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Corrigendum: In the Forth Naturalist and Historian Journal, Volume 39, 2016, page 1, "Naturalist Papers", the following text appears: "97 Orchards of the Forth Valley: A Programme for Revival - Dr. Crispin W. Hayes". This should read: "97 Orchards of the Forth Valley: A Programme for Revival - Dr. Crispin W. Hayes **and Diane C. Alderdice**".

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THE FORTH NATURALIST AND HISTORIAN

The Forth Naturalist and Historian (FNH) is an informal enterprise of Stirling University. It was set up in 1975 by several University and Central Regional Council staff to provide a focus for interests, activities and publications of environmental, heritage and historical studies for the Forth area, comprising now local authority areas Stirling, Falkirk and Clackmannanshire. Since then the organisation of an annual environment/heritage conference has been an important feature.

The annual Forth Naturalist and Historian has published numerous papers, many being authoritative and significant in their field, and includes annual reports of the weather, and of birds in the locality, plus book reviews and notes. These volumes provide a valuable successor to that basic resource, The Transactions of the Stirling Field and Archaeological Society, 1878-1939.

Four year contents/indexes are available, and selected papers are published in pamphlet form, while others are available as reprints. In addition, a 230 page book Central Scotland – Land, Wildlife, People, a natural history and heritage survey, was produced in 1994 and is available in the form of a CD-Rom, Heart of Scotland's Environment (HSE).

Other FNH and associated publications still in print include – Mines and Minerals of the Ochils, Airthrey and Bridge of Allan, Woollen Mills of the Hillfoots, The Ochil Hills – landscape, wildlife, heritage – an introduction with walks, Alloa Tower and the Erskines of Mar, and the Lure of Loch Lomond a journey round the shores and islands. Several of these are in association with Clackmannanshire Field Studies Society.

FNH publications are listed on the internet British Library (BLPC) and by booksellers e.g. Amazon, Bol, Barnes and Noble. Offers of papers/notes for publication and of presentations for conference are ever welcome. Visit the website for instructions to authors.

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Report on the Forth Naturalist and Historian Conference

Saturday November 11th 2017

The Inner Forth: New Connections for Nature, History and People

Richard Tipping

Three years on from the conference that introduced the ambitions of the Inner Forth Landscape Initiative (*FNH* v. 38, 5-9) we returned to hear of the achievements in a rich and diverse series of talks. **Anne McCall**, RSPB Scotland Director and former Chair of the Inner Forth Landscape Initiative (IFLI) Board, introduced the day. IFLI was a 4-year programme funded through the Heritage Lottery Fund's landscape partnership scheme with eight formal partners (Stirling, Falkirk and Clackmannanshire Councils, Historic Environment Scotland, the Royal Society for the Protection of Birds, Scottish Natural Heritage, the Central Scotland Green Network Trust (CSGNT) and Sustrans). Its mission was to celebrate, protect and improve the landscape and heritage of the Inner Forth, from Stirling old bridge to Blackness and Rosyth.

The day began with **Ellie Graham**, an archaeologist with the ScAPE Trust at St. Andrews University. She evaluated the project to re-discover the early 15th century Royal 'dockyard' on the Forth at Higgins Neuk, near Airth. The project drew on research by Falkirk historian John Reid and involved geophysical surveys, geomorphological reconstruction, cartographic analyses and excavation. The 'dockyard' is known to have accommodated the 'Great Michael', then Northern Europe's largest ship, but the ever-changing estuary and mudflats and later buildings have concealed the evidence. So where to look? The project focused on the Neuk itself, a headland lying adjacent to the new Clackmannanshire Bridge and, in the recent past, the location of ferries to Kincardine. An exciting discovery of a large and long stone wall deep extending beneath the salt-marsh surface was frustrated by radiocarbon dates on subsurface peat that didn't make sense until the team recalled the 18-19th century moss clearances above Stirling and the flushing of very old peat down-river. The wall is not the 'dockyard'. It is too young, as are the well-preserved 18-19th century remains of mills, roadways and sea-walls excavated in October 2017. The 'dockyard' is still out there - somewhere.

Murray Dickie, a founder member of the Clackmannanshire Field Studies Society (CFSS) and the Forth Naturalist and Historian, and editor of the *Journal* you're reading, described the work of the CFSS in the 'Two Estates' Project, looking at the development and decline of the Clackmannan and Alloa Estates between 1690 and 1900, when both engaged heavily in mining, transport, harbour development and water supply.

Employing the full range of landscape interpretation skills, field survey, document and cartographic research, clues in contemporary paintings, newspapers and even postcards, the CFSS have in a short time produced detailed reports on the Alloa and Clackmannan Waggonway 1760-1924, former lade from the Gartmorn Dam and the ice-house at Alloa, published in the FNH *Journal* (v 38, 109-130; v 39, 29-50; v. 40, 160-183) with more papers to come. More importantly, a team of trained volunteers were committed to continue research.

More archaeological skills (excavation, geophysics, architectural drawing, topographic survey and photogrammetry, including 3D laser-scanning) were employed by professional archaeologists from AOC Archaeology Group and volunteers who assisted **Geoff Bailey**, Keeper of Archaeology & Local History at Falkirk Museum since 1984, in 'Investigating Zetland Park'. Now surrounded by urban Grangemouth, the 8.5 acres (3.4 ha) of agricultural land given by the Earl of Zetland to the burgh in 1880 then lay well to the East of the town. Its cenotaph, with its rather triumphalist British lion devouring the German eagle, remembers losses in World War I and is amongst the largest memorials of this time. The park is also graced by the McPherson Fountain. Made in 1882, is now digitally preserved by laser-scanning and listed by Historic Environment Scotland. Zetland Park lies at the tidal limit of the River Carron, close to the site of the medieval Abbot's Grange stood, one of Holyrood Monastery's farms. Detailed topographic survey defined the ditch that surrounded the grange, and this was the target for excavation, which recovered 13-14th century pottery in its fill, an unusual survival given the re-moulding of this landscape in the last two centuries.

Orchards have a long history along the Forth (see Crispin Hayes in *FNH* v 39, 97-112) and **Emilie Wadsworth**, Biodiversity & Heritage Officer for the Central Scotland Green Network Trust, drew on this as background to her talk. The 20th century decline of orchards had resulted in only 25 remnants along the Inner Forth. Emilie talked about their revival and about the potential of orchards as inspiring learning tools for school children. The 'Fruitful Landscapes' Project aims to restore and celebrate this heritage at four localities; the Kinneil Estate, which had an orchard from at least the 17th century, Cambuskenneth Abbey; Zetland Park, also with 17-18th century traditions and at Skinflats, the Royal Society for the Preservation of Birds' reserve. Children from 30 schools and volunteers from four community groups planted hundreds of young fruit trees, a considerable achievement. They were supported by the Forth Valley Orchards Initiative, Falkirk Community Trust, the Friends of Kinneil, the Patrons of Cowane's Hospital and IFLI.

Wester Moss, just South of Fallin, has also recently featured in the FNH *Journal* (Currie & Bairner: v 38, 25-40) for its biodiversity. **David Hill**, Peatland Restoration Project Officer at Butterfly Conservation Scotland, developed on this by describing its habitat restoration. One of the last surviving raised mosses of the Stirling carse, Roy's Military Survey (1747-1755) recorded its cutting by 'moss lairds'. This cutting continued into the 20th century by which time it was only one third of its extent in the mid-18th century. The moss was designated a SSSI in 1985. It is home to the Large Heath butterfly, Britain's only bog specialist, which feeds solely on Hare-tail Cottongrass, its range now 58% less than it was some 40 years ago. The moss is also home to the Green Hairstreak butterfly as well as the Sun bog-jumper spider, known only from six sites, most lying along the Forth. Birch trees were invading the degraded and drained moss surface and ditch-damming to raise the water table, peat bunds to create new wetlands and scrub clearance were urgently needed. These were achieved by some 40 volunteers funded and supported by IFLI, EcoCo Life, Stirling Council and Scottish Natural Heritage.

Suzanne Burgess (Scotland Manager, Buglife) introduced a very different and imaginative approach to conservation and raising awareness: the creation of 'green' roofs and meadows. These are biodiverse roof-top gardens partially or completely covered with vegetation and a growing medium. Such roofs reduce energy costs, increase their lifespan through protection from frost, high temperatures, UV and mechanical damage, act as sound insulation, reduce CO_2 emissions, improve local air quality, slow rain runoff and imbue health and well-being. They can be low maintenance and can support a range of plant communities including trees. The 'Glorious Green Roofs' Project focused on two sites in Grangemouth, one the new ASN school roof: 200 square metres of roof were planned and 440 square metres achieved through funding by IFLI and EcoCo Life.

The IFLI programme has supported six Masters students through bursaries. **Sophie McDonald** graduated with a MSc in Environment, Heritage and Policy at the University of Stirling and is now studying for a PhD at Glasgow. She explored the motivations of volunteers in engaging with community-led cultural and natural heritage conservation in the Inner Forth area, an issue of relevance to national government bodies and many readers of the FNH *Journal*. Sophie defined the reasons that motivate involvement: the construction of local identities and social networks, the attachment to and pride in place, increases in leisure time and the ways that heritage make memories more concrete. Participation strengthens these, but threats to this include: the time-commitment, the 'jumping through' funding hoops and an ageing population of enthusiasts. Intriguingly, she found that natural heritage volunteers tend to be motivated more by global concerns and cultural heritage volunteers by more local allegiances. Landscape partnerships like IFLI are positive influences,

facilitating involvement, connecting people, providing expertise and collaboration.

Kate Fuller is the Community Engagement Officer with IFLI, having joined IFLI during the development period in 2012 and since then been a member of the partnership's delivery team. Kate manages the 'Forth Nature Counts' Project within IFLI, supporting others to build their wildlife knowledge and to build a better picture of nature (i.e. increase the number of verified wildlife records) throughout the Inner Forth landscape through biological recording. Although Fife Nature was operating as a Biological Recorder in Fife the remainder of the Inner Forth area did not have such a facility and this was a gap needing to be filled. To engage communities and help potential recorders to develop skills 102 free training events (workshops, guided survey walks, bioblitzes and moth mornings) were put on with help from many partners and individuals. Repeated transects are critical, and six have been established. These are walked around five times a year by some 28 volunteers committing more than 550 hours of their time. These transects have no specific targets, but IFLI generated lists of species to target each month. Biological data have been submitted to iRecord (www.brc.ac.uk/irecord/enter-inner-forth-records): more than 50 recorders providing 9,864 records of 1,164 species, 352 families and 44 taxon groups. Verification is by on-line specialists from photographs and verified data contribute to national data sets and greatly contribute to our understanding how species and habitats are doing.

At the end of a tremendous day, **Tom Churchyard**, IFLI Programme Manager, assessed the legacy of IFLI and how the initiative has furthered interpretation of the Inner Forth landscape. Tom introduced the suite of twelve permanent, visually striking but unobtrusive metal markers that will be placed around the estuary, contextualising each scene. There will also be seven larger 'beacons', inter-active installations which can be accessed by a mobile phone app. There is a physical legacy to IFLI, including the more than 10 hectares of wildflower meadow created, in excess of 20 hectares of woodland managed, the orchards created, the more than 10 kilometres of new or upgraded paths and the new RSPB Black Devon Wetlands reserve. There is also, as Anne McCall reminded us, the cognitive legacy, the engagement with over 70 schools, the 33 cultural heritage training events attended by nearly 500 people from 20 community groups, the 15 traineeships, the partnership working and a new future for the area of the inner Forth.

THE LARGER MOTHS OF THE POOL OF MUCKHART AREA: STATUS CHANGES ACROSS FOUR DECADES

David M. Bryant

Introduction

The status of the larger moths of three Vice Counties in Central Scotland (Stirlingshire, West Perthshire and Dunbartonshire) has been reviewed by Knowler (2010, 2017). His checklist draws on studies of 1-31 years duration between 1962 and 2010 and includes 29 sites, running from Inversnaid in the West to Pool of Muckhart in the East. The main time-period covered by Knowler (2010) overlapped with that analysed by Fox *et al*. (2006, 2013) when they investigated nationwide changes in the status of larger moths over 35 years (1968-2007). The widespread population trends they reported, including many previously undetected declines, were also noted by Knowler (2010, 2016, 2017) at regional and local levels in western Central Scotland.

Here I ask if nationwide changes in status were also apparent at a single site in the East of the area considered by Knowler; most particularly whether species showing nationwide declines are now absent or if generally-increasing species are now present. To do this, gains and losses to the moth assemblage in the Pool of Muckhart area between 1973 and 2017 are examined. Bryant (1981) reported on the larger moths during 1973-80, based mainly on a single light trap operating on the eastern edge of Pool of Muckhart. These records provide a baseline from which comparisons are made with a recent year of trapping at the western end of the same village, supplemented by a longer series of records from a second site nearby.

Location and Methods

The study was carried out from March to November 2016 at Middlehall Farm (OS NN994007); 150 metres above sea level. Five light traps were operated overnight, at monthly intervals, in order to cover the flight periods of most species. The light traps included two Robinson-type Mercury Vapour Traps (125W), one 40W Heath Actinic Trap and two 6W Heath Actinic Traps. The wider habitat comprised hill pasture with scattered small woods, conifer plantations and gardens, broadly resembling that of the 1970s study at OS NO002009. The traps in the present study were placed in and around a recently-planted (1980s) mixed woodland, dominated by native deciduous trees, including Oak, Ash, Birch and Hawthorn with a small conifer plantation nearby. Records from a site three kilometres to the South East are also considered.

These come from near Powmill during 2011-17, at around 175 metres altitude and with a similar farmed, upland landscape (OS NT0397, NT0398). These records were reported to the National Moth Recording Scheme (NMRS) by the recorder, T. Brain.

Many widespread species are easily identified and their veracity is normally unquestioned. Greater scrutiny is afforded to rarer species and to certain families or genera which include so-called 'confusion species'; these require detailed examination to establish their identity. Current recording practice requires that records in these categories are supported by a photograph or a specimen and scrutinised by a second assessor. All records considered here have been confirmed via this routine and are lodged with the NMRS.

Results

Evaluation of records from the list reported by Bryant (1981), mainly by re-examination of specimens in a collection, meant that eight species should be added to the published Parish of Muckhart records and six should be removed (Table 1). The 'additions' refer to 'confusion' species previously overlooked in the collection plus two species omitted in error. The 'deletions' involve species where evidence of their identity is no longer available or acceptable (Table 1). An update of Bryant's 1970s list of 210 species therefore contains a total of 211 species of Macro-moth.

Table 1. Additions and deletions of macro-moth species to the assemblage reported by Bryant (1981).

Additions	Deletions
Riband Wave (omitted in error)	Ling Pug (taxonomic re-evaluation)
Spruce Carpet (ID)	Chestnut-coloured Carpet (ID error)
Broken-barred Carpet (ID)	Spinach (ID error)
Pretty Pinion (ID)	Small Autumnal Moth (no evidence)
Common White Wave (omitted in error)	Exile/Northern Arches (ID error)
Grass Wave (ID)	Pale-lemon Sallow (ID error)
Dusky-lemon Sallow (ID)	Dingy Shears (ID error)
Glaucous Shears (ID)	
(ID) = additions based on re-examination of specimens in a collection; (ID error) = deletions based on re-examination of a collection; other reasons for changes are indicated in the table (and in explained below).	

The survey during 2016 in the Pool of Muckhart generated a list of 124 macro-moth species. Amongst these were 16 species not represented in Bryant's (1970s) original listing. Several of these were identified using the more comprehensive criteria presently available. Others, however, were likely to have been overlooked previously and one, the Slender Brindle, was likely to be new to the area.

Table 2. Additions during 2016 to the 1970s listing of moths in Pool of Muckhart.

Emperor Moth	Freyer's Pug	Coronet
May Highflyer	Willow Beauty	Flounced Chestnut
Blue-bordered Carpet	Pinion-streaked Snout	Least Black Arches
Welsh Wave	Lempke's Gold Spot	Slender Brindle
Golden-rod Pug	Small Clouded Brindle	
Dwarf Pug	Slender Brindle	

Discussion

Comparisons of moth assemblages across many decades are influenced by a range of factors. Principal amongst these is the improvement in identification aids and the accessibility of expert assistance, respectively due to the development of modern field guides and the advent of the NMRS. Arguably of greatest importance, however, is the advent of the digital camera which has allowed most Macro-moths to be reliably photographed and identified without collecting them. This facilitates the rapid electronic transfer of images for review and validation. The quality of most recent data sets within the NMRS, therefore, is generally reliable. The post-2010 studies at Pool of Muckhart (Bryant) and at Powmill (Brain) have added an additional 77 species to the Muckhart area's list, bringing it to 288 overall (Appendix). Eleven of the 15 Families of macro-moths found in Britain are represented in the area, showing a wide variety of colours and forms (Plates A1, A2 and A3, page 184). Some species recorded in the 1970s (n=10), however, have not been found recently. Hence, the list of species proven to be present in the early 21st Century is 278 Macro-moth species.

Species gains and losses

Species can be added to or removed from a listing for a variety of reasons. Six of the additions from Bryant's (1981, Table 1.) studies can be credited to improvements in identification aids. Richard South's classic guide (1961), the standard reference book at the time, was insufficiently detailed to allow all confusion species to be reliably distinguished. Broken-barred Carpet, Pretty Pinion, Grass Wave, Spruce Carpet and Glaucous Shears (see below also) were all added when the collection was re-examined. Two species present in the collection, Riband Wave and Common White Wave, were identified at the time but omitted in error. In contrast, evidence for the occurrence of Spinach, Chocolate-coloured Carpet, Dingy Shears, Exile/Northern Arches and Small Autumnal Moth is inadequate by present standards, so they have been deleted from the list (Table 1). These can be difficult species to identify, without prior experience, even using modern aids. None has been recorded subsequently in the local area but some have occurred sparingly elsewhere in Central Scotland.

The two records of Pale-lemon Sallow (unknown in Scotland) proved, on re-examination, to be mis-identifications of the similar Dusky-lemon Sallow (itself rare in Scotland), which is therefore now added to the list (Plate A4, page 185). One former species, Ling Pug, has since been lumped taxonomically with Wormwood Pug (as a subspecies), so it is deleted from the list of full species.

The principal means by which species have been added to the area-list, however, is the product of two new studies (see above). Bryant's study in 2016 added 15 species to his updated 1970s listing, including 8 'confusion' species probably overlooked earlier. Six further species were probably uncommon or possibly absent earlier (*e.g*. Blue-bordered Carpet). One species, Slender Brindle, was likely a newcomer to Central Scotland; first recorded in 2004 (Knowler 2010) and so was almost certainly absent from Muckhart in the 1970s.

The most comprehensive recent study in the area is due to Tim Brain. His listings on the NMRS database include 6 additional species associated with recent, mainly-Northward, range expansions: Scorched Wing, Red-necked Footman, Buff Footman, Pale Pinion, Figure of Eighty and Blair's Shoulder Knot (Plate A5, page 185). Overall, therefore, seven species have been newly-recorded in the area since the 1980s for reasons probably linked to climate warming. Experience from elsewhere in Central Scotland indicates that these species will become more frequent in the coming decade. The remaining species newly-recorded near Powmill include five which are generally scarce and are mostly represented by a single record: Vestal, Tissue, Buff Ermine, 4-dotted Footman and Dotted Rustic. Two of these are scarce migrants (Vestal and probably Dotted Rustic), two are likely occasional wanderers from established populations elsewhere (respectively Buff Ermine, 4-dotted Footman) and one (Tissue) is perhaps a stray from populations to the East. Some of these could be extending their ranges locally.

The majority of Brain's additions to Bryant's records (n=34) are of uncommon species or those with specialised habitat requirements, and perhaps never present in Pool of Muckhart itself. The remainder are probably newcomers to the wider area's list because they are uncommon or early-season or late-season species (*i.e*. from November to March) which were under-sampled by Bryant. Notable amongst these records are Seraphim, Svensson's Copper Underwing, Bulrush Wainscot, Olive, Heart and Club and Heath Rustic. Finally, there are some species which have been identified recently with the aid of modern facilities (n=14), including a panel of experts reviewing photographs, that might have been overlooked, or were perhaps irregular or absent, in the 1970s.

Comparison of local and national trends

Fox *et al.* (2006) listed the ten species which have declined most rapidly in 'Northern Britain' (covering Northern England and Scotland) from 1968-2002 (35 years). Amongst these, three species are known from the area of Pool of Muckhart: White-line Dart, Large Wainscot and Grass Rivulet, but only two (Grass Rivulet, Large Wainscot) are known to still be present. On a broader scale, Fox *et al*. (2006) noted 15 species which had declined by >90% across Britain as a whole and are now considered as 'Endangered'. Amongst 8 of these species that have been recorded near Muckhart, only 4 were found in recent surveys. The remainder (White-line Dart, Garden Dart, Anomalous and Dusky-lemon Sallow), therefore, appear to have declined. Fox *et al*. (2006) also identify a further 28 species which have declined rather less, by 70-79%. Amongst those species also recorded from Muckhart-Powmill (n=9), only two have not been recorded recently (Minor Shoulder-knot, July Belle). This analysis therefore points to four species showing the steepest national declines, all of which are now considered as Endangered, to have remained unrecorded during recent surveys (Table 3). It is a reasonable presumption that they have also declined in the Muckhart area, or perhaps been lost altogether, in line with wider-UK trends.

Table 3. **Species formerly present but not recorded recently in the Muckhart area.**

White-line Dart	Garden Dart	Anomalous	Dusky-lemon Sallow

Fox *et al*. (2014) inferred from the pattern of population changes amongst larger moths across Britain, that predominantly 'Southern' species (considered as relatively 'warm-adapted') will likely increase as Northern Britain warms under likely climatic change, whereas 'Northern' species (considered as relatively 'cool-adapted') will be displaced further northwards. Many species, of course, fall into neither of these categories and are presently found under a wide range of conditions throughout Britain. What is the evidence from this study for local increases in 'Southern' species or declines amongst 'Northern' species?

All of the seven species that have apparently colonised the Muckhart-Powmill area during the four decades of the present studies (see above and Table 4) fit the definition of 'Southern' species, with their northern range-limit presently moving further northwards (Table 4). This pattern is also evident elsewhere in Central Scotland as a whole (Knowler 2016). Furthermore, the pattern is clearly widespread and ongoing with recent first records in Central Scotland of Southern Wainscot and others (Bryant unpublished). There are also signs that some species previously confined to the milder West of Scotland are spreading eastwards, presumably as the eastern landscape becomes more

favourable. Oak Beauty and Buff Ermine, both frequent in West Central Scotland are now being recorded for the first time in the East, including in the wider Muckhart area.

Table 4. Species with a predominantly 'Southern or Western Britain' distribution that have been recorded in the Muckhart area for the first time since 2000.

'Southern' species	'Western' species
Red-necked Footman	Scorched Wing
Buff Footman	Buff Ermine
Pale Pinion	Oak Beauty
Figure of Eighty	
Blair's Shoulder Knot	
Slender Brindle	
Vestal	

Evidence of a northward retreat amongst 'cold-adapted' species is harder to detect amongst the status changes observed in the Muckhart area. Amongst the 10 species that have not been recorded since the 1970s (Table 5) and are apparently 'lost' to the area, most do not display an obvious northerly bias in their distributions. Hence, their apparent absence does not serve as an 'indicator' of a northerly-retreat. Two further species, however, could be of some relevance to this question: Golden-rod Brindle and Striped Twin-spot Carpet. Both are predominantly upland species in Britain with their widest distributions in Scotland. Neither species has been recorded in the Muckhart area since the 1970s.

At a superficial level, therefore, with eight species unrecorded but with no link to their N-S distributions and possibly two species with a tenuous link, the evidence of a northward retreat in the face of a warming climate is weak or lacking. It seems more likely that these ten local 'losses' can be ascribed to one or more of the following: **a**. not detected recently because always rare or very local (*cf* Bedstraw Hawk-moth, Bordered Sallow, Silvery Arches, Golden-rod Brindle); **b**. loss or change of a specialised habitat so its associated moth species are now rare or extinct (*cf* Broad-barred White); **c**. subject to fluctuating populations, so only likely to be detected in occasional 'boom' years (*e.*g. Golden-rod Brindle); **d**. overlooked as a 'confusion' species (*cf* Striped Twin-spot Carpet); **e.** no suitable weather conditions prompting the arrival of rare migrants (*cf* Bedstraw Hawk-moth); **f.** in widespread decline for unknown causes (Silvery Arches, Minor Shoulder-knot, Anomalous, July Belle).

Perhaps the most curious absence is the striking Puss Moth, recorded annually at Muckhart in the 1970s and early 1980s but not since. It has not yet been highlighted in any wider survey as being in decline and its larval foodplants (willows and poplars) remain widespread.

Table 5 Species found in the 70s but not recorded recently.

Bedstraw Hawk-moth	Bordered Sallow
July Belle	Golden-rod Brindle
Striped Twin-spot Carpet	Minor Shoulder-knot
Puss Moth	Silvery Arches
Anomalous	Broad-barred White

This account has focussed on the changing status of species of Macro-moths in the Muckhart area but there have also been some subtler changes within species. The most striking example concerns the Peppered Moth; famous as a contemporary example of evolution by natural selection (Cook *et a*l. 2012). The melanic form (f. *carbonaria*) was frequent in Muckhart in the 1970s but it is now absent (Bryant unpublished, Plate A6, page 185). The simplest explanation is that the Clean-air Acts of 1956 (and later) and the resulting reduction in sooty deposits, duly had a negative effect on the visibility of the melanic form, leading to increased bird-predation and, in turn, to its local decline and eventual loss, albeit occurring across several decades. It is likely that changes in the representation of different morphs amongst other species will also change, or continue to change, over the next four decades as natural and anthropogenic factors combine to affect their frequency in moth populations.

Conclusions

The Macro-moth assemblage reported by Bryant (1981) for the 1970s was reviewed and some additions and corrections were made. The greatest impact on our knowledge of the larger moths in the area, however, arose from the accumulation of species newly-found as a result of longer-term and more widely-spread studies. As a consequence, the corrected total of 211 species recorded by Bryant (1981) rose to 278 species, over four decades.

The majority (95%) of the species present in the Muckhart area in the 1970s have remained present until the current decade. The overarching pattern, therefore, is one of long-term stability at the level of local species-richness. This is consistent with the stability in the abundance of widespread species in Northern Britain but contrasts with trends in Southern Britain which have shown a marked deterioration (Fox *et al*. 2013). Nevertheless, there will have been many numerical changes amongst species recorded in the present area, positive, fluctuating or negative, which have not been detected by this species-level review.

Combining evidence from three studies of the larger moths in the Muckhart-Powmill area, shows an arrival by 10 species during the present decade that are also known to be spreading northwards or eastwards in Britain (Table 5). In most or all cases this has occurred under the direct or indirect influence of climate warming and habitat changes. Colonisation of the area can be inferred with some confidence because there are recent multi-year records of nine of these newcomers (the exception is the rare migrant, the Vestal, Table 5). A similar pattern of colonisation has been recorded over recent years elsewhere in Central Scotland (Knowler 2010, 2016, 2017; Bryant unpublished). While these patterns seem to be driven by factors related to climate change, the detailed causal agents are not known. Nevertheless, under predicted ongoing warming, and with the passage of time, other species known to be spreading northwards are likely to be seen in the future; perhaps Dot Moth will be the next to appear, having already established itself in Central Scotland not far to the South and West? Also, some 'confusion' species have been added because of recent improvements in identification aids and verification routines. Finally, an additional 61 species, themselves mostly widespread, and found elsewhere in Central Scotland have been added to the area-list, probably mainly through a sustained sampling effort.

There was only very weak evidence, amongst the 10 species apparently lost from the area (Table 5), that this reflected a northward range-retreat amongst 'cold-adapted', northerly species, that has been anticipated under a climate-warming scenario (Fox *et al*. 2014). It could be that the local climate in the Muckhart - Powmill area, or its component micro-climates, has not changed in line with nationwide averages, hence little or no retreat would be expected. A more likely explanation for these apparent losses, however, is that local habitats, or their condition, have deteriorated or been lost through agricultural and other land-use changes, especially where previously natural and semi-natural habitats are brought into production or developed. This will have had a knock-on effect on some associated moth species.

Acknowledgements

The author firstly draws much-deserved attention to the enormous contribution made to our knowledge of the moths of Central Scotland by the late John Knowler (1942-2017). He served as Recorder for the NMRS over many years covering three Vice Counties (86, 87, 99) and provided the author and many others with advice and information. I would also like to thank Vivian and William Read of Middlehall for hosting my moth traps during 2016. The recent contribution that Tim Brain has made to knowledge of Muckhart-Powmill's moths is enormous and has allowed our knowledge of the status of moths in

the area to be brought to a much higher level. Butterfly Conservation is thanked for hosting the National Moth Recording Scheme.

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Appendix

Macro-moth species list for the Pool of Muckhart – Powmill area, Vice County 87, West Perthshire. Listed in the sequence due to Agassiz *et. al*. (2013)

Orange Swift	*Triodia sylvina*
Common Swift	*Korscheltellus lupulina*
Map-winged Swift	*Korscheltellus fusconebulosa*
Gold Swift	*Phymatopus hecta*
Ghost Moth	*Hepialus humuli*
Six-spot Burnet	*Zygaena filipendulae*
Scalloped Hook-tip	*Falcaria lacertinaria*
Pebble Hook-tip	*Drepana falcataria*
Peach Blossom	*Thyatira batis*
Figure of Eighty	*Tethea ocularis*
Common Lutestring	*Ochropacha duplaris*
Yellow Horned	*Achlya flavicornis*
December Moth	*Poecilocampa populi*
Northern Eggar	*Lasiocampa quercus f. callunae*
Fox Moth	*Macrothylacia rubi*
Emperor Moth	*Saturnia pavonia*
Poplar Hawk-moth	*Laothoe populi*
Bedstraw Hawk-moth	*Hyles gallii*
Elephant Hawk-moth	*Deilephila elpenor*
Small Elephant Hawk-moth	*Deilephila porcellus*
Single-dotted Wave	*Idaea dimidiata*
Small Fan-footed Wave	*Idaea biselata*
Riband Wave	*Idaea aversata*
Vestal	*Rhodometra sacraria*
Shaded Broad-bar	*Scotopteryx chenopodiata*
Garden Carpet	*Xanthorhoe fluctuata*
Dark-barred Twin-spot Carpet	*Xanthorhoe ferrugata*
Flame Carpet	*Xanthorhoe designata*
Silver-ground Carpet	*Xanthorhoe montanata*
Yellow Shell	*Camptogramma bilineata*
Small Argent & Sable	*Epirrhoe tristata*
Common Carpet	*Epirrhoe alternata*
Shoulder Stripe	*Earophila badiata*
Streamer	*Anticlea derivata*
Beautiful Carpet	*Mesoleuca albicillata*
July Highflyer	*Hydriomena furcata*
May Highflyer	*Hydriomena impluviata*
Pine Carpet	*Pennithera firmata*
Spruce Carpet	*Thera britannica*
Grey Pine Carpet	*Thera obeliscata*
Blue-bordered Carpet	*Plemyria rubiginata*
Barred Yellow	*Cidaria fulvata*
Broken-barred Carpet	*Electrophaes corylata*
Purple Bar	*Cosmorhoe ocellata*

Phoenix	*Eulithis prunata*
Chevron	*Eulithis testata*
Northern Spinach	*Eulithis populata*
Barred Straw	*Gandaritis pyraliata*
Small Phoenix	*Ecliptopera silaceata*
Red-green Carpet	*Chloroclysta siterata*
Autumn Green Carpet	*Chloroclysta miata*
Common Marbled Carpet	*Dysstroma truncata*
Dark Marbled Carpet	*Dysstroma citrata*
Green Carpet	*Colostygia pectinataria*
Mottled Grey	*Colostygia multistrigaria*
Striped Twin-spot Carpet	*Nebula salicata*
Water Carpet	*Lampropteryx suffumata*
Northern Winter Moth	*Operophtera fagata*
Winter Moth	*Operophtera brumata*
November Moth	*Epirrita dilutata*
Pale November Moth	*Epirrita christyi*
Autumnal Moth	*Epirrita autumnata*
Welsh Wave	*Venusia cambrica*
Tissue	*Triphosa dubitata*
Chimney Sweeper	*Odezia atrata*
Twin-spot Carpet	*Mesotype didymata*
Rivulet	*Perizoma affinitata*
Small Rivulet	*Perizoma alchemillata*
Pretty Pinion	*Perizoma blandiata*
Sandy Carpet	*Perizoma flavofasciata*
Double-striped Pug	*Gymnoscelis rufifasciata*
V-Pug	*Chloroclystis v-ata*
Green Pug	*Pasiphila rectangulata*
Slender Pug	*Eupithecia tenuiata*
Foxglove Pug	*Eupithecia pulchellata*
Brindled Pug	*Eupithecia abbreviata*
Juniper Pug	*Eupithecia pusillata*
White-spotted Pug	*Eupithecia tripunctaria*
Golden-rod Pug	*Eupithecia virgaureata*
Dwarf Pug	*Eupithecia tantillaria*
Larch Pug	*Eupithecia lariciata*
Narrow-winged Pug	*Eupithecia nanata*
Angle-barred Pug	*Eupithecia innotata*
Ochreous Pug	*Eupithecia indigata*
Lime-speck Pug	*Eupithecia centaureata*
Freyer's Pug	*Eupithecia intricata arceuthata*
Wormwood Pug	*Eupithecia absinthiata*
Valerian Pug	*Eupithecia valerianata*
Currant Pug	*Eupithecia assimilata*
Common Pug	*Eupithecia vulgata*
Tawny Speckled Pug	*Eupithecia icterata*
Grey Pug	*Eupithecia subfuscata*

Treble-bar	*Aplocera plagiata*
Streak	*Chesias legatella*
Seraphim	*Lobophora halterata*
Yellow-barred Brindle	*Acasis viretata*
Early Tooth-striped	*Trichopteryx carpinata*
Clouded Border	*Lomaspilis marginata*
Tawny-barred Angle	*Macaria liturata*
Latticed Heath	*Chiasmia clathrata*
Brown Silver-line	*Petrophora chlorosata*
Scorched Wing	*Plagodis dolabraria*
Brimstone Moth	*Opisthograptis luteolata*
Feathered Thorn	*Colotois pennaria*
Canary-shouldered Thorn	*Ennomos alniaria*
Early Thorn	*Selenia dentaria*
Lunar Thorn	*Selenia lunularia*
Scalloped Hazel	*Odontopera bidentata*
Scalloped Oak	*Crocallis elinguaria*
Swallow-tailed Moth	*Ourapteryx sambucaria*
Feathered Thorn	*Colotois pennaria*
March Moth	*Alsophila aescularia*
Pale Brindled Beauty	*Phigalia pilosaria*
Oak Beauty	*Biston strataria*
Peppered Moth	*Biston betularia*
Scarce Umber	*Agriopis aurantiaria*
Dotted Border	*Agriopis marginaria*
Mottled Umber	*Erannis defoliaria*
Willow Beauty	*Peribatodes rhomboidaria*
Satin Beauty	*Deileptenia ribeata*
Mottled Beauty	*Alcis repandata*
Engrailed	*Ectropis crepuscularia*
Grey Birch	*Aethalura punctulata*
Bordered White	*Bupalus piniaria*
Common White Wave	*Cabera pusaria*
Common Wave	*Cabera exanthemata*
Clouded Silver	*Lomographa temerata*
Light Emerald	*Campaea margaritaria*
Barred Red	*Hylaea fasciaria*
Grass Wave	*Perconia strigillaria*
March Moth	*Alsophila aescularia*
Large Emerald	*Geometra papilionaria*
Puss Moth	*Cerura vinula*
Sallow Kitten	*Furcula furcula*
Lunar Marbled Brown	*Drymonia ruficornis*
Iron Prominent	*Notodonta dromedarius*
Pebble Prominent	*Notodonta ziczac*
Swallow Prominent	*Pheosia tremula*
Lesser Swallow Prominent	*Pheosia gnoma*

Coxcomb Prominent	*Ptilodon capucina*
Buff-tip	*Phalera bucephala*
Herald	*Scoliopteryx libatrix*
Straw Dot	*Rivula sericealis*
Snout	*Hypena proboscidalis*
Buff Ermine	*Spilosoma lutea*
White Ermine	*Spilosoma lubricipeda*
Ruby Tiger	*Phragmatobia fuliginosa*
Garden Tiger	*Arctia caja*
Muslin Footman	*Nudaria mundana*
Four-dotted Footman	*Cybosia mesomella*
Red-necked Footman	*Atolmis rubricollis*
Buff Footman	*Eilema depressa*
Fan-foot	*Herminia tarsipennalis*
Small Fan-foot	*Herminia grisealis*
Pinion-streaked Snout	*Schrankia costaestrigalis*
Mother Shipton	*Euclidia mi*
Spectacle	*Abrostola tripartita*
Burnished Brass	*Diachrysia chrysitis*
Silver Y	*Autographa gamma*
Beautiful Golden Y	*Autographa pulchrina*
Plain Golden Y	*Autographa jota*
Gold Spangle	*Autographa bractea*
Gold Spot	*Plusia festucae*
Lempke's Gold Spot	*Plusia putnami*
Nut-tree Tussock	*Colocasia coryli*
Grey Dagger	*Acronicta psi*
Miller	*Acronicta leporina*
Light Knot Grass	*Acronicta menyanthidis*
Knot Grass	*Acronicta rumicis*
Coronet	*Craniophora ligustri*
Shark	*Cucullia umbratica*
Anomalous	*Stilbia anomala*
Svensson's Copper Underwing	*Amphipyra berbera*
Mouse Moth	*Amphipyra tragopoginis*
Green-brindled Crescent	*Allophyes oxyacanthae*
Early Grey	*Xylocampa areola*
Bordered Sallow	*Pyrrhia umbra*
Marbled Beauty	*Bryophila domestica*
Mottled Rustic	*Caradrina morpheus*
Pale Mottled Willow	*Caradrina clavipalpis*
Uncertain	*Hoplodrina octogenaria*
Rustic	*Hoplodrina blanda*
Brown Rustic	*Rusina ferruginea*
Angle Shades	*Phlogophora meticulosa*
Small Angle Shades	*Euplexia lucipara*
Haworth's Minor	*Celaena haworthii*
Crescent	*Helotropha leucostigma*

Frosted Orange	*Gortyna flavago*
Rosy Rustic	*Hydraecia micacea*
Large Ear	*Amphipoea lucens*
Ear Moth	*Amphipoea oculea*
Crinan Ear	*Amphipoea crinanensis*
Flounced Rustic	*Luperina testacea*
Large Wainscot	*Rhizedra lutosa*
Bulrush Wainscot	*Nonagria typhae*
Small Wainscot	*Denticucullus pygmina*
Small Dotted Buff	*Photedes minima*
Dusky Brocade	*Apamea remissa*
Clouded-bordered Brindle	*Apamea crenata*
Rustic Shoulder-knot	*Apamea sordens*
Small Clouded Brindle	*Apamea unanimis*
Slender Brindle	*Apamea scolopacina*
Dark Arches	*Apamea monoglypha*
Light Arches	*Apamea lithoxylaea*
Confused	*Apamea furva*
Double Lobed	*Lateroligia ophiogramma*
Common Rustic	*Mesapamea secalis*
Lesser Common Rustic	*Mesapamea didyma*
Rosy Minor	*Litoligia literosa*
Cloaked Minor	*Mesoligia furuncula*
Marbled Minor	*Oligia strigilis*
Tawny Marbled Minor	*Oligia latruncula*
Rufous Minor	*Oligia versicolor*
Middle-barred Minor	*Oligia fasciuncula*
Orange Sallow	*Tiliacea citrago*
Pink-barred Sallow	*Xanthia togata*
Sallow	*Cirrhia icteritia*
Dusky-lemon Sallow	*Cirrhia gilvago*
Brown-spot Pinion	*Agrochola litura*
Flounced Chestnut	*Agrochola helvola*
Red-line Quaker	*Agrochola lota*
Yellow-line Quaker	*Agrochola macilenta*
Brick	*Agrochola circellaris*
Lunar Underwing	*Omphaloscelis lunosa*
Chestnut	*Conistra vaccinii*
Pale Pinion	*Lithophane socia*
Blair's Shoulder-knot	*Lithophane leautieri*
Golden-rod Brindle	*Xylena solidaginis*
Sword-grass	*Xylena exsoleta*
Red Sword-grass	*Xylena vetusta*
Satellite	*Eupsilia transversa*
Olive	*Ipimorpha subtusa*
Dun-bar	*Cosmia trapezina*
Centre-barred Sallow	*Atethmia centrago*

Minor Shoulder-knot	*Brachylomia viminalis*
Suspected	*Parastichtis suspecta*
Merveille du Jour	*Griposia aprilina*
Brindled Green	*Dryobotodes eremita*
Grey Chi	*Antitype chi*
Black Rustic	*Aporophyla nigra*
Brindled Ochre	*Dasypolia templi*
Dark Brocade	*Mniotype adusta*
Pine Beauty	*Panolis flammea*
Clouded Drab	*Orthosia incerta*
Common Quaker	*Orthosia cerasi*
Small Quaker	*Orthosia cruda*
Powdered Quaker	*Orthosia gracilis*
Hebrew Character	*Orthosia gothica*
Twin-spotted Quaker	*Anorthoa munda*
Antler Moth	*Cerapteryx graminis*
Silvery Arches	*Polia trimaculosa*
Pale-shouldered Brocade	*Lacanobia thalassina*
Bright-line Brown-eye	*Lacanobia oleracea*
Broom Moth	*Ceramica pisi*
Glaucous Shears	*Papestra biren*
Shears	*Hada plebeja*
Cabbage Moth	*Mamestra brassicae*
Campion	*Sideridis rivularis*
Broad-barred White	*Hecatera bicolorata*
Lychnis	*Hadena bicruris*
Brown-line Bright Eye	*Mythimna conigera*
Common Wainscot	*Mythimna pallens*
Smoky Wainscot	*Mythimna impura*
Clay	*Mythimna ferrago*
Shoulder-striped Wainscot	*Leucania comma*
White-line Dart	*Euxoa tritici*
Garden Dart	*Euxoa nigricans*
Heart and Dart	*Agrotis exclamationis*
Turnip Moth	*Agrotis segetum*
Heart and Club	*Agrotis clavis*
Dark Sword-grass	*Agrotis ipsilon*
Flame	*Axylia putris*
Flame Shoulder	*Ochropleura plecta*
Barred Chestnut	*Diarsia dahlii*
Purple Clay	*Diarsia brunnea*
Ingrailed Clay	*Diarsia mendica*
Small Square-spot	*Diarsia rubi*
Red Chestnut	*Cerastis rubricosa*
True Lover's Knot	*Lycophotia porphyrea*
Dotted Rustic	*Rhyacia simulans*
Large Yellow Underwing	*Noctua pronuba*
Broad-bordered Yellow Underwing	*Noctua fimbriata*

Lesser Yellow Underwing	*Noctua comes*
Lesser Broad-bordered Yellow Underwing	*Noctua janthe*
Great Brocade	*Eurois occulta*
Double Dart	*Graphiphora augur*
Green Arches	*Anaplectoides prasina*
Dotted Clay	*Xestia baja*
Square-spotted Clay	*Xestia stigmatica*
Neglected Rustic	*Xestia castanea*
Heath Rustic	*Xestia agathina*
Square-spot Rustic	*Xestia xanthographa*
Six-striped Rustic	*Xestia sexstrigata*
Setaceous Hebrew Character	*Xestia c-nigrum*
Double Square-spot	*Xestia triangulum*
Autumnal Rustic	*Eugnorisma glareosa*
Gothic	*Naenia typica*
Least Black Arches	*Nola confusalis*
Green Silver-lines	*Pseudoips prasinana*
Oak Nycteoline	*Nycteola revayana*

FORTH NATURE COUNTS: BUILDING A BETTER PICTURE OF WILDLIFE IN THE INNER FORTH LANDSCAPE

Kate Fuller

Introduction

Between 2014 and 2018, Forth Nature Counts (FNC) was one of around fifty projects provided through the Inner Forth Landscape Initiative (IFLI). The project aimed to increase the level of biological recording within the IFLI area and generate as many verified biological records as possible, ensuring that records ended up in the public domain and contributed to conservation work.

The project set its targets as:

- 2000 records generated/verified and uploaded onto the National Biodiversity Network (NBN).
- 250 attendees at biological training days.
- 50 volunteers submitting biological records via the project.
- 50 volunteers trained in the use of iRecord to ensure the sustainable upload of wildlife records after IFLI in 2018.
- 12 'themed' training days per year around the IFLI area for casual recorders to gain assistance with biological recording, learn how to identify taxa, upload their data, drop in their data and gain assistance from specialists in the field.

This paper explains the background to the FNC project and how the suite of activities ran between May 2014 and March 2018 compared with our aims and objectives. It follows the outline of the talk given at the joint IFLI and Forth Naturalist & Historian conference in November 2017, with additional reporting from the closing months of the project, to provide a full overview of achievements.

Background

The Inner Forth Landscape Initiative is a programme of works overseen by a partnership led by RSPB Scotland and comprising Stirling, Clackmannanshire and Falkirk Councils, Central Scotland Green Network Trust, Historic Environment Scotland, Scottish Natural Heritage and Sustrans. The partnership vision is of: "An Inner Forth landscape where the natural, cultural and historical wealth of the area is revealed, valued, enhanced, and made accessible to both the people who live here and visitors. Its important historical and natural landscape features will be in good condition, and the future is embraced by a landscape better-able to cope with change."

In 2012 the IFLI partnership were successful in obtaining a Stage One pass and development grant for a Landscape Partnership Scheme through the National Lottery's, Heritage Lottery Fund. Between 2012 and 2013, the IFLI partnership developed a Landscape Conservation Action Plan (LCAP) as part of their ultimately successful Stage Two Landscape Partnership Scheme bid. The LCAP described the Inner Forth landscape, its unique natural, built and cultural heritage features, the strengths, weaknesses, opportunities and threats related to heritage in this area and how the partnership's vision would be realised through a suite of fifty discrete but interlinked projects.

The FNC project was designed during the LCAP process in response to a known weakness linked to the way biological records in the area were captured and retained. Although Fife Nature was operating as a Local Biological Records Centre (LBRC) in Fife, the remainder of the Inner Forth area (parts of Falkirk, Stirling and Clackmannanshire) did not have such a service. The IFLI partnership and its Natural Heritage Working Group wished to explore how this gap could be overcome in the short term, and what sustainable options may exist in the longer term. The FNC project was designed to run during the full IFLI programme lifespan, from May 2014 to March 2018, be delivered across the whole IFLI landscape and be managed in-house by a member of the IFLI staff team with support from three consecutive paid, part-time Wildlife Recording Assistants, who would be beneficiaries of IFLI's Training Tomorrow's Talent project and a data management contractor.

Activities

The FNC project sought to meet its aims and objectives by delivering a wide range of free activities designed:

- To develop the skill and knowledge levels of novice and more experienced recorders, through formal and informal training methods;
- To engage and enthuse communities and recorders in their local wildlife using a range of events and social media;
- To increase the number of verified wildlife records for the Inner Forth area.

These activities were delivered free of charge to all participants, located at suitable sites (good quality habitats close to indoor spaces) throughout the Inner Forth area and were open to all, though mostly aimed at adults and students of higher education. The FNC project was supported by three Wildlife Recording Assistants who were appointed following recruitment at three times in the project: Paul Barclay, Adam Ross and Elizabeth Cairns. Buglife Services,

with staff based in Stirling, were appointed as data management contractors for the duration of the project.

Skill and Knowledge Development: Wildlife Identification Workshops

Over the four years of the project, an annual wildlife identification and survey skills workshop programme was provided. Sessions usually accommodated twelve participants and most sessions were fully booked prior to the day. Workshops were either delivered wholly out-of-doors or were built round a morning indoor session to introduce the topic, and an afternoon session in the field. Workshops were delivered by knowledgeable and expert individuals who were either staff of IFLI partner agencies or conservation NGO's operating in Scotland, consultants, specialist volunteers or trainees from the Training Tomorrow's Talent programme (Figure 1).

Figure 1. Saltmarsh Plant Identification session.

(image: Lizzy Cairns/IFLI)Team)

This session was held at RSPB Skinflats nature reserve, August 2017, led by ex-trainee Chris Knowles. In year 1 (May 2014 to March 2015), workshops focused on themes that could be readily delivered by colleagues who were members of the IFLI Natural Heritage Working Group and IFLI partnership. In years two to four, the scope of the workshops expanded and sessions were provided in all seasons by building links with suitably skilled ecological and botanical consultants, and wildlife or conservation focused NGO's who were keen to collaborate with the project and encourage volunteer skills to record certain species.

In year One of the FNC project seven sessions were delivered with eighty participants. Identification topics included summer and winter trees, fungi and distance wading birds. In year Two of the project (April 2015 – March 2016), 220 participants took part in 22 training sessions and bioblitz events at four locations. In year Three of the project (April 2016 to March 2017), 39 training sessions took place with 292 participants (see Figure 2). In year Four of the project (April 2017 to March 2018), 38 training sessions took place with 424 participants. Workshops suggested by attendees and delivered in subsequent years included identifications of beetles, woodland plants and bird song. We could not, unfortunately, cater for all of the many suggestions we received.

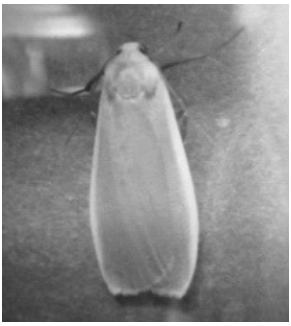
Figure 2. Example of promotional material for wildlife identification workshops during 2016.

Whilst workshops were a pre-designed element of the project, the exact topics were always intended to develop as the project evolved. In 2014, an email enquiry resulted in contact with Professor David Bryant, previously of Stirling University, who is an avian expert and also a keen moth recorder. Through David generously volunteering his time and expertise, a series of moth mornings in 2016 (7 sessions) and 2017 (four sessions) took a small group of regular attendees to a variety of locations in the Inner Forth area between April and September to set moth traps and then record the catch. The 'drivers' behind this were (a) generating records for the Butterfly Conservation Moth Atlas and (b) increasing the number of people who contribute these records. An effort was made to focus recording in 10km squares that had limited records or those where a variety of moths were known, and pleasingly five new records were made. We were able to visit woodland habitats at the munitions depot at MoD Crombie, FCS Devilla Forest, coastal and open grassland at Kennetpans distillery, the wetlands at RSPB Skinflats nature reserve and Polmaise Waste Recycling Facility during the programme.

Table 1. New 10km square moth species records generated 2016-17.

