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Beached birds at selected Orkney beaches 1976 - 8

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Oil in slicks and blobs on the sea, in contrast to the refined variety in the petrol pumps, seems to have increased alarmingly in the last year. This survey was done at an early stage in oil developments in Orkney and so provides baseline data for assessing subsequent damage to birds.

In 1975 only a few of Orkney's extensive beaches were being regularly covered for the national beached bird survey, and it was considered that an area with such substantial breeding populations of seabirds should be better monitored, and throughout the year if possible. Additionally, it was felt that spillages at Occidental's oil terminal on Flotta could increase the amount of seaborne oil in Orkney waters, Scapa Flow in particular, leading to a concomitant increase in the frequency of oiled birds on beaches.

The Nature Conservancy Council commissioned the Royal Society for the Protection of Birds to carry out a series of seabird projects in Orkney between March 1976 and February 1978, and this paper reports on some of the results obtained from beached bird surveys carried out during this period. Copies of the raw data and of the final report are lodged at the Huntingdon and Sandy headquarters of the respective organizations.

Aims and methods

The project's main aims were to carry out beached bird surveys in order generally to increase Orkney coverage for the national scheme, and in particular to monitor a selected sample of Scapa Flow beaches throughout the year.

Twenty-three sites were chosen: four on the west coast, facing the Atlantic; five on the east coast, facing the North

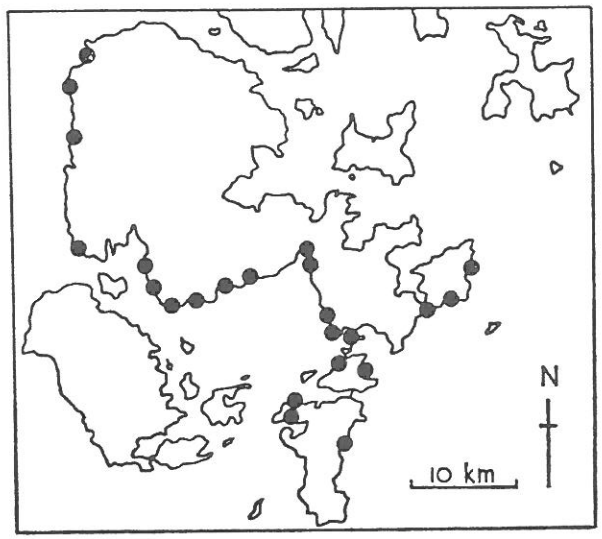

Fig. 1. Map of southern Orkney showing the location of the 23 sample beaches.

Sea; one facing into the Pentland Firth; and thirteen on the shores of Scapa Flow (fig. 1). The total length of shoreline was 34 km. Only a few of the beaches were sandy; most sites comprised angular cobbles or flattened stones resulting from the erosion of Orkney's sandstone slabs, and there were extensive drifts of decaying seaweed in places.

The survey method was based on the national scheme, but was not identical. Essentially, for each of the 23 sites, it comprised a relatively slow walk along a beach and back again, looking at the spring high tide mark once a lunar month for two years, and recording all corpses of birds and wild mammals and all live beached birds. It was early decided that a degree of standardization was preferable in order at least to reduce the numerous variables present in the system. The first standardization was to carry out the counts on the spring tide lines when it would be necessary to cover only the highest fresh tideline on the beach. The choice between new moon and full moon spring tides was arbitrarily resolved in favour of the latter, and the first day's counting took place on the day of the full moon or the day after it, with the remaining counts following immediately, the whole series normally taking between four and six days for completion.

Each tideline was walked in two directions from the access point. Beached birds having been noted, the corpses were then

thrown well above the highest tideline or else removed for further study. Additional birds found on the return walks were recorded separately; in this paper the grand totals are used. The spring tideline was usually easy enough to follow, and the two journeys were made at a moderate to slow walking pace—a speed anyway necessitated by the difficult nature of the terrain. All bird remains were identified where possible, the specimens being divided into categories of one wing, two wings, and whole birds (this last including everything with more than two-wings-plus-sternum).

Pattern of arrival through the year

Monthly details for the two years are set out in table 1. The very high figures in late summer are due largely to the arrival of corpses of juvenile Kittiwakes (discussed later), but even when these are omitted, it is still evident that the basic pattern was of low numbers in winter, increasing through spring to high numbers in late summer.

