Vagrancy of Brünnich's Guillemot *Uria lomvia* in Europe

Van Bemmelen, R.[1]*, & Wielstra, B.[2]

*Correspondence author. Email: rvanbemmelen@gmail.nl
[1] Stavangerweg 535, 1013 AX Amsterdam, The Netherlands; [2] Dr. Benthemstraat 10–91, 7514 CM Enschede, The Netherlands.

Abstract
We review the occurrence of vagrant Brünnich's Guillemots *Uria lomvia* in Europe. The 104 records of 109 individual birds that could be traced showed a distinct seasonal pattern. There were no September records, but a small autumn peak was apparent in late October and early November. Numbers increased again in early December, peaked in late January and early February, and declined through spring, with only seven records in summer. Autumn records were mostly of first-winter birds, whereas relatively more adults were recorded in winter, in line with expectations based on timing of migration for these different age classes. We speculate that vagrant birds to western Europe have strayed from the wintering grounds and migration routes south of Iceland and along the Norwegian coast, while overland movements from the Barents Sea may explain inland records from northern Scandinavia, and some from the Baltic Sea. Two spatial clusters of records were evident, one in Scotland and the other in the Skagerrak, Kattegat and southern Baltic Sea. Between 1975/76 and 2005/06, the number of records declined in the former region but increased in the latter, which may represent a real decrease in occurrence, and increased observer effort, respectively.

Introduction

Brünnich's Guillemot *Uria lomvia* is a circumpolar species, breeding in both the high and low (sub) Arctic (Figure 1a) (Nettleship & Evans 1985). The Atlantic population numbers c. 6.5 million birds, breeding at colonies in eastern Canada, west and east Greenland, Iceland, Jan Mayen, Svalbard, northern Norway, and the western Russian Arctic (CAFF 2004). Ringing recoveries have shown that the breeding populations of Canada and Greenland winter in the northwest Atlantic, where they are joined by a substantial (but unknown) number of birds from colonies in Iceland, Svalbard, Norway and Russia, although many of the latter remain in the Norwegian and Barents Seas throughout the year (Kampp 1988; Nikolaeva *et al*. 1996; CAFF 2004; Bakken & Mehlum 2005). Thus, a large number of Brünnich's Guillemots migrate in a southwesterly direction across the North Atlantic each autumn. Occasionally, Brünnich's Guillemots are recorded further south in Europe than usual (Figure 1b). We review the occurrence of such vagrants, analyse their temporal and geographic distribution, and examine differences between age classes. We attempt to relate the patterns found to the normal seasonal distribution of the species in the Atlantic and speculate on possible origins and causes of these extra-limital occurrences. Finally, we discuss whether Brünnich's Guillemots found in western Europe are truly lost, or whether they winter there in small numbers.

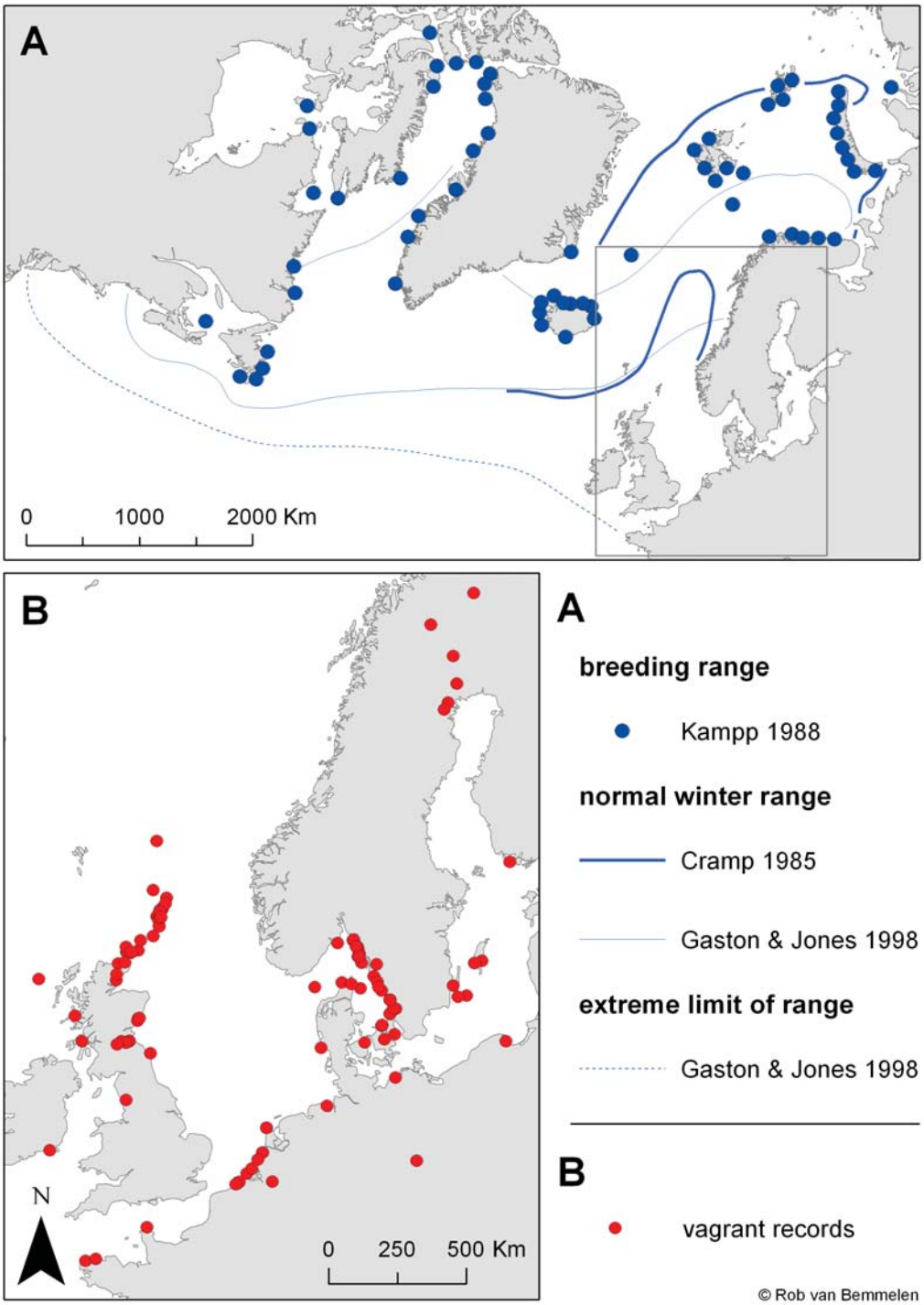

Figure 1. The normal range of Brünnich's Guillemot *Uria lomvia* in the North Atlantic (A), and the distribution of records of vagrants in Europe from 1900–2006 (B). Breeding areas are after Kampp (1988), boundaries of winter distribution are after Cramp (1985) and Gaston & Jones (1998), and extreme distribution limits are drawn from Gaston & Jones (1998).

Methods

A database was compiled of records of Brünnich's Guillemot in Europe that have been accepted by national rarity committees, for which location (at least province) and date (at least month) were known. A cut-off date of 31 August 2006 was used. The species is considered by all European national rarities committees, except those of Iceland, Norway and Russia, which were therefore left out of the analysis. The German rarities committee has not yet examined records of Brünnich's Guillemot, so we included only those German records for which museum specimens were available. We took a neutral stand on decisions made by rarities committees, but tried to gather as much additional detail as possible on age, sex and plumage by studying photos, drawings, and museum specimens.

