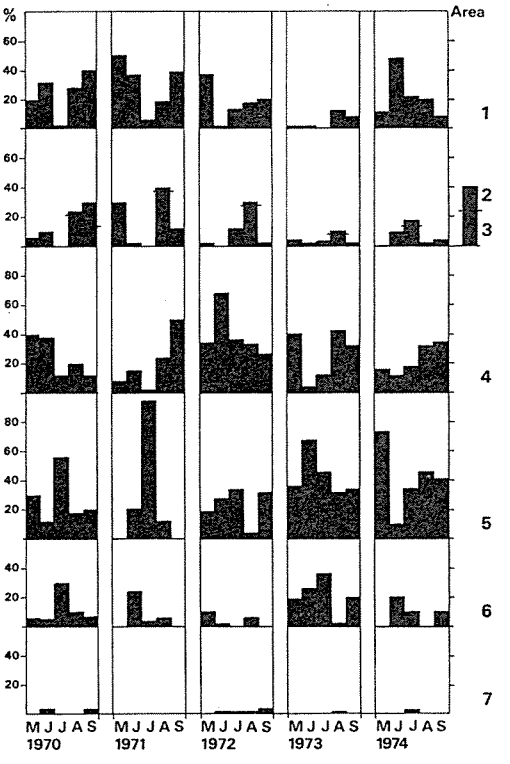

Fig. 4. The percentage distribution of Goldeneye in areas 1–7 at Hjarbæk Fjord (see Fig. 1) during May–September 1970 to 1974.

Goldeneye mainly forage during daylight, when the birds are dispersed over the area. The most important foraging areas are indicated in Fig. 2, on which the most commonly-used resting areas are also shown. The gradual dispersal of the Goldeneye to the south and east of the fiord is connected with their preference to forage in very shallow water during the moult, such areas occurring mainly in these regions of the fiord. The significance of the availability of food is discussed later (see page 12). The areas of occurrence of the birds are not only related to the availability of food, but are also influenced by other factors, such as the degree of disturbance by man. In addition, it is possible to discern in Goldeneye a tendency to seek sheltered coasts when the wind increases. During the summer months the prevailing wind direction is from the south-west.

The moulting period of the Goldeneye coincides with the peak period for leisure sailing. The deeper section of the fiord from Hjarbæk to Virksund is sailed on by larger yachts and cruisers, while in the shallow areas, particularly in the northern part of the fiord and in Kvols Vig where landing-stages have been established next to summer-house areas, smaller rowing- and sailing-dinghies and motor-boats are common. The degree of disturbance can be so great that the birds are excluded for longer periods from certain parts of the fiord. The eastern shallow section and the south-western area of the fiord are only used for leisure sailing to a limited extent.

FEEDING ECOLOGY

Feeding behaviour

As previously mentioned, the majority of the moulting population forage in shallow water. The search for food usually occurs as a series of dives, each dive being of only a few seconds' duration, and food is swallowed underwater. Conditions in Hjarbæk Fjord did not facilitate detailed observations of the feeding technique. JON FJELDSÅ informs (pers. comm.) that Barrows Goldeneye often swim just above the bottom with the bill in the mud and hereby larvae of *Chironomidae* etc. are caught by the lamellae of the bill. It is likely that a similar technique is used by the Goldeneye. While the Goldeneye are in full moult their manoeuvrability underwater is somewhat reduced, and this may be the reason why some birds seek their food around fixed fishing gear, where there are often large numbers of trichopteran larvae attached to nets and underwater ropes.

Foraging by grubbing in very shallow water is a phenomenon which, for Goldeneye in Hjarbæk Fjord, is only observed in moulting birds. In winter feeding Goldeneye prefer shoal waters of at most 6–7 metres' depth (NILSSON 1969).

In the early hours of the morning, before human traffic on the fiord begins, birds in full moult have also been observed to forage in washed-up belts of plant remains, consisting for instance of cut vegetation which has been carried out into the fiord by streams and later washed ashore. The food items gained here are presumably insects and molluscs, as plant remains only comprise a decreasing part of the diet during the moult, as is explained later.

Since 1973, an increasing number of observations of a particular type of behaviour have been made both during and outwith the moulting period, in which Goldeneye and Black-headed Gull *(Larus*

ridibundus) forage together in dense flocks. Such flocks move rapidly in different directions, and the Goldeneye show much diving activity; the food items are thus on the move, and are most likely to be fish. This foraging technique can probably only be used when the water has a high transparency, and it is only observed when the surface is still.

Stomach contents

In all the available material, including the 9 stomachs without proper food items, from 3 to over 40 smaller stones were found, the average number being 15. The stones were usually from 2–5 mm, although in a few cases stones of up to 11 mm were found. No lead shot was found in the stomach contents. Apart from these actual gizzard stones, almost all stomachs contained some sand particles of less than 1 mm, which probably originated from larval cases of Trichoptera.

A total of 11,858 individual animal food items were recorded in the material from 110 stomachs. In Fig. 5 are shown (A) the composition by weight of fish and invertebrates in the diet, (B) the numbers of the various groups in the diet expressed as a percentage, and (C) the percentage volume occupied by each group, all during the period 1969–1973. In Table 1 the distribution of the food items according to number, frequency and percentage volume is listed (see also Appendix 1).

