CHARACTERISTICS OF ATLANTIC PUFFINS *FRATERCULA ARCTICA* WRECKED IN THE NETHERLANDS, JANUARY-FEBRUARY 2003

KEES (C.J.) CAMPHUYSEN[1,2]

Camphuysen C.J. 2003. Characteristics of Atlantic Puffins *Fratercula arctica* wrecked in The Netherlands, January-February 2003. Atlantic Seabirds 5(1): 21-30. *An unprecedented 114 Atlantic Puffins were found dead in The Netherlands in a few weeks time, mostly early February 2003. The wreck coincided, but had no relation with the Tricolor oil incident in The Channel and numerous dead Puffins were found in Belgium and northern France as well. The stranding may have involved between 180 and 200 Atlantic Puffins and 51.1% were identified as first winter birds. The birds were clearly starved to death and a mass-stranding of unoiled, severely emaciated Little Auks and Razorbills occurred at the same time. Biometrics (wing length) pointed at British (North Sea?) colonies as a source; none of the casualties was ringed. The wreck coincided with an influx of birds, but the event lasted no more than a few days. Following this wreck, mass mortality of auks has been witnessed in the northern North Sea (Orkney, Shetland, and Norway), and these events may have been related. The event in 2003 was the largest influx and wreck of Puffins in 75 years in The Netherlands.*

[1]Royal Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg, The Netherlands, kees.camphuysen@wxs.nl; [2]Nederlandse Zeevogelgroep, werkgroep Nederlands Stookolieslachtoffer Onderzoek (NZG/NSO), Ankerstraat 20, 1794 BJ Oosterend, Texel, The Netherlands.

INTRODUCTION

Atlantic Puffins *Fratercula arctica* are scarce passage migrants and winter visitors in Dutch waters, with at most some tens of birds wintering in nearshore coastal waters and 4000-7000 individuals further offshore (Camphuysen & Leopold 1994). Strandings are sparse even in winter, but gradually increase in frequency from October through March (Bijlsma *et al.* 2001). Despite extensive beached bird surveys since the mid-1960s, numbers of Atlantic Puffins reported peaked at only 20 (1987/88) and 35 (1982/83, 1989/90) individuals in some winters, while in other years not a single corpse was found (Fig. 1). Ringing recoveries confirm that Dutch nearshore coastal waters are beyond the normal wintering range of this species (Harris 2002), although Atlantic Puffins breed relatively nearby and in considerable numbers on the British east coast (Lloyd *et al.* 1991). A wreck involving at least 150-200 dead Atlantic Puffins occurred in The Netherlands during February 2003. Although this was an insignificant number of casualties in relation to the North Sea wintering population of

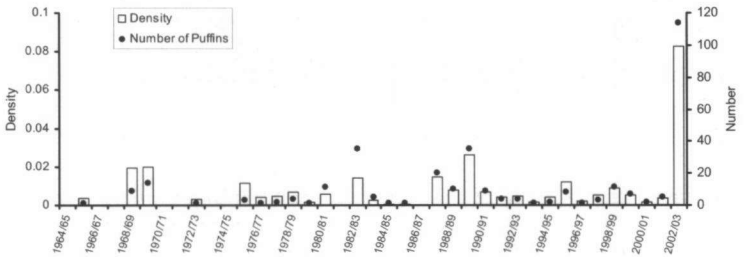

Figure 1. Mean density of Atlantic Puffins found dead in winter (Nov-Apr) along the North Sea coast in The Netherlands (bars) and total number of individuals recorded (dots), based on systematic beached bird surveys 1964/65 – 2002/03 (NZG/NSO unpubl. data).

Figuur 1. Gemiddelde dichtheid van 's winters gevonden Papegaaiduikers (nov-apr) (staafjes) en het totaal aantal gevonden individuen (stippen) langs de Nederlandse Noordzeekust, gebaseerd op systematische stookolieslachtoffer-tellingen 1964-2002/03 (ongepubl. data NZG/NSO).

Atlantic Puffins (Skov *et al.* 1995), this stranding comprised an unusually large number for The Netherlands, and the wreck extended to Belgium and northern France and was perhaps related to auk wrecks in Norway, Shetland and Orkney recorded at the same time or in the weeks immediately following this mass stranding (M. Heubeck, E. Meek, J. Bloggs *pers. comm.*). It was therefore considered useful to collect and examine Puffin corpses washed ashore in an attempt to characterise the birds and to make comparisons with birds collected in other (major) wrecks in the North Sea (Jones *et al.* 1984; Harris *et al.* 1991).

