



**BTO Research Report No. 175**

**Review of Natural Avian  
Mortality Rates**

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## 1. INTRODUCTION

In the attached table we present summary information regarding published reliable estimates of natural mortality rates for a list of bird species specified by JNCC. For a few species, published estimates are not listed because they are not considered to be reliable (e.g. Golden Eagle, Kingfisher, Raven). Where available we present age-specific survival estimates, along with an indication of the amount and type of data contributing to the estimate, the duration of the study, the region for which the data relate and the reference. Survival estimates printed in bold are those considered most likely to be representative of UK populations.

Below we list species for which we could not find any reliable published information. For these species we also list the numbers of recoveries available for birds ringed in the UK up until 1994, and we also indicate the existence of more detailed retrap/resight data available from other studies.

Great Crested Grebe	<b>316 recoveries</b>
Bittern	15 recoveries
Mandarin	36 recoveries
Pochard	<b>1279 recoveries</b>
Red-breasted Merganser	14 recoveries
Montagu's Harrier	39 recoveries
Golden Eagle	36 recoveries
Merlin	<b>702 recoveries</b>
Corncrake	15 recoveries; <b>RSPB study</b>
Dotterel	36 recoveries; <b>SNH study</b>
Grey Plover	<b>356 recoveries</b> ; retraps
Greenshank	67 recoveries
Great Black-backed Gull	<b>2226 recoveries</b>
Great Black-headed Gull	0 recoveries
Little Tern	<b>157 recoveries</b>
Rock Dove	30 recoveries
Nightjar	69 recoveries
Kingfisher	<b>726 recoveries</b>
Cuckoo	<b>130 recoveries</b>
Marsh Tit	<b>141 recoveries</b>
Great Grey Shrike	8 recoveries
Raven	<b>545 recoveries</b>
Hooded Crow	see Carrion Crow
Jay	<b>990 recoveries</b>
Cirl Bunting	6 recoveries; <b>RSPB study</b>

For species for which there are more than 500 recoveries there should be no problem in calculating a reliable adult survival estimate from these existing data. For species for which there are at least 100 recoveries (indicated in bold) it **MAY** be possible to obtain a reasonable estimate of adult survival from existing data.



Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference
<i>Fulmar Fulmarus glacialis</i>	97.2 (0.5)	Adult	-	17	Mark-resighting	Orkney, UK	1
	97.1 (0.4)	Adult ♂					
	97.2 (0.5)	Adult ♀	96	4	Mark-resighting	Scotland, UK	2
	98.0	Adult					
<i>Manx Shearwater Puffinus puffinus</i>	90.2	Adult	914	7	Retraps	Stockholm, UK	3
<i>Gannet Morus bassanus</i>	93.9	Adults	232	4	Mark-resighting	Bass Rock, UK	4
	92.4	Adult ♂	110				
	95.3	Adult ♀	122				
<i>Cormorant Phalacrocorax carbo</i>	39.8 (1.1)	1st year	} 2409	21	Recoveries	UK	5
	72.5 (1.2)	Adult					
<i>Shag Phalacrocorax aristotelis</i>	83.0 (0.7)	Adult	3297	11	Mark-resighting	Farne Islands, UK	6
	87.8	Adult	3495	25	Mark-resighting & recoveries	Scotland, UK	98
<i>Grey Heron Ardea cinerea</i>	44.6	1st year	-	31	Recoveries	UK	7
	58.7 (2.1)	2nd year					
	73.2 (1.8)	Adult					

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference			
Mute Swan <i>Cygnus olor</i>	41.4	1st year	-	18	Mark-resighting	UK	8			
	67.7	2nd year	-							
	69.3	3rd year	-							
	77.4	4th year	-							
	79.5	5th year	-							
Bewick's Swan <i>Cygnus columbianus</i>	85.0	3 years+	-	-	-	-	9			
Whooper Swan <i>Cygnus cygnus</i>	83.0	4 months+	-	-	-	Iceland	9			
Pink-footed Goose <i>Anser brachyrhynchus</i>	77.5 (5.7)	Juvenile	} 2384	9	Recoveries	UK	10			
	86.3 (2.2)	Adult								
White-fronted Goose <i>Anser albifrons</i>	72.0 (10.6)	Adult	62	6	Recoveries	Slimbridge, UK	11			
Greenland White-fronted Goose <i>Anser albifrons flavirostris</i>	59.6 (15.2)	1st year	-	6	Recoveries	UK	12			
	72.4 (7.2)	Adult	-							
	63.8 (7.2)*	1st year	-					8	Mark-resighting	UK
	73.8 (5.0)*	Adult								
Greylag Goose <i>Anser anser</i>	66.0 (2.3)	1st year	-	8	Recoveries	UK	13			
	77.0 (2.9)	Adult	-					7		
Canada Goose <i>Branta canadensis</i>	75.9 (1.3)	Juvenile	1105	24	Recoveries	UK	14			
	72.4 (0.6)	Adult						1652		
Barnacle Goose <i>Branta leucopsis</i>	90.3 (0.9)	All ages	-	11	Recoveries	UK	12			
	90.0 (0.8)	Adult ♂	1160					10	Mark-resighting	Europe
	90.0 (1.1)	Adult ♀	1105							