From 1971 on, smaller fish of up to 10 cm in length such as *Scardinius erythrophthalmus, Gasterosteus aculeatus, Perca fluviatilis* and *Acerina cernua* form an increasing part of the diet. Fish only occur in small numbers in relation to the other categories of food, but in volume they comprised 32 %, 51 % and 72 % in 1971, 1972 and 1973 respectively. On a weight basis fish comprised 22 % and 38 % of the animal food in 1970 and 1971, and 59 % and 68 % in 1972 and 1973, respectively. The comparative weights of fish and invertebrates for 1969 are not known, as stomach contents were not weighed. Of a total of 73 fish found in 56 stomachs, 42 were of the species *Acerina cernua.*

Molluscs comprised only 1.6 % of the volume of total stomach contents, *Potamopyrgus jenkinsi* being the dominant species in this category. In 1972 and 1973 *Cladocera* were numerous, comprising 42 % and 44 % of the individual food items respectively, while their contribution to

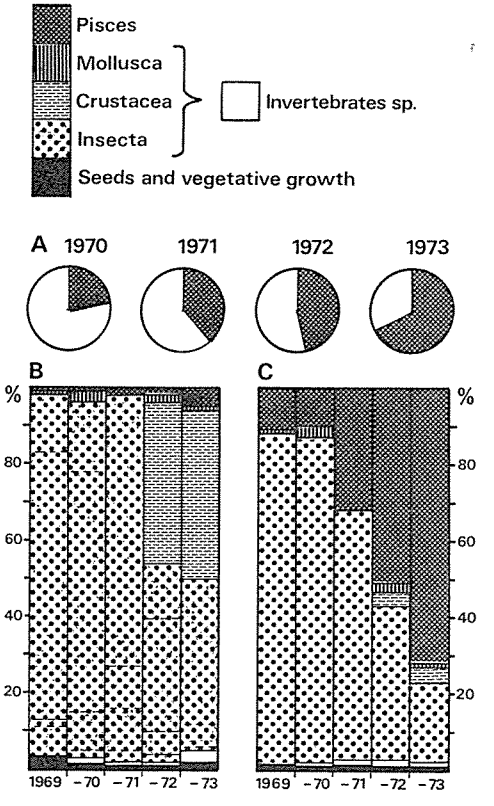

Fig. 5. The composition by weight (A), by percentage numbers (B), and by percentage volume (C) of Pisces and invertebrates in the diet of the Goldeneye.

Food items	No. of individuals	%	Frequency of occurrence no. birds	%	Percentage of vol. in total material
Pisces	**73**	**0.6**	**56**	**47.1**	**35.6**
Scardinius erythrophtalmus	14	0.1	9	7.6	
Gasterosteus aculeatus	2	–	2	1.7	
Perca fluviatilis	15	0.1	12	10.1	
Acerina cernua	42	0.3	23	19.3	
Mollusca	**407**	**3.3**	**13**	**10.9**	**1.6**
Hydrobia ulvae	16	0.1	1	0.8	x
Potamopyrgus jenkinsi	461	3.0	7	5.9	1.3
Lymnaea sp.	12	0.1	1	0.8	x
Lymnaea pereger	18	0.1	4	3.4	0.3
Crustacea	**3214**	**26.4**	**16**	**13.4**	**1.8**
Cladocera sp.	3195	26.2	10	8.4	1.0
Copepoda					
Argulus foliaceus	1	–	1	0.8	x
Mysidacea sp.	5	–	3	2.5	x
Isopoda					
Asellus aquaticus	13	0.1	8	6.7	0.2
Insecta	**8156**	**66.9**	**106**	**89.1**	**57.3**
Hemiptera					
Corixidae sp.	2331	19.1	64	53.8	8.3
Ephemeroptera					
Caenis sp.	4	–	1	0.8	x
Siphlonurus sp.	3	–	2	1.9	x
Odonata					
Calopteryx virgo (or *juncea*)	11	0.1	2	1.8	0.4
Trichoptera sp.	4633	38.0	102	85.6	39.6
Oxyethira sp.	9	0.1	5	4.2	x
Diptera					
Chironomidae sp.	1148	9.4	57	47.9	6.1
Brachycera sp.	2	–	2	1.9	x
Coleoptera					
Silphiidae sp. (terr.)	1	–	1	0.8	x
Haliplidae sp.	2	–	2	1.8	x
Carabidae sp. (terr.)	1	–	1	0.8	x
Myrmecinae sp. (terr.)	1	–	1	0.8	x
Unidentified insecta	10	0.1	3	2.5	1.2
Arachnoidea	**8**	**0.1**	**7**	**5.9**	**x**
Acarina					
Hydrachnella sp.	8	–	7	5.9	x
Total animal food	**11858**	**97.3**	**109**	**91.6**	**96.3**
Seeds	**306**	**2.5**	**41**	**34.5**	**1.4**
Myriophyllum sp.	1	–	1	0.8	
Potamogeton sp.	115	0.9	6	5.0	
Ruppia sp.	27	0.2	4	3.4	
Scirpus lacustris	12	0.1	11	9.2	
Zannichellia palustris	91	0.7	13	10.9	
Other identified seeds	41	0.3	18	15.1	
Unidentified seeds	19	0.2	13	10.9	
Vegetative growth	**25**	**0.2**	**19**	**16.0**	**2.3**
Total plant food	**331**	**2.7**	**51**	**42.9**	**3.7**
Total	**12189**	**100.0**			

Table 1. The species composition, occurrence, and percentage volume of food items from the total material. x = < 0.1 %.

volume comprised only 3 % and 4 %. In the total material *Cladocera* comprised 1.8 % of the volume.

There were 8,156 insects among the animal food items. Larvae of *Trichoptera spp.* comprised more than half of these (4,642 individuals), and formed 39.6 % of the total volume. 2,331 larvae and imagoes of *Corixidae* were present, forming 8.3 % of the total volume, while larvae and pupae of *Chironomidae* (1,148 individuals) formed 6.1 % of the volume. Larvae of *Ephemeroptera* and *Odonata (Calopteryx virgo* or *juncea)* were present in smaller numbers, and a few terrestrial insects including *Silphiidae, Caribidae* and *Myrmecinae* occurred by chance in stomach contents.

Plant remains formed 3.7 % of the total volume, seeds comprising 1.4 % of this figure. Altogether 306 seeds were found, mainly of *Potamogeton spp., Zannichiellia palustris* and *Ruppia spp.* In addition seeds of land plants were found, including *Empetrum nigrum spp., Circium spp.* and *Arctostaphylos uva uris.* These latter seeds were undoubtedly carried out into the fiord by streams or wind. Altogether seeds were found in 41 stomachs, and other plant remains (stems and portions of leaves, especially of *Potamogeton spp., Ruppia spp.,* and *Elodea canadensis),* in 19.