METHODS

Corpses were collected from beaches in The Netherlands during late January and early February 2003. Searching effort has not been complete and along the mainland coast many seabird corpses disappeared unrecorded as a result of bird collectors, clean-up operations and scavengers. As many as possible of the following measurements or observations were made: (a) bill length (tip to feathers and tip to nostril), (b) bill depth (at the gonys), (c) straight bill length (length of the cutting edge of the upper mandible), (d) head length, (e) wing length (maximum flattened chord), (f) tarsus length, (g) body mass, (h) age, based on the number of bill grooves, (i) sex and age by dissection (development and size of gonads, presence and size of bursa *Fabricii*), (j) physical condition (subcutaneous fat, deposited fat and breast muscle), (k) condition of some vital

organs (liver, lungs, guts and kidney), and (l) stomach contents. Few corpses were intact or fresh enough for a complete examination.

Harris *et al.* (1991) used four age categories based on the appearance of the bill: (1) first-winter birds (no grooves), (2) immature (less than 2 grooves), (3) intermediate (2 grooves) and (4) adult (more than 2 grooves). In this study we documented the development of the beak by a description and high resolution digital photography. Four categories were recognised, that were slightly different from Harris *et al.* (1991): (1) first winter (dark brownish-red bill, no grooves, (2) immature type (orange bill tip, no or faint bill grooves), (3) sub-adult type (orange beak, 1-1.5 clear bill grooves), (4) adult type (orange beak, τ2 clear bill grooves) (Fig. 2). Biometrics, descriptions of feet colour, and internal sex and age were analysed on the basis of these four categories. Some birds without a head were aged provisionally, but only as first winter birds and non-juveniles on the basis on the coloration of their feet (bluish grey or very pale yellow in first winter birds, yellow to bright orange in older categories).

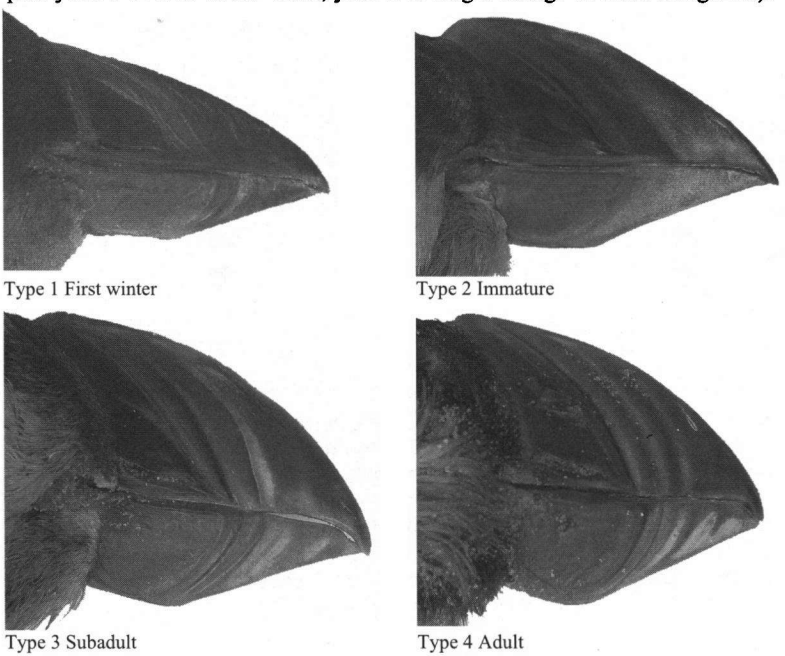

Figure 2. Examples of bill development in each of the age categories used for the analysis of stranded Atlantic Puffins in the 2003 wreck (J.A. van Franeker).

Figuur 2. Voorbeelden van snavels in de leeftijdscategorieën die zijn gebruikt bij de analyse van in 2003 aangespoelde Papegaaiduikers (J.A. van Franeker).