Table: Natural Avian Survival Rates



Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference
Brent Goose <i>Branta bernicla</i> <i>Branta bernicla hrota</i>	86.0 83.0	From 1st winter	-	-	-	UK	31
Wigeon <i>Anas penelope</i>	53.0	Adult	-	-	Recoveries	North-west Europe	31
Teal <i>Anas crecca</i>	56.6 (3.5) 54.1 (1.2)	Juvenile Adult	-	18	Recoveries	UK	17
Mallard <i>Anas platyrhynchos</i>	51.8 (2.7) 62.5 (2.1)	1st year ♂ Adult ♂	}1067	9	Recoveries	USA	18
Tufted Duck <i>Aythya fuligula</i>	54.0	All ages	-	-	Recoveries	North-west Europe	31
Scaup <i>Aythya marila</i>	48.0	All ages	-	-	Recoveries	Iceland	31
Eider <i>Somateria mollissima</i>	93.6 (1.9)	Adult	-	15	Recoveries	Scotland, UK	19
Goldeneye <i>Bucephala clangula</i>	82.9 77.0 (3.4)	Adult ♀ Adult ♀	54 -	12 23	Retraps Retraps & recoveries	Germany Sweden	20 21
Goosander <i>Mergus merganser</i>	60.0	All ages	-	-	-	-	31
Red Kite <i>Milvus milvus</i>	82.0	All ages	962 total population	22	Census	Wales, UK	22
White-tailed Eagle <i>Haliaeetus albicilla</i>	73.0 94.0	Immature Adult	15 home ranges	8	Mark-resighting	UK	23

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference
Marsh Harrier <i>Circus aeruginosus</i>	52.0	1st year	-	-	Recoveries	Finland, Germany & Holland	24
	47.0	2nd year					
	62.0	3rd year					
	74.0	4th year					
Hen Harrier <i>Circus cyaneus</i>	72.0	Adult ♂	-	7	Mark-resighting	Orkney, UK	25
	90.0	Adult ♀					
Goshawk <i>Accipiter gentilis</i>	42.0	1st year	-	-	Recoveries	Germany	26
	62.0	2nd year					
	52.0	Adult					
	37.0	1st year	-	-			
	67.0	2nd year					
81.0	Adult						
Sparrowhawk <i>Accipiter nisus</i>	57.6 (4.1)	Adult	243	13	Recoveries	UK	28
	31.0	1st year ♂	All ♂s 60	-			
	49.0	1st year ♀	All ♀s 79				
	67.0	Adult ♂					
	71.0	Adult ♀					
	65.7	3-5 years ♀	619	19			
Buzzard <i>Buteo buteo</i>	49.0	1st year	-	-	Recoveries	Germany	30
	68.0	2nd year					
	81.0	Adult					
Osprey <i>Pandion haliaetus</i>	42.7	1st year	-	22	Recoveries	USA	32
	81.5	Adult	206				
	46.7	1st year	47	14			
	80.4	Adult	37				
Kestrel <i>Falco tinnunculus</i>	58.7 (3.0)	Adult	352	13	Recoveries	UK	28
Hobby <i>Falco subbuteo</i>	45.0	1st year	-	-	-	Germany	24

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
<i>Peregrine Falco peregrinus</i>	41.0	1st year Adult	-	-	Recoveries	Sweden	33
	68.0	1st year Adult	-	-	Recoveries	Germany	34
Willow/Red Grouse <i>Lagopus lagopus</i>	44.0	0-4 years	411	6	Recoveries	Scotland, UK	35
	72.0	5-6 years	16				
Black Grouse <i>Tetrao tetrix</i>	66.0	Adult	228	11	Mark-resighting & retraps	Holland	36
Grey Partridge <i>Perdix perdix</i>	55.0	-	-	-	Winter losses excluding shooting	UK	37
Pheasant <i>Phasianus colchicus</i>	18.6	1st year Adult	-	-	-	Denmark	38
Moorhen <i>Gallinula chloropus</i>	41.6	Adult	-	-	-		
	62.3 (5.2)	Adult	164	13	Recoveries	UK	28
Coot <i>Fulica atra</i>	69.7 (4.6)	Adult	139	13	Recoveries	UK	28
	43.0	Adult		4	Retraps	France	39
Oystercatcher <i>Haematopus ostralegus</i>	92.5	-	-	5	Recoveries	Germany	40
	88.0	Adult	688	5	Mark-resighting	UK	97
Stone-curlew <i>Burhinus oedipnemus</i>	60.6	1st year					
	83.2	Adult	181	>20	Recoveries	England	99
Ringed Plover <i>Charadrius hiaticula</i>	77.2 (8.6)	Adult	58	13	Recoveries	UK	28

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference
Golden Plover <i>Pluvialis apricaria</i>	59.3	Adult	-	-	Recoveries	Europe	16
Lapwing <i>Vanellus vanellus</i>	59.5 (4.0) 75.2 (4.6)	1st year Adult	1085 545	29 58	Recoveries	UK	41
Sanderling <i>Calidris alba</i>	83.0	Adult	-	-	Mark-resighting	Wintering (UK) & breeding areas	42
Dunlin <i>Calidris alpina</i>	83.0	Adult	-	-	Mark-resighting	Wintering (UK) & breeding areas Finland	42
Snipe <i>Gallinago gallinago</i>	74.1 (2.8) 62.0 (3.7)	Adult	323	8	Mark-resightings		94
Woodcock <i>Scolopax rusticola</i>	47.0 (2.0) 58.0 (2.0)	Adult	209	13	Recoveries	UK	28
Black-tailed Godwit <i>Limosa limosa</i>	62.4 68.0 63.1	1st year 2nd year Adult	} 892	81	Recoveries	UK	43
Whimbrel <i>Numenius phaeopus</i>	89.0 (3.0)	Adult	-	-	-	Holland	44
Curlew <i>Numenius arquata</i>	47.0 73.6 (2.5)	1st year Adult	120	3	Mark-resighting	Shetland, UK	45
			153	66	Recoveries	UK	46

