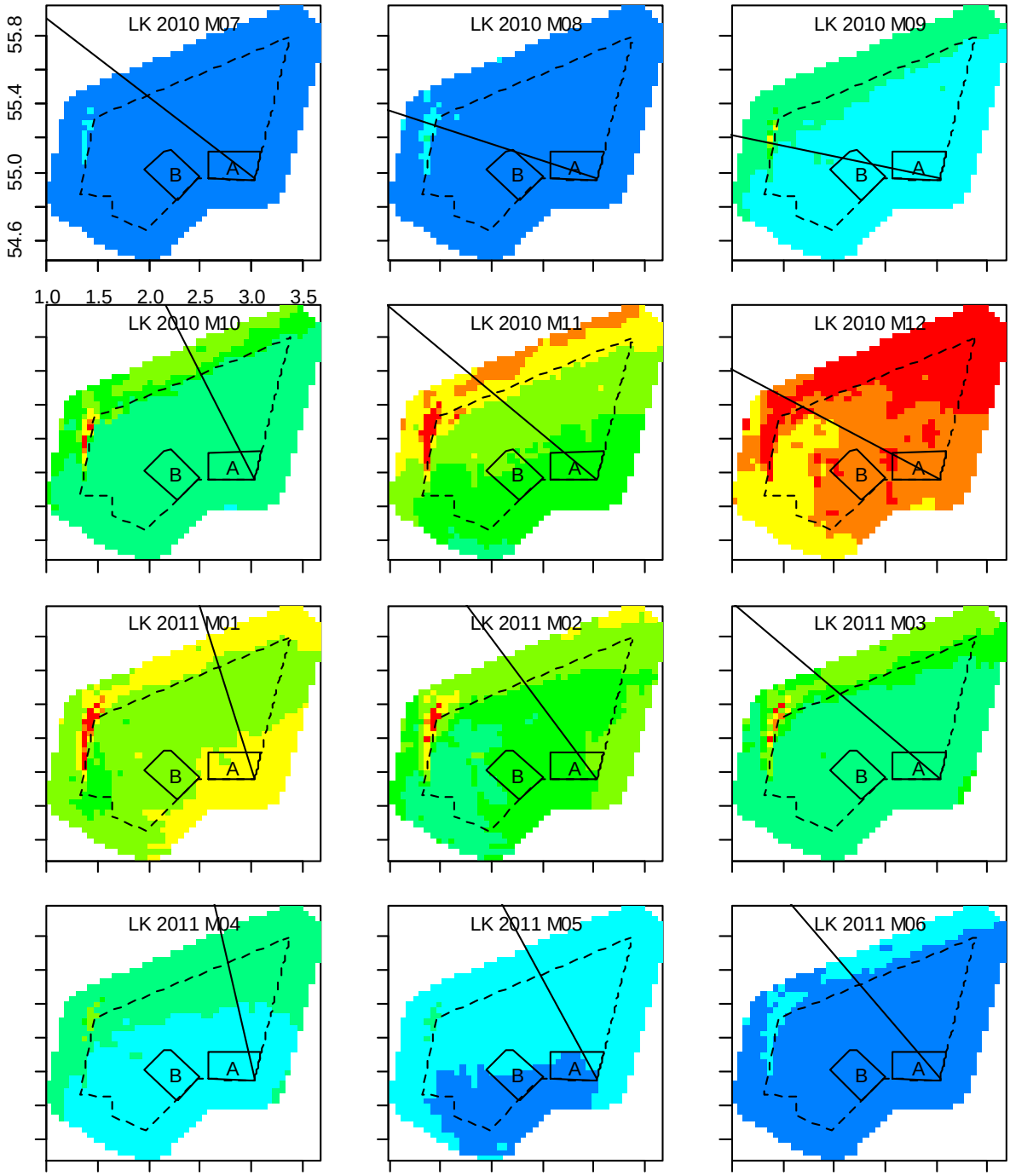

Figure 3.57 Monthly densities of little auk within the Dogger Bank Zone (dashed black outline) and the Dogger Bank Teesside A and B projects (solid black outline) in 2010/11.

Birds / km²
- 0
- 0.002
- 0.118
- 1.945
- 3.964
- 8.441
- 13.016
- > 22.757

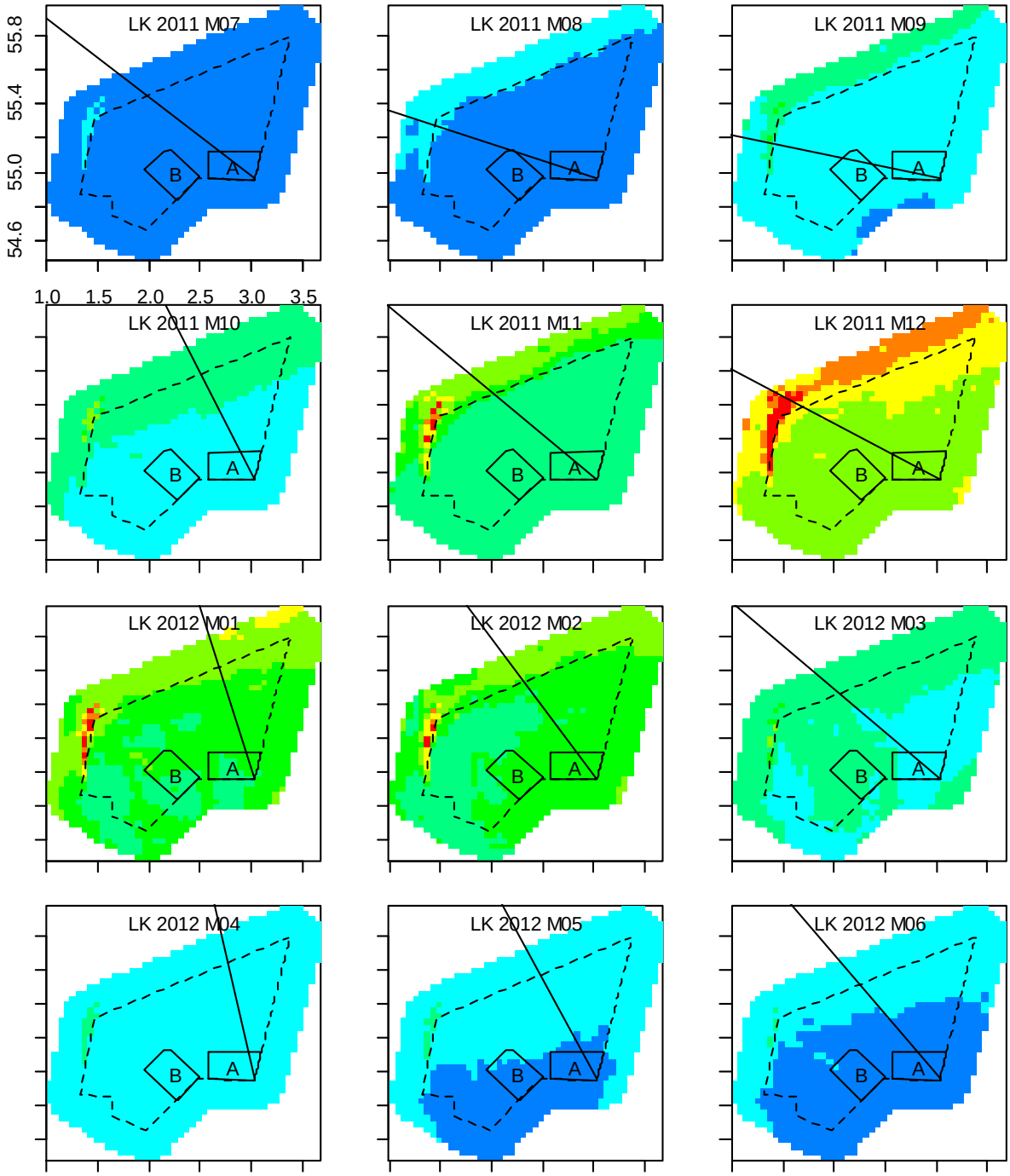

Figure 3.58 Monthly densities of little auk within the Dogger Bank Zone (dashed black outline) and the Dogger Bank Teesside A and B projects (solid black outline) in 2011/12.

Birds / km²
- 0
- 0.002
- 0.118
- 1.945
- 3.964
- 8.441
- 13.016
- > 22.757

Dogger Bank Teesside B

3.2.106 In 2010, the little auk population estimates for Dogger Bank Teesside B began with 1,281 birds (90% CIs = 843-1,934) in January, before decreasing to 55 (90% CIs = 39-82) in March and 0 (90% CIs = 0-1) in June. Little auks came back to the area in September and remained present until December, when the population peaked with 1,965 birds (90% CIs = 1,582-2,628). Similar population trends were predicted for the 2010/11 and 2011/12 periods, with population estimates peaking again in December 2011 (606 birds, 90% CIs = 502-807) (Table 3.38; Figure 3.59). There is no British population estimate for little auk. However, given the numbers estimated, this species is deemed to be of national importance in Dogger Bank Teesside B. (Tables 2.6 and 3.38). Mean populations across the two and a half years of survey peaked in December, with a mean of 1,285 birds (90 % CIs = 1,042-1,717) in the project and 1,721 birds (90% CIs = 1,395-2,301) present in the project and buffer.

3.2.107 The ESAS population estimates for little auk were highest for the combined period of December to January (2,236 birds) and no little auk were recorded in the period of March to September (Table 3.9). Higher winter numbers reflect a similar pattern identified by the baseline monthly population estimates.

Table 3.38 Modelled population estimates (and 90% confidence limits) for little auk for Dogger Bank Teesside B, and the surrounding 0-1km and 1-2km buffers, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

	2010				2010/11			2011/12			Mean			
Month	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**
Jan	1,281 (843-1,934)	215 (142-328)	227 (150-344)	Jul	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-0)	Jul	0 (0-1)	0 (0-0)	0 (0-0)
Feb	329 (240-506)	54 (39-84)	57 (41-87)	Aug	0 (0-1)	0 (0-0)	0 (0-0)	1 (0-1)	0 (0-0)	0 (0-0)	Aug	1 (0-1)	0 (0-0)	0 (0-0)
Mar	55 (39-82)	9 (6-13)	9 (7-14)	Sep	11 (7-18)	2 (1-3)	2 (1-3)	5 (3-8)	1 (0-1)	1 (1-1)	Sep	8 (5-13)	1 (1-2)	1 (1-2)
Apr	4 (3-7)	1 (0-1)	1 (0-1)	Oct	58 (43-83)	10 (7-14)	10 (8-15)	18 (13-26)	3 (2-4)	3 (2-5)	Oct	38 (28-55)	6 (5-9)	7 (5-10)
May	1 (1-2)	0 (0-0)	0 (0-0)	Nov	336 (265-451)	56 (44-76)	59 (47-80)	91 (74-117)	15 (12-19)	16 (13-20)	Nov	213 (169-284)	36 (28-47)	38 (30-50)
Jun	0 (0-1)	0 (0-0)	0 (0-0)	Dec	1,965 (1,582-2,628)	325 (262-437)	342 (275-457)	606 (502-807)	100 (82-132)	105 (87-140)	Dec	1,285 (1,042-1,717)	212 (172-285)	224 (181-299)
Jul	0 (0-0)	0 (0-0)	0 (0-0)	Jan	696 (523-934)	114 (85-153)	121 (90-163)	233 (198-303)	39 (33-50)	41 (35-53)	Jan	737 (521-1057)	123 (87-177)	130 (92-187)
Aug	0 (0-1)	0 (0-0)	0 (0-0)	Feb	256 (201-346)	42 (33-57)	44 (35-60)	244 (168-390)	40 (28-64)	42 (29-67)	Feb	276 (203-414)	45 (33-68)	48 (35-72)
Sep	11 (7-18)	2 (1-3)	2 (1-3)	Mar	160 (122-227)	26 (20-37)	27 (21-39)	34 (19-61)	6 (3-10)	6 (3-11)	Mar	83 (60-124)	13 (10-20)	14 (10-21)
Oct	58 (43-83)	10 (7-14)	10 (8-15)	Apr	17 (12-25)	3 (2-4)	3 (2-4)	4 (2-9)	1 (0-1)	1 (0-2)	Apr	8 (6-14)	1 (1-2)	1 (1-2)
Nov	336 (265-451)	56 (44-76)	59 (47-80)	May	2 (1-4)	0 (0-1)	0 (0-1)	2 (1-5)	0 (0-1)	0 (0-1)	May	2 (1-4)	0 (0-1)	0 (0-1)
Dec	1,965 (1,582-2,628)	325 (262-437)	342 (275-457)	Jun	1 (0-1)	0 (0-0)	0 (0-0)	2 (0-5)	0 (0-1)	0 (0-1)	Jun	1 (0-2)	0 (0-0)	0 (0-0)

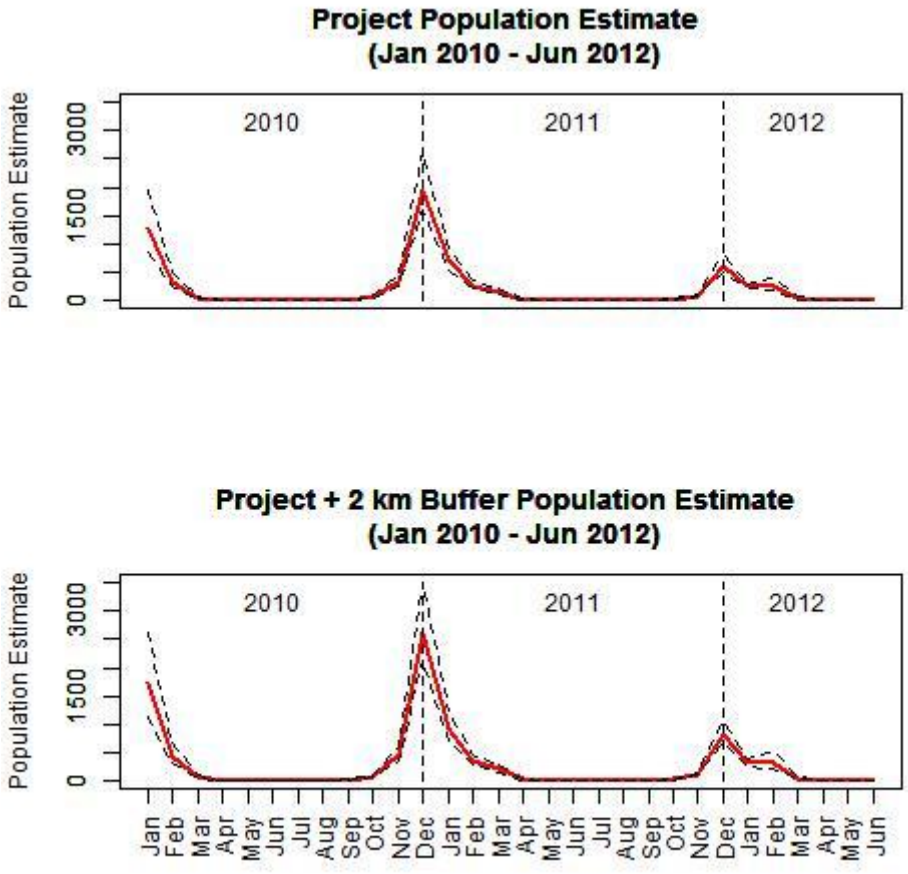

Figure 3.59 Modelled monthly population estimates (and 90% confidence limits) for little auk for the Dogger Bank Teesside B, and the project with a 2km buffer, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

Dogger Bank Teesside A and B

3.2.108 In 2010, the little auk population estimates for Dogger Bank Teesside B began with 2,108 birds (90% CIs = 1,377-3,127) in January, before decreasing to 96 (90% CIs = 68-145) in March and 0 (90% CIs = 0-1) in July. Little auks came back to the area in August and remained present until December, when the population peaked with 3,774 birds (90% CIs = 3,018-5,052). Similar population trends were predicted for the 2010/11 and 2011/12 periods, with population estimates peaking again in December 2011 (1,206 birds, 90% CIs = 992-1,623) (Table 3.39; Figure 3.60). There is no British population estimate for little auk. However, given the numbers estimated, this species is deemed to be of national importance in Dogger Bank Teesside A and B. (Tables 2.6 and 3.39). Mean populations across the two and a half years of survey peaked in December, with a mean of 2,490 birds (90 % CIs = 2,005-3,337) in the project and 3,379 birds (90% CIs = 2,717-4,531) present in the project and buffer.

3.2.109 The ESAS population estimates for little auk were highest for the combined period of December to January (4,347 birds) and no little auk were recorded in the period of March to September (Table 3.9). Higher winter numbers reflect a similar pattern identified by the baseline monthly population estimates.

Table 3.39 Baseline monthly population estimates (and 90% confidence limits) for little auk for Dogger Bank Teesside A and B, and the surrounding 0-1km and 1-2km buffers, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

	2010				2010/11			2011/12			Mean			
Month	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**
Jan	2,108 (1,377-3,127)	366 (240-545)	385 (252-571)	Jul	0 (0-1)	0 (0-0)	0 (0-0)	1 (0-2)	0 (0-0)	0 (0-0)	Jul	1 (0-1)	0 (0-0)	0 (0-0)
Feb	570 (417-871)	99 (72-151)	104 (76-159)	Aug	1 (0-2)	0 (0-0)	0 (0-0)	1 (1-3)	0 (0-0)	0 (0-0)	Aug	1 (1-2)	0 (0-0)	0 (0-0)
Mar	96 (68-145)	17 (12-25)	17 (12-26)	Sep	19 (12-31)	3 (2-6)	4 (2-6)	8 (5-14)	1 (1-2)	2 (1-3)	Sep	14 (9-23)	2 (2-4)	3 (2-4)
Apr	8 (6-14)	1 (1-2)	2 (1-3)	Oct	102 (75-145)	18 (13-26)	19 (14-27)	33 (24-48)	6 (4-8)	6 (4-9)	Oct	67 (50-96)	12 (9-17)	13 (9-18)
May	2 (1-4)	0 (0-1)	0 (0-1)	Nov	615 (486-825)	108 (86-145)	114 (91-153)	168 (136-217)	29 (24-38)	31 (25-40)	Nov	392 (311-521)	69 (55-92)	73 (58-97)
Jun	1 (0-1)	0 (0-0)	0 (0-0)	Dec	3,769 (3,009-5,052)	657 (525-880)	691 (551-923)	1,207 (992-1,623)	211 (173-284)	223 (184-301)	Dec	2,488 (2,000-3,337)	434 (349-582)	457 (368-612)
Jul	0 (0-1)	0 (0-0)	0 (0-0)	Jan	1,512 (1,144-2,023)	264 (200-353)	280 (212-375)	451 (382-587)	79 (67-103)	84 (71-109)	Jan	1,357 (968-1,912)	236 (169-334)	250 (178-352)
Aug	1 (0-2)	0 (0-0)	0 (0-0)	Feb	564 (445-756)	99 (78-133)	105 (83-141)	498 (341-802)	87 (59-140)	92 (63-148)	Feb	544 (401-810)	95 (70-141)	100 (74-149)
Sep	19 (12-31)	3 (2-6)	4 (2-6)	Mar	312 (236-444)	54 (41-77)	58 (43-82)	59 (33-107)	10 (6-18)	11 (6-20)	Mar	156 (112-232)	27 (20-40)	29 (21-43)
Oct	102 (75-145)	18 (13-26)	19 (14-27)	Apr	34 (24-50)	6 (4-9)	6 (5-9)	8 (4-18)	1 (1-3)	1 (1-3)	Apr	17 (11-27)	3 (2-5)	3 (2-5)
Nov	615 (486-825)	108 (86-145)	114 (91-153)	May	5 (3-9)	1 (0-2)	1 (0-2)	4 (2-10)	1 (0-2)	1 (0-2)	May	4 (2-7)	1 (0-1)	1 (0-1)
Dec	3,769 (3,009-5,052)	657 (525-880)	691 (551-923)	Jun	1 (1-3)	0 (0-0)	0 (0-1)	3 (1-10)	1 (0-2)	1 (0-2)	Jun	2 (1-5)	0 (0-1)	0 (0-1)

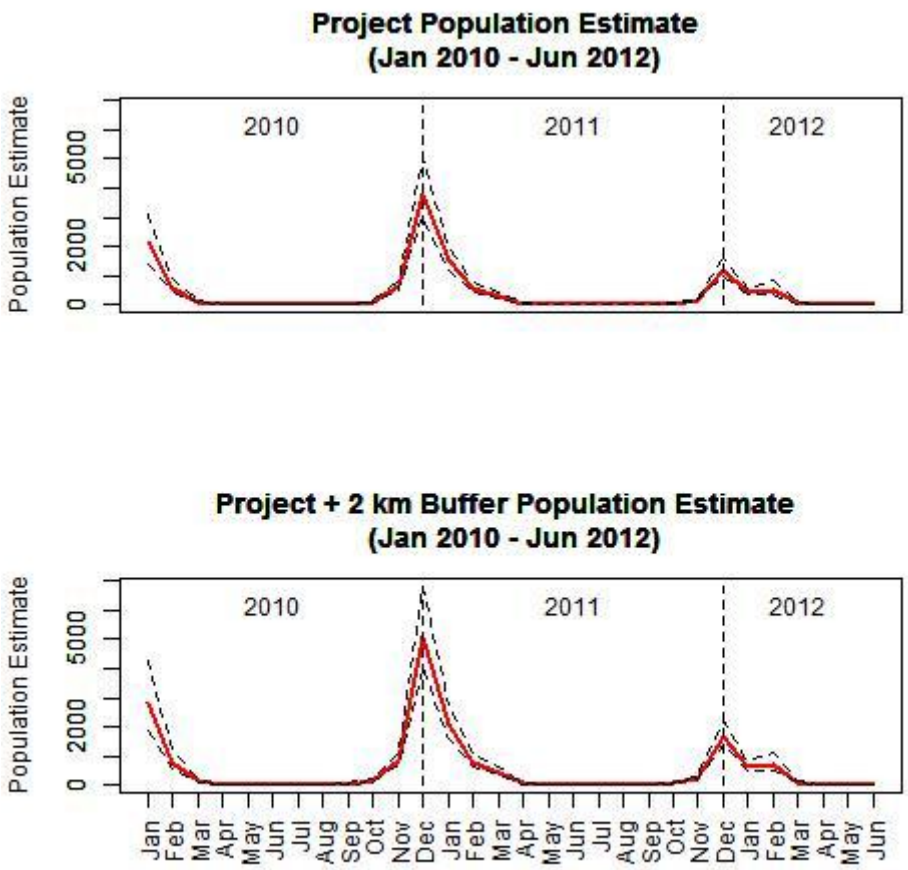

Figure 3.60 Baseline monthly population estimates (and 90% confidence limits) for little auk for Dogger Bank Teesside A and B, and the projects with a 2km buffer, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

***Atlantic puffin* Fratercula arctica**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.2.110 Atlantic puffin is a breeding feature of 16 SPAs in the Greater North Sea OSPAR region (Appendices 1 & 2). Therefore, the value of this receptor is assessed as very high (Table 2.6).

3.2.111 Numbers in the Dogger Bank Zone as a whole did not surpass the 1% threshold for populations of national importance (Tables 2.3, 3.4, 3.5 and 3.6).

Dogger Bank Teesside A

3.2.112 In 2010, there were two main peaks in Atlantic puffin population estimates in Dogger Bank Teesside A: from January to March (highest value in March of 219 birds with 90% CIs = 178-268) and from September to December (highest value in December of 422 birds with 90% CIs = 351-497). In 2010/11 abundance peaked between September and May (highest in March with 582 birds, 90% CLs = 509-681). Although a similar trend was observed in 2011/12, smaller population estimates were produced for this period (highest in February with 155 birds, 90% CLs = 126-188) (Table 3.40; Figure 3.61). Between January 2010 and June 2012 the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A area (Table 2.3 and 3.40). Mean populations across the two and a half years of survey peaked in March, with a mean of 316 birds (90 % CIs = 271-375) in the project and 434 birds (90% CIs = 372-514) present in the project and buffer.

3.2.113 The ESAS population estimates for Atlantic puffin were highest for the combined period of February to March, with 185 birds. The lowest numbers occurred in the combined August to September period with six birds (Table 3.9). Higher winter numbers reflect a similar pattern identified by the baseline monthly population estimates.

3.2.114 Atlantic puffins had a marked westerly distribution within the zone. On a monthly basis the densities of Atlantic puffin within the south-eastern and south south-eastern areas of the Dogger Bank Zone (which contain Dogger Bank Teesside A and Dogger Bank Teesside B) tended to be lower than the far western boundaries of the Dogger Bank Zone (Figures 3.62, 3.63 and 3.64).

Table 3.40 Baseline monthly population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside A, and the surrounding 0-1km and 1-2km buffers, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

	2010				2010/11			2011/12			Mean			
Month	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**
Jan	124 (83-175)	22 (15-31)	23 (16-33)	Jul	12 (9-15)	2 (2-3)	2 (2-3)	17 (14-22)	3 (3-4)	3 (3-4)	Jul	15 (11-19)	3 (2-3)	3 (2-4)
Feb	201 (153-257)	36 (28-46)	38 (29-49)	Aug	12 (9-15)	2 (2-3)	2 (2-3)	9 (7-11)	2 (1-2)	2 (1-2)	Aug	10 (8-13)	2 (1-2)	2 (2-3)
Mar	219 (178-268)	40 (32-48)	42 (34-51)	Sep	98 (76-127)	18 (14-23)	19 (15-25)	28 (21-36)	5 (4-7)	5 (4-7)	Sep	63 (49-81)	12 (9-15)	12 (10-16)
Apr	49 (40-62)	9 (7-11)	10 (8-12)	Oct	136 (107-172)	25 (20-32)	27 (21-33)	22 (16-28)	4 (3-5)	4 (3-5)	Oct	79 (61-100)	15 (11-18)	15 (12-19)
May	34 (28-42)	6 (5-8)	7 (5-8)	Nov	193 (152-227)	35 (28-41)	37 (29-43)	21 (15-27)	4 (3-5)	4 (3-5)	Nov	107 (84-127)	19 (15-23)	20 (16-24)
Jun	21 (17-27)	4 (3-5)	4 (3-5)	Dec	422 (351-497)	76 (63-89)	80 (66-93)	50 (37-61)	9 (7-11)	9 (7-12)	Dec	236 (194-279)	42 (35-50)	45 (37-53)
Jul	12 (9-15)	2 (2-3)	2 (2-3)	Jan	418 (350-502)	75 (63-91)	79 (66-95)	61 (48-75)	11 (9-13)	12 (9-14)	Jan	201 (161-251)	36 (29-45)	38 (30-47)
Aug	12 (9-15)	2 (2-3)	2 (2-3)	Feb	452 (380-533)	82 (69-96)	86 (72-101)	155 (126-188)	28 (23-34)	29 (24-36)	Feb	269 (220-326)	49 (40-59)	51 (42-62)
Sep	98 (76-127)	18 (14-23)	19 (15-25)	Mar	582 (509-681)	106 (93-123)	111 (98-130)	148 (125-176)	27 (23-32)	28 (24-34)	Mar	316 (271-375)	57 (49-68)	60 (52-71)
Oct	136 (107-172)	25 (20-32)	27 (21-33)	Apr	125 (105-151)	23 (19-28)	24 (20-29)	40 (32-53)	7 (6-10)	8 (6-10)	Apr	71 (59-89)	13 (11-16)	14 (11-17)
Nov	193 (152-227)	35 (28-41)	37 (29-43)	May	70 (59-83)	13 (11-15)	14 (12-16)	34 (28-44)	6 (5-8)	7 (5-8)	May	46 (38-56)	8 (7-10)	9 (7-11)
Dec	422 (351-497)	76 (63-89)	80 (66-93)	Jun	35 (28-43)	6 (5-8)	7 (5-8)	24 (20-31)	4 (4-6)	5 (4-6)	Jun	27 (22-34)	5 (4-6)	5 (4-7)

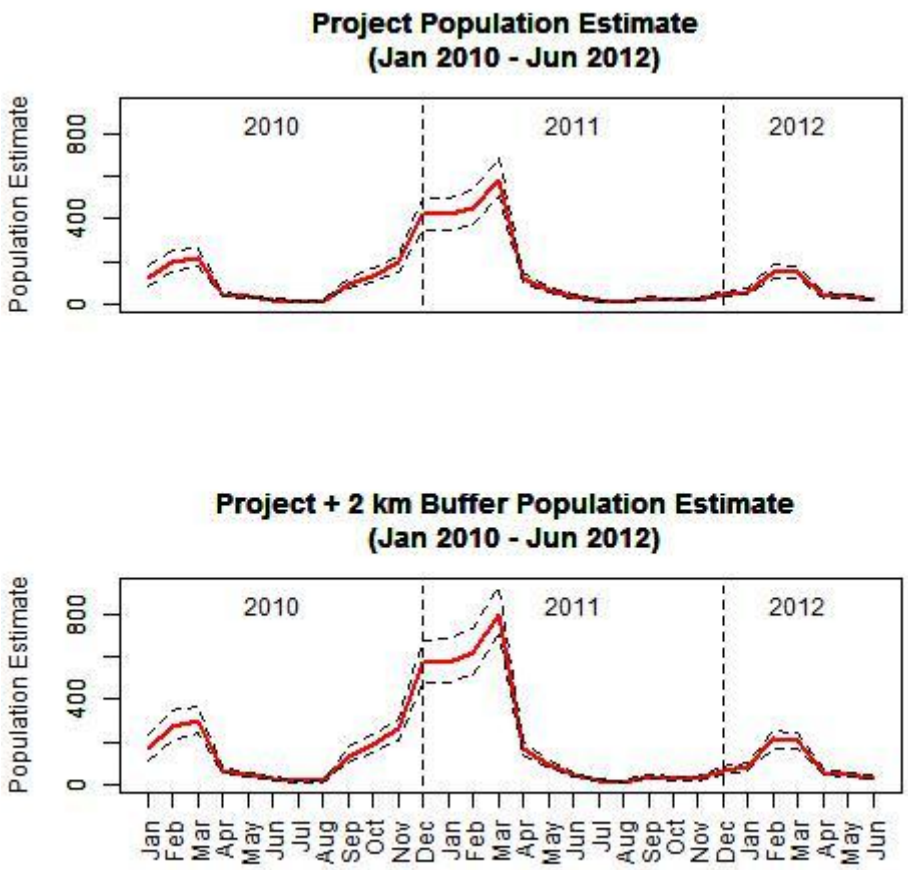

Figure 3.61 Baseline monthly population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside A, and the project with a 2km buffer, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

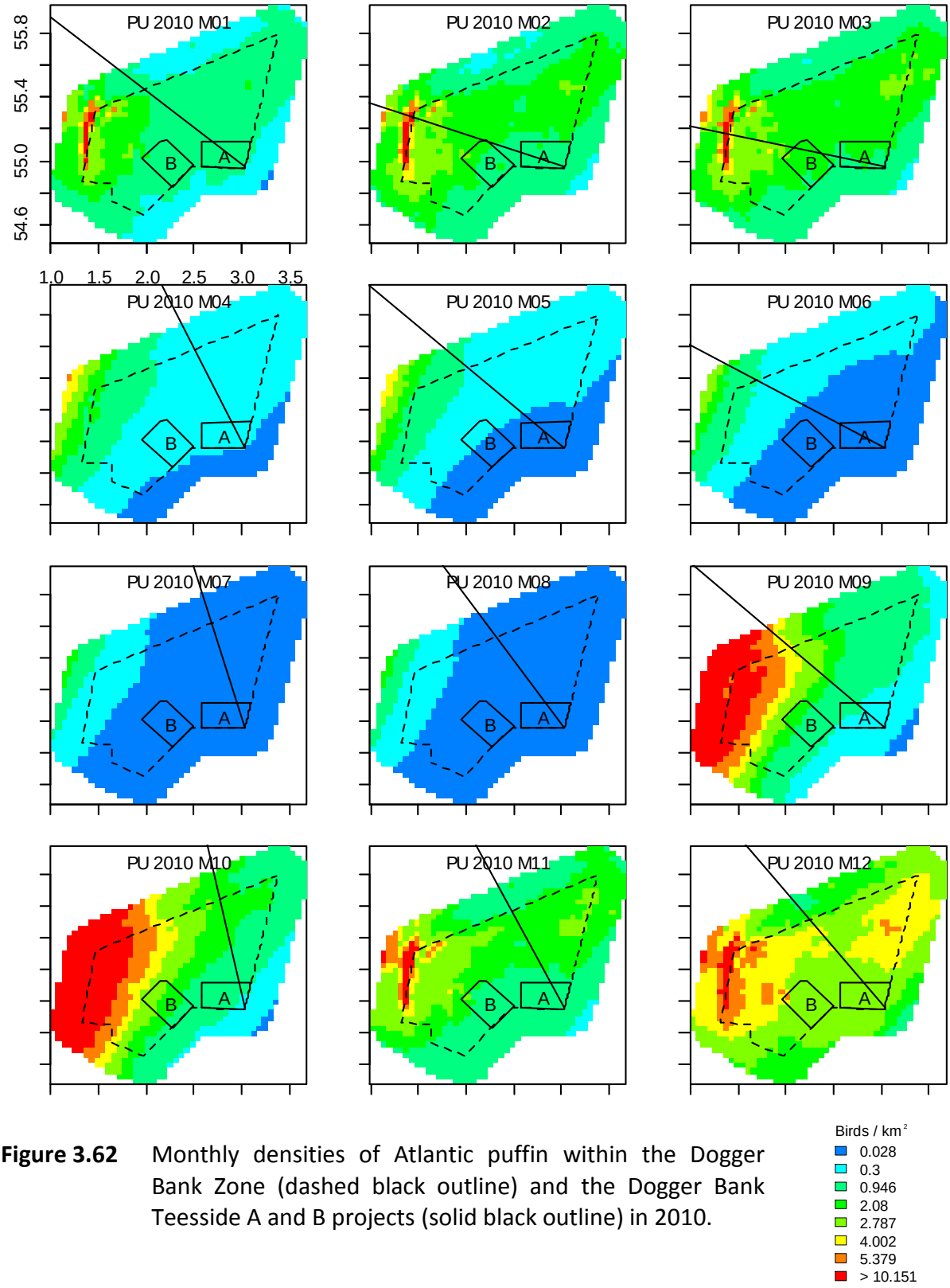

Figure 3.62 Monthly densities of Atlantic puffin within the Dogger Bank Zone (dashed black outline) and the Dogger Bank Teesside A and B projects (solid black outline) in 2010.

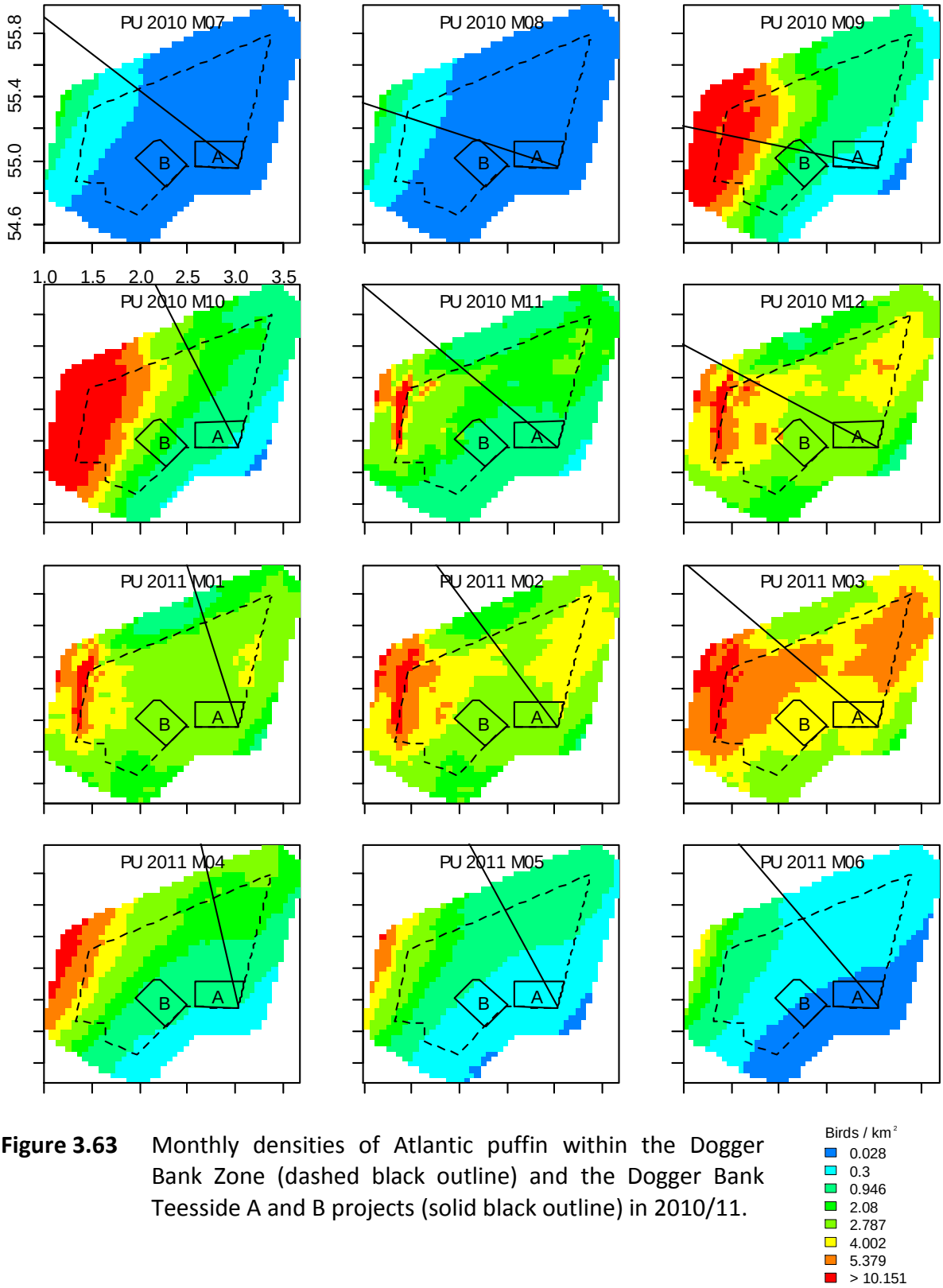

Figure 3.63 Monthly densities of Atlantic puffin within the Dogger Bank Zone (dashed black outline) and the Dogger Bank Teesside A and B projects (solid black outline) in 2010/11.

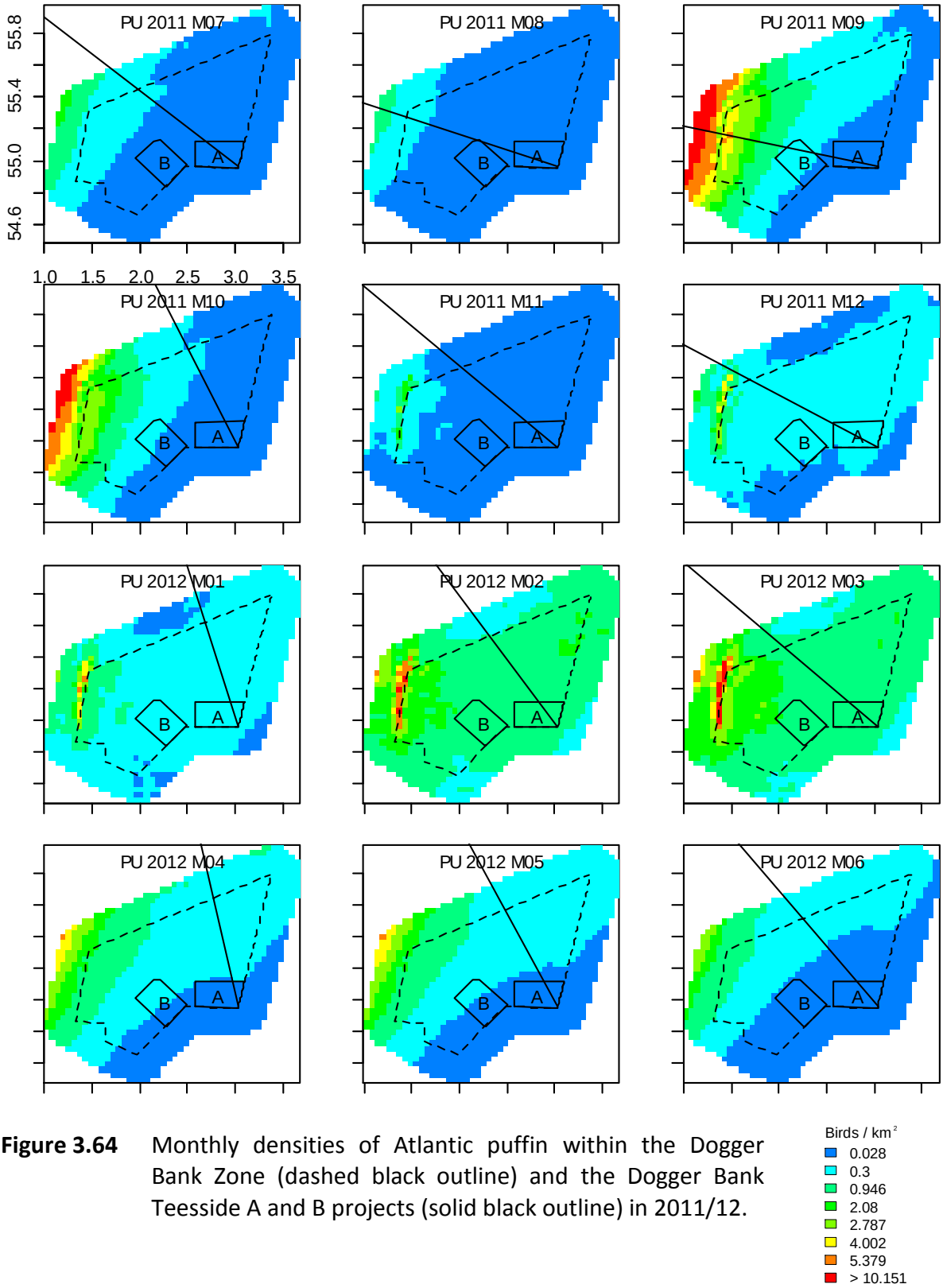

Figure 3.64 Monthly densities of Atlantic puffin within the Dogger Bank Zone (dashed black outline) and the Dogger Bank Teesside A and B projects (solid black outline) in 2011/12.

Dogger Bank Teesside B

3.2.115 In 2010, there were two main peaks in Atlantic puffin population estimates in Dogger Bank Teesside B: from January to March (highest value in March of 252 birds with 90% CIs = 207-304) and from September to December (highest value in December of 448 birds with 90% CIs = 383-527). In 2010/11, abundance peaked between September and May (highest in March with 608 birds, 90% CLs = 543-698). In contrast, population estimates showed a general decrease in 2011/12, with a peak in abundance between February and March (highest value was in March with 170 birds, 90% CLs = 145-205) (Table 3.41; Figure 3.65). Between January 2010 and June 2012 the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B area (Tables 2.3 and 3.41). Mean populations across the two and a half years of survey peaked in March, with a mean of 343 birds (90 % CIs = 298-402) in the project and 465 birds (90% CIs = 405-546) present in the project and buffer.

3.2.116 The ESAS population estimates for Atlantic puffin were highest for the combined period of February to March, with 196 birds. The lowest numbers occurred in the combined August to September period with six birds (Table 3.9). Higher winter numbers reflect a similar pattern identified by the baseline monthly population estimates.

Table 3.41 Modelled population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside B, and the surrounding 0-1km and 1-2km buffers, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

	2010				2010/11			2011/12			Mean			
Month	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**
Jan	150 (104-209)	26 (18-37)	28 (20-39)	Jul	17 (13-22)	3 (2-4)	3 (2-4)	24 (19-29)	4 (3-5)	4 (4-5)	Jul	21 (16-26)	4 (3-4)	4 (3-5)
Feb	234 (179-294)	41 (31-51)	43 (33-55)	Aug	17 (12-21)	3 (2-4)	3 (2-4)	12 (10-15)	2 (2-3)	2 (2-3)	Aug	14 (11-18)	3 (2-3)	3 (2-3)
Mar	252 (207-304)	43 (36-53)	46 (38-56)	Sep	209 (169-279)	38 (31-50)	41 (33-53)	60 (47-76)	11 (9-14)	12 (9-15)	Sep	134 (108-178)	24 (20-32)	26 (21-34)
Apr	62 (51-76)	11 (9-13)	11 (9-14)	Oct	289 (234-379)	52 (42-68)	56 (45-73)	45 (35-57)	8 (6-10)	9 (7-11)	Oct	167 (135-218)	30 (24-39)	32 (26-42)
May	44 (37-54)	8 (6-9)	8 (7-10)	Nov	213 (176-249)	37 (31-44)	40 (33-47)	23 (17-28)	4 (3-5)	4 (3-5)	Nov	118 (96-138)	21 (17-24)	22 (18-26)
Jun	27 (22-34)	5 (4-6)	5 (4-6)	Dec	448 (383-527)	78 (67-91)	83 (71-97)	51 (38-61)	9 (7-11)	9 (7-11)	Dec	250 (211-294)	44 (37-51)	46 (39-54)
Jul	17 (13-22)	3 (2-4)	3 (2-4)	Jan	399 (334-487)	69 (57-84)	73 (61-89)	64 (51-77)	11 (9-13)	12 (10-14)	Jan	204 (163-258)	35 (28-45)	38 (30-48)
Aug	17 (12-21)	3 (2-4)	3 (2-4)	Feb	432 (357-524)	75 (62-90)	80 (66-96)	155 (131-186)	27 (23-32)	29 (24-34)	Feb	273 (222-334)	47 (39-58)	50 (41-62)
Sep	209 (169-279)	38 (31-50)	41 (33-53)	Mar	608 (543-698)	104 (94-120)	111 (100-128)	170 (145-205)	30 (25-36)	31 (27-38)	Mar	343 (298-402)	59 (52-69)	63 (55-74)
Oct	289 (234-379)	52 (42-68)	56 (45-73)	Apr	159 (140-184)	28 (24-32)	30 (26-35)	50 (41-63)	9 (7-11)	9 (8-12)	Apr	90 (77-108)	16 (13-19)	17 (14-20)
Nov	213 (176-249)	37 (31-44)	40 (33-47)	May	91 (80-107)	16 (14-19)	17 (15-20)	44 (36-54)	8 (6-9)	8 (7-10)	May	60 (51-72)	10 (9-12)	11 (9-13)
Dec	448 (383-527)	78 (67-91)	83 (71-97)	Jun	46 (39-57)	8 (7-10)	9 (7-11)	31 (26-40)	5 (5-7)	6 (5-7)	Jun	35 (29-44)	6 (5-8)	6 (5-8)

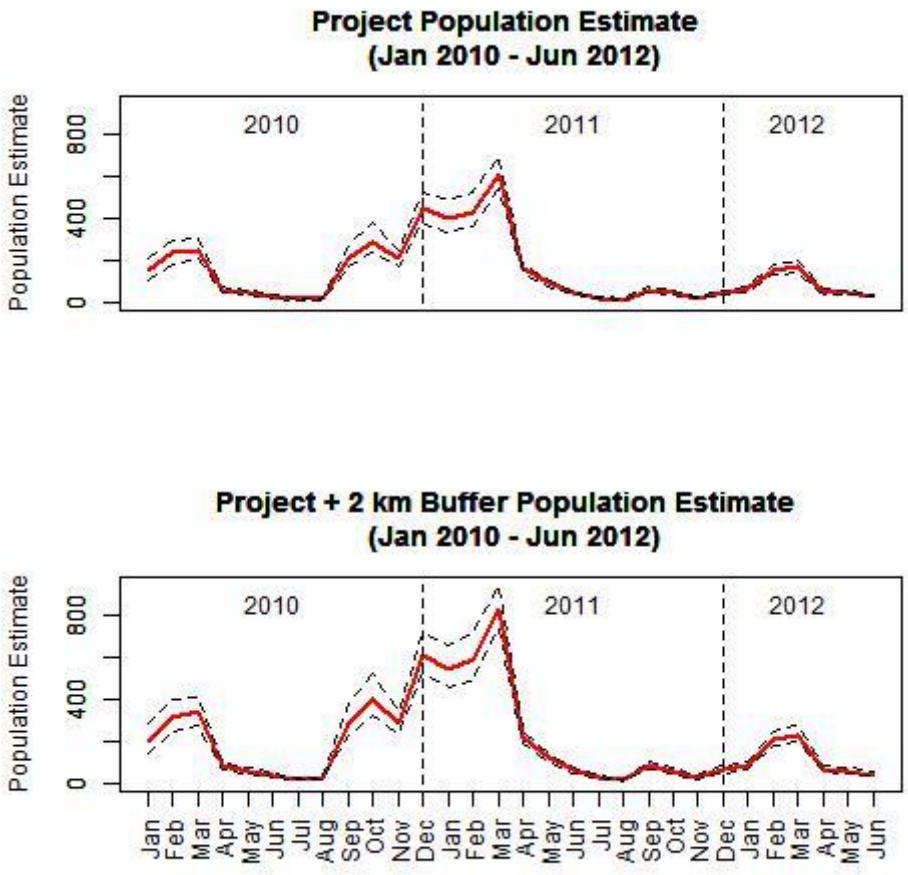

Figure 3.65 Modelled monthly population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside B, and the project with a 2km buffer, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

Dogger Bank Teesside A and B

3.2.117 In 2010, there were two main peaks in Atlantic puffin population estimates in the Dogger Bank Teesside A and B areas: from January to March (highest value in March of 471 birds with 90% CIs = 385-572) and from September to December (highest value in December of 870 birds with 90% CIs = 734-1,024). In 2010/11, abundance peaked between September and April (highest in March with 1,189 birds, 90% CLs = 1,052-1,379). In contrast, population estimates showed a general decrease in 2011/12, with a peak in abundance between February and March (highest value was in March with 318 birds, 90% CLs = 270-381) (Table 3.42; Figure 3.66). Between January 2010 and June 2012 the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B areas (Tables 2.3 and 3.42). Mean populations across the two and a half years of survey peaked in March, with a mean of 659 birds (90 % CIs = 569-777) in the project and 900 birds (90% CIs = 779-1,059) present in the project and buffer.

3.2.118 The ESAS population estimates for Atlantic puffin were highest for the combined period of February to March, with 380 birds. The lowest numbers occurred in the combined August to September period with 12 birds (Table 3.9). This is similar to the pattern identified by the baseline monthly population estimates.

Table 3.42 Baseline monthly population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside A and B, and the surrounding 0-1km and 1-2km buffers, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

	2010				2010/11			2011/12			Mean			
Month	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**	**Project**	**0-1km**	**1-2km**	**Month**	**Project**	**0-1km**	**1-2km**
Jan	272 (186-384)	48 (33-68)	51 (35-72)	Jul	29 (22-37)	5 (4-7)	6 (4-7)	42 (33-52)	7 (6-9)	8 (6-10)	Jul	35 (27-45)	6 (5-8)	7 (5-8)
Feb	435 (332-549)	77 (59-97)	82 (62-103)	Aug	28 (21-36)	5 (4-6)	5 (4-7)	21 (17-27)	4 (3-5)	4 (3-5)	Aug	25 (19-31)	4 (3-6)	5 (4-6)
Mar	471 (382-574)	83 (68-101)	88 (71-107)	Sep	309 (252-397)	56 (46-72)	60 (49-78)	87 (68-114)	16 (12-21)	17 (13-22)	Sep	198 (160-256)	36 (29-47)	39 (31-50)
Apr	112 (92-139)	20 (16-24)	21 (17-26)	Oct	426 (341-553)	77 (62-100)	83 (66-106)	67 (52-87)	12 (9-16)	13 (10-17)	Oct	246 (196-320)	45 (36-58)	48 (38-62)
May	78 (65-95)	14 (12-17)	15 (12-18)	Nov	405 (328-482)	72 (58-86)	76 (62-91)	44 (32-54)	8 (6-10)	8 (6-10)	Nov	224 (180-268)	40 (32-48)	42 (34-51)
Jun	49 (39-61)	9 (7-11)	9 (7-12)	Dec	869 (741-1,024)	154 (131-181)	162 (138-191)	101 (76-123)	18 (13-22)	19 (14-23)	Dec	485 (409-573)	86 (72-101)	91 (76-107)
Jul	29 (22-37)	5 (4-7)	6 (4-7)	Jan	818 (683-991)	144 (120-175)	153 (127-185)	126 (100-151)	22 (18-27)	24 (19-28)	Jan	405 (323-509)	72 (57-90)	76 (60-95)
Aug	28 (21-36)	5 (4-6)	5 (4-7)	Feb	885 (739-1,055)	156 (131-187)	166 (138-198)	311 (257-373)	55 (45-66)	58 (48-70)	Feb	544 (443-659)	96 (78-117)	102 (83-124)
Sep	309 (252-397)	56 (46-72)	60 (49-78)	Mar	1,191 (1,059-1,374)	210 (187-242)	223 (198-257)	317 (273-382)	56 (48-67)	60 (51-72)	Mar	660 (571-777)	116 (101-137)	123 (107-145)
Oct	426 (341-553)	77 (62-100)	83 (66-106)	Apr	286 (245-339)	51 (44-61)	55 (46-64)	90 (74-115)	16 (13-21)	17 (14-22)	Apr	163 (137-198)	29 (24-35)	31 (26-37)
Nov	405 (328-482)	72 (58-86)	76 (62-91)	May	162 (139-190)	29 (25-34)	31 (26-36)	77 (64-98)	14 (12-17)	15 (12-19)	May	106 (89-127)	19 (16-23)	20 (17-24)
Dec	869 (741-1,024)	154 (131-181)	162 (138-191)	Jun	81 (67-100)	15 (12-18)	15 (13-19)	55 (46-71)	10 (8-13)	10 (9-13)	Jun	62 (51-77)	11 (9-14)	12 (10-15)

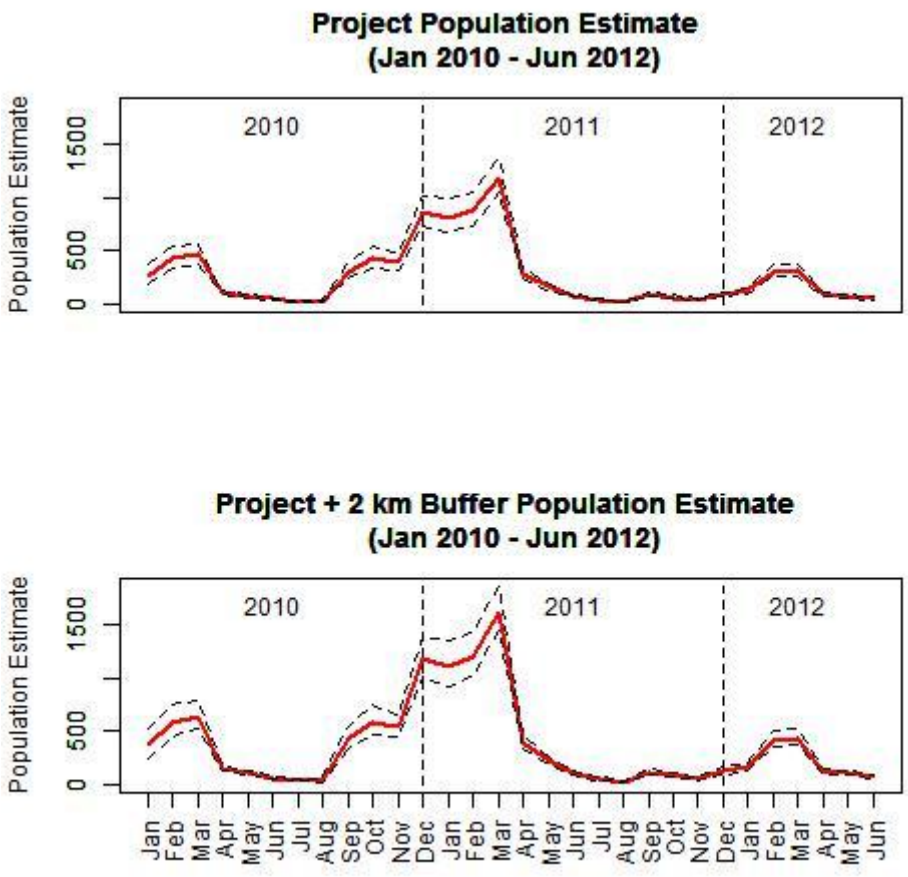

Figure 3.66 Baseline monthly population estimates (and 90% confidence limits) for Atlantic puffin for Dogger Bank Teesside A and B, and the projects with a 2km buffer, within the Dogger Bank Zone in 2010, 2010/11 and 2011/12.

3.3 Export Cable Corridor baseline populations

Introduction

3.3.1 Mean and maximum population densities of seabirds recorded in the European Seabirds at Sea database for the area of the proposed export cable corridor for the Dogger Bank Teesside A and B projects of the Dogger Bank Offshore Wind Farm Zone are shown in Table 3.43. Note, as the potential export cable corridor covers a much larger area than that which will actually be affected by the operations associated with the laying of cables, these estimates are at least an order of magnitude greater than the numbers that could be impacted by effects associated with cable laying.

3.3.2 The proposed export cable corridor lies within the foraging range of seven species from 27 protected sites (name sites) (see Appendix 1). The Teesmouth and Cleveland Coast is the nearest SPA to the corridor and landfall. This protected area does not contain relevant SPA feature species. However, where records exist, the presence of each receptor species has been reported in the text under each receptor account.

Table 3.43 Mean and maximum population densities of seabirds recorded in the European Seabirds at Sea database, for the export cable corridor for the Dogger Bank Teesside A and B projects of the Dogger Bank Offshore Wind Farm Zone. Population estimates based on mean densities of seabirds derived from the European Seabirds at Sea database have also been calculated for the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B, and Dogger Bank Teesside A and B projects.

