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CONTENTS

- 3 Editorial. On the Centenary of the Stirling Field Club. K. J. H. Mackay
- 10 Ecology of the Forth Estuary. Donald S. McLusky
- 23 Bird-Ringing in the Stirling Area, Report for 1977. Martin Davies
- 29 Corrigendum from Volume 2
- 30 Stirling and Clackmannan Bird Report 1977. C. J. Henty
- 47 Register of Ornithological Sites in the Stirling Region. Sandy Mitchell
- 56 The Heronry at Gartfairn Wood, Loch Lomondside. J. Mitchell
- 68 The Golden Eagle (*Aquila chrysaetos*); the Relationship between the Success and Tenure of Breeding Sites. T. D. H. Merrie
- 71 The Plants and Soils of two Mineral Workings in the Ochil Hills. John Proctor and Margaret E. Bacon
- 78 Preliminary List of Fungi in the Stirling District. Ian B. Crockart
- 81 Destination Kilmadock: Migration into the Parish of Kilmadock, Perthshire, using the 1861 Census Enumeration Book. Janette E. Cochrane
- 99 Excavation at the Fairy Knowe, Buchlyvie — 1975-78. Lorna Main
- 112 Alloa Port, Customs and Excise Accounts — Analysis of a Local History Group's Research Project. Marion Haynes
- 128 A Scottish Local Newspaper as a Source of Local History. B. J. Elliott
- 133 Instructions for Authors
- 135 Authors' Addresses

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EDITORIAL

3

On the centenary of the Stirling Field Club

K. J. H. Mackay

This 1978 issue of the Forth Naturalist and Historian is the third to have been published, and it follows the general pattern in that it includes research papers presented at the annual symposia 'Man and the Landscape', held since 1975 in Stirling University.

Not all conferences or societies publish their proceedings. Why should we? (This may be an example of the chicken and egg situation — the conference may be seen as the fruit of the publications, rather than vice versa!) It is fitting in 1978, to recall the formation in 1878, in Stirling, of a body with identical interests to ours, which also believed in publishing its *Transactions* and whose record is well worth studying. I refer of course to the Stirling Natural History and Archaeological Society, which was formed as the Stirling Field Club, adopted its revised title in 1882, and still flourishes as the Stirling Field and Archaeological Society.

Though circumstances have conspired to prohibit the current publishing of the text of lectures to the Society since its post-war rebirth, we are fortunate to have, in printed form, the Transactions of the Society from 1878 until 1939. The minute books of the Society and of its Council are also preserved, so that one is able to obtain a clear picture of the research interests and activities of the Society's members throughout 60 years or so of the Society's century. But beyond the social contrasts which are there reflected, there is an immense wealth of information, which any local naturalist or historian of today ignores at his peril. Fortunately, too, an index compiled in 1936 lists both the authors and the subjects for all but the final four issues.

Can we learn from the experiences of the contributors to these venerable Transactions? I propose to pay tribute to just a few of the 160 or so contributors listed in that index, and I hope that the message of encouragement which emerges will inspire future contributors to the present Journal.

One hundred years ago, biology was only just beginning to be taught in schools. The Rector of the High School of Stirling in 1878 was Mr. A. F. Hutchison, who, anxious to introduce science to the

curriculum, approached Mr. Alex. Croall (from 1873 the curator of the newly-opened Smith Institute Art Gallery and Museum) with the proposal that the latter should take a volunteer Saturday class in "Nature Knowledge". Mr. Croall, a nationally-respected botanist, and co-author of a highly-praised four-volume work on *British Seaweeds*, agreed to the suggestion, and for several years — from the age of 70! — he communicated his enthusiasm to his young charges, wherever possible by "excursions". Out of this contact between Messrs. Croall and Hutchison came the idea of the formation of the Stirling Field Club.

At the inaugural meeting, on 19th November, 1878, Alex. Croall was elected President, and duly gave a wide-ranging address on the objectives of such a Field Club. Bear in mind that his museum of local specimens had then scarcely any exhibits! I summarise here, for the benefit of my Editorial colleagues, the topics he surveyed — geology, mineralogy, palaeontology, meteorology, the study of diatoms, fungi, algae, mosses, ferns and flowering plants, of shells, crustacea, butterflies, moths, beetles and other insects, of spiders, fish, birds and mammals, and finally the history of mankind from earliest times to within living memory.

The impressive thing about these Victorian amateurs was that they tended to achieve their objectives! By 1882, Alex. Croall had compiled a local catalogue of 564 flowering plants from within a 20-mile radius of Stirling and had collected specimens of each for his herbarium of British flora. Before his death in 1885 he had similarly catalogued 149 mosses and 35 ferns and allied forms.

His mantle as chief botanist fell on a rather unlikely candidate, Robert Kidston. A fellow founder of the Field Club, Kidston forsook his calling as a bank clerk (on the collapse of the City of Glasgow Bank in 1878) to devote himself to science at the tender age of 26. He developed an extensive knowledge of botany which he combined with a growing interest in fossil plants. In due course he amassed one of the finest collections in the world — over 7,000 selected specimens — which provided the basis of his six-volume *Monograph on the British Carboniferous Flora* (1923-5). In 46 years of Society membership, 40 of them as Joint Secretary, he presented 29 lectures to the Society, and published altogether 188 scientific papers. In 1908 Glasgow University awarded him its LL.D., and subsequently he was elected a Fellow of the Royal Society, the ultimate accolade of the British scientific community.

The Stirling family, of Gargunnoch House, led by Col. Stirling, from 1893 onwards presented monthly rainfall figures for as many as 34 stations across the county, ranging from 550m (1,800 feet) above sea-level on Ben Lomond to 4m (12 feet) at Polmaise House near Fallin. Morris and Alan McLaurin detailed their researches into locally occurring species of moths (191) and butterflies (12). Picture them cycling off every sunny Saturday with a walking stick, an umbrella and a butterfly net apiece; an upturned umbrella apparently made an ideal caterpillar catchment area, placed under a selected birch tree which was then tapped sharply with the walking stick! Messrs. McLellan (English master at the High School) and McDougall (gardener from Raploch) issued a series of reports on the 90 or so land and fresh water snails of the area.

The published papers to some extent reflect the literary aspirations of their authors, but all display a commendable keenness to pass on the knowledge they have acquired. It ill becomes a modern reader to be patronising about our predecessors. One measure of their commitment to the serious study of natural history is surely given by the fact that, at their annual Microscopic Exhibition, no fewer than 21 privately-owned microscopes would be lovingly lined up by their owners with a range of prize specimens to be viewed by their fellow members.

Bird studies, in the absence of colour photography, required stuffed or skinned specimens of every species in every stage of development. Successive Smith Institute curators seem to have gone in for their own taxidermy, expressing regrets as they did so. One member with the appearance of double standards in this matter was J. A. Harvie-Brown, Vice-President from 1878 to 1893, and Honorary President from 1903 until his death in 1916. A veritable Nimrod of ornithology (his initials were playfully interpreted as "Johnny Always Hunting Birds"), he gives a cheerful account of the day he got a peregrine's eggs in the hills south of Kippen, yet deplores a proposal by a Birmingham group to collect eggs in the Shetlands. He launched a series of ten books on the *Vertebrate Fauna* of different districts in Scotland, and wrote 250 articles or books on natural history subjects. A fire destroyed most of his collection of bird skins and eggs in the private museum at Dunipace House, leaving "only a few hundred skins" stored in the library annexe. Yet he didn't spare himself. He lost the tip of a thumb in one youthful shooting accident, and shattered his ankle in another. When, later on, a broken wrist interrupted his book-writing, he bought a typewriter and carried on writing — with his left hand! Quite a character!

Another character whose name is honoured round the world as one of the founders of the science of oceanography, and who had a considerable influence on the Stirling Field Club, was Sir John Murray, of 'Challenger' fame. Born in Canada of Scottish parents, at 15 he came to Bridge of Allan in 1856 to stay with his maternal grandfather John Macfarlane, a wealthy Glasgow merchant who had retired to Edgehill House, and later to Coneyhill. The future oceanographer had already been captivated by his first experience of the Atlantic Ocean, and found great interest in the subject of navigation as taught at the High School of Stirling. Macfarlane had in 1855 founded a Free Library and Museum in Bridge of Allan, and for some years Murray was its custodian. In 1867, at the age of 26, he enrolled as a student at Edinburgh University, a connection he maintained for 17 years, attending classes in all the faculties but never sitting an examination or taking a degree. His attendance must have been rather spasmodic for in 1868 he embarked on his first expedition, joining a whaler bound for Greenland, as ship's surgeon. On this trip he began collecting marine specimens and making oceanographic observations. His keenness attracted the attention of the Professor of Natural History, Charles (later Sir Charles) Wyville Thomson, who invited him to join the staff of the 'Challenger' expedition. Its aim was to settle the question of the existence of life at great depths in the oceans. In three and a half years between 1872 and 1876, the Challenger sailed round the world in a 68,980 mile voyage, making observations at 362 stations. Murray was in charge of the specimen collections, and found himself on his return to Edinburgh with 20 years of work ahead of him preparing and editing the 50-volume report of the 'Challenger' research, a task made heavier by Sir Charles' death in 1882. The publishing of these results marked a highpoint in the study of the oceans.

Murray's grandfather, dying in 1868, left John as principal trustee of his library and museum. In 1882, possibly as a result of his increased responsibilities, he decided to hand over the library contents to the Smith Institute, and the museum collection to the Stirling Field Club. The Club Minutes make it clear that it was this latter proposal which precipitated the Society's change of name at this time. The hand-over of museum specimens was finally agreed in 1884.

In 1885, Edinburgh University awarded Murray an LL.D., and after the final 'Challenger' volumes were published in 1895 further honours followed, an FRS in 1896, and in 1898 a knighthood. Subsequent researches included studies of Scottish coastal waters on

behalf of the fishing industry, and of Scottish freshwater lochs, in which task he had as assistant a promising young Bridge of Allan scientist, Fred Pullar. (Fred, sadly, lost his life in 1901 while rescuing a lady skater who had fallen through the ice on Airthrey Loch). Sir John also took part in expeditions to the Faroes and to the North Atlantic, the latter at the age of 69. In 1903, he accepted nomination as an Honorary President of the Stirling Natural History and Archaeological Society, an office he still held at the time of his death in 1914.

So far I've ignored the archaeology/local history side of things. Yet this probably occupied Society members even more than natural history. Indeed, within two months of its formation the Society was engaged in a local archaeological excavation, which was carried out in a very creditable manner, and reported on fully within a month. This pace was not maintained but a pattern of solid historical research developed. Many an author of a respected work of local history cut his teeth, so to speak, on a lecture to the Society. Pride of place in this list should perhaps go to A. F. Hutchison, co-founder of the Society, whose *Lake of Menteith* and *High School of Stirling* are most scholarly and well-researched productions.

R. S. Shearer and his son John were experts on old maps and were responsible for *Stirling : Historical and Descriptive* a guide-book showing extensive knowledge of the Burgh records. A. B. Barty's *History of Dunblane* is a compendious work which highlights the absence of a definitive history of Stirling. It was supposed that W. B. Cook, a former editor of the *Stirling Observer* and a frequent contributor to the *Transactions* was engaged on this task, but on his death in 1913, no trace of a manuscript could be found. His volumes of *A Stirling Antiquary* merit closer acquaintance. James Ronald, William Drysdale and J. S. Fleming, in a total of near a dozen books, have together ensured the preservation in drawing, photograph and word-picture, of many of the details of life in 19th century Stirling. Several other members ventured into authorship in this field including R. Menzies Fergusson with his *History of Logie Parish*.

If there was one member above all who represented the soul of the Society it must be David B. Morris, Secretary to the Society for 49 years (from 1891 — 1939), and President for 13 of these. A man of tremendous energy, he held the post of Town Clerk of Stirling for 38 years (1901 — 1939) and served on no fewer than 21 committees of local or national bodies. Yet he not only organised the Society's affairs, but lectured on an incredible 76 topics on subjects as varied

- 8 as *Rambles over Old Red Sandstone* (geology), *Whale Remains in the Carse of Stirling* (archaeology), *The Yellow Star of Bethlehem* (Botany), *Causewayhead 100 years ago* (local history), *The Dance of Death* (art appreciation), and *The Rhymes used for Practising Psalm Tunes* (church history). He was an expert on Burgh affairs, wrote several papers on the Incorporated Trades of Stirling, and books on John Cowane and the Stirling Guildry, and on Robert Louis Stevenson.

What lessons can be learned from these worthies? Surely, that research into one's chosen subject benefits by being subjected to the disciplines of publication, communicates itself to a wider readership, and takes an established place in the chain of investigation, stimulating others to follow, and — who knows — perhaps leading its author to further and more glorious endeavours. Founders of the Stirling Field Club, a new generation salutes you!

PREFATORY NOTE.

THE Transactions for 1878-79, being the first Session of the Stirling Field Club, were not published at the time. They are now issued, on the completion of twenty years since the Club's formation, by the Stirling Natural History and Archaeological Society, under which name the Society has been known since 7th November, 1882.

The Council consider it desirable to publish this volume for three reasons: (first) to complete the record of the Society's work since its start, (second) to mark in this way a stage in the Society's history, and (third) to preserve many contributions, worth preserving, which otherwise would have been lost. The contents of this volume are taken from the Minute Book, and also from the file of the *Stirling Journal and Advertiser*, to the proprietrix of which the thanks of the Society are tendered.

STIRLING, 4th August, 1898.

The Stirling Society's *Transactions* are unique in that volume 1 was published simultaneously with volume 20! The above explanation appears in volume 1.

STIRLING FIELD CLUB.

INSTITUTED 19TH NOVEMBER, 1878.

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The first Constitution of the Stirling Field Club listed the above Office-bearers and Council members for 1878-79.

ECOLOGY OF THE FORTH ESTUARY

Donald S. McLusky

INTRODUCTION

The Firth of Forth below Queensferry widens out and the waters are predominantly marine, whilst above Stirling the rivers Forth, Teith and Allan are fresh-water. In between these limits the Forth Estuary stretches for 48km from Stirling to Queensferry and is subject to regular tidal fluctuations, with a gradation of salinity from fresh to salt water. Between Stirling and Alloa the Forth undergoes a series of narrow "windings" as it passes Cambuskenneth, Fallin and Cambus. East of Alloa the Forth gradually widens, and below Kincardine Bridge it is 5km wide at high tide, with the large mudflats of Skinflats, Kinneil, Torry Bay and others revealed at low water. The tidal inflow at Queensferry is over $350 \times 10^6 \text{m}^3$, which is over 130 times the volume of land-water entering the estuary (Stout, 1976), hence the dominance of marine conditions in the east.

Attention has been given in recent years to the intertidal fauna of the Forth Estuary (see McLusky *et al* 1976, 1978), whilst the condition of the water has been studied for the past 20 years by the Forth River Purification Board (See Annual Reports and Collett 1961 and 1971). Inevitably recent studies have often pointed to the impact of pollution on this area, especially considering the effects of industry in the Alloa/Cambus and the Grangemouth areas. Before considering the present-day ecology of the Forth, it is worth looking at the Forth in retrospect.

HISTORICAL REVIEW

The New Statistical Account of Scotland of 1848 provides a fascinating and comprehensive account of the Forth Estuary at that time, although opinions often differed. The minister of St. Ninians regarded the Forth as "not attractive", whilst his neighbour in Stirling described it as an area of "extradordinary majesty and beauty". They both agree however that the Roman name for the Forth was Bodotria. The Forth in 1848 was a busy river with Stirling having 22 registered vessels of up to 350 tons, plus 4 or 5 regular steamers to Edinburgh. Alloa had a busy harbour trade, with 19,000

tons registered (boats up to 800 tons), and trading to every quarter of the globe. In 1838, 1250 vessels cleared Alloa harbour. The windings of the Forth were distinguished by navigational problems caused by several ancient fords, as well as the phenomenon of double or "leaky" tides.

The fish fauna of the Forth was comprehensively described by Parnell (1837), who listed 125 species for the Forth as a whole, with 35 of them present at Alloa. Throughout the New Statistical Account much attention was given to salmon fisheries, with a substantial fishery at Stirling for salmon and grilse (*Salmo salar*) yielding a rent of £766 per annum. Further down the Forth all reports of salmon fishing (by coble or long net at Alloa, and stake nets at Abercorn, Carriden and Dalmeny) emphasised that a decline had been taking place for some years. Stirling had a major fishery for smelt or sparling (*Osmerus eperlanus*) which appeared in the spring and provided an abundant food for the poorer classes. Herring (*Clupea harengus*) fishing was also reported on the decline. Bo'ness reported good herring fishing in 1794-5, but little since; whilst Queensferry stated that herring was the main industry there from November to March each year, having begun in 1792, but it had been in decline since 1831. Haddock (*Gadus aeglefinus*) Cod (*Gadus callarias*), Skate (*Raja batis*) and Flounder (*Platichthys flesus*) were also present, and caught locally from Alloa to Inverkeithing. Exotic fish and cetaceans (whales, dolphins and porpoises) were occasionally stranded in the Forth, most notably Opah (*Lampris luna*) at Alloa and Inverkeithing in 1835.

The common mussel (*Mytilus edulis*) was reported at several localities in the lower estuary. Most remarkable perhaps is the case of Bo'ness where the local mussel bed was cleared out by Newhaven fishermen in 1803, and attempts to revive it had been unsuccessful.

The Statistical Account of 1791-99 contains many reports of successful salmon and other fisheries in the Forth Estuary, but the theme running through the 1848 account is of decline in fisheries. The apparent reason for the decline in the fisheries, and perhaps the first major change in the ecology of the Forth Estuary is not hard to find. The Tulliallan (Kincardine) account of 1848 mentions "large quantities of moss floating down the river is supposed to have ruined the fishings". Whilst at Carriden they reported "considerable quantities of peat moss in large coherent masses or in a pulpy state are deposited on the shore, which has been floated down the river". At Carriden and Kinneil today can be seen extensive remains of

- 12 oyster (*Ostrea edulis*) beds which were apparently smothered by these moss deposits. At Inverkeithing and Rosyth in 1848 they reported that "no submarine moss is known to exist on the shores of the parish, though frequently these are covered to a considerable depth, with the moss thrown into the water at Blair Drummond. The clearing of Blair Drummond Moss had begun in 1766 (see Cadell, 1913), and over the years an expanse of peat moss and heather approx. 20km by 3km to a depth of up to 4m had been cleared to reveal a plain of good alluvial land – the Carseland. As the settlers on the Moss cleared the peat, it was carried away in drainage channels and discharged into the Forth. By 1787 the progress of clearing the moss was limited by the supply of sufficient water to carry the peat away, so in that year a Great Wheel was erected which lifted water 5m from the Teith and discharged it into a 5km canal. With the aid of this water, work proceeded apace and by 1817, 1130 acres had been cleared. Later clearings continued until 1865, during which time many of the estuary shores as far as Bo'ness were covered with lumps of peat. While this method of removal was an easy and expeditious way for riparian proprietors to get rid of their waste, writes Cadell, it was not so convenient for some of their neighbours and for other people who had fishing interests lower down the river. Salmon fishing, as we have already seen, was an important industry on the Forth and the mass of floating moss and peat pulp was so great that it grew into a public nuisance, and the fish traps and oyster beds became choked with moss litter. The floating away of the mosses had to be prohibited in 1865, to prevent further damage to the fisheries.

In 1866 the first attempt was made to get Scottish Fisheries statistics, and the Fishery Board reports of that year list Queensferry, Bo'ness, Grangemouth, Dunmore, Alloa, Kincardine and Limekilns as operating as fishing ports. From then on the Fishery Board reports continue to chart the decline that was already evident in 1848. By 1900 all ports west of Edinburgh were declining, and by 1907 fishing west of Edinburgh was considered unimportant. First complaints about "pollution" from dye works and bleach works appear in 1905, from tanneries in 1910 and from gas works in 1911, and by 1913 upper firth salmon netters were seeking remedial measures against polluters. Pot ale and Nitre were blamed in 1917 for continuing the damage to the salmon fisheries. By 1937 it was declared that the Forth is undoubtedly in a most serious predicament due to mixed domestic and industrial effluent. Herring catches in the Forth estuary fluctuated, being fair in 1921, but poor or complete failures in other years (R. Johnstone; pers. comm.)

Rintoul and Baxter in "A Vertebrate Fauna of Forth" (1935) list 143 species of fish as occurring in the Forth, of which 33 may be recognised as living in the estuary, mostly up as far as Alloa. These totals compare closely with Parnell (1837). Some of the discrepancy is due to taxonomic changes between the authors, but also it must be observed that Rintoul and Baxter base some of their records on Parnell so therefore it is difficult to use their records as an indication of the state of the estuary in 1935. Rintoul and Baxter also list 17 species of cetacean in the Forth, with 9 occurring in the estuary. The Lesser Rorqual Whale (*Balaenoptera acuto-rostrata*) and the Porpoise (*Phocaena phocaena*) seem to have been commonest. Most remarkable perhaps are the records of Beluga or White Whales (*Delphinapterus leucas*) stranded at Stirling in 1915 and again in 1932.

The state of the fishing in the Forth was again reviewed by the Third Statistical Account published in 1966. In the post-war period boom-nets for herring, sprats (*Clupea sprattus*), eels (*Anguilla anguilla*) and flounders continued to operate, especially based at Kincardine. Most of the catch was for fish meal, although in 1961 an unsuccessful attempt was made to set up a whitebait (young herring) industry at Dunmore. By 1976 and 1977 only one boom-net boat was left at Kincardine. Dunmore continues as a centre for a sweep-net fishery for salmon, with most boats working the Alloa to Kincardine stretch. For many of the men this fishing is a casual occupation, but the high price of salmon appears to make the fishery worthwhile.

The Annual reports of the Forth River Purification Board provide a continuous record from 1959 onwards of the water quality of the Forth estuary. Their first survey in 1959 pointed out that the combination of crude sewage discharge plus industrial waste from textiles, brewing and distilling served to depress the oxygen concentration very severely, and at spring tides produced an impassable barrier to migratory fish. On average the position of the minimum dissolved oxygen concentration moved from about 4km above Alloa at high water, to about 4km below at low water. No improvement was recorded in 1961, and of 25 days devoted to tidal sampling, on 18 days the dissolved oxygen of some part of the estuary was found to be less than 50% of saturation, a figure which may be taken as critical for migratory fish. In several cases over 16 or more km of the estuary were below this level. In both 1962 and 1963 on 17 days out of 27 sampled, the dissolved oxygen level at some part of the estuary was below 50% of saturation. In 1964 a

- 14 spent-wash evaporation plant was commissioned at Cambus distillery which it was hoped would reduce the total polluting load to the upper estuary by half. However 1964, 1965 and 1966 saw little improvement in the water quality, which was attributed to a large amount of unstabilised organic matter in the mud, which when disturbed exerts an increased oxygen demand. A definite improvement was however noted in 1967, with the dissolved oxygen level being below 40% of saturation on 7 out of 25 surveys, and approximating to zero on 3 surveys. The 1969 report draws attention to the need for sewage purification plants for the Stirling area, as polluting matter from Stirling caused a marked dip in oxygen in the estuary. Conditions were much the same in 1970, but it was hoped that the commissioning of a recovery plant at Carsebridge distillery would reduce the future organic effluent load to the estuary. The 1971 report also looked to benefits from sewage treatment in the Stirling and Alloa areas. For the first time in 1973 it was reported that on no occasions did the dissolved oxygen level fall below 5% of saturation, however it must be commented that 8 out of 21 surveys did fall below 40% of saturation. By 1973 the improvement in water quality was manifest in an increased diversity of fauna and flora above Kincardine. In 1974, 1975 and 1976 only 3 out of 21 surveys each year showed oxygen levels below 40%. These lower oxygen conditions occurred at spring tides in June-August each year, when river flow might be lowest. At other times the water quality was generally above 80% dissolved oxygen, a notable improvement when compared to the situation before 1964 when the majority of surveys indicated less than 50% dissolved oxygen.

Apart from studying the oxygen content of the tidal waters, the Forth River Purification Board reports trace the planning and inception of Longannet Power Station, the heated effluent from which seems to have had little effect on water quality, and complaints of oil pollution in the estuary which have been generally attributed to shipping.

In parallel with the reductions in effluent discharge to the upper Forth estuary, there has been a steady increase in effluent discharge in the lower Forth estuary in the Grangemouth area. However Stout (1976) has calculated that due to the much greater volume of estuary water available for dilution there, these effluents should not produce a severe reduction in oxygen in the water, provided always that it is continuously and effectively dispersed in the water body.

The intertidal areas of the Forth comprise 22.6km², most of which is mudflat. Towards Queensferry patches of shingle or rock occur, but these are relatively small in area compared with Skinflats, Kinneil and Torry Bay mudflats which between them comprise 13km² (57% of total). Over the past few years a study has been made of the distribution and abundance of the intertidal fauna of the Forth estuary. Some of this work has been for research projects (Torry Bay — M. Elliott; Skinflats — J. Warnes, J. Leng and G. Moffat; Carriden — M. Teare), others under contract for the Nature Conservancy Council, and some by the author in conjunction with L. Brown. An attempt to summarise the results of these various studies has been made in Table 1. In this table each area has been listed, commencing at Rosyth, and moving westwards towards Stirling on the northern shore, then progressing eastwards to Port Edgar on the Southern Shore (Figure 1). For each area, the area in km² is given; this being the area between the tidal limits as indicated on the latest Ordnance Survey maps. The number of stations sampled is also shown. The sampling procedure generally involved a transect of the intertidal area along one or more lines from high to low water. At regular intervals (usually 100m) a 10 x 10 x 30cm deep sample and two 5 x 5 x 5cm deep samples were collected. These were sieved in the laboratory in a 1mm and a 0.25mm sieve respectively. The large sample material was examined for bivalve molluscs in particular, and the small sample material was examined for gastropods, amphipods and annelid worms. The results are expressed as mean number of each species per m² for each area, and for the entire intertidal area of the Forth estuary.

Molluscs

The baltic tellin (*Macoma balthica*) is the main bivalve inhabiting the intertidal areas. It is a deposit feeder, as well as a suspension feeder, and has been found most abundantly at Torry Bay and Skinflats each of which has almost 500m⁻² and between them they have 65.1% of the total Forth population. Those at Skinflats are generally rather small, whilst those at Torry Bay grow larger. The *Macoma* in the Forth have a slow growth rate in comparison with other North European populations (McLusky and Allan, 1976), but no clear reason has yet been found for this situation. The common cockle, (*Cardium (Cerastoderma) edule*) is generally less abundant than *Macoma* in the Forth, and until 3 years ago was confined to the

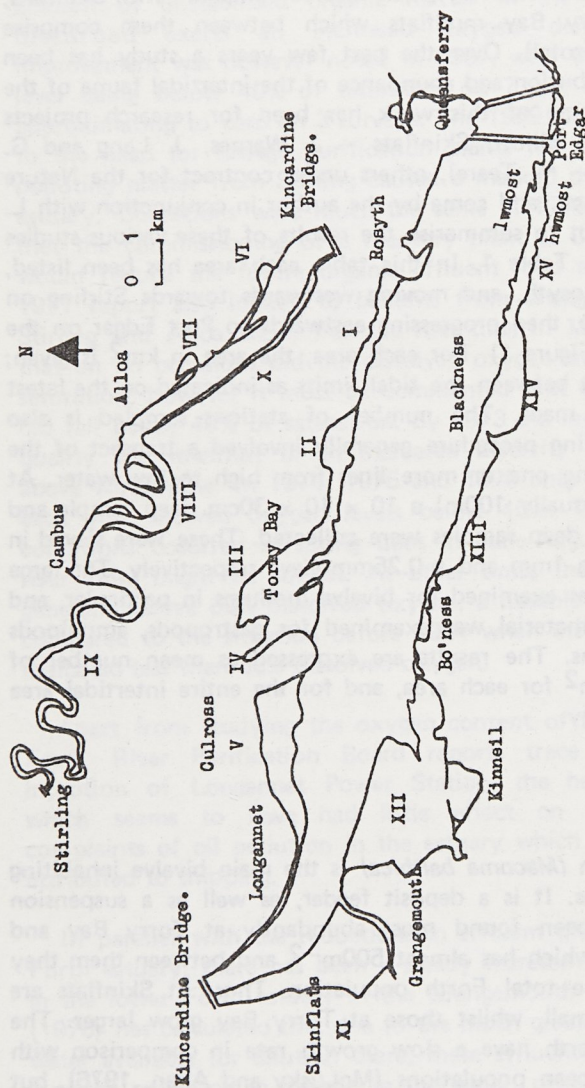


Figure 1 Map of the upper and lower Forth estuary, showing place names, and study areas (I - XV).

MEAN N. M⁻²

	Area	km ²	N. stns.	<i>Macoma</i>	<i>Cardium</i>	<i>Hydrobia</i>	<i>Nereis</i>	<i>Nephtys</i>	Oligoch.	<i>Corophium</i>	Sponid	<i>Mya</i>	<i>Mytilus</i>
I	Charlestown-Rosyth	0.77	6	350	33	2733	16	8	0	633	2933	33	166
II	Ironmill Bay	0.86	4	175	0	1450	87	0	0	3150	6750	0	575
III	Torry Bay	3.50	14	480	62	15300	36	123	24000	480	1680	79	181
IV	Valleyfield	0.20	6	383	0	3100	966	66	8033	21866	16	33	175
V	Culross	1.73	28	207	3.5	400	75	114	4864	28	0	0	320
VI	Kennetpans	0.14	5	80	0	840	760	0	14240	5720	14240	20	0
VII	Black Devon	0.22	5	0	0	480	1000	0	11440	260	0	0	0
VIII	Alloa-Devon	1.03	13	0	0	0	30	0	7107	15	0	0	0
IX	Devon-Stirling	0.20	4	0	0	0	0	0	23274	0	0	0	0
X	Kincardine Br.-Airth	0.36	3	133	0	66	733	0	7066	533	0	0	0
XI	Skinflats	3.82	10	496	174	11080	307	33	10400	1200	1040	0	0
XII	Kinnell	5.62	88	55	176	7984	232	114	10806	70	631	5	3
XIII	Carriden	1.40	28	78	43	1282	141	N.R.	1050	44	N.R.	N.R.	N.R.
XIV	Blackness Bay	1.39	15	220	33	1373	120	200	0	300	2013	7	13
XV	Hopetoun	1.38	13	200	15	1846	138	107	0	0	1476	8	84
	TOTAL	22.6	242										
	Mean for Area	m ⁻²	242	89	6721	185	89	9512	700	1252	15	78	
	TOTAL tonnes flesh dry wt.		17.4	10.6	54.9	10.4	4.0	21.5	7.9	3.1	1.3	14.3	

Table 1. Intertidal fauna of the Forth estuary. Number of each species expressed as number m⁻² for each study area, and for the entire estuarine area. Total weight of each species is also given.