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
Redshank <i>Tringa totanus</i>	76.0	Adult	-	-	-	wintering (UK) & breeding area Moray Firth, Scotland	42
	43.0 (3.6)	1st year	} 533	17	Retraps		
	67.0 (5.0)	Sub-adult					
	74.0 (1.4)	Adult					
	75.0	Adult ♂					
72.4	Adult ♀						
Turnstone <i>Arenaria interpres</i>	84.5	Adult	-	-	-	Lancashire, UK	95
	86.0	Adult	83	3	Mark-resighting		
Great Skua <i>Stercorarius skua</i>	80.0	1st year	-	4	Recoveries	Shetland, UK	47
	93.0 (2.0)	Adult	236				
Black-headed Gull <i>Larus ridibundus</i>	82.0 (3.2)	Adult	144	8	Retraps	France UK	48
	61.7	1st year	} 1855	28	Recoveries		
	72.5	2nd year					
	76.0	Adult					
Common Gull <i>Larus canus</i>	86.5 (1.9)	Ad-cold winter				-	16
	89.6 (1.0)	Adult-normal "					
	92.9 (1.9)	Adult-warm "					
Lesser Black-backed Gull <i>Larus fuscus</i>	90.7 (1.8)	Adult ♀	-	6	Mark-recapture	Isle of May, Scotland, UK	90
	91.8 (1.6)	Adult ♂					
Herring Gull <i>Larus argentatus</i>	77.6	1st year	298	3	Retraps	UK	51
	93.5 (10.0)	Adult	-	5			
	89.8 (1.6)	Adult ♀	-	6	Mark-recapture		
	85.8 (2.0)	Adult ♂	-				

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Species	Survival rate and (se)	Age of birds	Number of recoveries/ retraps	Study duration (years)	Type of data	Region	Reference
Kittiwake <i>Rissa tridactyla</i>	81.0 (1.0) 86.0 (0.8)	Adult ♂ Adult ♀	1338 ringed 1475 ringed	21	Mark-resighting	North Shields, UK	52
Common Tern <i>Sterna hirundo</i>	81.0	-	-	-	Recoveries	Germany	40
Arctic Tern <i>Sterna paradisaea</i>	89.5 - 91.0	-	-	-	Recoveries	Germany	40
Guillemot <i>Uria aalge</i>	95.0 (0.8) 95.5 (0.6) 94.9 (0.6) 87.9 (2.0) 91.5 94.0	Adult ♂ Adult ♀ All adults Adult Adult Adult	266 231 519 45 229 106	11 12 3 5	Mark-resighting Recoveries Mark-resighting Mark-resighting	Isle of May, UK UK Skomer, UK Skomer, UK	53 100 101 102
Razorbill <i>Alca torda</i>	89.0 (1.0)	Adult	96	11	Recoveries	UK	54
Puffin <i>Fratercula arctica</i>	97.5 (0.4)	Adult	-	8	Mark-resighting	Isle of May, UK	55
Feral Pigeon <i>Columba livia feral</i>	57.0 (7.3) 66.5 (4.9)	1st year Adult	235 341	4	Mark-resighting	UK	56
Woodpigeon <i>Columba palumbus</i>	60.7 (1.6) 54.8 (3.0)	Adult Adult	1365 319	26 13	Recoveries Recoveries	UK UK	57 28
Collared Dove <i>Streptopelia decaocto</i>	64.2 (2.2) 55.7 (4.3)	Adult Adult	583 160	26 13	Recoveries Recoveries	UK UK	57 28
Barn Owl <i>Tyto alba</i>	57.3 (3.4) 63.1	Adult Adult	246 1451	13 12	Recoveries Recoveries	UK UK	28 96

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference				
Little Owl <i>Athene noctua</i>	29.9	1st year	}35	71	Recoveries	Germany & Holland	58				
	<b>64.8</b> (5.8)	Adult									
Tawny Owl <i>Strix aluco</i>	59.6 (4.3)	Adult	173	13	Recoveries	UK	28				
	<b>76.8</b>	Adult	1293	12	Recoveries	UK	96				
Long-eared Owl <i>Astotus</i>	48.0	1st year	-	-	-	Germany & Switzerland	59				
	<b>69.0</b>	Adult									
Swift <i>Apus apus</i>	76.0 (2.5)	Adult	383	13	Recoveries	UK	28				
	76.2 (1.8)	Adult		40	Retraps	Scotland, UK	60				
	<b>80.8</b> (3.3)	Adult		20	Recoveries	UK	19				
Skylark <i>Alauda arvensis</i>	<b>67.0</b>	Adult	133	6	Mark-resighting	UK	61				
Swallow <i>Hirundo rustica</i>	34.5 (2.7)	Adult	650	13	Recoveries	UK	28				
	<b>57.0</b> (6.1)	Adult						18	Recoveries	France	62
	49.5 (4.7)	Adult						3	Retraps	France	63
House Martin <i>Delichon urbica</i>	<b>34.0</b> (7.2)	Adult	117	13	Recoveries	UK	28				
Meadow Pipit <i>Anthus pratensis</i>	54.3 (12.2)	Adult	50	13	Recoveries	UK	28				
	44.0 (2.6)	Adult & 1st year						908	25	Recoveries	Belgium
Pied Wagtail <i>Motacilla alba</i>	49.4 (3.1)	Adult	436	13	Recoveries	UK	28				
	49.7 (6.9)	Adult						123	6	Recoveries	UK
Dipper <i>Cinclus cinclus</i>	54.0	Adult	47	20	Recoveries	UK	66				
	56.0 (2.5)	Adult						133	6	Retraps	France