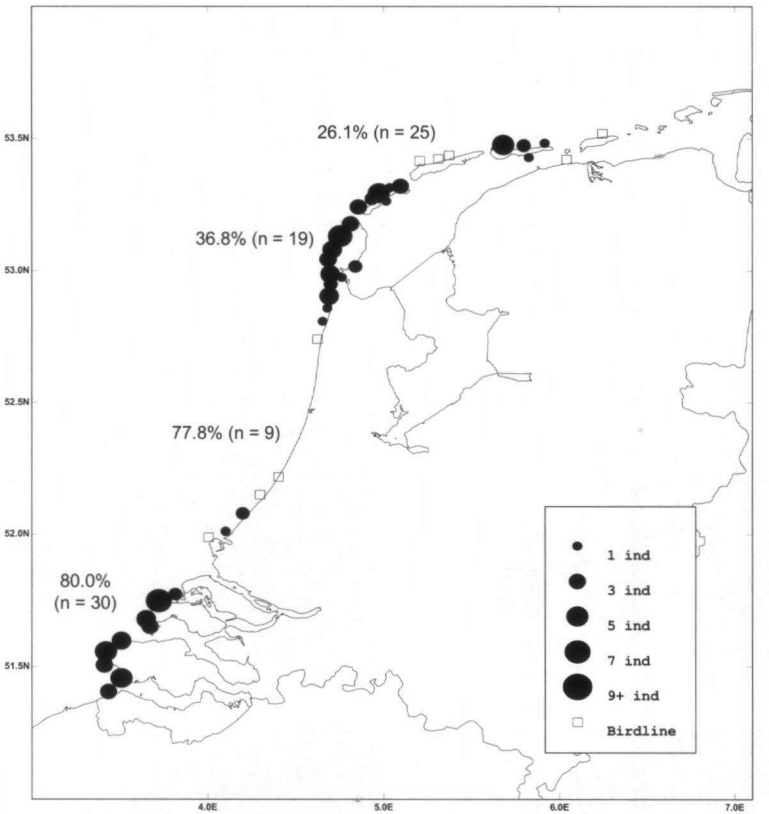

Figure 3. Reported corpses of Atlantic Puffins (n = 114, black symbols) and the proportion of first winter birds (see Table 1) during routine beached bird surveys in The Netherlands, and 12 dead birds reported on the national birdline (squares), January-February 2003.

Figure 3. Aantal kadavers van Papegaaiduiker (n = 114, zwarte cirkels) en het aandeel eerste-wintervogels (zie tabel 1), zoals doorgegeven tijdens de stookolieslacht-offertellingen in Nederland, en 12 dode vogels doorgegeven via de Dutch Birding vogellijn (vierkanten), januari-februari 2003.

RESULTS

In January and February 2003, 114 Atlantic Puffins were found during beached bird surveys (Fig. 3), of which 35% were oiled. A further 12 dead Atlantic Puffins were reported on the national birdline (www.dutchbirding.nl/). Most birds stranded and were found between 5 and 9 February 2003 in a period of calm weather with south-westerly winds, immediately following a three-week period with prevailing strong westerly winds and occasional westerly and north-westerly gales. The mean density of Atlantic Puffin corpses along the North Sea coast in February was 0.39 km^{-1}, whereas previous peak values between 1965 and 2003 were 0.14 km^{-1} in March 1970, 0.13 km^{-1} in March 1990, and 012 km^{-1} in March 1988. Most oiled birds were found in the Delta area, which was at the time affected by the *Tricolor* oil spill (oil leaking carrier that sunk off Dunkerque in France in December 2002), and many appeared to have become contaminated with oil only after death. Relatively low densities were found along the densely populated mainland coast (Zuid-Holland, Noord-Holland; Fig. 3), where corpses washing ashore are most likely to be removed by mammalian scavengers and beach clean-up operations. It is here that dedicated bird collectors were met, aiming specifically at these unusual auks. Their activities must have caused systematic surveys along the mainland coast to produce incomplete, biased data. Allowing for areas not covered (interpolation), removal by bird collectors, scavengers and beach clean-up operations (deploying densities measured in remote areas without mammalian scavengers over similar, nearby coastline with a high risk of corpse disappearance), 180-200 individuals probably washed ashore.

Of 114 Atlantic Puffins recorded, 88 could be aged and 51.1% of these were first winter birds. The proportion of first winter birds declined significantly from south to north when summarised over 4 subregions ($G_{adj} = 19.3$, df = 3, $P < 0.01$; Fig. 3). In all 12 first winter birds where the autopsy could be performed successfully a medium or large bursa *Fabricii* was found and the gonads were typical for first winter auks (oviduct straight and thin, non-structured ovary, thin, often bi-coloured testes). Eight birds were categorised as immatures (probably 3rd calendar year) and those that could be examined internally ($n = 3$) had a medium sized bursa *Fabricii* and slightly developed gonads (e.g. structured ovary). Of four subadults, one had a small bursa, but all had obviously further developed gonads than the two younger groups. Eleven out of 14 adults that could be examined did not have a bursa and the gonads were developed still further than in subadults. The ratio of males ($n = 10$) to females ($n = 14$) was not significantly different from equality (G_{adj}-test).