- 18 areas to the east of Torry Bay and Carriden. However recently young cockles have appeared in significant numbers at Skinflats and Kinneil. The settlement of young cockles can be rather erratic, and there is some evidence to suggest that the salinity in the Skinflats/Kinneil area has been higher than in the past, and thus has permitted successful spatfall.

The bivalve *Mya arenaria* is widely, if sparsely, distributed in the lower Forth estuary. The common Mussel (*Mytilus edulis*) occurs in large beds in the lower Forth, notably Ironmill Bay, Torry Bay, Culross and Hopetoun. Locally it may be very abundant, but when expressed for the whole area the abundance is only 78m^{-2} compared to 242 and 89m^{-2} for *Macoma* and *Cardium*. However because of their larger size mussels contribute 9.3% of the total biomass, as compared to 11.4 and 6.9% for *Macoma* and *Cardium* respectively. Rocky intertidal areas support large numbers of the winkles (*Littorina littorea* and *L. saxatilis*) as far up as Kincardine Bridge.

The laver spire shell (*Hydrobia ulvae*) is a small gastropod snail which occurs in immense numbers throughout the intertidal Forth, with a mean for the entire area of 6721m^{-2} and peaks of population abundance at Torry Bay, Skinflats and Kinneil. On a flesh dry weight basis (i.e. excluding water and shells) there are 55 metric tonnes of *Hydrobia* in the complete area, which is 35.9% of the total intertidal biomass. *Hydrobia* is preyed upon by a small but significant population of *Retusa obtusata*.

Annelids

The common rag worm (*Nereis diversicolor*) is a common inhabitant of brackish waters, and in the Forth reaches its maximum abundance ($700 - 1000\text{m}^{-2}$) in the Kincardine Bridge — Alloa area. This is an area with salinity generally below 20‰, and it is clear that *Nereis* is thriving here. Above Alloa the salinity is further reduced, and oxygen conditions deteriorate, and apparently *Nereis* does not live there. As conditions improve in the future it might be expected that *Nereis* will be found up at least to Cambus. Below Kincardine Bridge *Nereis* becomes less abundant and when present is usually associated with a local freshwater discharge. The catworm *Nephtys hombergii* is never found above Kincardine Bridge, and this study confirms that it is a more marine species than *Nereis*. The lugworm (*Arenicola marina*) is locally abundant, especially in Torry Bay.

Oligochaete worms (including *Tubifex*, *Limnodrilus* and *Pelosciolex* spp.) are some of the least conspicuous inhabitants of mudflats, however numerically they are the most numerous animal in the Forth, with a mean abundance of 9512m^{-2} , and peaks of over $24,000\text{m}^{-2}$. They are the dominant inhabitant of the upper Forth Estuary, where their wide salinity tolerance, coupled with their ability to withstand organic pollution, places them at an advantage. Below Kincardine Bridge, the distribution and abundance of oligochaetes is a valuable criterion for the community classification of mudflats as an indication of pollution (McLusky *et al* 1978). Oligochaetes are second only to *Hydrobia* in terms of total biomass, with 14% of the total for the intertidal Forth.

Others

The amphipod *Corophium volutator* is patchily distributed within the study area. Locally it can be very abundant, for example at Valleyfield or Kennetpans. Like *Nereis*, *Corophium* can successfully withstand low salinities, and occurs up the estuary as far as Alloa, and like *Nereis* should be able to live as far as Cambus, as water quality improves. The shore crab (*Carcinus maenas*) is found up as far as South Alloa. The small Spionid worms are widely distributed in the area, but do not appear to penetrate beyond Kennetpans. Nematode worms occur especially between Cambus and Kincardine.

Biomass

Utilising the data on number m^{-2} , the biomass may be calculated by use of appropriate conversion factors. In table 2 the mean flesh dry weight m^{-2} for each area is given. A maximum of 18.81gm^{-2} can be seen for the small area at Valleyfield, whilst the neighbouring Torry Bay has been calculated as 14.5gm^{-2} . The importance of the three main mudflat areas can be readily seen, for although Skinflats, Kinneil and Torry Bay contribute only 57% of the total area, they contribute 75% of the total biomass, due to their large populations of *Hydrobia* and bivalves. Elsewhere values of $2 - 3\text{gm}^{-2}$ are common. The lowest biomass is recorded in the Alloa — Devon Mouth (Cambus) area, where it falls to 0.88 gm^{-2} . As has been commented on for *Nereis* and *Corophium* above this area has been adversely affected by organic pollution, and abatement of the effluent discharges should lead to an increase in biomass. The overall estimate

Area	g. flesh dry wt/m ⁻²	Total g x 10 ⁶ biomass
I	4.07	3.13
II	8.60	7.39
III	14.50	50.73
IV	18.81	3.76
V	2.92	5.05
VI	8.57	1.20
VII	6.22	1.37
VIII	0.88	0.91
IX	2.32	0.46
X	3.20	1.15
XI	8.39	32.04
XII	5.74	32.28
XIII	4.97	6.96
XIV	2.28	3.16
XV	2.63	3.63
TOTAL		153.23 x 10 ⁶ g = 153.23 tonnes flesh dry wt.
Mean	6.78m ⁻²	
		data Jan. 76 except XII — Jan. 77
Aug 77:		
Mean	8.64m ⁻²	195 tonnes

TABLE 2

Mean biomass for each study area, expressed as g flesh dry wt m⁻², and total biomass at each area. The mean biomass for the entire Forth area, and the total for the entire area are also given.

for the winter biomass of the intertidal Forth estuary is 6.78g flesh dry wt. m^{-2} , which may be expressed as 153 tonnes for the total area of 22.6km^2 . Estimates of the summer biomass suggest 8.64gm^{-2} , or 195 tonnes for the entire area.

CONCLUSION

The important bird populations of the Forth have not been dealt with in this review. For information on these the reader should consult Bryant and McLusky (1975-77). From the historical record, it would appear that until the end of the 18th century the Forth estuary was largely unaffected by man. In the first half of the 19th century, the estuary was adversely affected by the clearing of Blair Drummond and other Mosses. Although this ceased in 1865, the estuary failed to improve because, throughout the latter half of the 19th century and the first half of the 20th century, increasing effluent loads have been discharged to the estuary from enlarging centres of population, and industrial expansion such as whisky distilling in the Cambus area. By the 1950's the upper part of the estuary was suffering from marked deoxygenation of the water for lengthy periods. Improvements in the 60's and 70's have resulted in a marked increase in water quality, especially oxygen content. Measures which have been taken, especially in the Cambus area, should facilitate the passage of migratory fish such as salmon, however vigilance is still essential if other domestic and industrial discharges are not to undo the work which has been done.

The latter part of the 20th century is witnessing a major expansion of industry in the area between Kincardine and Bo'ness, especially petro-chemicals and electricity generation. Grangemouth docks have become the busiest in Scotland, and projected expansion in this area will make it even more important. For the ecologist too, the focus of attention has moved from the windings of the upper Forth, down to the mudflats of the lower Forth estuary, which support large numbers of invertebrates, and internationally important shore bird populations (Bryant and McLusky 1975, 76, 77).

Overall despite its history of utilisation by man for effluent disposal, the Forth estuary today continues to function as a highly productive ecosystem. The intertidal fauna, on which many species of birds such as waders and Shelduck, as well as fish such as flounders, depend has been found to be highly productive, especially in the Skinflats, Kinneil and Torry Bay areas. The biomass of food available

is however reduced in polluted areas, and the continuing availability of this food source for birds and fish alike depends on the installation and maintenance of appropriate effluent treatments from present and future industries in the Grangemouth area. Obliteration of the mudflats by reclamation schemes also represents a major threat to the wildlife of the Forth. It is already possible for industry, man and wildlife to co-exist in the Forth estuary, and provided always that care is taken in the design and control of effluent treatment and reclamation schemes it will be possible for them to co-exist in the future.

ACKNOWLEDGEMENTS

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BIRD-RINGING IN THE STIRLING AREA REPORT FOR 1977

Martin Davies

This report is the first of its kind specifically concerning bird-ringing in the Stirling area. It is hoped that it will serve to stimulate local interest and encourage people to look out for ringed birds and particularly to examine for rings any corpses of birds that they might find. The list of recoveries shown below serves to illustrate how rewarding this can sometimes be.

The report has been compiled from information supplied by four active qualified ringers working in the Stirling area during 1977:— D. M. Bryant, M. Davies, S. Mitchell and H. Robb. Table 1 shows the total numbers of birds ringed of each species during the year by these four ringers. (Totals are given for all species ringed except Pied Flycatcher, details of which have been withheld by the ringer for confidential reasons). Table 2 gives a list of all recoveries reported to date for 1977, and a selection of some of the more interesting recoveries from previous years.

24 TABLE 1 Ringing Totals for 1977

Species	Full-grown	Pullus	Totals
Shelduck	1	—	1
Hen Harrier	—	6	6
Oystercatcher	4	2	6
Ringed Plover	2	4	6
Grey Plover	1	—	1
Lapwing	—	31	31
Knot	4	—	4
Sanderling	1	—	1
Dunlin	218	—	218
Bar-tailed Godwit	1	—	1
Curlew	—	2	2
Redshank	38	3	41
Greenshank	—	1	1
Common Sandpiper	1	—	1
Herring Gull	15	—	15
Common Tern	2	—	2
Tawny Owl	—	4	4
Sand Martin	144	—	144
Swallow	2	39	41
House Martin	94	89	183
Tree Pipit	—	6	6
Meadow Pipit	1	—	1
Yellow Wagtail	1	—	1
Pied Wagtail	132	5	137
White Wagtail	4	—	4
Dipper	1	18	19
Wren	10	—	10
Dunnock	10	—	10
Robin	39	11	50
Redstart	9	4	13
Whinchat	1	—	1
Blackbird	33	2	35
Song Thrush	14	6	20
Redwing	12	—	12
Mistle Thrush	—	2	2
Sedge Warbler	13	—	13
Whitethroat	12	—	12
Garden Warbler	5	—	5
Blackcap	5	—	5
Wood Warbler	—	16	16
Chiffchaff	1	—	1
Willow Warbler	183	—	183
Goldcrest	6	—	6
Spotted Flycatcher	4	—	4
Long-tailed tit	24	—	24

Species	Full-grown	Pullus	Totals
Coal tit	7	—	7
Blue tit	179	172	351
Great tit	41	90	131
Tree Creeper	7	—	7
Starling	2	2	4
Tree Sparrow	1	—	1
Chaffinch	77	—	77
Greenfinch	33	—	33
Goldfinch	2	—	2
Siskin	1	—	1
Linnet	1	—	1
Redpoll	15	—	15
Bullfinch	19	—	19
Yellowhammer	2	—	2
Reed Bunting	1	4	5
	<hr/> 1,436	<hr/> 533	<hr/> 1,969

TABLE 2 Recoveries and Controls

Key to the terms used in the following table:—

pullus	—	nestling or chick, not yet flying
1Y	—	bird in its first year
adult	—	at least one year old
controlled	—	caught or trapped and released with ring

SHELDUCK

Colour-ringed

Red/Metal, Yellow/Black pullus	16. 7.76	Aberlady Bay, East Lothian
Colour rings read in field	5. 3.77	East Grangemouth, Stirlingshire

MUTE SWAN

Z32518 adult (in moult)	30. 7.74	Loch Leven, Kinross
found dead	2. 3.77	Skinflats, Stirlingshire

KESTREL

EF88151 pullus	11. 6.75	Callander, Perthshire
found dead (shot)	10.11.75	Peterhead, Aberdeenshire

OYSTERCATCHER

SS43900 adult	6. 4.74	Barbush, Dunblane, Stirling
dead on beach	13. 7.75	Broughty Ferry, Angus

DUNLIN Stockholm 3319638	adult	1. 8.76	Ottenby, SWEDEN
	controlled	18.12.76	Bo'ness, West Lothian
Helgoland 80875609	1Y	7. 9.75	Bottsand, Plön, (Schleswig Holstein), WEST GERMANY
	controlled	19.12.76	Bo'ness, West Lothian
Stavanger 8162547	1Y	27. 8.77	Tjorve, Lista (West Agder), NORWAY
	controlled	15.10.77	Longannet, Kincardine, Fife

These 3 controls parallel a large number of similar movements to elsewhere in Britain. The Dunlin wintering on the Upper Forth Estuary are largely of Siberian origin and pass through the Baltic area on autumn passage.

COMMON GULL

EF97625	pullus	25. 6.74	Loch Arklet, Perthshire
	found dead	27. 8.74	Benderloch, Argyll

HERRING GULL

GP88041	adult	26. 7.73	Nigg, Ross-shire
	controlled	21. 8.77	Longannet, Kincardine, Fife

SANDWICH TERN

DS75422	pullus	5. 7.69	Farne Islands, Northumberland
	controlled	19. 8.77	Longannet, Kincardine, Fife

This parallels a number of similar controls by the Tay Ringing Group on the Angus and Fife coasts.

SAND MARTIN

The various recoveries of this species are listed according to the type of movement shown.

(a) Autumn movements

(1) Same year

KJ78331	1Y	15. 7.76	Barbush, Dunblane, Stirling
	controlled	5. 8.76	Great Linford, Bucks.
KJ78383	1Y	22. 7.76	Barbush, Dunblane, Stirling
	controlled	21. 8.76	Attenborough, Notts.
JX76464	adult	22. 7.76	Barbush, Dunblane, Stirling
	controlled	2. 9.76	Winterset Reservoir, Wakefield, Yorks.
JR99281	1Y	24. 6.74	Argaty, Doune, Perthshire
	controlled	14. 7.74	Winterset Reservoir, Wakefield, Yorks.

(2) Subsequent year

Paris	1Y	10. 9.72	La Chapelle sur Erde, FRANCE
1736434	controlled	18. 7.74	Argaty, Doune, Perthshire

(b) Subsequent breeding seasons

(1) Return to nearby colonies (N.B. large number of returns to same colony (= retraps) not listed)

JP28978	adult	12. 7.73	Cambusbeg, Callander, Perth
	controlled	18. 7.74	Argaty, Doune, Perthshire
JP76970	1Y	4. 7.74	Barbush, Dunblane, Stirling
	controlled	12. 6.77	Drymen, Stirling

(2) Recovered away from area of ringing

JR76978	1Y	4. 7.74	Barbush, Dunblane, Stirling
	found dead	end 5.77	Sandnes, Rogaland, NORWAY
HOUSE MARTIN			
JX67663	pullus	2. 8.75	Muckart, Perthshire
	died striking overhead wires	30. 8.77	Crook of Devon, Perthshire
PIED WAGTAIL			
KP76037	1Y	29. 1.77	University of Stirling
	found dead on road	15. 6.77	Stirling
KP76046	adult male	29. 1.77	University of Stirling
	found dead	24. 6.77	University of Stirling

Although no significant movements are indicated, this is in itself interesting as Scottish-breeding Pied Wagtails are usually considered to be almost completely migratory, (see Davis, P 1966, *Bird Study* 13: 147-162.) and yet here are two birds ringed at roost in January present in the breeding season.

SEDGE WARBLER

KS30251	1Y	6. 8.77	Port of Menteith, Perthshire
	controlled	21. 8.77	Thurrock, Essex

BLACKCAP

KS30415	1Y	30. 7.77	Logie, Stirling
	controlled	14. 9.77	St. Alban's Head, Purbeck, Dorset

WHITETHROAT

KJ78681	1Y	8. 8.76	Port of Menteith, Perthshire
	killed by car	16. 7.77	Ruskie, Port of Menteith

N.B. Returned to same area in following year

28

WILLOW WARBLER

818083	1Y	31. 8.75	Port of Menteith, Perthshire
	controlled	6. 9.75	Radipole Lake, Weymouth, Dorset

N.B. Recaptured only 7 days later

818379	1Y	12. 7.77	Bridge of Allan, Stirling
	controlled	21. 8.77	Great Salterns Lake, Portsmouth, Hants.

The Blackcap, Sedge Warbler and these two Willow Warblers form a nice collection of long distance autumn movements of summer visitors returning towards their winter quarters.

ROBIN

KJ79728	1Y	14. 8.76	Kippen, Perthshire
	found dead	1. 3.77	Livingston, West Lothian

HR17362	1Y	30.10.76	Logie, Stirling
	hit by car	16.11.76	Kinfauns, Perthshire

BLACKBIRD

CJ64655	pullus	12. 5.73	Cambusbeg, Callander, Perth
	leg only found	16. 3.75	Drumnadrochit, Inverness

CJ64890	1Y female	29. 9.74	Port of Menteith, Perthshire
	found dead	9. 1.76	Drumaness, Ballynahinch, Northern Ireland

XC27503	adult male	24.10.76	Stirling
	killed by cat	17. 6.77	Stirling

GREAT TIT

NA24106	adult female	15. 2.76	Thornhill, Perthshire
	controlled	26. 1.77	Ardentiruig, Argyll

GREENFINCH

NC48026	1Y female	23. 1.77	Bridge of Allan, Stirling
	found dead on road	29. 5.77	Balbeggie, Perthshire

If you find a ringed bird please make a note of the ring number (and address if the ring is not British), the date, place and circumstances of finding and send these details to the British Museum (Natural History), London SW7 (the address on most British rings) or else direct to the British Trust for Ornithology, Beech Grove, Tring, Herts. It is important also to include your own name and address so that the Ringing Office can inform you of the ringing details.

If the bird is still alive the ring should be left on and the bird released as soon as possible. If the bird is dead the ring should be removed and included along with your letter (securely stuck to it to prevent loss in the post).

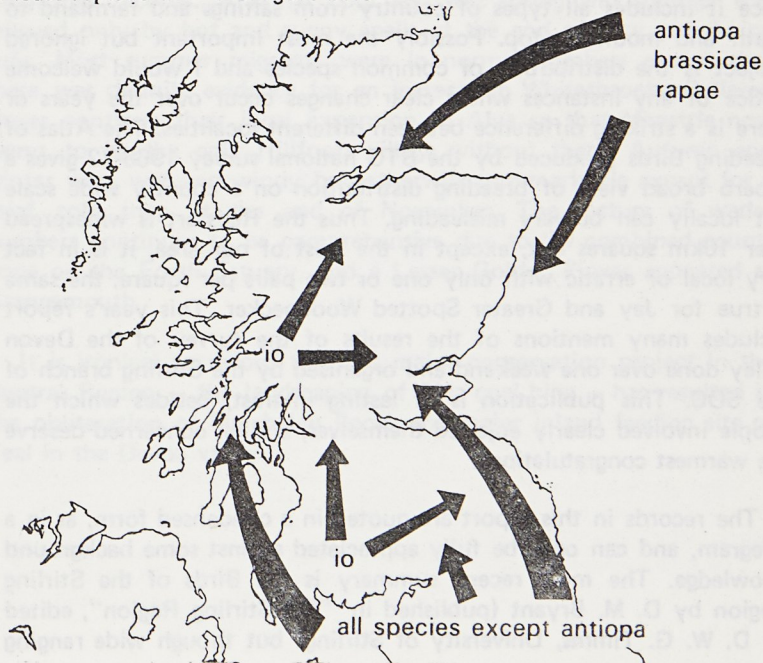
If you see a ringed bird in your garden please do NOT try to catch it. Not only would it be illegal except under licence, but it might harm the bird if undertaken without training.

If you would like to know more about bird-ringing please write to the B.T.O. (address above) and ask for a copy of their excellent booklet on the subject — B.T.O. Guide 16 'Bird Ringing' by Chris Mead, Price 50p.

CORRIGENDUM FROM VOLUME 2.

Migrant Butterflies of Central Scotland by George Thomson —
Figure 2, page 53

Unfortunately the wrong figure was reproduced.
Please replace with the figure below



C. J. Henty

This is the third report on the birds of Clackmannan and east-central Stirling and it may be useful to remind readers about what such annual reports can aim to do. There are of course the scarce species where all records for the area can be mentioned individually and these are indicated by an asterisk. In a rather similar category are cases where the largest recorded flocks of common species seem worth mentioning, or the earliest and latest dates for migrants. Since so little has been published on visible migration in this area I have also emphasised records where it seems that birds have been seen whilst on a long distance flight and these can be distinguished by the mention of the compass direction of movement. The reactions of birds to unusual or extreme circumstances — e.g. a hard winter — also receive emphasis and I urge people to look out for and note such instances. The whole field of seasonal phenomena such as the resumption of song in spring or the return of common species to the breeding habitat is much neglected whilst this district also offers a great opportunity for noting seasonal switches in habitat since it includes all types of country from saltings and farmland to heath and mountain top. Possibly the most important but ignored subject is the distribution of common species and I would welcome notice of any instances where clear changes occur over the years or there is a striking difference between different localities. The Atlas of Breeding Birds produced by the BTO national survey 1968-72 gives a superb broad view of breeding distribution on a country wide scale but locally can be very misleading. Thus the Redstart is widespread over 10km squares but, except in the west of our area, it is in fact very local or erratic with only one or two pairs per square; the same is true for Jay and Greater Spotted Woodpecker. This year's report includes many mentions of the results of the survey of the Devon valley done over one weekend and organised by the Stirling branch of the SOC. This publication is of lasting interest, besides which the people involved clearly enjoyed themselves, and all concerned deserve the warmest congratulations.

The records in this report are quoted in a condensed form, as in a telegram, and can only be fully appreciated against some background knowledge. The most recent summary is the Birds of the Stirling Region by D. M. Bryant (published in "The Stirling Region", edited by D. W. G. Timms, University of Stirling) but though wide ranging

in scope this essay does not set out to be fully comprehensive and for such an account it is necessary to consult the Vertebrate Fauna of Forth by Rintoul and Baxter, and this book is now forty years old and difficult to get. The simple information sent in by the contributors to these reports can make a real impact in bringing up to date our knowledge and I am disappointed that many observers in the district either suffer from false modesty in failing to realise the usefulness of their observations or cannot raise the energy to write things down and send them to me. The very incompleteness of these reports should be a challenge for people to make it better and a much larger contribution from young ornithologists would be particularly welcome.

Last December's bitter weather continued right through January of this year and overall in southern Scotland the 1976-77 winter was the coldest since 1962-63. Many diving duck left the lochs and appeared on the Forth around Stirling whereas Coot stayed on the ice or grazed on grassy margins. On the highest mosses of the Ochils Red Grouse and Snow Buntings were still abundant during the severest weather in mid January. During the breeding season Stonechats were decidedly scarce but Dippers and Grey Wagtails were seen in fair numbers during the Devon Survey and there was the usual sprinkle of Kingfisher records. A rather cool and wet spring and summer was relieved only by hot and sunny spells at the end of May and during July. Most summer migrants were in normal numbers except that there was definite evidence for an increase in Whitethroats. Collared Doves continue their local expansion in Alva so that Menstrie now seems to be the only Hillfoots village without them. Autumn and winter were wet and windy but otherwise unremarkable except for a brief cold snap at the end of November. The picture of wader numbers continues to be comprehensive due to the combined counts done on the Forth Estuary, and a Lesser Golden Plover appeared at Grangemouth.

It is ironical to record that the major conservation project in the Central Region — the landscaping of Alva coal bing — has resulted in the obliteration of Marchglen Pools, the major inland feeding site of Teal in the Devon valley.

32 SYSTEMATIC LIST 1977

LITTLE GREBE	S	4 pairs with young at Airthrey on 5th September (MD).
GREAT CRESTED GREBE	C	Gartmorn Dam, 2 pairs in breeding season (IN).
	S	Kinneil, 124 on 8th February, 175 on 6th March. 150 on 14th August and 158 on 2nd October (DMB).
MANX SHEARWATER	S	1 at Skinflats on 1st October (DMB).*
CORMORANT	C	120 at S. Alloa on 5th November (CJH).
	S	270 Alloa-Grangemouth on 17th January (DMB, MD, DRW). 22 Stirling-Cambus on 17th January (DMB, MD, DRW).
MALLARD	C	118 on 50 km. of R. Devon on 28th May (Devon S.), Gartmorn, 1,041 on 15th January and 638 on 18th December (CJH, IN).
	S	198 at Airthrey on 26th November, 111 males, 87 females (MWF). Upper Forth (Kinneil-Alloa), 1,648 on 17th January, 1,198 on 11th December (DMB, MD, DRW). 351 on Forth (Alloa-Stirling) on 17th January (DMB, MD, DRW).
TEAL	C	3 (1 pair) on U. Glendevon Reservoir on 28th May (Devon S.). Gartmorn, 114 on 15th January and 171 on 18th December (CJH, IN).
	S	R. Forth, 280 Alloa-Stirling on 17th January (DMB, MD, DRW). 120 at Manorneuk on 2nd January (CJH). 180 at E. Grangemouth on 13th November (DT).
GADWALL	S	pair at Kinneil on 17th April (DMB)*.
WIGEON	C	2 at Upper Glendevon Reservoir on 28th May (Devon S.). 2 males at Lower Glendevon Reservoir on 18th May (DMB). Gartmorn, 200 on 9th January (CJH) and 195 on 18th December (CJH, IN).
	S	Upper Forth, 208 on 17th January and 213 on 11th December (DMB, MD, DRW). 170 at Skinflats on 15th October (AMcl), and 2 pairs at Kinneil on 20th May (MD).

- PINTAIL S Upper Forth, 56 on 17th January, 30 at Kinneil on 26th January (DMB). 22 at Skinflats on 20th March (AMcl).
- SHOVELER S Kinneil, 3 on 14th August and 2 on 2nd October (DMB)*.
- SCAUP C 1 female and 2 imm. males at Gartmorn on 4th November (CJH).
- S Kinneil, 110 on 26th Jan. down to 10 on 17th April, female on 1st October (DMB). 7 at Grangemouth on 11th December (DMB, MD, DRW).
- TUFTED DUCK C 3 pairs at Marchglen pool on 19th March (CJH). 5 on Devon at Cambus and 4 at Upper Glendevon Reservoir on 28th May (Devon S.). Gartmorn, 206 on 31st July, 300 on 9th January, 137 on 15th January (much ice), 164 on 18th December (after ice cover) (CJH, IN).
- S On Forth, 70 at Cambuskenneth on 15th January (CJH) and 174 Stirling-Cambus on 18th January (DMB) — hard weather, 3 on sea at Kinneil with Scaup on 26th January (DMB). 40 males : 49 females at Airthrey on 26th November (MWF).
- POCHARD C 2 on Upper Glendevon Reservoir on 28th May (Devon S.). Gartmorn, 30 on 15th January and 25 on 18th December (CJH, IN).
- S 13 at Kinneil on 15th January (DMB). 100 at Blackness on 2nd October (AMcl).
- GOLDENEYE C Gartmorn, 22 on 15th January, 2 redheads, probably both adult, on 31st July, 34 on 18th December (CJH, IN).
- S Forth, 75 at Cambuskenneth on 15th January (CJH) 95 Stirling-Cambus on 18th January (DMB). 84 Cambus-Grangemouth on 20th February (MD, DRW).
- RED-BREASTED MERGANSER S 1 female on Sheriffmuir on 4th May (JHI). Upper Forth, 476 on 20th February and 159 on 11th December (DMB, MD, DRW), scarce higher up river — 2 Stirling-Alloa on 18th January (DMB).

- 34 GOOSANDER C 1 in Upper Glendevon on 28th May (Devon S.), pair at Gartmorn Dam on 29th October (DT).
- S 27 at Cambuskenneth and 13 Tullibody Inch on 18th January (DMB, MD).
- SHELDUCK C 38 at Tullibody Inch on 5th November (CJH). 2 at Peppermill Dam on 15th April (CJH).
- S Upper Forth, 2,655 on 17th January, 2,218 on 20th February, 500 on 20th March, 650 on 15th October, 2,358 on 11th December (DMB, MD, DRW, AMcl). Kinneil Summer Flock, on 14th August, 1,120 with at least 400 (probably 640) in moult (DMB).
- GREYLAG GOOSE C 30 W at Gartmorn on 9th January (CJH). 19 feeding in stubble at Menstrie on 16th January — rarely settle in the Devon valley (CJH).
- S At Airthrey, 60 NW on 9th January and 25 W on 25th November (CJH).
- PINK-FOOTED GOOSE C At Alva, calling at 23.00 on 30th April and 125 NW on 1st May (CJH). 75 E at Alva on 2nd October (CJH).
- S Bridge of Allan, 25 E on 16th September (CJH), several parties NW at Airthrey after 9th November (CJH).
- GREY GOOSE spp C 140 S, very high, at Alva on 25th November, also parties W, 24th November — 29th December (CJH).
- WHOOPEE SWAN C 1 at Cambus on 28th May (Devon S.), 1 at Kincardine on 4th August (MD), Menstrie-Tullibody, 1st 31 on 11th November, max. 84 on 22nd November and 75 on 13th December, up to 4 families and average frequency of juveniles 7.6% (MB).
- S At Kippen 1st January — 26th February, max. 37 on 13th February (DT), at Kildean from 19th February, max. 42 on 19th March, still 20 on 8th April (DT), Skinflats/Airth, max. 60, 13th November — December (RLG, JHI, DT).

