

The occurrence of dead auks *Alcidae* on beaches in Orkney and Shetland, 1976-1991

***Strandingen van dode alkachtigen op de Orkney en
Shetland Eilanden, 1976-1991***

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Introduction

Systematic beached bird surveys have been used widely in attempts to measure the impact of oil pollution on seabird populations and, more recently, changes in rates of mortality not caused by oil. Standardised, monthly beached bird surveys were started in Orkney in March 1976 and Shetland in March 1979, in response to concern over the potential impact of oil industry activities on the seabirds of the region. These surveys have continued unbroken and this paper describes the occurrence of dead auks found on surveys up to February 1991.

Methods

Survey methods used have been described fully elsewhere (Jones 1980, Heubeck 1987). Corpses were identified, checked for oil contamination and rings and then removed from the beach. Samples of corpses were collected and examined during several occasions when abnormally high numbers of auks washed ashore. Where possible, birds were aged by the presence (first-winter and immature) or absence (adult) of the cloacal bursa (Rose 1981). Surveys were carried out on, or in the week following, the last Sunday in each calendar month in Shetland and in the week following each full moon in Orkney. This difference between calendar and lunar monthly surveys meant that in some years there were 13 rather than 12 surveys in

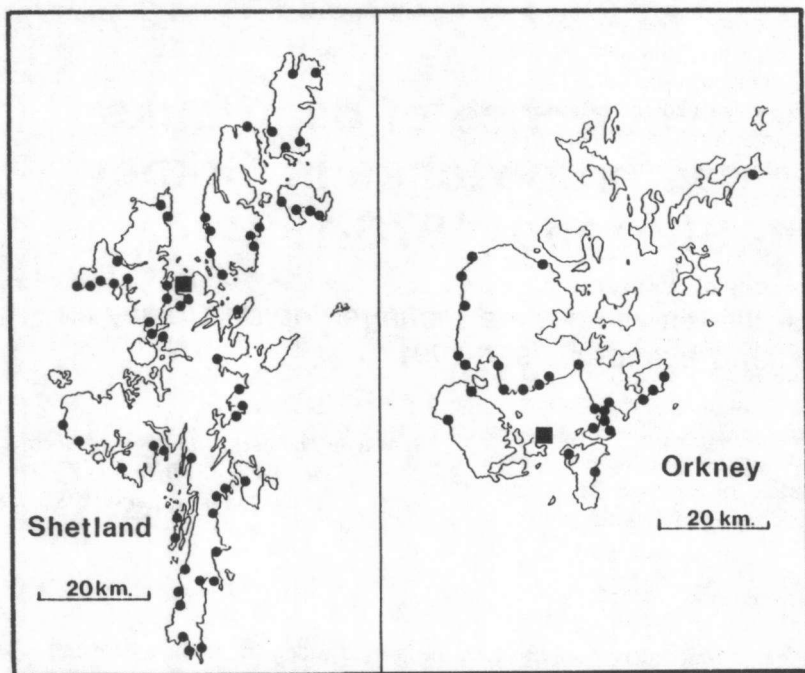


figure 1. Maps of Orkney and Shetland showing the distribution of beaches surveyed in 1990/91. In some cases, two short, adjacent beaches are represented by a single dot. The locations of the Flotta (Orkney) and Sullom Voe (Shetland) oil terminals are indicated (squares).

figuur 1. Kaart van de Orkney en Shetland Eilanden met daarop aangegeven de onderzochte strandjes. De olieterminals Flotta (Orkney) en Sullom Voe (Shetland) zijn aangegeven door een vierkant.

Orkney, while their asynchrony prevented comparisons of the exact timing of some mortality incidents. Because in both Orkney and Shetland surveys began in March, to make fullest use of the data 'annual' periods (e.g. 1980/81) or values refer to the totals for the 12 months from March to February, inclusive.

The number of beaches surveyed decreased slightly in Shetland over the years but increased in Orkney, largely as volunteers lost interest in or joined the respective schemes. The choice of beaches was planned to monitor the effects of oil spills from the oil terminals at Flotta in Scapa Flow, Orkney and at Sullom Voe in Shetland, as well as incidents offshore. In Orkney, most surveyed beaches were in the southern half of the islands, with a third of the distance covered being along the

north and east shores of Scapa Flow, a large, sheltered sea area of considerable importance to wintering seabirds (figure 1). Beaches covered in the Shetland scheme tended to be much shorter than in Orkney and separated by long stretches of cliff, which had the effect of concentrating relatively large numbers of corpses onto short distances of beach (Heubeck 1987). However, a third of the distance surveyed was of sheltered shore near the oil terminal at Sullom Voe.

Results

Five species of auks occur in numbers in Orkney and Shetland waters, but their seasonal patterns of distribution and abundance differ considerably. Guillemot *Uria aalge*, Razorbill *Alca torda* and Puffin *Fratercula arctica* breed in large numbers and are present from early spring to late summer, while their occurrence in local waters in autumn and winter is variable, especially so for Puffin. Black Guillemot *Cepphus grylle* is resident and confined to inshore waters, while Little Auk *Alle alle* is a winter visitor in variable numbers. Occurrence on beaches is therefore treated separately for each species, although all are grouped to examine certain trends. The distance surveyed and numbers of auks found are shown in table 1.