Date	Location	New Species for the relevant 10km square
1-2 July 2016	MoD Crombie, Fife	Cinnabar *Tyria jacobaeae*
13-14 July 2016	Devilla Forest, Fife	Beautiful Carpet *Mesoleuca albicillata* Welsh Wave *Venusia cambrica* Satin Beauty *Deileptenia ribeata*
11-12 August 2017	Devilla Forest, Fife	Buff footman *Eilema depressa* (Figure 3)

Figure 3. Buff footman.



(Image: David Bryant)

In the final twelve months of the project three events were provided that were aimed at those who had already volunteered or engaged with the FNC project. In March 2017, two sessions at the start of the recording season were designed to generate enthusiasm in the coming summer to encourage ad-hoc recording of species that are likely to be widely seen (e.g. butterflies, birds, flowering plants) and to introduce a range of specific recording schemes that our volunteers might be interested in as a 'next step' or 'another string to their bow'.

In February 2018 the Source to Resource conference aimed to highlight the way that data was transferred from the recorder, through a verifier, to datasets and end-users for conservation,

planning and other purposes. This event, held the month before the FNC project closed, attracted around eighty delegates and incorporated a mixture of talks and practical identification or survey sessions that aimed to develop survey skills and wider awareness of citizen science activity in the central belt of Scotland.

Figure 4. Source to Resource conference, February 2018.

Engaging and Enthusing: Bioblitz

To complement the workshop programme, to reach a wider audience and engage people in the wildlife of the Inner Forth we ran a series of mini bioblitz events in summer 2015 at Kinneil Local Nature Reserve, Gartmorn Dam near Alloa, Stirling city centre and Scottish Wildlife Trust's Jupiter Urban Wildlife Reserve in Grangemouth. At Kinneil and Stirling we attracted a small and very interested group and at Jupiter we successfully engaged families in pond dipping and bug hunting.

In 2016 we concentrated on linking wildlife recording with built heritage recording and generating new records for a previously un-recorded site through the 'Kennetpans Weekend'. In 2017 the focus was to re-record the rare Bog sun-jumper spider *Heliophanus damfi* at the Wester Moss SSSI at Fallin near Stirling. These sessions proved more successful, both in terms of variety and quantity of species recorded, participant numbers and perceived engagement of the attendees.

Figure 5. Bog sun-jumper spider page from the Buglife website.

(https://www.buglife.org.uk/bugs-and-habitats/bog-sun-jumper-spider accessed 05/07/2018)

The Kennetpans weekend (Plate B1 and B2, page 186), catered for two groups: those attracted to the citizen science element and those undertaking archaeological recording within the distillery's bonded warehouse. It enabled them to become aware of some of the wildlife that this previously un-recorded site held, to generate new records and to learn about species from the experts present. The Wester Moss SSSI event presented volunteers, and Angus Macdonald, MSP and Bog sun-jumper spider species 'champion', with an opportunity to come into contact with the species for the first time, and try-out the 'bug-vac' that helps survey a species that hides in *Sphagnum* moss clumps.

Figure 6. Angus Macdonald MSP with bug-vac at Wester Moss SSSI.

(Image: Kate Fuller/IFLI Team)

Figure 7. Attendees inspecting bug-vac contents at Wester Moss SSSI.

(Image: Kate Fuller/IFLI Team)

Survey Walks

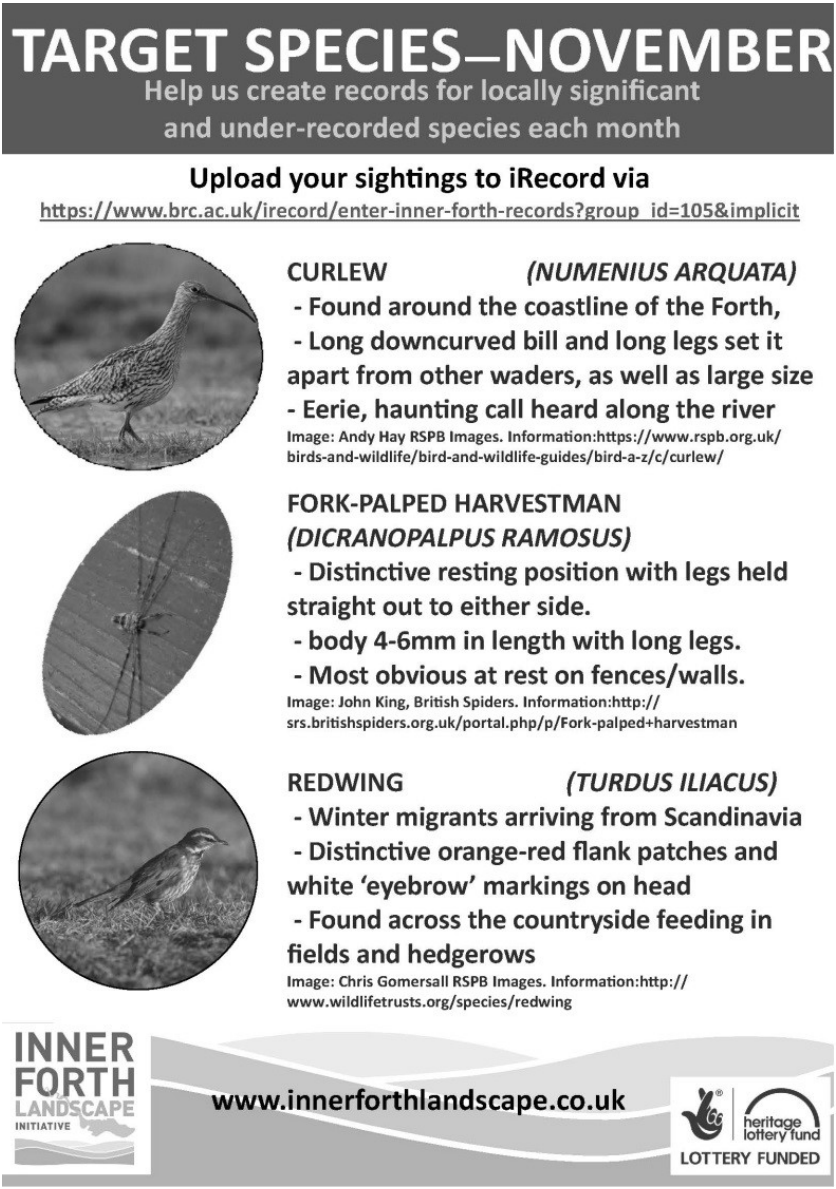
In parallel with increasing the knowledge of volunteers through workshops and training sessions, we wished to provide individuals with opportunities to generate their own records within the Inner Forth area in a structured manner. To introduce those new to citizen science, Paul, our first Wildlife Recording Assistant established five Survey Walks in 2014-15 at sites on or near to locations of IFLI projects: Fallin Bing (Stirlingshire); Kinneil Local Nature Reserve (Falkirk); Kinneil Estate (Falkirk); Valleyfield Woodland Park (Fife) and RSPB Black Devon Wetlands (Clackmannanshire). Adam, our second Wildlife Recording Assistant, added a sixth walk in 2016 at Devilla Forest (Fife) due to volunteer interest and in 2017 Lizzy, our third Wildlife Recording Assistant, updated the route of the Black Devon walk to incorporate new paths on the nature reserve. Each Survey Walk followed a roughly circular route of 2-4 km in length and adopted a transect-type methodology supported by written instructions. The route of each walk was subdivided into numbered 'sections' with each nominally beginning with a change of habitat type. Each section was identified by a central point grid reference to which records could be referenced. The pre-prepared route and guidance for volunteers allowed for repeat visits and for different individuals to collect data in comparable locations.

Figure 6. Map of Fallin Bing Survey Walk.

Designed by Paul Barclay.

Survey Walks asked volunteers to walk the route up to five times per year, generating records and then submitting them to the Forth Nature Counts form on iRecord. No prior experience was necessary and recording all species was encouraged. Over the project lifespan, 29 people registered, around double the number of initial enquiries. Of these, 21 volunteers took part and eleven regularly volunteered for more than six months – a tremendous effort. From 2015 to 2017, 'come and try' sessions were delivered by the Wildlife Recording Assistants to showcase each Survey Walk, demonstrate the methodology and support new and more established volunteers. As time progressed the volunteers who attended these started to share their experiences, recording skills and records, making for dynamic sessions that supported peer to peer learning.

Figure 7. The Target Species to Record image for social media in November 2017.



Compiled by Lizzy Cairns

Collating Records

A key output of the work that Buglife Services provided was the provision of a sustainable method for collecting biological records generated through the project. Buglife Services proposed the use of iRecord and in September 2014 the Inner Forth Nature Counts iRecord form was launched. iRecord is a free to use website for sharing wildlife observations, including associated photographs. Any form created on iRecord allows registered users to submit data. Forms tend to be family- (e.g. ladybird) or location-themed (e.g. Bioblitz at named location) and can be set up by contacting BRC who support the facility. The Inner Forth form can be accessed and used at: www.brc.ac.uk/irecord/enter-inner-forth-records

Figure 8. Screenshot of Inner Forth Nature Counts iRecord form.

Biological records added to iRecord are automatically validated and verified using verification rules from the NBN Record Cleaner. This system quickly identifies any unusual and potentially incorrect records and flags to users that there may be a problem. iRecord provides a centralised system for species experts to review potentially incorrect records for their taxonomic groups and geographic area. These experts are then able to comment on the records, request further information from the recorder or amend the record as appropriate. Data inputted is stored in the iRecord database, archived daily and accessible to anyone via the iRecord website. Records entered in the iRecord website using the Inner Forth form are made available to relevant individuals and organisation such as Vice County Recorders, National Recording Schemes and Societies and the Archive for Marine Species and Habitats Data (DASSH), at full capture resolution to enable verification and sharing via the NBN

Gateway/Atlas of Living Scotland. All verified wildlife sightings for non-sensitive species are shared directly by iRecord with these other users and the NBN Gateway/Atlas of Living Scotland. The use of iRecord ensures a streamlined approach to data collection, verification and sharing for the Inner Forth area. In addition, iRecord ensured that people who generated records could see their 'dot on the map' appear and readily answer any questions posed by verifiers, as well as ensuring the IFLI team or RSPB were not holding a large dataset at the close of the FNC project. Whilst we were most interested in generating records for the Inner Forth area, the system allows the user to enter records from anywhere in the UK. The form remains live following the end of the FNC project and we hope that users will continue to share their records in this way.

Project Results and Reflections

Achieving Targets

The IFLI team and volunteers feel that they have successfully fulfilled the ambition for the FNC project to increase the number of verified biological records for the Inner Forth area (Table 2).

Table 2 Achievement against project targets at the end of IFLI Year Four.

Target at project outset in IFLI Year One	Final achievement against Target at end IFLI Year Four
2000 Records verified and uploaded to National Biodiversity Network	Target achieved. 2,090 records verified. In all 13,625 records of 1,540 species from 45 taxon groups and 421 families were added to the FNC iRecord form.
250 participants in 28 training days	Target achieved. 290 different participants in training. 1,016 places filled in training events. 118 training events delivered.
50 volunteers regularly submitting biological records (later amended to 50 volunteers involved)	Target partially met. We recorded 27 active volunteers: 21 nature recorders (11 of whom volunteered for more than six months); four workshop assistants; two workshop leaders. However, in total 102 different people contributed records to the Forth Nature Counts iRecord form.
50 volunteers trained in use of iRecord or similar	Target met although this was not consistently recorded. 54 records of training volunteers (11 in Year three and 43 in Year four)

Popularly Recorded Species

As indicated in Figure 9, 14 and 15, flowering plants and birds were the most commonly recorded species. Over 6,300 records of flowering plant and over 3,600 records of birds were generated through the FNC project. Hymenoptera were the third most commonly recorded with 700 records. The remaining 42 taxon groups that generated records, list between 1 and 361 records each.

Some rarer highlights seen around the Inner Forth and selected by our Wildlife Recording Assistants include:

- Gypsy Cuckoo Bumblebee (Balallan House, Stirling)
- Red-horned Nomad Bee (Gartmorn Dam)
- Hairy Snail (Jupiter, Grangemouth)
- Flaming scalycap fungus (Dunkeld to Inver Path)
- Golden ringed dragonfly (Dumyat path)

Figure 9 Top ten species added to the Inner Forth iRecord form in 2017.

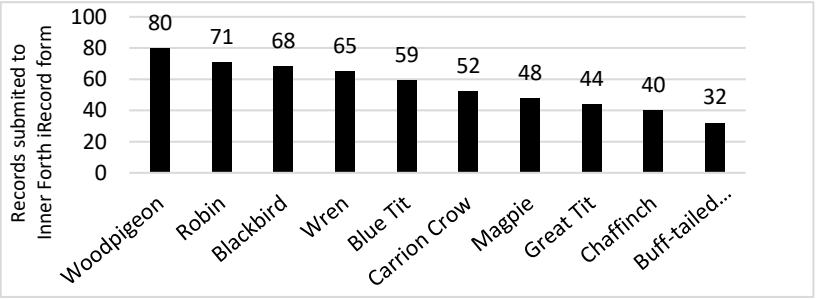


Figure 10 Top ten species added to the Inner Forth iRecord form in 2016.

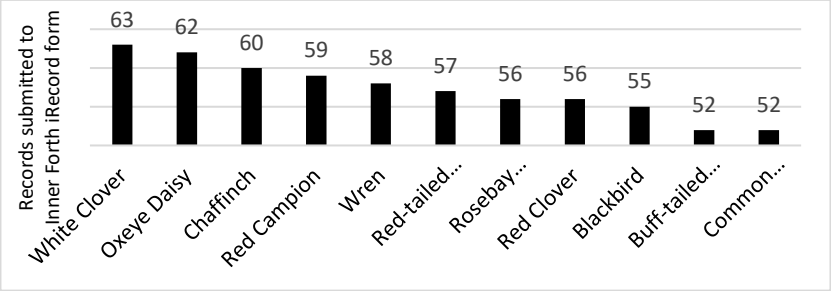
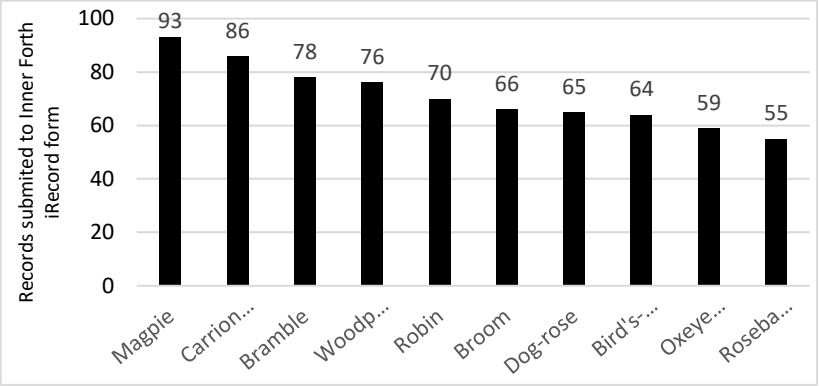


Figure 11 Top ten species added to the Inner Forth iRecord form in 2015.



What the FNC Project Meant to People

Around 43% of workshop participants were employed and 31% were retired, and 57% were female. Around 13% of workshop participants were 12-24 years old, 19% were aged 25-34, 11% were 35-44; 7% were aged 45-54, 15% aged 55-64 and 28% were 65 years old or older. The workshops attracted people from a wide area of Scotland's central belt, not only those within the Inner Forth project area. It is clear that the FNC project has made a positive difference on a high proportion of the people who participated. Taking a snapshot from 2017, we were delighted to find that:

- 75% of respondents completely agreed (5 on a scale of 1-5) with the statement: "*I have gained new skills in wildlife identification and surveying today*": 2016 and 2015 results were 71.8% and 67% respectively.
- 49% of respondents completely agreed (5 on a scale of 1-5) with the statement: *"I will submit records to the Inner Forth Nature Counts iRecord form"*: 2016 and 2015 results were 41.3% and 26% respectively.

From 2017 comments:

- 67.1% of responses described either an improvement in knowledge or an increase in confidence when handling the subject matter.
- 21.9% of responses suggested a positive change in behaviour for the participant, for example resolving to join relevant societies or setting up their own recording projects.

The project team greatly enjoyed receiving feedback from each volunteer, whether it was a quick note to say that a route had been walked and species records uploaded to iRecord, or a longer email with details of new species seen or heard and personal highlights.

"Before I started nature recording with IFLI I thought that I was aware of what was around me when I was out and about. However, nature recording had made me look at my surroundings differently and now I realise that I was only seeing a fraction of the natural world on my doorstep. It has also made me realise that the more I learned about wild flowers, fungi, insects etc how little I actually know." M, Nature Recorder volunteer.

Examples of responses from workshop evaluations are similar to those from volunteers:

- *"Made me realise the importance of monitoring and citizen science which I hope to work on when I graduate."*
- *"Better understanding of key species to look for when looking at habitats"*
- *"I know more about hoverfly species and what characteristics to look at for identifying them"*
- *"Professional information - will use for work"*
- *"It improved my knowledge, and got me out in the fresh air with likeminded people"*

Comments received from volunteers at the close of the FNC project additionally described ways in which the individuals will continue to use their skills and knowledge to benefit citizen science and their personal enjoyment. This included volunteering to undertake structured surveys and other opportunities with the BTO, Butterfly Conservation and RSPB Scotland.

Conclusions

In conclusion, the IFLI team are very pleased with the collective outcomes of the FNC project. Our top three recorded taxa have been fairly consistent, so our top 10 species reflect the popularity of recording flowering plants and birds. Common species can sometimes be overlooked in favour of rarities, so we are pleased to have generated such a diversity of records over the three years. We were surprised and delighted by the quantity of records generated and contributed to the iRecord form and feel this shows the level of interest and commitment shown by those who took part.

Whilst only around 15% of records added to the Inner Forth iRecord form had been verified by the close of the project, all unverified records will remain on iRecord awaiting review by a suitable species verifier. Data verification on iRecord (and elsewhere) is a known national issue or challenge, as not all recording schemes or VC recorders use iRecord, but through our experiences with the FNC project and encouraging new citizen scientists to take part in wildlife recording, we continue to see the benefit in using one system when people are recording across a range of species and taxa.

We know that the Inner Forth Nature Counts iRecord dataset has been downloaded by RSPB Scotland, Fife Nature and The Wildlife Information Centre (as well as standard verified data uploads to the Atlas of Living Scotland and exports by some species recording schemes), allowing data generated through the FNC project to assist in the work of these organisations and building collective knowledge about species diversity, abundance and presence/absence in the landscape.

In 2015 The Wildlife Information Centre (TWIC) expanded their Local Biological Record Centre operations North and West to cover Falkirk, Stirling, Clackmannanshire and Loch Lomond and Trossachs National Park. This expansion has resulted in the whole of the IFLI area bring covered by a local biological record centre, either TWIC or Fife nature. With the end of the FNC project, this development provides additional centralised support and events for the new and established recorders of the Inner Forth landscape, alongside the work carried out by Local Authority and conservation NGO staff.

Acknowledgements

We wish to thank the individuals, organisations, landowners and land managers that were involved in the development and delivery of the FNC project. Thanks to main funder the Heritage Lottery Fund and match funders Central Scotland Green Network Trust, Scottish Natural Heritage and RSPB Scotland. Thanks to Scott Shanks and Craig Macadam of Buglife Scotland for their work on the data management contract. Thanks to members of the IFLI Natural Heritage Working Group for steering the project and to Paul, Adam and Lizzy our Wildlife Recording Assistants who enabled much of the project activity. Without the interest and support of our volunteers and the participants of project workshops and events, the outputs and achievements of the project would have been far more restricted. Thank you for your ideas, enthusiasm and sharing your experiences of recording wildlife around the Inner Forth landscape.

Further Information

Images and documents generated through the FNC project including copies of the Survey Walks, Target Species to Record and talks from the Source to Resource conference can be viewed and freely downloaded from Forth Nature Counts page of the Inner Forth Landscape Initiative website at:

http://www.innerforthlandscape.co.uk/projects/recording-celebrating/forth-nature-counts

TWO LOCALLY RARE PARASITIC PLANTS: TOOTHWORT (*LATHRAEA SQUAMARIA*) AND YELLOW BIRD'S-NEST (*MONOTROPA HYPOPITYS).*

Roy Sexton

Introduction

There are a small number of local plants that during the course of evolution have lost the power of photosynthesis (i.e. using the energy from sunlight to convert carbon dioxide into the sugars which they use to grow).

Figure 1. A clump of Toothwort flowers.

Such plants look bizarre because they lack leaves and green chlorophyll pigment and simply produce a pale white/fawn flower stalk from subterranean rhizomes (Plate C1, page 187). They obtain all their nutrients by parasitizing either other plants or soil fungi and are referred to as 'holoparasites'. In the area covered by the Forth Naturalist and Historian we have four holoparasites. Two are: the Bird's-nest Orchid (*Neottia nidus-avis*) (Plate C2, page 187) and the Coral-root Orchid (*Corallorhiza trifida*) which parasitize fungi and have been dealt with in volumes 32 and 40 of the Journal.

There are two other 'holoparasites' which are the subject of this article: Toothwort (*Lathraea squamaria*) (Plate C3, page 187) which is a member of the Broomrape family and Yellow Bird's-nest (*Monotropa hypopitys*) (Plate C4, page 187) a member of the Ericaceae or heather family. The latter is very rare and is currently only found in four sites in Scotland. It was recently discovered by Niall Traynor in the woodland on the foreshore of the Forth Estuary at RSPB's Skinflats Reserve.

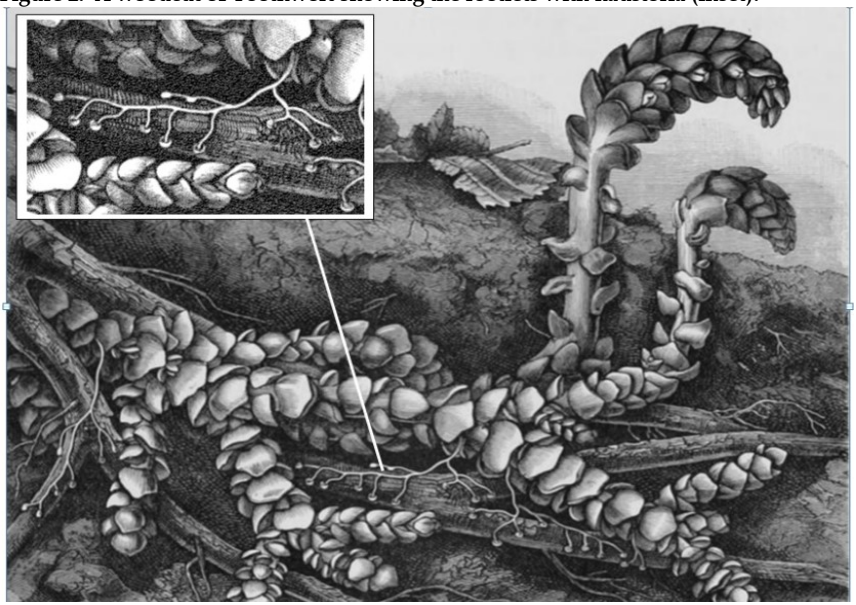
There are also two other Scottish 'holoparasites' known as Broomrapes which are related to Toothwort. Thyme Broomrape is particularly widespread in the machair of the Western Isles. Dodder a climbing holoparasite was found at 18 Scottish locations prior to 1970 but it is now thought to be extinct North of the border.

In addition to these 'holoparasites' there are a bigger number of partial or 'hemi-parasites'. These are able to photosynthesise and have green leaves but obtain part of their nutritional requirements by rooting into the stem or roots of other plants using specialised penetrative organs called haustoria. Mistletoe is an example of a local 'stem hemiparasite' and Yellow-rattle, Lousewort, Eyebright, Bartsia and Cow-wheat are all 'root hemiparasites'. Yellow Rattle is often sown as part of the management of conservation meadows. Yellow Rattle, by extracting nutrients from the grasses it parasitizes, dwarfs them and gives smaller plant species in the sward a competitive edge.

Toothwort (*Lathraea squamaria*)

Toothwort is currently found in 40 of Scotland's 1109 x 10 km recording squares. In the local vice counties of Stirlingshire and West Perthshire it has been recorded at eight sites including: Dollar Glen (NS 962989), Carron Glen (NS 780838), Callendar Park Woodlands (NS 904793) and the small park upstream of the A9 bridge over the River Allan in Bridge of Allan (NS 787977). Toothwort flowers from early April before most of the leaves are on the trees. The inflorescences occur in clumps and the Bridge of Allan colony had 370 flower spikes on April 27th 2018.

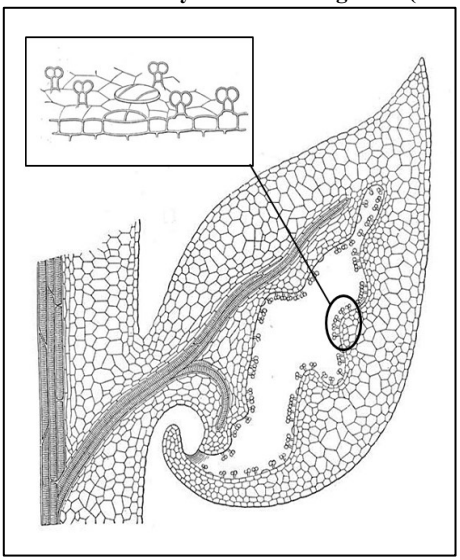
Figure 2. A woodcut of Toothwort showing the rootlets with haustoria (inset).



From 'The Natural History of Plants' by Anton Kerner Von Marilaun, 1902.

In most of our sites Toothwort is found in moist woodlands with a good layer of leaf litter. The plant is found in association with willow, hazel, poplar, oak, sycamore, ash, beech, lime and elm, all of which it is assumed to parasitize. Hidden under the soil is a multi-layered network of fleshy white rhizomes (Figure 2). These are covered in white scales from which radiate the adventitious roots which seek out their host's root system. When contact occurs the adventitious root swells and produces a structure known as a haustorium which penetrates the host's root. As a result, the vascular system of the parasite and host become linked together.

Figure 3. Cross section of a scale leaf showing the internal cavity covered with glands (inset).



From 'The Natural History of Plants' by Anton Kerner Von Marilaun, 1902.

The scales on the rhizome are swollen and have cavities lined with glands in their interiors (figure 2). Originally it was thought that Toothwort obtained its nutritional requirements by digesting small invertebrates trapped in these leaf canals using enzymes produced by the glands. However, it has been since discovered that the glands are hydathodes that secrete water (Heide-Jorgensen 2008). Normally water is pulled through a plant from the root system by the evaporation of water from the surfaces of the leaves, a process known as transpiration. Because the rhizomes of Toothwort are under the surface of humid soil, evaporation will not occur. Water has to be pumped out by the scale leaf glands to produce the flow from the host plant which will carry with it the sustenance essential for the Toothwort's growth.

The 20-40 flowers of Toothwort are arranged on one side of its 8-30 cm inflorescence which curves over at the tip. The plant's common name is derived from its resemblance to half a skeletal jaw with the teeth in place (Figure 4). Each white or pale pink floret arises in the axil of a scale leaf and the internal pink petals are tinged with purple. The flowers are visited by bumble bees which are nearly always present. The Bridge of Allan colony was visited by *Bombus terrestris*, *Bombus. pratorum. Bombus pascuorum* and *Bombus hortorum.*

Toothwort's seeds contain a food store which nourishes the seedling until its root contacts a suitable host. It is thought that germination is stimulated by secretions from the host tree roots. The growth of the rhizome system is very slow and it may take as many as ten years before the plant flowers.

There is a species of introduced Toothwort *Lathraea clandestina* which has purple flowers borne at ground level. It is a favourite of Botanic Gardens (Atkinson, 1996) and most of the recent research papers use this species for experimental work ignoring potential differences with our native plant. For instance, *L. squamaria* seems to lack the unusual alkaline nectar described in *L. clandestina* (Prys-Jones and Willmer, 1992).

Yellow Bird's-nest (*Monotropa hypopitys*)

The local flowers of Toothwort and Yellow Bird's-nest (YBN) look superficially similar when they emerge through the leaf litter, both lack chlorophyll, are crook shaped (*monotropa* means bends in one direction) and are pale pink (Figure 4 and Plates C3 and C4, page 187).

Figure 4. Inflorescences of Toothwort (left) and Yellow Bird's-nest (right).

They then straighten as they mature and, in the case of Yellow Bird's-nest, adopt an ivory hue as the fruit capsules develop. The species name *hypopitys* refers to under pine and one of the plant's best-known former sites was under

pines on the sand dunes of the Tentsmuir Forest in Fife. The plants newly discovered Skinflats location at Haughs of Airth (NS 920858) shares a proximity to sea water with the Tentsmuir site. However, at Skinflats these plants are growing on the flattened top of a 3 m high artificial ridge of industrial red bing-shale with pipe work running through it … not unlike an artificial sand dune. Originally between 1986 and 1998 the RSPB Skinflats site was the Engineering and Physical Sciences Research Council's National Facility 'for carrying out investigations into the geotechnical behaviour of soft clay'. As such the area was subject to extensive civil engineering work and as a consequence it is difficult to define the origin of the *Monotropa* embankment. The top of the bank is covered in a layer of humus which has formed under a canopy of willow and silver birch. At the end of July 2017 there were 49 flower spikes some already in fruit while others were just emerging. Stace (2010) recognises two subspecies of *Monotropa hypopitys* but they cannot be reliably distinguished using their gross morphology and separation requires chromosome counts.

Plants without chlorophyll have long fascinated botanists because they contradict the notion that all plants obtain their sustenance by photosynthesis. In the early 1800s the prevailing view was that like Toothwort YBN was a parasite on the roots of trees. This idea started to be questioned when authors including Prof. W.J. Hooker of Glasgow University could not find any obvious connection between YBN and the surrounding tree roots. What a number of investigators did note was that YBN roots were coated with *"a white covering of a matted or woolly substance"*. This was subsequently recognised as a sheath or mantle of fungal hyphae which penetrated between the root cells of YBN (Kamienski, 1881 see Berch et al. 2006).

While attempting to develop truffle farming, the German botanist Albert Frank (1885) showed that the roots of many tree species were covered in a similar fungal sheath which he termed mycorrhiza or fungus roots. It has subsequently been established that this relationship between plants and fungi was symbiotic, the growth of both organisms being promoted by the presence of the other. The fungi gained some of their carbohydrates from the photosynthetic plant and the plant gained some of its nitrates, phosphates and water from the fungus.

Modern scientific methods have revealed that the formation of mycorrhizae is much more widespread than once thought. A literature survey in 2006 by Wang and Qiu revealed that, of the 3,617 species of plant that had been examined, 80% were mycorrhizal. These not only included most of our trees and most of our wild flowers but also many crop plants like strawberries, potatoes, carrots, tomatoes, peas, beans, raspberries, onions, apples, tobacco, wheat and rice.

Because YBN does not photosynthesise (it lacks chlorophyll) it is unable to produce sugars, so its relationship with its mycorrhizal fungus cannot be viewed as symbiotic. Frank (1885) suggested that YBN parasitized the fungus attached to its roots. He visualised that the fungus was saprophytic obtaining its nutrition by digesting the leaf litter and humus in the soil and YBN extracted its carbohydrates directly from it. Kamienski (1881) further speculated that YBN and the surrounding forest trees might share the same mycorrhizal fungi. If this was the case it was possible to conceive that the sugars obtained by the fungus from the photosynthetic tree roots could be transported via its hyphae through the soil to be taken up from the same fungus when it formed mycorrhizae round the YBN roots. If this hypothesis was correct YBN was remotely parasitizing the trees around it.

Following Kamienski's suggestion, Bjorkman (1960) isolated and cultured fungi from the surface of YBN roots and showed they would form mycorrhiza with uninfected pine seedlings. This illustrated that a common interconnecting mycorrhizal fungus was possible. He also carried out experiments where he drove cylinders of sheet steel 70 cm in diameter and 80cm in depth into the soil round YBN plants. This severed any fungal connections with adjacent tree roots outside the cylinder but retained those fungi living as saprophytes on the humus in the enclosed soil. The subsequent growth of the YBN plants was very poor proving that normal development of *M. hypopitys* required some contact with surrounding trees. Finally, to demonstrate the movement of nutrients from the pine trees to close-by *Monotropa* plants, he injected radioactive glucose and phosphate into the phloem of the trees and showed this moved into the YBN plants. He noted that the radioactivity did not move into heather and bilberry plants growing the same distance from the experimental trees.

Using modern DNA sequence analysis, Bidartondo and Bruns (2002) identified the mycorrhizal fungi associated with *Monotropa hypopitys* to be members of the basidiomycete genus *Tricholoma;* which will be familiar mushrooms to those who have been on fungal forays in our local woodlands. This was also true of plants sampled from North American, Europe and Japan. This high degree of specificity for the fungal partner was also found in the American species *Monotropa uniflora* (Indian Pipe Plant) which was similarly always associated with basidiomycetes from the *Russula* genus. Analysis of *M. hypopitys* roots from the Newborough Warren on Anglesey and Miller's Dale in North Yorkshire yielded sequences identical with those of the mushrooms of the mycorrhizal fungus *Tricholoma cingulatum*. At both of these sites the YBN plants are associated with creeping and goat willow. Mycorrhizae associated with the willow roots near to the YBN plants had DNA sequences that matched the same fungus. *M. hypopitys* growing under Scots Pine in North Yorkshire

was associated with the related species *Tricholoma terreum* also a mycorrhiza fungus of Pine trees (Leake et al. 2004).

Ghostwort (*Cryptothallus mirabilis*)

Non-photosynthetic plants that are dependent on parasitizing fungi are not limited to flowering plants. It is a form of nutrition which developed early in plant evolution and is found amongst the liverworts, mosses, ferns and conifers (Leake, 1994). There is a pure white liverwort Ghostwort (*Aneura o*r *Cryptothallus mirabilis*, Figure 5) which is found growing in the centre of the mounds of sphagnum that form round the bases of birch trunks in wet woodland (Williams 1950).

Figure 5. Ghostwort. (Courtesy of Brian Eversham).

It is thought to be sustained by a mycorrhizal association with a basiomycete fungus which forms mycorrhizae with the roots of birch (Pocock and Duckett 1984). During a British Bryological Society field trip in late July 2017 David Long discovered Ghostwort growing in Ballangrew Wood 800 m East of Ballangrew Farm in Flanders Moss National Nature Reserve (NS 6179 9838).

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Associate Editor: Dr. Neville Dix

FORTH AREA BIRD REPORT 2017

N. Bielby

This is the 44th bird report for the Upper Forth SOC (Scottish Ornithologists Club) recording area. The area covered by the report comprises the council areas of Falkirk, Clackmannanshire and Stirling but excludes parts of the Clyde drainage basin such as Loch Lomondside and the Endrick Water area (including Fintry and Balfron) all of which are covered by the Clyde bird report. The report consists of a summary of the main bird news from 2017 followed by detailed species accounts.

Chris Pendlebury, the current SOC recorder, can be contacted by e-mail at chris@upperforthbirds.co.uk; by leaving a message on 07798 711134 or by mail to 3 Sinclair Street, Dunblane FK15 0AH. Records can be provided through the BTO BirdTrack system (29,298 records were entered into Birdtrack for our area in 2017) or by an Excel spreadsheet that can be sourced from Chris. Details of what type of records are required for each species along with advice on writing descriptions and submitting records can be obtained from the deputy recorder, Neil Bielby at n64b68@gmail.com or by phoning 01786 823830.

In this report a coded summary of general distribution is included after the species name. The codes used in this report are:

B	Breeding status: widespread (present in more than five 10 km squares)
B	Breeding status: local, scarce (present in fewer than five 10 km squares)
W	Winter status: widespread or often in groups of more than ten
w	Winter status: local, scarce or usually fewer than ten in a group
P or p	Passage (used for species usually absent in winter); P and p used for widespread and local/scarce, respectively, as in winter status above
S or s	Summer visitor (used for species present in summer but which do not normally breed); S and s used for widespread and local/scarce, respectively, as in winter status above.
Irr	Irregular: less than annually.
V	Vagrant: does not normally occur.

Rarer species for which a full list of records is provided are highlighted with the use of an asterisk (*). Records of rare species are subject to acceptance by the BBRC, SBRC or the local rarities panel. The latter currently consists of Graeme Garner, Mark Lewis, Duncan Orr-Ewing, Chris Pendlebury and Andre Thiel. A list of local rarities is available from Chris Pendlebury.

Much information and records- especially counts, rates and comparisons - come from the Wetland Bird Survey (WeBS) and Breeding Bird Survey (BBS) surveys carried out on behalf of the British Trust for Ornithology (BTO). In 2017 a total of 65 randomly selected km squares were surveyed for the BBS which, along with four Waterways BBS (WBBS) sites, resulted in 261.4 linear km's being perambulated. A total of 12,950 birds were recorded from 106 species by 39 surveyors with the coverage in each broad habitat type in the Upper Forth area being fairly close to that of the actual.

The monthly WeBS counts (Jan – Mar and Sep - Dec) are split into estuary and inland with the former being co-ordinated by Dr M.V. Bell. The estuary counts, which are downstream from Cambus, are split into five sectors in which 110,577 wildfowl and waders were counted in the seven months (Jan-Mar & Sep-Dec) by 13 volunteers. Inland, 107 still sites and 103.2 km's of rivers and canals were counted by 49 volunteers producing 40,470 wildfowl and waders in the same seven months during which there were 632 counts on still sites and 670.2 km of river and canal were walked.

Note: a detailed weather report for 2017 can be found elsewhere in this journal.

HIGHLIGHTS OF THE YEAR

January

Long-tailed Ducks were at Blairdrummond Ponds and the head of L. Tay (1st). An adult Mediterranean Gull was at Blackness (2nd) while a White-tailed Eagle flew W just to the N of Dunblane the following day. A Red-throated Diver and a Slavonian Grebe were on the Forth at Blackness (4th) while a Glaucous Gull flew up the R. Forth at Higgin's Neuk the day after. A Hen Harrier and five Black Grouse were at L. Mahaick (7th). A Blackcap and a Chiffchaff were in a Dunblane garden (14th). A Rock Pipit was at Powfoulis (15th). A Smew was at the head of L. Tay (23rd).

Waxwings: c.180 were in Dunblane (1st) with c.240 there (7th). Four were at Gartartan Pond, Aberfoyle (14th) and five in Doune (22nd).

February

Five Little Egrets and 11 Scaup were at Higgin's Neuk (2nd). A ♂ American Wigeon at S. Alloa was eventually presumed to be a hybrid (3rd). Two Scaup were on the Lake of Menteith (9th). A Great Grey Shrike was on Flanders Moss when a Red-throated Diver, 118 Pintails and 12 Guillemots were on the Forth at Grangemouth (10th). The Long-tailed Duck was still at Blairdrummond Ponds (11th) with a Hen Harrier spotted on Kippen Muir the next day.

March

Year firsts were a Sand Martin over the R. Carron (12th) and a Swallow at Little Denny Resr. (28th). 259 Pintails and a Spotted Redshank were recorded on the Forth Estuary (12th). A Goshawk flew over Dunblane (21st). A ♂ Smew appeared on Blairdrummond Ponds (25th).

Waxwings: a flock of 25 were at Arnothill, Falkirk (5th) while c.20 were seen in Camelon, Falkirk (19th). 12 were in a Dunblane garden (21st) with 45 in Bonnybridge (31st).

April

An Osprey flew over Falkirk Town centre (1st) while an immature White-tailed Eagle (being mobbed by a Red Kite) was over Tarmangie Hill, Dollar the following day. A Marsh Harrier was quartering Tullibody Inch (9th) with another at the Blackdevon Wetlands when a ♂ was seen at Kinneil (27th). The Long-tailed Duck and ♂ Smew were still present at Blairdrummond Ponds (4th). A Little Gull was at Kinneil (14th). Four White Wagtails were on Longcarse (22nd). A Snow Bunting was very unusual in a ploughed field at E. Frew (27th). A Hoopoe was in a Clackmannan garden (28th).

Year firsts: Willow Warblers at Blairdrummond Ponds (4th); a Common Sandpiper was on the R. Forth at Cambus (10th); a Tree Pipit was singing in Doune (19th); a Grasshopper Warbler at the Blackdevon Wetlands (20th); a Wood Warbler was at Abbey Craig, Stirling (21st); a Cuckoo was on Flanders Moss (22nd); 4 Sandwich Terns were off Blackness (23rd); a Redstart was at Doune Lodge (24th); a Whitethroat was at Kinneil when a Sedge Warbler was at the Blackdevon Wetlands (27th). A Ring Ouzel was above L. Voil (29th).

May

A Hobby was over Br of Allan (2nd). A summer plumaged Red-necked Grebe was at Blairdrummond Ponds when an Avocet was at the Kinneil Lagoon (5th). Also on the 5th, a Lesser Whitethroat and a Grasshopper Warbler were at Blairdrummond Ponds. A single Swift was over Bridge of Allan (3rd) with another at Doune when a party of seven was over Alloa with three at Dollar (6th). A pair of Little Ringed Plovers were reported from an undisclosed location (14th). A Marsh Harrier, three Common Terns and a Reed Warbler were at Skinflats Pools (23rd). A Marsh Harrier passed quickly through the Blackdevon Wetlands (30th).

June

Four Sanderling were at the head of L. Tay (7th). Two Short-eared Owls were in conflict near Sheriffmuir Inn (8th). A Marsh Harrier was at the Blackdevon Wetlands (22nd) with a Quail heard at Sheriff Muir the next day.

July

The bird of the month was a Hoopoe which was first seen in Tyndrum then at nearby Kirkton Fm (21st – 30th). A Marsh Harrier was SW of Kincardine Bridge (2nd). A Quail was heard off the A820 between Dunblane and Doune (30th).

August

A Great White Egret in non-breeding plumage at Kinneil was only the 3rd modern record for the area (24th) while a Pectoral Sandpiper on Alloa Inch was only the 7th record for the area (27th). A Black-throated Diver was on L. Tay at Killin (12th).

A Slavonian Grebe was on the R. Forth at Cambus (16th). At Kinneil there was a Curlew Sandpiper (19th) and a Sanderling (24th). An Arctic Tern was offshore at Blackness when two Green Sandpipers were at Powfoulis (20th). Two Little Stints and a Whimbrel were on the South Pool at Skinflats (23rd). A ♂ Marsh Harrier was just South of Kincardine Br. (26th).

September

A Pectoral Sandpiper at Skinflats Pools was the 8th record for the area (16th) with what was possibly the same bird seen again there (25th). A juv. Sabine's Gull off Blackness was the 5th record for the area (18th). Also at Blackness were two Red-throated Divers and two Arctic Skuas (17th) followed by two Common Scoters and a Mediterranean Gull the next day. A Ruff and a Green Sandpiper were at L. Ellrig (2nd). There were five Ruff at Kinneil (9th) followed by seven Whooper Swans – the first autumn returnees (28th). Skinflats recorded a Spotted Redshank (7th); 14 Ruff and an imm. Little Gull (9th); six Curlew Sandpipers and 10 Ruff (12th); two Curlew Sandpiper and c.20 Ruff (16th); a Little Egret (17th) and two Little Stints (25th). There were 3,121 Shelducks; 42 Sandwich Terns and seven Common Terns on the Upper Forth (17th). Three Guillemots were well inland at L. Iubhair, Tyndrum (12th) with four at the head of L. Tay (18th) with one on the R. Teith at Callander (27th).

October

A ♂ Ferruginous Duck on Gartmorn Dam was only the 3rd record for the area (12th -26th). A juvenile Woodchat Shrike at Kirkton Farm, Tyndrum was a first record for the area (13th) while a Grey Phalarope on L. Katrine was only the 3rd record for the area (29th). Two 'blue phase' Snow Geese were with Pink-footed Geese nr. S. Alloa (28th – 31st). A Long-tailed Duck was at the head of L. Tay all month. A Merlin was at Higgin's Neuk (7th). On the 8th, 165 Barnacle Geese circled over Skinflats where there were also a Little Stint, 39 Ruff and a Merlin while that same day at Kinneil another Little Stint and two Little Gulls were noted. A Ruff and two Mediterranean Gulls were at Skinflats Pools (15th). At Blackness there were two Slavonian Grebes, seven dark –bellied Brent Geese

and a Whimbrel (21st) with a pale-bellied Brent Goose the next day. A Ring Ouzel was feeding on berries with Redwings and Fieldfares at Skinflats Pools (24th). An adult Mediterranean Gull was near South Alloa and a Gannet flew West over Stirling (28th).

November

The two blue phase Snow Geese were near Airth (2nd) and Skinflats (4th). 83 Bean Geese and two White-fronted Geese (*albifrons*) were at Slamannan (4th). A Goshawk was near Dunblane (5th). Hawfinches were seen or reported from Argaty, Fintry, Kilbryde and Kinbuck (7th & 8th) with another at Carronshore (18th). A Slavonian Grebe was at Kinneil (13th) with a Common Scoter and four Jack Snipe there (19th). Two male Hen Harriers were at Braeleny Fm, Callander (19th). A Common Scoter, a Little Egret, a Jack Snipe and a Barn Owl were just to the South of Kincardine Br (25th).

December

A flock of 58 Snow Buntings were in Gleann a' Chlachain, Tyndrum (1st). A Blackcap was in an Alva garden (2nd). A Red-throated Diver, 30 Common Scoters and three Turnstones were at Blackness (8th). 189 *Taiga* Bean Geese and two European White-fronted Geese were at Slamannan (28th).

CONTRIBUTORS

This report has been compiled from records submitted by the contributors listed below. Where initials are given, the contributors are listed in species entries of birds that are rare, uncommon or otherwise noteworthy. The editors are grateful to all the contributors for submitting their records without which this report could not be written. Apologies to anyone who has been inadvertently missed out.

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SYSTEMATIC LIST

Codes – F, C and S refer to the Falkirk, Clackmannanshire and Stirling Council Areas respectively.

Names and species order: both the common and Latin names, along with the species order, have been in an ever-increasing state of flux over recent years. To maintain some semblance of continuity (in order to make locating a species in the report a little easier) the same order as last year has been retained. As with the species order, there appear to be several different sets of common English names by different authorities, but for this report the British Birds 2016 list has been used with the IOC International English names (2012) in brackets. Spring and autumn arrival and departure dates in this report have not usually been recorded systematically so that changes between years should only be seen as indicative and not interpreted as reflecting true phenological variation.

Abbreviations: ad (adult), AON ('s) (apparently occupied nest (s)), AOT (apparently occupied territories), approx. (approximately), av (average), Av (avenue), b/lkm (birds per linear km), br (bridge), BoA (Bridge of Allan), BoD (Braes of Doune), bldgs. (buildings), VP (Cambus Village Pools), CVR (Carron Valley Reservoir), c (clutch), conf (confluence), CP (country park), Cres (crescent), Dr (Drive), Est (estuary / estate), Ex (exchange), Fm (farm), F & C (Forth & Clyde), gdn (garden), G (glen), GP (gravel pit), Hosp (hospital), Imm (immature), Ind (industrial), juv (juvenile), Kinc. (Kincardine), km (kilometre), L. (loch), max (maximum), m (metres), mig (migration), min (minimum), nr (near), NE (nest with eggs), NH (new high), occ (occasional), pr (pair), pers comm (personal communication), resr (reservoir), rd (road), ssp (sub-species), St (Stirling), TE (tidal exchange), UF (Upper Forth), veg (vegetation), W (winter), yr (year), Y (young) & > (flying).

MUTE SWAN *Cygnus olor* (B, W)

Inland WeBS: 321 in Jan, 338 in Feb, 305 in Mar, 254 in Sep, 254 in Oct, 297 in Nov and 350 in Dec. Forth Est. WeBS: 4 in Jan, 16 in Feb, 22 in Mar, 15 in Sep, 13 in Oct, 6 in Nov and 13 in Dec.

F Breeding: 8Y Kinneil Ho. Pond 12 Jul & 10 Sep (RS, DB); 3Y W. Mains Pond 1 Sep (NB); Forth/Clyde Canal: 4Y Lock 16 – R. Carron 9 Sep (A&IB) and 1Y Bonnybridge 11 Sep (NB). 4Y Callendar Park 10 Sep (DB). Site max: 29 Helix Park Pond 6 Oct.

C Breeding: pr + 6 chicks Fire Sta Pool, Alloa 23 May (NB); pr + 9 chicks Blackdevon Wetlands 23 May with still 9Y on 12 Sep (JN, RLG); broods of 4 & 2 R. Devon, Alva 21 Jun (DTh); 6Y R. Devon, Kersiepow 12 Sep (NB) and pr + 1Y Longcarse Pond 12 Sep (NB). Site max: 148 R. Devon (Alva-Tullibody Br) 10 Feb; 31 Gartmorn Dam 10 Sep and 25 R. Devon, Tullibody Br.-A907.

S Breeding: pr's nesting on main & lowest ponds Cambusmore/Gart GP 30 Apr with 3 chicks on main pond 11 Jun and 3Y on main pond 17 Sep (NB); head of L. Tay: 5Y on 7 Jun & 3Y on 18 Jul (JPH); ad + 6Y Ochlochy Pond 21 Jun, 6Y on 18 Aug & 2Y on 21 Sep (MVB, NB). 3Y Brae of Cessintully Pond 9 Sep; 3Y Airthrey Loch 12 Sep and pr + 3Y R. Teith, Callander 14 Sep (NB). Site max: 61 Gogar 6 Apr; 36 Lake of Menteith 16 Dec; 21 head of L. Tay 12 Jun and 17 Cambusmore GP 5 Nov.

WHOOPER SWAN *Cygnus cygnus* (W)

Inland WeBS: 27 in Jan, 25 in Feb, 31 in Mar, 1 in Sep, 4 in Oct, 28 in Nov and 19 in Dec. Forth Est. WeBS: 0 in Jan, 0 in Feb, 0 in Mar, 0 in Sep, 1 in Oct, 14 in Nov and 0 in Dec. Spring departure: last one L. Dochart 30 May (JPH). Autumn arrival: first 7 juv. Kinneil Lagoon 28 Sep (RWP).

F Autumn/winter site max: 17 Airth fields 14 Oct; 11 Bellsdyke Rd, Falkirk 10 Nov; 11 Skinflats 22 Oct and 6 Slamannan 4 Nov.

C Winter/spring site max: 24 Haugh of Blackgrange 24 Mar. Autumn/winter site max: 23 >E R. Forth, Cambus 17 Oct and 14 Gartmorn Dam 19 Oct.

S Winter/spring site max: 53 flying over Beinn a' Chroin 15 Mar; 43 L. Dochart / Iubhair 20 Mar and 10 Lake of Menteith 10 Mar. Autumn/winter site max 15 CVR 10 Oct; 15 Ashfield 18 Oct; 14 L. Dochart 1 Dec and 6 Flanders Moss 16 Nov.