The food preference of Goldeneye has been investigated by several authors, including COTTAM (1939), CAMPBELL (1947), MADSEN (1954), OLNEY & MILLS (1963), DEMENT'EV et al. (1967) and NILSSON (1972), but most of the material originated from birds collected during the winter months. Their studies have revealed that Goldeneye rely on *Crustacea* and *Insecta* to a much greater extent than other diving ducks.

COTTAM (1939), whose material comprised almost 400 Goldeneye collected throughout the year in North America, found that *Mollusca, Crustacea, Insecta* and plant remains comprised 10 %, 32 %, 27 % and 26 % of the volume of the food respectively. MADSEN (1954) examined over 200 Goldeneye, all collected between October and February. The stomach contents of 38 birds from brackish-water areas of Ringkøbing Fjord and of 19 from the Limfjord showed that the respective percentage proportions of the birds containing different food categories were: *Mollusca* 68 % and 79 %, *Crustacea* 63 % and 68 %, *Pisces* 16 % and 5 %, *Insecta* 10 % and 26 %, and plant remains 76 % and 84 %. The author did not state the percentage volume of each food category, but mentions that *Mollusca, Crustacea* and plant remains comprise most of the diet. In birds collected from marine localities plant remains were less common, while *Mollusca, Crustacea* and to some extent fish were predominant in the stomach contents.

In the material of the above studies, plant remains comprised a considerably larger part of the diet than in birds from Hjarbæk Fjord .The same is also true for *Mollusca* and *Crustacea,* which in the Hjarbæk Fjord material comprise only 1.6 % and 1.7 % respectively of the total volume. These differences are mainly due to divergences in food preference, partly due to requirements and partly to seasonal availability. DEMENT'EV et al. (1967) are of the view that plant remains are only eaten in an emergency, or by chance.

It is worth noting that fish only comprise a small part of the diet of Goldeneye in winter, while in the summer-collected material from Hjarbæk Fjord they comprise 35.6 % of the total volume. DEMENT'EV et al. (1967) state that in the early spring on the Mologa River of North-west Russia, the diet of the Goldeneye consists of 60 % small fish and

20 % *Chironomid* larvae. Later in the year, in September and October, it is mainly larvae of *Phryganea striata* (75 %) which are found in stomachs. In the Caspian Sea region, the main winter food is *Crustacea*, consisting of 46 % *Gammaridae* and 45 % *Potamobius*.

In the studies mentioned, no comparisons were made between food preference and availability of food resources. It is thus not possible to know whether Goldeneye exercise their food preference by seeking localities which satisfy particular criteria which show seasonal variation, whether they forage on the food items available in a particular locality where other criteria such as lack of disturbance are satisfied, or whether they specialise on particular food species occurring in large quantities.

Nilsson (1972) examined 16 Goldeneye caught in fishing-gear during September–November in the fresh-water Lake Ringsjön, southern Sweden. Larvae of *Trichoptera* and *Chironomidae* were predominant in the food, and some fish together with small amounts of *Mollusca* and plant remains were also found. The percentage occurrence of *Insecta* was 89 %, *Mollusca* 4 %, fish 2 % and plant remains 4 %. These proportions in general correspond to the food preferences shown by Goldeneye in Hjarbæk Fjord in 1969, 1970 and 1971. In his studies, Nilsson compared the food preferences of Goldeneye and Tufted Duck *(Aythya fuligula)* with the food resources available, based on samples of the benthic fauna.

Food preference in relation to available supply

As mentioned previously, benthic samples were taken during the latter half of the moulting period of the Goldeneye at Hjarbæk Fjord in 1968 and 1971. However, as the Goldeneye obtained all originated from the eastern part of the fiord, it is really the samples from this area which are of most interest. It is not possible however to make a direct comparison between diet and available food supply, as benthic samples only indicate the composition of the epi- and infauna, and give no indication of free-swimming invertebrates and fish. During the period 1968–1971, the species composition of the benthic fauna and the number of animals per m^2 has changed considerably (Fig. 6).

Prior to the establishment of the Virksund dam, the species composition of the benthic fauna was that of a typical *Macoma* community, including *Littorina spp., Hydrobia spp., Pisidium spp., Mytilus edulis, Mya arenaria, Macoma baltica* and *Cardium edule* as typical components. Populations of *Hydrobia ulvae* and *H. ventrosa* existed in the fiord in the early years after 1966, and a few examples were found in Goldeneye stomachs. However the populations were previously extremely large, and empty shells of *Hydrobia* predominate in bottom samples from 1968 with an average of up to 84 % for the whole fiord. According to Muus (1967) *Hydrobia ulva* and *H. ventrosa* do not occur in oligohaline or limnetic-water localities (those of less than 5 ‰ salinity).

Fresh-water snails were first found in the fiord after 1968, and in 1971 some species were numerous in samples from stations in the vicinity of stream outlets. *Hydrobiidae*, in 1971 occurred at a population density of up to 7,870 individuals/m^2, while *Lymnaea pereger*, only present in small amounts in 1968, was numerous in samples taken in 1971 from the southern section of the fiord (Kvols Vig). In this latter case 8,800 individuals/m^2 were recorded, mainly attached to *Elodea canadensis* and *Spirogyra spp.*

The numbers of trichopteran and chironomid larvae increased greatly in samples from 1971 compared with 1968, *Trichoptera* being especially in the eastern part of the fiord, where up to 3,345 individuals/m^2 were found. *Chironomidae* had spread throughout the fiord, but were mostly off stream outlets where detritus layers occurred. The percentage proportions of live benthic fauna in the eastern part of the fiord (to the right of the broken line in Fig. 2) is shown in Fig. 6.