Records were not analysed by calendar year, but for intervals from September to August, hereafter referred to as years. Seasons were classed as autumn (September to November), winter (December to February), spring (March to May) and summer (June to August). Months were divided into three periods of approximately 10 days: early (1–10), mid (11–20) and late (21–28/30/31). Fisher's Exact Tests were performed to test whether years where a season had records had been preceded more frequently by a season holding records compared to years in which the season of interest did not have records. A potential shift over time in the proportion of dead versus live birds was tested for using a binomial linear regression analysis. The software package R was used for statistical analyses (R Development Core Team 2005).

Results

We traced 104 records of European vagrants, distributed as follows: UK and Ireland (39), the southern North Sea and English Channel (16), the Skagerrak, Kattegat and Baltic Sea (41), Lapland (6), and inland Western Europe (2) (Figure 1, Appendix 1). Five records involved two birds together, making a total of 109 individuals. Brünnich's Guillemot has only been recorded regularly since the mid 1950s, with just nine coastal records (ten individuals) and one inland record (two individuals) prior to 1950/51. During 1954/1955–2005/2006, an average of 1.9 individuals were recorded in Europe per year, with records in 41 (79%) of the 52 years (Figure 2). Since 1975, the number of individuals increased in the Skagerrak/Kattegat/Baltic Sea area ($t_{[1.4]} = 3.624$, $P = 0.02$), but declined in the UK/Ireland ($t_{[1.4]} = -3.292$, $P = 0.03$) (Figure 3). A negative trend was also suggested for the southern North Sea and the English Channel, but this was not statistically significant ($t_{[1.4]} = -1.207$, $P = 0.294$).

The occurrence of Brünnich's Guillemot showed a distinct seasonal pattern, with 19% of records in autumn, 56% in winter, 18% in spring, and 7% in summer (Figure 4). There were no records from mid August to late September.

Data for 1954/55–2005/06 showed that for years in which Brünnich's Guillemots were observed in a particular season, the preceding season did not hold records more frequently than those years that did not hold records in that season (Fisher's Exact Test for: summer and the preceding spring ($P = 0.589$); summer and the preceding winter ($P = 1.000$); spring and the preceding winter ($P = 0.237$); and winter and the preceding autumn ($P = 0.703$, $n = 52$ for all comparisons)).

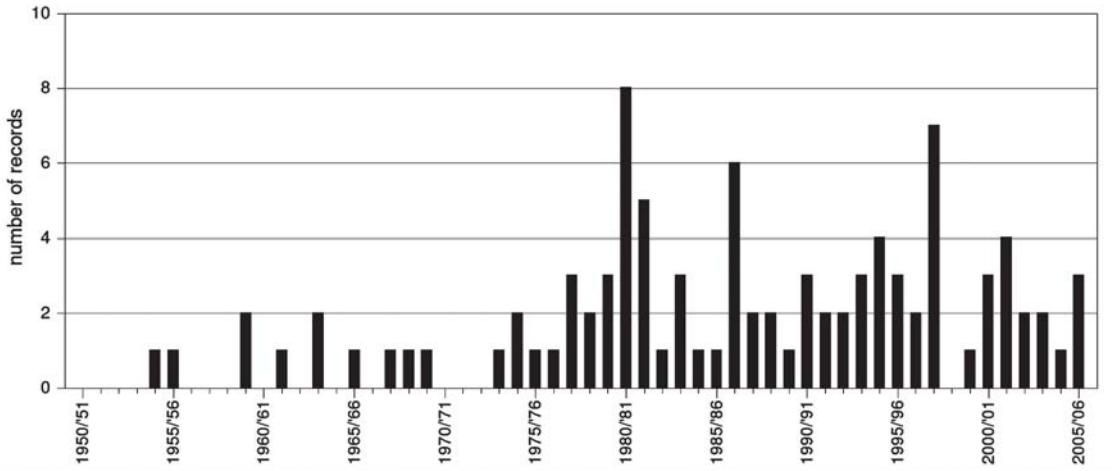

Figure 2. The number of records of vagrant Brünnich's Guillemots *Uria lomvia* per year in Europe during 1950/1951–2005/2006.

Of the 109 individual Brünnich's Guillemots, 43 (39%) were found dead. The remaining 66 (61%) were alive when discovered, but at least nine of these died soon after (including three in Sweden and one in Denmark that were shot). Seven birds were reported as oiled, five of which were dead when found while the other two died soon after being found. From 1975 onwards, the proportion of dead birds relative to live birds declined from 80% in 1975/76–1979/80 to 17% in 2000/01–2004/05 ($z = 4.224$, 4 df, $P < 0.01$). However, this did not hold for all regions. Whereas the proportion of dead individuals declined in UK and Ireland ($z = 2.521$, $P = 0.01$, 3 df), it remained stable in the Skagerrak/Kattegat/Baltic Sea area ($z = 1.081$, $P = 0.279$, 3 df) (Figure 3). Eight records have been accepted of birds seen only in flight, seven from Sweden and one from Denmark, occurring in October, November (2), January, February (2), April and May.

Only 38 birds were reportedly aged, 25 as adult, one as a first-summer, and 12 as first-winter. Three of the adults were found in autumn, ten were in winter, eight in spring and four in summer. The first-summer bird was in July, while six of the first-winter birds were in autumn and six were in winter. Apart from the 12 aged as first-winter (which by definition show a winter-plumaged head pattern), plumage details were noted for 61 birds. Fourteen were in breeding plumage, in October, January (2), March, April (2), May (2), June (2), July (2), and August (2). These were all reported as adults, except for four Swedish records from April (2), May and June, and a British record for June, for which no age was given. The 47 birds noted as being in non-breeding plumage were recorded in all months from October until April. Eleven of these were aged as adults, in October, November, December (2), January (3), February, March (2), and April. No details on age were provided for the remaining 36, recorded in October (3), November (7), December (10), January (6), February (9), and March. (Figure 4, Appendix 1).