- BUZZARD** C 1 at Dollar on 28th May (Devon S.). 1 at Muckhart on 12th August (DMB).*
- S 2 near Bridge of Allan on 12th September (CJH).*
- SPARROWHAWK** C/S Records throughout year except April-June.
- S 1 in centre of Stirling on 11th July (AM). 1 at Kinneil on 2nd October landed on mudflat (DMB).
- HEN HARRIER** S Ringtail at Stronend on 8th October (CJH).*
- PEREGRINE** C 1 male at Alva on 28th August, carrying prey and being mobbed by corvids (CJH), Ad. on Menstrie Moss at 600m on 26th November (CJH), imm. at Menstrie on 30th December, chased Lapwing, Woodpigeon and Feral Rock Dove (CJH).*
- S 1 at Gargunnoch on 29th March (DT), 1 at Bridge of Allan on 16th September (CJH), imm. at Skinflats on 8th December (MD), one occupied territory in area and 3 young reared (JM).*
- MERLIN** C 1 at Menstrie 27th November (CJH).*
- S 1 on W Flanders Moss on 3rd April (DC). 1 at Larbert on 18th October (DT). 1 at E Grangemouth on 13th November (DT). 1 over Forth at Stirling on 22nd December (CJH).*
- KESTREL** C Only 1 seen in Devon Valley on 28th May (Devon S.)
- C/S More records than usual in January and December.
- RED GROUSE** C Present on Menstrie and Alva Mosses at 650m. during heavy snow and hard frost on 12th January (CJH). 12 on Menstrie Moss on 26th November (CJH). 2 in 1m conifers at Lossburn on 19th March (AM).
- BLACK GROUSE** C no reports on leks, 6 females on Ben Ever, rough grass at 550m on 26th November (CJH).

36	CAPERCAILLIE	S	2 males and 1 female at W Flanders Moss on 3rd April (DC). Eggshell found at North Third Reservoir on 22nd May (AM).*
			The distribution of this species is very obscure though it was recorded in at least four 10 km. squares during the BTO atlas survey.
	PARTRIDGE	C	23 recorded in Devon Valley on 28th May, mainly in lowest and highest sections (Devon S.)
	MOORHEN	C	47 recorded in Devon Valley on 28th May, commonest around Dollar (Devon S.)
	COOT	C	4 on R Devon on 28th May, including 1 in upper section (Devon S.), Gartmorn, 160 on 15th January, 101 on 31st July, 141 on 18th December, remained during complete ice cover (CJH, IN).
		S	Max. 39 at Airthrey January-February and November-December, remained during ice cover (CJH).
	OYSTERCATCHER	C	33 on R Devon on 28th May, commonest above Cambus and around Crook of Devon (Devon S.), pair with C/2 at Cambus on 2nd May (MD).
		S	Heard over Airthrey and Bridge of Allan from 14th February (CJH, MD)
		C/S	Upper Forth, 1,110 on 17th January and 975 on 20th February, 1,175 on 18th August and autumn max. of 1,445 on 12th November (DMB, MD, DRW).
	LAPWING	C	100 along R Devon on 28th May (Devon S.). Menstrie, 650 on 13th February and 1,480 on 27th November (CJH).
		C/S	Upper Forth, max. 4,430 on 20th February and 1,456 on 14th October (DMB, MD, DRW).
	RINGED PLOVER	C	2 in Upper Glendevon on 28th May (Devon S.)

- C/S Upper Forth, 72 on 17th January, 309 on 19th August and 58 on 11th December (DMB, MD, DRW).
- GREY PLOVER C/S Upper Forth, 87 on 17th January and 77 on 20th February, 2 on 26th July, max. 77 on 14th October, 9 on 11th December (DMB, MD, DRW).
- GOLDEN PLOVER C Few inland in winter, e.g. at Menstrie 6 on 8th January, 83 on 27th November but only 30 on 30th December (CJH).
- S 100 at Kippen on 29th March, possibly spring passage (DT).
- C/S Upper Forth, 1,096 on 17th January and 837 on 20th February, 510 on 19th August increasing to 1,614 on 11th December (DMB, MD).
- LESSER GOLDEN PLOVER S 1 at Kinneil on 14th August (DMB), also 17th, 19th and 22nd (MD).
- TURNSTONE C/S Upper Forth, 136 on 17th January and 198 on 20th February, 106 on 19th August, 176 on 16th September, few in October/November but 130 on 11th December (DMB, MD, DRW).
- SNIFE C Only 3 on R.Devon on 28th May (Devon S.), 23 on flooded stubble at Longcarse on 5th November (CJH). 1 at 550m. (frost) on Alva Moss on 26th November (CJH). 7 on marshy spring at Alva on 16th January during hard frost (CJH).
- S Only 3 by Forth, Stirling-Bo'ness on 17th January and 20th February. 1 at 200m. damp spot in snow, on Pendreich on 1st January (AM).
- C/S Upper Forth, max. 8 on 12th November (DMB, MD, DRW).
- JACK SNIFE S At E. Grangemouth, 3 on 20th February and 1 on 6th March, 3 on 11th March, 1 on 12th November (MD).*
- WOODCOCK C 1 on Wood Hill on 6th March (CJH).
- S Roding at Airthrey on 5th March, Bridge of Allan on 12th March, N. Third on 22nd March (MD, AM).

CURLEW	C	15 in Devon Valley (mainly upper section) on 28th May (Devon S.)
	C/S	Upper Forth, 1,057 on 20th February (only 30 at Skinflats on 27th March (AMcl). 944 on 19th August, max. 1,156 on 16th September, 398 on 11th December (DMB, MD, DRW). 1st inland, 2 at Muckhart on 2nd March (DMB).
WHIMBREL	S	At Skinflats, 3 on 5th August and 2 on 12th August (AMcl). 3 at Kinneil on 22nd August (DT).*
BLACK-TAILED GODWIT	S	Grangemouth, 1 on 17th January, 2 on 20th February, 1 on 6th March, 1 on 19th August and 16th September, 3 on 14th October, 1 on 12th November and 11th December (DMB, MD, DRW).*
BAR-TAILED GODWIT	C/S	Upper Forth, 415 on 17th January, 438 on 20th February, 17 on 2nd May, 2 on 13th May, 60 on 23rd July rising to 453 on 12th November, 305 on 11th December (DMB, DT, DRW).
COMMON SANDPIPER	C	36 on R.Devon, mainly above Crook of Devon, 28th May (Devon S.). 5 at Gartmorn on 31st July (CJH).
	S	Upper Forth, 6 on 19th August, last 1 on 14th October (DMB, MD, DRW).
SPOTTED REDSHANK	C/S	Upper Forth, 1 on 20th February, 2 on 14th August, 1 on 19th and 22nd August, 2 on 16th September, 1 on 14th October, 1 on 11th December (DMB, MD, DRW, DT).*
REDSHANK	C	22 on R.Devon, commonest in Upper Glendevon, on 28th May (Devon S.), 50 at Tullibody Inch on 5th November (CJH). 30 at Blackdevonmouth on 27th December, flew in - shot at - flew off (CJH). Upper Forth, 2,387 on 17th January and 1,878 on 20th February, 1,245 on 19th August rising to 2,980 on 14th October, 1,892 on 11th December (DMB, MD, DRW).
	S	Skinflats, 500 on 20th March, 100 on 5th August (AMcl).
GREENSHANK	C/S	Upper Forth, 1 on 17th January and 20th February, 1 on 12th August, 11 on 19th August, max. 17 on 16th September, 1 flying S over R. Carron on 15th October, 1 on 12th November and 11th December (DMB, MD, AMcl, DRW).

KNOT	C/S	Upper Forth, 10,300 on 17th January, 10,000 on 20th February, last 14 on 13th May, 4 on 27th July, 60 on 16th September, 319 on 14th October, 2,761 on 12th November, 5,530 on 11th December (DMB, MD, DRW).
CURLEW SANDPIPER		Upper Forth, Longannet, 1 imm. on 27th August, 2 ad. in breeding plumage on 10th August (MD).*
DUNLIN	S	30 at Cambuskenneth on 15th January (CJH). 1,000 at Skinflats on 20th March (AMcl) and 100 on 5th August.
	C/S	Upper Forth, 10,846 on 17th January, 9,315 on 20th February, 1,245 on 19th August, 2,016 on 16th September, 3,673 on 14th October, 5,707 on 12th November, 6,616 on 11th December (DMB, MD, DRW).
RUFF	C	2 at Blackdevonmouth on 19th August (MD).
	S	Grangemouth area, 4 males on 23rd July, 9 on 25th July (MD). 1 on 14th and 17th August, 2 on 19th August, 1 on 16th September (DMB, MD, DT). 1 on 20th February.*
ARCTIC SKUA	S	2 W at Grangemouth on 17th August (MD).*
LESSER BLACK-BACKED GULL	S	1 ad. at Cambuskenneth on 18th January (MD). 95 at Kildean on 25th August (CJH).
GREAT BLACK-BACKED GULL	C	5 in Devon Valley, mainly Upper Glendevon on 28th May (Devon S.)
GLAUCOUS GULL		Upper Forth (Fife) 1 (2nd winter) at Longannet on 16th January (MD).*
LITTLE GULL		Upper Forth (Fife) 1 imm. at Longannet on 19th August (MD).*
COMMON GULL	C	85 (25 pairs) at Upper Glendevon Reservoir on 28th May (Devon S.)
BLACK-HEADED GULL	S	30 feeding in tops of oak trees (presumably for acorns) at Airthrey on 1st November (DMB).
KITTIWAKE	S	2 at Kinneil on 2nd October (DMB).*
BLACK TERN	S	1 at Skinflats on 14th August, flying down Forth (DT).*

COMMON TERN	C	1 "commic" at Upper Glendevon Reservoir on 28th May (Devon S.)
	S	Grangemouth Docks, 33 pairs on piles on 27th May, 10 pairs with 11 chicks and 3 clutches on 24th July (DMB, DT). 100 "commics" at Kinneil on 1st October — 21 rose high then flew SW overland, drifted to S track by W wind (DMB).
SANDWICH TERN	C/S	Upper Forth, 1st on 23rd July, 250 on 10th August (MD).
	S	2 at Kinneil on 1st October (DMB).
RAZORBILL	S	1 dead at Kinneil (not oiled) on 6th March (DMB).*
FERAL ROCK DOVE	C	80 near Menstrie (Gogar) on 27th November (CJH).
	S	85 on Albert Halls, Stirling on 4th January (CJH).
WOOD PIGEON	C	Small flocks in Devon Valley, e.g. 120 at Alva on 6th March (CJH). 500 at Gartmorn on 18th December (CJH). Many hundreds roosting Bath Moor Ptn. on 29th December (CJH).
TURTLE DOVE	S	1 at Skinflats on 27th May (DMB).*
COLLARED DOVE	C	Now well established at Alva, small colony at E end and 1 pair there for several years (H. Lewin).
CUCKOO	C	1 at Muckhart on 9th May (DMB) Only 2 in whole Devon Valley on 28th May (Devon S.)
BARN OWL	C/S	A few records from Alva and Bridge of Allan (DMB, AM).
LONG-EARED OWL	S	1 at Sheriffmuir on 17th April (AM) (likely breeding habitat, Ed).*
SHORT-EARED OWL	C	1 at Longcarse (Alloa) on 5th November (CJH).*
	S	1 at Kinneil on 8th February, Skinflats on 27th February, 13th November, 8th December, 2 on 15th October (DMB, MD, AMcl).* No breeding season records but no evidence that any observer visited plantations on Ochils or Gargunnocks.

SWIFT	C	35 over Alva on 10th August (CJH) and 35 over Muckhart on 29th July (DMB).
	S	2 at Airthrey on 11th May (DMB). 2 at Stirling on 12th May (DT).
KINGFISHER	S	At Airthrey, 2 on 30th January (RSPB). 1 on 4th February, 24th and 26th November (DMB, MD, DRW, MWF). Forth/Allan, 1 on 3rd April, 17th July, 6th August (MD, PWS).*
GREEN WOODPECKER	C	E end of range, 1 at Muckhart on 10th April (DMB).
GREAT SPOTTED WOODPECKER	C	1 at Dollar on 9th May (DMB).*
	S	1 at Airthrey on 4th February and 6th March (CJH). Bridge of Allan, still presumably breeds. Mine wood — 1 on 31st May (CJH). 1 predated a Blue Tit's nest on 25th May (AM).* 2 near Muckhart Mill on 28th May (Devon S.).
SKYLARK	C	Winter flocks on stubble : 130 at Tullibody on 2nd January and 300 at Menstrie on 27th November (CJH).
	S	Spring occupation, 1 sg. on Dumyat on 19th March and 40 on Sheriffmuir on 9th April (AM).
SWALLOW	C	Last, 3 at Muckhart on 8th October (DMB).
	S	35 high to W at Auchenbowie (Denny) on 17th September (CJH). Last 8 at Plean on 11th October (DT).
HOUSE MARTIN	C	2 at Gartmorn on 23rd April (DMB). 2 at Alva on 30th April (CJH).
	S	At Airthrey on 2nd September, 50 around oaks perching briefly and pecking at leaves; strong SW wind and rain (CJH).
SANDMARTIN	C	251 along Devon Valley, mainly Alva-Muckhart Mill, on 28th May (Devon S.).
	S	3 at Bridge of Allan on 21st March (PWS), a very early date. 3 at Airthrey on 13th April (DMB), typical early date.
RAVEN	C	No evidence of nesting this year, Upper Glendevon, 2 on 18th May (DMB). 2 on Menstrie Moss on 26th November (CJH).*
ROOK	C	Roost of 1,000 at Gartmorn on 9th January (CJH). 1 on bird table at Muckhart on 3rd January, hard frost (DMB).

	S	Airthrey roost : many hundreds through winter but numbers difficult to estimate. Up to 40 feeding on acorns at Airthrey from 25th October (DMB).
JACKDAW	S	200 at roost, Airthrey, on 5th March (CJH). 5 taking acorns at Airthrey on 5th November (DMB).
MAGPIE	C	Max. 5 at Vicar's Bridge on 6th March (DMB).
JAY	S	1 at Pendreich on 6th July (AM) — sole summer record. Max. 5 at Auchenbowie on 17th September (CJH).
LONGTAILED TIT	C	9 along Devon Valley on 28th May (Devon S.)
	S	Max. 13 at Skinflats on 23rd October (AMcl).
WREN	C	35 along Devon Valley on 28th May (Devon S.), deserted gorse slopes above Alva during hard frost, e.g. only 1 in 3 km. on 25th December (CJH).
MISTLE THRUSH	C/S	Scarce in winter, not more than 2 together in January, February and December.
	C	2 in whole Devon Valley on 28th May (Devon S.), 16 below Craigleith (300 m.) on 24th July (CJH).
FIELDFARE	S	1st, 18 SE at Bridge of Allan on 9th October (CJH) — most movement to between S & W. 200 SW at Kippen on 23rd October (CJH). 1,000 at Gargunnoch on 3rd November (DT).
REDWING	S	Foraged in woods among leaf litter in hard weather, e.g. 10 in Mine Wood on 1st January (CJH). 1st, 50 SW at Airthrey on 5th October (CJH), widespread from 7th October. 190 SW at Kippen on 23rd October (CJH).
SONG THRUSH	C	2 on shore at Cambus in hard frost on 3rd January (CJH). 24 along Devon Valley on 28th May (Devon S.) — Blackbirds were 4½ times as numerous.
DIPPER	C	47 along R. Devon on 28th May, mainly above Dollar (Devon S.)
WHEATEAR	C	1 male at Craigleith, 1 at Marchglen and Blackdevonmouth on 27th March (DMB, CJH).

- S 1 male at N. Third Reservoir on 28th March (AM). Last, 1 at Skinflats on 1st October (AMcl).
- STONECHAT C 1 male in gorse at Alva on 12th March and 4th April, did not breed or winter here (CJH). 1 by R.Devon at Alva and 2 in Upper Glendevon on 28th May (Devon S.)*
- S 2 at Kinneil on 8th February (DMB). Pair on Sheriffmuir (breeding site) on 26th February (CJH).*
- WHINCHAT C 5 by lower Devon and 9 in Upper Glendevon on 28th May (Devon S.)
- S 1st, 1 on Sheriffmuir on 4th May (AM).
- REDSTART S 1 male at White Hill (Bridge of Allan) on 13th May (JHI).* — sole record.
- SEDGE WARBLER C 59 along R.Devon on 28th May, mainly in 14 km. below Tillicoultry (Devon S.). 1 at Muckhart on 9th May (DMB).
- BLACKCAP C 4 by Devon on 28th May, Tillicoultry-Dollar (Devon S.)
- GARDEN WARBLER C 2 by Devon at Rumbling Bridge on 28th May (Devon S.)
- WHITETHROAT C 28 by Devon, mainly Cambus-Dollar, on 28th May (Devon S.) this suggests a definite return toward previous status at least in lowland damp scrub (Ed).
- WILLOW WARBLER C 86 along R.Devon on 28th May (Devon S.), 100 at Gartmorn on 31st July, much song (CJH).
- CHIFFCHAFF S 1st, sg. at Sheriffmuir (birch/conifer) on 19th April (AM).
- WOOD WARBLER S At Bridge of Allan (Mine Wood), 1 on 1st May and 2 on 1st June (AM, CJH). 4 singing at Abbey Craig on 29th May (CJH).
- GOLDCREST S Skinflats, 4 on 15th October and 6 on 23rd October (AMcl).
- SPOTTED FLY-CATCHER C 1st at Muckhart on 20th May (DMB). 9 by R Devon on 28th May (Devon S.)

DUNNOCK	C	Only 9 along R. Devon on 28th May (Devon S.)
MEADOW PIPIT	C	25 in Upper Glendevon, one along Lower Devon on 28th May (Devon S.), 7 in Ochils at 480 m. (on spring bog during frost) on 26th November (CJH).
	S	Return to breeding area 1 on Dumyat on 19th March (AM). Passage : 20 W at Stronend on 13th September, 25 SE-SW over E Gargunnock slope on 17th September, 40 on Manorneuk bing on 25th September (CJH).
ROCK PIPIT	C	2 at Blackdevonmouth on 27th December (CJH).*
	S	1 at Kinneil on 8th February (DMB).*
GREY WAGTAIL	S	3 over Bridge of Allan on 16th September (CJH), rare in winter, 1 at Cocksburn Reservoir on 1st January, otherwise none before 12th March (AM).
	C	18 on Devon, Dollar and above, on 28th May (Devon S.)
PIED WAGTAIL	S	Large numbers roost in courts at Stirling University — e.g. 150 on 29th April, 250 on 16th November, many ringed (MD). 4 White Wagtails (<i>M.a.alba</i>) trapped at this roost on 29th April (MD).
YELLOW WAGTAIL	S	1 male trapped at wagtail roost at Airthrey on 29th April (MD). E Grangemouth, 1 female anxious and with food on 23rd July, 1 on 24th July and 17th and 21st August (DMB, MD).*
STARLING	C	Commonest sp. along lower and middle Devon on 28th May (Devon S.) 2,000 roosting in reeds at Tullibody Inch on 9th October (CJH).
HAWFINCH	S	Bridge of Allan, 1 in Mine Wood on 21st May and 2 over White Hill on 1st June (CJH).*
GREENFINCH	C	12 along Devon on 28th May (Devon S.)
	S	Skinflats, 10 on 20th March and 28th on 15th October (AMcl).

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| GOLDFINCH | C | Only 1 along Devon on 28th May (Devon S.).
18 at Blackdevonmouth on 27th December (CJH). |
| SISKIN | S | Many singing in SE of Loch Ard Forest on 6th March and 3rd April (DC). 2 S at Auchenbowie (Denny) on 17th September (CJH). |
| LINNET | C | Only 7 along (lower) Devon on 28th May (Devon S.). 120 on stripped kale at Cambus on 15th January (CJH). |
| | S | 131 at Skinflats on 15th October (AMcl).
6 S at North Third Reservoir on 17th September (CJH). |
| TWITE | C | Blackdevonmouth, 20 on 29th January (J. Ballantyne). 5 on 27th December (CJH). |
| | S | 50 at Skinflats on 20th March (AMcl). |
| REDPOLL | C | 9 by R.Devon on 28th May (Devon S.),
20 at Tillicoultry on 2nd October (CJH). |
| | S | 37 in alders at Pendreich on 4th April (AM). |
| BULLFINCH | C | Only 5 along Devon on 28th May (Devon S.) |
| | S | 20 in new conifer ptn. on 9th January (AM). |
| CROSSBILL | S | SE Loch Ard Forest, 6, song and display, on 6th March, 11 (ad. and juv.) on 1st May (DC). Probably bred locally. * |
| CHAFFINCH | C | 140 all along Devon (2nd commonest sp.) on 28th May (Devon S.) Recording songs around Airthrey using Marler's notation showed different song types and locality dialects but it was impossible to be sure that the distinctions were made in the same way, e.g. In the critical characteristic of number of units in the terminal flourish. Without exchange of calibrated tapes it is impossible for two observers to be sure they are making the same distinctions, even if they try to follow the same written system (CJH). |
| | S | 180 (late flock) in young cereal at Airthrey on 1st May (CJH). |

	C/S	Winter flocks small, e.g. 60 at Pendreich on 19th March (AM). 160 at Bath Moor on 29th December (CJH).
BRAMBLING	S	30 at Falkirk (beech mast) on 15th January (AMcl).*
CORN BUNTING	S	Skinflats, 5 on 27th May (DMB). 2 on 5th August and 1(sg) on 23rd October (AMcl).* No other records.
YELLOWHAMMER	C	11 along middle and upper Devon on 28th May (Devon S.) 6 on waste ground in centre of Alva during hard weather on 25th December (CJH).
REED BUNTING	C	39 along Devon (absent Dollar-Rumbling Bridge) on 28th May (Devon S.)
SNOW BUNTING	C	SW Ochils, 264 (155+45+64) on 12th January, all around <i>Juncus squarrosus</i> , hard frost and snow (CJH). 257 (160+60+37) on 26th November, broken snow (CJH).*
HOUSE SPARROW	C	Alva, flocks of 30 regular in winter. An albinistic female with white rump (seen September 1976) on 4th and 12th January. From 22nd December another (different) female; rump and lower back white, forehead and crown white with whitish extending behind and below ear coverts. (CJH).
TREE SPARROW	C	6 at Powmill on 1st May (DMB). 5 at Gogar (Menstrie) on 30th December, regularly feed at sheep troughs at Alva in winter (CJH).

Addition to 1976 Report

CORNCRAKE	S	At least 4 calling near Gargunnoch during summer (none in 1977) (Mr. and Mrs. J. Gearing)
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Addendum : species that occur regularly in the area but for which no notes are published this year.

Heron, Mute Swan, Pheasant, Herring Gull, Stock Dove, Tawny Owl, Tree Pipit, Robin, Ring Ouzel, Blackbird, Coal Tit, Great Tit, Blue Tit, Treecreeper, Carrion Crow.

RECORDERS

The initials in this report refer to notes submitted by:— M. Brazil, D. M. Bryant, D. Clugston, M. Davies, M. W. Fraser, R. L. Gooch, C. J. Henty, J. H. Isom, A. Mitchell, J. Mitchell, A. McIver, I. Nicoll, P. W. Sandeman, D. Thorogood, D. R. Waugh.

N.B. An * indicates that all records have been mentioned.

THE REGISTER OF ORNITHOLOGICAL SITES IN THE STIRLING REGION

47

Sandy Mitchell

The Register of Ornithological Sites (originally called the Habitat Register) was conceived and organised by the British Trust for Ornithology (hereafter referred to as the B.T.O.).

The purpose of the project was to compile a register of sites of ornithological importance throughout the British Isles; an ornithological "domesday book". It was motivated by an appreciation of the value of various habitats important to birds at a time when such places are under increasing destructive pressure. By recording their ornithological significance it is intended to provide a point of reference so that threatened interference by man can be discouraged or development carried out with as much regard as possible for the ornithological value of sites.

It was felt moreover that such a project could utilise the widespread enthusiasm engendered in fieldwork by the project to prepare "The Atlas of Breeding Birds in Britain and Ireland", published by the B.T.O. in 1976, which ran from 1968 to 1972 and involved over 10,000 contributors.

After commencing in the autumn of 1973, on a "pilot scheme" basis until February 1974, the "Register" project was to continue until 31st December, 1976. It has now been extended until the end of 1978. Control of the project has been in the hands of a professional national organiser at the B.T.O. headquarters working through a network of regional organisers, mostly amateurs, covering the entire country. Fieldworkers have had to complete registration forms for sites, submit them to the regional organiser who checked them and sent them to the national organiser. It is thought that the fieldwork was carried out substantially by amateur ornithologists.

Particulars of each site and birds using it were noted on a prepared registration form. It provided for the name, map reference and area of the site, a sketch map, a description and notes on its ornithological importance. The form provided also for the recording of any features other than ornithological ones and for recording the type or types of habitat by code. The reverse of the form listed species for which the numbers of individual birds had to be indicated,

as using the site either on passage, for breeding, for summering (non-breeding) or for wintering. Provision was made for confidential treatment of records involving rare birds. One registered site is omitted from the map presented here because of the presence of a rare breeding bird.

The features of a place rendering it eligible for registration as a site were not defined and have been dependent on the discretion of the observer. Clearly recorders had to indicate the place was of greater ornithological value than its environs; every square inch of the country was not to be registered. In general numbers, variety and rarity of species using a place have been guiding considerations.

Sites registered in the Stirling region, (the boundaries of which were defined by agreement with the B.T.O.), are shown on the map (Figure 1). Many places in the region meriting registration, especially those of lesser importance may well not have been registered, mainly as a result of a lack of fieldworkers. Certain of the registered sites however deserve specific mention here. The information given is entirely from the registration forms and the reader is warned that not all the information registered is mentioned and registered information may be incomplete.

Sites which derive importance from their use by birds during the passage seasons

The passage seasons have no definite starting and finishing dates; indeed passage to some degree occurs all year round, but the periods when most birds are on passage in the Stirling region may be taken as mid-March till the end of May (spring) and August till mid-November (autumn).

A site of primary importance for passage waders, particularly in autumn, is Skinflats and neighbouring Kinneil. Part of this area became a reserve of the Royal Society for Protection of Birds in 1976. The main feature of these sites is an extensive tract of intertidal mud which provides feeding for waders while the bordering saltmarsh and pools provide roosts. Amongst others, Ringed Plover, Grey Plover, Golden Plover, Jack Snipe, Whimbrel, Bar and Black-tailed Godwits, Spotted Redshank and Little and Temminck's Stints and Curlew Sandpiper are recorded. At this season too Arctic Skuas are noted along with Common and Sandwich Terns gathering for their southern migration.

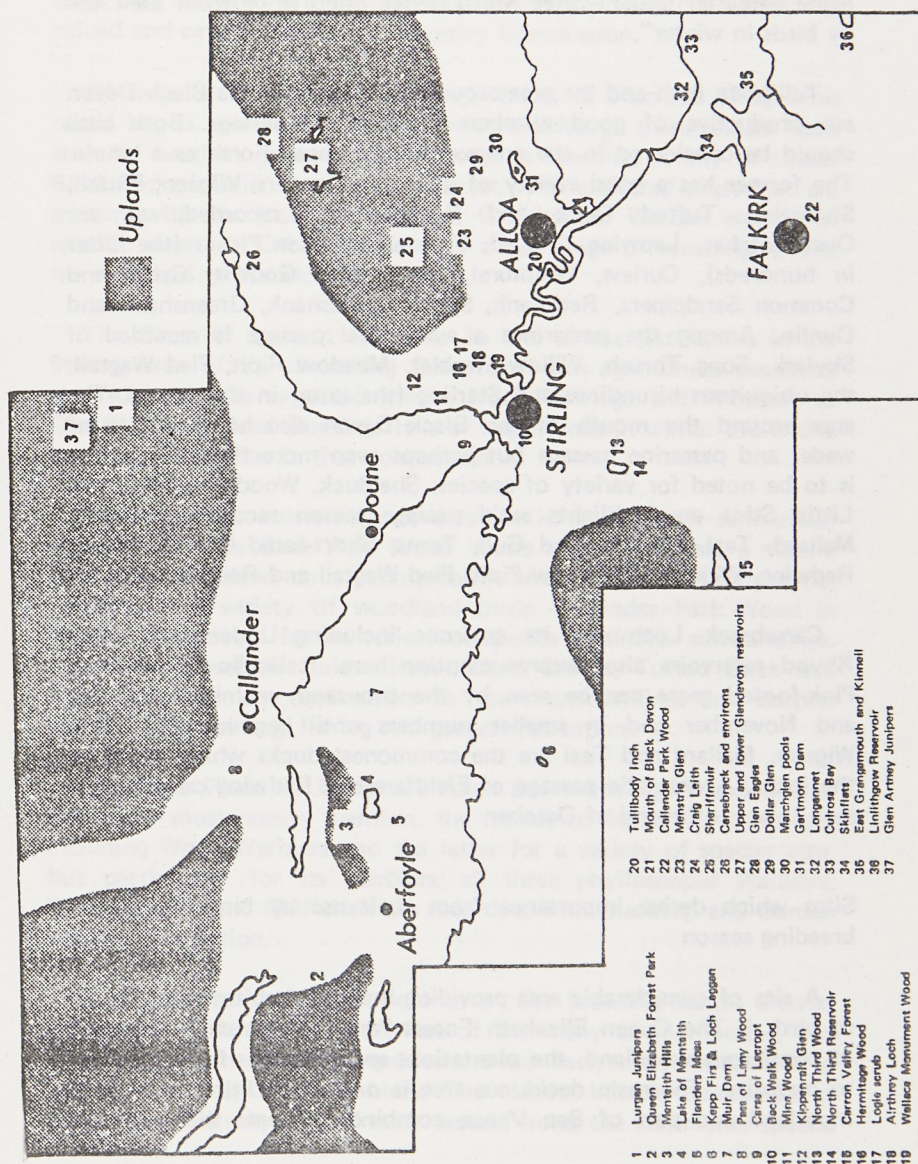


Figure 1 Map of the Stirling Region showing sites registered during the survey. The identity of sites is given in the key

The adjacent farmland with mature hedgerows and a few trees provides a hunting ground for raptors in autumn; Sparrowhawk, Kestrel, Merlin, Peregrine and Short-eared Owl have been recorded. Spring passage is less momentous. In all however seventy species are recorded on passage for these splendid sites, of which mention is made hereafter under "Sites which derive importance from their use by birds in winter".

Tullibody Inch and the area around the mouth of the Black Devon are productive of good numbers of birds on passage. Both sites should be considered in the context of the upper Forth as a whole. The former has a good variety of ducks and waders; Wigeon, Pintail, Shoveler, Tufted Duck and Pochard are recorded, as are Oystercatcher, Lapwing, Ringed, Grey and Golden Plover (the latter in hundreds), Curlew, Whimbrel, Black-tailed Godwit, Green and Common Sandpipers, Redshank, Spotted Redshank, Greenshank and Dunlin. Among the passerines a substantial passage is recorded of Skylark, Song Thrush, Willow Warbler, Meadow Pipit, Pied Wagtail, the ubiquitous hirundines and Starling (the latter in thousands). The area around the mouth of the Black Devon also has a wealth of wader and passerine passage but perhaps even more than the former is to be noted for variety of species; Shelduck, Wood Sandpiper and Little Stint are highlights amid passage season records of Heron, Mallard, Teal, Black-headed Gull, Terns, Short-eared Owl, Fieldfare, Redwing, Whinchat, Meadow Pipit, Pied Wagtail and Reed Bunting.