Some of the invertebrates present in aquatic ecosystems are not available as food for the Goldeneye because of their behaviour and mode of life. *Chironomidae* and other substrate-dwelling animals possibly occur in such small numbers in Goldeneye stomachs in relation to their number/m^2 because other items, e. g. small, slow moving fish, are so abundant that Goldeneye can specialize in them. The problem has been discussed by SWANSON et al. (1974) in connection with the feeding ecology of the Blue-winged Teal *(Anas discors)*, and by FJELDSÅ (1973) in connection with a study of the diet of the Horned Grebe *(Podiceps auritus)*.

In the case of fish species, Mr. O. BAGGE (pers. comm.) stated that sample trawls carried out by The Danish Institute for Fishery and Marine Research in 1969, 1970, 1972 and 1973 showed an increase in numbers, particularly of *Scardinius erythrophthalmus*, and *Gasterosteus aculeatus, Perca fluviatilis, Acerina cernus* and *Anguilla anguilla*. The catch after using an eel-trawl for one hour is shown in Table 2. Concurrent information was also given personally by Mr. SIGVALD JØRGENSEN, a fisherman, who noticed a decrease during the same period of marketable fish, together with a great increase of smaller fresh-water fish in catches.

Changes in the quantitative and qualitative composition of the benthic fauna and increases in the populations of certain fish species have also been evident in the stomach contents of the Goldeneye. The most striking fact is that fish form an increasing part of the diet, comprising up to 72 % of the volume in 1973, or 68 % of the weight (Fig. 5).

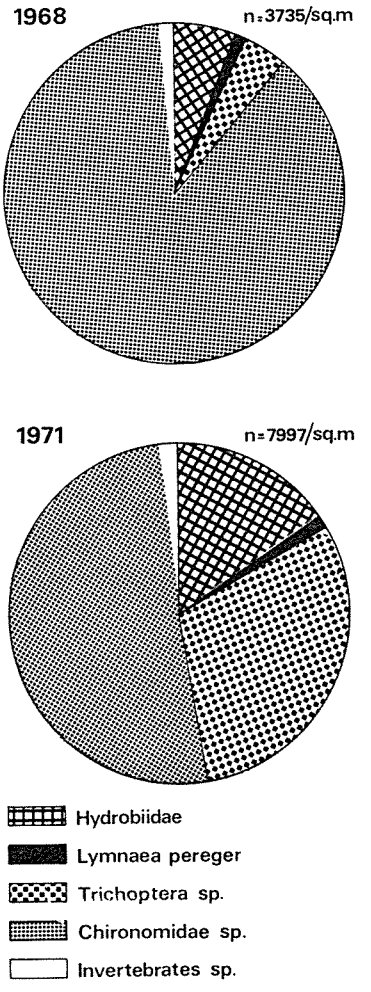

Fig. 6. The percentage species composition of the benthic fauna and the number of individuals per square metre in areas 5 and 6, Hjarbæk Fjord, in 1968 and 1971.

Species	1969		1970		1972		1973	
	No.	Kg.	No.	Kg.	No.	Kg.	No.	Kg.
Clupea harengus	–	–	–	–	–	–	4.5	0.060
Salmo trutta	–	–	–	–	–	–	0.5	0.400
Salmo irideus	–	–	–	–	4.0	1.000	1.5	0.325
Coregonus lavaretus	–	–	–	–	1.0	0.220	2.0	0.385
Platichthys flesus	2.0	0.280	10.7	1.072	–	–	1.5	0.225
Zoarces viviparus	0.8	0.040	–	–	–	–	–	–
Gasterosteus aculeatus	224.0	1.045	–	–	175.0	0.700	1730.0	6.788
Scardinius erythrophthalmus	541.2	34.172	358.5	15.933	155.0	26.100	868.0	31.593
Acerina cernua	0.4	0.040	24.1	0.268	172.0	2.900	1685.0	29.200
Perca fluviatilis	30.4	1.848	124.0	9.983	52.0	3.700	151.0	6.552
Osmerus eperlanus	107.2	1.160	2.0	0.040	17.0	0.600	1.0	0.010
Blicca bjørkna	4.8	0.200	214.4	4.317	8.0	0.600	45.0	16.750
Anguilla anguilla	28.8	2.740	45.6	4.087	30.0	2.900	115.0	9.795

Table 2. Results of a sample trawl by The Danish Institute for Fishery and Marine Research in Hjarbæk Fjord in July of 1969, 1970, 1972 and 1973. The catch was made by one hour's fishing with an eel trawl.

During the study period the amount of molluscs in the food contents was reasonably constant, being mainly comprised of *Potamopyrgus jenkinsi*. A few examples of *Hydrobia spp.* occurred in 1969, while in 1972 and 1973 quite a few *Lymnaea pereger* occurred in stomach contents. In relation to numbers of *Mollusca* occurring in the fiord, this category is only slightly represented in the food. This is striking considering that gastropods are abundant as an easily available epifaunal element. As mentioned previously, *Insecta* are predominant numerically, even although in 1971 this category only comprised about 40 % of the numbers of benthic fauna.

In 1972 and 1973 *Cladocera* comprised an important part of the food numerically, and it is probable that for this group also, populations have increased together with the gradual tendency towards a freshwater habitat in the fiord. There was no increase in the numbers of *Trichoptera* in stomach contents, in spite of an increase in population (Fig. 6). The reason for this possibly lies in the large annual variations in population numbers of these species, or also that other items of food have meanwhile become available to the Goldeneye. In addition, the food requirements of an increasing number of Goldeneye have had to be met during the moulting period in Hjarbæk Fjord (Fig. 3).

