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Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK APPENDIX B

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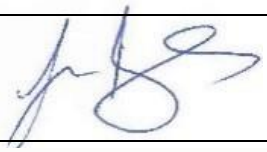
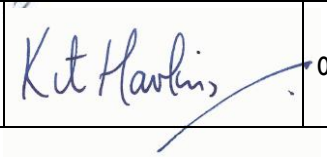
Checked By	Steve Burns		01 April 2016
Approved By	Kit Hawkins		01 April 2016

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Appendix B

Calculation of factors that influence the sensitivity of seabird species to oil pollution

1 Calculation of factors that influence the sensitivity of seabird species to oil pollution

1 A total of eight factors were used to calculate seabird oil sensitivity index scores for each species or species group. The method for calculating each of these is described in the following sections.

1.1 Proportion of time spent sitting on the water (F_1)

2 The number of birds sitting on the water as a percentage of all birds was calculated from all boat-based data in the ESAS Database within the study area between 1995 and 2015. Only birds recorded as being in transect were used. It would have been better to have used either data from digital video aerial surveys or from seabird tracking databases, because these surveys are not biased by response to the survey vessel. However, there were insufficient data for the full range of species for which a SOSI score was required, and providing a set of data derived from different sources would have biased the analysis more than using data with a consistent bias. No difference was found in the scores different times of the year. The percentage sitting and SOSI scores applied to these are given in Table B1, and the SOSI scores for Factor 1 for each species are given in Table B2.

Table B1 SOSI scoring applied to different proportions of time spent sitting on the water for Factor 1.

Lower limit of percentage time spent sitting on the water	Lower limit of percentage time spent sitting on the water	SOSI Score
0.00%	20.00%	0.2
20.01%	40.00%	0.4
40.01%	60.00%	0.6
60.01%	80.00%	0.8
80.01%	100.00%	1

Table B2 Percentage of individuals recorded sitting on the sea by species or species group and the SOSI scores assigned to them. N = sample size.

Species / species group	Scientific name	% sitting	N	SOSI Score
Red-throated diver	*Gavia stellata*	87.66%	3257	1
Black-throated diver	*Gavia arctica*	82.49%	217	1
Great northern diver	*Gavia immer*	93.90%	82	1
Diver sp.	*Gavia sp.*	90.22%	849	1
Great crested grebe	*Podiceps cristatus*	94.96%	3114	1
Red-necked grebe	*Podiceps grisegena*	98.25%	57	1
Slavonian grebe	*Podiceps auritus*	100.00%	35	1
Grebe sp.	*Podiceps sp.*	-	4	1
Northern fulmar	*Fulmarus glacialis*	59.77%	156,140	0.6
Cory's shearwater	*Calonectris diomedea*	-	12	0.4
Great shearwater	*Puffinus gravis*	27.87%	854	0.4

Species / species group	Scientific name	% sitting	N	SOSI Score
Sooty shearwater	*Puffinus griseus*	29.96%	671	0.4
Manx shearwater	*Puffinus puffinus*	76.57%	43019	0.8
Balearic shearwater	*Puffinus mauretanicus*	-	22	0.8
Shearwater sp.	*Puffinus sp.*	-	1	0.8
European storm-petrel	*Hydrobates pelagicus*	39.65%	5607	0.4
Leach's storm-petrel	*Oceanodroma leucorhoa*	39.98%	908	0.4
Storm-petrel sp.	*O. leucorhoa/H. pelagicus*	38.89%	54	0.4
Northern gannet	*Morus bassanus*	56.11%	42,121	0.6
Great cormorant	*Phalacrocorax carbo*	71.57%	2941	0.8
European shag	*Phalacrocorax aristotelis*	86.96%	2668	1
Cormorant sp.	*Phalacrocorax sp.*	-	11	0.8
Greater scaup	*Aythya marila*	93.15%	73	1
Common eider	*Somateria mollissima*	92.70%	56,611	1
Long-tailed duck	*Clangula hyemalis*	95.24%	1764	1
Common scoter	*Melanitta nigra*	91.00%	102,961	1
Scoter sp.	*Melanitta spec.*	100.00%	170	1
Velvet scoter	*Melanitta fusca*	97.39%	1645	1
Common goldeneye	*Bucephala clangula*	91.07%	56	1
Red-breasted merganser	*Mergus serrator*	84.81%	520	1
Goosander	*Mergus merganser*	20.00%	30	1
Duck sp.	*Anatidae sp.*	-	3	1
Grey phalarope	*Phalaropus fulicaria*	6.24%	497	0.2
Pomarine skua	*Stercorarius pomarinus*	39.09%	110	0.4
Arctic skua	*Stercorarius parasiticus*	41.34%	462	0.6
Long-tailed skua	*Stercorarius longicaudus*	48.54%	82	0.6
Great skua	*Stercorarius skua*	47.60%	2229	0.6
Skua sp.	*Stercorarius sp.*	-	21	0.6
Mediterranean gull	*Larus melanocephalus*	59.26%	27	0.6
Little gull	*Hydrocoloeus minutus*	58.26%	10,613	0.6
Sabine's gull	*Xema sabini*	-	12	0.6
Black-headed gull	*Chroicocephalus ridibundus*	70.39%	45,130	0.8
Common gull	*Larus canus*	63.23%	39,253	0.8
Small gull sp.	*Larus/Rissa sp.*	93.18%	44	1
Lesser black-backed gull	*Larus fuscus*	66.43%	76,908	0.8
Herring/lesser black-back	*L. fuscus/L. argentatus*	12.79%	86	0.2
Herring gull	*Larus argentatus*	72.67%	69,639	0.8
Glaucous gull	*Larus hyperboreus*	39.24%	288	0.4
Great black-backed gull	*Larus marinus*	70.85%	24,658	0.8
Large gull sp.	*Larus sp.*	64.29%	3061	0.8
Black-backed gull sp.	*L. fuscus/L. marinus*	43.34%	1156	0.6