	Dogger Bank Teesside A and B mean density in (birds/km²)	**Dogger Bank Teesside A and B maximum density (birds/km²)**	**Dogger Bank Teesside A / B / A + B Population estimates**
Common scoter	0	0	0
Red-throated diver	0	0	0
Northern fulmar	1.59	9.37	372
Manx shearwater	0	0	0
Northern gannet	0.20	0.68	47
European shag	0	0	0
Great skua	0.03	0.52	7
Common gull	0	0	0
Herring gull	0.14	1.81	33
Great black-backed gull	0.08	0.88	19
Black-legged kittiwake	2.37	15.89	555
Common tern	0	0	0
Arctic tern	0	0	0
Common guillemot	3.78	20.62	885
Razorbill	0.08	1.42	19
Atlantic puffin	0.21	2.14	49

Receptor Accounts

***Common scoter* Melanitta nigra**

SPA/Ramsar/SSSI feature

VALUE OF RECEPTOR-VERY HIGH

3.3.3 Between 1979 and 2002, no common scoter were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.4 Large numbers of common scoter were recorded during sea-watching activity on the Teesmouth and Cleveland Coast during the autumn and winter, where up to 694 were seen on a daily basis (Teesmouth Bird Club 2011).

3.3.5 Although ESAS derived population estimates for the export cable corridor area were 0, sea-watching data suggests higher numbers are likely to be present in the coastal regions of the area during the autumn and winter.

***Red-throated diver* Gavia stellata**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.6 Between 1979 and 2002, no red-throated diver were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.7 Low numbers have been recorded on and the Teesmouth and Cleveland Coast in the autumn and winter months, with a maximum daily count of 35 birds in October 2011 (Teesmouth Bird Club 2011).

3.3.8 Although ESAS derived population estimates for the export cable corridor area were 0, sea-watching data suggests low numbers are likely to be present in the coastal regions of the area during the autumn and winter.

***Northern fulmar* Fulmarus glacialis**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.9 Between 1979 and 2002, the mean recorded density of northern fulmar was 1.59 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 372 birds within the export cable

corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.10 The Teesmouth and Cleveland Coast is also a known breeding site for northern fulmars with 150 pairs recorded in 2011 (Teesmouth Bird Club 2011).

3.3.11 These data suggest that northern fulmar are likely to be present within the export cable corridor area and that over summer a small number may be associated with breeding colonies on the Teesmouth and Cleveland Coast.

***Manx shearwater* Puffinus puffinus**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.12 Between 1979 and 2002, no Manx shearwater were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.13 Low sea-watching trends were recorded in the spring and autumn of 2011 on the Teesmouth and Cleveland Coast. The highest daily count was 57 in late August (Teesmouth Bird Club 2011).

3.3.14 These data suggest that whilst Manx shearwater may be recorded in the export cable corridor area during the spring and autumn migration periods, they are likely to be largely absent from the area for the rest of the year.

***Northern gannet* Morus bassanus**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.15 Between 1979 and 2002, the mean recorded density of northern gannet was 0.20 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 47 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.16 On the Teesmouth and Cleveland Coast, the northern gannet is considered a common summer visitor. The largest record in 2011 was 500 off Redcar in mid-Jul (Teesmouth Bird Club 2011).

3.3.17 These data suggest that northern gannet are likely to be present within the export cable corridor area, particularly in the summer.

***European shag* Phalacrocorax aristotelis**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.18 Between 1979 and 2002, no European shag were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.19 The Teesmouth and Cleveland Coast has no breeding population, however, individuals are typically recorded in low numbers mainly during the autumn and winter. The highest daily count in 2011 was 39 individuals in December (Teesmouth Bird Club 2011).

3.3.20 These data suggest that European shag may be present in low numbers within the export cable corridor area in the autumn and winter.

***Great skua* Stercorarius skua**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.21 Between 1979 and 2002, the mean recorded density of great skua was 0.03 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of seven birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.22 Low numbers of great skua (usually single figures, daily) were recorded passing the Teesmouth and Cleveland Coast in the summer and autumn (Teesmouth Bird Club 2011).

3.3.23 These data suggest that the occurrence of great skua in both export cable corridor area is likely to be restricted to the autumn, when high numbers of birds may pass through on migration.

***Common gull* Larus canus**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.24 Between 1979 and 2002, no common gulls were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.25 WeBS counts showed common gull to be present on the coast year round, with higher numbers in the winter. The highest count in 2011 was 371 at South Tees in March (Teesmouth Bird Club 2011).

3.3.26 These data suggest that few common gull are likely to be found within the export cable corridor area.

***Herring gull* Larus argentatus**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Red list (Eaton *et al*. 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.27 Between 1979 and 2002, the mean recorded density of herring gull was 0.14 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 33 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.28 Some birds may be associated with the small breeding colonies present on the Teesmouth and Cleveland Coast, with 75 pairs at Hunt Cliff and *ca*. 460 pairs between Skenningrove and Cowbar (Teesmouth Bird Club 2011).

3.3.29 These data suggest that low numbers of herring gull are likely to be found within the export cable corridor area.

***Great black-backed gull* Larus marinus**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.30 Between 1979 and 2002, the mean recorded density of great black-backed gull was 0.08 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 19 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.31 WeBS counts showed great black-backed gull to be present on the coast year round, with higher numbers in the winter. The highest count in 2011 was 531 at North Tees in December (Teesmouth Bird Club 2011).

3.3.32 These data suggest great black-backed gull may be present in the export cable corridor area.

***Black-legged kittiwake* Rissa tridactyla**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.33 Between 1979 and 2002, the mean recorded density of black-legged kittiwake was 2.37 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 555 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.34 On the Teesmouth and Cleveland Coast, the black-legged kittiwake is considered an abundant breeder with 4,074 apparently occupied nests counted in 2011 (Teesmouth Bird Club 2011).

3.3.35 These data suggest that high densities of black-legged kittiwake may be present within the export cable corridor area, with noticeable peaks during the breeding season, when some may be associated with the small breeding colonies on the Teesmouth and Cleveland Coast.

***Common tern* Sterna hirundo**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.36 Between 1979 and 2002, no common terns were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.37 Large numbers were recorded on the Teesmouth and Cleveland Coast in 2011 due to a breeding colony at RSPB Saltholme reserve (Highest WeBS count = 251 in July) (Teesmouth Bird Club 2011).

3.3.38 These data suggest that common tern may be observed within the export cable corridor areas. However, these may be restricted to passage periods or in the breeding season on the Teesmouth and Cleveland Coast.

***Arctic tern* Sterna paradisaea**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.39 Between 1979 and 2002, no Arctic terns were recorded by ESAS within the area around the Dogger Bank Teesside A and B export cable corridor (Table 3.43).

3.3.40 During passage periods, very few birds were recorded during sea-watching activity on the Teesmouth and Cleveland Coast (Yorkshire Naturalists Union 2010; Teesmouth Bird Club 2011).

3.3.41 These data suggest that few Arctic terns are likely to be observed within the export cable corridor areas, and that these may be restricted to passage periods.

***Common guillemot* Uria aalge**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.42 Between 1979 and 2002, the mean recorded density of common guillemot was 3.78 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 885 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.43 Records from the Teesmouth and Cleveland Coast show low daily sea-watching counts with occasional peaks (600 on 18th June) (Teesmouth Bird Club 2011).

3.3.44 These data suggest common guillemots are likely to be observed within the export cable corridor area.

***Razorbill* Alca torda**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.45 Between 1979 and 2002, the mean recorded density of razorbill was 0.08 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 19 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.46 Razorbill breed in small numbers on the Teesmouth and Cleveland Coast (20 pairs in 2011). Data from sea-watching effort carried out within the SPA suggests a small presence in the winter and a larger presence in the summer (highest record in 2011 = 152 birds in mid-August) (Teesmouth Bird Club 2011).

3.3.47 These data suggest razorbill are likely to be observed within the export cable corridor area, particularly in the breeding season and the summer.

***Atlantic puffin* Fratercula arctica**

SPA/Ramsar/SSSI feature; Birds of Conservation Concern Amber list (Eaton *et al.* 2009).

VALUE OF RECEPTOR-VERY HIGH

3.3.48 Between 1979 and 2002, the mean recorded density of Atlantic puffin was 0.21 birds/km^2 within the area around the Dogger Bank Teesside A and B export cable corridor. These densities reflect a population of 49 birds within the export cable corridor area associated with the Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A and B projects (Table 3.43).

3.3.49 Sea-watching records show large numbers passing the coast in June. The highest day count in 2011 was 277 in June (Teesmouth Bird Club 2011).

3.3.50 These data suggest Atlantic puffin are likely to be observed within the export cable corridor area, particularly in the late breeding season.

3.4 Ornithology of the Intertidal Zone at the Export Cable Corridor Landfall

Wetland Bird Survey (WeBS)

3.4.1 There were no available WeBS data for the study area. Although there appears to be a core count section set up for the area of Redcar to Marske, no data has ever been submitted and the closest WeBS core counts are carried out at three sites in the Tees estuary as follows (shortest distances, as the crow flies, given in parentheses): Tees South (<9km), Teesmouth (<9km), Tees Estuary opposite Smiths Dock and Hargreaves Quarry (<10km).

Non-estuarine Coastal Waterbird Survey (NEWS)

3.4.2 Relevant NEWS data were available for the coastline area defined as Redcar to Saltburn. There were two NEWS sections which overlapped with the study area and were approximately 2.4km and 4.15km in length (see Figure A). Data were available for the winters of 1984/85, 1997/98 and 2006/07 but only data from the latter survey year was considered to be of relevance. Corrections were applied to count data which represented the degree of spatial overlap of the NEWS counts with the study area (0.5km and 1.6km respectively). Counts for these two sections were then combined to provide a peak count for NEWS data.

3.4.3 The following bird species were recorded by NEWS in the study area: Eurasian oystercatcher, northern lapwing, sanderling and ruddy turnstone (Table I).

Field survey based study

Wintering Bird Survey 2011/12

3.4.4 No bird species recorded during the winter bird surveys were relevant to the intertidal study (see 2.6.13).

Inshore sea-watch survey 2011/12

3.4.5 The following relevant bird species were recorded during the inshore sea-watches: Eurasian oystercatcher, ringed plover, grey plover, sanderling, dunlin, bar-tailed godwit, ruddy turnstone, black-headed gull, common gull, carrion crow (Table I).

Autumn passage and wintering bird surveys and inshore sea-watch survey 2012/13

3.4.6 The following bird species were recorded by the autumn passage, winter bird and inshore sea-watch surveys (see section 2.6.15 for explanation) relevant to the intertidal study: great cormorant, Eurasian oystercatcher, ringed plover, Eurasian curlew, bar-tailed godwit, ruddy turnstone, sanderling, black-headed gull, Mediterranean gull, great black-backed gull, common gull, herring gull, jackdaw, carrion crow, meadow pipit, goldfinch, linnet (see Table I).

Table 3.44 Summary of population counts for all species for the study area (for Dogger Bank Teesside A and B and Dogger Bank Teesside C and D) derived from survey schemes (WeBS and NEWS) and commissioned surveys (autumn and winter bird surveys and inshore sea-watches).

Species	Dogger Bank Teesside A+B			Dogger Bank Teesside C+D	
	NEWS combined[1]	Inland sea-watch surveys 2011/12[2]	Autumn/winter sea-watch surveys 2012/13[2]	NEWS[3]	Autumn/winter sea-watch surveys 2012/13[2]
Great cormorant	0	0	1	0	0
Eurasian oystercatcher	65	21	12	53 (74)	4
Grey plover	0	1	0	0	0
Northern lapwing	121	0	0	429 (600)	9
Ringed plover	0	18	2	0	0
Eurasian curlew	0	0	1	0	0
Bar-tailed godwit	0	1	1	0	1
Ruddy turnstone	5	5	22	19 (27)	120
Sanderling	3	104	3	0	0
Dunlin	0	47	0	0	2
Black-headed gull	0	175	318	0	103
Mediterranean gull	0	0	2	0	0
Great black-backed gull	0	0	2	0	2
Common gull	0	2	4	0	0
Lesser black-backed gull	0	0	3	0	0
Herring gull	0	0	115	0	13
Jackdaw	0	0	2	0	0
Carrion crow	0	12	10	0	26
Common starling	0	0	0	0	300
Meadow pipit	0	0	2	0	0
Goldfinch	0	0	12	0	30
Linnet	0	0	37	0	0

[1] Values given in brackets are the uncorrected counts for two NEWS sections summed together;
[2] Maximum numbers of individuals recorded;
[3] Only was section of NEWS was relevant.

Receptor accounts

3.4.7 Receptor accounts are provided for all species recorded or estimated to occur in the defined study area in numbers of 10 or more.

***Eurasian oystercatcher* Haematopus ostralegus**

VALUE OF RECEPTOR-LOW

Birds of Conservation Concern Amber list (Eaton *et al*. 2009)

3.4.8 Eurasian oystercatcher is not a feature of any SPA or any other protected site within 2km of the study area. As it is an amber listed species, the value of this receptor in relation to the intertidal zone is assessed as low.

3.4.9 The highest estimated count of 65 individuals occurred in the winter of 2006/07.

***Northern Lapwing* Vanellus vanellus**

VALUE OF RECEPTOR-VERY HIGH

UKBAP species

Birds of Conservation Concern Red list (Eaton *et al.* 2009)

3.4.10 Northern lapwing is listed as feature of Teesmouth and Cleveland Coast SPA (less than 2km from the study area) as part of the wintering assemblage. The value of this receptor in relation to the intertidal zone is assessed as very high.

3.4.11 The highest estimated count of 121 individuals occurred in the winter of 2006/07.

***Ringed Plover* Charadrius hiaticula**

VALUE OF RECEPTOR-VERY HIGH

Birds of Conservation Concern Amber list (Eaton *et al*. 2009)

3.4.12 Ringed plover is listed as feature of Teesmouth and Cleveland Coast SPA (less than 2km from the study area) during the passage season. The value of this receptor in relation to the intertidal zone is assessed as very high.

3.4.13 The highest estimated count of 18 individuals occurred in the winter of 2011/12.

***Ruddy turnstone* Arenaria interpres**

VALUE OF RECEPTOR-LOW

Birds of Conservation Concern Amber list (Eaton *et al*. 2009)

3.4.14 Ruddy turnstone is not a feature of any SPA or any other protected site within 2km of the study area. As it is an amber listed species, the value of this receptor in relation to the intertidal zone is assessed as low.

3.4.15 The highest estimated count of 22 individuals occurred in the winter of 2012/13.

***Sanderling* Calidris alba**

VALUE OF RECEPTOR-VERY HIGH

3.4.16 Sanderling is listed as feature of Teesmouth and Cleveland Coast SPA (less than 2km from the study area) as part of the wintering assemblage. The value of this receptor in relation to the intertidal zone is assessed as very high.

3.4.17 The highest estimated count of 104 individuals occurred in the winter of 2011/12.

***Dunlin* Calidris alpina**

VALUE OF RECEPTOR-LOW

Birds of Conservation Concern Red list (Eaton *et al.* 2009)

3.4.18 Dunlin is not a feature of any SPA or any other protected site within 2km of the study area. As it is a red listed species, the value of this receptor in relation to the intertidal zone is assessed as low.

3.4.19 The highest estimated count of 47 individuals occurred in the winter of 2011/12.

***Black-headed gull* Chroicocephalus ridibundus**

Birds of Conservation Concern Amber list (Eaton *et al*. 2009)

VALUE OF RECEPTOR-LOW

3.4.20 Black-headed gull is not a feature of any SPA or any other protected site within 2km of the study area. As it is an amber listed species, the value of this receptor in relation to the intertidal zone is assessed as low.

3.4.21 The highest estimated count of 318 individuals occurred in the winter of 2012/13.

***Herring gull* Larus argentatus**

VALUE OF RECEPTOR-MEDIUM

UKBAP species

Birds of Conservation Concern Red list (Eaton *et al.* 2009)

3.4.22 Herring gull is not a feature of any SPA or any other protected site within 2km of the study area. As it is a red listed species and a UK BAP species, the value of this receptor in relation to the intertidal zone is assessed as medium.

3.4.23 The highest estimated count of 115 individuals occurred in the winter of 2012/13.

***Carrion Crow* Corvus corone**

VALUE OF RECEPTOR-NONE

3.4.24 Black-headed gull is not a feature of any SPA or any other protected site within 2km of the study area. Since it is a common widespread species in the UK, it is not recognised as a species of conservation interest and as a receptor has no value.

3.4.25 The highest estimated count of 12 individuals occurred in the winter of 2012/13.

***Goldfinch* Carduelis carduelis**

VALUE OF RECEPTOR-NONE

3.4.26 Goldfinch is not a feature of any SPA or any other protected site within 2km of the study area. Since it is a common widespread species in the UK, it is not recognised as a species of conservation interest and as a receptor has no value.

3.4.27 The highest estimated count of 12 individuals occurred in the winter of 2012/13.

***Linnet* Carduelis cannabina**

VALUE OF RECEPTOR-LOW

Birds of Conservation Concern Red list (Eaton *et al*. 2009)

3.4.28 Linnet is not a feature of any SPA or any other protected site within 2km of the study area. As it is a red listed species, the value of this receptor in relation to the intertidal zone is assessed as low.

3.4.29 The highest estimated count of 37 individuals occurred in the winter of 2012/13.

Page No.

4. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

4.1 Basis of Impact Assessment Methodology

4.1.1 The EIA methodology used is based on current guidance, and has been shaped by expert judgement and results from other offshore wind farm EIAs and stakeholder consultation. Impacts are assessed in the context of the predicted baseline conditions and over the lifetime of the development. Following Maclean *et al.* (2009), the methodology combines the guidance provided by the Institute of Ecology and Environmental Management (IEEM 2006) and a matrix approach, this also ensures that results are compatible with those throughout the Environmental Statement. The IEEM approach provides a detailed characterisation of ecological effects and their potential impacts, such that it can clearly be determined whether or not impacts are likely to be ecologically significant and at what scale. Further marine guidance is supplied in a more recent IEEM document, together with a worked example (IEEM 2010).

4.1.2 As in the baseline, impact assessment is provided for the two Dogger Bank Teesside projects separately and also for Dogger Bank Teesside A and B together. Cumulative impact assessment – see section 4.6 – covers two geographic scales.

<u>The magnitude of an impact</u>

4.1.3 The matrix approach developed by Percival *et al.* (1999) considers the potential magnitude, or size, of any impact associated with an effect together with the sensitivity of the receptor. Definitions of magnitude are summarised below:

Table 4.1 Definitions of terms relating to the magnitude, or size, of an effect upon the ornithological receptors of the proposed site (after Percival *et al.* 1999).

Magnitude	Definition
Very High	Total loss or very major alteration to key elements/features of the baseline conditions such that post- development character/composition/attributes will be fundamentally changed and may be lost from the site altogether. Guide: >80% of population/habitat lost
High	Major alteration to key elements/features of the baseline (pre-development) conditions such that post -development character/composition/attributes will be fundamentally changed. Guide: 20-80% of population/habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post- development character/composition/attributes of baseline will be partially changed. Guide: 5-20% of population/habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the 'no change' situation. Guide: <1% of population/habitat lost

4.1.4 Here, the magnitudes of impacts are assessed first in relation to national and biogeographic populations and second in relation to the populations supported by individual protected sites (see section 4.2 below).

4.1.5 Following the IEEM (2006, 2010) guidance, effects and their potential magnitudes are further characterised as follows:

- Description of effect;
- The spatial extent of the effect;
- The timing and frequency of the effect;
- The duration of the effect;
- Whether the effect would be direct or indirect[1];
- The reversibility of the impact;
- Whether the impact is positive or negative; and
- The confidence in predictions (High, Medium, Low and Very Low).

4.1.6 IEEM (2006) suggests a terminology of Certain/near-Certain, Probable, Unlikely and Very Unlikely. However, for the purposes of this assessment, High, Medium, Low and Very Low are used to better capture the confidence in predictions as opposed to its likelihood.

[1] Not specifically suggested by IEEM (2006, 2010).

4.1.7 For marine bird species, separate estimations of the magnitudes of impacts associated with the effects of disturbance/displacement, barrier effects and collision risk in the project areas – see section 4.3 below – are provided based on the means of the monthly population estimates (and confidence limits) produced across the study period from January 2010 to June 12. Means are used to provide an assessment of the average impacts to bird populations that might result from the proposed projects, accounting for year on year variability. The use of means rather than peaks is necessary with respect to cumulative assessment as, if peaks were used, there would be potential for considerably over-estimating cumulative effects, due to double-counting of the same birds moving between sites.

The sensitivity of a receptor

4.1.8 Following the IEEM (2006) guidance, an ecologically significant impact is defined as an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or receptors within a given geographical area. Therefore, the assessment of the significance of an effect will reflect the receptor's sensitivity which, as outlined in Maclean *et al.* (2009), has two aspects – the non-impact sensitivity, or value, of the receptor and the specific sensitivity of the receptor to the effect.

4.1.9 Value – a measure of the receptor's importance, rarity and worth in particular based on existing designations and its wider conservation status – is categorised following Percival *et al.* (1999) as follows (see also Sections 2 and 3):

Table 4.2 Definitions of terms relating to the value of a receptor (after Percival *et al.* 1999).

Value	Definition
Very High	Feature species of SPAs, Ramsar sites and SSSIs
High	Other bird species that contribute to the integrity of an SPA, Ramsar site or SSSI Species of international or national importance, i.e. those whose numbers surpass 1% of international or national populations Ecologically sensitive species, e.g. large birds of prey or nationally rare species (< 300 breeding pairs in the UK)
Medium	Species of regional importance (either because of population size or distributional context) EU Birds Directive Annex 1 species, EU Habitats Directive priority habitat/species and Wildlife and Countryside Act Schedule 1 species (if not covered above) UK BAP species (if not covered above)
Low	Any other species of conservation interest, such as those on the Birds of Conservation Concern lists (if not covered above)

4.1.10 The geographic scope of the assessment is outlined below in section 4.2, but it is important to note here that the projects being considered have the potential to affect not just breeding seabirds, but also non-breeding seabirds and migrants and

hence might affect sites across a wide geographical area. Thus, both seabird species that might forage within the area of the projects being considered from breeding colony SPAs, Ramsar sites and SSSIs and also other seabird and migrant species that are features of SPAs, Ramsar sites and SSSIs and that may occur within the area of the projects being considered at other times of year are considered to be of Very High value.

4.1.11 Other species that occur in the project areas in internationally or nationally important numbers (i.e. surpassing respectively 1% of the species' biogeographic or national population estimates) are considered to be of at least High value.

4.1.12 Species are considered to be of regional importance, and of at least Medium value, if their numbers in the project areas are at least 1% of those that occur in the Dogger Bank Zone as a whole. This definition of region is arbitrary, but reflects data availability and the absence of alternate definitions.

4.1.13 Species-specific sensitivities to effects may reflect three potential factors:

- Adaptability – the degree to which a receptor can avoid or adapt to an effect;
- Tolerance – the ability of a receptor to accommodate temporary or permanent change without a significant adverse impact; and
- Recoverability – the temporal scale over and extent to which a receptor will recover following an effect.

4.1.14 For effects other than disturbance/displacement and barrier effects, species-specific sensitivities are combined with the receptor's value following Maclean *et al.* (2009) to determine the overall sensitivity of species to effects – see section 4.3:

Table 4.3 Overall sensitivity of species

Value	**Species-specific sensitivity**				
	Very High	**High**	**Medium**	**Low**	**Very Low**
Very High	Very High	Very High	Very High	High	Medium
High	Very High	High	High	Medium	Low
Medium	Very High	High	Medium	Low	Very Low
Low	High	Medium	Low	Low	Very Low

4.1.15 A bespoke approach is taken in the assessments of both disturbance/displacement and barrier effects, as aspects of sensitivity are incorporated within the determination of magnitude. For these effects, the significance of the impact is thus determined by combining the potential magnitude of the effect directly with the species' value – see section 4.3 for more details.

Determining significance

4.1.16 Following the detailed characterisation (based on the IEEM 2006, 2010 guidance), magnitudes of effects and the sensitivity of receptors are combined using a matrix

approach to determine the overall significance of the impact of an effect (e.g. as outlined in Percival *et al.* 1999 and as recommended by Maclean *et al.* 2009, and to ensure that results are compatible with those throughout the Environmental Statement).

Table 4.4 Categorisation of the significance of an impact (following Percival *et al.* 1999, with an additional category of Very Low Sensitivity for compatibility with the Sensitivity classifications used by Maclean *et al.* 2009)

Magnitude	**Sensitivity**				
	Very High	**High**	**Medium**	**Low**	**Very Low**
Very High	Major	Major	Major	Moderate	Minor
High	Major	Major	Moderate	Minor	Negligible
Medium	Major	Moderate	Minor	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible	Negligible

4.1.17 The assessment considers the proportion of birds potentially impacted by an effect at broader national and biogeographic scales, and additionally in relation to suites of protected sites within the North Sea (defined by the OSPAR Greater North Sea region) and at the scale of individual protected sites, with an associated assessment of the level of confidence of the effect at this scale. Methods for defining suites of sites and apportioning the magnitude of each impact determined for each wind farm project (or in-combination across the Dogger Bank Zone as a whole) to individual protected sites are outlined below.

Interpretation of significance

4.1.18 Mitigation measures associated with project designs are outlined in section 4.5 of this report and here the assessment process considers the residual impact after consideration of these measures.

4.1.19 Impacts assessed as being Negligible or Minor adverse are considered to be of relatively limited concern and not 'significant' in terms of the EIA regulations, whereas Moderate or Major impacts are considered 'significant' in terms of EIA regulations. Where Moderate or Major residual impacts are determined following the use of realistic worst case scenarios, the potential for other defined scenarios (e.g. for collision risk) to mitigate impacts is discussed.

4.1.20 It should also be noted that the conclusions of the assessment are based on currently available evidence and that the significance of impacts derived from the processes outlined for this assessment (and, in relation to protected sites, drawn upon by the associated Habitats Regulations Assessment) should only be considered a guide.

4.2 Assessment Methodology and the Geographical Scope of the Assessment – Export Cable Corridor and Project Areas

4.2.1 The assessment considers the proportion of birds potentially impacted by an effect at broader national and biogeographic scales, and additionally in relation to suites of protected sites (to provide North Sea-scale context) and at the scale of individual protected sites, with an associated assessment of the level of confidence of the effect at this scale. Methods for defining suites of sites and apportioning the magnitude of each impact determined for each wind farm project (or in-combination across the Dogger Bank Zone as a whole) to individual protected sites are outlined below. Definitions of breeding seasons for key seabird species considered in the assessment are provided in section 2.6.

Breeding seabirds

4.2.2 The apportioning of impacts for non-breeding seabirds draws from recent NE/JNCC (2013a) guidance. For breeding seabirds, information on foraging ranges (Thaxter *et al.* 2012) has been used to determine a suite of protected sites that might potentially be impacted by the effects associated with each wind farm project during the breeding season. The mean maximum foraging ranges across all studies reviewed by Thaxter *et al.* (2012) have been used, unless other evidence, e.g. from tracking studies, suggests that use of the these values may exclude birds from more distant protected sites that might also utilise feeding areas within the Dogger Bank Zone.

4.2.3 Recent tracking projects reviewed to demonstrate where there is known connectivity between the specific protected site breeding colonies of some species and the Dogger Bank Zone are summarised in Table 4.5. Tracking data for four species – northern gannet, great skua, black-legged kittiwake and Atlantic puffin – reveals overlap with Dogger Bank during the winter and/or breeding season. In these instances, for which data exist to attribute some of the birds recorded in the Dogger Bank Zone to specific protected sites (e.g. UK SPAs, Ramsar sites or other Natura 2000 sites in Europe), the confidence in predicting an effect on the site, as indicated above, will be higher than for all other sites for which the wind farm project is identified to be within the species' foraging range. Note that there is greater certainty in connectivity for breeding season studies than for overwinter studies on account of the greater accuracy of devices used to study species during the breeding season.

Table 4.5 Potential connectivity between species breeding colonies and the Dogger Bank Zone during the breeding season and over winter, assessed using tracking data.

Species	Breeding Colony	Breeding Season	Over Winter
Northern gannet	Flamborough & Bempton Cliffs SPA, UK	Yes[1,3]	Yes[5]
	Forth Islands SPA (Bass Rock) UK	Yes[2,3]	Yes[5,9]
	Storstappen, Norway		Yes[5]
	Ulvoyholmen, Norway		Yes[5]
Great skua	Iceland		Yes[6]
	Norway		Yes[6]
Black-legged kittiwake	Fair Isle, UK		Yes[7]
	Flamborough & Bempton Cliffs SPA, UK	Yes[4]	
	Forth Islands SPA (Isle of May) UK		Yes[7]
	Bear Island, Norway		Yes[7]
	Bulbjerg, Norway		Yes[7]
	Hornoya, Norway		Yes[7]
	Hjelmsoya, Norway		Yes[7]
	Cape Krutik		Yes[7]
Atlantic Puffin	Forth Islands SPA (Isle of May) UK		Yes[8]

[1]Langston & Boggio 2011, Langston & Teuten 2012; [2]Hamer *et al.* 2000, 2001; [3] Wakefield *et al.* 2013; [4] RSPB 2011, FAME 2012; [5]Fort *et al.* 2012; [6]Magnusdottir *et al.* 2012; [7]Frederiksen *et al.* 2011; [8]Harris *et al.* 2009; [9]Kubetzki *et al.* 2009.

4.2.4 For common guillemot and razorbill, more recent tracking studies (FAME 2012) have shown that these species may forage considerably further from their colonies than suggested by Thaxter *et al.* (2012) and this, together with the continuing use and concentration of birds in the western part of the Dogger Bank Zone during the breeding season, suggests that birds from breeding colonies do forage at least in this area. A maximum foraging range is thus used for these species, together with black-legged kittiwake, to determine the suite of protected sites that might potentially be impacted by the effects associated with each wind farm project during the breeding season (Table 4.6). With respect to northern gannet, more specific information is available for British, Irish and French breeding colonies (Hamer *et al.* 2000, 2001, Wakefield *et al.* 2013). This indicates that northern gannets may forage in the zone from both the Flamborough & Bempton Cliffs SPA and Forth Islands SPA, but not from 10 other colonies considered by this study. Thus the Dogger Bank Zone is considered to be within foraging range of birds from these two sites, while (given the foraging range of these birds) it cannot be discounted that birds from the Seevogelschutzgebiet Helgoland SPA in Germany might also forage within the zone.

Table 4.6 Relevant foraging ranges during the breeding season for key seabird species for the Dogger Bank Zone that occur in the North Sea during the breeding season (after Thaxter *et al.* 2012 unless stated).

Species	Scientific name	Foraging range
Northern fulmar	*Fulmarus glacialis*	400km (mean max)
Northern gannet	*Morus bassanus*	590km (max)
Arctic skua	*Stercorarius parasiticus*	24km (mean max)
Great skua	*Stercorarius skua*	86km (mean max)
Black-legged kittiwake	*Rissa tridactyla*	231km[b] (max)
Lesser black-backed gull	*Larus fuscus*	141km (mean max)
Great black-backed gull	*Larus marinus*	60km[a] (max)
Common guillemot	*Uria aalge*	340km[b] (max)
Razorbill	*Alca torda*	312km[b] (max)
Atlantic puffin	*Fratercula arctica*	105km (mean max)

[a] Single maximum value taken from Seys *et al.* (2001);
[b] FAME (2012).

4.2.5 Appendix 1 provides an overview, by species, of protected sites (SPAs, Ramsar sites, SSSIs in the UK) within the wider North Sea 'region' considered in the ornithology technical report at which breeding seabirds are a feature. This appendix does not consider protected sites for which seabirds or waterbirds are specified as either a passage or winter feature. It makes an assessment of whether, during the breeding season, species identified as features of breeding colonies should be screened in or out of the EIA process, by considering whether the foraging ranges of the species concerned are likely to overlap with the Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A or Dogger Bank Creyke Beck B projects within the Dogger Bank Zone, as outlined above.

4.2.6 Appendix 1 also provides details of population estimates used in the apportioning of impacts to protected sites. Analyses aimed to use up-to-date population estimates for sites, in order that impacts based on the population estimates produced for the Dogger Bank Teesside projects from the 2010, 2010/11 and 2011/12 survey data were appropriately apportioned. For Scottish SPAs, recent population estimates were provided by JNCC. Where available, data for English sites and Scottish SSSIs were taken from the JNCC Seabird Monitoring Programme Online Database (JNCC 2012b) for the most recent year between 2007 and 2011. If no data were available for these sites from this source for these years, data were obtained from the Seabird 2000 survey (which ran from 1998-2002) and numbers adjusted using country (Scotland, England) Seabird Monitoring Programme trends (JNCC 2012a) to provide a value for 2011. Population estimates used for the Flamborough Head and Bempton Cliffs SPA and its proposed extension were based on data for 2007 to 2011 and follow guidance provided by Natural England (see Appendix 3). For non-UK sites, data were taken from citation information available through Europa (2012) and Ramsar (2012). While up-to-date population estimates were used to best apportion

effects, the proportion of the site population estimated to be impacted was also applied to the citation population for information.

4.2.7 The assessment then aims to determine the significance of impacts, across the year, both at the level of the suite of protected sites in the wider North Sea 'region' and for each individual site. For the suite of protected sites, the assessment relates the magnitude of each impact determined for each wind farm project to the combined species' population for the suite as a whole. For individual protected sites, the magnitude of each impact determined for each wind farm project for the breeding season is apportioned to each protected site based on its population size and its distance from the project area (using an inverse distance squared weighting). For example, the magnitude of an impact at the first site A (m *A*) of i to n sites would be calculated from the overall magnitude of the impact for the project (m *P*) as follows:

$$\mathrm{m}\,A = \mathrm{m}\,P * \left(\mathrm{pop}\,A * \left(\frac{1}{\mathrm{dist}\,A * \mathrm{dist}\,A}\right)\right) / \sum_{i=A}^{n} \left(\mathrm{pop}\,i * \left(\frac{1}{\mathrm{dist}\,i * \mathrm{dist}\,i}\right)\right)$$

where pop is the population at a site and dist the distance from the site to the project.

4.2.8 Note, even for those species for which the wind farm project is within foraging range of birds from breeding colony protected sites, a proportion of the birds present will be non-breeding/immature birds that may not originate from these sites. For gulls and northern gannet, it was possible to derive estimates of this proportion from boat-survey observations of birds in breeding and juvenile plumages. For other species, it is assumed that, for species for which the wind farm project is within foraging range of birds from breeding colony protected sites, one third of the total number of birds (Stroud *et al.* 2004; Kober *et al.* 2010, 2012) present during the breeding season will be non-breeders. These are apportioned to protected sites surrounding the North Sea in the same manner as for seabirds outside the breeding season (see below).

4.2.9 The calculated magnitude of impact at the site-level is then related to the species' population size at the site. Note this is precautionary in that it assumes that all the birds come from protected sites. While it is possible to collate data for other colonies in the UK from Seabird 2000 (Mitchell *et al.* 2004) census data, for other countries within species' potential foraging ranges data are typically only available for protected sites. Consideration is thus provided as to whether the estimation of effects at the site level might be over-precautionary.

<u>Seabirds outside the breeding season/non-breeders and migrants</u>

4.2.10 The seabirds that are present in the Dogger Bank Zone outside the defined breeding seasons or during the breeding season as non-breeders, and migrants that pass through the area in autumn and spring, are not constrained to particular protected sites and could potentially originate from sites in a wider geographical area. Consequently, while it is possible to demonstrate or suggest breeding season

connectivity between some specific seabird colonies and the Dogger Bank Zone, in these other instances it is unlikely to be possible to directly link the birds observed in the Dogger Bank Zone to specific sites.

Migrants

4.2.11 A recent review (Wright *et al.* 2012) defined migration zones for those migratory birds designated as features of British SPAs (and other Annex 1 species) that are at potential risk from offshore wind farm developments. This review has been used to scope which species might migrate through the project areas. It is difficult to link the birds that might occur in the Dogger Bank Zone on migration to specific sites for three key reasons:

- Due to the distance of the zone offshore and thus the potential coastal and inland sites that birds may originate from;
- Birds may not migrate directly to or from the sites at which they are features; and
- Several sites might be used by the same individuals at different periods of the year (see comments in Appendix 3).

Therefore, no attempt has been made to apportion impacts to individual protected sites. Thus, for migrants, the assessment aims to determine the significance of impacts at the level of the species' national populations.

Non-breeding seabirds

4.2.12 The apportioning of impacts for non-breeding seabirds draws from recent NE/JNCC (2013b) guidance.

4.2.13 Seabirds that are present in the project areas outside the defined breeding seasons or during the breeding season as non-breeders may potentially originate from protected sites throughout the species' biogeographic ranges. However, apportioning the effects determined for each wind farm project to each protected site on the basis of the size of its population relative to the species' overall biogeographic population may lead to an underestimation of the magnitudes of impacts at some sites, particularly those closest to the Dogger Bank Zone. Therefore, greater weighting should be placed on those protected sites closer to the Dogger Bank Zone. For those species that breed around the North Sea, it is assumed that the birds that are present in the project areas outside the defined breeding seasons or during the breeding season as non-breeders originate from this wider 'region'. These results are qualified with new information on the dispersive and wintering areas from tracking studies. For instance, a recent study has shown that kittiwakes from North Sea colonies, such as the Isle of May, may also winter in the North Sea, but that it is unlikely that birds from westerly UK colonies would winter in the North Sea (Frederiksen *et al.* 2012). New information also exists on the non-breeding movements and distributions of the northern gannet (e.g. Kubetzki *et al.* 2009, Fort *et al.* 2012).

4.2.14 The magnitude of each impact determined for each wind farm project is thus apportioned to each protected site surrounding the North Sea, according to the size of the species' population at the site relative to that in this wider region as a whole. For example, the magnitude of an impact at the first site A (m *A*) of i to n sites would be calculated from the overall magnitude of the impact for the project (m *P*) as follows:

$$m\,A\ = m\,P * \ (\text{pop}\ A)/\sum_{i=A}^{n}(\text{pop}\ i)$$

4.2.15 During the non-breeding season, a number of protected sites may be connected with the Dogger Bank Zone (Table 4.6); however, studies providing information for this time of year are typically less accurate given the types of devices (geolocators) used to study species in this period. Greater certainty is available for breeding season movements from protected sites where GPS and satellite devices have been used. Given the difficulty of directly linking non-breeding birds observed in the Dogger Bank Zone to specific sites, confidence in predictions at the site-level will be lower than in the attribution of impacts during the breeding season to sites within foraging range (though this will also vary depending on whether species are dependent on relatively few or many sites).

4.3 Effects and Definitions of Worst Case Scenarios – Export Cable Corridor and Project Areas

4.3.1 Impacts are assessed assuming realistic 'worst case scenarios' developed according to the Rochdale Envelope approach. The Planning Inspectorate recognises the need for offshore wind farm developers to use this approach, which allows for flexibility in parameters (e.g. the number and size of wind turbines, wind turbine design and overall configuration). Worst case scenarios are discussed below in relation to specific effects and summarised at the end of this section.

4.3.2 Effects for birds may occur through the construction, operational and decommissioning phases and potentially impact on marine birds in the area of the projects themselves, along the export cable corridor and in the intertidal area at the cable landfall (for latter see section 4.4).

4.3.3 With respect to construction and decommissioning, two effects are considered:

- Disturbance/displacement;
- Effects associated with habitat loss and change.

4.3.4 With respect to operation, the potential effects of an offshore wind farm on birds are likely to arise through three main mechanisms (Langston and Pullan 2003; Peterson *et al.* 2006): behavioural responses, mortality associated with collision and

indirect effects associated with habitat loss or change. Four effects are thus considered:

- Disturbance and the displacement of birds from favoured habitats which could result in increased mortality and/or impacts on breeding productivity, thereby impacting the size of the population in the long-term;
- Barrier effects to migratory birds or those commuting between breeding sites and offshore feeding areas, which could potentially result in elevated energetic costs and thus increased mortality and/or impacts on breeding productivity;
- Collision risk (assumed mortality) with above surface structures, especially wind turbine blades; and
- Effects associated with habitat loss and change, e.g. changes in the seabed which may affect birds through their prey.

4.3.5 The text below describes each of these effects in turn, outlines realistic worst case scenarios and describes the methodology used to estimate the size or magnitude of impacts and the assessment of species-specific sensitivities and thus overall sensitivity to the effect.

Displacement – operation

Description

4.3.6 The assessment considers both the potential impacts of disturbance and displacement, though the two are interlinked and, in essence, reflect different levels of severity. "Disturbance" refers to an effect that causes a direct reaction in the behaviour of a bird, e.g. increased vigilance or flight/dive responses. However, prolonged disturbance could result in more long-term displacement from favoured habitat, which may become permanent if birds are unable to habituate to the cause of the effect. The sensitivity to these effects varies between species (Maclean *et al.* 2009).

4.3.7 Once operational, the wind farms will require regular maintenance throughout their lifetimes. This will require a team of dedicated Operations and Maintenance (O&M) technicians, technical specialists, and associated support staff, and transport to and from the locations using a variety of different types of vessel.

4.3.8 During the operations and maintenance period the maintenance crew will ensure that the wind turbines and platforms are operated in a safe and reliable manner, compliant with regulatory duties and in accordance with commercial objectives. In addition to the maintenance crew, specialists may be brought in to conduct specific activities, for example borescope inspection of components. Further maintenance activities will include maintenance of foundations, subsea cables, landfall, and offshore substation platforms.

4.3.9 During operation there is potential for a more long-term "displacement" of birds to occur due to the long-term presence of moving wind turbines and the associated

maintenance boat traffic. This displacement constitutes an effective loss of habitat (Desholm & Kalhert 2005). Only a regular, non-intermittent, low decibel level of noise is predicted for wind turbines in this project. Consequently, the main effect is likely to be associated with the presence of the wind turbines.

4.3.10 Behavioural displacement is commonly equated to macro-avoidance, though in the context of collision-risk modelling this refers to the far-field evasive action taken by a flying bird to avoid the wind farm as a whole (Band 2012). 'Micro' or 'near-field' avoidance refers to the evasive action taken by a bird in the vicinity of a wind turbine within the wind farm to avoid collision. Displacement, in contrast, reflects the long-term loss of all birds from an area of habitat. Although different, the macro-avoidance rates recorded in studies of birds flight paths can inform the potential displacement rates of different species.

Methodology used to estimate the size or magnitude of impacts and determine significance

4.3.11 For the worst-case scenario, displacement is assumed to be an on-going, non-reversible effect through the operational life of the wind farm, affecting birds both within the project area and a buffer area around this. As such, the assessment of displacement considers how many birds will be lost to the population in the long-term (based on the methodology outlined below), due to the effective loss of habitat associated with this effect.

4.3.12 At present, there is only a relatively limited evidence base on the effects of displacement at offshore wind farms (Appendix 4) and thus while some studies suggested there may be the potential for species to habituate to this effect, data are nonetheless lacking for most species. For the purposes of this assessment a precautionary worst case scenario assumed that displacement will occur at the same level throughout the lifetime of the projects. The size or magnitude of the impact associated with displacement reflects the real extent of the wind farm project and buffer considered and the proportion of birds assumed to be displaced.

Population estimates

4.3.13 Population estimates for the Dogger Bank Teesside A and B projects considered and buffer areas are provided in the baseline section of this report (section 3). For each of 2010, 2010/11 and 2011/12, mean population estimates for these areas were generated separately for the breeding season and other months of the year and the potential impacts of displacement assessed separately for these periods. Mean rather than peak population estimates for each season are used to better reflect overall usage of the project areas and buffers and in order that the impacts associated with displacement can be properly considered cumulatively. If peaks were used, there would be potential for considerably over-estimating cumulative effects, due to double-counting of the same birds moving between sites. Thus, while peak values from Wetland Bird Survey counts, for example, may be used to inform on site importance, these values should never be summed. It is considered unlikely

that the same proportion of birds would be displaced from the buffer as from the footprint of the wind farm project itself – details of different proportions chosen for the buffer are discussed below.

Displacement rates from operational wind farms

4.3.14 The determination of appropriate displacement rates draws from a review of the literature and recent monitoring studies (Appendix 4) and recent guidance from NE/JNCC (2012).

4.3.15 There is some evidence of displacement effects for species including seaducks, divers and auks (Zucco *et al.* 2006). Radar and visual scan studies for some seaducks, including scoter and long-tailed duck, and divers have recorded displacement effects and also strong avoidance of wind farms post-construction, where changes in flight paths have been noted up to 4km (APEM 2011, Krijgsveld *et al.* 2011, Petersen *et al.* 2006, 2011, (Petersen & Fox, 2007). Comparison of pre- and post-construction surveys at Horns Rev and Nysted has demonstrated displacement of divers and auks from sites (Peterson *et al.* 2006). Northern gannets may also avoid wind farms (Krijgsveld *et al.* 2011). Black-legged kittiwakes show much less avoidance of wind farms, even showing attraction (Krijgsveld *et al.* 2011). Other gull species have also been recorded within wind farms or even attracted to them post-construction (Krijgsveld *et al.* 2011, Petersen *et al.* 2006). However, there is limited information on displacement or macro-avoidance for northern fulmars and skuas (Petersen *et al.* 2006; Krijgsveld *et al.* 2011). For a full review, see Appendix 4.

4.3.16 The evidence provided by the review suggests differences do exist in rates of displacement, or attraction, between different species. The relative apparent displacement / attraction rates for different species suggested by the review are also not inconsistent with previous assessments of the relative sensitivities of species to disturbance.

4.3.17 The classification determined by Maclean *et al.* (2009), which incorporates information on species-specific behavioural responses using indications of sensitivity suggested by Garthe & Hüppop (2004), Petersen *et al.* (2004) and Petersen & Fox (2007), is presented in Table 4.7 below.

Table 4.7 Species-sensitivity to disturbance after Maclean *et al.* (2009).

Sensitivity due to disturbance	Species/species group
Very High	Scoters, divers
High	Long-tailed duck, cormorant
Medium	Eider, grebes, common guillemot, razorbill
Low	Northern gannet, most gulls including black-legged kittiwake, terns, Atlantic puffin
Very Low	Northern fulmar, skuas, little gull

4.3.18 Scores derived from more recent assessment of marine birds in Scottish waters by Furness and Wade (2012) and Furness *et al.* (2012, 2013) are assigned to a similar classification in Table 4.8. The classifications presented by/derived from these studies are similar, though those from the more recent review of Furness and Wade (2012) are followed here due to its UK context.

4.3.19 The recent NE/JNCC (2012) advice note on assessing displacement quotes the scores of Furness & Wade (2012). The NE/JNCC advice note differs from Furness and Wade (2012) in their assessment of the sensitivity of northern gannet as, whilst the species might not be highly sensitive to disturbance in general (e.g. ship and helicopter traffic), there are indications of a strong macro-avoidance of offshore wind farms (Krijgsveld et al. 2010, 2011). The guidance also notes that these sensitivity scores give an initial indication of potential displacement levels that may be exhibited by each species, and where in the full range of displacement each species might lie.

4.3.20 Given the variability in apparent displacement / attraction rates noted by the review provided in Appendix 4, we draw from these sensitivity scores in deriving rates of displacement to take forward in this assessment, unless there is sufficient evidence to suggest that an alternative displacement rate might be appropriate. The displacement rates for different species taken forward are derived by applying the scores for sensitivity to disturbance (as given by Furness & Wade 2012) across a range of potential displacement rates from 0 to 100% – see Table 4.8.

Table 4.8 Species-sensitivity to disturbance from boats (derived from Furness & Wade 2012, Furness *et al.* 2012, 2013[1]) and rates of displacement for seabirds in relation to an operational wind farm taken forward in this assessment.

Sensitivity to disturbance	Species/species group	Displacement rate
Very High	Common scoter, velvet scoter, red-throated diver, great northern diver, black-throated diver	100%
High	Common goldeneye, great cormorant, greater scaup	75%
Medium	Common eider, long-tailed duck, great-crested grebe, Slavonian grebe, shag, razorbill, black guillemot, common guillemot	50%
Low	Northern gannet[2], herring gull[2], great black-backed gull[2], little tern, little auk, black-headed gull[2], common gull[2], lesser black-backed gull[2], black-legged kittiwake[2], Sandwich tern, common tern, roseate tern, Arctic tern, Atlantic puffin	25%
Very Low	Great skua, northern fulmar, sooty shearwater, Manx shearwater, European storm-petrel, Leach's storm-petrel, Arctic skua, little gull	0%

[1] Scores presented in Furness & Wade (2012)/Furness *et al.* (2012, 2013) were translated into the same categories as presented in Maclean *et al.* (2009) as follows: 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high;
[2] See discussion in paragraphs 4.3.21 and 4.3.22 below.

4.3.21 For northern gannet, evidence suggests that although the species might not be highly sensitive to disturbance in general (e.g. ship and helicopter traffic) the species may show strong macro-avoidance of offshore wind farms (Krijgsveld *et al.* 2010, 2011). Hence, following recent NE/JNCC (2012) guidance, we apply a 75% displacement rate for this species.

4.3.22 With respect to gulls, while some studies suggest that avoidance of wind farms may occur, the relative evidence for either displacement or attraction is weak, and there is considerable variability in the apparent displacement / attraction rates reported in the studies reviewed in Appendix 4. Hence, following discussion with stakeholders, a 0% displacement rate is considered appropriate for these species (See Appendix 3).

4.3.23 Accounts of the potential impacts of the effects of displacement are provided in section 5 (the results of the impact assessments for the Dogger Bank Teesside A and Dogger Bank Teesside Beck B projects, together with an assessment of the combined effects of both) and section 6 (cumulative impacts) only for those species for which displacement is expected to occur. Thus, with respect to the key receptors considered in this assessment, no accounts are provided for northern fulmar, skuas or gulls.

Buffer distances

4.3.24 The review of recent displacement studies provided in Appendix 4 was used to inform appropriate species-specific buffer distances for use in the assessment. For divers (and seaducks), studies have indicated that numbers of birds may be reduced up to 4km from wind farms (Petersen *et al.* 2005, Krijgsveld *et al.* 2011, NE/JNCC 2012). Consequently, buffers of 4km around the wind farm projects are used for these species.

4.3.25 While there is some evidence that numbers of auks may also be reduced up to 4km from wind farms (Petersen *et al.* 2005, Krijgsveld *et al.* 2011, NE/JNCC 2012), an average scenario is for a 2km buffer (this reflecting the sensitivities of these species to displacement and recent guidance: NE/JNCC 2012). A 2km buffer is also used for gulls, including black-legged kittiwake, for which studies have suggested that displacement rates are likely to be much lower, and also for fulmar and skuas for which information is limited. This also follows guidance from NE/JNCC (2012).

4.3.26 Displacement rates within buffers are unlikely to be 100% of those in the wind farm and are likely to decline with increasing distance from the wind farm, as is evident from studies in Denmark (Petersen 2005, Petersen et al. 2004, 2006). As a simple mathematical way to apply a gradient to reflect decreasing avoidance with increasing distance from the wind farm, different displacement rates are thus

applied for two bands around the wind farm projects: 0-1km, 75% of the displacement rate for the wind farm; 1-2km, 25% of the displacement rate for the wind farm (average rate of 50% of the displacement rate for the wind farm over 0-2km).

Species-specific sensitivities – mortality

4.3.27 Studies of the impacts of habitat loss on the fitness, i.e. fecundity or survival of individuals, and on populations as a whole are few. Burton *et al.* (2006) reported how the body condition and survival rates of redshank were impacted following their displacement by a loss of intertidal habitat. However, similar studies of the impacts of habitat loss in the marine environment are lacking. In actuality, the survival of birds displaced through loss of habitat will depend on whether alternative areas are close to carrying capacity or, are able to support increased densities. If areas elsewhere do exist but are limited in quality or extent, and/or already occupied, then increasing pressure on those areas could lead to increased competition for resources (Goss-Custard 1985; Goss-Custard *et al.* 2002). Such competition will increase as the availability of alternate habitat below carrying capacity decreases with cumulative development.

4.3.28 Following Maclean *et al.* (2009) and Langston (2010), the sensitivity of species to displacement is taken to reflect their ability to tolerate the effect through their flexibility in using alternate habitats. This accords with previous assessments of habitat flexibility (Garthe & Hüppop 2004) and flexibility in foraging behaviour (Furness & Tasker 2000) in determining the sensitivities of species to this effect. The classification determined by Maclean *et al.* (2009) is presented in Table 4.9 below.

Table 4.9 Species-sensitivity to habitat loss (Maclean *et al.* 2009).

Sensitivity due to habitat loss	Species/species group
Very High	Red-necked grebe
High	Scoters, divers, great-crested grebe, great cormorant
Medium	Common eider, little gull, common tern, Arctic tern
Low	Great skua, black-legged kittiwake, black-headed gull, great black-backed gull, Sandwich tern, auks
Very Low	Northern fulmar, northern gannet, lesser black-backed gull, herring gull

4.3.29 Scores provided in a more recent assessment of marine birds in Scottish water by Furness and Wade (2012) and Furness *et al.* (2012, 2013), assigned to a similar classification, are provided in Table 4.10. The classifications presented by/derived from these studies are similar, though those from the more recent review of Furness and Wade (2012) and Furness *et al.* (2012, 2013) are followed here due to its UK context.

4.3.30 In essence, these scores reflect the ability of a species to cope with habitat loss following displacement, and may be viewed as a proxy for the proportion of the species' population that might be expected to be lost due to displacement.

Table 4.10 Species-sensitivity to habitat loss (derived from Furness & Wade 2012, Furness *et al.* 2012, 2013) and mortality rates for displaced marine birds taken forward in this assessment.

Sensitivity due to habitat loss[1]	Species/species group
Very High	Red-necked grebe
High	Greater scaup, common eider, long-tailed duck, common scoter, common goldeneye, red-throated diver, black-throated diver, great-crested grebe, Slavonian grebe, little tern, black guillemot
Medium	Velvet scoter, great northern diver, great cormorant, shag, Sandwich tern, common tern, roseate tern, Arctic tern, common guillemot, razorbill, Atlantic puffin
Low	Arctic skua, great skua, black-headed gull, common gull, great black-backed gull, black-legged kittiwake, little auk
Very Low	Northern fulmar, sooty shearwater, Manx shearwater, European storm-petrel, Leach's storm-petrel, northern gannet, lesser black-backed gull, herring gull

[1] Scores presented in Furness & Wade (2012) were translated into the same categories as presented in Maclean *et al.* (2009) as follows: 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high;

4.3.31 These sensitivity scores are drawn from in deriving rates of displacement to take forward in this assessment. Unless there is sufficient evidence to suggest that an alternative displacement rate might be appropriate, mortality rates for different species taken forward are derived by applying the scores for sensitivity to habitat loss (as given by Furness & Wade 2012) across a range of potential mortality rates from 0 to 50% (see Appendix 3).

4.3.32 Thus for, white-billed diver, a potential mortality rate of 37.5% is derived (based on the sensitivities to habitat loss of red-throated diver and black-throated diver).

4.3.33 As outlined above, the potential impacts of habitat loss to species' populations may occur both through impacts on productivity and on survival (both of young birds that might be recruited into the breeding population and breeding adults) and will reflect both the sensitivity of species to habitat loss and the availability of alternate habitat below carrying capacity. Drawing from the review provided in Furness (2013) (see Appendix 11C of the ES), for auks (common guillemot, razorbill, Atlantic puffin, little auk), it is probable that impacts in the breeding season are most likely to occur through impacts on breeding productivity. The Dogger Bank projects are only within foraging range of five of the key species considered in this assessment. However, even for these species, impacts on productivity might be expected to be small given

the distance of the projects offshore and that individual seabirds repeatedly commuting unusually long distances to find food tend to be unsuccessful in their breeding attempts because they are unable to provision chicks as frequently as necessary (Furness 2013). Furthermore, using 2007-2011 Danish Vessel Monitoring System (VMS) data as a proxy for sandeel and thus habitat availability, only 1.0% of the habitat within the foraging range of, for example, common guillemot lies within the Dogger Bank Teesside A and B projects (0.8% by area alone). The impact of food availability on adult survival is potentially the most influential factor affecting seabird population trend (Mitchell *et al.* 2004). Displacement by individual OWF projects is unlikely to reduce survival of breeding seabirds because they tend to buffer their survival by abandoning breeding when conditions are unfavourable (Furness 2013). However, displacement of non-breeders may impact survival rates, and thus populations, if the habitat lost is of high quality and other areas are at carrying capacity. Outside the breeding season, auks are distributed across much of the North Sea, favouring areas along the east coast of Britain from the Moray Firth to the Dogger Bank, the German Bight, and in the Skagerrak and Kattegat. While areas of high quality habitat exist in the north and west of the Dogger Bank zone and other parts of the wider Dogger Bank, the sediments in the project areas are on the whole not of the preferred sand grain size selected by sandeels. Given this and the larger areas of quality habitat available elsewhere within North Sea wintering areas, displacement of auks from the projects in the Dogger Bank might be expected to result in only a negligible increase in mortality. Furthermore, while the proportion of available sandeel habitat across Dogger Bank Teesside A and B is slightly lower than Dogger Bank Creyke Beck A and B projects (equivalent proportional value of 1.5% of habitat availability), the use of project-specific rates introduces additional complexity, especially when combining projects for cumulative assessment. Thus, for all Dogger Bank projects for auks, a potential mortality rate of 5% is considered for the assessment of displacement.

4.3.34 In the case of northern gannet, both breeding season foraging ranges and the species' wintering range are considerably greater than for auk species. Thus for this species, impacts on reference populations of the loss of habitat associated with any one project in the Dogger Bank zone are expected to be minimal (Furness 2013). However, while relative to foraging ranges and the species' wintering range the amount of habitat from which birds may be displaced by a single project might be considered minimal for this species, the impacts of cumulative developments may be significant if many are in high quality habitat. Thus, for this species, a potential mortality rate of 0% is considered in the assessment of displacement for the Dogger Bank Teesside A and B projects alone and 5% for the assessment of the cumulative impacts from the Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects combined and for these projects in combination with others in the North Sea.

4.3.35 As indicated above, with respect to the assessment of displacement, no accounts are provided for northern fulmar, skuas or gulls for which displacement rates are considered to be zero.

Bespoke assessment of magnitude and significance

4.3.36 As indicated in paragraph 4.1.15, rather than considering the species-specific sensitivities described above in conjunction with value to determine an overall sensitivity to this effect, a bespoke assessment is used, modifying the approach of Maclean *et al.* (2009).

4.3.37 In this assessment, the magnitude associated with displacement encapsulates consideration of both the numbers of birds estimated to be displaced (as determined by the population estimates for project areas and buffers and the displacement rates outlined in Table 4.8) – the 'displacement magnitude' – and the proportion of these that might be expected to then be lost to the species' overall population in the long-term (as determined by the species-specific sensitivities and mortality rates outlined above).