The condition of Goldeneye collected

The physical condition of the 119 Goldeneye collected from Hjarbæk Fjord was apparently good, when compared with the weight of birds in winter. No weight data were given in the previously-mentioned studies on food preference of Goldeneye, but SCHIØLER (1926) states that the average weight of 8 females from December, January and February was 788 g, and 1,136 g for 9 males from the same period, all the birds being in their second or more winters. During the moulting period the average weight of Goldeneye from Hjarbæk Fjord is 738 g for adult females and 1,032 g for adult males, in both cases thus slightly less than the winter weights.

Discussion and conclusions

Numbers of Goldeneye and the diet

It is remarkable that Goldeneye, which usually prefer oligotrophic fresh-water lakes as their breeding-areas (RAJALA & ORMIO 1970), are much less critical as regards water quality during the wing-feather moult. Oligotrophic lakes are characterised amongst other factors by high water transparency, and for many years Hjarbæk Fjord has been subject to eutrophication, not least since 1966, when the dam at Virksund (Fig. 1) was completed. At the same time, since 1967 there has been a greater influx of moulting Goldeneye to the fiord, rising from over 2,000 birds in 1968 to approximately 4,500 in 1973 (Fig. 3). This development is presumably correlated with increases in the numbers of animals forming their food.

As mentioned, this study of Goldeneye feeding was based on stomach contents of animals drowned by accident in fishing gear. The birds were thus caught while foraging, making it possible to preserve the mainly undigested food rapidly by freezing. This approach may however involve certain errors, as it may perhaps only be those ducks which are selectively feeding on *Trichopteran* larvae which are caught. These larvae occasionally occur in great numbers on underwater nets and ropes, and it is possible that as a food item, this category is over-represented in the material from stomachs. A food analysis of birds collected for example by shooting while feeding would possibly have made the food preference more clear.

In the Goldeneye examined from July, August and September 1969–73, the composition of the food according to the volume of each category was as follows (see Fig. 5 and Table 1):

Pisces	35.6 %
Mollusca	1.6 %
Crustacea	1.8 %
Insecta	58.9 %
Plant remains	3.7 %

Local distribution

The following factors influence the local distribution of Goldeneye at Hjarbæk Fjord during their wing-feather moult (Fig. 4):

1. *Topography:* in general, during the moult Goldeneye appear to prefer open areas of water free of larger zones of tall marginal vegetation such as reed swamps, in contrast to dabbling ducks, which prefer cover in vegetation while moulting (BEZZEL 1964, KORTEGAARD 1974). When Goldeneye are disturbed, they react by diving and moving out into deeper water.

2. *Disturbance:* during the moulting period, Goldeneye are very much exposed to disturbance by leisure sailing activities. This is one reason why they prefer the eastern and south-western areas of the fiord as resting places.

3. *Weather conditions:* these have some influence on the distribution of Goldeneye in the fiord, as they mainly seek lee coasts during strong winds.

4. *Availability of food:* in shallow waters this appears to be a necessity, but it is hardly possible to relate the distribution of Goldeneye completely to the distribution of their food. On this point, the factors mentioned above have some influence (Figs. 2 and 6). The daily food requirement of a Goldeneye does probably not exceed 200 g (NILSSON

1972). The daily amount of food of the Eider *(Somateria mollissima)*, has for example been determined as approximately 300 g of molluscs (GERAMISOVA & BARANOVA 1960), but daily requirements must vary both with the season and the quality of the food items. In 1973, the number of moulting Goldeneye in Hjarbæk Fjord exceeded 4,500 in the early part of August (Fig. 3), and the average number of birds from June until the end of September was 2,250 birds/day, giving an approximate value of 270,000 bird-day units. Thus the amount of food necessary during the period, at a daily consumption rate of 200 g/bird, amounts to approximately 400 kg per day, a total of 54 tonnes over the whole period. In 1971, the average weight of benthic fauna per m^2 in Hjarbæk Fjord was about 7 g, a figure which possibly underestimates the actual biomass (see page 5). An approximate, cautious estimate of the total weight of macrofauna in the 24 km^2 area of water is about 168 tonnes standing crop. Other diving ducks which forage on the benthic fauna of the fiord include Tufted Duck *(Aythya fuligula)*, Scaup *(Aythya marila)* and Pochard *(Aythya ferina)*, but in 1974 the numbers of Goldeneye comprised approximately 90 % of all diving ducks in the fiord during the months of June to September.

Dansk resumé

Hvinandens *(Bucephala clangula)* fødeøkologi under svingfjerfældningen i Danmark

1. Hvinanden *(Bucephala clangula)* er en ikkeynglende gæst i de danske farvande hele året. I sommermånederne forekommer fældende hvinænder på mange brak- og ferskvandslokaliteter. Bestanden er på mindst 12.000–14.000, hvoraf hovedparten forekommer i Limfjorden. Landets vigtigste fældningslokalitet er vildtreservatet Hjarbæk Fjord (fig. 1), hvor op til 4500 fældende hvinænder er registreret.

Studier af hvinandens fældningstræk og svingfjerfældning i Hjarbæk Fjord har været gennemført siden 1969 sideløbende med generelle vandfugleundersøgelser (JEPSEN 1973). Desuden er artens fødevalg under fældningen undersøgt på baggrund af maveindholdet fra i alt 110 fugle, der ved uheld er fanget og druknet i fiskeredskaber opstillet i den østlige del af Hjarbæk Fjord (fig. 2). Hvinandens lokale udbredelse i fjorden under fældningen er ligeledes undersøgt. Fødens kvantitative og kvalitative sammensætning i relation til tilgængelige føderessourcer diskuteres på baggrund af prøvetagninger af bundfaunaen i august-september 1968 og 1971.

2. De indsamlede hvinænder er omkommet under fouragering, umiddelbart før ruserne er blevet røgtet, idet fuglene er blevet skræmt, når en båd har nærmet sig, hvorved de, der har ligget mellem rusernes fangarme, har forvildet sig ind i den lukkede del af fangstredskabet. Maveindholdet har således oftest været ganske frisk. Kun i 10–15 % af fordøjelsesorganerne har der været større fødemængder i muskelmaven. Føden har overvejende befundet sig i spiserøret og kirtelmaven, hvilket i høj grad har lettet bestemmelsen og optællingen af de enkelte fødeemner.

