Scottish Birds

THE JOURNAL OF THE SOC

Vol 27 June 2007

Amendments to the Scottish List; Birds in a Borders valley
Autumn skua migration; Black Grouse in Lochaber
Goshawks in Argyll; White-tailed Eagles in Sweden
Loch Leven ducks; Firth of Tay counts

Scottish Birds – **The Journal of the SOC**

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Scottish Birds, the official journal of the SOC, publishes original material relating to ornithology in Scotland. Papers and notes should be sent to The Editor, *Scottish Birds,* SOC, The Scottish Birdwatching Resource Centre, Waterston House, Aberlady, East Lothian EH32 0PY.

Scottish Birds is published each year in June. *Scottish Birds* is issued free to members of the SOC, who also receive the quarterly newsletter *Scottish Bird News*, the annual *Scottish Bird Report* and the annual *Scottish Raptor Monitoring Report*.

Published by: The Scottish Ornithologists' Club, The Scottish Birdwatching Resource Centre, Waterston House, Aberlady, East Lothian EH32 0PY.

Design by: Pica Design, 51 Charlton Crescent, Aboyne, Aberdeenshire AB34 5GN.

Printed by: Meigle Colour Printers Ltd, Block 1, Tweedbank Industrial Estate, Galashiels TD1 3RS

Amendments to the Scottish List: species and subspecies

THE SCOTTISH BIRDS RECORDS COMMITTEE

SOC Council has delegated to SBRC responsibility for maintaining the* Scottish List *and SBRC has appointed a subcommittee to carry out this function. The current subcommittee consists of Dave Clugston, Dougie Dickson, Ron Forrester, Angus Hogg, Bob McGowan and Roger Riddington. The* Scottish List *was last published in full in 2001 (Clugston* et al *2001), since when there have been 2 sets of amendments (Forrester 2003, 2004). This is therefore the third update. For a full explanation of the procedure for maintaining the list see* Scottish Birds *22: 33-35.

The taxonomic subcommittee of The British Ornithologists' Union's Records Committee (BOURC) has made recommendations all of which have been adopted by BOURC for the* British List *(Sangster* et al *2004, 2005). The 7th edition of the* British List *was published in 2006 (Dudley* et al *2006) containing a number of additional changes. These recommendations and changes automatically apply to the* Scottish List*:

Canada Goose *Branta canadensis*
now treated as 2 separate species:
- **Greater Canada Goose** *B canadensis* (polytypic, with subspecies *canadensis, fulva, interior, maxima, moffitti, occidentalis* and *parvipes*)
- **Lesser Canada Goose** *B hutchinsii* (polytypic, with subspecies *hutchinsii, leucopareia, minima* and *taverneri*)

Greater Canada Goose is on Category C of the *Scottish List*.
There are many outstanding claimed Scottish records of various subspecies of Lesser Canada Goose. A paper on Canada Goose taxonomy is in preparation which should assist with the process of determining which, if any, of these records can be accepted. Meanwhile this species does not appear on the *Scottish List*.

Greater Scaup *Aythya marila*
Treat as polytypic (previously monotypic), with subspecies *A m marila* and *A m nearctica*. Only nominate *marila* has been recorded in Scotland.

Common Scoter *Melanitta nigra*
Common Scoter was previously a polytypic species, with both subspecies occurring in Scotland. Each taxa should be treated as a separate species. Both species are now monotypic.
Treat as 2 separate species:
- **Common Scoter** *M nigra* (monotypic)
- **Black Scoter** *M americana* (monotypic).

Add Black Scoter *Melanitta americana* to Category A. The status code SV is applicable.

Velvet Scoter *Melanitta fusca*
Treat as 2 separate species:
- **Velvet Scoter** *M fusca* (monotypic)
- **White-winged Scoter** *M deglandi* (polytypic, with subspecies *deglandi* and *stejnegeri*).

Velvet Scoter is on Category A of the *Scottish List*. There are no Scottish records of White-winged Scoter.

Red-throated Diver *Gavia stellata*
Treat as monotypic.

Little Shearwater *Puffinus assimilis*
The 3 taxa breeding in the tropical and subtropical parts of the Atlantic Ocean (*P l lherminieri, P a baroli, P a boydi*) that were included in a recent study formed a monophyletic group which is not closely related to the other forms of the complex (including nominate *P a assimilis*).
The 3 tropical and subtropical Atlantic taxa are best treated as 2 species:
- **Macaronesian Shearwater** *P baroli* (polytypic, with subspecies *baroli* and *boydi*)
- **Audubon's Shearwater** *P lherminieri* (monotypic)

Macaronesian Shearwater *P baroli* replaces Little Shearwater *P assimilis* on Category A of the *Scottish List* with the subspecies described as being 'nominate *baroli* (presumed)'. There are no Scottish records of Audubon's Shearwater.

White-tailed Eagle *Haliaeetus albicilla*
Previously Categories A, D. The introduced population now appears self sustaining and BOURC has changed the *British List* to Categories A, C. It is appropriate to make the same change for the *Scottish List*.

Yellow-legged Gull *Larus michahellis*
The combined evidence of morphology, vocalization and molecular phylogenetics strongly indicate that Yellow-legged Gull *L michahellis* should be treated as a separate species. There are 2 subspecies nominate *michahellis* and *atlantis*.
Add Yellow-legged Gull to Category A. The status code SV is applicable. It is the nominate subspecies that has been recorded in Scotland.

Generic limits of terns
As a result of a molecular phylogeny based on mitochondrial DNA sequencing, which compared the relationship of tern species, the species on the *Scottish List* should now be listed in the following sequence:

- **Sooty Tern** *Onychoprion fuscata*
- **Bridled Tern** *Onychoprion anaethetus*
- **Little Tern** *Sternula albifrons*
- **Gull-billed Tern** *Gelochelidon nilotica*
- **Caspian Tern** *Hydroprogne caspia*
- **Whiskered Tern** *Chlidonias hybrida*
- **Black Tern** *Chlidonias niger*
- **White-winged Tern** *Chlidonias leucopterus*
- **Sandwich Tern** *Sterna sandvicensis*
- **Royal Tern** *Sterna maxima*
- **Lesser Crested Tern** *Sterna bengalensis*
- **Forster's Tern** *Sterna forsteri*
- **Common Tern** *Sterna hirundo*
- **Roseate Tern** *Sterna dougallii*
- **Arctic Tern** *Sterna paradisaea*

Note that the scientific names for Sooty, Bridled, Little, Gull-billed and Caspian Terns have changed.

Atlantic Puffin *Fratercula arctica*
Treat as monotypic. There were previously 2 subspecies on the *Scottish List* the nominate subspecies and *grabae*.

Snowy Owl *Bubo scandiaca*
Change scientific name to *Bubo scandiacus*.

Generic limits of swallows
A recent molecular phylogeny improved our understanding of the relationships of the species of swallow on the *British List* and as a result the species on the *Scottish List* should be listed in the following sequence:

- **Sand Martin** *Riparia riparia*
- **Tree Swallow** *Tachycineta bicolor*
- **Eurasian Crag Martin** *Ptyonoprogne rupestris*
- **Barn Swallow** *Hirundo rustica*
- **House Martin** *Delichon urbicum*
- **Red-rumped Swallow** *Cecropis daurica*

Note that the scientific name for Red-rumped Swallow has changed.

Richard's Pipit *Anthus novaeseelandiae*
Anthus novaeseelandiae was treated as a polytypic species occurring in Europe, Asia, Africa and Australasia. The taxon occurring in Britain, *richardi*, is now treated as a monotypic species, retaining the English name Richard's Pipit. **Richard's Pipit** *Anthus richardi* (monotypic).
Richard's Pipit is in category A of the *Scottish List*.

Pallas's Leaf Warbler *Phylloscopus proregulus*
Treat as monotypic.

Generic limits of tits
Molecular phylogenetic analysis of tits suggests that our previous understanding of their relationships to each other was incorrect and a new species sequence has been recommended. The species on the *Scottish List* should be listed in the following sequence:
- **Blue Tit** *Cyanistes caeruleus*
- **Great Tit** *Parus major*
- **Crested Tit** *Lophophanes cristatus*
- **Coal Tit** *Periparus ater*
- **Willow Tit** *Poecile montana*
- **Marsh Tit** *Poecile palustris*

Note changes to some scientific names.

As a result of records that have recently been accepted, the following species have all been added to the *Scottish List*:

Canvasback *Aythya valisineria*
2000 Orkney Loch of Rummie, Sanday, f, 21-23 June, photo (I Dillon, B Ribbands, E J Williams *et al*) (*British Birds* 98: 634). The status code SV is applicable. Monotypic.
1st Scottish record. **Add to Category A.**

Redhead *Aythya americana*
2003 Outer Hebrides Loch Tangasdale, Barra, first winter f, 20 September to 15 April 2004 (K Gillon, S L Rivers, C Scott *et al* per M S Scott) (*British Birds* 97: 563; *Birding Scotland* 7: 130-135, *Birding World* 17: 59); same, Loch an Duin, Barra, female, 7-8 November 2004 (*British Birds* 100: 20). The status code SV is applicable. Monotypic.
1st Scottish record. **Add to Category A.**

American Coot *Fulica americana*
2003 Shetland Loch of Clickimin, first winter, 30 November to 5 April 2004; presumed returning bird, Loch of Benston, Mainland, 13 November to 28 March 2005, photo (S E Duffield *et al*); same Loch of Benston, Mainland 24 September – 2 October 2005 (J S Lees, M J McGill *et al*) (*British Birds* 97: 575-576, 97: plates 27 and 336, 98: 647, 100: 35; *Birding Scotland* 7: 16-18 and plates 7-11). The status code SV is applicable. Unlikely to be other than nominate race.
1st Scottish record. **Add to Category A.**

Lesser Sand Plover *Charadrius mongolus*
2004 Lothian Aberlady Bay, M *C m mongolus*, 8-9 July (J B Bell *et al*) (*British Birds* 98: 649). The status code SV is applicable. Attributed to the nominate subspecies.
1st Scottish record. **Add to Category A.**

Belted Kingfisher *Megaceryle alcyon* (1)
2005 North-east Scotland Peterculter, first summer male, 4-8 April, photo (I D Broadbent, K Landsman *et al*) (*British Birds* 98: plates 144 & 145, 100: 60, plate 22). This bird had previously been seen in Staffordshire on 1 April and in East Yorkshire on 2 April. The status code SV is applicable. Monotypic.
1st Scottish record. **Add to Category A.**

Purple Martin *Progne subis*
2004 Outer Hebrides Butt of Lewis, Lewis, juvenile, 5-6 September 2004 (S P Coyle, T Grant, M Witherall *et al*) (*British Birds* 97: plate 327, 98: 665-666, plates 429 & 430). BOURC have admitted Purple Martin to the *British List*.

This is the first British record. The status code SV is applicable.
1st Scottish record. **Add to Category A.**

Rufous-tailed Robin *Luscinia sibilans*
2004 Fair Isle first winter 23 October (*Ibis* 148: 594; *British Birds* 100: 78). BOURC have admitted Rufous-tailed Robin to the *British List*. This is the first British record. The status code SV is applicable.
1st Scottish record. **Add to Category A.**

Taiga Flycatcher *Ficedula albicilla*
2003 Shetland Sandgarth, Mainland, first winter 12-15 October, trapped, photo (M S Chapman, D P Hall, S J Minton *et al*) (*British Birds* 98: 682, Chapman 2003, 2004, 2005). This record closely followed the 1st British record, at Flamborough Head, East Yorkshire on 26 April 2003 and BOURC have admitted the species to Category A of the *British List*. The status code SV is applicable.
1st Scottish record. **Add to Category A**.

Masked Shrike *Lanius nubicus*
2004 Fife Kilrenny, 29 October to 14 November, trapped, photo (T Glass, A W Lauder, M Oksien, K D Shaw *et al*) (*British Birds* 98: 685, plate 441; 97: plate 395). This record has been accepted by BOURC as the first British record (*Ibis* 148: 594). The status code SV is applicable.
1st Scottish record. **Add to Category A**.

Chestnut-eared Bunting *Emberiza fucata*
2004 Fair Isle first winter, 15-20 October (D Shaw *et al*) (*British Birds* 100: 100; *Birding World* 17: 415-419; *Birding Scotland* 7: 145-151). Accepted as belonging to the nominate race. This record has been accepted by BOURC as the first British record (Press Release 5 December 2006). The status code SV is applicable.
1st Scottish record. **Add to Category A**.

The *Scottish List* Subcommittee of SBRC has made the following changes to the *Scottish List*:

Soft-plumaged/Madeira/Cape Verde Petrel *Pterodroma mollis/madeira/feae*
In line with names now in common usage, the English name for *Pterodroma madeira* is now changed from Madeira Petrel to **Zino's Petrel** and that of *Pterodroma feae* from Cape Verde Petrel to **Fea's Petrel**.

There were 2 records from England in 2001, accompanied by good photographs that enabled each to be confirmed as Fea's Petrel. As a result the *British List* has recently been changed to show Fea's Petrel (BOURC 2006a, 2006b), with Soft-plumaged/Zino's/Fea's Petrel removed.

The 1996 Scottish record was at the time accepted by BBRC as Soft-plumaged/Zino's/Fea's Petrel and that of the 2002 bird as Zino's/Fea's Petrel. BBRC has in recent years decided that Soft-plumaged Petrel is most unlikely to occur in Britain, but neither Scottish record has been specifically identified. The *Scottish List* is now changed to **Zino's/Fea's Petrel**.

Squacco Heron *Ardeola ralloides*
A record from the 'Glasgow Canal' in October 1852 (Martin 1853) was examined by SBRC in 2002 and not found to be acceptable. Although the identification of the bird was not in question, the locality where the specimen was obtained was inadequately documented and, as the reporter lived in Stockton-on-Tees, may possibly have been in northeast England.
2005 Fife Kilconquhar Loch, 22 May, photo (T Moodie *et al*) (*British Birds* 100: 27).
There are now 4 Scottish records, this being the first since 1950. Removed from Category B to Category A.

Red Knot *Calidris canutus*
The nominate race of Red Knot has appeared on the *Scottish List* with the status code 'PV'. Our knowledge of the migration route of this subspecies is exceedingly limited and although

in 1992 the nominate subspecies was described as a winter visitor and passage migrant to Britain (BOURC 1992), its occurrence in Britain and Ireland was by 2002 considered 'exceptional' (*Migration Atlas*). There is no evidence for its occurrence in Scotland, although it is likely to have occurred as a limited passage visitor or vagrant.
It is removed from the *Scottish List* until such time as ringing evidence proves its occurrence in Scotland. *C c islandica* is the race found commonly in Scotland during winter.

Black-tailed Godwit *Limosa limosa*
The nominate subspecies has appeared on the *Scottish List* with the status code MB. There is no evidence that nominate *limosa* breeds, and in fact, although it probably does occur, at least on passage, there are no formally substantiated records of this subspecies in Scotland. As a result the subspecies has been removed from the *Scottish List*. SBRC would welcome claimed records being submitted to it.

Bridled Tern *Sterna anaethetus*
The subspecies shown on the British List is *antarctica*, as a result of a specimen belonging to that subspecies having been found dead in Kent in 1931. It is clear that not all records of this species in Britain necessarily refer to that subspecies, and none of the 5 Scottish records have been racially determined, therefore the *Scottish List* is changed to show 'race undetermined'.

Dartford Warbler *Sylvia undata*
The only race accepted by BOURC for Britain is *dartfordiensis* which is shown on the *Scottish List*. There are 2 Scottish records neither of which has been assigned to race, in fact it has been suggested that at least one of the records is more likely to have been the nominate race.
This subspecies should be changed to 'race undetermined'.

Brown Shrike *Lanius cristatus*
2004 Shetland Skaw, Whalsay, adult *L c cristatus*, 19-24 September, trapped, photo (J Dunn, J L Irvine, B Marshall *et al*) (*British Birds* 97: plate 394, 98: 683-4).
This is the first occasion that the subspecies of a Brown Shrike recorded in Scotland has been determined. Change from 'race undetermined' to *L c cristatus*.

Ovenbird *Seiurus aurocapilla*
At the time subspecies were added to the *Scottish List* (*Scottish Birds* 22:46) the nominate subspecies was shown. Although this subspecies appears on the *British List*, the only Scottish record (Shetland 1973) was not assigned to race. Whilst the nominate subspecies is most likely, neither of the other 2 subspecies can be ruled out, therefore the race is now shown as 'undetermined'.

Category D
Add **Ross's Goose** *Anser rossii* and **Yellow-headed Blackbird** *Xanthocephalus xanthocephalus*, both of which now appear on Category D of the *British List* as a result of Scottish records.

Indigo Bunting *Passerina cyanea*
Indigo Bunting was on Category D of both the *Scottish* and *British Lists*. It is on the Scottish Category D list due to a 1964 record from Fair Isle (there is also a 1974 Fair Isle record). BOURC have recently accepted Indigo Bunting on to Category A of the *British List* on the strength of a 1996 record from Wales. The Fair Isle records, pre date the Welsh record and therefore have not been found acceptable for Category A by BOURC. BOURC/SBRC do not have a joint Category A/D, therefore as the Fair Isle record does not meet Category A criteria it requires to be downgraded to Category E.

As a result of the above changes, the *Scottish List* totals are now:

Category A	496
Category B	7
Category C	6
TOTAL	**509**
Category D	13

Category C
Category C had previously been subdivided into 5 sections. A 6th section has been added to the *British List* and should similarly be added to the *Scottish List* 'C6 former naturalised species'. At present there are no species that fall into this category. BOURC conducted a review of the British Category C (Dudley 2005). As a result of this review the following change should be made to the *Scottish List*:

English name	Current category	New category
Snow Goose	A	A,C

A population of Snow Goose originating from a waterfowl collection on the Isle of Mull (Argyll) has existed since the 1950s or 1960s and meets the Category C2 criteria.

Changes to Status Codes
Due to work undertaken by the team working on the new '*Birds of Scotland*' book, it is clear several status codes are incorrect and require to be changed. Table 1 shows the agreed changes.

Update to records of species and subspecies recorded in Scotland on up to 20 occasions
A list of all records of species and subspecies recorded in Scotland on up to 20 occasions was published on behalf of SBRC (Andrews & Naylor 2002) since when there has been a single update (Forrester 2004). Since that time BBRC has published its Reports on rare birds in Great Britain in 2003 (*British Birds* 97: 558-625), 2004 (*British Birds* 98: 628-694) and 2005 (*British Birds* 100: 16-61, 72-104). What follows is the second of what is intended to become regular updates.

Red-breasted Goose *Branta ruficollis*
2001 Moray & Nairn Redhill, adult, 17-18 April, and Roseisle, 19 April (*British Birds* 96: 555), now considered not same as Perth & Kinross 2001 (*British Birds* 95: 484, 98:634).
2002 Perth & Kinross Findatie and other sites, adult, 15 February to 27 April (*British Birds* 96: 555), now presumed returning bird, same as Perth & Kinross 2001 (*British Birds* 95: 484).
2003 Argyll Loch Gruinart, Islay, adult, 18 October 2002 to 9 April, same 10 November to at least 28 March 2004 (A W Reid *et al*); presumed returning individual of 2002 (*British Birds* 96: 555, 97: 562; *Scottish Bird Report* 2001: 10).
The Moray & Nairn bird is the 15th Scottish record.

American Black Duck *Anas rubripes*
2002 Shetland Loch of Hillwell, m, 13-25 May (G J Fitchett (*et al*) (*British Birds* 97:563).
2003 Shetland Dales Voe, m, 18 January-24 February (B H Thomason *et al*) (*British Birds* 97:563).
2004 Northeast Scotland New Pitsligo, m, 5 December to 1 January 2005 (J M Wills *et al*) (*British Birds* 98: 634).
8th-10th Scottish records.

Ferruginous Duck *Aythya nyroca*
2003Argyll Loch Bhasapol, Tiree, m, 21-29 April (J Bowler *et al*) (*British Birds* 97: 563).
2003 Fife Loch Gelly, m, 30 July to at least 18 August (D Ogilvie, K D Shaw, J J Squire); **Perth & Kinross** Vane Farm, Loch Leven, m, 1-16 September (K D Shaw *et al*) (*British Birds* 97: 564).
13th and 14th Scottish records (of 15 birds).

Lesser Scaup *Aythya affinis*
2001 Outer Hebrides Loch an Eilean, South Uist, f, age uncertain, 27 January (P R Boyer, B Rabbitts, A Stevenson *et al*) (*British Birds* 97: 566).
2003 Dumfries & Galloway Castle Loch, Lochmaben, m, 29 December to 27 January 2004 (A W Reid *et al*); same plus one other Milton Loch, 27 February to 10 March, one to 21st; one or other, Lochrutton Loch, 1 March; one or other, Caerlaverock, 16–17 March; both first noted in 2002 (*British Birds* 96: 558) (per P N Collin) (*British Birds 97: 566, 98: 635*).
2003 Perth & Kinross Vane Farm, Loch Leven, first winter m, 1st and 11th February (D Abraham, K D Shaw *et al*). Findatie, Loch Leven, m, 16-20 March (R Shand, K D Shaw, A Wilson *et al*) (*British Birds* 97: 566).
2004 Forth Gart Gravel pits, m, 19 June (A W Lauder, C McKeever, K A & K D Shaw) (*British Birds* 98: 635).
2004 Perth & Kinross Loch Leven, m, 4 December (A W Reid *et al*); first winter, 12-16 December (W McBay, J S Nadin, K D Shaw) (*British Birds* 98: 635).
2005 Perth & Kinross Blair Drummond, m, 23 March to 4 April (N Bielby *et al*) (*British Birds* 100: 22).
2005 Perth & Kinross Vane Farm, m, 3-4 July, photo (A W Lauder, J S Nadin, K D Shaw *et al*) (*British Birds* 100: 22).
There are now 21 reports of 25 birds in Scotland. Now removed from the list of species recorded on 20 or fewer occasions.

Harlequin Duck *Histrionicus histrionicus*
2004 Outer Hebrides Coll, Lewis, f, mid January to 20 May (M Hague, B Rabbitts, A Walker *et al*) (*British Birds* 98: 635; 97: plate 117).
9th Scottish record (11 birds).

Black Scoter *Melanitta americana*
2005 Moray & Nairn Burghead Bay, male 10 October (R Proctor) (*British Birds* 100:23).
5th Scottish record.

Bufflehead *Bucephala albeola*
2004 Outer Hebrides Balranald, North Uist, m, 10 May (M Darlaston, B Rabbitts, A Rennels); same, Loch Branahuie, Lewis, 20 May, photo (C A & R P Cockbain *et al*) (*British Birds* 98: 638).
2nd Scottish record.

Barrow's Goldeneye *Bucephala islandica*
2005 Northeast Scotland Ythan Estuary, m, 13-22 May, photo (P Shepherd *et al*); same Loch of Strathbeg 23 May – 23 June (per *Birding Scotland*) (*British Birds* 98: plates 177 & 178, 100: 24, plate 1).
2nd Scottish record.

Black-browed Albatross *Thalassarche melanophris*
2005 Outer Hebrides Sula Sgeir, adult, 25-31 August, photo (D Macfarlane per M S Scott) (*British Birds* 98: plates 392 & 393, 100: 25).
5th Scottish record.

Black Stork *Ciconia nigra*
1998 Highland Munlochy, first year, 22 July to 3 August (D C & J A Jardine *et al*) (*British Birds* 100: 30).
This is presumed to be the same bird as in North east Scotland from 3-19 July.

Black Kite *Milvus migrans*
2003 Highland Kinbrace, Sutherland, 15 June to at least 8 July (N Dales *et al*); **2004** Kinbrace, Sutherland, 3 June to 3 July (per A F McNee), presumed returning individual of 2002 (*British Birds* 96: 560; 97: 572, plate 267; 98: 645 *SBR* 2001: 11); probably same Glen Glass, Easter Ross, 2 August (R H Hogg) (*British Birds* 97: 572).
2005 Ayrshire Pinwherry, 7 July (R H Hogg) (*British Birds* 100: 30).
19th Scottish record.

Pallid Harrier *Circus macrourus*
2003 Shetland Baltasound/Haroldswick area, Unst, juvenile, 2-17 September, photo (S E Duffield, M A Maher *et al*) (*British Birds* 97: 573).
2003 Shetland Haroldswick, Unst, first summer m, 23-25 May (S E Duffield, M A Maher *et al*) (*British Birds* 98: 645).
2004 Shetland Trondra, juvenile, 25-26 September, photo (J D Okill *et al*) (*British Birds* 97: plate 384, 98: 645, plates 416 & 417).
2005 Shetland Sumburgh, Mainland, juvenile, 29 September (R Riddington) (*British Birds* 100: 31).
7th-10th Scottish records.

American Coot *Fulica americana*
2004 Dumfries & Galloway Castle Loch, Lochmaben, 10-17 February (A A Murray, A White *et al*) (*British Birds* 98: 647).
2004 Outer Hebrides West Loch Ollay, 25 January to 7 April (A Stevenson *et al*) (*British Birds* 98: 647).
2nd and 3rd Scottish records.

Collared Pratincole *Glareola pratincola*
2003 Orkney Loch of Tankerness, 30 May, photo (K E Hague) (*British Birds* 97: 576).
8th Scottish record.

Killdeer *Charadrius vociferus*
2004 Outer Hebrides Knockintorran, North Uist, first winter, 25 December to 8 January 2005, photo (J & S Entwhistle-Baker, B Rabbitts *et al*) (*British Birds* 98: 649, plates 56 and 421).
2005 Lothian Musselburgh, 22 January (B D & M Griffin, B A Hickman *et al*) (*British Birds* 100: 36).
10th and 11th Scottish records.

Pacific Golden Plover *Pluvialis fulva*
2003 Northeast Scotland Ythan Estuary, juvenile, 2-16 November, photo (P A A Baxter, P S Crockett, C N Gibbins *et al*) (*Birding Scotland* 7: 19-22 and plates 12-16; *British Birds* 97: 578).
2003 Outer Hebrides North Boisdale/Daliburgh, South Uist, adult, 9 February to at least 5 April 2003 (A Stevenson *et al*), presumed returning bird from 2001 and 2002 (*British Birds* 96: 567, 97: 578).
2004 Orkney North Ronaldsay, adult, 30 June (P A Brown, P J Donnelly) (*British Birds* 98: 650).
15th ad 16th Scottish records.

Semipalmated Sandpiper *Calidris pusilla*
2003 Fair Isle adult, 13 August, photo (A J Bull, D N Shaw *et al*) (*British Birds* 97: 578-579).
2005 Shetland Grutness, Mainland, juvenile, 1-6 November, photo (D Andrews, R Butcher, S Mitchell *et al*) (*British Birds* 99: plate 18, 100: 39, plate 8).
During 1999 there were multiple observations of this species in Argyll and the Outer Hebrides, making it difficult to accurately assess the numbers involved. This has been reviewed and there are now 14 Scottish records of 21 birds.

Western Sandpiper *Calidris mauri*
The 1956 Fair Isle record (*British Birds* 56: 55-58) is now considered to be unacceptable (Garner 2005). There are now 3 Scottish records.

Upland Sandpiper *Bartramia longicauda*
2004 Shetland Foula, 4–8 May, photo (G Atherton *et al*) (*British Birds* 98: 657, plate 427).
7th Scottish record.

Solitary Sandpiper *Tringa solitaria*
2003 Outer Hebrides Gravir, Lewis, 23-24 October, photo (M Witherall *et al*) (*Birding Scotland* 6: 183-185; *British Birds* 96: plate 405, 97: plate 341, 97: 582).
4th Scottish record.

Terek Sandpiper *Xenus cinereus*
2005 Shetland Funzie, Fetlar, 10-13 June, photo, (A Grove *et al*) (*British Birds* 100: 44).
10th Scottish record.

Franklin's Gull *Larus pipixcan*
2004 Shetland Hametoun, Foula, adult, 10 June (S Bearhop, C J McInerny, S C Votier) (*British Birds* 98: 659-660).
9th Scottish record.