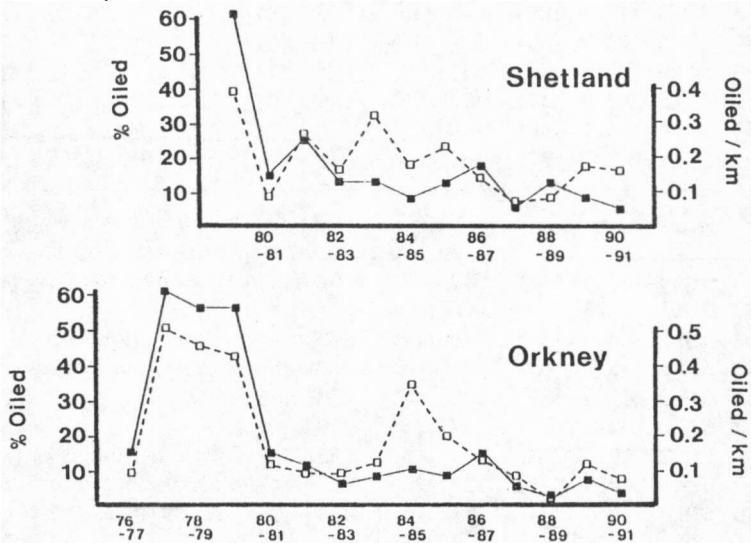


figure 2. Annual (March-February) values of the percentage of auks contaminated with oil (solid black squares) and the number of oiled auks per km (open squares) on beached bird surveys in Orkney and Shetland.

figuur 2. Jaarlijkse (mrt-feb) fluctuaties in het percentage met olie besmeurde alkachtigen (zwarte blokjes) en het aantal besmeurde alkachtigen per km (open blokjes) op Orkney en Sheiland.

table 1. The distance surveyed, the total number of each auks species and the number oiled (in brackets) found annually (March to February) on Beached Bird Surveys in Orkney (a) and Shetland (b).

tabel 1. Onderzochte kustlengte, het totaal aantal gevonden alkachtigen en aantal met olie (tussen haakjes), per jaar (mrt-feb), op de Orkney (a) en Shetland Eilanden (b).

(a) year	km surv.	<i>Uria</i> <i>aalge</i>	<i>Alca</i> <i>torda</i>	<i>Cepphus</i> <i>grylle</i>	<i>Alle</i> <i>alle</i>	<i>Frat.</i> <i>arctica</i>
1976/77	397.1	137 (22)	57 (14)	23 (0)	1 (0)	19 (0)
1977/78	431.4	257 (171)	62 (42)	16 (3)	1 (1)	20 (1)
1978/79	305.1	171 (99)	42 (28)	19 (6)	2 (2)	14 (4)
1979/80	386.9	193 (129)	57 (22)	22 (7)	3 (2)	20 (5)
1980/81	369.2	203 (33)	43 (7)	18 (1)	1 (0)	16 (1)
1981/82	445.2	278 (34)	38 (6)	17 (1)	0	18 (0)
1982/83	494.6	447 (25)	226 (20)	27 (0)	0	28 (0)
1983/84	446.7	453 (36)	138 (15)	26 (2)	0	44 (1)
1984/85	489.1	1423 (151)	110 (16)	26 (0)	5 (1)	39 (2)
1985/86	586.9	1321 (105)	46 (10)	25 (0)	0	11 (2)
1986/87	552.6	378 (49)	48 (11)	11 (0)	1 (1)	28 (10)
1987/88	544.0	758 (34)	61 (9)	18 (1)	6 (0)	11 (1)
1988/89	593.5	338 (7)	74 (2)	11 (0)	7 (0)	26 (1)
1989/90	538.4	611 (40)	160 (20)	16 (2)	7 (0)	49 (2)
1990/91	538.3	777 (32)	164 (6)	18 (0)	101 (0)	205 (3)
(b) year	km surv.	<i>Uria</i> <i>aalge</i>	<i>Alca</i> <i>torda</i>	<i>Cepphus</i> <i>grylle</i>	<i>Alle</i> <i>alle</i>	<i>Frat.</i> <i>arctica</i>
1979/80	918.0	236 (142)	17 (10)	50 (27)	51 (49)	36 (11)
1980/81	620.5	223 (40)	25 (11)	15 (1)	3 (0)	87 (10)
1981/82	516.5	430 (112)	49 (14)	13 (0)	1 (1)	40 (9)
1982/83	594.8	515 (49)	137 (18)	30 (4)	13 (3)	59 (2)
1983/84	645.0	1200 (153)	108 (7)	27 (1)	56 (16)	213 (28)
1984/85	622.2	1249 (102)	57 (5)	19 (0)	13 (1)	74 (3)
1985/86	657.2	1088 (120)	25 (8)	35 (14)	5 (0)	66 (8)
1986/87	672.8	424 (71)	32 (12)	23 (4)	3 (1)	41 (5)
1987/88	630.0	664 (34)	33 (2)	24 (2)	7 (0)	39 (6)
1988/89	633.2	329 (42)	39 (8)	11 (0)	12 (0)	35 (3)
1989/90	620.7	883 (69)	208 (23)	17 (1)	35 (1)	138 (14)
1990/91	569.9	1114 (81)	255 (9)	17 (0)	130 (0)	340 (3)
Orkney & Shetland						
%-oiled		12 %	15 %	13 %	17 %	8 %