Species / species group	Scientific name	% sitting	N	SOSI Score
Black-legged kittiwake	*Rissa tridactyla*	66.61%	74,294	0.8
Gull sp.	*Larus sp.*	96.07%	5824	1
Sandwich tern	*Sterna sandvicensis*	32.18%	7241	0.4
Roseate tern	*Sterna dougallii*	-	4	0.6
Common tern	*Sterna hirundo*	44.86%	10,817	0.6
Arctic tern	*Sterna paradisaea*	29.09%	2372	0.4
Common/Arctic tern	*S. hirundo/S. paradisaea*	28.00%	4796	0.4
Little tern	*Sterna albifrons*	40.32%	62	0.6
Black tern	*Chlidonias niger*	31.20%	125	0.4
Tern sp.	*Sterna sp.*	16.92%	65	0.2
Common guillemot	*Uria aalge*	96.31%	173,258	1
Guillemot/razorbill	*Alca torda/Uria aalge*	95.16%	19757	1
Razorbill	*Alca torda*	94.42%	31,685	1
Black guillemot	*Cepphus grylle*	89.22%	473	1
Little auk	*Alle alle*	82.74%	1217	1
Atlantic puffin	*Fratercula arctica*	85.68%	42,799	1
Auk sp.	*Alcidae sp.*	85.99%	421	1

1.2 Percentage of tideline corpses contaminated with oil (F_2)

3 An investigation of recent data from beached bird surveys in Shetland and the Netherlands found that sample sizes were too small to be able to calculate indices of contamination, given that there is a requirement to allocate a SOSI score to all species and species groups. It is unimportant whether data are recent or not; the index scores only need to be a measure of the relative frequency with which a given species or species group encounters oil at sea; the actual amount does not matter. For this reason, we used the same scores as used by Williams *et al.* (1994), but re-scaled them to range between 0.2 and 1.0, and these scores are given in Table B3.

Table B3 Sensitivity scores for each species and species group for proportion of beached birds contaminated with oil (after Williams *et al.* 1994).

Species/species group	Scientific name	SOSI score
Red-throated diver	*Gavia stellata*	1
Black-throated diver	*Gavia arctica*	1
Great northern diver	*Gavia immer*	1
Diver sp.	*Gavia sp.*	1
Great crested grebe	*Podiceps cristatus*	0.6
Red-necked grebe	*Podiceps grisegena*	0.6
Slavonian grebe	*Podiceps auritus*	0.6
Grebe sp.	*Podiceps sp.*	0.6
Northern fulmar	*Fulmarus glacialis*	0.6
Cory's shearwater	*Calonectris diomedea*	0.6

Species/species group	Scientific name	SOSI score
Great shearwater	*Puffinus gravis*	0.6
Sooty shearwater	*Puffinus griseus*	0.6
Manx shearwater	*Puffinus puffinus*	0.6
Balearic shearwater	*Puffinus mauretanicus*	0.6
Shearwater sp.	*Puffinus sp.*	0.6
European storm-petrel	*Hydrobates pelagicus*	0.2
Leach's storm-petrel	*Oceanodroma leucorhoa*	0.2
Northern gannet	*Morus bassanus*	0.6
Great cormorant	*Phalacrocorax carbo*	0.6
European shag	*Phalacrocorax aristotelis*	0.8
Cormorant sp.	*Phalacrocorax sp.*	0.8
Greater scaup	*Aythya marila*	0.4
Common eider	*Somateria mollissima*	0.6
Long-tailed duck	*Clangula hyemalis*	0.6
Common scoter	*Melanitta nigra*	0.8
Scoter sp.	*Melanitta spec.*	0.8
Velvet scoter	*Melanitta fusca*	0.8
Common goldeneye	*Bucephala clangula*	0.6
Red-breasted merganser	*Mergus serrator*	0.4
Goosander	*Mergus merganser*	0.6
Duck sp.	*Anatidae sp.*	0.6
Grey phalarope	*Phalaropus fulicaria*	0.2
Pomarine skua	*Stercorarius pomarinus*	0.4
Arctic skua	*Stercorarius parasiticus*	0.4
Long-tailed skua	*Stercorarius longicaudus*	0.4
Great skua	*Stercorarius skua*	0.6
Skua sp.	*Stercorarius sp.*	0.4
Mediterranean gull	*Larus melanocephalus*	0.4
Little gull	*Hydrocoloeus minutus*	0.4
Sabine's gull	*Xema sabini*	0.4
Black-headed gull	*Chroicocephalus ridibundus*	0.4
Common gull	*Larus canus*	0.4
Small gull sp.	*Larus/Rissa sp.*	0.4
Lesser black-backed gull	*Larus fuscus*	0.4
Herring/lesser black-back	*L. fuscus/L. argentatus*	0.4
Herring gull	*Larus argentatus*	0.4
Glaucous gull	*Larus hyperboreus*	0.4
Great black-backed gull	*Larus marinus*	0.4
Large gull sp.	*Larus sp.*	0.4
Black-backed gull sp.	*L. fuscus/L. marinus*	0.4

