

ISSN 0309-7560

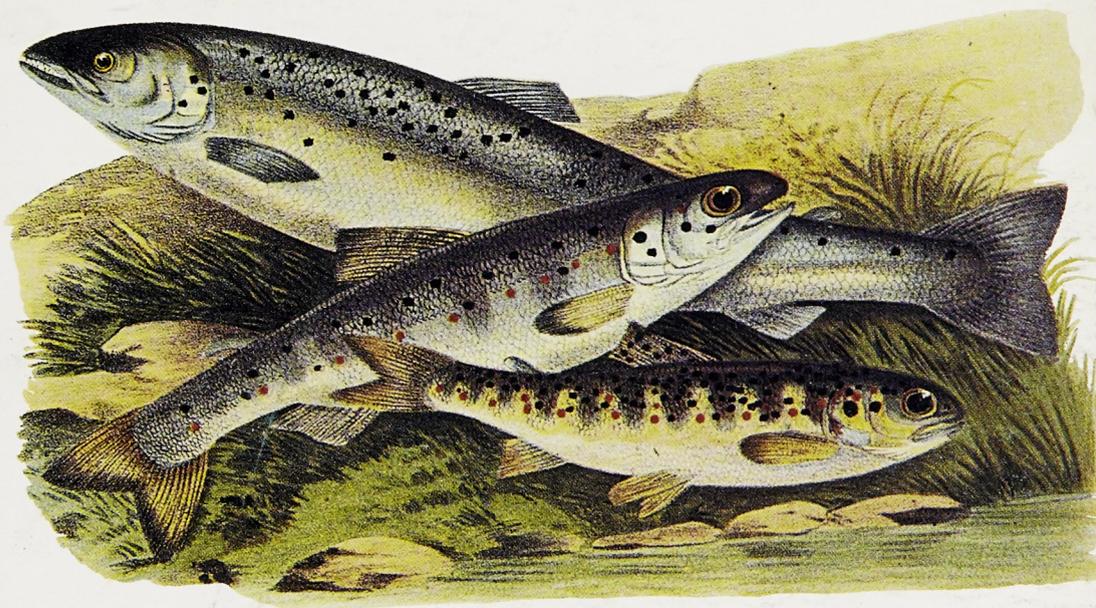
the Forth
Naturalist



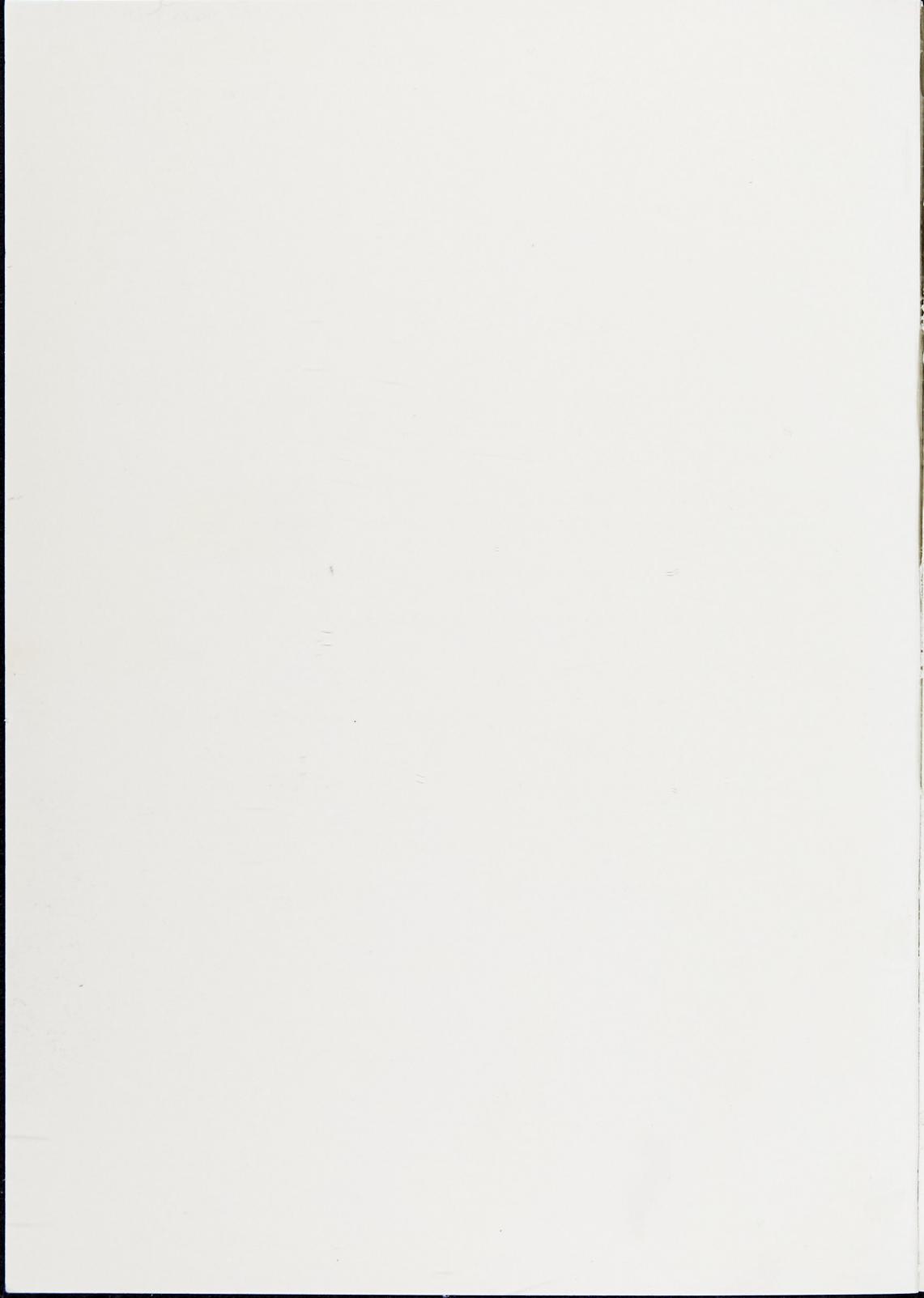
Historian

BARGAIN BOOKS

50p



Volume 4 1979





Volume 4, 1979

CONTENTS

- 3 Earthquake Swarms in Scotland. Paul W. Burton and Graham Neilson
- 27 Some Aspects of the Climate of Central Scotland. J. S. Hopkins
- 33 Freshwater Fish Fauna of the Forth Area. Peter S. Maitland
- 49 Stirling and Clackmannan Bird Report 1978. C. J. Henty
- 60 Stirling and Clackmannan Bird Report 1979. C. J. Henty
- 75 Peregrines and Man in the Stirling Region. J. Mitchell
- 87 Some Unusual Plant Records from Menstrie. R. Cook
- 95 Larger Fungi of the Stirling Area. Roy Watling
- 111 Towards a History of the Labour Movement in Stirlingshire 1789-1922. James D. Young

Notes and Observations:

- 47 Kidney Vetch in the Stirling/Clackmannanshire Area. G. Thomson
- 48 An Old Record of the Large Blue Butterfly in Clackmannanshire. G. Thomson
- 48 Has the Orange Tip Butterfly arrived yet? G. Thomson
- 86 Probable Breeding of the Common Crossbill. R. G. Caldow

Instructions for Authors

Authors Addresses

- 2** Published by the Editorial Board, University of Stirling and
the Central Regional Council, Stirling, 1980

ISSN 0309-7560

EDITORIAL BOARD

David Bryant,
University of Stirling

Murray Dickie,
Central Regional Council

Lindsay Corbett (Secretary),
University of Stirling

Kenneth Mackay,
High School of Stirling

John Elliott,
University of Stirling

J. M. Sanderson, Curator,
Falkirk Museum,
c/o Central Library,
Hope Street, Falkirk

I. Ferguson,
University of Stirling

George Thomson,
Humbleknow, Ramoyle, Dunblane

Robert Innes,
University of Stirling

John Proctor,
University of Stirling

Cover produced and donated by the BP Group of Companies in
Scotland.

Cover illustrations are from S. Day *British and Irish Salmonidae*. 1887.

Front: 1 grilse $1/2$ size, 2 smolt, 3 par — from Howietoun

Back: 1 male Lochleven trout $1/2$ size, 2 female $1/3$ size, 3 young reared at
Loch Goldenhoof (nr. Whins of Milton)

EARTHQUAKE SWARMS IN SCOTLAND

3

Paul W. Burton and Graham Neilson
Institute of Geological Sciences, Edinburgh

Scotland, including the region around the Ochil Hills, has a long history of low seismicity. Most people are not aware of this although earthquakes occur to some extent throughout the UK. It seems that this lack of awareness arises because the interval over which a local population experiences an earthquake often exceeds a generation: unlike countries with a higher seismic risk, we have little folklore which can be passed down by word of mouth. When the larger, but still relatively small, earthquakes of the UK are experienced they are still alarming to those involved. When several small earthquakes occur in a short period, as happened around the Ochil Hills during 1979, it is a noteworthy phenomenon for any local population.