Oil contamination

Both the number of oiled corpses per km surveyed and the percentage oiled are shown (figure 2). The incidence of oiling, i.e. the percentage of dead birds which were oiled, was initially low in Orkney but rose markedly in 1977/78 and remained high for three years, with similar levels in Shetland in 1979/80. Oil spills at the Flotta terminal in March 1977 and at Sullom Voe in December 1978 (Heubeck & Richardson 1980) contributed to the high incidence of oiled auks, although illegal discharges from tankers bound for those terminals were thought to be responsible for most of the oil present offshore (Richardson *et al.* 1982, Heubeck 1991). Stricter operational controls and the completion of de-ballasting facilities at Sullom Voe were followed by a downturn in both the number of dead auks and the proportion oiled by 1980/81.

Thereafter, the incidence of oiled auks stayed relatively low, except in February 1982 in Shetland. Although the number of oiled corpses per km was high in Shetland in 1983/84 and Orkney in 1984/85, this was due to the greatly increased numbers of beached auks; the proportion oiled remained low. Conversely, when relatively few auks were washed ashore in the winter of 1986/87, the proportion oiled rose but the number per km. remained low. Between 1980/81 and 1990/91, the annual values for percentage oiled were significantly higher in Shetland (mean 12.29, SD 5.85) than Orkney (mean 8.49, SD 4.30, $p < 0.05$, paired-sample *t* test) although there was no significant difference between the number of oiled corpses per km (Shetland mean 0.17, SD 0.08; Orkney mean 0.13, SD 0.08).

Guillemot *Uria aalge*

There was a strong seasonal pattern to the occurrence of corpses, with few in summer rising to a peak, usually in late winter (figure 3). Relatively few dead Guillemots were found in the late 1970s and early 1980s, but a series of winter 'wrecks'¹, mainly of unoled birds, raised the number of corpses/km in the early 1980s, especially in Shetland in the winters of 1981/82 and 1983/84 (figure 4a). Many dead Guillemots were found in both island groups in December 1984 and large numbers continued to be found in Orkney well into 1985. Thereafter, the occurrence of dead birds recorded by the Orkney and Shetland surveys was very similar. Few were found in the winter of 1986/87 but there was a further wreck in autumn 1987, when differences in the timing of surveys meant that high numbers of corpses were recorded on two surveys in Orkney but were concentrated onto one in Shetland. Few dead Guillemots were found in the winter of 1988/89 but further autumn and mid-winter wrecks occurred in 1989/90 and 1990/91.

¹ For the purposes of this paper, a 'wreck' refers to large numbers of unoled birds being washed ashore, often, but not necessarily, in conjunction with severe gales.

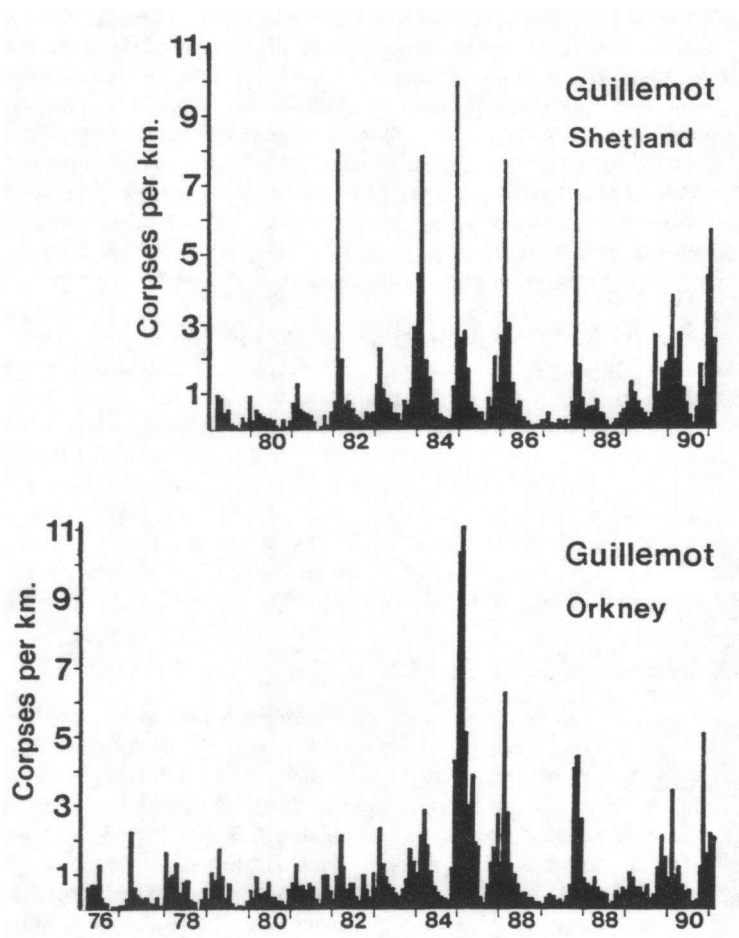


figure 3. Monthly number of Guillemot *Uria aalge* corpses per km, recorded on the Orkney and Shetland beached bird surveys.