Biometrics of Atlantic Puffins found dead are summarised in Table 1. The differences between age groups were significant for bill length tip to

Table 1. Bill length (tip-feathers), bill depth (gonys), length of cutting edge of upper mandible, head, tarsus, wing length and body mass (g), in Atlantic Puffins in four age categories based on the number of bill grooves.

Tabel 1. Snavellengte (punt-bevedering), snaveldiepte (gonys), lengte van de snijrand van de bovensnavel, kop, tarsus, vleugellengte en gewicht (g) van Papegaaiduikers per leeftijdscategorie (gebaseerd op het aantal snavelgroeven).

	Bill length	Gonys depth	Cutting edge	Head	Tarsus	Wing	Mass
First winter							
mean ± SE	37.3 ± 0.4	16.9 ± 0.3	31.2 ± 0.3	76.3 ± 0.6	26.7 ± 0.2	149.6 ± 0.8	250.0 ± 8
min	33.7	14.9	29.6	74	25	142	235
max	40.9	19.5	33.5	79	30	162	280
n=	22	20	20	10	26	27	5
Immature							
mean ± SE	40.7 ± 0.3	23.3 ± 0.5	32.2 ± 0.4	78.3 ± 0.3	26.6 ± 0.3	156.1 ± 1.3	-
min	39.7	21.2	30.1	78	25	151	-
max	41.6	24.9	34.4	79	28	163	-
n=	7	8	8	3	9	8	-
Subadult							
mean ± SE	41.8 ± 0.8	24.4 ± 0.6	31.8 ± 0.7	78.3 ± 1.4	26.5 ± 0.3	159.5 ± 1.8	-
min	38.9	21.8	30.0	76	26	154	-
max	44.1	26.4	34.7	82	27	162	-
n=	6	6	6	4	4	4	-
Adult							
mean ± SE	43.7 ± 0.5	27.3 ± 0.4	32.3 ± 0.4	79.0 ± 0.7	26.9 ± 0.3	161.3 ± 1.3	275.0 ± 19
min	39.4	24.1	28.7	76	26	152	245
max	45.5	29.5	35.0	83	29	168	310
n=	16	17	14	13	13	13	3

feathers (ANOVA $F_{3,47} = 40.8$, $P< 0.001$), gonys depth ($F_{3,47} = 173.4$, $P< 0.001$), and wing length ($F_{3,48} = 26.2$, $P< 0.001$), but *not* for cutting edge, head and tarsus (Table 1). Only five first winter birds and three adults were weighed (Table 1). No trace of fat (either subcutaneous or deposited) was found in 13 first winter birds, 4 immatures or subadults and 8 adults sufficiently intact for internal inspection, while the breast muscles in all of these were lean to very lean. One adult bird found on 29 January 2003 in Zeeuws Vlaanderen (near the Belgian border) was in exceptionally good condition when it died, with maximum fat stores and healthy organs. This bird was entirely covered with 2cm of heavy bunker oil from the *Tricolor* spill and its lungs were filled with oil.

None of the birds were moulting primaries, secondaries or tail feathers. Moult of contour feathers (belly, sides, neck and or back) was encountered

Table 2. Wing length of Atlantic Puffins from selected colonies in the North Atlantic (Harris 1984) and wing length of subadults and adults found wrecked in 2003.

Tabel 2. Vleugellengte van Papegaaiduikers in een aantal kolonies in de Noordzee (Harris 1984) en vleugellengte van subadulte en adulte vogels, die gevonden zijn tijdens de 2003-stranding.

Origin	sample	mean	SE	range
Skomer, Wales (52°N)	209	159.3	0.23	152-171
Isle of May, Scotland (56°N)	1615	161.8	0.14	149-176
Hermaness, Shetlands (61°N)	197	161.4	0.28	151-173
Lovunden, Norway (66°N)	190	167.7	0.28	158-178
Svalbard, Norway (78°N)	48	183.8	?	175-195
Adult birds, 2003 wreck, NL	13	161.3	1.3	152-168
Subadult birds, 2003 wreck, NL	4	159.5	1.8	154-162

occasionally in non-juveniles, but not scored systematically. Excessive feather wear was observed in 16 individuals (2 unaged, 3 immatures, 11 first winter birds), where part of or entire flight feathers were worn away to such an extent that only the shaft remained (Fig. 4).