Species/species group	Scientific name	SOSI score
Black-legged kittiwake	*Rissa tridactyla*	0.4
Gull sp.	*Larus sp.*	0.4
Sandwich tern	*Sterna sandvicensis*	0.2
Roseate tern	*Sterna dougallii*	0.2
Common tern	*Sterna hirundo*	0.2
Arctic tern	*Sterna paradisaea*	0.2
Common/Arctic tern	*S. hirundo/S. paradisaea*	0.2
Little tern	*Sterna albifrons*	0.2
Black tern	*Chlidonias niger*	0.2
Tern sp.	*Sterna sp.*	0.2
Common guillemot	*Uria aalge*	1
Guillemot/razorbill	*Alca torda/Uria aalge*	1
Razorbill	*Alca torda*	1
Black guillemot	*Cepphus grylle*	1
Little auk	*Alle alle*	1
Atlantic puffin	*Fratercula arctica*	1
Auk sp.	*Alcidae sp.*	1

1.3 Habitat flexibility (F_3)

4 The range of alternative places in which a species could feed in the event of an oil spillage would affect the ability of a species to adapt to what would in effect be a displacement event following an oil spillage. We have used this in preference to Williams *et al.* (1994) use of a factor described as reliance on the marine environment, which is too narrow in its scope. Furness *et al.* (2013) also used this factor in their assessment of sensitivity to wind farms. We have used the same values as Furness *et al.* (2013), and these are presented in Table B4.

Table B4 **Sensitivity scores for species ability to exploit alternative feeding locations in the event of an oil spillage (habitat flexibility), after Furness *et al.* (2013).**

Species/species group	Scientific name	SOSI Habitat flexibility
Red-throated diver	*Gavia stellata*	0.8
Black-throated diver	*Gavia arctica*	0.8
Great northern diver	*Gavia immer*	1
Diver sp.	*Gavia sp.*	0.8
Great crested grebe	*Podiceps cristatus*	0.8
Red-necked grebe	*Podiceps grisegena*	0.8
Slavonian grebe	*Podiceps auritus*	0.8
Grebe sp.	*Podiceps sp.*	0.8
Northern fulmar	*Fulmarus glacialis*	0.2
Cory's shearwater	*Calonectris diomedea*	0.2
Great shearwater	*Puffinus gravis*	0.2
Sooty shearwater	*Puffinus griseus*	0.2
Manx shearwater	*Puffinus puffinus*	0.2
Balearic shearwater	*Puffinus mauretanicus*	0.2
Shearwater sp.	*Puffinus sp.*	0.2
European storm-petrel	*Hydrobates pelagicus*	0.2
Leach's storm-petrel	*Oceanodroma leucorhoa*	0.2
Northern gannet	*Morus bassanus*	0.2
Great cormorant	*Phalacrocorax carbo*	0.6
European shag	*Phalacrocorax aristotelis*	0.6
Cormorant sp.	*Phalacrocorax sp.*	0.6
Greater scaup	*Aythya marila*	0.8
Common eider	*Somateria mollissima*	0.8
Long-tailed duck	*Clangula hyemalis*	0.8
Common scoter	*Melanitta nigra*	0.8
Scoter sp.	*Melanitta spec.*	0.8
Velvet scoter	*Melanitta fusca*	0.6
Common goldeneye	*Bucephala clangula*	0.8
Red-breasted merganser	*Mergus serrator*	0.6
Goosander	*Mergus merganser*	0.8
Duck sp.	*Anatidae sp.*	0.6
Grey phalarope	*Phalaropus fulicaria*	0.2
Pomarine skua	*Stercorarius pomarinus*	0.4
Arctic skua	*Stercorarius parasiticus*	0.4
Long-tailed skua	*Stercorarius longicaudus*	0.4
Great skua	*Stercorarius skua*	0.4
Skua sp.	*Stercorarius sp.*	0.4

Species/species group	Scientific name	SOSI Habitat flexibility
Mediterranean gull	*Larus melanocephalus*	0.4
Little gull	*Hydrocoloeus minutus*	0.2
Sabine's gull	*Xema sabini*	0.2
Black-headed gull	*Chroicocephalus ridibundus*	0.4
Common gull	*Larus canus*	0.4
Small gull sp.	*Larus/Rissa sp.*	0.2
Lesser black-backed gull	*Larus fuscus*	0.2
Herring gull	*Larus argentatus*	0.2
Glaucous gull	*Larus hyperboreus*	0.2
Great black-backed gull	*Larus marinus*	0.4
Large gull sp.	*Larus sp.*	0.2
Black-backed gull sp.	*L. fuscus/L. marinus*	0.2
Black-legged kittiwake	*Rissa tridactyla*	0.4
Gull sp.	*Larus sp.*	0.2
Sandwich tern	*Sterna sandvicensis*	0.6
Roseate tern	*Sterna dougallii*	0.6
Common tern	*Sterna hirundo*	0.6
Arctic tern	*Sterna paradisaea*	0.6
Common/Arctic tern	*S. hirundo/S. paradisaea*	0.6
Little tern	*Sterna albifrons*	0.8
Black tern	*Chlidonias niger*	0.2
Tern sp.	*Sterna sp.*	0.6
Common guillemot	*Uria aalge*	0.6
Guillemot/razorbill	*Alca torda/Uria aalge*	0.6
Razorbill	*Alca torda*	0.6
Black guillemot	*Cepphus grylle*	0.8
Little auk	*Alle alle*	0.4
Atlantic puffin	*Fratercula arctica*	0.6
Auk sp.	*Alcidae sp.*	0.6