Carsebreck Loch and its environs including Upper and Lower Rhynd reservoirs also deserve mention here. Icelandic Greylag and Pink-footed geese can be seen by the thousand, mainly in October and November and in smaller numbers until beginning of April. Wigeon, Mallard and Teal are the commonest ducks which occur on the lochs. A dramatic passage of Fieldfare and Redwing can often be seen towards the end of October.

Sites which derive importance from their use by birds during the breeding season

A site of considerable area providing breeding habitat for a variety of birds is The Queen Elizabeth Forest Park. It consists in the main of coniferous woodland, the plantations spanning ages from plantings to maturity. The main deciduous tree is oak. In addition burn, loch, moorland and part of Ben Venue combine to create the variety of

habitat. It is not surprising to find Stonechat, Whitethroat, Chiffchaff, Great, Blue and Coal Tits, Woodpigeon, Sparrowhawk, Redstart, Pied Flycatcher, Common Sandpiper, Mallard, Teal, Redshank and Curlew to name only some representatives of those habitats breeding there but it is satisfying to know that the variety of birds and habitats here exist in a place where wildlife conservation is valued and catered for by the Forestry Commission.

Of large area also are the boggy tracts of Flanders Moss. This raised bog is now substantially afforested although there remain open areas of heather, grass, sedge and reed. A breeding colony of Lesser Black-backed Gulls is of great interest. The expected passerines are present with the locally distributed Grasshopper Warbler worthy of specific mention. Otherwise there is a fair range of breeding species from Mallard to Woodcock.

The Carse of Lecropt seems to be one of the last haunts in the Stirling area of the dwindling Corncrake. This agricultural carseland also supports the expected species from Partridge and Pheasant to Chaffinch and Reed Bunting. It is of importance in winter too and is mentioned hereafter in that connection.

Some sites are noteworthy as they are in an urban or semi-urban environment. The Back Walk Wood in the town of Stirling, a mature deciduous woodland on a mainly south and south west facing slope, holds a good variety of woodland birds. Callendar Park Wood in Falkirk is notable for its variety of species in similar surroundings. Linlithgow Reservoir holds Great-crested Grebes, Tufted Duck and Sedge Warblers amongst others in town surroundings and despite much use by boating, fishing and general recreation.

The Mine Wood in Bridge of Allan and Hermitage Wood by the University must receive mention, the former for its variety of species including Wood Warblers and the latter for a variety of species also, but particularly for its warblers; all three phylloscopus Warblers; Willow, Wood and Chiffchaff are recorded, with Blackcap and Garden Warbler in addition.

It is important, perhaps more so at the breeding season than at any other, that sight not be lost of the many smaller places, and places lacking in variety of species and numbers, many similar one to another, used by breeding birds. The remote hillside birchwood of Monachyle Glen, typical of such woods, holds the commoner species

of such a wood, Wren, Robin, Willow Warbler, and others. The singular Lurgan and Glen Artney Junipers with their typical bird communities including Goldcrest, Marchglen pools (now sadly destroyed) Glen Eagles Oakwood, Kippenrait Glen and other sites are, or were, all important parts of the tapestry of habitats which can support a healthy breeding bird community.

Sites which derive importance from their use by summering (non-breeding birds)

For the purposes of the project, birds in this category are obvious non-breeders (e.g. immature gulls), and any birds known to be nesting elsewhere but using the site as a feeding area (e.g. hirundines).

No site in the Stirling region has this category as its sole source of importance. Of the non-breeders perhaps immature gulls are the most obvious. They tend to frequent water. The upper Forth area generally holds Great and Lesser Black-backed, and Herring Gulls by the hundred and some Common gulls as well. Black-headed gulls are recorded by the thousand. Both small and large areas of water are used; Airthrey Loch has the said four species and Lake of Menteith, Lesser Black-back, Herring and Black-headed Gulls.

Other non-breeders which may be mentioned are Teal, Tufted duck and Red-breasted Merganser (Lake of Menteith) and Shelduck on the upper Forth sites. The Kinneil mudflat area is used as a moulting ground by an increasing number of Shelduck, giving it a claim to fame as the third known moulting ground in Western Europe. The upper Forth area also holds summering individuals of the common dabbling and diving ducks and occasionally Common Scoter and Eider (latter two Kinneil). The Cormorant and waders including Turnstone are also present.

Generally, summering birds in this category are difficult to detect, especially on short visits to a place. In view of the lack of participants and generally short periods spent at places by field-workers recordings in this category are perhaps less noted and less complete than the others.

Breeders elsewhere, using sites for feeding are not uncommon. The best examples are the hirundines whose aerial insect food supply attracts them to virtually all habitats, and particularly in the case of the Swift often to such heights as must have little relevance to the

terrain below. The predilection of thrushes particularly Song and Mistle Thrushes for flat, short grass as a feeding place is well known, whether lawn or field, and such feeding grounds may be some distance from the breeding place.

Sites which derive importance from their use by birds in winter

The main sites in this category are the various areas on the upper Forth used by wintering waders, Gartmorn Dam for ducks and Carsebreck and environs for geese and ducks.

The upper Forth sites are Tullibody Inch; the mouth of the Black Devon; Kincardine Bridge to Dunmore including Kennet Pans; Longannet and Culross Ash Pans, Culross Bay, Torry Bay and Preston Island; Skinflats tidal mud and fields; and Kinneil Mudflats. These are feeding and roosting sites mainly for ducks and waders. None of those sites can properly be considered on its own because birds move from one to the other perhaps roosting at one place (e.g. Longannet Ash Pans) and feeding at another (e.g. Skinflats mud). They also move between sites as the lower ones are covered by the incoming tide.

The uppermost or westernernmost two sites, the mouth of the Black Devon and Tullibody Inch are recorded as holding not only substantial numbers but a good variety of species. They offer reedbeds and saltmarsh as well as mud. Black Devon has dabbling ducks and diving ducks including Goldeneye in the hundreds and Scaup are noted as are occasional Greylag and Pink footed Geese. Waders include Oystercatcher, Lapwing, Golden Plover, Snipe, Curlew, Redshank and Dunlin, the latter in hundreds. Turdines are well represented with Mistle and Song Thrushes, Redwing and Fieldfare. Goldfinch, Chaffinch and Twite are noted with flocks of House Sparrows by the hundred. Tullibody Inch is similar but adds Greenfinch, Linnet and Tree Sparrow. Both hold substantial numbers of Shelduck. The ducks and waders are believed to move to and from other sites further down the estuary. The stretch of the river from Kincardine bridge to Dunmore including Kennet Pans is tidal with exposed mud. Both dabbling and diving ducks are recorded; Mallard, Pochard, Goldeneye and Tufted by the hundred while Gadwall and Smew have occurred. Shelduck, Lapwing, Golden Plover, Curlew, Redshank and Dunlin are recorded by the hundred.

Longannet and Culross Ashpans, Culross Bay, Torry Bay and Preston Island form a unit lying together in a large indenture on the

- 54 north side of the Forth. The ashpanns are reclaimed areas for disposing of waste from Longannet and Kincardine Power Stations. They began life as open lagoons but are now being rapidly infilled with ash. They are roosting rather than feeding sites and appear to be particularly favoured at night by waders from both shores of the Forth. Culross Bay and Torry Bay provide mud flats for feeding with many exposed rocks in the upper shore zone. Preston Island lying off Culross ashpanns is rocky. The area holds Cormorant, Mallard, Wigeon, Goldeneye, Redbreasted Merganser and Shelduck by the hundred. Other ducks are represented. It is rich in waders; Knot and Dunlin occur by the thousand, Oystercatcher, Lapwing, Golden Plover, Curlew, Bar-tailed Godwit and Redshank occur by the hundred and Grey Plover are noted in lesser numbers.

Skinflats, already mentioned, holds a wealth of waterfowl in variety and numbers. Greylag and Pink footed Geese are recorded. Lapwing, Golden Plover, Redshank and Dunlin numbers reach thousands and Knot are recorded in excess of ten thousand. Substantial flocks of Skylark, Fieldfare, Redwing, Meadow Pipit, and finches including Twite occur along with Corn, Yellow Reed and Snow buntings.

The adjacent Kinneil mudflats traversed by the polluted River Avon attract a similar number of ducks and waders to Skinflats; Redshank, Knot, and Dunlin occur by the thousand as do Black headed gulls.

The wintering Knot in the area are of international significance. Up to 25,000 have been recorded though the average total may well be nearer 10,000. The area holds 1-4% of the national total for this species and about 85% of the Forth total.

The Dunlin population of the area is more than half of the Firth total and approaches 1% of the British total. Similarly more than a half of the wintering Redshank on the Forth use the area around 2% of the British total.

The Shelduck population mainly at Skinflats and Kinneil fluctuating between 1,700 and 2,700, has around 2% of the North-west European population of this species and over 3% of the British winter population.

Away from this winter wonderland other sites attain importance too. Inland, Gartmorn Dam holds good numbers and a variety of

ducks, with Mallard in excess of a thousand. Cormorant and Great-crested Grebe occur. Carsebreck and its environs hold Greylag and Pinkfeet by the thousand on agricultural land with a good variety of ducks also.

The Carse of Lecropt can be seen from the road which traverses it. Geese, particularly Pinkfeet, can be seen by the thousand. Here winter also produces flocks of finches; Chaffinch, Brambling, Greenfinch, Goldfinch, Redpoll and Linnet have all been recorded.

The many small places providing cover and, at least at times, food during winter, mainly for what are termed common birds, are in aggregate of primary importance to the survival of our wintering bird populations. The numbers of birds and rarer birds at other places tend to draw attention from such places and it is unfortunate that more small places have not been registered.

In summary it seems that the places in the Stirling region which hold the greatest numbers, rarest birds and greatest varieties of birds are registered but that the coverage of other possible sites is not as comprehensive as it could have been.

I had the privilege of being Stirling Regional Organiser of the project and in that capacity have written this report. The site registration cards on the basis of which the report is written were prepared by those named hereafter, whom I wish to thank, and by myself.

Dr D. M. Bryant; Dr C. J. Henty; D. C. MacMillan; the late T. Paterson; H. Robb; P. Sandeman; G. Shaw; P. Stirling-Aird; D. Thorogood; D. R. Waugh.

THE HERONRY AT GARTFAIR WOOD, LOCH LOMONDSIDE

J. Mitchell

Between 1973-1977 an investigation of the Gartfair heronry on Loch Lomondside was carried out by the writer in an attempt to demonstrate the importance of Gartfair Wood, with its adjoining biologically-rich marshes, as a breeding site for the Grey Heron *Ardea cinerea*. The following account is based on a series of five annual reports prepared for the Nature Conservancy Council.

Origin of the Gartfair Heronry

The original heronry in the policies of Buchanan Castle, part of the Montrose Estates, was first reported in the late 1890s when it was included in a census of Clyde heronries undertaken by natural historian Hugh Boyd Watt (Watt 1899). The 6-8 nest colony was then situated in larch *Larix sp.* at the southern edge of Rushypark, a mixed plantation bordering on the River Endrick near Mid (Woodend) Lodge. According to Watt's communicant, a Mr. Walter Brown, the heronry had been known 'as far back as present recollections go'. It is curious however, that the heronry had escaped the attention of local ornithologist James Lumsden, who had written only a few years earlier that he knew at that time of no herons breeding on Loch Lomondside (Lumsden 1895). Watt suggested that some of the herons in the Buchanan policies may have transferred from the grounds of Killearn House (6km distant) following the destruction by gales of their nesting trees about 1893. The colony remained at Rushypark until the early 1930s (F. Perryman *pers comm*), after which the herons moved about 2km north-west to Gartfair Wood (W. McLean *in litt*). A few of the herons also appear to have formed a short-lived colony in the wooded part of Mar Glen, a distance of 3km north from the original site (A. MacFadyen *pers comm*). The shift from Rushypark was timely, as the plantation was felled shortly afterwards during the national emergency of 1939-1945. In the past, herons in Scotland were often subject to persecution in the interests of game fishing, and the Rushypark — Gartfair colony was no exception. The keeping staff regularly 'thinned-out' the nesting herons, but were prevented from destroying the colony entirely on account of the role played by 'herons' in their employer's ancestral coat of arms (R. Lindsay — former gamekeeper

for the estate per I. C. Christie). Two such 'herons' appear in the Montrose and Graham's coat of arms as supporters, with a third depicted in mortal combat with an eagle or falcon as part of the crest. Under the circumstances, it seems providential those involved were apparently not aware that most heraldic works list these 'herons' as storks.

Site Description and History

Situated near the south-east corner of Loch Lomond, Gartfairn Wood overlooks the meandering lower reaches of the River Endrick. The wood is flanked by low-lying marshes and wet fields on all but its north side, and periodic flooding occurs when the loch and river levels are high. Much of its 38 hectares consists of formerly coppiced oak *Quercus sp.* grading into birch *Betula pubescens*, alder *Alnus glutinosa* and willow *Salix sp.* in the wetter parts.

An estate plan drawn by John Ainslie in 1788 shows the site entirely as agricultural ground, and evidence of 'ridge and furrow' can still be seen after two hundred years. Shortly after the production of Ainslie's plan, an account book for the estate records payments made for enclosing the plantations at Gartfairn with hedges and drainage ditches (Montrose Muniments GD220/6/51 – Scottish Record Office, Edinburgh). The system of coppice-with-standards management for tan-bark and other forest products probably differed little from what Tittensor (1970) has described for oak woods elsewhere on the estate, apparently ceasing about the turn of the century. With the abandonment of the coppicing regime, many multi-stemmed trees sprang up from the oak stools (stumps) of the last rotational cut. The sparseness of the shrub layer within the wood reflects its subsequent use for shelter and grazing by farm stock.

When compared with the original plantation as shown on Grasshom's map of Stirlingshire published in 1817, the boundaries of Gartfairn Wood today appear virtually unchanged. There have however been at least three threats to the wood's existence or suitability as a heron site, the first from a projected railway link between Glasgow and Inverness (see Thomas 1976). The Glasgow and North Western Railway bill, which was presented to Parliament in November 1882, proposed that the first stage of the line would head north from Glasgow via Strathblane and skirt the east side of Loch Lomond. Planned to pass just under 1km due west of Buchanan Castle, en route for a gap in the Conic ridge above Balmaha, the line

would have cut through Rushypark Plantation and run along the eastern edge of Gartfairn Wood. Fortunately for the herons (possibly established at Rushypark by that time) the application was dismissed by Parliament in May 1883, as Colquhoun (1878) comments on several heronries being deserted during the mid-19th century as the result of disturbance from railway construction. Excessive disturbance would have almost certainly occurred had a plan been carried out to canalise the lower reaches of the River Endrick as part of the proposed Mid-Scotland Ship Canal (see Pratt 1922). Routes for a major waterway connection between the firths of Forth and Clyde were first surveyed in 1763, but it was not until the early 1900s with the emergence of Germany as a maritime power that such an ambitious venture over looked like receiving sufficient financial support. The strategical advantage of being able to quickly switch a defensive naval force from one side of Britain to the other was stressed by the supporters of the scheme, but the cost of building a canal of sufficient width and depth to accommodate the largest battleships was eventually to prove prohibitive. In the early 1950s, the northernmost portion of Gartfairn Wood, together with adjoining Auchingle Wood, was sold by the estate to a timber firm. The original felling licence for these woods having expired, a renewed application was submitted by the owners in August 1974. Following consultations with the Nature Conservancy Council the company modified their application to exclude the northern part of Gartfairn Wood, which at that time contained a small number of herons' nests. Felling of Auchingle Wood began in April 1975, stopping short less than 90m from the most outlying occupied nest of the Gartfairn colony.

Recorded Numbers of Occupied Nests from 1928 (First National Census of herons) to 1977

The following criteria for recording that a nest is positively occupied by a breeding pair have been defined for the annual census of heronries organised by the British Trust for Ornithology — the presence of a sitting adult bird, eggs or young in the nest, and egg shells or dead young below the nest. Unless a nest is heavily 'white-washed' the finding of droppings below the nest is not necessarily conclusive evidence of occupation, as nests from previous seasons are sometimes used as resting places. The appearance of fresh nesting material is similarly inconclusive as it may be the work of a single unmated bird, and at least one or two unfinished nests were found each season during the five year study.

Prior to 1973 when the investigation began, there was undoubtedly a tendency on the part of observers (including the writer) to under-estimate the number of breeding pairs occupying Gartfairn Wood. This can mainly be attributed to the reasons given below:—

1. Not covering all of the 38 hectare wood, which can sometimes prove difficult when the loch level is high, thereby possibly missing isolated nests or 'splinter' groups of herons.
2. Visiting the heronry before all the potential breeding birds had taken-up their territories and commenced nest building. An analysis of nest occupation dates for 1973-76 has shown that a nest count carried out only in the first week of April would have resulted in an under-estimate of the final colony size in most years of roughly 25% (Mitchell 1978).

Unless regularly occupied and repaired, the Gartfairn nests (all in deciduous trees) soon succumb to the frequent strong winds experienced locally. There is little likelihood therefore that an accumulation of old deserted nests, such as described by Lowe (1954) for heronries in conifer plantations at Rosneath Castle (Dunbartonshire) and the Lake of Menteith (Perthshire), has ever led to excessive over-estimates of the number of breeding pairs at Gartfairn Wood.

In the following chronological list of nest-counts the names or initials of observers, reference to publication (where applicable) and other sources of information are also given. Despite a number of gaps and several questionable counts, the list spanning fifty years is probably the most continuous record of occupation for any heronry in Scotland.

23/5/1928	13 occupied nests — first national heron census (Bartholomew 1935/Garden 1958 / BTO ringing returns per C. J. Mead).
1929-34	No available counts or estimates. Colony transferred from Rushypark Plantation to Gartfairn Wood.
1935-39	c. 20 occupied nests (W. McLean).
1940-45	No available counts or estimates.
4/5/1946	24 occupied nests (I. C. Christie).
22/4/1947	7 occupied nests — following exceptionally severe winter (ICC)
19/4/1948	12 occupied nests (ICC).
27/3/1949	14 occupied nests (ICC).

60	19/3/1950	17 occupied nests (ICC).
	27/5/1951	17 occupied nests (ICC).
	30/4/1952	21 occupied nests (ICC).
	6/4/1953	14 occupied nests (ICC).
	24/4/1954	19 occupied nests — second national heron census (H. Mayer-Gross — BTO Nest Record Scheme / Garden 1958).
	22/5/1955	c. 10 occupied nests (H. Mayer-Gross — BTO Nest Record Scheme / Bird Study 5:123).
	1956	No available count or estimate.
	24/3/1957	17 occupied nests (H. Mayer-Gross — BTO Nest Record Scheme / Bird Study 5:123).
	1958-60	No available counts or estimates.
	1961	10 occupied nests (P. S. Maitland).
	1962	9 occupied nests (T. Weir).
	1963	6 occupied nests — following exceptionally severe winter (A. G. Gordon / Scot. Birds 5:311).
	1964-65	No available counts or estimates.
	1966	9 occupied nests (E. T. Idle & J. Mitchell).
	1967	c. 14 occupied nests (JM).
	1968	19 occupied nests (JM / Scot. Birds 5:311).
	1969	22 occupied nests (JM & TM Cameron / Scot. Birds 6:71).
	26/4/1970	18 occupied nests (JM).
	11/4/1971	21 occupied nests (JM & C Placido).
	26/4/1972	31 occupied nests (JM & CP / Scot. Birds 7:335).
	1973*	36 occupied nests — the largest heronry recorded in Scotland that year (JM / Scot. Birds 8:221).
	1974	39 occupied nests (JM / Clyde Area Bird Rep. 1974 pp 4-5).
	1975	38 occupied nests (JM / Scot. Birds 9:182).
	1976	35 occupied nests (JM / Clyde Area Bird Rep. 1976 p 3).
	1977	38 occupied nests — the largest heronry recorded in Scotland that year (JM / Loch Lomond Bird Rep. 1977 p 2).

*counts were undertaken at regular intervals throughout the breeding season from 1973.

Nest Sites and Movement of Nest Sites

Since the heron colony transferred from the former mixed plantation at Rushypark in the early 1930s, the majority of nests

appear to have been in oaks. Of the 54 trees (major stems from the same coppiced stool being treated as separate trees) used by the herons during the five year study at Gartfairn, 42 (78% of the total) were in oak, 9 in alder, 2 in birch and 1 in willow. Only 4 of the trees (all oaks) regularly held 2 nests, one of these holding 3 nests on two occasions. The distance of the nests from the ground varied with the crown height of the tree species, ranging from 7 – 10m in the alder, birch and willow, to 17 – 20m in the oak.

Mention has already been made of the generally short lives of the herons' nests in Gartfairn Wood unless regularly occupied and maintained. Of the original 36 occupied nests recorded in 1973, only 4 (11%) were still in existence and regular use four years later, the rest having been blown down or abandoned. First-season nests (replacement and new) proved particularly vulnerable, only 48% surviving to the end of their first winter compared with the 90% survival rate recorded at a heron study area in East Anglia (see Prestt and Bell 1973). The bulk of the nests are currently divided into two disjunct parts about a third of a kilometre apart, and other break-away pairs and small groups have been a feature of the Gartfairn colony for the last ten years at least. In 1967 Loch Lomondside was subjected to almost continuous gale-force winds from late February to early April, and 7 pairs of herons (about half the colony at that time) built new nests very low down in a more sheltered part of the wood. One successful nest was less than 1.5m from the ground. Some of these low nests were used again over the next two years, but were finally abandoned in 1970. During the study period, a 'splinter' group of 3 pairs took up residence in 1974 in the northern portion of Gartfairn Wood, thereby spreading out the heronry over 1km between the most outlying nests. Only one of these northern-most nests was still in existence and occupied by 1977. Not so noticeable unless accurate site records are kept is the apparent random movement of a heron colony that often occurs. As nests that are abandoned even for one season are rarely used again and the new nests are frequently slightly apart from the established ones, a 'rolling' effect can sometimes be created within the heronry. From the very start of the Gartfairn investigation, every tree utilised by a pair of nesting herons was allocated a number (painted on the trunk) and this greatly facilitated the keeping of detailed records on each nesting site. Using the first year of the investigation as a

62 base-line, the records for the four succeeding years show that on average the occupied nests each season were made up of 57% surviving nests, 29% replacement nests and 14% completely new nests. With the number of occupied nests not significantly fluctuating between 1974-77, the mean 14% new nests represent about five apparently previously unused sites being colonised each year and a similar number of established sites being abandoned. It is this type of almost imperceptible colony movement that may have been responsible for a gradual shift of the heronry at Gartfairn during the last twenty or so years. From a description of the heronry contained in two BTO nest record cards completed by H. Mayer-Gross in 1954 and 1955, it is evident that the main body of the nesting colony had begun to move south when the writer made his first visit to Gartfairn Wood in 1966. By 1977, the preponderance of deserted numbered trees on the north side of the main body of nests bore mute testimony to the southward drift that continued throughout the study period. Milstein et al (1970) list a number of recorded cases in intra-colonial movement by herons, including a colony that transferred from one bank of a river to the other and another heronry that moved successively down a hill and then back again.

Timing of the Breeding Cycle

The first herons can usually be seen gathering in or around Gartfairn Wood about the first week in February, although this can vary up to two weeks earlier or three weeks later according to the mildness or severity of the weather in the early part of the year. Following the exceptionally mild winter of 1974/75, the first pre-nesting gathering of herons was noted in the second half of January. Conversely, as a result of the prolonged wintry conditions experienced in the West of Scotland during the first weeks of 1977, no herons were seen anywhere near the wood until the last day of February when normally the earliest pairs to arrive would have been incubating full clutches of eggs. After the first 'wave' of herons have taken-up their nests in February — early March, the occupation of the remaining nests is usually a gradual process over the next two and a half months. However, in 1973 and 1976 second and third waves of nest occupation by groups of herons occurred, these being separated by intervals of several weeks. The average date for the first recorded young during the five year investigation was 24th March, but

variations were noted either side of this data in accordance with the nest occupation timing. At the two extremes, the earliest young recorded in 1975 was on 9th March, and over a month later – 11th April – in 1977. The total occupation period of the heronry during the breeding season, from the first pre-nesting gathering to the last young vacating the nests, averaged out during the investigation at seven months.

Breeding Success

Apart from counting occupied nests, the intention at the start of the investigation was to examine each occupied nest for clutch and brood size using an extendable pole and mirror. In the event, this part of the exercise proved too ambitious for the limited time available at each visit. The check on breeding success was carried out by a combination of nest observation by binoculars from the ground, and searching beneath every nest for shells of hatched eggs, shells of broken eggs (traces of yolk and/or membranes still firmly attached, remains of embryos) and dead young. Despite the obvious limitations of this method, with almost weekly visits being made to every nest site throughout the breeding season it is unlikely any major error occurred. A summary of the results obtained in 1973-77 is presented in Table 1.

TABLE 1 Breeding Success of the Gartfairn Heronry, 1973-1977

	1	2	3	4
	No. of pairs laying eggs	No. of pairs rearing young % of Col. 1	No. of pairs affected by egg loss % of Col. 1	No. of pairs affected by young loss % of Col. 1
Year				
1973	36	34 (94%)	16 (44%)	8 (22%)
1974	39	38 (97%)	6 (15%)	2 (5%)
1975	38	37 (97%)	11 (29%)	6 (16%)
1976	35	30 (86%)	10 (29%)	4 (11%)
1977	38	35 (92%)	10 (26%)	13 (34%)

For numbers of nesting pairs present each year of the study (Col. 1) the Gartfairn colony compared extremely well with the average sized heronry in Scotland, which was shown in the last national census conducted in 1954 (see Garden 1958) to be only six nests. The percentage of breeding pairs successfully rearing young (Col. 2) was also exceptionally high, and by far the majority of these nests that could be observed reasonably clearly were seen to hold either two or

three young by the fledgling stage. It was anticipated however that many of these young birds would not survive the following few months after leaving the nests, for an analysis of British and German heron ringing returns by F. A. Lowe (1954) shows that seven out of every ten fledged young probably perish in their first year.

One unexpected feature revealed by the regular monitoring of nests was the lack of any evidence of herons' eggs being predated, despite the Gartfairn area having more than its fair share of corvids. This is in contrast to two other heronries in the general area examined by the writer, where predated eggs were found on several occasions. Another unusual aspect was the occurrence of apparent double broods. The number of seemingly genuine cases of double broods recorded at Gartfairn during the study period was one in 1974, four in 1975, one again in 1976 and no less than six in 1977. In each instance a second brood was seen in a nest from which young had apparently just successfully flown. From examination of hatching and fledging dates it is clear that some of the second clutches were laid before the first broods had vacated the nests, the territorial behaviour of the parent birds during the breeding cycle effectively eliminating any possibility of these still occupied sites being taken over by incoming pairs. Although broods from replacement clutches (where an earlier clutch or brood had been lost) is considered normal in the breeding cycle of the Grey Heron, fledging of two broods in a single season has always been looked on as a rare event. Milstein et al (1970) describe only six authenticated examples in a review of the European literature on the Grey Heron. However, regular observations since 1970 on a 100+ heronry at Brownsea Island, Dorset, has shown that two or three pairs produce apparent double broods every year (J. C. Follett in litt). Like all large heronries, the occupation of nest sites at Gartfairn Wood is staggered over several months, resulting in some nests with very advanced young at a time when the last arrivals are engaged in preliminary territorial display and pair formation. It seems possible that these late courtship activities could provide some of the earliest breeding pairs with the necessary stimulus for successful re-mating. The continued peak condition of these birds would be crucial and in this respect a temporary surfeit of food may have become available, particularly in years 1975 and 1977. Discarded or dropped prey remains found below the occupied nests suggest that one of the most important food resources during the late spring is Roach *Rutilus rutilus*, of which vast pre-spawning shoals have been recorded migrating from Loch Lomond into the River Endrick during May-June (See Maitland 1966).

Monitoring of the occupied nests at Gartfairn throughout the breeding season has shown that the colony enjoys a high rate of reproductive success, and it is estimated that between 75-100 young were reared each year of the five year investigation. Although Lowe (1954) has shown that mortality in young herons may exceed 70% in their first year, it is likely higher numbers than usual have been attaining maturity due to the exceptionally long run of relatively mild winters experienced in the West of Scotland from 1963/64 to 1975/76 inclusive. Yet despite the high annual output of young the colony has shown no significant increase in the number of breeding pairs during the last few years, and actual decreases were recorded in 1975 and 1976. Lack (1954) has demonstrated that the size and spacing of heronries is greatly influenced by the availability of food, a non-random type of distribution he termed *dispersion*. As each male heron defends only a small breeding territory based on an individual tree, Lack suggested that it was not the scarcity of suitable nest sites that brought about dispersion by young herons about to breed for the first time, but the avoidance of feeding areas already crowded. Throughout the 1960s and perhaps earlier, Gartfairn was the only remaining heronry known on Loch Lomondside, but since 1971 three peripheral heronries (totalling twenty-two pairs by 1975) have been found within a 14km radius of what is probably the parent colony. It would appear that as the Gartfairn heronry approached an upper-size limit, dictated by the food resources normally available, some of the potential young colonists were obliged to seek feeding grounds and nest sites further afield.

Conservation Tail-piece

In the account of heronries in the Clyde Faunal Area written at the end of the last century, Hugh Boyd Watt (1899) appeared pessimistic as to the future of the heron in Scotland. Apart from natural disasters such as prolonged severe weather and the destruction of nesting sites by gales, Watt listed indiscriminate shooting, tree felling, draining of feeding grounds, spread of urbanisation and pollution of waterways as additional adverse factors likely to affect the species. Regrettably, Watt's apprehension has proved to be well founded, and several major heronries in Scotland have failed to survive the inevitable changes (see Baxter & Rintoul 1953). The Gartfairn heronry has been more fortunate than most, not only in its

chosen site but in the interest shown by successive owners of the estate. Following the purchase of the northern portion of Gartfairn Wood by the Nature Conservancy Council in March 1977, and an agreement concluded with the present owner of the remainder, all of the heronry and most of the surrounding marshes were incorporated into the Loch Lomond National Nature Reserve on 9th June, 1977.