figuur 3. Maandelijkse dichtheden Zeekoeten (*n/km*), op de Orkney en Shetland Eilanden.

table 2. *The age and sex structure of samples of Guillemots collected during four wrecks in Orkney and Shetland. Birds without a cloacal bursa were assumed to be adult, those with one were assumed to be immature or first winter. ?bursa and ?sex indicates birds in which one or the other could not be determined because of decomposition or scavenging. Chi-square tests were used to detect significant deviations from a male:female ratio of 1:1.*

tabel 2. *Leeftijds- en geslachtsverhouding bij Zeekoeten verzameld tijdens een viertal 'wrecks' op de Orkney en Shetland Eilanden. Vogels zonder en met bursa werden beschouwd als respectievelijk adult en onvolwassen. Chi-kwadraat toetsen werden uitgevoerd om na te gaan of de afwijking van een 1:1 sexratio significant was.*

Jan/early Feb 1985		male	female	? sex	X ²	signif.
Orkney & Shetland	+ bursa	62 55%	51 45%	3	0.88	n.s.
n= 153	- bursa	1 12%	7 88%	0		
93% immature	? bursa	16	13			
	total	79	71		0.24	n.s.
Feb 1986		male	female	? sex	X ²	signif.
Shetland	+ bursa	10 43%	13 57%	3	0.17	n.s.
n= 145	- bursa	35 38%	56 62%	1	4.39	p< 0.05
22% immature	? bursa	2	2			
	total	47	71		4.48	p< 0.05
Oct 1987		male	female	? sex	X ²	signif.
Orkney & Shetland	+ bursa	62 55%	50 45%	13	1.08	n.s.
n= 153	- bursa	1 100%	0	0		
99% immature	? bursa	1	0			
	total	64	50		1.48	n.s.
Dec 1990		male	female	? sex	X ²	signif.
Shetland	+ bursa	21 55%	17 45%	1	0.24	n.s.
n= 137	- bursa	37 39%	59 61%	1	4.59	p< 0.05
29% immature	? bursa	4	3			
	total	62	79		1.82	n.s.

The timing of these wrecks of uniled Guillemots changed somewhat over the period. In the early 1980s they occurred in late winter, most corpses being found on surveys in February or early March. The large wreck in the winter of 1984/85 began earlier, in December, while the highest number of corpses in the winter of 1987/88 were recorded on the October and early November surveys, with few in late winter. There were clear autumn and late winter peaks in the number of corpses per km in 1989/90 and a suggestion of a similar pattern in 1990/91.

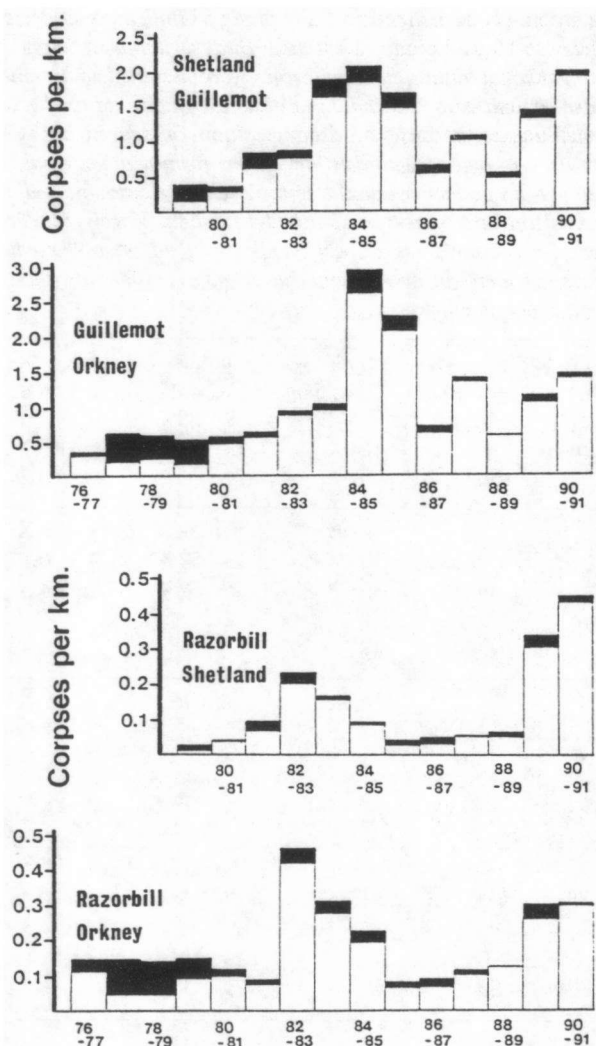


figure 4. Annual (March-February) number of (a) Guillemot *Uria aalge* and (b) Razorbill *Alca torda* corpses per km, recorded on the Orkney and Shetland beached bird surveys. Black: oiled, white: unoiled.

figuur 4. Jaarlijkse indices (mrt-feb) voor gestrande (a) Zeekoeten en (b) Alken (n/km), op de Orkney en Shetland Eilanden. Zwart: met olie, wit: zonder olie.