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
<i>Wren Troglodytes troglodytes</i>	31.9 (7.0)	Adult	202	13	Recoveries	UK	28
	31.8 (6.8)	Adult	29	8	Retraps	UK	68
	30.6 (4.2)	Adult	88	20	Retraps	UK	69
<i>Dunnock <i>Prunella modularis</i></i>	45.8 (1.9)	Adult	894	13	Recoveries	UK	28
	44.7 (5.0)	Adult	265	6	Recoveries	UK	65
	42.2 (4.0)	Adult	51	8	Retraps	UK	68
	45.1 (2.8)	Adult	272	21	Retraps	UK	70
	47.2	Adult	<300	9	Retraps	UK	71
<i>Robin <i>Erithacus rubecula</i></i>	48.4 (1.8)	Adult	1087	13	Recoveries	UK	28
	48.2 (3.8)	Adult	536	6	Recoveries	UK	65
	35.1 (4.9)	Adult	117	21	Retraps	UK	70
	50.0	Adult	19	4	Mark-resighting	Belgium	72
<i>Redstart <i>Phoenicurus phoenicurus</i></i>	49.0 (10.0)	All ages	30	-	Recoveries	Finland	73
<i>Blackbird <i>Turdus merula</i></i>	61.7 (1.0)	Adult	232	13	Recoveries	UK	28
	66.8 (2.0)	Adult	1307	6	Recoveries	UK	65
	58.1 (2.9)	Adult	165	8	Retraps	UK	68
<i>Fieldfare <i>Turdus pilaris</i></i>	39.0 (5.1)	All ages	90	-	Recoveries	Finland	73
<i>Song Thrush <i>Turdus philomelos</i></i>	57.2 (1.4)	Adult	2042	13	Recoveries	UK	28
	65.7 (4.8)	Adult	239	6	Recoveries	UK	65
	58.1 (2.0)	Adult	526	15	Recoveries	UK	74
<i>Redwing <i>Turdus iliacus</i></i>	42.0 (5.7)	All ages	73	-	Recoveries	Finland	73

Table: Natural Avian Survival Rates



Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
Mistle Thrush <i>Turdus viscivorus</i>	71.0 (5.0)	Adult	158	13	Recoveries	UK	28
Sedge Warbler <i>Acrocephalus schoenobaenus</i>	34.9 (8.9) 48.3 (2.9)	Adult Adult	100 179	13 14	Recoveries Retraps	UK UK	28 75
Reed Warbler <i>Acrocephalus scirpaceus</i>	54.5 (7.2) 61.2 (4.4) 55.8 (2.3) 49.6 (2.6)	Adult Adult Adult Adult	140 448 957 168	13 14 6 8	Recoveries Retraps Recoveries Retraps	UK UK UK UK	28 75 65 68
Whitethroat <i>Sylvia communis</i>	44.3	Adult	120	9	Retraps	UK	68
Blackcap <i>Sylvia atricapilla</i>	42.6 (11.6) 44.3 (5.7) 53.4 (12.8)	Adult Adult Adult	146 51 197	13 8 6	Recoveries Retraps Recoveries	UK UK UK	28 68 65
Wood Warbler <i>Phylloscopus sibilatrix</i>	39.5 (14.0)	All Ages	29	-	Retraps	Belgium	76
Goldcrest <i>Regulus regulus</i>	14.9 (12.6)	Adult	44	13	Recoveries	UK	28
Long-tailed Tit <i>Aegithalos caedatus</i>	46.4 (16.1)	Adult	78	13	Recoveries	UK	28
Coal Tit <i>Parus ater</i>	37.2 (7.8)	Adult	116	13	Recoveries	UK	28

Table: Natural Avian Survival Rates

Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
Blue Tit <i>Parus caeruleus</i>	54.2 (1.0)	Adult	2602	13	Recoveries	UK	28
	48.6 (3.5)	Adult	634	6	Recoveries	UK	65
	50.8	Adult	164	7	Retraps	Belgium	77
Great Tit <i>Parus major</i>	57.7 (1.6)	Adult	1006	13	Recoveries	UK	28
	38.1 (4.4)	Adult	275	6	Recoveries	UK	65
	51.0	Adult	362	9	Retraps	Netherlands	78
	42.0	Adult	1124	19	Retraps	UK	79
Nuthatch <i>Sitta europaea</i>	53.0	Adult	35	5	Mark-resighting	Belgium	80
	47.0	Adult	36	6	Mark-resighting	Sweden	81
Treecreeper <i>Certhia familiaris</i>	47.7 (5.0)	Adult	49	20	Retraps	UK	69
Magpie <i>Pica pica</i>	69.5 (7.6)	Adult	48	13	Recoveries	UK	28
	43.0 (6.8)	Adult	44	-	Recoveries	Finland	73
Chough <i>Pyrrhocorax pyrrhocorax</i>	71.0	1st year	}173	3	Mark-resighting	Scotland, UK	82
	74.0	2nd year					
Jackdaw <i>Corvus monedula</i>	69.4 (5.9)	Adult	97	13	Recoveries	UK	28
	62.0	1st year	117	-	Recoveries	UK	83
	64.0	2nd year	68				
		3rd-5th year	102				
Rook <i>Corvus frugilegus</i>	74.9 (3.2)	Adult	196	13	Recoveries	UK	28
Carrion Crow <i>Corvus corone</i>	60.8 (5.7)	Adult	84	13	Recoveries	UK	28