Table 1. Numbers of beached birds per kilometre, totalled for 23 Orkney beaches monthly, March 1976-February 1978

	First year	Without juvenile Kittiwakes	Second year	Without juvenile Kittiwakes
March	2.6		4.3	
April	4.7		1.8	
May	5.0		4.6	
June	—		—	
July	6.9	6.9	22.7	6.2
August	31.8	8.0	20.9	6.8
September	8.1	4.5	3.8	3.4
October	2.1		1.7	
November	2.8		0.4	
December	1.7		1.9	
January	1.4		2.7	
February	2.1		2.4	

One of the most interesting results to emerge from these surveys is evident from a comparison of Orkney data with those for the whole country (fig. 2). In both cases there is a peak of beached bird arrivals in August—and perhaps for both this reflects a mortality of juvenile birds—but whereas the national picture shows an even greater peak in midwinter, this is completely absent from Orkney. This, of course, assumes that the two years of the Orkney contract were normal in terms of beached bird arrivals; this cannot be proved, but there were no indications to the contrary.

The simplest explanation for this divergence is that many of Orkney's breeding seabirds are summer visitors, and so the

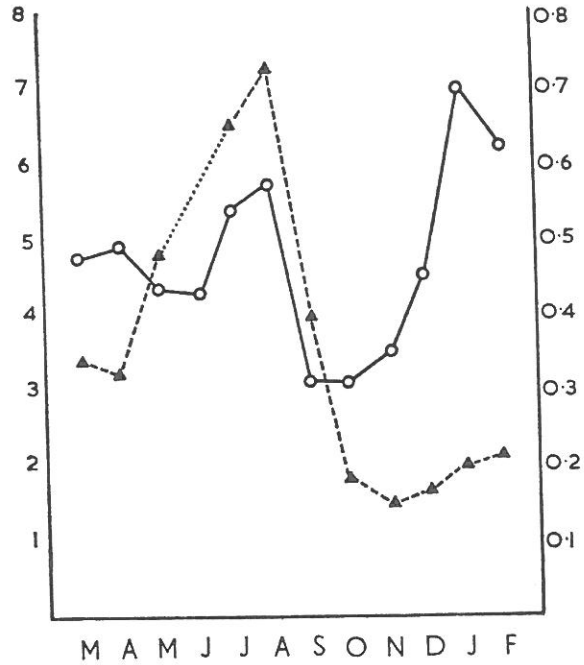

Fig. 2. Mean numbers of beached birds per kilometre per month: Orkney data (left-hand scale) compared with the national pattern (right-hand scale). National: solid line and circles. Orkney: dashed line and triangles (note (a) juvenile Kittiwakes excluded; (b) June data incomplete).

numbers present in the area are much lower during the winter, whereas the trend is reversed around many coasts further south in the rest of Britain and Ireland. The Orkney monthly figures (even without juvenile Kittiwakes) were often about ten times higher than the national ones. This must, to an unknown (but large) extent, be an artefact due to the more intensive surveillance during the contract: *all* birds and wings counted, birds recorded also on the return trip along each beach, etc., and fig. 2 must therefore be used mainly in comparing the two areas in terms of through-the-year pattern.

Species patterns

In sum, 57 species were recorded on the surveys; numbers of species per month varied between 19 and 28, averaging 24, but this parameter did not show any obvious patterns with season of the year. The overall Orkney picture—a late summer peak and a midwinter trough—hides several variations

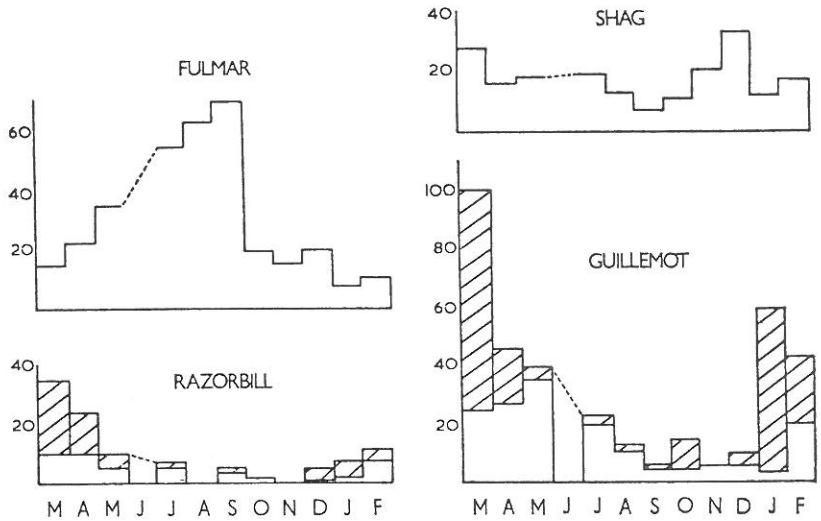

Fig. 3. Monthly totals of beached birds (from the Orkney sample sites) for two years combined for Fulmar, Shag, Razorbill and Guillemot. June data incomplete. Cross hatching (auks only) indicates oiled birds.

between species, and so monthly patterns for Fulmar, Shag, Razorbill and Guillemot are shown in fig. 3.