1.4 Percentage of biogeographical population in UKCS (F_4)

5 The importance of the UKCS as a percentage of the biogeographical population affects the impact of a mortality incident on the population of a species as a whole. For some species, there are considerable differences in the percentage between the winter and the summer. These data were sourced from Musgrove *et al.* (2013), Mitchell *et al.* (2004) and Wetlands International (2012) and where data were not available, from Kober *et al.* (2010) or by judgement in the case of species groups. The range of percentages of the biogeographical population and the SOSI scores for this factor are presented in Table B5, and the individual percentages and the SOSI scores for each species for winter and summer are presented in Table B6.

Table B5 SOSI scoring applied to different ranges of the UK population as a percentage of the biogeographical population used in Table B6 for Factor 4.

Lower limit of percentage biogeographical population	Upper limit of percentage biogeographical population	SOSI Score
0.00%	1.00%	0.2
1.01%	10.00%	0.4
10.01%	25.00%	0.6
25.01%	50.00%	0.8
50.01%	100.00%	1

Table B6 Percentage of biogeographical population present in UKCS in winter and summer and associated SOSI Scores.

Species/species group	Scientific name	% winter	SOSI % winter	% summer	SOSI % summer
Red-throated diver	*Gavia stellata*	5.67%	0.4	1.30%	0.4
Black-throated diver	*Gavia arctica*	0.15%	0.2	0.18%	0.2
Great northern diver	*Gavia immer*	50.00%	1	0.00%	0.2
Diver sp.	*Gavia sp.*	-	0.6	-	0.2
Great crested grebe	*Podiceps cristatus*	6.48%	0.4	4.42%	0.4
Red-necked grebe	*Podiceps grisegena*	0.05%	0.2	0.00%	0.2
Slavonian grebe	*Podiceps auritus*	1.93%	0.4	1.50%	0.4
Grebe sp.	*Podiceps sp.*	-	0.2	-	0.4
Northern fulmar	*Fulmarus glacialis*	-	0.2	14.80%	0.6
Cory's shearwater	*Calonectris diomedea*	-	0.2	0.00%	0.2
Great shearwater	*Puffinus gravis*	-	0.2	0.00%	0.2
Sooty shearwater	*Puffinus griseus*	-	0.2	0.00%	0.2
Manx shearwater	*Puffinus puffinus*	-	0.2	79.90%	1
Balearic shearwater	*Puffinus mauretanicus*	-	0.2	-	0.2
Shearwater sp.	*Puffinus sp.*	-	0.2	-	0.6
European storm-petrel	*Hydrobates pelagicus*	-	0.2	5.20%	0.4
Leach's storm-petrel	*Oceanodroma leucorhoa*	-	0.2	0.90%	0.2
Northern gannet	*Morus bassanus*	-	0.2	55.60%	1
Great cormorant	*Phalacrocorax carbo*	34.17%	0.8	2.40%	0.4
European shag	*Phalacrocorax aristotelis*	54.46%	1	38.30%	0.8
Cormorant sp.	*Phalacrocorax sp.*	-	0.8	-	0.6
Greater scaup	*Aythya marila*	3.87%	0.4	0.00%	0.2
Common eider	*Somateria mollissima*	7.41%	0.4	9.00%	0.4
Long-tailed duck	*Clangula hyemalis*	0.23%	0.2	0.00%	0.2
Common scoter	*Melanitta nigra*	6.25%	0.4	0.01%	0.2
Scoter sp.	*Melanitta spec.*	-	0.4	-	0.2