Bonaparte's Gull *Larus philadelphia*
2004 Caithness Castlehill and Thurso, adult, 12 September intermitently to 15 January 2005 (S Laybourne, S A M Manson *et al*) (*British Birds* 98: 660, plate 90.).
2004 Outer Hebrides Penrine, South Uist, adult, 31 March to 9 April, photo (D J Britton) (*British Birds* 98:660).
2004 Outer Hebrides Ardivachar, South Uist, adult, 10 April (A Stevenson *et al*) (*British Birds* 98:660).
2004 Outer Hebrides Penrine and South Bay, South Uist, adult, 18-22 April, North Bay, South Uist, adult, probably same 23 April (A Stevenson *et al*), possibly same as one or other of the above (*British Birds* 98:660, 100:49).
2005 North-east Scotland Peterhead, adult, 31 January (A Thiel *et al*) (*British Birds* 100: 49).
2005 Outer Hebrides Luskentyre, Harris, adult, 26 February to 5 March, photo, (T ap Rheinallt *et al*) (*British Birds* 100: 49).
2005 Outer Hebrides Balranald, North Uist, adult, 10 May, photo, (B Rabbitts *et al*) (*British Birds* 100: 49).
2005 Shetland Veensgarth, Tingwall, Mainland, adult, 17 July, photo (P Sclater *et al*) (*British Birds* 100: 49).
The South Uist birds in 2004 have been treated by BBRC as 3 separate birds, making the above records the 17th-24th Scottish records. Now removed from the list of species recorded on 20 or fewer occasions.

Bridled Tern *Sterna anaethetus*
2003 Angus & Dundee Arbroath, adult, 19 July (S R Green *et al*) (*British Birds* 98: 661).
5th Scottish record.

Gull-billed Tern *Sterna nilotica*
2003 Outer Hebrides Rubha Ardvule, South Uist, 13-31 July (A Stevenson *et al*) (*British Birds* 98: 661).
9th Scottish record.

Forster's Tern *Sterna forsteri*
2001 Orkney Tingwall and Eynhallow Sound area, adult, 24-27 October (I A Dillon, E J Williams *et al*) (*British Birds* 97: 585).
2003 Argyll Oban Bay and Loch Feochan, first winter, 8-11 January, photo (W Jackson *et al*) (*British Birds* 97: 585).
3rd and 4th Scottish records.

Oriental Turtle Dove *Streptopelia orientalis*
2002 Orkney Stromness, 20 November to 6 December (*British Birds* 96: 581; *SBR* 2001: 11). Extended last date to 20 December (*British Birds* 97: 587).
2003 Caithness Hill of Ratter area, first winter *O s meena*, 5 December to at least 24 March 2004, photo (N Money *et al*), same, St John's Brough, 23 February 2004, 6 and 24 March, photo (J Smith) (*British Birds* 97: 587, 97: plate 28, 98: 663).
4th Scottish record.

Barn Owl *Tyto alba*
Andrews & Naylor (2002) included 23 Scottish records of the dark breasted Continental subspecies *T a guttata*, but they suggested some might require to be reassessed, thus leaving fewer than 20 records. There have been at least 2 more records in recent years to add to those included by Andrews & Naylor and until such time as records are reassessed it is best to treat this race as having in excess of 20 records. Now removed from the list of subspecies recorded on 20 or fewer occasions.

Pallid Swift *Apus pallidus*
2004 Northeast Scotland Newburgh, 31 October to 1 November, photo (P A A Baxter, S Morrison) (*British Birds* 98: 664).
2005 Shetland Skaw, Whalsay, 3 July (J L Irvine, B Marshall *et al*) (*British Birds* 100: 58).
4th and 5th Scottish records.

Calandra Lark *Melanocorypha calandra*
2002 Orkney North Ronaldsay, 10-11 May (P J Donnelly *et al*) (*British Birds* 97: 590).
5th Scottish record.

Siberian Rubythroat *Luscinia calliope*
2003 Fair Isle first winter f, 17-19 October, photo (A J Bull *et al*) (*Birding Scotland* 6:181-182; *British Birds* 96: 97: 596, plate 406).
2005 Fair Isle 1st winter female, 23-27 October, trapped, photo. (M Culshaw, E Douglas *et al*)(*British Birds* 100: 78; *Birding Scotland* 8: 159-162).
3rd and 4th Scottish records.

Red-flanked Bluetail *Tarsiger cyanurus*
2003 Fife Denburn Wood, Crail, f or first winter, 15-17 October, photo (C Andrews, R Armstrong *et al*) (*Birding Scotland* 7: 9-11, plate 4; *British Birds* 97: 596).
2003 Shetland Funzie, Fetlar, first winter, 28 September (P Crockett, I Gordon) (*British Birds* 97: 596).
2003 Fair Isle f or first winter, 16 October (R J Curtis) (*British Birds* 97: 596).
2004 Shetland Fair Isle, M, 29 September (D N Shaw *et al*) (*British Birds* 98: 671).
12th-15th Scottish records.

Isabelline Wheatear *Oenanthe isabellina*
2004 Shetland Sumburgh Head, Mainland, 22-25 October (P M Ellis, P V Harvey, M Heubeck *et al*) (*British Birds* 98: 672).
5th Scottish record.

Pied Wheatear *Oenanthe pleschanka*
2002 Orkney North Ronaldsay, m, 13-27 October, photo (P J Donnelly *et al*) (*British Birds* 97: 597).
2003 Northeast Scotland Collieston, first winter m, 18-21 October, photo (P S Crockett *et al*) (*British Birds* 97: 597).
15th and 16th Scottish records.

Desert Wheatear *Oenanthe deserti*
2003 Fife Kilminning, f, 10-15 November, photo (A Whitehouse *et al*) (*Birding Scotland* 7: 31-34, plates 25 and 26; *British Birds* 97: 599).
2003 Northeast Scotland Girdleness, f, 12-15 November, photo (P S Crockett, I Gordon *et al*) (*British Birds* 97: 599, plate 56).
2003 Shetland Gulberwick, Mainland, m, 10 November (L Dalziel) (*British Birds* 98: 673).
15th-17th Scottish record.

Swainson's Thrush *Catharus ustulatus*
2003 Shetland Sandwick, Unst, first winter, 27-30 September, photo (M G & M J Pennington *et al*) (*Birding Scotland* 7: 35-38, plate 27; *British Birds* 97: 600, plate 353).
2003 Shetland Burrafirth, Unst, first winter, 15 October, photo (M A Maher, M G & M J Pennington *et al*) (*Birding Scotland* 7: 35-38, plates 28-31; *British Birds* 96: plate 409, 97: 600).
6th and 7th Scottish records.

Grey-cheeked Thrush *Catharus minimus*
2003 Shetland Foula, first winter, 27-30 September, trapped 27th, photo (A R Mainwood *et al*) (*British Birds* 97: 601).
9th Scottish record.

Veery *Catharus fuscescens*
2005 Shetland Northdale, Unst, 1st winter, 22 September, trapped, photo. (J Fairclough, R Lockwood, G Woodburn *et al*), later killed by cat. (*British Birds* 98: plate 402, 100: 81).
3rd Scottish record.

Savi's Warbler *Locustella luscinioides*
2005 Perth & Kinross Cairnie Pier, male in song 10-16 May, (A J Leitch *et al*) (*British Birds* 100: 83).
8th Scottish record (of 9 birds).

Thick-billed Warbler *Acrocephalus aedon*
2003 Shetland Fair Isle, adult, 16-17 May, trapped 16th, photo (A J Bull, G Tyler *et al*) (*British Birds* 96: plate 250, 97: 604, plate 357).
4th Scottish record.

Sykes's Warbler *Hippolais rama*
2002 Orkney North Ronaldsay, 26 August, trapped, photo; (P A Brown, M Gray, J S Lees *et al*); previously accepted as indeterminate Booted or Sykes's Warbler (*British Birds* 97: 606) but now accepted as the latter (*British Birds* 98: 677).
2003 Orkney North Ronaldsay, 29 September to 1 October, trapped 29th (P A Brown, A E Duncan, N Gates *et al*) (*British Birds* 97: 606).
2003 Shetland Baltasound, Unst, 4-8 October, trapped 5th, photo (M A Maher, M G Pennington, B H Thomason *et al*) (*British Birds* 96: plate 413, 97: 606).
4th-6th Scottish records.

Sardinian Warbler *Sylvia melanocephala*
2004 Shetland Skaw, Whalsay, first summer f, 30 May to 10 June, trapped, photo (J Dunn , J L Irvine, B Marshall *et al*) (*British Birds* 98: 677-8).
2005 Shetland Lerwick, female, 2-4 June (D Coutts, P V Harvey *et al*) (*British Birds* 100: 86).
2005 Fife Fife Ness Muir, male, 15 October to at least 3 November (A MacCormick, M Oksien *et al*) (*British Birds* 100: 86; *Birding Scotland* 8: 171-174).
10th-12th Scottish records.

Hume's Warbler *Phylloscopus humei*
2003 Fair Isle 13-14 November, trapped 13th, photo (D N Shaw *et al*) (*British Birds* 97: 611).
2003 Fair Isle 17-23 November (D N Shaw *et al*) (*British Birds* 97: 611).
2003 Fife Denburn Wood, Crail, 11 November (AM & T C Smout *et al*) (*British Birds* 98:679).
2003 Shetland East Ham, Bressay, 16-23 November, probably since 13th, photo (N Davies, S E Duffield *et al*) (*British Birds* 97: 611, plates 30 and 362).
2004 Northeast Scotland Cove, 16-22 October, trapped, photo (P A A Baxter, C N Gibbins, R A Mavor *et al*) (*British Birds* 98: 679).
6th-10th Scottish records.

Western Bonelli's Warbler
Phylloscopus bonelli
1983 Shetland Seafield and Helendale, Lerwick, 27 September to 3 October; (M S Chapman, C Robson *et al*); previously accepted as indeterminate Western or Eastern Bonelli's Warbler (*British Birds* 79: 575), but now accepted as the former (*British Birds* 98: 681).
2003 Shetland Scatness, Mainland, 13 May, photo (D P Hall, S J Minton *et al*) (*British Birds* 96: plate 251, 98: 681).
2004 Orkney Sanday, 12 October, photo (K E Durose, J Wright) (*British Birds* 98: 681).
2004 Orkney Herston, South Ronaldsay, 29 October to 15 November, trapped, photo (J A. & R McCutcheon *et al*) (*British Birds* 98: 681).
2005 Fair Isle 10 September (D, D R & J F Cooper *et al*) (*British Birds* 100: 91).
7th-11th Scottish records.

Collared Flycatcher *Ficedula albicollis*
2004 Shetland Fair Isle, first summer m, 9-12 May (A J Perkins *et al*) (*British Birds* 97: plate 186, 98: 682).
2004 Shetland Muness, Unst, adult m, 2 June, photo (M Grey, M G Pennington *et al*) (*British Birds* 97: plate 225, 98: 682).
15th & 16th Scottish records.

Brown Shrike *Lanius cristatus*
2004 Shetland Skaw, Whalsay, adult *L c cristatus*, 19-24 September, trapped, photo (J Dunn, J L Irvine, B Marshall *et al*) (*British Birds* 97: plate 394, 98: 683-4).
3rd Scottish record.

Isabelline Shrike *Lanius isabellinus*
2003 Shetland Out Skerries, first winter m, killed by cat, 30 September, now at National Museums of Scotland (J Lidster, M J McKee, E Tait *et al*) (*British Birds* 97: 615).
2004 Shetland Vidlin, Mainland, first winter, 17 October (M S Chapman *et al*) (*British Birds* 98: 684).
2005 Angus & Dundee Montrose 22-28 October (R A Bramhall *et al*) (*British Birds* 100: 92; *Birding Scotland* 8:167-170).
15th-17th Scottish record.

Long-tailed Shrike *Lanius schach*
2000 Outer Hebrides Howbeg and Howmore, South Uist, first winter, 3-4 November, probably since 27 October, photo (J C Brain, B Rabbitts, A Stevenson *et al*) (*SBR* 2001: 10). 1st Scottish record.
Add the following references: (*British Birds* 97: 615; *Ibis* 147: 246-250).

Red-eyed Vireo *Vireo olivaceus*
2003 Outer Hebrides Aird Mhor Plantation, Barra 5-7 October, photo (M Oksien *et al*) (*Birding Scotland* 6: 185-187, 172 - 174; *British Birds* 97: 617).
7th Scottish record.

Arctic Redpoll *Carduelis hornemanni*
Northwest Greenland race *C h hornemanni*
2003 Shetland Fair Isle, *C h hornemanni*, 22-27 September (D N Shaw *et al*) (*British Birds* 98: 686).
2004 Outer Hebrides Bru, Lewis, *C h hornemanni*, 11 October (M S Scott) (*British Birds* 98:686).
2004 Outer Hebrides Bru, Lewis *C h hornemanni* 23 October, photo (L & P Cunningham, M S Scott) (*British Birds* 98:686).
2004 Shetland Foula, *C h hornemanni*, 29 September to 8 October (P J Wright, R B Wynn *et al*) (*British Birds* 98: 686).
2004 Shetland Skaw, Unst, first winter *C h hornemanni*, 10-11 October, photo (M A Maher) (*British Birds* 98: 686).
20th- 24th Scottish records. Now removed from the list of subspecies recorded on 20 or fewer occasions.

Yellow Warbler *Dendroica petechia*
2004 Outer Hebrides Breibhig, Barra, 2-7 October, photo (S L Rivers *et al*) (*British Birds* 97: plate 396, 98: 687).
2005 Shetland Garths Ness, Mainland, 1st winter male, 15-17 September (R M Mellor *et al*) (*British Birds* 98: plate 409, 100: 98, plate 36).
3rd and 4th Scottish records.

Yellow-rumped Warbler *Dendroica coronata*
2003 Orkney Evie, 31 October to 6 November, photo (D Matson, J B Ribbands, E J Williams *et al*) (*Birding Scotland* 6: 175-177) (*British Birds* 96: plate 419, 97: 619).
6th Scottish record.

Blackpoll Warbler *Dendroica striata*
2003 Outer Hebrides Snishival Plantation, South Uist, 17-20 October, photo (P MacEwan, A Stevenson *et al*) (*British Birds* 98: 687).
2005 Highland Glasnakille, Skye, 1st winter, 4 October (R D Day, R Macmillan) (*British Birds* 100:99; *Birding Scotland* 8: 177-178).
2005 Outer Hebrides Loch Druidibeg, South Uist, 1st winter, 29 September (A Stevenson *et al*) (*British Birds* 100: 99).
5th-7th Scottish records.

Common Yellowthroat *Geothlypis trichas*
2004 Shetland Foula, first winter m, 9-10 October, trapped, photo (J M. & T P Drew, A R Mainwood, M A Wilkinson *et al*) (*British Birds*

97: plate 398, 98:689, plate 444).
3rd Scottish record.

Savannah Sparrow *Passerculus sandwichensis*
2003 Fair Isle first winter, 14-19 October, trapped 14th, photo (D N Shaw, J G Walmsley *et al*) (*Birding Scotland* 6: 178-180; *British Birds* 96: plate 420, 97: 619, plate 367).
2nd Scottish record.

White-throated Sparrow *Zonotrichia albicollis*
2003 Shetland Fetlar, 10-11 May, photo (A Hughson, M Smith *et al*) *(British Birds* 97: 619-620).
2003 Fair Isle m in song, 9 June, photo (D N Shaw *et al*) (*Birding Scotland* 6: plate 119; *British Birds* 96: plate 279, 97: 619-620).
14th and 15th Scottish records.

Table 1. ***Changes to status codes***

English name	**Current status code**	**New status code**
Bean Goose (nominate race)	WV	WV PV
Snow Goose (nominate race)	SV	SV IB
Tufted Duck	RB WV PV	RB MB WV PV
Long-tailed Duck	CB WV	WV
Spotted Crake	CB PV	MB PV
Dunlin (subspecies *schinzii*)	MB PV WV	MB PV
Ruff	CB PV	CB PV WV
Grey Phalarope	PV	PV WV
Pomarine Skua	PV	PV WV
Long-tailed Skua	PV	CB PV
Mediterranean Gull	PV	PV WV
Sabine's Gull	PV	PV WV
Lesser Black-backed Gull (*graellsii*)	MB PV	MB PV WV
Glaucous Gull	WV	WV HB
Great Auk	Extinct FB	Extinct FB FMB FWV
Eurasian Collared Dove	RB	RB PV
Common Kingfisher	RB MB	RB
Horned Lark	CB WV	CB WV PV
Meadow Pipit (nominate race)	MB RB PV WV	MB RB PV
Winter Wren (nominate race)	WV PV	PV
Black Redstart	PV WV	CB PV WV
Redwing (*coburni* race)	WV PV	CB? WV PV
Mistle Thrush	RB MB PV WV	RB MB PV
Firecrest	PV	PV WV
Bearded Tit	RB? PV	RB PV
Common Linnet (nominate race)	WV	CB? PV
Common Redpoll (nominate race)	WV PV	CB WV PV
Parrot Crossbill	[RB?] SV	RB SV

The following additional status codes should be added: HB = hybrid breeder, FMB = former migrant breeder, FWV = former winter visitor

Dark-eyed Junco *Junco hyemalis*
2003 Shetland Out Skerries, first summer m, 1-9 May, trapped 1st, 9th, photo (E Tait *et al* per R Riddington) (*British Birds* 96: plate 219, 97: 620; *Birding Scotland* 6: plate 118).
7th Scottish record.

Yellowhammer *Emberiza citrinella citrinella*
Andrews & Naylor (2002) included only 2 Scottish records for this subspecies. It is clear that most birds recorded in Shetland belong to this subspecies (Pennington *et al* 2003). There are therefore over 20 records. Now removed from the list of subspecies recorded on 20 or fewer occasions.

Rose-breasted Grosbeak *Pheuticus ludovicianus*
2005 Outer Hebrides Ardmhor plantation, Barra, 1st winter, male, 8 October (K Gillon *et al*) (*British Birds* 100: 102).
2nd Scottish record.

Bobolink *Dolichonyx oryzivorus*
2005 Shetland Foula, 30 September to 4 October, photo. (K B Shepherd, N D & P J Wright, R D Wynn *et al*) (*British Birds* 100: 102).
6th Scottish record.

References

Andrews I J & Naylor K A on behalf of the Scottish Birds Records Committee. 2002. Records of species and subspecies recorded in Scotland on up to 20 occasions. *Scottish Birds* 23: 61-116.

British Ornithologists' Union Records Committee. 2005. Thirty-first Report (January 2005). *Ibis* 147: 246-250.

British Ornithologists' Union Records Committee. 2006a. Thirty-second Report (October 2005). *Ibis* 148: 198-201.

British Ornithologists' Union Records Committee. 2006b. Thirty-third Report (April 2006). *Ibis* 148: 594.

Chapman M 2003. The Taiga Flycatcher in Shetland. *Birding World* 16: 429-432.

Chapman M S 2004. Scotland's first Taiga Flycatcher, Sandgarth, Shetland, October 2003. *Birding Scotland* 7: 39-44.

Chapman M 2005. Taiga Flycatcher in Shetland. *British Birds* 98: 547-550.

Clugston D L, Forrester R W, McGowan R Y & Zonfrillo B on behalf of the Scottish Birds Records Committee 2001. Scottish List – species and subspecies. *Scottish Birds* 22:33-49.

Dudley S P 2005. Changes to Category C of the British List. *Ibis* 147: 803-820.

Dudley S P, Gee M, Kehoe C, Melling T M & The British Ornithologists' Union Records Committee (BOURC) 2006. The British List: A Checklist of Birds of Britain (7th edition). *Ibis* 148: 526-563.

Forrester R W on behalf of Scottish Birds Records Committee 2003. Amendments to the Scottish List. *2000 Scottish Bird Report*: 5-7. (ed R Murray).

Forrester R W on behalf of Scottish Birds Records Committee 2004. Amendments to the Scottish List. *2001 Scottish Bird Report*: 7-12. (ed R Murray).

Garner M 2005. The Fair Isle Sandpiper: a review. *British Birds* 98: 356-361.

Martin W 1853. Miscellaneous notices. *The Naturalist* 3: 61.

Sangster G, Collinson J M, Helbig A J, Knox A G & Parkin D T 2004. Taxonomic recommendations for British birds: second report. *Ibis* 146: 153-157.

Sangster G, Collinson J M, Helbig A J, Knox A G & Parkin D T 2005. Taxonomic recommendations for British birds: third report. *Ibis* 147: 821-826.

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Revised manuscript accepted March 2007

The seasonal and altitudinal distribution of birds in a Scottish Borders valley

D G PYATT

Regular monitoring of birds has been undertaken from 2000 to 2005 in a 75 km^2 river catchment. Records were grouped into breeding seasons and winter periods and 2 altitudinal zones. In the breeding season tetrads in the lower altitudinal zone contained up to two thirds of the 107 species found in the valley; in the upper zone tetrads contained up to 30 species. In the winter periods tetrads in the lower zone contained up to two thirds of the 85 species found in the valley; tetrads in the upper zone contained only up to 10 species.

Introduction

National and regional surveys leading to the publication of bird atlases at 10km square or tetrad scales are underway or in preparation in Great Britain and Ireland (see BTO or SOC websites). National and regional atlases of breeding birds (Sharrock 1976, Gibbons *et al* 1993, Murray *et al* 1998, Stott *et al* 2002) have been joined by a national atlas of wintering birds (Lack 1986) and regional atlases that include breeding and wintering birds (eg Elkins *et al* 2003). Surveys in lowland areas during the breeding season follow well established procedures but for less accessible upland areas especially in winter such procedures may be impracticable. In remote areas and where birds are sparsely distributed there is a need to make the best use of survey time given the short daylight period available.

The present paper describes the number of species present in an inland valley in south east Scotland and compares the breeding and winter seasons within 2 altitudinal zones. This information could inform the discussion about winter atlas fieldwork for the hilly areas of Scotland.

Methods

Survey area

The results presented are from the Manor Valley in the Scottish Borders. At an earlier stage in the survey the Valley and its birds were briefly described by Pyatt (2003). The survey area comprises the complete catchment of the Manor Water, a tributary of the River Tweed, together with a minor extension into an adjoining catchment to furnish a neater boundary at the north east corner near to the town of Peebles. The area totals some 75 km^2 and lies within the rectangle defined by national grid references NT1725 and NT2541. The valley is within the Southern Uplands of Scotland and is deep and steep sided. The lowest point in the valley, in Peebles, is at 160m and the highest at 817m. The 375m contour is used to divide the catchment into upper and lower altitudinal zones. Habitats in the lower zone mainly comprise improved pasture interspersed with small but mature woods of varied species. The upper zone is dominated by rough grazing and heather moorland with extensive immature conifer plantations. There is virtually no native woodland. The Manor Water has many tributaries supplied by springs that never dry up. As a consequence all 1 km squares have permanent running water.

Survey method

The data were collected during 2000-2005 and comprise some 22,000 records. An individual record consisted of one or more birds of one species at a particular location. Until May 2002 locations were recorded as 6 figure grid references from a map (Harvey 1994), since then most recording was of 8 figure grid references obtained using a Global Positioning System. Survey was undertaken mainly through 'targeted walks'. These aimed to cover all parts of the valley and all habitats, roughly in proportion to their bird richness. In open country a band up to 1km wide could be observed, although of course not all small birds would have been flushed within the band. Two BTO Waterways Bird Survey (WBS) plots covered the lower half of the Manor Water itself. Each plot involved 9 walks at fortnightly intervals along the river. These plots comprised about 10% of the survey effort given to the whole Valley. In winter there were fewer species present than in the breeding season and far fewer individuals. The survey effort in the winter was less than in the breeding season, perhaps by a factor of 4, but was deemed sufficient to detect all the species present (see Discussion and Appendix). Outside the WBS plots no attempt was made to count all individuals or pairs except for a small number of 'key' species including Ring Ouzel *Turdus torquatus*, Black Grouse *Tetrao tetrix* and White-throated Dipper *Cinclus cinclus*.

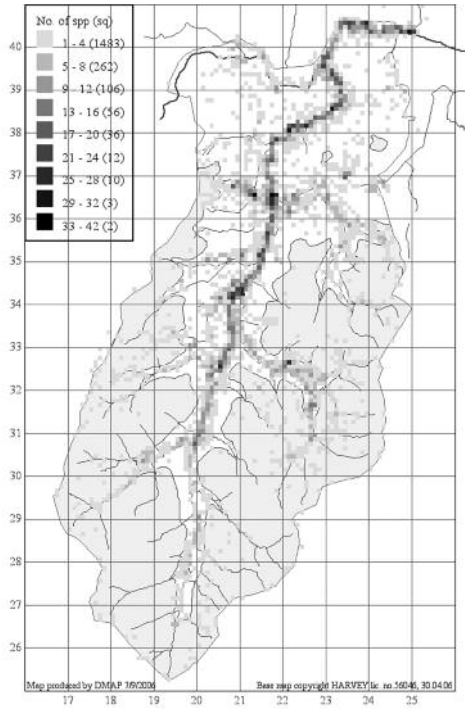

Figure 1. ***Number of species/1ha square, breeding season (no of squares)***

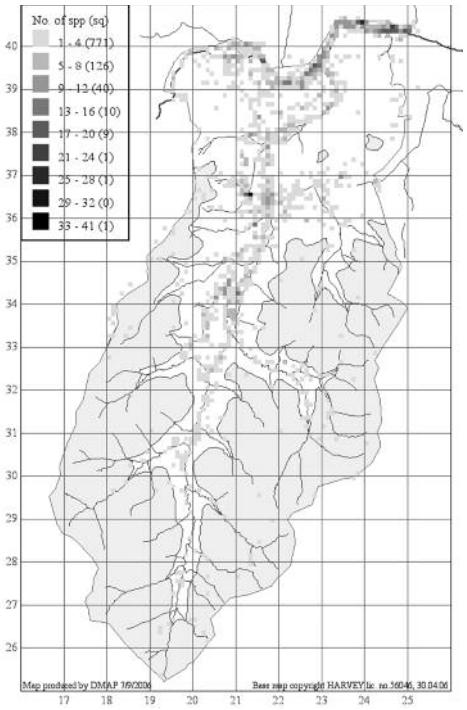

Figure 2. ***Number of species/1ha square, winter (no of squares)***

For The Atlas of Wintering Birds in Britain and Ireland (Lack 1986) the period chosen to represent 'winter' was mid November to end February. The beginning of November was avoided because some migrants, especially Fieldfare *Turdus pilaris* and Redwing *Turdus iliacus*, were still very mobile at that stage. In The New Atlas of Breeding Birds in Britain and Ireland (Gibbons *et al* 1993) the period taken to represent the breeding season was April to July. For this paper the records from the 4 months November to February were combined to represent the winter and the 4 months March to June were taken to represent the breeding season. The early start to the breeding season chosen here partly reflected the earlier arrival of migrants in these years. The inclusion of November in the winter period here equalised the length of the 2 seasons and ignored the mobility of winter visitors in that month.

Data were processed in a database (Microsoft Access) and records were then transferred to the DMAP mapping program (Morton 2003). In this paper extensive use is made of the DMAP utility of 'coincidence mapping' in which the number of species recorded in each grid square is counted. In what follows this number will be referred to as *N*. The number of species in each square reflects the range and richness of the habitats in the square. The size of the square can be chosen at will, but for the current purpose the side lengths used are 100 m (1 ha), 200 m, 500 m, 1 km and 2 km (a tetrad). Squares of 1 ha and 1 tetrad are the practical limits for a survey area of this size.

By progressively enlarging the square from a given starting location additional species are included. In uniform habitat the rate of inclusion may be small but where there is a range of habitats the rate of inclusion should be greater. Thus the number of species in the starting 1 ha and this rate of inclusion together provide a measure of local habitat diversity.

For display on maps it was convenient to choose 9 classes for *N*. DMAP also counts the number of squares in each *N* class; these numbers are shown in the key to each map in parentheses and are hereafter referred to as *S*. Although DMAP easily handles the data for breeding season or winter period separately, it cannot count squares in altitudinal zones (it is not a Geographic Information System). For the upper zone the squares within each *N* class were counted manually and then subtracted from the totals to get the numbers in the lower zone.

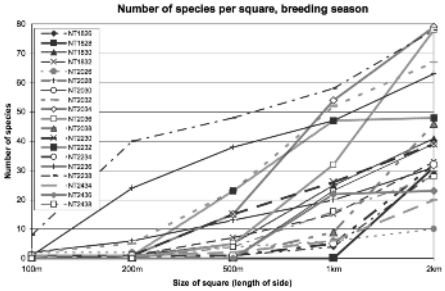

Figure 3. ***The effect on N of increasing the size of the square, breeding season.***

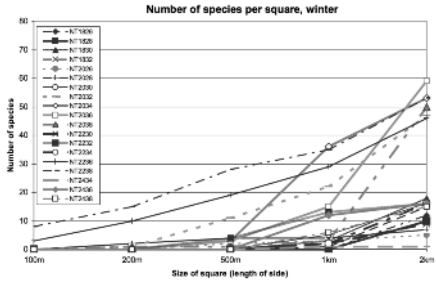

Figure 4. ***The effect on N of increasing the size of the square, winter.***

Table 1. ***Number of 1ha squares (S) with different numbers of species (N) in 2 altitudinal zones, in breeding season and winter.***

	Number of species per 1ha square (*N*)								
Zone	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-41
	Breeding season (*S*)								
Lower	1111	250	104	56	36	12	10	3	2
Upper	372	12	2						
	Winter (*S*)								
Lower	682	125	40	10	9	1	1		1
Upper	89	1							

Results

Seasonal and altitudinal distribution

Some 13,000 records were accumulated in the 6 breeding seasons, from 108 species, of which some 87 were thought to breed (see Appendix). By choosing the 1 ha grid square, the precise distribution of these records can be shown (Figure 1). The number of squares (ha) *S* decreases rapidly (actually exponentially) as class size *N* increases. What is not evident in Figure 1 is that of the 1483 ha in *N* class 1-4 about half (784) actually had only one species present.