Fulmar numbers show a very obvious build-up through the spring to late summer—presumably peaking at the time when many young birds are fledging. Shags, on the other hand, show a more diffuse pattern, though in both years there was an early winter peak and another, smaller, one in early spring.

Razorbill and Guillemot are similar in showing a distinct early spring peak, whilst Guillemot in the second year also produced good numbers in January (Guillemots occur occasionally in Orkney waters in winter and early spring, but Razorbills are apparently scarce then). With these two species, any natural mortality pattern is almost bound to be hidden by the periodic arrivals of oiled birds, but since one cannot normally say what proportions were dead before oiling, the problem is insuperable. However, fig. 3 also shows the proportion of oiled birds in the monthly totals for the two species, and evidently much of the late winter/early spring peak was due to oiling. The histograms for unoiled birds peak at different times from those for all birds, but it still seems as though there was a spring peak in arrivals of Razorbills and Guillemots.

Kittiwakes are a special, and very interesting, case. There was very little oiling in this species and the arrival pattern for beached adults is an obvious build-up to a midsummer peak with a complementary winter trough. There was little variation between years, either in numbers or in monthly distribution. From July to September, in both study years, the summer peak was stretched upwards by massive arrivals of corpses of juveniles on the beaches, particularly the west coast, to give the patterns shown in fig. 4. The reason for one August peak in 1976 and joint July/August peaks in 1977 is simply a function of the dates of the beached bird surveys in relation to the hatching/fledging times of the Kittiwakes: in 1976 the counts were in mid July when only few Kittiwakes were at the advanced fledging stage, whereas in 1977 the counts were very late in July, by which time the fledging season was well advanced. Mortality in pre-fledging Kittiwakes is considered by many to be mainly due to the young birds falling from nests before becoming capable of full flight (Hodges 1975), and with tens of thousands of young Kittiwakes being produced in Orkney each summer it would be surprising if there were *not* several hundreds found dead, so the phenomenon is probably quite usual, though it may vary quite considerably from one year to the next in the number of young birds beached.

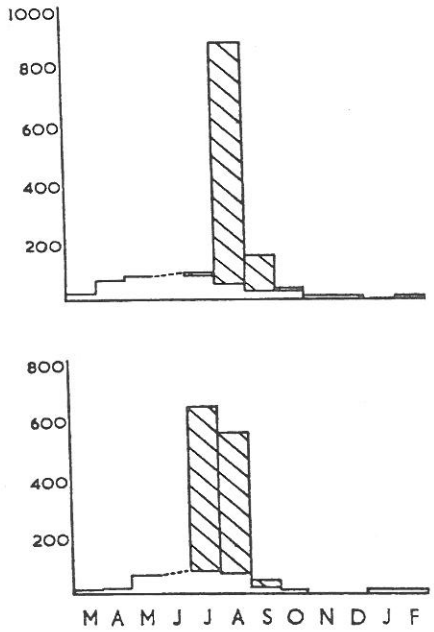

Fig. 4. Monthly totals of beached Kittiwakes at 23 Orkney sites in two years. Upper: 1976/7; lower: 1977/8. Cross-hatching, July-October, indicates juveniles.

Numbers varied greatly with the locality, the west coast beaches heading the league, presumably because of their close proximity to massive breeding colonies. The average number found per kilometre of searched beach (July to October totalled) was very similar at 28 in the first study year and 31 in the second, but the value differed considerably with area—122 and 152 per kilometre in the two years on the west coast, to between two and four per kilometre in both years within Scapa Flow. This brief, but very intensive, flurry of beached juvenile Kittiwakes inflates the annual totals of beached birds very dramatically, so various of the analyses have been made with the express omission of this group.