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Species	Survival rate and (se)	Age of birds	Number of recoveries/retraps	Study duration (years)	Type of data	Region	Reference
Starling <i>Sturnus vulgaris</i>	48.4 (1.0)	Adult	1321	13	Recoveries	UK	28
	64.9 (2.6)	Adult	768	6	Recoveries	UK	65
	48.0	Adult	197	-	Recoveries	UK	84
	47.2 (1.0)	Adult	1384	41	Recoveries	UK	85
House Sparrow <i>Passer domesticus</i>	55.4 (2.3)	Adult	846	13	Recoveries	UK	28
	46.8 (3.7)	Adult	541	7	Retraps	Spain	86
Tree Sparrow <i>Passer montanus</i>	43.3 (6.7)	Adult	33	13	Recoveries	UK	28
Chaffinch <i>Fringilla coelebs</i>	63.9 (2.1)	Adult	641	13	Recoveries	UK	28
	54.8 (4.7)	Adult	190	6	Recoveries	UK	65
	48.9 (13.1)	Adult	51	8	Retraps	UK	68
Greenfinch <i>Carduelis chloris</i>	48.8 (4.0)	Adult	714	6	Recoveries	UK	65
Crossbill <i>Loxia curvirostra</i>	46.3 (15.4)	Adult	27	4	Retraps	Spain	87
Bullfinch <i>Pyrrhula pyrrhula</i>	44.4 (1.9)	Adult	720	13	Recoveries	UK	28
	39.8 (4.9)	Adult	159	6	Recoveries	UK	65
Snow Bunting <i>Plectrophenax nivalis</i>	63.0	Adult	-	-	-	Scotland, UK	88
Corn Bunting <i>Miliaria calandra</i>	58.0 (4.0)	-	-	-	-	Germany	89

\* calculated arithmetic means from estimates

Table: Natural Avian Survival Rates



## REFERENCES

- 1 Dunnet & Ollason 1978; 2 Macdonald 1977; 3 Perrins et al. 1973; 4 Nelson 1966; 5 Christine Wernham pers comms.; 6 Potts et al. 1980; 7 Freeman & North 1990; 8 Coleman & Minton 1980; 9 Beer & Ogilvie 1972; 10 Gitay et al. 1990; 11 Boyd 1957; 12 Bell et al. 1993; 13 Boyd & Ogilvie 1972; 14 Will Peach pers comms.; 15 Ebbinge et al. 1991; 16 Boyd 1962a; 17 Gitay et al. 1990; 18 Freeman & Morgan 1992; 19 Baillie & Green 1987; 20 Bräger 1986; 21 Dow & Fredga 1984; 22 Walters et al. 1973; 23 Green et al. 1996; 24 Glutz et al. 1971; 25 Picozzi 1984; 26 Kramer 1973; 27 Haukioja & Haukioja 1970; 28 Dobson 1990; 29 Newton 1986; 30 Mebs 1964; 31 Boyd 1962b; 32 Henny & Wight 1969; 33 Lindberg 1977; 34 Mebs 1971; 35 Jenkins et al. 1967; 36 De Vos 1983; 37 Cramp 1980; 38 Paludan 1959; 39 Clobert et al. 1985; 40 Grosskopf 1964; 41 Peach et al. 1994; 42 Evans 1991; 43 Hoodless & Coulson 1994; 44 Glutz et al. 1977; 45 Grant 1991; 46 Bainbridge & Minton 1978; 47 Furness 1978; 48 Clobert et al. 1987; 49 Flegg & Cox 1975; 50 Rattiste & Lilleleht 1995; 51 Chabrzyk & Coulson 1976; 52 Coulson & Wooler 1976; 53 Harris & Wanless 1995; 54 Lloyd 1974; 55 Harris et al (in press); 56 Murton et al. 1972; 57 Aebischer 1995; 58 Exo & Hennes 1980; 59 Glutz & Bauer 1980; 60 Thomson et al. 1996; 61 Delius 1965; 62 Hemery et al. 1979; 63 Coquillart 1981; 64 Spaepen 1988; 65 Baillie & McCulloch 1993; 66 Galbraith & Tyler 1982; 67 Lebreton et al. 1992; 68 Peach 1993; 69 Peach et al. 1995; 70 Peach unpublished; 71 Davies 1992; 72 Adriaensen & Dhondt 1990; 73 Haukioja 1969; 74 David Thomson pers comm.; 75 Peach et al. 1990; 76 Fourage 1968; 77 Dhondt 1989; 78 Kluijver 1951; 79 Clobert et al 1988; 80 Matthysen 1989; 81 Nilsson 1982; 82 Bignal et al. 1987; 84 Lack & Schifferli 1948; 85 Coulson 1960; 86 Senar & Copete 1995; 87 Senar et al. 1993; 88 Cramp & Perrins 1994; 89 Lubcke 1977; 90 Wanless et al. in press; 91 Insley et al. in press; 92 Metcalfe & Furness 1985; 93 Newton et al. 1997; 94 Soikkeli 1970; 95 Thompson & Hale 1993; 96 Percival 1990; 97 Goss-Custard et al. 1982; 98 Harris et al 1994; 99 Green et al. in press; 100 Birkhead 1974; 101 Birkhead & Hudson 1977; 102 Hatchwell & Birkhead 1991.