BEAN GOOSE *Anser fabalis* (W)

F Regular wintering flock of Taiga race birds in the vicinity of the Slamannan Plateau. Last c.20 on 13 Feb (KD). First 55+ 8 Oct (RS). Winter/spring max: 236 Slamannan 2 Jan (BG's). Autumn/winter max: c.200 Slamannan 28 Oct (AA).

PINK-FOOTED GOOSE *Anser brachyrhynchus* (W)

With several birds over-summering it is now very difficult to ascertain an accurate spring departure date. Autumn arrival: first 42 Bellsdyke Rd, Falkirk 13 Sep (SW). 1 – 5 presumed summering birds at Higgin's Neuk, Kennet Pans, Longcarse, Skinflats Pools, Forth Est WeBS: 1,027 in Jan, 1,257 in Feb, 1,200 in Mar, 352 in Sep, 11,151 in Oct, 2,048 in Nov and 84 in Dec. (virtually all these birds are in fields above the high water mark. Although this species is recorded on inland WeBS counts most flocks spend the day grazing in non-wetland locations making the WeBS counts unrepresentative).

F Winter/spring site max: c.3,000 Skinflats 12 Feb. Autumn/winter site max: c.9,590 Skinflats 22 Oct; c.3,000 Bellsdyke Rd, Falkirk 4 Nov; c.2,000 S. Alloa 30 Oct; c.1,400 N. Doll 31 Oct & 1,061 L. Ellrig 10 Oct.

C Winter/spring site max: c.2,000 Tullibody Inch 25 Apr; Autumn/winter site max: c.4,260 Longcarse 21 Oct; c.2,160 Kennetpans 8 Oct and c.2,000 Cambus 17 Oct.

S Winter/spring site max: c.2,500 Gogar 3 Jan; c.2,000 Carse of Lecropt 29 Jan and c.1,710 Blairdrummond Moss 14 Jan. Autumn/winter site max: c.2,550 Cromlix 10 Oct and c.1,400 Cambusmore GP 8 Oct.

*WHITE-FRONTED GOOSE (Greater) *Anser albifrons* (w)

F 12 *ssp albifrons* flying upstream R. Forth, Dunmore – S. Alloa 16 Jan (DT). Two *ssp albifrons* Slamannan 8 Oct & 4 Nov (RS, NB).

GREYLAG GOOSE *Anser anser* (b, W)

Icelandic birds normally depart in Apr and return in Oct but the exact spring departure and autumn arrival dates of these birds are muddied by the presence of an ever increasing number of resident feral birds whose winter population probably matches the Icelandic one now. Forth Est. WeBS: 4 in Jan, 1 in Feb, 1 in Mar, 931 in Sep, 233 in Oct, 1 in Nov & 123 in Dec (virtually all these birds are in fields above the high water mark. Although this species is recorded on inland WeBS counts many flocks spend the day grazing in non-wetland locations making the WeBS counts unrepresentative).

F Winter/spring site max: 215 St Helen's Loch 28 Mar. Summer (feral / naturalised birds): 393 Skinflats Pools 12 Aug and 261 Higgin's Neuk 29 Aug. Autumn/winter site max: c.10,000 Blackness 22 Oct and 680 Blackness 20 Oct.

C Winter/spring site max: 276 Alva 11 Mar. Summer (feral / naturalised birds): c.780 R. Forth, Tullibody Inch 24 Aug; 429 Haugh of Blackgrange 12 Sep and 391 Kennet Pans 17 Sep. Autumn/winter site max: 484 Alva Floods 11 Dec and c.380 Longcarse 21 Oct.

S Winter/spring site max: c.230 Blairdrummond Moss 14 Jan and 216 Blairdrummond Ponds 8 Jan. Autumn/winter site max: 484 Cambusmore

GP 8 Oct; c.440 Fallin 29 Oct; 417 L. Coulter 12 Nov; 344 Fallin 31 Oct and 195 N. Third Resr. 10 Dec.

SNOW GOOSE *Anser caerulescens* (Irr)

F One dark morph (blue phase) and one intermediate bird were first seen on 28 Oct at S. Alloa (GG). Subsequently seen several times in the Dunmore to Brackenlees area with the last record on 13 Nov (TC).

CANADA GOOSE *Branta canadensis* (b W)

Numbers continue to increase. Inland WeBS: 708 in Jan, 339 in Feb, 216 in Mar, 606 in Sep, 1,043 in Oct, 1,002 in Nov and 837 in Dec. Forth Est. WeBS: 9 in Jan, 0 in Feb, 6 in Mar, 66 in Sep, 240 in Oct, 14 in Nov and 15 in Dec. BBS: recorded at 0.15 b/lkm (1997-2017 average: 0.11 b/lkm).

F Breeding: pr + 6 chicks Darnrigg Moss Pools 11 May with still 6 on 11 Jul (RD, TF). Site max: 381 Little Denny Resr 10 Oct; 221 Skinflats Pools 29 Aug and 179 St Helen's Loch (Bonnybridge) 4 Nov.

C Site max: c.470 Gartmorn Dam 11 Oct and c.200 Longcarse 26 Aug.

S Breeding: Cambusmore GP: Pr + 7 chicks 30 Apr, 7Y & 14 chicks 21 May and 24Y on 11 Jun. 2 pr's with 5 & 1 chicks head of L. Katrine 6 May (NB). 6Y Glen Finglas Resr 4 Jun (MVB) and pr + 5Y head of L. Tay 24 Jun (JPH). Site max: 441 Drip Moss 12 Oct; 386 Cambusmore/Gart GP 17 Sep; 304 Blairdrummond Ponds 14 Oct; 186 Blairdrummond Moss 23 Dec; 161 L. Venachar 20 Jan; 159 L. Coulter 10 Dec; 148 Glen Finglas Resr. 4 Jun; 117 N. Third Resr. 12 Nov and 102 Lake of Menteith 16 Dec.

BARNACLE GOOSE *Branta leucopsis* (w)

In our area it can be difficult distinguishing between wild migrants and feral birds resident in Britain but most records of groups between Feb - Mar & Sep – Nov will be of wild birds on migration between Svalbard & the Inner Solway Firth.

F One Powfoulis 2 Jan; 165 Skinflats 8 Oct; 1 Larbert 9 Oct; 3 Airth fields 14 Oct; 2 Skinflats 19 Nov and 1 Powfoulis 13 Nov.

C Five Tullibody Inch 25 Apr with 3 there 13 Jun. 1 Longcarse 21 Oct.

S One Gogar 3 Jan & 2 Ashfield 27 Oct.

*BRENT GOOSE (light-bellied) *Branta bernicla hrota* (w)

F One Blackness Bay 20 – 22 Oct (DMB, AB, AC).

SHELDUCK (Common) *Tadorna tadorna* (b, W)

Inland WeBS: 0 in Jan, 6 in Feb, 5 in Mar, 0 in Sep, 0 in Oct, 2 in Nov and 0 in Dec. Forth Est. WeBS: 566 in Jan, 449 in Feb, 1,030 in Mar, 3,197 in Sep, 1,573 in Oct, 629 in Nov and 574 in Dec.

F Breeding: 2 chicks & crèche of 15 Kinneil 5 Jul (NB). Moult flock max counts: 3,286 Kinneil & 2,730 Skinflats 3 Aug (DMB). Othersite max: 394 R. Forth, Powfoulis 20 Aug and 207 Blackness Bay 20 Oct.
C Breeding - Tullibody Inch: pr + 6 chicks & crèche of 14 on 17 Jun (NB). Site max. 101 Tullibody Inch 15 Mar; 6 Cambus 24 Sep; 3 Cambus Pools 30 May; 1 Alva floods 11 Mar and 1 Blackdevon Wetlands 23 May.
S Site max: 2 Blackdub Floods 25 Feb and 2 Allan Water, Kinbuck 12 Mar.

*MANDARIN DUCK *Aix galericulata* (b, w)

It is unknown whether the following records relate to a bird(s) bred in the wild or escapees.

S One ♂ The Meadows, Callander 26 Jan, 20 Feb and 6 Mar (NB).

WIGEON (Eurasian) *Anas penelope* (s, W)

Inland WeBS: 392 in Jan, 394 in Feb, 179 in Mar, 48 in Sep, 193 in Oct, 352 in Nov and 660 in Dec. Forth Est. WeBS: 1,675 in Jan, 1,769 in Feb, 1,324 in Mar, 74 in Sep, 527 in Oct, 895 in Nov and 1,395 in Dec.
F Winter/spring site max: c.250 Kinneil 3 Jan; 273 S. Alloa 7 Feb; 196 Skinflats (WeBS) 14 Jan & 159 Kinneil (WeBS) 12 Mar. Autumn/winter site max: 325 Blackness 20 Oct; 241 Skinflats 16 Dec & 113 Bo'ness 8 Dec.
C Winter/spring site max: 1,453 R. Forth, Cambus - Alloa on 3 Feb & 71 Gartmorn Dam 19 Jan. Autumn/winter site max: 812 R. Forth (Cambus-S. Alloa) 15 Dec.
S Winter/spring site max: 166 Cambusmore GP 8 Jan; 78 N. Third Resr. 12 Feb & 71 L. Dochart 11 Feb. Autumn/winter site max: 120 Cambusmore/Gart GP 3 Dec & c.120 R. Forth (E. Frew-Garg Br.) 8 Dec.

AMERICAN WIGEON *Anas Americana* (V)

F ♂ S. Alloa 3 Feb – 24 Feb (DMB *et al*). A presumed hybrid.
C ♂ Longcarse 5 Mar (JRC). Presumably the S. Alloa bird.

GADWALL *Anas strepera* (s, w)

F Site max: 5 Skinflats Pools 22 Jun; pr St Helen's Loch, Bonnybridge 28 Mar & 10 Oct; 2 Kincardine Br. 12 Mar & 2 Kinneil Lagoon 31 Mar.
C Site max: 11 Gartmorn Dam 18 Oct; 6 Cambus Village Pools 11 Apr; 4 Longcarse Pool 8 Apr; 4 R. Devon (Alva-Tullibody Br.) and 2 Blackdevon Wetlands 26 Oct.
S Three (2♂) N. Third Resr. 15 Oct with pr there 12 Nov.

TEAL (Eurasian) *Anas crecca* (b, W)

Inland WeBS: 1,916 in Jan, 1,396 in Feb, 1,227 in Mar, 454 in Sep, 1,143 in Oct, 1,4836 in Nov & 1,324 in Dec. Forth Est. WeBS: 2,666 in Jan, 2,146 in Feb, 1,867

in Mar, 618 in Sep, 1,833 in Oct, 1,986 in Nov & 2,294 in Dec.

F Winter/spring site max: 665 Kinneil 14 Jan; 567 Skinflats 14 Jan; c.520 R. Forth (S. Alloa-Kinc. Br.) 15 Jan and 102 R. Carron (Carron Ho.-A905) 15 Jan. Autumn/winter site max: 743 Kinneil (WeBS) 16 Dec; 479 Skinflats (WeBS) 16 Dec; c.230 R. Forth (S. Alloa-Kinc. Br.) 19 Nov and 134 R. Carron (Carron Ho.-A905) 19 Nov.

C R. Forth (Cambus-Alloa) monthly max: c.830 Jan; c.670 Feb; c.730 Mar; 180 Apr; 198 Sep; 1,159 Oct; 702 Nov & 829 Dec. Other site max: 332 Kennetpans 12 Feb; 323 R. Forth (Fallin-Cambus) 5 Jan & c.300 Devonmouth Pool 13 Oct.

S Site max: 229 L. Coulter 12 Jan; 181 N. Third Resr. 12 Nov; c.170 Flanders Moss Lochan 21 Mar; 151 Kinbuck 7 Jan; 151 Cambusmore GP 5 Nov; 123 R. Forth (A91-Fallin) 10 Mar; 119 R. Forth (St. Br.-A91) 18 Dec; 112 Blackdub Floods 25 Feb; 104 Killin Marshes 3 Jan & 102 Daldorn Lochs 5 Oct.

MALLARD *Anas platyrhynchos* (B, W)

Inland WeBS: 1,923 in Jan, 1,618 in Feb, 1,019 in Mar, 1,766 in Sep, 1,982 in Oct, 1,808 in Nov & 2,598 in Dec. Forth Est. WeBS: 392 in Jan, 173 in Feb, 102 in Mar, 2416 in Sep, 258 in Oct, 211 in Nov & 336 in Dec. BBS: recorded at 0.58 b/lkm (1997-2017 av: 0.62 b/lkm; range 0.33 (2007) to 0.98 (2006) b/lkm). Unsurprisingly, the highest recording rate was on WBBS at 3.38 b/lkm.

F Breeding recorded from Bantaskine (Falkirk), Lionthorn & Union Canal (Glen Village). Site max: 148 Skinflats (WeBS); c.100 Kinneil 2 Jan & 99 Grange Burn, Grangemouth 18 Dec.

C Breeding recorded from Cambus Pools, Cambus Village Pool, Devonmouth Pool and the tidal Black Devon. Site max: 182 Gartmorn Dam 11 Dec & 124 Kersiepow Pond 3 Oct.

S Breeding recorded at Cambusmore GP. Site max: 149 Blairdrummond Ponds 10 Dec; 132 Airthrey L. 28 Oct; 122 Lake of Menteith 14 Jan; 111 Killin Marshes 9 Sep. & 97 L. Dochart 29 Jan.

PINTAIL (Northern) *Anas acuta* (W)

Forth Est. max: 95 in Jan, 140 in Feb, 259 in Mar, 68 in Apr, 6 in Sep, 11 in Oct, 149 in Nov & 192 in Dec.

F Winter/spring site max: 90 Kinneil 2 Jan & 1 Skinflats TE 27 Apr. Autumn/winter site max: 114 Skinflats 16 Dec; 23 Kinneil 16 Nov & ♂ Larbert Hosp. Ponds 18 Nov (AB).

C Two Cambus 30 Jan; 1 Cambus 9 Apr; 2 Devonmouth Pool 10 Apr; 2 Tullibody Inch 25 Apr; 1 Gartmorn Dam 21 Oct & 3 Longcarse 18 Dec (GG, DH, DMB, AG, JRC).

*GARGANEY *Anas querquedula* (s)

F One Skinflats Pools 30 Apr (AB).

C One Devonmouth Pool 9 May (DH).

SHOVELER (Northern) *Anas clypeata* (p)

F Skinflats Pools (monthly max.): 11 on 14 Jan; 10 on 5 Feb; 3 on 15 Jun; 5 on 29 Jul; 5 on 5 Aug; 11 on 5 Sep; 5 on 8 Oct and 4 on 16 Dec. Two ♂'s S Alloa 7 Feb. 6 (1♂) St Helen's Loch, Bonnybridge 4 Nov.

C Longcarse (monthly max): 6 on 29 Jan; 3 on 3 Feb; 8 on 15 Mar and 3 on 26 Aug. 1 Gartmorn Dam 10 Sep with 3 on 26 Nov. 2 Devonmouth Pool 11 Jan. 1 Cambus Village Pools 9 Apr.

S Two ♂'s Pendreich Pool 2 Nov.

POCHARD (Common) *Aythya ferina* (w)

Inland WeBS: 5 in Jan, 11 in Feb, 14 in Mar, 1 in Sep, 0 in Oct, 31 in Nov & 1 in Dec. Numbers have reduced greatly over the past 15 years. The peak monthly count in 1995 was 230 (Jan).

F Skinflats Pools (monthly max): 3 in Jan; 1 in Jun; 3 in Sep and 2 in Oct. 4 on F & C Canal (Bonnybridge-Lock 16) 17 Jan. ♂ Kinneil 23 Aug and a ♂ St Helen's Loch, Bonnybridge 4 Nov.

C Gartmorn Dam (monthly max): 10 in Feb; 10 in Mar; 20 in Oct & 28 in Nov.

S One Carron Valley Resr. 15 Jan; head of L. Tay (monthly max): 3 in Feb; 3 in Mar & 2 in Dec). Single ♂ Cambusmore GP from 5 Feb – 20 Aug and on 4 Nov; 1 ♂ Lake of Menteith 9 Nov & 1 Blairdrummond Ponds 12 Nov.

FERRUGINOUS DUCK *Aythya nyroca* (V)

C A ♂ on Gartmorn Dam from 12 – 27 Oct was the 3rd record for the area (GG et al).

TUFTED DUCK *Aythya fuligula* (B, W)

Inland WeBS: 435 in Jan, 443 in Feb, 408 in Mar, 142 in Sep, 348 in Oct, 438 in Nov and 409 in Dec.

F Breeding: 2 chicks Darnrigg Moss Pools 27 Aug (TF). Site max: 54 Callendar Park Loch 25 Feb; 48 N. Pool Skinflats 12 Feb; 37 St Helen's Loch, Bonnybridge 4 Nov; 33 L. Ellrig 28 Mar; 25 Helix Ponds 18 Jan & 24 Little Denny Resr. 4 Nov.

C Gartmorn Dam winter/spring max: 92 on 12 Feb. Autumn/winter site max: 255 on 23 Oct.

S Breeding: ♀ with 9 chicks Ochlochy Pond 29 Jun, 5 on 21 Jul with only one fledging (MVB). 26 chicks from c.6 broods Cambusmore GP 8 Jul (NB). Winter/spring site max: 78 Lake of Menteith 9 Feb; 55 Blairdrummond Ponds 8 Jan; 46 Cambusmore / Gart GP 2 Apr; 30 Airthrey Loch 23 Feb and 26 CVR 15 Jan. Summer site max: 87 Cambusmore/Gart GP 8 Jul (moult flock). Autumn/winter site max: 113 Lake of Menteith 16 Dec; 45 Blairdrummond Ponds 12 Nov; 38 Cambusmore GP 3 Dec & 32 CVR 10 Dec.

SCAUP (Greater) *Aythya marila* (s, w)

Forth Est. WeBS: 1 in Jan, 1 in Feb, 25 in Mar, 10 in Oct & 3 in Nov.

F Kinneil monthly max: 14 in Jan; 4 in Feb; 19 in Mar; 28 in Apr; 4 in Jul; 8 in Oct & 3 in Nov. Other site max: 10 Powfoulis 30 Jan (GR); 2 Skinflats Pools 8 Oct (MVB); 1 Blackness 22 Oct (AB) & 1 Bo'ness 8 Dec (DMB).

C Four Gartmorn Dam 28 Oct & 2 on 4 Nov (IB, GG).

S A 1st W ♂ and a ♀ were on the Lake of Menteith from 14 Jan – 9 Mar with a ♂ there on 12 Oct (NB). One R. Forth (Carse of Lecropt) 1 Jan (DMB).

EIDER (Common) *Somateria mollissima* (s, w)

Forth Est. WeBS: 2 in Jan, 2 in Feb, 7 in Mar, 25 in Sep & 2 in Dec.

F Blackness max: 1 in Feb, 3 in Apr, 11 in May, 19 in Aug, 18 in Sep & 2 in Nov. Bo'ness max: 3 in Jan & 3 in Sep. Kinneil max: 4 in Jan, 2 in Feb, 1 in Mar, 6 in Apr, 4 in May, 9 in Aug, 12 in Sep & 2 in Nov.

*LONG-TAILED DUCK *Clangula hyemalis* (w)

S ♀/imm Blairdrummond Ponds 2 Jan – 7 May (DOE, CJP) & 1 Head of L. Tay 2 Jan – 11 Mar & 4 – 22 Oct (JPH).

*COMMON SCOTER *Melanitta nigra* (w)

F Two Blackness 18 Sep (DOE); 1 Kinneil 19 Nov (JRC); 30 ♀/juv Bo'ness 8 Dec & 9 ♀/juv Bo'ness 18 Dec (DMB, AIB)

GOLDENEYE (Common) *Bucephala clangula* (W)

Inland WeBS: 522 in Jan, 536 in Feb, 495 in Mar, 11 in Sep, 13 in Oct, 208 in Nov & 384 in Dec. Forth Est. WeBS: 46 in Jan, 24 in Feb, 16 in Mar, 0 in Sep, 0 in Oct, 4 in Nov & 42 in Dec.

F Site max: 24 R. Forth (S. Alloa-Kinc Br.) 15 Jan & 21 Black Loch 28 Mar.

C Winter/spring site max: 79 Gartmorn Dam 15 Jan & 72 R. Devon (Tullibody Br.-Cambus Weir) 16 Jan; Autumn/winter site max: & 63 R. Devon (Tullibody Br.-Cambus Weir) 20 Dec.

S Winter/spring site max: 126 (38♂) Lake of Menteith (9 Feb); 62 L. Venachar 26 Mar; 27 head of L. Tay 4 Feb; 21 R. Forth (Westley's) 12 Feb & 21 L. Laggan (Kippen) 12 Mar. Autumn/winter site max: 129 (30♂) Lake of Menteith 15 Nov; 33 R. Forth (Longcarse) 15 Dec) & 23 L. Venachar 12 Nov. Summering birds: up to 4♀ head of L. Tay Jun.

*SMEW *Mergellus albellus* (irr)

S What was probably the adult ♂ from 2015 /16 was at Blairdrummond Ponds from 25 Mar – 10 Apr (DOE et al).

RED-BREASTED MERGANSER *Mergus serrator* (B, W)

Inland WeBS: 0 in Jan, 8 in Feb, 5 in Mar, 5 in Sep, 3 in Oct, 2 in Nov & 0 in Dec. Forth Est. WeBS: 27 in Jan, 36 in Feb, 46 in Mar, 42 in Sep, 45 in Oct, 55 in Nov & 21 in Dec.

F Kinneil monthly max: 10 in Jan, 13 in Feb, 4 in Mar, 5 in Apr, 1 in May, 34 in Jul, 65 in Aug, 45 in Sep, 33 in Oct, 20 in Nov & 6 in Dec. Other site max: 16 R. Forth (Skinflats, WeBS) 12 Feb; 15 Skinflats tidal ex 3 Dec; 20 Blackness 22 Oct; 13 R. Forth (Powfoulis) 20 Aug & 4 Higgin's Neuk 3 Dec.

C Two R. Forth at Cambus 28 Feb & 3 R. Devon (A907-Cambus Weir) 9 Oct.

S Breeding: ♀ with 11 ducklings 5 Jul reduced to 9 ducklings 10 Aug head of L. Tay. 4 R. Teith (Lecropt) 12 Feb with 5 on 17 Mar; 3 head of L. Katrine 6 May, 2 R. Forth (A91-Fallin) 18 Nov & 1 R. Forth (Carse of Lecropt) 1, 25 & 29 Jan. Head of L. Tay monthly max: 1 in Mar, 2 in Apr; 2 in May, 2 in Jun, 1 in Jul, 7 in Aug & 6 in Sep.

GOOSANDER (Common Merganser) *Mergus merganser* (B, W)

Inland WeBS: 129 in Jan, 134 in Feb, 125 in Mar, 34 in Sep, 119 in Oct, 82 in Nov & 102 in Dec. Forth Est. WeBS: 11 in Jan; 3 in Feb, 15 in Mar, 17 in Sep, 31 in Oct, 19 in Nov & 0 in Dec.

F One Skinflats Pools 7 Aug; 13 Black Loch (Limerigg) 14 Feb & 12 Kinneil 4 Jul.

C Site max: 37 R. Forth (Longcarse) 5 Mar; 33 R. Forth at Cambus 5 Mar; 20 Gartmorn Dam 10 Oct; 14 R. Devon below Cambus Weir 3 Oct (all ♀/imm); 12 ♂ Cambus Pools 12 Dec & 10 Delph Pond (Tullibody) 7 Feb (a site NH).

S Site max: 20 Blairdrummond Ponds 14 Oct; 20 R. Forth (Teith-Allan conf's) 12 Feb; 14 R. Teith (W Row to Forth conf.) 17 Mar; 14 (6♂) The Meadows (Callander) 6 Mar; 13 (11♂) R. Forth (Fallin) 1 Dec; 12 (8♂) head of L. Tay 15 May & 10 W. Loch of Daldorn (20 Feb).

RED GROUSE (Willow Ptarmigan) *Lagopus lagopus* (B, W)

BBS: recorded at 0.2 b/lkm (1997-2017 av: 0.14 b/lkm. Range: 0.03 to 0.37 b/lkm). Only present in heather habitat and then in small numbers at a rate of 0.5 b/lkm.

C Two Blairdenon Hill 22 Apr & 3 Menstrie Moss 19 Nov.

S 12 G. Beich 3 May & 5 Sheriff Muir 27 Mar & 26 Oct.

*PTARMIGAN (Rock Ptarmigan) *Lagopus muta* (b, w)

S One Ben Ledi 12 Apr; 1 Meall Ghaordaidh 1 Jul; 2 Stuc a'Chroin 27 Aug (MF) & 2 Meall Dhamh 30 Sep (CA, NMcW, MF & SW).

*BLACK GROUSE *Tetrao tetrix* (b, w)

S Five Braes of Doune 7 Jan (CMcK); 5 Braeleny (Callander) 18 Feb (HD); 4 Strathyre Forest 11 Feb (GG); 4 G. Beich 17 May (CME); max 2 Gleann a' Chlachain (Auchtertyre) 11 Feb – 8 Jun (JPH) & 2 Gleann nam Meann (G. Finglas) 21 Apr.

RED-LEGGED PARTRIDGE *Alectoris rufa* (b, w).

Occasionally released for shooting it is thought unlikely that the small feral population is self-sustaining.

F Two Skinflats TE 12 Apr & 1 Grangemouth 5 Nov.
C Two Gartgreenie (Forest Mill) 7 May.
S Eight Sheriff Muir, 4 Cromlix 22 Apr.

GREY PARTRIDGE *Perdix perdix* (b, w)

Has become very scarce during the last 20 years. A small number of releases helps to sustain numbers.

F Site max: 13 Powfoulis 20 Aug (AB); 2 Skinflats Pools 2 May (GG) & 2 R. Carron (Larbert) 11 Dec (AE).
C Site max: 9 Longcarse 18 Dec (JRC); 4 Blackdevon Wetlands 8 Sep (DMB) & 2 Cambus 2 Dec (DH).
S Site max: 16 Stonehill (Dunblane) 5 Jan (MVB).

* QUAIL (Common) *Coturnix coturnix* (b)

S 1 Hill of Row 2 Aug & 1 Auchenteck area (Dunblane W) 30 Jul - 8 Aug (DI, CJS et al).

PHEASANT (Common) *Phasianus colchicus* (B, W)

Large numbers released on shooting estates, otherwise widespread but in small numbers. BBS: recorded at 0.5 b/lkm (1997-2015 av: 0.52 b/lkm. Range: 0.22 to 0.8 b/lkm). The highest recording rate was on farmland at 1.12 b/lkm.

F ♀ with Y Kinneil 5 Jul (NB).

*RED-THROATED DIVER (Red-throated Loon) *Gavia stellata* (b, w)

F One Blackness Bay 4 Jan with 2 on 17 Sep (DMB, EML); 1 Bo'ness 8 Dec (DMB) & 1 Kinneil 26 Dec (JRC).
S One Cambusmore GP 19 Feb (DT).

*BLACK-THROATED DIVER (Black-throated Loon) *Gavia arctica* (b)

S One L. Iubhair 4 & 7 Apr, 3 on 8 May & 1 on 25 Jun (JPH, GG); 1 present at an undisclosed location in the Trossachs 1 & 4 May (JC, PR) & 1 head of Loch Tay intermittently from 22 Apr – 27 Aug with 2 on 20 Jul (JPH, DOE).

LITTLE GREBE *Tachybaptus ruficollis* (B, w)

Inland WeBS: 113 in Jan, 80 in Feb, 46 Mar, 113 in Sep, 97 in Oct, 102 in Nov & 114 in Dec.

F Breeding: b/4 Glen Pool (Lionthorn) 29 May (CME); 4Y Darnrigg Moss Pools 27 Jul (TF) & 5 Y still being fed Drumbowie Resr. 2 Sep. (NB). Site max: 20 (NH) Drumbowie Resr. 2 Sep; 12 Darnrigg Moss Pools 24 Aug & 10 Little Denny Resr. 9 Dec.

C Site max: 16 Gartmorn Dam 21 Oct & 7 R. Devon (Alva-Tullibody Br) 19 Nov.

S Breeding: 2 Y Cocksburn Resr. 8 Jul (MVB). Site max: 26 Cambusmore GP 20 Aug; 26 (NH) L. Lubnaig 17 Jan; 17 (NH) L. Watston 11 Oct; 15 (NH) Lake of Menteith 16 Dec; 10 L. Dochart 11 Feb; 7 L. Voil 14 Nov; 14 Blairdrummond Ponds 10 Dec & 7 L. Ard 13 Jan & 9 Dec.

GREAT CRESTED GREBE *Podiceps cristatus* (b, w)

Inland WeBS: 18 in Jan, 10 in Feb, 33 in Mar, 35 in Sep, 13 in Oct, 6 in Nov & 13 in Dec. Forth Est. WeBS: 5 in Jan, 3 in Feb, 3 in Mar, 37 in Sep, 24 in Oct, 24 in Nov & 38 in Dec.

F Monthly max: Blackness: 6 in Jan, 25 in Sep, 32 in Oct & 30 in Nov. Kinneil: 6 in Jan, 11 in Jul, 11 in Aug, 36 in Sep, 15 in Oct, 36 in Nov & 36 in Dec. Other site max: 6 Bo'ness 18 Sep; 2 Black Loch (Limerigg) 28 Mar; 2 L. Ellrig 28 Mar; 2 N. Pool Skinflats 13 Jun; 2 Skinflats TE 20 Nov & 1 Darnrigg Moss Pools 26 Apr.

C Monthly max Gartmorn Dam: 4 in Jan, 1 in Feb, 1 in Mar; 2 in Apr, 5 in Jul, 3 in Aug, 4 in Sep, 10 in Oct & 6 in Nov.

S Breeding: 4 Y Lake of Menteith 9 Sep (NB). Lake of Menteith monthly max: 7 in Jan, 7 in Feb, 15 in Mar, 30 in Sep, 5 in Oct, 11 in Nov & 13 in Dec. Other sites max: 1-5 Cambusmore/Gart 5 Mar-9 Sep; 1-4 Blairdrummond Ponds 11 Mar-14 Oct; 4 L. Coulter 14 Mar; 3 Carron Valley Resr 12 Mar; 2 L. Venachar 20 Jan; 2 L. Watston 18 Feb; 2 N. Third Res. 14 Mar & 1 L. Ard 11 Nov.

*RED-NECKED GREBE *Podiceps grisegena* (v)

S One Blairdrummond Ponds 5 May (DOE).

*SLAVONIAN GREBE (Horned Grebe) *Podiceps auritus* (irr)

F One Blackness Bay 4 Jan; 1 Kinneil 13 Nov & 16 Dec (DMB, JRC) & 1 Skinflats TE 15 Nov (TC).

C One R. Forth at Cambus 16 Aug (DH).

*GANNET (Northern) *Morus bassanus* (p)

F Ad Blackness 16 May (DMB) & 1 Kinneil 19 Sep & 15 Oct (DT, CG).

S Juv >N up Strath Fillan 29 Sep (JPH) & a juv L. Coulter 15 Oct (NB).

CORMORANT (Great) *Phalacrocorax carbo* (S, W)

Inland WeBS: 82 in Jan, 89 in Feb, 107 in Mar, 50 in Sep, 84 in Oct, 95 in Nov & 103 in Dec. Forth Est. WeBS: 40 in Jan, 28 in Feb, 35 in Mar, 99 in Sep, 55 in Oct, 65 in Nov & 62 in Dec.

F 41 Skinflats 19 Nov (WeBS); 41 Kinneil 17 Sep (WeBS); 10 Higgin's Neuk 4 Mar & 10 Bo'ness 18 Sep.

C Monthly max R. Forth (Longcarse): 5 in Jan, 5 in Feb, 5 in Apr, 3 in May, 11 in Jun & 122 in Oct. Other site max: 55>E Cambus 1 Nov & 8 Gartmorn Dam 19 Jan & 12 Feb.

S Monthly site max: Lake of Menteith: 22 in Jan, 19 in Feb, 10 in Mar, 22 in Oct, 30 in Nov & 37 in Dec. Carron Valley Resr: 2 in Jan, 19 in Feb, 34 in Mar, 8 in Sep, 11 in Oct & 3 in Nov. Head of L. Tay: 18 in Jan, 9 in Feb, 8 in Aug, 15 in Sep, 16 in Oct, 14 in Nov & 8 in Dec. Other site max: 43 R. Forth (A91-Fallin) 10 Mar & 11 Ashfield 19 Nov & 1 Dec.

*SHAG (European) *Phalacrocorax aristotelis* (irr)

F 2 Kinneil 18 Oct (AE).

LITTLE EGRET *Egretta garzetta* (w)

F One Kinneil Sep, Oct & 9 Nov (latter had yellow ring on left leg and a red one on the right); 1 sporadically at Skinflats Pools & mudflats throughout the year; 1 Powfoulis 2 Jan & 19 Dec; 1-5 Skinflats Tidal Ex. occasionally between Mar - Sep; 1 R. Forth (S. Alloa – Dunmore16 Jan & 6 Feb); 1-2 Higgin's Neuk / Kincardine Br area Feb, Oct & Dec; 1 Bo'ness 30 Oct & 2 Higgin's Neuk 30 Oct with 1 on 3 Dec.

*C One Cambus Village Pool 28 Aug (DH).

GREAT WHITE EGRET (Great Egret) *Ardea alba* (V)

F One Kinneil 24 Aug (DMB, RS). This is the 4th record for the UF.

GREY HERON *Ardea cinerea* (B, W)

Inland WeBS: 105 in Jan, 66 in Feb, 41 in Mar, 74 in Sep, 77 in Oct, 99 in Nov & 102 in Dec. Forth Est. WeBS: 33 in Jan, 14 in Feb, 13 in Mar, 78 in Sep, 73 in Oct, 58 in Nov & 43 in Dec. BBS: recorded at 0.11 b/lkm (1997-2017 av: 0.12 b/lkm. Range 0.03 (1997) to 0.23 (2005) b/lkm). Again unsurprisingly the highest recording rate was on WBBS at 0.54 b/lkm.

F Breeding: 5 aon's Dalderse Sewage Works (AB). Site max: 37 Skinflats Pools & shore 17 Sep; 15 R. Forth (S. Alloa-Dunmore) 16 Jan; 11 Powfoulis 20 Aug & 10 Kinneil Lagoon 23 Aug.

C Site max: 20 R. Devon (Alva) 19 Nov & 16 R. Forth, Longcarse (15 Dec).

S Breeding: 10 aon's Nyadd (NB). Site max: 14 L. Venachar 12 Dec; 12 Blairdrummond Ponds 8 Jan; 12 Cambusmore/Gart GP 20 Aug & 9 head of L. Katrine 20 Jun.

RED KITE *Milvus milvus* (b,W)

Inland WeBS counts: 2 in Jan, 2 in Feb, 3 in Mar, 1 in Sep, 4 in Oct, 4 in Nov & 8 in Dec.

*C One Tarmangie Hill (Dollar) 2 Apr (KB).

S Breeding: of 31 pairs on territory with 16 nests fledging at least 27 Y plus a further 2 pairs laying eggs but failing to fledge any Y (DOE et al). Max of 31 Argaty 31 Jul; 7 Doune 20 Nov; 6 Sheriff Muir 24 Feb & 6 Ashfield 13 Nov. 1 Inverlochlarig 17 Apr. Regular around BoD, BoA, Callander, Cromlix, Dunblane & Stirling. Occ. sightings in areas of Carron Valley Resr., Earlsburn Resr's, Fintry Hills, Flanders Moss, Gargunnock, G. Dochart & Menteith.

*WHITE-TAILED EAGLE *Haliaeetus albicilla* (s, w)

Most likely to refer to birds from the Fife reintroduction scheme.

C One Tarmangie Hill (Dollar) 2 Apr (KB).

S One >NW Ashfield 3 Jan (CMcK) & 2 Uamh Mhor 24 May (GG).

*MARSH HARRIER (Western) *Circus aeruginosus* (p, s)

F Ad ♂ Kinneil Lagoon 27 Apr (DMB); 1 Skinflats Pools 19 May (RS); 1 Skinflats shore >E 23 May (NB); 1 Skinflats TE 19 Jun (TC) & 1 Skinflats Pool N 8 Aug (GG).

C One Blackdevon Wetlands 27 Apr (imm) & 22 Jun (NB). Singles Tullibody Inch: 9 Apr, 30 Apr, 20 May, 5 & 13 Jun (♂), 6 Aug (♂) & 23 Sep (juv) (JRC, GG, NB, DMB).

*HEN HARRIER *Circus cyaneus* (b, w)

S Flanders Moss: ♀/imm 12, 27 & 31 Jan (AH, KMcC, DAP), ♂ & 2 ♀/imm 13 Jan (AH), 1 on 26 Oct (JN). Other records: 1 Braes of Doune 7 Jan (CMcK); ♀/imm Sheriff Muir 25 Jan (DMB); ♀/imm Kippen Muir Dam 12 Feb (JS); 1 Buckieburn Resr. 18 Mar (AMcP); ♀/imm Drumloist 3 Feb & 26 Dec (DT); 1 Edinample 23 Aug (DOE); 1 Ben Lui 26 Aug (MF); 1 Ashfield 22 Oct (CMcK) & 2 Braeleny 19 Nov (DOE).

*GOSHAWK (Northern) *Accipiter gentilis* (b, w)

S Breeding: 5 pr's bred in the area. These are quite widely spread so there are probably more (CSRSG). Other records: 1 Cromlix Ponds 18 Feb (NB); 1 'dive-bombing' a Honey Buzzard in the Trossachs 10 May (AB); 1 Sheriff Muir 22 Aug (DOE); 1 W of Dunblane 5 Nov (NB) & 1 Blairdrummond 2 Dec (DOE).

SPARROWHAWK (Eurasion) *Accipiter nisus* (B, W)

Inland WeBS counts: 8 in Jan, 0 in Feb, 2 in Mar, 5 in Sep, 5 in Oct, 4 in Nov & 4 in Dec. Breeding: 32 pr's fledged 71 Y (CSRSG). Thinly spread throughout the majority of the recording area. Contributors are encouraged to submit breeding records.

F Breeding: Five nests Callendar Park all of which fledged Y. Range between nests varied between 550m-750m (CME). A pr fledged Y at Polmont 19 May (CME).

BUZZARD (Common) *Buteo buteo* B, W)

The most numerous raptor recorded throughout the majority of the recording area. Contributors are encouraged to submit breeding records. Inland WeBS counts: 52 in Jan, 48 in Feb, 50 in Mar, 27 in Sep, 47 in Oct, 50 in Nov & 42 in Dec. BBS: recorded at 0.32 b/lkm (1997-2017 av: 0.36 b/lkm. Range: 0.24 (2013) to 0.55 (1997) b/lkm). Recorded on all six broad habitat categories with the highest recording rate being on deciduous woodland etc. at 0.57 b/lkm.

F 5 Kinneil 31 Aug. Bird feeding on Pink-footed Goose carcase frozen into the ice at Skinflats Pool N 16 Dec (AB).

C 6 Tillicoultry E 5 Nov.

S Breeding: In a study area around Dunblane & B of A 39 aot's were visited of which 36 were monitored producing 62 fledglings (BD, CSR). Max: 10 Aberfoyle 8 Jul; 8 R. Forth (Meiklewood) 19 Nov; 6 Drumloist Rd 3 Feb; 6 R. Forth (Kippen) 22 Sep; 6 Flanders Moss SE 11 Dec; 5 R. Teith (Lecropt) 19 Nov & up to 5 Strath Fillan.

HONEY BUZZARD (European) *Pernis apivorus (*b)

Breeding: A population in the Trossachs contained 2-3 territories with up to 9 birds (c.6 breeders, 2 non-breeders & 1 juv) with a max of 3 birds seen at any one time. Much wing-clapping and territorial flights throughout the period 23 May-1Sep. One was 'dive-bombed' by a ♂ Goshawk 10 May (CMcI, AB).

*GOLDEN EAGLE *Aquila chrysaetos* (s, w)

S One Coire Chroisg G. Ample 4 Jan (DJC); 1 Edinchip 3 Mar (DOE); 1 G. Kendrum 3 Mar (DJC); 2 Ben Lui 7 Mar (PR); 2 Caol Ghleann 17 May (JPH); 1 Craigruie, Balquhidder 28 May (DI) & 1 G. Gyle 20 Jun (NB).

OSPREY (Western) *Pandion haliaetus* (B)

Breeding: c.20 pr's bred (CSRSG). First records of the year: one Lake of Menteith 30 Mar & 2 L. Rusky 30 Mar (DT). Last record: one CVR 12 Sep (JS/AM).

F 1 over Falkirk Town Centre 1 Apr & 1 Skinflats Pools 5 Sep.

S Summer: present and nesting throughout the district, particularly CVR, Callander, Doune, Menteith, L Tay / G. Dochart & the Trossachs.

KESTREL(Common) *Falco tinnunculus* (B, W)

Inland WeBS counts: 9 in Jan, 1 in Feb, 0 in Mar, 3 in Sep, 8 in Oct, 2 in Nov & 7 in Dec. (Spread thinly throughout most of the recording area. Contributors are encouraged to submit breeding records. Normally only single birds seen).

F Max: 6 Skinflats 10 Oct.

S Breeding: There were 6 aot's in a study area around Dunblane / B of A (BD, CSR).

HOBBY (Eurasion) *Falco Subbuteo* (v)

S One BoA stooping on a small bird 2 May (DMB). This is the 9th record for the area.

*MERLIN *Falco columbarius* (b?, w)

F Skinflats: 1 on 12 Feb, 1 on 8 & 12 Oct, 1 on 16 Nov & 1 on 4 Dec (SWo, AE, MVB). 1 S. Alloa 17 Jan (SWi) & 1 Kinneil 26 Dec (JRC).

C One Whitewisp Hill, Dollar 21 Jan (KB).

S ♀ Gleann a' Chroin 22 Jan (JG); ♀ Flanders Moss 6 Apr; 1 G. Finglas 25 Jun (?); ♂ Meall Buidhe (Tyndrum) 8 Jun (JPH); 1 Ben Lui 26 Aug (MF); 1 Sheriff Muir 31 Aug (MVB); 1 Ashfield 18 Oct & 1 BoA 20 Oct (CMcK).

PEREGRINE FALCON *Falco peregrinus* (B, W)

Widely, but thinly spread outwith the breeding season but in small numbers, mostly in lowland areas (incl. town centres) and especially along the tidal R. Forth and estuary.

WATER RAIL *Rallus aquaticus* (b, w)

Widespread in suitable habitat but greatly under-recorded. Most records are of birds heard rather than seen.

F Site max: 2 Skinflats Pools 5 Feb.

C Site max: 4 Longcarse/ Tullibody Inch 26 Aug (recorded here throughout the year) & 2 Gartmorn Dam 26 Oct.

S Site max: 2 L. Watston 17 Nov.

MOORHEN (Common) *Gallinula chloropus* (B, W)

Inland WeBS: 92 in Jan, 51 in Feb, 55 in Mar, 74 in Sep, 86 in Oct, 104 in Nov & 75 in Dec.

F Breeding: ad + 1 small Y Skinflats Pools 28 Aug (NB). Skinflats Pools monthly max: 5 in Jan, 12 in Feb, 8 in Mar, 12 in Apr, 8 in May, 8 in Aug, 15 in Sep, 7 in Oct, 4 in Nov & 3 in Dec. Other site max: 17 Forth/Clyde Canal (Lock 16- R. Carron) 18 Nov & 11 Callendar Park Loch 26 Feb.

C Breeding: pr + 2 chicks Devonmouth Pool 17 Aug (NB). Site max: 8 Cambus Village Pools 2 Nov; 7 Gartmorn Dam 18 Oct & 7 R. Devon (Alva-Tullibody Br) 16 Dec.

S Breeding: pr with 2 large Y Cornton Pond (Argaty) 21 Sep (NB). Monthly max Airthrey Loch: 14 in Jan, 19 in Feb, 11 in Mar, 9 in Sep, 4 in Oct, 18 in Nov & 9 in Dec. Other site max: 8 R. Teith (Lecropt) 17 Mar; 8 (incl 4 large Y) L. Watston 26 Sep & 5 head of L. Tay 26 Apr.

COOT (Common) *Fulica atra* (B, W)

Inland WeBS: 229 in Jan, 297 in Feb, 162 in Mar, 105 in Sep, 101 in Oct, 201 in Nov & 245 in Dec (wintering numbers have reduced greatly during the last decade).

F Breeding: 'at least 2 pr's nested' Callendar Park Loch & 1 aon Larbert Hosp. Ponds (CME). Site max: 29 Helix Park Pond 18 Nov & 24 Skinflats Pools 14 Jan.

C Breeding: 2 aon Fire Sta. Pool (Alloa) 23 May (NB). Gartmorn Dam max: winter/spring 105 on 12 Feb & autumn/winter 83 on 12 Nov.

S Breeding: 1 aon Ochlochy Pond 21 Jun (MVB). Lake of Menteith max: winter/spring 113 on 9 Feb & autumn/winter 74 on 16 Dec. Other site max: 68 Airthrey Loch 17 Jan & 37 L. Watston 9 Dec.

OYSTERCATCHER (Eurasian) *Haematopus ostralegus* (B, W)

Inland WeBS: 8 in Jan, 253 in Feb, 291 in Mar, 2 in Sep, 0 in Oct, 0 in Nov & 6 in Dec. Forth Est. WeBS: 210 in Jan, 327 in Feb, 310 in Mar, 275 in Sep, 206 in Oct, 243 in Nov & 409 in Dec. BBS: recorded at 0.44 b/lkm (1997-2017 av: 0.71 b/lkm. Range 0.24 (2016) to 1.64 (2003) b/lkm). Recorded in all habitat categories with the highest rate being on WBBS at 1.77 b/lkm. Early inland spring return: 1 Blairdrummond Ponds 8 Jan (DOE), 3 Airthrey Loch 17 Jan (ACC) & 1 Claish Pool (Callander) 26 Jan (NB).

F Breeding: nesting on the flat roof of the Calchem bldg. Site max: c.380 Kinneil 24 Jan & 204 16 Dec; 137 Blackness 10 Feb; 153 Skinflats (WeBS) 19 Nov & 98 Kincardine Br. 2 Nov.

C Site max: 64 Longcarse 25 Feb.

S Breeding: pr nested on Barbush (Dunblane) roundabout hatching 2 chicks 15 Jun (MVB). Site max: 81 Blairdrummond Ponds 11 Feb & 45 head of L. Tay 17 Jul. Inland in winter: 5 R. Forth (Kildean) 10 Dec.

AVOCET (Pied) *Recurvirostra avosetta* (V)

F One Kinneil 9 May and Skinflats TE 10 May (AMu, TC). This is the 14th record for the area.

*LITTLE RINGED PLOVER *Charadrius dubius* (Irr)

S Cambusmore GP: display & copulation of a pr 14 May with pr also present 18 Jun (DT).

RINGED PLOVER (Common) *Charadrius hiaticula* (b, W)

Forth Est. WeBS: 73 in Jan, 0 in Feb, 4 in Mar, 14 in Sep, 0 in Oct, 1 in Nov and 44 in Dec.

F Monthly max at Kinneil: 28 in Jan, 4 in Feb, 1 in Apr, 13 on 16 May were of the tundrae race (DMB), 5 in July, 117 in Aug, 25 in Sep, 12 in Oct, 41 in Nov & 44 in Dec. Other records: 42 Blackness 20 Aug with 41 on 22 Oct; 12 Skinflats Pools 2 Jun with 7 on 5 Sep & 1 R. Forth (S. Alloa-Dunmore) 29 Aug;

*C 29 Kennet Pans 16 May were of the tundrae race (DMB).

*S Monthly max Cambusmore/Gart GP: 2 on 13 Mar, 7 on 2 Apr, 4 in May, 2 in Jun, 2 in Jul & 1 in Aug. At the head of L. Tay from 9 Apr-24 Jun with a max of 5 on 30 Apr & 28 May & 1 Touch Resr's. 25 Jul.

GOLDEN PLOVER (European) *Pluvialis apricaria* (B, W)

Forth Est. WeBS: 63 in Jan, 108 in Feb, 0 in Mar, 25 in Sep, 121 in Oct, 3 in Nov & 7 in Dec.

F Monthly max Kinneil: c.67 in Jan, 1 in Aug, c.40 in Sep, c.131 in Oct & c.300 in Nov. Other site max: c.120 Skinflats (Webs) 16 Oct; c.40 Strathavon Fm (Slamannan) 1 Dec & 24 Blackness 13 Nov.

S Probable breeding birds: 1 Caol Ghleann (Strath Fillan) 17 May & 2 Meall Ghaordaidh 10 May with 5 on 1 Jul.

GREY PLOVER *Pluvialis squatarola* (p/w)

F Skinflats Pools & shore monthly max: 6 in Jan, 8 in Feb, 4 in Mar, then 1 from May-Nov with 2 in Aug. Other records: 1 Blackness 9 Feb & 1 Mar & 1 Kinneil 17 Sep.

LAPWING (Northern) *Vanellus vanellus* (B, W)

Inland WeBS: 196 in Jan, 195 in Feb, 146 in Mar, 123 in Sep, 97 in Oct, 248 in Nov and 72 in Dec. Forth Est. WeBS: 123 in Jan, 439 in Feb, 17 in Mar, 1,450 in Sep, 1,321 in Oct, 554 in Nov and 260 in Dec. BBS: recorded at 0.37 b/lkm (1997-2017 av: 0.72 b/lkm. Range 0.23 (2016) to 1.72 (2000) b/lkm). The highest recording rate was on farmland at 1.08 b/lkm, yet again closely followed by WBBS with 0.77 b/lkm.

F Kinneil monthly site max: c.930 in Jan, 264 in Feb, 254 in Aug, c.800 in Sep, 166 (WeBS) in Oct, 424 in Nov & 146 (WeBS) in Dec. Skinflats monthly site max: 126 in Feb, 218 in Aug, 407 (WeBS) in Sep, 475 (WeBS) in Oct, 293

(WeBS) in Nov & 61 (WeBS) in Dec. Other site max: 176 Higgin's Neuk 28 Oct & 82 L. Ellrig 2 Sep.

C Site max: 656 Longcarse/Tullibody Inch 23 Sep & 131 Kennet Pans 8 Oct.

S Winter/spring site max: 115 Cambusmore/Gart GP 8 Jan & c.100 L. Coulter 12 Feb. Autumn/winter site max: 186 Cambusmore GP 20 Aug & 145 Fiveyates (Bannockburn S) 12 Nov.

KNOT (Red) *Calidris canutus* (W)

Forth Est. WeBS: 1,650 in Jan, 848 in Feb, 510 in Mar, 81 in Sep, 0 in Oct, 45 in Nov and 657 in Dec (all at Kinneil).