Discussion

Seasonal occurrence: Records of vagrant Brünnich's Guillemots in Europe show a distinct seasonal pattern, and our results corroborated those from an earlier review of records from northwest Europe spanning the period 1963–1992 (Rønnest 1994). There

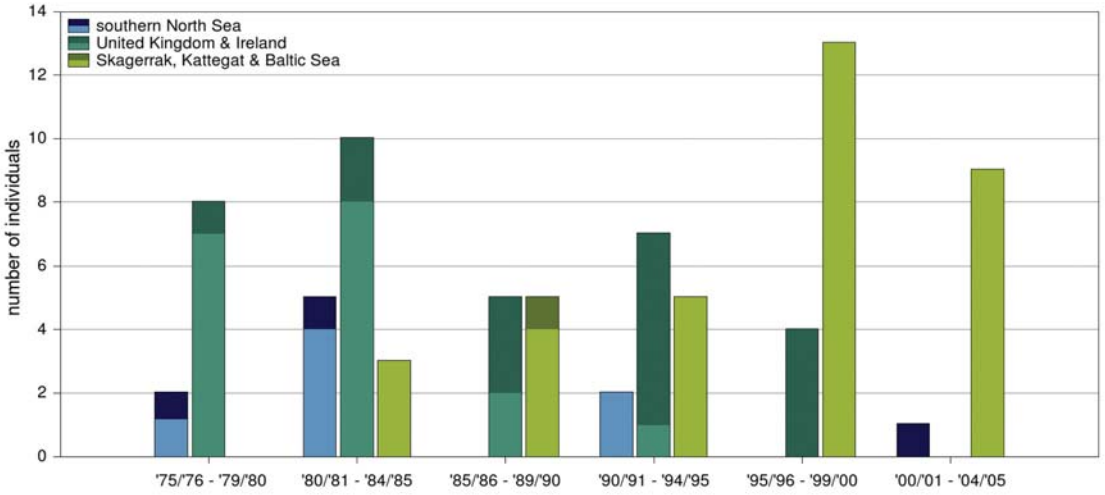

Figure 3. The number of live (upper bar parts) and dead (lower bar parts) vagrant Brünnich's Guillemot *Uria lomvia* individuals per 5-year period for three areas: the UK and Ireland, the Skagerrak, Kattegat and Baltic Sea, and the southern North Sea and English Channel.

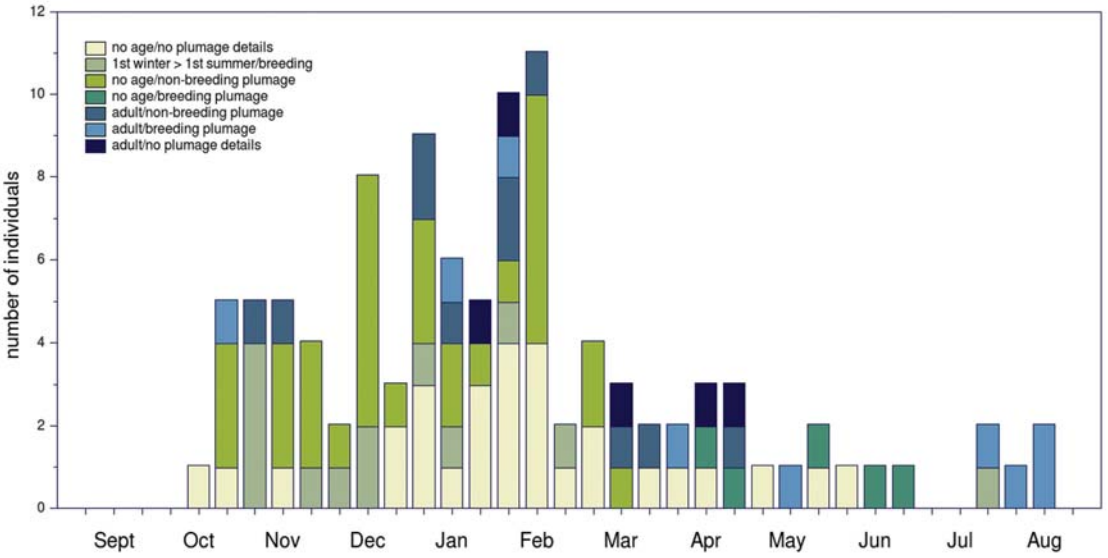

Figure 4. The seasonal occurrence of vagrant Brünnich's Guillemot *Uria lomvia* individuals in Europe per 10-day period (n=105), divided into age and plumage category. Three Swedish records of four individuals could not be assigned to 10-day periods (two unaged birds in non-breeding plumage in January 1925 and another in February 1962, and one with no plumage details in May 1955), and are therefore not shown.

were no September records, but a small autumn peak from mid October to mid November coincides with the onset of migration of birds from Barents Sea colonies (Gaston & Jones 1998; Bakken & Mehlum 2005). Records increased again from early December to a peak in late January and early February, perhaps reflecting prolonged migration of Brünnich's Guillemots, with many still arriving in wintering areas in December and January (Gaston & Jones 1998; Kampp 1988; Nikolaeva *et al*. 1996;

Bakken & Mehlum 2005). Some individuals found in winter may have arrived in the area in autumn but taken time to weaken, die and beach, but our data suggested that winters with records were not more likely to follow autumns with records, and it seems more probable that the winter peak was mainly of newly arrived birds.

Brünnich's Guillemots arrive back at their colonies in March–May, depending on latitude and ice conditions (Cramp 1985; Isaksen & Bakken 1995; Gaston & Jones 1998). The declining number of records from mid February, with only a few from May to August, suggests most vagrants had either returned to their normal range or died by then. Whether summer records refer to new arrivals from the north, or to lingering but previously undetected birds is unclear, but summers with records did not more often follow springs or winters with records. Some summer vagrants were clearly very disorientated, such as the adults found inland in Germany in August 1987, and in Belgium in August 2006, the only inland records apart from those in northern Scandinavia. In contrast, there are two UK records of Brünnich's Guillemots near Common Guillemot *Uria aalge* colonies (Farne Islands, July 1977; St Kilda, May/June 1992), and one of a bird present in a Common Guillemot colony for nearly a month (Shetland, June/July 1989).

Seasonal distribution of age classes: First-winter birds tend to arrive at wintering areas in the northwest Atlantic in October and November, whereas adults mainly arrive during or after December (Gaston & Jones 1998; Bakken & Mehlum 2005). The later migration of adults (or its slower progression) might result in a higher proportion of first-winter birds among autumn records, and a higher proportion of adults in winter. Indeed, of the nine aged records in the small autumn peak of European vagrants, six were identified as first-winters and three as adults (Figure 2). Furthermore, the three birds in mid October (and possibly the three in early November) in non-breeding plumage that were not aged may also have been first-winters, since adults are probably still in transitional moult at that time (Gaston & Jones 1998), but note the two records of adults in non-breeding plumage in late October and early November (Figure 4). Of the 16 aged individuals in winter, ten were reported as adults compared to six as first-winters.

Ageing Brünnich's Guillemots in the field is difficult, especially in winter (Cramp 1985; Blomdahl *et al*. 2003). Only nine of the live birds were reportedly aged in the field (eight adults and one first-winter). Separating first-winter Brünnich's Guillemots from older birds in winter is not particularly difficult in the hand (Gaston 1984; Gaston & Jones 1998), so although criteria used for ageing corpses were not documented for most records, ages given for museum specimens and weakened birds that were caught were probably correct. Separating immature birds (non-adults after their first winter) from adults is much harder (Cramp 1985), and the number of immatures among the records listed may have been underestimated. Since immature birds generally do not return to the breeding areas (Cramp 1985; Bakken & Mehlum 2005), summer records may include more immatures than is realised. The only record aged as immature was in July (1978, St. Cyrus, Scotland), and among the four summer records of adults, Grant (1981) suggested that the live bird at the Farne Islands in July 1977 (Ribbands 1977) may have been a first-summer bird rather than an adult.