SUMMARY

The account describes an investigation of the heronry at Gartfairn Wood, Loch Lomondside, carried out during the breeding seasons of 1973-1977. Monitoring of occupied nests over the five year period has shown the Gartfairn colony to be one of the largest heronries in Scotland, with a high rate of reproductive success. Gartfairn Wood, with its adjoining heron feeding grounds, is now safe-guarded as part of the Loch Lomond National Nature Reserve administered by the Nature Conservancy Council.

ACKNOWLEDGEMENTS

I would like to express my thanks to the Marquis of Graham for his courtesy in allowing me access to Gartfairn Wood, most of which falls within the Montrose Estates. Also to all those *Ardea cinerea* enthusiasts named in the text who have generously made available information (much of it previously unpublished) on the herons of Gartfairn and elsewhere. I am particularly grateful to Tony Bell (Institute of Terrestrial Ecology, Monks Wood Experimental Station, Huntingdon), not only for reading through the draft of this paper, but for much helpful advice and guidance during the five year investigation.

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Postscript

A count of occupied herons nests at Gartfairn Wood in 1978 showed the colony strength had increased to thirty-nine breeding pairs, equalling the previous highest number recorded in 1974. In contrast the three peripheral heronries on Loch Lomondside, which together totalled twenty-two occupied nests in 1975, have gradually declined to only twelve breeding pairs by 1978.

THE GOLDEN EAGLE (*Aquila chrysaetos*); THE RELATIONSHIP BETWEEN THE SUCCESS AND TENURE OF BREEDING SITES

T. D. H. Merrie

INTRODUCTION

A previous issue of this journal carried a report on the Golden Eagle (*Aquila chrysaetos*) in the west of Scotland (Merrie 1976). The report was based on observations lasting from 1964 to 1971 and gave a full description of the study area and methods. Since observations had been carried out over a long period (for many pairs without a break for up to seven years), it was possible to examine the relationship between the use of a nest site and its likelihood of success or failure, and vice-versa; the relationship between the success and failure and the subsequent usage of a nest site.

ANALYSIS

During analysis of results for the earlier paper it appeared that those pairs with infrequent success changed their nest sites more often than those which were regularly successful. This possibility was examined in detail by summing the number of occurrences of change (or retention) of site after years of success or failure. Following this, the success in the year after a change took place was compared with that when the nest was retained.

RESULTS AND DISCUSSION

It is commonly stated that eagles are more prone to shift their nest site after failure than after success. It was found that this "shepherd's tale" was amply borne out. Over the whole span of the survey, retention of nest site in the year following success occurred on 0.67 of all occasions; and following failure on 0.35 of all occasions (Table 1). However if the observations are split into those from the dieldrin period (1964-66) and those from the post-dieldrin period (1976-71) a different pattern emerges. Prior to 1967, retention of site following failure was more common than change of site, and in this period of notably poor success, the instances of retention totalled 12 as against 5 changes of site. More detailed

analysis of this period would be desirable but with the small sample would be unlikely to yield a significant result. From 1967 to 1971 when breeding success was relatively stable, the figures are much the same for retention following success (0.61), but only 0.25 for retention following failure (Table 1).

Table 1. Change of nest site after success or failure in the Golden Eagle.

Status	Occurrences		Total
	1964-1966	1967-1971	
Change following success	0	12	12
Retention following success	5	19	24
Change following failure	5	21	26
Retention following failure	7	7	14
Total changes of site 38	Total retentions 38		

An interesting question then arises, 'Is change of site a reaction to failure or to disturbance?', bearing in mind the behaviour exhibited in the dieldrin period. When breeding success was low due to organochlorine toxicity, it did not appear to lead to a change of site. Only when disturbance was in all probability the main cause of failure in later years did a change of site become the commonest reaction to breeding failure. Eagles may therefore distinguish between causes of failure, and change their nest-sites only when failure is linked with disturbance at a particular site.

The occurrences of failure or success following desertion or retention of the previous year's nest-site are given in Table 2. This shows that from 1964 to 1971 the degree of success following desertion of the old site is 0.51, and that following retention is 0.48. Thus, despite the fact that no nests built in completely new positions have been successful in the year in which they were built, changing of nest-sites in general has no adverse effect on the overall degree of breeding success. Change of site can therefore be seen to have evolved as a defensive action against disturbance; the majority of eagles changing to a new site, which have suffered failure, can expect an average chance of success in the next season.

70. Table 2. Breeding success following change of site in the Golden Eagle.

Status	Occurrences		Total
	1964-1966	1967-1971	
Success following desertion	1	16	17
Failure following desertion	4	12	16
Success following retention	2	18	20
Failure following retention	11	11	22

This feature of behaviour may serve to explain why the Golden Eagle was able to survive the years of intense persecution during the last century and the first part of this century, whilst the other two large birds of prey, the Osprey and Sea Eagle, using a single traditional site more frequently, were exterminated. It would be interesting to know whether instances of change from successful nests are associated with a higher than average level of disturbance. However a far larger sample would be needed than that obtained during the present survey. Undoubtedly some eagles are more sensitive to disturbance than others but again it would be extremely difficult to get satisfactory quantitative data on this subject.

SUMMARY

In the post-dieldrin period (1967-71) nest sites were retained on 0.61 of all occasions in the year following successful breeding, but on only 0.25 of all occasions following failure. Behaviour was however markedly different in the dieldrin period even though breeding success was low, retentions out-numbering changes by 12 to 5. This suggests that eagles may distinguish between causes of failure and that change could be a reaction to disturbance as a cause of breeding failure. In general a change to another nest site resulted in an average chance of success. Change is therefore a successful defensive reaction to non-toxic cause of failure, in that it restores the chance of success to average from below average.

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THE PLANTS AND SOILS OF TWO MINERAL WORKINGS IN THE OCHIL HILLS

71

John Proctor and Margaret E. Bacon

INTRODUCTION

The plants associated with copper, zinc, lead and other "heavy metal" mines have received much recent study in many parts of the world (Ernst, 1974). The mine sites often have areas of metalliferous spoil, waste from the mining operations, which are toxic and sparsely colonised by plants. It has been shown by many workers (reviewed in Antonovics et al., 1971) that the plants which grow on the spoil have frequently evolved races specifically tolerant to the metals present.

Studies of the vegetation of Scottish metal mine sites are few although chemical analyses of the plants and soils of the large lead working at Tyndrum have recently been published by Johnston and Proctor (1977). The location and history of the sites of mineral working in the Ochil Hills have been summarised by Dickie and Forster (1974). In 1975 the vegetation of all of these sites (which include calcite as well as heavy metal workings) was investigated. The full results of this study are given by Bacon (1976) who showed that at most of the mine sites there is no distinctive vegetation that seems influenced by heavy metals. Two sites, which have spoil containing high levels of "available" heavy metals and substantial areas of characteristic vegetation, are discussed in this paper.

SITE SURVEY

Burn of Sorrow (Grid Reference NN 946002) near Dollar

This site, at an altitude of c. 305 m, is the most impressive in the Ochils. Patches of the orange-grey spoil, which covers an area of about 2000m², are totally devoid of plants whilst much is only sparsely vegetated (figure 1).

The commonest species on the spoil is Common Bent-grass (*Agrostis tenuis*). This is frequently accompanied in the more extreme parts by, amongst the higher plants, Creeping Fescue (*Festuca rubra* ssp. *rubra*), and there are smaller quantities of Thyme (*Thymus drucei*), Common Mouse-ear Chickweed (*Cerastium holosteoides*),

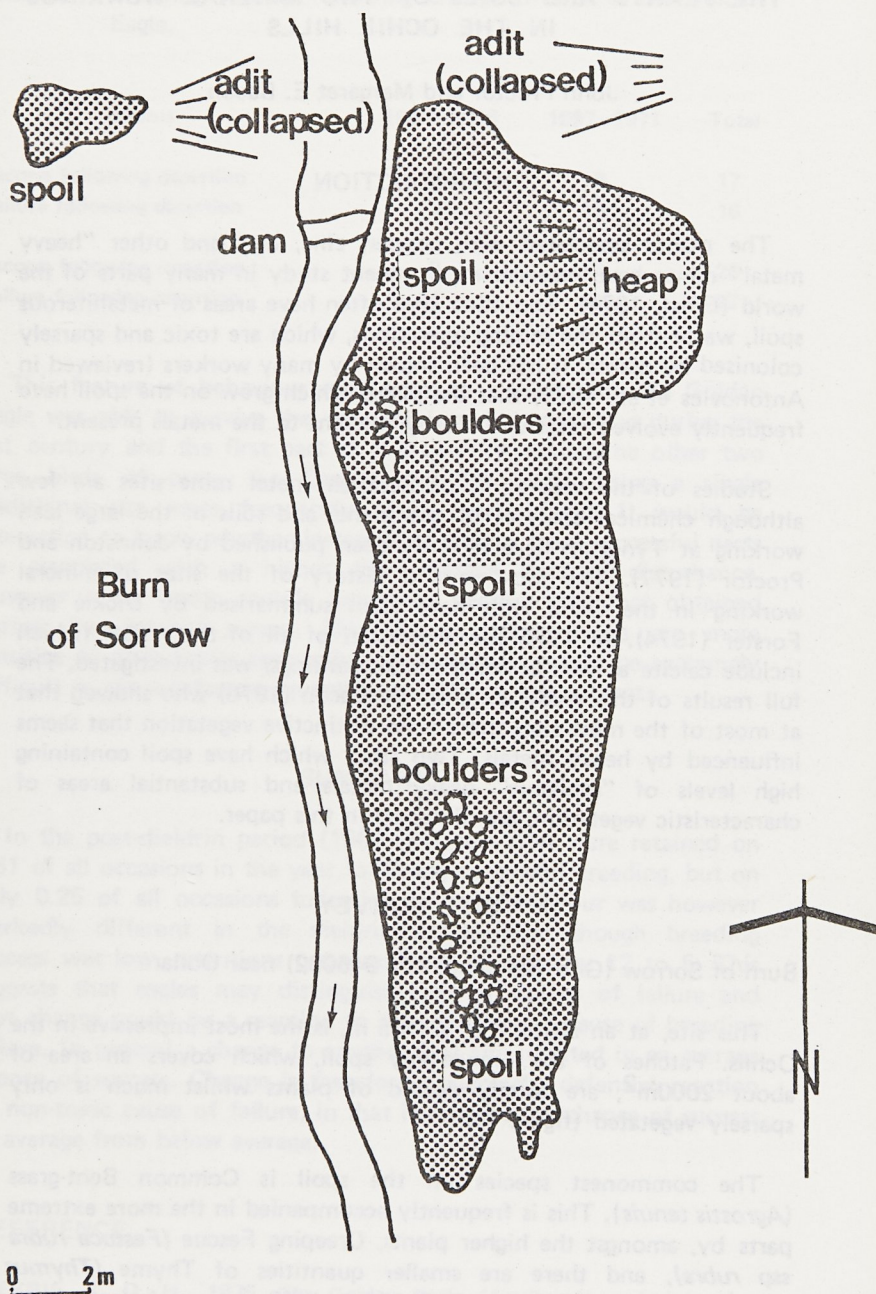


Figure 1 Burn of Sorrow site

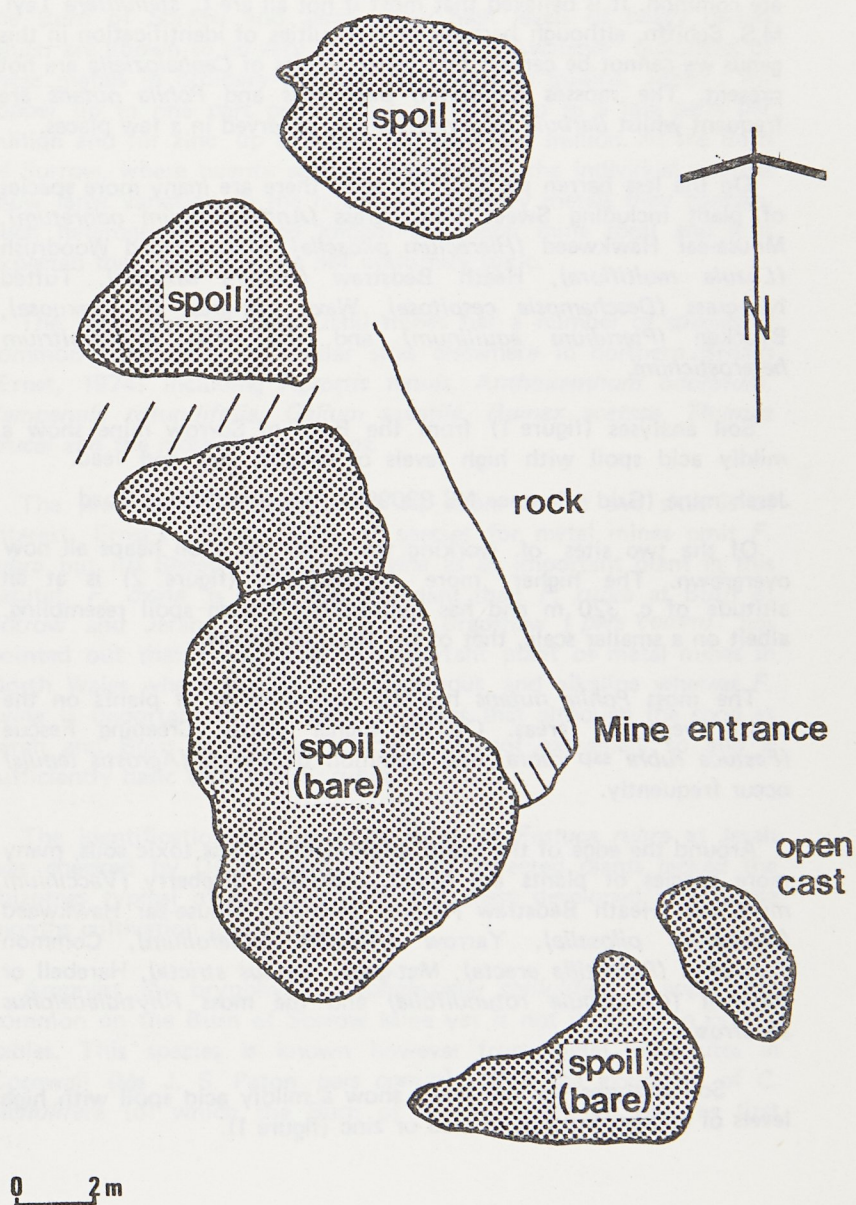


Figure 2 Jerah site

Sorrel (*Rumex acetosa*) and Sheep's Fescue (*Festuca ovina*). Of the bryophytes in the barer areas, liverworts of the genus *Cephaloziella* are common. It is believed that most if not all are *C. stellulifera* Tayl. M.S. Schiffn. although because of difficulties of identification in this genus we cannot be certain that other species of *Cephaloziella* are not present. The mosses *Ceratodon purpureus* and *Pohlia nutans* are frequent whilst *Barbula recurvirostra* was observed in a few places.

On the less barren parts of the spoil there are many more species of plant including Sweet Vernal-grass (*Anthoxanthum odoratum*), Mouse-ear Hawkweed (*Hieracium pilosella*), Many-headed Woodrush (*Luzula multiflora*), Heath Bedstraw (*Galium saxatile*), Tufted hair-grass (*Deschampsia cespitosa*), Wavy hair-grass (*D. flexuosa*), Bracken (*Pteridium aquilinum*) and the moss *Rhacomitrium heterostichum*.

Soil analyses (figure 1) from the Burn of Sorrow mine show a mildly acid spoil with high levels of copper, zinc and lead.

Jerah mine (Grid reference NS 830998) near Sheriffmuir Road

Of the two sites of working the lower has spoil heaps all now overgrown. The higher, more exposed site (figure 2) is at an altitude of c. 320 m and has impressively barren spoil resembling, albeit on a smaller scale, that of the Burn of Sorrow.

The moss *Pohlia nutans* has the highest cover of plants on the poorly vegetated areas. Of the higher plants, Creeping Fescue (*Festuca rubra* ssp. *rubra*) and Common Bent-grass (*Agrostis tenuis*) occur frequently.

Around the edge of the heaps, presumably in less toxic soils, many more species of plants are found, including Blaeberry (*Vaccinium myrtillus*), Heath Bedstraw (*Galium saxatile*), Mouse-ear Hawkweed (*Hieracium pilosella*), Yarrow (*Achillea millefolium*), Common Tormentil (*Potentilla erecta*), Mat-grass (*Nardus stricta*), Harebell or Bluebell (*Campanula rotundifolia*) and the moss *Rhytidiadelphus squarrosus*.

Soil analyses for the heaps show a mildly acid spoil with high levels of copper, but not of lead or zinc (figure 1).

DISCUSSION

75

The soils associated with the remains of mineral workings at the Burn of Sorrow and Jerah show high levels of heavy metals which are known to be very toxic to plants. "Available" quantities of these metals in ordinary soils are (according to Swaine, 1955) : for copper up to one part per million; for lead up to a few parts per million and for zinc up to about ten parts per million. At the Burn of Sorrow, where twenty samples were taken, the individual samples show large variation in the quantities of heavy metals they contain. Such heterogeneity is well known for metal mine spoil and it is expected that these sites are not uniformly toxic.

The vegetation of these Ochil mines has a number of species in common with those of similar sites elsewhere in northern Britain (Ernst, 1974) including *Agrostis tenuis*, *Anthoxanthum odoratum*, *Campanula rotundifolia*, *Galium saxatile*, *Rumex acetosa*, *Thymus drucei* and the moss *Pohlia nutans*.

The presence of *Festuca rubra* ssp *rubra* at the two sites is of interest. Ernst's (1974) tables of species for metal mines omit *F. rubra* but list Sheep's Fescue *F. ovina* as an important plant in this habitat. *F. ovina* is much less abundant than *F. rubra* at Burn of Sorrow and Jerah. Professor A. D. Bradshaw (*pers comm*) has pointed out that *F. rubra* is an important plant of metal mines in North Wales where the spoil is calcareous and alkaline whereas *F. ovina* is important in acid spoil. It seems that although the spoil at Jerah and Burn of Sorrow is acid it is not extremely so and is sufficiently basic to favour *F. rubra*.

The identification of subspecies *rubra* of *Festuca rubra* at Jerah was checked by Dr M. Borrill. Freshly collected plants lacked the rhizomes typical of this subspecies but these developed after some months cultivation in a glasshouse.

Amongst the bryophytes, *Cephaloziella stellulifera* is apparently common on the Burn of Sorrow Mine yet is not included in Ernst's tables. This species is known however from metal mine sites in Cornwall (Ms J. S. Paton *pers comm*). With the exception of *C. stellulifera* (of which the Burn of Sorrow collection was the first

- 76 record for the Vice County) the plants of these mine sites are commonplace species. Preliminary studies on Common Bent-grass (*Agrostis tenuis*) from the Burn of Sorrow by Bacon (1976) have indicated the existence of races tolerant to high levels of copper and zinc at least. It seems likely that specially-adapted races of the other species occur and we anticipate a continuing research interest at these sites.

ACKNOWLEDGEMENTS

The following are gratefully acknowledged for their help with identification of plants : Dr M. Borrill for *Festuca* species from Jerah; Mr Brian Brookes for mosses and Ms. J. S. Paton for *Cephaloziella*.

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Site	No. of samples	pH		copper		zinc		lead		calcium	
		mean	range	mean	range	mean	range	mean	range	mean	range
Burn of Sorrow	20	5.9	4.5-6.9	372	2.4-2875	212	2.5-3000	1959	14-6500	930	50.0-2729
Jerah	3	5.5	5.2-5.6	371	254- 643	3.1	2.5- 4.8	8.3	3.0- 12.8	305	30.7- 579

Notes on analytical methods

pH was measured in 1: 2.5 soil/deionised water mix. For exchangeable metal analyses air-dried soil samples were leached with M ammonium acetate solution adjusted to the mean pH of the samples for each site. Metal analyses were carried out in the ammonium acetate leachate by atomic absorption spectrophotometry.

It is important to note that the quantity of metals available to plants are estimated by the above method, not the total quantities of metals present. Full details of the methods and results of analyses for iron, magnesium, sodium and potassium are given by Bacon (1976).

Table 1 Soil pH and exchangeable metal analyses from Burn of Sorrow and Jerah spoil (metal concentrations in parts per million of dried soils)

PRELIMINARY LIST OF FUNGI IN THE STIRLING DISTRICT

Ian B. Crockart

INTRODUCTION

As far as is known no list of Stirling District fungi has ever been published. I have completed the following from my own field notes over the last few years. All the fungi have been identified without using a microscope. All except *Clavaria amethystina*, are from the descriptions in Lange and Hora (1965). *C. amethystina* was identified from Cooke (1891).

The fungi in this list have all been seen since 1970 in the Stirling District with the exception of *Hydnum repandum* which I last saw in 1939.

SPECIES LIST

(arranged following Lange and Hora (1965))

In the locality notes the following abbreviation is used:
D.G.C. for Dunblane Golf Club area.

Species	Locality Notes
<i>Peziza (Sarcoscypha) coccinea</i>	Glen Road, Dunblane
<i>Peziza (Aleuria) aurantia</i>	D.G.C.
<i>Xylaria hypoxylon</i>	D.G.C.
<i>Nectria cinnabarina</i>	common in woodlands
<i>Serpula lacrymans</i>	several houses in Dunblane
<i>Clavaria argillacea</i>	D.G.C.
<i>Clavaria amethystina</i>	D.G.C.
<i>Hydnum repandum</i>	Wharry Glen, near reservoir
<i>Piptoporus betulinus</i>	common on Birch trees
<i>Daedalea quercina</i>	D.G.C.
<i>Trametes versicolor</i>	common in woodlands
<i>Grifola gigantea</i>	D.G.C.
<i>Hygrophorus niveus</i>	King's Park, Stirling; D.G.C.
<i>H. pratensis</i>	D.G.C.
<i>H. puniceus</i>	D.G.C.
<i>H. conicus</i>	D.G.C.
<i>Lyophyllum connatum</i>	D.G.C.
<i>Tricholoma gambosum</i>	D.G.C.

<i>T. virgatum</i>	by Lake of Menteith
<i>Tricholoma (Lepista) nudum</i>	D.G.C.
<i>Tricholoma (Lepista) saevum</i>	Old Doune Road
<i>Armillaria mellea</i>	D.G.C.
<i>Clitocybe nebularis</i>	D.G.C.
<i>C. clavipes</i>	D.G.C.
<i>C. geotropa</i>	Airthrey estate
<i>Clitocybe (Leucopaxillus) gigantea</i>	D.G.C.; Keir estate
<i>Clitocybe dealbata</i>	Airthrey estate
<i>Laccaria amethystina</i>	D.G.C.
<i>Collybia butyracea</i>	by Lake of Menteith
<i>C. peronata</i>	D.G.C.
<i>Lentinellus cochleatus</i>	Dunblane
<i>Pleurotus ostreatus</i>	Glen Road (on Ash)
<i>Oudemansiella mucida</i>	Darn Road
<i>Mycena galopus</i>	Tinker's Loan, Dunblane
<i>Amanita muscaria</i>	D.G.C.
<i>A. fulva</i>	Pisgah Wood, Dunblane
<i>A. virosa</i>	D.G.C.
<i>A. phalloides</i>	by Lake of Menteith
<i>A. rubescens</i>	D.G.C.
<i>Pluteus cervinus</i>	D.G.C.
<i>Lepiota rhacodes</i>	D.G.C.
<i>L. cristata</i>	by River Allan between Bridge of Allan and Dunblane
<i>Agaricus silvaticus</i>	Dunblane
<i>A. augustus</i>	D.G.C.
<i>A. campestris</i>	Dunblane
<i>A. silvicola</i>	Keir estate road (east)
<i>A. arvensis</i>	Dunblane
<i>Coprinus comatus</i>	Dunblane
<i>C. atramentarius</i>	gardens in Dunblane
<i>C. plicatilis</i>	D.G.C.
<i>C. silvaticus</i>	Tinker's Loan, Dunblane
<i>Psathyrella conopileia</i>	D.G.C.
<i>P. multipedata</i>	Tinker's Loan, Dunblane
<i>Panaeolus rickenii</i>	by Lake of Menteith
<i>Stropharia semiglobata</i>	by Lake of Menteith
<i>Hypholoma sublateritium</i>	Tinker's Loan, Dunblane
<i>H. capnoides</i>	Dunblane
<i>H. fasciculare</i>	D.G.C.
<i>Psilocybe (Deconica) coprophila</i>	D.G.C. (on dung)
<i>Pholiota squarrosa</i>	Airthrey estate
<i>P. adiposa</i>	D.G.C.
<i>P. astragalina</i>	Tinker's Loan, Dunblane
<i>Pholiota (Kuehneromyces) mutabilis</i>	Dunblane
<i>Inocybe corydalina</i>	D.G.C.
<i>I. geophylla</i>	Dunblane
<i>I. pudica</i>	D.G.C.

<i>I. griseo-lilacina</i>	D.G.C.
<i>I. maculata</i>	D.G.C.
<i>Cortinarius tabularis</i>	D.G.C.; by Lake of Menteith
<i>C. bolaris</i>	Dunblane
<i>Gymnopilus junonius</i>	D.G.C.
<i>Crepidotus variabilis</i>	Dunblane
<i>Rhodophyllus (Entoloma) porphyrophaeus</i>	D.G.C.
<i>Rhodophyllus (Entoloma) nitidus</i>	sand and gravel quarry north Dunblane
<i>Rhodophyllus (Entoloma) sinuatus</i>	Airthrey estate
<i>Hygrophoropsis aurantiaca</i>	D.G.C.
<i>Boletus luteus</i>	by Lake of Menteith
<i>B. elegans</i>	D.G.C.
<i>B. bovinus</i>	by Lake of Menteith
<i>B. subtomentosus</i>	D.G.C.
<i>B. chrysenteron</i>	D.G.C.
<i>B. edulis</i>	D.G.C.; by Lake of Menteith
<i>B. calopus</i>	by Lake of Menteith
<i>B. luridus</i>	by Lake of Menteith
<i>B. testaceoscaber</i>	D.G.C.
<i>B. scaber</i>	near Dunblane Hydro Hotel
<i>Lactarius rufus</i>	D.G.C.
<i>L. helvus</i>	by Lake of Menteith
<i>Phallus impudicus</i>	Airthrey estate
<i>Lycoperdon (Calvatia) caelatum</i>	D.G.C.
<i>Lycoperdon (Calvatia) giganteum</i>	railway cutting in old Oban railway from Dunblane
<i>Lycoperdon (Calvatia) excipuliforme</i>	D.G.C.
<i>Lycoperdon molle</i>	D.G.C.
<i>L. pyriforme</i>	D.G.C.
<i>Scleroderma aurantium</i>	Dunblane
<i>Auricularia auricula</i>	D.G.C.; Airthrey estate
<i>Tremella mesenterica</i>	Dunblane
<i>Exidia glandulosa</i>	Dunblane
<i>Calocera viscosa</i>	D.G.C.; by Lake of Menteith
<i>Dacrymyces deliquescens</i>	by Lake of Menteith

EDITORIAL NOTE

Dr N. J. Dix kindly checked the above list and has confirmed that the majority of species in it have been seen by him in the area. I have not included Mr Crockart's records for *Russula* species and a few others which need microscopic confirmation. Future contributors on this topic should note that more detailed information on localities, substrate and dates of finding is desirable.

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DESTINATION KILMADOCK

81

Migration into the Parish of Kilmadock, Perthshire using the 1861 Census Enumeration Book

Janette E. Cochrane

INTRODUCTION

It was thought that in the past, a person spent his whole lifetime in the parish of his birth. To some extent this idea lingers on with migration considered to be a twentieth century phenomenon. Research into migration, however, has shown that it was a fairly common occurrence in earlier periods. This article will study migration into the parish of Kilmadock in the mid-nineteenth century, comparing the number of people born in the parish with the number of people born outwith the parish (migrants). The birth places of migrants will be studied in detail to see how far from Kilmadock parish they were born and an attempt will be made to find out if a relationship exists between distance migrated and occupation followed.

The parish of Kilmadock, situated in South-west Perthshire, was chosen for this study as it contained a cotton mill together with several agricultural estates, the number of persons migrating to this parish in search of work was therefore likely to be substantial and a comparison between migration into agricultural and industrial employment would be possible. Kilmadock therefore appeared to be a suitable parish for a migration study. In 1861 the main settlements in the parish were the Burgh of Doune, the factory village of Deanston and the hamlets of Drumvaich, Burn of Cambus, and Buchany. The parish contained several agricultural estates which provided work for some of the population. The major occupation was, however, cotton manufacture carried out at Deanston Mill by James Finlay and Co. of Glasgow. Deanston Mill provided work not only for the inhabitants of Deanston Village, but also for people in Doune and the surrounding district, perhaps even for some people whose place of residence was outwith Kilmadock parish. A government report of 1839 states "It has been uniformly found that the people of the immediately surrounding district have proved the best population and these works have been an asylum for many a reduced farmer with his family and for the widows and orphans of the agricultural and village population" (Factory Inspector's Report 1839).

Census enumeration books are the main source of information for mid-nineteenth century migration studies. Scottish enumeration books for the period 1841-1891 are available for inspection at New Register House, West Register Street, Edinburgh.

AN INTRODUCTION TO THE CENSUS AND CENSUS ENUMERATION BOOKS

A census of the population of Britain has been carried out on a regular basis since 1801. In the week preceding census night enumerators (the people who conducted the census) delivered blank forms known as schedules to every householder in their district. They collected them the morning after census night and checked them. The householders' schedules have not been preserved; what have been preserved are the forms onto which the enumerators copied the householders' schedules. These, bound together by parish or part of parish, comprise the enumeration books. Mention of how the 1861 census was actually carried out in Kilmadock parish occurs in a local newspaper of the time.

"The census of 1861 will be taken in this parish as in other parts of the Kingdom, on Monday first, the 8th April. During this week a householders' schedule has been left with the occupier of every house, or part of a house, in the parish, and early on Monday, the enumerators of the several divisions will begin to visit every house to collect the schedules, previously left which ought then to be ready, showing the names, with the required particulars of all persons who slept under the occupiers roof during the bygone night". (Stirling Journal 1861).