F Site max: c.3,600 Kinneil 24 Jan.

*SANDERLING *Calidris alba* (p)

F Kinneil: 2 on 16 Jul, 4 on 25 Jul & 1 on 24 Aug (RS, DMB).

S Four head of L. Tay 5 – 7 Jun (JPH).

*LITTLE STINT *Calidris minuta* (irr)

F Two Skinflats Pools 25 Sep & 1 Kinneil 6 Oct (AE, JRC).

C One Kennet Pans (DMB).

*PECTORAL SANDPIPER *Calidris melanotos* (V)

F One Skinflats Pools 16 Sep (AB, DOE, SWe). This is the 8th record in the UFBRA.

C One Longcarse 26 Aug (JRC). This is the 7th record in the UFBRA.

*CURLEW SANDPIPER *Calidris ferruginea* (p)

F One Kinneil 1 on 19 - 24 Aug, 5 Sep, 2 on 17 Sep & 1 on 1 Oct (GG, JRC, DT et al). 1 – 3 Skinflats Pools 6 – 22 Sep (AB, SW et al). 2 R. Carron (Glensburgh) 13 Aug & 1 on 18 Sep (PW, AE).

DUNLIN *Calidris alpina* (b? W)

Forth Est WeBS: 5,589 in Jan, 2,924 in Feb, 2,181 in Mar, 1,283 in Sep, 1,204 in Oct, 3,917 in Nov & 3,520 in Dec.

F Kinneil monthly max: 5,226 in Jan, 2,878 in Feb, 2,132 in Mar, 62 in Apr, c.100 in Jul, 10 in Aug, 1,113 in Sep, 172 in Oct, 3,746 in Nov & c.4100 in Dec. Skinflats Pools & shore monthly max: 331 in Jan, 36 in Feb, 45 in Mar, 2 in May, 35 in Jun, 4 in Aug, 179 in Sep, 1,025 in Oct, 109 in Nov & 3 in Dec. Blackness monthly max: 2 in Jan, 3 in Feb, 15 in Sep & 32 in Nov. Other sites: c.50 Bo'ness 19 Nov; 8 R. Forth (S. Alloa – Dunmore) 15 Jan; 4 S. Alloa 12 Feb with 2 on 3 Dec & 2 Higgin's Neuk 3 Dec.

C Monthly max Longcarse: 6 in Jan, 4 in Feb, 4 in Mar, 1 in Aug, 1 in Sep & 7 in Oct. 24 Kennet Pans 14 Jan.

*S One Cambusmore GP 14 May (DT) & 1 – 10 (13 May) head of L. Tay with 1st on 23 Apr & last on 17 Aug (JPH).

RUFF *Philomachus pugnax* (w, p)

F Skinflats Pools monthly max: 2 in Aug, 35 in Sep & 40 in Oct (AB, RS, SW, MVB). 1 Kinneil 17 Sep & 1 on 6 Oct, (JRC, CG). 3 Powfoulis area 22 Aug (RWP). 1 L. Ellrig 2 Sep (NB); 1 R. Forth (S. Alloa-Kinc. Br.) 8 Oct (RG) & 1 Carronshore 26 Oct (AE).

C Five Longcarse 26 Aug (JRC) with 1 on 10 & 25 Sep (GG, MVB); 1 Cambus Village Pools 20 May & 23 Aug (NB, GG).

*JACK SNIPE *Lymnocryptes minimus* (w)

Inland WeBS: 2 in Jan, 2 in Feb, 1 in Mar, 0 in Sep, 0 in Oct, 0 in Nov & 0 in Dec.

F One St Helen's Loch (Bonnybridge) 17 Jan, 14 Feb & 28 Mar (NB); 1 Braeface Pond (Banknock) 14 Feb (NB); singles Kincardine Br. 2 Jan & 25 Nov with 4 on 4 Dec (RS, RWP). 1 S. Alloa 29 Oct (DMB); 4 Kinneil 19 Nov & 1 on 18 Dec (JRC, RS).

S One Ashfield Pools 7 Jan (CJP); 1 R. Forth (Kildean) 15 Jan (DT); 1 Lees Hill 28 Mar (GG) & 1 Flanders Moss 6 Apr (DMB).

SNIPE (Common) *Gallinago gallinago* (B, W)

Inland WeBS: 17 in Jan, 35 in Feb, 66 in Mar, 43 in Sep, 46 in Oct, 27 in Nov & 92 in Dec. Forth Est. WeBS: 5 in Jan, 0 in Feb, 11 in Mar, 2 in Sep, 6 in Oct, 19 in Nov & 5 in Dec. BBS: recorded at 0.18 b/lkm (1997-2017 av: 0.1 b/lkm. Range 0.03 (1998) to 0.19 (2016) b/lkm). The highest recording rate was on mountains & moorland at 0.36 b/lkm (there were no records from the conifer, WBBS and urban habitats).

F c.40 Larbert Hosp. Ponds 9 Dec; 37 L. Ellrig 2 Sep; 16 Kinneil 19 Nov & 11 St Helen's Loch (Bonnybridge) 28 Mar.

C 24 Devonmouth Pool 7 Feb.

S Breeding: 2 AOT G. Beich 17 Mar & 17 May (CME). Site highs: 21 R. Forth (The Frews) 10 Dec; 17 R. Forth (Teith-Allan conf's) 12 Mar; 13 Cauldbarns Pools 14 Mar; 13 L. Coulter 15 Oct; 12 Cambusmore/Gart GP 8 Oct; 11 Flanders Moss 4 Sep; 11 R. Forth (St. Br.-A91) 18 Dec; 10 Carse of Lecropt 29 Jan & 10 R. Forth (Gargunnock) 8 Dec.

WOODCOCK (Eurasion) *Scolopax rusticola* (B, W)

Inland WeBS: 2 in Jan, 1 in Feb, 1 in Mar, 0 in Sep, 0 in Oct, 1 in Nov and 4 Dec.

F Singles Bo'ness, Carronshore, Darnrigg Moss, R. Carron (M876-Larbert), Skinflats (MVB, AE, TF, RS).

C No records.

S Four Torrie 5 Dec (DOE). Singles Ben Lui, Broomridge (Stirling), Braes of Doune, Carse of Lecropt, Doon Hill (Aberfoyle), Gleann a' Chlachain (Kirkton), head of L. Tay (roding), Inchie Wood (L. of Menteith), L. Ard, L. Rusky & Lanrick (R. Teith) (NB, KJD, JPH, CRM, TM, DOE, DT).

BLACK-TAILED GODWIT *Limosa limosa* (W)

Forth Est. WeBS: 536 in Jan, 693 in Feb, 768 in Mar, 780 in Sep, 1,394 in Oct, 786 in Nov & 338 in Dec.

F Kinneil monthly max: c.860 in Jan, 613 in Feb, 717 in Mar, 939 in Apr, 346 in May, c.70 in Jun, 398 in Jul, c.1,220 in Aug, c.1,240 in Sep (NH), 186 in Oct, 995 in Nov & c.940 in Dec. Skinflats Pools & shore monthly max: 31 in Jan, 5 in Feb, 4 in Mar, 13 in Apr, 10 in May, 224 in Jun, 48 in Jul, 178 in Aug, 226 in Sep, 28 in Oct & 11 in Nov & 2 in Dec. Other sites max: c. 670 Blackness 8 Oct (WeBS); c.510 Bo'ness 8 Oct & c.50 R. Forth (S. Alloa-Kinc Br) 12 Mar.

C Cambus Village Pools monthly max: 3 in Apr, 118 in May, 51 in Jun, 8 in Jul, c.80 in Aug & 8 in Sep. Longcarse monthly max: 5 in Apr, 74 in May, 4 in Aug & 1 in Nov. 34 Kennet Pans: 12 Feb.

BAR-TAILED GODWIT *Limosa lapponica* (W)

Forth Est. WeBS: 281 in Jan, 87 in Feb, 69 in Mar, 35 in Sep, 4 in Oct, 10 in Nov and 140 in Dec.

F Kinneil monthly max: 235 in Jan, c.659 in Mar; 16 in Apr, 33 in Sep; 4 in Oct; c.100 in Nov & 132 in Dec. Other site max: 46 R. Forth (S. Alloa- Kinc Br) 15 Jan; c.20 Blackness 1 Mar & 15 Skinflats Pools 16 Sep.

WHIMBREL *Numenius phaeopus* (p)

F Skinflats Pools monthly max: 5 on 26 Apr, 5 on 2 May, 1 on 16 Jul, 3 on 13 Aug & last one on 16 Sep (MVB, AB, GG, RS, DOE). 1 Skinflats TE 11 May & 16 Aug (TC) & 2 Kinneil 21 Jul, 1 on 16 Jul & 1 on 9 Sep (GG, RS, DOE). Blackness: 1 on 10 Feb, 1 on 1 Mar, 1 on 16 May, 1 on 20 Aug & 1 from 3 - 28 Nov (NB, DMB, PMG). 1 Kincardine Br 20 Aug (RWP).

C Site max: 15 Longcarse 25 Apr & 1 Cambus 29 Jul (DMB, GG).

*S One head of L. Tay 14 May (JPH) & 1 Flanders Moss 4 Sep (DAP).

CURLEW (Eurasion) *Numenius arquata* (B, W)

Inland WeBS: 117 in Jan, 235 in Feb, 456 in Mar, 102 in Sep, 7 in Oct, 41 in Nov and 26 in Dec. Forth Est. WeBS: 956 in Jan, 1095 in Feb, 851 in Mar, 972 in Sep, 653 in Oct, 754 in Nov and 767 in Dec. BBS: recorded at 0.28 b/lkm (1997-2017 av: 0.59 b/lkm. Range 0.28 (2017) to 0.98 (2003) b/lkm). The highest recording rate was on farmland at 0.52 b/lkm.

F Skinflats monthly max: 312 in Jan, c.380 in Feb, 302 in Mar, c.100 in Jun, 227 in Sep, 215 in Oct, 365 in Nov & 237 in Dec. Kinneil monthly max: c.240 in Jan, 245 in Feb, 201 in Mar, 371 in Sep, 175 in Oct, 192 in Nov & 198 in Dec. Other site max: c.300 Skinflats TE 16 Sep; c.190 Blackness 20 Oct; c.160 Higgin's Neuk 18 Sep & 133 Airth fields 26 Nov.

C R. Forth (Cambus-S. Alloa) monthly max: 182 in Jan, c.160 in Feb, c.160 in Mar, c.240 in Aug, 122 in Oct, 143 in Nov & c.320 in Dec. Other site max: 135 Cambus Village Pool 16 Jul & 29 Oct; c.110 Kennetpans 17 Sep & 84 Haugh of Blackgrange 16 Jan.

S 101 Killin Marshes 11 Mar (NH) & 78 Blackdub Floods 25 Feb.

COMMON SANDPIPER *Actitis hypoleucos* (B)

BBS: recorded at 0.12 b/lkm (1997-2017 av: 0.07 b/lkm. Range 0.05 (1999) to 0.12 (2017) b/lkm). Unsurprisingly, the highest recording rate was on WBBS at 0.88 b/lkm. First of year: one Dollar 12 Apr (KB). Last of year: 1 Kinneil 17 Sep (JRC).

F Site max: 6 Kinneil 9 & 18 Jul.

S Site max: 8 head of L. Tay 25 May & 28 Jun; 6 Cambusmore/Gart GP 30 Apr & 18 Jun; 6 head of L. Katrine 20 Jun; 6 L. Dochart 2 May & 6 Blairdrummond Ponds 27 Apr.

*GREEN SANDPIPER *Tringa ochropus* (w, p)

F Two Kincardine Br. 20 Aug; 2 Powfoulis 20 Aug (RWP) & 1 L. Ellrig 2 Sep (NB).

*WOOD SANDPIPER *Tringa* glareola (Irr)

C One Longcarse 26 Aug (JRC).

*SPOTTED REDSHANK *Tringa erythropus* (p)

F One Kinneil 7 & 12 Jan (RS, BG's). Skinflats Pools: one on 1 & 2 May (GG, AB) & 7 Sep (GG).

GREENSHANK *Tringa nebularia* (w, p)

F Kinneil monthly max: 2 in Jan, 3 in Feb, 4 in Jul, 5 in Aug, 4 in Sep, 7 in Oct, 7 in Nov & 5 in Dec. One Skinflats Pools 22 Jan – 18 Feb, 9 Sep, 8 Oct, 2 in Nov & 3 on 21 Dec. Monthly max. Skinflats Tidal Ex: 6 in Aug, 3 in Sep & 2 in Nov. Other sites max: 6 Powfoulis area 22 Aug & 4 Kincardine Br. 20 Aug. Singles Blackness 10 Feb, 1 Mar & 2 Sep; Bo'ness Harbour 15 Oct; Higgin's Neuk 29 Aug, 25 Nov & 3 Dec & R. Carron, Carronshore 10 Sep,

C One Tullibody Inch 15 Dec.

S 1-2 head of L. Tay 30 Mar-7 May.

REDSHANK (Common) *Tringa totanus* (B, W)

Inland WeBS: 1 in Jan, 0 in Feb, 8 in Mar, 0 in Sep, 1 in Oct, 2 in Nov & 2 in Dec Forth Est. WeBS: 2,207 in Jan, 1,664 in Feb, 2,089 in Mar, 1,800 in Sep, 2,820 in Oct, 2,912 in Nov & 2,526 in Dec.

F Kinneil monthly max: 802 in Jan, 456 in Feb, 857 in Mar, 884 in Apr, 1 in May, 239 in July, c.1,190 in Aug, c.1,300 in Sep, 1,364 in Oct, 1,139 in Nov & 933 in Dec. Skinflats monthly max: 1,124 in Jan, 1,036 in Feb, 1,157 in Mar, 23 in Apr, 12 in Jun, 1,196 in Sep, 1,120 in Oct, 1,369 in Nov & 1,381 in Dec. Other site max: c.200 Blackness 4 Jan; 172 R. Forth (S. Alloa-Kinc. Br.) 19 Nov; c.60 Skinflats Tidal Ex 16 Sep; 98 Bo'ness 8 Dec & 35 Higgin's Neuk 7 Feb.

C Site max: 15 R. Forth (Cambus-Alloa) 29 Jan; 3 R. Forth at Cambus 19 Oct; 2 Alva Floods 11 Mar (GEL) & 1 Blackdevon Wetlands 30 May & 9 Dec.

*S One Kinbuck 12 Mar (CJP); 1 L. Coulter 15 Mar (NB); 2 Cambusmore GP 2 Apr (DT) & 1 Flanders Moss NR 31 May (CC). At the head of L. Tay from 11 Mar to 17 Jul with a max. of 77 on 17 Apr (JPH).

TURNSTONE (Ruddy) *Arenaria interpres* (w)

Forth Est. WeBS: 0 in Jan, 13 in Feb, 6 in Mar, 0 in Sep, 0 in Oct, 9 in Nov & 5 in Dec.

F Bo'ness: 2 on 3 Jan (DOE), 13 on 13 Feb, 9 on 16 Nov & 8 on 17 Dec (WeBS). Blackness: 1 on 25 Jan (NB), 5 on 2 Sep (HS) & 3 on 8 Dec (DMB). Kinneil: 6 on 12 Mar, 1 on 20 & 31 Aug (MVB, DT) & 6 on 9 Sep (DMB).

*S One Cambusmore GP 14 May (DT, 1st record here).

*ARCTIC SKUA (Parasitic Jaeger) *Stercorarius parasiticus* (p)

F Two Blackness 17 Sep & 1 Kinneil 18 Sep (EMcL, DOE).

*SABINE'S GULL *Xema sabini* (V)

F One off Blackness 18 Sep (DOE). This is the 5th record for the UF.

* KITTIWAKE (Black-legged) *Rissa tridactyla* (P, w)

F Two Blackness 22 Oct (AB).

BLACK-HEADED GULL *Chroicocephalus ridibundus* (B, W)

Inland WeBS: 1,005 in Jan, 1,252 in Feb, 460 in Mar, 269 in Sep, 717 in Oct, 764 in Nov & 871 in Dec. Forth Est. WeBS: 1,205 in Jan, 1,434 in Feb, 74 in Mar, 1,216 in Sep, 200 in Oct, 754 in Nov & 806 in Dec. BBS: recorded at 0.1 b/lkm (1997-2017 av: 0.98 b/lkm. Range: 0.1 (2017) to 3.47 (1997) b/lkm). The highest recording rate was on WBBS at 0.73 b/lkm.

F Site max: c.1,300 Skinflats Pools 24 Jan; c.720 Higgin's Neuk 2 Nov; 254 Kinneil 16 Nov & c.250 Upper Kinneil Fm 30 Jan.

C Breeding: 39 aon Fire Station Pool (Alloa) 23 May with 202 ad & 2 large Y visible 17 Jun – veg rampant (NB). Site max: 463 Haugh of Blackgrange 7 Feb & 293 Longcarse 29 Jan.

S Site max: c.110 head of L. Tay 17 Apr.

*LITTLE GULL *Hydrocoloeus minutus* (irr)

F Two Kinneil 31 Jan & 6 Oct (FAC, JRC); 1 Skinflats Pools 9 Sep (DOE).

*MEDITERRANEAN GULL *Larus melanocephalus* (w)

F One off Blackness 17 Sep (EMcL); 1 S. Alloa 28/29 Oct (GG, JSN); 2 Skinflats Pools 15 Nov Skinflats Pools 15 Nov & 1 Kinneil Lagoon 21 Dec (JW).

COMMON GULL (Mew Gull) *Larus canus* (B, W)

Inland WeBS: 1,319 in Jan, 664 in Feb, 389 in Mar, 116 in Sep, 182 in Oct, 289 in Nov & 443 in Dec. Forth Est. WeBS: 134 in Jan, 61 in Feb, 14 in Mar, 266 in Sep, 412 in Oct, 369 in Nov & 49 in Dec. BBS: recorded at 0.19 b/lkm (1997-2017 av: 1.36 b/lkm. Range: 0.18 (2015) to 3.31 (1998) b/lkm). The highest recording rate was on farmland at 0.34 b/lkm.

F Site max: 961 Skinflats fields 26 Nov; 446 L. Ellrig 17 Jan & c.400 Pow Burn (Airth) 3 Dec.

C Site max: c.1,800 Cambus Village Pool 21 Mar & c.370 Meadowend (Clackmannan) 2 Nov.

S Breeding: bird nesting on top of 2 m high fence post in G. Lochay 6 May (CRM); 3 aon Cambusmore GP 11 Jun with min 3 large Y 8 Jul (NB). Site max: c.150 Cambusmore GP 2 Apr; c.150 Ashfield 18 Oct & 124 head of L. Tay 24 Jun.

LESSER BLACK-BACKED GULL *Larus fuscus* (w, b, S)

Inland WeBS: 48 in Jan, 18 in Feb, 493 in Mar, 240 in Sep, 221 in Oct, 62 in Nov & 19 in Dec. Forth Est. WeBS: 5 in Jan, 1 in Feb, 40 in Mar, 57 in Sep, 42 in Oct, 11 in Nov & 0 in Dec. BBS: recorded at 0.75 b/lkm (1997-2017 av: 0.98 b/lkm. Range: 0.53 (2016) to 1.89 (2009) b/lkm). The highest recording rate was in urban habitat at 6.36 b/lkm but it was recorded in all six broad habitat types.

F Breeding: Y from 3 territories food begging Falkirk town centre 17 Jul (CME). Site max: 82 L. Ellrig 2 Sep & 64 Little Denny Resr 10 Oct.

C Breeding: min 12 aon Kelliebank Ind Est (Alloa) 17 Jun (NB). Site max: 95 Longcarse 22 Apr.

S Breeding: 20 aon roofs of Ind Bldgs Braehead, Stirling 27 Jun (CME). Site max: 348 (all ad's) Gartartan (Aberfoyle) 9 Mar & c.100 BoA 15 May.

HERRING GULL (European) *Larus argentatus* (b, W)

Inland WeBS: 803 in Jan, 843 in Feb, 138 in Mar, 24 in Sep, 35 in Oct, 348 in Nov and 860 in Dec. Forth Est. WeBS: 631 in Jan, 185 in Feb, 36 in Mar, 324 in Sep, 454 in Oct, 951 in Nov and 98 in Dec. BBS: recorded at 0.34 b/lkm (1997-2017 av: 0.52 b/lkm. Range: 0.1 (2000) to 4.17 (1999) b/lkm). Recorded in all six broad habitat categories. The highest recording rate was in urban habitat at 1.93 b/lkm. Numbers much reduced in recent years following the closure of open refuse tips and greater recycling of food waste.

F Breeding: 1 Y food begging Falkirk town centre 17 Jul (CME). Site max: 517 Avon Valley, Slamannan 9 Dec; 212 Skinflats fields 26 Nov; 201 Little Denny Resr. 4 Nov & c.120 Higgin's Neuk 18 Sep.

C Breeding: min 2 aon Kelliebank Ind Est, Alloa 17 Jun (NB).

*GLAUCOUS GULL *Larus hyperboreus* (Irr)

F One flew up the Forth off Higgin's Neuk 5 Jan (CRM).

GREAT BLACK-BACKED GULL *Larus marinus* (S, W)

Inland WeBS: 15 in Jan, 9 in Feb, 9 in Mar, 5 in Sep, 5 in Oct, 15 in Nov & 21 in Dec. Forth Est WeBS: 19 in Jan, 2 in Feb, 11 in Mar, 9 in Sep, 4 in Oct, 13 in Nov & 17 in Dec. Recorded in small numbers. Widespread but scarce inland.

F Site max: 11 Skinflats TE 16 Sep; 6 Gardrum Moss 28 Mar & 6 Helix Pond 10 Dec.
C Site max: 10 Longcarse 29 Oct & 6 R. Forth (Fallin-Cambus) 5 Jan.
S Site max: 8 Lake of Menteith 11 Sep; 6 Cambusmore GP 21 May & 4 Carse of Lecropt 1 Jan.

SANDWICH TERN *Sterna sandvicensis* (s, P)

First for year: 2 Kinneil 26 Mar (RSm). Last of year 2 Blackness 25 Sep (RD).

F Site max: c.70 Blackness 18 Sep (DOE); c.50 Skinflats Tidal Ex 16 Sep (DOE); c.30 Skinflats 3 Aug (DMB); 27 Kinneil 17 (JRC) & 15 Kincardine Br 17 Sep (MVB).

COMMON TERN *Sterna hirundo* (S)

First of year: 1 Skinflats Pools 5 May (AB) Last of year Kinneil 14 Sep (DT).

F Site max: c.200 (ad & juv) Skinflats Pools 3 Aug; 24 Kinneil 15 Aug; 15 Blackness 2 Sep & 6 Grangemouth Docks 17 Sep.

*ARCTIC TERN *Sterna paradisaea* (p)

F One Skinflats 7 Jun (AI); 1 Kinneil 1 Aug with 2 on 24 Aug (AIB, DMB) & 1Blackness 20 Aug with 1 on 2 Sep (DMB, HS).

* GUILLEMOT (Common Murre)) *Uria aalge* (s, w)

F 12 Skinflats 12 Feb (MVB).
C One R. Forth at Cambus (DH).
S One dead on the road at Tyndrum 17 Feb (IMcP); 3 L. Iubhair 12 Sep, 1 on 16 Sep with 4 on 25 Sep; 1 - 4 head of L. Tay 16 – 30 Sep; 1 Kirkton Fm 15 & 19 Sep & 6 Oct with 2 on12 Oct (JPH).

FERAL PIGEON *Columba livia* (B, W)

BBS: recorded at 0.67 b/lkm (1997-2017 av: 0.97 b/lkm. Range: 0.29 (2016) to 2.19 (1997) b/lkm). The highest recording rate was in urban habitat at 5.29 b/lkm.

F Max: c.160 Orchardhead Fm. 26 Nov (NS 9184).
C Max: c.250 Craigrie Fm. 10 Jan (NS 9091); c.250 Longcarse 25 Sep & c.120 Gartenkeir Fm., Gartmorn 10 Dec.

STOCK DOVE *Columba oenas* (B, W)

Widely but thinly spread in farmland areas. Usually encountered in groups of <4. BBS: Recorded at 0.03 b/lkm (1997-2017 av: 0.05 b/lkm. Range: 0.01 to 0.12 b/lkm).

F Breeding: min 6 aot Callendar Park16 Apr & pr at a tree hole Hallglen 13 May (CME). Site max: 24 Powfoulis 16 Sep & 15 Kinneil 9 Jan.
C Site max: 19 Blackgrange 8 Jan & 10 Alva 11 Mar.
S Site max: 19 Blairdrummond 22 Jan & 11 Holmhill, Dunblane 19 Feb.

WOOD PIGEON (Common) *Columba palumbus* (B, W)

BBS: recorded at 3.34 b/lkm (1997-2017 av: 3.54 b/lkm. Range: 2.48 (1997) to 4.53 (1999) b/lkm). The highest recording rate was in urban habitat at 8.21 b/lkm followed by 7.09 b/lkm on farmland habitat but was recorded in all six broad habitat types. The 2nd most numerous species on this year's BBS.

F Max: c. 800 S. Bellsdyke 26 Apr (feeding on newly sown cereals); c.750 Higgin's Neuk 5 Jan & c.500 Kersebrock Fm 25 Dec.
C Max: c.100 Longcarse 13 Jan.
S Site max: 10,235 Ashfield 2 Nov (mig. count); c.450 Greenyards (Dunblane) 4 Feb & 77 Auchmore (Killin) 2 Apr.

COLLARED DOVE (Eurasion) *Streptopelia decaocto* (B, W)

BBS: recorded at 0.21 b/lkm (1997-2017 av: 0.26 b/lkm). Range: 0.13 (2014) to 0.48 (2006) b/lkm). The highest recording rate was in urban habitat at 2.43 b/lkm.

F Max: 8 Skinflats 22 Oct.
S Max: 8 Blairdrummond 17 Nov.

CUCKOO (Common) *Cuculus canorus* (B)

BBS: recorded at 0.13 b/lkm (1997-2017 av: 0.09 b/lkm. Range: 0.03 (2009) to 0.14 (2016) b/lkm). Recorded at the highest rate in deciduous etc. habitat at 0.37 b/lkm. First spring records: Singles L. Katrine & L. Venachar 28 Apr (CH, RE) - (7 year range 14 to 28 April). Last record 1 Kinneil 2 Aug (RS).

F One Bonnybridge 14 Jun.
C One Hillfoot Hill 6 May.
S Widespread in 'highland glens' along with the lowland moors and mosses. Site max: 4 Craigruie, Balquhidder 28 May & 3 Flanders Moss 12 May.

*BARN OWL (Western) *Tyto alba* (b, w)

F Singles Lathallan 2 Mar & Kinneil 22 Apr & 6 Sep (RS, DT). 1 Kincardine Br. 25 Nov (RWP).
C No records.
S Breeding: there was 1 aot in a study area around Dunblane / B of A (BD, CSR). Pr + 3Y Kirkton, Strath Fillan 15 Sep (JPH). Max: 6 Flanders Moss SE

11 Dec; 5 R. Teith (Lecropt) 19 Nov & up to 5 Strath Fillan. Singles at: Craigforth 20 Apr; Auchtertyre (Strath Fillan) 18 May; Blairdrummond 23 Jul; head of L. Tay 1 Sep; Hill of Row 6 Sep; R. Forth (Kippen) 22 Sep; Ardnagaul (G. Dochart) 2 Oct; Strath Fillan 13 & 29 Oct, 20 & 29 Nov; Manor Powis 14 Nov & Howlands (NS 7889) 20 Nov (RDG, JPH, DOE, GG, DBr).

TAWNY OWL *Strix aluco* (B, W)

Widespread but under-recorded.

F Recorded from: Bantaskine, Callendar Park, Larbert Ponds.
C No records.
S Recorded from: Argaty, Balquhidder, Blairdrummond Moss, B of A, Dunblane, Doune, Drumloist, Callander, Killin, Lanrick Est., Sheriff Muir & Strathyre.

*LONG-EARED OWL *Asio otus* (b, w)

Breeding: 10 pr's. in the UF (BD, CSR).

*SHORT-EARED OWL *Asio flammeus* (b, W)

Breeding: 6 pr's breeding incl. 1 in the L. Katrine area (BD, CSR). Non-breeding records:

F No records.
C One Hillfoot Hill 16 Jan & 1 Blairdenon Hill 22 Apr (KB, AE).
S 1 Ben Lui 26 Aug (MF).

SWIFT (Common) *Apus apus* (B)

Recorded throughout the area. BBS: recorded at 0.18 b/lkm (1997-2017 av: 0.41 b/lkm. Range: 0.13 to 0.98 b/lkm). The highest recording rate was in urban habitat at 0.86 b/lkm closely followed by conifer at 0.85 b/lkm. First for year: 2 B of A 3 May (DMB) then at Alloa, Dollar, Doune, Dunblane, Falkirk & Stirling 6 May (GG, KB, DOE, CJP, CME, TC) & head of L. Tay 7 May (JPH). 11 year range 24 April to 4 May. Last 2 Stirling Castle 24 Aug (ADM).

F Max: c.30 Dawson Pl. (Bo'ness) 2 Aug.
C Max: c.30 Godfrey Av. (Denny) 18 Jul; 15 Cambus 9 Aug & 10 Tullibody Inch 13 Jun.
S Max: 16 Dunblane Hydro 24 May & 15 Blairdrummond 16 May.

*HOOPOE (Eurasion) *Upupa epops* (p)

C A bird photographed in a Clackmannan garden on 28 Apr is the 5th record for the Upper Forth (A. Bi).
S One in a Tyndrum Gdn then at Kirkton Fm. at 15.00 on 21 Jul was the 6th record for the UF. What was almost certainly the same bird was sighted again at 09.00 at Kirkton Fm then at Crianlarich the following day (JPH, IMcP).

KINGFISHER (Common) *Alcedo atthis* (b, w).

Inland WeBS: 3 in Jan, 0 in Feb, 3 in Mar, 10 in Sep, 6 in Oct, 5 in Nov & 8 in Dec. Breeding in small numbers in suitable habitat throughout the area. More widespread outwith the breeding season.

GREEN WOODPECKER (European) *Picus viridis* (B, W)

F No records.
C Recorded from: Dollar Glen & Hillfoot Hill.
S Recorded from: Aberfoyle, Airthrey, Argaty, Balquhidder, Callander, Br of A, Brig o' Turk, Doune, Drumloist, Dunblane, Gartmore, Gartrenich, G. Finglas, Killin, L's. Ard, Katrine, Mahaick, Rusky & Venachar, Park of Keir, Pendreich (B of A) & Sheriff Muir.

GREAT SPOTTED WOODPECKER *Dendrocopos major* (B, W)

Recorded thinly throughout the area and year. BBS: recorded at 0.08 b/lkm (1997-2017. average 0.07 b/lkm. Range 0.0 (1997) to 0.15 (2012) b/lkm). The highest recording rate was on farmland habitat at 0.16 b/lkm.
F Breeding: ad feeding fledged Y Union Canal, Glen Village 7 Jun (CME).
S Breeding: ad + 1 Y Sheriffmuir Woods 12 Jun (MVB). Max counts: 4 W. Flanders Moss 22 Jun; 4 Brig O'Turk 25 Jun & 4 Cambusmore GP 6 Aug.

SKYLARK (Eurasion) *Alauda arvensis* (B, W)

BBS: recorded at 1.63 b/lkm (1997-2017 av: 1.69 b/lkm. Range: 1.25 (1997) to 2.71 (2000) b/lkm). The highest recording rate was in the mountain & moorland habitat at 3.23 b/lkm where it was the 2nd most numerous species after Meadow Pipit.
F Max: c.430 S. Bellsdyke 4 Oct; c.100 Skinflats Pools 21 Oct & 75 Higgin's Neuk 16 Dec.
C Max: 45 Gartmorn Dam 18 Oct.
S Max: c.50 Carse of Lecropt 4 Nov & c.40 Auchtertyre, Tyndrum 27 Feb.

SAND MARTIN *Riparia riparia* (B)

BBS: recorded at 1.15 b/lkm (1997-2017 av: 0.58 b/lkm. Range: 0.02 (2003) to 1.34 (2009) b/lkm. The wide annual range is largely due to changing colony locations). First for year 10 Blairdrummond Ponds 26 Mar (CJP) (11 year range of 4 Mar to 11 Apr). Last 4 Blairdrummond Ponds 9 Sep (DOE).
F Breeding: c.33 apparently used nests in peat bank, Black Loch (Limerigg) 2 Sep (NB).
C Site max: c.500 Tullibody Inch 24 Aug & c.110 Gartmorn Dam 6 Apr
S Site max: 1,000+ head of L. Tay 23 Apr (JPH); c.80 Blairdrummond Ponds 10 Apr & c.100 Cambusmore GP 11 May.

SWALLOW (Barn) *Hirundo rustica* (B)

BBS: recorded at 1.22 b/lkm (1997-2017 av: 2.18 b/lkm. Range: 1.0 (2016) to 3.53 (2009) b/lkm). The highest recording rate was in urban habitat at 3.5 b/lkm closely followed by farmland habitat with 2.96 b/lkm. First for year: 1 Little Denny Resr. 28 Mar (NB). Last: 3 nr Dunblane 29 Sep (JN). Breeding records please.

F Max: c.50 Skinflats Pools 14 Sep.
C Max: c.3,500 Tullibody Inch 24 Aug (pre roost count).
S Max: c.40 Blairdrummond Ponds 21 Aug.

HOUSE MARTIN (Common) *Delichon urbicum* (B)

BBS: recorded at 0.59 b/lkm (1997-2017 average: 0.75 b/lkm. Range: 0.23 (2016) to 1.29 (2003) b/lkm). The highest recording rate was on farmland at 1.25 b/lkm. More breeding records please. First of year: 2 Callander & 1 Stirling 2 Apr (TC). Last: 3 R. Forth (Kippen) 7 Oct (RJS).

F Max: c.200 Larbert Hosp. 30 Aug (roosting along guttering).
C Max: c.100 R. Forth (Cambus) 31 Aug.
S Max: 45 L. Mahaick 5 Jul.

TREE PIPIT *Anthus trivialis* (B)

BBS: recorded at 0.24 b/lkm (1997-2017 av: 0.09 b/lkm. Range: 0.0 (2004) to 0.24 (2017) b/lkm). This was the highest overall recording rate yet. The highest recording rate was in deciduous wood / scrub etc. habitat at 0.86 b/lkm. First of year: 1 Doon Hill, Aberfoyle 17 Apr (DT). Last: 1 Kinneil 31 Aug (RS).

*F One Laurieston 29 Apr.
C Two Gartmorn Dam 24 Apr.
S Breeding: 18 aot's Tyndrum 3 May (DMB) & 5 aot's Sheriff Muir 30 Apr (DMB). Max: 14 Craigruie, Balquhidder 28 May; 7 W. Flanders Moss path 22 Jun. Widespread to N & W of Stirling, scarcer elsewhere.

MEADOW PIPIT *Anthus pratensis* (B, W)

BBS: recorded at 5.85 b/lkm (1997-2017 av: 5.01 b/lkm. Range: 2.71 (1997) to 7.38 (2016) b/lkm). The highest recording rate was in mountain & moorland habitat at 12.77 b/lkm but was recorded in all habitats except urban. The most numerous species on this year's BBS.

F Max: c.100 Skinflats Pools 22 Sep.
S Max: c.140 Strath Fillan 6 Apr & c.70 The Linns, Sheriff Muir 21 Aug.

*ROCK PIPIT (Eurasion) *Anthus petrosus* (w)

F 2 Kinneil Kerse 14 Jan (JRC); 1 Skinflats foreshore 22 Jan (AB); 1 S. Alloa-Dunmore 6 Feb (DT) & 3 Kinneil 18 Oct (AE).
C 1 Longcarse 18 Nov (DMB) & 1 Longcarse 10 Dec (JRC).

GREY WAGTAIL *Motacilla cinerea* (B, w)

Recorded in small numbers in suitable habitat throughout region. Recorded on WBBS at 0.23 b/lkm. A partial migrant. Inland WeBS: 9 in Jan, 10 in Feb, 41 in Mar, 20 in Sep, 15 in Oct, 9 in Nov and 7 in Dec.

F Breeding: Pr reared 2 broods Union Canal, Glen Village 6 May (CME) & ad + 1 juv Fankerton, Carron Glen 2 Jun (RD). 2 Falkirk Town Centre 1 Apr then through the spring and summer.

S Breeding: Max: 6 aot's G. Beich, L. Earn 17 May (CME). 5 central G. Lochay 2 Aug & 4 Balquhidder Glen 30 Mar.

PIED WAGTAIL *Motacilla alba yarrellii* (B, w)

Recorded throughout the area. BBS: recorded at 0.31 b/lkm (1997-2017 av: 0.35 b/lkm. Range: 0.17 (2013) to 0.77 (1998) b/lkm). Found in all six broad habitat categories but most frequent on WBBS at 0.65 b/lkm closely followed by farmland at 0.61 b/lkm.

F Max: 25 Carron (Falkirk) 1 Jan & 10 Skinflats Pools 10 Sep.

C Max: 35 Blackgrange 8 Jan & 18 Alloa 23 Sep.

S Max: 36 head of L. Tay 28 Sep & 14 Carse of Lecropt 21 Dec.

*WHITE WAGTAIL *Motacilla alba* (p)

F Four Powfoulis 22 Apr & 2 Skinflats Pools 28 Apr (AB).

C Four Longcarse 22 Apr (NB) & 2 Tullibody Inch 25 Apr (DMB).

S Present head of L. Tay 21 Apr - 16 May with a max of 6 on 24 Apr. 12 L. Dochart 2 May (JPH).

WAXWING (Bohemian) *Bombycilla garrulus* (w)

The 2nd part of the 2016/17 'Waxwing Winter'. Many records from several locations throughout the lowland area with the last being 20 at Polmont 4 Apr (BG's).

F Max: 46 Carron 17 Jan, 45 Bonnybridge 30 Mar, 26 Arnothill, Falkirk 5 Mar 22 Bo'ness 7 Jan.

C Max: 6 Dollar 4 Jan.

S Max: c.240 Dunblane 7 Jan & 31 Stirling 6 Feb.

DIPPER (White-throated) *Cinclus cinclus* (B, W)

Recorded on suitable watercourses throughout the region. Inland WeBS: 34 in Jan, 61 in Feb, 43 in Mar, 22 in Sep, 38 in Oct, 34 in Nov and 63 in Dec.

F Site max: 7 R. Carron (M876-Larbert) 21 Jan & 11 Feb.

C R. Devon: Vicar's Br-Tillicoultry monthly max: 23 in Jan, 24 in Feb, 18 in Mar, 9 in Sep, 17 in Oct & 28 in Dec.

S Site max: 8 Allan Water (Ashfield-Dunblane) 3 Dec & 5 L. Lubnaig 10 Dec.

WREN (Eurasion) *Troglodytes troglodytes* (B, W)

Widespread and common. BBS: recorded at 1.96 b/lkm (1997-2017 av: 1.90 b/lkm. Range: 0.78 (2011) to 2.37 (2000) b/lkm). The highest recording rate was in deciduous wood / scrub etc. at 3.79 b/lkm but the rate in all the other habitats was only slightly lower except mountain & moorland where it was 0.36 b/lkm. The 7th most numerous species on this year's BBS.

F Breeding: of 5 nests monitored in Callendar Park only 1 was definitely successful. 3 nests Parkfoot, Falkirk (CME).

DUNNOCK *Prunella modularis* (B,W)

Widespread and common. BBS: recorded at 0.44 b/lkm (1997-2017 av: 0.46 b/lkm. Range: 0.28 b/lkm (2014) to 0.76 b/lkm (2005)). The highest recording rate was in urban habitat at 1.57 b/lkm but recorded in all habitats although at only 0.04 b/lkm on mountain & moorland.

ROBIN (European) *Erithacus rubecula* (B, W)

Widespread and common. BBS: recorded at 1.3 b/lkm (1997-2017 av: 1.2 b/lkm. Range: 0.79 (2011) to 1.52 b/lkm (2004)). The highest recording rate was in conifer woodland at 3.15 b/lkm. Recorded in all six broad habitat categories at good rates apart from mountain and moorland.

F Max: 7 Skinflats Pools 3 Jan.

C Max: 8 Alloa 23 Sep.

S Max: 15 G. Finglas 3 Jun; 12 Blairdrummond 14 Jan & 11 Holme Hill (Dunblane) 19 Feb.

REDSTART (Common) *Phoenicurus phoenicurus* (B)

Found in low numbers mostly to the N & W of Stirling. First spring record: 1 Sheriff Muir 12 Apr (DMB). Last: 1 Sheriffmuir Woods 21 Aug (MVB).

S Breeding: 13 territories Tyndrum 17 May (DMB). Ad with food Killin Marshes 7 Jun & ad + Y there 15 Jun (JPH). Max: 5 W. Flanders Moss 22 Jun & 4 Cambusmore GP 14 May.

WHINCHAT *Saxicola rubetra* (B)

BBS: recorded at 0.1 b/lkm (1997-2017 average: 0.09 b/lkm. Range: 0.01 (2007) to 0.22 (1997) b/lkm). Recorded mostly to the N & W of Stirling. First spring record 4 Gartrenich 4 May (NB). Last Skinflats TE 6 Sep (TC).

F Max: 5 R. Avon, Slamannan 17 Aug.

S Breeding: 4 aot's G. Beich 17 May (CME).

STONECHAT (European) *Saxicola rubicola* (b, w)

BBS: recorded at 0.08 b/lkm (1997-2017 average: 0.06 b/lkm. Range: 0.0 b/lkm (2012) to 0.19 b/lkm (2008)). In 2017 Stonechat continued its recovery after numbers were decimated during the prolonged snow cover of the 2009/10 and 2010/11 winters.

F Max of 2 Skinflats Pools Oct-Dec & 1 Kinneil 3 Jan & 18 Dec.
C Breeding: fledged juv Blackdevon Wetlands 22 Jun (NB). Max: 7 Blackdevon Wetlands 18 Sep.
S Max: 6 Kirkton Fm, Tyndrum 13 Oct; 5 Cauldhame, Sheriff Muir 18 Apr & 5 Edinample 31 Jul.

WHEATEAR (Northern) *Oenanthe oenanthe* (B)

BBS: recorded at 0.16 b/lkm (1997-2017 av: 0.18 b/lkm. Range: 0.07 b/lkm (2004) to 0.3 b/lkm (2015)). The highest recorded rate was on mountains and moorlands at 0.27 b/lkm while the rate of 0.18 b/lkm on farmland was presumably mostly of 'Greenland' passage birds as were birds in lowland areas during late April and early May. First spring record 1 Dumyat 25 Mar (TC). Last 2 Skinflats 22 Oct (AE).

F Max: 4 Powfoulis 22 Apr.
C Max: 4 Longcarse 22 Apr & 3 the Nebit 23 Apr.
S Max: 7 Gleann a' Chlachain, Tyndrum 26 Apr & 4 Kippen Muir (south) 29 Apr.

*RING OUZEL *Turdus torquatus* (b)

F One Skinflats Pools 24 Oct (SWo)
S One Lees Hill 17 Apr (VW); One Craigruie, Balquhidder 29 Apr with 2 on 28 May (DI); 1 Beinn Bhreac 6 May (CW); 2 Cruach Ardrain 9 May (PRG); ♀ Caol Ghleann 26 Apr; singing ♂ Ben Challum 1 Jun; 1 G. Lochay 1 Jul (NMcW); singing ♂ Cam Chreag 20 Jun & 1 Gleann a' Chlachain 18 Jul (JPH).

BLACKBIRD (Common) *Turdus merula* (B, W)

Widespread and common. BBS: recorded at 1.63 b/lkm (1997-2017 av: 2.13 b/lkm. Range: 1.28 (2016) to 2.72 (1999) b/lkm). The highest recording rate was in urban/suburban areas at 5.93 b/lkm but was recorded in good numbers on the other habitat categories except mountain and moorland where it was scarce.

F Breeding: ♀ carrying food at Parkfoot 7 Apr; 3 nests monitored Callendar Park (1 successful) with a successful nest (b2) Falkirk Town centre 15 Jun (CME). Max: 15 Skinflats Pools 5 Jan; 15 S. Alloa – Dunmore 6 Feb.
C Max: 6 Gartmorn Dam 19 Oct.
S Max: 12 Holmhill (Dunblane) 14 Jan & 9 Dec.

FIELDFARE *Turdus pilaris* (W)

Last spring record 3 Balquhidder 30 Mar (NB) was within 10 year range: 25 Mar to 14 May. First autumn record of 1 8 Oct (SWo) was within the 10 year range: 3 Sep to 22 Oct.

F Max: c.1,000 Skinflats 17 Nov.
C Max: 66 Alva 11 Mar.
S Site max: c.1,000 Carse of Lecropt 4 Nov & 264 Ashfield 26 Oct.

SONG THRUSH *Turdus philomelos* (B, W)

Widespread. BBS: recorded at 0.55 b/lkm (1997-2017 av: 0.53 b/lkm. Range: 0.24 (2011) to 0.82 2000 b/lkm). The highest recording rate was in deciduous wood / scrub etc. at 1.17 b/lkm but as with Blackbird, was recorded in all six broad habitat categories in similar numbers except mountain and moorland where it was scarce.

F Breeding: 1 nest Callendar Park failed (CME). 2 singing Lionthorn and 1 singing S. Bantaskine Estate (both Falkirk) 22 Jan; 5 singing Polmont Rd, Laurieston 6 Feb.
S Max: 24 Holmehill (Dunblane) 30 Sep & 12 Drumloist 19 Apr.

REDWING *Turdus iliacus* (W)

Last spring record of 1 Larbert 9 Apr (CME) is within the previous 10 year range: 7 Mar to 1 May. First autumn record of 12 Larbert 16 Sep (AE) is 10 days earlier than the previous 10 year range: 26 Sep to 12 Oct.

F Max: c.300 Skinflats 17 Nov.
C Max: 126 Gartmorn Dam 19 Feb & c.120 Cambus – Alloa Inch 7 Jan.
S Max: 4,915 passage birds Ashfield 19 Oct & c.750 Carse of Lecropt 4 Nov.

MISTLE THRUSH *Turdus viscivorus* (B, W)

Widespread. BBS: recorded at 0.11 b/lkm (1997-2017 av: 0.16 b/lkm. Range: 0.06 to 0.3). Recorded in low numbers on all habitat categories with the highest being conifer at 0.46 b/lkm.

F Breeding: 4 aot's Callendar Park 29 Apr (CME). Max: 15 Skinflats Pools 21 Oct.
S Max: 29 Kippenross (Dunblane) 21 Aug & 14 L. Rusky 5 Oct.

GRASSHOPPER WARBLER (Common) *Locustella naevia* (b)

Widely but thinly spread throughout the area. First spring record 1 CVP 20 Apr (GG), 1 Killin Marshes 28 Apr (JPH). [10 year range of 17 to 27 Apr]. Last: Last 1 Glensburgh 13 Aug (PW).

F Breeding: 3 fledged Y being fed by ad Skinflats Pools 5 Aug (SWo).

SEDGE WARBLER *Acrocephalus schoenobaenus* (B)

BBS: recorded at 0.08 b/lkm (1997-2017 av: 0.11 b/lkm. 0.04 to 0.26 b/lkm. Range: 0.04 (2013) to 0.27 (2012) b/lkm). The highest recording rate was on WBBS at 0.31 b/lkm. Fairly scarce elsewhere, no records from conifer woods. First spring record: 4 Carse of Lecropt & 1 Skinflats Pools 26 Apr (DT, MVB) [10 year range of 21-31 Apr]. Last: 1 Blackdevon Wetlands 26 Aug (RHS).

F Max: 4 Skinflats Pools 5 Aug.

C Max: 8 Tullibody Inch 17 Jun & 8 singing ♂'s Blackdevon Wetlands 22 Jun.

S Max: 6 W. Flanders Moss 22 Jun; 5 Blairdrummond Ponds 7 May & 4 Killin Marshes 13 May.

*REED WARBLER (Eurasion) *Acrocephalus scirpaceus* (b)

Breeding of the species in the Upper Forth area was first confirmed in 2011. First spring record: one Tullibody Inch 7 May (GG). Last 2 Skinflats Pools 5 Aug (SWo).

F Max 3 Skinflats Pools from 12 May-5 Aug (AB, NB, DMB, RS, SWo).

C Max 3 singing ♂'s Tullibody Inch 7 May-13 Jun (GG, JRC, NB, DMB).

BLACKCAP (Eurasion) *Sylvia atricapilla* (B)

Found throughout the area. BBS: recorded at 0.13 b/lkm (1997-2017 av: 0.15 b/lkm. Range: 0.07 (1999) to 0.25 (2012) b/lkm). The highest recording rate was in urban areas at 0.5 b/lkm followed by 0.27 in Farmland and 0.23 in conifer woodland. First spring records: singles Dunblane, Doune – Blair Drummond & CVP's 2 Apr (CJP, FAC, DH). [10 year range 23 Mar to 13 Apr]. Last ♀ CVP 15 Oct (DH). [It is difficult to separate the few over-wintering birds from E. Europe with the genuine summer migrants].

F Breeding: min 24 territories Callendar Park during the season & 4 aot's Hallglen scrub area 13 May (CME).

C Winter records: 1 Alva 31 Jan & 2 Dec (RE).

S Winter records: 1 in Broomridge gdn, Stirling 28 Dec (DT). Max: 10 Blairdrummond Ponds 16 May.

GARDEN WARBLER *Sylvia borin* (B)

Recorded throughout the area in small numbers. First spring record one Kilmahog 17 Apr (MF) [10 year range 14 Apr to 2 May]. Last Skinflats Pools 6 Sep - feeding on Elder berries (AB).

S Max: 4 Gartmorn Dam CP 3 May.

WHITETHROAT (Common) *Sylvia communis* (B)

BBS: recorded at 0.16 b/lkm (1997-2017 av: 0.20 b/lkm. Range: 0.11 (2015) to 0.32 (2000) b/lkm). First spring record 1 Kinneil 27 Apr (DMB) [10 year range 9 Apr to 2 May]. Last: 1 Skinflats 29 Sep (AE).

F Breeding: c/5 Lionthorn, Falkirk 21 May with b/4 4 Jun (CME) Max: 5 Skinflats Pools 20 Aug.

*LESSER WHITETHROAT *Sylvia curruca* (b?)

F One Blairdrummond Ponds 5 May (DOE).

WOOD WARBLER *Phylloscopus sibilatrix* (B)

First spring record 1 Killin Marshes 27 Apr (JPH). [10 year range: 17 Apr to 5 May]. Last 1 Cambusmore GP 6 Aug (DT).