## LITERATURE CITED

- Adriaensen, F and A.A Dhondt. 1990. Population dynamics and partial migration of the European Robin (*Erithacus rubecula*) in different habitats. *Journal of Animal Ecology* 59:1077-1090.
- Aebischer, N.J. 1995. Investigating the effects of hunting on British pigeons and doves by analysis of ringing recoveries. *Journal of Applied Statistics* 22:923-934.
- Baillie, S.R. and R.E. Green. 1987. The importance of variation in recovery rates when estimating survival rates from ringing recoveries. *Acta Ornithologica* Vol. 23 No. 1.
- Baillie, S.R., and N.M. McCulloch. 1993. Modelling the survival rates of passerines ringed during the breeding season from national ringing and recovery data. Pages 123-140 in J.D. Lebreton and P.M. North (eds.) *Marked Individuals in the Study of Bird Populations*. Birkhauser Verlag, Basel, Switzerland.
- Bainbridge, I.P. and Minton, C.D.T. 1978. The migration and mortality of the Curlew in Britain and Ireland. *Bird Study* 25:39-50.
- Beer, J.V. and Ogilvie, M.A. 1972. Pages 125-142 in Scott, P. and the Wildfowl Trust. *The Swans*.
- Bell, M.C., A.D. Fox, M. Owen, J.M. Black and A.J. Walsh. 1993. Approaches to estimation of survival in two Arctic-nesting Goose species in Lebreton, J.D. and P.M. North. *Marked Individuals in the Study of Bird Populations*.
- Signal, E., P. Monaghan, S. Benn, S. Signal, E. Still and P.M. Thompson. 1987. Breeding success and post-fledging survival in the Chough *Pyrhacorax pyrrhacorax*. *Bird Study* 34:39-42.
- Birkhead, T.R. 1974. Movement and mortality rates of British Guillemots. *Bird Study* 21: 241-254.
- Birkhead, T.R. & Hudson, P.J. 1977. Population parameters for the Common Guillemot *Uria aalge*. *Ornis Scandinavica* 8: 145-154
- Boyd, H. 1957. Mortality and fertility of the White-fronted Goose. *Bird Study* 4:80-93.
- Boyd, H. 1962a. Mortality and fertility of European Charadrii. *Ibis* 104: 368-387.
- Boyd, H. 1962b. Population dynamics and the exploitation of ducks and geese. In Le Cren, H.E.D. and Holdgate, H.M.W. (eds.) *The exploitation of natural animal populations*. Oxford.
- Boyd, H. and Ogilvie, M.A. 1972. Icelandic Greylag Geese wintering in Britain in 1960-1971. *Wildfowl* 23:64-82.

Bräger, S. 1986. Brutbiologie und Populationsdynamik einer Population der Schellente (*Bucephala clangula*) in Nord-deutschland. *Die Vogelwelt* 107:1-17.

Chabrzyk, G. and J.C. Coulson. 1976. Survival and recruitment in the Herring Gull *Larus argentatus*. *Journal of Animal Ecology* 45:187-203.

Clobert, J., J.D. Lebreton, M. Clobert-Gillet and H. Coquillart. 1985. The estimation of survival in bird populations by recapture or sightings of marked individuals in B.J.T. Morgan and P.M. North(eds.) *Statistics in Ornithology*. Springer Verlag, New York.

Clobert, J., J.D. Lebreton and D. Allaine. 1987. A general approach to survival rate estimation by recaptures or re-sighting of marked birds. *Ardea* 75:133-142.

Clobert, J., C.M. Perrins, R.H. McCleery, and A.G. Gosler. 1988. Survival rate in the great tit *Parus major* in relation to sex, age, and immigration status. *Journal of Animal Ecology* 57:287-306.

Coleman, A.E. and C.D.T. Minton. 1980. Mortality of Mute Swan progeny in the area of South Staffordshire. *Wildfowl* 31:22-28.

Coquillart, H. 1981. Modelisation de la dynamique des populations d'hirondelles de cheminee (*Hirundo rustica*) a l'echelle regionale. *These de 3eme cycle*. Universite Lyon I, Lyon, 93 pp.

Coulson, J.C. 1960. A study of the mortality of the Starling based on ringing recoveries. *Journal of Animal Ecology* 29:251-271.

Coulson, J.C. and R.D. Wooller. 1976. Differential survival rates among breeding Kittiwake gulls *Rissa tridactyla* (L.). *Journal of Animal Ecology* 45:205-213.

Cramp, S. (ed.) 1980. *Handbook of the Birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic*. Vol II.

Cramp, S. and C.M. Perrins (eds.) 1994. *Handbook of the Birds of Europe, the Middle East and North Africa: The birds of the Western Palearctic*. Vol IX.

Davies, N.B. 1992. *Dunnock behaviour and social evolution*. Oxford University Press, Oxford.

Delius, J.D. 1965. A population study of Skylarks *Alauda arvensis*. *Ibis* 107:466-492.

De Vos, G.J. 1983. Social behaviour of Black Grouse. An observational and experimental field study. *Ardea* 71:1-103.

Dhondt, A.A. 1989. Blue Tit. Pages 15-33 in I. Newton (ed.) *Lifetime Reproduction in Birds*. Academic Press, London.

Dobson, A.P. 1990. Survival rates and their relationship to life-history traits in some common British birds. *Current Ornithology* 7:115-146.



Dow, H. and S. Fredga. 1984. Factors affecting reproductive output of the goldeneye duck (*Bucephala clangula*). *Journal of Animal Ecology* 53:679-692.

Dunnet, G.M., and J.C. Ollason. 1978. The estimation of survival rate in the fulmar *Fulmarus glacialis*. *Journal of Animal Ecology* 47:507-520.

Ebbinge, B.S., J.B. Van Biezen and H. Van Der Voet. 1991. Estimation of annual adult survival rates of Barnacle Geese *Branta leucopsis* using multiple resightings of marked individuals. *Ardea* 79:73-112.

Evans, P.R. 1991. Seasonal and annual patterns of mortality in migratory shorebirds: some conservation implications in Perrins, C.M., J.D. Lebreton and G.J.M. Hirons (eds.) *Bird Populations Studies. Relevance to Conservation and Management*.