4.3.38 The overall estimated magnitude associated with displacement is then assessed in relation to national and biogeographic populations and the populations supported by individual protected sites.

4.3.39 As the consideration of species-specific sensitivities is encapsulated here within the evaluation of magnitude, the significance of the impact associated with displacement is determined by combining this magnitude directly with the species' value (following Table 4.4).

4.3.40 It should be re-iterated that the mortality rates considered here represent the proportion of those birds predicted to be displaced that might be expected to be lost to the population in the long-term. No attempt is made to assess this effect in relation to changes in background annual mortality that would be required to bring the population to the new lower equilibrium, as how long this will take to happen will depend on a number of factors (where displaced birds move to and the carrying capacity of those areas) and thus the changes in annual mortality required.

4.3.41 As noted above, there was a large degree of variability in the apparent displacement/attraction rates reviewed in Appendix 4. Furthermore, as highlighted in this review, there is a lack of empirical evidence regarding the mortality consequences of the displacement of marine birds from offshore wind farms. Given this uncertainty and as proposed by NE/JNCC (2012), therefore, we also present tabulated summaries for each species of the numbers of birds estimated to be displaced that are then estimated to die based on a range of alternative displacement and mortality rates from 0 to 100%.

Consideration of diving species for displacement

4.3.42 As with the assessment of other effects, the assessment of displacement was based on population estimates derived from aerial and boat-based surveys (see sections 2 and 3). However, white-billed diver, northern gannet, common guillemot, razorbill,

little auk, and Atlantic puffin can dive underwater and, consequently, may, potentially, be missed by aerial surveys leading to possible underestimates of populations that may be disturbed or displaced. Consideration of this issue is given in Appendix 5 and correction factors provided so that it may be determined whether the assessment of significance might change taking these into account. The number of northern gannets missed was considered negligible and no correction was applied. The correction factors applied (and associated confidence in these values) were as follows: white-billed divers 71.3% (very low confidence), common guillemot 18.0% (high confidence), razorbill 16.4% (high confidence), little auk 26.1% (high confidence), and Atlantic puffin 20.2% (low confidence).

Confidence

4.3.43 There is considerable uncertainty regarding the assessment of disturbance and displacement effects for marine birds at offshore wind farms. In particular, there is only a relatively limited evidence base on the effects of displacement at offshore wind farms (Appendix 4), and the determination of appropriate displacement rates needs to draw both on the avoidance of flying birds, rather than displacement per se, and expert judgement. Studies of the impacts of displacement (effective habitat loss) on the survival of individuals, and on populations as a whole, are even fewer and wholly lacking in the marine environment. Hence, it is necessary to draw on qualitative assessments of the ability to tolerate this effect through their flexibility in using alternate habitats in assessing the sensitivity of species to displacement. While the baseline surveys have provided robust estimates of the populations of birds using the project areas that have informed the assessment of this effect, given these uncertainties, the confidence in predictions in the assessment of displacement effects (and disturbance) is considered (at its most precautionary) to be low.

Displacement – construction/decommissioning of the wind farm

Description

4.3.44 Disturbance will be an on-going effect through the construction and decommissioning phases of the project, varying in frequency through the year according to the species' population size, and has the potential to impact birds throughout the range of the species' biogeographic population.

4.3.45 During construction and decommissioning, the main disturbance effects are likely to be from the construction of the wind turbines themselves, the laying of cables and the boat/helicopter traffic and noise and vibration associated with these activities. The duration of these effects will vary between activities.

4.3.46 For the Dogger Bank Teesside A and B projects up to 200 6MW turbines and 120 10MW turbines would be installed, which could take up to 11.5 years to construct after the consent award. This is assuming that each project is built in six years (foundations in years 1 and 2, turbines in 2 and 3, maximum pilings are based on multi-leg foundations, and assumes that construction of all six projects begins at the

same time), and that if built sequentially there would be a six month overlap between projects. For the purpose of this assessment, it is assumed that construction is continuous over this period. For cumulative across the entire zone, the total duration of construction activities is 20 years assuming overlapping construction of six projects.

4.3.47 During offshore construction and decommissioning, a wide range of vessels will be required, including helicopters. The maximum piling operations per year per project are 600 and 360 for 6 and 10 MW turbines, respectively with two simultaneous piling operations per project for both. In a single year, for offshore platforms up to 168 piling operations per foundation would take place per project, plus an extra 20 piling operations for other foundations. For both turbines sizes, up to 20 vessels will be engaged in construction of foundations per project, and 15 for WTG installation. In addition, up to 25 extra vessels will be associated with works including accommodation and commissioning vessels. The total vessels for six concurrent projects would be 396 but for individual projects would be 66. A total of 5,150 and 4,360 round trips to port will be required for 6MW and 10MW turbines respectively (including export cable vessels), constituting 858 and 726 round trips to port per project year (assuming a six year construction phase) – the same numbers are also assumed for decommissioning. The number of trips required per turbine will be the same and thus it is probable that the boat traffic associated with construction will be relatively even across the period. Temporary work areas around projects would be 1,000m, and individual turbine construction and decommissioning would include up to six jack-up operations.

4.3.48 Construction methodology will be dependent upon the technical solutions selected for the project. Key techniques which may be required include:

- Seabed preparation (based on dredging and/or rock placement);
- Scour & subsea damage protection;
- Installation of piles, through driving and drilling of piles;
- Installation of helical screw piles;
- Installation of self-installing and self-buoyant platforms and foundation structures (including jack-up foundations – potentially onto pre-installed plinths);
- Installation of Suction footings (as in suction bucket foundations, or suction anchors);
- Lowering into place (as in gravity foundations) using cranes, buoyancy or a combination of both;
- Grouting (many operations can include use of grout, for instance: connecting piles to foundation or transition piece structures, and under gravity bases and suction buckets);
- Assembly of components (as in the assembly of wind turbines or substations on top of installed foundations, and including the bolting, swaging, or grouting of joints and connections);

- Cable installation and protection (potentially via techniques such as ploughing, jetting, cutting, etc, as described in the cable installation sections along with the use of rock dumping or proprietary cable protection systems; and
- The use of all or a combination of the above techniques constitute the drivers behind the effect of disturbance and displacement (direct effect on birds), through vessel presence and gradual creation of above surface structures, and the effect of habitat loss or change – for instance release of suspended sediments, underwater noise, and Electro-magnetic fields as a result of construction activities.

4.3.49 Disturbance from inter-array and inter-platform activities is considered as part of wind farm construction/decommissioning overall activities. Inter-array and inter-platform cables will be installed from a cable laying vessel or barge, using either a multi-point anchoring or dynamic positioning system. The cable burial methodologies and decommissioning activites are similar to those discussed for the export cable activities in paragraph 4.3.59 and 4.3.60.

4.3.50 For each of Dogger Bank Teesside A and B, the maximum duration of inter-array cable installation is up to six years, i.e. half the project area for three years, then the other half in the subsequent three years. For inter-platform cables, up to six will be laid per project (consent for inter-link between Dogger Bank Teesside A and B only), using similar techniques to the export cable construction (including for inter-array cables). Thus, the duration of activities is short-lived but still has potential to impact birds throughout the range of the species' biogeographic population.

Methodology used to estimate the size or magnitude of impacts and determine significance

4.3.51 Maclean *et al.* (2009) recommend that assessment of the effect of disturbance during construction and decommissioning is also undertaken by assuming a worst case scenario that some or all birds are displaced from the area.

4.3.52 The same bespoke approach, used above for estimating the magnitude of impacts and determining significance for displacement during operation, was also used to assess displacement for construction and decommissioning periods. The same buffer distances, population estimates and displacement rates are also utilised. However, this maximal scenario will not be realised over the entire construction or decommissioning phase. The numbers of birds displaced will increase during construction and decrease during decommissioning in relation to the spatial extent of the wind farm. Assuming a linear progression of activities, the average spatial extent of the wind farm over the course of construction and decommissioning is thus taken to be half that during operation and the numbers of birds displaced consequently also 50% of those during operation. Mortality rates following displacement during construction and decommissioning are assumed to be the same as those during operation.

4.3.53 As the assessment of displacement considers how many birds will be lost to the population in the long-term, due to the effective loss of habitat associated with this effect, the impacts predicted during construction and decommissioning are encompassed by those predicted for the operational period and are not additive.

4.3.54 A number of scenarios exist regarding the scheduling of construction activities for the Dogger Bank Teesside A and Dogger Bank Teesside B projects, together with the Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B considered in the cumulative assessment for the Dogger Bank Zone. For the purpose of assessing the impacts from disturbance during construction, a worst case scenario is also assumed here that construction will occur across all these projects at the same time.

4.3.55 Disturbance will be an on-going effect through construction and decommissioning phases of the project, varying in frequency through the year according to the species' population size, and hence the opportunity for birds to recover from particular disturbance events may be limited. There is also a limited evidence base on the adaptability of species to disturbance, especially in a marine environment, and thus while there may be the potential for species to habituate to this effect, for the purposes of this assessment a worst case scenario assumed that the activities associated with construction and decommissioning will pose a displacement effect to birds throughout these phases.

Disturbance – export cable corridor activities

Description

4.3.56 Disturbance will be an on-going effect through the laying of export cables. For the Rochdale envelope, it is assumed that the projects will either be installed in parallel (maximum intensity) or separated (maximum separation time up to five years), the former of which is considered unlikely due to inevitable bottlenecks in the supply chain.

4.3.57 Up to six vessels will be engaged in installation of export cables per project. A total of 220 and 140 round trips will be required, for 6MW and 10MW turbines respectively, for export cable corridors – the same numbers are also assumed for decommissioning. Temporary work areas around offshore cable corridors would be 750m. Offshore cables will be left in situ or removed depending on the available information at the time of decommissioning.

4.3.58 HVDC export cables will be up to 550kV, but are expected to be between 300-400kV. The maximum cable length from landfall to offshore converter will be 261km and 220km for Dogger Bank Teesside A and Dogger Bank Teesside B, respectively, and the maximum cable length will be up to 573km and 484km for each project respectively. The expected duration of HVDC export cable-laying activities is 696 days for Dogger Bank Teesside A and 595 days for Dogger Bank Teesside B, based on a progress rate of 100m/hr and 60% total time based on weather conditions. This calculation assumes up to four campaigns per project and 30 days between each campaign. Thus, the duration of activities is short-lived but still has potential to impact birds throughout the range of the species' biogeographic population.

4.3.59 Offshore export cables will be installed from a cable laying vessel or barge, using either a multi-point anchoring or dynamic positioning system. The cable burial methodologies include: direct burial during the laying campaign pre-trenching, and post-lay burial. Methodologies for cable burial are likely to include: jetting, ploughing, trenching, rock cutting, mass flow excavation, and dredging, for which the maximum width affected is up to 10m from these activities (local disturbance only). These activities are typical of those that may cause direct disturbance to birds, or habitat loss or change in the vicinity of the export cable corridor.

4.3.60 For decommissioning the removal of structures is expected to involve the approximate reverse of the installation process. The following steps are anticipated:

- Disconnecting wind turbines and mobilisation of decommissioning vessels;
- Removal of any potentially hazardous or polluting materials from the wind turbine. With the use of appropriate vessels, remove rotor blades, then nacelle, then tower sections; and
- Offshore cables will be removed or left in situ based on the requirements at the time

Methodology used to assess the magnitude of impacts and significance

Population estimates

4.3.61 Population estimates for the export cable corridor were derived using ESAS data (see section 3 for more information).

4.3.62 Some species were not recorded by ESAS data as occurring within the export cable corridor area – namely for white-billed diver, Arctic skua, lesser black-backed gull and little auk. However, ESAS data are more than 20 years old. Hence, while these data are used for the export cable route assessment, they cannot be used to rule out potential occurrence in the area. .

Assessment

As indicated above, Maclean *et al.* (2009) recommend that assessment of the effect of disturbance during construction and decommissioning is also undertaken by assuming a worst case scenario that some or all birds are displaced from the area considered. However, it is noted that only a small proportion of the Dogger Bank Teesside A and B export cable route would be affected at any one time. A total of four separate campaigns are expected at any one time along the Dogger Bank Teesside A and B export cable route. For any individual campaign, assuming a 1.5km radius along the route, this would amount to 3km distance, covering an area of 4.5km^2, thus for four campaigns, amounting to a maximum of 12km distance, over 18km^2. Taking the proportion of the total cable route works area (233km^2), the total area affected at any one time is considered to be up to 7.7% of the total cable route population. Similar consideration is given to the cable route for Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D, incorporated into the cumulative assessment in section 6.2 (see Creyke Beck assessment and table below).

4.3.63 To assess the potential impacts of disturbance in the export cable corridor, the same bespoke approach used to estimate the magnitude of impacts and determine significance as described above for displacement from the wind farm area was applicable. Rates of displacement were derived directly from species-sensitivity scores to disturbance from boats (from Furness & Wade 2012, Furness *et al.* 2012, 2013), as given in Table 4.8.

4.3.64 However, given the relative small numbers of birds occurring in cable route areas (both absolute and with respect to reference biogeographic, national or protected site populations), the numbers of birds that might be displaced by disturbance in these areas are considered negligible for all receptors (Table 4.11). Furthermore, the exposure of birds to the effect of disturbance from cable-laying activities would be very limited temporally. Hence, the effect of disturbance in the export cable corridor is considered to be of negligible significance for all receptors.

Table 4.11 The numbers of birds predicted to be displaced due to cable-laying activities for Dogger Bank Teesside A and B, and together with all three cable routes including for Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D.

Species	Cable route Population		Number displaced		Final number impacted	
	Dogger Bank Teesside A and B	Dogger Bank Teesside A and B, Dogger Bank Creke Beck A and B and Dogger Bank Teesside C and D	Dogger Bank Teesside A and B	Dogger Bank Teesside A and B, Dogger Bank Creke Beck A and B and Dogger Bank Teesside C and D	Dogger Bank Teesside A and B	Dogger Bank Teesside A and B, Dogger Bank Creke Beck A and B and Dogger Bank Teesside C and D
Northern fulmar	372	698	0	0	0	0
Northern gannet	47	430	<1	8	0	<1
Great skua	7	32	0	0	0	0
Great black-backed gull	19	70	<1	1	0	0
Black-legged kittiwake	555	1,800	11	35	0	0
Common guillemot	885	6,342	34	244	2	12
Razorbill	19	373	<1	14	<1	<1
Atlantic puffin	49	201	1	4	<1	<1

Barrier effects – operation

Description

4.3.65 Wind farms may pose a barrier effect to migratory birds or those commuting between breeding sites and offshore feeding areas, which could result in elevated energetic costs (Speakman *et al.* 2009) and potentially increased mortality or impacts on productivity at colonies. Increases in the energetic costs of the daily movements of seabirds or of the movements of migratory birds have been shown in a number of studies (Tulp *et al.* 1999, Pettersson & Stalin 2003; Masden *et al.* 2009, 2010), although Masden *et al.* (2009), in reporting changes in the migratory trajectories of common eiders at a Danish offshore wind farm, post-construction, suggested that this had minimal likely effect on energetics. However, it was noted that cumulative effects could be significant, for instance, if other wind farms or human developments worked in combination to disrupt routes of birds. Desholm & Kalhert (2005) also reported that migrant wildfowl diverted around the Nysted wind farm, and Tulp *et al.* (1999), found that common eiders did not fly between wind turbines that were placed 200m apart in the Kattegat.

Methodology used to estimate the size or magnitude of impacts and determine significance

4.3.66 The assessment of barrier effects for the Dogger Bank Teesside projects concerns both breeding seabirds whose foraging ranges extend to the projects (see Table 4.5 and Appendix 1) and migrating birds.

4.3.67 The list of migrant species for which barrier effects are considered a potential effect is determined by the migration zones summarised in Wright *et al.* (2012), and put into context using the relevant biogeographic populations following that report. In Wright *et al.* (2012) biogeographic population estimates for waterbirds were taken from Wetlands International (2012), while for other receptors biogeographic population estimates are from BirdLife International (2004). The sizes of the British or Irish populations that use the migration zones described are derived from Musgrove *et al.* (2011) for wintering waterbirds in Great Britain, Crowe *et al.* (2008) for wintering waterbirds in Ireland, and from Baker *et al.* (2006) for other receptors, unless stated otherwise. The confidence that these species may occur in the Dogger Bank Zone is qualified by observations from boat surveys reported in the baseline of this report.

4.3.68 Assessing the magnitude of the potential impacts associated with barrier effects is particularly problematic. Two approaches have previously been used in assessing the magnitude of the potential impacts associated with barrier effects. The approach outlined by Maclean *et al.* (2009) is described in Table 4.12 below:

Table 4.12 The magnitude of the potential impacts associated with barrier effects (following Maclean *et al.* 2009).

Magnitude	Definition
Very High	(i) Wind farm is located between breeding site and key foraging area of a species flying through the site in nationally or internationally important numbers; and/or (ii) is located close to key stopover, breeding or wintering site of species flying through the site in internationally important numbers; and/or (iii) is located along the migration route of a species flying through the site in internationally important numbers.
High	(i) Wind farm is located close to key stopover, breeding or wintering site of species flying through the site in nationally important numbers; and/or (ii) is located along the migration route of a species flying through the site in nationally important numbers.
Medium	(i) Wind farm is located between breeding site and key foraging area of a species flying through the site in regionally important numbers; and/or (ii) is located close to key stopover, breeding or wintering site of a species flying through the site in regionally important numbers; and/or (iii) is located along the migration route of a species flying through the site in regionally important numbers.
Low	(i) Wind farm is located between breeding site and key foraging area of any other breeding species; and/or (ii) is located close to a key stopover, breeding or wintering site of any other species; and/or (iii) is likely to be located on a migration route of any other species.
Negligible	None of the above, hence negligible impact.

4.3.69 Alternatively, magnitude may be assessed using the standard classification based on the percentages of a reference population potentially impacted that is outlined in Table 4.1. This approach may result in lower levels of magnitude being assigned than that of Maclean *et al.* (2009).

4.3.70 In each of these cases, however, the approach effectively provides an assessment of the number of birds 'exposed' to the barrier effect presented by the wind farm, rather than the population-level consequence, i.e. the actual magnitude of the impact. The actual magnitude of the effect will be determined not only by the number of birds 'exposed' to the effect, but also whether the increase in the energetic costs associated with the barrier results in increased mortality.

4.3.71 As indicated by Maclean *et al.* (2009), the impact on survival of a given barrier and associated deviation in flight will differ between species – large, bulky species with small wing areas (i.e. those which have high wing-loadings) are likely to be more adversely affected than those that do not. Based on this assumption, Maclean *et al.* (2009), used body mass and wing-length ratios derived from information presented in the BTO BirdFacts website (Robinson 2005) to devise species-specific sensitivities to barrier effects (Table 4.13 below) to use in combination with a species' value to determine a species overall sensitivity (following Table 4.3).

Table 4.13 Species-specific sensitivities to barrier effects (following Maclean *et al.* 2009).

Species-specific sensitivity	Species
Very High	Black-throated diver
High	Red-throated diver, great cormorant, geese, auks
Medium	Ducks
Low	Northern fulmar, skuas, gulls
Negligible	Northern gannet, terns, passerines

4.3.72 The consideration of species-specific sensitivities provided by Maclean *et al.* (2009) is essentially an attempt to better quantify magnitude following the initial consideration of exposure. While this approach does indicate the relative likelihood of impacts between species, it retains an inherent limitation, however, as there remains no quantification of the percentage of the population of birds that might actually be lost, either directly through impacts of survival on those exposed to the effect or indirectly, through impacts on productivity.

4.3.73 Due to these limitations, an alternative approach is required and this is outlined below.

4.3.74 Here, for both breeding seabird and migrant species, the numbers of flying birds used in estimating collision risk (see below) are taken to represent the populations of birds exposed to the potential barrier effects associated with each wind farm

project. For breeding seabirds, the average of the mean numbers of birds recorded during each month of the 2010, 2011 and 2012 breeding seasons covered by the baseline surveys is used.

4.3.75 We also provide an indication of the increase in flight distance posed by the wind farm projects for both migrants crossing the North Sea and breeding seabirds commuting from their colonies to foraging sites. For breeding seabirds, we further indicate whether the increase in flight distance posed by barrier effects might prevent birds from any individual protected site from reaching foraging areas beyond the project areas considered, based on information on the species' maximum foraging range. (Note, there is a broad negative correlation between a species' foraging range and its sensitivity, sensu Maclean *et al.* 2009.)

4.3.76 The increase in flight distance posed by the potential barrier effects associated with wind farm projects provides a proxy for the increase in energetic cost and, together with information on the number of birds exposed, is considered in evaluating the potential magnitude. As it is not possible to fully quantify the number of birds that might potentially be impacted by barrier effects, this is by necessity a qualitative judgement and it should be noted that there is presently little understanding of the thresholds above which such increases might impact survival or productivity (Masden *et al.* 2009, Speakman *et al.* 2009).

4.3.77 As indicated in paragraph 4.1.15, as the consideration of species-specific sensitivities is encapsulated here within the evaluation of magnitude, the significance of the impact associated with barrier effects is determined by combining the potential magnitude of the effect directly with the species' value (following Table 4.4).

4.3.78 Barrier effects will be an on-going effect through the operational lifetime of the project for all species, and thus there is no potential for species to recover from this effect. As indicated above, there is a limited evidence base on barrier effects at present and thus while there may be the potential for species to habituate to this effect, for the purposes of this assessment a worst case scenario assumed that the projects will pose a barrier to 100% of flying birds throughout their lifetime.

Confidence

4.3.79 There is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms for both breeding seabirds and migrants. While the baseline surveys have provided robust estimates of the populations of marine birds using the project areas, there is uncertainty as to the proportion of these birds that might be associated with breeding sites and for which the projects pose a barrier effect to their foraging flights. For migrants, there is even greater uncertainty, both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Coupled with this, two different approaches are used to categorise magnitude, while species' sensitivities to this effect are determined through the proxy of wing-loading. Given these uncertainties, the confidence in predictions in the assessment of barrier

effects is considered to be very low, although it should be noted that the approach used is precautionary.

Collision – operation

Description

4.3.80 The possibility of collisions between birds and wind turbines is one of the key ornithological effects associated with offshore wind farms. Consequently, in impact assessments for offshore wind farms it is necessary to present estimates of collision risk associated with the development.

4.3.81 Collision will be an on-going effect through the operational lifetime of the project, varying in frequency through the year according to the species' population size. The size or magnitude of the risk for each receptor depends on a number of factors including its population in the area of the proposed development, the species own characteristics and their behaviour, notably the proportion of time that they spend flying and the heights at which they fly, and their avoidance of wind turbines. The latter may include macro-, or far-field avoidance of the wind farm as a whole, and micro-avoidance of individual wind turbines (see review by Cook *et al.* 2012). Other aspects such as the weather and differences between diurnal and nocturnal behaviour between species may also affect the magnitude of impacts. Following guidance from SNH, Natural England and a recent review (SNH 2010, Cook *et al.* 2012) an avoidance rate of 98% was assumed for all species, with the exception of northern gannet, for which a rate of 99% was used. This accords with the studies of Krijgsveld *et al.* (2010, 2011) which indicated that northern gannets may show strong macro-avoidance of offshore wind farms. This rate was also used in the assessment and confirmed as accepted in the decision for the recently consented Triton Knoll OWF.

4.3.82 Collision may potentially impact a number of species groups, including those seabirds that use the area of the proposed development for feeding during the breeding season and other times of year, and waterbirds and terrestrial species that pass through the area on migration in spring and autumn.

Methodology used to estimate the size or magnitude of impacts and worst case scenarios

4.3.83 Estimates of the probability of any individual bird colliding with a wind turbine can be obtained from models which incorporate information on the species of concern (flight height data, flight speeds and morphology) and wind turbine design. For the purposes of assessment, the Band model is used to provide information on collision impacts. While other models are in existence, at the time of writing the Band model is considered as the standard approach. From these probabilities and information on the numbers or densities of birds using the area of the wind farm, the potential collision mortality associated with offshore wind farms can be estimated.

Seabirds

4.3.84 Collision risk analyses were run using the Band model, updated for the offshore environment (Band 2012). The updated Band model differs from the original (developed for onshore wind farms: Band *et al.* 2007) in two key ways. Firstly, bird numbers are input as densities rather than raw counts, better reflecting the way in which data are collected in the offshore environment. Secondly, the updated Band model is capable of incorporating three options for considering flight heights:

- Option 1 - using the basic model, i.e. assuming that a uniform distribution of flight heights between lowest and highest levels of the rotors; and using the proportion of birds at risk height as derived from site survey;
- Option 2 - again using the basic model, but using the proportion of birds at risk height as derived from the generic flight height information;
- Option 3 - using the extended model, using the generic flight height information.

4.3.85 Option 3 which uses modelled flight height distributions for each of the study species allows comparison of the impact of varying the height of wind turbines, and to account for the fact that collision risk is not distributed evenly within the rotor swept area.

4.3.86 In each project, collision risk modelling was undertaken for all seabird species for which sufficient population data were available – northern gannet, northern fulmar, Arctic skua, great skua, lesser black-backed gull, great black-backed gull, black-legged kittiwake, common guillemot, razorbill, little auk and Atlantic puffin. Monthly population estimates for 2010, 2010/11 and 2011/12 for each of these species, in each project area, were derived following the methodology outlined in section 2 of this report, but considering only flying birds, a key assumption of the Band model (Tables 4.14a, 4.14b, 4.14c, 4.15a, 4.15b, 4.15c). Data on species morphology and flight behaviour used in analyses are shown in Table 4.16. From December 2010 onwards, surveyors specified the confidence with which they were assigning flying birds to individual flight height bands during boat surveys. Out of 25,927 records collected of flying birds, confidence in the band that individuals were assigned to was assessed as high on 23,870 occasions (92% of the time). These assessments were not made prior to December 2010.

4.3.87 A total of eight scenarios were considered within the collision risk modelling framework, covering a range of wind turbine sizes and heights (Table 4.17). Differences between these scenarios were initially assessed assuming a 98% avoidance rate (99% for northern gannet) across all three Band model options. The worst case scenario from these eight scenarios was then considered in greater detail in relation to a range of different avoidance rates.

4.3.88 It was considered that Option 3 of the updated Band model offered the most realistic assessment of collision risk within the Dogger Bank Zone. Firstly, it offers the opportunity to input the actual dimensions of the turbines to be used within each project. This means that the proportion of birds flying within the rotor-swept

area can be accurately estimated, rather than being constrained to the proportion estimated to be flying above 20m during the boat surveys. More importantly, collision risk is variable within the rotor-swept area. Collision risk is greatest towards the centre of the turbine, where the area of the rotor sweep is greatest. Under Option 1, birds are assumed to be distributed evenly within the rotor-swept area. However, as they are most likely to be clustered towards the lower reaches of the rotor-swept area, this results in an over-estimate of the number of collisions. By using Option 3, it is possible to account for this variable distribution. Therefore, we considered each of the eight model scenarios using Option 3 of the Band model.

4.3.89 Whilst data from the Dogger Bank Zone contributed to development of modelled flight height bands, the zone itself is considerably further offshore than the other projects considered in Cook *et al.* (2012). However, detailed examination of modelled outputs by Cook *et al.* (2012) suggested that there was no relationship between the distance to shore and the accuracy with which the proportion of birds flying within each flight height band could be predicted. This suggests that differences between the inshore and offshore environments were not having a significant impact on observed flight heights. Additionally, for each species, the proportion of birds observed flying above 20m during the survey programme on Dogger Bank were within the 95% confidence intervals of those predicted to be above this height by the modelled distribution of Cook *et al*. (2012) (Table 4.16). This provides support for the suggestion that the modelled distribution provides a reasonable reflection of flight heights of birds within the Dogger Bank Zone. However, as recommended by Band (2012) results from the alternative model options are also considered in order to qualify the results of the assessment. Due to limitiations in how the data have been collected, we present results from option 1 based on the proportion of birds flying at a height of 20m or above (Table 4.16); given that turbines with a minimum height above sea-level of 26m are considered, this is likely to be highly precautionary. For option 3 of the Band model, we estimated the proportion of birds flying within the rotor swept area of turbines from the modelled distributions presented in Cook *et al.* (2012) and based on the hub height and radius of the turbine designs presented in Table 4.17.

4.3.90 The number of wind turbines was adjusted accordingly to a target to generate 1200MW of electricity. The proportion of time wind turbines were operational varied throughout the year (Table 4.18), but averaged 94.5% of the time.

Table 4.14a Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside A project of the Dogger Bank Zone in 2010 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.05 (0.04-0.07)	0.12 (0.1-0.15)	0.12 (0.1-0.15)	0.18 (0.16-0.22)	0.27 (0.24-0.33)	0.26 (0.23-0.32)	0.13 (0.11-0.16)	0.07 (0.06-0.09)	0.07 (0.06-0.09)	0.07 (0.06-0.09)	0.05 (0.04-0.07)	0.08 (0.06-0.1)
Northern gannet	0.03 (0.02-0.03)	0.02 (0.02-0.03)	0.03 (0.02-0.04)	0.01 (0.01-0.01)	0.03 (0.03-0.04)	0.07 (0.05-0.08)	0.05 (0.04-0.06)	0.04 (0.03-0.05)	0.05 (0.04-0.06)	0.08 (0.07-0.1)	0.05 (0.04-0.06)	0.08 (0.07-0.09)
Arctic skua	0 (0-358.64)	0 (0-5.01)	0 (0-0.2)	0 (0-0.02)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	0.66 (0.59-0.73)	0.8 (0.72-0.89)	0.87 (0.78-0.99)	0.18 (0.16-0.2)	0.21 (0.19-0.24)	0.21 (0.19-0.24)	0.14 (0.12-0.16)	0.12 (0.11-0.14)	0.21 (0.18-0.24)	0.62 (0.55-0.7)	0.56 (0.5-0.63)	0.89 (0.79-1)
Lesser black-backed gull	0.01 (0-0.02)	0.01 (0.01-0.02)	0.03 (0.02-0.04)	0.06 (0.04-0.1)	0.09 (0.06-0.14)	0.09 (0.06-0.13)	0.04 (0.03-0.07)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)
Great black-backed gull	0.08 (0.06-0.1)	0.05 (0.04-0.08)	0.03 (0.02-0.05)	0.04 (0.03-0.06)	0.03 (0.02-0.04)	0.02 (0.01-0.03)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.02 (0.01-0.03)	0.02 (0.01-0.03)	0.03 (0.03-0.05)	0.08 (0.06-0.12)
Common guillemot	0.02 (0.02-0.04)	0.03 (0.02-0.04)	0.03 (0.02-0.04)	0.02 (0.01-0.03)	0.01 (0.01-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0.01-0.02)	0.03 (0.02-0.04)	0.07 (0.05-0.09)	0.13 (0.1-0.17)
Razorbill	0.04 (0.03-0.05)	0.02 (0.02-0.04)	0.02 (0.01-0.03)	0.01 (0.01-0.03)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.02)	0.03 (0.02-0.07)	0.05 (0.03-0.06)	0.06 (0.03-0.1)
Little auk	0.01 (0-0.03)	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.04 (0.03-0.06)	0.06 (0.04-0.09)
Atlantic puffin	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.02)	0 (0-0.01)	0 (0-0.01)

Table 4.14b Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside A project of the Dogger Bank Zone based on population estimates from July 2010 to June 2011 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.06 (0.05-0.08)	0.09 (0.07-0.12)	0.1 (0.08-0.12)	0.11 (0.09-0.13)	0.11 (0.09-0.13)	0.1 (0.08-0.12)	0.13 (0.11-0.16)	0.07 (0.06-0.09)	0.07 (0.06-0.09)	0.07 (0.06-0.09)	0.05 (0.04-0.07)	0.08 (0.06-0.1)
Northern gannet	0.06 (0.05-0.07)	0.09 (0.07-0.11)	0.27 (0.22-0.32)	0.06 (0.05-0.07)	0.06 (0.05-0.07)	0.06 (0.05-0.07)	0.05 (0.04-0.06)	0.04 (0.03-0.05)	0.05 (0.04-0.06)	0.08 (0.07-0.1)	0.05 (0.04-0.06)	0.08 (0.07-0.09)
Arctic skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	0.68 (0.6-0.77)	1 (0.88-1.13)	2.85 (2.53-3.22)	0.86 (0.76-0.99)	0.93 (0.83-1.05)	0.71 (0.62-0.81)	0.14 (0.12-0.16)	0.12 (0.11-0.14)	0.21 (0.18-0.24)	0.62 (0.55-0.7)	0.56 (0.5-0.63)	0.89 (0.79-1)
Lesser black-backed gull	0 (0-0.01)	0.01 (0-0.02)	0.03 (0.02-0.05)	0.06 (0.04-0.09)	0.04 (0.03-0.07)	0.02 (0.01-0.04)	0.04 (0.03-0.07)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)
Great black-backed gull	0.07 (0.05-0.1)	0.06 (0.05-0.09)	0.08 (0.06-0.11)	0.07 (0.05-0.1)	0.03 (0.02-0.04)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.02 (0.01-0.03)	0.02 (0.01-0.03)	0.03 (0.03-0.05)	0.08 (0.06-0.12)
Common guillemot	0.17 (0.13-0.22)	0.16 (0.12-0.21)	0.12 (0.1-0.16)	0.08 (0.06-0.11)	0.05 (0.03-0.06)	0.03 (0.02-0.04)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0.01-0.02)	0.03 (0.02-0.04)	0.07 (0.05-0.09)	0.13 (0.1-0.17)
Razorbill	0.08 (0.04-0.13)	0.1 (0.06-0.14)	0.11 (0.08-0.14)	0.08 (0.05-0.2)	0.02 (0-0.04)	0 (0-0.01)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.02)	0.03 (0.02-0.07)	0.05 (0.03-0.06)	0.06 (0.03-0.1)
Little auk	0.05 (0.03-0.08)	0.02 (0.01-0.04)	0.01 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.04 (0.03-0.06)	0.06 (0.04-0.09)
Atlantic puffin	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.02)	0 (0-0.01)	0 (0-0.01)

Table 4.14c Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside A project of the Dogger Bank Zone based on population estimates from July 2011 to June 2012 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.05 (0.04-0.06)	0.19 (0.15-0.26)	0.17 (0.14-0.21)	0.26 (0.22-0.33)	0.27 (0.22-0.33)	0.14 (0.12-0.18)	0.11 (0.09-0.13)	0.11 (0.09-0.13)	0.12 (0.1-0.15)	0.14 (0.11-0.17)	0.07 (0.06-0.08)	0.07 (0.06-0.09)
Northern gannet	0.02 (0.01-0.02)	0.15 (0.11-0.19)	0.51 (0.43-0.6)	0.31 (0.25-0.37)	0.41 (0.33-0.49)	0.16 (0.12-0.2)	0.09 (0.07-0.11)	0.14 (0.11-0.16)	0.2 (0.17-0.24)	0.35 (0.29-0.42)	0.08 (0.07-0.1)	0.04 (0.03-0.06)
Arctic skua	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.13)	0 (0-1.34)	0 (0-19.23)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.02)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	0.46 (0.4-0.52)	2.32 (2.03-2.7)	3.34 (2.95-3.81)	0.84 (0.73-0.98)	0.76 (0.67-0.87)	0.44 (0.38-0.51)	0.43 (0.38-0.49)	0.19 (0.17-0.22)	0.11 (0.09-0.13)	0.22 (0.19-0.25)	0.16 (0.14-0.19)	0.37 (0.33-0.43)
Lesser black-backed gull	0.01 (0-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.03)	0.03 (0.02-0.05)	0.03 (0.01-0.05)	0.02 (0.01-0.04)	0.01 (0.01-0.02)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)
Great black-backed gull	0.03 (0.02-0.04)	0.07 (0.05-0.11)	0.05 (0.03-0.08)	0.07 (0.05-0.11)	0.05 (0.03-0.09)	0.03 (0.01-0.06)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.01 (0.01-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.03)	0.04 (0.03-0.06)
Common guillemot	0.04 (0.03-0.05)	0.09 (0.07-0.12)	0.16 (0.12-0.2)	0.15 (0.11-0.2)	0.08 (0.06-0.1)	0.03 (0.02-0.04)	0.02 (0.01-0.02)	0.01 (0.01-0.01)	0.01 (0-0.01)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0.01-0.02)
Razorbill	0.02 (0.01-0.03)	0.09 (0.06-0.13)	0.18 (0.14-0.24)	0.11 (0.07-0.21)	0.01 (0-0.04)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)
Little auk	0.01 (0.01-0.02)	0.01 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.02 (0.02-0.04)
Atlantic puffin	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 4.15a Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside B project of the Dogger Bank Zone in 2010 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.07 (0.05-0.1)	0.15 (0.13-0.2)	0.13 (0.1-0.16)	0.17 (0.14-0.2)	0.27 (0.23-0.32)	0.25 (0.22-0.31)	0.14 (0.12-0.17)	0.08 (0.06-0.1)	0.08 (0.06-0.1)	0.09 (0.07-0.11)	0.06 (0.05-0.08)	0.09 (0.08-0.11)
Northern gannet	0.04 (0.04-0.05)	0.03 (0.03-0.04)	0.05 (0.03-0.06)	0.01 (0.01-0.01)	0.03 (0.03-0.04)	0.07 (0.06-0.08)	0.06 (0.05-0.08)	0.05 (0.04-0.06)	0.06 (0.05-0.07)	0.12 (0.1-0.14)	0.07 (0.06-0.08)	0.1 (0.08-0.12)
Arctic skua	0 (0-310.61)	0 (0-4.34)	0 (0-0.18)	0 (0-0.02)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	1.09 (0.98-1.21)	1.24 (1.12-1.37)	1.32 (1.18-1.48)	0.31 (0.28-0.36)	0.39 (0.36-0.44)	0.39 (0.35-0.44)	0.29 (0.26-0.33)	0.26 (0.23-0.29)	0.44 (0.39-0.5)	0.94 (0.84-1.05)	0.8 (0.72-0.89)	1.2 (1.08-1.34)
Lesser black-backed gull	0.01 (0-0.01)	0.01 (0.01-0.02)	0.02 (0.02-0.04)	0.05 (0.04-0.08)	0.1 (0.08-0.15)	0.1 (0.08-0.13)	0.05 (0.03-0.07)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)
Great black-backed gull	0.11 (0.09-0.15)	0.07 (0.05-0.1)	0.05 (0.03-0.06)	0.03 (0.02-0.04)	0.02 (0.01-0.03)	0.01 (0.01-0.02)	0.01 (0.01-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.04)	0.03 (0.02-0.04)	0.04 (0.03-0.06)	0.1 (0.07-0.14)
Common guillemot	0.03 (0.02-0.05)	0.04 (0.03-0.06)	0.04 (0.03-0.05)	0.03 (0.02-0.04)	0.01 (0.01-0.02)	0.01 (0.01-0.01)	0.01 (0.01-0.01)	0.01 (0.01-0.01)	0.02 (0.01-0.02)	0.04 (0.03-0.06)	0.1 (0.07-0.12)	0.18 (0.13-0.23)
Razorbill	0.05 (0.04-0.07)	0.03 (0.02-0.05)	0.02 (0.01-0.04)	0.01 (0.01-0.04)	0 (0-0.01)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.02 (0-0.02)	0.04 (0.03-0.09)	0.06 (0.05-0.08)	0.08 (0.05-0.13)
Little auk	0.01 (0-0.03)	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.04 (0.03-0.06)	0.06 (0.04-0.09)
Atlantic puffin	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.02)	0 (0-0.04)	0 (0-0.02)	0 (0-0.02)

Table 4.15b Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside B project of the Dogger Bank Zone based on population estimates from July 2010 to June 2011 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.07 (0.06-0.09)	0.09 (0.08-0.12)	0.08 (0.07-0.1)	0.09 (0.08-0.11)	0.09 (0.08-0.11)	0.09 (0.08-0.11)	0.14 (0.12-0.17)	0.08 (0.06-0.1)	0.08 (0.06-0.1)	0.09 (0.07-0.11)	0.06 (0.05-0.08)	0.09 (0.08-0.11)
Northern gannet	0.06 (0.05-0.08)	0.1 (0.08-0.11)	0.34 (0.29-0.4)	0.06 (0.05-0.08)	0.06 (0.05-0.07)	0.07 (0.06-0.08)	0.06 (0.05-0.08)	0.05 (0.04-0.06)	0.06 (0.05-0.07)	0.12 (0.1-0.14)	0.07 (0.06-0.08)	0.1 (0.08-0.12)
Arctic skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	0.78 (0.69-0.89)	1.13 (1-1.28)	3.67 (3.31-4.09)	1.57 (1.41-1.74)	1.72 (1.56-1.9)	1.38 (1.23-1.53)	0.29 (0.26-0.33)	0.26 (0.23-0.29)	0.44 (0.39-0.5)	0.94 (0.84-1.05)	0.8 (0.72-0.89)	1.2 (1.08-1.34)
Lesser black-backed gull	0 (0-0.01)	0.01 (0-0.02)	0.02 (0.01-0.04)	0.05 (0.03-0.07)	0.05 (0.03-0.07)	0.02 (0.02-0.04)	0.05 (0.03-0.07)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)
Great black-backed gull	0.07 (0.05-0.1)	0.07 (0.05-0.09)	0.09 (0.07-0.13)	0.05 (0.04-0.06)	0.02 (0.01-0.03)	0.01 (0.01-0.02)	0.01 (0.01-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.04)	0.03 (0.02-0.04)	0.04 (0.03-0.06)	0.1 (0.07-0.14)
Common guillemot	0.24 (0.18-0.31)	0.23 (0.17-0.29)	0.17 (0.14-0.21)	0.11 (0.09-0.14)	0.07 (0.05-0.09)	0.04 (0.03-0.05)	0.01 (0.01-0.01)	0.01 (0.01-0.01)	0.02 (0.01-0.02)	0.04 (0.03-0.06)	0.1 (0.07-0.12)	0.18 (0.13-0.23)
Razorbill	0.11 (0.05-0.17)	0.13 (0.08-0.19)	0.15 (0.12-0.19)	0.1 (0.07-0.26)	0.02 (0-0.05)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.02 (0-0.02)	0.04 (0.03-0.09)	0.06 (0.05-0.08)	0.08 (0.05-0.13)
Little auk	0.05 (0.03-0.08)	0.02 (0.01-0.04)	0.01 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.04 (0.03-0.06)	0.06 (0.04-0.09)
Atlantic puffin	0 (0-0.01)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.02)	0 (0-0.04)	0 (0-0.02)	0 (0-0.02)

Table 4.15c Monthly density estimates of flying birds (birds km^{-2}) within the area of the proposed Dogger Bank Teesside B project of the Dogger Bank Zone based on population estimates from July 2011 to June 2012 (with 90% confidence limits).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern fulmar	0.06 (0.05-0.07)	0.21 (0.17-0.28)	0.17 (0.14-0.21)	0.22 (0.18-0.27)	0.24 (0.2-0.3)	0.13 (0.11-0.16)	0.1 (0.08-0.12)	0.1 (0.09-0.12)	0.11 (0.09-0.14)	0.17 (0.15-0.21)	0.08 (0.07-0.1)	0.08 (0.07-0.1)
Northern gannet	0.02 (0.02-0.03)	0.18 (0.14-0.22)	0.76 (0.62-0.9)	0.31 (0.25-0.36)	0.43 (0.36-0.5)	0.17 (0.13-0.2)	0.11 (0.09-0.12)	0.16 (0.14-0.19)	0.25 (0.21-0.28)	0.5 (0.42-0.58)	0.11 (0.09-0.13)	0.05 (0.04-0.07)
Arctic skua	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0.11)	0 (0-1.19)	0 (0-17.1)	0 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.02)	0 (0-0.01)	0 (0-0.01)	0 (0-0)
Great skua	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0.01 (0.01-0.02)	0 (0-0.01)	0 (0-0)
Black-legged kittiwake	0.6 (0.54-0.68)	2.89 (2.57-3.32)	5.01 (4.46-5.72)	1.48 (1.31-1.68)	1.41 (1.26-1.59)	0.83 (0.73-0.93)	0.85 (0.76-0.95)	0.39 (0.35-0.43)	0.22 (0.2-0.25)	0.3 (0.26-0.34)	0.22 (0.2-0.25)	0.46 (0.42-0.53)
Lesser black-backed gull	0.01 (0-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.03)	0.02 (0.01-0.04)	0.03 (0.02-0.05)	0.03 (0.01-0.04)	0.01 (0.01-0.02)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0-0.01)
Great black-backed gull	0.04 (0.03-0.05)	0.08 (0.05-0.12)	0.07 (0.04-0.1)	0.05 (0.03-0.07)	0.04 (0.02-0.06)	0.02 (0.01-0.04)	0.01 (0.01-0.01)	0.01 (0.01-0.01)	0.01 (0.01-0.02)	0.02 (0.01-0.02)	0.02 (0.02-0.03)	0.05 (0.03-0.07)
Common guillemot	0.05 (0.04-0.07)	0.13 (0.1-0.17)	0.22 (0.17-0.28)	0.21 (0.16-0.28)	0.11 (0.08-0.13)	0.04 (0.03-0.05)	0.02 (0.01-0.03)	0.01 (0.01-0.02)	0.01 (0-0.01)	0.01 (0-0.01)	0.01 (0.01-0.01)	0.02 (0.01-0.03)
Razorbill	0.02 (0.01-0.04)	0.12 (0.08-0.18)	0.25 (0.19-0.31)	0.15 (0.09-0.28)	0.02 (0-0.06)	0 (0-0.02)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)
Little auk	0.01 (0.01-0.02)	0.01 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0.01)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0-0.01)	0.02 (0.01-0.03)	0.02 (0.02-0.04)
Atlantic puffin	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 4.16 Species biometric data used in collision risk models.

Species	Body Length[1]	Wingspan[1]	Flight Speed[2]	Nocturnal Activity[3]	Flight	Observed Prop. At CRH (proportion of birds recorded flying above 20m during boat surveys)	Prop. Above 20m Based on Models Presented in Cook *et al.* (2012) (with 95% CIs)	Modelled Prop. At CRH (26m – 193m) Based On Models Presented in Cook *et al.* (2012) (with 95% CIs)
Northern fulmar	0.48	1.07	13.00	0.75	Glide	0.01	<0.01 (0-0.26)	<0.01 (0-0.23)
Northern gannet	0.94	1.72	14.90	0.25	Flap	0.16	0.10 (0-0.21)	0.03 (0-0.12)
Arctic skua	0.44	1.18	13.30	0	Flap	0.01	0.04 (0-0.96)	0.02 (0-0.16)
Great skua	0.56	1.36	14.90	0	Flap	0.08	0.04 (0-1)	0.03 (0.01-0.27)
Black-legged kittiwake	0.39	1.08	13.10	0.50	Flap	0.20	0.16 (0.08-0.24)	0.08 (0.03-0.13)
Lesser black-backed gull	0.58	1.42	9.95	0.50	Flap	0.36	0.28 (0-0.58)	0.18 (0.04-0.42)
Great black-backed gull	0.71	1.58	13.00	0.50	Flap	0.32	0.34 (0.19-0.63)	0.24 (0.11-0.45)
Common guillemot	0.40	0.67	19.10	0.25	Flap	0.04	<0.01 (0-0.06)	<0.01 (0-0.03)
Razorbill	0.38	0.66	16.00	0	Flap	0.07	0.04 (0-0.80)	<0.01 (0-0.27)
Little auk	0.18	0.44	17.66	0	Flap	0.02	<0.01 (0-0.99)	<0.01 (0-1.00)
Atlantic puffin	0.28	0.55	17.60	1	Flap	<0.01	<0.01 (0-0.08)	<0.01 (0-0.04)

[1]Taken from BTO BirdFacts website (Robinson 2005);
[2]Taken from Pennycuik (1997);
[3]Taken from Garthe & Hüppop (2006) following Band (2012);

Table 4.17 Wind turbine designs considered within the collision risk modelling process.

Wind Turbine Capacity (MW)	Number of Wind Turbines Required	Wind Turbine Hub Height[1]	Blades	Mean Rotation Speed (m/s)	Rotor Radius	Blade Width	Pitch
6	200	109.5	3	8.84	83.5	5.5	10
6	200	113.5	3	8.84	83.5	5.5	10
6	200	133.5	3	8.84	83.5	5.5	10
6	200	183.5	3	8.84	83.5	5.5	10
10	120	138.5	3	6.85	112.5	6.7	10
10	120	142.5	3	6.85	112.5	6.7	10
10	120	162.5	3	6.85	112.5	6.7	10
6	200	182.5	3	8.84	83.5	5.5	10

[1] Meters above highest astronomical tide

Table 4.18 Monthly proportion of time wind turbines are operational.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97	97	97	94	93	92	92	92	95	96	97	96

4.3.91 Results of the collision risk analyses for the Dogger Bank Teesside A and Dogger Bank Teesside B projects and the combined results for the two projects are presented in sections 5.2, 5.3 and 5.4 of this report respectively. In each case, results are presented separately for each month in 2010, 2010/11 and 2011/12, based on the median population estimates and lower and upper confidence limits around these values. Collision estimates based on the means of the monthly values, and thus for the breeding and non-breeding seasons, are also presented.

4.3.92 For the purposes of the impact assessment and the apportioning of impacts to protected sites (see section 4.2), collision risk estimates are summed for breeding months and non-breeding months in each of the three years. The magnitude of the impact associated with collision risk is assessed using the mean monthly estimates across the years (and based on the upper confidence limit)..

Migrants

4.3.93 Collision risk analyses for migrant birds were run using the Band model, following the guidance specifically for migrants at offshore sites (Annex 6 of Band 2012). As there are limited data available on the flight heights of birds during migration, only Option 1 (described under *marine birds* above) for consideration of flight heights was used; i.e. the basic model using the proportion of birds at risk height, with proportions taken from Wright *et al.* (2012). Three scenarios were run, using the lower, central and upper limits of the range of the proportion of birds at risk height, as described in Wright *et al.* (2012).

4.3.94 The species whose migration routes would potentially cross each project area were determined using the maps provided in Wright *et al.* (2012). For each of these species, the proportion of the total number of birds crossing the North Sea that would cross the footprint of the wind farm (at any height) during each migration season was calculated using the methods described in Wright *et al.* (2012). The methods described in Wright *et al.* (2012) were also used to determine the reference population relevant to the assessment (i.e. the total number of birds crossing the North Sea during each migration), and details of the derivation of each population estimate is given in Table 4.19.

4.3.95 A single scenario for wind turbine size and height was considered in collision risk models for migrating birds, using the worst case scenario described for marine birds above. Collision risk was modelled with a precautionary avoidance rate of 98%. The value used in collision risk models for the proportion of time wind turbines were operational was taken as the average across the year (94.6%) as migration occurs in many months, but the distribution of migrating bird numbers across the months during which migration occurs is not known.

4.3.96 Biometric data and flight speeds of each species, for use in collision risk models, were taken from published information as detailed in the footnotes to Table 4.19.

Table 4.19 Species biometric data and derivation of population estimates used in collision risk models for migrating birds.

Species	Body Length (m)[1]	Wingspan (m)[1]	Flight Speed (ms^{-1})[2]	Flight Type	Prop. At CRH[3] (Lower Limit)	Prop. At CRH[3] (Best Estimate)	Prop. At CRH[3] (Upper Limit)	Reference Population Size[4]	Population Size Correction Factor[5]	Derivation of Population Size[6]
Bean goose *Anser fabalis*	0.75	1.58	21.08	Flap	0.05	0.30	0.75	730	1	Musgrove W (*fabalis* + *rossicus*)
Barnacle goose (Svalbard population) *Branta leucopsis*	0.64	1.38	21.08	Flap	0.05	0.30	0.75	33,000	1	Musgrove W
Light-bellied brent goose (Svalbard population) *Branta bernicla hrota*	0.58	1.15	21.08	Flap	0.05	0.30	0.75	3,400	1	Musgrove W
Common shelduck *Tadorna tadorna*	0.62	1.12	18.65	Flap	0.001	0.15	0.60	75,610	1	Musgrove W + Crowe
Eurasian wigeon *Anas penelope*	0.48	0.80	18.65	Flap	0.001	0.15	0.60	522,370	0.95	Musgrove W + Crowe
Gadwall *Anas strepera*	0.51	0.90	18.65	Flap	0.001	0.15	0.60	21,975	0.6	Musgrove W – Musgrove B
Eurasian teal *Anas crecca*	0.36	0.61	18.65	Flap	0.001	0.15	0.60	249,510	0.5	Musgrove W + Crowe – Musgrove B
Mallard *Anas platyrhynchos*	0.58	0.90	18.65	Flap	0.001	0.15	0.60	459,500	0.7	Musgrove W + Crowe – Musgrove B
Northern pintail *Anas acuta*	0.58	0.88	18.65	Flap	0.001	0.15	0.60	30,235	0.5	Musgrove W + Crowe
Northern shoveler *Anas clypeata*	0.48	0.77	18.65	Flap	0.001	0.15	0.60	18,800	0.75	Musgrove W + Crowe – Musgrove B
Common pochard *Aythya ferina*	0.46	0.77	18.65	Flap	0.001	0.15	0.60	74,555	0.75	Musgrove W + Crowe – Musgrove B
Tufted duck *Aythya fuligula*	0.44	0.70	18.65	Flap	0.001	0.15	0.60	102,860	0.9	Musgrove W + Crowe – Musgrove B
Greater scaup *Aythya marila*	0.46	0.78	18.65	Flap	0.001	0.15	0.60	9,360	0.05	Musgrove W + Crowe

Species	Body Length (m)[1]	Wingspan (m)[1]	Flight Speed (ms^{-1})[2]	Flight Type	Prop. At CRH[3] (Lower Limit)	Prop. At CRH[3] (Best Estimate)	Prop. At CRH[3] (Upper Limit)	Reference Population Size[4]	Population Size Correction Factor[5]	Derivation of Population Size[6]
Common scoter *Melanitta nigra*	0.49	0.84	18.65	Flap	0.001	0.01	0.17	123,060	0.5	Musgrove W + Crowe – Musgrove B
Velvet scoter *Melanitta fusca*	0.54	0.94	18.65	Flap	0.001	0.15	0.60	2,500	0.9	Musgrove W
Common goldeneye *Bucephala clangula*	0.46	0.72	18.65	Flap	0.001	0.15	0.60	29,165	1	Musgrove W + Crowe – Musgrove B
Red-breasted merganser *Mergus serrator*	0.55	0.78	18.65	Flap	0.001	0.15	0.60	2,900	0.1	Musgrove W - Musgrove B
Goosander (breeding males) *Mergus merganser*	0.62	0.90	18.65	Flap	0.001	0.15	0.60	3,500	1	Musgrove B (males only)
Goosander (non-breeding) *Mergus merganser*	0.62	0.90	18.65	Flap	0.001	0.15	0.60	3,250	1	Musgrove W – Musgrove B
Great bittern *Botaurus stellaris*	0.75	1.30	11.00	Flap	0.05	0.50	0.95	400	0.7	Musgrove W - Musgrove B
Great crested grebe *Podiceps cristatus*	0.48	0.88	18.65	Flap	0.01	0.10	0.40	24,385	1	Musgrove W + Crowe
Slavonian grebe *Podiceps auritus*	0.34	0.62	18.65	Flap	0.01	0.10	0.40	1,100	0.5	Musgrove W
Hen harrier (breeding) *Circus cyaneus*	0.48	1.10	8.64	Flap	0.25	0.50	1.00	285	0.1	25% of Musgrove B adults only (GB)
Hen harrier (non-breeding) *Circus cyaneus*	0.48	1.10	8.64	Flap	0.25	0.50	1.00	375	0.8	SOSS (0.5*Baker W)
Eurasian coot *Fulica atra*	0.37	0.75	18.65	Flap	0.05	0.25	0.95	105,000	0.5	Musgrove W - Musgrove B
Eurasian oystercatcher (non-breeding) *Haematopus ostralegus*	0.42	0.83	16.20	Flap	0.05	0.25	0.75	200,000	0.35	SOSS

Species	Body Length (m)[1]	Wingspan (m)[1]	Flight Speed (ms^{-1})[2]	Flight Type	Prop. At CRH[3] (Lower Limit)	Prop. At CRH[3] (Best Estimate)	Prop. At CRH[3] (Upper Limit)	Reference Population Size[4]	Population Size Correction Factor[5]	Derivation of Population Size[6]
Common ringed plover (non-breeding) *Charadrius hiaticula*	0.19	0.52	16.20	Flap	0.05	0.25	0.75	73,000	0.5	SOSS (autumn only/exclude spring for carry forward)
Golden plover (non-breeding) *Pluvialis apricaria*	0.28	0.72	16.20	Flap	0.05	0.25	0.75	400,000	0.5	Musgrove W
Grey plover *Pluvialis squatarola*	0.28	0.77	16.20	Flap	0.05	0.25	0.75	49,315	1	Musgrove W + Crowe
Northern lapwing *Vanellus vanellus*	0.30	0.84	16.20	Flap	0.05	0.25	0.75	448,950	1	Musgrove W + Crowe – Musgrove B - Gibbons_Ire
Red knot *Calidris canutus*	0.24	0.59	16.20	Flap	0.05	0.25	0.75	338,970	0.5	Musgrove W + Crowe
Sanderling *Calidris alba*	0.20	0.42	16.20	Flap	0.05	0.25	0.75	60,000	0.75	WPE5 (x50%) (MusgroveW+CroweW)x2.5 Logic of 2.5 from Holt W + (turnover(P-W)) where turnover@x3 [both methods come up with similar figure - turnover needed because there are SPAs for passage birds]
Dunlin (passage) *Calidris alpina schinzii*	0.18	0.40	16.20	Flap	0.05	0.25	0.75	3,700	1	WPE5 Baltic breeders only
Dunlin (non-breeding) *Calidris alpina alpina*	0.18	0.40	16.20	Flap	0.05	0.25	0.75	438,480	1	Musgrove W + Crowe
Ruff *Philomachus pugnax*	0.25	0.53	16.20	Flap	0.05	0.25	0.75	2,400	1	Musgrove W x turnover @x3
Common snipe *Gallinago gallinago*	0.26	0.46	16.20	Flap	0.05	0.25	0.75	1,000,000	0.5	Musgrove W
Black-tailed godwit *Limosa limosa islandica*	0.42	0.76	16.20	Flap	0.05	0.25	0.75	5,620	1	WPE5 - Musgrove W - Crowe (spring passage only via North Sea)

Species	Body Length (m)[1]	Wingspan (m)[1]	Flight Speed (ms^{-1})[2]	Flight Type	Prop. At CRH[3] (Lower Limit)	Prop. At CRH[3] (Best Estimate)	Prop. At CRH[3] (Upper Limit)	Reference Population Size[4]	Population Size Correction Factor[5]	Derivation of Population Size[6]
Bar-tailed godwit *Limosa lapponica*	0.38	0.75	16.20	Flap	0.05	0.25	0.75	54,280	1	Musgrove W + Crowe (does not allow for passage = different race)
Whimbrel *Numenius phaeopus*	0.41	0.82	16.20	Flap	0.05	0.25	0.75	23,040	0.5	Baker P x turnover x underestimate adjustment (3840x3x2=23040) Wernham (on migration)
Eurasian curlew *Numenius arquata*	0.55	0.90	16.20	Flap	0.05	0.25	0.75	81,850	1	Musgrove W + Crowe - 0.9*Gibbons(B&I) 0.95=estimate of those not going south from Wernham
Greenshank *Tringa nebularia*	0.32	0.69	16.20	Flap	0.05	0.25	0.75	275	0.1	Musgrove B 10% of British breeders assumed to winter south. North sea crossings concentrated south 'southern north sea'. Passage not considered (no SPAs).
Common redshank (breeding) *Tringa totanus britannica*	0.28	0.62	16.20	Flap	0.05	0.25	0.75	30,000	0.1	Musgrove B North sea crossings concentrated south 'southern north sea'. Irish birds assumed to cross channel if leaving B&I. Assume 50% stay in B&I (SOSS).
Common redshank (Icelandic population) *Tringa totanus robusta*	0.28	0.62	16.20	Flap	0.05	0.25	0.75	275,000	0.5	WPE5/SOSS
Common redshank (mainland Europe population) *Tringa totanus totanus*	0.28	0.62	16.20	Flap	0.05	0.25	0.75	25,000	1	SOSS
Ruddy turnstone *Arenaria interpres*	0.23	0.54	16.20	Flap	0.05	0.25	0.75	48,000	0.5	Musgrove W

Species	Body Length (m)[1]	Wingspan (m)[1]	Flight Speed (ms^{-1})[2]	Flight Type	Prop. At CRH[3] (Lower Limit)	Prop. At CRH[3] (Best Estimate)	Prop. At CRH[3] (Upper Limit)	Reference Population Size[4]	Population Size Correction Factor[5]	Derivation of Population Size[6]
Short-eared owl *Asio flammeus*	0.38	1.02	8.64	Flap	0.10	0.50	0.95	1,030	0.35	Musgrove B x emigration (@guessimate 30%)
European nightjar *Caprimulgus europaeus*	0.27	0.60	8.64	Flap	0.10	0.50	0.95	11,500	0.1	Musgrove B

[1]Taken from BTO BirdFacts (Robinson 2005);

[2]Taken from published values for flight speed of related species (or those expected to fly at a similar speed) during migration; for all goose species, the average speed readings from 10 Svalbard barnacle geese recorded by satellite transmitters during migration was taken from Griffin *et al.* (2011); for all duck species, grebes and coot, the average of Eurasian wigeon and common eider from Pennycuik (2001) was used; for great bittern, the value for grey heron from Pennycuick for hen harrier, short-eared owl and European nightjar the average of common buzzard, Eurasian sparrowhawk and red kite from Pennycuik (2001) was used; for all waders, the average of great knot (calculated from time and distance values in Pennycuick & Battley 2003) and bar-tailed godwit (calculated from track speeds recorded by satellite transmitters during migration from Gill *et al.* 2001) was used.