Species/species group	Scientific name	% winter	SOSI % winter	% summer	SOSI % summer
Velvet scoter	*Melanitta fusca*	0.25%	0.2	0.00%	0.2
Common goldeneye	*Bucephala clangula*	2.35%	0.4	0.06%	0.2
Red-breasted merganser	*Mergus serrator*	5.29%	0.4	4.00%	0.4
Goosander	*Mergus merganser*	4.51%	0.4	3.89%	0.4
Duck sp.	*Anatidae sp.*	0.00%	0.4	-	0.2
Grey phalarope	*Phalaropus fulicaria*	0.05%	0.2	0.01%	0.2
Pomarine skua	*Stercorarius pomarinus*	-	0.2	0.00%	0.2
Arctic skua	*Stercorarius parasiticus*	-	0.2	8.40%	0.4
Long-tailed skua	*Stercorarius longicaudus*	-	0.2	0.00%	0.2
Great skua	*Stercorarius skua*	-	0.4	60.00%	1
Skua sp.	*Stercorarius sp.*	-	0.2	-	0.4
Mediterranean gull	*Larus melanocephalus*	0.00%	0.2	0.10%	0.2
Little gull	*Hydrocoloeus minutus*	13.01%	0.6	0.00%	0.2
Sabine's gull	*Xema sabini*	0.00%	0.2	0.01%	0.2
Black-headed gull	*Chroicocephalus ridibundus*	51.76%	1	5.60%	0.4
Common gull	*Larus canus*	40.57%	0.8	9.30%	0.4
Small gull sp.	*Larus/Rissa sp.*	-	0.6	-	0.2
Lesser black-backed gull	*Larus fuscus*	23.64%	0.6	62.60%	1
Herring gull	*Larus argentatus*	22.84%	0.6	18.50%	0.6
Glaucous gull	*Larus hyperboreus*	0.00%	0.2	0.00%	0.2
Great black-backed gull	*Larus marinus*	17.47%	0.6	16.00%	0.6
Large gull sp.	*Larus sp.*	-	0.6	-	0.6
Black-backed gull sp.	*L. fuscus/L. marinus*	-	0.6	-	0.6
Black-legged kittiwake	*Rissa tridactyla*	-	0.2	13.80%	0.6
Gull sp.	*Larus sp.*	-	0.4	-	0.4
Sandwich tern	*Sterna sandvicensis*	0.00%	0.2	16.90%	0.6
Roseate tern	*Sterna dougallii*	0.00%	0.2	2.60%	0.4
Common tern	*Sterna hirundo*	0.00%	0.2	4.20%	0.4
Arctic tern	*Sterna paradisaea*	0.00%	0.2	4.70%	0.4
Common/Arctic tern	*S. hirundo/S. paradisaea*	0.00%	0.2	-	0.4
Little tern	*Sterna albifrons*	0.00%	0.2	9.70%	0.4
Black tern	*Chlidonias niger*	0.00%	0.2	0.00%	0.2
Tern sp.	*Sterna sp.*	0.00%	0.2	0.00%	0.2
Common guillemot	*Uria aalge*	-	0.4	33.30%	0.8
Guillemot/razorbill	*Alca torda/Uria aalge*	-	0.2	-	0.8
Razorbill	*Alca torda*	-	0.2	23.60%	0.6
Black guillemot	*Cepphus grylle*	-	0.2	5.80%	0.2
Little auk	*Alle alle*	-	0.2	0.00%	0.2

Species/species group	Scientific name	% winter	SOSI % winter	% summer	SOSI % summer
Atlantic puffin	*Fratercula arctica*	-	0.2	9.60%	0.4
Auk sp.	*Alcidae sp.*	-	0.2	-	0.4

1.5 Listing in Birds of Conservation Concern (F_5) and on EU Birds Directive Annexes (F_6)

6 The listing of bird species in Birds of Conservation Concern 2 ("BOCC 2"), BOCC 3 (Eaton *et al.* 2009) and the most recent, BOCC 4 (Eaton *et al.* 2015) represents the status of birds species in the UK assessed using multiple factors, with particular focus on whether numbers are increasing or declining. Furness *et al.* (2013) used the presence of seabird species on one or both of the first two of these lists as an index of the threats faced by them. We adapted their rules to introduce the most recent assessment of conservation concern for birds in the UK and by altering the range of SOSI values to range between 0 and 1 instead of 0 and 5 in Table B7. Seabird species' presence on annexes to the EU Birds Directives is a measure of their importance to the European Community. We have followed Furness *et al.* (2013) in giving species listed in Annex 1 of the Directive a value of 1, those listed as migratory species a value of 0.6 and those not on either list a value of 0.2. Individual species scores for their listing on BOCC and on the EU Birds Directive are set out in Table B8.

Table B7 **SOSI scoring applied to different combinations of status levels on BOCC 2, BOCC 3 and BOCC 4 as used in Table B8 for Factor 5.**

Species status on BOCC 2, 3 and 4	SOSI Score
Green status on all three lists	0.2
Green on BOCC 4 but Amber in either BOCC 2 or BOCC 3	0.4
Amber on BOCC 4 but Green on both BOCC 2 and BOCC 3	0.6
Amber on BOCC 4 and Amber on either BOCC 2 or BOCC 3	0.8
Red on BOCC 4	1

Table B8 Conservation importance scores for species and species groups by listing in Birds of Conservation Concern ("BOCC") and on EU Birds Directive annexes.

Species/species group	Scientific name	BOCC 2	BOCC 3	BOCC 4	SOSI BOCC (F_5)	SOSI Birds Directive (F_6)
Red-throated diver	*Gavia stellata*	Amber	Amber	Green	0.4	1
Black-throated diver	*Gavia arctica*	Amber	Amber	Amber	0.8	1
Great northern diver	*Gavia immer*	Amber	Amber	Amber	0.8	1
Diver sp.	*Gavia sp.*	Amber	Amber	Amber	0.8	1
Great crested grebe	*Podiceps cristatus*	Green	Green	Green	0.2	0.6
Red-necked grebe	*Podiceps grisegena*	Amber	Amber	Red	1	0.6
Slavonian grebe	*Podiceps auritus*	Amber	Amber	Red	1	1
Grebe sp.	*Podiceps sp.*	Green	Green	Amber	0.6	0.6