Oiled birds

One of the main aims in beached bird work is to establish the proportion of oiled birds amongst the corpses and live beached birds found on the tideline. In this Orkney study, the gross figures were 279 birds oiled out of a total of 4,979 birds found, that is, a very low oiling rate of 5.6%. However, of the grand total of birds found, nearly half were juvenile Kittiwakes, so when this category is removed, the oiling rate rises to a more realistic 9.4% (279 out of 2,982). Bourne & Bibby (1975) calculated the proportion of oiled bodies from beached bird surveys, 1967-73, to be 45% in eastern and 10% in western Scotland, though with up to 80% in parts of south-east England and on the Channel and North Sea shores of continental Europe. The Orkney figure can be further broken down, as shown in table 2, where the two species Guillemot

Table 2. Total numbers of oiled birds found on beached bird surveys of 23 Orkney beaches, March 1976 - February 1978

	Total birds found	Total oiled	% oiled
Red-throated Diver	1	1	—
Great Northern Diver	3	1	—
Fulmar	378	3	0.8
Gannet	42	2	4.8
Shag	199	1	0.5
Eider	63	1	1.6
Long-tailed Duck	18	6	—
Velvet Scoter	2	2	—
Redshank	9	1	—
Common Gull	153	1	0.6
Herring Gull	291	2	0.7
Kittiwake	765*	7	0.9
Guillemot	403	190	47.1
Razorbill	108	56	51.9
Black Guillemot	36	3	8.3
Little Auk	2	1	—
Puffin	39	1	2.6

*omitting juveniles, July to October

and Razorbill comprise 88% of all oiled birds among the 17 species affected by this form of pollution. For both these auk species, about half the beached birds found were oiled, whereas no other species (for which over 30 individuals were recorded) could muster 10%. In the national situation (Cadbury & Meyer pers. comm.) 55% of auks are oiled (about half, as in Orkney) and 64% of divers and 39% of seaducks, but for these two groups the Orkney sample was not large enough for valid comparison, though out of 63 Eiders found in the 1976-8 counts only one was oiled.

In both years the west coast sites turned up about half of all the oiled birds found, even though the beaches in that area comprised only one-fifth of the shorelines examined. This proportion was similar for both years, even though there was a four-fold increase in arrivals of oiled birds in the second working year, due in large measure to the impact of three specific incidents off the west coast.

In March 1977 there was a spillage of North Sea crude oil from the terminal in Scapa Flow, and if such oil normally has the appearance shown in that incident, then it is easy to identify on beached bird corpses by virtue of its tawny cinnamon colour—which contrasts markedly with that of the black or brownish-black tarry covering resulting from contact with some other crude oils and fuel oils. Between October and December 1977, a small series of feather samples was taken from oiled birds found on Orkney beaches, and this was forwarded to the Laboratory of the Government Chemist by K. T. Standring of the RSPB's Edinburgh office. The main components were fuel oils, often with admixtures of other oils, and if this is typical of the pollution shown by most of the Orkney oiled birds then the main cause of oiling during the study period was fuel oil and bilge washings. Pollution by North Sea crude oil was restricted to the effects of two out of several spillages within Scapa Flow in 1977, one serious enough to warrant a published report (RSPB 1977), the other of no great consequence.

Observations and experiments

(a) Relative durability of corpses in the sea

Of the auks, 89% arrived as whole corpses, whereas only 25% of the Kittiwakes did so. These figures reinforced my impression in the field that the gulls as a group were more fragile and disintegrated more quickly in the sea than chunkier, thicker plumaged birds such as auks and divers.

During the summer (here an arbitrary period of April to September inclusive), the proportion of corpses of adult Kittiwakes that came ashore whole was between 18% and 31% for three groups of beaches; in juveniles, the proportion changed from 67% on the west coast, through 40% on the east coast, down to a mere 16% within Scapa Flow. This I interpret as a rapid disintegration of juvenile corpses as they are moved, in seawater, away from their natal colonies; it would appear that these juveniles were much more prone to come apart rapidly than were adults that died during the same period.

The durability of corpses in seawater and their ability to withstand the wave pounding (and perhaps destruction by seaweed fronds) are thus very important in interpreting the numbers of different species washed ashore whole or in bits, but as yet one can only point to this factor without being able to quantify it in any constructive manner.

(b) Corpses found on the return walk

Figures were kept separately for the numbers of beached birds found on returning along the same tideline as that examined on the outward walk. The major conclusion was that up to one fifth of the birds present on a tideline were missed by an observer who was looking hard for beached birds. And this cannot, of course, include those birds that must have been missed on both trips. Figures were remarkably constant from year to year, even though they varied slightly from one set of beaches to another.

This percentage is not necessarily universally applicable, since it applies only to the Orkney beaches sampled, and to only one observer, whose capability in spotting beached birds may, or may not, have been near the national average. However, it does highlight the existence of yet another variable, and shows that observers, however conscientious, can miss a considerable proportion of the beached birds actually present on any given site.