[3]Taken from Wright *et al.* (2012), except for common scoter which is taken from Cook *et al.* (2012). "Prop. At CRH" is the proportion of migrating birds that are estimated to fly at collision risk height.

[4]The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank.

[5]The "population size correction factor" is the proportion of each reference population that we estimate will cross the North Sea (required to estimate the proportion that will cross the footprint of the wind farm), based on the information in Wright *et al.* (2012), other published sources and expert opinion.

[6]Derivation of population size refers to how population estimates from different sources have been combined. Sources used are SOSS guidance (Wright *et al.* 2012), the Migration Atlas (Wernham *et al.* 2002), breeding/non-breeding population size estimates (GB/UK: Musgrove *et al*. 2013, except for non-breeding hen harrier and passage whimbrel which are from Baker *et al.* 2006; GB/Ireland: Gibbons *et al.* 1993), wintering waterbird population estimates (Ireland: Crowe *et al.* 2008; International: Wetlands International 2012 (WPE5)). Holt *et al*. 2012 was used to look at the ratio of wintering to passage numbers of sanderling. . To convert from breeding pairs to individuals, we multiplied the number of pairs by 2.5 (assuming that three-times the number of breeding pairs would migrate in autumn, following the convention from Stroud *et al.* 2004, but only two times the number of breeding pairs would migrate in spring, so 2.5-times on average per migration).

Species-specific sensitivities

4.3.97 Collision will be an on-going effect through the operational lifetime of the project for all species, and thus there is no potential for species to recover from this effect. The degree to which species might be able to avoid or adapt to the effect is incorporated into the estimation of collision rates, by means of specified avoidance rates. A 98% rate has been used in the realistic worst case scenario presented here (Cook *et al.* 2012), though results using rates of 99% and 99.5% are also presented. The species-specific sensitivity of receptors to collision thus primarily reflects the tolerance of the species' populations to the mortality associated with collision (Table 4.20). Many seabird species are long-lived, with correspondingly low reproductive rates and thus may be considered sensitive to any source of increased mortality.

Table 4.20 Species-specific sensitivities to collision (for key seabird species and migrants considered in this assessment), based on the tolerance of populations to this effect, as assessed by annual survival rates (following Maclean *et al.* 2009 with data taken from Robinson 2005, Grémillet *et al.* 2012, Harding *et al.* 2011 for little auk).

Species-specific sensitivity	Annual adult survival rate[1]
Very High	>0.90: northern fulmar (0.972), northern gannet (0.919), barnacle goose (Svalbard population), light-bellied brent goose (Svalbard population), shelduck, black-tailed godwit, black-legged kittiwake (0.941), black-headed gull, lesser black-backed gull (0.913), great black-backed gull, little tern, Sandwich tern, common tern, common guillemot (0.946), razorbill (0.900), Atlantic puffin (0.924)
High	0.85-0.90: black-throated diver, great cormorant, oystercatcher, grey plover, whimbrel, ruddy turnstone, Arctic skua (0.886), great skua (0.888), herring gull
Medium	0.80-0.85: common eider, goosander, red-throated diver , hen harrier, red knot, sanderling, little auk
Low	0.75-0.80: bean goose, common scoter, goldeneye, ringed plover
Very Low	<0.75: wigeon, gadwall, teal, mallard, pintail, shoveler, pochard, tufted duck, scaup, long-tailed duck, bittern, coot, golden plover, lapwing, dunlin, ruff, snipe, bar-tailed godwit, curlew, redshank, nightjar

[1] Values taken from Robinson (2005) are provided for key marine birds species considered in this assessment. For species for which no published estimates of annual survival exist, species-specific sensitivity was assessed based on proxy species.

4.3.98 Following Maclean *et al.* (2009), these species-specific sensitivities are combined with the receptor's value to determine the overall sensitivity of species to collision.

4.3.99 An alternative approach used in assessing the significance of the potential collision mortality associated with offshore wind farms has been to relate the number of collisions predicted to the background mortality of a given population. In this way, the magnitude of the impact encompasses the consideration of the species-sensitivity to the effect described above. Here, for marine birds, the number of collisions of adult birds predicted across the year is considered in relation to the background mortality at each protected site, where the background mortality is calculated from the adult mortality (1-adult survival) rates presented in the BTO BirdFacts website (Robinson 2005) and the size of the breeding population at the site.

4.3.100 Typically, the magnitude of the percentage increase in background mortality determined in this way has been categorised according to the same thresholds presented in Table 4.1, and this categorisation of magnitude then combined the categorisation of species' value to provide a determination of significance. However, the application of these thresholds (proposed for the assessment of magnitude in relation to the size of a reference population) to the percentage increase in background mortality is inappropriate, not least because there is the potential for an increase in background mortality of over 100%. In order that there is consistency in the outcomes of the assessments of significance of the effect of collision based on consideration of the proportion of the population impacted or the percentage increase in background mortality, an alternative classification of magnitude is thus proposed for the latter:

Table 4.21 Alternative definition of the magnitude associated with collision mortality assessed by the percentage increase in background adult mortality.

Magnitude	Definition
Very High	>100% increase in background adult mortality
High	50-100% increase in background adult mortality
Medium	20-50% increase in background adult mortality
Low	5-20% increase in background adult mortality
Negligible	<5% increase in background adult mortality

4.3.101 Differences in the level of significance determined following this alternative procedure are highlighted in the receptor accounts.

Confidence

4.3.102 The assessment of collision risk has been the subject of much development (e.g. Band 2012), although there is still considerable uncertainty regarding some of the key variables used in collision risk modelling, notably avoidance rates and flight heights (Chamberlain *et al.* 2006, Cook *et al.* 2012). For marine birds, the baseline surveys have provided robust estimates of the populations of birds using the project areas that inform the assessment of collision risk. However, given the range of scenarios that need to be considered in relation to this effect, the confidence in predictions in the assessment of collision risk for marine birds is considered to be

medium at its most precautionary. For migrants, there is much greater uncertainty, both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Given these uncertainties, the confidence in predictions in the assessment of collision for migrants is considered to be very low, although it should be noted that the approach used is precautionary.

Habitat loss and change – construction/decommissioning/operation

Description

4.3.103 In addition to the direct impacts posed by disturbance and displacement, barrier effects and collision, offshore wind farms may also potentially impact birds indirectly through changes to habitat. These effects include:

- Habitat loss due to export cable corridor and wind farm (long-term, but the extent of habitat loss is likely to be spatially limited);
- Habitat change affecting prey species (both during construction and decommissioning periods, and through the operational life of the wind farm) due to:
  - Suspended sediments (temporary through construction and decommissioning of the wind farm and cable laying);
  - Underwater noise (long-term, through both construction and decommissioning and the operational life of the wind farm);
  - Introduction of novel underwater habitat (long-term, through the operational life of the wind farm);
  - Electro-magnetic fields (EMFs) (long-term, through both construction and decommissioning and the operational life of the wind farm);
- Attraction to offshore structures (long-term, through the operational life of the wind farm);
- Changes to fishing activity as a result of the presence of a wind farm (long-term, through the operational life of the wind farm).

4.3.104 Worst case scenarios follow those detailed in Chapter 13 Fish and Shellfish Ecology.

Habitat loss

4.3.105 The installation of wind turbines will in itself lead to a loss of habitat that may affect birds' prey species. Introduction of foundations and scour protection will result in permanent loss of seabed habitat throughout operation, for which the worst case is considered as 200 GBS foundations per project. Loss of habitat in the footprints of the foundations would arise giving a maximum total net loss of 4.21km^2 of seabed habitat. This effect is considered permanent and long-term through operation. For export cables, direct loss of seabed habitat will occur throughout operation as a result of cable protection measures and crossings including scour protection (up to 1.01km^2). However, burial will be carried out where possible and

in these areas the seabed would be expected to return to its natural condition over time. Hence, the extent of habitat loss will be spatially limited.

Habitat change

4.3.106 Evidence from similar activities such as aggregate dredging (Cook & Burton 2010) suggests that seabed habitats and the benthic invertebrates and fish fauna associated with them might be altered by wind turbine installation and cable laying activities, thereby leading to potential impacts for birds.

Suspended sediments

4.3.107 Disturbance to the seabed would result in an increase in suspended sediment concentrations and subsequent redeposition, for which the worst case is associated with installation of 12m monopoles, where the greatest increase in suspended sediment concentrations and sediment deposition would be seen as a result of both drilling and pile-driving. For cable installation, different techniques may be used, such as jetting, ploughing, trenching, cutting, mass flow excavation and pre-sweeping (dredging). In the worst case the whole volume of sediment from the trench dimension is released for dispersion and coarser particles would be released from cable installation activities than drilling activities associated with monopole installation.

4.3.108 These effects may impact shellfish, sandeel, herring adult and juvenile fish, as well as their eggs and larvae, for instance through hatching success of eggs, reduced larval feeding rate and survival, adult suffocation (e.g. of buried sandeels), and temporary loss of spawning grounds. A progressive loss of habitat for prey species will also occur as the wind farm is constructed and disturbance of the seabed may impact less mobile prey species directly if unable to avoid construction machinery. Increased suspended sediment concentrations are expected to be temporary in nature, significant increase in sediment thickness will cover small areas, and persistency of such thickness will be small.

4.3.109 Suspended sediments may also directly impact the foraging ability of diving birds. However this effect is considered to be short lived – see Chapter 9 Marine Physical Processes – and is therefore considered to have a negligible impact.

4.3.110 In the particular case of the export cable corridor, direct loss of seabed habitat may also occur progressively throughout construction and into the operational phase as a result of cable protection measures and crossings (up to 1.359km^2). Furthermore, export cables during operation will also give off EMFs during operation (worst case 261km and 220km for Dogger Bank Teesside A and Dogger Bank Teesside B of HVDC 550kV cables, two cables per circuit), which may in turn effect prey of seabirds – these are considered under operational effects.

Underwater noise

4.3.111 Underwater noise may be produced through a range of activities. These include: impact piling associated with installation of pin piles and monopiles, rock placement for scour protection and dredging associated with seabed preparation for installation of gravity bases. In addition, noise may be produced from cable laying related activities such as vessel noise, dredging, trenching and rock dumping for cable protection. Impact piling is potentially the most detrimental for fish and shellfish, for which 200 6MW wind turbines and the use of jacket foundations on pin piles (up to six piles per foundation) constitutes the worst case – this gives the smallest hammer energy but the longest duration and frequency of piling activity. However, the lethal effect from piling on fish is localised to within a few metres of the pile, particularly at smaller hammer energies. Underwater noise may affect prey species through direct lethal/injury, for instance from auditory tissue damage, behaviourally through changes in swimming and schooling behaviour affecting spawning which may in turn affect nursery grounds, migration, and feeding patterns. However, underwater noise during construction and decommissioning will be intermittent, localised and short term.

4.3.112 During operation, noise may originate from the wind turbine gearbox and generator, as well as surface vessels servicing the wind farm. Radiated levels of noise are expected to be low (on the basis of the worst case scenario considered by Chapter 13 of the ES (Fish and Shellfish Ecology) that wind turbines are spaced at 750m), decaying rapidly from each wind turbine. Ambient noise including sea-state would increase with addition of wind turbine and vessel noise and would continue throughout operation; however, the spatial extent is considered small and unlikely to result in changes to fish behaviour or injury.

Introduction of novel underwater habitat

4.3.113 Given the soft seabed environment for Dogger Bank Teesside A and B, sub-surface wind turbine towers and foundations may require scour protection material, requiring hard substrate introduction. This represents a novel sub-littoral habitat and is expected to be colonised by a range of organisms (e.g. mussels, barnacles, tubeworms, sponges, hydroids, etc), and therefore may attract fish, increasing the prey available to seabirds. This effect is considered long-term through operation.

4.3.114 In addition, changes to currents during the operational lifetime of the projects, resulting from installation of the wind turbines, may also affect seabed habitats and the benthic invertebrates and fish fauna associated with them, thereby also leading to potential impacts for birds. Such effects may lead to either positive or negative impacts.

Electro-magnetic effects

4.3.115 Disruption of prey species due to electro-magnetic fields (EMFs) may potentially occur throughout the operational life of the wind farm. EMFs may impact

prey species that are electro-sensitive, resulting in changes in behaviour (e.g. migration patterns and feeding activity); in Chapter 13 of the ES, EMF effects on fish and shellfish were deemed to be minor adverse. However, the potential impacts of EMFs from cables on seabirds are highly uncertain (Gill 2005, Gill & Bartlett 2010, Gill *et al.* 2005, 2009).

4.3.116 Effects associated with EMFs will be mitigated through armoured array and export cables, and burial to 0.7m. Where burial is not possible cables will be protected and in the absence of further information, it is assumed that the level of residual EMF emission will be the same in each instance. In the worst case, a maximum cabling length is expected to give the strongest field, and cables will include inter-array (up to 950km), inter-platform (up to 320km), and export cables (up to 222km). Although EMFs may occur throughout operation hence being long-term, given the relatively small area where EMF may occur, limited to the vicinity of cables, the magnitude of impact is thought to be small.

Attraction to offshore structures

4.3.117 During operation, wind turbines may also provide platforms for perching and roosting birds and could also extend foraging ranges by allowing birds to rest. Evidence suggests that gulls may either fly through or forage within wind farms, or even actively perch on above-surface structures. Moreover, boat traffic during all phases may attract receptors such as northern fulmar, northern gannet, skuas and gulls. Receptors may also be attracted to lighting around offshore structures, which may help in nocturnal prey location (Sage 1979, Hope-Jones 1980, Tasker *et al.* 1986, Wiese *et al.* 2001).

Changes to fishing activity

4.3.118 Changes to fishing activity due to presence of the operational wind farm could impact negatively on the seabird species that rely on discards (northern fulmar, northern gannet, gulls and skuas). However, changes to fishing practice may affect fish and shellfish populations and hence birds indirectly. Since fishing may cause physical damage to seabed habitat, disturb sediments, directly remove plants and other organisms, and alter habitat structure, a reduction in fishing could have a positive effect for marine communities and seabird prey species. For the export cable corridor, fishing activities are expected to continue un-interrupted.

Methodology used to estimate the size or magnitude of impacts and worst case scenarios

4.3.119 The individual effects outlined above and also (with the exception of attraction to offshore structures) considered in Chapter 13 of the ES (Fish and Shellfish Ecology) were considered as one single overall effect of direct habitat loss or change, though separately for the construction/decommissioning, and operational phases.

4.3.120 The magnitude of impacts associated with habitat loss and change was assessed qualitatively and draws upon the results of Chapter 13 of the ES, which itself draws upon the Chapter 9 (Marine Physical Processes) and Chapter 12 (Marine and Intertidal Ecology).

4.3.121 Information on adult diet for all marine bird receptors (BirdLife International 2012) was reviewed to allow the relevant direct habitat loss effects on fish, shellfish, and other species provided from Chapter 13 of the ES to be used appropriately. The significances of effects on fish receptors were considered for all marine bird receptors, while the significances of effects on 'other' potential prey species were also considered for all species except auks and black-legged kittiwake.

4.3.122 Summarising from Chapter 13, during construction and decommissioning of the wind farm projects, the impact associated with underwater noise was predicted to be negative and of minor adverse significance for fish and shellfish (including eggs and larvae) for all but one receptor, for which an impact of negligible significance was predicted. The impact associated with the effect of increased suspended sediment concentrations during construction and decommissioning of the wind farm projects was also predicted to be negative and of minor adverse significance for all receptors.

4.3.123 The impact associated with effect of underwater noise during construction and decommissioning in the export cable corridor was predicted to be negative and of minor significance for Diadromous species and 'other fish species', but of negligible significance for all other receptors. The impact associated with effect of increased suspended sediment concentrations during construction and decommissioning in the export cable corridor was predicted to be of negligible significance for all species

4.3.124 During operation, all impacts associated with effects on fish and shellfish in the wind farm project areas were predicted to be negative and of minor adverse significance.

4.3.125 To determine the magnitudes of the potential impacts associated with habitat loss and change for marine bird receptors, the percentages of national and biogeographic populations exposed to the effects in the project areas were first considered. Based on the assessment of effects for prey species detailed in Chapter 13, a qualitative assessment was then made as to the proportion of these birds that might be impacted, so as to determine a final magnitude in each case.

Species-specific sensitivities

4.3.126 Species-specific sensitivities to habitat loss and change followed Maclean *et al.* (2009), Furness & Wade (2012)/Furness *et al.* (2012, 2013) using the sensitivities defined in the assessment of indirect habitat loss, i.e. displacement (see Tables 4.7 and 4.8). Species-specific sensitivities are combined with the receptor's value following Maclean *et al.* (2009) to determine the overall sensitivity of species to the effect.

Confidence

4.3.127 Since the assessment for indirect effects is qualitative and based upon presumed species reactions to changes in habitat and prey rather than actual observations, very low confidence (under a precautionary worst case) was assigned to final predicted significance.

Summary of worst case scenarios

4.3.128 Table 4.22 below provides a summary of the worst case scenarios associated with each of the effects described above.

Table 4.22 Summary of worst case scenarios used in the impact assessment.

Potential Effect	Realistic Worst Case	Rationale
Displacement – operation	Results using a range of displacement and mortality rates are presented for each receptor. Realistic species-specific displacement and mortality rates considered in the assessment reflect species-specific sensitivities to disturbance and habitat loss respectively. A buffer distance of 4km is assumed for divers, 2km for all other species, following guidance from NE/JNCC (NE/JNCC 2012)	The determination of appropriate displacement and mortality rates and buffer distances draws from several recent studies, and follows guidance from NE/JNCC (NE/JNCC 2012)
Displacement – construction/decommissioning of the wind farm	As above, though with displacement estimates halved	The numbers of birds displaced will increase during construction and decrease during decommissioning in relation to the spatial extent of the wind farm. Assuming a linear progression of activities, the numbers of birds displaced are hence taken to be 50% of those during operation
Disturbance – export cable corridor activities	Displacement rates as above for displacement during operation	Maclean *et al.* (2009) recommend that assessment of the effect of disturbance during construction and decommissioning is also undertaken by assuming a worst case scenario that some or all birds are displaced from the area considered. However, given four separate campaigns are predicted individually covering a 1.5km radius each, only a maximum of 7.7% of the total population would be affected at any one

		time.
Barrier effects – operation	That the wind farm project poses a barrier to 100% of birds that are estimated to fly through its area at turbine height	Follows the protocol of Maclean *et al.* (2009)
Collision – operation	A total of 200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m, blade width of 5.5m, rotation speed of 8.84rpm, pitch of 10 degrees; for exceptions, see Appendix 6. Avoidance rate of 99% used for northern gannet and 98% used for all other species; Option 3 of the updated Band (2012) model followed for flight heights for marine bird species.	Based on collision risk analyses of eight scenarios, covering a range of wind turbine sizes and heights (see Appendices 6 and 12). Option 3 of the updated Band (2012) model allows for a variable collision risk within the rotor swept area and, therefore, a more realistic representation of collision risk. Consideration of the results from use of the other flight height model options, as recommended by Band (2012), is provided in Appendix 7
Habitat loss and change – construction/decommissioning/operation	See Chapter 13 of the ES (Fish and Shellfish Ecology) for summary of worst case scenarios related to Increased Suspended Sediment Concentrations and Sediment Re-deposition, Construction Noise, Electro-magnetic fields, Loss of Habitat, Introduction of Hard Substrate, Operational Noise, Changes in Fishing Activity	Effects of habitat loss and change primarily affect birds through impacts on their prey

Considerations regarding the assessment of significance

4.3.129 As outlined in the sections above, a number of considerations need to be taken into account in determining the significance of impacts. These considerations may be relevant to all or only some of the effects assessed, and include:

- The initial assumptions in apportioning effects to protected sites that all birds come from the protected sites identified and that all birds using the project areas through the year originate from breeding sites around the North Sea. To adjust for these initial assumptions, corrections are made using information from the UK SPA Review (Stroud *et al.* 2001) and Skov *et al.* (1995). The former provides an indication, from a Great Britain perspective at least, of the proportions of national breeding populations supported on these protected sites. In those cases where the proportion of the Great Britain breeding population supported by SPAs is significantly less than 100%, correction factors for apportioning impacts to protected sites were derived as follows: for great skua (73.7% of the GB population held by the Great Britain SPA suite: Stroud *et al.* 2001), black-legged kittiwake (78.1%), razorbill (76%), a correction factor of 0.80; for northern fulmar (57.3%) a correction factor of 0.60; for Arctic skua (24.4%) and great black-backed gull (32%), a correction factor of 0.40. For all other species, for which the proportion of the Great Britain breeding population supported by SPAs is close to 100%, no correction was calculated. These correction values allow for the fact that impacts are also apportioned to SSSIs. Numbers of birds supported by the total protected site suite considered here were also expressed as a proportion of North Sea populations, separately for the breeding season and non-breeding seasons, using mean seasonal figures taken from Skov *et al.* (1995) and using assumptions regarding non-breeding birds outlined above, in order to provide alternative correction factors. As the projects are mostly only within the foraging range of protected sites in Great Britain, the apportioning correction factors derived from the values in Stroud *et al.* (2001) were applied to the impacts predicted for breeding birds (Table 4.23). For non-breeders, in the breeding season or in the non-breeding seasons, the lesser of the two correction factors described above was used (Table 4.23);

Table 4.23 Correction factors used in the apportioning of impacts to protected sites.

Species	Breeders	Non-breeders, breeding season	Non-breeders, non-breeding season
Northern fulmar	0.600	0.312	0.284
Northern gannet	1.000	1.000	1.000
Arctic skua	0.400	0.400	0.400
Great skua	0.800	0.800	0.800
Black-legged kittiwake	0.800	0.800	0.800
Lesser black-backed gull	1.000	1.000	1.000
Great black-backed gull	0.400	0.335	0.076
Common guillemot	1.000	1.000	1.000
Razorbill	0.800	0.800	0.515
Atlantic puffin	1.000	1.000	1.000

- That for diving species, there is the potential that some birds may not have been detected by aerial surveys. Consideration of this issue is given in Appendix 5 and correction factors applied to the apportioning to protected sites as above. This is pertinent to the assessment of disturbance, displacement and habitat loss and change, but not collision;
- That the national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Banks *et al.* 2007) and thus do not include birds that frequent offshore waters and so underestimate the overall national populations. Consideration is thus given as to whether the impacts at the national level for these species might be over-estimated;
- That the populations estimated for some species may be underestimated due to the turnover of birds on passage through the area – this is particularly considered for skuas and lesser black-backed gull. Consideration is thus given as to whether the impacts for these species might be under-estimated;
- The alternative scenarios considered in collision risk modelling concerning avoidance rates and model options for considering flight heights. Appendix 6 provides an overview of collision risk results for the range of wind turbine options considered (thus helping to determine worst case scenarios), as well as results for different avoidance rates and flight height model options. Appendix 7 evaluates whether conclusions regarding the significance of impacts might differ according to the different model options for considering flight heights;
- That some species, such as gulls and cormorants, may potentially utilise wind turbines or other above sea structures as roosting or perching posts, and may also be attracted to the wind farm due to changes in fish populations. The potential for attraction is captured within the displacement rates used in the evaluation of that effect, the determination of which draws from several recent studies (Appendix 4). Among the species considered, low displacement rates are assumed for gulls, including black-legged kittiwake, these rates reflecting that both fewer birds of these species might be displaced by offshore wind farms and that some birds may also be attracted. The potential for attraction is also particularly pertinent to the assessment of

collision. However, given the limited evidence regarding the extent of attraction of birds to offshore wind farms and that any attraction might be balanced by the mostly minor adverse impacts predicted for fish for all effects (see in Chapter 13 of the ES), this effect is not considered further in qualifying collision risk.

Inter-relationship between effects

4.3.130 As recommended by IEEM (2006, 2010) guidance, the combined impact from each effect will be considered for each receptor. Quantitative combining of separate effects is not possible due to the assumptions associated with the assessment of different effects.

4.4 Effects and Definitions of Worst Case Scenarios – Intertidal

Habitat loss and disturbance – construction

Description

4.4.1 To date, the cable landfall installation methods have not been finalised. The preferred option is to use Horizontal Directional Drill (HDD) to install the cable from the offshore route, under the cliffs to the onshore transition pit. The HDD exit hole will ideally be located in the sub-tidal zone and is anticipated to have little impact on the intertidal area. However, if offshore access is limited, the exit hole may have to be located on the beach above the high water mark or in the intertidal zone and will likely have a bigger impact on the inter-tidal area. The alternate two options may also require the installation of cofferdams in order to contain the slurry produced during drilling operations and to stabilise the exit point. Dimensions of the cofferdam will be no larger than 10m wide, 10m long and 3m deep but up to two per connection could be required.

4.4.2 The preferred construction technique is use of horizontal directional drilling (HDD) which will reduce the likelihood of disruption on the shoreline. In addition to the HDD, some trenching might be required to allow burial of the export cable from the HDD exit point (if on the beach) to the offshore area. This is not anticipated to increase the impact on the inter-tidal area.

4.4.3 The landfall cable installation will be completed by burial using methods similar to those used for the offshore cables but if access is limited, other techniques will have to be considered: ploughing, jet trenching, mechanical trenching from barges and tractors or building temporary barge bridges.

4.4.4 Coastal erosion has been highlighted as an issue via consultation and is reflected in the Environmental Statement and, therefore, will be taken into account in the landfall works (and the position of the transition pit inland).

4.4.5 Construction activities in the inter-tidal area will impact on the ornithological receptors in two main ways:

- *Habitat loss* for feeding birds during the winter (less likely to be an issue for roosting/breeding birds which are likely to make use of the area);
- *Physical, visual and noise disturbance* to feeding and roosting birds (as above). Bird receptors are likely to respond by being displaced from the area affected.

Methodology used to estimate the size or magnitude of impacts and worst case scenarios

Habitat loss

4.4.6 The impact of habitat loss is likely to be highly localised and is unlikely to extend beyond the boundary of the export cable corridor itself, which is estimated to be no more than 1km in length at the landfall region. Therefore, the scale of the area affected is very small.

4.4.7 The intertidal zone of the landfall is classified as barren littoral coarse sand with no mud to retain moisture. There is little in the way of plant or invertebrate species supported and hence the impact of the inter-tidal installation is likely to be very limited.

4.4.8 The worst case scenario with respect to the cable landfall installation would be if there was limited offshore access as this would result in the HDD exit being located on the beach above the high water mark or in the inter-tidal area and the need for cofferdams. Cofferdams would be removed following installation. However as all of the cabling, the transition pit and cofferdams would ultimately be buried, the duration of the effect of habitat loss would not extend beyond 16 weeks for a single project or 24 weeks for both projects together in parallel.

Physical, visual and noise disturbance

4.4.9 The impact of disturbance is likely to be very localised and is unlikely to extend beyond a buffer of 300m from the boundary of the final export cable corridor itself, this distance representing the maximum distance at which coastal waterbirds typically show behavioural responses to human disturbance (see Smit & Visser 1993, Burton *et al.* 2002). Therefore, the scale of area affected is very small and it should not be necessary to close the beach during operations. If closed at all for maintenance, an area in the intertidal zone to low water mark of 10mx10m would be allowed per project. (Note the transition pits and works areas themselves will be less than 1km long.)

Species-specific sensitivities and overall sensitivity

Habitat loss

4.4.10 Species-specific sensitivities for marine bird receptors were allocated using scores assigned by Furness & Wade (2012)/Furness *et al.* (2012, 2013) in relation to habitat specialisation (see Table 4.10 for further details).

4.4.11 As waders and coastal wildfowl are more typically confined to intertidal habitats, and previous studies have shown that habitat loss can impact their survival (e.g. Burton *et al.* 2006), these species are assumed to have a High species-sensitivity to this effect.

Physical, visual and noise disturbance

4.4.12 Species-specific sensitivities for marine bird receptors were allocated using scores assigned by Furness & Wade (2012)/Furness *et al.* (2012, 2013) for their vulnerability to boat disturbance (see Table 4.8 for further details).

4.4.13 There has been considerable research into the potential impacts of disturbance on waders (e.g. Burton *et al.* 2002, Drewitt 2007, Davidson & Rothwell 1993, Smit & Visser 1993) which are typically more sensitive to this effect than gulls, though this varies by species. Large species, such as Eurasian curlew generally take flight at greater disturbance distances than small species such as dunlin (Burton *et al.* 2002, Blumstein *et al.* 2005, Smit & Visser 1993). For the species considered here, a High species-sensitivity to this effect is assumed for Eurasian oystercatcher and northern lapwing whereas a Medium species-sensitivity is assumed for ringed plover, dunlin, sanderling and ruddy turnstone.

Operational effects

4.4.14 Assuming that all cables are buried, it is anticipated that there will be no operational effects.

Decommissioning

4.4.15 It is most likely that buried assets such as cables will be left in situ when the project is decommissioned. Although it may be possible to partially recover these cables, an additional EIA would have to be carried out in order to investigate the potential effects of the retrieval operations.

4.5 Mitigation Measures and Residual Impacts

4.5.1 Mitigation has been incorporated in the project design through the early consideration of the results of baseline surveys which revealed concentrations of birds (notably associated with concentrations of sandeels – see also in Chapter 13 Fish and Shellfish Ecology) in the north-western and western edges of the Dogger

Banks Zone. This area, which supports some of the highest bird densities in the Dogger Bank Zone, has been excluded from the determination of project boundaries – see Project Boundary Selection Report.

4.5.2 Mitigation has also been introduced specifically with respect to the effect of collision risk for birds, a change that was introduced following consultation on the draft Environmental Statement (ES) where concerns were raised over the level of collision impacts. Across species, the probability of avian collision tends to be statistically greater for smaller turbines, both due to their absolute size (Cook *et al.* 2011) – as a greater proportion of the rotor swept area occurs at lower altitudes where, for most species, the densities of flying birds are greatest (Cook *et al.* 2012) – and importantly because with a fixed project capacity, the numbers of turbines may be greater. The maximum number of wind turbines has thus been capped at 200, meaning that the worst case scenario becomes 6MW wind turbines (the largest wind turbines for which the maximum of 200 can be constructed). Also, the minimum lower tip height for all wind turbines has been increased from 22m to 26m above highest astronomical tide.

4.5.3 Following IEEM guidance, where Moderate or Major residual impacts are determined following the use of realistic worst case scenarios, the potential for other defined scenarios (e.g. for collision risk) to mitigate impacts is discussed.

4.5.4 Other specific guidance from the EN-3 National Policy Statement (DECC 2011) on mitigation relating to ornithology, that has been considered in the overall project design, includes the following:

- That aviation and navigation lighting should be minimised to avoid attracting birds, taking into account impacts on safety – this minimum represents compliance with the requirements of the relevant aviation and navigation stakeholders;
- That subject to other constraints, where there is significant risk of collision, wind turbines should be laid out within a site to minimise the risk;
- That construction vessels associated with offshore wind farms should, where practical, avoid rafting seabirds during sensitive periods, hence a code of conduct will be followed by all vessel operators;
- That the exact timing of peak migration events is inherently uncertain. Therefore, shutting down wind turbines during estimated peak migration periods is unlikely to offer suitable mitigation.

4.6 Cumulative Impact Assessment Methodology

<u>Cumulative Impacts – Export Cable Corridor and Project Areas</u>

4.6.1 Cumulative effects are assessed in relation to all of the main effects outlined above and has drawn from the overall Forewind Cumulative Impact Assessment strategy, which had the following considerations:

i. Whether impacts on a receptor can occur on a cumulative basis between the wind farm project(s) subject to the application(s) and other wind farm projects, activities and plans in the Dogger Bank Zone. At this level, the assessment considers the effects of the Dogger Bank Teesside A and B projects in conjunction with the Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects (Figure 1.1);

ii. Whether impacts on a receptor can occur on a cumulative basis between the wind farm project(s) subject to the application(s) and other activities, projects and plans outside the Dogger Bank Zone.

4.6.2 Thus other activities, projects and plans for which there is medium to high confidence data and project information are included in the CIA. Only those activities, projects and plans which may have similar effects on birds as those outlined for the Dogger Bank Teesside A and B projects outlined above are considered here (see Appendix 8).

4.6.3 The methodology for assessing cumulative effects for birds draws from the recommendations of King *et al.* (2009). In brief summary, these recommendations are divided into two parts: data gathering and cumulative effects:

"Data gathering and analysis currently suffer from a lack of standardisation, therefore, guidelines are given for selection of receptors for consideration, projects to be included in the assessment and the spatial scale of the bird reference population to be used. An overarching recommendation is for the provision of quantitative data on raw numbers, densities and population estimates for all receptors and that, wherever possible, impacts are assessed in a quantitative rather than a qualitative way.

The cumulative effects of collision risk and displacement should be assessed by summing the impacts from each component project. Where collision mortality is likely to be significant, more detailed population modelling studies may be required. Disturbance and barrier effects may accrue in a non-linear manner. They should, therefore, firstly be considered in a qualitative manner and, if thought likely to be significant, then a more detailed quantitative study of bird bioenergetics in relation to the effect should be carried-out. In general, all analyses should interpret the significance of mortality in relation to the receptors' background mortality rate to enable its life history parameters and ecology to be taken into account."

Note that when assessing the consequences for population impacts from effects, some impacts may be quite subtle in their implications for population trajectory. These, however, are also just as valid as those more obvious population impacts such as direct collision mortality, especially since adult survival is the key parameter in several population models developed for seabirds, e.g. for gannet (WWT/Macarthur Green/RPS for SOSS-04)".

4.6.4 The cumulative impact assessment for birds considers two spatial scales, for which the methodologies used and the confidence in predictions vary.

4.6.5 At the scale of the Dogger Bank Zone, i.e. for the Dogger Bank Teesside A and B projects in conjunction with the Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects, the determination of the magnitudes of cumulative impacts follow the methodologies described in section 4.3 above, with associated assessment of confidence.

4.6.6 Cumulative assessment is also undertaken at the scale of the wider North Sea region (defined by the OSPAR Greater North Sea region). Appendix 8 outlines which projects (which include wind farms and also aggregate sites) were initially considered in the ornithological cumulative impact assessment and which of these projects are also within foraging range of the same protected sites identified to be of relevance to the Dogger Bank Teesside A and B projects.

4.6.7 These projects include those recently constructed, those for which consent has been provided and which are under construction or will be shortly, and others not yet consented. Further screening was undertaken to refine this list based on the status of the projects and the confidence that could be placed in the predictions made in the available project assessments (following the overall Forewind Cumulative Impact Assessment strategy). Thus, completed projects that became operational prior to the collection of baseline data for the present assessment are considered to already have influenced the baseline data and are thus not considered further (e.g. Blyth). Also, because stakeholder discussions are on-going on many Round 3 offshore wind projects (e.g. Firth of Forth Alpha and Bravo, Moray Firth, Neart na Gaoithe), the confidence that can be placed on the predictions provided in the available reports for these projects is considered low and subject to change, and hence these sites are also not included in the cumulative assessment.

4.6.8 At this level a quantitative assessment is made of the potential cumulative effects of displacement and collision associated with offshore wind farms. Following the overall cumulative impact assessment strategy, information on the numbers of birds predicted to be displaced and collision risk estimates were taken from impact assessments or environmental statements where available and no attempt was made to estimate values in other cases. Thus, the projects for which data were available only represent a subset of the suite of projects initially considered in the cumulative assessment in the North Sea region as a whole.

4.6.9 Further, no attempt was made to standardise estimates using the same assumptions as presented in this assessment, as, based on the information presented on other assessments, this would have only have been possible in some cases. In addition the values / assumptions used in other assessments may have been agreed with statutory advisors and/or be specific to those projects and thus it would not be appropriate to use standardised estimates here. The assumptions used in deriving displacement and collision risk estimates in other assessments are highlighted where these differ from those used in this assessment.

4.6.10 It should also be noted that the detailed collision estimates and displacement estimates required for the cumulative assessment were not always both available in the same assessments. Even where data were available, estimates were not available for all the key marine species considered here.

4.6.11 Cumulative impacts were assessed at the scale of the wider North Sea region in relation to national and biogeographic populations. Where collision estimates and displacement estimates were also apportioned in other assessments to individual protected sites, an assessment was made of the cumulative impacts at these sites from these projects in conjunction with those from the Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects.

4.6.12 Due to the above, and the inherent difficulties of combining information from different sources, where methods may have varied, confidence in all predictions is assigned as very low.

<u>Disturbance/displacement</u>

4.6.13 Guidance on the assessment of disturbance/displacement at the cumulative scale is provided in King *et al.* (2009). In the absence of resource competition, the effect of cumulative displacement would be negligible. However, such an assumption is unlikely to be correct given that many areas for seabirds are likely to be at or near carrying capacity, given their sensitivity to changes in prey availability (Frederiksen *et al* 2004; Wanless 2005; Ashbrook *et al.* 2009). Since there is currently no simple method to determine carrying capacity, King *et al.* (2009) recommend that cumulative displacement should be calculated by summing displacement effects from each of the contributing developments.

4.6.14 In assessing the potential impacts of displacement, estimates are required both of the numbers of birds predicted to be displaced and then of the numbers of these that might be expected to die. Following the overall Forewind Cumulative Impact Assessment strategy, information regarding the potential impacts of displacement was taken from impact assessments or environmental statements where available and no attempt was made to estimate values in other cases.

4.6.15 Estimates of numbers of displaced birds were obtained by reviewing environmental statements for planned offshore wind farms in the North Sea. In some cases, while population estimates may have been provided, specific displacement estimates were not available. Thus the sites for which data were available only represent a subset of those considered in the cumulative assessment in the North Sea region as a whole.

4.6.16 The final cumulative assessment presented here considers only those projects for which estimates were provided of the numbers of displaced birds that might then be expected to die. In many instances, while predictions were provided of the numbers of birds that might be expected to be displaced, no information was provided of the likely mortality rates of these birds (often, as mortality was considered as part of the

sensitivity of species to this effect – see Maclean *et al.* 2009). As with displacement rates, mortality rates considered varied between projects, some providing results for a range of rates and carrying through either a worst case or 'realistic' value into the assessment.

4.6.17 Estimates of the numbers of displaced birds that might be expected to die from these projects were added to the numbers predicted for the Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects, and placed in national and biogeographic contexts. Where estimates were also apportioned to protected sites, these were added to respective apportioned estimates from the Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects to assess potential impacts at a protected site level.

4.6.18 Note, as in the present assessment, estimates of the numbers of displaced birds and those that might be expected to die are separated into different seasons for most other projects. For consistency with the overall cumulative impact strategy, whereby information is taken from other assessments as presented, total estimates of the numbers of displaced birds and those that might be expected to die are summed across seasons, even where these seasons may not be consistent with those used here.

Collision

4.6.19 Annual collision estimates were obtained by reviewing environmental statements for planned offshore wind farms in the North Sea. For each site, the estimate used is that presented in the final assessment of effects, even if this has been calculated using a different avoidance rate. Further, not all estimates will be strictly comparable with those presented within this report as they may use site-specific flight height data rather than the generic flight height curves used in the collision risk modelling for the six Dogger Bank projects.

Barrier effects

4.6.20 As indicated in section 4.3, there is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms. Assessment of the potential cumulative effects for seabirds from their breeding colonies has not been attempted because of: i. the difficulties in assessing the magnitude of the potential impacts of this effect; ii. the complexities in the numbers of potential projects affecting birds foraging from different colonies (see Appendix 8); and iii. the potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009), and thus are problematic to quantify. Likewise, no attempt was made to assess in a quantified manner the cumulative impact of the potential barrier effects posed by the Dogger Bank Teesside A and B and Dogger Bank Teesside C, Dogger Bank Teesside D, Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B projects and other wind farm projects within the

North Sea on the populations of those terrestrial or waterbird migrants that are UK SPA features whose migration zones (defined by Wright *et al.* 2012) overlap with the Dogger Bank Teesside A and B project areas.

Direct habitat loss and change

4.6.21 A qualitative assessment only is made of the potential of cumulative impacts of habitat loss and change at this scale. Information on the significance of indirect effects from the impact assessments reviewed is presented, where this was available. While indirect effects were considered in most assessments for offshore wind farms, in many they were either scoped out or included in the assessment of other effects, such as displacement. No similar predictions of the potential impacts from habitat loss and change for birds were found in relation to aggregate developments.

Cumulative Impacts – Intertidal

4.6.22 There are some other projects which are relevant to the landfall area. The Breagh pipeline runs to the north of the intertidal area, but based on published timescales, it is not expected that construction of this project would overlap with the construction work associated with the cable landfall installation. Further potash mines are also in the vicinity but given that they are underground, no further assessment is carried out. There are also several decommissioned cables in the area, which do not need further consideration.

4.6.23 Of most relevance is the Teesside Offshore Wind Farm (EDF 2004). Aside from the potential effects associated with the wind farm itself (considered elsewhere in the cumulative assessment), this project also considered the potential impacts associated with the grid connection which passes across Coatham Sands, ca. 6km north of the landfall connection for the projects considered here. That part of the Teesside Offshore Wind Farm assessment considered potential impacts of the grid connection for feeding and roosting non-breeding waterbirds (principally waders), roosting seabirds (principally terns and black-legged kittiwakes) and breeding waterbirds and seabirds (principally terns). Due to the short period of disturbance associated with installation of the cable in the intertidal zone, the occurrence of other forms of human disturbance in the area and the availability of alternative suitable habitat, no significant impacts were predicted for these receptors. However, mitigation was proposed in terms of the timing of works in order that impacts on breeding little terns should be avoided. Given that no significant residual impacts were predicted for birds for the installation of the cable in the intertidal zone following this mitigation, that these works have now been completed, and that breeding terns do not occur in the area of the landfall connection for the Dogger Bank Teesside projects, no additional impacts are expected from these projects in combination.

Page No.

5. ENVIRONMENTAL IMPACT ASSESSMENT RESULTS

5.1 Introduction

5.1.1 This section of the report provides the results of the impact assessments for the Dogger Bank Teesside A and Dogger Bank Teesside Beck B projects, together with an assessment of the combined effects of both.

5.1.2 In each case, assessment is first provided of the magnitudes of the impacts from different effects during construction/decommissioning and during operation. Following this, accounts review the sensitivities of each key receptor to these effects and, in combination with the assessment of magnitude, provide an assessment of the overall significance of impacts for each species.

5.1.3 Impacts on receptors in intertidal areas are considered separately as these will apply to both projects cumulatively.

5.1.4 For the effects of disturbance/displacement, barrier effects and collision, apportioning of impacts is made to protected sites (see section 4 for more details and Appendix 9 for detailed results). However, for many species only a proportion of populations may originate from protected sites. Therefore, adjustments were applied to account for proportions of populations that were not covered by the protected site suite – see section 4 for more details.

5.1.5 The apportioning of impacts to protected sites also assumes that all birds using the project area through the year originate from sites in the North Sea. In the case of northern gannet, a recent review has shown that the birds that occur in the North Sea in the winter include birds from colonies further north in Norway as well as from the North Sea. However, many birds from North Sea breeding colonies, such at Bass Rock in the Forth Islands SPA, may winter further south, as far as west Africa (Fort *et al.* 2012). Likewise, in the case of black-legged kittiwake, a recent review has shown that the birds that occur in the North Sea in the winter include birds from colonies further north in the Norwegian Sea, Barents Sea and West Spitsbergen OSPAR regions, as well as from the North Sea; while birds from North Sea breeding colonies may also winter in the Celtic Seas OSPAR region and in the north-west Atlantic, off Labrador (Frederiksen *et al.* 2012).

5.1.6 In addition for five species: white-billed diver, common guillemot, razorbill, little auk, and Atlantic puffin, the proportions of populations impacted by disturbance/displacement were also adjusted for the time potentially spent underwater (see section 4 and Appendix 5).

<u>Construction and Decommissioning</u>

5.1.7 Potential impacts associated with the construction and decommissioning of the wind farm, which may occur both within the area of the wind farm project and along the export cable corridor, include:

- Disturbance/displacement; and
- Direct habitat loss or change.

Disturbance/displacement

5.1.8 In accordance with guidance from NE/JNCC (2012), for key receptors, a range of displacement and mortality rates were investigated (see Appendix 10). For the chosen displacement and mortality rates for each receptor (see section 4), the numbers of birds predicted to be lost due to the effect of displacement are highlighted in Appendix 10. The numbers of birds displaced at chosen displacement rates (before assessing mortality) are also presented at the start of each assessment in Table 5.1 for Dogger Bank Teesside A, Table 5.8 for Dogger Bank Teesside B, Table 5.17 for Dogger Bank Teesside A and B, and Table 6.1 for the cumulative assessment of Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D.

Direct habitat loss or change

5.1.9 The main effects influencing prey species of seabirds during construction and decommissioning are temporary disturbance of the seabed and underwater noise. These individual effects may influence the prey available to seabirds in turn constituting indirect habitat loss. Further changes to habitat occur through presence of additional vessels which may offer positive attraction benefits to seabirds (see section 4). These alterations to the habitat are combined into one single effect of "direct habitat loss and change" to assess the impact on seabirds. Assessment follows the methodology for direct habitat loss or change (see section 4).

5.1.10 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during construction and decommissioning (see section 4).

Operation

5.1.11 Potential impacts associated with the operation of the wind farm include:
- Disturbance/displacement;
- Barrier effects;
- Collision; and
- Direct habitat loss or change.

Disturbance/displacement

5.1.12 In accordance with guidance from NE/JNCC (2012), for key receptors, a range of displacement and mortality rates were investigated (see Appendix 10). For the chosen displacement and mortality rates for each receptor (see section 4), the numbers of birds predicted to be lost due to the effect of displacement are highlighted in Appendix 10. The numbers of birds displaced at chosen displacement rates (before assessing mortality) are also presented at the start of

each assessment in: Table 5.1 for Dogger Bank Teesside A; Table 5.8 for Dogger Bank Teesside B; Table 5.16 for Dogger Bank Teesside A and B; and Table 6.1 for the cumulative assessment of Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D.

Barrier effects – Marine Birds

5.1.13 Dogger Bank Teesside A and B are each within the maximum foraging range of six seabird species – northern fulmar, northern gannet, black-legged kittiwake, common guillemot, razorbill and Atlantic puffin – from protected sites at which they are features (see Appendix 1 for details). Thus, these project areas may potentially pose a barrier effect to these species during the breeding season. Estimates of the maximum numbers of breeding adult birds of these species in flight in the project area, based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, are provided in Table 5.2 for Dogger Bank Teesside A, Table 5.9 for Dogger Bank Teesside B and 5.17 for Dogger Bank Teesside A and B. Table 6.2 presents the rates for the cumulative assessment of Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D.

Collision – Marine Birds

5.1.14 An overview of the results of collision risk analyses for marine birds for the Dogger Bank Teesside A and B projects is provided in Appendix 6.

Worst case scenario per project

5.1.15 For the nine species considered, the worst case scenario for each of the Dogger Bank Teesside A and B projects was found to be the use of 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m. These are the worst case scenarios against which the environmental impact of the project is assessed. Observed flight heights were within those of the confidence limits of the modelled distribution (see section 4.3). Consequently, it was felt that Option 3 of the Band model, which accounts for differing collision risk within the rotor-swept area, would provide the most realistic estimates of collisions.

Direct habitat loss or change

5.1.16 The main effects influencing prey species of seabirds during operation are loss of habitat, introduction of hard substrate, operational noise, electromagnetic fields (EMFs) and changes to fishing activity (see section 4). These effects are combined as a single direct habitat loss and change effect for both the project area and export cable corridor and are assessed following the methodology for direct habitat loss or change.

5.1.17 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology',were determined to be minor adverse for fish and shellfish during operation (see section 4).

5.2 Dogger Bank Teesside A Offshore Ornithology Impact

Disturbance/displacement

5.2.1 The numbers of birds predicted to be displaced from the Dogger Bank Teesside A project area and buffer during construction/decommissioning and operation, under chosen displacement rates, are shown in Table 5.1 and are also discussed at the start of each species' account. The values presented incorporate the correction factors for birds underwater (see section 4), but do not represent final magnitude, taking into account mortality rates. Based on a full range of alternative displacement and mortality rates, from 0 to 100%, tabulated summaries of the numbers of birds for each species estimated to be displaced and die, are provided in Appendix 10.

5.2.2 Results of the apportioning of disturbance/displacement impacts to protected sites, incorporating mortality, are shown in Appendix 9. These tables also correct for the initial assumption that all birds come from the protected sites identified (see section 4).

5.2.3 Table 5.1 also provides separate estimates of the numbers of birds predicted to be displaced in respective breeding and winter periods. Birds predicted to be impacted during the breeding season will potentially include both breeders from any breeding colonies that the project is within range of, in addition to a non-breeding component. For gulls and northern gannet, it was possible to estimate the proportion of breeders from boat-survey observations of birds in breeding and juvenile plumages. For all other species within foraging range from protected breeding coloby sites, it was assumed one third of the total number of birds (Stroud *et al.* 2004; Kober *et al.* 2010) present during the breeding season will be non-breeders. These are apportioned to protected sites surrounding the North Sea in the same manner as for seabirds outwith the breeding season (see section 4) in Appendix 10.

Table 5.1 Numbers of birds displaced during construction / decommissioning and operation for the Dogger Bank Teesside A project during 2010, 2010/11 and 2011/12; mean values are subsequently combined with species specific mortality rates to assess the impact of displacement (see section 4). Full matrices of displacement and mortality are given in Appendix 10.

		Construction / decommissioning			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	4	4	4	4
Northern gannet	Breeding	16 (13-19)	32 (27-38)	108 (91-130)	56 (47-67)
	Winter	29 (24-35)	99 (84-119)	158 (131-191)	99 (83-119)
	All	45 (38-54)	131 (111-157)	266 (222-321)	155 (130-187)
Common guillemot	Breeding	103 (95-114)	196 (180-216)	233 (211-261)	181 (165-200)
	Winter	878 (810-954)	1127 (1045-1220)	719 (659-777)	853 (787-924)
	All	982 (905-1068)	1323 (1225-1436)	952 (869-1038)	1034 (952-1125)
Razorbill	Breeding	14 (11-17)	31 (24-38)	69 (53-85)	38 (29-46)
	Winter	336 (295-379)	424 (374-478)	276 (240-316)	321 (282-364)
	All	349 (306-396)	455 (398-516)	344 (294-401)	358 (311-410)
Little auk	Winter	51 (38-70)	54 (42-72)	19 (15-27)	37 (29-51)
Atlantic puffin	Breeding	5 (4-6)	9 (7-11)	4 (4-6)	6 (5-8)
	Winter	35 (28-44)	58 (49-70)	12 (10-15)	32 (26-39)
	All	40 (32-49)	67 (56-81)	17 (13-21)	38 (31-47)
		Operation			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	8	8	7	7
Northern gannet	Breeding	31 (27-38)	64 (55-77)	216 (183-259)	112 (95-134)
	Winter	58 (49-69)	198 (167-238)	317 (262-383)	198 (166-239)
	All	89 (75-107)	263 (222-315)	533 (445-642)	310 (260-373)
Common guillemot	Breeding	206 (189-228)	393 (360-432)	466 (421-522)	361 (329-401)
	Winter	1757 (1620-1908)	2253 (2090-2440)	1439 (1318-1554)	1707 (1575-1849)
	All	1963 (1809-2136)	2646 (2450-2873)	1905 (1739-2076)	2068 (1904-2250)
Razorbill	Breeding	27 (21-34)	61 (49-75)	137 (106-170)	75 (59-93)
	Winter	671 (591-758)	848 (747-957)	552 (481-632)	641 (563-727)
	All	698 (612-792)	909 (796-1032)	689 (587-802)	716 (622-820)
Little auk	Winter	102 (76-140)	107 (84-143)	37 (29-53)	75 (57-102)
Atlantic puffin	Breeding	9 (7-12)	18 (15-22)	9 (7-12)	12 (10-15)
	Winter	71 (56-87)	117 (98-139)	25 (20-30)	65 (53-78)
	All	80 (63-99)	135 (113-161)	33 (27-42)	77 (63-93)

Barrier effects – Marine Birds

5.2.4 Numbers of key species in flight potentially exposed to barrier effects are shown in Table 5.2.

Table 5.2 Estimates of the numbers of breeding adult birds of these species in flight in the Dogger Bank Teesside A project area using the mean of 2010 and 2010/2011 and 2011/12 data.

Species	Breeding season	Mean
Northern fulmar	Mar-Sep	79 (64-95)
Northern gannet	Apr-Sep	54 (45-64)
Black-legged kittiwake	Apr-Sep	327 (288-367)
Common guillemot	May-Jul	55 (50-61)
Razorbill	May-Jul	22 (17-27)

Collision – Marine Birds

5.2.5 An overview of the results of collision risk analyses for marine birds for the Dogger Bank Teesside A project is provided in Appendix 6.

5.2.6 There were strong between-year differences in both the total numbers of birds present within Dogger Bank Teesside A, and annual patterns in their abundance. With only three years of data, it was not possible to determine which year was the most representative of bird abundance within Dogger Bank Teesside A. For these reasons, collision risk estimates were produced for each year separately, rather than for a mean value from the three years.

5.2.7 Using a realistic, precautionary avoidance rate of 98% (SNH 2010, Cook *et al.* 2012), the numbers of Arctic skua, great skua, common guillemot, little auk and Atlantic puffin colliding with wind turbines, based on population estimates from 2010 to 2012, were predicted to be less than one bird per year. Even assuming a more conservative avoidance rate of 95%, the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin predicted to collide with wind turbines were less than one bird per year. Northern fulmar and razorbill had a similarly low collision risk, with just one northern fulmar and one razorbill predicted to collide annually.

5.2.8 The numbers of lesser black-backed gull and great black-backed gull predicted to collide with wind turbines were greater. The collision rates were highest based on the 2010 population estimates for the lesser black-backed gull with 24 birds. For great black-backed gull, the highest collision estimate, of 33 birds, came from the 2010/11 population estimate.

5.2.9 Estimates were greatest for black-legged kittiwake and northern gannet. The maximum collision estimate for black-legged kittiwake was 63 birds based on data from both 2010/11 and 2011/12. For northern gannet the maximum collision estimate was 54 birds based on the 2011/12 population estimate, assuming a 99% avoidance rate.

5.2.10 Collision estimates were greatest for northern gannet, black-legged kittiwake and lesser black-backed gulls during the breeding season. Collision estimates were greater for great black-backed gull during the non-breeding season (Table 5.4).