Species/species group	Scientific name	BOCC 2	BOCC 3	BOCC 4	SOSI BOCC (F_5)	SOSI Birds Directive (F_6)
Northern fulmar	*Fulmarus glacialis*	Amber	Amber	Amber	0.8	0.6
Cory's shearwater	*Calonectris diomedea*	Green	Green	Green	0.2	1
Great shearwater	*Puffinus gravis*	Green	Green	Green	0.2	1
Sooty shearwater	*Puffinus griseus*	Green	Amber	Green	0.4	0.6
Manx shearwater	*Puffinus puffinus*	Amber	Amber	Amber	0.8	0.6
Balearic shearwater	*Puffinus mauretanicus*	N/A	Red	Red	1	1
Shearwater sp.	*Puffinus sp.*	Amber	Amber	Amber	0.8	0.6
European storm-petrel	*Hydrobates pelagicus*	Amber	Amber	Amber	0.8	1
Leach's storm-petrel	*Oceanodroma leucorhoa*	Amber	Amber	Amber	0.8	1
Northern gannet	*Morus bassanus*	Amber	Amber	Amber	0.8	0.6
Great cormorant	*Phalacrocorax carbo*	Amber	Green	Green	0.4	0.6
European shag	*Phalacrocorax aristotelis*	Amber	Amber	Red	1	0.6
Cormorant sp.	*Phalacrocorax sp.*	Amber	Amber	Amber	0.8	0.6
Greater scaup	*Aythya marila*	Amber	Red	Red	1	0.6
Common eider	*Somateria mollissima*	Amber	Amber	Amber	0.8	0.6
Long-tailed duck	*Clangula hyemalis*	Amber	Green	Red	1	0.6
Common scoter	*Melanitta nigra*	Red	Red	Red	1	0.6
Scoter sp.	*Melanitta spec.*	Red	Red	Red	1	0.6
Velvet scoter	*Melanitta fusca*	Amber	Amber	Red	1	0.6
Common goldeneye	*Bucephala clangula*	Amber	Amber	Amber	0.8	0.6
Red-breasted merganser	*Mergus serrator*	Green	Green	Green	0.2	0.6
Goosander	*Mergus merganser*	Green	Green	Green	0.2	0.6
Duck sp.	*Anatidae sp.*	Amber	Amber	Red	0.6	0.6
Grey phalarope	*Phalaropus fulicaria*	Green	Green	Green	0.2	0.6
Pomarine skua	*Stercorarius pomarinus*	Green	Green	Green	0.2	0.6
Arctic skua	*Stercorarius parasiticus*	Green	Red	Red	1	0.6
Long-tailed skua	*Stercorarius longicaudus*	Green	Green	Green	0.2	0.6
Great skua	*Stercorarius skua*	Amber	Amber	Amber	0.8	0.6
Skua sp.	*Stercorarius sp.*	Green	Amber	Amber	0.8	0.6
Mediterranean gull	*Larus melanocephalus*	Amber	Amber	Amber	0.8	1
Little gull	*Hydrocoloeus minutus*	Green	Amber	Green	0.4	1
Sabine's gull	*Xema sabini*	Green	Green	Green	0.2	0.6
Black-headed gull	*Chroicocephalus ridibundus*	Amber	Amber	Amber	0.8	0.6
Common gull	*Larus canus*	Amber	Amber	Amber	0.8	0.6
Small gull sp.	*Larus/Rissa sp.*	Amber	Amber	Amber	0.8	0.6

Species/species group	Scientific name	BOCC 2	BOCC 3	BOCC 4	SOSI BOCC (F_5)	SOSI Birds Directive (F_6)
Lesser black-backed gull	*Larus fuscus*	Amber	Amber	Amber	0.8	0.6
Herring gull	*Larus argentatus*	Amber	Red	Red	1	0.6
Glaucous gull	*Larus hyperboreus*	Green	Amber	Amber	0.8	0.6
Great black-backed gull	*Larus marinus*	Green	Amber	Amber	0.8	0.6
Large gull sp.	*Larus sp.*	Amber	Amber	Amber	0.8	0.6
Black-backed gull sp.	*L. fuscus/L. marinus*	Amber	Amber	Amber	0.8	0.6
Black-legged kittiwake	*Rissa tridactyla*	Amber	Amber	Red	1	0.6
Gull sp.	*Larus sp.*	Amber	Amber	Amber	0.8	0.6
Sandwich tern	*Sterna sandvicensis*	Amber	Amber	Amber	0.8	1
Roseate tern	*Sterna dougallii*	Red	Red	Red	1	1
Common tern	*Sterna hirundo*	Green	Amber	Amber	0.8	1
Arctic tern	*Sterna paradisaea*	Amber	Amber	Amber	0.8	1
Common/Arctic tern	*S. hirundo/S. paradisaea*	Green	Amber	Amber	0.8	1
Little tern	*Sterna albifrons*	Amber	Amber	Amber	0.8	1
Black tern	*Chlidonias niger*	Green	Amber	Green	0.4	1
Tern sp.	*Sterna sp.*	Amber	Amber	Amber	0.8	1
Common guillemot	*Uria aalge*	Amber	Amber	Amber	0.8	0.6
Guillemot/razorbill	*Alca torda/Uria aalge*	Amber	Amber	Amber	0.8	0.6
Razorbill	*Alca torda*	Amber	Amber	Amber	0.8	0.6
Black guillemot	*Cepphus grylle*	Amber	Amber	Amber	0.8	0.2
Little auk	*Alle alle*	Green	Green	Green	0.2	0.6
Atlantic puffin	*Fratercula arctica*	Amber	Amber	Red	1	0.6
Auk sp.	*Alcidae sp.*	Amber	Amber	Amber	0.8	0.6

1.6 Potential annual productivity (F_7)

7 The speed with which a species can recover from a significant mortality incident relates to its annual fecundity and the age at which the species first breeds. This factor was used by Williams *et al.* (1994) and we updated the individual scores using more recent information where available. The scores used were a composite of the species maximum and mean clutch size (all seabird species only produce one clutch or replacement clutch per year) and their age at first breeding. Those species which produce large clutches of eggs are able potentially to increase their population size more rapidly than those with small clutch sizes. Species with a long period of immaturity also exhibit slow increases in their population size when undergoing expansion than species with relatively short periods of immaturity. The method for scoring these three components of potential annual productivity are listed in Table B9; as with other factor scores, the values of these ranged between 0 and 1 instead of the range of 0 to 5 used by Williams *et al.* (1994). Mean and maximum clutch size was sourced from Horswill and Robinson (2015), and where not listed for a given species from Cramp and Simmons (1977) and Cramp (1985). Age of first breeding was obtained

from Horswill and Robinson (2015), Cramp and Simmons (1977), Cramp and Simmons (1983) and Cramp (1985).