S Max: 5 G. Finglas 3 Jun. Also recorded from: Brig o' Turk, Balameanach Woods (Callander), Dunblane, Flanders Moss, Little Drum Wood, L. Chon & Strath Fillan.

CHIFFCHAFF (Common) *Phylloscopus collybita* (B, w)

BBS: recorded at 0.2 b/lkm (1997-2017 av 0.13 b/lkm. Range: 0.01 (1997) to 0.26 b/lkm (2012)). The highest recording rate was in urban areas at 0.71 b/lkm. Numbers have increased noticeably over the past 20 years and the sp's is now widespread in suitable habitat. A few birds overwinter which makes recording the first spring record difficult. First singing record Alva 4 Apr (RE).

F Winter records: singles Skinflats Pools & Carronshore 12 & 20 Feb with one at Skinflats TE 20 Nov. A bird showing the characteristics of the SSP *tristis* (Siberian Chiffchaff) was at Skinflats Pools 3 Dec (AB, DOE). Breeding: min 16 territories Callendar Park 13 May (CME).

WILLOW WARBLER *Phylloscopus trochilus* (B)

BBS: recorded at 1.82 b/lkm (1997-2017 av: 1.7 b/lkm. Range: 1.15 (2007) to 2.84 (1997) b/lkm). The highest recording rate was in conifer woodland at 1.23 b/lkm closely followed by deciduous wood / scrub etc. at 4.08 b/lkm. Recorded in all six broad habitat categories. The 8th most numerous species on this year's BBS. First of year 1 Cambus 3 Apr (DH). [10 year range 3-18 Apr]. Last: 1 Skinflats Pools 8 Oct (SWo).

F Breeding: 10 aot's Callendar Park in May (CME). Max: 15 Skinflats Pools 20 Aug.

S Breeding: 62 aot's Tyndrum 3 May (DMB). Max: 22 G. Finglas 3 Jun.

GOLDCREST *Regulus regulus* (B, W)

Widespread. BBS: recorded at 0.3 b/lkm (1997-2017 av: 0.48 b/lkm. Range: 0.17 (2009) to 1.07 (2005) b/lkm). As expected, the highest recording rate was in conifer wood at 1.38 b/lkm.

F Breeding confirmed in Callendar Park, Hallglen & Parkfoot, Falkirk (CME). Max: 24 Callendar Park 18 Nov.

S Breeding: confirmed in Stank Glen (Ben Ledi) & around Aberfoyle. Max: 12 Lanrick Est. 11 Dec; 10 Blairdrummond 13 Nov & 10 L. Mahaick 31 Dec.

SPOTTED FLYCATCHER *Muscicapa striata* (B)

First spring record 2 Blairdrummond & 1 Killin marshes 16 May (DOE, JPH). [10 year range: 2 to 20 May]. Last: singles Sheriffmuir Woods & Killin Marshes 21 Aug (MVB, JPH). Found in ever decreasing numbers – mostly to the N & W of Stirling.

*F Two Callendar Park 23 Jul.

*C One Alva Glen 4 Jun.

S Max: five Edinample 31 Jul.

*PIED FLYCATCHER (European) *Ficedula hypoleuca* (b)

S Two singing ♂'s G. Lochay 6 May (JPH).

*BEARDED TIT (Bearded Reedling) *Panurus biarmicus* (b?)

Monthly max at a confidential location: 2 in Jan, 1 in Mar, 1 in Jun, 4 in Nov & 1 in Dec (JRC, DMB, GG).

LONG-TAILED TIT *Aegithalos caudatus* (B, W)

Widespread. BBS: recorded at 0.08 b/lkm (1997-2017 av: 0.14 b/lkm. Range: 0.03 (2009) to 0.38 (1997) b/lkm). The highest recording rate was on WBBS at 0.54 b/lkm. No records from the mountain and moorland, conifer woodland or urban habitat categories.

F Breeding: nests in Falkirk at Callendar Park, Union Canal, Eastburn Park & Hallglen (CME). Max: 20+ Parkfoot, Falkirk 11 Jun & c.20 Skinflats 29 Jul.

C Max: 17 Cambus Pools 8 Jan & 15 Gartmorn Dam 26 Nov.

S Max: 21 Ashfield 16 Nov.

BLUE TIT (Eurasion) *Cyanistes caeruleus* (B, W)

Widespread. BBS: recorded at 1.25 b/lkm (1997-2017 av: 1.56 b/lkm. Range: 0.8 (2016) to 2.51 (2005) b/lkm). Recorded in all six broad habitat categories with farmland being the highest at 2.08 b/lkm.

F Breeding: 3Y fledged from a nest in a traffic light at Hallglen 28 May; two successful nests in the wall of the Union Canal, Falkirk & ad feeding juv in Falkirk Town centre 11 Jun (CME). 10 nest boxes being used in Carron Glen 2 Jun (RD). Max: 11 Woodhead Fm (Bo'ness).

C Max: 27 Tullibody Inch reed beds 2 Dec.
S Breeding: nest with Y head of L. Tay 7 Jun (JPH). Max: 27 Holmehill (Dunblane) 14 Jan & 12 Blairdrummond 14 Jan.

GREAT TIT *Parus major* (B, W)

Widespread. BBS: recorded at 0.77 b/lkm (1997-2017 av: 0.87 b/lkm. Range: 0.41 (2000) to 1.32 (2010) b/lkm). Recorded in all six broad habitat categories with all but mountain / moorland at similar rates and deciduous wood / scrub etc. being the highest at 1.91 b/lkm. 1st song of the year Parkfoot, Falkirk 2 Jan (CME).
F Breeding: nest in hole of wall on the Union Canal (Falkirk) 28 Jun (CME).
S Max: 16 Holmehill (Dunblane) 27 Aug & 10 Blairdrummond 25 Feb.

COAL TIT *Periparus ater* (B, W)

Widespread. BBS: recorded at 0.22 b/lkm (1997-2017 av: 0.49 b/lkm. Range: 0.14 (2009) to 1.00 (2002) b/lkm). The highest rate was in conifer woodland at 1.08 b/lkm.
S 12 Invertrossachs 22 Jan & 15 L. Ard at NN 4800 & 4801 11 Nov.

NUTHATCH (Eurasion) *Sitta europaea* (B)

After the first record in 1999 breeding was recorded in 2009. Now widespread in small numbers.
F Breeding: min of 10 aot's in Callendar Wood with food taken into a nest hole 28 May & 2 family parties 4 Jun (CME). Max: 21 Callendar Park 18 Nov.
S Breeding: pr + 3Y Killin Marshes 2 Jun (JPH). Max: 5 Blairdrummond 14 Jan & 9 Sep. 5 Holmehill, Dunblane 27 Aug.

TREECREEPER (Eurasion) *Certhia familiaris* (B, W)

Widespread in small numbers.
F Breeding: min of 13 territories Callendar Park with 2 confirmed breeding incl. c/5 behind loose bark on a Horse Chestnut tree (*Aesculus hippocastanum*) of which 2 fledged. Also 2 aot's Parkfoot, Falkirk (CME).

*GREAT GREY SHRIKE *Lanius excubitor* (irr)

S One E. Flanders Moss 10 Feb (DOE, DWP).

JAY (Eurasion) *Garrulus glandarius* (B, W)

Widespread in small numbers. Secretive in the breeding season.
F Max: 7 Callendar Park 18 Nov where a min. of 3 pr's in breeding season.
S Max: 9 feeding in a Tyndrum gdn 24 Feb.

MAGPIE (Eurasion) *Pica pica* (B, W)

Widespread in Falkirk and Clackmannan districts plus the Stirling area. Very unusual N of the Highland Line. BBS: recorded at 0.41 b/lkm (1997-2017 av 0.49 b/lkm. Range 0.31 (2003) to 0.75 (2010) b/lkm). Most numerous in urban/suburban habitats at 2.64 b/lkm. No records from the mountain and moorland category.

F Max: c.40 entering a roost in Callendar Park 2 Jan; 15 S. Alloa shore 4 Mar; 12 R. Carron, (Falkirk) 12 Feb & 12 F & C Canal (Camelon) 20 Nov.
C 10 Cambus 4 Dec – around a sheep carcase.
S Max: 18 Glen Rd, (Dunblane) 16 Feb; 11 Carse of Lecropt 27 Dec & 10 Holmehill (Dunblane) 19 Feb.

JACKDAW (Western) *Corvus monedula* (B, W)

BBS: recorded at 2.19 b/lkm (1997-2017 av 2.45 b/lkm. Range: 1.56 (2016) to 3.27 (2005) b/lkm). Recorded in all six broad habitat categories but most frequent in urban/suburban areas at 8.5 b/lkm followed by farmland at 5.38 b/lkm. The 6th most numerous species on 2017 BBS.

S Site max: c.300 Doune 19 Apr & c.350 Blairdrummond 10 Aug.

ROOK *Corvus frugilegus* (B, W)

BBS: recorded at 1.68 b/lkm (1997-2017 av: 3.31 b/lkm. Range: 1.37 (2016) to 6.74) b/lkm). Most frequent on farmland at 4.96 b/lkm followed by urban at 3.64 b/lkm. No records from the mountain and moorland category. The 10th most numerous species on 2017 BBS.

F Max: c.300 Callendar Park 13 Jan.
C. Max: c.270 Orchard Farm / Longcarse 7 Jan.
S Breeding: 346 nests Dunblane in Apr - an increase of 3 on 2016 (MVB). Max: c.1,800 Muirmailing (Plean) 8 Nov.

CARRION CROW *Corvus corone* (B, W)

Ubiquitous. BBS: recorded at 2.51 b/lkm (1997-2017 av: 3.2 b/lkm. Range 2.03 (2014) to 6.22 (2005) b/lkm). Recorded in all six broad habitat categories but most frequent in farmland at 5.47 b/lkm followed by urban/suburban areas at 4.43 b/lkm and WBBS at 3.69 b/lkm. The 5th most numerous species on 2017 BBS.

C Max of 21 Kennetpans 19 Nov.
S Max of c.50 W. Flanders Moss 11 Dec.

HOODED CROW *Corvus cornix* (b, w)

Hybrids with Carrion Crow are common in a fairly narrow transition band running E-W across the area to the N of Callander.

S Most pure birds are found in far northwestern part of the area. 2 at Bracklinn (Callander) 3 Apr were out of the normal range.

RAVEN (Northern) *Corvus corax* (B, W)

Now quite widespread but mostly in small numbers apart from non-breeding groups. BBS: recorded at 0.1 b/lkm (1997-2017 av 0.09 b/lkm. Range 0.01 (2000) to 0.17 (2015) b/lkm).

F Recorded in small numbers (max 2) from: Callendar Park & Cleuch plantation (Falkirk), Gardrum Moss, Skinflats Pools & Skinflats TE.

C Recorded in small numbers (max 5) from: Alva, Blackdevon Wetland, Cambus (feeding on a sheep carcase) 30 Nov, Dollar Glen, & the Ochils.

S Max: c.30 Braes of Doune 20 Nov; 15 L. Mahaick 28 Nov & 11 Gleann a' Chlachain (Kirkton) 18 Jul.

STARLING (Common) *Sturnus vulgaris* (B, W)

BBS: recorded at 2.78 b/lkm (1997-2017 av: 4.9 b/lkm. Range: 2.08 (2016) to 10.70 (2000) b/lkm). Most frequent in urban/suburban areas at 12.57 b/lkm (the 2nd highest rate for any sp's in any habitat) and recorded in all habitat categories. The 4th most numerous species on this year's BBS. 1st fledged juv of the year Skinflats Pools 23 May (NB).

F Breeding: a late nest with Y Polmont 8 Jun (CME). Site max: c.350 Westerglen 14 Jan; c.300 Greenrig 14 Jan; c.150 The Helix 11 Mar & c.120 Grangemouth Old Town 29 Aug. Much mimicry noted incl. the quack of a duck.

C Site max: c.100 Tullibody Inch 13 Jun.

S Site max: c.400 Pirnhall, Stirling 18 Oct; c.250 N. Third Resr. 10 Dec; c.230 R. Forth, Kippen 15 Jan; c.170 Cromlix Ponds 18 Feb & c.100 Kirkton Fm, Tyndrum 22 Jul.

HOUSE SPARROW *Passer domesticus* (B, W)

BBS: recorded at 1.70 b/lkm (1997-2017 av: 1.72 b/lkm. Range: 1.20 b/lkm (2016) to 2.93 b/lkm (2010)). Most frequent in urban/suburban areas at 16.79 b/lkm (the highest rate for any sp's in any habitat) then 3.23 b/lkm on farmland but largely absent elsewhere. The 9th most numerous species on this year's BBS.

F Max: c.40 Skinflats Pools 16 Sep.

C Max: 45 Alloa Tower 6 Aug & 25 Gartmorn Dam 18 Oct.

S Max: c.40 Causewayhead 29 Jul, 35 Killin 6 May & 35 in a Dunblane gdn 5 Aug.

TREE SPARROW (Eurasion) *Passer montanus* (B, W)

BBS: recorded at 0.15 b/lkm (1997-2017 average: 0.10 b/lkm. Range: 0.00 (2002) to 0.28 (2010) b/lkm).

F Max: c.40 Higgin's Neuk 5 Jan; 37 Higgin's Neuk 26 Nov & c.30 Skinflats fields 17 Nov. Numbers have also increased at Bo'ness Meadows since the erection of nest boxes (AIB).
C Max: 16 Blackdevon Wetlands 21 Jan.
S Max: c.30 Carse of Lecropt 11 Sep &16 Kippenross, Dunblane 10 Jan.

CHAFFINCH (Common) *Fringilla coelebs* (B, W)

BBS: recorded at 3.13 b/lkm (1997-2017 av: 3.87 b/lkm. Range: 2.94 (2014) to 5.15 (1998) b/lkm). Recorded in all six broad habitat categories but most frequent in conifer woodland at 8.31 b/lkm followed by deciduous wood / scrub etc at 6.39 b/lkm. The 3rd most numerous species on this year's BBS.

S Site max: c. 480 Greenyards, Dunblane 3 Jan; c.250 Stonehill, Dunblane 5 Jan & c.200 Sheriff Muir 17 Jan.

BRAMBLING *Fringilla montifringilla* (W)

Last spring record: 1 Cambusmore GP 2 Apr (DT). First autumn record: 2 BoA 20 Oct (Trek).

F Max: 3 Strathavon Fm, Slamannan 1 Dec.
C Only record: 1 Ochil Woodland Park 12 Nov.
S Site max: c.100 Greenyards, Dunblane 18 Feb; 35 Drip Moss 14 Feb & 26 Ashfield 26 Oct.

GREENFINCH (European) *Carduelis chloris* (B, W)

Still widely but now thinly spread, numbers have fallen by c.90% in the last decade largely due to the parasite *Trichomonosis gallinae*. BBS: recorded at 0.03 b/lkm – the lowest rate yet in this area. (1997-2017 av: 0.47 b/lkm. Range: 0.03 (2017) to 1.07 b/lkm (2005)). Recorded at the highest rate in urban/suburban areas at 0.43 b/lkm.

F Breeding: 2 fledged Eastburn Dr, Falkirk by 20 Jun (CME). Max: 22 Callendar Park 2 Jan.
C Max: 6 Longcarse 29 Jan.
S Site max: c.60 Lennieston Muir 7 Jan & 55 Dykedale, Dunblane 8 Nov.

GOLDFINCH *Carduelis carduelis* (B, W)

BBS: recorded at 0.43 b/lkm. (1997-2017 av: 0.43 b/lkm. Range: 0.12 (1998) to 1.00 (2010) b/lkm). The highest recording rate was in urban/suburban areas at 1.5 b/lkm. Recorded in all six broad habitat categories.

F Site max: c.350 S. bank R, Forth (Alloa-Kinc. Br) 17 Sep (approx. 2/3rds were juvs); c.100 Skinflats Pools 5 Aug; c.100 Grangemouth Old Town 29 Aug & c.100 Kinneil 31 Aug.
C Site max: c.170 Blackdevon Wetlands & c.100 Cambus Village Pools 8 Sep.
S Site max: 96 Berryhill, N. Third 16 Sep; c.60 Newton Crescent, Dunblane 7 Nov; c.60 Bannockburn 27 Jan & c.50 Strath Fillan 15 Oct.

SISKIN (Eurasion) *Spinus spinus* (B, W)

BBS: recorded at 0.2 b/lkm (1997-2017 av: 0.33 b/lkm. Range: 0.1 (2000) to 0.75 (1997) b/lkm). As would be expected, the highest recording rate was in conifer woodland at 0.62 b/lkm closely followed by deciduous etc. at 0.51 b/lkm. Recorded in all six habitat categories this year.
F Site max: 52 Kingseat Pl gdn 11 Mar.
C. Max: 8 Gartmorn Dam 14 Oct.
S Site max: c.60 Newton Crescent, Dunblane 31 Mar; 59 Eas Gobhain, Callander 5 Dec; c.50 by R. Teith, Callander 14 Nov & 45 by R. Forth, Stirling 9 Jan.

LINNET (Common) *Linaria cannabina* (B, W)

BBS: recorded at 0.13 b/lkm (1997-2017 av: 0.27 b/lkm. Range: 0.05 (2005) to 0.83 (2006) b/lkm). Essentially a farmland bird where it was recorded at 0.34 b/lkm.
F Site max: c.550 Skinflats Pools 14 Jan; c.300 S. Alloa-Dunmore 16 Jan; c.250 S. Alloa-Kinc. Br 17 Sep & c.170 Kinneil 27 Jan.
C Max: c.70 Cambus 24 Sep.
S Max: c.300 Stonehill 5 Jan.

TWITE *Linaria flavirostris* (b, W)

F Site max: 95 Higgin's Neuk area 16 Dec & 70 Skinflats TE 2 Jan.
C Max: 6 Cambus Pools 7 Feb & 2 Longcarse 17 Nov.
S Breeding season: max 3 Strath Fillan area 2 May–8 Aug (JPH) & 2 G. Finglas 23 Apr. Max: c.30 Drip Moss 14 Feb.

LESSER REDPOL(Common) *Acanthis cabaret* (b, W)

BBS: recorded at 0.19 b/lkm (1997-2017 av: 0.10 b/lkm. Range: 0.01 (2008) to 0.35 (2015) b/lkm). The highest recording rate on BBS was in the deciduous etc. habitat at 0.58 b/lkm with no records from conifer woodland this year.
F Max: 12 Larbert House Loch 21 Apr.
C Max: 3 Gartmorn Dam 14 Oct.
S Site Max: c.300 Touch 9 Dec; c.130 Cambusmore 5 Dec & c.40 Invertrossachs 22 Jan.

CROSSBILL (Red) *Loxia curvirostra* (b, W)

BBS: recorded at 0.11 b/lkm (1997-2017 av: 0.08 b/lkm. Range: 0.00 (2010) to 0.56 (2012) b/lkm). As expected, the highest recording rates were in conifer woodland (1.92 b/lkm) with the only other birds recorded on farmland.

F Max: 4 Callendar Park 18 Jun.
C No records.
S Max: 20 Scout Head plantation 31 Jul; 16 Kingshouse, Balquhidder 16 Aug. Recorded in small numbers at several other sites.

BULLFINCH (Eurasion) *Pyrrhula* (B, W)

Recorded in low numbers in the lowlands. BBS: recorded at 0.05 b/lkm (1997-2017 av: 0.06 b/lkm. Range: 0.01 (2003) to 0.12 (1998) b/lkm).

F Max: 10 Gardrum Moss 8 Jan & 8 Bo'ness 8 Dec.
C Max: 8 Gartmorn Dam CP 12 Oct.
S Max: 22 Sheriff Muir 17 Jan; 12 Invertrossachs 1 Jan & 10 Braes of Doune 7 Jan.

*HAWFINCH *Coccothraustes coccothraustes* (v)

S 3 Crianlarich 21 Feb (RDH); 1 Argaty 8 Nov (DOE); 1 Ashfield 8 Nov (CRM) & 1 Blairlogie 10 Nov (JRC).

*SNOW BUNTING *Plectrophenax nivalis* (W)

C One Myreton Hill 14 Jan (GG) & 1 Wood Hill 17 Nov (AE).
S 58 Gleann a' Chlachain 1 Dec & 48 Caol Ghleann 27 Jan (JPH); c.40 G. Kendrum 3 Mar (DJC, DOE); 5 Kirkton Glen & 5 Strathyre 5 Dec (DOE); 5 Gleann a' Chlachain 9 Feb (JPH). Singles Beinn Stacath 19 Feb (GG); Beinn Dubhchraig 20 Apr (AMcG) & 1st yr ♂ Nr E. Frew 27 Apr (DR).

YELLOWHAMMER *Emberiza citrinella* (B, W)

BBS: recorded at 0.42 b/lkm (1997-2017 av: 0.46 b/lkm. Range: 0.08 (2003) to 0.74 (2010) b/lkm). Recorded in all six broad habitat categories but, as would be expected, most frequent on farmland at 1.71 b/lkm.

F Breeding: 3 aot's Lionthorn, Falkirk (CME). Site max: c.30 Skinflats fields 29 Dec.
C Max: 17 Gartmorn Dam 19 Feb & 17 Longcarse 25 Feb.
S Site max: c.40 Carse of Lecropt 29 Jan & 34 Blair Drummond 14 Jan.

REED BUNTING (Common) *Emberiza schoeniclus* (B, W)

BBS: recorded at 0.22 b/lkm (2004-2017 av: 0.23 b/lkm. Range: 0.10 (2005) to 0.45 (2006) b/lkm). Recorded fairly evenly in all habitat categories except conifer woodland but was most frequent on WBBS at 0.58 b/lkm.

F Breeding: 4 singing ♂'s Larbert House Loch 12 Jun (CME). Site max: 10 Skinflats fields 29 Dec.

C Breeding: 16 singing ♂'s Blackdevon Wetlands 22 Jun (NB); Max: 15 Longcarse 24 Sep & 15 Braeleny 19 Dec.

S Site max: c.40 Carse of Lecropt 10 Dec.

Clifford J. Henty (1934 – 2018)

The sad news of Cliff's passing on the 25th June, 2018 at the age of 84 closed the curtain on the doyen of bird recording in the Scottish Ornithologists Club's (SOC) Upper Forth area. Cliff was born and brought up on the English South coast where his interest in birds was born and developed. After gaining a PhD in behavioural ecology at Oxford he took up a post in the Psychology Department at Stirling University in the early 1970's.

His early years saw him travel far and wide on ornithological forays, but he was also very active in local birding activities – notably with the local branch of the SOC where, amongst many initiatives, he took a leading role both in the designing and running of the Birds of the River Devon Survey as well as providing much sage advice in the early years of The Birds of Clackmannanshire project.

His contribution to the Forth Naturalist and Historian's Journal was immense: submitting several papers over the years, starting with the first issue and including the esoteric 'Nocturnal Migration in Southwest and Central Scotland Detected by Moonlight' (migration being a particular interest of his), He compiled and edited the annual Bird Report for 29 years from 1974 (the first) to 2002 before finally handing on the baton. However, it is as a friend and birding companion that those who knew him will remember him for his gentle humour and quiet dispensing of knowledge made him an ideal companion.

Neil Bielby (Sept 2018)

DUNBLANE AND KIRKTON WEATHER REPORTS, 2017

Neil Bielby and John Holland

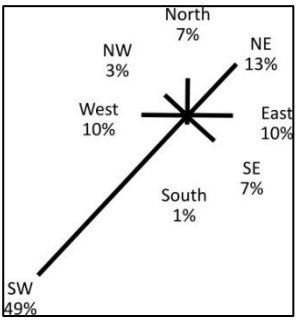
The Dunblane weather station is in my suburban back garden in Ochiltree, Dunblane. This is situated 50 metres to the East of the Dunblane Hydro ridge, 100 metres above sea level., in a shallow, sheltered valley (G.R. NN 78990143).

I have been recording the weather since 1995 and all averages etc. refer to the last 23 years. (Note: because there is much variation from year to year in Britain in the parameters used to define climate, climatological averages are usually taken over periods of 30 years for temperature and 35 years for rainfall. Therefore, all averages in this report should be viewed with some caution). I am indebted to Dr. John P. Holland for providing Met Office and additional weather records from Kirkton Farm, Strathfillan (NN 359283; 170 m a.s.l.). Weather recording began in 1991 at Kirkton Farm and means etc. for this site date from that year. The data from Kirkton allows for some interesting meteorological comparisons between the far north-west and central areas of our region.

Daily rainfall (> 0.2 millimetres), maximum and minimum temperatures, barometric pressure, cloud cover, wind direction and speed (Beaufort scale) are recorded. All except the maximum daily temperature are recorded at 09.00 hours. A brief description of the day's weather is also noted along with exceptional and unusual weather phenomena across the UK. Unless indicated otherwise, daily (24 hour) rainfall amounts are measured from 09.00 hours on the date mentioned until 09.00 hours the following morning.

2017 in **Dunblane** was slightly warmer and noticeably drier than average. The mean temperature of 8.68°C was 0.2°C above the norm with precipitation of 941.1 millimetres (37.1 inches) being 185.6 millimetres (16%) below the mean. The wettest month was August with 116.5 millimetres whilst the driest was April with 27.0 millimetres. The warmest month was July (mean temp. 14.75°C) and the coldest December (mean temp. 1.72°C). The highest recorded temperature was 28.0°C (26th May) and the lowest -9.78°C (10th Dec.). There were 66 air-frosts (mean 70) while snow lay on the ground at 09.00 hours on 18 occasions (mean 21). Temperatures of over 25°C were recorded on 3 days (two in May and one in July). There were 210 (58%) 'rain days' (mean 209) and the highest 24 hour total was 22.0 millimetres measured at 09.00 hours on 22nd of February. The average barometric pressure was 1012.2 mb (mean 1011.3 mb) with a high of 1037 mb (12th Feb.) and a low of 978 mb (23rd Nov.). The number of days with 100 % cloud cover at 09.00 hours was 188 (52 %).

Figure 1. Wind Direction, Dunblane, 2017



Due to the sheltered position of the weather station (detailed above) it receives less wind than more normally exposed locations and the number of calm mornings (09.00 hours) was 200 (55 %). However, winds often developed during the day and Figure 1 shows the percentages from which they blew throughout the year. Turning to the seasons: winter (Dec. 2016 – Feb. 2017) was milder (+1.48°C) and slightly wetter (+8 %) than average. Spring (Mar. – May) was warmer (+1.06°) and drier than the norm (-11 %). Summer (June – July) was cooler (-0.56°C) and wetter (+17 %) while autumn was very slightly warmer (+0.05°C) and wetter (+11 %) than average. Met Office UK maps showing unusually low rainfall for January and April can be found on plates D1 & D2, pages 189 and 189.

January was a little milder but much drier and calmer than normal. The mean temperature of 2.61°C was 0.28°C above the average with a high of 9.8°C (17th. 14.2°C Plockton, 25th) and a low of -4.7°C (13th. -10.1°C Braemar, 30th). There were 16 air-frosts (mean 14) while snow lay on the ground at 09.00 hours on four occasions (mean seven). Precipitation of 42.6 millimetres was only 35 % of the average with measurable amounts on 13 days (mean 20). It was the 2nd lowest at this station after 29.3 millimetres in January 1997. The average barometric pressure was 1019 mb (mean 1008) with a high of 1035 mb and a low of 999 mb. Scotlandwide, precipitation was only 53% of the norm while it was the third sunniest January dating back to 1929 with 135% of average sunshine.

It was mostly sunny and cold for the first 4 days (-7.0°C, 4th). The high pressure system then produced misty, murky and calm conditions for the next 3 days. Strong westerly winds on the 11th blew over a lorry on the Forth Road Bridge at 02.00 hours after the driver ignored the 'closed to high sided vehicles' signs. The bridge was closed for the rest of the day and the driver was charged with various motoring offences. Regular snow showers during the night of the 11th / 12th resulted in 5 centimetres (2 inches. 18 centimetres Tulloch Br, 13th) of lying snow at 08.00 hours on the 12th with snow showers that morning depositing another centimetre. Overnight frosts (-4.7°C, 13th) and clear skies on the 13th and 14th gave perfect winter weather before a rapid thaw took place on the 15th. A high pressure system then built over the UK (1035 mb, 19th) but instead of sunshine our area, along with much of Scotland, was blanketed in cloud. It was mostly dry, calm and mild with a high of 10.1°C (17th). Dense fog persisted all day on the 21st. The high pressure and associated calm weather

persisted until the 28th when a weak front from the NW produced some light sleet and wet snow which only just settled. Rain during the daylight hours of the 31st confirmed a change to much more changeable weather.

February was milder and a little wetter than the norm with the mean temperature of 4.21°C being 1.15°C above the average making it the 2nd mildest February at this station after 6.99°C in 1998. There were only five air-frosts (average 13) which equals the previous low number (1998). The maximum day temperature was 11.8°C (15.4°C Inverbervie 20th) with a minimum night temperature of -4.3°C (11th). Precipitation of 117.8 millimetres (112.7 millimetres East Scotland; 141.3 millimetres Scotlandwide) was 15 % above the norm with measurable amounts on 21 days (average 17) while snow lay at 09.00 hours on 5 mornings (average 5). The mean barometric pressure was 1010.0 mb (average 1009 mb) with a high of 1037 mb and a low of 981 mb. UK wide, the mean temperature of 5.3°C was 1.6°C above 1981-2010 mean making it the 9th warmest February since 1910. The highest temperature in the UK was 18.3°C at Kew Gardens (London, 20th) with the lowest being -9.8°C at Altnaharra (Sutherland, 11th). 50.2 millimetres of rain fell at Cluanie Inn during the 24 hours ending at 09.00 hours on the 22nd.

A south-westerly airstream brought rain most days during the first week of the month culminating in 18.3 millimetres in the 24 hours ending at 09.00 hours on the 7th. Gale force winds on the 6th (gusts of 82 mph on S. Uist) caused most ferry services in western Scotland to be cancelled. A thin covering of snow that morning heralded a change to much colder weather as yet another continental high pressure system (1037 mb, 12th) introduced biting north-easterly winds. These brought snow flurries from the 10th – 12th although little settled. A south-westerly airstream pertained from the 16th bringing milder, wetter and windier weather culminating in storm 'Doris' which deposited 10 cm (4 inches) of snow during the morning of the 23rd causing some chaos on the roads including the M80 being closed at the Castlecary Arches due to accidents. Several schools were also closed across the Central Belt. Further afield, strong winds (94 mph, Capel Curig) around the depression (982 mb) caused quite a bit of destruction – chiefly across N. Wales and the Midlands where two people were killed by falling trees and many flights were cancelled. Rain and rising temperatures on the 24th caused a rapid melt resulting in flooding in low lying areas – notably in the fields below Alva where a mini loch formed. The final 2 days of the month were mostly sunny and calm in the Central Belt although storm 'Ewan' brought snow to the borders during the afternoon of the 27th stranding 30-40 cars on the A68.

March was milder and wetter than normal with the mean temperature of 5.92°C being 0.96°C above the average. The maximum temperature recorded was 17.7°C (26th) and the lowest -4.2°C (1st). There were 8 air-frosts (average 11). The night high of 10.0°C was the third warmest for March after 10.5°C in

2000 and 2005. Precipitation of 107.4 millimetres was 40 % above the average with a daily high of 16.0 millimetres (20th). Snow lay on the ground at 09.00 hours on two occasions. Across Scotland the mean temperature was 1.3°C above the long-term average with precipitation close to normal. The highest temperature of the month was 20.6°C at Cromdale, Moray (26th) with the lowest being -8.6°C at Dalwhinnie (22nd). The wettest 24 hours was at Eskdalemuir with 46.8 millimetres (30th) and the windiest in the Northern Isles on the 14th with gusts reaching 77 mph.

The first 3 days of the month were mostly sunny and dry but rain during the night of the 3rd / 4th heralded the start of a series of low pressure systems which predominated until the 23rd. These brought rain of varying amounts most days with a fall of heavy, wet snow during the morning of the 21st (7 cm Penicuik). This only lasted for 2 days to be followed by a high pressure system (1034 mb, 24th). The weekend of the 25th / 26th was cloudless, calm and warm with temperatures reaching a year high of 17.7°C (26th). The final 4 days of the month saw a return to wetter, unsettled conditions.

April was a little warmer but much drier than the norm. The mean temperature of 8.3°C was 0.49°C above the average with a day high of 16.4°C (27th) and a night low of -3.8°C (18th). There were 4 air-frosts (mean 5) and 2 ground frosts. Rainfall of 27.0 millimetres was only 44 % of the average and the 3rd lowest April amount after 21.5 millimetres (1995) and 25.6 millimetres (2007). 81 % of the rain fell in one 24 hour period: 21.8 millimetres (3rd). The average barometric pressure of 1020 mb was 8 mb above the norm. The mean Scottish temperature was 0.6°C above the long-term average with a high of 19.8°C at Oyne, Aberdeenshire (8th) and a low of -6.2°C at Cromdale, Morayshire (18th). Precipitation was 70 % of average with NW Scotland being the wettest part where 58.8 millimetres of rain fell at Achfary, Sutherland (11th). A gust of 77 miles per hour was recorded in Shetland (5th) while Fair Isle had 13.3 hours of sunshine (28th).

After heavy rain during the evening of the 3rd (21.8 millimetres) a building high pressure system produced a spell of dry weather which lasted for 9 days until the 13th. However, sunshine was sporadic and temperatures were around the norm for the time of year. Largely sunny days with the occasional shower followed before another high pressure system (1034 mb, 18th) built over the country. Again, sunshine was patchy and temperatures were around the norm for the time of year. The dry conditions continued until the month end with no measurable rain from the 18th. A strong, unstable northerly airstream on the 24th and 25th saw a couple of night frosts but these were not sharp enough to worry gardeners. Further North was not so fortunate with a frost of -6.2°C at Cromdale, Morayshire (18th) which also received 12 cm of snow (25th).

May was warmer and drier than the norm with the mean temperature of 12.61°C being 1.6° above the average. The maximum temperature was 28.0°C (26th) with a low of 1.8°C (5th). Rainfall of 48.7 millimetres was only 70 % of the average with measurable amounts on 12 days (average 16). Mean barometric pressure of 1017 mb was 4 mb above average with a high of 1034 mb and a low of 999 mb. Scotlandwide, the mean temperature was 1.8°C above the LTA making this the 2nd warmest May (after 2008) in a series from 1910. It was also the 3rd sunniest since 1929. Rainfall was 63 % of the average.

At the start of the month barometric pressure built again (1034 mb, 4th) thus prolonging the unusual spell of dry weather. A year high of 18.2°C was recorded on the 6th (21.0°C Achnagart (Sutherland) 3rd) when the minimum temperature in Braemar was -5.0°C. Although it was mostly sunny a cool E wind developed each day until the 8th which resulted in a marked E - W temperature gradient. The 11th saw another year high temperature of 20.2°C (21.9°C Drumnadrochit, 12th) but the unprecedented 24 day spell of dry weather was brought to an end with some light showers the following day (12th - the previous longest spell at this station was 19 days). Gardens received some much needed rain with 9.6 millimetres falling on the 13th. The unsettled weather lasted until the 24th when building high pressure (1024mb, 25th) introduced warm air from the south. This pushed temperatures to a year high of 28.0°C (29.4°C Lossiemouth, 26th). Moist, humid, thundery air on the 27th brought rain in the afternoon but this station escaped lightly with only 1.6 millimetres. In contrast, there was localized flooding in parts of Lanarkshire and in Cupar, Fife. The final days of the month comprised of two sunny and two damp days as a spell of more unsettled weather developed.

June was slightly warmer but wetter than the norm. The mean temperature of 14.29°C was 0.28°C above the average with a daytime high of 23.4°C (19th) and a night low of 5.0°C (3rd). The maximum daytime temperature of 23.4°C was the 2nd lowest for June at this station (after 21.8°C in 2012) while the average night low of 10.39°C was the 3rd highest after 10.69°C (2014) and 10.44°C (2005). Total rainfall of 103.9 millimetres was 30% above the June average with measurable amounts on 19 days (av. 15). Across Scotland it was the wettest June since the start of records in 1910 with 178 % of average rainfall. Average barometric pressure of 1009.0 mb equaled the previous low in 2012 as did the minimum pressure of 989 mb. The following UK monthly extremes were: max. temp. 34.5°C Heathrow (21st); min. temp -2.3°C Altnaharra (8th) and 112.4 millimetres of rain fell at Torwinny, Moray (6th).

The unsettled weather continued but rainfall amounts were moderate. The first electrical storms of the year occurred during the afternoon of the 3rd. A wet week followed as Atlantic depressions deposited 60.5 millimetres of rain from the 4th – 10th with 26.2 millimetres on the 6th (37.8 millimetres Strathallan). Strong winds accompanied the rain on the 6th and there were two

deaths due to trees falling on cars – one in Perthshire and the other in Hampshire. There was also much localized flooding and both the Edinburgh trams and the Inverness to Aberdeen rail line were affected. The unsettled weather continued until the 16th when a developing ridge of high pressure brought higher temperatures from the south. It remained mostly overcast but breaks during the afternoon saw temperatures rise to 22.9°C. The unsettled theme returned on the 23rd as more Atlantic weather systems brought some windy weather but not much rain until the 27th when it persisted all day. Another day of rain on the 29th (10.8 millimetres) was accompanied by NE 3-4 winds which kept the maximum temperature down to a month low of 10.8°C.

July was cooler and slightly drier than normal. The mean temperature of 14.75°C was 1.03°C below the average with the mean daily high of 18.85°C being 1.98°C below the norm. A monthly high of 25.1°C was recorded on the 24th while a night low of 5.5°C occurred on the 12th. Rainfall of 82.0 millimetres was 92 % of the average with measurable amounts on 22 days (mean 16). The average barometric pressure of 1011 mb was 2 mb below the norm for the month. The following UK monthly extremes were: max. temp. 32.2°C Heathrow (6th); min. temp. 0.1°C Altnaharra (1st); 79.0 millimetres of rain Okehampton, Devon (30th) and a gust of 71 mph was recorded at the Needles, Isle of Wight (28th). The first few days of the month were quite mixed with some rain on the first 5 days but also sunny spells. Two dry and sunny days were then followed by very mixed weather for the rest of the month with rain most days although amounts were mostly moderate. There was a welcome brief dry spell from the 16th to the 18th when monthly temperatures in Scotland peaked at 27.4°C (Kinlochewe).

August in Dunblane, much like the rest of Scotland, was cooler and wetter than the norm. The mean temperature of 14.13°C was 0.99°C below the average with a high of 21.2°C (3rd. 24.1°C Threave, 22nd) and a low of 5.5°C (13th). The rainfall total of 116.5 millimetres was 32 % above the average making this the wettest August since 2012 and the wettest month of the year. The highest 24 hour total was 19.0 millimetres (14th) with measurable rainfall on 20 days (mean 16). Average pressure was 1012 mb with a high of 1024 mb and a low of 994 mb. Some UK monthly extremes were: max. temp. 29.3°C Frittenden, Kent (29th); 76.4 millimetres of rain on South Uist (22nd) and a gust of 66 mph was recorded at the Needles, Isle of Wight (18th).

A very wet start to the month with 28.0 millimetres in the first 2 days and 45.9 millimetres in the first 7 days. A welcome spell of drier and warmer weather then followed but this was soon replaced by further unsettled conditions as a succession of Atlantic lows crossed the country. This gave some rain almost every day with the 14th being particularly wet (19.7 millimetres).

The unsettled theme continued with an electrical storm in the early hours of the 23rd and a day of rain producing 17.6 millimetres on the 25th. The night of the 27th / 28th was particularly warm with a minimum temperature of 15.8°C (17.0°C Grangemouth).

September weather was very close to the norm with the mean temperature of 12.2°C being only 0.06°C below the LTA and the total rainfall of 98.9 millimetres being 8 % above the LTA. The mean minimum temperature was 8.41°C with a low of 1.5°C (17th) while the mean high was 15.99°C with a high of 18.9°C (1st. 20.6°C Kinloss, 3rd). There were 19 'rain days' (mean 16) with the highest 24 hour total being 16.6 millimetres (10th). The average pressure was 1009 mb (mean 1014 mb) with a high of 1023 mb and a low of 989 mb. Some UK monthly extremes were: max. temp. 24.0°C Hawarden, Clwyd (4th); min. temp. -1.2°C Altnaharra (22nd); 64.0 millimetres of rain at Cullen, Morayshire (12th) and a gust of 83 mph was recorded at the Needles, Isle of Wight (12th).

Unsettled with some rain almost every day until high pressure developed from the 14th. It rained all day on the 4th, 7th and 10th. The barometric pressure dropped to a low of 977 mb (11th). The generally overcast, often damp weather, was interrupted on the 19th which was a day of unbroken sunshine in very clear air after early autumnal mist quickly evaporated. The unsettled theme persisted until the month end with some rain most days and even hail during a heavy convection shower on the 30th.

October was warmer and drier than average. The mean temperature of 10.05°C was 1.42°C above the average with a high of 16.5°C (15th) and a low of -3.1°C (30th). There was one air and one ground frost. Rainfall of 87.0 millimetres was 31% below the average with measurable amounts on 21 days – the same as the mean. The average barometric pressure of 1010.0 mb was also equal to the mean. Some UK monthly extremes were: max. temp. 23.5°C Manston, Kent (16th); min. temp. -5.0°C Tulloch Bridge (30th); 90.4 millimetres of rain at Alltdearg Ho., Skye (10th) and a gust of 90 mph was recorded at Capel Curig, Wales (16th).

The first 4 days were unsettled with 26.7 millimetres of rain, quite windy at times and only a little sun. A brief ridge of high pressure produced plenty of sunshine during the following 3 days. A south-westerly airstream predominated from the 8th bringing mild, damp air across Scotland. Temperatures peaked at 16.2°C (13th). This area escaped relatively lightly as storm 'Ophelia' hit Britain during the early hours of the 17th with gusts of 70 mph through the Central Belt. However, by dawn, these had moderated to SW 4-5 easing further as the day progressed. Ireland, especially the SW, bore the brunt with 100 mph winds causing much damage and killing three people. Dumfries and Galloway was the worst affected part of Scotland with fallen trees blocking many roads. The often wet, autumnal weather continued until

the 25th when high pressure (1031 mb, 27th) brought more settled and drier conditions along with the first ground frost of the winter (27th). This was soon followed by the first air frost: -3.1C on the morning of the 30th.

November was colder, sunnier and much drier than usual. The mean temperature of 3.41°C was -1.16°C below the average with a maximum daytime high of 12.3°C (1st) and a night low of -4.4°C (25th). There were 14 frosts (average nine) and two ground frosts. Precipitation of 54.2 millimetres was only 49 % of the average with measurable rain on 17 days (mean 20). Snow lay on the ground at 09.00 hours on 2 days. The average pressure was 1011 mb (mean 1008) with a high of 1022 mb and a low of 978 mb. The Scottish max. and min. temperatures were: 16.2°C Aboyne (1st) and -6.0°C Braemar (6th). The UK monthly extremes were: max. temp. 16.8°C Chivenor, Devon (2nd); min. temp. -6.9°C Cumbria (30th); 73.6 millimetres of rain at Hazelrigg, Lancashire (22nd), a gust of 84 mph at Capel Curig, Wales (22nd) and the depth of snow at Fettercairn, Kincardineshire was 10 cm (30th). The month continued where October finished with some good sunny days, little rain and cooler weather which lasted until the 21st when rain all day heralded a change to much wetter weather. The 2nd was a perfect late autumn day of calm, unbroken sunshine. There were occasional frosts with -3.6°C (6th) being the coldest of the winter to date while a dusting of snow above 700 m. on the 5th was the first of the winter. The hills were snow-capped above 3,000 feet on the 12th when there was a cold northerly wind. It was warmer during the night of the 13th/14th than either day reaching 10.9°C at 02.00 hours. There was a short spell of wet, 'Atlantic' weather from the 20th – 23rd with 20.2 millimetres deposited during the 21st and 22nd.

The NW of England fared much worse with 18 flood alerts as homes in both Lancashire and Cumbria were inundated, their occupants having to be rescued. 43.0 millimetres (1.7") fell during the 22nd in Lancashire while 88.9 millimetres (3.5") fell at Shap in 36 hours. The temperature during the night of the 21st / 22nd rose to 12.4°C in comparison to highs of 9.2°C and 5.9°C respectively during those days. Barometric pressure fell to a low of 978mb early on the 23rd. A snow shower at midday (24th) heralded a return to colder conditions with the light covering of wet snow lying until the 26th. A front brought rain that night to be followed by a northerly airstream which lasted until the month end bringing night frosts and at times, a bitterly cold northerly wind. This brought snow to Scotland North of the Highland Fault, to the SE of Scotland and patchily to about 50 % of England. This area remained snow free as it often does in snow-laden northerlies.

December was colder, sunnier and drier than the norm. The mean temperature of 1.72°C was 0.43°C below the average with a high of 11.2°C

(23rd) and a low of -9.8C (10th). There were 18 air-frosts (average 14). Precipitation of 74.9 millimetres was 66 % of the average with measurable rain on 14 days (mean 19) while snow lay on the ground at 09.00 hours on five occasions (mean six). The UK monthly extremes were: max. temp. 15.2°C Cassley, Sutherland (18th); min. temp. -13.0°C Dalwhinnie (11th); 71.0 millimetres of rain at Achnagart, Ross & Cromarty (6th), a wind gust of 93 mph on Fair Isle (7th) and snow depth of 31 cm at Sennybridge, Wales (11th).

A mixed month with alternating mild and cold spells. Named storm 'Caroline' brought storm force winds to the northern half of Scotland on the 7th. Gusts of 90 mph were recorded with one of 116 mph on the summit of Cairngorm. Many ferry services were cancelled with the Scrabster to Stromness ferry, unable to dock, having to sit out the storm in Scapa Flow. Many schools were closed in the Western and Northern Isles where c.20,000 homes had their electricity supplies cut. The northerly winds accompanying the storm brought heavy snowfalls to the North with the usual high-level roads closed. The Central Belt escaped relatively lightly with only force 4-5 winds and no snow at low levels although the hills were white on the morning of the 8th. Temperatures plummeted with nightly frosts from the 8th until the 17th reaching a low of -9.8°C on the 10th (-12.0°C L. Glascarnoch, 11th) when the maximum daytime temperature was only -3.1°C. The reward was virtually unbroken sunshine and light winds on the 8th - 12th and the 15th - 16th. In between we had rain and sleet on the 13th followed by some short spells of wet snow on the 14th. Again, we missed the worst of the weather as Wales and the English Midlands received c.12 cm of snow on the 12th which caused the usual travel chaos along with c.300 schools being closed in both areas. High pressure built from the 17th (1033 mb, 22nd) but unusually for December, this introduced milder weather (11.2°C, 23rd) along with a lot of calm but damp, murky days. The 24th & 25th were mild and wet but clearer skies saw temperatures fall (-6.8°C, 29th) culminating in a snowfall during the morning of the 29th (c.8 cm). A rapid thaw then ensued aided by named storm 'Dylan' on the morning of the 31st with driving rain and gusts of wind up to 55 mph.

2017 summary for **Kirkton**

The total rainfall recorded at the Met Office automatic station at Kirkton in 2017 was 2216.0 millimetres (87.2 inches). This was 397.8 millimetres less than the 1991-2015 twenty 5 year average (2613.8 millimetres), and 1369.8 millimetres less than the rainfall in 2015. 2017 was the driest year since 2010. The wettest month was October when a total of 341.0 millimetres (13.43 inches) of rainfall was recorded. The rainfall was above average in February, June, July, August, and October. The driest month was April with 65.4 millimetres of rainfall (only 43% of the 25 year average). The highest rainfall over a calendar week (Monday to Sunday) was 140.0 millimetres between the 19th and the 25th February. The highest rainfall in a single 24 hour period (09:00 GMT to 09:00

GMT) was 62.6 millimetres on the 6th December. There were only two days in 2017 when more than 50 millimetres of rainfall was recorded (1st October and 6th December). The highest rainfall in a single half-day 12 hour period (21:00 GMT to 09:00 GMT) was 35.0 millimetres again on the 6th December. The total number of rain days was 283 (77.5 %). There were 16 days when there was more than 25 millimetres of rainfall recorded.

The lowest temperature recorded during 2017 was on the 11th December when the temperature fell to -10.8°C. This was the lowest temperature since January 2011. The lowest maximum temperature was recorded on the 10th December (-2.3°C). This was the only day during 2017 when the temperature failed to rise above freezing. An air frost was recorded on a total of 88 days (exactly the same number as in 2016). There were no air frosts recorded in June, July or August. The highest temperature recorded was on the 26th May (25.7°C). July was the warmest month with a mean temperature of 13.42°C and a mean maximum temperature of 17.28°C. Temperatures of 25°C or above were recorded on 2 days (26th May and 18th July), while temperatures above 20°C (but less than 25° C) were recorded on a further 10 days (4 days in May, 1 day in June and 5 days in July).

Sleet or snow was recorded falling at the weather station on 23 days during 2017 and lying snow (recorded at 09:00 hours) was noted on 26 days. Unusually there was only one storm in 2017 when sustained gale force winds were recorded at the farm (11th January); and there were only 2 days when thunder and lightning were recorded (23rd August and 29th September).

The Weather through the Year at Kirkton

The year started with an unusually dry January. The 128.2 millimetres of rainfall recorded was only 35% of the 1991-2015, 25 year average. There were only 3 days of snowfall in January and the maximum snow depth was only 5 cm (measured on the morning of the 13th). The temperature fell to -8.2°C on 5th January. February was relatively mild and wet with above average rainfall. Rain was recorded on 25 of the 28 days and there were 5 days in February when more than 20 millimetres of rainfall was recorded. Sleet or wet snow was recorded on 5 days; however, the maximum snow depth recorded was only 1 cm. The rainfall in March was slightly below average. There was a covering of snow (3 cm) on the 21st, but this was then followed by a week of sunny, dry weather with overnight frosts but increasing daytime temperatures reaching a maximum of 18.1°C on the 26th.

It was the driest April at Kirkton since 1995 with only 65.4 millimetres of rain (the 1991-2015, 25 year average is 153.0 millimetres). Rain was however recorded on 22 of the 30 days. There was no measurable rainfall between 30th

April and 11th May (a period of 12 days). The rainfall for May (78.6 millimetres) was also well below the 1991-2015, 25 year average (140.9 millimetres). There were a number of warm days in May particularly in the first and last weeks of the month, with a maximum temperature of 25.7°C recorded on 26th. Since 1991 the maximum temperature recorded in May has only exceeded this value twice (both times in May 2012).

Following the dry April and May the summer of 2017 was relatively wet with above average rainfall in June, July and August. It was the wettest June since 2002 and the fourth wettest summer since 1991 (538 millimetres compared to an average of 401.2 millimetres). There were 77 days during the summer when more than 0.2 mm of rainfall was recorded and only 15 dry days. The highest temperature of the summer (25.0°C) was recorded on the 18th July, although this temperature had been exceeded in May. The August maximum temperature of 19.6°C was the lowest since 2001.