The information contained in enumeration books changed from census to census, see Drake in Wrigley (1972). It is only from the 1841 census onwards that enumeration books contain detailed information on individuals, and the 1851 census, was the first to include information on parish and county of birth. The 1861 enumeration books include the following information:

Road, Street etc.

Number and name of house.

Whether house is inhabited or uninhabited.

Name and surname of each person.

Relationship of each person to head of household.

Whether married, single or widowed.

Age.

Sex.

Occupation.

Where born.

Whether blind, deaf or dumb.

Number of rooms with windows.

From this and similar information provided by other censuses a variety of studies have been carried out. Anyone interested in such studies could consult Barke (1973), Cowper (1973), Olney (1975), Smith (1976).

THE RELIABILITY OF THE 1861 ENUMERATION BOOK FOR KILMADOCK PARISH.

Information for the study of migrants to Kilmadock was collected using data collection forms. (see Figure 1). As the enumeration book contained more information than is required for this particular study the following information was first transferred onto data collection forms (see Figure 1).

Relationship to head of household

Age

Sex

Occupation

Where born

Once all the data had been transferred the next stage was to check the accuracy of this data. Census information has been considered as being reliable as "continued examination of the returns suggest very strongly that they are reliable and that for almost all purposes the extent of error... is slight". — Tillott in Wrigley (1972). In attempting to find how far the 1861 enumeration book for Kilmadock measured up to this high standard it was considered under the following headings:

Where born: from the point of view of the present study this is the most important column and it was accordingly most rigorously checked for errors. In the "where born" column, county and parish of birth should be stated for each person. Each entry was checked in detail and the following problems arose:

- 1) Only the county of birth was given.
- 2) The place of birth is attributed parish status when it is only part of a parish, for example Bridge of Allan (part of Logie or Lecropt parish) is given the status of a parish.
- 3) The wrong county is given for a parish.
- 4) There was no entry in "birthplace" column.
- 5) There were a few other errors where only the name of village, or in one case the name of a cottage was given.

Despite the fact that a number of errors did exist the total number of entries unable to be corrected was very small. Many of the errors were easily corrected using a gazetteer and out of 1789 migrant birthplaces only 19 were unidentifiable, slightly over one per cent.

Occupation: In general there are two major problems involved in the interpretation of the occupational data of any census. Both arise in cases where enumerators failed to carry out the instructions to —

- a) differentiate clearly between masters and journeymen.
 - b) in the case of labourers specify the exact type of labour involved.
- However, as regards the 1861 enumeration book for Kilmadock both sets of instructions have been carried out, the enumerators having clearly distinguished between masters and journeymen and having also specified the exact type of work done by labourers.

Age: Work on census returns has indicated a tendency for people to "round off" ages e.g. ages 20 and 25 are "preferred" to ages 23 or 27. The enumeration book for Kilmadock was checked by means of an age pyramid to find out if there was a preponderance of ages ending in 0's and 5's but this was found not to be the case.

Relationship to Head of Household: One very common error in census enumeration books is the listing of the children of married children of heads of household as sons and daughters instead of grandchildren — see Tillot in Wrigley (1972). The context usually makes the relationship clear, for example, wife or head of household over childbearing age, or in the case of a married daughter different surname listed. This error did occur several times in the Kilmadock enumeration book for 1861.

These intensive checks made it clear that the Kilmadock 1861 enumeration book was reliable, the entries probably more accurate than those occurring in most enumeration books. It may therefore be regarded as a satisfactory one for detailed study.

Relationship to Head	Age		Occupation	Where Born
	M	F		
Head	56		Assistant Cloth Inspector	Perthshire, Methven
Wife		54	Assistant Cloth Inspector Wife	Perthshire, Fowlis Wester
Daughter		29	Cotton Weaver	Perthshire, Methven
Son	27		Weaver (Woollen)	Perthshire, Methven
Daughter		20	Cotton Spinner	Perthshire, Methven
Daughter		17	Cotton Weaver	Perthshire, Methven
Head	52		Cotton Power Loom Overlooker	Perthshire, Methven
Daughter		19	Cotton Power Loom Weaver	Perthshire, Kilmadock

Figure 1 Data collection form

From early theoretical work carried out on migration, especially Raverstein (1883 and 1889) and Redford (1926), and later empirical work for example Anderson (1971), it would appear that migration in nineteenth century Britain occurred only over short distances. Did migration into the parish of Kilmadock conform to this pattern of short distance migration, i.e. were most of the migrants born in parishes only a short distance away from Kilmadock parish? In other migration studies, for example those by Anderson (1971) and Olney (1976) a measure of ten miles was taken to indicate short distance migration. In order to allow for comparisons the same measure was used for the Kilmadock study. Anyone whose parish of birth was ten miles or less from Kilmadock parish was counted as a short distance migrant, and anyone whose parish of birth was more than ten miles from Kilmadock parish was taken to be a long distance migrant. The measurement made was from parish boundary to parish boundary (i.e. any parish with any part of its boundary within ten miles of Kilmadock parish boundary was designated a short distance migration parish).

This method has its drawbacks and limitations as the boundary of a parish may fall just within ten miles of Kilmadock parish boundary, but the parish itself may be large and many of the population of the parish might well have been born more than a short distance away from Kilmadock parish. Other methods which were considered but subsequently rejected include:

- a) counting only those parishes where more than half of the parish was within ten miles of Kilmadock parish boundary. As the actual place of birth within a parish is not specified in enumeration books it is possible that a parish may be counted as a short distance migration parish although the populated part of the parish might be outside the ten miles. Conversely, a parish more than half of which is outwith the ten miles could have its main settlement within ten miles but would not be counted as a short distance migration parish.
- b) The centre of gravity of population method, was considered too complex and time-consuming for this particular study.
- c) Consideration was given to the grid square method, that is relating the data to one kilometre grid squares on Ordnance Survey Maps. However, this method would still result in some arbitrary allocation of results to the different grid squares as the parishes themselves tend to be amorphous in shape.

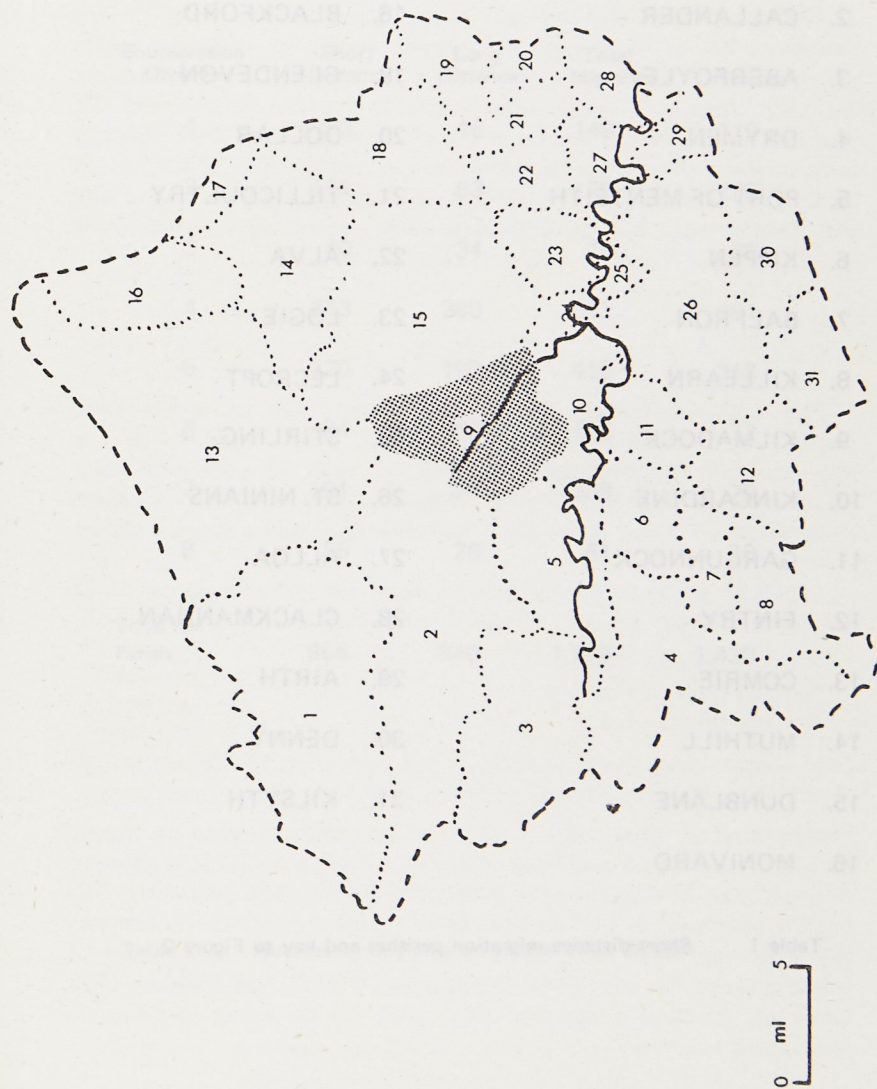


Figure 2 Short distance migration parishes.

- | | |
|---------------------|------------------|
| 1. BALQUHIDDER | 17. CRIEFF |
| 2. CALLANDER | 18. BLACKFORD |
| 3. ABERFOYLE | 19. GLENDEVON |
| 4. DRYMEN | 20. DOLLAR |
| 5. PORT OF MENTEITH | 21. TILlicoULTRY |
| 6. KIPPEN | 22. ALVA |
| 7. BALFRON | 23. LOGIE |
| 8. KILLEARN | 24. LECROFT |
| 9. KILMADOCK | 25. STIRLING |
| 10. KINCARDINE | 26. ST. NINIANS |
| 11. GARGUNNOCK | 27. ALLOA |
| 12. FINTRY | 28. CLACKMANNAN |
| 13. COMRIE | 29. AIRTH |
| 14. MUTHILL | 30. DENNY |
| 15. DUNBLANE | 31. KILSYTH |
| 16. MONIVARD | |

Table 1 Short distance migration parishes and key to Figure 2

Enumeration Division	Short Distance	Long Distance	Total Migrants	Natives
1	103	46	149	119
2	112	63	175	135
3	40	34	74	36
4	243	380	623	601
5	220	198	418	318
6	84	56	140	72
7	101	37	138	79
8	55	26	81	70
Total for Parish	958	840	1,798	1,430

Table 2 Number of migrants by enumeration division

It was decided that the method of measuring from parish boundary to parish boundary, though crude, would be a reasonable indicator in this study.

A map of parishes having any part of their boundaries within ten miles of Kilmadock parish boundary was drawn (Figure 2), and a list of short distance migration parishes was drawn up (Table 1).

The next stage was to go through the data collection forms examining birthplace entries with respect to the list of short distance migration parishes. When a short distance migration parish occurred, the birthplace on the data collection form was underlined in red ink; when a long distance migration parish occurred the birthplace was underlined in green ink. The birthplace of natives was not underlined at all. The total number of birthplaces underlined in each colour and the total number not underlined were found for each enumeration division and for the whole parish (Table 2).

RESULTS

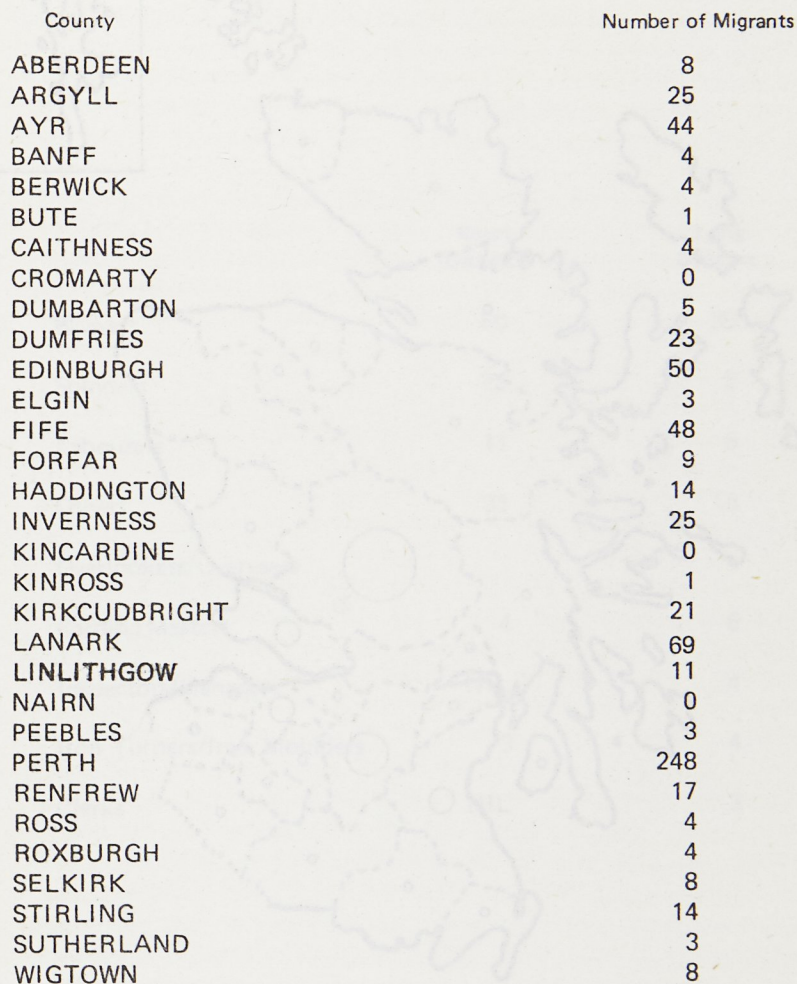
The total population of the parish was 3228 of whom 1430 (44.3%) were natives and 1798 (55.7%) were migrants. Of the migrants, 958 (53.28%) had migrated less than 10 miles from their parish of birth and 840 (46.72%) had migrated more than 10 miles from parish of birth. A majority had migrated only a short distance.

Migrants who had migrated more than ten miles from parish of birth were divided into the following categories.

Number born in Scotland	=	678
Number born in England	=	21
Number born in Ireland	=	136

One migrant was born in each of the following places:— Cape of Good Hope, Malta, Australia, America, Crimea.

The number of those born in Scotland was then analysed by county of birth (see Table 3 and Figure 3). The majority of the long distance migrants had birthplaces still within Perthshire (245 migrants). The next largest number had birthplaces in Lanarkshire including Glasgow (69 migrants). The next three counties sending a fair number of migrants were Ayrshire (44), Edinburghshire (50) and Fifeshire (48), while all the other counties each sent 25 or fewer migrants to Kilmadock.



County	Number of Migrants
ABERDEEN	8
ARGYLL	25
AYR	44
BANFF	4
BERWICK	4
BUTE	1
CAITHNESS	4
CROMARTY	0
DUMBARTON	5
DUMFRIES	23
EDINBURGH	50
ELGIN	3
FIFE	48
FORFAR	9
HADDINGTON	14
INVERNESS	25
KINCARDINE	0
KINROSS	1
KIRKCUDBRIGHT	21
LANARK	69
LINLITHGOW	11
NAIRN	0
PEEBLES	3
PERTH	248
RENFREW	17
ROSS	4
ROXBURGH	4
SELKIRK	8
STIRLING	14
SUTHERLAND	3
WIGTOWN	8

Table 3 Migrants who were born in parishes more than 10 miles from
Kilmadock parish boundary (by county)

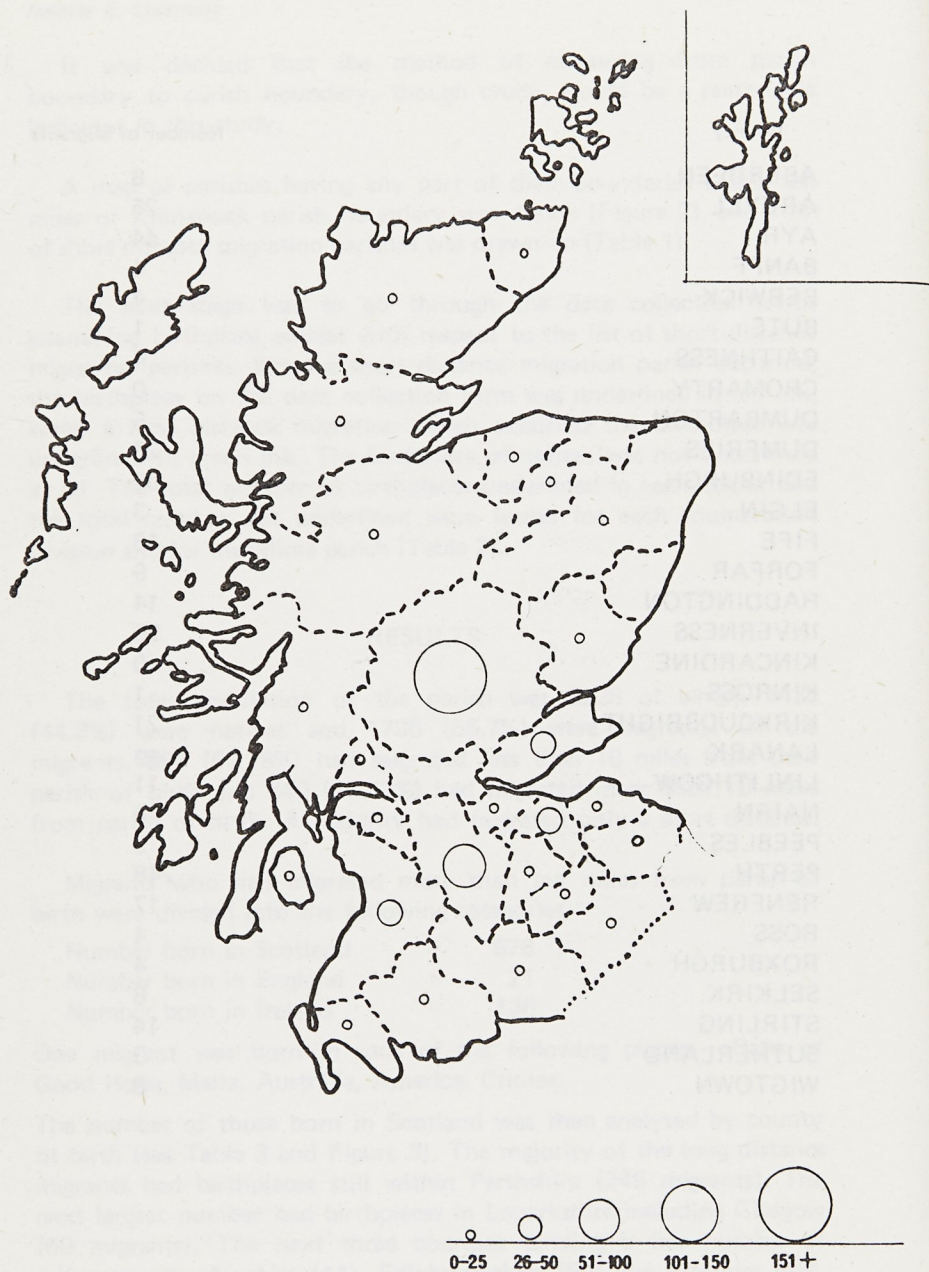


Figure 3 Long distance migrants by county of birth

	Short Distance	Long Distance
Weavers	50	35
Spinners	22	8
Labourers	11	6
Others	31	15
Overlookers/Overseers		
Carding Masters	4	5
Inspectors/Managers	NIL	4
Iron Turners/Iron Moulders	3	4
Clerks	NIL	3

Table 4 Migrant cotton mill workers

- 94 Migrants employed in cotton manufacturing and living in Deanston (enumeration division 5) were considered in detail to see if a relationship existed between occupation and distance migrated. The number of cotton mill workers migrating long and short distances was considered (see Table 4). From this table it appears that skilled workers migrated longer distances than less skilled workers.

DISCUSSION

The results will be discussed under the following headings:—
Natives and migrants, short and long distance migrants, and occupations within the cotton trade.

Natives and migrants. More than half of the people living in Kilmadock parish at the time of the 1861 census had not been born there. How much this is due to the presence of Deanston Cotton Mill and the agricultural estates can only be speculated upon at present. Further research is needed to see how the parishes around Kilmadock parish compare with regard to percentages of natives to migrants. Another avenue of research which could be explored would be to find out how many of the natives were first generation and how many were second generation. For example as regards the 1861 enumeration book this could be carried out by comparing birthplace of father with birthplace of children. A second generation native would be one where Kilmadock was the birthplace of both father and children. What it is not possible to do using only one enumeration book is to establish whether the father himself was a first or second generation native. This could be attempted by tracing an individual back to the 1851 Kilmadock enumeration book using the method known as nominal record linkage. Anyone requiring further information on this technique could consult Wrigley (1973).

Short and long distance migrants. A majority of the migrants to Kilmadock had been born in parishes only a short distance away from Kilmadock parish. This adds further confirmation to the theory of Ravenstein (1883 and 1889) and others. Even when long distance migrants are considered (see Figure 3) it is found that most of the migration is from Perthshire followed by Lanarkshire, Ayrshire, Edinburghshire and Fife. The exception to this is of course long distance migration from Ireland. If migration is considered at enumeration division level (enumeration divisions split parishes up into areas to be covered by each enumerator, Kilmadock had eight enumerators and hence eight enumeration divisions) (see Table 2), it is

found that in enumeration division four (the Burgh of Doune) the majority of the migrants had migrated a long distance. 70% of the migrants to Doune had been born in parishes more than 10 miles from Kilmadock parish boundary. When the birthplaces of these migrants were checked on the data collection forms it was found that a considerable number of migrants had been born in Ireland. To date no further research had been undertaken to attempt to explain this situation. It is known that the Irish potato famine brought many people over to Scotland. According to the 1851 census the number of Irish who settled in Perthshire and Angus was 5.7% of the total population. What would be particularly interesting to find out is why Doune was chosen as a settlement. This could be carried out as regards occupation, because from a preliminary analysis it appears that they were employed as agricultural labourers and not as cotton mill workers. Literary sources such as newspapers may well reveal further information on this question. It would also be of interest to find out the rates of Irish immigration into parishes surrounding Kilmadock parish. The enumeration books can only reveal birthplace and place of present residence of an individual. However, it may well be that other migrations had occurred. Migration to intermediate places can be shown to a certain extent by using the enumeration books to look at birthplace(s) of children. This provides only a partial guide as it cannot indicate intermediate migration of childless couples or single people, nor can it show migrations to places where no children were born.

Occupations within the cotton trade. There does seem to be some connection between occupation followed and distance migrated. The analysis carried out for Deanston seems to suggest that more highly skilled workers were likely to migrate farther in search of work. Since the actual numbers of migrants involved in the study were small, too much reliance cannot be put on the results. The possibility cannot be ruled out that skilled workers may have been directed from one Finlay mill to another; for example, iron turners might well have been sent from Catrine Cotton Works, Ayrshire, to Deanston.

An analysis of occupations within the cotton industry not only by migrants but also of natives, may well reveal some interesting results. It might be that some occupations were carried out almost exclusively by natives.

CONCLUSION

This analysis of the 1861 census enumeration book for Kilmadock

- 96 parish has revealed that the parish contained more migrants than natives. A majority of the migrants had been born in parishes only a short distance away from Kilmadock parish, and were now living only ten miles or less from their place of birth. In order to judge how typical a picture of migration is presented by Kilmadock parish further research is necessary particularly into the following areas. A detailed analysis of the 1851 and 1871 enumeration books for Kilmadock parish is needed to see how they compare with 1861 enumeration book. The 1861 books for neighbouring parishes could be analysed by considering such details as proportion of migrants to natives, occupations followed, and distances migrated. Irish migration into Doune needs further investigation as does Irish migration into neighbouring parishes. A comparison between migrants to Deanston and migrants to other cotton factory villages such as New Lanark or Catrine, Ayrshire would be another useful area of study.

ACKNOWLEDGEMENTS

I wish to acknowledge the permission of the General Register Office for Scotland to quote data collected from Census of Scotland 1861 — enumeration book (Registration district 362, Kilmadock, Perthshire, enumeration divisions 1-8)

I would also like to acknowledge the help and advice of the following — D. M. Dickie for help with Figure 2, Professor C. Turner for helpful comments on an earlier draft of the article, C.P. Aitken not only for commenting upon various drafts, but also for encouraging me to begin writing the article in the first place.

(This article is based on "Migration into the parish of Kilmadock, Perthshire" which was submitted as a project for the Open University D301 course — Historical Data and the Social Sciences 1976).

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EXCAVATION AT THE FAIRY KNOWE, BUCHLYVIE, STIRLINGSHIRE – 1975-78

Lorna Main

INTRODUCTION

The site stands on a natural boulder clay mound (Grid Reference NS 586943) located on the southern fringe of the flat carselands of the Forth Valley, one mile east of the village of Buchlyvie, Stirlingshire (Figure 1). It appears in the landscape as a small green knoll, some 7m high, surrounded by intensively used agricultural land, and commands extensive views northwards to the Highland Boundary Fault. The River Forth runs approximately one mile to the north and a small stream runs along its western side.

The mound is marked on Ordnance Survey maps as the site of a Bronze Age cist, an interpretation on the Old Statistical Account of 1796 which states: "A small green mound on the eastern confines of the lands of Buchlyvie, appears to have been a tumulus. Some human bones, inclosed in flags of stone, were lately found in it; but there is no tradition which gives any account of its origin" (O.S.A. 1796).

In 1974, when a road improvement scheme proposed to destroy half of the mound, I was given the opportunity of commenting on the archaeological potential of the site. Two possibilities were considered: firstly, that the mound was wholly or partly a man-made burial cairn; or secondly, that the mound was entirely natural. In either case there was a possibility that further cists remained to be discovered. A trial excavation was therefore carried out in 1975 to establish the exact status of the mound in advance of the road improvement.

Apart from the above reference to the removal of a cist in the 18th century there was no record of previous archaeological excavation. The mound had, however, been disturbed on the northern side, possibly when the road was first metalled; the eastern side had been scarped in the 1920's when material was removed for embanking on the other side of the road; and during the Second World War at least one trench had been dug in the summit by the Home Guard, recognising the site's natural defensive position.

Other than a vaguely circular depression on the north of the

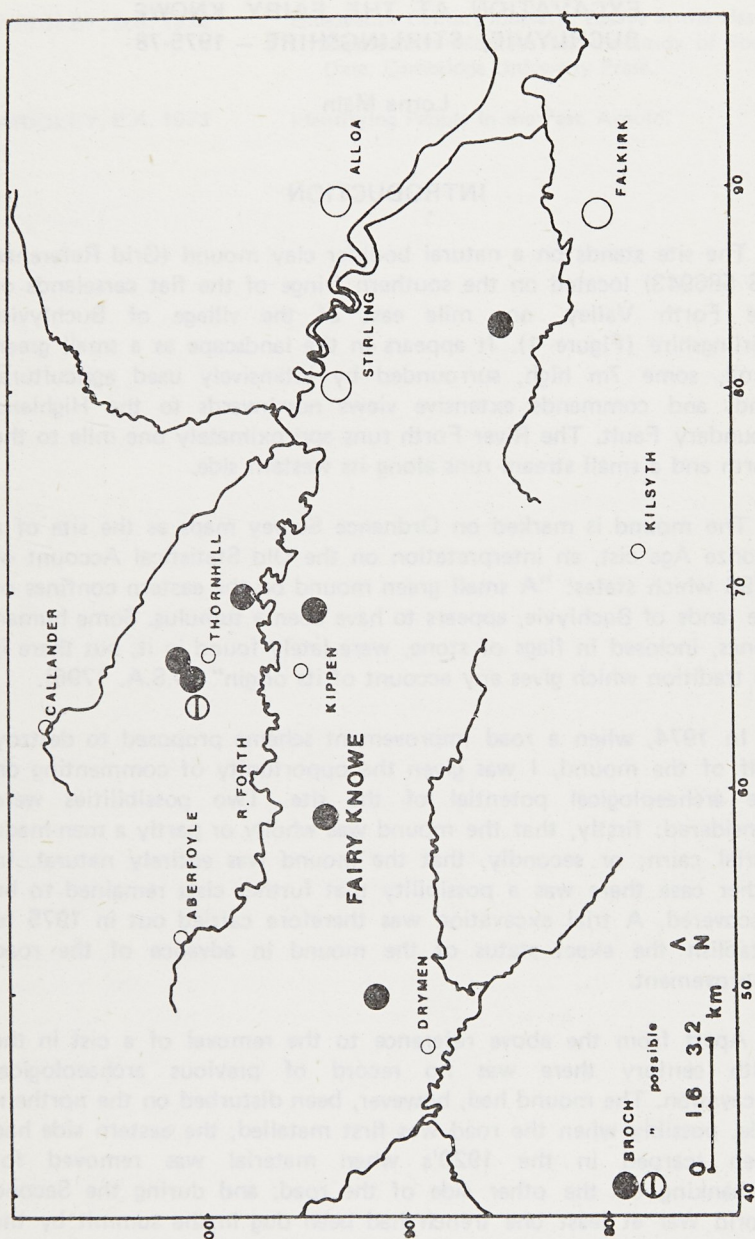


Figure 1

Distribution of brochs in Central Region



Plate 1 (above)

Phase 1 Post hole F53 at an early stage of excavation

Plate 2 (right)

Looking along the entrance passage to the broch interior



mound, visible only after vegetation clearance, no evidence of structural remains existed before excavation. The site has been scheduled as an Ancient Monument giving it statutory protection and has now been backfilled. All the finds and the records from the excavation will be located in the Smith Museum in Stirling.

PHASE 1

Phase 1 (Figure 2) consisted of a ring of eleven post holes representing a circular post-built structure with an overall diameter of 8.0m. Six were fully excavated, three were half-sectioned, and the remaining two were only briefly examined. Those excavated averaged 50cm in depth and 45cm in diameter at the floor level. The eleven post holes were spaced at intervals of between 210 and 260cm. All the excavated post holes had evidence either of stone packing in situ or of stone packing which had collapsed, probably as a result of post removal. Several had been sealed with an upper packing of clay; some had been infilled with stones, and a number were overlain either by walling or by paving slabs belonging to later structures.