Hvinænderne er hurtigst muligt efter, at de er fjernet fra ruserne, blevet forsynet med dato, pakket i plasticpose og lagt i dybfryser. Fordøjelsesorganerne er senere udtaget og i endnu frossen tilstand præpareret i en 4 % formalinopløsning. Det totale maveindhold samt fisk er vejet i våd tilstand. Vægten af invertebrater er derefter beregnet. De enkelte fødeemner er ikke vejet. Volumen-procenten for de enkelte fødeemner er bedømt efter rumfang i våd tilstand i præparatglas.

3. Antallet af hvinænder i Hjarbæk Fjord fra maj til september 1968–1974 ses i fig. 3. Den nordlige del af fjorden, samt i nogen grad den centrale del, benyttes af fuglene som rasteplads efter ankomsten, hvorefter der gradvis, som fældningstiden nærmer sig, sker en spredning til fjor-

dens sydvestlige og østlige afsnit. Under selve svingfjerfældningen opholder 40–60 % af bestanden sig i den østlige del af fjorden (fig. 4).

Hvinandens vigtigste fourageringspladser og overnatningsområder i Hjarbæk Fjord er vist i fig. 2.

4. I materialet fra de 110 maver (119 indsamlede, men 9 var tomme) er der i alt registreret 11.858 individuelle fødeemner. Fig. 5 viser fødens fordeling efter vægt mellem fisk og invertebrater (A), efter antal i % (B) og efter volumenprocent (C) i perioden 1969–1973, og i tabel 1 ses fødeemnernes fordeling efter antal, hyppighed og volumen. (Se også appendix 1). Fødens fordeling efter volumenindhold er følgende:

Fisk	35,6 %
Bløddyr	1,6 %
Krebsdyr	1,8 %
Insekter	58,9 %
Plantedele	3,7 %

5. I løbet af perioden fra 1968 til 1971 har bundfaunaens artssammensætning og antallet af dyr pr. m^2 ændret sig væsentligt, hvilket skyldes forandringer i fjordens naturforhold fra et brakt til et limnisk miljø. Dette var en følge af, at den frie vandgennemstrømning i Virksund (fig. 1) blev standset i forbindelse med Virksunddæmningens etablering i 1966. Dæmningen er forsynet med sluser, der kun tillader vandpassage mod nord. Fig. 6 viser den procentiske fordeling af bunddyr i fjordens østlige del. Fiskefaunaen i Hjarbæk Fjord har også ændret sig i undersøgelsesperioden. Tabel 2 viser fangstresultater pr. 1 times fiskeri med åletrawl i 1969, 1970, 1972 og 1973. Ændringerne i bundfaunaens artssammensætning og en stigning i bestanden af visse mindre fiskearter afspejler sig i maveindholdet hos hvinanden.

I løbet af undersøgelsesperioden udgjorde fisk en voksende andel af føden, således i 1973 68 % af fødens vægt eller 72 % af volumen.

6. Gennemsnitsvægten hos hvinænderne fra Hjarbæk Fjord i fældningstiden ligger hos adulte hunner på 738 g og hos adulte hanner på 1032 g, hvilket ifølge MADSEN (1954) er en smule mindre end vægten hos fugle fra vinterhalvåret.

Резюме на русском языке

Экология условий питания обыкновенного гоголя (*Bucephala clangula*) во время линьки маховых перьев в Дании.

1. Обыкновенный гоголь *(Bucephala clangula)* в течение круглого года является неразмножающимся посетителем датских вод. В летние месяцы линяющие гоголи встречаются на многих солоноватых и пресных водных пространствах. Численность популяции не менее 12.000–14.000, и большинство ее встречается в Лимфиорде. Важнейшим в стране районом линьки служит заповедник Ярбек-Фиорд (фиг. 1), где зарегистрировано до 4500 линяющих гоголей.

Исследования перелета гоголей на линьку и линьки маховых перьев в Ярбек-Фиорде проводились с 1969 г. попутно с общими исследованиями водоплавающих птиц (JEPSEN, 1973). Кроме того, выбор пищи этого вида во время линьки был исследован на основании содержания желудков всего 110 птиц, случайно попавших в рыболовные ставные неводы, установленные в восточной части Ярбек-Фиорда, и утонувших в них (фиг. 2). Местное распространение гоголя во время линьки в этом фиорде также было исследовано. Количественный и качественный состав пищи по отношению к имеющимся в распоряжении пищевым ресурсам обсуждается на основании образцов донной фауны, взятых в течение августа-сентября 1968 и 1971 г.

2. Собранные гоголи погибли во время фуражирования непосредственно перед прибытием рыбаков к ставным неводам для собирания рыбы, так как птицы испугались приближающейся лодки, и те из них, которые находились между крыльями невода, попали в закрытую часть рыболовной снасти. Таким образом, содержание их желудка в большинстве случаев было довольно свежим. Только в 10–15 % органов пищеварения было обнаружено значительное количество пищи в мускульном желудке. Пища главным образом находилась в пищеводе и железистом же-

лудке, что в значительной степени облегчало определение и учет отдельных предметов пищи.

Как можно скорее после удаления гоголей из рыболовных снастей они были помечены датой, упакованы в пластмассовые мешочки, и заморожены в холодильнике. Позднее, органы пищеварения были вынуты, и еще в замороженном состоянии препарированы в 4-процентном растворе формалина. Общее содержание желудка и рыба взвешивались в мокром состоянии. Затем вес беспозвоночных определялся вычислением. Проценты отдельных предметов пищи по объёму определялись по их объёму в мокром состоянии в препаратных склянках.