Table 5.3 Annual collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A project of the Dogger Bank Zone, assuming a worst case scenario of 200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m in response to different avoidance rates. Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010				July 2010 – June 2011				July 2011 – June 2012				Mean			
	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%
Northern fulmar	2 (2 – 2)	1 (1 – 1)	0 (0 – 0)	0 (0 – 0)	1 (1 – 2)	0 (0 – 1)	0 (0 – 0)	0 (0 – 0)	2 (2 – 3)	1 (1 – 1)	0 (0 – 1)	0 (0 – 0)	2 (1-2)	1 (1-1)	0 (0-0)	0 (0-0)
Northern gannet	57 (46 – 69)	23 (18 – 27)	11 (9 – 14)	6 (5 – 7)	99 (81 – 118)	40 (32 – 47)	20 (16 – 24)	10 (8 – 12)	269 (219 – 322)	108 (88 – 129)	54 (44 – 65)	27 (22 – 32)	152 (123-181)	61 (49-73)	30 (25-36)	15 (12-18)
Arctic Skua	0 (0 – 673)	0 (0 – 269)	0 (0 – 135)	0 (0 – 67)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 77)	0 (0 – 31)	0 (0 – 15)	0 (0 – 8)	0 (0-250)	0 (0-100)	0 (0-50)	0 (0-25)
Great Skua	0 (0 – 1)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	1 (0 – 1)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	1 (1 – 2)	0 (0 – 1)	0 (0 – 0)	0 (0 – 0)	1 (0-1)	0 (0-1)	0 (0-0)	0 (0-0)
Black-legged kittiwake	87 (78 – 98)	35 (31 – 39)	17 (16 – 20)	9 (8 – 10)	158 (140 – 179)	63 (56 – 72)	32 (28 – 36)	16 (14 – 18)	159 (139 – 182)	63 (56 – 73)	32 (28 – 36)	16 (14 – 18)	132 (117-150)	53 (47-60)	26 (23-30)	13 (12-15)
Lesser black-backed gull	61 (40 – 95)	24 (16 – 38)	12 (8 – 19)	6 (4 – 10)	38 (23 – 63)	15 (9 – 25)	8 (5 – 13)	4 (2 – 6)	26 (14 – 47)	10 (6 – 19)	5 (3 – 9)	3 (1 – 5)	41 (25-67)	16 (10-27)	8 (5-13)	4 (3-7)
Great black-backed gull	70 (50 – 102)	28 (20 – 41)	14 (10 – 20)	7 (5 – 10)	81 (58 – 119)	33 (23 – 48)	16 (12 – 24)	8 (6 – 12)	68 (43 – 107)	27 (17 – 43)	14 (9 – 21)	7 (4 – 11)	71 (49-107)	28 (20-43)	14 (10-21)	7 (5-11)
Common guillemot	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Razorbill	1 (1 – 2)	1 (0 – 1)	0 (0 – 0)	0 (0 – 0)	3 (2 – 6)	1 (1 – 2)	1 (0 – 1)	0 (0 – 1)	3 (2 – 5)	1 (1 – 2)	1 (0 – 1)	0 (0 – 0)	2 (1-4)	1 (1-2)	0 (0-1)	0 (0-0)
Little auk	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 5.4 Seasonal collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A project of the Dogger Bank Zone, assuming a worst case scenario of 200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m and an avoidance rate of 98 % (99% for northern gannet). Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010		July 2010 – June 2011		July 2011 – June 2012		Mean	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Northern fulmar	1 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	1 (0 - 1)	0 (0 - 0)	0 (0-1)	0 (0-0)
Northern gannet	6 (5 - 7)	5 (4 - 6)	8 (6 - 9)	12 (10 - 14)	31 (25 - 37)	23 (19 - 27)	16 (13-19)	14 (12-17)
Arctic Skua	0 (0 - 0)	0 (0 - 269)	0 (0 - 0)	0 (0 - 0)	0 (0 - 31)	0 (0 - 0)	0 (0-10)	0 (0-90)
Great Skua	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Black-legged kittiwake	13 (12 - 15)	21 (19 - 24)	41 (36 - 46)	23 (20 - 26)	43 (37 - 49)	21 (18 - 24)	33 (29-37)	20 (18-23)
Lesser black-backed gull	17 (11 - 25)	7 (4 - 13)	9 (5 - 14)	6 (4 - 12)	5 (2 - 8)	6 (3 - 10)	10 (6-15)	6 (4-12)
Great black-backed gull	8 (5 - 12)	20 (15 - 29)	10 (7 - 15)	23 (17 - 33)	12 (7 - 21)	15 (10 - 22)	10 (6-16)	18 (13-27)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Razorbill	0 (0 - 0)	1 (0 - 1)	0 (0 - 0)	1 (1 - 2)	0 (0 - 0)	1 (1 - 2)	0 (0-0)	1 (1-1)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)

Evaluation for Ornithological Receptors

White-billed diver

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	1	100% displaced 37.5% mortality 4km buffer	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	3		10,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		1,066	<0.1	533	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.11 Numbers in the Dogger Bank Zone as a whole surpassed 1% thresholds for populations of national and international importance. White-billed diver were present in the Dogger Bank Zone between November and April when an average of seven birds were estimated to occur in the Dogger Bank Teesside A project area.

5.2.12 Considering the population of this species in the Dogger Bank Teesside A project area was assessed to be of regional importance, the value of this receptor is assessed to be **medium**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.13 White-billed diver has high sensitivity to habitat loss and is considered to have a **high species-specific sensitivity** (i.e. a low tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.14 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside A project area (a monthly average of just four birds

was estimated to be displaced between November and April, of which one bird would then be lost through mortality).

5.2.15 The numbers potentially displaced and then lost through mortality are below the thresholds for national and international importance. Therefore, the effect of displacement for white-billed diver for Dogger Bank Teesside A during construction/decommissioning is considered to be of **negligible magnitude** at the national and biogeographic levels.

Significance

5.2.16 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.17 White-billed diver have high sensitivity to habitat loss, and are considered to have a **high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.18 Considering this and the species' **medium value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.19 White-billed divers are present in the Dogger Bank Zone during winter months only. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), the effect of direct habitat loss or change on white-billed diver is considered to be of **negligible magnitude**.

Significance

5.2.20 Combined with the species' high overall sensitivity to direct habitat loss or change, the impact of this effect for white-billed diver is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.21 White-billed diver has high sensitivity to displacement from boats and helicopters and is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.22 Considering this and the species' **medium value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.23 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish within the export cable corridor (see section 4). Information from ESAS data suggests this species is not present within the area (see section 3). However, the data cannot be used to completely deny occurrence of this species (see section 4). Therefore, for this receptor, the effect of direct habitat loss or change on white-billed diver is considered to be of **negligible magnitude**.

Significance

5.2.24 Combined with the species' high overall sensitivity to direct habitat loss or change, the impact of this effect for white-billed diver is considered to be **negligible**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.25 White-billed diver has high sensitivity to habitat loss and is considered to have a **high species-specific sensitivity** (i.e. a low tolerance) to this effect. Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.26 Displacement analysis was not undertaken for this species, due to the low numbers predicted for the Dogger Bank Teesside A project area (a monthly average of just seven birds was estimated between November and April, of which three birds would then be predicted to be lost through mortality).

5.2.27 The numbers potentially displaced and then lost through mortality are below the thresholds for national and international importance. Consequently, the effect of displacement for white-billed diver for Dogger Bank Teesside A during operation is considered to be of **negligible magnitude** at the national and biogeographic levels.

Significance

5.2.28 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.29 The annual survival rate of white-billed diver is unknown. However, the annual survival rate for red-throated diver is in the order of 80-85% and that of black-throated diver in the order of 85-90% (Robinson 2005). Assuming an annual survival rate of 85-90%, this species is considered to have a **high species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.30 Considering this and the species' **medium value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.31 Collision risk analysis was not undertaken for this species due to the low numbers predicted for the Dogger Bank Teesside A project area (a monthly average of just five birds was estimated between November and April), and because divers typically fly close to the seas below the height of wind turbines. The modelling work of Cook *et al.* (2012), for example, indicated that just 2% of red-throated diver and 0.1% of black-throated diver flew within an assumed wind turbine collision risk window of 20-150m. Given this, the number of collisions that might be predicted for white-billed diver will be very much less than 0.1 per year, and thus of **negligible magnitude** in relation to national and biogeographic thresholds.

Significance

5.2.32 The effect of collision for white-billed diver for Dogger Bank Teesside A is, thus, considered to be **negligible**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.33 The white-billed diver has high sensitivity to habitat loss and is considered to have a **high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.34 Considering this and the species' **medium value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.35 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during operation (see section 4). White-billed diver are present in the Dogger Bank Zone during winter months only. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), the effect of direct habitat loss or change on white-billed diver is considered to be of **negligible magnitude**.

Significance

5.2.36 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for white-billed diver is considered to be **negligible**.

Northern fulmar

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	1	98% avoidance Flight height option 3	10,200,000	<0.1	1,500,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		190,400	<0.1	28,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.37 The peak population estimates for the Dogger Bank Teesside A project area in 2010, 2010/2011 and 2011/12 were 569 birds (90% CIs = 476-676) in May, 253 birds (90% CIs = 204-307) in July, and 258 birds (90% CIs = 205-309) in May, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.38 The value of this receptor is assessed as **very high** as the species is a breeding feature of 26 SPAs and a wintering feature of two SPAs in the Greater North Sea OSPAR region.

5.2.39 Dogger Bank Teesside A is within foraging range of seven protected breeding sites in Great Britain, and is within foraging range of eight protected breeding sites around the North Sea at which the species is a feature.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.40 Northern fulmar have a very low sensitivity to habitat loss, and, therefore, and are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

5.2.41 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.42 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), the effect of direct habitat loss or change on this receptor is considered to be **negligible**.

Significance

5.2.43 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.44 Northern fulmar have a very low sensitivity to habitat loss, and are considered to have a **very low species-specific sensitivity** (i.e. a very high tolerance) to this effect.

5.2.45 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.46 For northern fulmar, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be **negligible**.

Significance

5.2.47 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Operation

Barrier effects

Magnitude

5.2.48 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 95 adult northern fulmars in flight in the project areas in the breeding season using 2010, 2010/11 and 2010/12 data (Table5.2).

5.2.49 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.1 (Appendix 9) which indicates that between 1 and 5% of the population at the Flamborough Head and Bempton Cliffs SPA, the Weybourne Cliffs SSSI and the Hunstanton Cliffs SSSI might be potentially exposed to this effect.

5.2.50 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although averages approximately 25km (6.25% of the species' maximum foraging range of 400km). The project is between 195km and 370km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1).

5.2.51 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.2.52 Based on the assessment of magnitude and the species' **very high value**, the overall **impact** of the potential barrier effect associated with the Dogger Bank Teesside A project for northern fulmar is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.53 Northern fulmar is long-lived with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.54 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of one per year for northern fulmar.

5.2.55 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.56 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each protected site within foraging range of the project. Mean

annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.57 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, French and German breeding populations.

5.2.58 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.59 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.60 Considering the collision risk estimates, based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for northern fulmar for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales. The impact is thus assessed to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.61 Northern fulmar have a very low sensitivity to habitat loss, and, therefore, are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

5.2.62 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.63 For northern fulmar, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.64 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Northern gannet

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	0	75% displaced 0% mortality 2km buffer	967,000	0	660,000	<0.1	0	Minor adverse
Displacement (o)	0		967,000	0	660,000	<0.1	0	Minor adverse
Collision – population	36	99% avoidance Flight height option 3	967,000	<0.1	660,000	<0.1	0	Minor adverse
Collision – background adult mortality	27		52,218	<0.1	35,640	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.65 The peak population estimates for the Dogger Bank Teesside A project area in 2010, 2010/11 and 2011/12 were 109 birds (90% CIs =93-131) in October, 820 birds (90% CIs = 691-980) in March, and 1,244 birds (90% CIs = 1,036-1,490) in March respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in any year.

5.2.66 The value of this receptor is assessed as **very high**, as the species in the Greater North Sea OSPAR region is a breeding feature of nine SPAs, a wintering feature of five SPAs and a passage feature of five SPAs.

5.2.67 Dogger Bank Teesside A is within foraging range, during the breeding season, of three protected breeding sites around the North Sea at which the species is a feature – the Seevogelschutzgebiet Helgoland, Forth Islands, and Flamborough Head and Bempton Cliffs SPAs. Dogger Bank Teesside A is therefore within foraging range of two protected breeding sites in Great Britain.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.68 Northern gannet has very low sensitivity to displacement, and is considered to have a **very low species-specific sensitivity** (i.e. a very high tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.69 Based on 50% of the worst case values for displacement, analysis provided estimates of 45 (using 90% confidence limits = 38-54) displaced birds using 2010 data (16 during breeding months, 29 during other months of the year), 131 (using 90% confidence limits = 111-157) displaced birds using 2010/11 data (32 during breeding months, 99 during other months of the year), and 266 (using 90% confidence limits = 222-321) displaced birds using 2011/12 data (108 during breeding months, 158 during other months of the year). The mean value was 155 (using 90% confidence limits = 130-187) displaced birds (56 during breeding months, 99 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for northern gannet for Dogger Bank Teesside A is thus considered of **negligible magnitude** at all scales.

Significance

5.2.70 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.71 Northern gannet have a very low sensitivity to habitat loss, and, therefore, are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

5.2.72 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.73 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Therefore, the effect of direct habitat loss or change is assessed as being of **negligible magnitude**.

Significance

5.2.74 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.75 Northern gannet have a very low sensitivity to habitat loss, and, therefore, are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

5.2.76 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.77 The 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.78 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.79 Northern gannet have a very low sensitivity to habitat loss, and, therefore, and are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.80 Based on worst case values for displacement, analysis provided estimates of 89 (using 90% confidence limits = 75-107) displaced birds using 2010 data (31 during breeding months, 58 during other months of the year), 263 (using 90% confidence limits = 222-315) displaced birds using 2010/11 data (64 during breeding months, 198 during other months of the year), and 533 (using 90% confidence limits = 445-642) displaced birds using 2011/12 data (216 during breeding months, 317 during other months of the year). The mean value was 310 (using 90% confidence limits = 260-373) displaced birds (112 during breeding months, 198 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for

northern gannet for Dogger Bank Teesside A is thus considered of **negligible magnitude** at all scales.

Significance

5.2.81 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.82 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 64 adult northern gannets in flight in the project areas in the breeding season, using 2010, 2010/11 and 2011/12 data (Table 5.2).

5.2.83 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.2 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.2.84 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although averages approximately 25km (10.9% of the species' maximum foraging range of 229km). The project is 195km from the Flamorough Head and Bempton Cliffs SPA, the only protected site within foraging range that would be potentially impacted by this effect (Appendix 1). Recent tracking studies indicate that additional individuals from some other North Sea protected sites may also be impacted (e.g. Wakefield et al. 2013).

5.2.85 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.2.86 Based on the assessment of magnitude and the species' **very high value**, the overall significance of the potential barrier effect associated with the Dogger Bank Teesside A project for northern gannet is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.87 The overall northern gannet population in Great Britain and Ireland increased in size between the 1985-88 and 1998-2002 seabird censuses (Mitchell *et al.* 2004), and has continued to increase in recent years. As such, there is capacity for the species' population to accommodate a threshold of deaths through collision with offshore wind turbines (Trinder *et al.* 2012). Nevertheless, as is typical for many seabird species, the northern gannet is long-lived with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.88 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 30 (90% confidence limits = 25 - 36) per year for northern gannet. Of these, 16 were predicted to occur during the breeding season and 14 in the non-breeding season.

5.2.89 Tables A9.3a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. At the protected site level, the largest relative impact was predicted for the Flamborough Head and Bempton Cliffs SPA although, even here, the maximum annual estimates of the number of collisions represent just 0.1% of the site population, using mean annual collision estimates. Mean annual collision estimates represent just 0.01% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.90 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population. There are no national population estimates for this species for the winter.

5.2.91 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.92 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.93 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than

1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for northern gannet for the Dogger Bank Teesside A project is considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and considered to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.94 Northern gannet have a very low sensitivity to habitat loss, and, therefore, and are considered to have a very low species-specific sensitivity (i.e. a very high tolerance) to this effect.

5.2.95 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.96 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during operation (see section 4). For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.97 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Arctic skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	75,000	<0.1	6,300	<0.1	0	Minor adverse
Collision – background adult mortality	<1		5,700	<0.1	479	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.98 Arctic skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A project area in 2010, 2010/11 and 2011/12 were 1 bird (90% CIs = 0-5), 1 bird (90% CIs = 0-5), and 4 birds (90% CIs = 2-10), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.99 The value of this receptor is assessed as **very high** as the species is a breeding feature of 12 SPAs and a passage feature of two SPAs in the Greater North Sea OSPAR region.

5.2.100 Dogger Bank Teesside A is outside the foraging range of any protected site at which the species is a breeding feature.

5.2.101 It should be noted that the estimated numbers of Arctic skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.102 The Arctic skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.103 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.104 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.105 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.106 Arctic skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.107 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.108 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during construction/decommissioning (see section 4). The 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.109 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Operation

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.110 Arctic skua is long-lived, with an annual survival rate of 85-90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **high species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.111 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.112 The Band collision risk model (Band *et al.* 2012) provided mean annual estimates of less than one Arctic skua collision per year.

5.2.113 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.114 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.115 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.116 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A project, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.2.117 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.118 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for Arctic skua for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.119 Arctic skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.120 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.121 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.122 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Great skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	48,000	<0.1	28,800	<0.1	0	Minor adverse
Collision – background adult mortality	<1		3,584	<0.1	2,150	<0.1	0	

Summary of population estimates and value

5.2.123 Great skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A project area in 2010, 2010/11 and 2011/12 were 2 birds (90% CIs = 1-3), 2 birds (90% CIs = 1-3), and 6 birds (90% CIs = 5-11), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.124 The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of seven SPAs and a passage feature of two SPAs.

5.2.125 The proposed project is outside the foraging range of any protected site at which the species is a breeding feature.

5.2.126 It should be noted that the estimated numbers of great skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.127 The great skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.128 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.129 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.130 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.131 The great skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.132 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.133 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during construction/decommissioning (see section 4). The 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.134 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Operation

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.135 Great skua is long-lived, with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.136 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.137 The Band collision risk model (Band *et al.* 2012) provided mean annual estimates of less than one great skua collision per year.

5.2.138 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.139 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.140 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.141 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for Dogger Bank Teesside A, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.2.142 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.143 Considering the collision risk estimates, based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for great skua for Dogger Bank Teesside A is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and consequently considered to be **minor adverse.**

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.144 The great skua has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.145 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.146 Individual effects, defined in Chapter 13 'Fish and Shellfish Ecology', were determined to be minor adverse for fish and shellfish during operation (see section 4). For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.147 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Black-legged kittiwake

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	60	98% avoidance Flight height option 3	6,600,000	<0.1	1,110,000	<0.1	0	Minor adverse
Collision – background adult mortality	49		259,600	<0.1	43,660	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.148 The peak population estimates for the Dogger Bank Teesside A project area were 2,196 (90% CIs = 1,914-2,467), 4,889 (90% CIs = 4,332-5,464), and 3,540 (90% CIs = 3,117-3,981) for 2010, 2010/11 and 2011/12 respectively, in March in all years. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.149 The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 24 SPAs, a wintering feature of four SPAs and a passage feature of six SPAs.

5.2.150 Dogger Bank Teesside A is within foraging range, during the breeding season, of one protected breeding sites around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.151 The black-legged kittiwake have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.152 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.153 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.154 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.155 The black-legged kittiwake have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.156 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.157 The 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.158 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Operation

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.159 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 367 adult black-legged kittiwakes in flight in the project areas in the breeding season, using 2010, 2010/11 and 2011/12 data (Table 5.2).

5.2.160 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.4 (Appendix 9) which indicates that less than 1% of the breeding population at the Flamborough Head and Bempton Cliffs SPA – the only site in foraging range - would be potentially exposed to this effect.

5.2.161 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although averages approximately 25km (10.8% of the species' maximum foraging range of 231km). The project is 195km from the Flamborough Head and Bempton Cliffs SPA, the only protected site within foraging range that would be potentially exposed to this effect (Appendix 1).

5.2.162 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.2.163 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A project for black-legged kittiwake is assessed as **minor adverse** at protected site, national and biogeographic levels.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.164 Black-legged kittiwake is long-lived, with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.165 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.166 The Band collision risk model (Band *et al.* 2012) provided mean annual collision estimates of 53 (90% confidence limits = 47-60) for black-legged kittiwake. Of these, 33 were predicted to occur during the breeding season and 20 during the non-breeding season.

5.2.167 Tables A9.5a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed project is within foraging range of one protected breeding site around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA. Mean annual estimates of the number of collisions represent less than 0.1% of the site's population. Mean annual estimates using the same data also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.168 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British population.

5.2.169 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.170 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.171 Considering the collision risk estimates, based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect.

5.2.172 The effect of collision for black-legged kittiwake for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and, is considered to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.173 Black-legged kittiwake have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.174 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.175 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded Dogger Bank Teesside A in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.176 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Lesser black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	27	98% avoidance Flight height option 3	550,000	<0.1	B 120,000	<0.1	0	Minor adverse
					W 330,000	<0.1		
Collision – background adult mortality	9		31,900	<0.1	B 6,960	<0.1	0	
					W 19,140	*<0.1*		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.2.177 The peak population estimates for Dogger Bank Teesside A were 201 birds (90% CIs = 140-286) in June, 108 birds (90% CIs = 76-154) in May, and 55 birds (90% CIs = 22-148) in May for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year.

5.2.178 The value of this receptor is assessed as **very high**, as the species in the Greater North Sea OSPAR region is a breeding feature of 21 SPAs, a wintering feature of two SPAs and a passage feature of three SPAs.

5.2.179 Dogger Bank Teesside A is outside the foraging range of any protected site at which the species is a breeding feature.

5.2.180 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated, given that those present in the spring may be *intermedius* birds on passage to Scandinavia, and thus due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.181 Lesser black-backed gull has very low sensitivity to habitat loss, and is considered to have a **very low species-specific sensitivity** (i.e. a very high tolerance) to this effect.

5.2.182 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.183 The 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.184 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.185 Lesser black-backed gull has very low sensitivity to habitat loss, and is considered to have a **very low species-specific sensitivity** (i.e. a very high tolerance) to this effect.

5.2.186 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.187 For lesser black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.188 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Operation

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.189 Lesser black-backed gull is long-lived, with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.190 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.191 The Band collision risk model (Band *et al.* 2012) provided mean annual collision estimates of 16 (90% confidence limits = 10-27) for lesser black-backed gull using 2010 data (ten during breeding months, six during other months of the year).

5.2.192 Tables A9.6a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed project is outside the foraging range of any protected site at which the species is a breeding feature. Mean annual collision estimates represent less than 0.1% of the populations of each of the protected sites around the North Sea at which the species is a feature.

5.2.193 Mean winter estimates represent less than 0.1% of the winter population estimate for the species in Great Britain.

5.2.194 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.2.195 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A project, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.2.196 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.197 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for lesser black-backed gull for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently assessed to be **minor adverse** at all scales.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.198 Lesser black-backed gull has very low sensitivity to habitat loss, and is considered to have a **very low species-specific sensitivity** (i.e. a very high tolerance) to this effect.

5.2.199 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.200 For lesser black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.
Significance

5.2.201 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Great black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
					W 75,860	0		
Collision – population	43	98% avoidance Flight height option 3	420,000	<0.1	B 51,000	<0.1	0	Minor adverse
					W 75,860	<0.1		
Collision – background adult mortality	12		24,360	<0.1	B 2,958	0.4	0	
					W 4,400	0.3		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.2.202 The peak population estimates for Dogger Bank Teesside A were 155 birds (90% CIs = 118-188) in January, 113 birds (90% CIs = 87-146) in January, and 81 birds (90% CIs = 56-110) in February for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year.

5.2.203 The value of this receptor is assessed as **very high**, as the species in the Greater North Sea OSPAR region is a breeding feature of 17 SPAs and a wintering feature of two SPAs.

5.2.204 The proposed project is outside the foraging range of any protected site at which the species is a breeding feature.

5.2.205 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated due to the potential turnover of birds at this time.

Construction and Decommissioning

Significance

5.2.206 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at both national and biogeographic scales.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.207 The great black-backed gull have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.208 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.209 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.210 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.211 Great black-backed gull have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.212 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.213 The 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.214 Combined with the species' **high sensitivity** to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Operation

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.215 Great black-backed gull is long-lived, with an annual survival rate of over 90% and a corresponding low reproductive rate (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.216 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.217 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 28 (90% confidence limits = 20-43) great black-backed gull collisions (10 during breeding months, 18 during other months of the year).

5.2.218 Tables A9.7a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed project is outside the foraging range of any protected site at which the species is a breeding feature. Mean annual collision estimates represent less than 0.1% of the populations of each of the protected sites around the North Sea at which the species is a feature.

5.2.219 Mean winter estimates using represent less than 0.1% of the winter population estimate for the species in Great Britain.

5.2.220 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.2.221 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.222 Considering the collision risk estimates, based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for great black-backed gull for the Dogger Bank Teesside A project is thus considered of

negligible magnitude at protected site suite, national and biogeographic scales, and is consequently considered to be **minor adverse** at all scales.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.223 Great black-backed gull have a low sensitivity to habitat loss and are considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.224 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.225 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.226 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Common guillemot

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	56	50% displaced 5% mortality 2km buffer	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Displacement (o)	113		5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		201,600	<0.1	95,040	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.227 The peak population estimates for the Dogger Bank Teesside A project area were 4,196 birds in December (90% CIs = 3,915-4,553), 6,546 birds in April (90% CIs = 6,074-7,052), and 6,681 birds in April (90% CIs = 6,146-7,176) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in Dogger Bank Teesside A in either year.

5.2.228 The value of this receptor is assessed as **very high,** as the species is a breeding feature of 26 SPAs, a wintering feature of 11 SPAs and a passage feature of one SPA in the Greater North Sea OSPAR region.

5.2.229 Dogger Bank Teesside A is within foraging range of five protected breeding sites around the North Sea at which the species is a feature, of which four are in Great Britain – the Farne Islands, Forth Islands, Flamborough Head and Bempton Cliffs, and St Abb's Head to Fast Castle SPAs, and one borders the North Sea – Seevogelschutzgebiet Helgoland. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.230 Common guillemot has medium sensitivity to displacement, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.231 Based on 50% of the worst case values for displacement, analysis provided estimates of 982 (using 90% confidence limits = 905-1,068) displaced birds using 2010 data (103 during breeding months, 878 during other months of the year), 1,323 (using 90% confidence limits = 1,225-1,436) displaced birds using 2010/11 data (196 during breeding months, 1,127 during other months of the year), and 952 (using 90% confidence limits = 869-1,038) displaced birds using 2011/12 data (233 during breeding months, 719 during other months of the year). The mean value was 1,034 (using 90% confidence limits = 952-1,125) displaced birds (181 during breeding months, 853 during other months of the year).

5.2.232 Tables A9.8a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data) would be impacted.

5.2.233 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.234 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.235 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.236 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.237 Common guillemot has medium sensitivity to habitat loss, and is considered to have a **medium** species-specific sensitivity (i.e. a medium tolerance) to this effect.

5.2.238 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.239 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.240 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.241 Common guillemot has medium sensitivity to habitat loss, and is considered to have a **medium** species-specific sensitivity (i.e. a medium tolerance) to this effect.

5.2.242 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.243 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.244 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.245 Common guillemot has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.246 Based on worst case values for displacement, analysis provided estimates of 1,963 (using 90% confidence limits = 1,809-2,136) displaced birds using 2010 data (206 during breeding months, 1,757 during other months of the year), 2,646 (using 90% confidence limits = 2,450-2,873) displaced birds using 2010/11 data (393 during breeding months, 2,253 during other months of the year), and 1,905 (using 90% confidence limits = 1,739-2,076) displaced birds using 2011/12 data (466 during breeding months, 1,439 during other months of the year). The mean value was 2,068 (using 90% confidence limits = 1,904-2,250) displaced birds (361 during breeding months, 1,707 during other months of the year).

5.2.247 Tables A9.9a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 1% (using mean data) of birds would be impacted.

5.2.248 Displacement would affect much less than 0.1 % of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.249 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.250 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.251 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.252 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 61 adult common guillemots in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.2).

5.2.253 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.10 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.2.254 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although averages approximately 25km (7.4% of the species' maximum foraging range of 340km). The project is between 195km and 340km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from one site – the Forth Islands SPA – from reaching foraging areas beyond the project area.

5.2.255 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.2.256 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A project for common guillemot is assessed as **minor adverse** at the protected site, national and biogeographic level.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.257 The common guillemot is long-lived with an average annual survival rate of over 90% (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.258 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.259 The Band collision risk model (Band *et al.* 2012) provided estimates of less than one common guillemot collision per year in each study year.

5.2.260 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.261 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of the five protected breeding sites for the species that the proposed project is within foraging range of. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.262 Mean estimates of the number of collisions of birds in the breeding represent less than 0.1% of the species' British, breeding population.

5.2.263 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.264 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.265 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for common guillemot for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.266 The common guillemot has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.267 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.268 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.269 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Razorbill

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	21	50% displaced 5% mortality 2km buffer	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Displacement (o)	41		1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – population	2	98% avoidance Flight height option 3	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		92,000	<1	22,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.270 The peak population estimates for the Dogger Bank Teesside A project area were 1,585 birds in December (90% CIs = 1,401-1,765), 3,009 birds in April (90% CIs = 2,660-3,364), and 2,464 birds in April (90% CIs = 2,150-2,787) for 2010, 2010/11 and 2011/12 respectively. The 1% threshold for a population of national importance was not exceeded in the Dogger Bank Teesside A project area during the breeding season and the 1% threshold for a population of international importance was not exceeded in either year.

5.2.271 The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 18 SPAs, a wintering feature of five SPAs and a passage feature of two SPAs.

5.2.272 The proposed project is within foraging range of three protected breeding sites around the North Sea at which the species is a feature – the Farne Islands, Flamborough Head and Bempton Cliffs, and St Abb's Head to Fast Castle, all of which are in Great Britain. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.273 The razorbill has medium sensitivity to displacement, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.274 Based on 50% of the worst case values for displacement, analysis provided estimates of 349 (using 90% confidence limits = 306-396) displaced birds using 2010 data (14 during breeding months, 336 during other months of the year), 455 (using 90% confidence limits = 398-516) displaced birds using 2010/11 data (31 during breeding months, 424 during other months of the year), and 344 (using 90% confidence limits = 294-401) displaced birds using 2011/12 data (69 during breeding months, 276 during other months of the year). The mean value was 358 (using 90% confidence limits = 311-410) displaced birds (38 during breeding months, 321 during other months of the year).

5.2.275 Tables A9.11a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data), would be impacted.

5.2.276 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.277 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.278 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.279 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.280 The razorbill has a medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.281 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.282 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.283 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.284 The razorbill has a medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.285 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.286 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in any year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.287 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.288 The razorbill has a medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.289 Based on worst case values for displacement, analysis provided estimates of 698 (using 90% confidence limits = 612-792) displaced birds using 2010 data (27 during breeding months, 671 during other months of the year), 909 (using 90% confidence limits = 796-1032) displaced birds using 2010/11 data (61 during breeding months, 848 during other months of the year), and 689 (using 90% confidence limits = 587-802) displaced birds using 2011/12 data (137 during breeding months, 552 during other months of the year). The mean value was 716 (using 90% confidence limits = 622-820) displaced birds (75 during breeding months, 641 during other months of the year).

5.2.290 Tables A9.12a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data), would be impacted.

5.2.291 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.292 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.293 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.294 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.295 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 27 adult razorbills in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.2).

5.2.296 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.13 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.2.297 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although averages approximately 25km (8.0% of the species' maximum foraging range of 312km). The project is between 195km and 308km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from one site – the St Abb's Head to Fast Castle SPA – from reaching foraging areas beyond the project area.

5.2.298 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.2.299 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A project for razorbill is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.300 The razorbill is long-lived with an average annual survival rate of over 90% (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.301 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

The Band collision risk model (Band *et al.* 2012) provided estimates of just one razorbill collisions per year using data from 2010/11.

5.2.302 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.303 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of the four protected sites within foraging range of Dogger Bank Teesside A. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.304 The proposed project is within foraging range of four protected breeding sites in Great Britain. Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population. There are no national population estimates for this species for the winter.

5.2.305 Mean annual collision estimates using represent less than 0.1% of the species' biogeographic population.

5.2.306 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.307 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for razorbill for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.308 The razorbill has a medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.309 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.310 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.311 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Little auk

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	3	25% displaced 5% mortality 2km buffer	125,000,000	<0.1	5,000 [3]	<0.1	0	Negligible
Displacement (o)	5		125,000,000	<0.1	5,000 [3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	125,000,000	<0.1	5,000 [3]	<0.1	0	Negligible
Collision – background adult mortality	<1		8,333,333	<0.1	333	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

5.2.312 The peak population estimates for the Dogger Bank Teesside A project area were 1,809 birds in December (90% CIs = 1,436-2,424), 1,809 birds in December (90% CIs = 1,436-2,424), and 600 birds in December (90% CIs = 490-816) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.313 The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. Although there is no British population estimate for little auk, given the numbers estimated, this species is deemed to be of national importance in the Dogger Bank Teesside A project area. Consequently, the value of this receptor is assessed to be **high**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.314 The little auk has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.315 Taking 50% of the worst-case maximum annual estimates in winter months, when this species occurs, a total of 51 birds would be displaced during 2010 (using 90% confidence limits = 38-70), 53.5 during 2010/11 (using 90% confidence limits = 42-72) and 19 during 2011/12 (using 90% confidence limits = 15-27). The mean value was 37 (using 90% confidence limits = 29-51) displaced birds.

5.2.316 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.317 Less than 1% of reference populations at the national and biogeographic scale would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at both the national and biogeographic levels.

Significance

5.2.318 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at the national and biogeographic scales.

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.319 The little auk has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.320 Considering this and the species' **high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.321 Little auks occur in the Dogger Bank Zone during winter months. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.322 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.323 The little auk has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.324 Considering this and the species' **high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.325 For little auk, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.326 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.327 The little auk has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.328 Full methodological details and results of displacement analyses are provided in section 4 of this report. Based on worst case values for displacement, analysis provided estimates in winter months, when this species occurs, of 102 birds displaced during 2010 (using 90% confidence limits = 76-140), 107.0 during 2010/11 (using 90% confidence limits = 84-143) and 37.5 during 2011/12 (using 90% confidence limits = 29-53). The mean value was 75 (using 90% confidence limits = 57-102) displaced birds.

5.2.329 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.330 Less than 1% of reference populations at the national and biogeographic scale would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at the national and biogeographic scale.

Significance

5.2.331 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Collision

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.332 The little auk is long-lived with an average annual survival rate in the order of 80-85% (Grémillet *et al.* 2012, Harding *et al.* 2011), and thus is considered to have a **medium species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.333 Considering this and the species' **high value**, the species' **overall sensitivity** to this effect is considered to be **high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.334 The Band collision risk model (Band *et al.* 2012) provided a maximum annual collision estimate of less than one little auk collision in each study year.

5.2.335 The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. There are no national population estimates for this species for the winter. Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.336 The predicted number of collisions represents an increase in background mortality of less than 1% at the national and biogeographic population levels.

Significance

5.2.337 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for

little auk for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **negligible**.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.338 The little auk has low sensitivity to habitat loss, and is considered to have a **low species-specific sensitivity** (i.e. a high tolerance) to this effect.

5.2.339 Considering this and the species' **high value**, the species' **overall sensitivity** to this effect is considered to be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.340 Little auks occur in the Dogger Bank Zone during winter months. For little auk, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.341 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Atlantic puffin

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	2	25% displaced 5% mortality 2km buffer	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Displacement (o)	5		13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		684,000	<0.1	88,160	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.2.342 The peak population estimates for the Dogger Bank Teesside A project area were 422 birds in December (90% CIs = 351-497), 582 birds in March (90% CIs = 509-681), and 155 birds in March (90% CIs = 126-188) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A project area in either year.

5.2.343 The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 16 SPAs.

5.2.344 Dogger Bank Teesside A is outside the foraging range of any protected site at which the species is a breeding feature.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.345 The Atlantic puffin has medium sensitivity to displacement, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.346 Based on 50% of the worst case values for displacement, analysis provided estimates of 40 (using 90% confidence limits = 32-49) displaced birds using 2010 data (5 during breeding months, 35 during other months of the year), 67 (using 90%

confidence limits = 56-81) displaced birds using 2010/11 data (9 during breeding months, 58 during other months of the year), and 17 (using 90% confidence limits = 13-21) displaced birds using 2011/12 data (4 during breeding months, 12 during other months of the year). The mean value was 38 (using 90% confidence limits = 31-47) displaced birds (6 during breeding months, 32 during other months of the year).

5.2.347 Tables A9.14a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.348 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.349 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.350 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.351 The Atlantic puffin has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.352 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.353 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.354 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Export cable corridor

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.355 The Atlantic puffin has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.356 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.357 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the export cable corridor area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.2.358 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.359 The Atlantic puffin has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.360 Based on worst case values for displacement, analysis provided estimates of 80 (using 90% confidence limits = 63-99) displaced birds using 2010 data (9 during breeding months, 71 during other months of the year), 135 (using 90% confidence limits = 113-161) displaced birds using 2010/11 data (18 during breeding months, 117 during other months of the year), and 33 (using 90% confidence limits = 27-42)

displaced birds using 2011/12 data (9 during breeding months, 25 during other months of the year). The mean value was 77 (using 90% confidence limits = 63-93) displaced birds (12 during breeding months, 65 during other months of the year).

5.2.361 Tables A9.15a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.2.362 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.2.363 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at all scales.

Significance

5.2.364 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Collision

Species-specific sensitivity and overall sensitivity
(Recoverability/Adaptability/Tolerance/Value)

5.2.365 The Atlantic puffin is long-lived with an average annual survival rate of over 90% (Robinson 2005), and thus is considered to have a **very high species-specific sensitivity** (i.e. a low tolerance) to this effect.

5.2.366 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.367 The Band collision risk model (Band *et al.* 2012) provided a maximum annual collision estimate of less than one Atlantic puffin collision in each study year.

5.2.368 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.2.369 Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.2.370 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

5.2.371 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.2.372 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.2.373 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for Atlantic puffin for the Dogger Bank Teesside A project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and the impact of the effect is consequently considered to be **minor adverse** at all scales.

Direct habitat loss or change

Species-specific sensitivity and overall sensitivity (Recoverability/Adaptability/Tolerance/Value)

5.2.374 The Atlantic puffin has medium sensitivity to habitat loss, and is considered to have a **medium species-specific sensitivity** (i.e. a medium tolerance) to this effect.

5.2.375 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect is considered to be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.2.376 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.2.377 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Migrants

Operation

Collision

5.2.378 The migration zones (defined by Wright *et al.* 2012) of 45 species' populations of terrestrial or waterbird migrants that are UK SPA features overlap with the Dogger Bank Teesside A project during migration. Collision risk estimates suggest that, on an annual basis, the mortality associated with the Dogger Bank Teesside A project is likely to represent less than 1% of the reference population of each of these species (Table 5.5).

5.2.379 The effect of collision for migrants for the Dogger Bank Teesside A project is thus considered to be of **negligible magnitude** at the national level and **minor adverse** for 15 species' populations and **negligible** for 30 species' populations.

5.2.380 Due to the lack of knowledge concerning species' precise migration routes and their likely variability, no attempt was made to apportion impacts to individual protected sites, and thus it is unknown whether impacts may potentially be greater or less at any one particular site.

5.2.381 It should also be noted that for migrants there is much uncertainty in these calculations, and thus the assessment, both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Given these uncertainties, the confidence in predictions in the assessment of collision for migrants is considered to be very low.

Table 5.5 Assessment of collision risk for migrants for the Dogger Bank Teesside A project. Estimated numbers of collisions are based on the numbers of birds predicted to pass through the wind farm, a 98% avoidance rate, and expert judgement of the proportion of individuals flying at collision risk height. Values in brackets under "estimated annual collisions" represent the estimates using the lower and upper estimates of the proportion of birds at risk height (as described in Wright *et al*. 2012), and are not a measure of confidence in the collision estimates (which would have a far greater range).

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Bean goose *Anser fabalis*	0.02 (0.003 - 0.05)	<0.1%	4.18%	Very High	Low	High	Negligible	Negligible
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0.004 (0.001 - 0.01)	<0.1%	0.19%	Very High	High	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0.75 (0.005 - 3.01)	<0.1%	3.39%	Very High	High	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	4.26 (0.03 - 17.04)	<0.1%	3.16%	Very High	Very Low	Medium	Negligible	Negligible
Gadwall *Anas strepera*	0.07 (0.0004 - 0.26)	<0.1%	1.81%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian teal *Anas crecca*	1.01 (0.01 - 4.04)	<0.1%	3.17%	Very High	Very Low	Medium	Negligible	Negligible
Mallard *Anas platyrhynchos*	3.10 (0.02 - 12.40)	<0.1%	3.39%	Very High	Very Low	Medium	Negligible	Negligible
Northern pintail *Anas acuta*	0.14 (0.001 - 0.54)	<0.1%	3.17%	Very High	Very Low	Medium	Negligible	Negligible
Northern shoveler *Anas clypeata*	0.10 (0.001 - 0.42)	<0.1%	2.71%	Very High	Very Low	Medium	Negligible	Negligible
Common pochard *Aythya ferina*	0.41 (0.003 - 1.63)	<0.1%	2.71%	Very High	Very Low	Medium	Negligible	Negligible
Tufted duck *Aythya fuligula*	0.77 (0.01 - 3.08)	<0.1%	3.14%	Very High	Very Low	Medium	Negligible	Negligible
Greater scaup *Aythya marila*	0.003 (0.00002 - 0.01)	<0.1%	2.60%	Very High	Very Low	Medium	Negligible	Negligible
Common scoter *Melanitta nigra*	0.04 (0.004 - 0.60)	<0.1%	3.17%	Very High	Low	High	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Velvet scoter *Melanitta fusca*	0.02 (0.0002 - 0.09)	<0.1%	3.72%	Very High	Low	High	Negligible	Negligible
Common goldeneye *Bucephala clangula*	0.26 (0.002 - 1.06)	<0.1%	3.39%	Very High	Low	High	Negligible	Negligible
Red-breasted merganser *Mergus serrator*	0.03 (0.0002 - 0.14)	<0.1%	2.28%	Very High	Medium	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	0.004 (0.0004 - 0.01)	<0.1%	3.67%	Very High	Medium	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0.09 (0.01 - 0.37)	<0.1%	1.25%	Very High	Very Low	Medium	Negligible	Negligible
Great crested grebe *Podiceps cristatus*	0.003 (0.0003 - 0.01)	<0.1%	2.10%	Very High	Medium	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0.0002 (0.0001 - 0.0004)	<0.1%	3.17%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0.01 (0.01 - 0.03)	<0.1%	0.60%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0.34 (0.03 - 0.65)	<0.1%	3.72%	Very High	Medium	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	1.44 (0.29 - 4.32)	<0.1%	0.76%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	0.25 (0.05 - 0.75)	<0.1%	3.17%	Very High	High	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	0.03 (0.0002 - 0.14)	<0.1%	3.45%	Very High	Low	High	Negligible	Negligible
Golden plover *Pluvialis apricaria* (non-breeding)	2.67 (0.53 - 8.01)	<0.1%	3.15%	Very High	Very Low	Medium	Negligible	Negligible
Grey plover *Pluvialis squatarola*	0.72 (0.14 - 2.16)	<0.1%	3.42%	Very High	High	Very High	Negligible	Minor adverse

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Northern lapwing *Vanellus vanellus*	6.65 (1.33 - 19.96)	<0.1%	3.42%	Very High	Very Low	Medium	Negligible	Negligible
Red knot *Calidris canutus*	2.22 (0.44 - 6.65)	<0.1%	3.18%	Very High	Medium	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	0.57 (0.11 - 1.7)	<0.1%	3.18%	Very High	Medium	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii* *(passage)*	0.05 (0.01 - 0.14)	<0.1%	3.16%	Very High	Very Low	Medium	Negligible	Negligible
Dunlin *Calidris alpina alpina* (passage & winter)	4.78 (0.96 - 14.35)	<0.1%	2.78%	Very High	Very Low	Medium	Negligible	Negligible
Ruff *Philomachus pugnax*	0.04 (0.01 - 0.12)	<0.1%	4.03%	Very High	Very Low	Medium	Negligible	Negligible
Common snipe *Gallinago gallinago*	6.54 (1.31 - 19.61)	<0.1%	3.19%	Very High	Very Low	Medium	Negligible	Negligible
Black-tailed godwit *Limosa limosa islandica*	0.04 (0.01 - 0.11)	<0.1%	2.90%	Very High	Very High	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0.86 (0.17 - 2.57)	<0.1%	3.55%	Very High	Very Low	Medium	Negligible	Negligible
Whimbrel *Numenius phaeopus*	0.17 (0.03 - 0.51)	<0.1%	3.24%	Very High	High	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	1.42 (0.28 - 4.25)	<0.1%	3.58%	Very High	Very Low	Medium	Negligible	Negligible
Greenshank *Tringa nebularia*	0.0003 (0.0001 - 0.0009)	<0.1%	2.47%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank *Tringa totanus britannica* (breeding)	0.04 (0.01 - 0.12)	<0.1%	3.14%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	1.67 (0.33 - 5)	<0.1%	2.89%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0.39 (0.08 - 1.16)	<0.1%	3.68%	Very High	Very Low	Medium	Negligible	Negligible
Ruddy turnstone *Arenaria interpres*	0.31 (0.06 - 0.93)	<0.1%	3.17%	Very High	High	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	0.01 (0.003 - 0.02)	<0.1%	3.28%	Very High	Very Low	Medium	Negligible	Negligible
European Nightjar *Caprimulgus europaeus*	0.01 (0.002 - 0.02)	<0.1%	0.75%	Very High	Very Low	Medium	Negligible	Negligible

[1] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[2] The migration zone referred to here is the North Sea migration area appropriate to assessment for the Dogger Bank, and not the entire migration zone used by the species around the whole of the UK. The percentage given can be roughly interpreted as the percentage of birds migrating across the North Sea that would cross the wind farm footprint during a single migration period (note for most species there are 2 migrations per year crossing the North Sea). For further details see the SOSS migration modelling tool guidance (Wright *et al*. 2012).

Barrier effects

5.2.382 An assessment of the potential barrier effects posed by the Dogger Bank Teesside A project to the 45 species' populations of terrestrial or waterbird migrants that are UK SPA features, whose migration zones (defined by Wright *et al.* 2012) overlap with the project area, is provided in the Table 5.6 below.

5.2.383 The percentages of reference populations estimated to pass through the project area at risk height (following Wright *et al.* 2012), and thus exposed to potential barrier effects were less than 1% for most species considered, but greater than 1% for bean goose, hen harrier and ruff. The estimates of numbers passing through the project area greatly exceed the numbers recorded by boat surveys, though it should be noted that boat surveys were not designed to record migrants and as they only provide a (diurnal) snapshot of birds flying close to the sea, they will inevitably greatly underestimate overall numbers of migrants.

5.2.384 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A varies by direction of flight, although for the shortest approximately east-west route across the North Sea passing through the project, equates to a maximum of approximately 10km (an increase of just 2% on the ca. 575km route).

5.2.385 Considering both the numbers of birds exposed to this effect and the relative increase in flight distance due to the barrier presented by Dogger Bank Teesside A, this impact is considered to be of **negligible magnitude** for all species' populations.

5.2.386 It should be noted that there is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms. For migrants, there is great uncertainty in the determination of the numbers of birds passing through each project area. There is little evidence to suggest whether or not migration may be concentrated within corridors within overall migration zones (Wright *et al.* 2012) and it cannot be assumed that birds fly directly to or from the protected sites that they are features of. It is also assumed that the wind farm poses a barrier effect to 100% of birds attempting to fly through at risk height (Maclean *et al.* 2009) which may be over-precautionary. In particular, there is considerable uncertainty as to the actual consequences for survival, and thus for population-level impacts, from the increase in energy expenditure associated with the increases in flight distance for those birds exposed to barrier effects. Given these uncertainties, the confidence in predictions in the assessment of barrier effects is considered to be very low and considerable caution is urged in considering the outcomes of this assessment.

Table 5.6 Assessment of barrier effects for migrants for the Dogger Bank Teesside A project.

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Bean goose *Anser fabalis*	0	1	9	1.25%	Very High	Negligible	Minor adverse
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*			2	0.06%	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0	0	385	0.51%	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	0	8	2353	0.45%	Very High	Negligible	Minor adverse
Gadwall *Anas strepera*	0	0	36	0.16%	Very High	Negligible	Minor adverse
Eurasian teal *Anas crecca*	0	1	593	0.24%	Very High	Negligible	Minor adverse
Mallard *Anas platyrhynchos*	2	3	1636	0.36%	Very High	Negligible	Minor adverse
Northern pintail *Anas acuta*	2	1	72	0.24%	Very High	Negligible	Minor adverse
Northern shoveler *Anas clypeata*	0	0	58	0.30%	Very High	Negligible	Minor adverse
Common pochard *Aythya ferina*	0	3	227	0.30%	Very High	Negligible	Minor adverse
Tufted duck *Aythya fuligula*	2	0	436	0.42%	Very High	Negligible	Minor adverse
Greater scaup *Aythya marila*	0	0	2	0.02%	Very High	Negligible	Minor adverse
Common scoter *Melanitta nigra*	113	191	20	0.02%	Very High	Negligible	Minor adverse
Velvet scoter *Melanitta fusca*	4	9	13	0.50%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common goldeneye *Bucephala clangula*	2	0	148	0.51%	Very High	Negligible	Minor adverse
Red-breasted merganser *Mergus serrator*	0	0	1	0.03%	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	5	0	18	0.55%	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0	0	2	0.44%	Very High	Negligible	Minor adverse
Great crested grebe *Podiceps cristatus*	0	0	51	0.21%	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0	0	2	0.16%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0	0	<1	0.03%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0	0	6	1.49%	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0	0	199	0.19%	Very High	Negligible	Minor adverse
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	2	8	793	0.40%	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	4	4	315	0.43%	Very High	Negligible	Minor adverse
Golden plover *Pluvialis apricaria* (non-breeding)	0	5	1574	0.39%	Very High	Negligible	Minor adverse
Grey plover *Pluvialis squatarola*	0	0	421	0.85%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Northern lapwing *Vanellus vanellus*	0	19	3834	0.85%	Very High	Negligible	Minor adverse
Red knot *Calidris canutus*	3	15	1349	0.40%	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	6	0	358	0.60%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	16	18	29	0.79%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina alpina* (passage & winter)	16	18	3052	0.70%	Very High	Negligible	Minor adverse
Ruff *Philomachus pugnax*	0	3	24	1.01%	Very High	Negligible	Minor adverse
Common snipe *Gallinago gallinago*	1	0	3989	0.40%	Very High	Negligible	Minor adverse
Black-tailed godwit *Limosa limosa islandica*	0	0	41	0.72%	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0	0	482	0.89%	Very High	Negligible	Minor adverse
Whimbrel *Numenius phaeopus*	6	27	93	0.40%	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	51	4	733	0.90%	Very High	Negligible	Minor adverse
Greenshank *Tringa nebularia*	0	1	<1	0.06%	Very High	Negligible	Minor adverse
Common redshank *Tringa totanus britannica* (breeding)	0	0	24	0.08%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	0	0	993	0.36%	Very High	Negligible	Minor adverse
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0	0	230	0.92%	Very High	Negligible	Minor adverse
Ruddy turnstone *Arenaria interpres*	7	12	190	0.40%	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	2	23	6	0.57%	Very High	Negligible	Minor adverse
European Nightjar *Caprimulgus europaeus*	0	0	4	0.04%	Very High	Negligible	Minor adverse

[1] Across Dogger Bank Zone as a whole (see section 3).

[2] The estimated number of individuals of each species crossing the project is the number that would pass through at risk height (using the best estimate of the proportion of migrating birds at risk height from Wright *et al*. 2012 and not accounting for uncertainty) during a single migration season. Note that for most species, two migrations per year would be expected, and different individual birds may be involved during spring and autumn passage.

[3] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[4] Magnitude is assessed here according to Table 4.1.

Summary for all receptors

5.2.387 Table 5.7 below provides a summary of impacts from each effect for all key marine bird receptors.

Table 5.7 Summary of potential impacts from the Dogger Bank Teesside A project for key marine bird receptors.

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
White-billed diver	Displacement (construction/decommissioning)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	Medium	High	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Medium	High	High	Negligible	Negligible	Very Low
	Displacement (operation)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Collision (operation)	National	Medium	High	High	Negligible	Negligible	Medium
		Biogeographic	Medium	High	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	Medium	High	High	Negligible	Negligible	Very Low
Northern fulmar	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Northern gannet	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Disturbance (cable construction)	National	Very High	-	-	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Arctic skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Great skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Black-legged kittiwake	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Lesser black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Great black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Common guillemot	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Razorbill	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Little auk	Displacement (construction/decommissioning)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Collision (operation)	National	High	Medium	High	Negligible	Negligible	Medium
		Biogeographic	High	Medium	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	High	Low	Medium	Negligible	Negligible	Very Low
Atlantic puffin	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low

5.3 Dogger Bank Teesside B Offshore Ornithology Impact

Disturbance/displacement

5.3.1 The numbers of birds predicted to be displaced from the Dogger Bank Teesside B project area and buffer during construction/decommissioning and operation, under chosen displacement rates, are shown in Table 5.9 and are also discussed at the start of each species' account. The values presented incorporate the correction factors for birds underwater (see section 4), but do not represent final magnitude, taking into account mortality rates. Tabulated summaries for each species of the numbers of birds estimated to be displaced that are then estimated to die based on a full range of alternative displacement and mortality rates from 0 to 100% are provided in Appendix 10.

5.3.2 Results of the apportioning of disturbance/displacement impacts to protected sites, incorporating mortality, are shown in Appendix 9. These tables also correct for the initial assumption that all birds come from the protected sites identified (see section 4).

5.3.3 Table 5.8 also provides separate estimates of the numbers of birds predicted to be displaced in respective breeding and winter periods. Birds predicted to be impacted during the breeding season will potentially include both breeders from any breeding colonies that the project is within range of, and also a non-breeding component. For gulls and northern gannet, it was possible to derive estimates of proportion of breeders from boat-survey observations of birds in breeding and juvenile plumages. For other species, it is assumed that, for species for which the wind farm project is within foraging range of birds from breeding colony protected sites, one third of the total number of birds (Stroud *et al.* 2004; Kober *et al.* 2010) present during the breeding season will be non-breeders. These are apportioned to protected sites surrounding the North Sea in the same manner as for seabirds outwith the breeding season (see section 4).

Table 5.8 Numbers of birds displaced during construction / decommissioning and operation for the Dogger Bank Teesside B project during 2010, 2010/11 and 2011/12; mean values are subsequently combined with species specific mortality rates to assess the impact of displacement (see section 4). Full matrices of displacement and mortality are given in Appendix 10.

		Construction / decommissioning			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	4	4	4	4
Northern gannet	Breeding	21 (18-25)	43 (37-50)	136 (117-160)	72 (62-85)
	Winter	39 (33-46)	116 (99-136)	214 (178-256)	128 (107-152)
	All	60 (51-71)	158 (135-186)	350 (295-416)	200 (169-237)
Common guillemot	Breeding	212 (197-232)	412 (383-447)	477 (437-528)	373 (345-409)
	Winter	1483 (1367-1605)	1724 (1597-1859)	1113 (1022-1201)	1348 (1244-1455)
	All	1694 (1564-1836)	2137 (1980-2306)	1590 (1459-1729)	1721 (1589-1864)
Razorbill	Breeding	20 (17-25)	46 (39-55)	101 (82-123)	56 (45-67)
	Winter	556 (491-624)	623 (553-699)	405 (355-461)	488 (431-550)
	All	576 (507-648)	669 (591-754)	506 (437-585)	544 (476-617)
Little auk	Winter	62 (46-88)	54 (42-72)	19 (15-27)	41 (31-57)
Atlantic puffin	Breeding	6 (5-7)	12 (10-14)	6 (5-7)	8 (7-9)
	Winter	45 (37-57)	66 (56-79)	14 (12-17)	38 (31-46)
	All	51 (41-64)	77 (66-93)	20 (16-25)	45 (38-56)
		Operation			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	8	8	7	7
Northern gannet	Breeding	42 (36-50)	85 (74-100)	272 (233-321)	144 (124-169)
	Winter	77 (66-92)	231 (197-273)	428 (356-511)	255 (215-304)
	All	119 (102-141)	316 (271-373)	700 (589-832)	399 (339-473)
Common guillemot	Breeding	424 (393-463)	824 (765-894)	954 (875-1056)	747 (690-818)
	Winter	2965 (2735-3210)	3449 (3194-3717)	2226 (2044-2402)	2696 (2488-2911)
	All	3389 (3128-3673)	4273 (3959-4611)	3180 (2919-3458)	3442 (3177-3729)
Razorbill	Breeding	41 (33-49)	93 (77-110)	201 (164-247)	111 (91-135)
	Winter	1112 (981-1247)	1245 (1105-1398)	811 (711-923)	976 (861-1100)
	All	1153 (1014-1296)	1338 (1182-1507)	1012 (874-1169)	1087 (952-1235)
Little auk	Winter	124 (93-176)	107 (84-145)	38 (30-53)	81 (62-113)
Atlantic puffin	Breeding	12 (9-15)	23 (20-28)	11 (9-14)	16 (13-19)
	Winter	91 (73-113)	131 (111-159)	29 (23-35)	75 (62-92)
	All	103 (83-128)	155 (131-186)	40 (33-49)	91 (75-111)

Barrier effects – Marine Birds

5.3.4 Numbers of key species in flight potentially exposed to barrier effects for Dogger Bank Teesside B are shown in Table 5.9.

Table 5.9 Estimates of the numbers of breeding adult birds of these species in flight in the Dogger Bank Teesside B project area using the mean of 2010 and 2010/2011 and 2011/12 data.

Species	Breeding season	Mean
Northern fulmar	Mar-Sep	73 (59-87)
Northern gannet	Apr-Sep	70 (60-82)
Black-legged kittiwake	Apr-Sep	540 (485-594)
Common guillemot	May-Jul	114 (105-125)
Razorbill	May-Jul	33 (27-39)

Collision – Marine Birds

5.3.5 An overview of the results of collision risk analyses for marine birds for the Dogger Bank Teesside B project is provided in Appendix 6.

5.3.6 There were strong between year differences in both the total numbers of birds present within Dogger Bank Teesside B, and annual patterns in their abundance. With only three years of data, it was not possible to determine which year was most representative of bird abundance within Dogger Bank Teesside B. For these reasons, collision risk estimates were produced for each year separately, rather than for a mean value from the three years.