Over the 6 winters 4,300 records were collected from 86 species. The 1 ha distribution of these records is shown in Figure 2. Of the 771 ha in *N* class 1-4 more than half (421) actually had only one species present. Although the highest *N* class had the same number of species as in the breeding season, there was only one ha in this class. There are indeed only 3 ha spanning the 4 highest *N* classes.

The preponderance of records at the lower altitudes in both seasons evident in Figures 1 and 2 is quantified in Table 1. In the breeding season the overall proportion of records in the upper zone was 19%, whereas in the winter it was only 9%.

Number of species per square

For the breeding season records, as the size of square was increased to 200 m, then to 500 m the increase in *N* was modest. At the 1 km size there was an appreciable increase in *N* and the inverse relationship between *N* and *S* was less evident. The 3 most bird-rich 1 km squares had slightly more than half of the total number of species in the survey area. When the squares were increased to tetrads, the highest value of *N* was 65-79 species and there were 4 such tetrads.

For the winter records, as the size of square was increased to 200 m the *N* classes remained the same but there were then 12 squares in the highest 4 classes. With squares of 500 m the *N* classes were again unchanged but there were 22 squares in the highest 4 classes. The 1 km distribution had similar *S* values to the breeding season but with much lower *N* classes. As in the breeding season, the highest *N* class (with 4 squares) had about half as many bird species as the total for the survey area. When the squares were increased to tetrads, the highest value of *N* was 49-60 species and there were 4 such tetrads.

The effect on number of species per square (*N*) of increasing the size of the square was studied

by taking as starting points the grid reference of each tetrad that had at least half its area within the survey area. For each size of square the value of *N* was found to the nearest unit by manipulating the class intervals within the DMAP coincidence mapping utility. By this means it was possible to 'home in' on the precise value of *N*. For the breeding season and winter records separately the results are shown in graphical form in Figures 3 and 4. Breeding season values of *N* were always larger than winter values, but the differences were small for many squares.

Comparison with existing atlases

During the 6 years of the survey 111 species were recorded in the Manor Valley. In the first 4 columns of Table 2 these are classified in terms of number and breeding status. In the breeding season 107 species were recorded of which some 87 were thought to breed. In the winter 86 species were recorded. In Table 2 the column headed Breeding Atlas lists 86 species found breeding by Murray *et al* (1998) in 31 tetrads wholly or partly lying within the Manor Valley. The Breeding Atlas included a further 6 species that were not recorded in the present survey, namely Dunlin *Calidris alpina*, Stock Pigeon *Columba oenas*, Short-eared Owl *Asio flammeus*, Wood Warbler *Phylloscopus*

Table 2. ***Checklist of birds in the Manor Valley 2000-2005***

Number Code = breeding status
Blank = does not breed
0 = has bred, not regularly
1 = 1-10 pairs
2 = 11-100 pairs
3 = 101-1000 pairs
4 = over 1000 pairs

Letter Code = time of year when most likely to be seen
B = Breeds, but not resident all year
R = Resident all year
W = Winters
P = Mainly seen on passage
S = Non-breeding summer visitor
V = Vagrant, recorded less than annually

	Standard Name/Scientific Name	Number Code	Letter Code	Breeding Atlas	Winter Atlas
1	Little Grebe *Tachybaptus ruficollis*		W	#	
2	Great Cormorant *Phalacrocorax carbo*		W		
3	Grey Heron *Ardea cinerea*	2	R	#	#
4	Mute Swan *Cygnus olor*	1	R	#	#
5	Whooper Swan *Cygnus cygnus*		V		
6	Greylag Goose *Anser anser*		S		
7	Eurasian Wigeon *Anas penelope*		V		
8	Eurasian Teal *Anas crecca*	2	RW	#	
9	Mallard *Anas playrhynchos*	2	R	#	#
10	Tufted Duck *Aythya fuligula*		V		
11	Common Goldeneye *Bucephala clangula*		V		#
12	Goosander *Mergus merganser*	1	RW	#	#
13	Hen Harrier *Circus cyaneus*	0	B	#	
14	Eurasian Sparrowhawk *Accipiter nisus*	1	R	#	#
15	Common Buzzard *Buteo buteo*	2	R	#	

16	Golden Eagle *Aquila chrysaetos*		V		#
17	Osprey *Pandion haliaetus*		S		
18	Common Kestrel *Falco tinnunculus*	2	R	#	#
19	Merlin *Falco columbarius*	1	B	#	
20	Peregrine Falcon *Falco peregrinus*	1	R	#	#
21	Willow Ptarmigan *Lagopus lagopus*	3	R	#	#
22	Black Grouse *Tetrao tetrix*	2	R	#	#
23	Red-legged Partridge *Alectoris rufa*		R		
24	Grey Partridge *Perdix perdix*	1	R	#	#
25	Common Pheasant *Phasianus colchicus*	2	R	#	#
26	Common Moorhen *Gallinula chloropus*	2	R	#	#
27	Common Coot *Fulica atra*		W	#	
28	Eurasian Oystercatcher *Haematopus ostralegus*	2	B	#	#
29	Ringed Plover *Charadrius hiaticula*	1	B		
30	Eurasian Dotterel *Charadrius morinellus*		P		
31	European Golden Plover *Pluvialis apricaria*	2	B	#	
32	Northern Lapwing *Vanellus vanellus*	2	B	#	#
33	Common Snipe *Gallinago gallinago*	2	R	#	#
34	Eurasian Woodcock *Scolopax rusticola*	2	R	#	#
35	Eurasian Curlew *Numenius arquata*	2	B	#	#
36	Common Redshank *Tringa totanus*	1	B	#	
37	Common Sandpiper *Actitis hypoleucos*	2	B	#	
38	Black-headed Gull *Larus ridibundus*	2	R	#	#
39	Mew Gull *Larus canus*		W		#
40	Lesser Black-backed Gull *Larus fuscus*		S		
41	Herring Gull *Larus argentatus*		S		#
42	Great Black-backed Gull *Larus marinus*		W		#
43	Feral Pigeon *Columba livia*	2	R	#	#
44	Common Wood Pigeon *Columba palumbus*	3	R	#	#
45	Eurasian Collared Dove *Streptopelia decaocto*	1	R	#	#
46	Common Cuckoo *Cuculus canorus*	1	B	#	
47	Barn Owl *Tyto alba*	1	R	#	#
48	Tawny Owl *Strix aluco*	2	R	#	#
49	Common Swift *Apus apus*		S	#	
50	Common Kingfisher *Alcedo atthis*	1	R	#	#
51	Green Woodpecker *Picus viridis*	1	R	#	#
52	Great Spotted Woodpecker *Dendrocopus major*	2	R	#	#
53	Sky Lark *Alauda arvensis*	2	B	#	
54	Sand Martin *Riparia riparia*	2	B	#	
55	Barn Swallow *Hirundo rustica*	2	B	#	
56	House Martin *Delichon urbica*	2	B	#	
57	Meadow Pipit *Anthus pratensis*	4	B	#	
58	Grey Wagtail *Motacilla cinerea*	2	B	#	#
59	Pied Wagtail *Motacilla alba*	2	B	#	#
60	Bohemian Waxwing *Bombycilla garrulus*		V		

61	White-throated Dipper *Cinclus cinclus*	2	R	#	#
62	Winter Wren *Troglodytes troglodytes*	3	R	#	#
63	Hedge Accentor *Prunella modularis*	2	R	#	#
64	European Robin *Erithacus rubecula*	3	R	#	#
65	Common Redstart *Phoenicurus phoenicurus*	1	B	#	
66	Whinchat *Saxicola rubetra*	1	B	#	
67	Stonechat *Saxicola torquata*	2	B	#	
68	Northern Wheatear *Oenanthe oenanthe*	2	B	#	
69	Ring Ouzel *Turdus torquatus*	1	B	#	
70	Blackbird *Turdus merula*	2	RW	#	#
71	Fieldfare *Turdus pilaris*		W	#	#
72	Song Thrush *Turdus philomelos*	2	B	#	#
73	Redwing *Turdus iliacus*		W		#
74	Mistle Thrush *Turdus viscivorus*	2	R	#	#
75	Sedge Warbler *Acrocephalus schoenobaenus*	0	B	#	
76	Lesser Whitethroat *Sylvia curruca*		P		
77	Common Whitethroat *Sylvia communis*	0	B		
78	Garden Warbler *Sylvia borin*	1	B	#	
79	Blackcap *Sylvia atricapilla*	1	B	#	
80	Common Chiffchaff *Phylloscopus collybita*	0	B	#	
81	Willow Warbler *Phylloscopus trochilus*	3	B	#	
82	Goldcrest *Regulus regulus*	3	R	#	#
83	Spotted Flycatcher *Muscicapa striata*	1	B	#	
84	Long-tailed Tit *Aegithalos caudatus*	1	R	#	#
85	Coal Tit *Parus ater*	3	R	#	#
86	Blue Tit *Parus caeruleus*	3	R	#	#
87	Great Tit *Parus major*	3	R	#	#
88	Wood Nuthatch *Sitta europaea*	1	R	#	
89	Eurasian Treecreeper *Certhia familiaris*	2	R	#	#
90	Eurasian Jay *Garrulus glandarius*		P		
91	Black-billed Magpie *Pica pica*	1	R	#	#
92	Eurasian Jackdaw *Corvus monedula*	3	R	#	#
93	Rook *Corvus frugilegus*	3	R	#	#
94	Hooded Crow/Hybrid Crow *Corvus corone corvix*	1	R		
95	Carrion Crow *Corvus corone corone*	2	R	#	#
96	Common Raven *Corvus corax*	1	R	#	#
97	Common Starling *Sturnus vulgaris*	2	R	#	#
98	House Sparrow *Passer domesticus*	2	R	#	#
99	Chaffinch *Fringilla coelebs*	3	R	#	#
100	Brambling *Fringilla montifringilla*		W		#
101	European Greenfinch *Carduelis chloris*	2	R	#	#
102	European Goldfinch *Carduelis carduelis*	2	R	#	#
103	Eurasian Siskin *Carduelis spinus*	2	R	#	#
104	Common Linnet *Carduelis cannabina*	1	B	#	#
105	Twite *Carduelis flavirostris*		W		

106	Lesser Redpoll *Carduelis cabaret*	1	R	#	#
107	Common Crossbill *Loxia curvirostra*	1	R	#	
108	Common Bullfinch *Pyrrhula pyrrhula*	2	R	#	#
109	Hawfinch *Coccothraustes coccothraustes*		V		#
110	Yellowhammer *Emberiza citrinella*	0	B	#	#
111	Reed Bunting *Emberiza schoeniclus*	1	B		#
	Totals		**111**	**86**	**66**

sibilatrix, Pied Flycatcher *Ficedula hypoleuca* and Marsh Tit *Parus palustris*. The status of Coot *Fulica atra* and Fieldfare *Turdus* pilaris differed between the Breeding Atlas and the present survey. Four 10 km squares intersect within the Manor Valley, of which square NT23 provides the best match of habitats with the valley as a whole. In Table 2 the column headed Winter Atlas lists the 66 species found wintering in square NT23 by Lack (1986).

Discussion

Seasonal and altitudinal distribution

The apparent concentration of birds near to the watercourses in both seasons is striking. Riverside and streamside habitats are diverse, relatively sheltered and presumably tend to be productive of food for many bird species but this explanation is more convincing for the winter distribution than for the breeding season. Furthermore, Figure 2 is likely to be a more accurate representation of the winter distribution of birds than Figure 1 is of the breeding distribution. For example, in spring and summer it would be possible to find Meadow Pipits in many of the apparently blank areas of the upland zone. The 'string of beads' records that can be seen in various places such as along the watershed boundary show the birds encountered along a particular walking route. Detailed surveys by Pearce-Higgins and Grant (2006) have shown that Meadow Pipits occupy habitat typical of the upland zone at a density of about 1 pair per ha. At the tetrad scale the concentration of breeding species along watercourses was also found by Murray *et al* (1998) in south east Scotland (see their map on p27).

The 1 ha square with the highest number of species, 42 in the breeding season and 41 in winter, surrounded the surveyor's garden and although a bird feeding station may have had some influence in winter, this was inevitably the most observed part of the survey area. On the other hand all the species recorded in this square were found elsewhere in the survey area, indicating that concentrated survey effort increased the number of species locally but not for the survey area as a whole.

Number of species per square

The 1 km size of square is used in national surveys such as the British Trust for Ornithology (BTO) Breeding Bird Survey. In the Manor Valley there are more species per 1 km square in the breeding season than in winter (Figures 3 and 4). In each season the highest *N* value is just over half of the total number of species for the survey area. The upland zone (see Figure 2 for the boundary) is almost entirely composed of the lowest *N* value, 1-7 species in the breeding season and 1-5 in the winter. It should be emphasized however that these are numbers in individual squares and not the total number of species in the upland zone.

The tetrad is used in most regional atlases, such as that for South east Scotland (Murray *et al*.1998) that includes the Manor Valley. In the breeding season there are 4 tetrads with the highest N value of 65-79, which represents

about two thirds of the total number of species for the survey area. In the winter there are also 4 tetrads with the highest *N* value of 49-60, again about two thirds of the number of species for the survey area.

Comparison with existing atlases

The comparison of species lists between the present survey and existing breeding and winter atlases shows remarkably good agreement for both seasons. This adds further weight to the view that it is not necessary to spend anything like the 1500 hours fieldwork of the present survey to obtain an accurate list of the species present in an area the size of the Manor Valley. Where there are omissions of species in the atlases, these are species that are known to have increased in the last decade eg wintering Little Grebe *Tachybaptus ruficollis*, wintering Common Buzzard *Buteo buteo*. Ringed Plover *Charadrius hiaticula* recently extended its breeding range to the Manor Valley. It is a minor criticism of the winter atlas that it underestimated the status of the Twite *Carduelis flavirostris* or that the same may be said of the breeding atlas about the Reed Bunting *Emberiza schoeniclus*.

The numbers of species per 1 km square or per tetrad recorded in the Manor Valley are probably typical of the western and southern parts of the Scottish Borders. Murray *et al* (1998) found 43 and 34 breeding species per tetrad in altitudinal bands 200-299 m and 300-399 m respectively, equivalent to the lower zone of the Manor Valley. They found 24, 17 and 9 breeding species per tetrad in altitudinal bands 400-499 m, 500-599 m and over 600 m respectively, equivalent to the upper zone of the Manor Valley (see their p27). Moreover it should be noted that the Valley lacks a substantial loch and therefore is deficient in waterfowl, particularly in the breeding season, compared to many parts of the Scottish Borders.

References

BTO 2006. *Why another atlas?* Atlas 2007-2011. British Trust for Ornithology internet website. www.bto.org.

Gibbons D W, Reid, J B and Chapman R A 1993. *The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991*. T & A D Poyser, London.

Harvey 1994. *Peebles, Manor Hills & St Mary's Loch*. Map at 1:40,000 scale, Harvey Map Services.

Lack P 1986. *The Atlas of Wintering Birds in Britain and Ireland*. T & A D Poyser, Calton.

Morton A J 2003. DMAP for Windows (2003). Software for Distribution Mapping, Version 7.2a. Internet Web Site: http://www.dmap.co.uk/

Murray R D, Holling M, Dott H E M and Vandome, P 1998. *The Breeding Birds of South-east Scotland: a tetrad atlas 1988-1994*. The Scottish Ornithologists' Club, Edinburgh.

Pearce-Higgins J W and Grant M C 2006. Relationships between bird abundance and the composition and structure of moorland vegetation. *Bird Study* 53, 112-125.

Pyatt D G 2003. Birds of the Manor Valley. *Scottish Bird News* 67 :12-13. Scottish Ornithologists' Club.

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Revised manuscript accepted August 2006

Autumn skua migration at Hound Point, Lothian

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The autumn migration of 4 species of skuas was studied at Hound Point, Lothian. Systematic observations over a 20 year period from 1986-2005 revealed regular passage of a large number of birds at this site. Arctic Skua was the most frequently observed species, largely in September and October, usually seen in small groups, with day totals rarely exceeding 100. Long-tailed Skua was seen more irregularly in smaller numbers during August and September. In most years only a few immatures and adults were recorded; very rarely, day totals of 100-200 adults in flocks of up to 20 were recorded. A similar, irregular pattern was observed for Pomarine Skua, although with larger numbers and flocks of up to 50, and a broader seasonal occurrence from August to November. Great Skua was seen every year, usually as singles or in small groups of up to 10, mostly in September and October. Many birds of all 4 species were observed passing west, apparently moving overland to the west coast of Scotland and the Atlantic Ocean.

Introduction

The 4 species of skua breeding in the northern hemisphere undergo long migrations, wintering from equatorial coastal waters to deep waters and rich currents in the southern oceans (Furness 1987, Olsen & Larsson 1997). For 2 species, Arctic Skua *Stercorarius parasiticus* and Great Skua *Stercorarius skua*, their breeding range includes northern and western Scotland (Loyd *et al* 1991, Mitchell *et al* 2004). These, along with Long-tailed Skua *Stercorarius longicaudus* and Pomarine Skua *Stercorarius pomarinus*, are observed migrating through Scottish waters each spring and autumn (*Scottish Bird Reports*, Critchley 1972, Davenport 1979, 1987, 1992, Fox & Aspinall 1987, Dunn & Hirschfield 1991, Harrop *et al* 1993).

In autumn most migrating skuas seen in Scotland are recorded in the North Sea, observed from land based sites along the east coast, particularly at exposed headlands after strong onshore winds (Wallace & Bourne 1981, Steele 1987, Innes 1993). Large numbers have also been recorded at coastal sites in the Firth of Forth and Moray Firth at geographic bottlenecks, many kilometres from the open North Sea. The 2 best known of these are Hound Point, Lothian (Griffin & McInerny 2001), and Chanonry Point on the Black Isle, Ross & Cromarty (McInerny 2004).

In the Firth of Forth skuas have been recorded in its upper stretches since the late 18th Century (Pennant 1771, Gray 1871, Godfrey 1899, Harvie-Brown 1906, Rintoul & Baxter 1935), with a regular autumn passage first noted at Hound Point in the late 1970s (Andrews 1986). Occasionally, exceptional influxes have occurred resulting in very large numbers being observed (Dalgleish 1880, Rintoul & Baxter 1935, Brown & Andrews 1986, Andrews 1986, Andrews & Griffin 1989, McGarry & Speak 1992, Griffin & McInerny 2001). Since the mid 1980s this migration has been monitored on a regular basis, with birds seen from July to early December. In this paper we describe our observations from Hound Point during the period 1986-2005, and discuss the autumn movements of skuas at this site.

Study area and methods

Hound Point is a small promontory on the south side of Firth of Forth, 8 km west of Edinburgh and 4 km east of South Queensferry, where the firth becomes constricted. In this area the waters narrow to 3 km, with the Forth Railway Bridge artificially 'sealing' the firth 2 km to the west. These geographic features result in the concentration of migrating seabirds entering from the east, with Northern Gannet *Sula bassana*, Black-legged Kittiwake *Rissa tridactyla*, Northern Fulmar *Fulmaris glacialis* and skuas the most commonly seen. Hound Point, although only at elevation of 10 m, has the advantage of giving an unrestricted view to the north and east out of the firth.

Regular visits to the site began in 1986, with between 5 and 47 per year (Table 1). Each visit lasted for at least 2 hours, resulting in the total viewing time each year of 15.5 to 81.5 hours. Binoculars and viewing telescopes were used to scan for skuas, which could pass both low over the water and high in the sky. The species, number, and direction of movement were recorded, with age class determined for Arctic, Pomarine and Long-tailed Skuas. Duplication of records was avoided wherever possible, with recognisable individuals and flocks only counted once. This was important as some birds were observed passing the point on a number of occasions, either entering and leaving the firth, or re entering a number of times.

Results

Pomarine Skua

This species was observed on 53% of visits with 2,635 recorded. The annual total numbers varied considerably, from 3 to 790; 61% were observed moving west, 14% east, and the remainder indeterminate (Figure 1). Most passed in October (57%) and September (23%), with fewer in August (15%) and November (6%); in July just 4 in total were noted (Figure 2). The majority were adults (73%) and 27% immatures. Most adults passed in October (56%) and September (26%), with fewer in August (18%), November (2%) and July (<1%). Immatures passed later, as more were noted in October (67%) and November (11%), with fewer in September (16%) and August (7%).

The number seen on each visit varied enormously. On many days singles and small groups of up to 6 were observed, but a number of larger flocks of up to 20, and day counts of 50-100 were recorded. The largest day count was of *c* 420, including 350 adults and 70

Table 1. ***Observer coverage at Hound Point, Lothian, 1986-2005.***

Year	Visits	Viewing time (hr)	Year	Visits	Viewing time (hr)
1986	5	15.5	1996	14	27
1987	22	60.0	1997	23	53
1988	24	59.0	1998	19	34
1989	31	77.5	1999	14	29
1990	47	81.5	2000	15	33
1991	34	67.5	2001	20	31
1992	23	56.0	2002	20	54
1993	25	52.0	2003	13	27
1994	37	77.5	2004	13	26
1995	25	50.0	2005	9	26

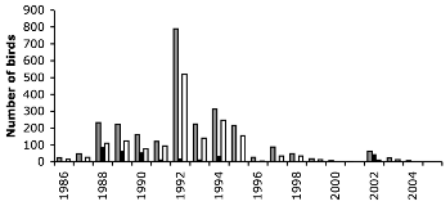

Figure 1. ***Annual occurrence and direction of migration of Pomarine Skuas at Hound Point, Lothian, 1986-2005. Grey, total numbers; black, numbers moving east; white, numbers moving west.***

immatures, on 16 October 1992, the highest day tally for any of the 4 skua species. This influx was followed 4 days later by 145 passing on 20 October 1992, which included 130 adults and 15 immatures. Weather conditions on both occasions were force 4-5 north to north easterly winds, after a period of westerly and north westerly airflows. Another exceptional passage occurred on 1 October 1994 during a period of moderate easterly winds and low cloud: 186, including 173 adults and 13 immatures, were watched flying west past the point. This movement contained the largest flock of Pomarine Skuas seen at the site, 48 birds.

Adult Pomarine Skua exists in 2 colour phases, the light phase being the most common in the North Atlantic (Olsen & Larsson 1997). We observed only 70 dark phase birds, 4.6% of the total number of adults.

Arctic Skua

This species was the most regularly seen passing Hound Point and was observed on almost all visits (98%), with numbers reasonably constant between years, although showing a range of 50 to 541; 50% were observed moving west, 9% east, and the remainder indeterminate (Figure 3). Out a total of 5,501 recorded the majority passed

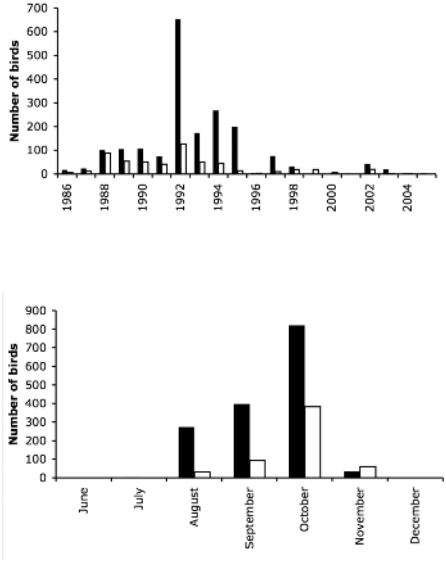

Figure 2. ***Annual and seasonal occurrence of adult (black) and immature (white) Pomarine Skuas at Hound Point, Lothian, 1986-2005.***

in September (63%), with fewer in August (21%) and October (15%); less than 1% were seen both in July and November (Figure 4). Of these *c* 60% were immatures.

The number seen on each visit was the most constant amongst the 4 species of skua: between 10 and 20 were seen, with counts above 50 being unusual. The largest day counts were 105 on 12 September 1996 in a northerly force 4-5 wind, with 84 moving west; and 102 on 19 September 1999 in an easterly force 5-6 wind, including 78 migrating west.

Arctic Skua only rarely formed larger flocks of more than 10 birds. Most were seen migrating either as singles or in small loose groups of up to 5. The largest flock recorded was of 21 on 11 September 1989.

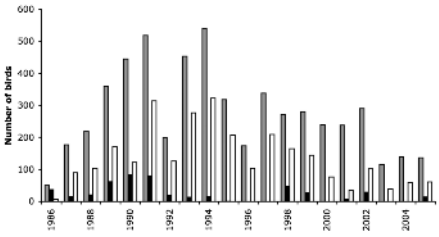

Figure 3. ***Annual occurrence and direction of migration of Arctic Skuas at Hound Point, Lothian, 1986-2005. Grey, total numbers; black, numbers moving east; white, numbers moving west.***

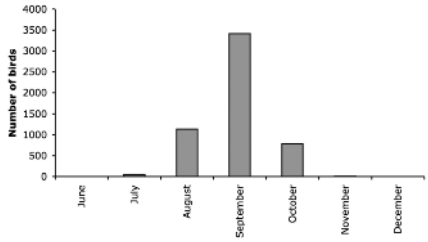

Figure 4. ***Seasonal occurrence of Arctic Skuas at Hound Point, Lothian, 1986-2005.***

Arctic Skua exists in 2 colour phases, pale birds predominating in the northern part of the breeding range and dark birds in southern latitudes, including Scotland (Furness 1987). Numbers of each phase varied between years, but of the adults, 60-70% were dark and 30-40% were pale.

Long-tailed Skua

This was the rarest species with 920 recorded, observed on 27% of visits, and annual total numbers varying considerably, from 0 to 415; 79% were observed moving west, 4% east, and the remainder indeterminate (Figure 5). Most passed in September (57%) and August (35%), with fewer in October (15%); just one, an adult, was recorded in July (Figure 6). Most recorded were adult (85%) and 15% immature, although the latter were likely under recorded due to the difficulty of separating individuals of this age class from Arctic Skua. The majority of adults passed in September (55%), and August (38%), with few in October (8%). Immatures appeared to pass later as more were noted in October (21%), although most were seen in September (64%), and a significant number, 14%, were recorded in August.

Typically, birds passed as singles or in small groups of up to 4. However, a number of exceptional passage days were recorded, when over 100 were seen. The first of these was on 7 September 1991 when 180 adults and 10 immatures were counted, of which 177 moved west, during a westerly force 2-3 wind followed by north easterly force 3-4. This movement continued over the next 3 days, with 35, 24 and 60 recorded. The largest passage was on 7 August 1995, when 217 migrated west past the point, including 214 adults and 3 immatures, during a force 4 north easterly wind. This day had the largest group, of 22 adults, recorded at Hound Point. Just 4 were noted the following day.

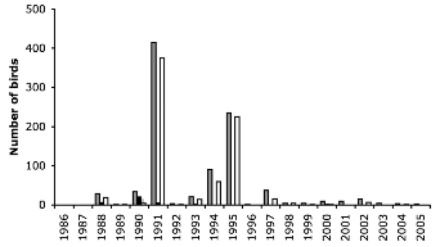

Figure 5. ***Annual occurrence and direction of migration of Long-tailed Skuas at Hound Point, Lothian, 1986-2005. Grey, total numbers; black, numbers moving east; white, numbers moving west.***

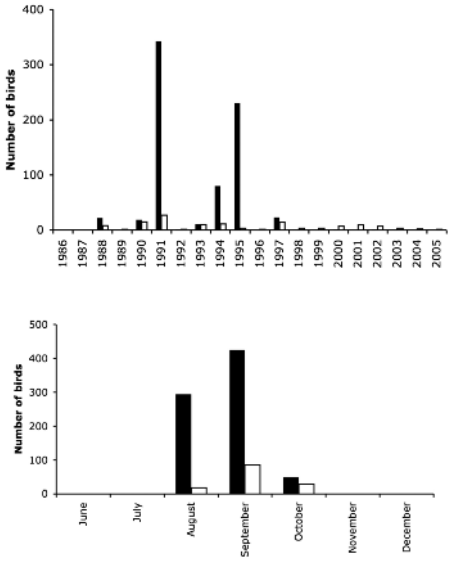

Figure 6. ***Annual and seasonal occurrence of adult (black) and immature (white) Long-tailed Skuas at Hound Point, Lothian, 1986-2005.***

Two adults showing characteristics of the Nearctic subspecies *pallescens* were observed. One was on 30 September 1988 and the other on 27 August 1998. While the status of this subspecies on the *British List* is currently under review (Sangster *et al* 2004), its appearance in Britain seems plausible, considering the migration pattern of east North American and Greenland breeding birds through the mid Atlantic, and their likely displacement westwards after strong anticyclonic winds.

