Thirty-eight years of monitoring show a large-scale oil development has had little long-term impact on local seabird populations

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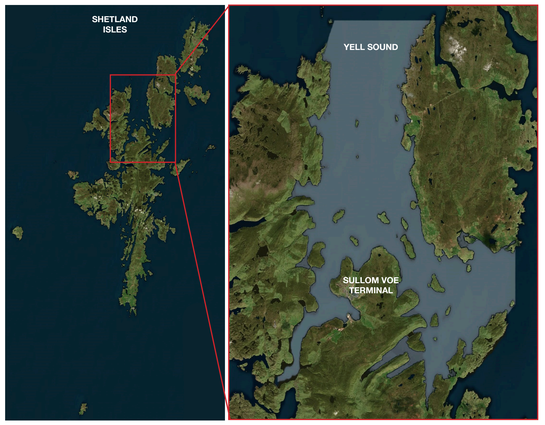
INTRODUCTION

In 1978 the Shetland Oil Terminal Environmental Advisory Group (SOTEAG) initiated a programme to monitor seabirds, following the building of the Sullom Voe Terminal (SVT). This continues, funded by industry (67%) and the local authority (33%), with independent academic oversight.

The main elements are to:

- document population trends of breeding seabirds throughout Shetland;
- record numbers of seaduck and seabirds wintering inshore;
- conduct monthly beached bird surveys, including sampling of oiled seabird feathers for analysis;
- respond to, and assess the population impact of oil pollution events.

Since then there have been two tanker incidents: the *Esso Bernicia* at the SVT (1,200 t of heavy fuel; December 1978) and the *Braer* in southern Shetland (84,000 t of crude; January 1993).



BEACHED BIRD SURVEYS

Monthly surveys began in autumn 1978 but were disrupted by the *Esso Bernicia* oil spill, and other oiling incidents in 1979. Coverage since 1980 has remained largely unchanged, at 21 km of sheltered shoreline in Sullom Voe and Yell Sound, and 28 km of exposed coastline facing the Atlantic and the North Sea. Surveys are conducted by SOTEAG contractors and by volunteers to monitor chronic oil pollution and maintain an index of seabird mortality in the seas around Shetland.

The number and species of beached birds has changed due to changes in population size, breeding success and wintering distribution (Table 1). Black-legged Kittiwakes *Rissa tridactyla* (including large numbers of juveniles in late summer) comprised 17% of corpses in the early 1980s, but only 3% in the early 2010s, by which time the Shetland breeding population had decreased by 90% (Figure 1). Winter 'wrecks' of Common Guillemots *Uria aalge* and (sometimes) Razorbills *Alca torda* occurred in the 1980s and 1990s, but recently few corpses of either species have been found in winter.

The incidence of oiling has fluctuated, but has been low since 1998 (Figure 2). Throughout, oiling rates have been lower in Yell Sound than for all-Shetland (Table 1). Periods of a high incidence of oiling tended to last for several months and occur at different times of year. That from April to August 1995 mainly involved crudes of Middle East and North Sea origins. That from January to April 1996 mainly involved a North Sea crude (probably Claymore field) and fuel oils. There was nothing to link this offshore pollution with the SVT, but it prompted routine sampling and analysis of oil found on beached birds surveys (Table 2). Since 1996, fuel oils have predominated, with crude oils typed to various North Sea and West of Shetland fields, and to Russian, Middle Eastern, West African and South American origins. By 2010-15, 67% of oiled birds found were Northern Fulmars *Fulmarus glacialis*, most of which were very slightly oiled and could have flown a long way from the point of contamination before dying. Oiling rates for inshore species have become extremely low.

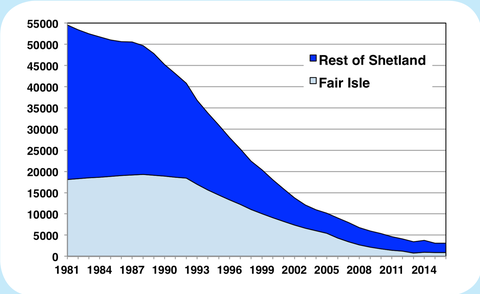


Figure 1. The estimated Shetland Black-legged Kittiwake *Rissa tridactyla* population (nests), 1981-2016.