Table B9 **Mean and maximum clutch size and age of first breeding scoring method and the method for calculating the method for calculating potential annual productivity SOSI scores in Table B10 (after Williams *et al.* 1994).**

Mean clutch size (i)	Maximum clutch size (ii)	Age of first breeding (iii)	Score	Sum (i, ii and iii)	SOSI Score (F_7)
6 +	8 +	1 – 2	1	≤ 4	0.2
4 – 5	6 – 7	3	2	5 – 6	0.4
3	4 – 5	4	3	7 – 8	0.6
2	2 – 3	5	4	9 – 11	0.8
1	1	6 +	5	12 – 15	1

Table B10 **Potential annual productivity and SOSI scores of seabird species and species groups.**

Species/species group	Scientific name	Potential annual productivity score	SOSI Score (F_7)
Red-throated diver	*Gavia stellata*	10	0.8
Black-throated diver	*Gavia arctica*	10	0.8
Great northern diver	*Gavia immer*	13	1
Diver sp.	*Gavia sp.*	11	0.8
Great crested grebe	*Podiceps cristatus*	5	0.4
Red-necked grebe	*Podiceps grisegena*	6	0.4
Slavonian grebe	*Podiceps auritus*	6	0.6
Grebe sp.	*Podiceps sp.*	7	0.6
Northern fulmar	*Fulmarus glacialis*	15	1
Cory's shearwater	*Calonectris diomedea*	14	1
Great shearwater	*Puffinus gravis*	14	1
Sooty shearwater	*Puffinus griseus*	14	1
Manx shearwater	*Puffinus puffinus*	14	1
Balearic shearwater	*Puffinus mauretanicus*	14	1
Shearwater sp.	*Puffinus sp.*	14	1
European storm-petrel	*Hydrobates pelagicus*	14	1
Leach's storm-petrel	*Oceanodroma leucorhoa*	14	1
Northern gannet	*Morus bassanus*	14	1
Great cormorant	*Phalacrocorax carbo*	6	0.6
European shag	*Phalacrocorax aristotelis*	7	0.6
Cormorant sp.	*Phalacrocorax sp.*	7	0.6
Greater scaup	*Aythya marila*	3	0.2
Common eider	*Somateria mollissima*	5	0.4

Species/species group	Scientific name	Potential annual productivity score	SOSI Score (F_7)
Long-tailed duck	*Clangula hyemalis*	3	0.2
Common scoter	*Melanitta nigra*	4	0.2
Scoter sp.	*Melanitta spec.*	4	0.2
Velvet scoter	*Melanitta fusca*	3	0.2
Common goldeneye	*Bucephala clangula*	4	0.2
Red-breasted merganser	*Mergus serrator*	4	0.2
Goosander	*Mergus merganser*	4	0.2
Duck sp.	*Anatidae sp.*	4	0.2
Grey phalarope	*Phalaropus fulicaria*	5	0.4
Pomarine skua	*Stercorarius pomarinus*	10	0.8
Arctic skua	*Stercorarius parasiticus*	11	0.8
Long-tailed skua	*Stercorarius longicaudus*	11	0.8
Great skua	*Stercorarius skua*	13	1
Skua sp.	*Stercorarius sp.*	12	1
Mediterranean gull	*Larus melanocephalus*	9	0.8
Little gull	*Hydrocoloeus minutus*	8	0.8
Sabine's gull	*Xema sabini*	8	0.8
Black-headed gull	*Chroicocephalus ridibundus*	8	0.8
Common gull	*Larus canus*	9	0.8
Small gull sp.	*Larus/Rissa sp.*	8.5	0.8
Lesser black-backed gull	*Larus fuscus*	10	0.8
Herring gull	*Larus argentatus*	10	0.8
Glaucous gull	*Larus hyperboreus*	10	0.8
Great black-backed gull	*Larus marinus*	10	0.8
Large gull sp.	*Larus sp.*	10	0.8
Black-backed gull sp.	*L. fuscus/L. marinus*	10	0.8
Black-legged kittiwake	*Rissa tridactyla*	10	0.8
Gull sp.	*Larus sp.*	10.5	0.8
Sandwich tern	*Sterna sandvicensis*	10	0.8
Roseate tern	*Sterna dougallii*	10	0.8
Common tern	*Sterna hirundo*	9	0.8
Arctic tern	*Sterna paradisaea*	11	0.8
Common/Arctic tern	*S. hirundo/S. paradisaea*	11	0.8
Little tern	*Sterna albifrons*	9	0.8
Black tern	*Chlidonias niger*	10	0.8
Tern sp.	*Sterna sp.*	11	0.8
Common guillemot	*Uria aalge*	14	1
Guillemot/razorbill	*Alca torda/Uria aalge*	14	1

Species/species group	Scientific name	Potential annual productivity score	SOSI Score (F_7)
Razorbill	*Alca torda*	13	1
Black guillemot	*Cepphus grylle*	12	1
Little auk	*Alle alle*	12	1
Atlantic puffin	*Fratercula arctica*	14	1
Auk sp.	*Alcidae sp.*	14	1

1.7 Adult survival rate (F_8)

8 Adult mortality of most seabird species is generally low, and an oiling incident will have a disproportionate impact on those species with the highest adult survival rates. Data on adult survival rates were sourced mainly from Horswill and Robinson (2015), but where not available from Rodewald (2015) (Table B11). The same factor was used by both Garthe and Hüppop (2004) and Furness *et al.* (2013) and we followed the same banding as they did, only our values ranged between 0 and 1 instead of their range of 0 – 5.