Both adults and immatures were sometimes noted in mixed flocks, especially with Arctic Skuas. Lone, immature Long-tailed Skuas were also rarely noted migrating in flocks of Black-legged Kittiwakes.

Great Skua

This species was the second most regularly seen passing Hound Point, being observed on 67% of visits, with some fluctuation in numbers between years, showing a range of 17 to 248; 55% were observed moving west, 30% east, and the remainder indeterminate (Figure 7). Out a total of 2,099 recorded, the vast majority passed in September (49%) and October (41%); just 8% were seen in August and less than 1% and 2%, respectively, were noted in July and November (Figure 8). Separation of adults from immatures is extremely difficult under distant field conditions, and so we did not differentiate age classes.

Most were seen migrating as singles or in small groups of up to 6; larger groups of up to 34 were rare. The largest flock recorded was on 30 September 1998 when a group of up to 73 was seen during a north easterly force 4-6 storm. These birds did not move west in the low cloud and rain, but instead formed a raft on the sea off the point, with individuals continuously entering and leaving the Firth of Forth from the east.

Great Skua was occasionally noted migrating with Northern Gannet, typically singles within various group sizes. Such migration by skuas along side their host species has been noted elsewhere (Olsen & Larsson 1997).

Mixed flocks

Mixed flocks of various skua species were observed on many occasions migrating together past the point. The most common combinations were Pomarine and Arctic Skuas, Arctic and Great Skuas, and Arctic and Long-tailed Skuas. Pomarine and Great Skuas were also more rarely seen together, and on a few occasions flocks containing all 4 species were noted.

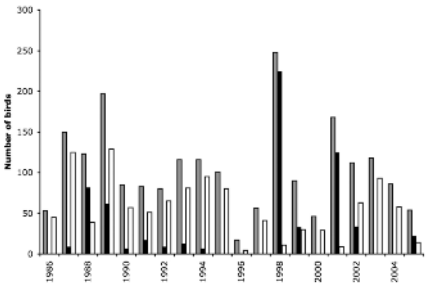

Figure 7. ***Annual occurrence and direction of migration of Great Skuas at Hound Point, Lothian, 1986-2005. Grey, total numbers; black, numbers moving east; white, numbers moving west.***

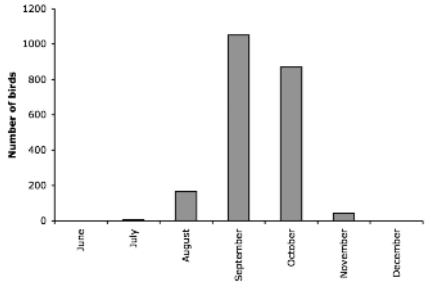

Figure 8. ***Seasonal occurrence of Great Skuas at Hound Point, Lothian, 1986-2005.***

Discussion

The North Sea is an established regular autumn passage route for skuas (Webb *et al* 1990, Stone *et al* 1995). The annual appearance of Arctic and Great Skuas in these waters indicates that they intentionally use this sea area each year on their journey to southerly wintering areas. At least for Great Skua, satellite tracking of Shetland bred birds has revealed a number of individuals moving south along the east side of Britain (Robert Furness, personal communication). These 2 species probably pass through the North Sea because of the large number of other seabird species present at the time of the year, which they kleptoparasitise for food (Wourinen 1992). The Firth of Forth attracts very large flocks of post breeding *Sterna* terns in August and September, particularly Sandwich Tern *Sterna sandvicensis*.

In contrast, Pomarine and Long-tailed Skuas are seen very much more irregularly in the North Sea, with only small numbers noted in most years, and occasional larger influxes. Both species are thought to prefer to migrate over deeper waters through the mid Atlantic (Stone *et al* 1995, Pollock *et al* 2000), those seen in the North Sea brought there only after unusual weather conditions such as strong westerly winds. Another crucial factor influencing their occurrence is breeding success. Both skua species show dramatic fluctuations in annual breeding productivity due to changes in numbers of lemmings (*Lemmus, Myopus* and *Dicrostonyx*) in the Arctic breeding grounds (Bell 1965). At least 2 of the years when large numbers of Long-tailed and Pomarine Skuas were seen off Hound Point, 1991 and 1994, coincided with 'lemming years' (Stenseth *et al* 1998). However, it must be emphasised over 90% of birds seen in 1991 and 1994 were adults, and large numbers of the 2 species, including in 1992 when 790 Pomarine Skuas were counted, were present in years when lemming numbers were low. Furthermore, small counts of both Pomarine and Long-tailed Skuas were recorded at Hound Point since 1995, although a number of lemming years occurred during this time.

Most of the skuas seen at Hound Point were observed entering the Firth of Forth from the east, moving in a westerly direction toward the Forth Railway Bridge. On many occasions, flocks were seen to gain height in front of the bridge, before continuing to fly in a south westerly direction overland. We are convinced that many skuas seen at Hound Point use an overland route between the Firth of Forth and the west coast of Scotland to

return to the Atlantic Ocean. Such overland passage by Great Skuas has been proved in England on the Wash in Cambridgeshire (Easy 1990, 1993), and overland movements by skuas have been observed elsewhere in both North America and the Palearctic region (Olsen & Larsson 1997). Similar westward overland passage by Black-legged Kittiwakes has also been observed in the Firth of Forth at South Queensferry and Skinflats (Sandeman 1974, 1975, Griffin & McInerny 2001).

We also observed a smaller number of skuas flying east past the point out of the Firth of Forth. Some of these were recognisable as individuals or groups that had previously arrived from the east. We believe that all birds seen moving east in autumn past Hound Point were leaving the Firth of Forth, having entered earlier from the North Sea and, instead of attempting overland passage, had opted to return to the North Sea. Numbers of skuas are seen flying north past east coast headlands elsewhere in Scotland and England in autumn, with some believed to re enter the North Atlantic via a route around the north of Scotland (Wallace & Bourne 1981, Innes 1993).

For all species where age classes could be identified, adults predominated earlier in autumn than immatures. However, immature Pomarine and Long-tailed Skuas were both recorded in August, suggesting in some cases very rapid dispersal from the breeding areas. These early immatures were invariably migrating with adults, possibly their parents. In contrast, many later immatures were seen passing by themselves.

The fact that 30-40% of adult Arctic Skuas were pale phase indicates that significant numbers of this species breeding in more northerly latitudes, where this colour phase predominates, pass through Scottish coastal waters in autumn.

Acknowledgements

We thank Rosebery Estates for allowing access to Hound Point and Ian Andrews for help with the graphics.

References

Andrews I J 1986. *The Birds of the Lothians*. SOC, Edinburgh.

Andrews I J & Griffin M 1989. Influx of Long-tailed Skuas in Lothian, autumn 1988. *Lothian Bird Report* 1988: 79-81.

Bell D G 1965. Studies of less familiar birds. 133. Long-tailed Skua. *British Birds* 58: 139-145.

Brown A & Andrews I J 1986. Influx of Pomarine Skuas in autumn 1985. *Lothian Bird Report* 1985: 104-108.

Critchley G 1972. A large movement of skuas in the Outer Hebrides. *Scottish Birds* 7: 205-206.

Davenport D L 1979. Spring passage of skuas at Balranald, North Uist. *Scottish Birds* 10: 216-220.

Davenport D L 1987. Large passage of skuas off Balranald, North Uist in May 1986. *Scottish Birds* 14: 180-181.

Davenport D L 1992. The spring passage of Long-tailed and Pomarine Skuas in Britain and Ireland. *Birding World* 5: 92-95.

Dalgleish J J 1880. Pomarine Skuas in the Firth of Forth in the autumn of 1879. *Proceedings Royal Physical Society of Edinburgh* April 27, 4: 274.

Dunn P J & Hirschfield E 1991. Long-tailed Skuas in Britain and Ireland in autumn 1988. *British Birds* 84: 121-136.

Easy G M S 1990. Skua migration over Cambridgeshire. *Cambridge Bird Club Report* 41: 41-42.

Easy G M S 1993. An update on skua movements inland from the Wash. *Cambridge Bird Club Report* 67: 85-87.

Fox A D & Aspinall S J 1987. Pomarine Skuas in Britain and Ireland in autumn 1985. *British Birds* 80: 404-421.

Furness R W 1987. *The Skuas*. T & A D Poyser, London.

Godfrey R 1899. Pomatorhine Skua in West Lothian. *Annals of Scottish Natural History* 1899: 52.

Gray R 1871. *The Birds of the West of Scotland*. Thomas Murray, Glasgow.

Griffin M & McInerny C J 2001. Skua watching at Hound Point, Lothian. *Birding Scotland* 4: 2-7.

Harrop H, Mellor M & Suddaby D 1993. Spring passage of Pomarine Skuas off Shetland in May 1992. *Scottish Birds* 17: 50-55.

Harvie-Brown J A 1906. Richardson's Skua at Kincardine-on-Forth. *Annals of Scottish Natural History* 1906: 118.

Innes M 1993. The movement of Skuas off Peterhead, Grampian. *North-east Scotland Bird Report* 1992: 10-14.

Lloyd C S, Tasker M L & K Partridge 1991. *The Status of Seabirds in Britain and Ireland*. T & A D Poyser, Calton.

McGarry O & Speak P W 1992. Long-tailed Skua passage, autumn 1991. *Lothian Bird Report* 1991: 113-115.

McInerny C J 2004. Sea-watching at Chanonry Point, Highland. *Birding Scotland* 7: 49-55.

Mitchell P I, Newton S F, Ratcliffe N & Dunn T E 2004. *Seabird Populations of Britain and Ireland*. T & A D Poyser, London.

Olsen K M & Larsson H 1997. *Skuas and Jaegers*. Pica Press, Sussex.

Pennant, T. 1771. *A Tour of Scotland in 1769*. John Monk, Chester.

Pollock C M, Mavor R, Weir C R, Reid A, White R W, Tasker M L, Webb A & Reid J B 2000. *The Distribution of Seabirds and Marine Mammals in the Atlantic Frontier, North and West of Scotland*. JNCC, Aberdeen.

Rintoul L J & Baxter E V 1935. *A Vertebrate Fauna of Forth*. Oliver and Boyd, Edinburgh.

Sandeman G L 1974. A large movement of Kittiwakes in the Forth. *Scottish Birds* 8: 77-78.

Sandeman G L 1975. Another Kittiwake movement in the Firth of Forth. *Scottish Birds* 8: 324-325.

Sangster G, Collinson J M, Helbig AJ, Knox AG & Parkin D T 2004. Taxonomic recommendations for British birds: second report. *Ibis* 146: 153-157.

Steele R D 1987. Large movement of skuas off Rattray Head. *North-east Scotland Bird Report* 1986: 50.

Stenseth N, Chan K-S, Framstad E & Tong H 1998. Phase-and density-dependent population dynamics in Norwegian lemmings: interaction between deterministic and stochastic processes. *Proceedings of the Royal Society of London* B 265: 1957-1968.

Stone C J, Webb A, Barton C, Ratcliffe N, Reed T C, Tasker M L, Camphuysen C J & Pienkowski M W 1995. *An Atlas of Seabird Distribution in North-western European Waters*. JNCC, Peterborough.

Wallace D I M & Bourne W R P 1981. Seabird movements along the east coast of England. *British Birds* 74: 417-426.

Webb A, Harrison N M, Leaper G M, Steele RM, Tasker M L & Pienkowski M W 1990. *Seabird Distribution West of Britain*. JNCC Report.

Wourinen J D 1992. Do Arctic Skuas *Stercocarius parasiticus* exploit and follow terns during autumn migration? *Ornis Fennica* 69: 198-200.

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Revised manuscript accepted August 2006

Numbers, distribution and habitats of Black Grouse leks in Lochaber

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In spring 2000, a survey of lekking Black Grouse in 3 study areas in Lochaber (Glen Garry, Glen Spean and South Lochaber, comprising 933 km^2) recorded 133 males at 43 lek sites. Thirteen of the leks had only single males, and over half of these were in the Glen Garry area. The average number of males per lek was highest in Glen Spean (4.4) and lowest in Glen Garry (1.6) with an overall average for the 3 study areas of 3.1males per lek. The average distance between nearest neighbour leks was 1.42 km.

Most of the leks in the Glen Garry area were associated with Heather dominated clearings in young conifer plantations which were reaching thicket stage. Black Grouse in Glen Spean were found lekking on a mosaic of hill farmland, forest and moorland habitats on the north side of the glen. In South Lochaber, there were 2 Black Grouse groups isolated by almost 10 km of largely unsuitable habitat. Both groups were associated with Birch and Ash woodland.

The risk of Black Grouse being killed on forest fences was high in all areas except around Kinlochleven, where there were no deer fences within 1.5 km of any of the lek sites. The average length of deer fence within a 1.5 km radius around the lek sites was 6.0 km (range 0 – 13.2 km). It is recommended that a Lochaber Black Grouse Group forms and that the landowners take steps to reduce possible collisions with fences.

Introduction

The Black Grouse *Tetrao tetrix* is a species of high and growing conservation concern (Anon 1999). Black Grouse have been in decline in many parts of Britain for over a century, but in the last 25 years, the rate of decline has accelerated (Hancock *et al* 1999). Despite their widespread distribution in Europe, their conservation status on the continent is equally unfavourable, apart from Sweden (Tucker & Heath 1994). Although the overall downward trends are clear, our knowledge and understanding of the status and dynamics of some local populations is poor.

Systematic counts of Black Grouse males at leks in Britain were undertaken in spring 1995 and 1996 (Hancock *et al* 1999). Although this survey gave a general picture of the status of the population nation wide, it did not provide sufficient local information on which to base conservation objectives and actions. For some areas, basic knowledge of Black Grouse numbers and distribution exists (Robinson *et al* 1993). However, Lochaber has not had a comprehensive survey. The first aim of this study was to describe the numbers and distribution of males at leks, and to describe associated habitat.

Studies have highlighted the effect of fencing associated with woodland on a variety of birds (Catt *et al* 1994, Andrew & Baines 1997, Baines

& Summers 1997). Owls, passerines, pigeons and woodpeckers have all been found dead against fence lines, but grouse appear to be particularly vulnerable. Therefore, a secondary aim was to describe the amount of fencing close to lek sites, as a measure this potential hazard. Information on numbers, distribution, habitat and potential collision risk with fences can then be used as a baseline for future monitoring and targeting conservation action.

Study areas

The 3 study areas are shown in Figure 1. The Glen Garry study area extended over 308 km^2 between Glen Moriston in the north, Inchnacardoch Forest and the Great Glen in the east, Kingie in the west and the watershed of the Glen Garry deer forest in the south. Much of this area is moorland and conifer plantation, along with substantial areas of clear fell around the ancient pinewoods on the south shore of Loch Garry. The mountainous terrain along the southern margin and the northwest corners of the study area were largely unsuitable for Black Grouse and were excluded from the survey.

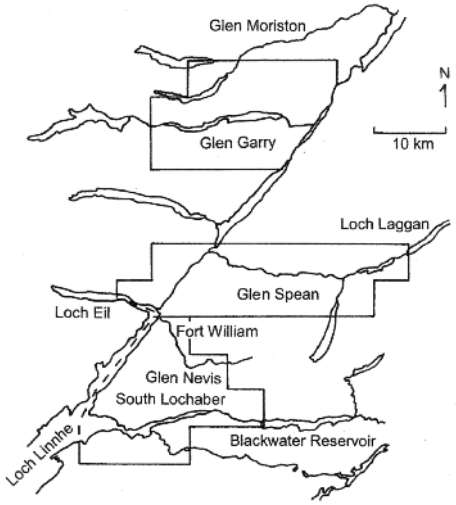

Figure 1. ***The study area in Lochaber showing the different sections that were surveyed.***

The 337 km^2 Glen Spean study area extended in a 5-10 km wide band from Loch Laggan in the east to Loch Eil in the west. Land use and habitats contrasted on either side of Glen Spean; extensive dense maturing conifer plantations occurred on the lower ground on the south side of the glen, while the south facing slopes comprised a mosaic of hill farmland, Heather *Calluna vulgaris* moorland and small commercial plantations.

The 288 km^2 South Lochaber study area abutted the Glen Spean area at Fort William and extended south almost as far as Argyll. It was bounded by Loch Linnhe in the west, and Glen Nevis and the Blackwater Reservoir in the east. With the exception of the Mamore deer forest and the western end of the Aonach Eagach ridge, the terrain was made up of a mosaic of mature conifer plantations, Birch *Betula* spp woodland, hill farmland and grassy moorland.

Field methods

The survey methods were based on those used in the national survey in 1995-96 (Hancock *et al* 1999). The 3 study areas, totalling 933 km^2, were split into 5-km squares. The survey was carried out between late March and early May 2000. Surveyors walked to within 500 m of all suitable habitat during the early morning or evening, to locate display sites (leks). Areas deemed unsuitable for Black Grouse were ground above 550 m, dense conifer and broadleaved woodland, enclosed arable farmland and built-up areas (Hancock *et al* 1999). In addition, poor weather was avoided (Koivisto 1965, Baines 1996).

Once located, surveyors revisited the leks within one hour either side of dawn to obtain peak counts of attending males (Cayford & Walker 1991). Where possible, counts were made from

vantage points to avoid disturbing the birds. However, there were a few sites in woodland where there was no suitable vantage point, and the birds were counted by flushing them.

All locations where males were found displaying were defined as lek sites. This is contrary to the guidelines followed in other Black Grouse surveys, where single lekking birds were not classed as leks (Robinson *et al* 1993, Hancock *et al* 1999). Displaying males separated by 300 m or less were counted as belonging to the same lek site.

Habitat assessments were made within a 200 m radius of the leks. The following categories were recognised: grass moor, Heather moor, field/rough grazing/improved grass, conifer plantation and Birch or Birch/Ash *Fraxinus excelsior* native woodland. Categories were assigned as primary or secondary depending on their relative abundance within the 200 m radius.

Deer fences within a radius of 1.5 km from the lek sites were noted in the field and measured from 1:25.000 maps. It is the radius recommended by Cayford (1993), within which management improvements for Black Grouse should be targeted. Therefore, birds within this radius were assumed to be at risk from collisions.

Results

Glen Garry

Sixteen lek sites were identified and 26 males counted (Table 1, Figure. 1). One lek site (GG4) extended over a broad area of hillside, with displaying birds about 200 m apart. At GG7, birds appeared to use an alternative site on different days. The average number of males at a lek was 1.6, with half the sites holding only two males. One site had three males and the remaining leks had only one male each. Ignoring leks which were nearer the boundary of the study area than their nearest neighbour, the average distance between neighbouring leks was 1,260 m and the closest leks were separated by only 400 m.

The length of deer fence within a 1.5 km radius of leks varied from 2.94 km (GG4) to 13.2 km (GG14), and the average for the 16 leks was 7.5 km (Table 1). Proximity of deer fences to leks ranged from 50 m (GG5) to 575 m (GG12), and the average was 290 m.

Table 1. ***Black Grouse lek statistics in Lochaber.***

	Glen Garry	Glen Spean	South Lochaber	All sites
Number of leks	16	17	10	43
Maximum number of males per lek	3	12	10	12
Total number of males	26	74	33	133
Maximum number of females per lek	1	4	2	4
Total number of females	5	15	4	24
Average number of males	1.6	4.4	3.3	3.1
Average distance (m) between leks *	1260	2130	870	1420
Total length (km) deer fence within 1.5 km radius of the leks	119.5	107.9	31.1	258.5
Average length (km) deer fence in 1.5 km radius	7.5	6.3	3.1	6.0

* These figures exclude leks close to edge of the survey area that may have biased results.

Fifteen out of the 16 leks were associated with varying amounts of Heather moorland and conifer plantation (Table 2). Although Heather moorland was the most common primary habitat in the immediate vicinity of the leks, most of this occurred in clearings or rides within extensive conifer plantations.

Glen Spean

Seventy four males were recorded at 17 leks (Table 1, Figure. 1). The number of males counted on a lek ranged from one (at 3 sites) to 12 (one site), with an average of 4.4 males per lek. The nearest neighbouring leks were separated by 500 m, and the average distance between neighbouring leks within the study area was 2,130 m. This calculation ignored 5 lek sites (GS1, GS2, GS3, GS6 and GS10), which were closer to the edge of the study block than the nearest neighbours within it.

The length of deer fence within a 1.5 km radius of lek sites ranged from 0.96 km to 9.75 km and the average was 6.3 km (Table 1). The closest deer fence to a lek site was 30 m (GS13), although lek GS2 was only 10 m away from a stock fence.

Thirteen of the 17 lek sites recorded were located in Glen Spean itself and 10 of those were on the north side of the glen or the valley bottom. This distribution pattern reflects the availability of suitable habitat: a mosaic of conifer plantation, Heather moor, grass moor and small fields or rough grazing (Table 2). There was a tendency for the grassy habitats to dominate the vegetation on the lower slopes and on the valley bottom where the main concentrations of sheep were found. Most of the lek sites were located on grass moors, with conifer plantations or Heather making up the secondary habitat. The young, open plantations, such as the one close to GS7 supported a lush dwarf shrub layer, and appeared to be used by birds, particularly before and after visiting the adjacent lek site (J Gordon pers comm). In contrast, the extensive dense conifer plantations on the south side of Glen Spean occupied all the lower, more fertile and sheltered slopes. Apart from birds attending leks GS13 (one male) and GS17 (2 males), there were few Black Grouse associated with this habitat. Most of the open ground available on the south side of the glen was steep, exposed deer forest and was probably unattractive to Black Grouse.

South Lochaber

Thirty three males occurred at 10 leks in 2 distinct geographical areas (Table 1, Fig. 1). A cluster of 7 leks was recorded between Blarmafoldeach and Cow Hill, south of Fort William. The remaining 3 were between the

Table 2. ***The number of Black Grouse leks associated with different primary and secondary habitat categories in Lochaber.***

	Glen Garry		Glen Spean		South Lochaber		All areas	
	Prim	Second	Prim	Second	Prim	Second	Prim	Second
Wood	0	0	0	0	3	6	3	6
Field	0	0	3	1	1	0	4	1
Heather	10	5	4	5	5	1	19	11
Grass	1	3	10	0	1	3	12	6
Plant	5	8	0	11	0	0	5	19

Key to habitat categories: Wood - Birch/Ash and Ash native woodland; Field - Field/rough grazing/improved grassland; Heather - Heather moor; Grass - Grass moor; Plant - Conifer plantation.

shore of Loch Leven and the Leven Valley. Black Grouse at SL4 appeared to use alternative fields on different days. The frequency distribution of numbers of birds at leks was skewed, with 10 birds at one site but only 1 - 4 birds at the remaining 9. Therefore, the average of 3.3 males per lek is somewhat misleading. Three lek sites held only single males. Although the SL6 site appeared to be favoured by displaying birds, there was considerable interchange of males within the cluster of sites immediately south of Fort William. Due to the grouping of lek sites, the closest were only 500 m apart and the average distance between sites was 870 m. This calculation excludes SL1, which was over 6 km from the nearest lek site.

Three of the sites (those around Kinlochleven) did not have any deer fences within a 1.5 km radius. With these sites included in the calculation of the average length of deer fence within a 1.5 km radius of leks, the result (3.1 km) is less than half of that recorded in the Glen Garry (7.5 km) and Glen Spean (6.3 km) study areas (Table 1).

The Kinlochleven sites were predominantly associated with Birch woodland. Grass moor and Heather moor habitats were of secondary importance (Table 2). In contrast, the primary habitat in the northern group of sites was largely Heather moorland, with Birch and Birch/Ash woodlands of secondary importance.

Although the risk from fence collision may be less in South Lochaber compared to the other study sites, the risk of collision from overhead cables was more of an issue here. Pylons carrying high voltage cables run through a gully separating lek SL6 from leks SL9 and SL10. One fresh Black Grouse corpse was found beneath these cables during the survey. Black Grouse collisions with electricity transmission wires have also been noted in Norway (Bevanger 1995).

One additional factor influencing Black Grouse displays at SL9, SL10 and to a lesser degree at SL6, was disturbance from early morning joggers and dog walkers from Fort William. During the periods of observation, birds were regularly flushed from the leks (T Millard pers com). Disturbance may also compound the risk of collision with the overhead cables.

Discussion

Numbers and distribution

The Glen Garry Black Grouse population was fragmented and lek sites were almost entirely associated with patches of Heather in rides and clearings within conifer plantations. Several of these plantations were young, pre thicket woodlands, but much of the area was at the thicket stage and becoming increasingly unattractive for Black Grouse. It is now recognised that fragmented groups of Black Grouse tend to have lower genetic diversity due to inbreeding (Höglund *et al* 2003), so steps should be taken to connect neighbouring groups through habitat management.

By contrast, the Black Grouse population in Glen Spean was less fragmented than in Glen Garry and the birds appeared to favour the mosaic of habitats on the north side of the glen. The high number of birds at GS16 in the west of this area was likely to reflect the favourable conditions for Black Grouse on the Creag Meagaidh reserve to the east of the study area.

The South Lochaber Black Grouse population was localised and split into 2 groups, isolated by a large area of unsuitable habitat. Disturbance is an issue regarding sites close to Fort William and may have contributed to the apparent decline in the number of birds attending the leks close to houses (J Rowbottom pers com). With limited movement of birds and dwindling numbers around Kinlochleven (only 7 males recorded) the risk of losing this group is acute.

This was the first comprehensive study of Black Grouse in Lochaber. It provides baseline data in the three study areas that comprise the bulk of the Lochaber population. In order to retain this population and guide ongoing conservation management, it is important to continue monitoring numbers at regular intervals. It would be useful to initiate formation of a Lochaber Black Grouse Study Group, similar to that in Tayside (Robinson *et al* 1993), to continue monitoring.

Habitat

The lek sites were predominantly located on Heather moorland with conifer plantations forming the most common secondary habitat (Table 2). This association was most clearly seen in the Glen Garry study area. In Glen Spean, grass moors formed the dominant primary habitat in association with secondary habitats of conifer plantations or Heather. The 2 groups of leks in south Lochaber showed a stronger association with semi natural native woodland and moorland.

Although there are clear differences in the proportions of the various habitats being used by, and available to the Black Grouse in each of the study areas, it was beyond the scope of this project to examine the quality of these habitats. A condition assessment of the various habitats of importance to the Black Grouse and examination of the changes in habitats in the various areas over the past 25 years might shed more light on the apparent changes in numbers.

Habitat management

Landowners and forestry agencies should make better provision for Black Grouse in new and existing woodlands by adopting the design and management recommendations that are known to benefit this species (Cayford 1993). These include maintaining significant amounts of open space with ericaceous vegetation and damp, boggy ground, linked by wide rides and riparian zones in new conifer plantations, maximising forest edges and providing a broad (at least 200 m) graded interface adjacent to moorland habitats. These can be achieved by leaving areas unplanted, using variable spacing of trees and using species such as Scots Pine *Pinus sylvestris*, Larch *Lari*x sp and Birch (Cayford 1993). Management measures for Black Grouse can be adopted at the design, restructuring or clear felling stages of forestry management or in a continuous cover forestry system.

The average length of deer fence within a 1.5 km radius of surveyed lek sites was 6.0 km (Table 1), although the figures varied enormously from 0 in the case of 3 South Lochaber sites to 13.2 km at one site in the Glen Garry study area. The shortest distance from a deer fence to a display site was 10 m and may on occasions have separated displaying birds. Twenty three percent of surveyed sites were located 100 m or less from a deer fence, several of which were recently constructed. Only one of those fences in Glen Garry was reported to have been colour marked to enhance its visibility to woodland grouse.

Baines & Summers (1997) demonstrated that collision rates for different grouse species vary seasonally, with $^2/_3$ of Black Grouse collisions occurring between February and May. This coincides with the period when birds are most active on lek sites. It is likely that certain lengths of fence claim more lives than others, according to, for example, their visibility, type of wire mesh and/or the length of time they have been in place. However, with possible collision rates of 0.7 Black Grouse per kilometre of fence per year (Baines & Summers 1997), and the lengths of fences in the vicinity of lek sites, it is likely that fences will account for a significant proportion of the annual mortality.