3. Численности гоголей в Ярбек-Фиорде с мая по сентябрь 1968–1974 г. показаны в фиг. 3. Северная часть фиорда, а до некоторой степени и средняя часть его, служат птицам местом привала после их прибытия, после чего они постепенно, по мере приближения времени линьки, распространяются в юго-западную и восточную части фиорда. Во время самой линьки маховых перьев 40–60 % популяции находятся в восточной части фиорда (фиг. 4).

Важнейшие районы фуражирования и ночевки гоголя в Ярбек-Фиорде показаны в фиг. 2.

4. В материале из 110 желудков (было собрано 119, но 9 оказались пустыми) зарегистрировано всего 11.858 животных предметов пищи. В фиг. 5 показано распределение по весу рыбы и беспозвоночных (A), по численности в % (B) и по объёму в % (C) в течение периода с 1969 по 1973 г., а в табл. I показано распределение предметов пищи по численности, частоте и объёму (см. также приложение I). Распределение пищи по объёму было следующее:

Рыбы (*pisces*)	35,6 %
Моллюски (*mollusca*)	1,6 %
Ракообразные (*crustacea*)	1,8 %
Насекомые (*insecta*)	58,9 %
Растительные частицы	3,7 %

5. В течение периода с 1968 по 1971 г. состав донной фауны по видам и количество животных на $м^2$ значительно изменились вследствие того, что природные условия фиорда превратились из солоноватой в лимническую среду. Это произошло потому, что свободный проток воды через Виркзунд (фиг. 1) был остановлен в связи с сооружением Виркзундской плотины в 1966 г. Плотина снабжена шлюзами, позволяющими воде протекать только в северном направлении. Фиг. 6 показывает распределение в процентах животных донной фауны в восточной части фиорда. Рыбная фауна Ярбек-Фиорда в течение периода исследования также изменилась. Табл. 2 показывает результаты ловли за час ловли тралом для угрей в 1969, 1970, 1972 и 1973 годах. Изменения видового состава донной фауны и рост популяций некоторых мелких видов рыб отражается в содержании желудков гоголей.

В течение периода исследования, рыбы составляли возрастающую долю пищи, напр. в 1973 г. 68 % общего веса или 72 % общего объёма пищи.

6. Средний вес гоголей из Ярбек-Фиорда во время линьки у взрослых самок составляет 738 г, а у взрослых самцов – 1032 г. По Madsen (1954) это немного меньше веса птиц в зимнем полугодии.

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Appendix 1. Data of the sex, age, weight, and date of capture of Goldeneye caught accidentally in nets at Hjarbæk Fjord. The frequency of occurrence of the different categories of food items in each stomach specimen are also given. Age: 1 = > 22 months old; 2 = 10–16 months old.

Year and collection number	Date	Sex	Age	Weight	Number of individuals										Weight	
					Pisces	Mollusca	Crustacea	Trichoptera	Chironomidae	Corixa	Insecta sp.	Other and unidentified animal food	Seeds	Veg. growth	Total food contents g	Pisces g
1969 H 1	17.7.	♂♂	2	1050	1			216		10			2			
2	17.7.	♂♂	2	740		8		3					1			
3	17.7.	♂♂	1	970				117		4						
4	17.7.	♂♂	2	920	1					16						
5	18.7.	♂♂	1	940	1			53								
6	18.7.	♂♂	2	1080				157		25	1					
7	18.7.	♂♂	1	1060				106	24	1						
8	18.7.	♂♂	1	1100	1			104		1						
9	20.7.	♂♂	2	950				72	11	36	1		2			
10	20.7.	♂♂	1	1050				74		26						
11	25.7.	♂♂	1	1100				161		2						
12	11.8.	♂♂	1	900				16	12				1			
13	13.8.	♂♂	1	1050	1			13		1						
14	14.8.	♂♂	1	1155	1			11	1	8			2			
15	14.8.	♂♀	2	620				3		15						
16	15.8.	♂♂♀	2	900	1											
17	20.8.	♂♀♀	1	810				4	1	1						
18	21.8.	♂♀♀	1	730				10	8	9						
19	23.8.	♂♂♀	1	995	2			20	10				1			
20	25.8.	♂	1	1000		2	1	18		93			2			
1970 H 1	3.7.	♂♂	2	1120				39		51					7.8	
2	27.7.	♂♂	1	1050				19		56			1		9.3	
3	25.7.	♂♂	2	950				37	16				1		6.6	

	4	25.9.	♀♂♂	1	750	1			62	22	47			16			9.9	5.3
	5	11.9.	♀♂	1	975	1			8	9	11						6.3	5.8
	6	24.9.	♀♂♀	1	700				13					3			4.1	
	7	18.9.	♀♂	1	1025	1	12		22		5			2			7.8	4.3
	8	11.9.	♀♂♀	1	1050				100	11							10.6	
	9	27.10.	♀♀♀	2	675				2		10						3.3	
	10	4.9.	♀♀♀	1	750				239	10	11			4			9.8	
	11	30.8.	♀♀♀	1	750				24		7						4.0	
	12	1.8.	♀♂♂	1	1100	1			80		14						17.2	9.4
	13	1.8.	♀♂♂	2	1075				28		81						10.7	
	14	25.8.	♀♂♂	1	1100	1			11	162	10	1					15.1	7.9
	15	6.9.	♀♂♂	1	975	1			117	12			1	2			9.3	6.2
	16	1.8.	♀♀	1	975		45		2	2							6.1	
1971	H 1	8.8.	♀♂♂	2	690	1			20		1						3.4	2.0
	2	15.8.	♀♂♂	1	850	1			11	11	2						4.1	2.6
	3	5.8.	♀♂♂	1	1100	1			5	12							5.2	2.4
	4	13.7.	♀♂♂	2	1090	2			98	62	428			5			25.0	8.4
	5	29.8.	♀♂♀	1	700				8	31	29	1					5.8	
	6	24.8.	♀♀	1	740	1			15	44	103						12.3	5.8
1972	H 1	18.8.	♀♂	1	790				5		18						5.7	
	2	18.8.	♀♂♂	1	1000	1			4	5	1			1			7.5	6.2
	3	26.7.	♀♂♂	1	1125			130	38	10	60		1				8.5	
	4	26.7.	♀♂♂	2	1105				1	11	1						7.2	
	5	11.7.	♀♂	1	1165		25		37	1						1	15.5	
	6	15.9.	♀♀♂	1	645				53	39	5					2	7.1	
	7	23.7.	♀♂♂	2	1015		1		28	3							7.3	
	8	14.9.	♀♀♂	1	670				12			1					6.2	
	9	30.8.	♀♂♂	1	940		1	27	54	123	212						14.9	
	10	10.7.	♀♂♂	2	1040				60							1	10.1	
	11	26.9.	♀♀♂	1	700	1				32							6.8	6.6
	12	31.7.	♀♂♂	2	930	1			270	1	235			5			38.0	15.3
	13	3.8.	♀♂♂	1	1210													
	14	3.8.	♀♂♂	2	935			2	131		4	1					17.9	
	15	7.8.	♀♂♂	1	1030	1		130	40	12	31						13.9	9.0
	16	2.8.	♀♂♂	1	1080	2			10	5	4						22.5	18.0
	17	2.8.	♂♂	1	1190	2			5					1			17.9	17.3