Adult Guillemots predominated in the February 1986 and December 1990 samples, while the wrecks of January 1985 and October 1987 involved almost exclusively immature and first-winter birds (table 2). There was no difference from parity in the sex ratio of first-winter and immature birds in any of the four samples, but there were significantly more adult females than males in the 1986 and 1990 wrecks.

Brünnich's Guillemot *Uria lomvia*

Single birds were found dead in Orkney in January 1985 and in Shetland in February 1980 and October 1983. None was oiled.

Razorbill *Alca torda*

In years when no wrecks were recorded, the underlying seasonal occurrence of dead, unoiled Razorbills differed from that of Guillemots, with higher numbers in spring and summer than in winter (figure 5), although very few were found in some years, especially in Shetland where the number of corpses per km was generally lower than in Orkney (figure 4b). Two-thirds of the birds found in winter (October-March) during 1977-80 in Orkney were oiled (65.6%, $n = 99$).

As with Guillemot, the first wreck of unoiled Razorbills occurred in February 1982, when similar numbers of corpses per km were recorded in Orkney and Shetland. In contrast, Shetland was on the fringe of the February 1983 wreck, when numbers of corpses per km on the east coast of mainland Britain exceeded even those in Orkney (Underwood & Stowe 1984). A smaller wreck in February/March 1984 was followed by five winters when the late winter peaks of corpses were much lower in Orkney and non-existent in Shetland. Further wrecks occurred in the winters of 1989/90 and 1990/91. Numbers per km in Orkney were lower than in early 1983, but considerably higher in Shetland. A sample of 134 corpses from the December 1990 to February 1991 surveys in Shetland were aged according to the number of bill grooves (Anker-Nilssen *et al.* 1988): 42% were first-winter, 5% second winter, 3% were probably immature and 49% probably adult.

Black Guillemot *Cephus grylle*

While the annual numbers of corpses per km fluctuated in both Orkney and Shetland, there was no clear change or trend over the period apart from slightly lower values in Orkney from 1986/87 onwards (figure 6a). As might be expected with a largely resident species, there was no marked seasonal pattern to the occurrence of corpses although the numbers per km were slightly higher during April-July, and especially in August, following post-fledging mortality of juveniles.

Because of their more coastal habits, Black Guillemots are better indicators of the occurrence of inshore oil slicks than the other auks. As with Guillemot and Ra-

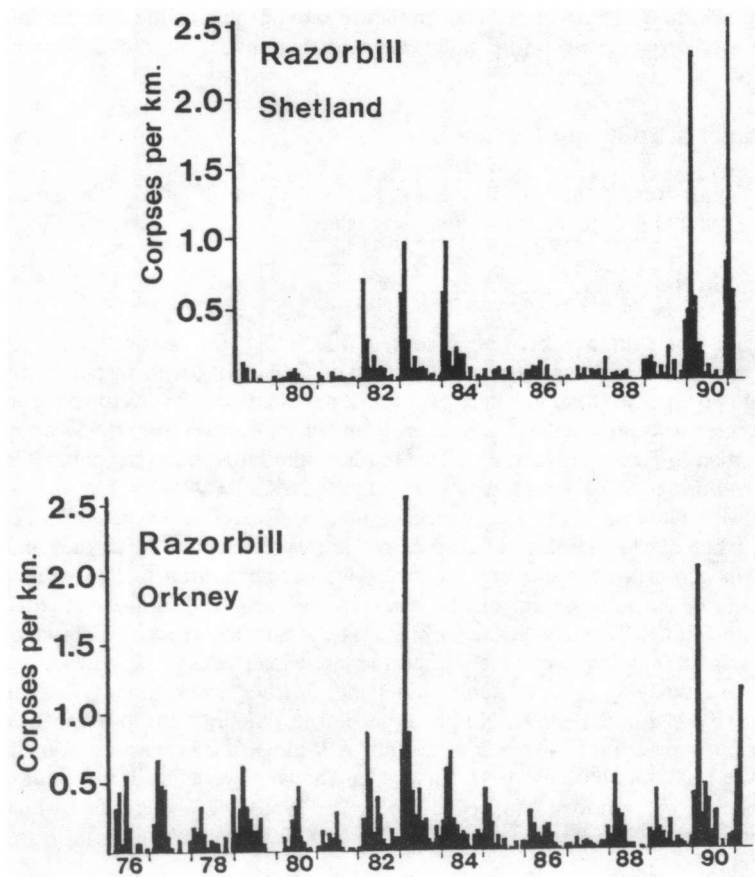


figure 5. Monthly number of Razorbill *Alca torda* corpses per km, recorded on the Orkney and Shetland beached bird surveys.

figuur 5. Maandelijkse dichtheden Alken (n/km), op de Orkney en Shetland Eilanden.