Although fence strikes may be contributing to the decline of this species, they are not solely responsible for the changes in numbers. The 3 lek

sites around Kinlochleven did not have any fences within a 1.5 km radius and were associated with a higher proportion of semi natural habitats. These leks were attended by few Black Grouse in 2000, but anecdotal information suggests that numbers were much higher only a few years previously (T Piggot pers com).

There are now a number of reports that make recommendations with regard to reducing fence collisions (Goddard *et al* 2001, Summers & Dugan 2001). These include recommending that the Deer Commission for Scotland (DCS) should adopt a more strategic approach to deer fencing, particularly in consultations regarding woodland grant schemes and in the development of local deer management plans through the individual Deer Management Groups. In addition, the Forestry Commission Scotland should continue to rationalise use of deer fences in Black Grouse areas, particularly where they merely mark ownership boundaries in woodland. Posts without wire could be as effective in boundary marking.

Landowners should ensure that where Black Grouse occur new fences associated with woodland schemes or existing fences should be marked to reduce the number of bird collisions. Further, removal of fencing after it has served its useful purpose should be made a condition of Woodland Grants where its purpose is to temporarily ensure woodland establishment. Where it is erected for other purposes, it should become the responsibility of individual landowners to remove deer fences after they have served their purpose.

In addition, steps should be made to mark the electric cables that pass through the cluster of leks south of Fort William.

Disturbance

Given the potential human disturbance at the leks in the Fort William area, the community at Achintore should be requested to use alternative routes for walking and jogging in the early morning during the main time for lekking by Black Grouse (April - early May). Distribution of leaflets to occupants in the adjacent housing estate explaining the situation may be sufficient to alleviate the problem.

Acknowledgements

This project was funded by RSPB and Scottish Natural Heritage, with financial contributions from Forest Enterprise and Alcan Smelting and Power Ltd. Thanks go to James Gordon, Duncan MacNicol and Tony Millard for their dedicated work in the field. We would also like to take this opportunity to thank the numerous landowners, land managers, estate staff, farmers, crofters, foresters and rangers who permitted access to their land and provided local information. Chris Donald and Murray Grant commented on the draft.

References

Andrew M & Baines D 1997. The impact of deer fences on woodland grouse and other birds. *Game Conservancy Report*.

Anon 1999. UK Biodiversity Group. Tranche 2 Action Plans. Vol. VI – terrestrial and freshwater species and habitats. English Nature, Peterborough.

Baines D 1996. The implications of grazing and predator management on the habitats and breeding success of Black Grouse *Tetrao tetrix*. *Journal Applied Ecology* 33: 54 - 62.

Baines D & Summers RW 1997. Assessment of bird collisions with deer fences in Scottish forests. *Journal Applied Ecology*. 34: 941 - 948.

Bevanger K 1995. Estimates and population consequences of tetraonid mortality caused by collisions with high tension power lines in Norway. *Journal Applied Ecology* 32: 745 - 753.

Catt DC, Dugan D, Green RE, Moncrieff R, Moss R, Picozzi N, Summers RW & Tyler GA 1994. Collisions against fences by woodland grouse in Scotland. *Forestry* 67: 105 - 118.

Cayford JT 1993. Black Grouse and forestry: Habitat requirements and management. *Forestry Commission Technical Paper* 1. Forestry Commission, Edinburgh.

Cayford JT & Walker F 1991. Counts of male Black Grouse *Tetrao tetrix* in North Wales. *Bird Study* 38: 80-86.

Goddard PJ, Summers RW, Macdonald AJ, Murray C & Fawcett AR 2001. Behavioural responses of Red Deer to fences of five different designs. *Applied Animal Behaviour Science* 73: 289-298.

Hancock M, Baines D, Gibbons D, Etheridge B & Shepherd M 1999. Status of male Black Grouse *Tetrao tetrix* in Britain in 1995-96. *Bird Study* 46: 1-15.

Höglund J, Baines D, Larsson JK & Segelbacher G 2003. Population fragmentation and genetic variability in European Black Grouse – a progress report. *Sylvia* 39 (suppl): 17-23.

Koivisto I 1965. Behaviour of the Black Grouse, *Lyrurus tetrix* (L.), during the spring display. *Finnish Game Research* 26: 1 - 60.

Robinson MC, Baines D & Mattingley W 1993. A survey of Black Grouse leks in Perthshire. *Scottish Birds* 17: 20-26.

Summers RW & Dugan, D 2001. An assessment of methods used to mark fences to reduce bird collisions in pinewoods. *Scottish Forestry* 55: 23-29.

Tucker GM & Heath MF 1994. *Birds in Europe: their conservation status*. BirdLife International, Cambridge.

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Revised manuscript accepted May 2006

An unsuccessful attempt to establish Northern Goshawks in Argyll

STEVE J PETTY

Details are provided of an unsuccessful attempt to establish a breeding population of Northern Goshawks in Argyll with 11 birds imported from northern Europe. Birds were released in 2 batches, during 1969-1973 (8 birds) and in July-August 1980 (3 birds). One successful breeding attempt was reported following each batch of releases, in 1973 and 1982-83, and although apparently genuine, with the passing of time the validity of these records cannot be confirmed. Reasons why Goshawks failed to establish a self sustaining population in Argyll are discussed. A lack of suitable food is considered to be the most likely cause, unlike elsewhere in Scotland where persecution is the main factor restricting population growth.

Introduction

Northern Goshawks *Accipiter gentilis* are expanding their range in Britain following unregulated releases of birds by hawk keepers in the latter half of the 20th century (Marquiss & Newton 1982, Petty, 1996a). These releases started in the 1950s, but were few in number, with birds coming mainly from central Europe. By the 1970s and 1980s, more were being imported into Britain, especially from Scandinavia, where many birds were taken as nestlings or trapped annually around Pheasant *Phasianus colchicus* release pens. On their arrival in Britain, some birds were intentionally released into the wild to establish breeding populations and others escaped while being flown by falconers. Kenward (1981) noted that from 1970 to 1975, 549 Goshawks were imported under licence into the UK, and during 1970-78, 25 birds a year were estimated to have entered the wild as the result of deliberate releases or escapes.

The success of this clandestine attempt at reestablishment was due largely to the method employed. Small groups of birds were released in numerous, widely scattered locations over a short period of time, which largely overcame the problem of extinction due to random events. However, some released birds failed to establish viable populations, but such failures have received little attention in the literature. Even where establishment was successful, there was no site specific information provided about numbers, ages, sexes and dates when birds were released, although early breeding records can be used to estimate the general area where birds were liberated.

The present population in Scotland appears to have originated mainly from birds released in the north east (NES) and in the Scottish/English Borders (SEB) (Petty in press). The first recorded breeding attempts in Scotland occurred in SEB in 1972 and in NES in 1973, indicating birds had been released a year or 2 before these events. Subsequently, populations in both areas have increased in numbers and range, although population growth rates in the 2 areas differ, probably due to different levels of persecution (Marquiss *et al* 2003).

This investigation started during preparation of the Goshawk account for BS3. In this paper I review the status of Goshawks in Argyll, drawing on previously unpublished information, to document

an apparently unsuccessful release of birds at around the same time that the SEB and NES population were established. Although successful breeding was reported on 2 occasions, these events did not generate a self sustaining population in Argyll as occurred elsewhere in Scotland. The reasons for this failure are discussed.

Methods

The data used to piece together the recent history of Goshawks in Argyll were obtained from a number of sources; unpublished records from friends and contacts, literature searches/references and records from the Argyll Bird Database, managed by the Argyll Bird Recorder (see acknowledgements).

Results

Release of birds

The first batch, consisting of 5 males and 3 females, was released near the head of Loch Sween in Knapdale Forest, Mid Argyll between December 1969 and 1973 (Table 1). The 1972 birds were imported from Finland after being taken from the nest as large chicks. Only 2 were successfully released, although 12 birds had been imported. Ten of these died possibly due to lack of food during transit from Finland and adverse weather in Argyll (D Kent pers comm). They were placed on man made platforms in trees at various locations in the forest and fed daily. They were able to pull food apart themselves, but there were several days of heavy rain during which the birds chilled. They were taken back into captivity, but only 2 survived. Later, these were returned to one artificial nest and fed. They subsequently fledged, learned to hunt and were noted to be in very good shape. They were seen well into August 1972 and possibly September, by which time they had become very unapproachable. All the liberated first winter and adults birds (Table 1) were in pristine condition and were fed well for a period before release. This project was conducted in tandem with similar numbers being released on Speyside through Doug Weir (cross fostering with Common Buzzards *Buteo buteo*) and in South Scotland (cross fostering with Eurasian Sparrowhawks *Accipiter nisus,* David Kent pers comm, Kenward 2006).

A further batch of 3 birds was released in the same area in July/August 1980 (Table 1). David Kent was not aware of any other releases of Goshawks in Argyll before or after those above (Table 1), and was doubtful that any would have been released without his knowledge, at least in the 1970s and 1980s. Lost falconers' birds from the Glasgow area could conceivably have found their way into Argyll and account for some earlier sightings in Argyll.

Possible breeding records

The first recorded breeding attempt was in 1973 (Rainier 1975). It is worth quoting this account in full:

> 'A nest with young was found on 7th August 1973 in a Forestry Commission Plantation within the area (Mid Argyll); the nest was watched daily until 12th August when the young birds were seen in flight. Although the site has remained undisturbed the birds have not returned. Since then Goshawks have been seen as follows: One on 23rd March and 13th April 1974; 2 on 9th March 1975 and single birds on 27th March, 12th April, 23rd August and 21st November 1975. The possibility that the nesting record and subsequent sightings had their origins in falconers' escapes must be born in mind.'

In a further paper, Rainier (1983) mentioned some additional records of Goshawks in Mid Argyll:

> 'No further breeding records known, but several additional sightings of single birds, as follows: Achnamara 18th January1976 and 15th October 1976, Lochgilphead 19th October 1977,

Achnamara 12th February 1978, Minard 13th May 1979, and Tarbert 20th October 1979.'

Unfortunately, the author of these papers died a few years ago, and it has not been possible to trace the original source of her records. Neither is the actual location of the breeding attempt given, but all sightings in the second paper were within 25km radius of the original release site, suggesting that the breeding attempt was in this area too.

The second reported breeding attempt was in early 1980s, possibly in 1982-83. The nest was in a larch tree, near Lochgilphead in Mid Argyll and contained at least 3 large nestlings. The nest was approximately 8km east of the release site. Matthew Wilson, who reported this event, was familiar with Goshawks, having flown falconry birds of this species, and also Sparrowhawks. Neither this nor the 1973 breeding record have been submitted to the Argyll Bird Records Committee (ABRC).

Discussion

Prior to 1970, there had been few records of Goshawks in Argyll. There were no historical breeding records for Argyll (ap Rheinallt in press), although they may have bred prior to widespread forest clearances in the Middle Ages. The only apparently genuine record in the 19th century was at Glenforsa on Mull on 9 November 1892, although no description of the bird was given (Buckley 1893). Three reports, of 4 birds, from the late 1850s into the 1860s in Gray (1871) were not mentioned by Harvie-Brown & Buckley (1892), and were thus probably unreliable, as were some of the other Goshawk records mentioned by Gray.

Table 1. ***Details of goshawks released in Knapdale Forest[1], Argyll during 1969-1980. (David Kent pers comm)***

Date	Sex	Age	Origin[2]	Other information
Dec 1969	male	first year[2]	Norway	
Jan or Feb 1970	male	first year[2]	Norway	
March 1970	male	adult[2]	Germany	Shot in Achnamara in 1970 after killing a chicken!
May 1970	female	first year[2]	Norway	
June 1972	male	large nestling	Finland	Food provided for a period after release
June 1972	female	large nestling	Finland	Food provided for a period after release
1972/73	male	not known	not known	
1972/73	female	5-6 years old[2]	Sweden	Imported in 1967 as first year bird
July/August 1980	male	juvenile	Norway	
July/August 1980	female	juvenile	Norway	
July/August 1980	female	juvenile	Norway	

[1] All birds were liberated either by the Fairy Isles (NR7688) or close to Loch Coille-Bharr (NR7890).
[2] Trapped at game rearing establishments, 2 birds had spent brief periods in the care of falconers.

The first record and description of the 20th century was not until 1959 when an adult was seen at Loch Ballygrant, Islay on 28 April (Greenwood 1960). This was followed by a first year bird on 15 September 1963, near the Mull of Kintyre lighthouse (Gordon & Merrie 1964). Both latter records occurred before the release of birds in Mid Argyll (Table 1), but were likely to be of imported origin. At this time, there was no evidence of Goshawks breeding anywhere in Scotland and true migrants from northern Europe were very scarce. For example, Petty (in press) showed that over a 143 year period, only 34 Goshawks had been recorded on Fair Isle, Outer Hebrides, Orkney and Shetland, and some of these might not have been genuine migrants; or even Goshawks, as unfortunately, much confusion still exists over identification.

The 2 claimed breeding attempts (1973 and 1982-83) occurred soon after each batch of birds (1969-73 and 1980) had been released (Figure 1). Goshawks can breed as yearlings, but are more likely to breed for the first time at 2-3 years of age (S J Petty unpublished). Thus, both breeding attempts were at a time when they would have been expected. In Goshawks, adult males appear to stay within their home range for most of the year in contrast to females, which tend to be more mobile outside the breeding season (Petty 2002). In the first batch of releases, males had been liberated a few years before the first female, thus allowing them time to establish home ranges before females were released. In fact, a 5-6 year old female had been released just before the first breeding attempt in 1973. The second batch, of 3 fledged juveniles, was released in 1980 followed by a breeding attempt 2-3 years later, again at a time when it would have been expected, even if no birds had survived from the initial breeding attempt and releases in the early 1970s.

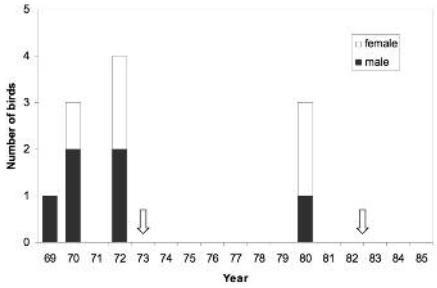

Figure 1. ***Number of goshawks released in Argyll and years when breeding was reported (each arrow is one record)***

More information is available about the first breeding attempt than about the second, although the brood size was not recorded (Rainier 1975). The chicks fledged sometime during 7-12 August, which meant the first egg must have been laid in mid May. In the ESB population this date falls towards the end of the recorded laying period (SJ Petty unpublished), but bearing in mind the generally poorer habitat in Argyll and the likelihood of a pair breeding for the first time, this date is certainly feasible. It is too late for Sparrowhawk chicks to be fledging (Newton 1986). There is less information available on the second breeding attempt, apart from at least 3 large chicks being recorded in the nest. The modal successful brood in the SEB population was 3 chicks (Petty & Anderson 1996). This second breeding attempt was observed by a person with experience in flying falconry Goshawks, who was unlikely to misidentify the birds.

Why did these apparently successful breeding attempts fail to lead to Goshawks becoming established in Argyll? In both NES and SEB, the number of breeding pairs started to increase within a year to 2 of the first broods being successfully reared (Marquiss *et al* 2003, Petty in press). Persecution is widely perceived to be the main factor limiting population growth in Scotland (Marquiss *et al* 2003), but this was

unlikely to be the main cause of failure in Argyll, as persecution levels are much lower than in either SEB or NES. Most illegal killing of Goshawks occurs around Pheasant release pens, and while Pheasants are reared for shooting in Argyll, this is on a far smaller scale than in eastern and southern Scotland.

Food shortage is the most likely reason why Goshawks failed to colonise the forests of Argyll. Peregrines *Falco peregrinus* have a considerable dietary overlap with Goshawks (Petty 1996a). Thus, the breeding performance of Peregrines may reflect to some extent the suitability of habitats for Goshawks, although Goshawk are more versatile than Peregrines, being able to take medium sized mammals, such as Rabbits *Oryctolagus cuniculus* and Red Squirrels *Sciurus vulgaris*, as well as birds (Marquiss & Newton 1982; Petty *et al* 2003). In the national Peregrine survey of 1991, mean brood size per territory holding pair in Argyll was 0.92 for occupied inland territories compared to 1.64 for occupied coastal territories (Crick & Ratcliffe 1995). Inland territories would be closer to the forested parts of Argyll that Goshawks would most likely occupy. Furthermore, the food supply for Peregrines may be worsening, as the latest national survey in 2002 revealed a 38% decline in the number of breeding pairs in north west Scotland including Argyll since 1991; a greater decline than anywhere else in the UK (Crick *et al* 2003). It is hard to imagine any factor, other than food, being linked to such a widespread deterioration in the performance of Peregrine. Moreover, winter food supply may be even more critical. At this time of the year, little suitable bird prey remains in and around upland forests in mainland Argyll. Thus, Goshawks would have to move to survive the winter, either to the coast or to prey rich locations on the larger islands, such as Islay and Mull. From 1970 until 1996 there were 77 records of Goshawks submitted to the Argyll Bird Recorder. Inevitably, these will include an unknown proportion of misidentified Sparrowhawks, but it is interesting to note that 59% of records came from Islay and Mull and just 27% from Mid Argyll. Interestingly, the latest accepted record of an adult male, in March 2006, was within 2km of where birds were released (Table 1).

What are the prospects for the future? A few pairs breed to the north of Argyll, in Highland Region, but numbers are small, breeding success is low and the population may have declined over recent years, again apparently reflecting prey scarcity. Therefore, few if any recruits are likely to enter Argyll from the north. The largest breeding population is in southern Scotland with a few pairs extending into south Ayrshire (Petty in press), but still a substantial distance from Argyll. In addition, a few pairs now breed in Central Scotland. Recent reports of birds breeding on Arran (Arran and Clyde Islands Bird Reports), just a few kilometres from the Argyll mainland, are incorrect (SJ Petty unpublished). Thus, recent sightings of Goshawks in Argyll are most likely to originate from south/central Scotland, unless some progeny survive from the original breeding attempts. The other possibility is that some birds have continued to breed in Argyll since the initial reports of breeding, but this is unlikely. Goshawks often use the same restricted area of forest for breeding, and over a period of years are unlikely to avoid detection, particularly by forestry workers (Petty 1996b). Thus, the chance of recruiting enough birds to establish a viable population in Argyll from population elsewhere in Scotland would, at present, appear to be slim.

Acknowledgements

I thank David Kent for details of Goshawks he released in Argyll, Matthew Wilson for information about one breeding attempt and Paul Daw, Argyll Bird Recorder, for records of Goshawk sightings in Argyll. Helpful comments on a first draft were received from Paul Daw, Jim Dickson David Kent, Peter Kirk and Stan da Prato.

References

ap Rheinallt T in press. Northern Goshawk *Accipiter gentilis*. In *Birds of Argyll* (eds) T ap Rheinallt, J C A Craik, P C Daw, R W Furness, S J Petty. & D Wood). Argyll Bird Club, Lochgilphead.

Buckley T E 1893. Goshawk in Mull. *Annals of Scottish Natural History* 5: 45.

Crick H, Banks A & Coombes R 2003. Findings of the national Peregrine survey 2002. *BTO News* 248: 8-9.

Crick H Q P & Ratcliffe D A 1995. The Peregrine (*Falco peregrinus*) breeding population of the United Kingdom in 1991. *Bird Study* 42: 1-19.

Gordon, A G & Merrie, T D H 1964. Goshawk in north and south Argyll. *Scottish Birds* 3: 27.

Gray R 1871. *Birds of the West of Scotland, including the Outer Hebrides*. Thomas Murray & Son, Scotland.

Greenwood S 1960. Goshawks in Islay. *Scottish Birds* 1: 186.

Harvie-Brown J A & Buckley T E 1892. *A Vertebrate Fauna of Argyll and the Inner Hebrides*. David Douglas, Edinburgh.

Kenward R 2006. *The Goshawk*. T & AD Poyser, London.

Kenward R E 1981. Goshawk re-establishment in Britain: causes and implications. *Falconer* 7: 304-310.

Marquiss M & Newton I 1982. The Goshawk in Britain. *British Birds* 75: 243-260.

Marquiss M, Petty S J, Anderson D I K & Legge G 2003. Contrasting population trends of the Northern Goshawk (*Accipiter gentilis*) in the Scottish/English Borders and north-east Scotland. In *Birds of prey in a changing environment*. (eds) D B A Thompson, S M Redpath, A H Fielding, M Marquiss & C A Galbraith, pp. 143-148. The Stationery Office, Edinburgh.

Newton I 1986. *The Sparrowhawk*. T & A D Poyser, Berkhamsted.

Petty S J 1996a. History of the Northern Goshawk *Accipiter gentilis* in Britain. In *The introduction and naturalisation of birds*. (eds) J S Holmes, & J R Simons, pp. 95-102. The Stationery Office, London

Petty S J 1996b. *Reducing Disturbance to Goshawks during the Breeding Season*. Forestry Commission Research Information Note 267. Forestry Commission Edinburgh.

Petty S J 2002. Northern goshawk *Accipiter gentilis*. In *The Migration Atlas: Movements of the Birds of Britain and Ireland*. (eds) C V Wernham, M P Toms, J H Marchant, J A Clark, G M Siriwardena & S R Baillie, pp. 232-234. T & A D Poyser, London.

Petty S J in press. Northern goshawk *Accipiter gentilis*. In *The Birds of Scotland*. (eds) I Andrews, M Betts, D. Clugston, R. Forrester, D Grundy, R McGowan, R Murray & B Zonfrillo) Scottish Ornithologists' Club, Edinburgh.

Petty S J & Anderson, D I K 1996. *Population Growth and Breeding Performance of Goshawks in the English/Scottish Borders during 1987-1996*. Forestry Commission, Northern Research Station, Edinburgh

Petty S J, Lurz P W W & Rushton S P 2003. Predation of Red Squirrels by Northern Goshawk in a conifer forest in northern England: can this limit squirrel numbers and create a conservation dilemma? *Biological Conservation* 111: 105-114.

Rainier I 1975. Notes on the birds of Mid-Argyll. *Western Naturalist* 4: 95-113.

Rainier I 1983. Additional notes on the birds of Mid-Argyll *Scottish Naturalist* 103-107.

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Revised manuscript accepted March 2007

The White-tailed Eagle in Sweden – past, present and future

BJÖRN HELANDER

This is the text of the Derek Ratcliffe Memorial Lecture given at Battleby in February 2006

Introduction

I have worked with the White-tailed Eagle *Haiaeetus albicilla* over the last 40 years in Sweden. This work has focussed mainly on our threatened populations but also the national history of the species and 'Project Sea Eagle', monitoring effects from chemical pollutants.

White-tailed Eagle in Sweden

The historical distribution of the eagle in Sweden is outlined in Figure1. The dense hatching in the map, representing the situation around year 1800, is where we know that the species was breeding based on specimens in collections and on specified records in literature from that time. Swedish zoological reference books from the 19th century tell that the eagle was then breeding all over the country, but must have been sparse in some areas. The smallest recorded distribution range for this eagle was in the mid1970s.

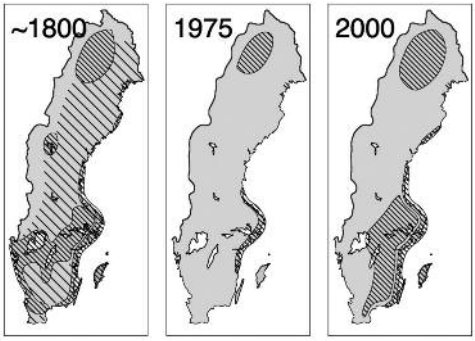

Figure 1. ***Historical and recent distribution of the White-tailed Eagle in Sweden. From Helander 2003b***

What was the population size long ago? Based on records of distribution in the 19th century I estimated the probable minimum population around year 1800 as 500 pairs. This appears to be on the low side, because we know from recent years that population density can be a lot higher than has been recorded before. In the early 1920s the population was reduced to some few tens of pairs. Contemporary estimates say about 20, which was clearly too low, but there were probably no more than 50 pairs left. The reason behind this massive decline was the usual story for that time: persecution. Nest destruction, shooting and poisoning wiped out many eagles. This was also a time when egg collecting and taxidermy were very popular, so nest robbing and shooting at the nests was common. This shooting took away many breeding birds, the most important segment of the population in a slow reproducing species.

The marked population decline in the first half of the 19th century was clearly indicated by Wilhelm von Wright (1850), a very skilful naturalist and painter of Scottish lineage, who came from Finland and settled in Sweden in the 1830s. In his account on the west coast of Sweden, he says (in translation) that the White-tailed Eagle is 'still common all along the coast but has decreased considerably over the last 15-20 years as a result of an *extermination war* against him'. He was a good marksman and had himself shot about 25 eagles in 8 years, 'in addition to all those killed by farmers' in surrounding areas. It is interesting to compare this account with the contemporary statements on the decline of this eagle in Britain, made by

the famous egg collector John Wolley, who concluded 'It is therefore a melancholy reflection that they can scarcely exist much longer. The White-tailed Eagle, in its sea girt fortresses, will be the last to disappear; but each inland 'Craig-an-Eulah' will soon be an empty name' (Newton 1864).

In those days there were even published guides in Sweden on how to kill predators. A good example was one entitled (in translation) 'On the most reliable means to exterminate our harmful predators and birds of prey' (Hahr 1868).

Legal protection in 1924

As the species declined and disappeared from many areas, words began to be spoken in favour of these majestic birds. The most important pioneers in Sweden in the early 1900s were Thor Höhdahl, who was the first secretary of the Swedish Society for Nature Conservation that was founded in 1909, and the famous photographer, filmmaker and author Bengt Berg. Thor Högdahl's book 'Gammel-Ante'; a local nick name for the eagle in the archipelago of Stockholm, was the result of many years of study and work to protect the eagles. Bengt Berg's classic book and film 'The last eagles', with fantastic pictures for that time, had a great impact. The publication of both these books happened in 1923, and in 1924 both the White-tailed Eagle and the Golden Eagle *Aquila chrysaëtos* were finally protected in Sweden.

By this time, White-tailed Eagles were already gone from the west coast (last breeding attempt in 1904), from the south coast (still breeding "here and there" by 1890) and was nearly gone from all former strongholds both inland and along the coast. During the following 30 years, all remaining scattered pairs inland in Southern and Central Sweden disappeared and the remnant population was concentrated in parts of the Baltic coastline. This population increased from less than 50 pairs in 1924 to at least 100 pairs in the late 1950s. There were also a few pairs left in northern Lapland in the mid 1920s but relevant estimates are lacking from that time. The number must have been very small, possibly a few tens of pairs.

Figure 2. *Both on the Baltic coast and in Lapland pike* Esox lucius *are common prey. Other important prey on the coast like carp* Cyprinidae *and eider* Somateria mollissima *are not available in Lapland, where reindeer carrion* Rangifer tarandus *is important.*

New threats

In the 1960s, reports from different parts of the coast indicated that there was almost no production of young, although adults were still present at nests. If successful nests were found, they usually contained only one nestling, instead of the usual 2, and nests sometimes contained shell fragments and even whole, dead eggs. These observations led the Swedish Society for Nature Conservation (SNF) to organize a survey

Table 1. ***Project Sea Eagle, catalogue of activities.***

Monitoring & research	**Conservation & management**
Surveys of breeding pairs & nest success	*Protection of nest sites & habitat*
Contaminants and their effects on reproduction	*(forestry and land use planning, reserves)*
Artificial incubation of eggs	*Building of artificial nests*
Food composition	*Surveillance of nests*
Nest tree characteristics	*Feeding programme*
International colour ringing programme	*International cooperation*
Examination of dead eagles	*Public information*
Population genetics	*(Captive breeding for release, not realised)*

of distribution and breeding success, starting in 1964. I volunteered and soon became strongly involved in this work. The survey revealed an alarming situation: productivity was very poor; almost no immature birds were observed, indicating poor productivity in previous years; persecution still occurred locally; and there were threats to nest sites in many places from forestry, road projects, the building of summer homes, etc. SNF decided to continue the surveys and they showed a further decline in 1965-1970. Still fewer successful breeding attempts were found, and still fewer young per productive nest. There was clearly something wrong with the eggs.

By that time, it had already been shown that there was significant thinning of eggshells among several species. This was first highlighted by Derek Ratcliffe (1967) in his classic paper in *Nature*. His so called eggshell index is nowadays referred to as the *Ratcliffe index*.