Exo, K.M. and Hennes, R. 1980. Beitrag zur Populationsökologie des Steinkauzes (*Athene noctua*) - eine Analyse deutscher und neiderländischer Ringfunde. *Die Vogelwarte* 30:162-179.

Flegg, J.J.M. and C.J. Cox. 1975. Mortality in the Black-headed Gull. *British Birds* 68:437-449.

Fourage, J.G. 1968. Le Pouillot siffleur *Phylloscopus sibilatrix*. *Gerfaut* 58:179-368.

Freeman, S.N. and P.M. North. 1990. Estimation of survival rates of British, Irish and French Grey Herons. *The Ring* 13:139-166.

Freeman, S.N. and B.J.T. Morgan. 1992. A modelling strategy for recovery data from birds ringed as nestlings. *Biometrics* 48:217-235.

Furness, R. 1978. Movement and mortality rates of Great Skuas ringed in Scotland. *Bird Study* 25:229-238.

Galbraith, H., and S.J. Tyler. 1982. The movement and mortality of the Dipper as shown by ringing recoveries. *Ringling & Migration* 4:9-14.

Gitay, H., A.D. Fox and H. Boyd. 1990. Analysis of historical Pink-footed Goose ringing recovery data. *The Ring* 13:103-112.

Gitay, H, A.D. Fox and S.C. Ridgill. 1990. Survival estimates of Teal *Anas crecca* ringed at three stations in Britain. *The Ring* 13:45-58.

Glutz Von Blotzheim, U.N., K.M. Bauer and E. Bezzel. 1971. *Handbuch der Vögel Mitteleuropas*. Band 4.

Glutz Von Blotzheim, U.N., K.M. Bauer and E. Bezzel. 1977. *Handbuch der Vögel Mitteleuropas*. Band 7.

Glutz Von Blotzheim, U.N. and K.M. Bauer. 1980. *Handbuch der Vögel Mitteleuropas*. Band 9.

- Goss-Custard, J.D., S.E.A. Le V. dit Durell, H.P. Sitters and R. Swinfen. 1982. Age structure and survival of a wintering population of Oystercatchers. *Bird Study* 29:83-98.
- Grant, M.C. 1991. Nesting densities, productivity and survival of breeding Whimbrel *Numenius phaeopus* in Shetland. *Bird Study* 38:160-169.
- Green, R.E., M.W. Pienkowski and J.A. Love. 1996. Long-term viability of the re-introduced population of the White-tailed Eagle *Haliaeetus albicilla* in Scotland. *Journal of Applied Ecology* 33:357-368.
- Green, R.E., Hodson, D.P. and Holness, P.R. Survival and movements of Stone Curlews ringed in England. *Ringing & Migration* (in press).
- Grosskopf, G. 1964. Sterblichkeit und Durchschnittsalter einiger Küstenvögel. *Journal for Ornithology* 105:427-449.
- Harris, M.P., S.T. Buckland, S.M. Russell and S. Wanless. 1994. Year- and age-related variation in the survival of adult European Shags over a 24-year period. *Condor* 96:600-605.
- Harris, M.P. and S. Wanless. 1995. Survival and non-breeding of adult Common Guillemot *Uria aalge*. *Ibis* 137:192-197.
- Harris, M.P., S.N. Freeman, C.V. Wernham, B.J.T. Morgan and S. Wanless. The survival of Puffins *Fratercula arctica* at a North Sea colony over a 20-year period. *Journal of Avian Biology* (in press).
- Hatchwell, B.J. & Birkhead, T.R. 1991. Population dynamics of Common Guillemots *Uria aalge*. *Ornis Scandinavica* 22: 55-59.
- Haukioja E. 1969. Mortality rates of some Finnish Passerines. *Ornis Fenn.* 46:171-178.
- Haukioja E. and Haukioja, M. 1970. Mortality rates of Finnish and Swedish Goshawks (*Accipiter gentilis*). *Pap. Finn. Game Res.* 31:13-20.
- Hemery, G., P. Nicolau-Guillaumet and J.C. Thibault. 1979. Etude de la dynamique des populations françaises d'Hirondelles de cheminée (*Hirundo rustica*) de 1956 à 1973. *L'Oiseau et R.F.O.* 49:213-230.
- Henny C.J. and H.M. Wight. 1969. An endangered Osprey population: estimates of mortality and production. *Auk* 86:188-198.
- Hoodless, A.N. and J.C. Coulson. 1994. Survival rates and movements of British and Continental Woodcock *Scolopax rusticola* in the British Isles. *Bird Study* 41:48-60.
- Insley, H., W.J. Peach, R.Swann and B. Etheridge. Survival rates of Redshank *Tringa totanus* wintering on the Moray Firth. *Bird Study* (in press).