5.3.7 Using a realistic, precautionary avoidance rate of 98% (SNH 2010, Cook *et al.* 2012), the numbers of Arctic skua, great skua, common guillemot, little auk and Atlantic puffin colliding with wind turbines, based on population estimates from 2010 to 2012, were predicted to be less than one bird per year. Even assuming a more conservative avoidance rate of 95%, the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin predicted to collide with wind turbines were less than one bird per year. Northern fulmar and razorbill had a similarly low collision risk, with just one northern fulmar predicted to collide each year and a maximum of two razorbills predicted to collide annually.

5.3.8 The numbers of lesser black-backed gull and great black-backed gull predicted to collide with wind turbines were greater. The collision rates were highest based on the 2010 population estimates for the lesser black-backed gull with 25 birds. For great black-backed gull, the highest collision estimates, of 34 birds, came from the 2010/11 population estimate.

5.3.9 Estimates were greatest for black-legged kittiwake and northern gannet. The maximum collision estimate for black-legged kittiwake was 98 birds based on the 2011/12 population estimate. For northern gannet the maximum collision estimate

was 66 birds, also based on the 2011/12 population estimate and assuming a 99% avoidance rate.

5.3.10 Collision estimates were greatest for northern gannet, black-legged kittiwake and lesser black-backed gulls during the breeding season. Collision estimates were greater for great black-backed gull during the non-breeding season (Table 5.11).

Table 5.10 Annual collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside B project of the Dogger Bank Zone, assuming a worst case scenario of 200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m in response to different avoidance rates. Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010				July 2010 – June 2011				July 2011 – June 2012				Mean			
	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%
Northern fulmar	2 (2 - 2)	1 (1 - 1)	0 (0 - 0)	0 (0 - 0)	1 (1 - 2)	1 (0 - 1)	0 (0 - 0)	0 (0 - 0)	2 (2 - 2)	1 (1 - 1)	0 (0 - 0)	0 (0 - 0)	2 (1-2)	1 (1-1)	0 (0-0)	0 (0-0)
Northern gannet	72 (60 - 85)	29 (24 - 34)	15 (12 - 17)	7 (6 - 9)	121 (100 - 142)	48 (40 - 57)	24 (20 - 28)	12 (10 - 14)	331 (273 - 388)	132 (109 - 155)	66 (55 - 78)	33 (27 - 39)	187 (155-220)	75 (62-88)	38 (31-44)	19 (16-22)
Arctic Skua	0 (0 - 582)	0 (0 - 233)	0 (0 - 117)	0 (0 - 58)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 69)	0 (0 - 27)	0 (0 - 14)	0 (0 - 7)	0 (0-217)	0 (0-87)	0 (0-43)	0 (0-22)
Great Skua	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	1 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	1 (1 - 2)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	1 (0-1)	0 (0-1)	0 (0-0)	0 (0-0)
Black-legged kittiwake	139 (125 - 156)	56 (50 - 62)	28 (25 - 31)	14 (13 - 16)	237 (213 - 265)	95 (85 - 106)	47 (43 - 53)	24 (21 - 26)	244 (217 - 277)	98 (87 - 111)	49 (43 - 55)	24 (22 - 28)	203 (182-229)	81 (73-92)	41 (36-46)	20 (18-23)
Lesser black-backed gull	63 (44 - 94)	25 (18 - 38)	13 (9 - 19)	6 (4 - 9)	37 (24 - 59)	15 (10 - 24)	8 (5 - 12)	4 (2 - 6)	25 (14 - 44)	10 (5 - 18)	5 (3 - 9)	3 (1 - 4)	41 (27-64)	16 (11-26)	8 (5-13)	4 (3-6)
Great black-backed gull	81 (58 - 113)	32 (23 - 45)	16 (12 - 23)	8 (6 - 11)	84 (61 - 119)	34 (25 - 47)	17 (12 - 24)	8 (6 - 12)	67 (43 - 101)	27 (17 - 40)	13 (9 - 20)	7 (4 - 10)	75 (52-107)	30 (21-43)	15 (10-21)	7 (5-11)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Razorbill	2 (1 - 3)	1 (0 - 1)	0 (0 - 1)	0 (0 - 0)	4 (3 - 8)	2 (1 - 3)	1 (1 - 2)	0 (0 - 1)	4 (3 - 6)	2 (1 - 3)	1 (1 - 1)	0 (0 - 1)	3 (2-5)	1 (1-2)	1 (0-1)	0 (0-1)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 5.11 Seasonal collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside B project of the Dogger Bank Zone, assuming a worst case scenario of 200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m and an avoidance rate of 98 % (99% for northern gannet). Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010		July 2010 – June 2011		July 2011 – June 2012		Mean	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Northern fulmar	1 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	1 (0 - 1)	0 (0 - 0)	0 (0-1)	0 (0-0)
Northern gannet	7 (6 - 8)	8 (6 - 9)	9 (7 - 10)	15 (13 - 18)	34 (28 - 39)	32 (27 - 38)	18 (15-21)	20 (16-23)
Arctic Skua	0 (0 - 0)	0 (0 - 233)	0 (0 - 0)	0 (0 - 0)	0 (0 - 27)	0 (0 - 0)	0 (0-9)	0 (0-78)
Great Skua	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Black-legged kittiwake	24 (21 - 27)	32 (29 - 36)	65 (59 - 73)	29 (26 - 33)	71 (63 - 81)	26 (24 - 30)	54 (48-61)	27 (24-31)
Lesser black-backed gull	19 (14 - 27)	6 (4 - 11)	9 (6 - 14)	6 (3 - 10)	5 (3 - 9)	5 (3 - 9)	11 (7-16)	6 (4-10)
Great black-backed gull	6 (4 - 8)	27 (19 - 37)	7 (5 - 10)	27 (19 - 37)	9 (5 - 14)	18 (12 - 26)	7 (5-11)	23 (16-32)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Razorbill	0 (0 - 0)	1 (0 - 1)	0 (0 - 0)	2 (1 - 3)	0 (0 - 0)	1 (1 - 2)	0 (0-0)	1 (1-2)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)

Evaluation for Ornithological Receptors

White-billed diver

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	1	100% displaced 37.5% mortality 4km buffer	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	3		10,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		1,066	<0.1	533	<0.1	<0.1	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

5.3.11 Numbers in the Dogger Bank Zone as a whole surpassed 1% thresholds for populations of national and international importance. White-billed divers were present in the Dogger Bank Zone between November and April when an average of seven birds was estimated to occur in the Dogger Bank Teesside B project area. The population of this species in the Dogger Bank Teesside B project area was assessed to be of regional importance, and consequently the value of this receptor is assessed to be **medium**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.12 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside B project area (a monthly average of just four birds was estimated between November and April), of which one bird would then be predicted to be lost through mortality.

5.3.13 Consequently, following the method and assumptions presented for Dogger Bank Teesside A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

5.3.14 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm and export cable corridor

5.3.15 The impact of habitat loss for both the wind farm area and cable corridors for Dogger Bank Teesside B is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Disturbance/displacement

5.3.16 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside B project area (a monthly average of just seven birds was estimated between November and April), of which three birds would be predicted to be lost through mortality.

5.3.17 Consequently, following the method and assumptions presented for Dogger Bank Teesside A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

5.3.18 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Collision

5.3.19 The effect of collision for white-billed diver for Dogger Bank Teesside B is considered to be **negligible** following the assessment methodology and justification presented for Dogger Bank Teesside A.

Direct habitat loss or change

5.3.20 Following the methodology and justification presented in section 5.2, the impact of habitat loss for white-billed diver is as assessed for Dogger Bank Teesside A – **negligible.**

Northern fulmar

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	1	98% avoidance Flight height option 3	10,200,000	<0.1	1,500,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		190,400	<0.1	28,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.21 The peak population estimates for the Dogger Bank Teesside B project area in 2010, 2010/2011 and 2011/12 were 540 birds (90% CIs = 450-640) in May, 268 birds (90% CIs = 213-323) in July, and 223 birds (90% CIs = 179-264) in May, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year.

5.3.22 The value of this receptor is assessed as **very high** as the species is a breeding feature of 26 SPAs and a wintering feature of two SPAs in the Greater North Sea OSPAR region. Dogger Bank Teesside B is within foraging range of eight protected breeding sites in Great Britain, and is within foraging range of nine protected breeding sites around the North Sea at which the species is a feature.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.23 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.24 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Export cable corridor

5.3.25 The impact of habitat loss of change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Barrier effects

Magnitude

5.3.26 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 87 adult northern fulmars in flight in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.9).

5.3.27 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.14 (Appendix 9) which indicates that between 1 and 5% of the population at the Flamborough Head and Bempton Cliffs SPA might be potentially exposed to this effect.

5.3.28 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although averages approximately 25km (6.25% of the species' maximum foraging range of 400km). The project is between 164km and 388km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1). This increase might prevent birds from one site – the Troup, Pennan and Lions Heads SPA – from reaching foraging areas beyond the project area.

5.3.29 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.3.30 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside B project for northern fulmar is assessed as **minor adverse** at protected site, national and biogeographic levels.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.31 The Band collision risk model (Band *et al.* 2012) provided estimates of less than 1 northern fulmar collision per year in each study year.

5.3.32 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.33 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of the eight sites in foraging range of Dogger Bank Teesside B. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.34 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

5.3.35 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.36 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.37 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for northern fulmar for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and the impact of the effect is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.38 For northern fulmar, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.39 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Northern gannet

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	0	75% displaced 0% mortality 2km buffer	967,000	0	660,000	0	0	Minor adverse
Displacement (o)	0		967,000	0	660,000	0	0	Minor adverse
Collision – population	44	99% avoidance Flight height option 3	967,000	<0.1	660,000	<0.1	0	Minor adverse
Collision – background adult mortality	34		52,218	<0.1	35,640	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.40 The peak population estimates for the Dogger Bank Teesside B project area in 2010, 2010/11 and 2011/12 were 155 birds (90% CIs =133-181) in October, 984 birds (90% CIs = 840-1,151) in March, and 1,811 birds (90% CIs = 1,506-2,160) in March respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of nine SPAs, a wintering feature of five SPAs and a passage feature of five SPAs.

5.3.41 The proposed project is within foraging range of three protected breeding sites around the North Sea at which the species is a feature – the Seevogelschutzgebiet Helgoland, Forth Islands and Flamborough Head and Bempton Cliffs, and two protected breeding sites in Great Britain at which the species is a feature. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.42 Based on 50% of the worst case values for displacement, analysis provided estimates of 60 (using 90% confidence limits = 51-71) displaced birds using 2010 data (21 during breeding months, 39 during other months of the year), 158 (using 90% confidence limits = 135-186) displaced birds using 2010/11 data (43 during breeding months, 116 during other months of the year), and 350 (using 90% confidence limits

= 295-416) displaced birds using 2011/12 data (136 during breeding months, 214 during other months of the year). The mean value was 200 (using 90% confidence limits = 169-237) displaced birds (72 during breeding months, 128 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for northern gannet for Dogger Bank Teesside B is thus considered of **negligible magnitude** at all scales.

Significance

5.3.43 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.44 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.3.45 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Export cable corridor

5.3.46 The impact of habitat loss/change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Disturbance/displacement

Sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.47 Based on worst case values for displacement, analysis provided estimates of 119 (using 90% confidence limits = 102-141) displaced birds using 2010 data (42 during breeding months, 77 during other months of the year), 316 (using 90% confidence

limits = 271-373) displaced birds using 2010/11 data (85 during breeding months, 231 during other months of the year), and 700 (using 90% confidence limits = 589-832) displaced birds using 2011/12 data (272 during breeding months, 428 during other months of the year). The mean value was 399 (using 90% confidence limits = 339-473) displaced birds (144 during breeding months, 255 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for northern gannet for Dogger Bank Teesside B is thus considered of **negligible magnitude** at all scales.

Significance

5.3.48 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.49 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 70 adult northern gannets in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data.

5.3.50 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.17 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.3.51 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although averages approximately 25km (10.9% of the species' maximum foraging range of 229km). The project is 164km from the Flamborough Head and Bempton Cliffs SPA - the protected site within foraging range that would be potentially impacted by this effect (Appendix 1). Recent tracking studies indicate that additional individuals from some other North Sea protected sites may also be impacted (e.g. Wakefield et al. 2013).

5.3.52 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.3.53 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside

B project for northern gannet is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.54 The Band collision risk model (Band *et al.* 2012) provided mean annual collision estimate of 38 (90% confidence limits = 31-44) per year for northern gannet. Of these, 18 were predicted to occur during the breeding season and 20 during the non-breeding season.

5.3.55 Tables A9.18a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites.

5.3.56 The largest relative impact was predicted for the Flamborough Head and Bempton Cliffs SPA, although even here the mean annual estimates of the number of collisions represent just 0.1% of the site population using the maximum estimates. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.57 Mean estimates of the number of collisions of birds in the breeding represent less than 0.1% of the species' British breeding population.

5.3.58 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.59 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.60 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for northern gannet for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.61 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.3.62 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Arctic skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	75,000	<0.1	6,300	<0.1	0	Minor adverse
Collision – background adult mortality	<1		5,700	<0.1	479	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.63 Arctic skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside B project area in 2010, 2010/11 and 2011/12 were 1 bird (90% CIs = 0-5), 1 bird (90% CIs = 0-5), and 4 birds (90% CIs = 2-9), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 12 SPAs and a passage feature of two SPAs.

5.3.64 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

5.3.65 It should be noted that the estimated numbers of Arctic skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.66 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4),

the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.67 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Export cable corridor

5.3.68 The impact of habitat loss of change is as assessed for Dogger Bank Teesside A - **negligible**.

Significance

5.3.69 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Operation

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.70 The Band collision risk model (Band *et al.* 2012) provided estimates of less than one Arctic skua collision per year in each of the study years.

5.3.71 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.72 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.73 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.74 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside B project, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.3.75 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.76 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for Arctic skua for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.77 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.78 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Great skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	48,000	<0.1	28,800	<0.1	0	Minor adverse
Collision – background adult mortality	<1		3,584	<0.1	2,150	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.79 Great skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside B project area in 2010, 2010/11 and 2011/12 were 1 bird (90% CIs = 0-5), 1 bird (90% CIs = 0-5), and 4 birds (90% CIs = 2-9), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of seven SPAs and a passage feature of two SPAs.

5.3.80 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

5.3.81 It should be noted that the estimated numbers of great skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.82 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4),

the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.83 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Export cable corridor

5.3.84 The impact of habitat loss of change is as assessed for Dogger Bank Teesside A - **negligible**.

Significance

5.3.85 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Operation

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one great skua collision.

5.3.86 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.87 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.88 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.89 It should be noted that the estimated numbers of this species in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season. However, even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside B project, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.3.90 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.91 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for great skua for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and the impact of effect is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.92 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.93 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Black-legged kittiwake

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	92	98% avoidance Flight height option 3	6,600,000	<0.1	1,110,000	<0.1	0	Minor adverse
Collision – background adult mortality	74		259,600	<0.1	43,660	0.3	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.94 The peak population estimates for the Dogger Bank Teesside B project area were 3,398 (90% CIs = 2,985-3,779), 6,487 (90% CIs = 5,864-7,207), and 5,507 (90% CIs = 4,859-6,188) for 2010, 2010/11 and 2011/12 respectively, in March in all years. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 24 SPAs, a wintering feature of four SPAs and a passage feature of six SPAs.

5.3.95 The proposed project is within foraging range during the breeding season of two protected breeding sites around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA and Durham Coast and Marsden Bay SSSI, both of which are in the UK. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.96 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.97 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Export cable corridor

5.3.98 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.99 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 540 adult black-legged kittiwakes in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data.

5.3.100 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.19 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.3.101 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although averages approximately 25km (10.8% of the species' maximum foraging range of 231km). The project is 164km from the Flamborough Head and Bempton Cliffs SPA, the only protected site within foraging range that would be potentially exposed to this effect (Appendix 1).

5.3.102 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.3.103 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside B project for black-legged kittiwake is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.104 The Band collision risk model (Band *et al.* 2012) provided a mean collision estimate of 81 (90% confidence limits = 73-92) black-legged kittiwake collisions based on data for 2011/12 (54 during breeding months, 27 during other months of the year).

5.3.105 Tables A9.20a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Dogger Bank Teesside B is within foraging range of one protected breeding site around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA. Mean annual estimates of the number of collisions represent less than 0.1% of the site population.

5.3.106 Mean annual estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.107 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British population.

5.3.108 Mean annual collision estimates using represent less than 0.1% of the species' biogeographic population.

5.3.109 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.110 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect.

5.3.111 Based on the size of the impacts predicted relative to population size, the effect of collision for black-legged kittiwake for the Dogger Bank Teesside B project would be considered to be of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and the impact is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.112 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.113 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Lesser black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
					W 330,000	0		
Collision – population	26	98% avoidance Flight height option 3	550,000	<0.1	B 120,000	<0.1	0	Minor adverse
					W 330,000	<0.1		
Collision – background adult mortality	8		31,900	<0.1	B 6,960	<0.1	0	
					W 19,140	<0.1		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.3.114 The peak population estimates for Dogger Bank Teesside B were 160 birds (90% CIs = 115-228) in June, 81 birds (90% CIs = 59-113) in May, and 44 birds (90% CIs = 18-121) in May for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 21 SPAs, a wintering feature of two SPAs and a passage feature of three SPAs.

5.3.115 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature.

5.3.116 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated, given that those present in the spring may be *intermedius* birds on passage to Scandinavia, and thus due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.117 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.118 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Export cable corridor

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.119 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A – **negligible**.

Operation

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.120 The Band collision risk model (Band *et al.* 2012) provideds mean annual collision estimate of 16 (90% confidence limits = 11-26) lesser black-backed gull collisions based on 2010 data (11 during breeding months, six during other months of the year).

5.3.121 Tables A9.21a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed project is outside the foraging range of any protected site at which the species is a breeding feature. Mean annual collision

estimates represent less than 0.1% of the populations of each of the protected sites around the North Sea at which the species is a feature.

5.3.122 Mean winter estimates represent less than 0.1% of the winter population estimate for the species in Great Britain.

5.3.123 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.3.124 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside B project, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.3.125 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.126 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for lesser black-backed gull for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and the impact of the effect is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.127 For lesser black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.128 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Great black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
					W 75,860	0		
Collision – population	43	98% avoidance Flight height option 3	420,000	<0.1	B 51,000	<0.1	0	Minor adverse
					W 75,860	<0.1		
Collision – background adult mortality	14		24,360	<0.1	B 2,958	0.5	0	
					W 4,400	0.4		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.3.129 The peak population estimates for Dogger Bank Teesside B were 204 birds (90% CIs = 161-239) in January, 132 birds (90% CIs = 100-172) in March, and 95 birds (90% CIs = 70-127) in February for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 17 SPAs and a wintering feature of two SPAs.

5.3.130 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature.

5.3.131 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.132 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project

area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.133 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Export cable corridor

5.3.134 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.135 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 30 (90% confidence limits = 21-43) great black-backed gull collision (seven during breeding months, 23 during other months of the year).

5.3.136 Tables A9.22a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Mean annual collision estimates represent 0.1% respectively of the populations of each of the protected sites around the North Sea at which the species is a feature.

5.3.137 Mean winter estimates represent less than 0.1% of the winter population estimate for the species in Great Britain.

5.3.138 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.3.139 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.140 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less

than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect.

5.3.141 The effect of collision for great black-backed gull for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.142 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.143 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Common guillemot

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	93	50% displaced 5% mortality 2km buffer	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Displacement (o)	186		5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		201,600	<0.1	95,040	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.144 The peak population estimates for the Dogger Bank Teesside B project area were 6,317 birds in December (90% CIs = 5,877-6,806), 9,719 birds in March (90% CIs = 9,108-10,385), and 9,645 birds in March (90% CIs = 8,879-10,389) for 2010, 2010/11 and 2011/12 respectively. The 1% threshold for a population of national importance was not exceeded in the Dogger Bank Teesside B project area during the breeding season and the 1% threshold for a population of international importance was not exceeded in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 26 SPAs, a wintering feature of 11 SPAs and a passage feature of one SPA.

5.3.145 The proposed project is within foraging range of five protected breeding sites around the North Sea at which the species is a feature, all which all are in Great Britain – the Farne Islands, Forth Islands, Flamborough Head and Bempton Cliffs, Fowlsheugh, and St Abb's Head to Fast Castle SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.146 Based on 50% of the worst case values for displacement, analysis provided estimates of 1,694 (using 90% confidence limits = 1,564-1,836) displaced birds using

2010 data (212 during breeding months, 1,483 during other months of the year), 2,137 (using 90% confidence limits = 1,980-2,306) displaced birds using 2010/11 data (412 during breeding months, 1,724 during other months of the year), and 1,590 (using 90% confidence limits = 1,459-1,729) displaced birds using 2011/12 data (477 during breeding months, 1,113 during other months of the year). The mean value was 1,721 (using 90% confidence limits = 1,589-1,864) displaced birds (373 during breeding months, 1,348 during other months of the year).

5.3.147 Tables A9.23a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds would be impacted.

5.3.148 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.3.149 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.150 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.151 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.152 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.153 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Export cable corridor

5.3.154 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.155 Based on worst case values for displacement, analysis provided estimates of 3,389 (using 90% confidence limits = 3,128-3,673) displaced birds using 2010 data (424 during breeding months, 2,965 during other months of the year), 4,273 (using 90% confidence limits = 3,959-4,611) displaced birds using 2010/11 data (824 during breeding months, 3,449 during other months of the year), and 3,180 (using 90% confidence limits = 2,919-3,458) displaced birds using 2011/12 data (954 during breeding months, 2,226 during other months of the year). The mean value was 3,442 (using 90% confidence limits = 3,177-3,729) displaced birds (747 during breeding months, 2,696 during other months of the year).

5.3.156 Tables A9.24a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data) would be impacted.

5.3.157 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1%, of the British breeding population.

5.3.158 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.159 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.160 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.161 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 125 adult common guillemots in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data.

5.3.162 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.25 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.3.163 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although averages approximately 25km (7.4% of the species' maximum foraging range of 340km). The project is between 164km and 330km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from one site – the Fowlsheugh SPA – from reaching foraging areas beyond the project area.

5.3.164 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.3.165 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside B project for common guillemot is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.166 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one common guillemot collision.

5.3.167 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.168 Mean annual estimates of the number of collisions represent less than 0.1% of the populations the six protected breeding sites around the North Sea. Mean annual estimates data also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.169 The proposed project is within foraging range of six protected breeding sites in Great Britain. Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

5.3.170 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.171 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.172 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for common guillemot for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.173 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.174 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Razorbill

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	31	50% displaced 5% mortality 2km buffer	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Displacement (o)	112		1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – population	2	98% avoidance Flight height option 3	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		92,000	<0.1	22,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.175 The peak population estimates for the Dogger Bank Teesside B project area were 2,514 birds in February (90% CIs = 2,235-2,793), 4,245 birds in April (90% CIs = 3,800-4,702), and 3,923 birds in March (90% CIs = 3,492-4,386) for 2010, 2010/11 and 2011/12 respectively. The 1% threshold for a population of national importance was not exceeded in the Dogger Bank Teesside B project area during the breeding season and the 1% threshold for a population of international importance was not exceeded in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 18 SPAs, a wintering feature of five SPAs and a passage feature of two SPAs.

5.3.176 The proposed project is within foraging range of four protected breeding sites around the North Sea at which the species is a feature – the Farne Islands, Forth Islands, Flamborough Head and Bempton Cliffs, and St Abb's Head to Fast Castle SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.177 Based on 50% of the worst case values for displacement, analysis provided estimates of 576 (using 90% confidence limits = 507-648) displaced birds using 2010 data (20.5 during breeding months, 556 during other months of the year), 669 (using 90% confidence limits = 591-754) displaced birds using 2010/11 data (46 during

breeding months, 623 during other months of the year), and 506 (using 90% confidence limits = 437-585) displaced birds using 2011/12 data (101 during breeding months, 405 during other months of the year). The mean value was 544 (using 90% confidence limits = 476-617) displaced birds (56 during breeding months, 488 during other months of the year).

5.3.178 Tables A9.26a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data), would be impacted.

5.3.179 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.3.180 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.181 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.182 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.183 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.184 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Export cable corridor

5.3.185 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.186 Based on worst case values for displacement, analysis provided estimates of 1,153 (using 90% confidence limits = 1,014-1,296) displaced birds using 2010 data (41 during breeding months, 1,112 during other months of the year), 1,338 (using 90% confidence limits = 1,182-1,507) displaced birds using 2010/11 data (93 during breeding months, 1,245 during other months of the year), and 1,012 (using 90% confidence limits = 874-1,169) displaced birds using 2011/12 data (201 during breeding months, 811 during other months of the year). The mean value was 1,087 (using 90% confidence limits = 952-1,235) displaced birds (111 during breeding months, 976 during other months of the year).

5.3.187 Tables A9.27a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data), would be impacted.

5.3.188 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.3.189 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.190 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.191 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.192 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 33 adult razorbills in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data.

5.3.193 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.28 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.3.194 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although averages approximately 25km (8.0% of the species' maximum foraging range of 312km). The project is between 164km and 308km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from one site – the Forth Islands SPA – from reaching foraging areas beyond the project area.

5.3.195 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.3.196 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside B project for razorbill is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.197 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just two razorbill collisions.

5.3.198 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.199 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of the five protected sites within foraging range around the North Sea. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.200 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

5.3.201 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.202 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.203 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for razorbill for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and the impact of the effect is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.204 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.205 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Little auk

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	3	25% displaced 5% mortality 2km buffer	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	6		125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		8,333,333	<0.1	333	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

5.3.206 The peak population estimates for the Dogger Bank Teesside B project area were 1,965 birds in December (90% CIs = 1,582-2,628), 1,965 birds in December (90% CIs = 1,582-2,628), and 606 birds in December (90% CIs = 502-807) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. Although there is no British population estimate for little auk, given the numbers estimated, this species is deemed to be of national importance in the Dogger Bank Teesside B project area. Consequently, the value of this receptor is assessed to be **high**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.207 Taking 50% of the worst-case maximum annual estimates in winter months, when this species occurs, a total of 62 birds would be displaced during 2010 (using 90% confidence limits = 46-88), 53.7 during 2010/11 (using 90% confidence limits = 42-72) and 19.0 during 2011/12 (using 90% confidence limits = 15-27). The mean value was 41 (using 90% confidence limits = 31-57) displaced birds.

5.3.208 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.209 Less than 1% of reference populations at the national and biogeographic scale would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at both the national and biogeographic scale.

Significance

5.3.210 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.211 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.212 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be of **negligible**.

Export cable corridor

5.3.213 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.214 Based on worst case values for displacement, a total of 124 birds would be displaced during 2010 (using 90% confidence limits = 93-176), 107.4 during 2010/11 (using 90% confidence limits = 84-145) and 38 during 2011/12 (using 90% confidence limits = 30-53). The mean value was 81 (using 90% confidence limits = 62-113) displaced birds.

5.3.215 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.216 Less than 1% of reference populations at the national scale would be affected and less than 1% of reference populations at the biogeographic scale would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at the national and biogeographic scale.

Significance

5.3.217 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Collision

Overall sensitivity to collision – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.218 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one little auk collision.

5.3.219 The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. There are no national population estimates for this species for the winter. Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.220 The predicted number of collisions represents an increase in background mortality of less than 1% at the national and biogeographic population levels.

Significance

5.3.221 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for little auk for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **negligible**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.222 For little auk, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.223 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Atlantic puffin

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	3	25% displaced 5% mortality 2km buffer	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Displacement (o)	6		13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		684,000	<0.1	88,160	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.3.224 The peak population estimates for the Dogger Bank Teesside B project area were 448 birds in December (90% CIs = 383-527), 608 birds in March (90% CIs = 543-698), and 170 birds in March (90% CIs = 145-205) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B project area in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 16 SPAs.

5.3.225 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.226 Based on 50% of the worst case values for displacement, analysis provided estimates of 51 (using 90% confidence limits = 41-64) displaced birds using 2010 data (6 during breeding months, 45 during other months of the year), 77 (using 90% confidence limits = 66-93) displaced birds using 2010/11 data (12 during breeding months, 66 during other months of the year), and 20 (using 90% confidence limits = 16-25) displaced birds using 2011/12 data (6 during breeding months, 14 during other months of the year). The mean value was 45 (using 90% confidence limits =

38-56) displaced birds (8 during breeding months, 38 during other months of the year).

5.3.227 Tables A9.29a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.3.228 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.229 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.230 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.231 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.232 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Export cable corridor

5.3.233 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.234 Based on worst case values for displacement, analysis provided estimates of 103 (using 90% confidence limits = 83-128) displaced birds using 2010 data (12 during breeding months, 91 during other months of the year), 155 (using 90% confidence limits = 131-186) displaced birds using 2010/11 data (23 during breeding months, 131 during other months of the year), and 40 (using 90% confidence limits = 33-49) displaced birds using 2011/12 data (11 during breeding months, 29 during other months of the year). The mean value was 91 (using 90% confidence limits = 75-111) displaced birds (16 during breeding months, 75 during other months of the year).

5.3.235 Tables A9.30a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.3.236 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.3.237 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at all scales.

Significance

5.3.238 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Collision

Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.239 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one Atlantic puffin collision.

5.3.240 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.3.241 Dogger Bank Teesside B is outside the foraging range of any protected site at which the species is a breeding feature. Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of these sites. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.3.242 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

5.3.243 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.3.244 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.3.245 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for Atlantic puffin for the Dogger Bank Teesside B project is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently the impact of this effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.3.246 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside B Project area in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.3.247 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Migrants

Operation

Collision

5.3.248 The migration zones (defined by Wright *et al.* 2012) of 45 species' populations of terrestrial or waterbird migrants that are UK SPA features overlap with the Dogger Bank Teesside B project during migration. Collision risk estimates suggest that, on an annual basis, the mortality associated with the Dogger Bank Teesside B project is likely to represent less than 1% of the reference population of each of these species (Table 5.12).

5.3.249 The effect of collision for migrants for the Dogger Bank Teesside B project is thus considered to be of **negligible magnitude** at the national level and **minor adverse** for 15 species' populations and **negligible** for 30 species' populations.

5.3.250 Due to the lack of knowledge concerning species' precise migration routes and their likely variability, no attempt was made to apportion impacts to individual protected sites, and thus it is unknown whether impacts may potentially be greater or less at any one particular site.

5.3.251 It should also be noted that for migrants there is much uncertainty in these calculations, and thus the assessment, both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Given these uncertainties, the confidence in predictions in the assessment of collision for migrants is considered to be very low.

Table 5.12 Assessment of collision risk for migrants for the Dogger Bank Teesside B project. Estimated numbers of collisions are based on modelling of the numbers of birds predicted to pass through the wind farm project, a 98% avoidance rate, and expert judgement of the proportion of individuals likely to be flying at a height which places them at risk of collision. Three scenarios were run, using the lower, central and upper limits of the range of the proportion of birds at risk height, as described in Wright *et al.* (2012), with the central value used for the purposes of assessment. It is important to note that the values in brackets under "estimated annual collisions" simply represent the estimates using the lower and upper estimates of the proportion of birds at risk height, and do not represent any kind of measure of confidence in the collision estimates (which would have a far greater range).

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Bean goose *Anser fabalis*	0.02 (0.003 - 0.05)	<0.1%	4.87%	Very High	Low	High	Negligible	Negligible
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0.003 (0.001 - 0.008)	<0.1%	0.19%	Very High	High	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0.70 (0.005 - 2.79)	<0.1%	3.80%	Very High	High	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	3.95 (0.03 - 15.82)	<0.1%	3.54%	Very High	Very Low	Medium	Negligible	Negligible
Gadwall *Anas strepera*	0.07 (0.0005 - 0.27)	<0.1%	2.25%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian teal *Anas crecca*	0.94 (0.01 - 3.75)	<0.1%	3.55%	Very High	Very Low	Medium	Negligible	Negligible
Mallard *Anas platyrhynchos*	2.88 (0.02 - 11.51)	<0.1%	3.80%	Very High	Very Low	Medium	Negligible	Negligible
Northern pintail *Anas acuta*	0.13 (0.001 - 0.50)	<0.1%	3.55%	Very High	Very Low	Medium	Negligible	Negligible
Northern shoveler *Anas clypeata*	0.08 (0.001 - 0.32)	<0.1%	2.52%	Very High	Very Low	Medium	Negligible	Negligible
Common pochard *Aythya ferina*	0.31 (0.002 - 1.26)	<0.1%	2.52%	Very High	Very Low	Medium	Negligible	Negligible
Tufted Duck *Aythya fuligula*	0.72 (0.005 - 2.86)	<0.1%	3.51%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Greater scaup *Aythya marila*	0.003 (0.00002 - 0.01)	<0.1%	2.40%	Very High	Very Low	Medium	Negligible	Negligible
Common scoter *Melanitta nigra*	0.03 (0.003 - 0.56)	<0.1%	3.55%	Very High	Low	High	Negligible	Negligible
Velvet scoter *Melanitta fusca*	0.02 (0.0001 - 0.09)	<0.1%	4.17%	Very High	Low	High	Negligible	Negligible
Common goldeneye *Bucephala clangula*	0.25 (0.002 - 0.98)	<0.1%	3.80%	Very High	Low	High	Negligible	Negligible
Red-breasted merganser *Mergus serrator*	0.001 (0.00001 - 0.01)	<0.1%	2.20%	Very High	Medium	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	0.03 (0.0002 - 0.13)	<0.1%	4.11%	Very High	Medium	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0.01 (0.001 - 0.01)	<0.1%	1.77%	Very High	Very Low	Medium	Negligible	Negligible
Great crested grebe *Podiceps cristatus*	0.08 (0.01 - 0.34)	<0.1%	2.30%	Very High	Medium	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0.003 (0.0003 - 0.01)	<0.1%	3.55%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0.0003 (0.0002 - 0.001)	<0.1%	1.25%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0.01 (0.01 - 0.02)	<0.1%	4.17%	Very High	Medium	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0.25 (0.02 - 0.47)	<0.1%	0.66%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	1.34 (0.27 - 4.01)	<0.1%	3.55%	Very High	High	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	0.23 (0.05 - 0.69)	<0.1%	3.81%	Very High	Low	High	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Golden plover *Pluvialis apricaria* (non-breeding)	1.78 (0.36 - 5.35)	<0.1%	2.53%	Very High	Very Low	Medium	Negligible	Negligible
Grey plover *Pluvialis squatarola*	0.66 (0.13 - 1.97)	<0.1%	3.76%	Very High	High	Very High	Negligible	Minor adverse
Northern lapwing *Vanellus vanellus*	6.07 (1.21 - 18.22)	<0.1%	3.76%	Very High	Very Low	Medium	Negligible	Negligible
Red knot *Calidris canutus*	2.03 (0.41 - 6.09)	<0.1%	3.51%	Very High	Medium	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	0.52 (0.1 - 1.56)	<0.1%	3.51%	Very High	Medium	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	0.04 (0.01 - 0.13)	<0.1%	3.58%	Very High	Very Low	Medium	Negligible	Negligible
Dunlin *Calidris alpina alpina* (passage & winter)	3.80 (0.76 - 11.40)	<0.1%	2.67%	Very High	Very Low	Medium	Negligible	Negligible
Ruff *Philomachus pugnax*	0.03 (0.01 - 0.10)	<0.1%	3.92%	Very High	Very Low	Medium	Negligible	Negligible
Common snipe *Gallinago gallinago*	5.98 (1.20 - 17.93)	<0.1%	3.52%	Very High	Very Low	Medium	Negligible	Negligible
Black-tailed godwit *Limosa limosa islandica*	0.03 (0.01 - 0.09)	<0.1%	2.95%	Very High	Very High	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0.80 (0.16 - 2.40)	<0.1%	4.01%	Very High	Very Low	Medium	Negligible	Negligible
Whimbrel *Numenius phaeopus*	0.14 (0.03 - 0.43)	<0.1%	3.31%	Very High	High	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	1.09 (0.22 - 3.26)	<0.1%	3.32%	Very High	Very Low	Medium	Negligible	Negligible
Greenshank *Tringa nebularia*	0.0002 (0.00005 - 0.001)	<0.1%	2.38%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Common redshank *Tringa totanus britannica* (breeding)	0.03 (0.01 - 0.10)	<0.1%	3.30%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	1.45 (0.29 - 4.35)	<0.1%	3.04%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0.36 (0.07 - 1.07)	<0.1%	4.12%	Very High	Very Low	Medium	Negligible	Negligible
Ruddy turnstone *Arenaria interpres*	0.29 (0.06 - 0.86)	<0.1%	3.55%	Very High	High	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	0.01 (0.002 - 0.02)	<0.1%	3.67%	Very High	Very Low	Medium	Negligible	Negligible
European nightjar *Caprimulgus europaeus*	0.01 (0.002 - 0.02)	<0.1%	1.27%	Very High	Very Low	Medium	Negligible	Negligible

[1] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[2] The migration zone referred to here is the North Sea migration area appropriate to assessment for the Dogger Bank, and not the entire migration zone used by the species around the whole of the UK. The percentage given can be roughly interpreted as the percentage of birds migrating across the North Sea that would cross the wind farm footprint during a single migration period (note for most species there are 2 migrations per year crossing the North Sea). For further details see the SOSS migration modelling tool guidance (Wright *et al*. 2012).

Barrier effects

5.3.252 An assessment of the potential barrier effects posed by the Dogger Bank Teesside B project to the 45 species' populations of terrestrial or waterbird migrants that are UK SPA features whose migration zones (defined by Wright *et al.* 2012) overlap with the project area is provided in Table 5.13 below.

5.3.253 The percentages of reference populations estimated to pass through the project area at risk height (following Wright *et al.* 2012), and thus exposed to potential barrier effects were less than 1% for most species considered, but greater than 1% for bean goose, hen harrier, bar-tailed godwit and common redshank (from the mainland Europe population – *totanus* race). The estimates of numbers passing through the project area greatly exceed the numbers recorded by boat surveys, though it should be noted that boat surveys were not designed to record migrants and as they only provide a (diurnal) snapshot of birds flying close to the sea, they will inevitably greatly underestimate overall numbers of migrants.

5.3.254 The increase in flight distance due to the barrier presented by Dogger Bank Teesside B varies by direction of flight, although for the shortest approximately east-west route across the North Sea passing through the project, equates to a maximum of approximately 20km (an increase of just 3% on the ca. 575km route).

5.3.255 Considering both the numbers of birds exposed to this effect and the relative increase in flight distance due to the barrier presented by Dogger Bank Teesside B, this impact is considered to be of **negligible magnitude** for all species' populations.

5.3.256 It should be noted that there is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms. For migrants, there is great uncertainty in the determination of the numbers of birds passing through each project area. There is little evidence to suggest whether or not migration may be concentrated within corridors within overall migration zones (Wright *et al.* 2012) and it cannot be assumed that birds fly directly to or from the protected sites that they are features of. It is also assumed that the wind farm poses a barrier effect to 100% of birds attempting to fly through at risk height (Maclean *et al.* 2009) which may be over-precautionary. In particular, there is considerable uncertainty as to the actual consequences for survival, and thus for population-level impacts, from the increase in energy expenditure associated with the increases in flight distance for those birds exposed to barrier effects. Given these uncertainties, the confidence in predictions in the assessment of barrier effects is considered to be very low and considerable caution is urged in considering the outcomes of this assessment.

Table 5.13 Assessment of barrier effects for migrants for the Dogger Bank Teesside B project.

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Bean goose *Anser fabalis*	0	1	11	1.46%	Very High	Negligible	Minor adverse
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0	4	2	0.06%	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0	0	431	0.57%	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	0	8	2635	0.50%	Very High	Negligible	Minor adverse
Gadwall *Anas strepera*	0	0	45	0.20%	Very High	Negligible	Minor adverse
Eurasian teal *Anas crecca*	0	1	665	0.27%	Very High	Negligible	Minor adverse
Mallard *Anas platyrhynchos*	2	3	1833	0.40%	Very High	Negligible	Minor adverse
Northern pintail *Anas acuta*	2	1	81	0.27%	Very High	Negligible	Minor adverse
Northern shoveler *Anas clypeata*	0	0	54	0.28%	Very High	Negligible	Minor adverse
Common pochard *Aythya ferina*	0	3	212	0.28%	Very High	Negligible	Minor adverse
Tufted duck *Aythya fuligula*	2	0	488	0.47%	Very High	Negligible	Minor adverse
Greater scaup *Aythya marila*	0	0	2	0.02%	Very High	Negligible	Minor adverse
Common scoter *Melanitta nigra*	113	191	22	0.02%	Very High	Negligible	Minor adverse
Velvet scoter *Melanitta fusca*	4	9	14	0.56%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common goldeneye *Bucephala clangula*	2	0	166	0.57%	Very High	Negligible	Minor adverse
Red-breasted merganser *Mergus serrator*	0	0	1	0.03%	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	5	0	20	0.62%	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0	0	2	0.62%	Very High	Negligible	Minor adverse
Great crested grebe *Podiceps cristatus*	0	0	56	0.23%	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0	0	2	0.18%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0	0	<1	0.06%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0	0	6	1.67%	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0	0	174	0.17%	Very High	Negligible	Minor adverse
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	2	8	888	0.44%	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	4	4	347	0.48%	Very High	Negligible	Minor adverse
Golden plover *Pluvialis apricaria* (non-breeding)	0	5	1267	0.32%	Very High	Negligible	Minor adverse
Grey plover *Pluvialis squatarola*	0	0	464	0.94%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Northern lapwing *Vanellus vanellus*	0	19	4225	0.94%	Very High	Negligible	Minor adverse
Red knot *Calidris canutus*	3	15	1489	0.44%	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	6	0	395	0.66%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	16	18	33	0.90%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina alpina* (passage & winter)	16	18	2926	0.67%	Very High	Negligible	Minor adverse
Ruff *Philomachus pugnax*	0	3	24	0.98%	Very High	Negligible	Minor adverse
Common snipe *Gallinago gallinago*	1	0	4403	0.44%	Very High	Negligible	Minor adverse
Black-tailed godwit *Limosa limosa islandica*	0	0	41	0.74%	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0	0	544	1.00%	Very High	Negligible	Minor adverse
Whimbrel *Numenius phaeopus*	6	27	95	0.41%	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	51	4	679	0.83%	Very High	Negligible	Minor adverse
Greenshank *Tringa nebularia*	0	1	<1	0.06%	Very High	Negligible	Minor adverse
Common redshank *Tringa totanus britannica* (breeding)	0	0	25	0.08%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	0	0	1043	0.38%	Very High	Negligible	Minor adverse
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0	0	257	1.03%	Very High	Negligible	Minor adverse
Ruddy turnstone *Arenaria interpres*	7	12	213	0.44%	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	2	23	7	0.64%	Very High	Negligible	Minor adverse
European Nightjar *Caprimulgus europaeus*	0	0	7	0.06%	Very High	Negligible	Minor adverse

[1] Across Dogger Bank Zone as a whole (see section 3).

[2] The estimated number of individuals of each species crossing the project is the number that would pass through at risk height (using the best estimate of the proportion of migrating birds at risk height from Wright *et al*. 2012 and not accounting for uncertainty) during a single migration season. Note that for most species, two migrations per year would be expected, and different individual birds may be involved during spring and autumn passage.

[3] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[4] Magnitude is assessed here according to Table 4.1.

Summary for all receptors

5.3.257 Table 5.14 below provides a summary of impacts from each effect for all key marine bird receptors.

Table 5.14 Summary of potential impacts from the Dogger Bank Teesside B project for key marine bird receptors.

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
White-billed diver	Displacement (construction/decommissioning)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	Medium	High	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Medium	High	High	Negligible	Negligible	Very Low
	Displacement (operation)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Collision (operation)	National	Medium	High	High	Negligible	Negligible	Medium
		Biogeographic	Medium	High	High	Negligible	Negligible	Medium
	Habitat loss/change (operation)	All	Medium	High	High	Negligible	Negligible	Very Low
Northern fulmar	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss/change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Northern gannet	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	(construction/decommissioning)							
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss/change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Arctic skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Great skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Black-legged kittiwake	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Lesser black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Great black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Common guillemot	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Razorbill	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	(construction/decommissioning)							
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Little auk	Displacement (construction/decommissioning)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Collision (operation)	National	High	Medium	High	Negligible	Negligible	Medium
		Biogeographic	High	Medium	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	High	Low	Medium	Negligible	Negligible	Very Low
Atlantic puffin	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low

5.4 Dogger Bank Teesside A and B Offshore Ornithology Impact

Disturbance/displacement

5.4.1 The numbers of birds predicted to be displaced from the Dogger Bank Teesside A and B project areas and buffers during construction/decommissioning and operation, under chosen displacement rates, are shown in Table 5.15 and are also discussed at the start of each species' account. The values presented incorporate the correction factors for birds underwater (see section 4), but do not represent final magnitude, taking into account mortality rates. Tabulated summaries for each species of the numbers of birds estimated to be displaced that are then estimated to die based on a full range of alternative displacement and mortality rates from 0 to 100% are provided in Appendix 10.

5.4.2 Results of the apportioning of disturbance/displacement impacts to protected sites, incorporating mortality, are shown in Appendix 9. These tables also correct for the initial assumption that all birds come from the protected sites identified (see section 4).

5.4.3 Table 5.15 also provides separate estimates of the numbers of birds predicted to be displaced in respective breeding and winter periods. Birds predicted to be impacted during the breeding season will potentially include both breeders from any breeding colonies that the project is within range of, and also a non-breeding component. For gulls and northern gannet, it was possible to derive estimates of proportion of breeders from boat-survey observations of birds in breeding and juvenile plumages. For other species, it is assumed that, for species for which the wind farm project is within foraging range of birds from breeding colony protected sites, one third of the total number of birds (Stroud *et al.* 2004; Kober *et al.* 2010) present during the breeding season will be non-breeders. These are apportioned to protected sites surrounding the North Sea in the same manner as for seabirds outwith the breeding season (see section 4).

Table 5.15 Numbers of birds displaced during construction / decommissioning and operation for the Dogger Bank Teesside A and B projects during 2010, 2010/11 and 2011/12; mean values are subsequently combined with species specific mortality rates to assess the impact of displacement (see section 4). Full matrices of displacement and mortality are given in Appendix 10.

		Construction / decommissioning			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	8	8	7	7
Northern gannet	Breeding	37 (31-44)	75 (64-88)	244 (208-290)	128 (109-152)
	Winter	67 (57-81)	215 (182-255)	372 (309-447)	227 (190-271)
	All	104 (89-124)	289 (246-344)	616 (517-737)	355 (299-423)
Common guillemot	Breeding	315 (291-346)	609 (563-663)	710 (649-789)	554 (510-610)
	Winter	2361 (2177-2558)	2851 (2642-3077)	1832 (1681-1978)	2201 (2031-2379)
	All	2676 (2469-2904)	3460 (3205-3741)	2542 (2330-2768)	2755 (2541-2989)
Razorbill	Breeding	34 (27-42)	77 (63-92)	169 (134-208)	93 (75-114)
	Winter	892 (786-1002)	1048 (927-1178)	681 (595-778)	809 (712-914)
	All	926 (814-1044)	1125 (990-1270)	851 (730-985)	902 (787-1027)
Little auk	Winter	113 (84-158)	107 (84-144)	38 (30-53)	78 (60-108)
Atlantic puffin	Breeding	11 (8-13)	21 (18-25)	10 (8-13)	14 (11-17)
	Winter	81 (65-100)	124 (105-149)	27 (22-33)	70 (58-85)
	All	91 (73-113)	145 (122-174)	37 (30-45)	84 (69-102)
		Operation			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	15	16	15	15
Northern gannet	Breeding	73 (63-87)	149 (128-177)	488 (416-580)	256 (219-303)
	Winter	135 (115-161)	429 (364-510)	745 (618-894)	454 (380-543)
	All	208 (178-248)	579 (493-687)	1233 (1034-1474)	709 (599-846)
Common guillemot	Breeding	630 (583-692)	1218 (1126-1327)	1420 (1298-1578)	1108 (1020-1219)
	Winter	4721 (4354-5117)	5702 (5284-6155)	3664 (3362-3957)	4403 (4062-4759)
	All	5351 (4937-5809)	6921 (6410-7482)	5084 (4659-5535)	5511 (5082-5978)
Razorbill	Breeding	68 (54-83)	154 (126-185)	338 (269-416)	186 (149-227)
	Winter	1783 (1573-2004)	2096 (1854-2355)	1363 (1191-1555)	1618 (1425-1827)
	All	1852 (1627-2088)	2250 (1980-2540)	1701 (1459-1971)	1804 (1574-2054)
Little auk	Winter	225 (169-316)	214 (168-289)	76 (59-106)	156 (119-216)
Atlantic puffin	Breeding	21 (17-26)	42 (35-50)	20 (17-26)	28 (23-34)
	Winter	162 (130-201)	248 (210-298)	53 (43-65)	140 (116-170)
	All	183 (147-227)	290 (245-348)	74 (60-91)	168 (139-204)

Barrier effects – Marine Birds

5.4.4 Numbers of key species in flight potentially exposed to barrier effects for the Dogger Bank Teesside A and B project is shown in Table 5.16.

Table 5.16 Estimates of the numbers of breeding adult birds of these species in flight in the Dogger Bank Teesside A and B project area using the mean of 2010 and 2010/2011 and 2011/12 data.

Species	Breeding season	Mean
Northern fulmar	Mar-Sep	152 (123-182)
Northern gannet	Apr-Sep	124 (106-180)
Black-legged kittiwake	Apr-Sep	867 (774-961)
Common guillemot	May-Jul	169 (156-186)
Razorbill	May-Jul	54 (44-66)

Collision – Marine Birds

5.4.5 An overview of the combined results of collision risk analyses for marine birds for the Dogger Bank Teesside A and B projects is provided below.

5.4.6 There were strong between year differences in both the total numbers of birds present within Dogger Bank Teesside A and B, and annual patterns in their abundance. With only three years of data, it was not possible to determine which year was most representative of bird abundance within Dogger Bank Teesside A and B. For these reasons, collision risk estimates were produced for each year separately, rather than for a mean value from the three years.

5.4.7 Using a realistic, precautionary avoidance rate of 98% (SNH 2010, Cook *et al.* 2012), the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin colliding with wind turbines, based on population estimates from 2010 to 2012, were predicted to be less than one bird per year. Even assuming a more conservative avoidance rate of 95%, the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin predicted to collide with wind turbines were less than one bird per year. Northern fulmar, great skua and razorbill had a similarly low collision risk, with just two northern fulmar, and a maximum of three razorbill and one great skua predicted to collide annually.

5.4.8 The numbers of lesser black-backed gull and great black-backed gull predicted to collide with wind turbines were greater. The collision rates were highest based on the 2010 population estimates for the lesser black-backed gull with 50 birds. For great black-backed gull, the highest collision estimates, of 66 birds, came from the 2010/11 population estimate.

5.4.9 Estimates were greatest for black-legged kittiwake and northern gannet. The maximum collision estimate for black-legged kittiwake was 161 birds based on the 2011/12 population. For northern gannet the maximum collision estimate was 120

birds, also based on the 2011/12 population estimate and assuming a 99% avoidance rate.

5.4.10 Collision estimates were greatest for northern gannet, black-legged kittiwake and lesser black-backed gulls during the breeding season. Collision estimates were greater for great black-backed gull during the non-breeding season (Table 5.18).

Table 5.17 Annual collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A and B projects of the Dogger Bank Zone, assuming a worst case scenario of 400 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m in response to different avoidance rates. Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010				July 2010 – June 2011				July 2011 – June 2012				Mean			
	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%	0.95	0.98	0.99	0.995
Northern fulmar	4 (3 - 5)	1 (1 - 2)	1 (1 - 1)	0 (0 - 0)	3 (2 - 3)	1 (1 - 1)	1 (0 - 1)	0 (0 - 0)	4 (3 - 5)	2 (1 - 2)	1 (1 - 1)	0 (0 - 1)	3 (3-4)	1 (1-2)	1 (1-1)	0 (0-0)
Northern gannet	130 (106 - 154)	52 (42 - 61)	26 (21 - 31)	13 (11 - 15)	242 (181 - 259)	97 (72 - 104)	48 (36 - 52)	24 (18 - 26)	600 (492 - 710)	240 (197 - 284)	120 (98 - 142)	60 (49 - 71)	339 (278-401)	136 (111-160)	68 (56-80)	34 (28-40)
Arctic Skua	0 (0 - 1255)	0 (0 - 502)	0 (0 - 251)	0 (0 - 126)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 146)	0 (0 - 58)	0 (0 - 29)	0 (0 - 15)	0 (0-467)	0 (0-187)	0 (0-93)	0 (0-47)
Great Skua	1 (0 - 2)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	1 (1 - 2)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	2 (1 - 4)	1 (1 - 2)	0 (0 - 1)	0 (0 - 0)	1 (1-3)	1 (0-1)	0 (0-1)	0 (0-0)
Black-legged kittiwake	226 (203 - 254)	90 (81 - 102)	45 (41 - 51)	23 (20 - 25)	474 (353 - 444)	190 (141 - 178)	95 (71 - 89)	47 (35 - 44)	403 (356 - 459)	161 (143 - 184)	81 (71 - 92)	40 (36 - 46)	335 (298-379)	134 (119-152)	67 (60-76)	34 (30-38)
Lesser black-backed gull	124 (84 - 189)	50 (33 - 76)	25 (17 - 38)	12 (8 - 19)	75 (47 - 122)	30 (19 - 49)	15 (9 - 24)	8 (5 - 12)	51 (28 - 91)	20 (11 - 36)	10 (6 - 18)	5 (3 - 9)	82 (52-132)	33 (21-53)	16 (10-26)	8 (5-13)
Great black-backed gull	150 (108 - 216)	60 (43 - 86)	30 (22 - 43)	15 (11 - 22)	168 (120 - 238)	67 (48 - 95)	34 (24 - 48)	17 (12 - 24)	135 (86 - 208)	54 (34 - 83)	27 (17 - 42)	13 (9 - 21)	146 (101-214)	58 (40-85)	29 (20-43)	15 (10-21)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Razorbill	3 (2 - 6)	1 (1 - 2)	1 (0 - 1)	0 (0 - 1)	9 (5 - 14)	4 (2 - 5)	2 (1 - 3)	1 (0 - 1)	7 (4 - 11)	3 (2 - 4)	1 (1 - 2)	1 (0 - 1)	6 (4-10)	2 (1-4)	1 (1-2)	1 (0-1)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 5.18 Seasonal collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A and B projects of the Dogger Bank Zone, assuming a worst case scenario of 400 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m and an avoidance rate of 98 % (99% for northern gannet). Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010		July 2010 – June 2011		July 2011 – June 2012		Mean	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Northern fulmar	2 (0 - 2)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	2 (0 - 2)	0 (0 - 0)	1 (1-1)	0 (0-1)
Northern gannet	13 (11 - 15)	13 (10 - 15)	17 (13 - 19)	27 (23 - 32)	65 (53 - 76)	55 (46 - 65)	34 (28-40)	34 (28-40)
Arctic Skua	0 (0 - 0)	0 (0 - 502)	0 (0 - 0)	0 (0 - 0)	0 (0 - 58)	0 (0 - 0)	0 (0-19)	0 (0-168)
Great Skua	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-1)	0 (0-1)
Black-legged kittiwake	37 (33 - 42)	53 (48 - 60)	106 (95 - 119)	52 (46 - 59)	114 (100 - 130)	47 (42 - 54)	87 (77-98)	48 (42-54)
Lesser black-backed gull	36 (25 - 52)	13 (8 - 24)	18 (11 - 28)	12 (7 - 22)	10 (5 - 17)	11 (6 - 19)	20 (13-31)	12 (7-22)
Great black-backed gull	14 (9 - 20)	47 (34 - 66)	17 (12 - 25)	50 (36 - 70)	21 (12 - 35)	33 (22 - 48)	17 (11-27)	41 (29-59)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Razorbill	0 (0 - 0)	2 (0 - 2)	0 (0 - 0)	3 (2 - 5)	0 (0 - 0)	2 (2 - 4)	0 (0-0)	2 (1-3)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)

Evaluation for Ornithological Receptors

White-billed diver

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	3	100% displaced 37.5% mortality 4km buffer	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	5		10,000	<0.1	5,000[3]	0.11	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	10,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		1,066	<0.1	533	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

5.4.11 Numbers in the Dogger Bank Zone as a whole surpassed 1% thresholds for populations of national and international importance. White-billed divers were present in the Dogger Bank Zone between November and April when an average of 15 birds was estimated to occur in the Dogger Bank Teesside A and B project areas. The population of this species in the Dogger Bank Teesside A and B project areas was assessed to be of regional importance and consequently the value of this receptor is assessed to be **medium**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.12 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside A and B project areas (a monthly average of just seven birds was estimated between November and April), of which three birds would be predicted to be lost through mortality.

5.4.13 Consequently, following the method and assumptions presented for Dogger Bank Teesside A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

5.4.14 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm and export cable corridor

5.4.15 The impact of habitat loss for both the wind farm area and cable corridors for Dogger Bank Teesside A and B combined is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Disturbance/displacement

5.4.16 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside A and B project areas (a monthly average of just 15 birds was estimated between November and April), of which five birds would be predicted to be lost through mortality.

5.4.17 Consequently, following the method and assumptions presented for Dogger Bank Teesside A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

5.4.18 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Collision

Species Overall sensitivity to collision – High (see section 5.2)

5.4.19 The effect of collision for white-billed diver for Dogger Bank Teesside A and B is considered to be **negligible** following the assessment methodology and justification presented for Dogger Bank Teesside A.

Direct habitat loss or change

5.4.20 Following the methodology and justification presented in section 5.2, the impact of habitat loss for white-billed diver in Dogger Bank Teesside A and B is as assessed for Dogger Bank Teesside A – **negligible.**

Northern fulmar

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	2	98% avoidance Flight height option 3	10,200,000	<0.1	1,500,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		190,400	<0.1	28,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.21 The peak population estimates for the Dogger Bank Teesside A and B project area in 2010, 2010/2011 and 2011/12 were 1,110 birds (90% CIs = 926-1,316) in May, 522 birds (90% CIs = 417-630) in July, and 481 birds (90% CIs = 384-574) in May, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project area in either year.