Table B11 **Adult survival rate and SOSI Score for seabird species and species groups. Where no adult survival rate was available in the published literature, a score was estimated from related species for which there were published survival rates.**

Species/species group	Scientific name	Adult survival rate	SOSI score
Red-throated diver	*Gavia stellata*	0.84	0.6
Black-throated diver	*Gavia arctica*	0.817	0.6
Great northern diver	*Gavia immer*	0.87	0.8
Diver sp.	*Gavia sp.*	-	0.8
Great crested grebe	*Podiceps cristatus*	0.725	0.2
Red-necked grebe	*Podiceps grisegena*	0.7	0.2
Slavonian grebe	*Podiceps auritus*	0.65	0.2
Grebe sp.	*Podiceps sp.*	0.7	0.2
Northern fulmar	*Fulmarus glacialis*	0.936	1
Cory's shearwater	*Calonectris diomedea*	0.92	1
Great shearwater	*Puffinus gravis*	0.9	1
Sooty shearwater	*Puffinus griseus*	0.9	1
Manx shearwater	*Puffinus puffinus*	0.87	0.8
Balearic shearwater	*Puffinus mauretanicus*	-	1
Shearwater sp.	*Puffinus sp.*	-	1
European storm-petrel	*Hydrobates pelagicus*	0.90	1
Leach's storm-petrel	*Oceanodroma leucorhoa*	0.90	1
Northern gannet	*Morus bassanus*	0.92	1
Great cormorant	*Phalacrocorax carbo*	0.87	0.8
European shag	*Phalacrocorax aristotelis*	0.86	0.8
Cormorant sp.	*Phalacrocorax sp.*	-	0.8

Species/species group	Scientific name	Adult survival rate	SOSI score
Greater scaup	*Aythya marila*	0.81	0.6
Common eider	*Somateria mollissima*	0.89	0.8
Long-tailed duck	*Clangula hyemalis*	0.73	0.2
Common scoter	*Melanitta nigra*	0.79	0.4
Scoter sp.	*Melanitta spec.*	-	0.4
Velvet scoter	*Melanitta fusca*	0.77	0.4
Common goldeneye	*Bucephala clangula*	0.77	0.4
Red-breasted merganser	*Mergus serrator*	0.81	0.6
Goosander	*Mergus merganser*	0.61	0.2
Duck sp.	*Anatidae sp.*	-	0.4
Grey phalarope	*Phalaropus fulicaria*	0.92	1
Pomarine skua	*Stercorarius pomarinus*	0.91	1
Arctic skua	*Stercorarius parasiticus*	0.91	1
Long-tailed skua	*Stercorarius longicaudus*	0.95	1
Great skua	*Stercorarius skua*	0.88	0.8
Skua sp.	*Stercorarius sp.*	-	1
Mediterranean gull	*Larus melanocephalus*	-	0.6
Little gull	*Hydrocoloeus minutus*	0.80	0.6
Sabine's gull	*Xema sabini*	0.89	0.8
Black-headed gull	*Chroicocephalus ridibundus*	0.83	0.6
Common gull	*Larus canus*	0.83	0.6
Small gull sp.	*Larus/Rissa sp.*	-	0.6
Lesser black-backed gull	*Larus fuscus*	0.89	0.8
Herring gull	*Larus argentatus*	0.83	0.6
Glaucous gull	*Larus hyperboreus*	0.84	0.6
Great black-backed gull	*Larus marinus*	0.93	1
Large gull sp.	*Larus sp.*	-	0.8
Black-backed gull sp.	*L. fuscus/L. marinus*	-	1
Black-legged kittiwake	*Rissa tridactyla*	0.85	0.8
Gull sp.	*Larus sp.*	-	0.8
Sandwich tern	*Sterna sandvicensis*	0.90	0.8
Roseate tern	*Sterna dougallii*	0.86	0.8
Common tern	*Sterna hirundo*	0.88	0.8
Arctic tern	*Sterna paradisaea*	0.84	0.6
Common/Arctic tern	*S. hirundo/S. paradisaea*	-	0.8
Little tern	*Sterna albifrons*	0.80	0.6
Black tern	*Chlidonias niger*	0.75	0.4
Tern sp.	*Sterna sp.*	-	0.8
Common guillemot	*Uria aalge*	0.94	1

Species/species group	Scientific name	Adult survival rate	SOSI score
Guillemot/razorbill	*Alca torda/Uria aalge*	-	1
Razorbill	*Alca torda*	0.90	0.8
Black guillemot	*Cepphus grylle*	0.87	0.8
Little auk	*Alle alle*	0.80	0.6
Atlantic puffin	*Fratercula arctica*	0.91	1
Auk sp.	*Alcidae sp.*	-	1