After the wet summer September was slightly drier than average (180.2 millimetres compared to an average of 191.3 millimetres), but there was no Indian summer, with the temperature reaching a maximum of only 18.3°C on the 9th. There was a dry period in the middle of the month when there were 4 consecutive days without rain. There was only one day of frost in September (-0.9°C on the 17th). The rainfall in October was above average (341 millimetres compared to an average of 269.8 millimetres) and rainfall was recorded on 30 of the 31 days. Two inches of rain (50.4 millimetres) was recorded on 1st October and there were four other days when more than 30 millimetres of rainfall was recorded. November in contrast was considerably drier than average with only 168.4 millimetres of rain (compared to an average of 286.8 millimetres) and only one day when the rainfall exceeded 20 millimetres (31.4 millimetres on the 6th). However, rainfall was still recorded on 25 of the 30 days. December was also drier than average with only 218.4 millimetres of precipitation (compared to an average of 333.9 millimetres), however the month did contain the wettest day of the year (6th December). December was the coldest and snowiest month with 22 days when the temperature was below 0.0°C, 8 days of snowfall and 15 days of lying snow. Despite the wet summer total rainfall for the year was well below average primarily due to the exceptionally dry January and relatively dry November and December.

Thanks to the Met Office for supplying the data from the automatic weather station at Kirkton.

UNCOVERING THE HIDDEN HISTORY OF HIGGINS NEUK.

Ellie Graham, John Reid, Geoff Bailey and Richard Tipping

Summary

As part of the Inner Forth Landscape Initiative, an archaeological project was undertaken at the site of Higgins Neuk, adjacent to the South approach of the Clackmannanshire Bridge, at the mouth of the Pow Burn. The primary objective of the work was to test the hypothesis that this was the site of the royal dockyards built by James IV for the maintenance and fitting out of the ships of his navy during the Anglo-Scots wars, as suggested by historical research. Further, the project also aimed to characterise the industrial and maritime archaeology of this small area which is nevertheless broadly representative of the wider Inner Forth landscape and the history of human interaction with the river, exploitation of its resources and management of the environment. Features on the site include a mill and waterfront infrastructure associated with a ferry crossing. Techniques employed included coring, geophysics, metal detecting, topographic survey and excavation and all aspects of the work involved volunteers from the local community and further afield.

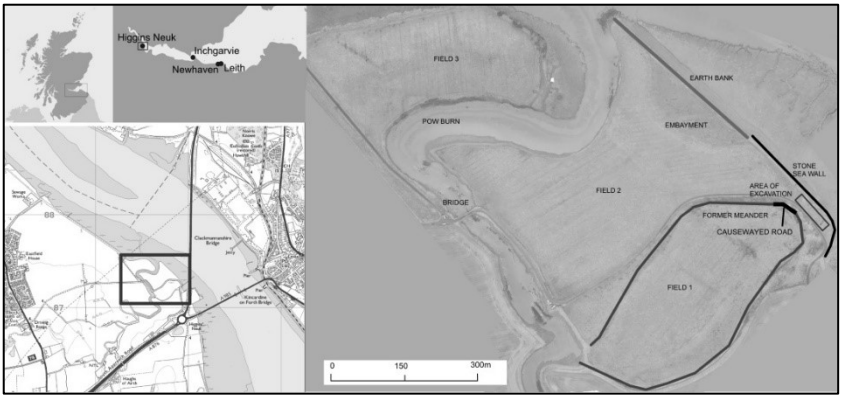
Introduction - Site location and description

The area of agricultural land on the South bank of the River Forth now known as Higgins Neuk is a palimpsest landscape, layer upon layer of history, representative of the wider Inner Forth. A meandering stream, the Pow Burn, is a tributary of the Forth and for hundreds of years its confluence with the Forth has formed the focal point of a range of industries and maritime activities. The complex interactions between the tidal influence of the Forth estuary, the effects of the burn and the impacts of human agency with changing patterns of land management, drainage and reclamation over several centuries, have created a dynamic landscape which continues to evolve.

The area of investigation comprises three fields of approximately 22 hectares which straddle the mouth of the Pow Burn to the East of the village of Airth, adjacent to the South approach of the Clackmannanshire Bridge and centred on NS 917 873. The underlying geology is carse clay, estuarine deposits laid down by the Forth through the Holocene. In this area the current land surface had been formed by the Iron Age (Smith *et al* 2010). Abutting the estuary, a sea wall, stone-faced to the East and changing to an earth bank further West, defines the coast edge and forms the boundary between pasture and the unenclosed saltmarsh of the foreshore, which turns to intertidal mud flats towards the channel of the Forth. Across these three fields the modern coastline appears to have been largely formed by the middle Iron Age (Smith *et al* 2010)

Elsewhere along the Forth, and in the areas immediately to the East and West of the site, significant post-medieval reclamation of the riverbank for agriculture has altered the shape of the coast edge, but this specific area appears to have always formed a small promontory jutting into the water. The Pow Burn runs through this area, and a former meander, visible as a depression, follows the inside curve of the boundary of field 1 (presumably influencing its shape). A single-track road runs through the site, crossing the Pow Burn over a small stone bridge to continue West to Airth.

Figure 1. Site location map and plan.



Base map © Maproom at www.maproom.net. 1:25 000 Scale Colour Raster [TIFF geospatial data], Scale 1:25000, Tiles: ns98, updated: 14 August 2015, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey Service, <http://digimap.edina.ac.uk>, Downloaded: 2016-01-14 15:22:10.809.

The project

Following 30 years of research which concluded that this area was the location of an early 16th century dockyard constructed by James IV (Reid 2002), John Reid approached The SCAPE Trust in 2013 to propose a project to investigate the landscape and attempt to uncover archaeological evidence of the docks. The development of the HLF-funded Inner Forth Landscape Initiative (IFLI) presented an ideal opportunity to undertake the research and a proposal was developed and submitted. IFLI's aims of working with local communities to enhance and promote the natural and cultural heritage of the Inner Forth landscape dovetailed well with SCAPE's remit of researching and celebrating the coastal archaeology of Scotland as well as the longstanding approach of engaging the public in doing so.

Over four seasons of fieldwork in October 2016, March 2017, October 2017 and May 2018, a range of techniques, including detailed topographic survey, landscape modelling, coring, metal detecting, geophysical survey and archaeological excavation were employed to investigate the site. Volunteers from the local community and further afield were involved in all aspects of the project, and several workshops and feedback events were held locally as part of the post-excavation work and in order to disseminate results to participants and more widely to the public.

Aims and objectives

Although the area's importance had first been highlighted due to its connection with the royal dockyards, research also revealed a number of other aspects of the site's history and development. Significant and varied maritime and industrial activities for which the Pow Burn has formed a focal point from the medieval period onwards, make Higgins Neuk an exemplar of the wider Inner Forth landscape and a range of human interactions with the river. The project therefore aimed to understand recent changes to the landscape, record the archaeological remains and engage the community with the process of environmental and archaeological investigation, in addition to sharing and celebrating the heritage of the area.

Background

History and the site

James IV came to the throne in 1488 following a rebellion against his widely-unpopular father James III, which culminated in the latter's death at Sauchieburn. This took place against a backdrop of longstanding tensions between Scotland and England. Despite truces and treaties, these had occasionally boiled over into open hostility; from border skirmishes to a naval attack along the Forth in 1481 when Blackness was burned and Scottish vessels captured, followed by the loss of both Berwick and Dunbar Castle to the English in 1482, the latter only recovered in 1486.

The early years of James IV's reign, however, saw the tide turn generally in Scotland's favour in these clashes, with two attempted raids by England both culminating in victory and the capture of ships and captains. In contrast to his unpopular father, James IV was the embodiment of medieval kingship; while also representing the spirit of the Renaissance. His chief investment, described as an 'obsession' was in the development of Scotland's royal navy (MacDougall 2015).

Not only would a strong naval presence safeguard Scottish merchant shipping and offer protection from the threat of further naval raids by England,

it would raise the king's international prestige. During this period, maritime technology in northern Europe was undergoing a sea change, with the introduction of new construction techniques permitting the development of larger, faster and more manoeuvrable ships which were well-suited for naval warfare. The seafaring nations of Europe rapidly adopted the new style *carracks,* which acted as large floating platforms for heavy artillery, in order to establish dominance of the seas, effectively precipitating a 16th century naval arms race.

James began construction of a fleet, with the *Margaret* in 1502 followed by the *Great Michael,* started in 1507. The former, probably similar to England's slightly-later *Mary Rose*, was named after James' Queen. His 1503 marriage to Margaret Tudor, daughter of Henry VII, was intended to seal the aspirational "Treaty of Perpetual Peace" between the traditional enemies; although as it transpired, relations between the two deteriorated, culminating in Flodden in 1513 (MacDougall 2001). By contrast, Scottish relations with other European nations, particularly France, grew increasingly warm, as James procured assistance, materials and expertise in the form of two master shipwrights from Louis XII as well as from Scandinavia, Flanders, Spain and Portugal. The famous *Great Michael*, frequently called either the *Michael* or simply the *great ship* in contemporary records, is thought to have been the largest vessel in Europe when she was launched in 1512, her build time of five years probably a reflection of her size and complexity. Representing a watershed in maritime technology, she was the first ship built in the British Isles designed to carry heavy artillery and her launch provoked a response from other European monarchs to keep up (MacDougall 1991; Osborne & Armstrong 2007).

Although the *Margaret* had been built at Leith, issues with the location caused difficulties at her launch, prompting the creation of a new dockyard for the construction of the *Michael*. Slightly to the West, Newhaven was established in 1504. A small chapel in the village was dedicated in 1507, the same year the keel of the Michael was laid, attesting to the permanence of the settlement. However, this new site remained vulnerable to attack, lying downstream of the fortifications on Inchgarvie and the narrows at Queensferry (Figure 1). A second dockyard was ordered by the king and established at the Pool (or Pow) of Airth, opposite Kincardine on Forth.

In addition to its more defensible location, the Pow of Airth, was attractive for a number of reasons; it was already an established harbour, first recorded in the 14th century.

It was close to the royal forest of Torwood, a source of timber. Furthermore, the land was already in the hands of the crown, and adjacent to land held by the king's close retainer Lord Elphinstone, who was entrusted with much of the administration and management of the docks' construction (Reid 2002).

The scale of the Airth dockyard, and its importance to the crown, is illustrated by the extent of royal investment, detailed in the Treasurers Accounts and Exchequer Rolls. The site is first mentioned in 1506 with a payment made for the excavation of docks (Exchequer Rolls of Scotland, ii 342; iii 332), followed by expenses for the construction of stables (TA iii, 296) and further docks, including one specifically for the Michael in 1512 (TA iv, 280). A number of references are made to the presence of the ships there, firstly the *Margaret* for maintenance (TA iii, 296) in 1506-8 and again in 1512, and also to costs of keeping a number of ships in 1512-13 (TA iv, 444). The presence of key players in the development of the navy; Captain Robert Barton (TA iii, 104-120) and the French shipwright Jacques Terrell, at Airth (TA iv, 131), as well as a number of visits by the king who took a personal interest in his navy, further attest to the site's importance. Additionally, quantities of timber are recorded as being sent to Airth, as well as generous provisions for the ships (TA iv, 104; 458; 281). Although the hulls were constructed at Newhaven, the quantities of wood sent to Airth suggest that parts of the superstructures may have been constructed there, and it is likely that activities were focused on fitting out as well as repairs and maintenance. Both the *Margaret* and the *Michael*, as well as a third ship, the *James*, are recorded as being at Airth in 1512 (MacDougall 2015, 236) with a flurry of activity that winter, as cross-border tensions grew, revealing the preparations for the war which ended at Flodden.

Following the defeat and the death of the king, all naval activity came to an abrupt end, the dockyard ceased functioning and the location was effectively lost. However, Higgins Neuk was pinpointed as the site of the docks by extensive historic research (Reid 2002). Although now known as the Pow Burn, this watercourse, the focal point of the dockyard activity, was originally known as the Pow of Airth. The late-16th century map drawn by Timothy Pont (Pont 32, The East Central Lowlands) depicts the Pow's course beneath Airth Castle, and three ships at its mouth, the only port in Scotland to be distinguished by the depiction of vessels. Further documentary evidence relates more recent place-names to land called 'Docks' in the later 16th century. Associated with a landowner Patrik Hagins, the charters and sasines locate this land specifically in the Halls of Airth, a tract of Crown land of which the Pow Burn formed the North boundary. The name Docks continues into the 19th century, and becomes synonymous with Newmiln / Newmill. This small estate also gives its name to the area and is depicted on General Roy's 1740s survey, which also names the area immediately to the south *Higgins Neuk*.

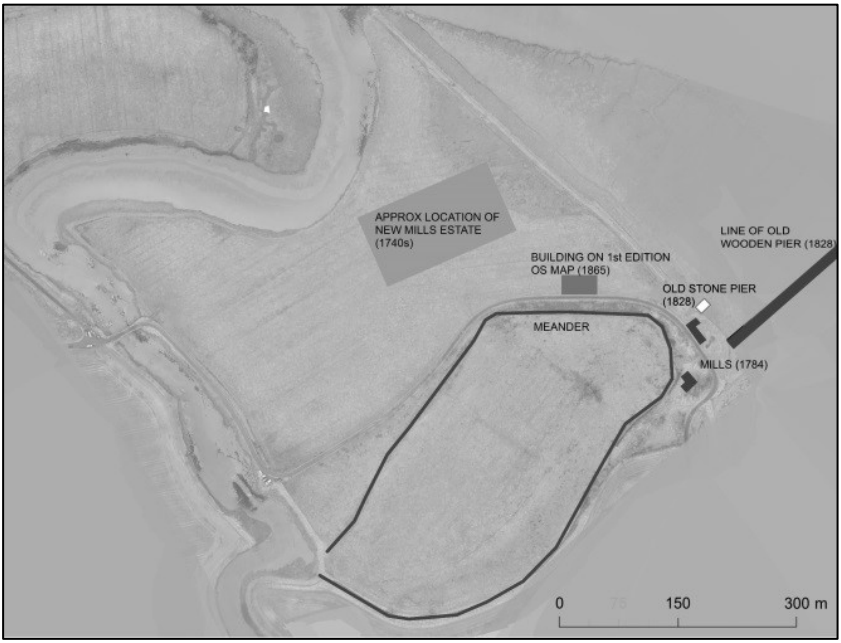
Other features on site

The name Newmill implies the existence of a mill on the shore here, and this is first attested in a 1597 grant to the Bruce family of Airth for the construction of a mill (as well as a saltpan) on the site (Register of the Great Seal of Scotland vi, 634). The name New Milne and a definitive record of a mill here appear in a charter of 1654 (Register of Sasines, RS58/9 f.254), while a 1621 charter refers in passing to the 'new mill of… Patrick Hegins' (Register of the Great Seal of Scotland viii, 1022). A mill remained in use until the mid-19th century, when it was described as partially ruinous, with half occupied as a cothouse.

This mill, on the narrow spit of land between the former meander and the Forth, apparently harnessed the water of the Pow Burn as well as tidal water from the Forth (Figure 2). At the South end of the meander, an artificial channel dug across its neck, straightening the line of the burn and isolating the loop, is depicted on a map of 1784 (National Records of Scotland RHP80865) and appears to have served to transform it into a mill pond. With the addition of raised embankments and a sluice at the junction with the burn, this would have formed a reservoir with the capacity to retain freshwater flowing down the burn. At the northern end of the loop, a culvert carried the water under the road to the site of the mill, presumably then draining into the Forth. Water from the Forth at high tide may also have been permitted to flow up this channel to be held in the reservoir, turning this into a tidal mill.

A second mill was constructed on the Pow Burn, probably as early as the late 17th century when the name changed from Newmill to Newmills. A second structure is depicted on historic maps just to the southeast of the earlier buildings, called New Mill on the 1st edition OS map (1865). A ferry crossed the river Forth from here to Kincardine, and is first recorded in 1330, when it is described as the 'Ferry of Airth' (Exchequer Rolls I, 326). Multiple references from the 15th century onwards mention the problem of siltation. It is later depicted at Higgins Neuk on the 1784 map (National Records of Scotland RHP80865). A subsequent plan of 1828 (National Records of Scotland RHP4298) shows that the South terminus of the ferry has moved slightly East from Higgins Neuk, although the redundant infrastructure is depicted as a structure, labelled 'Old Stone Pier', and a notation 'Line of Old Wooden Pier' (Figure 2). The importance of this ferry crossing was partly due to its location on the main drove road from the northeast of Scotland to the Falkirk Tryst, which from the mid-18th century was the biggest cattle fair in Scotland. The Kincardine-Higgins Neuk ferry, along with Alloa slightly to the West were the two natural crossing points on the Forth for the cattle from the northeast of Scotland, though the high rates costs for ferrying black cattle at Alloa prompted complaints in 1827 (Haldane 2008).

Figure 2. Features and structures depicted on historic maps located on the modern landscape survey.



The use of this area as a harbour into the 18th century is attested by an advertisement in the *Edinburgh Evening Courant* in 1757 which describes Newmills as a "safe and convenient harbour" for ships of up to 200 tons. For comparison, the *Margaret* was around 500 tons, and the *Great Michael* is believed to have been *c*. 1000 tons (Osborne & Armstrong 2007). The advertisement also mentions a girnel which could hold 2,500 bolls of grain. The Old Statistical Account for the parish of Airth also mentions Newmiln as one of three harbours in the parish, with occasional boatbuilding there (Sinclair 1792, 489).

Given the well-documented problems that the accretion of sediment caused for the ferry, it is possible that the mill lade channel which ran from the former meander of the Pow Burn also operated as a sluice for the harbour and pier.

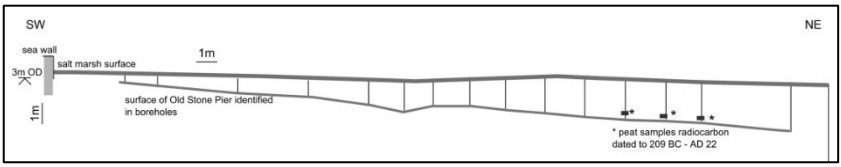
Fieldwork

Methodology

The landscape of the Inner Forth has changed substantially over the past centuries, with changing sea levels and significant land reclamation

dramatically altering much of the coastline. In order to understand the medieval and industrial landscape and inform decisions about where to excavate in search of the dockyards, a programme of coring was undertaken by teams of volunteers after training and under supervision of Richard Tipping, David Smith and Jason Jordan. Firstly, this showed that the carse clay here had been formed by the Forth in the later prehistoric period and that the coast edge had been largely unchanged here long prior to the period of interest, confirming that it was a feasible location for a dockyard in the early 16th century. Investigation initially focused on a semi-circular embayment in field 2 (Figure 1), now behind the sea wall, but significantly lower than the surrounding land. However, the results here did not show evidence of any deliberate excavation or alteration for the creation of docks. Focus shifted to the intertidal area in front of the known location of the mill and ferry. Coring targeted the Old Stone Pier depicted on historic maps (Figure 2) and identified a structure buried in the saltmarsh, projecting *c.* 40m towards the Forth and gently sloping from a depth of *c.* 0.2m in front of the sea wall to *c.* 2.4m at its furthest seaward extent. Three peat samples recovered from the top of the structure yielded prehistoric radiocarbon dates: these are interpreted as redeposited peat which was washed down the River Forth during the reclamation of Stirling Mosses in the 18th and 19th centuries (Smout & Stewart 2012).

Figure 3. The Old Stone Pier buried in the saltmarsh as defined by coring, showing locations of redeposited peat recovered from its surface.



Metal detecting was also undertaken, which recovered mostly 19-20th century ironwork, although iron spikes and copper nails possibly indicate boat building activity. Additionally, the survey revealed metal finds on a buried mortar floor and nearby, a hardy tool fitting for an anvil, suggesting that ironworking activity had been carried out on site.

A drone survey was carried out across the entire area of interest, and a 3D model of the landscape was created from the photos taken (Figures 1, 2). The tidal range was then mapped against this to examine how the area would have flooded at high tide prior to the construction of the sea wall or the road, which has been partly built on a causeway (Figure 1). This showed that field 1 and the area of the meander would have flooded at high tide, and could thus have functioned as a tidal basin or dock where large ships could have been brought in for work.

Figure 4. The landscape model mapped against low tide (a) and high tide (b) showing the areas that would have flooded prior to the construction of the sea wall and causewayed road.

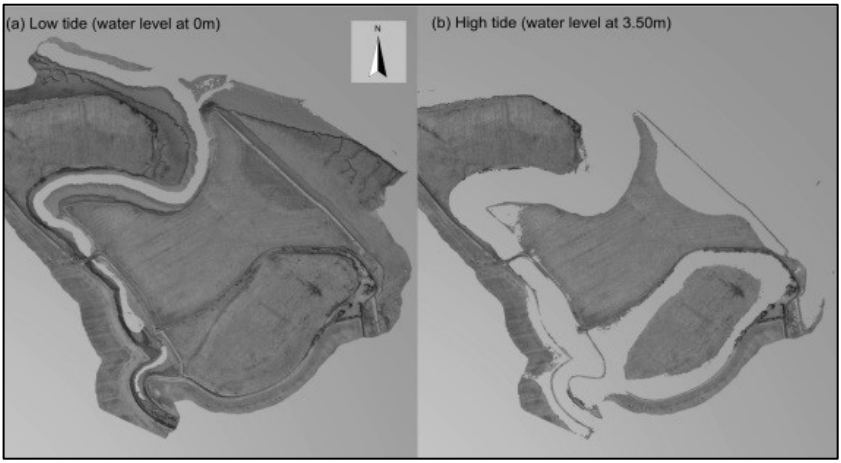


Figure 5. Aerial photograph of the site during excavation at high tide.

A geophysical survey was also undertaken. Firstly, an electromagnetic survey was carried out by Richard Bates of University of St Andrews across the entire area. Subsequently, a resistivity survey by Edinburgh Archaeological Field Society targeting smaller areas which the earlier work identified as potentially of interest. Both surveys showed possible buried features in several areas, particularly the site of the mill and area adjacent to the Old Stone Pier.

This area had also been covered by a topographic survey by John Reid and Allan Meek in 1984, which appeared to show the foundations of several buildings (Figure 6). It was thought that structures depicted in this area on 18th century maps were likely to have been sited here to take advantage of earlier infrastructure, and so it was decided to target this area for excavation, which took place over two weeks starting in September 2017 with a second season of 10 days in April-May 2018 (Figure 7).

Figure 6. 1984 survey of the mill area by John Reid and Allan Meek.

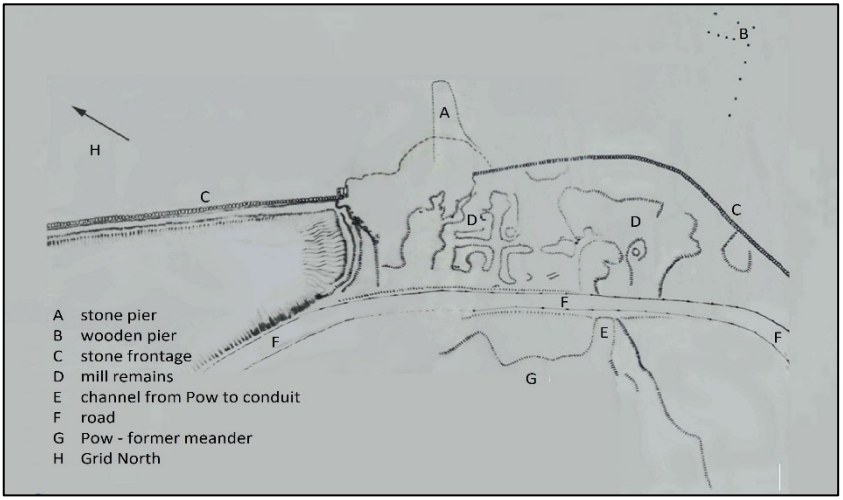
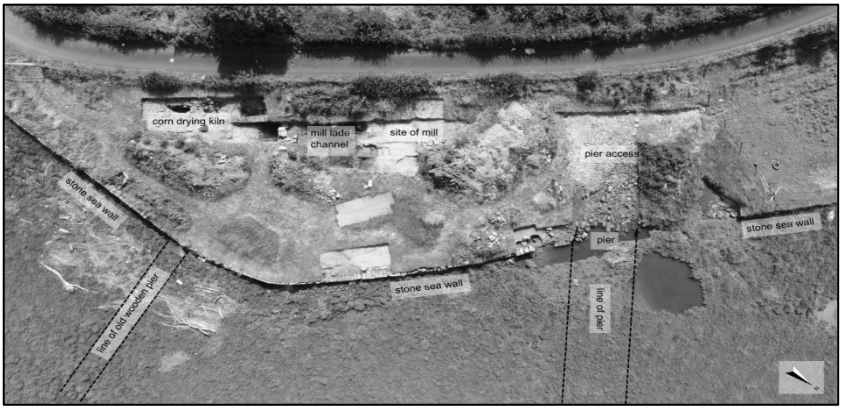


Figure 7. Drone photograph of the excavated area showing main features identified (May 2018).

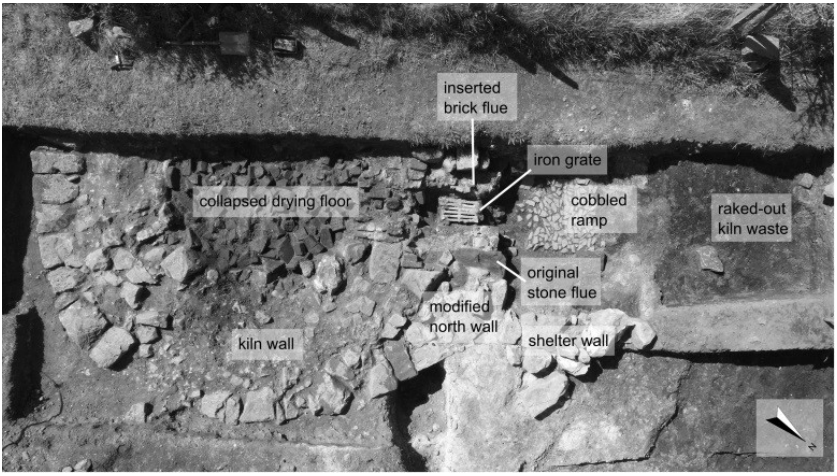


Results

The mill area

The eastern end of the trench was positioned to investigate the mill which had been identified on historic maps. Excavation revealed a number of structures and associated features, including the very truncated remains of the mill building, the mill lade and a corn drying kiln.

Figure 8. Drone photograph of the East area of the site showing the corn drying kiln.



Corn Drying Kiln

The uppermost feature was a rough cobbled surface of Victorian date, which appears to have been well-used, with several areas of patching and repairs. Underneath the cobbles, a brick hearth associated with a curving stone wall was identified. It was revealed to be the northern half of a circular corn-drying kiln, (the southern side continued beyond the edge of the excavated area and under the road).

The upper part of the kiln has been demolished and robbed, and a deposit of glass bottles adjacent to the northern arc of the structure may be associated with this robbing event. The kiln was built into a hole dug into the natural clay, with well-built walls over 1m thick enclosing the bowl. The wall was faced with dressed stone on the inner and outer faces and had a rubble core. The flue on the West side was originally made of stone and later modified with the insertion of a brick flue. The iron grate associated with this phase of the flue remained in situ.

The collapsed drying floor above the bowl of the kiln had been constructed of specially-made square clay tiles with small holes to allow warm air to circulate. Underneath the collapsed tiles, layers of sediment and brick dust within the kiln bowl had also incorporated deposits of burnt grain which have trickled through the holes in the tiles. Although these have not yet been fully analysed, rapid assessment suggests that some of the grains had sprouted, suggesting that the structure may have been used for malting as part of a brewing process, as well as drying grain prior to grinding in the mill.

A sloping ramp with a rough cobbled surface provided access, to the flue from the West and a short length of straight walling on the North side of the flue was added later and formed a shelter wall. Immediately to the West of the kiln, underneath the cobbled layer, are deep deposits of raked-out ash. At least two linear trenches have cut through these deposits in front of the flue, presumably to facilitate the flow of air to the fire. The dumps of kiln waste have filled and levelled the slope on the East side of the channel which formed the mill lade.

Mill lade

This wide channel may originally have been cut to direct water from the former meander of the Pow Burn to sluice the harbour and ferry landing and later repurposed as a mill lade; or it may have been a natural channel which has been substantially modified for these purposes. Unfortunately, due to the water table, the flow of water from the former meander, and flooding of the channel from the Forth at every high tide, it was impossible to investigate it fully.

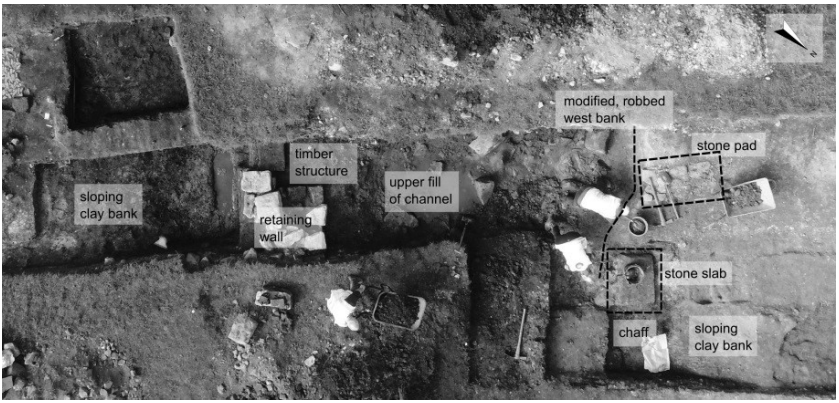
The upper fill contained large quantities of late 19th-early 20th century material, indicating that it had remained open long after it ceased to function as a lade. Deep deposits of chaff have accumulated on the West side of the channel. Given that this would have impeded the functioning of the channel as a lade, this presumably represents later dumping into the then-redundant watercourse, after the mill had gone out of use.

The East side of the channel originally sloped gently westward and has been modified with the insertion of a stone retaining wall to straighten the bank (Figures 9, 10). A recess in this wall contains a timber structure with iron fittings, possibly one side of a sluice gate (Figure 9). The sloping bank between the wall and the corn drying kiln had been levelled with dumps of raked out material from the kiln. A small exploratory trench was excavated behind the stone wall and below the layers of rake-out from the kiln was a smear of mortar possibly associated with the construction of the retaining wall.

Figure 9. The timber structure with iron fittings.

Underlying this, waterlogged deposits appeared to have been formed of naturally accumulated silt laid down by the action of the water. These contained a significant quantity of wood offcuts with tool marks, indicating that wood working had been undertaken in this channel prior to the construction of the retaining wall.

Figure 10. Drone photograph of the mill lade area. This photograph shows the modified sloping banks, inserted wall on the East side, robbed face on the West side and truncated remains of mill structure to West.

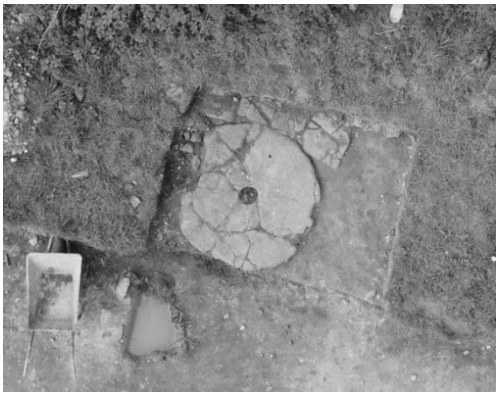


The West side of the channel has been badly damaged by robbing activity, but the sloping clay bank had been recut and straightened, perhaps to take the insertion of another, now partly robbed stone wall. All that survives is a single large square stone block, laid flat at the side of the channel, which represents the foundations of the robbed wall. This modification of the bank, in combination with the map evidence for the mill itself being located here, suggests that this may be engineering for the channel to function as a lade, or may be the badly damaged remains of the setting for the mill wheel at the side of the channel. This is partly suggested by the area opposite the alcove housing the timber feature. Although no structure survives, the plan of the West side of the channel mirrors the East, suggesting that it may originally have been modified with a similar recessed revetment wall containing a counterpart timber structure.

Remains of the mill structure

Although the historic map evidence indicated that the mill itself was located on the West side of the channel, excavation revealed the area to have been largely robbed out and badly truncated by later clearance, leaving a deposit of stone, brick and mortar rubble, which across most of this area sat directly on top of the natural clay.

Figure 11. The reused millstone in a paved surface.



A line of three stone slabs running at right angles from the West side of the channel appears to have formed a pad. This, along with three stones around 3.5m to the West of this, which may represent the lowest course of a very damaged stone wall. Associated with this was a patch of paving which included a repurposed millstone (Figure 11). This surface appears to have formed an external yard or access from the road to the mill building.

Sea wall and ferry

The entire area of investigation was enclosed by a stone sea wall. Further West in field 2, in front of the semi-circular embayment, the construction material for the bank changes from stone to earth. The sea wall was investigated on both the landward and seaward sides and excavation showed that the wall was built against the natural bank of the estuary after it had been cut back and straightened. Excavation on the landward side revealed stone packing and a clay bank behind the sea wall, with small patches of rough cobbling and metalling forming an irregular surface above. Trenches excavated against the face of the wall showed it extended to a depth of *c*. 2.2m from the top, and the good face exposed on the seaward side indicated that it was constructed prior to the formation of the saltmarsh. The wall would originally have had tidal waters coming up to the face.

Although several test pits were dug in the salt marsh in front of the wall to investigate the outflow of the mill lade, no evidence was found of any culvert to allow the discharge of water. It is therefore uncertain whether the outflow lies in an unexcavated area, or if the construction of the sea wall blocked the channel off from the Forth completely, which would suggest that the mill was out of use by the time the sea wall was constructed.

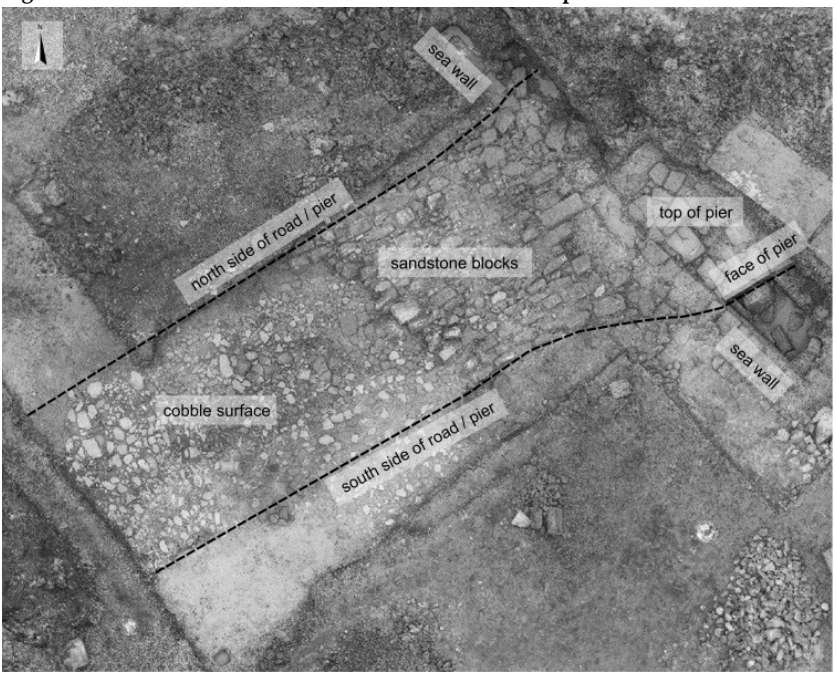
Figure 12. Test pit dug against face of sea wall.

As well as formalising and straightening the bank, the sea wall may have been intended to stabilise the coast edge here, to prevent erosion, and was likely associated with the ferry crossing. Ironically, if the construction of the wall blocked the outflow of the mill lade, it would have prevented sluicing action and probably almost immediately impeded the ferry by encouraging siltation and the formation of the saltmarsh which was bemoaned by users of the ferry during the 18th and 19th centuries. It appears that the wall was rapidly buried by the saltmarsh, and chaff was found within the silts which accumulated against the sea wall, together with rubble which had collapsed from the structure. This demonstrates that some milling activities continued in the vicinity after the wall had fallen into disrepair.

Stone pier

The western end of the trench was positioned to investigate the area of landfall of the old stone pier depicted on historic maps. Coring had confirmed the presence of a sloping stone structure *c*. 5m wide and almost 40m long projecting from the sea wall into the saltmarsh. The stone sea wall dips for *c*. 15m in the area of the pier, and excavation revealed a cobbled access track which joined the pier to the road. The track was not at a right angle to the coast edge, but approached it at a slight angle, pointing downstream. The surface of the track closest to the road is formed of rounded cobbles and incorporates occasional fragments of brick and slag. Small linear indentations running along its length appear to be wheel ruts. Excavation revealed the latest phase of the track, which had been laid as a replacement surface on top of earlier, very worn out, cobbles. The construction of the surface changes to rectangular sandstone blocks laid on edge and set in parallel lines approximately 5m behind the line of the sea wall. The reason for the change in construction material was explained during a very high spring tide during the October 2017 fieldwork (Figure 5) when the high water reached the top of the sandstone blocks. It appears that the change in construction techniques was deliberately positioned at the top of the intertidal zone, perhaps to facilitate runoff of the tidal water from the surface.

Figure 13. The access road and landward end of the stone pier.



The landward end of the pier was exposed, with a surface of rounded paving slabs built with a slight camber, over and across the gap in the sea wall. The pier structure itself continued the downstream alignment of the trackway, running seawards for a further *c*. 40m.

Figure 14. East side of the Old Stone Pier.

Small test pits dug at the interface of the pier and the sea wall showed that the edging stone forming the seaward face of the pier was constructed of three courses of well-dressed ashlar blocks laid on top of a pine plank, radiocarbon dated to younger than around 1800. The stones of the top course have finely dressed faces, but differences in the tooling suggest that they may be reused stones. This probably represents a later re-facing and widening of the earlier pier structure (Figure 14), and the facing stones were seen to be butting against (and therefore later) than the sea wall.

Wooden pier

A small test pit was excavated to examine the line of the 'Old Wooden Pier' depicted on the 1828 map (National Records of Scotland RHP4298; Figure 2). Three wooden posts visible in the surface of the saltmarsh along this alignment were thought to be the remnants of this structure, and a further three substantial timber posts were revealed in the test pit. One was submitted for radiocarbon dating and was found to be of probable 18th century date.

Discussion

The investigations at Higgins Neuk have uncovered a complex maritime and industrial landscape which has evolved and undergone several substantial alterations. The first phase of activity detected during the excavation appears to relate to the channel which later acted as a mill lade and possibly also as a sluice. This may originally have been a natural channel which has been significantly modified, probably at the same period as the construction of the corn drying kiln and the mill itself. A putative earlier use of the channel remains a possibility, though unproven. Although no evidence was found in the construction of the sea wall for the outflow of the mill lade, the flooding of the channel from the seaward side at high tide attests to the existence of a culvert or conduit through the wall now buried in the saltmarsh.

The sea wall, and associated ferry piers are only the latest phase of ferry infrastructure here. Works associated with the earlier phases of the ferry may be buried in the saltmarsh elsewhere in the vicinity, or underlie these features or have been destroyed by the later construction. The two piers appear to be broadly contemporary in date, which may be explained by a 19th century reference to the ferry which mentions that three piers were built on this site in a very short period of time (Transactions of the Highland and Agricultural Society of Scotland, 1839, xii, 489-501) because of problems with the accumulation of mud. The later re-facing of the stone pier, widening the pier and slightly altering its alignment, may relate to an attempt to manage the siltation problem, while the mid-19th century end date of the mill here may have exacerbated the problem by stopping the sluicing action of the lade.

The saltmarsh appears to have formed rapidly through the 19th century, illustrated by the build-up of chaff which both contributed further to the sediment in the system and indicates the depositional environment in the water against the sea wall and pier. The sea wall fell into disrepair as the saltmarsh formed against it, illustrating the lack of maintenance in the area and probably related to the early-19th century move of the ferry terminal from Higgins Neuk to its later location slightly to the East, beneath the present position of the South end of the Kincardine Bridge. This eventual abandonment of Higgins Neuk in

favour of the new site was due to the issue of sedimentation after almost 500 years of complaints about the problem.

Conclusion

Although the project has not located definitive evidence of the dockyards in the area of investigation, the results have informed our understanding of the landscape. They have led to the suggestion that several of the features, particularly the mill lade channel, may be related to the dockyards and have been subsequently altered for the mill and ferry, leaving a number of avenues for future investigation. One suggestion is that the docks themselves lie within field 1 and that the former meander of the Pow Burn could have formed a tidal basin and functioned as a dry dock, with the mill lade channel possibly forming an entrance. Further work on the site may reward investigation in this area.

Furthermore, the work has uncovered a number of industrial and maritime features which are broadly representative of the history of human interaction with the River Forth and illustrate the evolution of this landscape. The interest within the local community has been demonstrated by the extent of volunteer participation in the project and engagement through talks, walks and site open days. An on-site interpretation panel will share the results with visitors, while the increased awareness of the hidden and previously largely-unknown heritage of Higgins Neuk will form a lasting legacy for the area.

Figure 15. The site under excavation during an open day tour.

Acknowledgements

Thanks are due to the Universities of St Andrews, Stirling, Oxford and Coventry, Prof David Smith and Dr Jason Jordan, colleagues at SCAPE and the partners and staff of the Inner Forth Landscape Initiative for their support throughout. The authors gratefully acknowledge the significant contribution made by all volunteers and participants in the project.

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THE INNER FORTH LANDSCAPE INITIATIVE

Sue Walker and Tom Churchyard

Summary

This article describes the development, delivery and achievements of the Inner Forth Landscape Initiative (IFLI), which was an exciting programme of work that aimed to conserve, enhance and celebrate the unique landscape and heritage of the upper reaches of the Firth of Forth. It explains that between May 2014 and April 2018, 54 discrete but inter-related projects, mainly funded by the National Lottery through the Heritage Lottery Fund, took place around the Inner Forth area to work towards these aims. Through a series of case studies, and statistics, it shows how these projects addressed IFLI's vision of an Inner Forth landscape where the natural, cultural and historical wealth of the area is revealed, valued, enhanced, and made accessible to both the people who live here and visitors, and what was achieved. It goes on to look to the legacy of the Initiative, and what might follow it to ensure that those achievements are carried forward into the future.

Introduction

The Inner Forth Landscape Initiative was developed by a partnership of nine organisations who came together to take coordinated action to conserve the important heritage assets within this landscape in 2011. The Royal Society for the Protection of Birds (RSPB) Scotland was the lead partner. The formal partnership originally involved three local authorities (Stirling, Clackmannanshire and Falkirk Councils), three public bodies (Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) and Historic Scotland (now Historic Environment Scotland - HES)), and three NGOs (RSPB Scotland, Sustrans and the Central Scotland Green Network Trust (CSGNT)). Of these, all but SEPA continued their involvement during the delivery phase. In addition, the initiative worked in collaboration with a wide range of national and local organisations and community groups who played a significant role in the development and delivery of projects. A Board, Steering Group and Working Groups were established in 2012 to oversee the development of the scheme. The Working Groups included IFLI's partners and other organisations with specialist knowledge. During 2012-2013, the Board, Steering Group and Working Groups helped the project team by guiding the development process and the selection of the 50 projects that were chosen to go forward out of the 100 that were submitted for consideration.

During the delivery phase the IFLI project team consisted of six core members – Project Manager, Community Engagement Officer, Communications Officer, Cultural Heritage Officer, Finance Officer, and Interpretation Officer. They were supported by a number of trainee posts who also played a valuable role in helping the team deliver the programme of work during the four years of the Initiative. As well as being responsible for the delivery of a number of projects themselves, the team worked closely with all the project leads, giving them support to deliver their projects, co-ordinating the financial, reporting and monitoring aspects, and providing communications and networking opportunities for the programme as a whole.

Through our projects, IFLI planned to:

- Conserve and restore the built and natural heritage features that define the Inner Forth Landscape
- Increase community participation in the area's local heritage
- Increase access to the landscape and knowledge of its heritage
- Increase training and development opportunities in heritage skills

The Firth of Forth is the central and dominant feature of the landscape. Not only is it at the centre of the IFLI partnership scheme area, the natural and cultural history, land use and landscape of the area are physically, visually and strategically linked with the River Forth. This Heritage Lottery funded, Landscape Partnership Scheme covered an area of 202 sq km including: the river, estuary and inter-tidal zone; the floodplain and coastal margins and the settlements on both sides of the Forth from the Old Stirling Bridge to Blackness Castle and Rosyth.

Together, projects developed and delivered through IFLI:

- turned perceptions of the Inner Forth around and increased local pride in the area,
- connected disparate habitats to create landscapes flourishing with biodiversity,
- celebrated, protected and improved access to important historical and natural features,
- trained and supported committed and motivated local community groups, individuals and organisations to act to conserve their area's heritage, and
- increased physical and intellectual access to the area's important heritage.

This article describes and explains why the Inner Forth is such an important and valuable landscape, how the projects sought to address the needs of this landscape and the people who live, work and visit it, what has been achieved over the last four years and the prospects for the future.

About the Landscape

Centred on the River Forth, the Inner Forth is a landscape of carselands and coast, with the dramatic rise of the Ochil escarpment beyond. Moulded by geological, glacial and fluvial processes, this broad basin comprises extensive flat lands of predominantly agricultural use. This land is highly productive and richly varied, presenting a patchwork of colours and textures with the pattern of the agricultural landscape strongly influenced by the types of crops and seasonal changes in land cover. Woodlands and forests are mostly associated with the policy landscapes of the principal estates, although the natural topography of coastal bluffs, scarps and incised river valleys has preserved other small but significant woodlands. Many of these scarps are the remnants of raised beaches which fringe the firth.

The River Forth meanders across the carse from Stirling, its course broadening and straightening, before it opens up into the estuarine firth at Grangemouth. The river is integral to the wider landscape, forming a key part of the setting of Stirling. The tidal nature of the river system has a significant effect on the landscape on a daily basis and the seasonal migration of birds to the area to feed on the mudflats contributes to its sense of this being a dynamic, changing landscape. The river is also integral to the cultural landscape, as the basis for the industrial activity which continues today. Infrastructure is a major presence in the landscape, with the now-closed Longannet Power Station, key transport routes, overhead power lines, Grangemouth Docks and Grangemouth Oil Refinery being not just dominant features within the landscape but significant to the economy of Scotland.

The 'shape' and character of the landscape has changed over millennia, but more so in the last 400 years, with the building of sea walls to reclamation land for agriculture, industry and the large- scale industrial infrastructure including pylons and chimneys. Settlement is generally located on the shores of the River Forth where the ground is sufficiently elevated to reduce the risks of flooding, or on higher ground set further back. Stirling and Kincardine are at the major bridging points over the Forth. Stirling Castle and the Wallace Monument represent key focal features to the West of the area, whilst the distant Forth bridges form iconic features when looking East.

The low river valley and coastal landscape of the Inner Forth is of European significance for supporting internationally important wintering and migratory waterfowl. The floodplain exhibits a range of outstanding riverine features that include tidal banks, rare saltmarsh habitat and extensive areas of mudflats. Most are designated as a Site of Special Scientific Interest and form part of the Firth of Forth Special Protection Area under the EC Birds Directive. A host of local sites of importance for nature conservation exist throughout the area, supporting a wide range of estuarine, freshwater, woodland, peatland and grassland habitats, and harbouring many species and natural features.

The natural habitats in the area have been progressively modified, reduced, replaced or eradicated through agricultural improvement, urban expansion and commercial and industrial development, leaving a fragmented nature conservation resource. However, there remain sizeable areas of estuarine and coastal-fringe habitats with high biodiversity value. It is this vast ecosystem, focused on the River Forth that lies at the heart of the Inner Forth landscape.

Agriculture is the dominant land use and, despite some neglect, traditional field boundaries and hedgerows still form important linear features within the landscape. Sites for the deposition of waste products from industry, mining or salt panning have created new landscape features such as coal bings, or areas of land reclamation. These sites have created a unique habitat for biodiversity, often supporting populations of rare and endangered invertebrates alongside other wildlife such as birds, reptiles, plants and lichens. Today, nationally important industry sits adjacent to urban settlements, internationally important natural heritage assets and rich agricultural land, creating a unique juxtaposition of features.

Cultural heritage

Throughout history, the society and economy of the Inner Forth has been closely connected to the river and the landscape's wealth of natural resources. The exploitation of the area's natural mineral resources has historically been a great source of wealth and has shaped the landscape. The richness of the soils and mineral resources, coupled with proximity to the Forth, meant that this area was highly accessible and highly prized. The area is significant for its long history of occupation: evidence from shell-midden sites dates back to the Mesolithic period, some of which are a monumental size.

Due to its strategic location, the area has long been the location of significant military defences and battlegrounds. This includes the Antonine Wall World Heritage Site, where the Romans took strategic advantage of the raised beach, to create their frontier with the North. Stirling Bridge and Bannockburn represent other iconic battlefield sites. Other landmarks make good use of hill-top positions overlooking the flat landscape, such as Blackness Castle and Clackmannan Tower.

The course of the river has been directly shaped by human activity; forming ports and harbours and reclaiming land along the edges of the estuary. The main settlements in the area were formed in the medieval period, particularly the burghs and ports. During this time early industries developed and grew significantly, fuelled by the easy access to international trade routes. Salt pans were worked by medieval monasteries. The mineral resources of the large carboniferous coal measures were exploited, including the establishment of the first coal mine in the world to extend under the sea, established at Culross in 1575. The influence of overseas trade on local villages and towns can still be read within the landscape today: distinctive red roof tiles are prevalent in many villages in Fife and are said to have been brought back as ballast by collier ships returning to Culross from the Low Countries.

Remains of former industries remain throughout the landscape, including: disused salt pans, limekilns, coal mines, whisky distilleries and infrastructure associated with the ship-building, fishing and export industries, local ironworks, colliery and planned villages, docks and harbours, the Forth and Clyde Canal, railways, and bridges. Place names reflect the importance of local industries: Kennetpans for its salt panning, Limekilns for its lime production. The industrial wealth of the area led to the establishment of important designed landscapes such as the Pineapple and Dunmore Park, Valleyfield Estate and Culross Abbey House, all listed on the Inventory of Gardens and Designed Landscapes. Many of these sites have connections to notable architects and landscape designers including Sir William Bruce, William and Robert Adam, and Robert Lorimer. Valleyfield is the only Scottish example of a Humphrey Repton designed landscape. The wooded policy landscapes and parkland trees of these landed estates are a significant feature of the area.