5.4.22 The value of this receptor is assessed as **very high** as the species is a breeding feature of 26 SPAs and a wintering feature of two SPAs in the Greater North Sea OSPAR region. Dogger Bank Teesside A and B is within foraging range of eight protected breeding sites in Great Britain, and is within foraging range of nine protected breeding sites around the North Sea at which the species is a feature.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.23 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.24 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Export cable corridor

5.4.25 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Barrier effects

Magnitude

5.4.26 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 182 adult northern fulmars in flight in the projects areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.18).

5.4.27 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.31 (Appendix 9) which indicates that over 5% of the population at the Flamborough Head and Bempton Cliffs SPA and between 1 and 5% of the populations at the Weybourne Cliffs SSSI, the Hunstanton Cliffs SSSI, the North Berwick Coast SSSI and the Forth Islands SPA might be potentially exposed to this effect.

5.4.28 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is unlikely to be more than the greater presented by the two wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is thus approximately 25km (6.25% of the species' maximum foraging range of 400km). The projects are between 164km and 388km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1). This increase might prevent birds from one site – the Troup, Pennan and Lions Heads SPA – from reaching foraging areas beyond the project areas.

5.4.29 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.4.30 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A and B projects for northern fulmar is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.31 The Band collision risk model (Band *et al.* 2012) provided mean estimates of just one northern fulmar collision per year.

5.4.32 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.33 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of the eight sites in foraging range around the North Sea. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.34 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

5.4.35 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.36 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.37 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for northern fulmar for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.38 For northern fulmar, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species' diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.39 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Northern gannet

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	0	75% displaced 0% mortality 2km buffer	967,000	0	660,000	0	0	Minor adverse
Displacement (o)	0		967,000	0	660,000	0	0	Minor adverse
Collision – population	80	99% avoidance Flight height option 3	967,000	<0.1	660,000	<0.1	0	Minor adverse
Collision – background adult mortality	61		52,218	<0.1	35,640	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.40 The peak population estimates for the Dogger Bank Teesside A and B project areas in 2010, 2010/11 and 2011/12 were 264 birds (90% CIs =226-312) in October, 1,805 birds (90% CIs = 1,532-2,131) in March, and 3,054 birds (90% CIs = 2,542-3,650) in March respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of nine SPAs, a wintering feature of five SPAs and a passage feature of five SPAs.

5.4.41 The Dogger Bank Teesside A and B projects are within foraging range of three protected breeding sites around the North Sea at which the species is a feature – the Seevogelschutzgebiet Helgoland, Forth Islands and Flamborough Head and Bempton Cliffs, and is therefore within foraging range during the breeding season of two protected breeding sites in the UK at which the species is a feature. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.42 Based on 50% of the worst case values for displacement, analysis provided estimates of 104 (using 90% confidence limits = 89-124) displaced birds using 2010 data (37 during breeding months, 67 during other months of the year), 289 (using 90% confidence limits = 246-344) displaced birds using 2010/11 data (75 during breeding

months, 215 during other months of the year), and 616 (using 90% confidence limits = 517-737) displaced birds using 2011/12 data (244 during breeding months, 372 during other months of the year). The mean value was 355 (using 90% confidence limits = 299-423) displaced birds (128 during breeding months, 227 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for northern gannet for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at all scales.

Significance

5.4.43 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.44 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.4.45 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Export cable corridor

5.4.46 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Disturbance/displacement

Sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.47 Based on worst case values for displacement, analysis provided estimates of 208 (using 90% confidence limits = 178-248) displaced birds using 2010 data (73 during

breeding months, 135 during other months of the year), 579 (using 90% confidence limits = 493-687) displaced birds using 2010/11 data (149 during breeding months, 429 during other months of the year), and 1233 (using 90% confidence limits = 1034-1474) displaced birds using 2011/12 data (488 during breeding months, 745 during other months of the year). The mean value was 709 (using 90% confidence limits = 599-846) displaced birds (256 during breeding months, 454 during other months of the year). However, for this species at the project level, mortality from displacement is considered as zero (see section 4), therefore the effect of displacement for northern gannet for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at all scales.

Significance

5.4.48 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.49 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a maxima of 124 adult northern gannets in flight in the projects areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.18).

5.4.50 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Appendix 9 (Table A9.32) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.4.51 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is unlikely to be more than the greater presented by the two wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is thus approximately 25km (10.9% of the species' maximum foraging range of 229km). The projects are 164km from the Flamborough Head and Bempton Cliffs SPA, the only protected site within foraging range that would be potentially impacted by this effect (Appendix 1). Recent tracking studies indicate that additional individuals from some other North Sea protected sites may also be impacted (e.g. Wakefield et al. 2013).

5.4.52 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, this

impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.4.53 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A and B projects for northern gannet is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.54 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 68 (90% confidence limits = 56-80) for northern gannet. Of these, 34 were predicted to occur during the breeding season and 34 during the non-breeding season.

5.4.55 Tables A9.33a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The largest relative impact was predicted for the Flamborough Head and Bempton Cliffs SPA, where the mean annual estimates of the number of collisions represent less than 0.1% of the site population. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.56 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

5.4.57 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.58 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.59 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted. The effect of collision for northern gannet for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and the impact of the effect is consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.60 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

5.4.61 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Arctic skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	75,000	<0.1	6,300	<0.1	0	Minor adverse
Collision – background adult mortality	<1		5,700	<0.1	479	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.62 Arctic skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A and B project areas in 2010, 2010/11 and 2011/12 were 3 birds (90% CIs = 0-10), 3 birds (90% CIs = 0-10), and 8 birds (90% CIs = 4-19), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 12 SPAs and a passage feature of two SPAs.

5.4.63 The Dogger Bank Teesside A and B projects are outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

5.4.64 It should be noted that the estimated numbers of Arctic skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.65 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see

section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.66 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Export cable corridor

5.4.67 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.68 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one Arctic skua collision.

5.4.69 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.70 The proposed projects are outside the foraging range of any protected site at which the species is a breeding feature. Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.71 There are no national population estimates for this species for the passage or winter seasons. Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.72 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A and B projects, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.4.73 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.74 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for Arctic skua for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and consequently, the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.75 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.76 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Great skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	1	98% avoidance Flight height option 3	48,000	<0.1	28,800	<0.1	0	Minor adverse
Collision – background adult mortality	<1		3,584	<0.1	2,150	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.77 Great skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A and B project areas in 2010, 2010/11 and 2011/12 were 4 birds (90% CIs = 2-6), 4 birds (90% CIs = 2-6), and 13 birds (90% CIs = 10-22), all peaks being in September, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of seven SPAs and a passage feature of two SPAs.

5.4.78 The Dogger Bank Teesside A and B projects are outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

5.4.79 It should be noted that the estimated numbers of great skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.80 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see

section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.81 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Export cable corridor

5.4.82 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.83 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just one great skua collision.

5.4.84 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.85 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.86 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.87 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A and B projects, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.4.88 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.89 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for great skua for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales, and consequently, the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.90 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.91 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Black-legged kittiwake

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	152	98% avoidance Flight height option 3	6,600,000	<0.1	1,110,000	< 0.1	0	Minor adverse
Collision – background adult mortality	123		259,600	<0.1	43,660	0.5	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.92 The peak population estimates for the Dogger Bank Teesside A and B project areas were 5,594 (90% CIs = 4,899-6,246), 11,376 (90% CIs = 10,196-12,671), and 9,047 (90% CIs = 7,976-10,170) for 2010, 2010/11 and 2011/12 respectively, in March in all years. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 24 SPAs, a wintering feature of four SPAs and a passage feature of six SPAs.

5.4.93 The proposed project is within foraging range during the breeding season of two protected breeding sites around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA and Durham Coast and Marsden Bay SSSI, both of which are in the UK. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.94 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.95 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Export cable corridor

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.96 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.97 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a maxima of 867 adult black-legged kittiwakes in flight in the projects areas in the breeding season using 2010, 2010/11 and 2011/12data (Table 5.18).

5.4.98 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The Dogger Bank Teesside A and B projects are within foraging range of the Flamborough Head and Bempton Cliffs SPA. Between 1 and 5% of the population at the Flamborough Head and Bempton Cliffs SPA might be potentially exposed to this effect (Table A9.34).

5.4.99 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is unlikely to be more than the greater presented by the two wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is thus approximately 25km (10.8% of the species' maximum foraging range of 231km). The projects are 164km from the Flamborough Head and Bempton Cliffs SPA, the only protected site within foraging range that would be potentially exposed to this effect (Appendix 1).

5.4.100 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.4.101 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A and B projects for black-legged kittiwake is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.102 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 134 (90% confidence limits = 119-152) for black-legged kittiwake. Of these, 87 were predicted to occur during the breeding season and 48 were predicted to occur in the non-breeding season.

5.4.103 Tables A9.35a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed project is within foraging range of one protected breeding site around the North Sea at which the species is a feature – the Flamborough Head and Bempton Cliffs SPA. Mean annual estimates of the number of collisions represent less than 0.1% of this site's population.

5.4.104 Mean annual estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.105 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British population.

5.4.106 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.107 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.108 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for black-legged kittiwake for the Dogger Bank Teesside A and B projects is considered

to be of **negligible magnitude**, and consequently the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.109 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.110 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Lesser black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
					W 330,000	0		
Collision – population	53	98% avoidance Flight height option 3	550,000	<0.1	B 120,000	<0.1	0	Minor adverse
					W 330,000	<0.1		
Collision – background adult mortality	16		31,900	<0.1	B 6,960	0.2	0	
					W 19,140	<0.1		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.4.111 The peak population estimates for Dogger Bank Teesside A and B project areas were 361 birds (90% CIs = 254-514) in June, 189 birds (90% CIs = 136-267) in May, and 99 birds (90% CIs = 39-269) in May for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 21 SPAs, a wintering feature of two SPAs and a passage feature of three SPAs.

5.4.112 The Dogger Bank Teesside A and B projects are outside the foraging range of any protected site at which the species is a breeding feature.

5.4.113 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated, given that those present in the spring may be *intermedius* birds on passage to Scandinavia, and thus due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.114 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.115 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Export cable corridor

5.4.116 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.117 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 33 (90% confidence limits = 21-53) for lesser black-backed gull. Of these, 20 were predicted to occur during the breeding season and 12 during the non-breeding season.

5.4.118 Tables A9.36a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Mean annual collision estimates represent less than 0.1% of the populations of each of the protected sites around the North Sea at which the species is a feature.

5.4.119 Mean winter estimates represent less than 0.1% of the winter population estimate for the species in Great Britain.

5.4.120 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.4.121 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A and B projects, the magnitude of impact predicted at each geographic scale considered would be unchanged.

5.4.122 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.123 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for lesser black-backed gull for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.124 For lesser black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.125 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Great black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	85	98% avoidance Flight height option 3	420,000	<0.1	B 51,000	0.2	0	Minor adverse
					W 75,860	0.1		
Collision – background adult mortality	26		24,360	0.1	B 2,958	0.9	0	
					W 4,400	0.6		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.4.126 The peak population estimates for Dogger Bank Teesside A and B projects were 360 birds (90% CIs = 279-427) in January, 243 birds (90% CIs = 189-305) in March, and 177 birds (90% CIs = 127-237) in February for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 17 SPAs and a wintering feature of two SPAs.

5.4.127 The Dogger Bank Teesside A and B projects are outside the foraging range of any protected site at which the species is a breeding feature.

5.4.128 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013), and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.129 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B

project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.130 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Export cable corridor

5.4.131 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A – **negligible**.

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.132 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 58 (90% confidence limits = 40-85) for great black-backed gull. Of these, 17 were predicted to occur during the breeding season and 41 during the non-breeding season.

5.4.133 Tables A9.37a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Mean annual collision estimates represent less than 0.1% of the populations of the protected sites around the North Sea at which the species is a feature.

5.4.134 Mean winter estimates represent less than 0.2% of the winter population estimate for the species in Great Britain.

5.4.135 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

5.4.136 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.137 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less

than 1% of reference populations at the protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for great black-backed gull for the Dogger Bank Teesside A and B projects is thus considered to be of **negligible magnitude**, and thus the impact of the effect is considered to be **minor adverse** at the protected site suite, national and biogeographic scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.138 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.139 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Common guillemot

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	149	50% displaced 5% mortality 2km buffer	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Displacement (o)	299		5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		201,600	<0.1	95,040	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

5.4.140 The peak population estimates for the Dogger Bank Teesside A and B project areas were 10,513 birds in December (90% CIs = 9,792-11,359), 16,188 birds in March (90% CIs = 15,159-17,360), and 16,170 birds in April (90% CIs = 14,947-17,377) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for a breeding population of national importance and a population of international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. However, numbers of common guillemots within the areas of the Dogger Bank Teesside A and B projects and the 2km buffers around these were of national importance in the 2011 breeding season. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 26 SPAs, a wintering feature of 11 SPAs and a passage feature of one SPA.

5.4.141 The Dogger Bank Teesside A and B projects are within foraging range of six protected breeding sites around the North Sea at which the species is a feature, five of which are in Great Britain – Seevogelschutzgebiet Helgoland, the Farne Islands, Forth Islands, Flamborough Head and Bempton Cliffs, Fowlsheugh and St Abb's Head to Fast Castle SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.142 Based on 50% of the worst case values for displacement, analysis provided estimates of 2,676 (using 90% confidence limits = 2,469-2,904) displaced birds using 2010 data (315 during breeding months, 2,361 during other months of the year), 3,460 (using 90% confidence limits = 3,205-3,741) displaced birds using 2010/11 data (609 during breeding months, 2,851 during other months of the year), and 2,542 (using 90% confidence limits = 2,330-2,768) displaced birds using 2011/12 data (710 during breeding months, 1,832 other months of the year). The mean value was 2,755 (using 90% confidence limits = 2,541-2,989) displaced birds (554 during breeding months, 2,201 during other months of the year).

5.4.143 Tables A9.38a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data) would be impacted.

5.4.144 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.145 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.146 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

5.4.147 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.148 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.149 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Export cable corridor

5.4.150 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.151 Based on worst case values for displacement, analysis provided estimates of 5,351 (using 90% confidence limits = 4,937-5,809) displaced birds using 2010 data (630 during breeding months, 4,721 during other months of the year), 6,921 (using 90% confidence limits = 6,410-7,482) displaced birds using 2010/11 data (1,218 during breeding months, 5,702 during other months of the year), and 5,084 (using 90% confidence limits = 4,659-5,535) displaced birds using 2011/12 data (1,420 during breeding months, 3,664 other months of the year). The mean value was 5,511 (using 90% confidence limits = 5,082-5,978) displaced birds (1,108 during breeding months, 4,403 during other months of the year).

5.4.152 Tables A9.39a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data) would be impacted.

5.4.153 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.154 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.155 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

5.4.156 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.157 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 169 adult common guillemots in flight in the projects areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.18).

5.4.158 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Appendix 9 (Table A9.40) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.4.159 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is unlikely to be more than the greater presented by the two wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is thus approximately 25km (7.4% of the species' maximum foraging range of 340km). The projects are between 164km and 340km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from two sites – the Fowlsheugh SPA and the Forth Islands SPA – from reaching foraging areas beyond the project areas.

5.4.160 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, this

impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.4.161 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A and B projects for common guillemot is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.162 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one common guillemot collision.

5.4.163 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.164 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of the five protected breeding sites for the species that the proposed project is within foraging range of. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.165 The proposed projects are within foraging range of six protected breeding sites in Great Britain. Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

5.4.166 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.167 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.168 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for

common guillemot for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.169 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.170 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Razorbill

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	51	50% displaced 5% mortality 2km buffer	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Displacement (o)	103		1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – population	4	98% avoidance Flight height option 3	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		92,000	<0.1	22,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.171 The peak population estimates for the Dogger Bank Teesside A and B project areas were 3,978 birds in February (90% CIs = 3,537-4,433), 7,254 birds in April (90% CIs = 6,459-8,065), and 6,207 birds in April (90% CIs = 5,533-6,935) for 2010, 2010/11 and 2011/12 respectively. The 1% threshold for a population of national importance was not exceeded in the Dogger Bank Teesside A and B project areas during the breeding season. However, the upper confidence limit for the numbers of razorbills within the areas of the Dogger Bank Teesside A and B projects and the 2km buffers around these exceeded the 1% threshold for national importance in the 2011 breeding season. The 1% threshold for a population of international importance was not exceeded in either year. However, the numbers of razorbills within the areas of the Dogger Bank Teesside A and B projects and the 2km buffers around these were of international importance in 2011. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 18 SPAs, a wintering feature of five SPAs and a passage feature of two SPAs.

5.4.172 The Dogger Bank Teesside A and B project is within foraging range of four protected breeding sites around the North Sea at which the species is a feature – the Farne Islands, Forth Islands, Flamborough Head and Bempton Cliffs and St Abb's Head to Fast Castle SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.173 Based on 50% of the worst case values for displacement, analysis provided estimates of 926 (using 90% confidence limits = 814-1,044) displaced birds using 2010 data (34 during breeding months, 892 during other months of the year), 1,125 (using 90% confidence limits = 990-1,270) displaced birds using 2010/11 data (77 during breeding months, 1,048 during other months of the year), and 851 (using 90% confidence limits = 730-985) displaced birds using 2011/12 data (169 during breeding months, 681 other months of the year). The mean value was 902 (using 90% confidence limits = 787-1,027) displaced birds (93 during breeding months, 809 during other months of the year).

5.4.174 Tables A9.41a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds (using mean data), would be impacted.

5.4.175 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.176 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.177 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

5.4.178 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.179 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.180 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Export cable corridor

5.4.181 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.182 Based on worst case values for displacement, analysis provided estimates of 1,852 (using 90% confidence limits = 1,627-2,088) displaced birds using 2010 data (68 during breeding months, 1,783 during other months of the year), 2,250 (using 90% confidence limits = 1,980-2,540) displaced birds using 2010/11 data (154 during breeding months, 2,096 during other months of the year), and 1,701 (using 90% confidence limits = 1,459-1,971) displaced birds using 2011/12 data (338 during breeding months, 1,363 other months of the year). The mean value was 1,804 (using 90% confidence limits = 1,574-2,054) displaced birds (186 during breeding months, 1,618 during other months of the year).

5.4.183 Tables A9.42a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where less than 0.1% of birds (using mean data), would be impacted.

5.4.184 Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.185 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.186 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.187 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 66 adult razorbills in flight in the projects areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 5.18)..

5.4.188 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.43 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

5.4.189 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is unlikely to be more than the greater presented by the two wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B is thus approximately 25km (8.0% of the species' maximum foraging range of 312km). The projects are between 164km and 308km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from two sites – the Forth Islands SPA and St Abb's Head to Fast Castle SPA – from reaching foraging areas beyond the project areas.

5.4.190 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A

and B, this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

5.4.191 Based on the assessment of magnitude and the species' **very high value**, the overall **significance** of the potential barrier effect associated with the Dogger Bank Teesside A and B projects for razorbill is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.192 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just three razorbill collisions.

5.4.193 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.194 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of all five of the protected sites around the North Sea that are within foraging range for this species. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.195 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

5.4.196 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.197 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.198 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for razorbill for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.199 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.200 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Little auk

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	5	25% displaced	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	11	5% mortality 2km buffer	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1	Flight height option 3	8,333,333	<0.1	333	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

5.4.201 The peak population estimates for the Dogger Bank Teesside A and B project areas were 3,774 birds in December (90% CIs = 3,018-5,052), 3,774 birds in December (90% CIs = 3,018-5,052), and 1,206 birds in December (90% CIs = 992-1,623) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. Although there is no British population estimate for little auk, given the numbers estimated, this species is deemed to be of national importance in the Dogger Bank Teesside A and B project areas. Consequently, the value of this receptor is assessed to be **high**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.202 Taking 50% of the worst-case maximum annual estimates in winter months, when this species occurs, a total of 113 birds would be displaced during 2010 (using 90% confidence limits = 84-158), 107.2 during 2010/11 (using 90% confidence limits = 84-144) and 37.8 during 2011/12 (using 90% confidence limits = 30-53). The mean value was 78 (using 90% confidence limits = 60-108) displaced birds.

5.4.203 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be

affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.204 Less than 1% of reference populations at the national and biogeographic scales would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at the national and biogeographic scale.

Significance

5.4.205 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.206 Little auks occur in the Dogger Bank Zone during winter months. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.207 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Export cable corridor

5.4.208 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **negligible**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.209 Based on worst case values for displacement, a total of 225 birds would be displaced during 2010 (using 90% confidence limits = 169-316), 214.4 during 2010/11 (using 90% confidence limits = 168-289) and 76 during 2011/12 (using 90% confidence limits = 59-106). The mean value was 156 (using 90% confidence limits = 119-216) displaced birds.

5.4.210 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.211 Less than 1% of reference populations at the national and biogeographic scale would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at the national and biogeographic scale.

Significance

5.4.212 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Collision

Species Overall sensitivity to collision – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.213 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one for little auk.

5.4.214 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

5.4.215 The predicted number of collisions represents an increase in background mortality of less than 1% at the national and biogeographic population levels.

Significance

5.4.216 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for little auk for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **negligible**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.217 Little auks occur in the Dogger Bank Zone during winter months. For little auk, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.218 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Atlantic puffin

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	5	25% displaced 5% mortality 2km buffer	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Displacement (o)	10		13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		684,000	<0.1	88,160	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

5.4.219 The peak population estimates for the Dogger Bank Teesside A and B project areas were 870 birds in December (90% CIs = 734-1,024), 1,189 birds in March (90% CIs = 1,052-1,379), and 318 birds in March (90% CIs = 270-381) for 2010, 2010/11 and 2011/12 respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 16 SPAs.

5.4.220 The Dogger Bank Teesside A and B projects are outside the foraging range of any protected site at which the species is a breeding feature.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.221 Based on 50% of the worst case values for displacement, analysis provided estimates of 91 (using 90% confidence limits = 73-113) displaced birds using 2010 data (11 during breeding months, 81 during other months of the year), 145 (using 90% confidence limits = 122-174) displaced birds using 2010/11 data (21 during breeding months, 124 during other months of the year), and 37 (using 90% confidence limits = 30-45) displaced birds using 2011/12 data (10 during breeding months, 27 other months of the year). The mean value was 84 (using 90%

confidence limits = 69-102) displaced birds (14 during breeding months, 70 during other months of the year).

5.4.222 Tables A9.44a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.223 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.224 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

5.4.225 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.226 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.227 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Export cable corridor

5.4.228 The impact of habitat loss or change is as assessed for Dogger Bank Teesside A - **minor adverse**.

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.229 Based on worst case values for displacement, analysis provided estimates of 183 (using 90% confidence limits = 147-227) displaced birds using 2010 data (21 during breeding months, 162 during other months of the year), 290 (using 90% confidence limits = 245-348) displaced birds using 2010/11 data (42 during breeding months, 248 during other months of the year), and 74 (using 90% confidence limits = 60-91) displaced birds using 2011/12 data (20 during breeding months, 53 other months of the year). The mean value was 168 (using 90% confidence limits = 139-204) displaced birds (28 during breeding months, 140 during other months of the year).

5.4.230 Tables A9.45a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

5.4.231 Displacement would affect much less than 0.1% of the species' biogeographic population.

5.4.232 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A and B project is thus considered of **negligible magnitude** at all scales.

Significance

5.4.233 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.234 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one for Atlantic puffin.

5.4.235 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

5.4.236 Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

5.4.237 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

5.4.238 Mean annual collision estimates using represent less than 0.1% of the species' biogeographic population.

5.4.239 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

5.4.240 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for Atlantic puffin for the Dogger Bank Teesside A and B projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales, and consequently considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

5.4.241 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B project areas in either year (see section 3). Combined with information on this species diet (see section 4), the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

5.4.242 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Migrants

Operation

Collision

5.4.243 The migration zones (defined by Wright *et al.* 2012) of 45 species' populations of terrestrial or waterbird migrants that are UK SPA features overlap with the Dogger Bank Teesside A and B projects during migration. Collision risk estimates suggests that on an annual basis the mortality associated with the Dogger Bank Teesside A and B projects is likely to represent less than 1% of the reference population of each of these species (Table 5.19).

5.4.244 The effect of collision for migrants for the Dogger Bank Teesside A and B projects is thus considered to be of **negligible magnitude** at the national level and **minor adverse** for 15 species' populations and **negligible** for 30 species' populations.

5.4.245 Due to the lack of knowledge concerning species' precise migration routes and their likely variability, no attempt was made to apportion impacts to individual protected sites, and thus it is unknown whether impacts may potentially be greater or less at any one particular site.

5.4.246 It should also be noted that for migrants there is much greater uncertainty in these calculations, and thus the assessment both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Given these uncertainties the confidence in predictions in the assessment of collision for migrants is considered to be very low.

Table 5.19 Assessment of collision risk for migrants for the Dogger Bank Teesside A and B projects. Estimated numbers of collisions are based on modelling of the numbers of birds predicted to pass through the wind farm project, a 98% avoidance rate and expert judgement of the proportion of individuals likely to be flying at a height which places them at risk of collision. Three scenarios were run using the lower central and upper limits of the range of the proportion of birds at risk height as described in Wright *et al.* (2012) with the central value used for the purposes of assessment. It is important to note that the values in brackets under "estimated annual collisions" simply represent the estimates using the lower and upper estimates of the proportion of birds at risk height, and do not represent any kind of measure of confidence in the collision estimates (which would have a far greater range).

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Bean goose *Anser fabalis*	0.03 (0.01 - 0.08)	<0.1%	8.33%	Very High	Low	High	Negligible	Negligible
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0.003 (0.0005 - 0.007)	<0.1%	0.19%	Very High	High	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	1.23 (0.01 - 4.92)	<0.1%	6.80%	Very High	High	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	6.98 (0.05 - 27.90)	<0.1%	6.33%	Very High	Very Low	Medium	Negligible	Negligible
Gadwall *Anas strepera*	0.09 (0.001 - 0.36)	<0.1%	3.01%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian teal *Anas crecca*	1.65 (0.01 - 6.61)	<0.1%	6.35%	Very High	Very Low	Medium	Negligible	Negligible
Mallard *Anas platyrhynchos*	5.07 (0.03 - 20.30)	<0.1%	6.80%	Very High	Very Low	Medium	Negligible	Negligible
Northern pintail *Anas acuta*	0.22 (0.001 - 0.89)	<0.1%	6.35%	Very High	Very Low	Medium	Negligible	Negligible
Northern shoveler *Anas clypeata*	0.14 (0.001 - 0.58)	<0.1%	4.59%	Very High	Very Low	Medium	Negligible	Negligible
Common pochard *Aythya ferina*	0.56 (0.004 - 2.26)	<0.1%	4.59%	Very High	Very Low	Medium	Negligible	Negligible
Tufted duck *Aythya fuligula*	1.26 (0.01 - 5.05)	<0.1%	6.29%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Greater scaup *Aythya marila*	0.005 (0.00003 - 0.02)	<0.1%	4.30%	Very High	Very Low	Medium	Negligible	Negligible
Common scoter *Melanitta nigra*	0.06 (0.01 - 0.99)	<0.1%	6.35%	Very High	Low	High	Negligible	Negligible
Velvet scoter *Melanitta fusca*	0.04 (0.0003 - 0.15)	<0.1%	7.45%	Very High	Low	High	Negligible	Negligible
Goldeneye *Bucephala clangula*	0.43 (0.003 - 1.74)	<0.1%	6.80%	Very High	Low	High	Negligible	Negligible
Red-breasted merganser *Mergus serrator*	0.003 (0.00002 - 0.01)	<0.1%	3.86%	Very High	Medium	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	0.06 (0.0004 - 0.23)	<0.1%	7.35%	Very High	Medium	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0.01 (0.001 - 0.01)	<0.1%	2.15%	Very High	Very Low	Medium	Negligible	Negligible
Great crested grebe *Podiceps cristatus*	0.13 (0.01 - 0.51)	<0.1%	3.52%	Very High	Medium	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0.005 (0.0005 - 0.02)	<0.1%	6.35%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0.0005 (0.0002 - 0.001)	<0.1%	1.85%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0.02 (0.01 - 0.04)	<0.1%	7.45%	Very High	Medium	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0.39 (0.04 - 0.73)	<0.1%	1.04%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	2.36 (0.47 - 7.08)	<0.1%	6.35%	Very High	High	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	0.41 (0.08 - 1.22)	<0.1%	6.86%	Very High	Low	High	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Golden plover *Pluvialis apricaria* (non-breeding)	3.79 (0.76 - 11.38)	<0.1%	5.47%	Very High	Very Low	Medium	Negligible	Negligible
Grey plover *Pluvialis squatarola*	1.17 (0.23 - 3.50)	<0.1%	6.78%	Very High	High	Very High	Negligible	Minor adverse
Northern lapwing *Vanellus vanellus*	10.79 (2.16 - 32.38)	<0.1%	6.78%	Very High	Very Low	Medium	Negligible	Negligible
Red knot *Calidris canutus*	3.60 (0.72 - 10.80)	<0.1%	6.33%	Very High	Medium	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	0.92 (0.18 - 2.77)	<0.1%	6.33%	Very High	Medium	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	0.08 (0.02 - 0.23)	<0.1%	6.39%	Very High	Very Low	Medium	Negligible	Negligible
Dunlin *Calidris alpina alpina* (passage & winter)	6.49 (1.30 - 19.48)	<0.1%	4.63%	Very High	Very Low	Medium	Negligible	Negligible
Ruff *Philomachus pugnax*	0.06 (0.01 - 0.17)	<0.1%	7.22%	Very High	Very Low	Medium	Negligible	Negligible
Common snipe *Gallinago gallinago*	10.61 (2.12 - 31.83)	<0.1%	6.34%	Very High	Very Low	Medium	Negligible	Negligible
Black-tailed godwit *Limosa limosa islandica*	0.06 (0.01 - 0.17)	<0.1%	5.36%	Very High	Very High	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	1.41 (0.28 - 4.22)	<0.1%	7.16%	Very High	Very Low	Medium	Negligible	Negligible
Whimbrel *Numenius phaeopus*	0.26 (0.05 - 0.79)	<0.1%	6.23%	Very High	High	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	2.09 (0.42 - 6.26)	<0.1%	6.46%	Very High	Very Low	Medium	Negligible	Negligible
Greenshank *Tringa nebularia*	0.0004 (0.0001 - 0.001)	<0.1%	4.07%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Common redshank *Tringa totanus britannica* (breeding)	0.06 (0.01 - 0.18)	<0.1%	5.91%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	2.57 (0.51 - 7.7)	<0.1%	5.45%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0.63 (0.13 - 1.89)	<0.1%	7.37%	Very High	Very Low	Medium	Negligible	Negligible
Ruddy turnstone *Arenaria interpres*	0.51 (0.10 - 1.52)	<0.1%	6.35%	Very High	High	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	0.02 (0.004 - 0.04)	<0.1%	6.56%	Very High	Very Low	Medium	Negligible	Negligible
European nightjar *Caprimulgus europaeus*	0.01 (0.002 - 0.02)	<0.1%	1.35%	Very High	Very Low	Medium	Negligible	Negligible

[1] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[2] The migration zone referred to here is the North Sea migration area appropriate to assessment for the Dogger Bank, and not the entire migration zone used by the species around the whole of the UK. The percentage given can be roughly interpreted as the percentage of birds migrating across the North Sea that would cross the wind farm footprint during a single migration period (note for most species there are 2 migrations per year crossing the North Sea). For further details see the SOSS migration modelling tool guidance (Wright *et al*. 2012).

Barrier effects

5.4.247 An assessment of the potential barrier effects posed by the Dogger Bank Teesside A and B projects to the 45 species' populations of terrestrial or waterbird migrants that are UK SPA features whose migration zones (defined by Wright *et al.* 2012) overlap with the project area is provided in Table 5.20 below.

5.4.248 The percentages of reference populations estimated to pass through the project areas at risk height (following Wright *et al.* 2012), and thus exposed to potential barrier effects were less than 1% for 28 of the species' populations considered, but greater than 1% for 17 species' populations. The estimates of numbers passing through the project areas greatly exceed the numbers recorded by boat surveys, though it should be noted that boat surveys were not designed to record migrants and as they only provide a (diurnal) snapshot of birds flying close to the sea, they will inevitably greatly underestimate overall numbers of migrants.

5.4.249 The increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B varies by direction of flight, although due to the positions of the projects, for the shortest approximately east-west route across the North Sea passing through the project, equates to a maximum of approximately 25km (an increase of just 4% on the ca. 575km route).

5.4.250 Considering both the numbers of birds exposed to this effect and the relative increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, this impact is considered to be of **negligible magnitude** for all species' populations.

5.4.251 It should be noted that there is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms. For migrants, there is great uncertainty in the determination of the numbers of birds passing through each project area. There is little evidence to suggest whether or not migration may be concentrated within corridors within overall migration zones (Wright *et al.* 2012) and it cannot be assumed that birds fly directly to or from the protected sites that they are features of. It is also assumed that the wind farm poses a barrier effect to 100% of birds attempting to fly through at risk height (Maclean *et al.* 2009) which may be over-precautionary. In particular, there is considerable uncertainty as to the actual consequences for survival, and thus for population-level impacts, from the increase in energy expenditure associated with the increases in flight distance for those birds exposed to barrier effects. Given these uncertainties, the confidence in predictions in the assessment of barrier effects is considered to be very low and considerable caution is urged in considering the outcomes of this assessment.

Table 5.20 Assessment of barrier effects for migrants for the Dogger Bank Teesside A and B projects.

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Bean goose *Anser fabalis*	0	1	18	2.50%	Very High	Negligible	Minor adverse
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0	4	2	0.06%	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0	0	771	1.02%	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	0	8	4715	0.90%	Very High	Negligible	Minor adverse
Gadwall *Anas strepera*	0	0	60	0.27%	Very High	Negligible	Minor adverse
Eurasian teal *Anas crecca*	0	1	1189	0.48%	Very High	Negligible	Minor adverse
Mallard *Anas platyrhynchos*	2	3	3279	0.71%	Very High	Negligible	Minor adverse
Northern pintail *Anas acuta*	2	1	144	0.48%	Very High	Negligible	Minor adverse
Northern shoveler *Anas clypeata*	0	0	98	0.52%	Very High	Negligible	Minor adverse
Common pochard *Aythya ferina*	0	3	385	0.52%	Very High	Negligible	Minor adverse
Tufted duck *Aythya fuligula*	2	0	873	0.85%	Very High	Negligible	Minor adverse
Greater scaup *Aythya marila*	0	0	3	0.03%	Very High	Negligible	Minor adverse
Common scoter *Melanitta nigra*	113	191	39	0.03%	Very High	Negligible	Minor adverse
Velvet scoter *Melanitta fusca*	4	9	25	1.01%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common goldeneye *Bucephala clangula*	2	0	297	1.02%	Very High	Negligible	Minor adverse
Red-breasted merganser *Mergus serrator*	0	0	2	0.06%	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	5	0	36	1.10%	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0	0	3	0.75%	Very High	Negligible	Minor adverse
Great crested grebe *Podiceps cristatus*	0	0	86	0.35%	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0	0	3	0.32%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0	0	<1	0.09%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0	0	11	2.98%	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0	0	273	0.26%	Very High	Negligible	Minor adverse
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	2	8	1588	0.79%	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	4	4	626	0.86%	Very High	Negligible	Minor adverse
Golden plover *Pluvialis apricaria* (non-breeding)	0	5	2737	0.68%	Very High	Negligible	Minor adverse
Grey plover *Pluvialis squatarola*	0	0	836	1.70%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Northern lapwing *Vanellus vanellus*	0	19	7614	1.70%	Very High	Negligible	Minor adverse
Red knot *Calidris canutus*	3	15	2681	0.79%	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	6	0	712	1.19%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	16	18	59	1.60%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina alpina* (passage & winter)	16	18	5072	1.16%	Very High	Negligible	Minor adverse
Ruff *Philomachus pugnax*	0	3	43	1.80%	Very High	Negligible	Minor adverse
Common snipe *Gallinago gallinago*	1	0	7927	0.79%	Very High	Negligible	Minor adverse
Black-tailed godwit *Limosa limosa islandica*	0	0	75	1.34%	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0	0	971	1.79%	Very High	Negligible	Minor adverse
Whimbrel *Numenius phaeopus*	6	27	179	0.78%	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	51	4	1323	1.62%	Very High	Negligible	Minor adverse
Greenshank *Tringa nebularia*	0	1	<1	0.10%	Very High	Negligible	Minor adverse
Common redshank *Tringa totanus britannica* (breeding)	0	0	44	0.15%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	0	0	1872	0.68%	Very High	Negligible	Minor adverse
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0	0	461	1.84%	Very High	Negligible	Minor adverse
Ruddy turnstone *Arenaria interpres*	7	12	381	0.79%	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	2	23	12	1.15%	Very High	Negligible	Minor adverse
European Nightjar *Caprimulgus europaeus*	0	0	8	0.07%	Very High	Negligible	Minor adverse

[1] Across Dogger Bank Zone as a whole (see section 3).

[2] The estimated number of individuals of each species crossing the project is the number that would pass through at risk height (using the best estimate of the proportion of migrating birds at risk height from Wright *et al*. 2012 and not accounting for uncertainty) during a single migration season. Note that for most species, two migrations per year would be expected, and different individual birds may be involved during spring and autumn passage.

[3] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[4] Magnitude is assessed here according to Table 4.1.

Summary for all receptors

5.4.252 Table 5.21 below provides a summary of impacts from each effect for all key marine bird receptors.

Table 5.21 Summary of potential impacts from the Dogger Bank Teesside A and B projects for key marine bird receptors.

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
White-billed diver	Displacement (construction/decommissioning)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	Medium	High	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Medium	High	High	Negligible	Negligible	Very Low
	Displacement (operation)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Collision (operation)	National	Medium	High	High	Negligible	Negligible	Medium
		Biogeographic	Medium	High	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	Medium	High	High	Negligible	Negligible	Very Low
Northern fulmar	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Northern gannet	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Arctic skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Great skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable	All	Very High	Low	High	Negligible	Negligible	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	construction)							
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Black-legged kittiwake	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Lesser black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Great black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Common guillemot	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Razorbill	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Little auk	Displacement (construction/decommissioning)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Collision (operation)	National	High	Medium	High	Negligible	Negligible	Medium
		Biogeographic	High	Medium	High	Negligible	Negligible	Medium
	Habitat loss or change	All	High	Low	Medium	Negligible	Negligible	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	(operation)							
Atlantic puffin	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low

5.5 Ornithology Impact Assessment for the Intertidal Areas of the Dogger Bank Teesside A and B Cable Landfall

Ornithological interest of the intertidal site

5.5.1 The study area is likely to be of the highest importance during the following periods: autumn passage, winter and spring passage. Most of survey data (NEWS and commissioned surveys) focussed on the wintering period with the exception of the winter of 2012/13 where it was possible to distinguish between records from the autumn passage and wintering period from the field maps. Therefore, in terms of the ornithological interest, the winter bird assemblage and to a lesser extent the autumn passage period is referred to hereafter.

5.5.2 The key ornithological receptors, based on count numbers (≥10) and receptor value (low to very high value), found at the intertidal site during the winter and autumn period are as follows: Eurasian oystercatcher, northern lapwing, ringed plover, ruddy turnstone, sanderling, dunlin, black-headed gull, herring gull and linnet. (Note, assessment of the latter terrestrial species is considered separately under the onshore assessment.)

Evaluation for Ornithological Receptors

***Eurasian oystercatcher* Haematopus ostralegus**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.3 This species is considered to have a **high species-specific sensitivity** to this effect.

5.5.4 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.5 Habitat loss for feeding birds could potentially occur during the intertidal installation of the cable. The impact of this effect would be restricted to the area in which drilling or open trenching operations occur and is likely to be less than 1km in length of the coastline.

5.5.6 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects on the habitat beyond several days from completion.

5.5.7 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.8 The effect of habitat loss for Eurasian oystercatcher for the intertidal project is thus considered to be **negligible**.

Physical, visual and noise displacement

5.5.9 This species is considered to have a **high species-specific sensitivity** to this effect.

5.5.10 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **medium**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.11 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the impact of this effect would be restricted to an intertidal zone of less than 2.1km in length.

5.5.12 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.13 Given this, the likely effect of physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.14 The effect of physical, visual and noise displacement on Eurasian oystercatcher for the intertidal project is thus considered to be **negligible**.

***Northern lapwing* Vanellus vanellus**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.15 This species is considered to have a **high species-specific sensitivity** to habitat loss.

5.5.16 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.17 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.18 Given this, the likely habitat loss experienced will be of **negligible magnitude.**

Significance

5.5.19 The effect of habitat loss for northern lapwing for the intertidal project is thus considered to be **minor adverse.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.20 This species is considered to have a **high species-specific sensitivity** to this effect

5.5.21 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.22 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the impact of this effect would be restricted to an intertidal zone of less than 2.1km in length.

5.5.23 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.24 Given this, the likely effect of physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.25 The effect of physical, visual and noise displacement on northern lapwing for the intertidal project is thus considered to be **minor adverse**.

***Ringed Plover* Charadrius hiaticula**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.26 This species is considered to have a **high species-specific sensitivity** to this effect.

5.5.27 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.28 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion and would be limited to the area in which drilling or trenching operations took place.

5.5.29 Given this, the likely habitat loss experienced will be of **negligible magnitude.**

Significance

5.5.30 The effect of habitat loss on ringed plover associated with works in the intertidal is thus considered to be **minor adverse.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.31 This species is considered to have a **medium species-specific sensitivity** to this effect.

5.5.32 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.33 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the impact of this effect would be restricted to an intertidal zone of less than 2.1km in length.

5.5.34 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.35 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.36 The effect of habitat loss on ringed plover for the intertidal project is thus considered to be **minor adverse.**

***<u>Ruddy Turnstone</u>* <u>Arenaria interpres</u>**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.37 This species is considered to have a **high species-specific sensitivity** to habitat loss.

5.5.38 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **medium.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.39 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.40 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.41 The effect of habitat loss for ruddy turnstone for the intertidal project is thus considered to be **negligible.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.42 This species is considered to have a **medium species-specific sensitivity** to this effect.

5.5.43 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **low**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.44 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the intertidal zone affected will be less than 2.1km in length.

5.5.45 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete.

5.5.46 Given this, the likely physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.47 The effect of physical, visual and noise displacement on ruddy turnstone for the intertidal project is thus considered to be **negligible**.

***Sanderling* Calidris alba**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.48 This species is considered to have a **high species-specific sensitivity** to habitat loss.

5.5.49 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.50 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.51 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.52 The effect of habitat loss for sanderling for the intertidal project is thus considered to be **minor adverse**.

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.53 This species is considered to have a **medium species-specific sensitivity** to this effect.

5.5.54 Considering this and the species' **very high value**, the species' **overall sensitivity** to this effect will be **very high**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.55 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the intertidal zone affected will be less than 2.1km in length.

5.5.56 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.57 Given this, the likely physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.58 The effect of physical, visual and noise displacement for sanderling for the intertidal project is thus considered to be **minor adverse**.

***Dunlin* Calidris alpina**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.59 This species is considered to have a **high species-specific sensitivity** to habitat loss.

5.5.60 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **medium.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.61 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.62 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.63 The effect of habitat loss for dunlin for the intertidal project is thus considered to be **negligible.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.64 This species is considered to have a **medium species-specific sensitivity** to this effect.

5.5.65 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **low**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.66 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the intertidal zone affected will be less than 2.1km in length.

5.5.67 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete.

5.5.68 Given this, the likely physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.69 The effect of physical, visual and noise displacement on dunlin for the intertidal project is thus considered to be **negligible**.

***Black-headed gull* Chroicocephalus ridibundus**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.70 Black-headed gulls display little habitat specialisation. They are highly capable of exploiting a range of coastal and inland habitats during the winter such as ploughed

land, grass, refuse tips, lochs and estuaries (Furness *et al.* 2012) and have a **low species-specific sensitivity** to habitat loss.

5.5.71 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **low**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.72 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.73 Given this, the likely habitat loss experienced will be of **negligible magnitude.**

Significance

5.5.74 The effect of habitat loss for black-headed gull for the intertidal project is thus considered to be **negligible.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.75 There is little information on the sensitivity of black-headed gulls to displacement which could arise during the intertidal installation of the cable. Black-headed gulls, in response to ship traffic, however, are known to show slight avoidance at short range (Furness *et al.* 2012) and consequently, this species is considered to have a **low species-specific sensitivity** to this effect.

5.5.76 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **low**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.77 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the impact of this effect would be restricted to an intertidal zone of less than 2.1km in length.

5.5.78 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.79 Given this, the likely effect of physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.80 The effect of physical, visual and noise displacement on black-headed gull for the intertidal project is thus considered to be **negligible.**

***<u>Herring Gull</u>* <u>Larus argentatus</u>**

Operation

Habitat loss

Species sensitivity to habitat loss (Recoverability/Adaptability/Tolerance/Value)

5.5.81 Herring gulls display little habitat specialisation. They are known to forage around in open sea (and specifically around ships at sea) and in inshore areas as well as more terrestrial habitats such as the intertidal zone, agricultural areas, on refuse and in urban areas (Furness *et al.* 2012). Consequently, this species is considered to have a **low species-specific sensitivity** to this habitat loss, notably for inland areas.

5.5.82 Considering this and the species' **medium value**, the species' **overall sensitivity** to this effect will be **low.**

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.83 As for Eurasian oystercatcher, the impact of this effect would be restricted and it is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects beyond several days from completion.

5.5.84 Given this, the likely habitat loss experienced will be of **negligible magnitude**.

Significance

5.5.85 The effect of habitat loss for herring gull for the intertidal project is thus considered to be **negligible.**

Physical, visual and noise displacement

Species sensitivity to physical, visual and noise displacement (Recoverability/Adaptability/Tolerance/Value)

5.5.86 There is little information on the sensitivity of herring gulls to displacement which could arise during the intertidal installation of the cable. Herring gulls, in response to ship traffic, however, show slight avoidance at short range (Furness *et al.* 2012) and consequently, this species is considered to have a **low species-specific sensitivity** to this effect.

5.5.87 Considering this and the species' **low value**, the species' **overall sensitivity** to this effect will be **low**.

Magnitude of effect (Duration/Frequency/Extent/Size)

5.5.88 The impact of physical, visual and noise displacement would extend beyond the study area. Assuming that birds will be affected up to a distance of 300m, the impact of this effect would be restricted to an intertidal zone of less than 2.1km in length.

5.5.89 It is unlikely that any of the potential methods of intertidal cable installation would result in any residual effects in terms of physical, visual and noise displacement once construction was complete (no available information on anticipated time required).

5.5.90 Given this, the likely effect of physical, visual and noise displacement experienced will be of **negligible magnitude**.

Significance

5.5.91 The effect of physical, visual and noise displacement on herring gull for the intertidal project is thus considered to be **negligible**.

6. CUMULATIVE IMPACT ASSESSMENT RESULTS

6.1 Introduction

6.1.1 This section of the report provides the results of the cumulative impact assessment for the Dogger Bank Teesside A and Dogger Bank Teesside B projects.

6.1.2 In each case, assessment is first provided of the magnitudes of the impacts from different effects during construction and decommissioning and during operation. Following this, accounts review the sensitivities of each key receptor to these effects and, in combination with the assessment of magnitude, provide an assessment of the overall significance of impacts for each species.

6.1.3 Impacts on receptors in intertidal areas are considered separately as these will apply for both projections in combination.

6.1.4 The cumulative impact assessment for birds considers two spatial scales, for which the methodologies used and the confidence in predictions vary:

i. At the scale of the Dogger Bank Zone, i.e. for the Dogger Bank Teesside A and B projects in conjunction with the Dogger Bank Creyke Beck A and B projects and Dogger Bank Teesside C and D projects;
ii. On a regional scale, between the Dogger Bank Teesside A and B projects and other activities, projects and plans outside the Dogger Bank Zone which share receptors with the Dogger Bank Teesside A and B projects.

6.2 Cumulative Impacts of the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D Projects

<u>Disturbance/displacement</u>

6.2.1 The numbers of birds predicted to be displaced from the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas and buffers during construction/decommissioning and operation, under chosen displacement rates, are shown in Table 6.1 and are also discussed at the start of each species' account. The values presented incorporate the correction factors for birds underwater (see section 4), but do not represent final magnitude, taking into account mortality rates. For each species, tabulated summaries of the number of birds estimated to be displaced, that are then estimated to die, based on a full range of alternative displacement and mortality rates, from 0 to 100%, are provided in Appendix 10.

6.2.2 Results of the apportioning of disturbance/displacement impacts to protected sites, incorporating mortality, are shown in Appendix 9. These tables also correct for the initial assumption that all birds come from the protected sites identified (see section 4).

6.2.3 Table 6.1 also provides separate estimates of the numbers of birds predicted to be displaced in respective breeding and winter periods. Birds predicted to be impacted during the breeding season will potentially include both breeders from any breeding colonies that the project is within range of, and also a non-breeding component. For gulls and northern gannet, it was possible to derive estimates of proportion of breeders from boat-survey observations of birds in breeding and juvenile plumages. For other species, it is assumed that, for species for which the wind farm project is within foraging range of birds from breeding colony protected sites, one third of the total number of birds (Stroud *et al.* 2004; Kober *et al.* 2010) present during the breeding season will be non-breeders. These are apportioned to protected sites surrounding the North Sea in the same manner as for seabirds outside the breeding season (see section 4).

Table 6.1 Numbers of birds displaced during construction / decommissioning and operation for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects during 2010, 2010/11 and 2011/12; mean values are subsequently combined with species specific mortality rates to assess the impact of displacement (see section 4). Full matrices of displacement and mortality are given in Appendix 10.

		Construction / decommissioning			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	24	23	21	22
Northern gannet	Breeding	153 (129-181)	296 (253-349)	940 (799-1119)	501 (427-594)
	Winter	232 (196-277)	626 (533-742)	1203 (1004-1435)	719 (605-856)
	All	384 (326-458)	922 (786-1091)	2143 (1803-2554)	1220 (1031-1450)
Common guillemot	Breeding	2268 (2098-2479)	4252 (3925-4620)	4940 (4495-5460)	3870 (3552-4242)
	Winter	11192 (10274-12172)	12805 (11806-13865)	7969 (7333-8648)	9907 (9120-10749)
	All	13460 (12371-14650)	17057 (15731-18485)	12909 (11828-14108)	13777 (12671-14991)
Razorbill	Breeding	148 (121-181)	323 (268-386)	710 (577-879)	392 (320-480)
	Winter	3747 (3266-4252)	4165 (3664-4715)	2558 (2241-2930)	3202 (2805-3641)
	All	3896 (3387-4433)	4488 (3933-5102)	3268 (2818-3809)	3594 (3125-4121)
Little auk	Winter	347 (260-488)	283 (223-377)	109 (87-151)	225 (173-311)
Atlantic puffin	Breeding	51 (40-64)	104 (88-124)	50 (40-62)	68 (56-83)
	Winter	386 (314-479)	524 (441-635)	114 (93-136)	303 (250-369)
	All	437 (354-543)	629 (529-759)	164 (133-198)	371 (306-453)
		Operation			
Species	**Season**	**2010**	**2010/2011**	**2011/2012**	**Mean**
White-billed diver	All	45	48	43	43
Northern gannet	Breeding	305 (259-363)	592 (507-698)	1880 (1597-2238)	1002 (854-1188)
	Winter	463 (393-554)	1252 (1065-1485)	2406 (2009-2869)	1438 (1209-1713)
	All	768 (652-916)	1844 (1572-2183)	4286 (3606-5108)	2440 (2063-2901)
Common guillemot	Breeding	4536 (4196-4957)	8504 (7850-9239)	9880 (8989-10919)	7741 (7103-8483)
	Winter	22385 (20547-24343)	25609 (23611-27731)	15937 (14666-17297)	19814 (18239-21499)
	All	26921 (24743-29301)	34114 (31462-36970)	25817 (23655-28216)	27555 (25342-29982)
Razorbill	Breeding	297 (242-362)	646 (537-773)	1420 (1154-1758)	784 (640-959)
	Winter	7495 (6532-8504)	8329 (7329-9431)	5115 (4483-5860)	6405 (5610-7283)
	All	7792 (6774-8866)	8976 (7865-10204)	6536 (5636-7618)	7188 (6251-8242)
Little auk	Winter	693 (519-977)	565 (447-755)	218 (174-301)	450 (346-622)
Atlantic puffin	Breeding	101 (80-129)	208 (176-248)	100 (81-124)	137 (112-167)
	Winter	772 (628-958)	1049 (882-1269)	227 (186-272)	605 (500-739)
	All	873 (708-1087)	1257 (1057-1517)	328 (267-396)	742 (613-906)

Barrier effects – Marine Birds

6.2.4 Numbers of key species in flight potentially exposed to barrier effects for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are shown in Table 6.2.

Table 6.2 Estimates of the numbers of breeding adult birds of these species in flight in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project area using the mean of 2010 and 2010/2011 and 2011/12 data.

Species	Breeding season	Mean
Northern fulmar	Mar-Sep	446 (360-540)
Northern gannet	Apr-Sep	482 (411-572)
Black-legged kittiwake	Apr-Sep	3,877 (3,468-4,307)
Common guillemot	May-Jul	1,179 (1,082-1,293)
Razorbill	May-Jul	228 (186-278)

Collision – Marine Birds

6.2.5 An overview of the combined results of collision risk analyses for marine birds for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D Projects is provided below.

6.2.6 There were strong between year differences in both the total numbers of birds present within Dogger Bank Teesside A, B, C and D and Dogger Bank Creyke Beck A and B, and annual patterns in their abundance. With only three years of data, it was not possible to determine which year was most representative of bird abundance within Dogger Bank Teesside A, B, C and D and Dogger Bank Creyke Beck A and B. For these reasons, collision risk estimates were produced for each year separately, rather than for a mean value from the three years.

6.2.7 Using a realistic, precautionary avoidance rate of 98% (SNH 2010, Cook *et al.* 2012), the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin colliding with wind turbines, based on population estimates from 2010 to 2012, were predicted to be less than one bird per year. Even assuming a more conservative avoidance rate of 95%, the numbers of Arctic skua, common guillemot, little auk and Atlantic puffin predicted to collide with wind turbines were less than one bird per year. Northern fulmar, great skua and razorbill had a similarly low collision risk, with a maximum of two great skua, four northern fulmar and 11 razorbill predicted to collide annually.

Table 6.3 Annual collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A and B, Dogger Bank Creyke A and B and Dogger Bank Teesside C and D projects of the Dogger Bank Zone, assuming a worst case scenario of 1,200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m in response to different avoidance rates. Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010				July 2010 – June 2011				July 2011 – June 2012				Mean			
	95%	98%	99%	99.5%	95%	98%	99%	99.5%	95%	98%	99%	99.5%	0.95	0.98	0.99	0.995
Northern fulmar	10 (8 - 13)	4 (3 - 5)	2 (2 - 3)	1 (1 - 1)	7 (6 - 9)	3 (2 - 4)	1 (1 - 2)	1 (1 - 1)	11 (9 - 14)	4 (4 - 6)	2 (2 - 3)	1 (1 - 1)	10 (8-12)	4 (3-5)	2 (2-2)	1 (1-1)
Northern gannet	434 (354 - 518)	174 (142 - 207)	87 (71 - 104)	43 (35 - 52)	684 (561 - 810)	274 (225 - 324)	137 (112 - 162)	68 (56 - 81)	1,910 (1,560 – 2,266)	765 (624 - 907)	382 (312 - 454)	191 (156 - 227)	1085 (888-1287)	434 (356-515)	217 (178-258)	109 (89-129)
Arctic Skua	0 (0 - 3121)	0 (0 - 1249)	0 (0 - 625)	0 (0 - 312)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 363)	0 (0 - 145)	0 (0 - 73)	0 (0 - 36)	0 (0-1162)	0 (0-465)	0 (0-233)	0 (0-116)
Great Skua	2 (1 - 4)	1 (0 - 2)	0 (0 - 1)	0 (0 - 0)	3 (1 - 6)	1 (1 - 2)	1 (0 - 1)	0 (0 - 1)	5 (3 - 10)	2 (1 - 4)	1 (1 - 2)	1 (0 - 1)	4 (2-7)	2 (1-3)	1 (0-1)	0 (0-1)
Black-legged kittiwake	924 (824 – 1,049)	370 (330 - 420)	185 (165 - 210)	93 (82 - 105)	1,629 (1,448 – 1,841)	652 (579 - 737)	326 (290 - 369)	163 (145 - 184)	1,651 (1,457 – 1,888)	661 (583 - 756)	330 (292 - 378)	165 (146 - 189)	1382 (1225-1571)	553 (490-629)	277 (245-314)	138 (123-157)
Lesser black-backed gull	336 (226 - 516)	135 (91 - 207)	67 (45 - 103)	34 (23 - 52)	202 (125 - 325)	81 (50 - 130)	40 (25 - 65)	20 (13 - 33)	135 (69 - 240)	54 (28 - 96)	27 (14 - 48)	13 (7 - 24)	219 (137-353)	88 (55-141)	44 (27-71)	22 (14-35)
Great black-backed gull	448 (312 - 642)	179 (125 - 257)	90 (63 - 129)	45 (31 - 64)	452 (316 - 646)	181 (127 - 259)	91 (63 - 129)	45 (32 - 65)	361 (229 - 551)	145 (92 - 221)	72 (46 - 110)	36 (23 - 55)	407 (276-592)	163 (111-237)	81 (55-118)	41 (28-59)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Razorbill	12 (7 - 19)	5 (3 - 8)	2 (1 - 4)	1 (1 - 2)	27 (16 - 47)	11 (6 - 19)	5 (3 - 9)	3 (2 - 5)	23 (15 - 38)	9 (6 - 15)	5 (3 - 8)	2 (2 - 4)	20 (12-33)	8 (5-13)	4 (2-7)	2 (1-3)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 1)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table 6.4 Seasonal collision risk estimates (with 90% confidence limits) for study species within the Dogger Bank Teesside A and B, Dogger Bank Creyke A and B and Dogger Bank Teesside C and D projects of the Dogger Bank Zone, assuming a worst case scenario of 1,200 6MW wind turbines with a lower rotor tip height of 26m above highest astronomical tide and a rotor diameter of 167m and an avoidance rate of 98 % (99% for northern gannet). Estimates generated using option 3 of Band collision risk model, which corrects for variable collision risk within the rotor-swept area.