(c) Beached birds and wind direction

West and east coast sample beaches totalled 5.9 and 5.7 km respectively. An analysis was carried out comparing, for each month's counts, the wind direction (weighted according to its speed) at three-hourly intervals for one, five and ten days before the count. For five winter and five summer counts each year, the indices for both westerly and easterly component winds were compared with the numbers of corpses. The only correlation at the 5% level was that numbers on the west coast in winter were negatively correlated with east winds in the period ten days before the count (Kendall's rank correlation coefficient). For the rest, one must conclude that, at the 5% level tested, there was no correlation.

However, the total numbers of corpses found on west and east coast beaches was 1,613 of which 951 (59%) were on the west coast and 662 (41%) on the east. If all the wind indices are added for ten-day periods prior to counts at these sites, the totals are 1,400 (59%) for west winds and 959 (41%) for east winds. This is a chance concordance because the figures for separate years are slightly different, but it does suggest that the link between wind and numbers of corpses is more likely to be in the nature of a long term phenomenon than an immediate one, and that immediate correlations for single counts are perhaps often overridden by the changeable nature of the wind and by corpses remaining for quite a time on the tideline.

(d) Length of corpse stay on the tideline

Corpses can remain visible for quite a while if left high and dry at the top of a beach after a particularly high spring tide. However, many corpses brought in on neaps or ordinary springs will be disturbed by subsequent tides, and a series of counts was made on marked individual corpses to discover how many would be refound. Of 56 corpses set out in three tests on neap tidelines, and examined daily, 28 (50%) were still visible on the same beach after the next series of spring tides, seven (12%) were hidden under seaweed, six (11%) were shifted away some distance by the tides, one (2%) was removed by a scavenger, and the remaining 14 (25%) had disappeared without trace.

(e) Corpse disintegration

Corpses of beached birds obviously disintegrate over the course of time, and in fact many of them are well on the way by the time they are cast ashore. In two series of corpses put out above the high water mark it was found that a five month interval through the late winter and spring was sufficient to make five out of eight corpses almost unrecognizable, though two divers seemed hardly to change in this period—perhaps their feather structure and tough skin slowed the process of decay; on the other hand, a three month interval over the midwinter period seemed to effect relatively little change in the state of six more corpses. Although some of these carcasses may have mummified to some extent, an examination of two Guillemot corpses left for four months over the 1977/8 winter suggested that they would be very fragile, and likely to fall apart if moved. Thus corpses remaining at one place can last several months (and perhaps for a longer period in winter than in summer) but only if left almost completely undisturbed. Corpses moved about by seawater are likely to

disintegrate much more quickly, though this was not tested. A variety of tideline scavengers hastens the process of disintegration: in Orkney, gulls, Great Skua, Hooded Crow and Common Rat *Rattus norvegicus* were all heavily involved, together with invertebrate carrion feeders. Changes caused by chemical action and by microscopic organisms were not investigated.

Conclusions

The main value of the two year survey may perhaps only become apparent when there are sufficient data with which to make valid comparisons, that is, when the project has been repeated in the future.

The first essential in 1976-8 was to establish the pattern of beached bird arrivals at a variety of Orkney sites, and insofar as this was possible within the relatively short time of two years, it was done. Whilst the details will perhaps change considerably from year to year, it seems likely that the basic system of high numbers of beached birds in spring and summer, low numbers in winter, is the normal state of affairs for Orkney.

The second essential was to establish the oiling frequency amongst the beached bird arrivals. This showed the great disparity between the rates for Razorbills and Guillemots on the one hand, and a variety of different species on the other hand. One conclusion here was that it would be misleading to quote just one figure for the oiling rate for Orkney, but again if the project is repeated or continued, the figures for individual species can validly be compared.

As more oil is removed from below the North Sea (and possibly the Atlantic) there is an increasing likelihood of seaborne pollution from that source, and it will be valuable to know—in the event of an almost inevitable increase in bird oiling in Orkney waters—whether the increase is due to North Sea oil as such or to bilge water and tank washings from the greater volume of shipping associated with oil developments in northern British waters.

This two year survey forms the basis for monitoring numbers of beached birds ashore at selected sites in Orkney. Despite the variables involved in the collection and interpretation of data, I believe the system to be invaluable in providing indices to numbers of corpses arriving, species composition, and percentage oiling in different species, thus contributing to surveillance of the important seabird populations in the physically and economically turbulent waters of northern Scotland.