Year and collection number	Date	Sex	Age	Weight	Number of individuals: Pisces	Mollusca	Crustacea	Trichoptera	Chironomidae	Corixa	Insecta sp.	Other and unidentified animal food	Seeds	Veg. growth	Weight: Total food contents g	Pisces g
18	6.8.	♂	1	920			67	115	3	15			6	1	10.3	
19	6.8.	♂	1	990	1		50	22	8	5	5		2		13.1	9.3
20	5.8.	♂	1	1140				3	12	4			2	1	14.6	
21	5.8.	♂	1	990	1			10		30					10.6	8.8
22	15.8.	♂	1	1020				20	9	60			10	1	9.8	
23	15.8.	♀	1	640				5	29	1					6.8	
24	10.8.	♂	1	900				41							6.3	
25	10.8.	♂	1	1075	1			10	18						7.7	6.8
26	14.8.	♀	2	655												
27	12.8.	♂	1	1100	1								8	1	14.0	13.1
28	12.8.	♂	1	1020	1			107		3	3				17.2	10.3
29	10.8.	♀	1	750				24	14	6		1	1		6.6	
30	10.8.	♂	1	1015	1		75	25	4	3	4		4		10.4	7.4
31	10.8.	♂	1	1060	2			4	1				1		16.8	15.3
32	12.8.	♂	1	1100	1										8.4	8.4
33	30.7.	♂	1	1170			1006	125	28	16	2		5	1	11.3	
34	21.8.	♂	1	1040	1			2		1					11.9	10.2
35	18.8.	♂	1	1095		6		40	34	250	2		54	2	11.9	
36	18.8.	♂	1	1020	1			32							11.0	9.0
37	17.8.	♂	1	1150										1	8.6	
38	17.8.	♀	2	795		4		26		5	1				7.6	
39	17.8.	♂	1	990				16			1				7.0	
40	19.8.	♀	1	820				39	33	15			112		9.8	
41	19.8.	♂	1	955	1			2			1				13.5	12.3
42	19.8.	♀	2	655						21	5		13		4.0	
43	27.8.	♀	1	650			2	21		36				1	5.7	
44	27.8.	♀	2	640				4		10					7.5	
45	27.8.	♀	1	680		11		7	1	34					9.4	

46	28.8.	♀♀♂	1	710		10		10					7		6.1		
47	28.8.	♀♀♀♂	1	760	2			21	1						20.5	17.5	
48	28.8.	♀♀♂	1	710	1			25	22				6		10.4	6.9	
49	29.7.	♂♂	1	1010				150	8	1			1		15.8		
50	29.7.	♂♂	1	1090	1			2						1	8.8	7.9	
51	6.8.	♂♂	1	955	2			94					2	2	21.1	15.9	
52	6.8.	♂♂	1	980	1		2	55		8	2		2	1	21.9	13.0	
53	6.8.	♂♂	1	1170	3			20		1					40.7	36.0	
54	1.8.	♂♂	1	1160		14	1207	31		6			5		26.4		
55	1.8.	♂♂	2	1130				2							11.9	11.1	
56	8.8.	♀♀♀	1	730				18							5.3		
57	8.8.	♀♀♀	1	760				101	15	115			3		14.8		
58	8.8.	♂♂	1	1100	1			6	2						17.8	15.3	
59	8.8.	♂♂	1	1025				5						1	7.4	6.2	
60	8.8.	♂♂	1	1070	3			23						2	18.6	15.8	
61	8.8.	♂	1	955	1			4							8.8	8.2	
1973 H 1	11.9.	♀♀	1	640	2			48	3					1	7.8	7.2	
2	?	♀♀♀	1	690	1		2	36	18						5.5	5.1	
3	20.8.	♀♀♀	2	590													
4	24.7.	♂♂	1	1045	3		240	177	20					1	26.0	20.3	
5	6.7.	♂♂	2	940	1	43		90	16		1		6		9.6	6.7	
6	5.9.	♂♂	1	1020	1			50	28				1		9.3	6.8	
7	13.8.	♂♂	1	1170	1		170	27			1				17.1	13.6	
8	12.9.	♂♂	1	1420	2			17	23			3	2		15.6		
9	28.9.	♀♀	1	675													
10	6.10.	♂♂	1	1160	1			40	46				1	1	6.5	5.3	
11	6.10.	♀♀	1	860													
12	6.10.	♀♀♀	2	575													
13	10.9.	♀♀♀	1	690													
14	10.9.	♀♀	1	660													
15	21.8.	♂♂	1	1150	2		103	25	29						11.5	9.0	
16	8.9.	♀♀	1	665													
Total 119					73	407	3214	4633	1148	2331	34	18	306	25	1037.7		

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