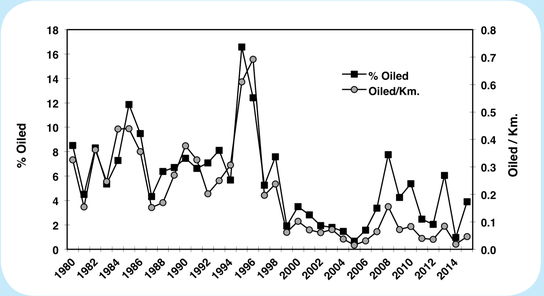


Figure 2. The annual percentage oiled and number of oiled seabird corpses per km on the Shetland beached bird survey, 1980-2015.

Table 1. The percentage oiled (bold) for all seabirds found on Shetland beached bird surveys, for those found in Yell Sound and Sullom Voe, and for 8 species.

Years	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-15
Shetland, % oiled All species (n)	**6.9** 13,535	**7.9** 11,427	**6.9** 12,231	**9.3** 11,142	**2.3** 8,697	**3.4** 5,626	**3.2** 5,477
Yell Sound, % oiled All species (n)	**4.7** 1,546	**4.6** 1,425	**2.4** 1,410	**1.4** 1,401	**0.9** 1,012	**2.2** 692	**1.7** 724
Pelagic surface-feeders							
Northern Fulmar *Fulmarus glacialis*	**5.4** 2,731	**6.6** 3,486	**4.9** 3,545	**6.9** 4,007	**1.7** 3,193	**4.8** 2,462	**5.1** 2,305
Black-l. Kittiwake *Rissa tridactyla*	**2.4** 2,246	**9.4** 947	**5.7** 1,528	**5.6** 1,036	**3.9** 437	**6.4** 220	**2.2** 186
Pelagic auks							
Common Guillemot *Uria aalge*	**13.6** 3,340	**8.9** 3,276	**9.7** 3,329	**16.8** 2,565	**3.4** 2,413	**2.9** 791	**1.2** 785
Razorbill *Alca torda*	**11.4** 350	**17.3** 197	**9.1** 565	**16.8** 340	**2.3** 388	**4.4** 158	**2.0** 147
Atlantic Puffin *Fratercula arctica*	**11.1** 440	**12.0** 284	**4.0** 527	**9.5** 283	**1.4** 219	**0.4** 225	**0.0** 94
Resident inshore							
European Shag *Phalacrocorax aristotelis*	**4.3** 774	**3.3** 549	**5.5** 512	**1.6** 492	**0.0** 400	**0.0** 327	**0.8** 370
Common Eider *Somateria mollissima*	**5.2** 154	**6.5** 139	**13.8** 116	**7.2** 83	**1.9** 53	**2.2** 46	**0.0** 48
Black Guillemot *Cepphus grylle*	**5.0** 101	**16.4** 110	**25.2** 107	**5.2** 193	**3.0** 99	**0.0** 79	**0.0** 83

Table 2. Analyses of samples of oil taken from dead birds and beaches.

1996-99 (n = 64)	2000-04 (n = 73)	2005-09 (n = 46)	2010-15 (n = 49)
refined (fuel) = 78% crude = 22%	refined (fuel) = 86% crude = 14%	refined (fuel) = 67% crude = 33%	refined (fuel) = 65% crude = 35%

THE LONG-TERM IMPACT OF THE 1978 SPILL ON WINTERING GREAT NORTHERN DIVERS *Gavia immer*

Surveys in the mid 1970s suggested a wintering population of c.110-150 Great Northern Divers in Yell Sound and Sullom Voe, and 53 were recorded in November 1978 along a boat route covering Sullom Voe and central Yell Sound. Five weeks later a spill of 1,200 t of heavy bunker oil from the tanker *Esso Bernicia* at the SVT caused extensive mortality of inshore seabirds, with 131 Great Northern Divers (mostly adults) found oiled in Yell Sound and Sullom Voe in early 1979, and a further 53 elsewhere in Shetland.