Spatial distribution, origin, and possible causes of vagrancy: There are two obvious geographic clusters in the records of vagrant Brünnich's Guillemot in Europe. Of the 82 records during 1975/76 to 2004/05, 34 (41%) were from the UK and Ireland, mostly in northern Scotland, and 35 (43%) were from the Skagerrak, Kattegat and the entrance to the Baltic Sea (Figure 1b). The cluster of records in Scotland is not surprising, since Scotland is closest to the species' normal migratory and wintering range around Iceland and the coast of northern Norway (Cramp 1985; Kampp 1988; Nikolaeva *et al*. 1996; Bakken & Mehlum 2005; Fraser *et al*. 2007). Brünnich's Guillemots also stray further south along the Norwegian coast than their normal range (Engebretsen & Pettersen 2001), and such birds are probably the source of many of those recorded in the eastern Skagerrak and the Kattegat.

The six inland records in northern Sweden and northern Finland, five in winter and one in spring, suggest that at least some birds recorded in the Baltic Sea may have flown overland across Lapland. That Brünnich's Guillemots can move inland from the Barents Sea was illustrated by a large influx covering much of Finland from mid November 1902 to mid January 1903 (Mela 1903). These records were not dealt with by the Finnish rarities committee so were not included in our analysis, but can be seen at http://koti.netplaza.fi/~pply/havikset/lajisto/support/urilom_1902.htm. In the same winter, two birds were shot inland in Norrbotten, northern Sweden. Mela (1903) attributed the invasion to an early onset of severe weather conditions in the Barents and White Seas. Such an influx, which must have involved many hundreds of birds, has never recurred, and the most recent inland records from the area were of single birds in northern Finland in December 1986 and northern Sweden in January 1987. In contrast, inland movements of Brünnich's Guillemots in the Great Lakes region of Canada and northeast USA, mainly during 1890–1910, were thought to have been related to changes in prey abundance (Gaston 1988). The 1902/03 Finnish influx also involved Atlantic Puffins *Fratercula arctica*, but no other alcids were recorded in the Great Lakes movements.

TEXTBOX: Little Auk invasions and Brünnich's Guillemot vagrancy

Four recent autumn reports of Brünnich's Guillemot around the North Sea in 2005–2007, which have not yet been accepted by rarity committees, coincided with (or just preceded) large coastal movements (invasions) of Little Auks *Alle alle*, and it is tempting to speculate whether the two phenomena were related. Breeding and wintering areas of both species overlap to a large extent (Cramp 1985) and Camphuysen & Leopold (1996) suggested that Little Auks wintering in the North Sea originate from the Barents Sea, as we do for Brünnich's Guillemots that turn up in the North Sea. Invasions of Little Auks generally coincide with their arrival on the wintering grounds in late autumn, and Camphuysen & Leopold (1996) suggested that such movements are triggered by local food shortages, with wind conditions playing only a secondary role in making the displacement visible to sea-watchers. Gaston (1988) noted a lack of synchrony between invasions of the two species in Canada and the northeast USA and attributed this to differences in diet. However, there may be some dietary overlap in winter in large zooplankton and small pelagic fish (Blake 1983; Skov *et al*. 1989; Moody & Hobson 2007; Stempniewicz 2001), so food shortage may in certain circumstances affect both species simultaneously. However, as Gaston (1988), we found no support for synchronized occurrence. An analysis of years with high numbers of Little Auks (taken from

Camphuysen & Leopold (1996)) and records of Brünnich's Guillemots during autumn and winter, both only in countries directly surrounding the North Sea, did not find more records of Brünnich's Guillemots in years with Little Auk invasions than in years without (analysed by year for 1975/1976 - 1996/1997: Fisher's Exact Test: n = 52, P = 0.380). However the few records of Brünnich's Guillemots might make it impossible to detect any potential correlation.

For Brünnich's Guillemot sightings, see Van Bemmelen *et al*. 2005 (Figure 9); *Birding World* 18: 425, 430 (photo), 19: 30; 19: 442, 447; 20: 447; *British Birds* 99: 658; 101: 54. For details on Little Auk numbers, see Van Bemmelen & Wielstra 2005; *Birding World* 18: 405; 19: 447; 20: 447, 450; *British Birds* 99: 658; 101: 54.

Brünnich's Guillemots breeding in the northeast Atlantic average slightly larger than those breeding in the western Atlantic, but there is considerable overlap in measurements (Cramp 1985; Gaston & Jones 1998), and biometrics are unlikely to help identify the geographic origin of a small sample of vagrant birds (but see Gaston (1988) for an attempt). Although stable-isotope analysis has been successfully applied to trace bird movements (Rubenstein & Hobson 2004; Fox *et al*. 2007; Fox & Bearhop 2008), strong longitudinal gradients in isotope ratios are absent in the Atlantic (Kroopnick 1980; Rubenstein & Hobson 2004) and as the latitudinal distribution of Brünnich's Guillemot colonies is relatively narrow (at least in the northeast Atlantic), assignment of individuals to specific geographic regions by this method seems problematic. It proved impossible to unambiguously segregate birds from different populations based on mitochondrial DNA sequence data (Birt-Friesen *et al*. 1992). Similar difficulties are to be expected for the nuclear genome, but no attempts have yet been made as far as we are aware.

Given the above, the recovery of a Brünnich's Guillemot ringed at a breeding colony seems the most likely way of identifying its origin. However, while extensive ringing has been carried out in the past (Kampp 1988; Nikolaeva *et al*. 1996; Bakken & Mehlum 2005), and expanded programmes have been proposed for the future (CAFF 2004), the relatively small number of European vagrants means the chance of finding a ringed, extra-limital Brünnich's Guillemot is slim, making the only known ringing recovery all the more remarkable, a bird ringed in August 1948 at Novaya Zemlya, Russia and caught alive in April 1964 in Poland (Tomialojć 1990; Rønnest 1994).

As with other vagrant seabirds, one likely explanation for the occurrence of Brünnich's Guillemots in western Europe is displacement by severe weather events. A number of live birds have been found moribund or sheltering in harbours after severe gales, and some temporal clusters of records coincided with or followed periods of strong northerly winds over the seas around and to the east of Iceland. This was the case in January 1981, when six birds were found after two spells of northerly gales, and again in January 1995, after an intense anti-cyclone in the mid Atlantic and low pressure over Scandinavia at the beginning of the year brought Arctic northerly gales across the northern North Sea; the five records that month were the only ones in 1994/95. However, records in other years (such as the seven in 1986/87) were more spread

throughout the year and there was little obvious to connect them to any specific weather event. In some circumstances, wind may simply help land-based observers detect vagrants already in the area instead of being the cause of their displacement.

Environmental factors other than brief weather events, and operating over a larger sea area and a longer timeframe, may also influence the occurrence of Brünnich's Guillemots in Europe. Winter movements of Brünnich's Guillemots are generally contained within cold currents of Arctic water temperature (Cramp 1985), and a reduction in sea temperature could cause a shift in the southerly limit of their normal range, decreasing the distance to the North Sea. Irons *et al*. (2008) found that population fluctuations of Brünnich's Guillemots were associated with decadal changes in winter (January to March) sea surface temperature (SST) in the vicinity of breeding colonies, and plotted a 3-year running mean of deviation of SST in the northeast Atlantic from the 50-year average. Interestingly, the lowest two points on this graph (i.e. when SSTs were coldest) were in 1981 and 1987, coincident with above average number of vagrant Brünnich's Guillemots (Figure 2), although a third peak in records (the seven in 1997/98, six of which were in the Skaggerak/Kattegat) occurred when SSTs had returned to above average levels.