Species	2010		July 2010 – June 2011		July 2011 – June 2012		Mean	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Northern fulmar	4 (0 - 5)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	4 (0 - 5)	0 (0 - 1)	2 (2-3)	1 (1-2)
Northern gannet	41 (5 - 50)	5 (37 - 54)	52 (41 - 62)	84 (70 - 100)	195 (160 - 229)	187 (154 - 222)	104 (85-122)	114 (93-135)
Arctic Skua	0 (0 - 0)	0 (0 - 1248)	0 (0 - 0)	0 (0 - 0)	0 (0 - 144)	0 (0 - 0)	0 (0-48)	0 (0-417)
Great Skua	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	1 (0-1)	1 (0-2)
Black-legged kittiwake	173 (12 - 197)	21 (177 - 223)	477 (424 - 538)	175 (155 - 200)	503 (442 - 574)	159 (141 - 182)	388 (344-441)	165 (146-188)
Lesser black-backed gull	101 (11 - 150)	7 (20 - 57)	51 (32 - 80)	29 (17 - 52)	28 (14 - 50)	26 (14 - 46)	58 (38-88)	30 (17-53)
Great black-backed gull	29 (5 - 44)	20 (106 - 213)	36 (25 - 54)	145 (102 - 204)	43 (25 - 76)	101 (67 - 146)	36 (23-58)	127 (88-179)
Common guillemot	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Razorbill	0 (0 - 0)	1 (2 - 7)	0 (0 - 0)	10 (6 - 17)	0 (0 - 0)	8 (6 - 14)	0 (0-1)	7 (5-12)
Little auk	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)
Atlantic puffin	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0 (0-0)	0 (0-0)

6.2.8 The numbers of lesser black-backed gull and great black-backed gull predicted to collide with wind turbines were greater. The collision rates were highest based on the 2010 population estimates for the lesser black-backed gull with 135 birds. For great black-backed gull, the highest collision estimates, of 181 birds, came from the 2010/11 population estimate.

6.2.9 Estimates were greatest for black-legged kittiwake and northern gannet. The maximum collision estimate for black-legged kittiwake was 661 birds based on the 2011/12 population. For northern gannet the maximum collision estimate was 382 birds, also based on the 2011/12 population and assuming a 99% avoidance rate.

6.2.10 Collision estimates were greatest for black-legged kittiwake and lesser black-backed gulls during the breeding season. Collision estimates were greater for the northern gannet and great black-backed gull during the non-breeding season (Table 5.4).

Evaluation for Ornithological Receptors

White-billed diver

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	8	100% displaced 37.5% mortality 4km buffer	10,000	<0.1	5000[3]	0.16	0	Negligible
Displacement (o)	16		10,000	0.16	5000[3]	0.32	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	10,000	<0.1	5000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		1,066	<0.1	533	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

6.2.11 Numbers in the Dogger Bank Zone as a whole surpassed 1% thresholds for populations of national and international importance. White-billed divers were present in the Dogger Bank Zone between November and April when an average of 43 birds was estimated to occur in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas. The population of this species was assessed to be of regional importance and consequently, the value of this receptor is assessed to be **medium**.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.12 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas (a monthly average of just 22 birds was estimated between November and April), of which eight birds would be predicted to be lost through mortality.

6.2.13 Consequently, following the method and assumptions presented for Dogger Bank Teesside A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

6.2.14 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be of **negligible** at both national and biogeographic scales.

Direct habitat loss or change

Wind farm and export cable corridors

6.2.15 The impact of habitat loss for both the wind farm area and cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Disturbance/displacement

6.2.16 A full displacement analysis was not undertaken due to the low numbers predicted for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas (a monthly average of just 43 birds was estimated between November and April), of which 16 birds would be predicted to be lost through mortality.

6.2.17 Consequently, following the method and assumptions presented for Dogger Bank Creyke Beck A, the effect of displacement for white-billed diver is considered to be of **negligible magnitude** at the national and biogeographic scales.

Significance

6.2.18 This species has a **medium value**. Combining the species' magnitude with value, the impact of this effect for white-billed diver is considered to be **negligible** at both national and biogeographic scales.

Collision

Species Overall sensitivity to collision – High (see section 5.2)

6.2.19 The effect of collision for white-billed diver for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is considered to be **negligible** following the assessment methodology and justification presented for Dogger Bank Teesside A.

Direct habitat loss or change

6.2.20 Following the methodology and justification presented in section 5.2, the impact of habitat loss for white-billed diver in Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Northern fulmar

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	5	98% avoidance Flight height option 3	10,200,000	<0.1	1,500,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		190,400	<0.1	28,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.21 The peak population estimates for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D in 2010, 2010/11 and 2011/12 were 3,285 birds (90% CIs = 2,684-3,894) in June, 1,611 birds (90% CIs = 1,283-1,968) in July, and 1,458 birds (90% CIs = 1,144-1,758) in October, respectively. The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project area in either year.

6.2.22 The value of this receptor is assessed as **very high** as the species is a breeding feature of 26 SPAs and a wintering feature of two SPAs in the Greater North Sea OSPAR region. The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are within foraging range of eight protected breeding sites in Great Britain, and a further site - Seevogelschutzgebiet Helgoland - around the North Sea.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.23 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.24 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Export cable corridor

6.2.25 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.26 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 540 adult northern fulmars in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 6.2).

6.2.27 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.46 (Appendix 9), and indicates that between 5 and 20% of the population at the Flamborough Head and Bempton Cliffs SPA and the Weybourne Cliffs and Hunstanton Cliffs SSSIs, and 1 and 5% of the populations at Buchan Ness to Collieston Coast SPA, Forth Islands SPA, Fowlsheugh SPA, Seevogelschutzgebiet Helgoland SPA, North Berwick Cliffs SSSI, Troup, Pennan and Lions Heads SSSI and Weybourne Cliffs SSSI are potentially exposed to this effect.

6.2.28 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009). In this case, the positions and separation of the projects means the increase in flight distance, due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D, is unlikely to be more than the distance presented by the six wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is approximately 25km (6.25% of the species' maximum foraging range of 400km). The projects are between 130km and 388km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1). This increase might prevent birds from two sites – the Troup, Pennan and Lions Heads and Seevogelschutzgebiet Helgoland SPAs – from reaching foraging areas beyond the project areas.

6.2.29 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

6.2.30 Based on the assessment of magnitude and the species' **very high value**, the overall significance of the potential barrier effect associated with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects for northern fulmar is assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.31 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just five northern fulmar per year.

6.2.32 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

6.2.33 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of the protected sites around the North Sea within foraging range. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.34 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

6.2.35 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.36 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.37 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and

biogeographic scales would be impacted by this effect. The effect of collision for northern fulmar for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and consequently, the impact of the effect considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.38 For northern fulmar, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.39 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern fulmar is considered to be **negligible**.

Northern gannet

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	73	75% displaced 5% mortality 2km buffer	967,000	<0.1	660,000	<0.1	0	Minor adverse
Displacement (o)	145		967,000	<0.1	660,000	<0.1	0	Minor adverse
Collision – population	258	99% avoidance Flight height option 3	967,000	<0.1	660,000	<0.1	0	Minor adverse
Collision – background adult mortality	198		52,218	0.4	35,640	0.5	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.40 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in 2010, 2010/11 and 2011/12 were 1,075 birds (90% CIs =916-1,269) in October, 5,047 birds (90% CIs = 4,323-5,903) in March, and 9,628 birds (90% CIs = 8,053-11,449) in March respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of nine SPAs, a wintering feature of five SPAs and a passage feature of five SPAs.

6.2.41 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are within foraging range of three protected breeding sites around the North Sea (two of which are within Great Britain) at which the species is a feature – the Seevogelschutzgebiet Helgoland, Firth of Forth Islands, and Flamborough Head and Bempton Cliffs SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.42 Based on 50% of the worst case values for displacement, analysis provided estimates of 384 (using 90% confidence limits = 326-458) displaced birds using 2010 data (153 during breeding months, 232 during other months of the year), 922 (using 90% confidence limits = 786-1,091) displaced birds using 2010/11 data (296 during breeding months, 626 during other months of the year), and 2,143 (using 90%

confidence limits = 1,803-2,554) displaced birds using 2011/12 data (940 during breeding months, 1,203 during other months of the year). The mean value was 1,220 (using 90% confidence limits = 1,031-1,450) displaced birds (501 during breeding months, 719 during other months of the year).

6.2.43 Tables A9.47a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where less than 0.1% of birds would be impacted.

6.2.44 Maximum estimates of the number of birds that are displaced and subsequently die, suggests that displacement would affect less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Less than 0.1% of the British breeding population would be impacted by this effect.

6.2.45 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.46 Less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for northern gannet for is thus considered of **negligible magnitude** at all scales.

Significance

6.2.47 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.48 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

6.2.49 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Export cable corridor

6.2.50 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Disturbance/displacement

Sensitivity to habitat loss – Very Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.51 Based on worst case values for displacement, analysis provided estimates of 768 (using 90% confidence limits = 652-916) displaced birds using 2010 data (305 during breeding months, 463 during other months of the year), 1,844 (using 90% confidence limits = 1,572-2,183) displaced birds using 2010/11 data (592 during breeding months, 1,252 during other months of the year), and 4,286 (using 90% confidence limits = 3,605-5,108) displaced birds using 2011/12 data (1,880 during breeding months, 2,406 during other months of the year). The mean value was 2,440 (using 90% confidence limits = 2,063-2,901) displaced birds (1,002 during breeding months, 1,438 during other months of the year).

6.2.52 Tables A9.48a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where much less than 0.1% of birds would be impacted.

6.2.53 Maximum estimates of the number of birds that are displaced and subsequently die, suggests that displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Less than 0.1% of the British breeding population would be impacted by this effect.

6.2.54 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.55 Less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for northern gannet is thus considered of **negligible magnitude** at all scales.

Significance

6.2.56 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.57 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 572 adult northern gannets in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 6.2).

6.2.58 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.49 (Appendix 9) which indicates that between 1 and 5% of the population at the Flamborough Head and Bempton Cliffs SPA might be potentially exposed to this effect.

6.2.59 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is unlikely to be more than the value presented by the six wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is thus approximately 25km, which is 10.9% of the species' maximum foraging range of 229km. The projects are between 130km and 195km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1). Recent tracking studies indicate that additional individuals from some other North Sea protected sites may also be impacted (e.g. Wakefield *et al.* 2013).

6.2.60 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

6.2.61 Based on the assessment of magnitude and the species' **very high value**, the overall significance of the potential barrier effect associated with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects for northern gannet is therefore, assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.62 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 217 (90% confidence limits = 178-258) northern gannet per year. Of these, 104 were predicted to occur during the breeding season and 114 were predicted to occur during the non-breeding season.

6.2.63 Tables A9.50a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The largest relative impact was predicted for the Flamborough Head and Bempton Cliffs SPA, where estimates of collisions during the breeding season represent 0.22% of the site population. Mean annual estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.64 The mean annual estimates, using 2011/12 data, of the numbers of collisions of adult birds apportioned to the Flamborough Head and Bempton Cliffs SPA represent 2.7% of the background mortality of adult northern gannets at this site and thus may be considered to be of **negligible magnitude** using this alternative approach.

6.2.65 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

6.2.66 Mean annual collision estimates represent much less than 0.1% of the species' biogeographic population.

6.2.67 The predicted number of collisions represents an increase in background mortality of less than 1% at the national and biogeographic population levels.

Significance

6.2.68 At the protected site, protected site suite, national and biogeographic scales, the effect of collision for northern gannet for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is considered to be of **negligible magnitude** and consequently, the impact is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.69 For northern gannet, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Therefore, we consider the effect of direct habitat loss or change to be of **negligible magnitude**.

Significance

6.2.70 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for northern gannet is considered to be **negligible**.

Arctic skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	<1	98% avoidance Flight height option 3	75,000	<0.1	6,300	<0.1	0	Minor adverse
Collision – background adult mortality	<1		5,700	<0.1	479	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.71 Arctic skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in 2010, 2010/11 and 2011/12 were 8 birds (90% CIs =1-26), 7 birds (90% CIs = 1-26), and 22 birds (90% CIs = 12-51), all peaks being in September, respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 12 SPAs and a passage feature of two SPAs.

6.2.72 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

6.2.73 It should be noted that the estimated numbers of Arctic skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.74 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for

this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.75 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Export cable corridor

6.2.76 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.77 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one Arctic skua collision per year.

6.2.78 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

6.2.79 Mean annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.80 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.81 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects, the magnitude of impact predicted at each geographic scale considered would be unchanged.

6.2.82 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.83 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for Arctic skua for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales and consequently, the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.84 For Arctic skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.85 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for Arctic skua is considered to be **negligible**.

Great skua

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	3	98% avoidance Flight height option 3	48,000	<0.1	28,800	<0.1	0	Minor adverse
Collision – background adult mortality	<1		3,584	<0.1	2,150	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.86 Great skua were present in the Dogger Bank Zone during autumn only. The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in 2010, 2010/11 and 2011/12 were 10 birds (90% CIs = 5-19), 10 birds (90% CIs = 5-19), and 39 birds (90% CIs = 28-61), all peaks being in September, respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of seven SPAs and a passage feature of two SPAs.

6.2.87 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are outside the foraging range of any protected site at which the species is a breeding feature. There are no national population estimates for this species for the passage or winter seasons.

6.2.88 It should be noted that the estimated numbers of great skua in the Dogger Bank Zone are probably underestimated due to the turnover of birds through the passage season.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.89 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for

this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.90 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Export cable corridor

6.2.91 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.92 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just two great skua collisions per year.

6.2.93 Estimates have not been apportioned to protected sites, due to the small numbers predicted. Maximum annual collision estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.94 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.95 Given that numbers of this species are possibly underestimated due to turnover (see above), even assuming an order of magnitude difference in the numbers estimated for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects, the magnitude of impact predicted at each geographic scale considered would be unchanged.

6.2.96 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.97 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite and biogeographic scales would be impacted by this effect. The effect of collision for great skua for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite and biogeographic scales and consequently, the impact of the effect is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.98 For great skua, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.99 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great skua is considered to be **negligible**.

Black-legged kittiwake

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	629	98% avoidance Flight height option 3	6,600,000	<0.1	1,110,000	<0.1	0	Moderate adverse
Collision – background adult mortality	510		259,600	0.1	43,660	1.1	1	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.100 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 18,441 (90% CIs = 16,021-20,618), 36,712 (90% CIs = 33,142-41,034), and 32,286 (90% CIs = 28,419-36,529) for 2010, 2010/11 and 2011/12 respectively, in March in all years. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 24 SPAs, a wintering feature of four SPAs and a passage feature of six SPAs.

6.2.101 The proposed project is within foraging range during the breeding season of three protected breeding sites around the North Sea at which the species is a feature, all of which are in Great Britain – Flamborough Head and Bempton Cliffs and Farne Islands SPAs and the Durham Coast and Marsden Bay SSSI. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.102 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.103 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Export cable corridor

6.2.104 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.105 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 4,307 adult black-legged kittiwakes in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 6.2).

6.2.106 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.51 (Appendix 9). The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are within foraging range of the Flamborough Head and Bempton Cliffs SPA and the Farne Islands SPA. Between 5 and 20% of the population at the Flamborough Head and Bempton Cliffs SPA and 1 and 5% of the Farne Islands SPA might be potentially exposed to this effect.

6.2.107 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is unlikely to be more than the greater presented by the six wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is thus approximately 25km (10.8% of the species' maximum foraging range of 231km). The projects are between 130km and 225km from the protected sites within foraging range that would be potentially impacted by this effect (Appendix 1). This increase might prevent birds from one site – the Durham Coast and Marsden Bay SSSI – from reaching foraging areas beyond the project areas.

6.2.108 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

6.2.109 Based on the assessment of magnitude and the species' **very high value**, the overall significance of the potential barrier effect associated with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects for black-legged kittiwake is therefore, assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.110 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 553 (90% confidence limits = 490-629) black-legged kittiwake collisions per year. Of these, 388 were predicted to occur during the breeding season and 165 during the non-breeding season.

6.2.111 Tables A9.52a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. The proposed projects are within foraging range of the Flamborough Head and Bempton Cliffs and Farne Islands SPAs, and the Durham Coast SSSI. Maximum annual estimates of the number of collisions represent 0.34%, 0.11% and 0.20% of these sites' respective populations.

6.2.112 The mean annual estimates of the numbers of collisions of adult birds apportioned to the Flamborough Head and Bempton Cliffs SPA represent 5.72% of the background mortality of adult black-legged kittiwakes at this site and thus may be considered to be of **low magnitude** using this alternative approach.

6.2.113 Mean annual estimates represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.114 The proposed projects are within foraging range of two protected breeding sites in Great Britain. Mean estimates of the number of collisions of birds in the breeding season represent 0.1% of the species' British population.

6.2.115 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.116 The predicted number of collisions represents an increase in background mortality of 1.1% at the national population level.

6.2.117 The predicted number of collisions represents an increase in background mortality of less than 1% at the biogeographic population level.

Significance

6.2.118 Based on the size of the impacts predicted relative to population size, the effect of collision for black-legged kittiwake for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects would be considered to be of Negligible magnitude and consequently, **Minor adverse** for the Farne Islands SPA and at protected site suite, national and biogeographic scales. However, the number of collisions of adult birds apportioned to the Flamborough Head and Bempton Cliffs SPA exceeds 5% of the background mortality of adult black-legged kittiwakes at this site. According to this alternative approach, this effect should also be considered of **low magnitude** for black-legged kittiwake at this site and thus the impact of the effect is considered to be **moderate adverse**.

6.2.119 At the protected site suite, national and biogeographic scales, effect of collision for black-legged kittiwake for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is considered to be of **negligible magnitude** and consequently, the impact is considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.120 For black-legged kittiwake, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.121 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for black-legged kittiwake is considered to be **negligible**.

Lesser black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	141	98% avoidance Flight height option 3	550,000	<0.1	B 120,000	<0.1	0	Minor adverse
					W 330,000	<0.1		
Collision – background adult mortality	39		31,900	0.1	B 6,960	0.5	0	
					W 19,140	0.2		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

6.2.122 The peak population estimates for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 916 birds (90% CIs = 648-1,303) in June, 462 birds (90% CIs = 329-639) in May, and 250 birds (90% CIs = 97-708) in May for 2010, 2010/11 and 2011/12 respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 21 SPAs, a wintering feature of two SPAs and a passage feature of three SPAs.

6.2.123 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are outside the foraging range of any protected site at which the species is a breeding feature.

6.2.124 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013) and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated, given that those present in the spring may be *intermedius* birds on passage to Scandinavia and thus due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.125 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.126 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Export cable corridor

6.2.127 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.128 The Band collision risk model (Band *et al.* 2012) provided a meanannual collision estimate of 88 (90% confidence limits = 55-141) lesser black-backed gull collisions per year. Of these, 58 were predicted to occur during the breeding season and 30 during the non-breeding season.

6.2.129 Tables A9.53a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Mean annual collision estimates represent less than 0.1% of the populations of each of the protected sites around the North Sea at which the species is a feature.

6.2.130 Mean winter estimates represent 0.1% of the winter population estimate for the species in Great Britain.

6.2.131 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

6.2.132 The predicted number of collisions represents an increase in background mortality of less than 1% (up to 0.29% using mean data) at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.133 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for great black-backed gull for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered to be of **negligible magnitude** at all scales and thus **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.134 For lesser black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.135 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for lesser black-backed gull is considered to be **negligible**.

Great black-backed gull

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Collision – population	237	98% avoidance Flight height option 3	420,000	<0.1	B 51,000	0.5	0	Minor adverse
					W 75,860	0.3		
Collision – background adult mortality	79		24,360	0.3	B 2,958	2.6	0	
					W 4,400	1.7		

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided; B = Breeding, W = winter.

Summary of population estimates and value

6.2.136 The peak population estimates for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 1,237 birds (90% CIs = 959-1,467) in January, 756 birds (90% CIs = 565-959) in March, and 553 birds (90% CIs = 406-725) in February for 2010, 2010/11 and 2011/12 respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 17 SPAs and a wintering feature of two SPAs.

6.2.137 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are outside the foraging range of any protected site at which the species is a breeding feature.

6.2.138 It should be noted that national winter population estimates for gulls come from a survey of terrestrial habitats and inshore waters (Burton *et al.* 2013) and thus do not include birds that frequent offshore waters; therefore, underestimating the overall national populations. It should also be noted that the estimated numbers of this species in the Dogger Bank Zone are possibly underestimated due to the potential turnover of birds at this time.

Construction and Decommissioning

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.139 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B,

Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.140 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Export cable corridor

6.2.141 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.142 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of 163 (90% confidence limits = 111-237) great black-backed gull collisions per year. Of these, 36 were predicted to occur in the breeding season and 127 were predicted to occur in the non-breeding season.

6.2.143 Tables A9.54a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites. Mean annual collision estimates represent 0.34% of the populations of each of the protected sites around the North Sea at which the species is a feature.

6.2.144 The mean annual estimates of the numbers of collisions represent an increase in background mortality of 1.1% at each of the protected sites around the North Sea at which this species is a feature. Under this alternative approach, the impact of collisions would be considered as being of **negligible magnitude** at the protected site and protected site suite levels.

6.2.145 Mean winter estimates represent 0.2% of the winter population estimate for the species in Great Britain.

6.2.146 Mean annual estimates represent less than 0.1% of the species' biogeographic population.

6.2.147 The predicted number of collisions represents an increase in background mortality of 2.6% at the national level during the breeding season and 1.7% during the non-breeding season.

6.2.148 The predicted number of collisions represents an increase in background mortality of less than 1% at the biogeographic population level.

Significance

6.2.149 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for great black-backed gull for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered to be of **negligible magnitude** at all scales and thus **minor adverse** at all scales. Background mortality at the protected site and protected site suite level is also considered to be of **negligible magnitude** and therefore **minor adverse** at these scales following this alternative approach.

Direct habitat loss or change

Overall sensitivity to habitat loss – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.150 For great black-backed gull, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.151 Combined with the species' High overall sensitivity to direct habitat loss or change, the impact of this effect for great black-backed gull is considered to be **negligible**.

Common guillemot

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	750	50% displaced 5% mortality 2km buffer	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Displacement (o)	1,499		5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	5,600,000	<0.1	2,640,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		201,600	< 0.01	95,040	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.152 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 43,806 birds in January (90% CIs = 40,080-47,811), 61,271 birds in March (90% CIs = 57,309-65,435), and 67,841 birds in April (90% CIs = 62,995-73,587) for 2010, 2010/11 and 2011/12 respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 26 SPAs, a wintering feature of 11 SPAs and a passage feature of one SPA.

6.2.153 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are within foraging range of seven protected breeding sites around the North Sea at which the species is a feature, of which six are in Great Britain – Buchan Ness to Collieston Coast, the Farne Islands, Firth of Forth Islands, Flamborough Head and Bempton Cliffs, Fowlsheugh and St Abb's Head to Fast Castle SPAs, and one borders the North Sea - Seevogelschutzgebiet Helgoland. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.154 Based on 50% of the worst case values for displacement, analysis provided estimates of 13,460 (using 90% confidence limits = 12,371-14,650) displaced birds

using 2010 data (2,268 during breeding months, 11,192 during other months of the year), 17,057 (using 90% confidence limits = 15,731-18,485) displaced birds using 2010/11 data (4,252 during breeding months, 12,805 during other months of the year), and 12,909 (using 90% confidence limits = 11,828-14,108) displaced birds using 2011/12 data (4,940 during breeding months, 7,969 during other months of the year). The mean value was 13,777 (using 90% confidence limits = 12,671-14,991) displaced birds (3,870 during breeding months, 9,907 during other months of the year).

6.2.155 Tables A9.55a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where up to 0.13 (0.11-0.14)% of birds (using mean data) would be impacted.

6.2.156 Displacement would affect less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

6.2.157 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.158 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for common guillemot for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.159 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.160 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.161 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Export cable corridor

6.2.162 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **minor adverse.**

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.163 Based on worst case values for displacement, analysis provided estimates of 26,921 (using 90% confidence limits = 24,743-29,301) displaced birds using 2010 data (4,536 during breeding months, 22,385 during other months of the year), 34,114 (using 90% confidence limits = 31,462-36,970) displaced birds using 2010/11 data (8,504 during breeding months, 25,609 during other months of the year), and 25,817 (using 90% confidence limits = 23,655-28,216) displaced birds using 2011/12 data (9,880 during breeding months, 15,937 during other months of the year). The mean value was 27,555 (using 90% confidence limits = 25,342-29,982) displaced birds (7,741 during breeding months, 19,814 during other months of the year).

6.2.164 Tables A9.56a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where less than 1%, of birds, up to 0.25 (0.23-0.27)% (using mean data), would be impacted.

6.2.165 Displacement would affect up to 0.11% (using mean data), of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect less than 0.1% of the British breeding population.

6.2.166 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.167 Less than 1% of the reference population at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect

of displacement for common guillemot for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.168 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.169 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 1,292 adult common guillemots in flight in the project areas in the breeding season using 2010, 2010/11 and 2011/12 data (Table 6.2).

6.2.170 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.57 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

6.2.171 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is unlikely to be more than the greater presented by the six wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is thus approximately 25km (7.4% of the species' maximum foraging range of 340km). The projects are between 130km and 340km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from five sites – the Fowlsheugh SPA, Forth Islands SPA, Buchan Ness to Collieston Coast SPAand St Abb's Head to Fast Castle SPA – from reaching foraging areas beyond the project areas.

6.2.172 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.173 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one common guillemot collision.

6.2.174 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

6.2.175 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of the six protected sites within foraging range around the North Sea. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.176 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

6.2.177 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.178 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.179 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for common guillemot for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and consequently, the impact of the effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.180 For common guillemot, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.181 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for common guillemot is considered to be **minor adverse**.

Razorbill

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	206	50% displaced 5% mortality 2km buffer	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Displacement (o)	412		1,380,000	<0.1	330,000	0.12	0	Minor adverse
Collision – population	17	98% avoidance Flight height option 3	1,380,000	<0.1	330,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		92,000	<0.1	22,000	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.182 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 16,113 birds in January (90% CIs = 13,809-18,637), 29,932 birds in April (90% CIs = 26,685-33,522), and 23,879 birds in March (90% CIs = 21,320-26,916) for 2010, 2010/11 and 2011/12 respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 18 SPAs, a wintering feature of five SPAs and a passage feature of two SPAs.

6.2.183 The Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects are within foraging range of five protected breeding sites around the North Sea at which the species is a feature – the Farne Islands, Firth of Forth Islands, Flamborough Head and Bempton Cliffs, Fowlsheugh and St Abb's Head to Fast Castle SPAs. There are no national population estimates for this species for the winter.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.184 Based on 50% of the worst case values for displacement, analysis provided estimates of 3,896 (using 90% confidence limits = 3,387-4,433) displaced birds using 2010 data (148 during breeding months, 3,747 during other months of the year), 4,488 (using 90% confidence limits = 3,933-5,102) displaced birds using 2010/11 data (323 during breeding months, 4,165 during other months of the year), and 3,268

(using 90% confidence limits = 2,818-3,809) displaced birds using 2011/12 data (710 during breeding months, 2,558 during other months of the year). The mean value was 3,594 (using 90% confidence limits = 3,125-4,121) displaced birds (392 during breeding months, 3,202 during other months of the year).

6.2.185 Tables A9.58a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where up to 0.11 (0.1-0.13)% of birds (using mean data), would be impacted.

6.2.186 Displacement would affect less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

6.2.187 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.188 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.189 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at the all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.190 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.191 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **negligible**.

Export cable corridor

Export cable corridor

6.2.192 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **minor adverse.**

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.193 Based on worst case values for displacement, analysis provided estimates of 7,792 (using 90% confidence limits = 6,774-8,866) displaced birds using 2010 data (297 during breeding months, 7,495 during other months of the year), 8,976 (using 90% confidence limits = 7,866-10,204) displaced birds using 2010/11 data (646 during breeding months, 8,329 during other months of the year), and 6,536 (using 90% confidence limits = 5,636-7,618) displaced birds using 2011/12 data (1,420 during breeding months, 5,115 during other months of the year). The mean value was 7,188 (using 90% confidence limits = 6,251-8,242) displaced birds (784 during breeding months, 6,405 during other months of the year).

6.2.194 Tables A9.59a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). The biggest effect would be at the Flamborough Head and Bempton Cliffs SPA, where less than 1%, up to 0.23 (0.19-0.26)% of birds (using mean data), would be impacted.

6.2.195 Displacement would affect up to 0.16% (using mean data), of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect up to 0.12% (using mean data), of the British breeding population.

6.2.196 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.197 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for razorbill for the Dogger Bank Teesside A and B, Dogger Bank

Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.198 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Barrier effects

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.199 Based on upper 90% confidence limits and estimates of the proportions of birds in flight from boat surveys, it was estimated that there would be a mean maxima of 278 adult razorbills in flight in the project areas in the breeding season using 2010,2010/11 and 2011/12 data (Table 6.2).

6.2.200 The numbers of birds exposed to this effect represent less than 0.1% of national or biogeographic populations. The apportioning of these estimates to individual protected sites is summarised in Table A9.60 (Appendix 9) which indicates that less than 1% of the breeding populations at each of the sites within foraging range would be potentially exposed to this effect.

6.2.201 The potential cumulative impacts of barrier effects from multiple wind farms are not likely to be additive (King *et al.* 2009) and in this case, due to the positions and separation of the projects, the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is unlikely to be more than the greater presented by the six wind farm projects on their own. The average increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is thus approximately 25km (8.0% of the species' maximum foraging range of 312km). The projects are between 130km and 308km from the protected sites within foraging range that would be potentially exposed to this effect (Appendix 1). This increase might prevent birds from three sites – the Firth of Forth Islands, Fowlsheugh and St Abb's Head to Fast Castle SPAs – from reaching foraging areas beyond the project areas.

6.2.202 Considering both the numbers of birds exposed to this effect and the increase in flight distance due to the barrier presented by Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D this impact is considered to be of **negligible magnitude** at protected site, national and biogeographic levels.

Significance

6.2.203 Based on the assessment of magnitude and the species' **very high value,** the overall significance of the potential barrier effect associated with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and

D projects for razorbill is therefore, assessed as **minor adverse** at the protected site, national and biogeographic levels.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.204 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of just 10 (90% CIs 6 – 17) razorbill collisions, restricted to the non-breeding season.

6.2.205 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

6.2.206 Mean annual estimates of the number of collisions represent less than 0.1% of the populations of each of the five protected sites within foraging range around the North Sea. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.207 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British breeding population.

6.2.208 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.209 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.210 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for razorbill for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and consequently, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.211 For razorbill, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.212 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for razorbill is considered to be **minor adverse**.

Little auk

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	16	25% displaced 5% mortality 2km buffer	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Displacement (o)	31		125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – population	<1	98% avoidance Flight height option 3	125,000,000	<0.1	5,000[3]	<0.1	0	Negligible
Collision – background adult mortality	<1		8,333,333	<0.1	333	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.
[3] Assumption of 50 birds used as a national threshold (see section 4).

Summary of population estimates and value

6.2.213 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 9,781 birds in December (90% CIs = 7,998-12,775), 9,781 birds in December (90% CIs = 7,998-12,775), and 3,442 birds in December (90% CIs = 2,871-4,531) for 2010, 2010/11 and 2011/12 respectively. The little auk breeds in the high Arctic and only occurs in the North Sea during the winter. Although there is no British population estimate for little auk, given the numbers estimated, this species is deemed to be of national importance in the Dogger Bank Creyke Beck A and B project areas. Consequently, the value of this receptor is assessed to be **high**.

Construction and Decommissioning

Disturbance/displacement

Wind farm

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.214 Taking 50% of the worst-case maximum annual estimates in winter months, when this species occurs, a total of 347 birds would be displaced during 2010 (using 90% confidence limits = 260-488), 282.7 during 2010/11 (using 90% confidence limits = 223-377) and 108.9 during 2011/12 (using 90% confidence limits = 87-151). The mean value was 225 (using 90% confidence limits = 173-311) displaced birds.

6.2.215 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), much less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.216 Less than 1% of reference populations at the national and biogeographic scales would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at national level and biogeographic scales.

Significance

6.2.217 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at national and biogeographic scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.218 The 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.219 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Export cable corridor

6.2.220 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **negligible.**

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Low (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.221 Based on worst case values for displacement, a total of 693 birds would be displaced during 2010 (using 90% confidence limits = 519-977), 565.4 during 2010/11 (using 90% confidence limits = 447-755) and 218 during 2011/12 (using 90% confidence limits = 174-301). The mean value was 450 (using 90% confidence limits = 346-622) displaced birds.

6.2.222 Using a national 1% threshold of 500 birds (in the absence of a national winter population estimate), less than 0.1% of this population would be affected. Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.223 Less than 1% of reference populations at the national and biogeographic scales would be impacted by this effect. The effect of displacement for little auk for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at national and biogeographic scales.

Significance

6.2.224 This species has a **high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **negligible** at both national and biogeographic scales.

Collision

Species Overall sensitivity to collision – High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.225 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one little auk collision per year.

6.2.226 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.227 The predicted number of collisions represents an increase in background mortality of less than 1% at the national and biogeographic population levels.

Significance

6.2.228 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for little auk for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and consequently, considered to be **negligible**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.229 For little auk, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.230 Combined with the species' Medium overall sensitivity to direct habitat loss or change, the impact of this effect for little auk is considered to be **negligible**.

Atlantic puffin

Effect[1]	Impact	Assumptions	Biogeographic population[2]		National population[2]		Protected sites impacted	Significance
			Size	%	Size	%		
Displacement (c/d)	23	25% displaced 5% mortality 2km buffer	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Displacement (o)	45		13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – population	<1	98% avoidance Flight height option 3	13,500,000	<0.1	1,740,000	<0.1	0	Minor adverse
Collision – background adult mortality	<1		68,4000	<0.1	88,160	<0.1	0	

[1] The effects of habitat loss or change and barrier effects are assessed in a qualitative or semi-quantitative manner; for details see text below; c= construction, d = decommissioning; o = operation.
[2] Individuals; in relation to collision, the estimated background adult mortality is also provided.

Summary of population estimates and value

6.2.231 The peak population estimates for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas were 3,634 birds in October (90% CIs = 3,018-4,502), 4,119 birds in March (90% CIs = 3,699-4,734), and 1,157 birds in March (90% CIs = 996-1,380) for 2010, 2010/11 and 2011/12 respectively. The value of this receptor is assessed as **very high** as the species in the Greater North Sea OSPAR region is a breeding feature of 16 SPAs.

6.2.232 The proposed project is outside the foraging range of any protected site at which the species is a breeding feature.

Construction and Decommissioning

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.233 Based on 50% of the worst case values for displacement, analysis provided estimates of 437 (using 90% confidence limits = 354-543) displaced birds using 2010 data (51 during breeding months, 386 during other months of the year), 629 (using 90% confidence limits = 529-759) displaced birds using 2010/11 data (104 during breeding months, 524 during other months of the year), and 164 (using 90% confidence limits = 133-198) displaced birds using 2011/12 data (50 during breeding months, 114 during other months of the year). The mean value was 371 (using 90% confidence limits = 306-453) displaced birds (68 during breeding months, 303 during other months of the year).

6.2.234 Tables A9.61a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

6.2.235 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.236 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.237 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Direct habitat loss or change

Wind farm

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.238 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.239 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Export cable corridor

6.2.240 The impact of habitat loss for the cable corridors for Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D is as assessed for Dogger Bank Teesside A – **minor adverse.**

Operation

Disturbance/displacement

Species-specific sensitivity to habitat loss – Medium (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.241 Based on worst case values for displacement, analysis provided estimates of 873 (using 90% confidence limits = 708-1,087) displaced birds using 2010 data (101 during breeding months, 772 during other months of the year), 1,257 (using 90% confidence limits = 1,057-1,517) displaced birds using 2010/11 data (208 during breeding months, 1,049 during other months of the year), and 328 (using 90% confidence limits = 267-396) displaced birds using 2011/12 data (100 during breeding months, 227 during other months of the year). The mean value was 742 (using 90% confidence limits = 613-906) displaced birds (137 during breeding months, 605 during other months of the year).

6.2.242 Tables A9.62a-d (Appendix 9) summarise the apportioning of these estimates to individual protected sites for the maximal displacement scenario, after applying the mortality value for this species (5%). Displacement would affect much less than 0.1% of the total population of the suite of protected sites around the North Sea at which the species is a feature. Displacement would affect much less than 0.1% of the British breeding population.

6.2.243 Displacement would affect much less than 0.1% of the species' biogeographic population.

6.2.244 Less than 1% of reference populations at the protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of displacement for Atlantic puffin for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project is thus considered of **negligible magnitude** at all scales.

Significance

6.2.245 This species has a **very high value**. Combining the species' magnitude with value, the impact of this effect is considered to be **minor adverse** at all scales.

Collision

Species Overall sensitivity to collision – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.246 The Band collision risk model (Band *et al.* 2012) provided a mean annual collision estimate of less than one Atlantic puffin collision per year.

6.2.247 Estimates have not been apportioned to protected sites, due to the small numbers predicted.

6.2.248 Mean annual estimates of the number of collisions represent less than 0.1% of the populations at the protected site level. Mean annual estimates also represent less than 0.1% of the total population of the overall suite of protected sites around the North Sea at which the species is a feature.

6.2.249 Mean estimates of the number of collisions of birds in the breeding season represent less than 0.1% of the species' British, breeding population.

6.2.250 Mean annual collision estimates represent less than 0.1% of the species' biogeographic population.

6.2.251 The predicted number of collisions represents an increase in background mortality of less than 1% at the protected site, protected site suite, national and biogeographic population levels.

Significance

6.2.252 Considering the collision risk estimates based on the upper 90% confidence limit of the population in the year in which the species' population was greatest, less than 1% of reference populations at protected site, protected site suite, national and biogeographic scales would be impacted by this effect. The effect of collision for Atlantic puffin for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered of **negligible magnitude** at protected site, protected site suite, national and biogeographic scales and consequently, considered to be **minor adverse**.

Direct habitat loss or change

Overall sensitivity to habitat loss – Very High (see section 5.2)

Magnitude of effect (Duration/Frequency/Extent/Size)

6.2.253 For Atlantic puffin, the 1% thresholds for populations of national and international importance were not exceeded in the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D project areas in

either year (see section 3). Combined with information on this species diet (see section 4), for this receptor the effect of direct habitat loss or change is considered to be of **negligible magnitude**.

Significance

6.2.254 Combined with the species' Very High overall sensitivity to direct habitat loss or change, the impact of this effect for Atlantic puffin is considered to be **minor adverse**.

Migrants

Operation

Collision

6.2.255 The migration zones (defined by Wright *et al.* 2012) of 47 species' populations of terrestrial or waterbird migrants that are UK SPA features overlap with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects during migration. Note, the migration zone of two of these – barnacle goose (from the Svalbard population) and goosander (males from the British Isles breeding population on moult migration) – only overlapped the Dogger Bank Creyke Beck B and Dogger Bank Teesside C and D projects. Collision risk estimates suggest that, on an annual basis, the mortality associated with the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is likely to represent less than 1% of the reference population of each of these species (Table 6.5).

6.2.256 The effect of collision for migrants for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects is thus considered to be of **negligible magnitude** at the national level and **minor adverse** for 17 species' populations and **negligible** for 30 species' populations.

6.2.257 Due to the lack of knowledge concerning species' precise migration routes and their likely variability no attempt was made to apportion impacts to individual protected sites and thus it is unknown whether impacts may potentially be greater or less at any one particular site.

6.2.258 It should also be noted that for migrants there is much greater uncertainty in these calculations and thus the assessment both in regard to the determination of the numbers of birds passing through each project area and the proportions of these flying at heights which pose a risk of collision. Given these uncertainties the confidence in predictions in the assessment of collision for migrants is considered to be very low.

Table 6.5 Assessment of collision risk for migrants for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects. Estimated numbers of collisions are based on modelling of the numbers of birds predicted to pass through the wind farm project, a 98% avoidance rate and expert judgement of the proportion of individuals likely to be flying at a height which places them at risk of collision. Three scenarios were run using the lower central and upper limits of the range of the proportion of birds at risk height as described in Wright *et al.* (2012) with the central value used for the purposes of assessment. It is important to note that the values in brackets under "estimated annual collisions" simply represent the estimates using the lower and upper estimates of the proportion of birds at risk height, and do not represent any kind of measure of confidence in the collision estimates (which would have a far greater range).

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Bean goose *Anser fabalis*	0.10 (0.02 - 0.24)	<0.1%	12.47%	Very High	Low	High	Negligible	Negligible
Barnacle goose (Svalbard population) *Branta leucopsis*	0.08 (0.01 - 0.20)	<0.1%	0.24%	Very High	Very High	Very High	Negligible	Minor adverse
Light-bellied brent goose (Svalbard population) *Branta bernicla hrota*	0.25 (0.041 - 0.62)	<0.1%	7.40%	Very High	High	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	3.93 (0.03 - 15.70)	<0.1%	10.28%	Very High	High	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	22.25 (0.15 - 89.01)	<0.1%	9.58%	Very High	Very Low	Medium	Negligible	Negligible
Gadwall *Anas strepera*	0.36 (0.002 - 1.45)	<0.1%	5.77%	Very High	Very Low	Medium	Negligible	Negligible
Eurasian teal *Anas crecca*	5.27 (0.04 - 21.09)	<0.1%	9.61%	Very High	Very Low	Medium	Negligible	Negligible
Mallard *Anas platyrhynchos*	16.19 (0.11 - 64.75)	<0.1%	10.28%	Very High	Very Low	Medium	Negligible	Negligible
Northern pintail *Anas acuta*	0.71 (0.005 - 2.84)	<0.1%	9.61%	Very High	Very Low	Medium	Negligible	Negligible
Northern shoveler *Anas clypeata*	0.54 (0.004 - 2.17)	<0.1%	8.19%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Common pochard *Aythya ferina*	2.12 (0.01 - 8.49)	<0.1%	8.19%	Very High	Very Low	Medium	Negligible	Negligible
Tufted duck *Aythya fuligula*	4.03 (0.03 - 16.10)	<0.1%	9.51%	Very High	Very Low	Medium	Negligible	Negligible
Greater scaup *Aythya marila*	0.02 (0.0001 - 0.07)	<0.1%	7.63%	Very High	Very Low	Medium	Negligible	Negligible
Common scoter *Melanitta nigra*	0.19 (0.02 - 3.16)	<0.1%	9.61%	Very High	Low	High	Negligible	Negligible
Velvet scoter *Melanitta fusca*	0.12 (0.001 - 0.49)	<0.1%	11.27%	Very High	Low	High	Negligible	Negligible
Common goldeneye *Bucephala clangula*	1.38 (0.01 - 5.54)	<0.1%	10.28%	Very High	Low	High	Negligible	Negligible
Red-breasted merganser *Mergus serrator*	0.01 (0.0001 - 0.04)	<0.1%	7.18%	Very High	Medium	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (breeding males)	0.003 (0.00002 - 0.01)	<0.1%	0.15%	Very High	Medium	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	0.18 (0.001 - 0.72)	<0.1%	11.12%	Very High	Medium	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0.02 (0.002 - 0.05)	<0.1%	4.17%	Very High	Very Low	Medium	Negligible	Negligible
Great crested grebe *Podiceps cristatus*	0.53 (0.05 - 2.10)	<0.1%	6.87%	Very High	Medium	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0.02 (0.002 - 0.06)	<0.1%	9.61%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0.003 (0.001 - 0.005)	<0.1%	4.70%	Very High	Medium	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0.07 (0.03 - 0.14)	<0.1%	11.27%	Very High	Medium	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0.84 (0.08 - 1.59)	<0.1%	1.07%	Very High	Very Low	Medium	Negligible	Negligible

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	7.53 (1.51 - 22.58)	<0.1%	9.61%	Very High	High	Very High	Negligible	Minor adverse
Common ringed plover *Charadrius hiaticula* (non-breeding)	1.30 (0.26 - 3.91)	<0.1%	10.39%	Very High	Low	High	Negligible	Negligible
Golden plover *Pluvialis apricaria* (non-breeding)	13.45 (2.69 - 40.36)	<0.1%	9.20%	Very High	Very Low	Medium	Negligible	Negligible
Grey plover *Pluvialis squatarola*	3.73 (0.75 - 11.19)	<0.1%	10.29%	Very High	High	Very High	Negligible	Minor adverse
Northern lapwing *Vanellus vanellus*	34.52 (6.90 - 103.55)	<0.1%	10.29%	Very High	Very Low	Medium	Negligible	Negligible
Red knot *Calidris canutus*	11.51 (2.30 - 34.53)	<0.1%	9.59%	Very High	Medium	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	2.95 (0.59 - 8.84)	<0.1%	9.59%	Very High	Medium	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	0.24 (0.05 - 0.72)	<0.1%	9.62%	Very High	Very Low	Medium	Negligible	Negligible
Dunlin *Calidris alpina alpina* (passage & winter)	26.27 (5.25 - 78.81)	<0.1%	8.88%	Very High	Very Low	Medium	Negligible	Negligible
Ruff *Philomachus pugnax*	0.19 (0.04 - 0.56)	<0.1%	11.06%	Very High	Very Low	Medium	Negligible	Negligible
Common snipe *Gallinago gallinago*	33.91 (6.78 - 101.73)	<0.1%	9.61%	Very High	Very Low	Medium	Negligible	Negligible
Black-tailed godwit *Limosa limosa islandica*	0.20 (0.04 - 0.60)	<0.1%	9.08%	Very High	Very High	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	4.47 (0.89 - 13.41)	<0.1%	10.78%	Very High	Very Low	Medium	Negligible	Negligible
Whimbrel *Numenius phaeopus*	0.85 (0.17 - 2.55)	<0.1%	9.47%	Very High	High	Very High	Negligible	Minor adverse

Species	Estimated annual collisions	% reference population[1]	% migration zone[2]	Value	Species sensitivity	Overall Sensitivity	Magnitude	Significance
Eurasian curlew *Numenius arquata* (non-breeding)	6.83 (1.37 - 20.49)	<0.1%	10.03%	Very High	Very Low	Medium	Negligible	Negligible
Greenshank *Tringa nebularia*	0.002 (0.0003 - 0.005)	<0.1%	7.62%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank *Tringa totanus britannica* (breeding)	0.22 (0.04 - 0.65)	<0.1%	9.95%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	9.11 (1.82 - 27.34)	<0.1%	9.17%	Very High	Very Low	Medium	Negligible	Negligible
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	2.01 (0.40 - 6.04)	<0.1%	11.15%	Very High	Very Low	Medium	Negligible	Negligible
Ruddy turnstone *Arenaria interpres*	1.62 (0.32 - 4.85)	<0.1%	9.60%	Very High	High	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	0.07 (0.01 - 0.13)	<0.1%	9.93%	Very High	Very Low	Medium	Negligible	Negligible
European nightjar *Caprimulgus europaeus*	0.06 (0.01 - 0.11)	<0.1%	3.09%	Very High	Very Low	Medium	Negligible	Negligible

[1] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[2] The migration zone referred to here is the North Sea migration area appropriate to assessment for the Dogger Bank, and not the entire migration zone used by the species around the whole of the UK. The percentage given can be roughly interpreted as the percentage of birds migrating across the North Sea that would cross the wind farm footprint during a single migration period (note for most species there are 2 migrations per year crossing the North Sea). For further details see the SOSS migration modelling tool guidance (Wright *et al*. 2012).

Barrier effects

6.2.259 An assessment of the potential barrier effects posed by the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects to the 47 species' populations of terrestrial or waterbird migrants that are UK SPA features whose migration zones (defined by Wright *et al.* 2012) overlap with the project area is provided in Table 6.6 below. Note, the migration zone of two of these – barnacle goose (from the Svalbard population) and goosander (males from the British Isles breeding population on moult migration) – only overlapped the Dogger Bank Creyke Beck B and Dogger Bank Teesside C and D projects.

6.2.260 The percentages of reference populations estimated to pass through the project areas at risk height (following Wright *et al.* 2012) and thus exposed to potential barrier effects were less than 1% for 17 of the species' populations considered, but greater than 1% for 30 species' populations. The estimates of numbers passing through the project areas greatly exceed the numbers recorded by boat surveys, though it should be noted that boat surveys were not designed to record migrants and as they only provide a (diurnal) snapshot of birds flying close to the sea, they will inevitably greatly underestimate overall numbers of migrants.

6.2.261 The increase in flight distance due to the barrier presented by the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects varies by direction of flight, although due to the positions of the projects, for the shortest approximately east-west route across the North Sea passing through the project, equates to a maximum of approximately 45km (an increase of just 8% on the ca. 575km route).

6.2.262 Considering both the numbers of birds exposed to this effect and the relative increase in flight distance due to the barrier presented by the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects, this impact is considered to be of **negligible magnitude** for all species' populations.

6.2.263 It should be noted that there is considerable uncertainty regarding the assessment of barrier effects posed by offshore wind farms. For migrants, there is great uncertainty in the determination of the numbers of birds passing through each project area. There is little evidence to suggest whether or not migration may be concentrated within corridors within overall migration zones (Wright *et al.* 2012) and it cannot be assumed that birds fly directly to or from the protected sites that they are features of. It is also assumed that the wind farm poses a barrier effect to 100% of birds attempting to fly through at risk height (Maclean *et al.* 2009) which may be over-precautionary. In particular, there is considerable uncertainty as to the actual consequences for survival, and thus for population-level impacts, from the increase in energy expenditure associated with the increases in flight distance for those birds exposed to barrier effects. Given these uncertainties, the confidence in predictions in the assessment of barrier effects is considered to be very low and considerable caution is urged in considering the outcomes of this assessment.

Table 6.6 Assessment of barrier effects for migrants for the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects.

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Bean goose *Anser fabalis*	0	1	27	3.74%	Very High	Negligible	Minor adverse
Barnacle goose (Svalbard population) *Branta leucopsis*	0	4	23	0.07%	Very High	Negligible	Minor adverse
Light-bellied Brent Goose (Svalbard population) *Branta bernicla hrota*	0	30	75	2.22%	Very High	Negligible	Minor adverse
Common shelduck *Tadorna tadorna*	0	0	1166	1.54%	Very High	Negligible	Minor adverse
Eurasian wigeon *Anas penelope*	0	8	7132	1.37%	Very High	Negligible	Minor adverse
Gadwall *Anas strepera*	0	0	114	0.52%	Very High	Negligible	Minor adverse
Eurasian teal *Anas crecca*	0	1	1799	0.72%	Very High	Negligible	Minor adverse
Mallard *Anas platyrhynchos*	2	3	4960	1.08%	Very High	Negligible	Minor adverse
Northern pintail *Anas acuta*	2	1	218	0.72%	Very High	Negligible	Minor adverse
Northern shoveler *Anas clypeata*	0	0	174	0.92%	Very High	Negligible	Minor adverse
Common pochard *Aythya ferina*	0	3	687	0.92%	Very High	Negligible	Minor adverse
Tufted duck *Aythya fuligula*	2	0	1321	1.28%	Very High	Negligible	Minor adverse
Greater scaup *Aythya marila*	0	0	6	0.06%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common scoter *Melanitta nigra*	113	191	59	0.05%	Very High	Negligible	Minor adverse
Velvet scoter *Melanitta fusca*	4	9	38	1.52%	Very High	Negligible	Minor adverse
Common goldeneye *Bucephala clangula*	2	0	450	1.54%	Very High	Negligible	Minor adverse
Red-breasted merganser *Mergus serrator*	0	0	3	0.11%	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (breeding males)	5	0	1	0.02%	Very High	Negligible	Minor adverse
Goosander *Mergus merganser* (non-breeding)	5	0	54	1.67%	Very High	Negligible	Minor adverse
Great bittern *Botaurus stellaris*	0	0	6	1.46%	Very High	Negligible	Minor adverse
Great crested grebe *Podiceps cristatus*	0	0	167	0.69%	Very High	Negligible	Minor adverse
Slavonian grebe *Podiceps auritus*	0	0	5	0.48%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (breeding)	0	0	1	0.24%	Very High	Negligible	Minor adverse
Hen harrier *Circus cyaneus* (non-breeding)	0	0	17	4.51%	Very High	Negligible	Minor adverse
Eurasian coot *Fulica atra*	0	0	281	0.27%	Very High	Negligible	Minor adverse
Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)	2	8	2403	1.20%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Common ringed plover *Charadrius hiaticula* (non-breeding)	4	4	948	1.30%	Very High	Negligible	Minor adverse
Golden plover *Pluvialis apricaria* (non-breeding)	0	5	4602	1.15%	Very High	Negligible	Minor adverse
Grey plover *Pluvialis squatarola*	0	0	1268	2.57%	Very High	Negligible	Minor adverse
Northern lapwing *Vanellus vanellus*	0	19	11548	2.57%	Very High	Negligible	Minor adverse
Red knot *Calidris canutus*	3	15	4063	1.20%	Very High	Negligible	Minor adverse
Sanderling *Calidris alba*	6	0	1079	1.80%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina schinzii (passage)*	16	18	89	2.40%	Very High	Negligible	Minor adverse
Dunlin *Calidris alpina alpina* (passage & winter)	16	18	9729	2.22%	Very High	Negligible	Minor adverse
Ruff *Philomachus pugnax*	0	3	66	2.77%	Very High	Negligible	Minor adverse
Common snipe *Gallinago gallinago*	1	0	12015	1.20%	Very High	Negligible	Minor adverse
Black-tailed godwit *Limosa limosa islandica*	0	0	128	2.27%	Very High	Negligible	Minor adverse
Bar-tailed godwit *Limosa lapponica*	0	0	1462	2.69%	Very High	Negligible	Minor adverse
Whimbrel *Numenius phaeopus*	6	27	273	1.18%	Very High	Negligible	Minor adverse
Eurasian curlew *Numenius arquata* (non-breeding)	51	4	2052	2.51%	Very High	Negligible	Minor adverse

Species	Number recorded by boat surveys in 2010[1]	Number recorded by boat surveys in 2011[1]	Estimated number crossing project[2]	% reference population[3]	Value	Magnitude[4]	Significance
Greenshank *Tringa nebularia*	0	1	1	0.19%	Very High	Negligible	Minor adverse
Common redshank *Tringa totanus britannica* (breeding)	0	0	75	0.25%	Very High	Negligible	Minor adverse
Common redshank Icelandic population *Tringa totanus robusta* (non-breeding)	0	0	3152	1.15%	Very High	Negligible	Minor adverse
Common redshank mainland Europe population *Tringa totanus* (non-breeding)	0	0	697	2.79%	Very High	Negligible	Minor adverse
Ruddy turnstone *Arenaria interpres*	7	12	576	1.20%	Very High	Negligible	Minor adverse
Short-eared owl *Asio flammeus*	2	23	18	1.74%	Very High	Negligible	Minor adverse
European Nightjar *Caprimulgus europaeus*	0	0	18	0.15%	Very High	Negligible	Minor adverse

[1] Across Dogger Bank Zone as a whole (see section 3).

[2] The estimated number of individuals of each species crossing the project is the number that would pass through at risk height (using the best estimate of the proportion of migrating birds at risk height from Wright *et al*. 2012 and not accounting for uncertainty) during a single migration season. Note that for most species, two migrations per year would be expected, and different individual birds may be involved during spring and autumn passage.

[3] The reference population size is defined as the total number of individuals of each species in the population that uses the migration route that encompasses the Dogger Bank. For further details and derivation see Table 4.18.

[4] Magnitude is assessed here according to Table 4.1.

Summary for all receptors

6.2.264 Table 6.7 below provides a summary of impacts from each effect for all key marine bird receptors.

Table 6.7 Summary of potential impacts from the Dogger Bank Teesside A and B, Dogger Bank Creyke Beck A and B and Dogger Bank Teesside C and D projects for key marine bird receptors.

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
White-billed diver	Displacement (construction/decommissioning)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	Medium	High	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Medium	High	High	Negligible	Negligible	Very Low
	Displacement (operation)	National	Medium	-	-	Negligible	Negligible	Low
		Biogeographic	Medium	-	-	Negligible	Negligible	Low
	Collision (operation)	National	Medium	High	High	Negligible	Negligible	Medium
		Biogeographic	Medium	High	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	Medium	High	High	Negligible	Negligible	Very Low
Northern fulmar	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Northern gannet	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Arctic skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Great skua	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	High	Very High	Negligible	Minor adverse	Low
		National	Very High	High	Very High	Negligible	Minor adverse	Medium

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Biogeographic	Very High	High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Black-legged kittiwake	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Low	Moderate adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low
Lesser black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Very Low	Medium	Negligible	Negligible	Very Low
Great black-backed gull	Habitat loss or change (construction/decommissioning)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	Very High	Low	High	Negligible	Negligible	Very Low
	Collision (operation)	Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Low	High	Negligible	Negligible	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
Common guillemot	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Razorbill	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Barrier effects (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Very Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Very Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
Little auk	Displacement (construction/decommissioning)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Habitat loss or change (construction/decommissioning)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Habitat loss or change (cable construction)	All	High	Low	Medium	Negligible	Negligible	Very Low
	Displacement (operation)	National	High	-	-	Negligible	Negligible	Low
		Biogeographic	High	-	-	Negligible	Negligible	Low
	Collision (operation)	National	High	Medium	High	Negligible	Negligible	Medium
		Biogeographic	High	Medium	High	Negligible	Negligible	Medium
	Habitat loss or change (operation)	All	High	Low	Medium	Negligible	Negligible	Very Low
Atlantic puffin	Displacement (construction/decommissioning)	Protected site	Very High	-	-	Negligible	Minor adverse	Low
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Habitat loss or change (construction/decommissioning)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Habitat loss or change (cable construction)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low
	Displacement (operation)	Protected site	Very High	-	-	Negligible	Minor adverse	Low

Receptor	Effect	Geographical scale	Value	Species sensitivity	Overall sensitivity	Magnitude	Significance	Confidence
		Site suite	Very High	-	-	Negligible	Minor adverse	Very Low
		National	Very High	-	-	Negligible	Minor adverse	Low
		Biogeographic	Very High	-	-	Negligible	Minor adverse	Low
	Collision (operation)	Protected site	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Site suite	Very High	Very High	Very High	Negligible	Minor adverse	Low
		National	Very High	Very High	Very High	Negligible	Minor adverse	Medium
		Biogeographic	Very High	Very High	Very High	Negligible	Minor adverse	Medium
	Habitat loss or change (operation)	All	Very High	Medium	Very High	Negligible	Minor adverse	Very Low