Project Sea Eagle

The alarming situation led us in 1970 to plan for a rescue project, and in 1971 Project Sea Eagle was launched. This was the first species action plan in Sweden. The catalogue of activities under this project are organised under 2 main headings: *Monitoring and Research* and *Conservation and Management* (Table 1; Helander 2003a). The surveys of breeding pairs and nest success can be regarded as the backbone of this project: this is where we keep up with the current situation on nest sites (essential for protective measures), reproduction (for trend studies, relationships with contaminants) and collect material for analyses (eggs and shell, blood and feather samples). Occupied nests are located in March-April by observations from helicopter, or by ground observations from a distance. Helicopter surveys prove to be efficient: flying about 1800 km and covering 160 territories takes about 23 hours and is completed in 5 days. In May and June, all occupied nests are visited and climbed to assess breeding results. At the nest, we take measurements and ring the nestlings, take feather samples, and also record fresh prey. Since 1995 we have also taken blood samples from the nestlings for analyses of contaminants and genetics. All these procedures are made in the same way whether on the Baltic coast or at freshwater nests (Helander 2003b).

Lapland

The population in Lapland is living under different conditions than birds on the coast. The arctic lakes are much less polluted than the Baltic Sea but the climate is colder, the breeding season is shorter and food is a limiting factor. We used to make 3 flights in Lapland: one in April to locate nests, one in late June to check all occupied nests and ring the nestlings, and one in

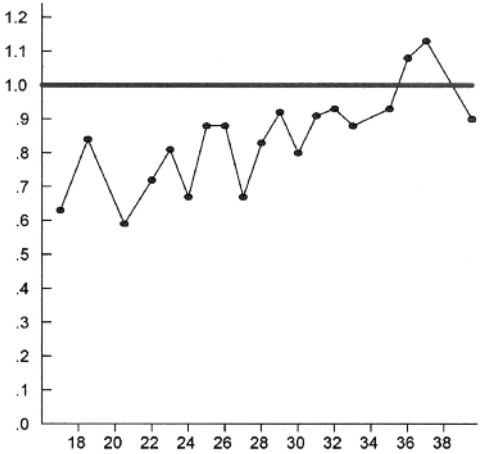

Figure 3. *Weight of nestlings from Lapland in relation to nestlings from the Baltic coast (1.0) over ages from 3.5 to 7 weeks, as indicated by wing length in cm (Helander 1981)*

Figure 4. *Old nest tree with "ladder" nailed to the trunk - a memory from the days of systematic persecution.* *B Helander*

Figure 5. *Breeding and foraging habitat in Lapland. Sea eagles may search for food everywhere in this landscape, but they breed in the lowland areas, in trees; they do not nest higher up in the cliffs like the golden eagles do.* *B Helander*

September to verify breeding success and collect prey remains. Nowadays we make only one survey flight, in late June, to check breeding success. Since the eagles are so faithful to their sites we usually find them even if they have built a new nest. The compromise of making only one flight is simply for the lack of funding.

A shortage of food in Lapland is evident when comparing the weights of nestlings of the same age, as indicated by wing length (maximum chord, Hardey *et al* 2006), from Lapland and the Baltic coast (Figure 3). At 3.5 – 5 weeks of age Lapland nestlings weigh about one third less than Baltic nestlings, but the difference decreases with age and surviving Lapland nestlings eventually catch up at age 7 weeks. We see high mortality from starvation in Lapland nests: nearly 50 % of second hatched chicks there die at ages from about 3 up to 5-6 weeks. This is not seen in nests on the coast or lakes in southern Sweden.

It has been very rewarding to have data from this northern population for comparison and reference to the heavily polluted Baltic population. The difference between these areas in the concentrations of DDE was near an order of magnitude.

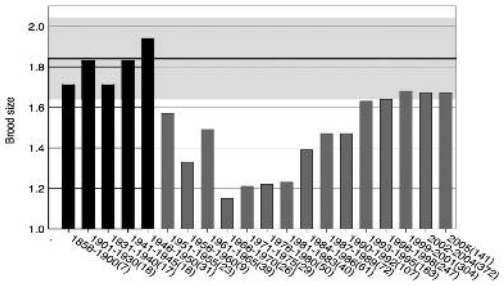

Figure 6. *Mean number of nestlings in white-tailed eagle nests on the Swedish Baltic coast over time (no of broods in brackets). The reference line and shaded area represent mean brood size up to 1950, with 95% confidence limits (Helander 2003b).*

The sea eagle in environmental monitoring

The national Environment Monitoring Programme (EMP), under the Swedish Environment Protection Agency, includes the monitoring of selected organisms and parameters in a range of environments. The White-tailed Eagle was adopted into this programme in 1989 as an indicator for effects from pollutants. The history behind this is that the eagle was the first species to signal the alarming state of the Baltic Sea, by showing a dramatic decrease in productivity that was linked to contaminants, especially DDE and PCB (Helander *et al* 2002). Figure 6 illustrates the changes over time in brood size (number of nestlings per successful pair). There was a significant drop in the brood size already in the first half of the 1950s, but this was not really noticed until about 10 years later. The Swedish Museum of Natural History is responsible for the monitoring of the eagle under the EMP.

The White-tailed Eagle also has features that are favourable in a monitoring perspective: mates of pairs are faithful to each other and to their breeding sites; breeding territories are generally used over many generations of eagles providing good opportunities for long trend studies; territorial adults on the coast are mainly sedentary and thus reflect the regional contaminant situation; and a large proportion of the breeders are ringed, helping the study of individual birds over time. The monitoring of reproduction focuses on 2 robust parameters:

- the annual proportion of reproducing pairs
- the distribution of brood sizes, based on >4 weeks old nestlings

All dead eggs, shell fragments and shed feathers of the adult birds are collected, and nestlings are weighed, measured (wing chord, tarsus width and depth), colour ringed and sampled for blood and feathers (upper wing coverts). So far, all collected eggs have been analysed on a regular basis for organochlorine contaminants; the blood samples have been saved for special research projects (eg Olsson *et al* 2000, Hailer 2006).

Contaminants and reproduction

The most striking thing we have seen in the White-tailed Eagle was the phenomenon of 'dry' eggs. In the 1960s – 1980s, most dead eggs that were retrieved from nests on the Baltic coast were strongly desiccated, whereas this was very rarely the case in Lapland. Figure 7 illustrates the relationship between desiccation index (Di) and DDE in eagle eggs from the Swedish Baltic coast. Di is calculated as weight divided by volume of the individual egg; a fresh egg would have a Di of near 1.0. There is a slow natural weight loss of eggs from evaporation through the shell (Rahn *et al* 1979). The weight of most of the eagle eggs collected in our studies was determined around 100 days after they were laid. Eggs with normally functioning shells would then have expected Di-values exceeding 0.7. In Figure 7, a dramatic effect on shell functionality is indicated as the DDE-levels exceed 170 $\mu g/g$ and at concentrations exceeding 470 there was not a single 'normal 'egg.

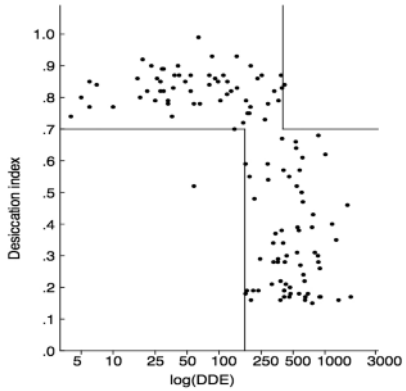

Figure 7. *Desiccation index (Di) in relation to DDE (μg/g, lipid weight) in 126 eagle eggs from the Swedish Baltic coast 1969-1997. From Helander* et al *(2002).*

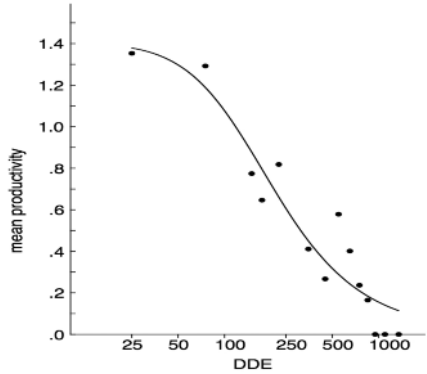

Figure 8. *Mean 5-year productivity of 82 individual females in relation to DDE concentrations (μg/g lipid weight) in their eggs, grouped into 14 concentration intervals. From Helander* et al *(2002).*

Remaining effects from contamination

When testing productivity of the Baltic population versus concentrations of DDE, PCB and shell parameters, the strongest correlation was with Di. There was no significant correlation between productivity and shell thickness or index. All 3 shell parameters were most strongly correlated with DDE. Some females were studied over many years after the bans of DDE and PCB were enforced in the 1970s. Although residue concentrations decreased strongly in their eggs during the 1980s, their ability to produce functioning shells did not improve and productivity remained at zero. This indicates remaining effects from the previously much higher contamination of those old females. The presence of eggs from such females in statistical analyses of relationships between productivity versus contaminants and eggshell parameters would confuse the results and was probably contributing to the observed stronger correlation to productivity for Di than for DDE, the suggested cause for the desiccation syndrome.

Effect levels

Our studies have shown strong relationships between productivity (number of young produced per pair and year) and DDE and PCB. Figure 8 shows a suggested dose response relationship for DDE, indicating normal productivity (>1.0) at concentrations up to about 100$\mu g/g$ in the egg lipids, a reduction to half at 200$\mu g/g$, and no reproduction at >900$\mu g/g$ (for conversion to a wet weight basis, multiply by 0.05). Based on individual data, a lowest observable effect level (LOEL) of about 120 is indicated for DDE. There is a strong correlation between concentrations of PCB and DDE in the eggs. But DDE has decreased faster than PCB since the 1970s, so the possibility to separate between effects from these major contaminants has improved with time. In the late 1980s and 90s, PCB but not DDE concentrations were significantly higher in eggs with dead embryo as compared to infertile eggs, and a LOEL of 500$\mu g/g$ for embryo mortality was implied for PCB. In the 1970s, the range of PCB concentrations in eagle eggs from the Baltic coast was

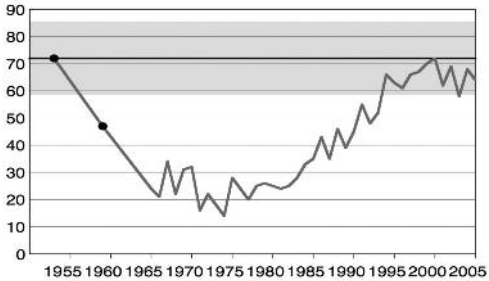

Figure 9. *Successful breeding attempts on the Swedish Baltic coast (%). Pre 1954 reference line with 95% confidence limits (shaded) from Helander (2003b)*

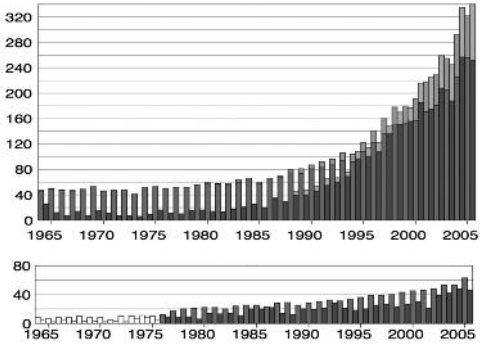

Figure 10. *Number of pairs (left bar) and nestlings (right bar) in Sweden. Upper graph shows populations on the Baltic coast (dark grey and black) and lakes in Southern and Central Sweden (light grey, on top of Baltic bars); lower graph shows the population in Lapland.*

0.5-4 times higher and the range of DDE concentrations as much as 2-15 times higher than the estimated LOELs, respectively. Thus, effects also from PCB on eagle reproduction were for a long time largely concealed by the effects from DDE.

Reproduction –much better but not good enough!

A good improvement in the breeding success of the Baltic population began in the late 1980s, and by the year 2000 the proportion of successfully breeding pairs reached the background level (Figure 9). In 1998-2005, concentrations of DDE and PCB in analysed eggs were on average 25 % below estimated LOELs, but 20 % of the analysed eggs exceeded those levels. Thus, although the breeding success has improved and is no longer significantly different from the background level, this population is still in the risk zone. The number of young per productive nest also increased from the 1980s but levelled in the mid 1990s at about 1.65, that is significantly below the reference level (Figure 6). This is mainly due to smaller broods along a particular stretch of coastline, the southern part of the Bothnian Sea (mean brood size = 1.4). DDE and PCB concentrations in eagle eggs from that region are not higher than in eggs from regions with brood sizes around 1.8 (equalling the background level). A new study is in progress in order to investigate possible effects from other contaminants to explain the observed differences in brood sizes, with polybrominated flame retardants (PBDEs) and dioxins among the suspects.

Population trends and expansion

Following the improvement in productivity on the Baltic coast, this population increased from 56 to 256 pairs in 1979-2005 (Figure 10). In addition, offspring from nests on the coast began to re-colonise old inland sites from 1980. This inland population had increased to 66 pairs in 2005, and has the potential for a further increase. The mean annual rate of increase of the Baltic and inland populations combined was near 10 % between 1990 and 2005. The annual rate of increase of the population in Swedish Lapland was only about 5 % over the same period, reflecting lower productivity and probably also a lower annual survival rate there. Illegal

persecution is still occurring at least locally in Lapland. Along with the increase in numbers we have seen an extensive geographical expansion (Helander 2003c) and the current range is beginning to resemble the historical distribution. But the White-tailed Eagle is still absent as a breeder on the Swedish west coast, a former stronghold, and in areas in Northern Sweden where it was also known to breed.

Outlook for the future

With a good annual increase rate and much of the historical range already reoccupied, the outlook for the White-tailed Eagle seems good. But there are things that still need to be managed for the future. Some of the goals in a national Species Action Plan for the eagle over the next 5 years are:

- a population of 500 pairs, and resettlements on the west coast and in the county of Jämtland in the north.
- regional protection plans should be made for each county, as a means in land use planning.
- a network of protected breeding areas should be established all over the species' natural distribution range in Sweden.
- a new routine should be implemented in forestry in order to create a succession of old trees for nesting, saved as 'eternity trees'. This will benefit other raptors too.
- better routines should be enforced in forestry regarding protection zones around nests, in order to save nests sites from cutting.
- the frequent killing of eagles by trains should be reduced by more effective removal of carcasses from the railways.
- mortality by lead intoxication through ingestion of gunshot pellets from prey should be investigated.
- mortality from blade strikes and collisions at wind power plants should be investigated; nothing is done so far with raptors and wind parks in Sweden.
- risk areas for wind power plants should be identified

When making a Species Action Plan, you are also asked to give a vision for the future. To me, such a vision should mean that the whole natural breeding range should be recolonised; this would imply a capacity population of about 1000 pairs in Sweden. And there should be no need for feeding programmes or the building of artificial nests to support the population. Such a vision may not be realistic, but is still what should be strived for. What will really happen in the long future we cannot really anticipate - but at least for the near future I expect to see more eagles in competitive fights over the best territories, and a further growth and expansion of this eagle population in Sweden!

References

Berg B 1923. *De sista örnarna*. Bonniers, Stockholm.

Hailer F 2006. *Conservation genetics of the white-tailed eagle*. Dissertation, University of Uppsala. Acta Universitatis Upsaliensis. Uppsala.

Hahr T 1868. *Om de tillförlitligaste medlen att utrota våra skadligare rofdjur och roffoglar*. P.B.Eklund, Stockholm.

Hardey J, Crick H Q P, Wernham C V, Riley H T, Etheridge B & Thompson D B A 2006. Raptors: a field guide to survey and monitoring. The Stationary Office Ltd, Edinburgh.

Helander B 2003a. "Project Sea Eagle" – the first species action plan in Sweden. *SEA EAGLE 2000* (eds B Helander, M Marquiss & W Bowerman) pp 13-22. Åtta45 Tryckeri AB, Stockholm.

Helander B 2003b. The white-tailed sea eagle in Sweden – reproduction, numbers and trends *SEA EAGLE 2000* (eds B Helander, M Marquiss & W Bowerman) pp 57-66. Åtta45 Tryckeri AB, Stockholm.

Helander B 2003c. The international colour-ringing programme – adult survival, homing and the expansion of the white-tailed sea eagle in Sweden. *SEA EAGLE 2000* (eds B Helander,

M Marquiss & W Bowerman), pp 145-154. Åtta45 Tryckeri AB, Stockholm

Helander B, Olsson A, Bignert A, Asplund L & Litzén K 2002. The role of DDE, PCB, coplanar PCB and eggshell parameters for reproduction in the white-tailed sea eagle in Sweden. Ambio 31(5):386-403.

Högdahl T 1923. *Gammel-Ante*. L. Hökerbergs Förlag, Stockholm.

Newton A 1864. Ootheca Wolleyana. Part I. Accipitres. John van Voorst, London.

Olsson A, Ceder K, Bergman Å & Helander B 2000. Nestling blood of the white-tailed sea eagle (*Haliaeetus albicilla*) as an indicator of territorial exposure to organochlorine compounds – an evaluation. *Environ. Sci. Technicol*. 34:2733-2740.

Rahn H, Ar A & Paganelli C V 1979. How bird eggs breathe. *Sci. Amer.* 240:46-55.

Ratcliffe D 1967. Decrease in eggshell weight in certain birds of prey. *Nature* 215:208-210. von Wright W 1850. Förteckning, jemte några anteckningar, öfver de i Bohuslänska skärgården observerade foglarne. Götheb. K. Vet. O. Vitt. Samh. Handl., ny följd I:43-78.

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The Derek Ratcliffe Memorial Lectures

In memory of the late Dr Derek Ratcliffe (1929-2005) the Scottish Raptor Study Groups (SRSG) established an annual Memorial Lecture, delivered during the SRSG Conference at Battleby. The inaugural and second lectures were delivered in 2006 and 2007 respectively.

Derek was one of the world's leading raptor conservationists and made the key discovery about the link between pesticides and eggshell thinning in birds of prey. He published classic bird monographs, *The Peregrine Falcon* (1980, 1993) and *The Raven* (1997), and other books including *Bird Life of Mountain and Upland* (1990), *Galloway and the Borders* (2007), *Lapland: a natural history* (2005) and *Lakeland: the wildlife of Cumbria* (2002). He effectively led the UK statutory nature conservation movement in the 1970s and 1980s and in *A Nature Conservation Review* (1977) laid the foundations for the wildlife legislation and protected areas we have in Britain today.

The SOC, in partnership with the SRSGs and Scottish Natural Heritage, is delighted to honour Derek's work by publishing summaries of the memorial lectures.

P K Stirling-Aird and Des Thompson

Trends in breeding duck populations at Loch Leven, Perth & Kinross

ALAN LAUDER

Results of annual breeding duck surveys from 1985 to 2004 are presented. Comparisons with earlier studies show that some significant population changes have occurred. Notable increases occurred with Gadwall, Eurasian Teal and Common Pochard while decreases have occurred with Common Shelduck, Eurasian Wigeon, Northern Shoveler and Tufted Duck. Possible reasons for these changes are discussed including the role of submerged macrophytes, water quality and increases in predator populations.

Introduction

Loch Leven lies to the east of Kinross in Perth & Kinross in east central Scotland (Figure 1). At 1597ha it is the largest lowland freshwater loch in Scotland. It is shallow and eutrophic lying amidst rich agricultural land in a basin bounded by the uplands of the Lomond Hills, Benarty Hill and, further to the west, the Ochil Hills.

Loch Leven is afforded legal protection under a number of designations mainly on account of its important waterbird populations notably wintering Pink-footed Geese *Anser brachyrhynchus* and a rich assemblage of breeding, passage and wintering waterfowl. It is a Site of Special Scientific Interest (SSSI), Ramsar site and Special Protection Area (SPA) and has been managed by Scottish Natural Heritage (SNH) as a National Nature Reserve since 1964.

Loch Leven holds the largest concentration of breeding ducks on a freshwater site within Britain. St Serf's Island holds the vast majority of the nesting ducks. The population size of all the breeding duck species were first formally estimated by researchers from 1966 to 1971 (Newton & Campbell, 1975). Regular monitoring, largely by counting territorial pairs in spring, has been carried out since then. Wright (1986) gave an update at that time of the status of the population, relying on spring counts of pairs and males for most species. Wright assessed the population to be at least as large as it was in Newton and Campbell's time, numbering around 1000 pairs of 6 main species, mostly Tufted Duck *Aythya fuligula* and Mallard *Anas platyrhynchos*.

Since 1986, a number of potentially significant developments have occurred. These include improvements in water quality, conservation management of loch shore habitats and changes in the size and distribution of breeding gull populations (Laridae).

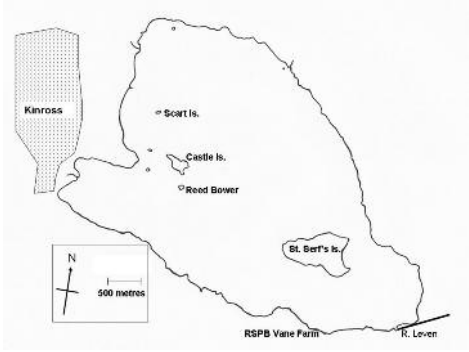

Figure 1. ***Location map of Loch Leven.***

Methods

This paper compares data generated by surveys from the periods 1966 to 1971 and 1980 to 1984 to data collected between 1985 and 2004 and examines population trends since 1980. Methods of surveys in 1966-71 and from 1980-1984 are given in Newton & Campbell (1975) and Wright (1986) respectively.

Method A: Counting pairs
The method of counting pairs and males used by Wright (1986) has been followed annually since 1981with only slight amendments in coverage to encompass newly created wetland areas, primarily at Vane Farm. In brief the method requires 2 observers in a slow moving boat and in calm conditions, recording all pairs, males and groups of ducks encountered around the shoreline of the loch and islands, plotting these on a large scale map. In addition lagoons and pools away from the main loch shore are counted by viewing from vantage points.

This method broadly follows that recommended in Gilbert *et al* (1998) though it was adapted for the very large size and open nature of the loch by relying on good viewing conditions and utilising boat transport. Difficulties arise when attempting to count Tufted Duck and Mallard using this method, due to the large number of birds present, the nature of large groups of Tufted, widespread use of sites away from the loch by Mallard and the occurrence of, sometimes large influxes of presumed migrant Tufted Ducks well into May. This method was therefore not used to count these 2 common species.

Method B: Counting nests
Full sweep searches of all suitable nesting habitat on the main nesting island were carried out in 1981 (Wright, 1981). This was repeated using similar methods in 1993, 1994, 1998 (except for Tufted Duck) and 2003. This required a team of between 3 and 8 people walking in a line intensively searching all potentially suitable duck nesting habitat on St. Serf's Island, identifying and recording all duck nests and their contents including old or predated nests. The total population was then determined by multiplying the number of nests found by a conversion factor. The conversion factor was derived from weekly cumulative nest totals observed by Newton & Campbell (1975) and is illustrated below:

$$\textit{Predicted total population} = n\{100/p\}$$

n is the total number of nests detected on the sweep search, and *p* is the mean percentage of the total nests detected by the equivalent week in the period 1966-70. Thus, the figure derived was the predicted total number of nests for a species in any year. The survey visits were timed for Mallard (third week in April) and for Tufted Duck (second week in June) to coincide with the peak numbers initiated nests (Mallard) and the peak incubation period (Tufted Duck).

Method C: Sample nest counts
In 1998, 1999, 2002 and 2004 randomised sample quadrat surveys were carried out to estimate the size of the Tufted Duck population. This required searching a number of 25mx25m randomly selected quadrats within the known duck nesting area. The number of quadrats searched was equivalent to approximately 10% of the total colony area. The total population was then estimated for that week and the conversion factor applied as in method B.

In addition, for scarce breeding species such as Northern Pintail *Anas acuta*, Garganey *Anas querquedula,* Goosander *Mergus merganser* and Ruddy Duck *Oxyura jamaicensis*, casual records gleaned from bird reports and unpublished sources have been used to document the size of the population.

Statistical analysis

Population trends over time were analysed using the S-Plus 2000 statistical package (Mathsoft Inc, Seattle, WA). As pairs counts and nest surveys result in observed count data and thus the data appeared to follow a Poisson distribution, log-linear regression models were used to determine the significance of trends in the population.

Results

Common Shelduck *Tadorna tadorna*

Wright (1986) described a marked increase from an estimated population of around 10 pairs in the period prior to 1970 up to a mean of 48 (range 39-56) in 1980 to 1984. Since then Shelduck numbers have varied considerably with both the highest and lowest pairs counts occurring in this period. Despite the 2 high counts of 56 and 62 in 1998 and 1999 respectively, the overall trend was one of significant decline (Figure 2).

Eurasian Wigeon *Anas penelope*

This was the fourth commonest breeding duck in Newton & Campbell's time with a mean of 31 pairs (range 23-40). It had been elevated to third place with a mean of 39 pairs (range 35-46) during 1980-1984. The situation changed dramatically between 1985 and 1986 with a decline from 44 pairs in 1985 to just 8 pairs in 1986. Numbers only slightly recovered thereafter and in at least 2 years since 1985 no pairs were confirmed on the loch though some years were also not surveyed (Figure 2). The decline was found to be statistically highly significant.

Gadwall *Anas strepera*

Newton & Campbell (1975) found a mean Gadwall population of 36 pairs in 1966-1970 (range 24-47), Wright (1986) reported similar numbers with a mean population in 1980-1984 of 37 pairs (range 25-47). Between 1980 and 2000 the population has undergone a statistically significant increase (Figure 2) and the population between 1990 and 2000 has been at least 50 pairs annually. Since 2000, numbers appear to have declined to early levels with 23 to 29 pairs between 2002 and 2004. These are still within the range seen since 1980 however.

Figure 2. ***Changes in major breeding duck populations at Loch Leven 1980-2004.***

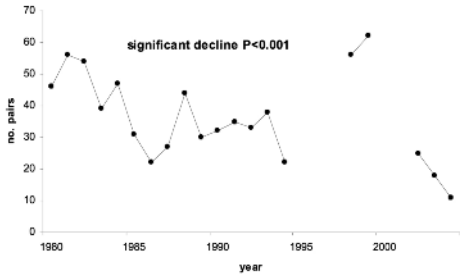

Figure 2a. ***Common Shelduck.***

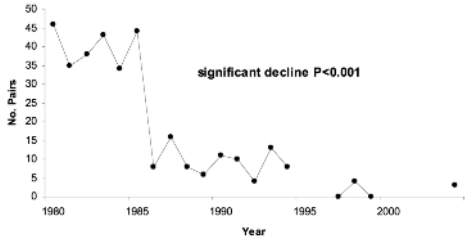

Figure 2b. ***Eurasian Wigeon.***

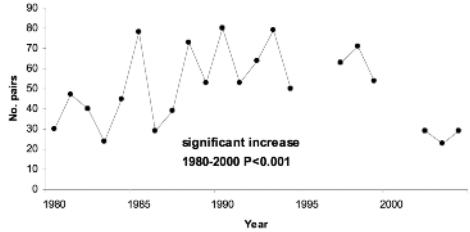

Figure 2c. ***Gadwall.***

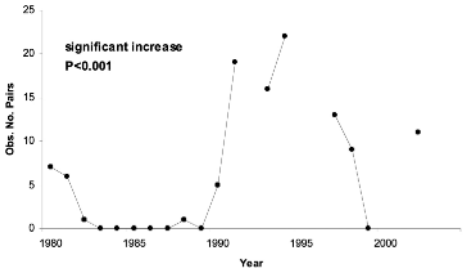

Figure 2d. ***Eurasian Teal.***

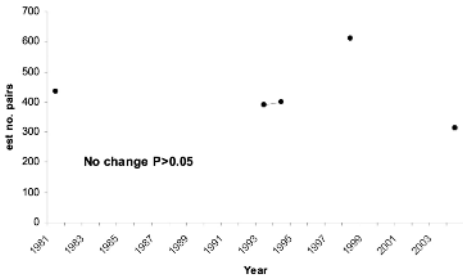

Figure 2e. ***Mallard.***

Eurasian Teal *Anas crecca*

Breeding Teal numbers at Loch Leven have historically been difficult to determine but in the pre1970 period the mean population was 3 pairs (range 0-8). In 1980 to 1984 Wright (1986) again also found a mean of 3 pairs (range 0-7). Since 1985, numbers of breeding Teal increased significantly (Figure 2), with a mean of 7 pairs (range 0-22). Despite this recorded population change Teal nests were never found on the main nesting area on St. Serf's Island from 1981 onwards, despite periodic extensive searches for all ducks (pers obs and Lauder & Brooks, 1998) though nests are occasionally found on the loch shore including one to the west (W Wilson pers comm) and older records from the North east shore (G A Wright pers comm)

Mallard

Full surveys carried out in 1993, 1994 and 1998 produced estimates of 389, 401 and 612 pairs respectively. A sample quadrat survey in 2004 estimated 313 pairs. The mean of these 4 years is 429 pairs.

Newton & Campbell (1975) found a mean of 441 pairs (range 312 – 664) in the period 1966-1970. Wright (1986) conservatively estimated the population in 1981 to be in the range 420-450 pairs. Data from this study indicates that the population has shown no significant change since 1981 (Figure 2) and is also comparable to the mean Figure found in Newton & Campbells study.