Trends and status: Vagrant Brünnich's Guillemots have been only recorded regularly in Europe since the mid 1950s, with three records or more in 14 of the 29 years from 1977/78. However, the balance has shifted between the two geographic clusters of records, with fewer in the UK and Ireland (Scotland, essentially) and more in the Skagerrak/Kattegat (Figure 3). Their seasonal occurrence also differed considerably, with more autumn records in the latter region (14) than the former (2). There is no obvious explanation for these disparities in both annual and seasonal occurrence. Given the increase in observer activity and identification skills in recent decades, and the increased proportion of live birds found (Figure 3), the decrease in the number of records in the UK and Ireland must reflect (and under-estimate) a decreased occurrence of the species there. Whether this is due to changes in population size, migratory routes or wintering areas, or disruptive climatic events or regimes is unknown. The contrasting increase in southern Scandinavia, however, where virtually all recent records have been of live birds (Figure 3), is more likely to reflect an increased sea-watching effort, a better understanding of alcid identification, higher quality optical equipment, and perhaps a greater willingness to submit and accept records of birds seen only in flight (since 1991/1992, records of nine 'migrating' individuals have been accepted in Denmark and Sweden). Brünnich's Guillemots may also have been ranging further south along the Norwegian coast than in the past, in which case they would be more likely to be found in southern Scandinavia than in the western North Sea, but there is no systematic evidence for this (G. Mobakken, T. Anker-Nilssen, R. Barrett pers. comm.).

In the UK, the accumulation of Brünnich's Guillemot records has led some to suggest the species may winter regularly in small numbers in the northern North Sea (e.g. Rogers *et al*. 1978), but others consider this unlikely (Cramp 1985; Fraser *et al*. 2007; McGeehan 1991). In Shetland, just three dead Brünnich's Guillemots were found on systematic beached bird surveys from 1979 to 2004 compared to 15,107 Common

Figure 5 (above). Brünnich's Guillemot *Uria lomvia*, probable first-winter, Lerwick, Shetland, UK, December 2005 © *Hugh Harrop*.

Figure 6 (left). Brünnich's Guillemot *Uria lomvia*, probably 2nd calendar year, Scousburgh, Shetland, UK, 25 March 2007 © *Roger Riddington*. This record fell outside the period under consideration here, but has been accepted by the British Birds Rarities Committee (Hudson *et al*. 2008).

Figure 7. Brünnich's Guillemot *Uria lomvia*, adult summer, Lille, Antwerp, Belgium, 5 August 2006 © *Tom Goossens*.

Figure 8. Brünnich's Guillemot *Uria lomvia*, adult summer, Yell, Shetland, UK, 4 May 2006 © *Mick Mellor*.

Guillemots (Heubeck 2006), and Brünnich's Guillemot has never been seen during 31 years of ship-based inshore surveys of wintering seabirds there (M. Heubeck pers. comm.). The lack of any English record south of Northumberland (Figure 1), and totals of 45,357 Common Guillemots but no Brünnich's Guillemots found on systematic beached bird surveys during 1965–2007 in The Netherlands (C. J. Camphuysen pers. comm.) also suggest no regular presence in the western or southern North Sea. Despite this, observers should always consider the possibility of encountering the species during beached bird surveys or sea-watches. Field identification of Brünnich's Guillemot may be challenging, but is – even in flight – not insurmountable (McGeehan 1991; Ullman 1998; Blomdahl *et al*. 2003).

Acknowledgements

Many people helped us prepare this article and we thank them all. Earlier drafts were improved by comments from Martin Heubeck, who also provided information on some Shetland records. Mardik Leopold encouraged us and helped gather records and forward requests for information. Museum specimens were checked by Bob McGowan (National Museums of Scotland), Joan McLaren (Montrose Museum, UK), Mike Nicoll (Dundee Museum, UK) and Richard Sutcliffe (Glasgow Museum, UK). The following sent lists of national records: Jochen Dierschke (Germany), Roger Riddington (UK), Marnix Vandegehuchte (Belgium) and Georges Olioso (France), while Killian Mullarney commented on the Irish record. John Chardine and Eeva-Liisa Alanen provided useful references, Arnoud van den Berg helped at the Dutch Birding Association library, and we thank the EuroBirdNet community for their help. Finally, we thank two anonymous referees for their comments.

Figure 9. Alcid identified in the field as a Brünnich's Guillemot *Uria lomvia*, Schiermonnikoog, Friesland, The Netherlands, 23 October 2005 © *Martijn Renders*. This 'fly-by' sighting was rejected by the Dutch rarities committee, but this decision is to be reviewed.

References

Bakken, V. & Mehlum, F. 2005. Wintering areas and recovery rates of Brünnich's Guillemots *Uria lomvia* ringed in the Svalbard Archipelago. *Arctic* 58: 268–275.

Birt-Friesen, V. L., Montevecchi, W. A., Gaston, A. J. & Davidson, W. S. 1992. Genetic structure of Thick-Billed Murre (*Uria lomvia*) populations examined using direct sequence analysis of amplified DNA. *Evolution* 46: 267–272.

Blake, B. F. 1983. A comparative study of the diet of auks killed during an oil incident in the Skagerrak in January 1981. *Journal of Zoology, London* 201: 1–12.

Blomdahl, A., Breife, B. & Holmström, N. 2003. *Flight identification of European seabirds*. Christopher Helm, London.

Breife, B., Hirschfeld, E., Kjellén, N. & Magnus, U. 1990. *Sällsynta fåglar i Sverige*. Sveriges Ornitologiska Förening, Lund.

CAFF. 2004. *Distribution of murres outside the breeding season. "Circumpolar Murre Banding Program – North Atlantic Region"*. CAFF Technical Report No. 13. CAFF International Secretariat, Akureyri, Iceland.

Camphuysen, C. J. & Leopold, M. F. 1996. Invasies van de Kleine Alk *Alle alle*: voorkomen en achtergronden. *Sula* 10: 169–182.

Cramp, S. (ed.) 1985. *The Birds of the Western Palearctic*. Vol. IV. Oxford University Press, Oxford.

Dubois, P. J. & Yésou, P. 1991. *Les oiseaux rares en france*. Chabaud, Bayonne Cedex.

Engebretsen, S. & Pettersen, M. 2001. Østfold neste stopp? – Polarlomvi *Uria lomvia*. *Natur I Østfold* 20: 79-84.

Fox, T. A. D., Christensen, T. K., Bearhop, S & Newton, J. 2007. Using stable isotope analysis of multiple feather tracts to identify moulting provenance of vagrant birds: a case study of Baikal Teal *Anas formosa* in Denmark. *Ibis* 149: 622–625.

Fox, T. A. D. & Bearhop, S. 2008. The use of stable-isotope ratios in ornithology. *British Birds* 101: 112–130.

Fraser, P. A., Rogers, M. J. & the Rarities Committee 2007. Report on rare birds in Great Britain in 2005. Part I: non-passerines. *British Birds* 100: 16–61.

Gaston, A. J. 1984. How to distinguish first-year murres, *Uria spp*., from older birds in winter. *Canadian Field-Naturalist* 98: 52–55.