This same survey route has since been followed at least once per winter in calm conditions, apart from a gap in the mid 1990s, and the maximum number of Great Northern Divers seen was 18 in 1989/90, with counts in single figures in 10 of the last 13 winters (Figure 1). This is despite the use of larger and more stable boats with a greater viewing height, and improved weather forecasting. The most recent coverage of the entire coastline of Yell Sound and Sullom Voe, in January 2014, recorded 25 Great Northern Divers.

Only one Great Northern Diver has been found oiled in Yell Sound or Sullom Voe since 1979 (March 1987), and the species is rarely found on routine beached bird surveys (23 individuals during 1980-2015, 7 of which were oiled). Their continued scarcity in Yell Sound is difficult to explain, given that they winter in good numbers (c.150 individuals) along the east-central coast of Mainland Shetland, immediately south of Yell Sound.

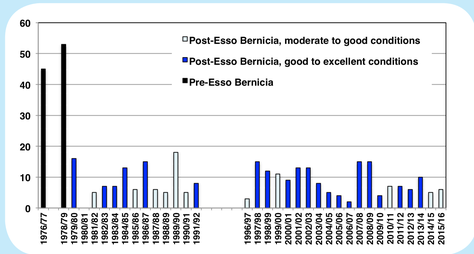


Figure 1. Counts of Great Northern Divers during winter (late November to early March) from boats along a standard survey route in Yell Sound and Sullom Voe. Plotted are the higher of 1-3 counts per winter until 1998/99, and of 1-2 counts per winter from 1999/2000; no counts were made in 1977/78, or 1992/93-1995/96.

MONITORING THE SHETLAND COMMON EIDER *Somateria mollissima* POPULATION

Common Eiders are resident within the archipelago. Moult flocks occur at traditional locations, usually large headlands or remote offshore islands, and a population estimate of 17,000 birds was derived from a survey of these flocks by the Nature Conservancy Council in 1977. The species' vulnerability to inshore oil pollution was demonstrated by the *Esso Bernicia* oil spill in winter 1978/79 when 570 were found oiled, which was followed by an unexplained (but not oil-related) mass mortality in winter 1979/80 that affected the largest flock in the islands.

SOTEAG began surveys of moult flocks in the early 1980s, the most thorough of which gave a population estimate of 11,900 birds in 1984 (Figure 1). This 30% decrease since 1977 could probably be explained by the two mortality events in the late 1970s. However, the cause(s) of a further 40% decrease, to 7,000 birds in 1991, was unknown. The January 1993 *Braer* oil spill (66 Common Eiders found oiled) and a series of small oil spills associated with a fleet of East European factory trawlers in 1994-96 will have contributed to a further slight decline, to 6,200 birds in 1997.

In the early 2000s it became evident that some Eiders were spending the late-summer moult at the increasing number of inshore aquaculture sites (salmon farms and Blue Mussel lines) rather than at traditional locations. Coverage of these, as well as the traditional sites, located 5,800 birds in 2009, and 4,600 in both 2012 and 2015. On these three surveys, 70%, 64% and 82% of the respective totals were at aquaculture sites, while away from aquaculture sites the largest concentration in 2015 (160 birds) was in Sullom Voe, close to the oil-loading jetties. The next survey is scheduled for August 2018.

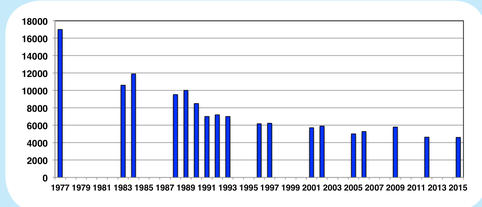
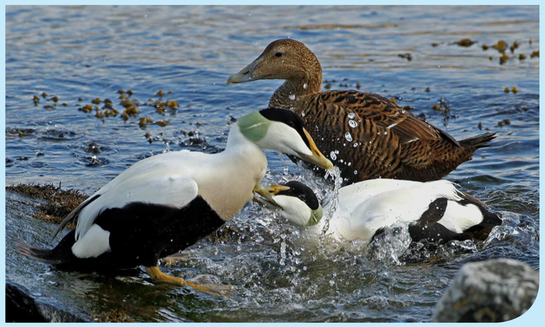


Figure 1. Population estimates for the Shetland Common Eider population, based on surveys of moult flocks in late summer.



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