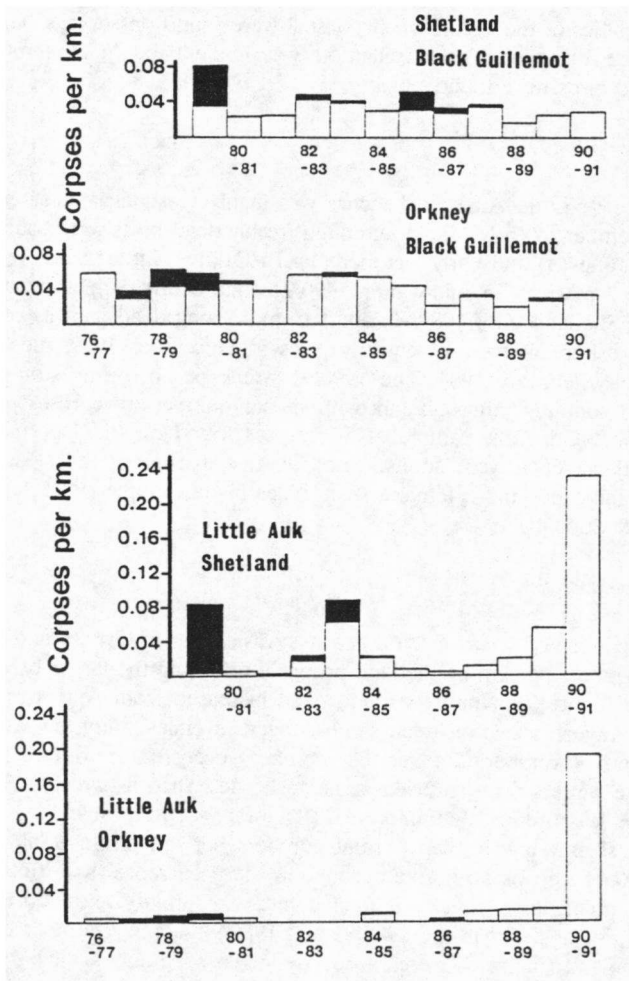


figure 6. Annual (March-February) number of (a) Black Guillemot *Cephus grylle* and (b) Little Auk *Alle alle* corpses per km, recorded on the Orkney and Shetland beached bird surveys. Black: oiled, white: unoled.

figuur 6. Jaarlijkse indices (mrt-feb) voor gestrande (a) Zwarte Zeekoeten en (b) Kleine Alken (n/km), op de Orkney en Shetland Eilanden. Zwart: met olie, wit: zonder olie.

zorbill, the incidence of contamination was relatively high in Orkney in 1977/78-1979/80 (28.1% oiled, $n = 57$; table 1) and in Shetland in the spring of 1979, when long-dead casualties of the *Esso Bernicia* oilspill were found on surveys. Thereafter, the only notable oiling of Black Guillemots was in Shetland in September 1985 when nine oiled birds were found.

Little Auk *Alle alle*

The occurrence of Little Auks on beaches was highly seasonal, almost exclusively from late November to early March, although freshly dead birds were found in late May (4), late June (3) and early October (1). In Orkney, Little Auks were found only rarely until a wreck in mid-winter 1990/91 (figure 6b). Similarly, rather few were found in Shetland until 1989/90, apart from 46 long dead, heavily oiled birds which washed ashore after south-easterly gales in December 1979 and 54 (30% oiled) in January/February 1984. The 1990/91 wreck began during storms in late December and continued through Jan, with similar numbers of corpses per km in Orkney and Shetland. Of a sample of 57 corpses found on the December 1990 survey in Shetland, 88% were adults, based on the absence of the cloacal bursa. There were significantly more females than males in the sample (68% female, $n = 47$; Heubeck & Suddaby 1991).

Puffin *Fratercula arctica*

The seasonal pattern of occurrence on beaches was similar in Orkney and Shetland, with higher numbers per km in Shetland probably reflecting the larger breeding population there (figure 7). Numbers found dead increased from April to a peak in late July and August, which included some fledged juveniles. Very few were found in October and November, but variable numbers occurred from December onwards, in some winters on a sufficient scale to be described as wrecks. The Puffin was the species least frequently found oiled (8% of all corpses; table 1).

Apart from slightly higher than normal numbers per km during January-March 1984 and 1990, there was no marked change in the occurrence of Puffins on Orkney beaches until a large wreck of unoiled birds in January and February 1991 (figure 7). The slight peaks in the 1980/81 and 1989/90 'annual' number of corpses per km at Shetland (figure 8) were caused by increased numbers of birds in both summer and mid-winter, but those of 1983/84 and 1990/91 were due to wrecks of birds in January and February 1984 and December 1990 and January 1991. A sample of 98 corpses collected on the December 1990 survey in Shetland were aged according to the number of bill grooves: 17% were first-winter, 21 % immature, 51% adult and 10% intermediate between immature and adult. There was no significant difference from parity in the sex ratio (68% females, $n = 68$) and the age structure was thought to indicate no age bias in the mortality (Harris *et al.* 1991).