Gaston, A. J. 1988. The mystery of the murres: Thick-billed Murres, *Uria lomvia*, in the Great Lakes region, 1890–1986. *Canadian Field-Naturalist* 102: 705–711.

Gaston A. J. & Jones, I. L. 1998. *The Auks*. Oxford University Press, Oxford.

Goethe, F. & Ringleben, H. 1964. Ein neuerer Nachweis von Uria lomvia (L.) für Deutschland. *Journal of Ornithology* 105: 54–56.

Goossens, T. 2006. Kortbekzeekoet in Belgisch binnenland. *Dutch Birding* 28: 340–341.

Grant, P. J. 1981. Mystery photographs 51. *British Birds* 74: 144–145.

Heubeck, M. 2006. The Shetland beached bird survey 1979–2004. *Marine Ornithology* 34: 123–127.

Irons, D. B., Anker-Nilssen, T. A., Gaston, A. J., Byrd, G. V., Falk, K., Gilchrist, G., Hario, M., Hjernquist, M., Krasnov, Y. V., Mosbeck, A., Olsen, B., Petersen, A., Reid, J. B., Robertson, G. J., Strøm, H. & Wohl, K. D. 2008. Fluctuations in circumpolar seabird populations linked to climate oscillations. *Global Change Biology* 14: 1455–1463.

Hudson, N. & the Rarities Committee. 2008. Report on rare birds in Great Britain in 2007. *British Birds* 101: 516–577.

Isaksen, K. & Bakken, V. 1995. Breeding populations of seabirds in Svalbard. Pp 11–15 In Isaksen, K. & Bakken, V. (eds.) Seabird populations in the northern Barents Sea – source data for the impact assessment of the effects of oil drilling activity. *Norsk Polarinstitutt Meddelelser* 135.

Jaeschke, G. & Schulz, U. 1968. Dickschnabellumme (*Uria lomvia*) 1966 an der Mecklenburgischen Ostseküste. *Journal of Ornithology* 109: 131.

Kampp, K. 1988. Migration and winter ranges of Brünnich's Guillemots *Uria lomvia* breeding or occurring in Greenland. *Dansk Ornitologisk Forenings Tidsskrift* 82: 117–130.

Kroopnick, P. 1980. The distribution of 13C in the Atlantic Ocean. *Earth and Planetary Science Letters* 49: 469–484.

McGeehan, A. 1991. Brünnich's Guillemot: rare or overlooked? *Irish Birding News* 1: 105–112.

Mela, A. J. 1903. Pohjankiisla. *Luonnon Ystävä* 7: 37–45.

Meyer, M. & Thorwarth, H. J. 1987. Erstnachweis der Dickschnabellumme (*Uria lomvia*) für das Binnenland der DDR. *Beiträge zur Vogelkunde* 34: 313–314.

Moody, A. T. & Hobson, K. A. 2007. Alcid winter diet in the northwest Atlantic determined by stable isotope analysis. *Marine Ornithology* 35: 39–46

Mullarney, K. 1988. Brünnich's Guillemot in County Wexford – an addition to the Irish list. *Irish Birds* 3: 601–605

Nettleship, D. N. & Evans, P. G. H. 1985. Distribution and status of the Atlantic Alcidae. In: Nettleship, D.N. & Birkhead T.R. (eds.). *The Atlantic Alcidae. The evolution, distribution and biology of the auks inhabiting the Atlantic Ocean and adjacent water areas:* 53–154. Academic Press, London.

Nikolaeva, N. G., Krasnov, Y. V. & Barrett, R. T. 1996. Movements of Common *Uria aalge* and Brünnich's Murre *U. lomvia* breeding in the southern Barents Sea. *Fauna norvegica Series C, Cinclus* 19: 9–20.

Olsen, K. M. 1992. *Danmarks fugle – en oversigt*. Dansk Ornitologisk Forening, København.

R Development Core Team 2005. *R: A language and environment for statistical computing. R Foundation for Statistical Computing*, Vienna, Austria. URL http://www.R-project.org.

Ribbands, J. B. 1977. Brünnich's Guillemot in Northumberland. *British Birds* 73: 225–226.

Risberg, L. 1990. *Sveriges fåglar. Aktuell översikt över deras utbredning, numerär och flyttning samt något om svensk ornitologi*. Sveriges Ornitologiska Förening, Stockholm.

Rogers, M. J. & the Rarities Committee. 1978. Report on rare birds in Great Britain in 1977. *British Birds 71*: 481–532.

Rønnest S. 1994. *Sjældne fugle i Danmark. En oversigt over forekomsten af sjældne fugle i Danmark og Nordvesteuropa 1963–1992*. Forlaget Pinus, Skjern.

Rubenstein, D. R. & Hobson, K. A. 2004. From birds to butterflies: animal movement patterns and stable isotopes. *Trends in Ecology and Evolution* 19:256–263.

Skov, H., Durinck, J. & Danielsen, F. 1989. Sammenfaldende forekomst mellem Søkonger *Alle alle* og Glaskutling *Aphya minuta* i Flekkefjord, Sydnorge, November 1988. *Pelagicus* 4: 22–24.

Stempniewicz, L. 2001. Little Auk *Alle alle*. BWP Update. *The Journal of Birds of the Western Palearctic* 3: 145–201.

Tomialojć, L. 1990. *Ptaki Polski. Rozmieszczenie i liczebność*. Państwowe Wydawnictwo Naukowe, Warszawa.

Ullman, M. 1998. Fältbestämning av spetsbergsgrissla. *Vår Fågelvärld* 8: 28–33.

Van Bemmelen, R. S. A., Wielstra, B., Renders, M. & Hendriks, K. 2005. Black-and-white weekend: Kleine Alken en Kortbekzeekoet langs Schiermonnikoog. *Dutch Birding* 27: 448–449.

Van Bemmelen, R. S. A. & Wielstra, B. M. 2005. Invasie van kleine alken op 23 oktober 2005: kort maar krachtig. *NZG Nieuwsbrief* 7: 1–4.

Van Gompel, J. 1981. De massale zeevogelsterfte aan de Belgische kust tijdens de voorbije winter. *Wielewaal* 47: 137–142.

Van Gompel, J. 1982. First record in Belgium of a living specimen of Brünnich's Guillemot (*Uria lomvia*). *Wielewaal* 48: 169–170.

Appendix 1.
List of vagrant Brünnich's Guillemot records in Europe, arranged by country and date. Details given are date, location, age, plumage, sex, condition, and the fate of the specimen, as far this information could be traced. Abbreviations used are. Age: Ad = adult, 1st w = first-winter, 1st s = first-summer; Plumage: B = breeding, NB = non-breeding; Sex: F = female, M = male. Museums: NMS = National Museums of Scotland; NNM = Nationaal Natuurhistorisch Museum, Leiden; ZMA = Zoologisch Museum Amsterdam. References to rarity reports and reports of rarities committees are provided in a simplified form, providing the name of the journal, page numbers and information on published photographs. Journal abbreviations: IB = Irish Birds, BB = British Birds, SB = Scottish Birds, DB = Dutch Birding, DOFT = Dansk Ornitologisk Forenings Tidsskrift, SF = Sveriges Fåglar, FoFl = Fauna och Flora, VF = Vår Fågelvärld, Fåg = Fågelåret.