Northern Pintail

Pintail was absent as a breeder during Newton & Campbell's 1966- 1970 study and Wright's 1980 -1984 study, despite previously being a regular breeder prior to 1952 with up to 20 pairs in the 1930's (Allison, Newton & Campbell, 1974). Sporadic pairs have appeared since and breeding was proved in 1992 when a female with a brood of 7 young was seen on the south shore of the loch near the mouth of the Gairney Burn.

Northern Shoveler *Anas clypeata*

Newton & Campbell (1975) found a mean Shoveler population of 6 pairs during 1966-1970 (range 3-10), Wright (1986) reported larger numbers with a mean population in 1980-1984 of 17 pairs (range 9-30). The 30 pairs level was reached in 1984 and 1988 but out with those higher years the population has largely remained under 20 pairs and has shown a significant decline since 1980 (see Figure 2). In 2004 no birds were recorded on pairs counts but 11 nests were found during sweep searches, with 5 broods being seen on the loch later in the summer thus pairs count data may under represent the population in at least some years.

Common Pochard *Aythya ferina*

Pochard was never a common breeding species at Loch Leven. During Newton & Campbell's study no nests were found and Allison *et al* (1974) refer to breeding as never having been proven though mentions 'a few pairs recorded as breeding from 1886' Wright's 1980 to 1984 surveys found no confirmed pairs and no known breeding occurred. Breeding was first confirmed in 1988 with a nest found on St Serf's Island (G A Wright, pers comm). Since then breeding was initially sporadic but increasing numbers of pairs present gave rise to further confirmed breeding records with nests found and broods increasingly seen. The mean number of pairs recorded annually since 1985 was 5 (range 0-14). The increase recorded was found to be highly significant.

Tufted Duck

Tufted Ducks have probably been at least as numerous as Mallard since Newton & Campbell's time. The 1966-1970 mean was 368 (range 250 - 485) and Wright (1986) felt they were at least as numerous during his survey in 1981, with an estimated population of 556 nests, which exceeds the upper limit of the 1966-71 range. Between 1993 and 2004, 7 surveys were undertaken and a mean estimate of 327 pairs was found (range 190 - 463). When tested, a statistically significant decline was found since 1981 all but one of the estimates remain above Newton and Campbell's minimum estimate which may indicate little overall change since the 1960s.

Other species

Other duck species to have established or re established themselves as breeders since 1985 are Garganey, Common Goosander and Ruddy Duck.

Garganey are recorded increasingly frequently on the floods and pools at Vane Farm RSPB Reserve and have shown signs of breeding in at least 2002 and 2003 though no broods or nests were found (Brooks *et al* 2004)

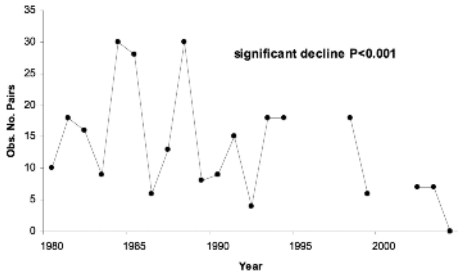

Figure 2f. ***Northern Shoveler.***

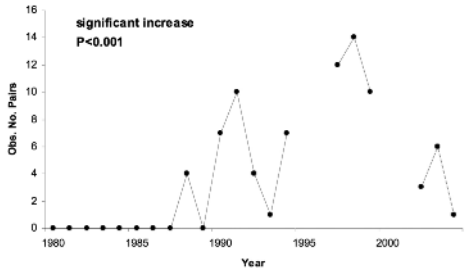

Figure 2g. ***Common Pochard.***

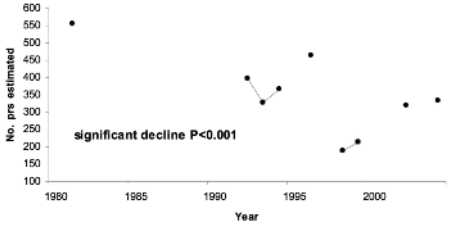

Figure 2h. ***Tufted Duck.***

Goosander was recorded during the breeding season at times (Allison, Newton & Campbell, 1974) but was not suspected as a breeder by Wright (1986). Since 1985 the species has increased its frequency as a breeder and since 1991 has appeared near annually with at least one brood in most years.

Occasional males or pairs of Greater Scaup *Aythya marila* and Red-Breasted Merganser *Mergus serrator* were seen in potentially suitable habitat in some springs from 1991 onwards but have never been proved to breed. A non breeding flock of around 50 Common Goldeneye *Bucephala clangula* occur in summer but have not been shown to breed despite the presence of a range of natural nest sites and the erection of many nest boxes.

Ruddy Duck definitely bred at least once during the period since 1985 as a brood was seen in 1992 and pairs were regularly seen in spring and summer from 1991 onwards. They have become less common since around 1998.

Discussion

The pairs counts undertaken since 1980 were thought to be broadly representative of the total populations of most duck species nesting at Loch Leven, except for the commonest 2 species, Mallard and Tufted Duck. Occasional apparent anomalies occurred during surveying, for example in 2004 when no Shoveler pairs were observed during the pairs count but 11 nests were found on St. Serf's Island during the census of Tufted Duck and subsequently 5 broods were observed. The trend is probably still representative of a real decline in the Shoveler population as shown by the statistical analysis of pairs count data as pairs counts are widely regarded to provide a repeatable and relatively accurate measure of the populations of most breeding species holding territories on water bodies (eg Koskimies & Poysa, 1985, 1987 and 1989, Koskimies & Vaisanen, 1991, Poysa, 1996 and Gardarsson, 1979). One caveat however is that the detection rates of pairs remains the same and this is largely dependent upon suitable counting conditions occurring in spring, observer coverage remaining the same and observer ability remaining consistently high.

At Loch Leven, with the existence of long term datasets using this simple pairs counting technique, it would seem sensible to continue its use as the main method for estimating population size and abundance of most duck species on Loch Leven. To enhance the method additional calibration would lend greater confidence in the technique by comparing the pairs counts against season total nest counts if these were carried out over a series of years, though this would require very significant manpower resources to achieve.

Sample period nest counts of the 2 main species, Mallard and Tufted Duck, may well have still been valid in 1981 when Wright undertook the work for his study. Since then apparent changes in climate, loch water level regime, and subtle habitat or species associations may have altered the timing of breeding and hence caused a potentially significant source of error in the population estimates. This could be reduced in future by resurveying the colony using Newton & Campbell's method and deriving new weekly nest totals for future use.

Four duck species breeding at Loch Leven have shown statistically significant population declines since 1980: Common Shelduck, Eurasian Wigeon, Northern Shoveler and Tufted Duck. A further 5 species have shown increases, 3 of which were statistically significant; Gadwall, Teal and Pochard. The only species to show no significant population change was Mallard.

The decline in the Eurasian Wigeon population reflects a perceived national trend where breeding numbers on lowland sites have declined (C Mitchell pers comm). This contrasts with the total national population which has remained fairly constant since the 1960s (Owen, 1993). Declines found in Shoveler and Tufted Duck, while statistically significant, fall within the range of variation in the population since

1966. In addition the methodological difficulties may be a result of a change in the timing of the peak incubation period, or in the case of Shoveler, a change in the detection rate of pairs due to both changes in observer and a shift in the distribution of birds to more vegetated lagoons developed adjacent to the loch. Shoveler have also have shown a national decline since 1968-72 (Mitchell, 1993, Boyd *et al*, 1994)

Increases in the Gadwall population are in line with the continuing national increase as described by Fox (1988). More recent declines are likely to be temporary and may be due to local changes as for Shoveler.

Duckling predation by an increasing population of Lesser Black-backed *Larus fuscus* and Herring *Larus argentatus* Gulls has been suggested as potentially affecting the duck population. Evidence to support this has been anecdotal thus far and is based on casual observations collected by a number of observers over many years rather any systematic recording. Dabbling duck species are thought to be the less susceptible to predation by gulls as they use the cover of thick emergent vegetation on the loch shore and along ditches and inflow burns (Clark *et al*, 1987). Shelduck and diving ducks are more susceptible to predation but recent analyses (Lauder, 2006) suggest the overall impact of gull predation is likely to be lower than perceived from casual observations.

There is no evidence to suggest that large gulls predate duck nests on St Serf's Island. Other potential aerial predators, eg Corvids, have not significantly increased their populations on the island and are unlikely to have had any negative impact, particularly given the buffering effects of more available gull nests (Liordos, 1996). There are normally no ground predators on the island and any influxes of rats or mink are quickly controlled once detected. The nest failure rate at least for Tufted Duck has remained fairly constant since Newton & Campbell's study (Liordos, 1996 and Lauder, in prep). The availability of nesting habitat has not declined and may in fact have increased with recent reductions in summer grazing resulting in new areas of *Deschampsia caespitosa* dominated cover.

The nesting association of ducks with Black-headed Gulls *Larus ridibundus* at Loch Leven is well known and has been described by various authors eg Allison *et al* (1974) and Liordos (1996). At least since 1990 the colony of Black-headed Gulls on St Serf's Island has been dynamic in its size and location and appears to have responded to the increasing presence of large gulls. It appears that competition for nest sites has moved Black-headed Gulls to new areas. Ducks continue to nest in suitable habitat in association with both large gulls as well as Black-headed Gulls.

Shelduck nests in burrows on St. Serf's Island are relatively safe from predation. However, Western Jackdaw (*Corvus monedula*) which also utilises burrows for nesting on St. Serf's Island, may have an impact on Shelduck through competition or nest predation. No nest data has been collected and thus the level of impact remains unknown.

Water quality in Loch Leven has undergone changes over the past 100 years. In modern times it has been the subject of a great deal of press coverage and subsequent efforts to improve it (LLCMP, 1999). Until around 1996 the loch suffered increasing eutrophication with increases in phytoplankton, resultant reduced light penetration and reduced growth of submerged macrophytes (LLCMP, 1999). Subsequent efforts to reduce nutrient inputs have resulted in slight improvements in water quality and light penetration (A Kirika pers comm) with resultant benefits to aquatic plant and invertebrate

communities. The exact effects of changing water quality on breeding duck populations are poorly understood but broadly those species which feed on the seeds or leafy matter of aquatic plants at some time of the year eg Teal (Cramp & Simmons, 1977) and Pochard (Stewart & Lauder, 1997), and fish eaters such as Goosander, are likely to have benefited and this is reflected in increasing populations of these species.

The Loch Leven population retains its status as the largest inland concentration of breeding ducks in Britain. However, management will be required in future to halt or reverse the observed recent declines in some species. Management to benefit many key species would entail maintenance of suitable nesting areas and the associated Black-headed Gull colony, improvement in potential brood rearing areas by expanding areas of emergent vegetation and provision of further sheltered lagoon areas and continuing efforts to improve water quality to benefit invertebrate and submerged plants.

Acknowledgements

Data collection and analysis was funded by SNH. Thanks to Paul Brooks at SNH for much discussion and helpful comments on drafts of the text, to Jeremy Squire at SNH for collection, inputting and provision of the data used since 2000 and to Ken Shaw who gave data, comments and discussion on breeding ducks at RSPB Vane Farm. Thanks are also due to all those who have ably collected data and have written about the ducks of Loch Leven before, not least Alan Allison, Colin Campbell, Ian Newton and Gordon Wright. Willie Wilson of Kinross Estate has been helpful in discussing old records. Dr Claire McKeever provided much needed help and advice with statistical analysis.

References

Allison A, Newton I & Campbell C R G 1974. *Loch Leven National Nature Reserve: a study of waterfowl biology* WAGBI, Chester.

Brooks P M, Devine M, Lauder A W, Shaw K D & Wilson A S 2004. *Bird Report 2003: Loch Leven NNR including Vane Farm RSPB Reserve* RSPB/SNH, Kinross.

Boyd H, Quinn J & Owen M 1994. *An Overview of Wildfowl Research Surveys and Monitoring at Loch Leven NNR* Wetlands Advisory Service draft report to SNH.

Clark N A, Varley T A, Evans J & Wright G A 1987. Breeding success of Mallard Anas Platyrhynchos at Loch Leven National Nature Reserve *Bird Study* 34: 129-134.

Cramp S & Simmons K E L 1977. *The Handbook of the Birds of Europe, the Middle east and North Africa, The birds of the Western Palearctic (Vol 1)* Oxford University Press, Oxford.

Crawley M J 2002. *Statistical Computing: An Introduction to Data Analysis Using S-Plus*. John Wiley.

Fox A D 1988. Breeding status of the Gadwall in Britain and Ireland *British Birds* 81:51-65

Gardarsson A 1979. Waterfowl populations of Lake Myvatn and recent changes in numbers and food habits *Oikos* 32: 250-270.

Koskimies P & Poysa H 1985. Monitoring Waterfowl populations in Finland; methodological remarks *Lintumies* 20:270-279.

Koskimies P & Poysa H 1987. Vesilinnuston seuranta ja laskentamenetelmat *Suomen Riista* 34: 31-41.

Koskimies P & Poysa H 1989. Waterfowl censusing in environmental monitoring: a comparison between point and round counts *Ann. Zool. Fennici* 26: 201-206.

Koskimies P & Vaisanen R A eds 1991. *Monitoring Bird Populations* Zool. Mus., Finnish Mus. Nat. Hist., University of Helsinki, Helsinki.

Lauder A W 2006. The Impact of Large Gulls on the Breeding Duck Population at Loch Leven NNR, Perth & Kinross *Scottish Natural Heritage Commissioned Report* (unpublished report).

Lauder A W & Brooks P M 1998. The 1994 and 1998 Surveys of Breeding Duck, St Serf's Island, Loch Leven National Nature Reserve *internal SNH report* (unpublished report).

Liordos V 1996. *A study of Nesting Tufted Duck* Aythya fuligula *on St. Serf's Island Loch Leven National Nature Reserve: Factors involved in determining nesting density and success with particular regard to the importance of the Black-headed Gull* Larus ridibundus. Unpublished MSc thesis, University of Edinburgh.

Loch Leven Catchment Management Project 1999. *The Loch Leven Catchment Management Plan* LLCMP Steering Group, Perth

Mitchell C in Gibbons D W, Reid J B and Chapman R A eds 1993. *The New Atlas of Breeding Birds in Britain and Ireland:1988-1991* T & A D Poyser, London.

Newton I & Campbell C R G 1975. Breeding ducks at Loch Leven, Kinross *Wildfowl* 26: 83-102.

Owen M in Gibbons D W, Reid J B & Chapman, R A eds 1993. *The New Atlas of Breeding Birds in Britain and Ireland:1988-1991* T. & A.D. Poyser, London.

Poysa H 1996. Population estimates and the timing of waterfowl censuses *Ornis Fennica* 73:60-68.

S-Plus 2000. *Guide to Statistics Vol 1* Data Analysis Products Division, Mathsoft, Seattle, WA, USA.

Stewart B & Lauder A W 1997. Gizzard contents of Pochard, Tufted Duck and Goldeneye from Loch Leven, Kinross, in winter 1994-95 *Scottish Birds* 18:28-35.

Wright G A 1981. Duck Breeding Survey of St. Serf's Island, Loch Leven *internal NCC report* unpublished.

Wright G A 1986. Breeding Wildfowl of Loch Leven National Nature Reserve *Scottish Birds* 14: 39-43.

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Revised manuscript accepted March 2007

Low tide counts on the Firth of Tay

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Monthly Wetland Bird Survey (WeBS) counts are made throughout coastal Britain but are chiefly of birds roosting in estuarine habitats at high tide. As the importance of feeding sites within estuaries cannot be determined from these counts, a programme of counts ensures that each major estuary is counted at low tide every few years. Substrates, and therefore available food for waterfowl, vary considerable across an estuary, so that monitoring of the location and activity of feeding birds is vital to determine the conservation value of its component parts. In the winter of 2006-07, The Firth of Tay, part of a Special Area of Conservation (SAC), was the subject of comprehensive counts under the WeBS Low Tide scheme. Counts for this winter period are compared to previous counts and the results confirm findings from high tide roost counts that certain species of waterfowl, notably Dunlin, have undergone considerable declines.

Introduction

As part of the rolling programme of Wetland Bird Survey (WeBS) Low Tide counts on Britain's estuaries, organised by the British Trust for Ornithology (BTO) for the WeBS partnership (BTO, RSPB, WWT and JNCC), the Firth of Tay was counted in its entirety during the winter of 2006-07. Previous counts had been made during the winters of 1993-94 and 1996-97 (see Musgrove *et al* 2003). The aim of Low Tide counts is to determine those sections of an estuary most used by each species, rather than the total numbers. However, the counts do give an idea of the numbers involved, since they are made on specific predetermined dates or within one or 2 days of this.

Methods

Counts were made near or at low tide on specified dates in November and December 2006 and January and February 2007. The estuary was divided into 69 sections and counts were made from both north and south shores between the mouth of the River Earn and Buddon Ness/Tentsmuir. All shorebirds and wildfowl were counted, plus divers, grebes, Grey Heron *Ardea cinerea* and Great Cormorant *Phalacrocorax carbo*. All sections were counted, with the exceptions of Dundee harbour and Buddon Ness itself.

Results

Most species favoured particular feeding sites within the estuary. Great Cormorants were found mainly at Tentsmuir Point and near the rail bridge. Grey geese *Anser spp*. concentrated on the mudflats east of Mugdrum Island with Common Shelduck *Tadorna tadorna* in the Mugdrum area and at Tayport but spreading out as numbers built in late winter. Of the dabbling duck, Eurasian Wigeon *Anas penelope* favoured downstream shores from Broughty Ferry and Tayport, mainly on the south shore, whereas Eurasian Teal *Anas crecca* were found mostly in Invergowrie bay and north of Mugdrum. Mallard *Anas platyrhynchos* were much more widespread, but concentrated in the upper reaches near and downstream of Mugdrum, between the rail bridge and Lucky Scalp and off Monifieth. Common Eiders *Somateria mollissima* favoured the main channel

downstream from Lucky Scalp while Common Goldeneye *Bucephala clangula* were mostly found in the channel between Mugdrum and Flisk. Red-breasted Mergansers *Mergus serrator* were mainly off Tentsmuir Point, with some in the river between Broughty Ferry and Tayport, and a few upriver off Flisk.

Not surprisingly, waders were found in good feeding areas on the mudflats and on mussel beds. Eurasian Oystercatchers *Haematopus ostralegus* concentrated between Tayport and Tentsmuir Point and also off Barnhill but considerable numbers also used the north shore between Invergowrie and Templehall. Ringed Plovers *Charadrius hiaticula* were almost entirely found at Tentsmuir Point but Grey Plovers *Pluvialis squatarola* were spread from there along to Tayport. The very small numbers of Northern Lapwing *Vanellus vanellus* were located in Invergowrie Bay with even smaller numbers of European Golden Plover *Pluvialis apricaria* off Powgavie. Both Red Knot *Calidris canutus* and Sanderling *Calidris alba* continued to favour the Lucky Scalp and Tentsmuir Point area. Dunlins *Calidris alpina* were found mainly east of Tayport. Bar-tailed Godwits *Limosa lapponica* fed along both shores of the outer estuary east of Broughty Ferry and Tayport with a small flock at Invergowrie. Eurasian Curlews *Numenius arquata* were widespread, inhabiting all shores with the largest numbers between Kingoodie and Powgavie. Common Redshank *Tringa totanus* were ubiquitous in small numbers, with the main flock at Invergowrie. Ruddy Turnstones *Arenaria interpres* were confined to the outer estuary, particularly east of Tayport.

A small minority of relatively empty sections were uncounted during at least one of the winters and, for direct comparison, Table 1 shows the counts of the 60 sections covered in every winter.

Discussion

The Low Tide counts show a similar trend to high tide roost counts, namely a significant decrease in the numbers of species for which the Firth of Tay is deemed especially important (see Elkins & Lynch 1997, Elkins 2006). These include Bar-tailed Godwit and Common Redshank, but the largest numerical decrease has been for Dunlin. Sanderling was the only wader that increased in numbers. The figures for Great Cormorant and wildfowl also show decreases, especially for Tufted Duck *Aythya fuligula*, of which none was present in the most recent winter. The variation in both Pink-footed Geese *Anser brachyrhynchus* and Greylag Geese *Anser anser* illustrate local movements between the estuary and feeding sites on surrounding agricultural land. Likewise, the discrepancy in the Common Eider counts is due to the difficulty of counting mobile birds moving in and out of the estuary. Recent counts at high tide suggest that there are at least 10,000 Common Eider still present in the Outer Tay. Mute Swans *Cygnus olor* are at their fewest in midwinter and Whooper Swans *Cygnus cygnus* also winter in only small numbers. High tide wader roost counts also indicate that a proportion of some feeding populations roost outwith the Firth. Even when this is taken into account, there are some species that are notably fewer than in the 1990s. Wintering European Golden Plovers have diminished greatly. Low tide flocks were common in the early 1990s, but are now very unusual. Even inland flocks seem scarcer, a fact endorsed by the low numbers of the species on both the Non Estuarine Waterbird Survey (NEWS) and the Winter Plover survey, both carried out during this same winter in east Fife.

There have been some marked changes in distribution since earlier counts. The decline in Mallard appears to have been mainly in Invergowrie Bay where considerable numbers were once found. A similar situation applies to

Table 1. ***Peak mid winter low tide counts in the Tay Estuary. Figures represent the highest monthly count between December and February. Those in brackets are peak high tide roost counts for waders in the same months.***

Species	1993/94	1996/97	2006/07
Great Cormorant	237	174	118
Mute Swan	14	16	20
Whooper Swan	4	8	7
Pink-footed Goose	2	93	5
Greylag Goose	150	83	910
Common Shelduck	80	56	70
Eurasian Wigeon	122	339	133
EurasianTeal	4	16	48
Mallard	729	948	374
Tufted Duck	17	173	0
Common Eider	no count	12253	4555
Common Goldeneye	191	220	21
Red-breasted Merganser	55	60	40
Eurasian Oystercatcher	2264 (*1905*)	2239 (*1880*)	1587 (*982*)
Ringed Plover	51 (*73*)	188 (*145*)	29 (*32*)
European Golden Plover	350 (*249*)	775 (*0*)	44 (*0*)
Grey Plover	275 (*233*)	159 (*187*)	179 (*110*)
Northern Lapwing	687 (*134*)	615 (*168*)	77 (*93*)
Red Knot	84 (*67*)	305 (*480*)	42 (*51*)
Sanderling	44 (*75*)	113 (*106*)	145 (*84*)
Dunlin	3769 (*4657*)	5195 (*1581*)	980 (*449*)
Bar-tailed Godwit	755 (*1387*)	2238 (*2305*)	1000 (*588*)
Eurasian Curlew	430 (*180*)	735 (*210*)	496 (*329*)
Common Redshank	889 (*961*)	1203 (*633*)	413 (*565*)
Ruddy Turnstone	49 (*42*)	28 (*46*)	17 (*48*)

Table 2. ***Low tide counts of waders made in the inner Tay between the rail bridge and Port Allen for 4 winter periods.***

Species	1989	1994	1997	2007
Eurasian Oystercatcher	210	743	1263	822
Ringed Plover	23	4	14	0
European Golden Plover	134	189	0	0
Northern Lapwing	579	597	585	77
Dunlin	3058	3543	4792	165
Bar-tailed Godwit	0	236	0	48
Eurasian Curlew	220	258	420	483
Common Redshank	706	773	626	359

Tufted Duck, Common Goldeneye, Dunlin and Common Redshank, and flocks of the latter 2 species are a shadow of their former size. The former Tayport flock of European Golden Plover has now disappeared and the large inner estuarine flocks of Northern Lapwing have also declined significantly. Both could be due to milder winters allowing them to feed inland more often.

Low numbers of feeding waders on the expanse of mud in the western part of the inner estuary is thought to be due to poor feeding opportunities (Elkins & Lynch 1997). The bulk of the feeding flocks use the eastern portion and Table 2 shows counts in the inner estuary for 4 winters. Included in Table 2 is a count made in late January 1989 (Laing & Taylor 1993) and the peak January/February low tide counts in each of 1994, 1997 and 2007. The declines in European Golden Plover, Northern Lapwing, Dunlin and Common Redshank are apparent and match those found on high tide counts.

Acknowledgements

The logistics of organising this type of survey are considerable. I am grateful to the BTO for the opportunity to participate in the survey and for providing data for previous winters. I wish also to thank David Bell for detailed statistics for the winter of 1996-97. Dave Ferguson and Bruce Lynch kindly found extra counters for their areas. Those who took part were: George Adam, Dave Arthur, David Bell, Paul Blackburn, Dan Carmichael, Graham Craig, Cliff Davies, Dave Ferguson, Alistair Godfrey, David Hill, Garden Johnston, Alan Leitch, Niall Lobley, Bruce Lynch, Ian Montgomery, David Shepherd, Donald Stewart, Jean Stewart, Paul Taylor, Andy Wight and the author. I thank them all and it is testimony to their commitment that all counts were made within one day of the due date despite some miserable weather, with several finding few birds to console them.

References

Elkins N 2006. Waterfowl counts on the Tay Estuary. *Scottish Birds* 26:30-38

Elkins N & Lynch B M 1997. Waterfowl counts on the Tay Estuary, 1985-1995. *Scottish Birds* 19: 36-54.

Laing S & Taylor N W 1993. The status of autumn passage and winter wader populations on the inner Tay Estuary, 1971-89. *Perthshire Society of Natural Sciences* 1993: 14-29.

Musgrove A J, Langston R H W, Baker H & Ward R M (eds) 2003. *Estuarine Waterbirds at Low Tide: the WeBS Low Tide Counts 1992/93 to 1998/99*. WSG/BTO/WWT/RSPB/JNCC. Thetford.

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Revised manuscript accepted March 2007

SHORT NOTES

Gannet laying dates

My note (*Scottish Birds* 26:50) suggested that in 2005 the Atlantic Gannets *Morus bassanus* on the Bass Rock laid significantly later than in preceding years. On July 15 2006 a visit to the Rock revealed that, judged by eye, the average age of visible chicks in the chapel area was around 26 days (for age criteria see Nelson J B 2002, *The Atlantic Gannet* second edition, Fenix Books Ltd, Great Yarmouth). None were much older than 5 weeks, which is the age at which the black tips of the growing tail feathers begin to show. An average age of 26 days suggests a mean laying date as least as late as the end of the first week in May. Any pairs which may have had eggs or tiny chicks which I did not see would make the MLD even later. A date of approximately 7 May is again significantly later than in the recent past. The chapel area is not, in my experience, the place in which the oldest Bass chicks occur, so it is possible that the MLD on other parts of the rock, especially the NW slopes, could have been slightly earlier, but this would not alter the general conclusion.

It was noticeable that an unusually high proportion of nests which were being attended by one or both adults did not hold a chick. Past experience strongly suggests that they were highly unlikely to have lost their chicks, in which case the conclusion is that they had not laid. These apparently non breeding pairs taken together with the comparatively late MLD could suggest that something is happening to the relationship between the Bass Gannets and their food supply. Unfortunately it is impossible to judge whether food is being affected by factors other than, or in addition to, the increasing population of Gannets, although I am strongly inclined to dismiss Gannets as the principal factor affecting fish numbers and, through them, gannet breeding biology.

Notwithstanding the important 'unknowns' in the above scenario it is worth recording both the lateness of the MLD and the associated speculation, in case really substantive changes occur in future years, in which case this record could be relevant.

It would be useful to be able to compare the growth rate of Bass Gannet chicks at the present time with the rate which I recorded in the early 1960s (Nelson 1964, *Ibis* 106: 63-77). Whilst it would be somewhat difficult to establish current growth rates (simply because of logistics) it would be perfectly feasible to determine the fledging period, that is between hatching and leaving the nest, by using the live cameras in the Scottish Seabird Centre in North Berwick. Given an adequate sample this could demonstrate both the range and the average length of the fledging period for comparison with earlier records. The fledging period relates to the chick's food intake and thus to the apparent food supply. This and other comparable observational work would be a valuable use of the extraordinary but greatly under used facilities at the Scottish Seabird Centre.

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Revised manuscript accepted August 2006

Great Spotted Woodpecker in Red Squirrel's drey

After strong westerly gales on the night of 31 December 2006 a Red Squirrel's *Sciurus vulgaris* winter drey was found blown out of a Serbian Spruce *Picea omorika* at Cluny House Gardens, Aberfeldy on 1 January 2007. The drey was composed typically of layers of interwoven twigs, mainly birch and dead spruce, and an inner thick bundle of fresh lichens and mosses.