DISCUSSION

The number of stranded Atlantic Puffins, however unusual for the area where the wreck was observed, was miniscule compared to wintering numbers in the North Sea (75,000 in Feb-Mar; Skov *et al.* 1995). Most Atlantic Puffins were clean (unoiled) or were presumed oiled after death, and all examined were starved with the notable exception of a single adult bird referred to above. Several features characterised this wreck: the weather had not been particularly severe in the southern North Sea, the stranding took place over a period of only a few days, and a mixture of adult, immature and first winter Atlantic Puffins washed ashore. It is interesting to note the clear north to south increase in the proportion of first winter birds, even on this scale (only 300 km distance).

It is difficult to determine the breeding origin of stranded auks on the basis of biometrics alone, but without ringing recoveries there is no other option. Unfortunately, in the absence of reference material, first winter birds and younger immatures are usually of little help with this. The wing measurements of adult and sub-adult Atlantic Puffins in this study are similar to *F. arctica grabae* of the British population (Table 2; Harris 1984). One (unsexed and unaged) Atlantic Puffin found dead possessed a wing length of 176 mm, just

Figure 4. Excessive flight feather wear in a juvenile Atlantic Puffin (#NSO 203008.001 C.J. Camphuysen).
Figuur 4. Extreem gesleten vleugelpennen van een juveniele Papegaaiduiker (#NSO 203008.001 C.J. Camphuysen).

within the range of the large Isle of May sample. On the basis of biometrics alone, there is no reason to believe that the Atlantic Puffins found in the Dutch wreck came from much further a field than the northern UK: there is no evidence of an influx from (sub)arctic breeding populations.

The excessive feather wear is a phenomenon that is rarely observed in (starved) auks in winter (pers. observ.). In the affected Atlantic Puffins examined here, no further abnormalities were observed. The patterns of wear (often completely asymmetrical and with a very strong contrast between affected and non-affected feathers) excluded the possibility that the Puffins were simply approaching their normal flight and tail-feather moult (Oct-Apr, most often Jan-Feb; Cramp 1985).

With the exception of one heavily oiled adult bird (probably unrelated to the wreck), all Atlantic Puffins that could be examined were extremely underweight. Adults were 67% the mass of birds returning to the Isle of May in March (Jones *et al.* 1984). First winter birds were 90% the mass of fledglings from that colony whereas young continue to grow through the first winter and would be more likely to weigh somewhere near 400 g (in which case the wrecked birds weighed two-thirds of the expected body mass). The absence of any fat in more or less complete corpses and the deterioration of the breast muscles confirmed that the birds had starved to death. Such body condition is typical for wrecked auks (Jones *et al.* 1984; Harris *et al.* 1991).

This wreck coincided with, but was unrelated to a major oil incident in The French Channel (the *Tricolor* oil spill off Dunkerque). Atlantic Puffins penetrated deep into the Channel upon their arrival and appeared to have died swiftly, whether oiled or not. There were numerous sightings of Atlantic Puffins in The Netherlands, mainly in early February, and at the time when the casualties washed ashore. After 10 February, that is immediately following the wreck, very few Atlantic Puffins were observed and few fresh corpses were found. The observations suggest one single mass-displacement of weakened auks from areas further north in the North Sea. The most recent, similar wreck involving Atlantic Puffins in The Netherlands occurred as long ago as in December 1929, nearly 75 years ago (Haverschmidt 1930).

ACKNOWLEDGEMENTS

Atlantic Puffins are uncommon in Dutch waters and an unprecedented 'gold-rush' developed to search and collect corpses for private collections by people that do not normally visit the coast. Thanks to an early warning system and the co-operation of numerous volunteers normally involved in systematic beached bird surveys, a substantial number of corpses could be 'rescued' and borrowed for examinations before they were to be returned to the finder. Specimens used for detailed examinations were found by the author or either borrowed or obtained from Mark Bertens, Henk Besjes, Peter de Boer, Henk Brugge, Maarten Brugge, A. Dwarshuis, Arnold Gronert, Simon Hart, F Janssens, Michel de Lange, Mardik F. Leopold, Sander Lilipaly, Barbara van der Molen, Peter Spannenburg, Wouter Vahl, Rinse van der Vliet, Pim A. Wolf and Carl Zuhorn. Pieter Honkoop and Peter Spannenburg kindly assisted during the autopsies, Jan Andries van Franeker skillfully produced digital images of the beaks of more or less complete individuals. Mike Harris, Martin Heubeck, and Mardik Leopold kindly refereed and improved the manuscript.