Ireland (1 record, 1 individual)

24 Dec. 1986	Kilmore Quay, Ballyteigue Bay, Wexford. NB, alive. *IB* 3: 478; *BB* 80: 547; Mullarney 1988.

United Kingdom (38 records, 39 individuals)

10 Dec. 1908	Craigielaw Point, Lothian. 1st w, F, dead, specimen at NMS. *BB* 2: 425.
15 Apr. 1960	Middleton Sands, near Morecambe, Lancashire & North Merseyside. Ad, dead. *BB* 54: 188, 284–286.
20 Mar. 1968	Norwick, Unst, Shetland. NB, F, dead, specimen at NMS. *BB* 62: 473; *SB* 5: 272 (plate 19b), 285–287.
11 Oct. 1969	Knapdale, Loch Caolisport, Argyll. Dead. *BB* 63: 281; *SB* 6: 334–335.
31 Jan. 1976	Reay, Thurso, Caithness. Ad, NB, dead, specimen at NMS. *BB* 71: 509–510.
13 Jul. 1977	Farne Islands, Northumberland. Ad, B, alive, at sea near a Common Guillemot colony. *BB* 72: 528; 73: 225–226.
18 Dec. 1977	Sumburgh, Shetland. Dead. *BB* 71: 509.
14 Jul. 1978	St Cyrus, northeast Scotland. 1st s, B, M, dead, specimen at Montrose Museum. *BB* 72: 528.
25 Feb. 1979	Rattray Head, northeast Scotland. Dead. *BB* 73: 514.
9 Feb. 1980	Kilspindie Beach, Lothian. Ad, NB, dead, specimen at Glasgow Museum. *BB* 74: 478.
9 Feb. 1980	Ferry Ness, Lothian. Dead, specimen in L. Simmen private collection. *BB* 74: 478.
24 Feb. 1980	Burrafirth, Unst, Shetland. NB, dead. *BB* 81: 569.
16–17 Oct. 1980	Fair Isle, Shetland. Ad, B, alive but presumed to have died on 17 Oct.. *BB* 74: 478 (plate 279); 81: 569.
26 Dec. 1980	At Sea, Brent Oilfield, Norwegian Sea, 61°03'N 01°43'E. Alive. *BB* 75: 511.
25 Jan. 1981	Johnshaven, Kincardine, northeast Scotland. Dead, specimen at Dundee Museum. *BB* 75: 511.
29 Dec. 1981	Bay of Ireland, Stenness, Orkney. Dead. *BB* 75: 511.
3 Feb. 1982	Brora, Sutherland, Highland. Dead. *BB* 76: 502.
3 Apr. 1982	Stromness, Orkney. Dead. *BB* 77: 537.
24 Dec. 1982	Golspie, Highland. 1st w, dead, specimen at NMS. *BB* 100: 55-56.
30 Oct. 1983	Banna Minn, West Burra, Shetland. 1st w, F, dead, specimen at NMS. *BB* 78: 561.
20 Mar. 1984	Birsay, Orkney. Dead. *BB* 78: 561.
9 Jan. 1985	Scapa Bay, Orkney. NB, dead. *BB* 79: 558.
3–7 Feb.1987	Off Hamnavoe, West Burra, Shetland. Alive, NB & 7 Feb 1987, Off Hamnavoe, West Burra, Shetland. NB, dead, (different individual, live bird still present), specimen in D. Coutts private collection. *BB* 81: 569.
9 Mar. 1988	Dunnet Bay, Caithness. Ad, M, dead, specimen at NMS. *BB* 82: 533.
16 Jun.–12 Jul. 1989	Sumburgh Head, Shetland. Alive, B, site holding in a Common Guillemot colony. *BB* 83: 469.
25 Jan. 1991	Sule Skerry, Orkney. Alive. *BB* 85: 531.
26 May–8 Jun. 1992	Hirta, St Kilda, Outer Hebrides. Alive. *BB* 86: 496.
27 Mar. 1993	Musselburgh, Lothian. Ad, B, alive. *BB* 87: 536.
6 Feb. 1994	Seafield, Lothian. Alive. *BB* 88: 523; 89: 509.
12 Feb. 1994	Wadbister Voe, Shetland. 1st w, dead, oiled, specimen at NMS. *BB* 88: 523.

4 Jan. 1995	Gulberwick, Shetland. Alive, weak, taken into care, released at Wadbister Voe 1 February, last seen there 2 February. *BB* 89: 509.
23 Jan. 1995	At Sea, north of Fair Isle, 62°41'N 01°34'W. Alive. *BB* 89: 509.
27 Mar. 1996	Kilchoan Bay, Ardnamurchan, Argyll. Alive. *BB* 90: 488.
25–30 Dec. 1997	Fetlar, Shetland. Alive. *BB* 91: 496.
21 Dec. 2000	Scapa Flow, Orkney. Ad, NB, dead, specimen at NMS. *BB* 94: 480.
29 Jan. 2001	Orkney North Ronaldsay, Orkney. 1st w, dead, specimen at NMS. *BB* 95: 501.
30 Nov.–20 Dec. 2005	Lerwick & Bressay, Shetland. NB, alive. *BB* 100: 55–56 (photo); 100: 55 (photo).
4 May 2006	Southladie Voe, Yell, Shetland. Ad, B, dead, specimen at NMS. *BB* 100: 694–754.

France (3 records, 3 individuals)

21 Apr. 1978	near Plougerneau, Finistère. Dead, oiled. Dubois & Yésou 1991.
21 Jan. 1981	near Santec, Finistère. Dead, oiled. Dubois & Yésou 1991.
3 Feb. 2003	Audinghen, Pas-de-Calais. Alive. *Ornithos* 12: 24.

Belgium (5 records, 5 individuals)

4 Jan. 1981	Klemskerke/De Haan, West-vlaanderen. 1st w, dead, oiled. *Oriolus* 52: 73; Van Gompel 1981.
18 Jan. 1981	Wenduine, West-vlaanderen. Ad, dead, oiled. *Oriolus* 52: 73.
7 Dec. 1981	Blankenberge, West-vlaanderen. 1st w, alive, oiled, died same day. *Oriolus* 52: 73; Van Gompel 1982.
21 Jan. 1995	Bredene, West-vlaanderen. Ad, NB, dead. *Aves* 34: 195-223; *Oriolus* 63: 81-82; *DB* 17: 79, 86 (photo).
4 Aug. 2006	Visbeek Wechelderzande, Lille, Antwerp. Ad, B, alive. Goossens 2006; *BW* 19: 320 (photo).

The Netherlands (7 records, 7 individuals)

24 Dec. 1919	Noordwijk aan Zee, Noordwijk, Zuid-Holland. Ad, F, NB, dead, specimen at NNM. *Ardea* 9: 32–33.
28 Dec. 1924	Noordwijk aan Zee, Noordwijk, Zuid-Holland. M, NB, dead, specimen at NNM.
19 Feb. 1969	Texel, Noord-Holland. Dead, specimen at NNM.
10 Mar. 1974	Oostkapelle, Domburg, Zeeland. M, NB, dead, specimen at ZMA.
4–10 Feb. 1979	Brouwersdam, Goedereede, Zeeland. M, NB, alive, oiled, found dead on 10 February, specimen at ZMA. *DB* 1: 109–111 (photos); 2:20 (photo).
10 Jan. 1981	Monster, Zuid-Holland. Ad, B, dead, speciman in private collection. *DB* 3: 99 (photo).
18 Apr. 1992	Texel, Noord-Holland. Ad, NB, dead, specimen at ZMA. *DB* 15: 43.