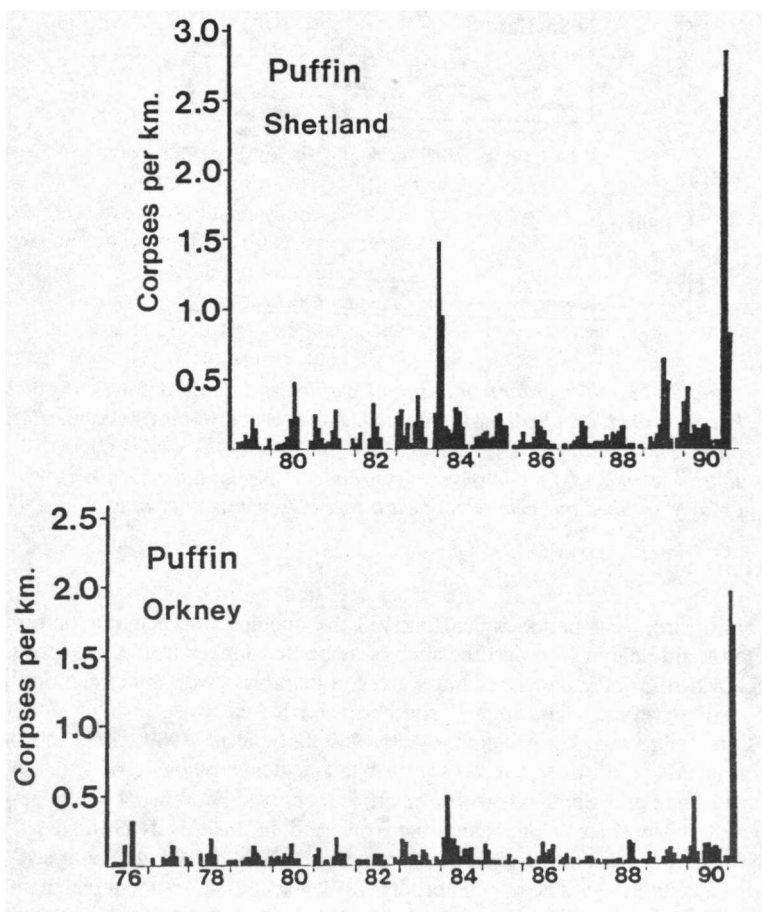


figure 7. Monthly number of Puffin *Fratercula arctica* corpses per km, recorded on the Orkney and Shetland beached bird surveys.

figuur 7. Maandelijkse dichtheden Papegaaiduikers (n/km), op de Orkney en Shetland Eilanden.

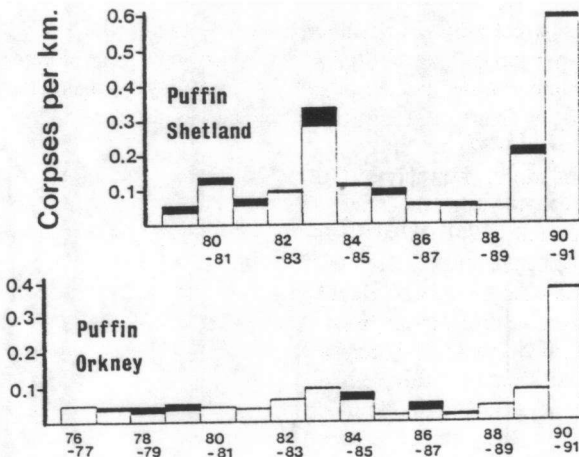


figure 8. Annual (March-February) number of Puffin *Fratercula arctica* corpses per km, recorded on the Orkney and Shetland beached bird surveys. Black: oiled, white: unoiled.

figuur 8. Jaarlijkse indices (mrt-feb) voor gestrande Papegaaiduikers (n/km), op de Orkney en Shetland Eilanden. Zwart: met olie, wit: zonder olie.

Discussion

Apart from a three year period which followed the opening of the major oil terminals at Flotta and Sullom Voe and the start of associated tanker traffic, the levels of oiling of auks in Orkney and Shetland were considerably lower than recorded on beached bird surveys on eastern and southern North Sea coasts, where shipping density is greater (Stowe 1982, Camphuysen 1989, Skov *et al.* 1989). Beached bird surveys in the Moray Firth showed a very similar incidence of oiling of Guillemots to that in Orkney and Shetland, with a sharp increase in February 1977 to levels which persisted for three winters and then reverted to low levels (Mudge *et al.* 1992). No other published British data from the 1980s have been analysed by region, but a nationwide survey in February 1991 showed the percentage of auks oiled in eastern and southern England to be 19 times as high as in Orkney and Shetland (RSPB unpubl. data) and the number of oiled corpses per km more than twice as high, despite the 'concentrating effect' of short beaches in the north isles (Heubeck 1987).

The main changes in the occurrence of auks that were not oiled involved the winter wrecks of the four pelagic species (i.e. excluding Black Guillemot). Although wrecks of each of these species have been recorded in the past (e.g. Anon. 1876, Bailey & Davenport 1972, Dacker 1948, Murphy & Vogt 1932), it was highly unusual for there to have been, in the case of Guillemot, a series of wrecks in succes-

sive winters. Such wrecks did not occur in eastern Britain in the 1970s. The number of oiled auks per km on late February beached bird surveys along the east coast of mainland Britain during the period 1972-81 was low, ranging from 0.02-0.15, apart from a higher figure in 1979 (0.32), which was ascribed to the effects of a severe winter (Stowe 1982).