Many of the buildings and settlements in the area have fascinating stories to tell, being associated with important people and events, but also increasingly forgotten cultural and historical associations. For example, the village of Airth (meaning level green place) has long association with the River Forth and hosted a royal dockyard during the

14th century, used to build ships for war. However, the changing flows of the River Forth led to the silting up of the South West shore. As a result, the village's role as a port waned in the 1700s, though not before a number of residents had made their fortunes from trade.

The Firth of Forth is geographically and strategically at the heart of Scotland. It has been a major point of entry to the country throughout history and remains an important seaway linking the Central Belt with the rest of the world. Evidence of the strategic importance of the firth is present in countless features all around the Inner Forth, from the medieval battle site of Stirling Bridge to the Victorian landmark of the Forth Bridge. At the same time, the Inner Forth is home to some of Scotland's most important natural heritage sites. The Forth valley and adjacent hills illustrate the geology and ancient past of the region and have permitted the development of the rich habitats found in the area today. The landscape of the Inner Forth is host to nationally and internationally important flora and fauna, both coastal and land-based. The presence of these valued habitats alongside active industrial centres and the depth of the cultural landscape, all within reach of large sections of Scotland's population, is what make the Inner Forth a unique and valuable landscape resource as the focus of IFLI's work.

Delivering the vision

Between 2014 and 2018 the eight members of the Inner Forth Landscape Initiative Partnership invested around £1,215,000 in the Initiative as a whole. This combined with a grant of £1.75m from the Heritage Lottery Fund, and match funding from a range of other funders. This provided almost £4m to enable IFLI's vision to conserve, protect and celebrate the natural, historic and cultural heritage of the Inner Forth landscape. As a result, the Inner Forth has benefitted from 54 inspiring and intrinsically-linked projects. Some were site-specific, but many covered the whole of the IFLI area. The projects were divided into four thematic areas. Within these themes, IFLI also identified sub-themes to guide delivery of the projects to achieve some of its key aims for the landscape.

Conserving and restoring

- Habitat stepping stones – restoring and managing habitats on brownfield sites;
- Historic and designed landscapes – conserving and restoring features of three historic and designed landscapes;
- Inner Forth Wetland Network – creating and improving the network of

pools, lagoons and peatlands in the area to increase biodiversity;
- Woodland and wildlife corridors – improving the connectivity between woodland and wildlife sites; and
- Safeguarding and securing built historic features – consolidating four historic structures in the landscape.

Recording and celebrating

- Conservation volunteering – a chance to learn new practical nature conservation skills;
- Reaching back, forth and into the future – supporting local communities to explore and record their local heritage; and
- Inner Forth events – a wide and varied programme of events and activities to help people reconnect with the landscape of the Inner Forth.

Exploring and learning

- Improving access – creating and enhancing the path network to allow many more people to access the landscape;
- Active communities – encouraging people to get active within the Inner Forth landscape on foot or by bike;
- Telling the Inner Forth Story – creating a suite of interpretive installations, materials and activities about the Inner Forth; and
- A learning landscape – working with schools to encourage access and understanding of their local landscape.

Skills and training

- Developing our skills - providing access to vocational skills training, LANTRA awards, NPA, SCQF level 4 and 6, local employability awards, and student and graduate placements.

IFLI's achievements

Over the course of the last four years these 54 projects have combined to deliver many improvements and benefits for the people, wildlife, heritage and landscape of the Inner Forth. Here are some of the statistics:

- c1000 volunteers gave 3,680 days of their time to work on projects;
- 132.5 hectares of new habitat were created – including 48ha of woodland; 38ha grasslands; 12.5ha wetlands and reedbeds; 10ha intertidal habitat; 9ha wildflower meadows; 2ha invasive scrub was removed;
- 514 events were held, engaging over 4000 people;
- 438 people received heritage training;
- 153 school sessions engaged over 700 schoolchildren;
- 15.7km paths were created or improved;

- Four new community orchards were planted at Valleyfield (see Plate E1, page 190), Kinneil, Cambuskenneth and Kennetpans;
- Four historic buildings were consolidated, at Kinneil Kirk, Kennetpans, Clackmannan Tower and Charlestown Limekilns;
- Supported the creation and infrastructure for one new nature reserve at RSPB Black Devon Wetlands, near Alloa (see Plate E2, page 190);
- Over 30 videos about the Inner Forth were created and shared on IFLI's You Tube channel;
- One IFLI website that carries a wealth of information and inspiration about the Inner Forth, including an interactive map, wildlife guide, art gallery and walking and cycling guide to the area, as well as information about all the projects and the Initiative; and
- By the end of the programme seven interpretive 'beacons', 11 'markers', one 16pp booklet guide to the area and one Explore the Forth mobile app will be in place to help local people and visitors understand and appreciate the area's heritage and encourage them to visit new places within the Inner Forth landscape.

The programme and the projects have engaged people of all ages and all walks of life. HLF funding has allowed IFLI to deliver events and activities free of charge, making them accessible to a much wider range of people, whatever their means. This has included families with young children, primary and secondary school pupils, young people, those looking for opportunities to find work in the sector, amateurs and professionals looking to improve their natural or historic heritage skills, older people and those with additional needs.

Case studies

The following case studies provide an idea of the breadth and ambition that characterised all of IFLI's projects. You can find detailed information about each project on the IFLI website www.innerforthlandscape.co.uk.

Kinneil Kirk - Conserving and Restoring

The very first project to be completed, recorded and consolidated what remains of an important 12th century church building near Bo'ness in order to protect it for future generations (see Plate E3. Page191) While Kinneil Kirk was built in the medieval period, it stands on the Roman Wall, boasts a collection of colliers' gravestones, and was used as billets by Hanoverian cavalry in the 18th century. What remained of the building was saved as a seamark for ships in the River Forth and endured as a Romantic ruin in a designed landscape on the Kinneil Estate. As such, it is a unique structure with connections to various aspects of local natural and cultural heritage. By the early 21st century, however, the remains of the church were in a state of considerable disrepair.

Falkirk Community Trust (FCT) supported local community groups, individuals and organisations in acting to record and safeguard this key built heritage site. Ivy was removed, stones from the remaining low-level walls were repositioned and consolidated with lime mortar, the West gable end was re-pointed, and the nave was excavated and recorded.

Among the discoveries were two 13/14th century grave markers, one carved with a Calvary cross and the other with a sword. There were also seven early 17th century stones, many depicting hammers and picks, the trade emblems of masons and colliers, which were previously unrecorded. Guided tours were given to over 100 visitors, the Edinburgh Archaeological Field Society and the Borders Group before several tons of topsoil was laid to protect the nave floor. A small booklet on the history of the church was produced, as well as an in-depth article on the gravestones in the churchyard for local history publication, *Calatria*.

Like the Back of My Hand (LTBMH) - Recording and celebrating

This project aimed to help reconnect people with the natural, historic and cultural heritage of the Inner Forth through a series of events, activities and celebrations over the lifetime of the Initiative. It was based on an exciting and inclusive series of activities and events linked to IFLI partnership projects and themes, but evolved over the period of the Initiative to reflect an increasing understanding of audiences and from feedback received. During the development period a programme of many, mostly small events was devised and, during the first year of delivery, a number of these events, such as guided walks, talks etc. were organised. Later, the project concentrated on delivering fewer but larger events, many of them part of the month-long IFLI Festival held in September each year. Partner organisations and project leads were invited to hold events during the same period, which enabled us to offer a much bigger package of activities to attract much greater publicity and higher and wider attendance. The festival grew over the three years from 27 events to 49 events. The project worked as a catalyst to encourage other organisations to hold events to promote the Inner Forth landscape, including boat trips to see the Forth from a new perspective, conferences, exhibitions, walks, talks and discovery workshops.

Figure 1. Artist-in-residence

In addition, ways were sought to reach new audiences who would not necessarily be attracted by traditional wildlife or history themed events. This included appointing an artist in residence, Darren Woodhead, who not only created his own paintings of the landscape or use in the project, but ran a series of free outdoor watercolour workshops encouraging local people with an interest in art to look at the landscape in a new way. Other artistic approaches included poetry, writing, sketching, photography, and ceramics workshops.

Four World Wetlands Day events were run for secondary schools, an age group that is less well catered for by many wildlife and history organisations. These celebratory events gave young people a chance to get outside and have fun in a wilder environment, while learning about the importance and value of the landscapes on their doorstep by means of curriculum-based learning delivered through geography, biology, art, and poetry-themed activities. Alloa Academy produced an animated film about their local nature reserve (RSPB Black Devon Wetlands, where a number of IFLI projects took place) and another film documented what they felt was special about their town. They also did some hands-on conservation work and guerrilla interpretation!

Figure 2. IFLI's mini-festival at Kinneil Estate.

(Image: Ian Shearer)

Members of the local community at Bo'ness were helped to develop their idea for a fun run into reality. The route went past four IFLI project sites, giving us the chance to highlight IFLI's work to an audience of over 200 runners over the two years we organised and funded the event, who may not have been attracted to standard guided walks. The run is now being organised by the community itself, drawing on the experience and confidence they gained over the first two years, and this year over 150 people ran the course.

The project also funded the development and production of a suite of videos showcasing the importance and value of the Inner Forth, which aimed

to increase local pride in the area, and encourage others to come and visit. As well as a main film, six 'mini-films' were produced focussing on particular projects or aspects of the Initiative. These have now been watched by over 2,000 people.

LTBMH also supported improvements to the IFLI website to make it more interactive and attractive to a wider audience. This included creating an interactive map of the Inner Forth, showing places of interest, walking routes, project sites etc, wildlife guide, gallery of local artists' and photographers work, and information about walking and cycling routes in the area.

Finally, the project helped support other IFLI projects and project leads in offering a range of events to reconnect people with the landscape of the Inner Forth at many levels. These included part-funding the writing and performance of a play for secondary schools about Alloa's history; a series of events in Bo'ness called 'Wild About Kinneil' and the Forth Naturalist and Historian Conferences of 2014 and 2017 (see Plate E4, page 191). Every event was aimed at raising awareness of the Inner Forth landscape and its natural, historic and cultural heritage and connecting the local communities to the area around them.

Future Tides - Exploring and learning

This project engaged school children with the changing landscape and wildlife of the Inner Forth to build a greater understanding of why the landscape is shaped like it is and how it may change in the future. Through the RSPB's Outdoor Learning Officer led, Curriculum for Excellence-aligned sessions, connections were established between the pupils, their local community and the nature that surrounds them, encouraging them to take ownership of the landscape's future. The project centred around wildlife, people and the landscape they live in - looking at the past, present and future. Bespoke sessions were delivered to nine classes from primary schools around the IFLI area. Each class received seven visits; four in class, three outdoor and an end of project event to present their work.

Pupils were not expected to have prior knowledge, but were encouraged to explore sites, look at information presented and give their opinions on matters raised. Class session 1 introduced the landscape and its formation and prepared pupils for their first site visit. Class session 2 built on the first site visit and explored in a more detail the origins of the Firth of Forth and the factors, both human and natural, that shaped it over time. A large story mat was used to make this session engaging and interactive. Class session 3 brought together knowledge of land use from previous sessions and trips in a role play activity focussing on a fictional area of land recently put on the market for sale.

Figure 3. The Future Tides project.

(Image: Miranda Shephard/RSPB)

Site visits were made to RSPB Black Devon Wetlands, Kinneil Local Nature Reserve, RSPB Skinflats, Blackness Castle and Cambuskenneth Abbey. During these sessions pupils explored similarities and differences in the landscape; formation of the Inner Forth landscape; why sites may have been, or are good places for humans and wildlife; impacts of climate change and how creating habitats for wildlife can help alleviate its effects, particularly flooding from sea level rise.

This project highlighted to school children why the Inner Forth is so important for wildlife and looked at how the changing land use impacts upon nature. It demonstrated how communities and stakeholders can, and must, work together to achieve a sustainable future for the landscape. Overall the project had benefits for natural heritage by ensuring there is a greater understanding of the issues facing wildlife in the Inner Forth and engendering a sense of pride through communities in their local area. It raised the profile of sustainable flood management as a response to climate change which could have great benefits for local people. It was a learning opportunity not only for the pupils, but also for teachers, parents and local people who attended the final debate event.

Training Tomorrow's Talent - Skills and Training

This project created a range of paid training opportunities for unemployed people and students within the Inner Forth area, in the heritage and conservation sector. It aimed to create a pool of local people with skills and experience suitable for the heritage sector who could help to raise the profile of this landscape and this sector as suitable career opportunities.

Through their work, trainees and bursary students added value, skill and knowledge to a range of IFLI projects. During the first year, the project was co-ordinated by Clackmannanshire Council's Employment Training Unit as part of the Coastal Communities Funded Clackmannanshire Forth Coastal project. Ten paid work placements were created with trainees employed by Clackmannanshire Council, Stirling Council, RSPB Scotland (IFLI team and with RSPB team), The Conservation Volunteers (TCV) and Scottish Wildlife Trust (SWT). The model was deemed to be a success and moving into years two to four the project was managed by the IFLI team.

In addition to providing two training posts as IFLI Wildlife Recording Assistants, three new posts were created: an RSPB Inner Forth Futurescape Assistant (2 post-holders), IFLI Historic & Natural Environment Trainee, and IFLI Events & Outreach Assistant. A positive relationship with the Making the Most of Masters project at Stirling University and staff from the Stirling University Faculty of Arts & Humanities resulted in students from the MSc courses of Environmental Management and Environment, Heritage and Policy being supported by bursaries to undertake research into a range of subjects following a proposal and interview process. The following research papers are available via the IFLI website:

- Kennetpans Distillery: The Site and Wider Landscape
- Conserving Communities: Comparing the motivations and opportunities of community-led action in the natural and cultural heritage sectors.
- Bridging Scotland's B-Lines: The Effects of Wildflower Grassland Restoration on Pollinator Conservation in Bo'ness.
- Heritage Engagement and the Process of Developing Social Capital.
- A Study of the Memories Associated with Stirling Harbour

Trainee placements and MSc dissertation research have contributed time and knowledge to a range of natural and built heritage projects around the Inner Forth. As a result, they have helped to manage and promote heritage features; facilitate novel research; deliver events to encourage visits and learning by adults, families, and schools; and raise the profile of the natural, cultural and built heritage of the Inner Forth within a range of communities and interest groups

Trainees and students developed their skills, knowledge and experiences while working with host organisations that look after natural or built heritage features of the Inner Forth. They were supported by agency staff, university lecturers and the IFLI team members and benefitted from on-the-job training and a wide range of specialist courses reflecting their learning needs and career development plans. While destinations of all trainees and bursary students are not known, most have gone on to secure jobs in the conservation and heritage sector, and reflected positively that their experiences with IFLI provided opportunities for personal and professional development that boosted their CVs or provided a stepping-stone into their next paid role in the sector.

IFLI's legacy

The work achieved through the Inner Forth Landscape Initiative will have wide ranging legacy outcomes for both natural and cultural heritage as well as the people living in and around the Inner Forth. For natural heritage we have improved over 130 ha of habitat, including woodland, wildflower meadows and intertidal habitats. The management of these sites over the past four years has not only increased the suitability of habitat for a wide range of species now, but by working with the expertise in wildlife organisations such as RSPB, SWT and Buglife the long-term management of these sites has been initiated, ensuring that they remain viable for years to come.

The spread of these wildlife sites across the Inner Forth and, in particular those within more urban areas, helps increase the connectivity of habitat between sites. This will facilitate movement of wildlife through previously hostile environments and contribute to attempts at improving the robustness of populations within the Inner Forth.

Improving sites for wildlife provided opportunities to run regular identification workshops through our Forth Nature Counts project. By providing access to training for local people we have increased the skills of local wildlife recorders. The result of this was that during the last four years over 13,625 records of 1,540 species from 45 taxon groups were submitted through iRecord, which, being an independent platform, will continue to accept records well beyond the lifespan of IFLI. This will allow the use of these new skills to continue to contribute to our ever-growing knowledge and understanding of the wildlife of the Inner Forth.

IFLI has also played an important part in ensuring some of the Inner Forth's important and under-recognised historical buildings are in much better condition. Works at Charlestown limekilns and Clackmannan Tower have secured their place within the landscape for years to come, increasing their visibility to all through vegetation removal and opening up more engaging access opportunities. Consolidation works, re-pointing, grids and barriers now mean that visitors are able to experience these buildings without the presence of modern scaffolding, giving a more immersive appreciation of the history.

Figure 4. Work at Kennetpans

(Image: HES)

A longer-term programme of works between HES and the Kennetpans Trust was undertaken at Kennetpans Distillery. Vegetation has been removed from the main distillery building revealing it within the landscape. It is now viewable to all who drive across the Clackmannan Bridge. Initial consolidation works have been carried out to prevent the building collapsing and providing time for longer-lasting conservation work to take place. Coupled with these physical works has been a continual series of tours and talks telling the stories of these buildings that can now be clearly seen.

Over the four years of IFLI these stories and buildings have cemented their place within the local landscape and the pride of local people. They now stand as appreciated assets for local communities to value and enjoy. Increased historical knowledge has not been restricted to what can be seen above the ground. Archaeological digs have taken place at Kinneil Kirk, Grangemouth, Higgins Neuk, Valleyfield Estate and the Stirling Watergate. Scraping back the more recent deposits of the land has brought a forgotten past back to the surface, reminding us all of the long-standing importance of the Inner Forth as a place of industry and trading, and of all the trappings of wealth associated with such activities.

While some projects have focused on field work other projects matched together field work and literature research to tease out the stories from the land, producing detailed reports and accounts. In particular the work undertaken by Clackmannan Field Studies Society has produced numerous important accounts that are freely available from our website on various aspects of the history of Clackmannanshire.

Whilst all these projects stand alone in their own right we have invested heavily in two further areas to ensure that this legacy is long lasting. Over 15km of path network has been upgraded or installed, all of which directly links to project sites. Access has been improved, opening up many of these locations for people of all abilities, continuing to bring people closer to the heritage of the Inner Forth in a way that enhances their everyday lives. Secondly, a set of interpretive beacons and markers – coupled with a digital app and leaflet – will provide to anyone who visits access to all the information generated, helping to guide them through this fascinating landscape.

Forth Futures

Looking to the future, the IFLI partnership will continue to work together to ensure that all projects are maintained for the next ten years. After working so successfully over the past few years the partnership does not see the conclusion of IFLI as the end point, but will continue to explore funding avenues to build upon the work achieved over the past four years. While it will not be possible at this time to maintain a programme of the size and scale of IFLI, it will be important to build on success to date and showcase the Inner Forth as a destination to visit and explore, while supporting and promoting the opportunities to invest in our local heritage.

Conclusion

While this is not the end of the partnership working together, it is an appropriate point to reflect on what has been achieved. It is clear from both this summary and the other articles in issues of the Forth Naturalist and Historian that a monumental amount of work has been undertaken. None of this could have been achieved without the dedication of everyone involved with IFLI. The support the partnership has given the IFLI team has made it possible to work alongside a huge number of organisations on the ground. Much more is known about the heritage of the Inner Forth, many sites are in a better condition and have a more secure future, it is easier to find the information, more local people are engaged with their local heritage and sites are easier to access. Together, all those involved have made the Inner Forth a better place to live.

Acknowledgement

Without the support from funders, in particular HLF, none of this would have been possible. The largest thank you must be extended to those who gave their free time to make projects a success: all the community groups and volunteers that spend countless hours in all weathers on project sites or researching documents. This overwhelming response from people who live within the area demonstrates the level of interest and willingness to contribute, and it is this level of engagement that provides the confidence that the legacy of IFLI is just beginning. Some of the content of this article has been taken from the text of the IFLI website, originally written by Kate Studd and Kate Fuller of the IFLI Development staff team.

NEW LIGHT ON THE RANDOLPHFIELD STONES

James Savakis, Murray Cook, Fiona Watson and Gordon Cook

Summary

New research has been undertaken at two standing stones in Stirling, known locally as the Randolphfield Stones. Oral tradition links them to skirmish at the Battle of Bannockburn, however, it is also possible that the stones had a prehistoric origin or were post-medieval fakes. Excavations at one of the stones recovered charcoal which has recently been dated indicating its erection as potentially contemporary with the Battle of Bannockburn.

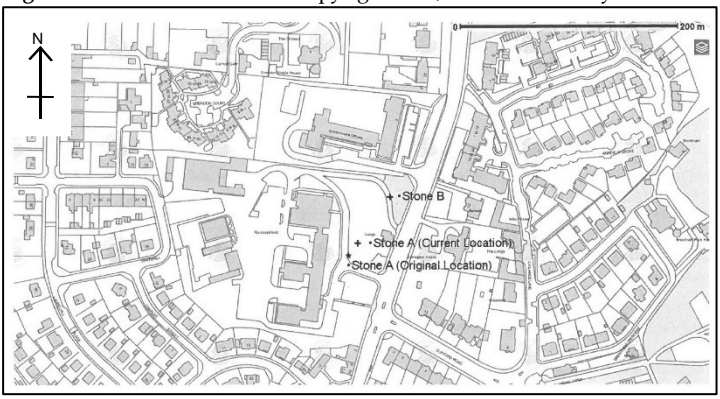
Introduction

In 2014 a small-scale excavation was undertaken by Stirling Council's Archaeologist to explore the nature and origins of one of a pair of standing stones in Randolphfield, often linked to the Battle of Bannockburn. This paper summarises the known history of the stones and presents the results of the excavation, a radiocarbon date on material recovered from the foundation cut of the stones and speculates on their origin.

Background

The Randolphfield Stones (NGR NS79465 92481; CANMORE NS79SE 43; Figure 1) are located in the landscaped front garden of Police Scotland's buildings at Randolphfield, Stirling and surrounded by either main roads or access road on all sides

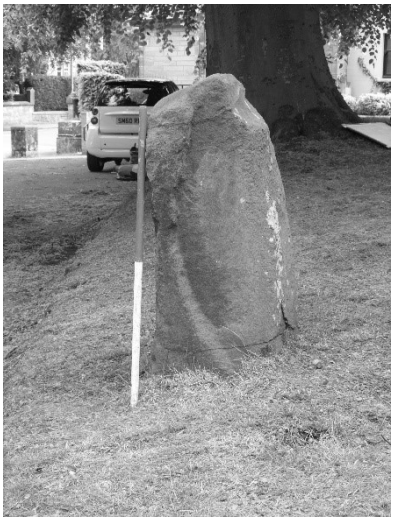
Figure 1: Site location Crown Copyright 2018, Ordnance Survey 100020780



Both stones are made of dolerite rock (The Northern Antiquarian, undated). The larger of the two stones is referred to as stone A (Figures 1 and 2) which is an upright rectangular pillar and located to the South West of Stone B (Figures 1 and 3). Stone A is approximately 1.6 metres high, 0.56 metres long at ground level and 0.48 metres wide at ground level. Stone B is also an upright rectangular pillar, which sits close to a sloped embankment next to a wired post fence. Stone B is 0.93 metres high, 0.5 metres long at ground level, and 0.3 meters wide at ground level. The stones currently stand about 45.75 metres apart and stone A has been reconstructed or repaired with cement (Cook M. *pers obs*).

Figure 2. Stone A from North

Figure 3. Stone B from North



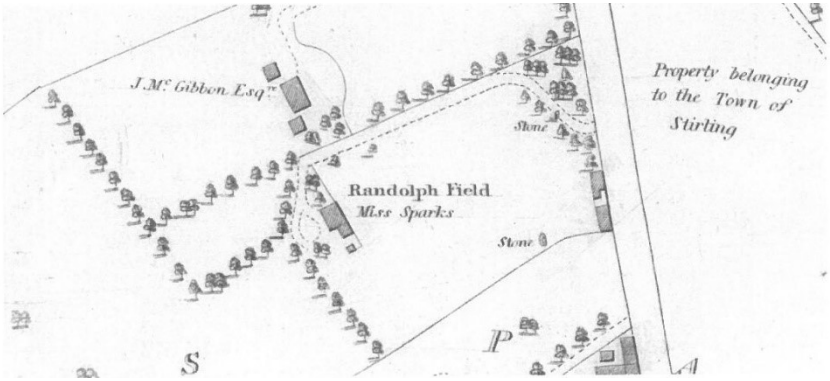
Recorded History of the Stones

The first historical evidence for the stones existence and location comes from a late 18th century account by William Nimmo (1880, 55). In his book, *The History of Stirlingshire*, Nimmo mentions how common it was for Scots to erect large stones in fields of battle as memorials of victories or to commemorate where the battle was fought. Nimmo (*ibid*) states that two stones stand in a field near Stirling where Sir Thomas Randolph, Earl of Moray and the English forces of Sir Robert Clifford fought in a skirmish on June 23, 1314, the first day of the Battle of Bannockburn. He then goes on to describe the events by stating that Randolph was observed by the English with 500 foot soldiers near the fields of St. Ninians. Randolph pursued Clifford's forces to where Nimmo describes as a field where "*the village Newhouse now stands*" (*op cit* 184).

It is likely that Nimmo's account draws heavily on John Barbour's poem "Bruce" or "Brus." The poem goes through similar details of the battle (Barbour, J., 1914, 214-33). Nimmo states that, after Randolph wins this skirmish, two large stones are erected in the field of battle where they can still be seen. He goes on to say that the spot containing the stones was ultimately enclosed by a garden, but he does not specify when. Nimmo does specify that the stones can be seen at the North end of the village of "*New-House*", about a quarter of a mile from the South port of Stirling (*op cit*, 185).

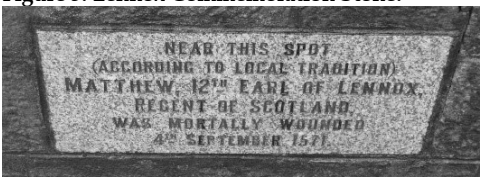
The stones are mentioned again by Reverend Sheriff (1796) in *The Old Statistical Account of St. Ninian's*, where he reiterates that the stones were erected to commemorate the skirmish before the main battle of Bannockburn. It seems likely that Sheriff is drawing on Nimmo's account. The stones are first mapped by John Wood in 1820 (Figure 4) and are shown as lying in the front garden of a private house known as Randolph Field, the house to the immediate South is called Clifford Park

Figure 4. Extract of John Wood's 1820 'Plan of the Town of Stirling', used with permission from the National Library of Scotland'.



In the wall of the front garden of Clifford Park is a stone plaque recording a local tradition that Matthew, 12th Earl of Lennox and regent of Scotland was fatally injured near this location on September 4th, 1571. While Mathew was indeed fatally shot in a skirmish in Stirling (Lynch 1991, 220) there is no evidence it took place at Randolphfield.

Figure 5. Lennox Commemoration Stone.



The first edition Ordnance survey from the middle of the 19th century gives the first accurate record of the stones and also plots the supposed line of the Roman Road to the immediate West of the stones (Figure 6). Excavations elsewhere along the line of the road as mapped have confirmed the presence of a cobbled road surface associated with 17th century material assumed to be the road's final resurfacing (Cook and Watson 2013).

Figure 6: Extract of an Ordnance Survey 1st Edition map covering Stirling (the parallel lines to the left are the line of the Roman Road), used with permission from the National Library of Scotland.

The Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS), first measured the stones in 1954 (CANMORE NS79SE 43): Stone A was measured at 1.21 metres high and 0.6 metres by 0.46 metres at ground level. Stone B was measured at is 1.12 metres high and 0.43 metres by 0.3 metres at ground level. It is worth noting that these are different to the current dimensions of the stones, Stone A is currently bigger and Stone B is currently smaller. In 1960 Dorothy Hunter undertook a small excavation at the site with negative findings (1960). In 1985 both Randolphfield and Clifford Park were demolished (Stirling Council 2014, 12) and a new access road was constructed. It seems probable that the movement of Stone A from its original position to its

current was undertaken to facilitate the construction of the access road. There is no record of any archaeological monitoring taking place during this exercise. It seems possible that the repositioning of the stone resulted in both its fracturing and subsequent repair as well as its change in height. In addition, it may be that the spreading of spoil from the construction of the road resulted in the apparent shrinking of Stone B as the ground level was raised.

In December 2010, Historic Scotland (now Historic Environment Scotland) published their Inventory of Historic Battlefields in Scotland and the Battle of Bannockburn was amongst the first to be considered. This document (HES 2010) reviews the known history and archaeology of the battle over its two days and attempts to map all of the key features of the battle and associated commemorative monuments and oral traditions. Explicitly the Bannockburn entry excludes the Randolphfield stones and thus implicitly concludes that the stones are not connected to the battle in any way. This interpretation remains untested.

Alternatives

If the stones are not necessarily connected to the Battle of Bannockburn there are two other possibilities: the first that the stones are 17th or 18th century fakes, designed as garden features; and the second that they are the remains of a prehistoric monument around which oral tradition has accumulated. Regarding the first theory, there is certainly argued to be at least one 17th century fake antiquity in Stirling: the so-called Roman stone on Gowan Hill (RCAHMS 1963, 112), which purports to be an abbreviated Latin inscription regarding troop movements. However, the Randolphfield stones are rather unimpressive and surely fakes would be more impressive? Initially, the authors were of the opinion that the stones were more likely to be the truncated remains of prehistoric stone row. Certainly, there are other stone rows around Stirling, for example Lairhill (CANMORE NN80SW 2) and Glenhead (CANMORE NN70SE 3).

Additionally, to the north-west of the stones during landscaping works in the front garden of Viewfield House in 1856, a Bronze Age cist cemetery was uncovered (Stirling Council SMR Site No 2914). The cemetery and two stones in their original position appeared to be roughly aligned. An initial assessment of the stones by Douglas Scott revealed a potential lunar alignment to the stones, apparently supporting the truncated stone row theory. Accepting this premise, it might be proposed that in a medieval landscape without road signs, a pair of standing stones or a row of them next to a Roman Road, would be an excellent landmark to either direct troops to, or an ambush or even a feature about which to assign stories and myths. Certainly, elsewhere in Stirling and across Scotland, prehistoric monuments acquired stories and explanations, all of which were written down in the 18th century as society first began to

document and map its history. The Wallace Stone on Sheriffmuir (Canmore NN80SW 2), for example, is an element of a prehistoric stone row associated as a mustering point for William Wallace; or the Bore Stone on Monument Hill, argued to be where Bruce raised his standard on Day 1 of the Battle of Bannockburn, but more likely to be a rough out for a medieval millstone (Wright 2011, 14). Finally, Comyns Camp in Aberdeenshire, a prehistoric hillfort said to have been used in the Battle of Inverurie (1308) which features Wallace's Putting Stane, said to have been thrown by Wallace from Bennachie, in an apparent superhuman aerial bombardment of the Comyn's position, in support of Robert the Bruce, three years after he had been killed (Cook 2012).

Excavation

In order to explore the origin of Stone B, a small-scale excavation was carried out by Cook and Watson in May 2014. The topsoil [101] around Stone B was around 0.44 metres deep, and was associated with Victorian and post-medieval pottery and which sealed a lower buried soil [103] around 0.16 metres deep and not associated with any pottery.

The foundation cut for Stone B was sealed by [101] and cut through [103] into the underlying natural sands and gravel and was steep sided with a flat base and up to 0.4 metres deep.

Figure 7. Plan of excavation of Stone B.

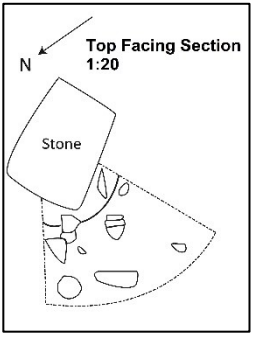


Figure 8. West facing section of Stone B.

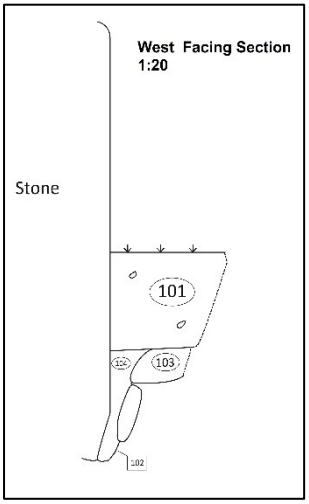


Figure 9. Picture of Stone B being excavated from the south-west.

The fill of the cut, [104] was a mid-brown silty soil, which contained no Victorian pottery, but did contain a piece of burnt hazel nut shell. This hazel nut shell was dated to 640 ±28 (SUERC 70000), which when calibrated to two sigma give a potential range of AD 1283-1396, potentially contemporary with the Battle of Bannockburn.

Discussion and Conclusion

The radiocarbon date means that the hazel nut shell was burnt between AD 1283-1396, and its presence in the fill of the cut of the standing stone means that the stone was erected when this material was present in the ground, i.e. after it had been both burnt and subsequently spread into soil, presumably as fertilizer, which at face value rules out a prehistoric origin. The absence of modern pottery from the fill of the cut, makes it unlikely that the stones are 18th century in origin. The evidence indicates that the stone was erected between 1283 and say 1700.

There are clearly three interpretations of this evidence:

1. The stone was prehistoric in origin and had been knocked down at some point and re-erected after the battle for some unknown purpose but perhaps in commemoration of the skirmish;
2. The stone was erected at the time of the battle in commemoration of the skirmish;
3. The stone was erected or re-erected for some purpose, currently unknown at some point after the battle and was subsequently the focus of oral tradition and myth connecting it to the Battle of Bannockburn.

At present there is no basis to distinguish between the three options, though the authors would like to think that the stones were definitely connected to the Battle of Bannockburn as this makes for a better story!

Acknowledgments

The authors would like to thank both the former Central Scotland Police and Police Scotland for permission to work on their land, to GUARD Archaeology who assisted the project in its earliest phases, the charcoal ids were done by Jackaline Robertson at AOC Archaeology. Thanks must also be offered to the various volunteers who helped with the excavation. Finally, the

radiocarbon dates and associated costs were paid for by the authors with generous assistance from both Historic Environment Scotland and Torbrex Community Council.

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KEIR HILL OF GARGUNNOCK: REDEFINING THE NEBULOUS. THE REASSESSMENT OF A ROMAN IRON AGE SETTLEMENT.

Murray Cook, Therese McCormick, Ross Greenshields, Fraser Hunter, Gemma Cruickshanks and Gordon Cook with contributions from Colin Wallace, Torben Bjarke Ballin and Jackaline Robertson.

Introduction

As part of a wider review of the later prehistoric settlement forms of the Forth Valley, a limited programme of resurvey, key-hole excavation and reanalysis of archived finds was under taken at Keir Hill of Gargunnock in June 2016. All material costs were paid for by Historic Environment Scotland while the excavation and write up were undertaken in the main authors' own time ably assisted by local volunteers and students.

Location and background

Keir Hill is a prominent knoll located in the South East of the village of Gargunnock, (NS 70626 94272). The knoll rises steeply to approximately 10m from the ground level with its top approximately 16 metres from North to South and 20 metres from East to West.

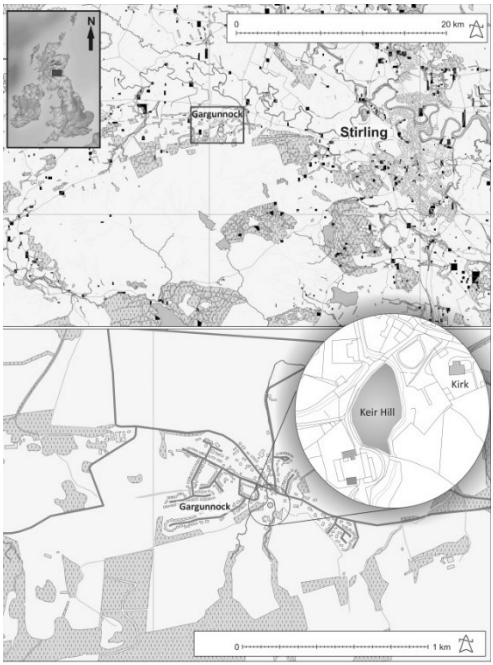
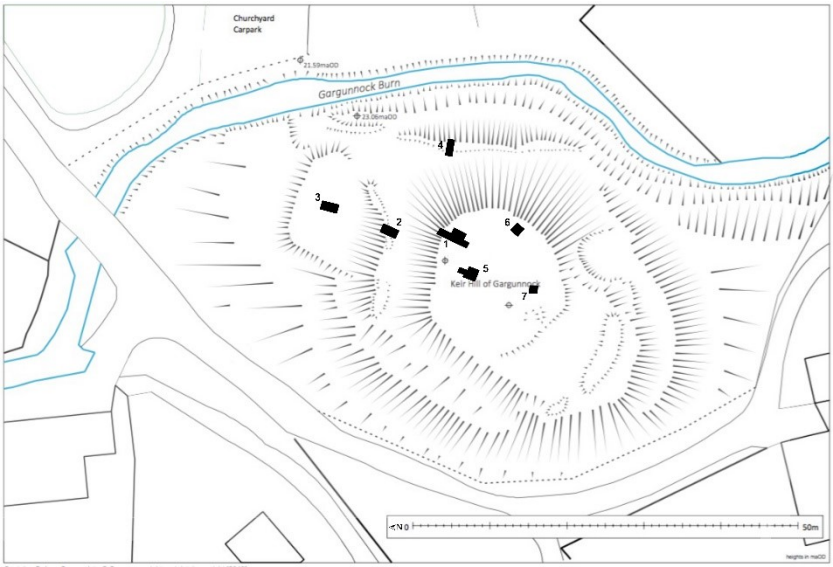


Figure 1: Site Location

Two banks interrupt the slope, one on the northern side approximately three metres from the top and the other on the south-eastern side approximately seven metres from the top.

Figure 2: Site Plan.



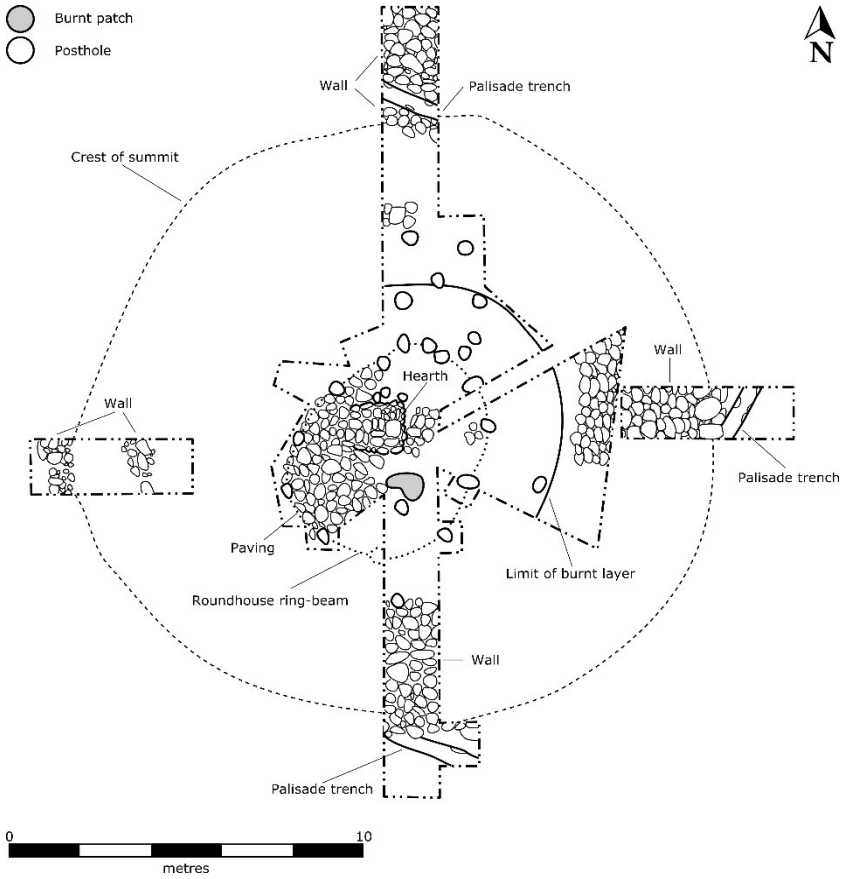
A platform approximately eight metres North to South and 12 metres East to West is located on the north-eastern side of the slope, approximately three metres above ground level. The site is covered in bramble and broom with a variety of deciduous trees.

The site was first described by Maclagan (1872) and was partially excavated by the Royal Commission of Ancient and Historical Monuments of Scotland (RCAHMS) in 1957 (MacLaren 1958) - along with another at Keir Knowe of Drum – with the aim of investigating two representative sites of a series of sites named 'Keir' also located on natural prominences (*ibid*). The name 'Keir' may be related to 'caer', an old Celtic or Gaelic word meaning fort (Watson 1926, 365-369), which might suggest that hills bearing this name represent the locations of defensive structures. However, the nebulous nature of toponymic origins makes it unclear if such names necessarily derive directly from the nature of a site's use or rather from later antiquarians' assumptions about the function of the site.

MacLaren (*op cit*) describes the site as a 'homestead' (now 'a non-preferred term' in the National Monument Record) which was truncated by later activity, but the interior contained a roughly circular post-built structure, 8.8 metres in

diameter (Figure 3) with an inner and outer ring and a possible entrance and porch in the South. The eastern half was roughly cobbled and associated with a hearth. The interior was covered by a layer of ash and burnt material indicating that the structure had been burnt.

Figure 3: Original Excavation Plan



The timber structure was surrounded by a truncated rubble-built wall up to four metres wide with a diameter of around 13 metres. The wall overlay a palisade trench which was 0.46 metres wide and 0.38 metres deep. A series of late first century AD Roman finds were recovered from the interior. The outer banks were considered to be later than the excavated occupation. The sides of the hill also appear to have been impacted by quarrying.

Results

Excavation The excavation was carried out by Murray Cook and Therese McCormick and local volunteers between the 10th and 13th June 2016 (Cook and McCormick 2016). All trenches were deturfed and excavated by hand. Seven trenches were established: Trenches 1, 5, 6 and 7 at the top of the knoll, Trenches 2 and 4 on the banks of the slope and Trench 3 on a platform below the slope (See Figure 2). As the results are recorded in detail in the Data Structure Report (*ibid*), only a summary of the key results is presented here. Trenches 2 and 4 confirmed the presence of possible palisades within the outer banks. Trench 3 revealed negative results. Trenches 1 and 7 confirmed the location of the original 1957 excavation and recovered a number of previously unrecorded artefacts. Trenches 5 and 6 examined previously un-excavated portions of the site. Trench 6 identified the previously recorded palisade and Trench 5 identified the truncated wall and some of the interior.

Outer Palisades

Figure 4: Trench 2 Palisade.

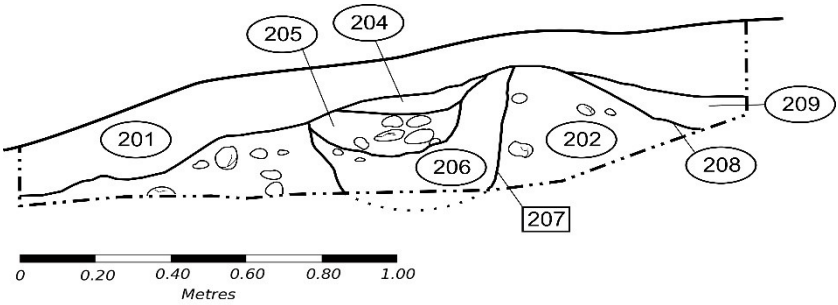
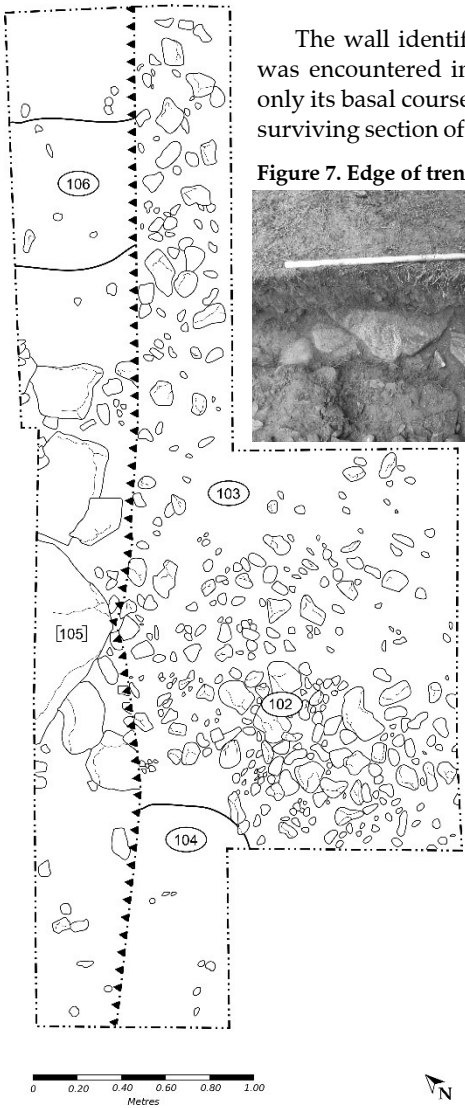


Figure 5. Trench 4, Outer Palisade.

In both cases the outer banks contained palisade structures at their cores. The cut [207] in Trench 2 measured 0.54 metres wide with steep sides and a minimum depth of 0.34 metres and was cut into the natural soil. It was filled with rounded to sub-rounded stones, which are assumed to be packing stones, although no post-pipes were recorded.

Wall

Figure 6. New excavation wall in Trench 1.



The wall identified by MacLaren (see Figure 3) was encountered in Trenches 1, 5 and 6, although only its basal course was still *in situ* in Trench 1. The surviving section of wall measured around 2m wide.

Figure 7. Edge of trench 5.

In Trench 5, it was clear that the wall comprised a rubble core with larger facing stones, as per MacLaren's excavations (*op cit* 82).

Pre-wall Palisade

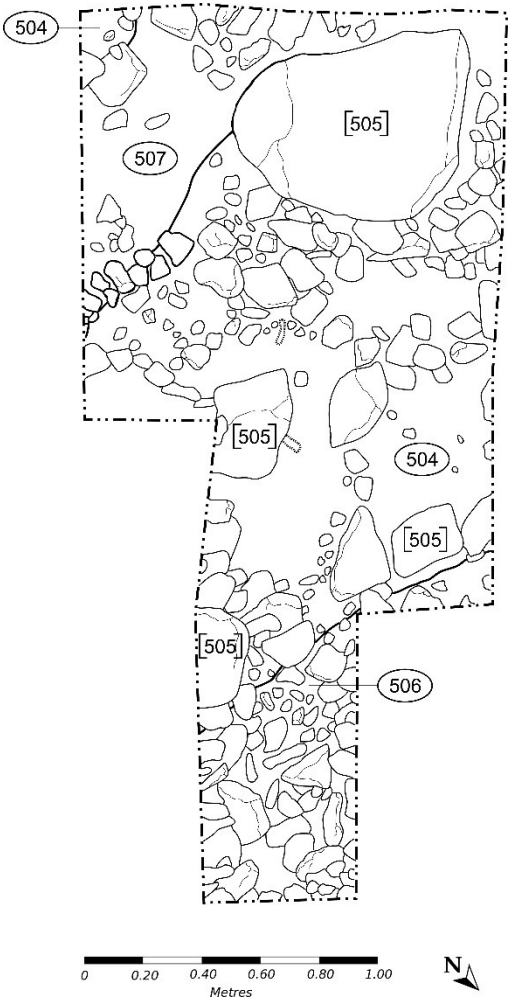
The pre-wall palisade was identified in Trench 6 and comprised a cut [606] into the natural on a north-east to south-west orientation, with near vertical sides (Figure 6). It measured 0.7m wide and at least 0.2m deep and was filled by [607], a pale brown soil containing sub-rounded and sub-angular stones [604] between 0.12 metres and 0.16 metres in size. A single piece of short, live alder charcoal from this material was dated to 1865±28 bp (SUERC 69996) which, when calibrated to two sigma, gives a date of cal AD 78-227.

Interior

A small portion of the interior was tentatively identified in Trench 5, to the inside of the large stone, assumed to be a facing element of the rubble wall (Figure 7) and comprised [507] a pale brown soil up to 0.30 metres thick with occasional charcoal deposits. This material is assumed to be the same as the dense layer of charcoal and burnt material identified by MacLaren (1958, 80).

A single piece of short lived alder charcoal from [507] was dated to 1948±29 bp (SUERC-69995) which, when calibrated to two sigma, gives a date of cal 2 BC to AD 127.

Figure 8. Trench 5 Plan.



Artefacts from Keir Hill of Gargunnock

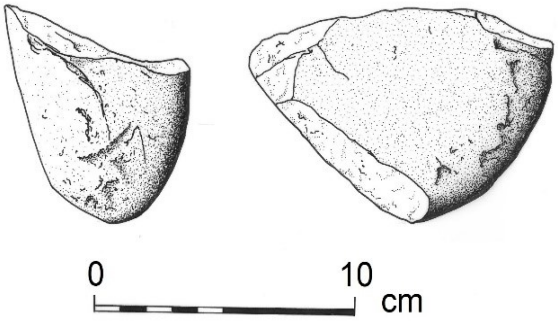
Fraser Hunter and Gemma Cruickshanks, with lithic identification by Torben Bjarke Ballin and notes on Roman pottery by Colin Wallace

Summary

A small assemblage of 22 artefacts was collected from two excavations on Keir Hill of Gargunnock in 1957 and 2016 (see Table 2, page 165). Though small, the assemblage comprises a range of artefacts, from everyday cobble tools to more exotic items such as sherds from Roman glass vessels, a melon bead and a sherd of painted Roman fineware pottery. An early Neolithic leaf-shaped arrowhead provides evidence of activity on the site several millennia before the Iron Age settlement's construction (though it could be a found object brought to the site later), while a range of modern artefacts (mainly pottery, glass and coins) indicate more recent use. Artefactual dating relies on the Roman finds: the glass is of first-second century date, while the pottery (identified by Gillam and confirmed by Colin Wallace as Flavian) provides a tighter chronology. A number of sites show Roman contact in Stirlingshire in this period; the specific range of finds is unique to Keir Hill, but the evidence for contact with the army can be paralleled elsewhere.

Coarse Stone

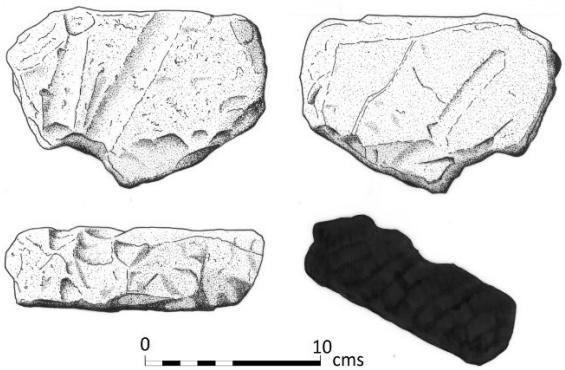
Figure 9. Two cobble tools for pounding.