Germany (3 records, 3 individuals)

1 Nov. 1959	Voslapp, north of Wilhemshaven, Niedersachsen. NB, dead, specimen at Museum Heineanum Halberstadt and Vogelwarte Helgoland, Wilhelmshaven. Goethe & Ringleben 1964.
8 Mar. 1966	Warnemunde, Mecklenburg-Vorpommern. Ad, NB, F, dead, specimen in Meereskundlichen Museums Stralsund. Jaeschke & Schulz 1968.
7 Aug. 1987	Leipzig, Sachsen. Ad, B, alive, weak, died next day, specimen in Naturkunde-museum Leipzig. Meyer & Thorwarth 1987 (photo).

Denmark (10 records, 10 individuals)

14 May 1886	Storsømmen, Sjælland. Dead. Olsen 1992.
2 Oct. 1905	Kalveboderne, København, Sjælland. Alive, shot. Olsen 1992.
8 Nov. 1925	Mesinge ved Kerteminde, Fyn. Dead. Olsen 1992.
29 Oct. 1974	Blåvand Strand, Ribe. 1st w, dead. *DOFT* 74: 134–135 (photo); Olsen 1992.
10 Dec. 1989	Hundested Havn, Sjælland. NB, alive. *DOFT* 85: 27 (photo); Olsen 1992.
14 Jan. 1991	At Sea between Hanstholm & Kristianssand, Nordjylland. Alive. *DOFT* 87: 236.
17 Jan. 1995	Hirtshals Havn, Nordjylland. Alive. *DOFT* 91: 142.
21 Jan. 1998	Læsø Rende, Nordjylland. Ad, B, alive. *DOFT* 93: 133

23 Jan. 1998	Strandby Havn, Nordjylland. Ad, alive. From 24 January to 3 February 1998 at Frederikshavn Havn, Nordjylland. *DOFT* 93: 133.
28 Feb. 1998	Kikhavn, Hundested, Sjælland. Alive, migrating. *DOFT* 93: 133.

Sweden (34 records, 38 individuals)

10 Dec. 1874	Kosterfjorden, Bohuslän. NB, dead, specimen at Strömstads Museum. Risberg 1990.
5 Feb. 1875	Strömstad, Bohuslän. NB, alive. *FoFl* 39: 95.
1 Dec. 1902	Parish of Pajala, Norrbotten. NB, 2 individuals, alive, shot. *FoFl* 2: 216–217.
Jan. 1925	Grebbestad, Bohuslän. NB, 2 individuals, alive. *SF* 4: 64.
May 1955	Karesuando, Lappland. Alive. *SF* 1978: 130.
17 Dec. 1955	Kälvudden, Överkalix, Norrbotten. NB, alive, ringed and released. *VF* 15: 280.
Feb. 1962	Killingholmen, Boden, Norrbotten. NB, alive. *VF* 32: 307.
9 Feb. 1964	Båstad, Skåne. NB, dead. *Anser* 5: 9.
6 Jan. 1981	Fjällbacka, Bohuslän. NB, alive, shot. *VF* 46: 327.
19 Apr. 1982	Lilla Karlsö, Gotland. B, alive. *VF* 42: 401.
5 Nov. 1983	Busör, Halland. NB, alive. *VF* 43: 544; Breife *et al*. 1990 (photo).
11 Jan. 1987	Klöverträsk - Älvsbyn, Norrbotten. NB, dead, found on a road. *VF* 47: 456.
21 Jul. 1987	Sotenäs, Bohuslän. Ad, B, alive. *VF* 47: 456.
28 Nov.–6 Dec. 1987	Varbergs hamn, Halland. 1st w, alive, eventually "collected". *VF* 47: 456.
3 Jan. 1991	St. Amundön, SW Askim, Västergötland. Ad, NB, alive. *VF* 51 7: 24.
21 Jan. 1993	Sote huvud, Bohuslän. NB, alive, migrating. *Fåg* 1993: 112.
14 Nov. 1993	Sebybadet, Öland, NB, alive, migrating. *Fåg* 1993: 112.
18–19 Oct. 1995	Hovs hallar,Skåne, 2 individuals, one also seen at Kullen, Skåne, NB, alive, migrating. *Fåg* 1995: 134.
8 Dec. 1995	Segerstads fyr, Öland. NB, alive. *Fåg* 1995: 134.
16–17 Nov. 1996	Soten, Sotenäs, Bohuslän. Two individuals, NB, alive. *Fåg* 1996: 140.
17 Oct. 1997	Busör, Halland. NB, alive. *Fåg* 1997: 160.
28–29 Oct. 1997	Välen - Askimsviken, Västergötland. 1st w, F, alive, found dead on 30 October, specimen at Göteborg Natural History Museum. *Fåg* 1997: 160.
30 Dec. 1997	Kullen, Skåne. NB, alive. *Fåg* 1997:160.
28 Feb. 1998	Hovs hallar, Skåne, NB, alive, migrating. *Fåg* 1998: 145.
20–21 May 2000	Lilla Karlsö, Gotland. B, alive, migrating. *Fåg* 2001: 136.
10 Jun. 2001	Revsudden, Kalmarsund, Småland. B, alive. *Fåg* 2001:1 36.
30 Oct. 2001	Tussebo, Skepplanda, Västergötland. Ad, M, NB, alive, died on 1 November, specimen at Göteborg Natural History Museum. *Fåg* 2001: 136.
3 Nov. 2001	Busör, Halland. NB, alive, migrating. *Fåg* 2001: 136.
7 Feb. 2002	Valnäsudden, Nordkoster, Bohuslän. NB, alive. *Fåg* 2002: 139.
7 Apr. 2002	Hermanö huvud, Bohuslän. B, alive, migrating. *Fåg* 2002: 139.
17 Jan. 2003	Bua udde, Väröbacka, Halland. Alive. *Fåg* 2003: 184.
15 Nov. 2003	Busör, Halland. 1st w, alive. *Fåg* 2003: 184.
3 Dec. 2003	Segelskär, Tanum, Bohuslän. NB, alive. *Fåg* 2003: 184
5–19 Nov. 2004	Guleskärskajen, Kungshamn, Bohuslän. Ad, NB, alive. *Fåg* 2004: 145.

Poland (1 record, 1 individual)

10 Apr. 1964	Gdynia, Pomorskie. Ad, alive, trapped, ringed at Novaya Zemlya in August 1948 (number D-117833 Moskva). Tomialojć, 1990; Rønnest 1994.

Finland (2 records, 2 individuals)

14 Dec. 1986	Inari, Lappland. Alive, brought to Korkeasaari Zoo, Helsinki, where it died on 26 January 1987. *Lintumies* 23: 199.
22 Oct. 1988	Nauvo Sandö, Varsinais-Suomi. 1st w, dead, drowned in fishnet. *Lintumies* 23: 278.