The patterns of winter mortality of Guillemots in the Moray Firth were very similar to those in Orkney and Shetland, with an increase in the number of oiled corpses from February 1982 onwards (Mudge *et al.* 1992). Large numbers of auks washed ashore along the entire east coast of Britain in February 1983 (Underwood & Stowe 1984), but apart from that year, the absence of other published systematic information makes it difficult to know how extensive in the rest of Britain the wrecks recorded in northern Scotland were. Certainly, unusual numbers of oiled Guillemots were noticed on beaches in Fife in February 1986, in Fife and Northumberland in October 1986 and in Aberdeenshire in the spring of 1990 (Bourne 1990, Kinnear 1990). The resumption in 1991 of a nationwide February beached bird survey is therefore to be welcomed. However, with auk wrecks having occurred in October and December in recent years, it is questionable whether a single survey each winter would adequately monitor changes in the patterns of mortality of pelagic auks.

There is mounting evidence that changes in the distribution and a decline in the abundance of Sprat *Sprattus sprattus* in the North Sea during the 1980s have led to changes in the winter distribution and a decline in the survival of the larger auks (Blake 1984, Camphuysen 1990, Harris & Bailey *in press*). The considerable increase in numbers of dead Guillemots, mostly oiled, on beaches in the Netherlands, Germany and Belgium in the 1980s has probably been due to greater numbers wintering in the south-eastern North Sea, where food may be more readily available but where levels of chronic oil pollution remain high (Camphuysen 1989). These changes in patterns of distribution and mortality, which may have led to changes in breeding populations (Harris & Wanless 1988, Heubeck *et al.* 1991), emphasise the need for improved co-ordination and standardisation of beached bird surveys in all countries bordering the North Sea.

Acknowledgements

We are extremely grateful to the many people who have participated in beached bird surveys in Orkney and Shetland over the years. The Orkney scheme was begun by Peter Hope Jones, under contract to the then Nature Conservancy Council and since 1978 has been administered by the Orkney Officer of the Royal Society for the Protection of Birds. The Shetland scheme has been carried out under contract to the Shetland Oil Terminal Environmental Advisory Group.

Samenvatting

*Veranderingen in het voorkomen dode alkachtigen op strandjes op de Orkney Eilanden sinds mrt 1976 en op de Shetland Eilanden sinds mrt 1979, zoals vastgelegd met behulp van maandelijks strandtellingen, worden beschreven. Het aandeel olieslachtoffers op Orkney was laag in 1976, maar was relatief hoog op zowel Orkney als Shetland van mrt 1977 tot het voorjaar van 1980. Aangenomen wordt dat illegale lozingen van tankers die de zojuist geopende olieterminals bij Flotta (Orkney, figuur 1) en Sullom Voe (Shetland, figuur 1) aandeden daarvan de oorzaak zijn geweest. Sinds het voorjaar van 1980 is het percentage olieslachtoffers aanzienlijk gedaald (figuur 2, tabel 1) en bleef het op een aanmerkelijk lager niveau dan bijvoorbeeld in de zuidelijke en zuidoostelijke Noordzee, waar veel meer illegale olielozingen plaatsvinden. Sinds de winter 1981/82 vonden op de beide eilandengroepen herhaaldelijk massastrandings van 'schone' (zonder olie) Zeekoeten *Uria aalge* plaats (figuur 3, 4a). Deze wrecks vonden niet elke winter plaats en ook niet steeds op beide eilandengroepen tegelijk. De strandingen vonden hoofdzakelijk plaats tussen okt en feb. Soms domineerden volwassen vogels, soms was het merendeel juveniel (tabel 2). Wrecks van de andere pelagische alkachtigen (*Alk Alca torda*, *Papegaaiduiker Fratercula arctica*, *Kleine Alk Alle alle*) traden minder regelmatig op. Grote aantallen Alken werden gevonden in feb 1983, voorjaar 1990 en winter 1990/91 (figuur 4b, 5). De enige duidelijke wreck van de *Kleine Alk* werd geregistreerd in winter 1990/91 (figuur 6b), maar in jan/feb 1984 was het aantal op Shetland ook wat groter dan gewoonlijk. *Papegaaiduikers* strandden massaal in jan/feb 1984 en winter 1990/91 (figuur 7, 8). De gepresenteerde gegevens komen in aanzienlijke mate overeen met vergelijkbaar cijfermateriaal dat werd verzameld in de Moray Firth (NO Schotland; Mudge et al. 1992). Het was niet mogelijk om na te gaan hoever de wrecks zich uitstrekten over de rest van de Britse Eilanden, omdat systematisch olieslachtofferonderzoek hier halverwege de jaren tachtig is stopgezet.*

*Bij de *Papegaaiduiker* werd het laagste oliebevuilingspercentage gevonden: 8% van alle kadavers, vergeleken met 12% voor de *Zeekoet*, 15% voor de *Alk*, 13 % voor *Zwarte Zeekoet* *Cephus grylle* en 17% voor *Kleine Alk*. Een nationale telling in feb 1991 wees uit dat het percentage olieslachtoffers aan de zuidkust en oostkust van Engeland ongeveer 19 keer hoger ligt dan op Orkney en Shetland en dat, ofschoon de onderzochte kleine strandjes in beide eilandengroepen een 'concentrerend' effect hebben op de strandingen, in Engeland meer dan twee maal hogere dichtheden gevonden werden. Gepleit wordt voor het opnieuw invoeren van systematische strandtellingen in Groot-Brittannië, afgestemd op tellingen in andere Noordzeelanden.*

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