Five of the post holes yielded the stumps of their timber uprights still in place, and these had survived because of the damp conditions in the clay. Between a number of the post holes a curving gully was excavated and from its relationship to Feature 69 was shown to be contemporary with this outer ring of eleven posts. This gully has been interpreted as a ring groove which was constructed to give support to the external wall of the structure, which was probably built of wattle and daub set on a framework of stakes. In three areas regularly spaced stake holes, which had been cut into the base of the groove, were excavated. The groove had been disturbed by later structures and was irregular both in shape and depth, averaging 4cm deep and 4 – 14cm wide. The stake holes were cut into the base to an average depth of 4cm. The groove was not traced over the whole circumference of the structure but was shown to run on the inner side of the post holes. The absence of the groove in the east and south-east suggests that the entrance lay in this area, possibly a simple gap somewhere between Features 68 and 70.

Inside the building a number of post holes, stake holes and gullies had been cut into the floor which was formed by the natural pinkish-grey clay of the mound. Contemporaneity between the main post holes and any of these internal features cannot be proved. It is, however, probable that at least some had a function within Phase 1

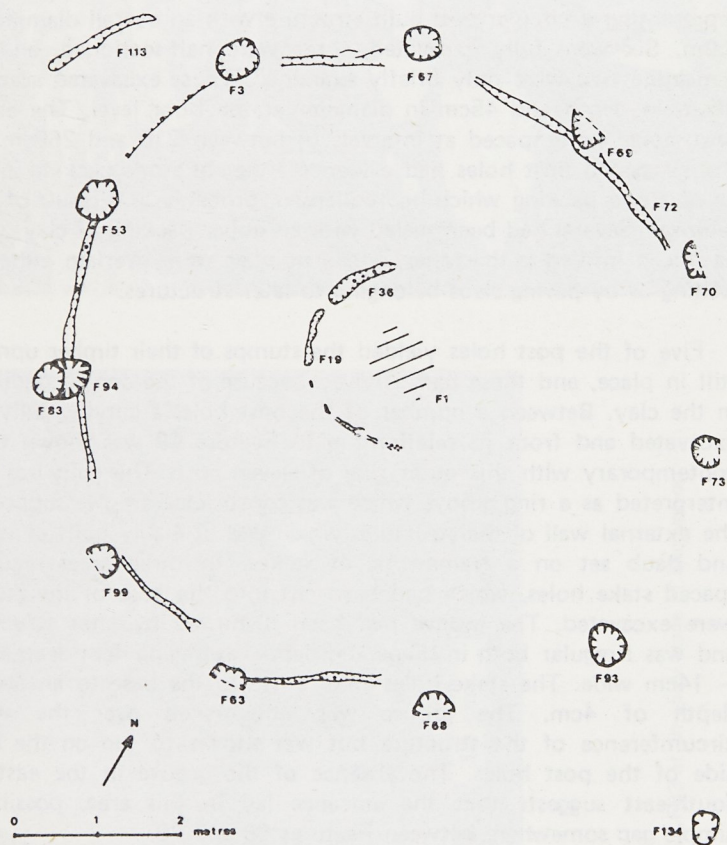


Figure 2

Phase 1

The Round House

although they have been omitted from the plan for the sake of clarity. A number of the post holes in the interior may represent an inner series of free-standing posts which, with the outer ring, would have supported the roof which was probably thatched with either straw or rushes although neither material survived.

The central hearth showed several phases of construction and although it was not possible to ascertain which of these were related to Phase 1 it is assumed that the first hearth probably belonged to this Phase. This earliest hearth was represented by a square some 90cm across of reddened clay indicating an area of burning on the natural clay floor. Associated with the earlier hearths was a discontinuous curving groove and an area of stake holes which lay on the west and south sides of the hearth. These were overlain on the south side by the later hearths and may represent the former existence of a screen partly surrounding the hearth. Unfortunately where the groove was associated with one of the possible inner post holes, Feature 31, the relationship between the two was unclear.

The Buchlyvie post-built structure is similar to the timber round houses which are known to occur widely in the Iron Age. No finds were, however, associated with this building and one of the posts is to be submitted for carbon 14 dating.

PHASE 2

The Broch

The main stone building excavated (Figure 3) comprised a circular drystone structure which has been interpreted as a broch. A broch has been described as a drystone tower fort, generally characterised by hollow wall construction, where the wall comprises an inner and outer casement linked by rows of stone lintels to form a series of intra-mural galleries linked by a stairway. Some brochs are galleried on the ground floor while others have a solid base with the walls dividing at first floor level. Because of the surviving height of the walls at Buchlyvie, just over 1 metre, it would not be classed as a broch by this definition since there is no evidence of double wall construction. However, relatively few of the structures which are classed as brochs still possess evidence in the form of at least one upper gallery for the existence of the high double wall, 10 – 12m in height. The majority are diagnosed as brochs on the basis of (a) the circular ground plan, (b) massive walls, (c) the narrow entrance

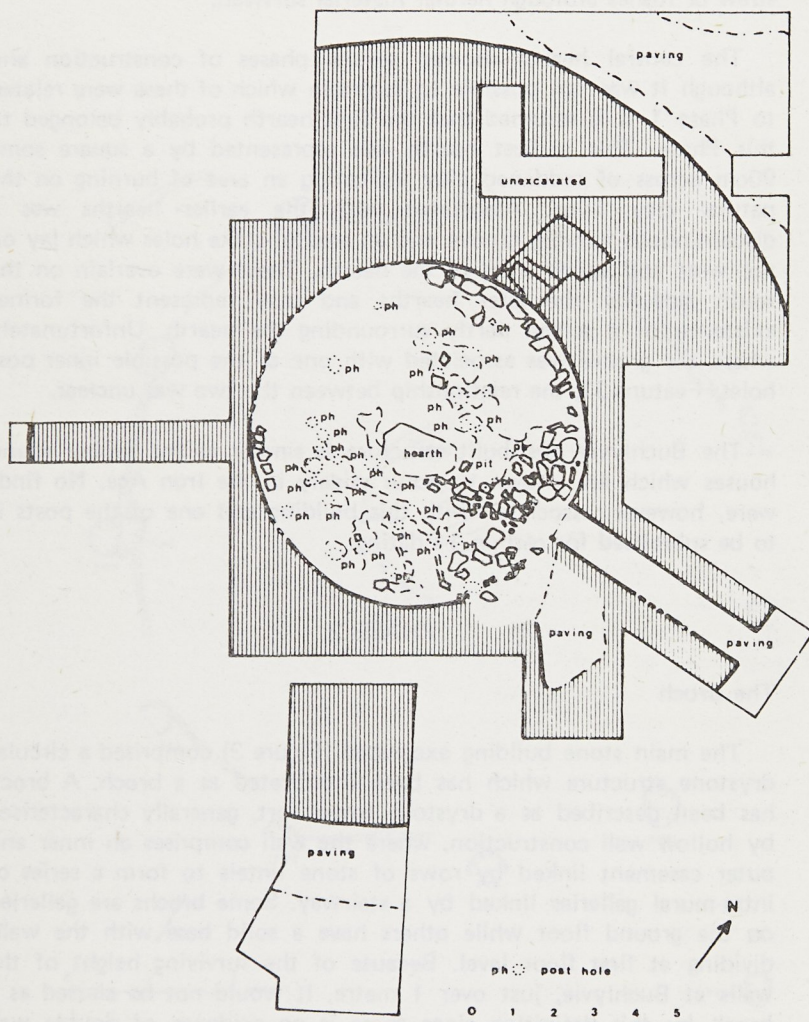


Figure 3

Phase 2 The Broch

passage, and (d) the scarcement ledge. These features occur in the existing high towers and may lend some support to the view that a number of brochs were once high enough to be towers of these proportions. At Buchlyvie (a)–(c) have been confirmed and on this basis the Phase 2 structure at Buchlyvie is accepted as a broch of the solid-based type.

The Stone Structures

(a) The Broch Wall

The broch comprised walls 5.4m thick enclosing a circular courtyard 8.2m in diameter. The outer face was constructed of large rounded boulders with up to three courses surviving and the base course was embedded in the clay. The spaces between the boulders were infilled with small packing stones. The inner face was of a different construction being built of sandstone blocks of varying size and the wall core consisted of loose random rubble and earth. The walls survived to a maximum height of just over 1m.

On the north and west sides only the base course of the outer face remained; the wall core in this area had been largely removed and the inner face had been completely robbed out. Excavation revealed the impressions left in the clay by the bottom course of the inner face, and the outline of some of the individual blocks could be traced on the ground. These "ghost marks" of the wall enabled the complete inner circumference of the broch to be planned even although parts of it had been completely demolished. The lack of disturbance in the trench sections confirmed that this length of the wall had been removed as a deliberate act of demolition some time in antiquity.

The inner broch wall had been constructed on and partly overlying some of the main post holes of the Phase 1 building.

(b) The Entrance Passage

The narrow entrance passage lay on the south-east and was 90cm wide at its inner end, although the corner on the southern side did not survive intact. The side walls of the passage ran parallel for a distance of 5.48m on the north and 5.44m on the south side and were constructed of both sandstone blocks and large boulders. At its outer end the passage was 90cm wide and was fronted by two large boulders which although they formed part of the base course of the outer face were not embedded in the clay.

These side walls were in a fragmentary state with only one course surviving over much of their length, although they stood approximately 80cm high at the inner end of the northern side. No lintels survived either in situ or in the rubble which filled the entrance passage.

The passage floor was paved with flat slabs which varied in size, but which were more massive at the inner end where they ran underneath both side walls. At a distance of some 65cm from the outer end of the passage three stones were set on edge running across the width of the passage and rising above the level of the floor. These may be related to the location of the doorway of the broch.

(c) The Intra-Mural Structures

A small L-shaped chamber was located within the width of the wall in the north-east quadrant. It measured 1.3m by 1.7m and its back wall stood 3 courses high with up to 60cm surviving. The floor was paved with large flat slabs laid on a foundation layer of sand and gravel which served to even out the irregularities of the rubble core. The chamber was entered from the central court by two irregular steps and its floor was some 50cm above the paving on the floor of the interior. The chamber was separated from the steps by a narrow channel, partly stone based, the function of which is uncertain.

Immediately to the left of the entrance passage, with access direct from the central area, a length of wall face up to 4 courses high was uncovered running back approximately 1.5m from the inner wall face although not linked directly to it. Between this intra-mural wall and the entrance passage wall face lay an area of paving which was continuous with that in the floor of the passage. From the evidence of other brochs this probably represents the remains of a guard cell and/or stairway entrance.

(d) The Extra-Mural Structures

The trench on the east side of the mound excavated as part of the trial excavation in 1975 revealed a drystone channel of which up to four courses survived. This structure was some 4m long, 10 – 50cm wide, with a compacted rubble base, and curved and narrowed towards the summit of the mound. A number of cover slabs remained in situ at its upper end and a single cover slab remained at its eastern end where the rest of the feature was presumed to have been destroyed by the roadworks in the 1920s.

The function of this channel is uncertain but its association with a number of finds, in particular with a number of iron furnace bottoms of a type generally associated with iron smelting in a bowl furnace, suggested an industrial function, possibly as a flue for some kind of furnace. Excavation in this area was not continued and therefore this hypothesis cannot be confirmed.

In front of the outer wall face on both the north and south of the brochs, areas of external paving were excavated. This external paving was also found in front of the entrance passage. On the north the paving was separated from the wall by a cobbled clay strip 20 – 30cm wide. On both the north and south a rubble "drain" was found to run concentric with the broch wall at a distance of 90cm; it was 30cm wide, with an average depth of 80cm and was packed with rounded boulders of varying size. Some of the overlying paving acted as cover slabs to this "drain".

The possibility that this feature had its origins and perhaps its main function in Phase 1 has not been discounted.

THE BROCH INTERIOR

The internal diameter of the broch was 8.2m. A complex of post and stake holes cut into the clay floor confirmed that the central courtyard formerly contained a variety of timber structures.

The accumulation of a black occupation layer associated with the central hearth gave evidence of the domestic use of the building. This organic layer (layer 4) lay directly on the clay floor and also on the paving which ran between the hearth and the entrance passage. This layer was thickest close to the hearth and thinned out towards the walls, being almost absent in the north-west quadrant. In addition to the paved area in the south-east the paving extended in a peripheral strip running round the court in the north-east and south-west quadrants.

The stone hearth which was set in the central space showed a number of phases of use and reconstruction. In its final phase the hearth was paved with slabs of red sandstone which had been blackened through use and its north and west sides were edged with kerbstones. The south side had collapsed. To the west of the hearth the occupation layer was separated into three sub-layers, 4(i), 4(iii), and 4(v) by two distinctive but discontinuous layers of orange/red

108 sand, layers 4(ii) and 4(iv). This stratification was closely related to the phases of hearth reconstruction.

THE FINDS

There were some 500 small finds from the excavation in addition to quantities of bone, iron slag and carbonised grain. Most of the artefacts were recovered from the occupation layer in the central courtyard.

Items of jewellery included one complete bronze spiral finger ring, two other bronze finger rings, two bronze penannular brooches and several bronze pins. Iron objects included some 150 possible or probable nails and a sickle blade. A number of waste lumps of lead were also found as well as several small lead ingots and a small perforated lead weight.

The stone finds included a sandstone lamp, fragments of four rotary querns, one handled cup, a number of perforated weights and whorls, a black flint scraper and a Neolithic axe.

Among the finds which served as evidence of contact with the Romans were two Roman bronze coins, one of which has been identified by Professor Anne Robertson as a copper 'as' of Vespasian (A.D. 69 – 79), sherds of samian, amphora and mortarium fragments, and pieces of coarse ware and glass.

THE HISTORY OF THE SITE

The excavations have suggested that the change in house type from timber roundhouse to stone-built broch was not accompanied by any significant break in the occupation of the site. The outer ring of posts of the roundhouse were either removed or reduced and sealed by the construction of the broch wall. The central hearth continued in use; the entrance to both buildings was in the south-east; and a number of the internal structures may have been re-used. The emphasis is on continuity. The end of the broch occupation was accompanied or closely followed by the almost complete demolition of the broch wall on the north-western side.

The roundhouse was the traditional type of building throughout the native Iron Age over a wide geographical area. The building of

drystone tower forts or brochs was widespread only among the Iron Age tribes of Northern Scotland from the first few centuries B.C. to the first few A.D. More than 500 broch sites are known or suspected and the majority are concentrated in the area north of the Great Glen known as the "Broch Province". A few outlying brochs are, however, known from south-west and south-east Scotland and it is to an outlying group (Figure 1) of at least seven, possibly eight (R.C.H.A.M.S., 1979) that the broch at the Fairy Knowe belongs and it is an example of the fully developed type.

The interpretation of the broch occupation and, by implication, that of the roundhouse until the radio carbon (C14) date is known for the Phase 1 post, is dependent partly on the dating of the Roman finds and partly on the C14 dates given below.

The Roman finds suggest that the broch may have been constructed in the latter half of the first century A.D. and occupied during the second century A.D., its occupation having ceased by the end of the second century. The C14 dates broadly confirm this interpretation. On this basis a date in the first century A.D. is suggested for the roundhouse.

GU 1107	A.D. 80 ± 130	(uncorrected)
GU 1108	A.D. 200 ± 50	(uncorrected)
GU 1109	A.D. 210 ± 45	(uncorrected)

The occurrence of brochs outside the main area has been explained in a number of ways, all linked with the appearance of Roman objects in the far north. One theory is that their construction resulted from the penetration of broch builders from the west coast under an alliance with the Caledonii to serve on their southern frontiers against the Roman forces (Chadwick, 1949). The number of brochs now known from the Forth Valley may reflect the incoming of such a group. It has, however, also been suggested that after the initial development of the brochs somewhere in the main area they were subsequently built to order by groups of professional broch building engineers. This has been suggested because of the highly specialised nature of their construction and also because of the wide range of culturally diverse communities in which they occur.

The continuity at the Fairy Knowe between Phases 1 and 2 may suggest that the broch occupants were part of the local native population who had imported the technical skills required to build a broch from the north and the absence of certain items from the

assemblage, in particular the characteristic broch pottery, adds further weight to this argument.

Whatever their origins the occupants of the broch at Buchlyvie, and perhaps also those of the roundhouse, were an important group in the community supported by a mixed farming economy, with a knowledge of weaving and the working of metals, and in close contact, either by trading or by looting, with the Roman forces sometime in the first two centuries A.D.

GLOSSARY

amphora	—	two-handed earthenware vessel used for storing wine, oil, etc.
as	—	Roman copper coin
cist	—	slab — lined grave
mortarium	—	thick, coarsely gritted, bowl in which substances are pounded and ground up
quern	—	stone hand-mill for grinding grain
samian	—	also known as Terra Sigillata, a fine red pottery, the Roman equivalent of "best china"
scarce ment	—	a narrow ledge formed where a wall is set back
whorl	—	a small perforated stone or clay disc, generally circular or oval in shape

ACKNOWLEDGEMENTS

Permission to investigate the site was given by Mr. W. Middlemass of Mains of Buchlyvie Farm and by the Central Regional Council as co-owners. I am grateful to both these parties for the encouragement and assistance given.

Finance for the 3-week excavation in 1976, for two weeks in 1977, and for four weeks in 1978 was provided by the Department of the Environment, now the Scottish Development Department, the work in 1975 having been carried out on a part-time basis largely with the help of volunteers from the Stirling Field and Archaeological Society.

Special thanks also to Messrs. F. Bracewell, G. Barclay, L. Keppie, to Professor A. S. Robertson, Dr. E. Slater, and not least to the supervisory staff, in particular to my husband, and to all volunteers for their invaluable assistance over the past four years.

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111

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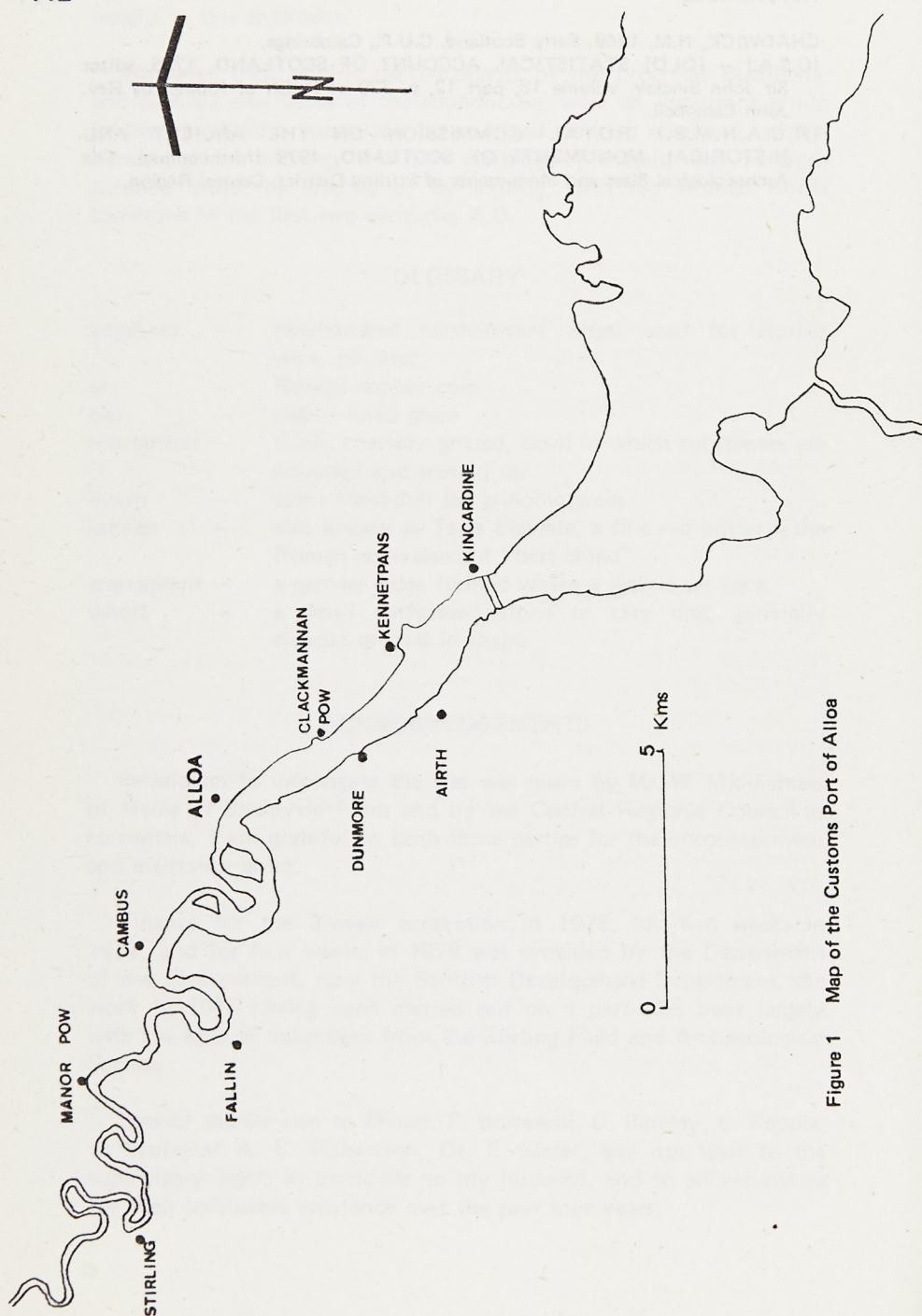


Figure 1 Map of the Customs Port of Alloa

ALLOA PORT, CUSTOMS AND EXCISE ACCOUNTS
— ANALYSIS OF A LOCAL HISTORY GROUP'S
RESEARCH PROJECT

113

Marion Haynes

Several members of the Clackmannanshire Field Studies Society had expressed an interest in undertaking research into the history of Alloa Harbour and the possibilities of looking into the Historical Records of the Port were examined. It was initially suggested that the Salt Tax Records should form the starting point for research but a brief examination showed that work on them was likely to be extremely dull, as far as amateur historians were concerned, and the Customs and Excise Accounts were found to be much more interesting, containing references to exotic, far away places, names of ships and people and to a wide variety of cargoes, some of which defied explanation.

It was thought that any work which was undertaken on the Accounts would be of interest to other bodies, notably local schools, libraries and the University of Stirling, and the process of handling the records, together with their analysis, would prove of benefit to those taking part in the research. In the event, much of the success of the project has been related to the tremendous help given by the staff of the Scottish Record Office, within which these particular records are held.

The Alloa Customs Accounts from 1742 — 1880, are available in the Historical Research Department of the Scottish Record Office. The Port of Alloa includes the harbours of the Upper Forth Estuary; Kincardine, Kennetpans, Airth, Dunmore, Clackmannan Pow, Alloa, Cambus, Fallin, Manor Pow, Stirling.

The possibility of photo-copying the accounts was looked into, but this would have proved expensive and would have placed a tremendous burden on the Record Office Staff. Also, in the end, we would have had only one quality-reduced copy which would be difficult to read, difficult to translate and difficult to analyse.

It was decided to manually extract the information in the accounts on a pro-forma designed to produce a first stage analysis. This form gives a title, in this case the Port of Alloa, the year and

the quarter, whether incoming or outgoing goods, and the name of the researcher.

PORT		YEAR		QUARTER		RESEARCHER	
Date	Ship	Port of Registry	Master	Origin or Destination	Agent	Cargo	
	1	2	3	4	5	6	

Below this in columns, are the date, the name of the ship, the Port of Registry, the Master of the ship, the Origin or Destination of the cargo, the Agent paying the duty and finally the Cargo. The completed format, which lends itself better to copying as it is in pencil on white A4 sheets, is not simply a copy of the accounts, as they have been to a certain extent translated, corrected and interpreted and are now ready for further analysis.

A number of problems were encountered in handling the Accounts. Firstly, only one person could work on one book at a time, so that if several people were working at the same time they were each working on the first year in a particular volume, not on a continuous period. Secondly, some pages of the records were torn with pieces missing, the spellings were inconsistent and the handwriting, though often attractive, was difficult to read. At first, the cargoes were strange to the researcher, and the weights and measures unfamiliar, numbers were written out in full, often in a strange form. (e.g. One hundred, two quarters and eight; meaning 158.)

Lastly, only foreign trade, or that on which duty had to be paid, was being recorded on the accounts, the bulk of coastal traffic being unrecorded.

We soon realised that, with the available workers, it would take 5 or 6 years to transcribe all the accounts and as the first year of nine books had been started it was decided to finish these nine years, which came at intervals from 1742 to 1786, and attempt an analysis of what amounted to a sample of the accounts. The limitations of such an analysis are considerable, as only ships exporting and importing chargeable goods are recorded in the accounts. The analysis is not definitive, as only a sample of nine years is available, but we carried on with the limited information to see if such an analysis was a viable proposition or whether a better approach could be devised, or a revision of the transcription form appeared to be necessary.

Various ways of analysing the information on the transcription form were investigated. We could look at the analysis from the "Ship" point of view; that is from column 1 on the transcription form, where individual ship movements and voyage studies could be undertaken. From column 2, the Port of Registry, we could look at the increase or decline in the importance of the various ports of registry of vessels in relation to total traffic of the Port of Alloa in overseas trade. From columns 3 and 5, the Master and the Agent, ship-owning and trading families could be investigated. It was found for example, that the Master often acted as his own Agent, and carried cargo on his own behalf. From the trade point of view, we could use column 4, the Origin or Destination of the cargo, to study patterns of trade and its movement to or away from certain areas and ports. From column 6, the Cargo, we could look at the types of cargo, and their relative importance by weight and volume, e.g. in 1763 timber was the most important import into Alloa. We could then go into finer detail, comparing quantities of Fir and Oak wood or see the growing importance at certain times, of ready worked timbers such as wainscots, boom spars and harrow bills. We could analyse certain cargo movements, for example, the quantity of coal exported, either as gross port figures or the export volumes from Alloa to an individual destination. An interesting study could be made of the cargo in general, looking at the weights and numeration used during this period and deducing the increasing size of ships from the increasing weights of cargo. Finally the date, months and season could be studied in relation to movements of ships and different types of cargo in an endeavour to arrive at patterns of annual trade.

Summary Form Analyses

The first step in the analysis after the transcription of information from the records was to devise a Summary Form, which enabled the extraction of four columns; the Ship, the Port of Registry, the Master and the Origin or Destination of the cargo.

PORT	YEAR	RESEARCHER
Ship	Port of Registry	Master
		Origin/Destination

This greatly simplified the available information and moved away from complicated investigations of the cargo. As the Accounts referred to duties paid, the total cargo from one vessel might be recorded as a large number of separate entries spread over several pages. From these sometimes numerous entries relating to one ship as

it unloaded or loaded its cargo, the information was now rationalised to a single entry. This created the major problem related to the Summary Form, and was a potential source of error; a decision had to be taken on whether a ship stayed in harbour during its various unloading or loadings, or whether it may have undertaken a coastwise journey while waiting. Ship movements between entries are mere supposition and, therefore, some ships appear to have been in harbour several weeks, which may indeed have been the case if the weather was unfavourable for sailing. Three to four weeks was in general allowed for a return journey to the Low Countries and Scandinavia, and longer for a Baltic journey, before a ship was counted as being involved on another trip.

The next step was the construction of various synopses to try to identify trends and in Figure 2 we can see the basic trade pattern involving the gross volume of the traffic in terms of the number of ships going in and out of the Port of Alloa. It can be seen that the number of ships exporting is generally greater than the number importing. In only two of the years we were able to study is this pattern reversed and these have the smallest differences between outgoing and incoming traffic. Perhaps we may conjecture that ships importing landed their cargoes at other ports and then came to Alloa to load up with coal for export. It may be possible to clarify this supposition by studying the Customs Records of other East Coast ports.

It is important to bear in mind that a decrease in the number of ships over the period studied would not necessarily mean a decrease in the volume of cargo as ships became bigger as the century progressed.

In Figure 3 the yearly totals are broken down into the four quarters of the year. At this time of sailing ships we expected to find that the bulk of trade would be in the mid-summer quarter, but it is interesting to note that this is not often the case, and that trade is often biased towards the Michaelmas and Christmas quarters. This suggests that if the market was there ships braved all weathers to deliver, and of course, there would be more demand for coal in the colder months and a higher demand for wines before Christmas.

The synopses in Figure 4 list, in A1, the annual totals of the Ports of Registry for incoming ships and, in A2, the annual totals of the Ports of Origin. In B1 the annual totals of the Ports of Registry for outgoing ships and B2 the annual totals of the Ports of Destination.

If we look at A1, ignoring infrequent entries, we have a short list of local ports, in order of importance; Alloa, Kincardine, Airth, Bo'ness, Stirling, Leith and Elphinstone. If we look at the trends we see a build up of vessels registered in Alloa and Kincardine and a run down of those from Airth, with Bo'ness coming to a peak at mid-period, then declining and finally reviving at the end of the period under study.

Looking at the Ports of Origin, in A2, we see a wide scatter of ports with a few such as Campvere, Gottenburg, Danzig, Memel and Rotterdam pre-eminent and we see trade moving increasingly from the Low Countries to the Baltic Ports.

In B1, the Ports of Registry of outgoing traffic, Alloa, Airth, Bo'ness, Leith and later Kincardine are the most important ports using Alloa and we see significantly many East Coast ports, and this is possibly where the missing imports are. Ships could have taken imports to the East Coast ports before coming on to Alloa for coal and this could be an interesting area for study.

An analysis from the synopses looked at trade between Alloa Port and Campvere, figures 5a and b, with block graphs of the percentage of total dutiable trade in import and exports. (Percentages were used because of the discrepancy between exports and imports in the total figures.) As far as trade into Alloa is concerned Campvere is important with an average of 10%, but exports are much more significant with an average of 23%, with most years considerably in excess of this. Secondly there is a decline in both so that by the end of the period trade with Alloa has more or less disappeared. There are wide variations within the period and, to be more specific, there is a need to fill in the missing years.

In an analysis of a single Port of Registry, in figure 5c, ships from Airth using the Port of Alloa are expressed as a percentage of the total trade of Alloa Port. It can be seen that these vessels were more important in Alloa's imports than in exports, with a decline to near zero towards the end of the period. Here again more data is needed to show the intervening years and perhaps explain the 'wild' years in mid-period.

A number of conclusions may be tentatively drawn from the work so far accomplished. Firstly, the system of forms designed to transfer information from the original records is technically viable using "amateur" labour. Secondly, the hierarchical nature of the summary

forms does permit easy handling of the more specific types of information. Thirdly, the years currently available would appear to be too widely spaced to permit any detailed patterns of trade being postulated. Lastly, and perhaps most importantly, we might conclude that the work was sufficiently interesting to attract the necessary "volunteers" to undertake it.