- Jenkins, D., A. Watson and G.R. Miller. 1967. Population fluctuations in the Red Grouse *Lagopus lagopus scoticus*. *Journal of Animal Ecology* 36:97-122.
- Kluijver, H.N. 1951. The population ecology of the Great Tit *Parus major*. *Ardea* 39:1-135.
- Kramer, K. 1973. Habicht und Sperber. *Die Neue Brehm-Bücherei*. Wittenberg Lutherstadt: Ziemsen Verlag.
- Lack, D., and A. Schifferli. 1948. Die Lebensdauer des Stares. *Der Ornithologische Beobachter* 45:107-114.
- Lebreton, J.D., K.P. Burnham, J. Clobert and D.R. Anderson. 1992. Modelling survival and testing biological hypotheses using marked animals: a unified approach with case studies. *Ecological Monographs* 62:67-118.
- Lindberg, P. 1977. The Peregrine Falcon in Sweden. *Proc. ICBP World Conference on birds of prey*. Vienna 1975:329-38.
- Lloyd, C.S. 1974. Movement and survival of British Razorbills. *Bird Study* 21:102-116.
- Lubcke, W. 1977. 17 Jahre Beringung an einem Schlafplatz der Grauammer (*Emberiza calandra*). *Vogelkdl.Hefte*. 3:57-73.
- Macdonald, M.A. 1977. Adult mortality and fidelity to mate and nest-site in a group of marked Fulmars. *Bird Study* 24:165-168.
- Matthysen, E. 1989. Nuthatch *Sitta europaea* demography, beech mast, and territoriality. *Ornis Scandinavica* 20:278-282.
- Mebs, T. 1964. Über Wanderungen und bestandsgestaltende Faktoren beim Mäusebussard (*Buteo buteo*) nach deutschen Ringfunden. *Die Vogelwarte* 22:180-195.
- Mebs, T. 1971. Death causes and mortality rates of Peregrines (*Falco peregrinus*) calculated by German and Finnish band-recoveries. *Die Vogelwarte* 26:98-105.
- Metcalf, N.B. and R.W. Furness. 1985. Survival, winter population stability and site fidelity in the Turnstone *Arenaria interpres*. *Bird Study* 32:207-214.
- Murton, R.K., R.J.P. Thearle and J. Thompson. 1972. Ecological studies of the Feral Pigeon *Columba livia* var. I. Population, breeding biology and methods of control. *Journal of Applied Ecology* 9:835-874.
- Nelson, J.B. 1966. Population dynamics of the Gannet (*Sula bassana*) at the Bass Rock, with comparative information from other Sulidae. *Journal of Animal Ecology* 35:443-70.

- Newton, I. 1986. *The Sparrowhawk*. T & AD Poyser.
- Newton, I. 1997. Age-related survival in female Sparrowhawks. *Ibis* 139:25-30.
- Nilsson, S.G. 1982. Seasonal variation in the survival rate of adult Nuthatches *Sitta europaea* in Sweden. *Ibis* 124:96-100.
- Paludan, K. 1959. *Danish Review of Game Biology*. 4:1-23.
- Peach, W.J., S.T. Buckland and S.R. Baillie. 1990. Estimating survival rates using mark-recapture data from multiple ringing sites. *The Ring* 13:87-102.
- Peach, W.J. 1993. Combining mark-recapture data sets for small passerines. Pages 107-122 in J.D. Lebreton and P.M. North (eds.) *Marked Individuals in the Study of Bird Populations*. Birkhauser Verlag, Basel, Switzerland.
- Peach, W.J., P.S. Thompson and J.C. Coulson. 1994. Annual and long-term variation in the survival rates of British Lapwings *Vanellus vanellus*. *Journal of Animal Ecology* 63:60-70.
- Peach, W.J., C. du Feu, and J. McMeeking. 1995. Site tenacity and survival rates of Wrens *Troglodytes troglodytes* and Treecreepers *Certhia familiaris* in a Nottinghamshire wood. *Ibis* 137:497-507.
- Percival, S.M. 1990. *Population trends in British Barn Owls and Tawny Owls in relation to environmental change*. BTO Research Report No.57. BTO, Thetford.
- Perrins, C.M., M.P. Harris and C.K. Britton. 1973. Survival of Manx Shearwaters *Puffinus puffinus*. *Ibis* 115:535-548.
- Picozzi, N. 1984. Sex ratio, survival and territorial behaviour of polygynous Hen Harriers *Circus c. cyaneus* in Orkney. *Ibis* 126:356-365.
- Potts, G.R., J.C. Coulson and I.R. Deans. 1980. Population dynamics and breeding success of the Shag *Phalacrocorax aristotelis* on the Farne Island, Northumberland. *Journal of Animal Ecology* 49:465-484.
- Rattiste, K and V. Lilleleht. 1995. Survival rates of breeding Common Gulls in Estonia. *Journal of Applied Statistics* 22:1057-1062.
- Senar, J.C., A. Borrás, T. Cabrera and J. Cabrera. 1993. Testing for the relationship between coniferous crop stability and common crossbill residence. *Journal of Field Ornithology* 64:464-469.
- Senar, J.C., and J.L. Copete. 1995. Mediterranean house sparrows *Passer domesticus* are not used to freezing temperatures: an analysis of survival rates. *Journal of Applied Statistics* 22:1069-1074.

Soikkel, M. 1970. Mortality and reproductive rates in a Finnish population of Dunlin. *Ornis Fenn.* 47:149-158.

Spaepen, J.F. 1988. Estimation of the survival rates of Meadow Pipits - a comparison of two different methods. *Ringling & Migration* 9:117-128.

Thomson, D.L., H. Douglas-Home, R.W. Furness and P. Monaghan. 1996. Breeding success and survival in the common swift *Apus apus*: a long-term study on the effects of weather. *Journal of Zoology*. London 239:29-38.

Thompson, P.S. and W.G. Hale. 1993. Adult survival and numbers in a coastal breeding population of Redshank *Tringa totanus* in northwest England. *Ibis* 135:61-69.

Walters Davies, P. and P.E. Davis. 1973. The ecology and conservation of the Red Kite in Wales. *British Birds* 66:183-224.

Wanless, S., M.P. Harris, J. Calladine and P. Rothery. Modelling responses of herring gull and lesser black-backed gull populations to reduction of reproductive output: implications for control measures. *Journal of Applied Ecology* (in press).