Buried and rolled up within this was the decomposing complete body of an adult Great Spotted Woodpecker *Dendrocopus major*. Feathers and fur have both been recorded as materials used by Red Squirrels to line their dreys (Holm, J. *The Red Squirrel*. Shire Natural History 2005) but there is no reference to a complete body being used.

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Revised manuscript accepted January 2007

Hen Harriers' bowing behaviour and cocks' nests

Watson (1977, The *Hen Harrier* Berkhamsted) could only cite a brief description by Delamain (1932, *Why Birds Sing* London) of bowing by a male Hen Harrier *Circus cyaneus* 'repeatedly lower his empty his white breast towards his talons then standing erect again, exhibited his white breast'. Subsequently Dickson (1982, *British Birds* 75:329-330) recorded bowing behaviour in west Galloway in 1978 and 1979. This note gives 19 additional occurrences of this behaviour and suggests that bowing by Hen Harriers may not be uncommon especially when females are scarce in the local population.

Most cocks' nests were built in April-May. When a female was attracted to such a nest the males would bow apparently in greeting. The majority of adult males bowed from one to 30 times. Immature males - recognised by the grey patches on the greater coverts, yellow eye colour and smaller size - bowed from 2 to 20 times (Table 1). Delamain (1932) states the male 'then standing erect again, exhibits his white breast'. The opposite occurred at breeding areas in west Galloway. The adult males showed their white rumps to the females 76 times. Immature males did so 25 times; on only 48 occasions the adult males faced the females. When a male did not attract a female, he remained in the area of the cock's nest for several weeks either adding nest material or skydancing; on one occasion in 1988 an adult male carried out 185 successive dives. The most times that an immature male bowed was 20 in 1979 after delivering prey to an incubating female who was mated to an adult male. Females attracted to a cock's nest usually built their own nest about 10-15m away; one female built her nest about 250m from the cock's nest (Dickson 2006, *Scottish Birds* 26:49-50). A cock's nest which was built behind a stone wall for 3 years was occupied on the fourth year by a pair of harriers; the female added nest material to the cock's nest and laid 4 eggs; this was the only case of a female building on top of a cocks nest. Immature males sometimes built up to 3 other nests in the vicinity of the original one but none were successful in attracting females. In 1983 a female laid 3 addled eggs and in July, when the nest should have contained young, the adult male bowed 5 times to the female which was still sitting on the 3 eggs; she continued to incubate for 62+ days. In 1984 an adult bowed to a female at a cock's nest 30 times because of intrusion by another unmated male from a neighbouring site 1.5km away. In 1988 the most nest material that a male added to a cock's nest was 41 pieces in 35 minutes; on one occasion he lifted a large wad of material then dropped it, but this male did not breed. In 1997 a 5 year old tagged female was present in a breeding area. The next day a male flew up from a cock's nest, tail fanned, and landed about 1m from an untagged female and bowed once facing her. Fifteen minutes later the male landed beside the tagged female but it was the untagged female who bred laying 5 eggs.

All known Hen Harrier breeding areas were located in west Galloway from 1968 to 1999. Although there appears to be much suitable ground throughout the district, breeding has

Table 1. ***Hen Harriers' bowing behaviour at cocks' nests at breeding areas in West Galloway 1969-1999.***

Year	Site	Cocks' nests built	Bowing behaviour	Male	Imm male	Breeding success
1969	1	Male	None	-	-	Bred
1975	1	Male	Male to female	1	-	Bred
1978	1	Imm male	None	-	-	Did not breed
	7	Male	Male to female	6	-	Did not breed
1979	1	Male	Imm male to female	-	20	Bred
1980	13	Male	None	-	-	Bred
	11	Male	Male to female	3		Did not breed
1981	4	Male	Male to female	16	-	Did not breed
	7	Male	Male to female	18	-	Did not breed
	7	Male	Male to female	-	2	Did not breed
	11	Male	None	-	-	Did not breed
1982	11	Male	Male to female	2	-	Did not breed
	9	Male	None	-	-	Did not breed
1983	7	Imm male	Imm male to female	-	3	Did not breed
	17	Male	None	-	-	Bred
	1	Male	Male to female	5	-	Bred
1984	4	Male	Male to female	30	-	Bred
1985	7	Male	Male to female	5	-	Bred
	4	Male	Male to female	3	-	Did not breed
1986	15	Male	Male to female	2	-	Bred
1988	6	Male	None	-	-	Did not breed
	1	Male	None	-	-	Did not breed
1994	13	Male	Male to female	7	-	Did not breed
1996	7	Imm male	None	-	-	Did not breed
1997	7	Male	Male to female	6	-	Bred

been confined to about 70 sq km. The majority of nests were located between the 130 and 230m contours, separated by an average distance of 5.5 km, with the exception of peak 'vole years' in 1978-79 and 1997-98 when the average distance was 1.3km. Of 174 nesting areas monitored in 1968-1999, 28 (16%) were cocks' nests bui1t by adult males, 25 (14%) and immature males 3 (2%) and bowing behaviour (19) were correlated with them. A minimum of 95 males, 20 immature males and 82 females were noted during this study suggesting that females were in the minority. Montagu's Harriers *Circus pygargus* bui1t cocks' nests where males outnumbered females (Weis 1923, *Life* of *the Harrier in Denmark*. Copenhagen) while Simmons et al (1987, Reproductive behaviour of *Circus cyaneus* in North America and Europe: a comparison. *Ornis Scandinavica* 18:33-41) considered that 'male built platforms' were a possible 'frustration' or displacement function by males that could not attract a mate.

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Revised manuscript accepted August 2006

Hen Harriers driving Goshawk away from a roost

At around 1930 hrs on 12 September 1997, I arrived at my usual position to overlook a Hen Harrier *Circus cyaneus* roost in Galloway. The roost was characteristically (for the region) in an open, wet flow of *Phalaris* and *Juncus* on the edge of a pre thicket forestry plantation, which I had monitored regularly since discovering it in September 1993. It was a mild, dry evening with a light, southwest wind and visibility was good. No harriers were over the roost when I arrived, and I began to check the usual pre roosting perches on dykes and fence posts etc. From a distance of 750m and using binoculars, I discerned the pale front of what appeared to be a perched medium sized raptor showing against lower foliage of the dark conifer background. Without a telescope I could not immediately confirm the identification. About half an hour later I became aware of first one and then 2 adult male harriers approaching the roost from the northeast, about 20m and 50m above the ground respectively. However, they continued over the main settling area and began to dive at the perched bird, `yickering' loudly. They kept this up for a minute or so, usually pulling out of each dive a few metres above the intruder. I became aware of a third adult male harrier over the roost. The perched raptor then made off low through the conifers to its rear, confirming my initial suspicions that it was a Northern Goshawk *Accipiter gentilis*. The harriers did not pursue the accipiter, but neither did they settle to roost. Although I did not see the Goshawk return, the 3 harriers circled `yickering' for several minutes, then circled ever higher and eventually soared off to the northeast in the fading light. The nearest alternative roost I was aware of was some 6 km away in the same direction. I saw an adult male harrier roost at the site the following evening, 2 adult males on 17 September and one on each of 24 and 28 September respectively. Since then, the roost has been occupied by harriers on an annual basis, but I have not seen Goshawk again in the area.

I have watched Hen Harriers at various roosts for over 20 years, and have often seen them dive at each other, and occasionally at a variety of other birds including Short-Eared owl *Asio flammeus* and Common Buzzard *Buteo buteo*. Calling away from the nest, however, is quite rare and I have never heard anything approaching the squeal call described at winter roosts by Harold (1989. Squeal call of the hen harrier at winter roost. *British Birds* 82: 93-96) and Clarke (1990. *Harriers of the British Isles*.

Shire, Princes Risborough), which is a confrontational intra specific call. The calling heard on this occasion was the characteristic `yickering' commonly issued by birds disturbed at or near the nest and described by Watson (1977. *The hen harrier*. Poyser, Berkhamsted).

Successive attacks by a Goshawk on up to 4 ringtail Hen Harriers near a communal roost on a moor in Yorkshire on 17 February 1980, were reported separately by Marshall (1983. Prolonged aerial encounters between Hen Harrier and Goshawk. *British Birds* 76: 448-449) and Watson (1986. Prolonged aerial encounters between Hen Harriers and Goshawk. *British Birds* 79: 89-91). Watson considered there to be a territorial aspect to the attacks since Goshawks and Hen Harriers both hunted over the area.

Several instances of late afternoon interactions between individual Goshawks and groups of up to 15 harriers have been noted in Suffolk on the Hen Harrier Winter Roost Survey. On all these occasions the harriers eventually settled in their usual roosts (Roger Clarke pers comm).

Kropp and Munch (1979. Observations at the roosting sites of overwintering Hen Harriers *Circus cyaneus* in the Rench Plain, Central Baden. *Okologie der Vogel* :1:165-179) reported repeated Goshawk disturbance of a Hen Harrier roost in a winter rape *Brassica rapa sativa* field in southern Germany. During the filming of *Skydancer*, a 1993 RSPB film on Hen Harriers, photographer Mark Smith captured a remarkable sequence of disturbance by an immature Golden Eagle *Aquila chrysaetos* of a Highland roost of some 12 harriers, which rose en masse and chased the eagle off. Goshawk and Golden Eagle are 2 powerful avian predators, which could be potential threats to roosting birds on the ground.

I am grateful to Roger Clarke for commenting on an earlier draft of this note.

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Revised manuscript accepted November 2006

Conflict between Long-tailed Tit and Blue Tit at nest site

The area known as the Castle Grounds in Stornoway is the only significant area of deciduous and mixed woodland in the Western Isles. Some woodland birds such as Blue Tit *Parus caeruleus,* have become established breeders whereas others, such as the Long-tailed Tit, *Aegithalos caudatus,* which first bred in 1996, have held on precariously with only 2 birds known to be present at the beginning of 2000.

On 2 May I located a Long-tailed Tit in the Castle Grounds carrying nesting material. I was puzzled, however when a Blue Tit chased the bird on 2 occasions that same day and on 3 May. On 5 May I saw the Long-tailed Tit carrying more nesting material, this time without harassment and over the following 2 days I was able to trace the nest site to a small Scots Pine *Pinus sylvestris* . The nest site was about 3 metres above the ground with the entrance formed by a horizontal split in a short stump protruding from the trunk. On the following days I observed the Long-tailed Tit collecting more nesting material and on 8 May it was seen entering the nest cavity with a small insect in its bill, suggesting that its mate was incubating eggs.

Two days later on 10 May, I returned to find one of a pair of Blue Tits perched beside the nest entrance pulling out material. A Long-tailed Tit appeared and was chased by both Blue Tits. The Long-tailed Tit then chased one of the Blue Tits until both birds disappeared from my view. A few minutes later one of the Blue Tits and the Long-tailed Tit appeared about 5 metres from

the tree with legs entangled. The Blue Tit appeared victorious and the Long-tailed Tit flew off. However, it returned a few minutes later only to be set upon again by one of the Blue Tits. After more mid air combat both birds fell to the ground a few metres in front of me. The Long-tailed Tit was on its back on the ground protecting itself with outstretched legs from the Blue Tit. This altercation lasted about 5 seconds before both birds flew off.

After about 20 minutes one of the Blue Tits entered the nest cavity and began to pull out more material from the Long-tailed Tit's nest. Thereafter, only Blue Tits were seen at the nest site. On 19 May one of the pair entered the cavity carrying nesting material. On 29 May I observed both birds with food in their bills. On 9 June one was seen carrying a faecal sac out of the nest confirming that young were present. The young could clearly be heard on 18 June and by 21 June the Blue Tits had left presumably with their brood.

The site chosen by the Long-tailed Tits for nesting was unusual for a species more likely to build a hanging, or supported nest, outside the trunk. The aggression between the Long-tailed Tit and the Blue Tit witnessed on 2, 3 and 10 May could indicate that the Blue Tit was trying to reclaim its former nest site. A pair of Blue Tits nested at this location for the next 4 years until 2004. The tree was partly destroyed in storms in early 2005, the trunk of the tree breaking at the split where the Blue Tits had nested.

A single Long-tailed Tit was seen on 26 July and then in mixed tit flocks on 10 separate occasions until the end of the year. The species has only been a sporadic visitor since then and has returned to its previous status as a nonbreeder in the Western Isles.

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Revised manuscript accepted February 2007

Interactions between birds and a day flying bat

Whilst visiting the Dun Troddan broch in upper Glen Beag, near Glenelg (57 11' 40" N, 05 35' 08" W), on 2 September 2006, we watched several Barn Swallows (*Hirundo rustica*) feeding on insects in the clearing above the broch between 2 large trees. A Spotted Flycatcher (*Muscicapa striata*) was also seen feeding, using both the broch and one of the trees as perches. After a few minutes of observation, during a lull in bird activity at approximately 1235hrs, a bat, presumed to be a Pipistrelle (*Pipistrellus pipistrellus*) on the basis of flight pattern and size, appeared above the broch apparently also feeding. For several minutes the bat continued flying unhindered in the area above the broch, until several Barn Swallows returned to the area. These flew very close to the bat on at least 5 occasions, causing it to take evasive action by rapidly altering its flight path and height. In addition, the Spotted Flycatcher was also seen to fly out towards the bat from its perch on at least 3 occasions, again causing the bat to take evasive action.

We are unaware of previous records of interactions between day flying bats and insectivorous birds, although attempted predation of bats by raptors has been recorded (eg Shimmings 1985 *British Birds* 78:109). Competition, of an unspecified nature, between insectivorous birds and bats has been suggested as a reason for bats predominantly flying nocturnally, despite lower abundance of insects at night (eg Speakman et al 2000 *Oikos* 88:75-86). The observations provided here suggest that interference competition between bats and insectivorous birds of disparate taxonomic groups, mediated through direct antagonistic interactions, may be a significant component of such competition.

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Revised manuscript accepted October 2006

Survey of roof nesting gulls in Caithness

The number of Herring Gulls *Larus argentatus* breeding in Caithness has been in decline for at least the past 3 decades. Operation Seafarer (1969-70) found a total of 22,483 apparently occupied nests (aon) and this had fallen to 10,033 aon by the time of the Seabird Colony Register Survey in 1985-88 and had further decreased to 3,743 aon by 1998-2002 when the Seabird 2000 Survey was carried out (Mitchell *et al*, 2004, *Seabird Populations of Britain and Ireland*, T & A D Poyser, London). Our own observations show that almost all colonies in the county have reduced numbers and a few have disappeared altogether. The only exceptions appear to be the county's 2 principal roof nesting colonies, one on the buildings of the Dounreay nuclear establishment and the other in Wick. These appear to have been established in the first half of the 1980s but were not fully surveyed until 1994 when there was a total of 131 aon roof nesting birds, nearly all Herring Gulls but including a few Lesser Black-backed Gulls *L fuscus*, and Common Gulls *L canus* (Table 1). Only a partial survey of these birds appears to have been undertaken as part of Seabird 2000 and, as it was our impression that these colonies were thriving, we undertook a full survey during the 2006 breeding season.

The results of the survey are summarised in Table 1. In total we located 210 ± 10 aon Herring Gulls in 4 colonies. The survey in Wick was carried out mainly on 27 May 2006, with a number of further checks over the following 4 weeks. Nests were mostly straightforward to locate from street level or from vantage points around the town, but we suspect that a few were overlooked. The total includes one nest on the roof of the Sheriff Court which was only visible from one particular window at the top of the building. Overall 60 nests (52%) were located on chimney stacks, 22 (19%) on flat roofs, 20 (17%) on sloping roofs, 9 (8%) in the V between 2 sloping roofs, 4 (3%) on the tops of walls of ruined buildings and one (1%) on a ledge. The main concentration of nests was around the harbour and the principal commercial district of the town in Lower Pulteneytown (45 aon) with smaller numbers in the town centre (17 aon) and the residential areas of Hillhead (21 aon), Upper Pulteneytown (31 aon) and Broadhaven (2 aon). Compared with the position in 1994, this represents a spread northward from Lower Pulteneytown into the town centre and Hillhead and south into Upper Pulteneytown.

A figure for the number of birds breeding at Dounreay was estimated from information supplied by Johnson Controls, the contractors responsible for the maintenance of the buildings there. They undertook a campaign to control the number of gulls breeding there during 2006, and pricked a total of 238 eggs. At least 3 nests containing a total of 5 chicks were missed, so a minimum of 243 eggs were laid. Unfortunately no record was kept of the clutch sizes but all nests contained either 2 or 3 eggs, and we estimate that 243 eggs is equivalent to about 80-100 aon (*i e* assuming a mean clutch size of 2.5 - 3.0). At the end of the breeding season some 70-80 nests were identified, a figure which is not inconsistent with the figure estimated from the egg count, allowing for those destroyed or lost due either to the weather or the birds themselves. No doubt a few nests were overlooked and taking this, and these 2 estimates into account, we think the total number of roof nesting birds here was probably 90 ± 10 aon.

Table 1. ***Roof nesting Herring Gulls in Caithness, 1994-2006.***

Colony	Map ref	Number of breeding pairs (aon)		
		1994[a]	2000[b]	2006
Dounreay	NC9866/67, NC9967	58[c]	*ca*.50[d]	90 ± 10
Thurso	ND1168	0	e	3
Castletown	ND1967	0	e	1
Wick Airport	ND3653	7[f]	g	0
Wick	ND3650/51, ND3751	66	h	116
Total		131	-	210 ± 10

[a] Data from H Clark and E W E Maughan, 1994, Survey of roof nesting gulls at Dounreay and Wick, *Caithness Bird Report*, 56-58.
[b] Data from Mitchell et al, 2004, *Seabird Populations of Britain and Ireland*.
[c] One Herring Gull paired with a Lesser Black-backed Gull; in addition 12 aon Common Gull.
[d] Also 86 aon Common Gulls (13 aon on roofs, 73 aon on ground nearby).
[e] Not counted, presumed nil.
[f] In addition 1 aon Common Gull.
[g] Not counted; status unknown.
[h] Not counted, but definitely some birds breeding (Clark & Sellers, unpublished data).

Table 2. ***Productivity of Herring Gulls nesting in Caithness in 2006.***

Colony	Map ref	Habitat	Productivity	
			chicks per pr	nests
Wick	ND3650/51, ND3751	roofs	2.53	31
Castle of Old Wick	ND3648	cliff ledges	2.00	27
Badbea	ND0920	boulder beach	1.83	89

In addition to these 2 main colonies we found a minimum of 3 aon in Thurso, one on a chimney stack, a second actually in a chimney pot, and a third on a flat roof. All were in the town centre. There are few really suitable vantage points here and it is possible that others were missed. A number of loafing birds were seen, but we were unable to establish unequivocally that these were birds associated with active nests. Finally there was one aon in Castletown, located on a chimney stack. We checked all other coastal villages in Caithness including the Vulcan Naval Reactor Test Establishment and Forss Business Park but found no evidence for any breeding gulls, nor were there any in Halkirk. The 1994 survey found birds nesting on the tops of the Second World War bomb magazines at the north side of Wick Airport and about 1 km north of the northern edge of Wick town, but we found none here in 2006.

At the end of June 2006 we undertook a further survey of the Wick birds to provide an estimate of chick productivity, with the results shown in Table 2. For comparison we include results from a coastal colony at the Castle of Old Wick, a kilometre or so south east of the centre of Wick, and another from a large but declining coastal colony at Badbea, in the south of Caithness. Chick productivity at Dounreay and Wick was higher than at Badbea, for which the productivity was typical of other coastal colonies in the south of Caithness (R M Sellers, unpublished data). The colony at the Castle of Old Wick was intermediate between these 2 groups, perhaps because the birds there were able to take advantage to some extent of the scavenging opportunities in Wick. We have no direct evidence of this at the Castle of Old Wick colony, but at another coastal colony at Papigoe, a kilometre or so east north east of Wick, regurgitates obtained during ringing operations contained amongst other things the remains of cooked human foodstuffs.

This survey shows that the numbers of roof nesting gulls in Caithness has increased by about 60% in the 12 years since the earlier survey, the colonies at Dounreay and Wick being the only ones of any size in Caithness to have increased during this period, so far as we are aware. By contrast the small roof nesting colony at Wick Airport has disappeared. Birds definitely bred here in 1995 (*ca* 10 pr Herring Gull, 2 pr Great Black-backed Gulls and 1 pr Common Gull), but breeding appears to have ceased a year or 2 later. Despite its proximity to the runways, which at their closest are only about 250 m away, we understand from the airport authorities that no direct attempts have ever been made to discourage nesting here. However, around this time gulls had taken to roosting on the runways at night and as a preventative measure gas guns were used to scare the birds away. This appears to have been successful and, though the evidence is circumstantial, we suspect that the increased levels of disturbance may also have resulted in the breeding colony being deserted.

We are indebted to Mike Rennie, Sandy Moran and the staff of Johnson Controls for making available the information on gulls at Dounreay, and UKAEA for their permission to publish this data. Our thanks also to Matt Parsons and JNCC for providing information from Seabird 2000.

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Revised manuscript accepted October 2006

Late breeding season in Northern Gannets at Hermaness, Shetland in 2006

Nelson (*Scottish Birds* 2006 26:50. Mean laying dates in the Northern Gannet) noted that the Gannets *Morus bassanus* on the Bass Rock were significantly later breeding in the 2005 season and stated that this had not previously been observed before at that colony.

On 26 June 2006, together with other members of the Shetland Ringing Group, I visited the Gannet colony at Hermaness, Unst intending to ring a sample of chicks. Unfortunately, few chicks were old enough to ring and many nests had newly hatched chicks or well incubated eggs, indicating that most females had laid about 3 weeks later than usual.

The colony has been visited on similar dates or slightly earlier in many previous years since 1979, (but not 2005) and such a late season has not been recorded previously, the chicks normally being ready to ring in large numbers by the third week of June.

Nelson suggested that the late laying '…could potentially be linked to the relative paucity of sand eels *Ammodytes* spp within the foraging range of Bass Gannets. These fish are an important part of the Gannet's diet prior to egg laying'.

The effects of the lack of availability of sand eels are well documented in other seabirds but there is little information on the food of Shetland Gannets during the prebreeding season, although there is information on diet collected during ringing visits.

It is worth noting that in 1981 sand eels made up 90% of the diet of Gannets at Hermaness but this had fallen to 15% by 1986, with Herring *Clupea harengus* and Mackerel *Scromber scrombus* being the most important species. By 1997, sand eels were again available and made up 50% of the diet (*The Birds of Shetland*. 2004. Helm. London). In 2003, 2004 and 2006 sand eels were not recorded in the diet at all, with the main species being Mackerel and Herring with small numbers of whitefish *Gadus* spp. There is no evidence that breeding success has been affected by this change in diet away from sand eels.

Given that the laying dates for this species have been regarded as very consistent from year to year, it would be valuable to have information on the phenology of the breeding season for Northern Gannets in other colonies and in other years.

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Revised manuscript accepted October 2006

Eurasian Sparrowhawk attacking Red Squirrels

It is well known that Eurasian Sparrowhawks *Accipiter nisus* wi11 attack birds at garden feeders (eg Wilson and Weir 1989, *Scottish Birds* 15:126-130). Newton (1986, *The Sparrowhawk,* Calton) could only document a few Red Squirrels *Sciurus vulgaris* as prey of Sparrowhawks in Europe, mainly in forest plantations, while no Sparrowhawks have been reported attacking Red Squirre1s at garden feeders.

From November 2005 to May 2006 up to 3 Red Squirrels fed at nut feeders and fat balls on Rowans *Sorbus aucuparia* and Hawthorns *Crataegus mongyna* in a garden in Galloway. Eight direct attacks were made on squirrels by a male Sparrowhawk attempting to make a kill with its feet and legs extended but none were successful; to evade capture the squirrels quickly climbed a tree and lay flat, hugging a branch.

During the same months, 30 attacks on birds by a male Sparrowhawk were recorded of which 6 (20%) were successful: 2 Chaffinches *Fringilla coelebs,* 2 European Goldfinches *Carduelis carduelis,* one European Greenfinch C *chloris* and one Eurasian Siskin C *spinus*.

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Revised manuscript received August 2006

Dr Pamela Mary Collett

1925 – 2006

The SOC has lost a strong supporter in Pam who died on 13 March 2006. Less than 3 months earlier she had celebrated her 80th birthday with friends and had been 'on good form', reminiscing over old times and birdwatching trips both at home and abroad.

After studying medicine in London, Pam McMorran worked at a paediatric hospital in Norwich where, through friendship with a staff nurse from the north, she was introduced to Caithness. She moved to Thurso in the late 1950s and was a highly respected GP for over 30 years, continuing as police doctor for several years after retiring from general practice in 1990.

Apart from birds, Pam had a sound knowledge of wild flowers and her later holidays had been in search of these; she claimed that her eyesight was not as good as it used to be, and plants didn't fly away. She also loved music, had learned some Gaelic, the better to communicate with some of her patients, and was active in country dancing. She loved dogs and apart from her last year or so she had always shared her life with a dog. After retirement, and right up until her death, she helped at Riding for the Disabled. She also had a fine library of bird books which she bequeathed to the SOC.

Pam must have joined the SOC soon after arriving in Thurso, perhaps about the time of the birth of *Scottish Birds*; certainly the first time she appeared in print was with a short note on a Marsh Harrier in Caithness dated 5 March 1961, (*Scottish Birds* 1: 426-427). In that, she mentioned her familiarity with the species in Norfolk so her passion for birds must have come early in her life. In 1970, when I met her, she was in the driving seat of birdwatching in Caithness, organising the cover for the first breeding atlas as BTO local representative. She was also the local representative of the RSPB and the Local Recorder from 1970-1983. During these years she also produced the Caithness Bird Report and many of us remember her cajoling to submit our records at the end of each year, threatening to omit them if we missed her deadline. Of course she never did. All this she somehow fitted around her busy professional commitments, working nights and weekends as well as days.

Pam had a love of islands and early on she joined groups surveying the birds on Stroma, the Pentland Skerries and Sule Skerry. She was possibly the first woman ever to land on Sule Stack; the Duchess of Bedford in 1914 had not been able to land (*Scottish Birds* 1: 266). She visited St Kilda and knew Fair Isle well from

regular visits to friends on the island. After marriage to Tony Collett in 1971 together they reached Spitzbergen, Mongolia and Peru as well as the Middle East and North Africa. Neither did they neglect islands nearer home: the writer's tent still has a hint of eau de Fulmar after they borrowed it for a few days on North Rona. Although she continued to travel after Tony died in 1990, a spark had gone. She did, though, realise an ambition of which she was proud, to visit all the island groups on the mid Atlantic Ridge.

Pam loved Caithness, the wild coast, and especially the vast peatlands, and I remember a trip with her when we surprised a Wood Sandpiper from a nest at our feet. We looked at each other, she grabbed me, and we danced around like children, having finally proved breeding in the county, before withdrawing to allow the bird to return. For Pam, the bird's welfare was always paramount. Birds need more champions like Pam and her many friends in the SOC, and we in Caithness, miss her.

My thanks to David Glass, Peter James and Sinclair Manson for memories of Pam, and to Peter James for the photograph of Pam en route to the Pentland Skerries in 1965.

Stan Laybourne

CORRECTION

Crossbill numbers in old pinewoods on upper Deeside and Speyside

In our paper in *Scottish Birds* 26, 2006, pp 51-55, it was invalid to use proportionate change on scores. This does not affect conclusions, but we make corrections below.

Page 51, second paragraph, line 10: 'This also held with change, ranking the change in score from year 1 to year 2, eg +2 for 3 rising to 5, or – 3 for 5 falling to 2 ($n = 17$, $r_S = – 0.25$)'.

Page 51, right column, second paragraph, line 3: 'likewise for change', and line 4: '$r_S = – 0.01$'.

Table 2. Title and Correlations 2 and 4, alter 'proportionate change' to 'change'. In Correlation 2, change 0.09 to 0.07. In Correlation 4, change –0.15 to –0.06. Proportionate change is valid for use on the index in Correlation 6.

A Watson & M Marquiss

Advice to contributors

Authors should bear in mind that only a small proportion of the *Scottish Birds* readership are scientists and should aim to present their material concisely, interestingly and clearly. Unfamiliar technical terms and symbols should be avoided wherever possible and, if deemed essential, should be explained. Supporting statistics should be kept to a minimum. All papers and short notes are accepted on the understanding that they have not been offered for publication elsewhere and that they will be subject to editing. Papers will be acknowledged on receipt and are normally reviewed by at least 2 members of the editorial panel and, in most cases, also by an independent referee. They will normally be published in order of acceptance of fully revised manuscripts. The editor will be happy to advise authors on the preparation of papers.

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Scottish Birds

Volume 27 **June 2007**

Contents

Published by the Scottish Ornithologists' Club,
The Scottish Birdwatching Resource Centre, Waterston House,
Aberlady, East Lothian EH32 0PY.