Six coarse stone artefacts were recovered between the two excavations. Two cobble tools were used for pounding (SF2) and hammering/ pounding (SF7) and would have been multi-purpose tools used for a range of tasks.

A small sandstone disc (SF5) shows possible flaking around the edges while a flat, fine-grained siltstone cobble (SF4) has multiple fine striations and clusters of peck-marks on both faces, suggesting it was used as a small working surface, for instance for cutting and piercing small leather items. X.1961.6 (MacLaren 1958, 82, fig. 3) is a perforated flat cobble and was most likely used as a weight, perhaps for thatch or weaving.

Figure 10. Small sandstone fragment.



A red sandstone fragment (SF9) has distinct round-sectioned grooves on both faces which were probably formed when shaping or sharpening rounded objects, perhaps of wood or bone. Part of a groove on one corner may have been the central perforation of a rotary quern, but no traces of grinding surface survive to confirm this.

Flint arrowhead *(Torben Bjarke Ballin)*

The single struck lithic artefact (SF 22) is a finely shaped flint leaf-shaped arrowhead. The point's outline defines it as a Type 4Cw according to Green's (1980, 72) leaf-shaped arrowhead typology and such forms are generally associated with the Early Neolithic period. Since this artefact was recovered from topsoil on top of the Iron Age structure, it is certainly redeposited, possibly during construction work in the Iron Age, though the idea of it being found and brought to the site as a curio in the Iron Age cannot be ruled out.

Cannel coal bangle

A finely-shaped and polished fragment of shale bangle (X.L.1961.2) with large D-shaped section was discovered during the earlier excavation near posthole no. 23 on the floor of the hut under the burnt layer (MacLaren 1958, 82). The internal diameter of 65-70 mm falls into the size which could represent either a male or a female bangle (Hunter 2016, fig. 4).

This is a rare type within the large corpus of such bangles; it falls into Hunter's group 3 (large D-sectioned), of which only 11 examples are known to us (Hunter 2012). Unfortunately, their dates (from contextual data) are either vague or varied, from the late Bronze Age to the early Medieval period; the associated finds from Keir Hill suggest a Roman Iron Age date for this example. Cannel coals are known from the central Scottish coalfield (Cameron & Stephenson 1985, 84-91, fig. 26), which lies at its closest some 15 kilometres from the site, though precise outcrops have not been traced. While not a highly exotic import, it was clearly a well-made and valued item, as the rarity of the type and the traces of repair attempts indicate.

Glass

The Roman glass vessel shards (X.L.1961.5) were recently published by Dominic Ingemark (2014, 122, 157, 257). They come from two separate vessels. Three shards are from a blue-green unguent bottle of first-second century date which would have contained perfumes, cosmetics or medicines (*ibid*, 120-1). These are a rare type in Scotland, with only four examples known from non-Roman contexts: an intact find of mid-first century AD date from Loch Kinord, Aberdeenshire (probably a votive deposit); another Stirlingshire find from the Camelon homestead and a fragment from the great hillfort of Traprain Law, East Lothian (Curtis and Hunter 2006, 211; Proudfoot 1978, 119, fig. 5.8; Ingemark, 2014, 122, fig. 3.21.4). Clearly this was not a favoured type on indigenous sites, in contrast to its popularity in the Roman world; both Camelon and Traprain were sites with strong links to Rome, so such finds may be a marker of more intensive influences. Eight other green shards are less distinct, but probably come from some form of cup or beaker (*ibid*, 157), fitting the wider indigenous preference for glass connected with eating and drinking (*ibid*, 178-181).

The only other glass artefact is an intact translucent dark blue melon bead (X.L.1961.3). This is a Roman type, typical of the first century but continuing in use into the second century and beyond (Hoffmann 2006). Such beads had a range of functions in a Roman context. Finds from the Caerleon bathhouse (inter alia) indicate human use, and this is implied more locally by a small hoard of ornaments from Cowden Hill, Stirlingshire, consisting of a brooch, spiral finger ring and melon bead (Brewer 1986, 151; Hunter 2001a, 116-8). However, they were commonly used to adorn horses, and are also found attached to other equipment (an example hangs on a dolabra sheath from Bonn (Bishop 1988, fig 1; Curle, 1911, 279). The large perforation diameter, much larger than is normal for necklaces, supports use on a heavier-duty cord.

It is tricky to assess how such items were used in a local context, but a role as beads or amulets for human use is most likely; they are the commonest kind of Roman bead from Iron Age sites, being found on 26 of the 34 sites which have produced beads, generally as single finds or in small numbers (unpublished work by authors). This example was certainly heavily used, whether before it came to the site or after; the extensive end-wear indicates use in a necklace, where it rubbed against adjacent beads.

Roman pottery *(Colin Wallace)*

A sherd of early Roman fineware pottery (X.L.1961.4) was initially identified by J. P. Gillam (in MacLaren 1958, 82) and has recently been confirmed as Flavian by the writer, placing it in the late first century AD. It is a fine oxidised ware with contrasting slip-decoration from a ring-and-dot

decorated beaker of a type found on Flavian-period Roman military sites in Northern Britain. Work on London material strongly suggested a source for most of these beakers in the St. Albans-London area (Davies *et al*, 1994, 142-5).

Later material

A range of more recent material was recovered, predominantly from topsoil contexts (C.101, 301 and 401) and comprising Victorian or later pottery sherds, glass fragments, coins and brass buttons. A possible medieval, green-glazed, redware sherd (SF16) from a layer beneath the topsoil (C.302), provides the only evidence of medieval activity on the site. A catalogue of this material is in the archive.

Finds Discussion

The two assemblages from 1957 and 2016 are notably different in nature. While the 2016 assemblage comprises typical, everyday items such as cobble tools, the 1957 excavations produced rarer, more decorative objects. This suggests items like cobble tools may not have been recognised or retained in 1957; such collection biases were common at that time. The 2016 assemblage is therefore an important addition as it adds the everyday to the exotic, both of which are required to understand fully the range of activities and connections associated with the site. Most of the stone tools cannot be attributed a specific function, but the pounder and pounder/hammer are likely to have been utilised in everyday tasks such as food-processing. The grooved stone and small work-surface hint at craft activities, though their exact nature remains opaque.

The Roman material (melon bead, pottery and glass) provides clear evidence that the residents of Keir Hill had contact with the Romans. While the objects present fit within the typical range of Roman material on native Iron Age settlements - personal ornaments and food/ drink (Hunter 2001b) - the specifics are unusual as painted fineware beakers and glass unguent flasks are unusual types from native sites. Few other Scottish native sites have produced Roman finewares beyond samian, though nearby Fairy Knowe is an exception (Willis 1998, 324, fabric 5).

Although the assemblage is a small one, it fits a pattern of a minority of sites with a more extensive range of material: not just lowland brochs such as Fairy Knowe and Leckie, but also the enclosed site of Camelon (Main 1998; Mackie 2017; Proudfoot 1978). While the melon bead, glass vessels and radiocarbon dates at Keir Hill fit a broad first-second century AD date, the painted fineware beaker narrows this down to the first century AD, consistent with the dating of Fairy Knowe and some of the Leckie material (see table 1, page 165).

Discussion

Keir Hill sequence

In broad terms the stratigraphic sequence of the site recorded by MacLaren (1958) has not changed: the earliest phase of activity (other than the Neolithic arrowhead,) is the timber palisade. It seems likely that this enclosure was associated with a timber roundhouse in the manner of the enclosures at West Plean (Steer 1958) or Bannockburn (Rideout 1996), although both of these are undated and perhaps some of the post-holes MacLaren assigns to a porch (Figure 3) may be an earlier structure. It may also be that the outer palisades are associated with this phase, although they remain undated.

The inner palisade was replaced by a substantial stone wall, in the manner of a broch or dun, although there was no recorded architectural complexity. The presence of stone tools from the backfilled trenches suggests that they were reused in the wall. It is not clear if the coherent timber roundhouse excavated by MacLaren is associated with this wall. It might be an enclosure wall, or something akin to broch wall with a timber inner structure or a different phase of activity. This timber roundhouse was destroyed by fire and it is likely that the stone wall was subsequently robbed out. Certainly, there are quarry scoops around the hill.

Dating

The radiocarbon dates from the inner palisade and the burnt internal roundhouse overlap with each other, indicating a rapid change from enclosing works of timber to stone. This transformation was also observed at Fairy Knowe (Main 1998) where a substantial timber roundhouse was replaced by a broch. Equally, the settlement at East Coldoch appears to have undergone a series of reconstructions across the 1st to 4th centuries AD (Woolliscroft 2005; NS79NW 34).

The radiocarbon dates and revisited artefact identifications confirm a date of the late 1st or 2nd centuries AD, slightly earlier than that proposed by MacLaren but in keeping with the dates established from other structures: Castlehill (Feachem 1959), Fairy Knowe (Main 1998), Mote Hill (Cook *et al* 2016) and Leckie (Mackie 2016). In turn it is assumed these sites may be broadly contemporary with other undated sites on the basis of architecture, i.e. Torwood and Coldoch brochs. While this argument may be extended to other cognate forms (brochs, duns and homesteads) (Harding 2004, 129-32, 238-40) this argument is not pursued in this short paper (see Cook *et al* forthcoming).

Hierarchy

On the basis that these sites may be contemporary, their different sizes and different architectures (see Table 3, page 166) suggest some form of hierarchical patterning: inhabitants of larger structures or those with more complex architecture may be differentiating themselves from those with smaller or simpler structures. Certainly, the distribution of exotic Roman goods supports this argument (Hunter 2001b), with the architecturally complex Leckie (Mackie 2016) and Fairy Knowe (Main 1998) containing both a greater volume and range of Roman imports than Keir Hill. MacInnes (1984) argued that the southern brochs reflected an evolution of conspicuous consumption in the face of growing quantities of Roman imports. It is therefore proposed that the rapid evolution of design and the variety of architectural forms present within the sample area reflects the same process of social competition and conspicuous consumption.

It is likely that the resources fuelling this competition were in part derived from the Roman occupation. In the Flavian period (late first century AD) there were forts to the North, while in the mid-second century the Antonine Wall lay to the South, with a line of forts North to the Tay. The local population may have been involved in trade, or the Roman army may have targeted links to more powerful groups as much for diplomatic as commercial reasons. The key factor affecting movement in the area is of course the Forth Valley, which is dominated by the low lying Carse, an extensive boggy area which restricted North-South movement to a handful of areas, the most obvious of which is of course Stirling and Stirling Bridge, famously exploited by Wallace at the Battle of Stirling Bridge. The strategic significance of this crossing is illustrated by Matthew Paris' 13th century map of Britain, which portrays Scotland North of the Forth as another island, only accessible via the bridge at Stirling.

The presence of very large medieval and post-medieval cattle trysts at Crieff and latterly Falkirk (Matthews 1974, 180-2) involved in transporting cattle to southern markets gives one possible model of exchanges which may have occurred during the Roman occupation of southern Scotland. Indeed, as Stallibrass (2009) observes 60% of animal bone from sites on Hadrian's Wall are cattle bone and the evidence indicates that it arrived on the foot rather than as carcasses.

Destruction by Fire

It is noteworthy that a majority of the excavated sites with the Forth Valley show evidence of destruction by fire (Table 3, page 166). Some have linked this process to the changing nature of the Roman occupation of southern Scotland (MacInnes 1984; Mackie 2016); there are parallels to the deliberate abandonment of souterrains in Angus and Perthshire (Armit 1999), though the mechanisms behind this have been queried (Dunwell 2015, 148). The two main

alternative interpretations for the burnt site are destruction by Roman troops versus ritual destruction by the occupants. Of course, one may also add accidental destruction (these are dry timber buildings after all) or internal warfare between tribal rivals.

It is unlikely that any one model explains the different circumstances of the destruction of the various sites: for example, Mote Hill was vitrified, a process which requires extensive and prolonged firing (Cook *et al* 2016), while Fairy Knowe was dismantled and then burnt (Main 1998) and while Torwood contained what may have been burnt roof timbers, these were not properly recorded (Dundas 1868; Cook *et al* forthcoming). It may be more interesting to consider East Coldoch, the single excavated site with both evidence of reoccupation and evidence of later Roman objects. Did the effects of the varying Imperial policy result in a consolidation of access rights to routes across the Forth Valley, resulting in fewer more prominent settlements and less competition?

Conclusion

While the works at Keir Hill broadly confirmed the results of the previous project, the greater recognition of coarse stone tools, the application of radiocarbon dates and the more nuanced review of the Roman finds have provided greater insights into the site than was previously possible. Additionally, it is clear that Keir Hill fits into a broader settlement pattern with nearby brochs and forts and that each individual architectural form cannot be studied in isolation. Indeed, Keir Hill shares specific aspects of its architecture with forts and brochs/duns. It is clear that the late first and second centuries AD in the Forth Valley was a period of rapid change, architectural innovation and social competition, presumably fuelled by interaction with the Roman Empire and the exploitation of restricted travel routes.

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Table 1. Radiocarbon dates from Keir Hill of Gargunnock.

Sample	**SUERC 69995**	**SUERC 69996**
Material	Alder charcoal	Alder charcoal
Context	507	604
Description	Burnt material in interior	fill of palisade
Depositional Context	primary	secondary
Uncal BP	1948±29	1865±28
Calibrated 1-sigma	AD 20-82	AD118-174
Calibrated 2-sigma	2 BC-AD127	AD 78-227
Delta-13C ‰	-28.4 ‰	-27.0 ‰

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program
(OxCal3 http://www.rlaha.ox.ac.uk/oxcal/oxcal.htm)

Table 2: summary of prehistoric and Roman artefacts recovered from Keir Hill.

Artefact type	**Excavation**		**Total**
	1957	**2016**	
Coarse stone	1	5	6
Lithics		1	1
Roman glass bead	1		1
Roman vessel glass	11		11
Cannel coal bangle	1		1
Roman pottery	1		1
Slag		1	1
Total	15	7	22

Artefacts from the 1957 excavation are in the National Museum of Scotland (NMS) (Accession numbers X.Q.L.1961.2-6) while those from the 2016 excavation are not yet allocated to a museum at the time of writing.

Table 3: excavated Later Prehistoric Settlement Sites in the Forth Valley.

Site Name	Roman Finds	Type	RC dates	Burnt
Coldoch	no	broch		?
Gallow Hill	1st C AD	fort		?
Wallstale	no	dun		no
Torwood	no	broch		yes
Keir Hill	1st C AD	fort		yes
Mote Hill	no	fort	1st-2nd C AD	yes
Leckie	1st C AD	broch	1st C AD	yes
Fairy Knowe	1st C AD	broch	1st C BC/AD	yes
Castlehill	1st C AD	dun		yes
East Coldoch	1st-4th C AD	palisaded enclosure	1st - 4th C AD	yes

Coldoch (Graham 1951); Gallow Hill (Stirling 1960); Wallstale (Thomson 1971); Torwood (Dundas 1868); Keir Hill (MacLaren 1958); Mote Hill (Cook *et al* 2016); Leckie (Mackie 2017); Fairy Knowe (Main 1998). This excludes two sites which are likely to be contemporary but cannot be confirmed due to limited dating (Myrehead, Falkirk, (Barclay 1983) and Greenyards, Bannockburn (Rideout 1996)).

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THE HIGHLANDMAN'S WELL AND THE LOGIE HOLY WELL

John A Smith

Summary.

Highlandman's (or Hielandman's) Well is located beside the Sheriffmuir road in Logie Parish, about a mile from Logie Old Kirk. A fresh water spring has existed here for centuries, but during the 20thC a belief developed that it is, or was at some time, a holy well. This is not correct and there is a risk that if this view is left unchallenged it will eventually become the accepted truth to the detriment of accurate local history. The following notes describes both the Hielandman's Well and the Logie Holy Well and explains the confusion between the two

Highlandman's (Hielandman's) Well (NS: 813980)

Hielandman's Well sits at a sharp bend in Sheriffmuir road three kilometres or so from Old Logie Kirk. This was a main route between Blackford and the Forth crossing at Stirling. It was a route for northern Highland drovers heading for Stenhousemuir tryst, until droving ended towards the close of the 19thC. It is generally believed the well is named after them. Back then, the Sheriffmuir area was more populous, so the farms, dwellings, mills and inns plus through travellers on foot or horseback all used the road too. The well was therefore important for the animal-based transport and walkers of the time, particularly as it is sited at the top of a long steep climb.

The source for the spring is not known, but water flows from it out of an iron pipe believed to be the overflow of an original gravel pool. Around 1850 the Roads Trustees deepened this pool and lined it with stone using a lime mortar. Local criticism maintained this caused the well to became *'a receptacle for frogs, lizards and various kinds of dirt'*. Eventually it became infilled and nearly hidden from view. During minor debris removal work in 2010 pieces of stone and lime mortar as described as being used in 1850 were uncovered.

Holy Well (NS 816975)

About half a kilometre south-east of Hielandman's Well, behind Yellowcraig Wood, is a small wetland area. It is fed by numerous springs from an escarpment to the North and as little as 30 years ago held open water. This is site of the Holy Well. It is first mentioned in an undated land charter confirmed by both Bishop Symon (tenure c.1178-c.1196) and Bishop Abraham (tenure c.1212-c.1225 of Dunblane. This confirmed that land in Logie was given by the Earls of Fife to North Berwick Nunnery. The extent of the land is described, including the Holy Well within it.

In 1228 Malcolm, Earl of Fife, confirmed to the Nunnery of North Berwick… the Church of Login, along with Drumnach, said to be the land pertaining to the church. Drumnach…the field on the ridge…which is supposed to comprise the fertile land north of the church, extended from the Sheriffmuir road on the west to Fossoquhie on the east, within which is the Holy Well.

This perfectly describes the location of the Holy Well. Fossoquhie, now in ruins, is 600 metres or so south-east and the Sheriffmuir Road lies a similar distance northwest. No relationship with, or description of, any other well is given or suggested.

Behind Dumyat, some four kilometres from Logie Kirk, lay the farming estate of Loss owned for 80 years by the Wright family, whose interests included, amongst others, sheep, cattle and droving. The Reverend James Wright was appointed minister of Logie from 1761 through the influence of his well-connected family with the heritors and much against the wishes of the congregation who subsequently left en-masse in protest to build their own kirk at Blairlogie. He served as minister of Logie until 1800. He is described as…*'a man of culture, shrewdness and ability*'. Reverend James Wright inherited Loss in 1769 and also leased other grazings in the area, including Fossoquhie where the 1228 charter places the Holy Well.

In 1791 Wright compiled Logie Parish's report for the First Statistical Account (FSA), a providing part of a survey of every Scottish parish. Ministers were urged to respond in their own styles to a set of guidance questions, presumably to create some common quantifiable facts. Question number six is given a surprisingly high priority (12th of 160). Perhaps the subject of Holy Wells was still a sensitive one in kirk politics;*…(In your parish)….Are there any mineral springs? And in what diseases are they serviceable?*

Wright included all the parish mineral sources under *miscellaneous observations,* including the numerous local copper and silver mines. The only 'mineral spring', he described lay; *……..about a half mile from the foot of this hill (Dumyat) to the north, is a very fine well which issues from more than sixty springs that rise through the sand and channel. It is called a Holy Well and is said to have been resorted to by the Roman Catholics*. This description correlates with the location given in the 1288 charter and the reference to its multiplicity of feed springs separates it from the Hielandman's Well which has no visible feed spring. This was the first 'recent' historical description of the Holy Well since the 1288 charter.

Wright did not specify from where exactly to measure his *'half a mile north'* but doubtless wrote his FSA entry in old Logie Manse, located then somewhere below Logie Old Kirk in what is now the Airthrey Castle gardens. From this manse site his, *north about half a mile*, as he puts it, corresponds with the Holy Well's location on a modern Ordnance Survey map.

Since he farmed the ground, Wright would know all the local water sources around Fossoquhie in detail, including the Holy Well. In describing it for FSA he was already familiar with its reputation and location from personal, agricultural and kirk perspectives. His very specific description of it confirms an intimate knowledge which still describes the area today.

In the 1880's James Bryce of Blawlowan, whose family had lived there for a hundred years or so, identified in his *Topographical notes on Stirling & Perthshire* many Sheriffmuir/Logie sites based on personal and inherited family knowledge. He too names and locates the Holy Well in the same place as described by Rev., James Wright in 1791. From inherited knowledge based on generations of family connections with Logie, whose members lived on and were employed at various times by Airthrey Estate as gamekeeper, gardeners and porters, I believe both Wright and Bryce correctly identified the site of the Holy Well.

A brief history of holy wells in Scotland.

Spiritually significant wells were once commonly accepted in Scotland. A few maybe even having early, pre-Christian roots, from when water itself was believed to hold spiritual powers. After the coming of Christianity many remained in use as Holy Wells, with missionaries in their task of Christian conversion appending saint's names to some of them in order to usurp old beliefs. They were believed to have curative properties, different ones being specific to certain ailments. Some were believed to cure whooping cough: others insanity and some ensured female fertility, clearly seen as important then. Women were reportedly the wells' main users.

Immersion in the waters was not necessary, tokens thrown in or superstitious offerings such as cow horn or natural items were invoked. The Kirk and State vilified them and their users, decrying visitors seeking physical benefit as *'superstitious and gullible'*. While belief in them declined after the Reformation, a 1579 Statute prohibiting their use was followed by Privy Council proscription in 1629. Regular admonishments from Presbytery and pulpit did not stop those driven by desperation from making clandestine visits. The Roman Catholic church took a more relaxed view, neither encouraging or discouraging, further aggravating the Kirk leaders' already jaundiced views of Catholicism.

How did the confusion arise?

According to written local tradition and knowledge the well beside Sheriffmuir road was always called the Hielandman's Well. No evidence is known for it being called Holy Well, Fairy Well, Smugglers Well or any other appellation. However, there is local knowledge and documentary evidence for a Holy Well at a different location. Despite this, a mistaken belief grew that the Hielandman's Well is a Holy Well, some authors even going so far as to confirm

it as ***the*** Holy Well. Numerous published examples repeating this error have lent it false credence, even amongst professionals. The Royal Commission on Ancient Historical Monuments of Scotland's Canmore search site, for example, wrongly repeats it.

How did this misconception arise?

The Reverend R Menzies Fergusson became minister of Logie Parish in 1885. His education was formal and he attended both the Universities of Edinburgh and Oxford. A highly literate man, he wrote on quite diverse subjects; more the man of letters to Wright's man of business. In his 1905 *History of the Parish of Logie* (HPL) he describes past ministers of Logie including James Wright's tenure in its pulpit. Fergusson goes on to quote Wright's *FSA* report with its description of the Holy Well, …*springs that rise through sand etc*. and its 'North half a mile' location.

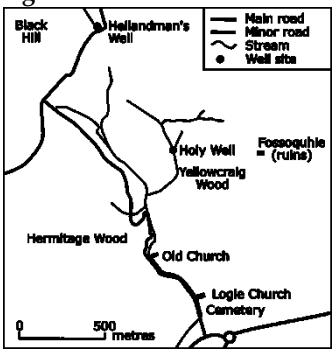
However, for reasons known only to himself Fergusson decided to expand on Wright's description by adding to it a footnote of his own. Wright's original FSA account reads; *'about a half mile from the foot of this hill (Dumyat) to the north is a very fine well, which issues from more than sixty springs that rise through the sand and channel. It is called a Holy Well and is said to have been resorted to by the Roman Catholics'*. Fergusson repeats this verbatim in HPL but then he adds the following footnote of his own; '*Now popularly known as the 'Hielandman's Well, a possible reminiscence of the '15, where the battle of Sheriffmuir was fought nearby'*.

This footnote is erroneous. It is a fiction and the reason why Hielandman's Well is now considered by many to be a Holy Well or specifically the Logie Holy Well. If he personally knew Hielandman's Well it is hard to see how he could consider Wright's '*issues from sixty springs that rise through the sand etc.,*' descriptive of its single small flow. It appears he simply read Wright's FSA entry then either misunderstood or embellished it. He compounded his mistake by creating a romantic notion for the Hielandman's Well being named for the 1715 battle when it had been known as that long before. Fergusson was aware of the 1228 land charter reference to the Holy Well but he nevertheless still linked both wells. Unfortunately, his HPL became, and still is, the standard authoritative reference for anyone interested in Logie Parish history. As a result, it has been, and continues to be, widely quoted, and therefore so too does his erroneous footnote, thus perpetuating the confusion.

Conclusion

The objective of this study was to show that Hielandman's Well and the Holy Well are unconnected and explain how confusion over them arose. The Holy Well is documented in 1228, 1791 and noted in 1887 memoirs. Mention in a land charter, an important document, confirms it was an important local feature.

Figure 1. Location of Wells.



It is clear that repeated quoting of the erroneous reference in the 1905 *History of the Parish of Logie* are the cause of this local history distortion. All the evidence indicates two individual, unconnected ancient wells. Hielandman's Well beside Sheriffmuir road is, and always was, only a drinking well. It is not, and never has been a Holy Well or related to it. It is hoped these notes will counteract the current confusion and that Researchers will use the correct information covering the Holy Well in Rev., James Wright's 1791 FSA report and should quote from it, not Fergusson's 1905 History of the Parish of Logie.

Figure 2. Refurbished Heilandman's Well.

Highlandman's Well was recently refurbished as part of larger mitigation works to improve the landscape and screen a new 400Kv power line. This also included repair to drystone walling, footpaths and native woodland planting. The refurbished style is very different from the historic description but the original iron outlet pipe has been used.

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THE GRANGE AT GRANGEMOUTH & THE IFLI 'DIG IN THE PARK'

Geoff B Bailey

Introduction

Over a four day period from 20th to 23rd May, 2015 AOC Archaeology directed a community archaeology project in Zetland Park, Grangemouth, to encourage public participation in the investigation and the recording of its past landscapes from key archaeological features within the park. These were the World War I memorial of 1923, the McPherson Fountain of 1882, and an earthwork within the area known as "The Orchard" traditionally associated with the 14th century monastic grange that gives the town its name. The project was initiated by the Inner Forth Landscape Initiative and assisted by Falkirk Community Trust and the Friends of Zetland Park. This paper will focus on the examination of the medieval earthwork.

Historic background

A grange was a monastic estate or farm whose revenues supported the parent monastery. The earliest mention of the Grange at Zetland Park is from 1314 (Reid 1997, 63-64) when the Abbot of Holyrood pleaded for a reduction in its land dues owing to the devastation caused by the Wars of Independence. In 1363 Holyrood Abbey "*possessed the lordship lands of the Cars with manor, grange and pertinents within the grange and with a meadow which is called Dubet*" (Regesta Regnum Scottorum, vi, 298). The grange is next encountered in 1543 when Thomas Livingstone appears as a "kindly" tenant. In August 1565 a feu confirmation was granted to Alexander Chalmer of "*the lands called Abbots-grange [occupied by Thomas Livingstoun, David Kincaid and others], with the mansion thereof, meadow, yards, gardens, houses, buildings, with garbal teinds included, in their barony of Carse and the sherrifdom of Stirling; Rendering £46 13s 6d as old ferme and 20s as augmentation, with customary services; together with services in the three head courts at the burgh of Canongate, and in the courts of justiciary and chamberlain of the said monastery when they should happen; with doubling of ferme at entry to heirs; Moreover the commander and convent incorporate all the said lands into one tenandry, so that one sasine at Abotis-grange should stand for all*" (Hall 2006, 91).

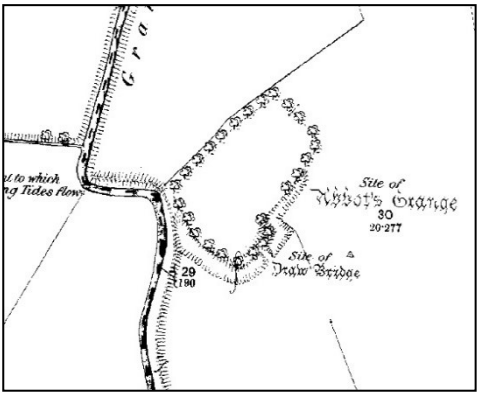
The estate subsequently passed through several families, including the Bellendens and Drummonds. It eventually came into the hands of the Blair Drummond Estate. In 1880 the Earl of Zetland gave 8.5 acres of land to the north of the Orchard to the growing town of Grangemouth for a new public park, but it was only in 1921 that the park was expanded to include the Orchard itself (Figure 1).

The site

The Orchard is readily picked out in Zetland Park as it has a perimeter marked by a single row of large mature trees (NS 9295 8140). These are anchored into an artificial earthen bank that encloses an irregularly shaped, slightly elevated piece of ground of 1.3 acres (0.52 hectares) extent. It still stands proud of its surroundings to the east, but after the First World War domestic rubbish was tipped around the other three sides to raise them to its level. The Grange Burn, named after the monastic establishment, now runs 130m to the west of the enclosure in its canalised course. Originally it touched the enclosure's western side and this is shown on the 1st Edition Ordnance Survey map of 1864, which also notes that this point was the tidal limit of that burn. A small feeder stream enters the burn a little to the south of the Orchard, draining the lower lying clay soils in that vicinity. The bank of the enclosure survives best along its South East side and is still 1m higher than the land to the east. Its low mound can be traced all around the enclosure delineated by trees on the 1st Edition OS map at 6":1 mile (Figure 2). That map shows that when it was surveyed there was also a large ditch along the southern front and recorded the position of a "draw-bridge", indicated as a causeway. The ditch and the causeway are no longer visible.

Figure 1. Aerial photograph of Zetland Park *c.* 1950 showing the tree-lined enclosure of the Orchard with a bandstand in the centre.

Figure 2. Extract from the 1st Ed OS 6":1mile map showing the site of the Orchard and tidal limit.

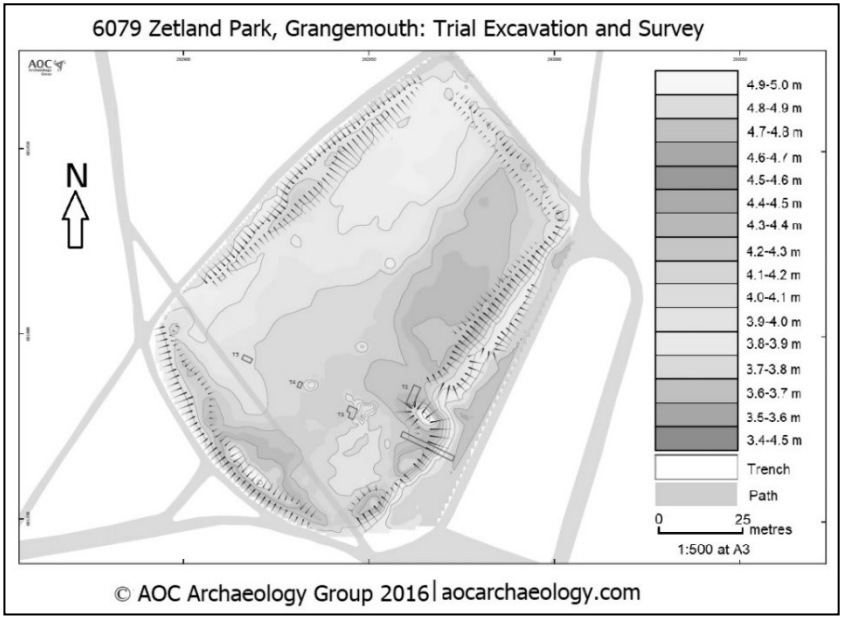


Archaeological Investigations

The work in 2015 was conducted by Graeme Cavers, Gemma Hudson and Jamie Humble of AOC Archaeology. A laser-defined topographical survey was undertaken (Figure 3): hachures on this illustration were added by use of a plane table and present day footpaths have been included.

These lie outside the boundary embankment on all the sides apart from the South East. They presumably lie over recent material infilling the perimeter ditch. An old paddling pool lies to the South East (Figure 4) and here space had been left for a large drain to empty the pond: consequently the ground level here had not been raised. One relatively recent path traverses the enclosure close to its South West side and creates two gaps in the bank in its progress.

Figure 3. Topographic survey produced in 2015 showing the locations of trenches and footpaths (courtesy AOC Archaeology Group).

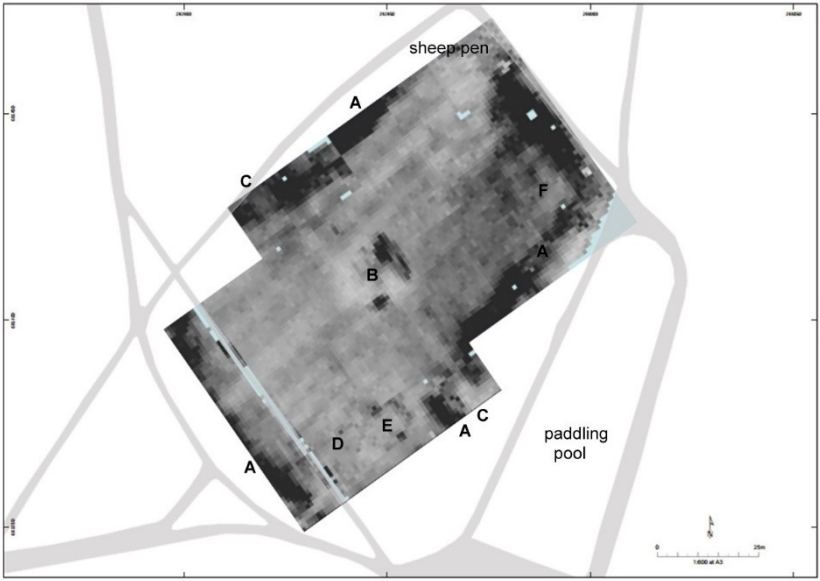


The enclosure is roughly rectangular, *c*. 104 metres by 52 metres internally, oriented South West to North East. The South West side bows slightly outwards and there is a rectangular extension of about 13 metres at the South end of the South East side. Here the bank is most prominent and there is a minor gap, corresponding with the position of the "draw-bridge" already noted. The interior of the enclosure is relatively level, being 0.2 metres or so higher along the South side.

A resistivity survey also recorded the perimeter bank (A: black on Figure 4) with gaps at the northern tip and at the re-entrant angle on the South East side. The former was found to have been created by a sheep pen (below). The latter appears to belong to a linear feature (C) that may represent a former path leading to a central bandstand, which appears on the survey as a circular area of low resistance (white) around 15m in diameter (B). The path continued North

West beyond this. There were two arcs of disturbed readings: D can be associated with the setting of a sundial (now in the collection of Falkirk Museum: below) but E is of unknown origin. The most prominent feature, due to its linear nature, is a series of broad lines running South West to North East. As these disregard path C they are probably earlier in date. Evidence from Trench 5 (below) suggests that they were shallow surface drains, possibly associated with use of the area as an orchard. Finally, at the East corner of the enclosure an L-shaped internal projection from the bank (F) is of particular interest as it lies on the slightly higher ground and may point to a sub-enclosure or even an early building.

Figure 4. Resistivity survey of the area in Figure 3 (courtesy AOC Archaeology Group).



All the excavation trenches were dug and backfilled by hand. The main trench, T1, was 1.5 metres wide and 15.5 metres long and was placed across the bank a little to the north of the supposed entrance where it survived well (Figure 3, 5). To the west it included a sample of the interior, and to the east part of the ditch. The earthen bank (F4) was composed of compact mid orange-brown silty clay and was 1.65 metres broad at the base, but only survived to a height of 0.28 metres at this point. Below it was a trapped ground surface (F6) of mid brown silty clay with occasional coal and charcoal. This did not survive further west into the interior.

Figure 5. Section across the bank and ditch looking north.

Outside the bank the ground fell rapidly away. At the extreme East end of T1 the top of the natural clay was found at a height 0.7 metres below that of the bottom of the bank and in between it had been dug out for a large ditch (F10). Its sides sloped down gently at first. These sides could be expected to have steepened as they went down but this could not be ascertained because the ingress of water meant a halt to excavation at 1.05 metres below the present ground level. The natural contours make it difficult to be sure where the ditch actually began, but a width of around 5.3 metres would not be unreasonable.

The upper 0. 7 metres of the ditch had been filled with ash, cinder, coal and domestic refuse (F2) which included early 20th century glass bottles, clay tobacco pipes, pottery and the odd coin (including one of Christian IX of Denmark, perforated for suspension). Below this the brown silty clay (F7) of the next fill was beginning to appear when digging was abandoned. The northern slope of the ditch up to the bank was covered by a thick deposit of compact mid-brown silty clay with very occasional pieces of coal and charcoal (F5). Two small body sherds of 14-15th century coarse pottery came from this context which may represent either collapse from the bank or a secondary widening of it.

T2 was positioned to investigate the dip in the bank at the dog-leg on the SE side of the enclosure (Figure 3). The proximity of trees made soil colours difficult to see. The earth bank was again encountered on the west side of the trench, covered by a thin layer of small sub-angular stones (F205). Over the eastern half of the trench the bank had been cut away to a depth of 0.85m by F210, which was flat-bottomed. Its basal layer (F203) was compact dark brown-grey silty clay with occasional coal and cinder suggesting that it was a secondary feature (perhaps the path referred to earlier or maybe the course of the drain for the paddling pool).

Three small trenches were placed on line with T1 to sample the interior of the enclosure (Figure 3). The southernmost, T3, encountered patchy cobbling (F305) and so it was extended.

This revealed a North to South electricity cable, the trench of which (F303) could only just be distinguished through the stonework. Oral tradition places a 1618 sundial in this area and it is reasonable to assume that the stone is associated with its setting. The electricity cable did not appear on the resistivity survey (Figure 4), though it is apparent on an infra-red photograph taken by the West Lothian Archaeological Trust (Figure 6). That image also shows the linear features associated with the post-medieval surface drainage of the orchard.

Figure 6. Infra-red image of the area taken with a fish-eye lens looking North.

(courtesy West Lothian Archaeological Trust).

T4 (Figure 3) measured 1.5 metres by 1.0 metres and here the topsoil sealed a relict cultivation soil of dark brownish-grey silty clay (F402), which lay over the natural substrate, a grey-orange silty clay. A shallow sub-oval pit (F404) cut into the natural and was filled with material similar to F402. It extended beyond the trench, but seems to have been associated with the cultivation (perhaps a tree bole).

The final trench, T5, found a second relict cultivation soil (F502) between the topsoil and an even older cultivation soil (F503 similar to F402). It was darker brown and up to 0.39 metres thick. The depth of the natural from the present surface increased from T3 to T4 and then to T5 (Figure 3).

Discussion

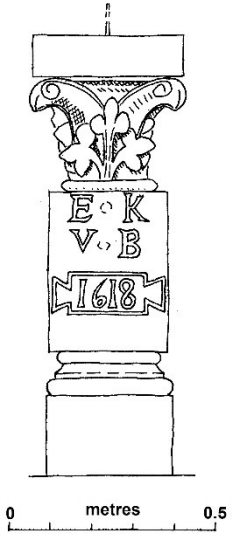
The project confirmed the presence of an early enclosure surrounded by a substantial earthen bank and a large ditch. The proximity of the present water table probably means that the ditch would have rapidly filled with water in the past. The 14th/15th century coarse pottery from the slump or widening of the bank (F5) places this enclosure in the time period for the grange and late medieval pottery from later contexts suggests continuing occupation for some time. The later use of the interior as an orchard appears to have removed most of the stratified levels from this period, leaving only post-medieval relict cultivation soils over most of the area.

The grange was the centre of a large estate (Reid 1997) and produce from this hinterland would have been gathered for storage at it for onward shipment to Leith and thence to Holyrood Abbey. Placing the site at the tidal limit of the burn, assuming this has not changed, would have allowed this produce to be taken directly to the Forth. The upper reaches of the stream were still in use in

the 18th century for importing lime, with a wharf at the site of the later Grange School (just to the North of Zetland Park). The area was probably prone to flooding but the naturally elevated site of the Orchard was drier: the large ditch and bank may have been as much for drainage as for security. It would have been sensible to have placed any storage buildings (the name grange derives from the same root as granary) on the east side of the enclosure where the ground is ever so slightly higher.

The grange fell into secular hands in the 16th century, but would have remained the centre of an ever-diminishing estate for some time (Reid 1996). On 23 August 1565 the lands passed to Sir John Bellenden of Auchnoull who received a charter from Robert, Commendator of Holyrood (Porteous 1967, 53). In 1587 they were annexed to the Barony of Broughton. In 1601 John's grandson, James, married Elizabeth Ker, sister of the first Earl of Roxburgh, but he died just five years later. Two stones were found in the Orchard in the late 19th century - a date stone and an armorial stone containing a chevron and three mullets for Ker (RCAHMS 1963, 450). The former is a rectangular block with an ansate (e.g. having a handle or handle-shaped part) panel bearing the date 1618 below the inscription "*EK/VB*" (Figure 7).

Figure 7. The Zetland Park sundial.



It was later incorporated into the sundial for the park. The initials appear to be those of Elizabeth Ker and her son William Bellenden who would have been 18 or 19 years old at the time. This suggests some form of stone dwelling house in the vicinity. Elizabeth Ker certainly seems to have taken an interest in the area as is shown by her protracted dispute with Falkirk Church over seating arrangements that started in 1635 and lasted almost five years (Murray 1887, 87-91). A mid-17th century tobacco pipe from Trench 5 belongs to this period, when tobacco was quite expensive and the prerogative of the richer classes. A stone spindle whorl from the topsoil in T3 may be of this period. However, by this date the Bellenden connection had been severed in favour of the Hamiltons, and in any case, for most of the time the Bellenden family would have resided in their other properties in Scotland. It is notable that Pont's late 16th century map does not show any building of significance here. Whatever there was did not last long and the area was turned into an orchard. Eventually Abbotsgrange was passed on to the Drummond family. It had too many possessions with good houses and so the grange would have been little used.

The orchard was cut down in the early 19th century because passers-by were stealing the fruit. It was then set in pasture and a sheepfold constructed over its northern tip (hence the gap in the bank at that point: from 2nd Edition OS mapping). Shortly after it was incorporated into Zetland Park a bandstand was placed in the centre of the Orchard in 1925, at a time when the park was very popular with the local community (Figure 8). It was removed in 1973.

Figure 8. The Zetland Park bandstand with the trees in the background, taken in the 1960s.

Acknowledgements

The work in 2015 was undertaken by keen members of the public, many of whom continued to actively participate in other archaeological projects within the Falkirk area. Thanks are due to Falkirk Council for giving permission to explore the park.

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Plate A1. Small Elephant Hawk-moth.
Four species of Hawk-moth in the Family *Sphingidae* have been recorded in the Pool of Muckhart area.

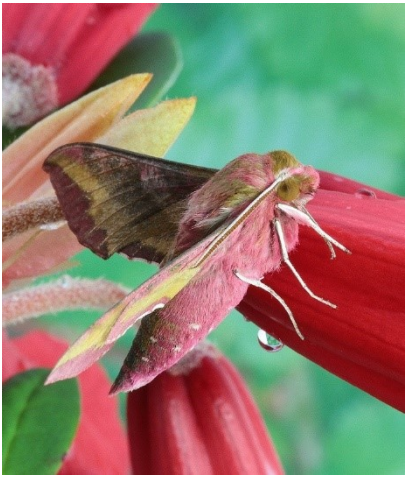

Plate A2. Lunar Thorn.
A member of the Family *Geometridae*, one of the commonest family groups in the area; several resemble their butterfly relatives.

Plate A3. Bordered Sallow.
The commonest Family of macro-moths occurring in the Muckhart area is the *Noctuidae***.** This example is one of the rarest to be found to date, with just a single record in the 1970s.

Plate A4. **Peach Blossom** .
The Drepanidae, one of the smaller Families, has just six species represented in the area.

Plate A5. Figure of Eighty.
A recent arrival in the Muckhart area, likely involving colonisation from populations to the South. Its name derives from the white markings on the wings.

Plate A6. Peppered Moth.

Known to occur in three forms: the usual one has black speckles on its white wings, contrasting with the wholly black form named *carbonaria*. The black form was frequent in the 1970s but is absent forty years later.

Plate B1. Bioblitz participants exploring the shoreline at Kennetpans.

(image: Kate Fuller/IFLI Team)

Plate B2. Bioblitz participants in the orchard at Kennetpans.

(image: Kate Fuller/IFLI Team)

Plate C1. Clump of Toothwort.

Plate C2. Birds-nest Orchid.

Plate C3. Toothwort.

Plate C4. Yellow Birds-nest.

Plate D1. PUK Rainfall, January 2017, Actual Value.

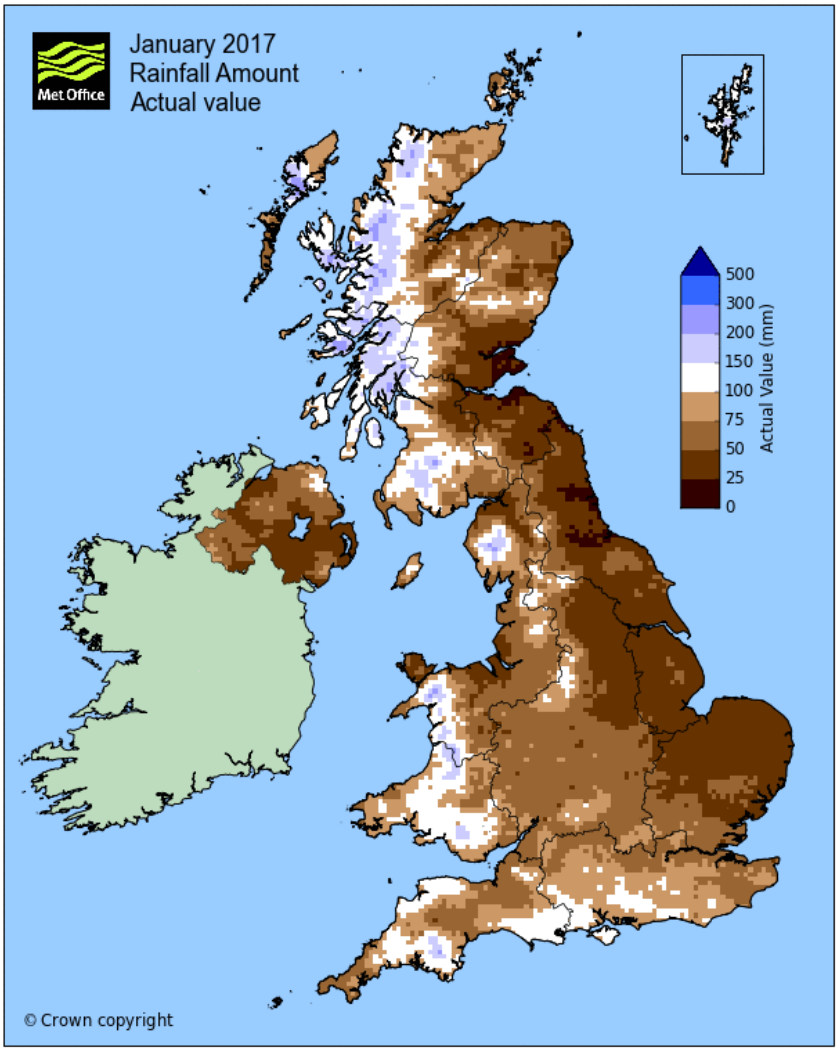

Plate D2. UK Rainfall, April 2017, Actual Value.

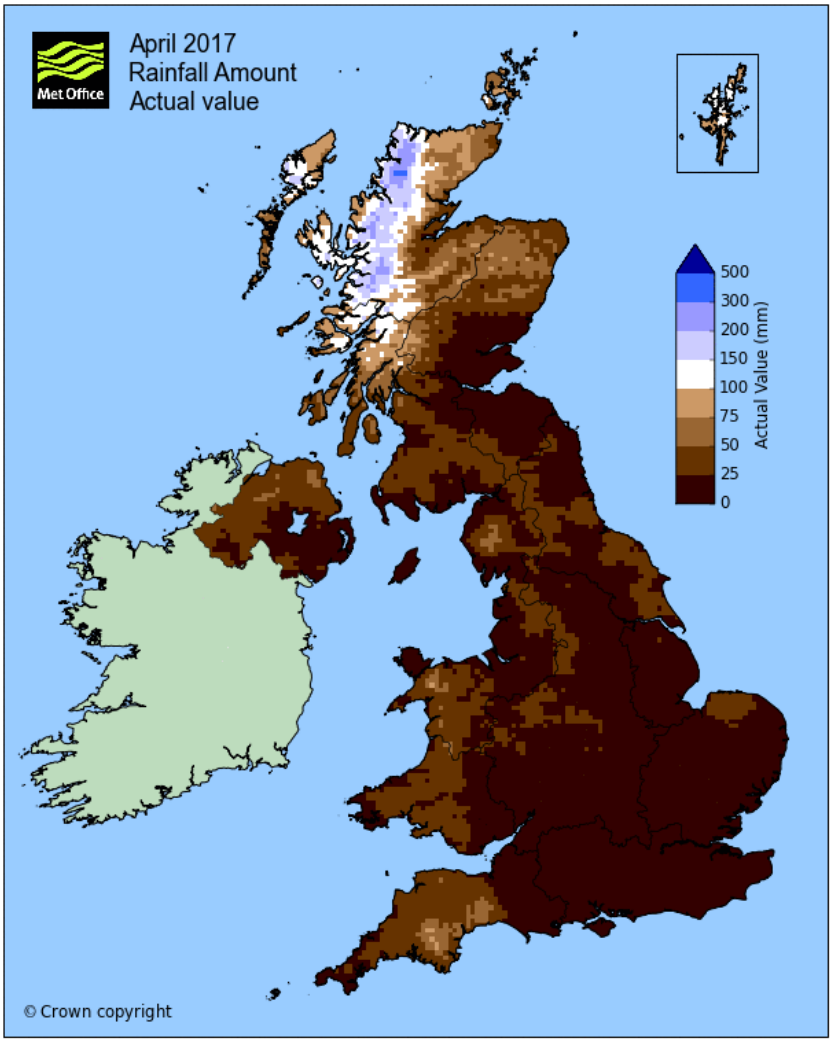

Plate E 1. Volunteers from West Fife Woodlands organised a series of tree-planting days with seven local primary schools to create the community orchard at Valleyfield Woodland Park.

(IImage: John le Marie

Plate E 2. Work at the new nature reserve at RSPB Black Devon Wetlands.

(image: **David Palmar, www.photoscot.co.uk)**

Plate E 3. Volunteers unearth the nave of Kinneil Kirk.

(image: Geoff Bailey)

Plate E 4. **One of two FNH Conferences run jointly with IFLI, the 2017 event celebrated IFLI's achievements over the four years of the Initiative, following on from the 2014 event which introduced many of its hopes and aims.**

(image: IFLI)