We are hoping to continue with the work of filling in the gaps and would like to take the opportunity of thanking all those members of the Clackmannanshire Field Studies Society who have given of their time. We would also like to express our appreciation for the vast amount of guidance and assistance afforded to us by the Keeper of the Scottish Record Office and his staff.

Ports of Registry	1743	1748	1755	1761	1766	1771	1776	1781	1785
Airth	8	8	3	1	8	2	5	—	1
Alloa	5	1	4	1	7	11	11	5	12
Amsterdam	—	—	—	—	—	—	—	—	—
Arbroath	—	—	—	—	—	—	—	—	1
Bo'ness	1	5	1	5	—	—	—	3	3
Burntisland	1	—	—	—	—	—	—	—	—
Carron	—	1	—	—	—	1	—	1	2
Christiansands	—	3	—	2	—	—	—	—	—
Clackmannan	—	—	—	—	1	—	—	—	—
Culross	—	—	—	—	—	—	—	2	1
Dundee	—	—	—	—	1	1	—	—	1
Dunmorepark	—	—	—	—	1	—	—	—	—
Dysart	—	—	1	—	—	1	2	1	1
Elphinstone	4	1	2	—	—	—	—	—	—
Ely	—	—	—	—	—	1	—	—	—
Fallin	—	1	1	—	—	—	—	—	—
Fleckyfever	—	—	—	—	2	1	—	—	—
Fraserburgh	—	—	—	—	—	—	1	—	—
Frederickshalls	—	—	—	1	—	—	—	—	—
Frieland	—	—	1	—	—	—	—	—	—
Glasgow	—	—	2	—	—	—	—	—	—
Glenburgh	—	—	—	—	—	—	—	—	2
Gottenburgh	—	—	—	8	—	—	—	—	1
Grangemouth	—	—	—	—	—	—	—	—	1
Inverkeithing	—	1	—	—	—	—	1	—	1
Kennet	—	—	—	—	—	—	—	1	1
Kincardine	—	2	—	1	7	8	20	8	22
Kirkcaldy	—	—	—	—	—	—	—	—	1
Leith	2	1	—	1	1	—	—	—	—
Leven	—	—	1	—	—	—	—	—	—
Longraind	—	—	—	—	—	—	—	—	1
Lymkilns	—	—	—	—	1	2	—	—	—
Mandale	—	—	—	—	—	1	—	—	—
Queensferry	—	—	—	1	—	—	—	—	—
Redhead	—	—	1	—	—	—	—	—	—
Stirling	4	1	—	1	3	1	—	—	—
Stockholm	—	—	—	2	—	—	—	—	—
Sunderland	—	—	—	—	1	—	—	—	—
Torryburn	—	—	—	—	1	—	—	—	2

Figure 4 A1 Annual totals incoming by port of registry

PORT OF ALLOA CUSTOMS ACCOUNTS

Figure 2 Analysis so far completed

Totals of Outgoing Ships:		Total of Incoming Ships.....	
1742-43.....	60		25
1748-49	34		25
1755-56	35		17
1761-62	20		24
1766-67	54		35
1771-72	45		30
1776-77	46		39
1781-82	35		21
1785-86	49		54

Figure 3 Quarterly totals

Year	Outgoing Ships				Incoming Ships			
	Xmas	Lady-day	Mid-sum	Mic.-mas.	Xmas	Lady-day	Mid-sum	Mic.-mas.
1743	11	11	21	23	6	2	8	9
1748/9	6	6	12	10	6	4	9	8
1755/6	14	2	7	11	6	3	6	2
1761/2	2	1	6	11	8	1	9	6
1766/7	16	14	6	18	11	8	5	11
1771/2	5	10	8	22	10	4	8	10
1776/7	11	10	18	7	16	4	7	12
1781/2	4	8	7	16	9	3	—	9
1785/6	3	4	18	24	29	4	4	17

Figures 2 and 3

Ports of Origin	1743	1748	1755	1761	1766	1771	1776	1781	1785
Amsterdam	1	—	1	—	2	—	—	—	1
Arrundale	1	3	—	—	—	—	1	—	2
Bergen	—	—	1	—	—	—	—	—	—
Bremen	—	—	—	—	—	—	—	—	1
Campvere	5	1	3	1	6	4	5	—	—
Christiana	—	—	—	—	—	—	1	—	—
Christiansands	2	8	2	2	—	—	—	—	1
Copenhagen	—	—	2	—	1	—	1	—	—
Danzig	—	—	—	—	4	4	5	2	10
Drunton	1	—	—	—	—	—	—	—	—
Dunkirk	1	—	—	—	—	—	—	—	—
Easterspere	—	—	—	—	—	1	—	—	—
Flecky fever	—	2	—	—	2	—	—	—	—
Frederickshalls	—	—	—	1	—	—	—	—	—
Gottenburg	3	4	3	13	11	9	10	10	15
Guernsey	—	—	—	2	—	—	—	—	—
Hamburg	—	—	—	—	—	1	—	—	—
Koningsburgh	—	—	—	—	—	—	—	—	2
Larwick	1	—	—	—	—	—	—	—	—
Lisbon	—	—	—	—	1	—	—	—	—
London	—	—	2	1	1	—	—	1	—
Mandale	2	—	2	—	—	2	—	—	2
Memel	—	—	—	—	1	3	11	7	14
Moss	1	2	—	—	—	—	—	—	—
Nefsham	—	2	—	—	—	—	—	—	—
Norway	3	—	—	—	—	1	—	—	—
Oporto	1	—	1	—	2	—	—	—	—
Petersburgh	—	—	—	—	—	1	—	1	—
Pillaw	—	—	—	—	—	—	—	—	1
Prigas	—	—	—	—	—	—	—	—	2
Prostocks	—	—	—	—	—	—	—	—	1
Riga	—	—	—	4	1	—	—	—	—
Rotterdam	3	2	—	—	1	3	4	—	1
Seibon	—	—	—	—	2	—	—	—	—
Shien	—	—	—	—	—	—	—	—	1
Stavanger	—	1	—	—	—	—	—	—	—
Stetin	—	—	—	—	—	—	1	—	—
Stockholm	—	—	—	—	—	1	—	—	—

Figure 4 A2 Annual totals incoming by ports of origin

Ports of Registry	1743	1748	1755	1761	1766	1771	1776	1781	1785
Aberdeen	—	—	—	—	—	—	—	—	3
Airth	14	9	1	—	6	1	3	2	2
Alloa	6	—	2	2	6	9	8	8	15
Amsterdam	—	1	—	2	—	—	—	—	—
Anstruther	1	1	—	—	—	—	—	—	—
Arbroath	—	—	1	—	3	—	2	—	1
Arrundale	—	—	—	1	—	—	—	—	—
Berwick	—	—	—	—	—	—	—	—	—
Bo'ness	—	8	4	1	4	4	3	1	9
Burntisland	6	1	2	—	—	—	—	—	—
Campbeltown	—	—	—	—	—	—	—	1	—
Garron	—	1	—	—	—	1	1	2	—
Christiana	—	—	—	—	—	—	—	1	—
Christiansands	—	—	—	2	—	—	—	—	—
Clackmannan	—	—	1	—	—	—	—	—	—
Crail	—	—	—	—	1	—	—	—	—
Denbigh	—	—	—	—	—	—	1	—	—
Dunbar	—	—	—	—	—	—	—	—	1
Dundee	3	2	3	—	1	—	1	—	1
Dunnyker	—	—	—	—	—	—	—	1	—
Dysart	2	—	—	—	—	1	1	—	—
East Friesland	—	—	1	—	—	—	—	—	—
Edinburgh	1	—	—	—	—	—	—	—	—
Elphinstone	4	3	2	—	—	—	—	1	—
Eyemouth	—	—	—	1	—	—	—	—	—
Fain	—	—	1	—	—	—	—	—	—
Fallin	—	1	2	—	—	—	—	—	—
Fraserburgh	—	—	—	—	—	1	1	—	—
Frederickshall	—	—	—	1	—	—	—	2	—
Frietyland	—	—	1	—	—	—	—	—	—
Gardenstone	—	—	—	—	—	1	—	—	—
Glensburgh	—	—	—	—	—	—	—	—	1
Gottenburgh	—	—	—	2	—	—	—	1	—
Grangemouth	—	—	—	—	—	—	—	—	1
Helensburgh	—	—	—	—	—	—	—	—	1
Hull	—	—	1	—	—	—	—	—	—
Inverkeithing	6	—	—	—	—	1	—	—	—
Kincardine	—	—	—	1	10	7	11	10	7

Figure 4 B1 Annual totals outgoing by port of registry

Ports of Registry	1743	1748	1755	1761	1766	1771	1776	1781	1785
Kinghorn	2	—	3	—	—	—	—	—	—
Kirkcaldy	6	—	—	—	2	—	2	1	—
Leith	4	3	4	—	8	5	7	2	5
Leven	—	—	—	—	1	4	—	—	—
Lymekilns	—	—	—	—	1	4	—	—	—
Methill	—	—	—	—	1	—	—	—	—
Montrose	—	1	—	—	1	1	1	—	—
Newburgh	—	—	1	—	—	—	—	—	—
North Arrundale	1	—	—	—	—	—	—	—	—
North Berwick	—	1	—	—	—	—	—	—	1
North Queensferry	1	—	—	—	1	—	—	—	—
Ostend	—	—	—	—	—	—	—	1	—
Perth	2	—	1	—	3	—	1	—	—
Pittenweem	1	—	1	—	—	—	—	—	—
Portsoy	—	—	—	—	1	1	1	—	—
Prestonpans	1	—	—	—	—	—	—	—	—
Queensferry	1	—	—	1	—	—	—	—	—
Rotterdam	—	—	1	—	—	—	—	—	—
Sealoch	—	—	—	—	—	—	—	1	—
Spey	—	—	—	—	—	—	1	—	—
Stavanger	—	—	1	—	—	—	—	—	—
Stirling	2	—	—	—	2	1	—	—	—
Stockholm	—	—	—	1	—	—	—	—	—
Stonehaven	—	—	1	—	—	—	—	—	—
Sunderland	—	—	—	4	2	1	—	—	—
Torrey	—	—	—	—	—	2	—	—	—
Wemyss	—	—	—	—	—	—	1	—	—
Whitby	—	1	—	—	—	—	—	—	—
Zurichzee	—	—	—	1	—	—	—	—	—

Figure 4 B1 Annual totals outgoing by port of registry — continued

Port of Destination	1743	1748	1755	1761	1766	1771	1776	1781	1785
Amsterdam	12	4	10	6	3	1	1	—	—
Arnholt	—	—	—	—	—	—	—	—	1
Arrundale	1	—	—	1	—	—	—	—	—
Bergin	1	1	—	—	—	—	—	—	—
Bremen	—	—	—	—	—	—	—	—	1
Campvere	29	17	10	1	17	14	11	—	3
Christiansands	1	—	1	2	—	1	—	—	1
Clayholm	—	—	—	—	—	—	—	—	1
Copenhagen	4	1	—	2	6	12	10	11	11
Danzig	—	—	—	—	—	—	—	1	—
Denmark	—	—	1	—	—	—	—	—	—
Dram	—	—	—	—	—	—	—	1	—
Emden	—	—	—	—	—	—	—	—	1
Fardel Island	1	—	1	—	1	—	—	—	—
Frederickshall	—	—	—	1	1	—	—	2	—
Gibraltar	—	—	—	—	—	—	1	—	—
Gottenburgh	2	2	1	3	8	2	3	12	14
Guernsey	—	—	1	—	—	—	—	1	—
Hamburgh	—	—	2	2	5	7	7	1	3
Holland	2	1	—	—	—	—	—	—	—
Koningsburgh	—	—	—	—	1	—	—	—	—
Leghorn	—	—	—	—	—	—	—	—	1
Lentort	—	—	1	—	—	—	—	—	—
Lisbon	—	—	—	—	—	—	—	—	1
Mandale	1	—	—	—	—	—	—	—	—
Middleburg	3	—	—	—	—	—	—	—	—
Naze	—	3	—	—	—	1	—	—	1
Norway	1	—	—	—	—	1	—	—	—
Nyding	—	1	—	—	1	—	—	—	—
Oporto	—	—	—	—	1	—	—	1	1
Ostend	—	—	—	—	—	—	—	1	—
Petersburgh	—	—	—	—	—	—	1	4	5
Rotterdam	6	4	6	1	9	5	9	—	1
Sandisand	—	—	—	—	—	1	1	—	—
Soiban	—	—	—	—	1	—	—	—	—
Scaw	—	—	—	—	—	—	—	—	1
Stavanger	—	—	1	—	—	—	1	—	1
Stockholm	—	—	—	—	—	—	1	—	1
Strabourd	1	—	—	—	—	—	—	—	—
Zealand	1	—	—	—	—	—	—	—	—
Zurichzee	—	—	—	1	—	—	—	—	—

Figure 4 B2 Annual totals outgoing by port of destination

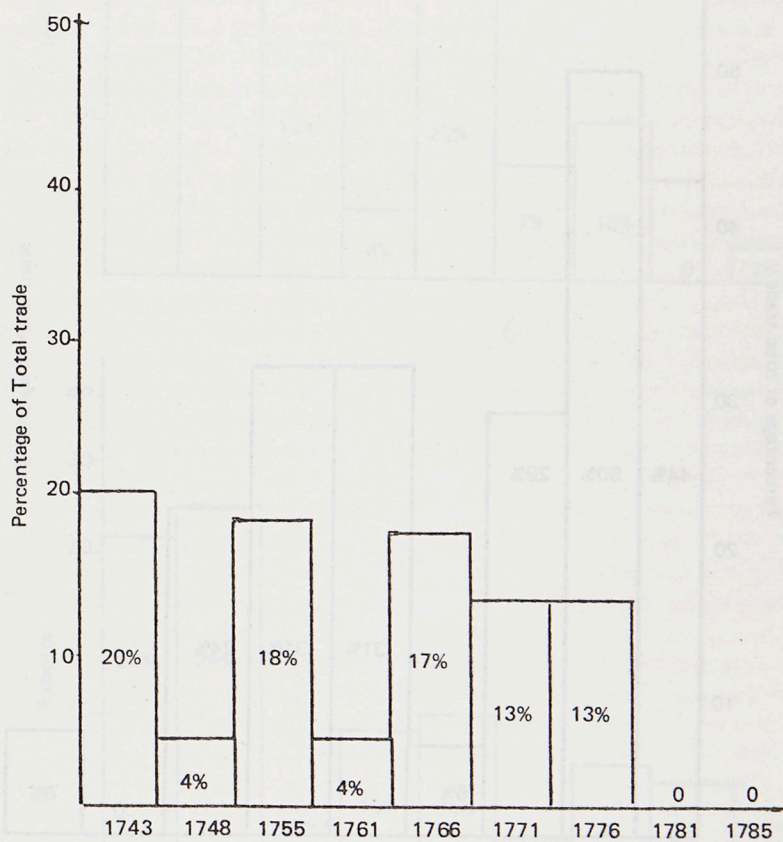


Figure 5(a) Port of origin : detailed imports from Campvere

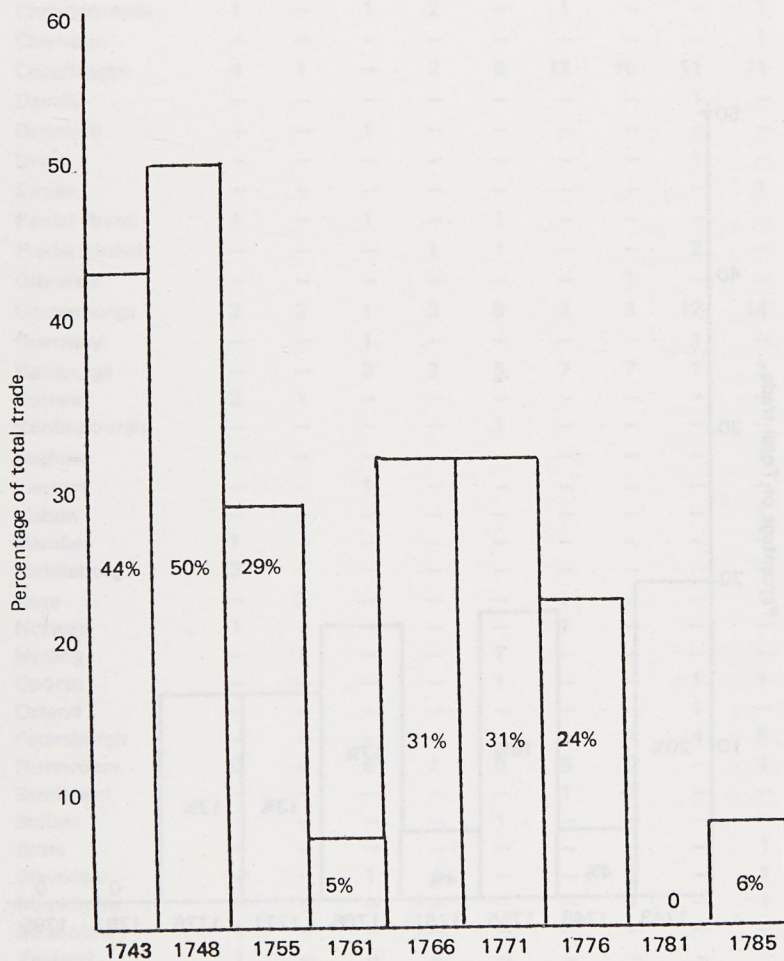


Figure 5(b) Port of destination : detailed exports to Campvere

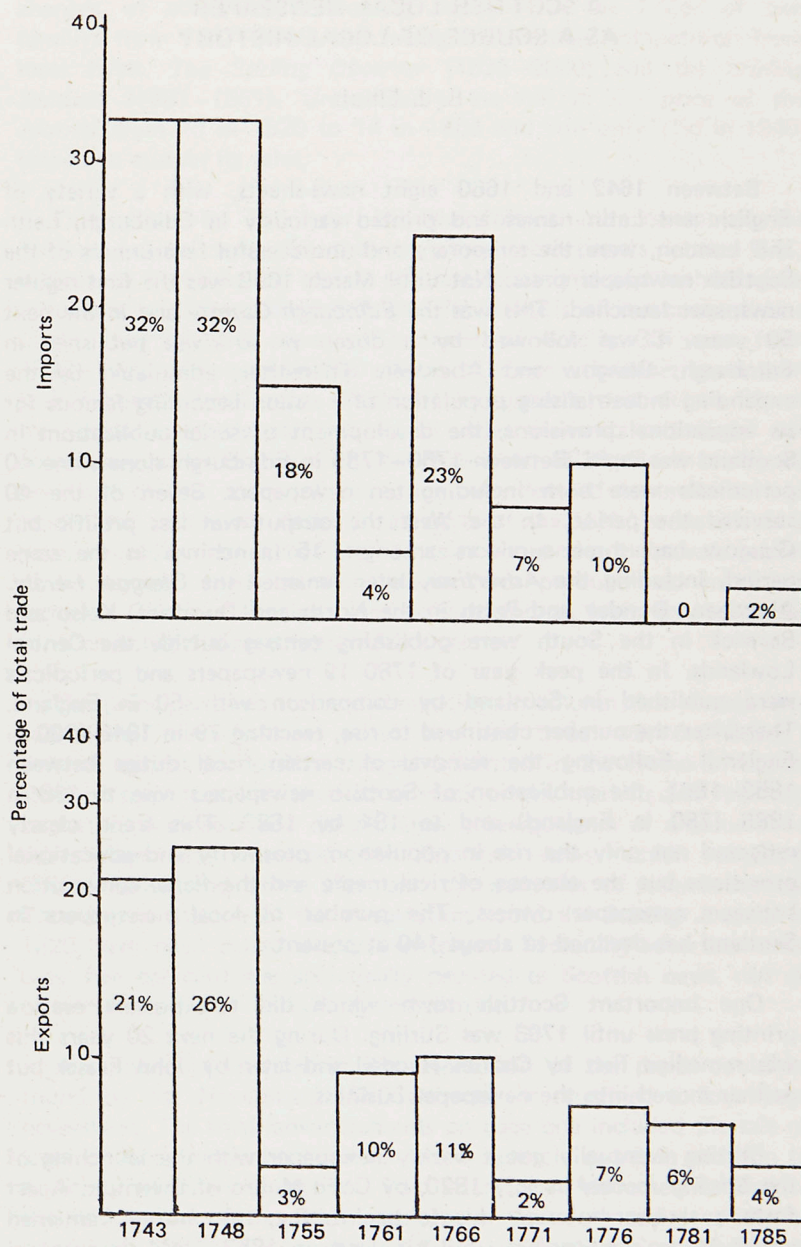


Figure 5(c) Port of registry Airth : imports and exports

A SCOTTISH LOCAL NEWSPAPER AS A SOURCE OF LOCAL HISTORY

B. J. Elliott

Between 1642 and 1660 eight news-sheets, with a variety of English and Latin names and printed variously in Edinburgh, Leith and London, were the temporary and unsuccessful forerunners of the Scottish newspaper press. Not until March 1699 was the first regular newspaper launched. This was the *Edinburgh Gazette* and in the next 50 years it was followed by a dozen or so rivals published in Edinburgh, Glasgow and Aberdeen. Thereafter, stimulated by the expanding industrialising population of a nation becoming famous for its educational provisions, the development of serial publications in Scotland was rapid. Between 1750–1789 in Edinburgh alone some 40 periodicals were born including ten newspapers. Seven of the 40 survived the period. In the West the output was less prolific but Glasgow had three survivors amongst 15 launchings in the same period, including the *Advertiser*, later renamed the *Glasgow Herald*. Aberdeen, Dundee and Perth in the North and Dumfries, Kelso and Berwick in the South were publishing centres outside the Central Lowlands. In the peak year of 1780 19 newspapers and periodicals were published in Scotland by comparison with 50 in England. Thereafter the number continued to rise, reaching 79 in 1846 (200 in England). Following the removal of certain fiscal duties between 1853–1861, the publication of Scottish newspapers rose to 138 in 1866 (750 in England) and to 184 by 1883. This trend clearly reflected not only the rise in population, prosperity and educational provisions but the absence of rival media and the fierce competition between newspaper owners. The number of local newspapers in Scotland has declined to about 140 at present.

One important Scottish town which did not possess even a printing press until 1793 was Stirling. During the next 20 years this was remedied first by Charles Randall and later by John Fraser but neither moved into the newspaper business.

Stirling eventually got a weekly newspaper with the launching of the *Stirling Journal* in July 1820, by Colin Munro of Inverness. Apart from a six-year interval, due to bankruptcy, the *Journal* remained under Munro's editorship until his death in 1853. Until its eventual take-over by George Outram in 1968 the *Journal* had relatively few

changes of editorship, remaining basically in the hands of two families from 1867–1968, but facing considerable competition from local rivals, *The Stirling Observer* (1836–0000) and the *Stirling Sentinel* (1881–1961). Undoubtedly the fall in the price of the *Journal* from 7d in 1820 to 1d in 1886 and still only 1½d in 1940, helped to sustain its sales.

Throughout its 150 year life, the format and content of the *Stirling Journal* was, like that of other local papers in the U.K., subject to a variety of social, political, economic and technological influences and changed accordingly. An analysis of the content of a single issue of this paper at intervals of exactly 30 years from 1820–1970 demonstrates the effects of these influences upon even such a humble local paper. Page one throughout most of the life of the paper was devoted to small advertisements although not completely so in the issue of 2nd November, 1820. On that day 70 per cent of the space of page one was devoted to invitations to tender for post-horse duties in all parts of the U.K., to details of a government-licensed lottery and to sales by auction or private tender of houses and lands or their leases, farm produce and municipal lotteries. Offers of life insurance policies and an invitation to tender for a church building completed this section.

The principal news story, commencing on column five of page one and filling the whole of pages two and three, was the Queen's defence against immorality charges presented in the House of Lords. Most of page four was devoted to stock prices, markets and fairs and to births, marriages and deaths. Only three-quarters of a column on this page was reserved for Scottish news which included Courts-martial and other trials and the activities of resurrectionists. Thus by no stretch of the imagination could the *Stirling Journal* in 1820 have been called a local newspaper. Excluding advertisements, only five per cent was specifically devoted to Scottish news, not all of which was 'local' to Stirling and district.

A number of changes in the orientation of the paper could be found by 1st November, 1850 although it remained a four page news-sheet. The small advertisements on page one included the sale or lease of land, property, livestock and household goods in addition to a variety of financial notices. Two interesting newcomers related to the withdrawal of the Stirling–Glasgow stagecoach and a variety of medicinal offers. The remaining three pages carried a bewildering array of news from Europe, America and the Arctic as well as from many parts of Britain. The greatest amount of space was devoted to

the recent establishment of the Roman Catholic Archdiocese of Westminster. The principal Scottish news included ecclesiastical, legal and agricultural matters, railways and a Clyde collision. Additionally, on page four, almost two columns were devoted to Stirling's Ragged School and School of Arts. Thus, although Stirling had been on the national rail network for more than two years and had the electric telegraph, the *Journal* was still fulfilling the principal function of distributing national and international news and only in a minor way could it be called a local paper.

During the next 30 years a radical transformation of the paper took place. It expanded to eight pages of six columns and page one had adopted the now familiar format of classified advertisements. In the issue of 5th November, 1880 these included Money, Insurance, Education, Jobs, To Let, For Sale and Business. Three separate advertisements were put in by the Stirling Total Abstinence Society. Furthermore the amount of advertising increased dramatically. With the exception of shipping news and details of the services of Stirling GPO, the whole of pages seven and eight and two-and-a-half columns of page five were devoted to advertisements. Nine small advertisements masquerading as news items appeared on page six. The nature of the products advertised also supports clearly the theory that the principal entrepreneurial effort in late 19th century Britain was being channelled into the consumer goods and financial service markets rather than into technologically advanced industry. Foodstuffs, toiletries, cosmetics, clothing and furniture predominated. Meanwhile the publication of local news stories had expanded almost as rapidly as advertisements to replace the national and international news stories which had become the prerogative of national 'dailies'. Thus, pages two and three carried almost five columns of municipal election results. Pages four, five and part of six were devoted to local news and sports. Only four columns mostly on page three were specifically devoted to English (mainly sensational), Irish and foreign news stories. By 1880 therefore the *Stirling Journal* had truly assumed the format and role of the local newspaper as it is widely known today, with a preponderance of local minutiae subsidised by a heavy volume of advertising.

This new role had intensified by the issue of 4th November, 1910. The *Journal* maintained eight pages but had expanded to seven columns. The classified advertisements on page one had become more formalised and considerable amounts of advertising appeared throughout except on page four which with page five carried local news from churches, courts, local associations and 'news from

villages.' Non-local news was relegated to one column on page two. Notable innovations included four columns of motor-car advertisements and a motoring column on page eight and feature articles on 'The Romance of Civil Engineering', 'Health and Home', 'Science and Invention', 'Practical Agriculture', and 'Social Betterment'. Short stories also received an inordinate amount of space, with six columns on page three, three on page six and two on page seven. The inclusion of motoring is understandable in 1910 and by reason of the lack of competitive media so also is the short story vogue. The feature articles are more intriguing because they reflect some of the social concerns of the period and indicate the educational possibilities of a local paper, although a cynic might argue that given the overwhelming superiority of the new dailies, and the relative lack of local news, something had to be found to fill the columns in addition to advertisements. However, it is clear that by 1910 the *Stirling Journal* had transformed completely its role of 90 years earlier and had taken on also many of the characteristics of a women's magazine, clearly reflecting the interests of a wider if less exclusively educated readership.

Despite the abundance of dramatic international news the issue of 31st October, 1940 did not seek to compete with BBC radio news, the national dailies or even cinema newsreels. War economies had reduced the size to six pages but the price was only ½d more than 50 years previously. Classified advertisements, including appeals to buy War Bonds continued to fill page one. Advertisements also dominated pages four and six and took a third of page five. However, apart from articles on the history of the Mackay Regiment and Sir Sydney Smith, the remainder of the paper was devoted to local news. The War was confined to a brief leader article and one or two brief mentions.

Towards the end of its life the *Stirling Journal* became a tabloid and the issue of 18th June, 1970 contained eight pages of six columns each. Page one had abandoned classified advertisements (on 16th October, 1952) and the space was shared between three news stories, two photographs and a rainwear advertisement. Classified advertisements had moved to pages seven and eight while pages five and six were reserved for 'News from the District'. Sports news appeared on page three and photographs of local social events on page four. 'Hard' news including the imminent General Election was thus confined to page two, of which 25 per cent was also advertising.

The transition of the *Stirling Journal* from disseminating

second-hand national news during its early years to becoming a truly local newspaper took about half a century. Technological developments in communications, the development of mass education and deflation were clearly the influential factors here, facilitating the rise of cheap popular national dailies. This forced local papers such as the *Journal* back into their home territory marketing a mixture of local news and feature articles subsidised by advertising from both local and national brand name sources. It maintained this role for almost a century before succumbing to the combined effects of inflation, regional broadcasting and local press competition.

The nature of the local news published rested heavily on the three-legged stool of Religion, Education and, above all, the activities of local clubs and associations. This analysis is not surprising because not only did they involve a very large percentage of the population at one time or another but most of these institutions themselves actively court publicity to gain increased congregations, pupils or parental support or members respectively. Most of the news items relating to these subjects would have been, and still are, contributed by their own officials. News items relating to crime, Courts of Law and legal punishments were also covered comprehensively although the last two would await the routine court sittings. The third item which was of concern to most local citizens was local government particularly by reason of its expenditure of the former's contributions in the form of rates.

The items most comprehensively covered by this and undoubtedly other local papers in Scotland were the very foundation stones of Scotland's nationhood, namely its unique systems of Religion, Education, Law and Government and the cultural social groupings of its people.

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133

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The title of the paper should be short and meaningful.

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Presentation and style should be concise and designed to appeal to the educated layman/sixth year studies student. The paper should be typed, double-spaced, with ample margins, on one side of A4 size paper, and the pages numbered top right. Only words to be printed in italic e.g. Latin names of species or titles of publications, should be underlined.

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RUSSELL, F.S. and YONGE, C.M., 1928. *The Seas*. 397pp. F. Warne, London.

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