KARAKTERISTIEKEN VAN IN NEDERLAND AANGESPOELDE PAPEGAAIDUIKERS *FRATERCULA ARCTICA*, JANUARI-FEBRUARI 2003

Eind januari en begin februari 2003 werden in korte tijd 114 Papegaaiduikers *Fratercula arctica* gevonden tijdens tellingen op de Nederlandse kust. De stranding viel min of meer samen met de door een lek in het schip *Tricolor* veroorzaakte olieramp, maar had daar verder niets mee te maken. Toch werden ook in België en Noord-Frankrijk meer Papegaaiduikers dan normaal gevonden. In totaal is het bij deze stranding vermoedelijk om tenminste 180-200 Papegaaiduikers gegaan, waarvan 51% als juveniel kon worden gedetermineerd. De vogels waren sterk vermagerd en vermoedelijk door verhongering en verzwakking om het leven gekomen. Helaas werden er geen geringde Papegaaiduikers gevonden, maar de biometrische gegevens wezen op de Britse Eilanden als de meest voor de hand liggende plaats van herkomst. Het hele evenement, de invasie en de sterfte, vond zijn beslag in enkele dagen. De sterfte van alkachtigen die vervolgens in Orkney, Shetland en langs de Noorse kust werd gerapporteerd staat wellicht in verband met de gebeurtenissen in de zuidelijke Noordzee, zodat de werkelijke sterfte misschien aanzienlijk grootschaliger is geweest. Sinds 1929 waren er niet meer zoveel Papegaaiduikers in Nederland aangespoeld.

REFERENCES

Bijlsma R.G., Hustings F. & Camphuysen C.J. 2001. Schaarse en algemene vogels van Nederland. Avifauna van Nederland, 2. KNNV Uitgeverij Utrecht en GMB Uitgeverij, Haarlem.

Camphuysen C.J. & Leopold M.F. 1994. Atlas of seabirds in the southern North Sea. IBN Research report 94/6, NIOZ-Report 1994-8, Institute for Forestry and Nature Research, Netherlands Institute for Sea Research and Dutch Seabird Group, Texel.

Cramp S. (ed.) 1985. The Birds of the Western Palearctic, 4. Oxford Univ. Press, Oxford.

Harris M.P. 1984. The Puffin. T. & A.D. Poyser, Calton.

Harris M.P. & Yule R.F. 1977. The moult of the Puffin *Fratercula arctica*. Ibis 119: 535-541.

Harris M.P. 2002. Atlantic Puffin *Fratercula arctica*. In: Wernham C., Toms M., Marchant J., Clark J., Siriwardena G. & Baillie S. (eds). The migration atlas: movements of the birds of Britain and Ireland: 407-409. T. & A.D. Poyser, London.

Harris M.P., Heubeck M. & Suddaby D. 1991. Results of an examination of Puffins *Fratercula arctica* washed ashore in Shetland in winter 1990-91. Seabird 13: 63-66.

Haverschmidt F. 1930. Invasie van Kleine Alken (*Alle alle* (L.)) en Papegaaiduikers (*Fratercula arctica* (L.)) na de stormen in de tweede helft van December 1929. Ardea 19: 63-65.

Hudson R. & Mead C.J. 1984. Origins and ages of auks wrecked in eastern Britain in February-March 1983. Bird Study 31: 89-94.

Jones P.H., Barrett C.F., Mudge G.P. & Harris M.P. 1984. Physical condition of auks beached in eastern Britain during the wreck of February 1983. Bird Study 31: 95-98.

Lloyd C., Tasker M.L. & Partridge K. 1991. The Status of Seabirds in Britain and Ireland. T. & A.D. Poyser, London.

Skov H., Durinck J., Leopold M.F. & Tasker M.L. 1995. Important bird areas for seabirds in the North Sea, including the Channel and the Kattegat. Birdlife International, Cambridge.