An investigation into the historical seismicity of the Comrie and Menstrie region shows a number of such episodes, and moreover previous earthquake swarms in this region have been a major stimulus in the early development of seismology in Britain and elsewhere.

To obtain an understanding of how often earthquakes of a particular size occur in a region it is necessary to compile catalogues covering several centuries. An early cataloguer of note was Robert Mallet (1852, 1853, 1854) who listed several hundred British earthquakes; Wartnaby (1972) described the work of many other investigators. These early attempts were followed by two interesting developments which culminated in the work of Davison (1924). The first was O'Reilly's (1884) publication of an earthquake catalogue which was "arranged relatively to localities and frequency of occurrence to serve as a basis for an earthquake map of the three kingdoms". O'Reilly included a map which detailed the number of earthquakes felt in each place and had individual districts tinted to represent the local frequency. He was followed by Ballore (1896) writing on "Seismic Phenomena in the British Empire", who included ten British districts among which are the Scottish Lowlands, Perthshire and the north-east coasts. His maps showed numbers of felt earthquakes, also an early quantitative seismic risk map with the country divided into squares, the size of which was related to the degree of local seismicity. Although these early publications are better studied in the original form, particularly O'Reilly's coloured map, they are reproduced in black and white and briefly discussed by Burton (1978a).

TABLE I. Earthquake intensity on Davison's (1924) scale with the closest corresponding values on the Modified Mercalli Scale

Perceptible Definition	Davison's Intensity I _D	Closest Modified Mercalli Intensity I _{MM}
Recorded only by instruments	I	I
Felt only by a few persons lying down and sensitive to weak tremors	II	II
Felt by ordinary persons at rest; not strong enough to disturb loose objects	III	III
Window, doors, fire-irons, etc., made to rattle	IV	III ½ *
The observer's seat perceptibly raised or moved	V	IV
Chandeliers, pictures, etc., made to swing	VI	V
Ornaments, vases, etc., overthrown	VII	V ½ *
Chimneys thrown down and cracks made in the walls of some, but not many, houses in one place	VIII	VI
Chimneys thrown down and cracks made in the walls of about one-half the houses in one place	IX	VII

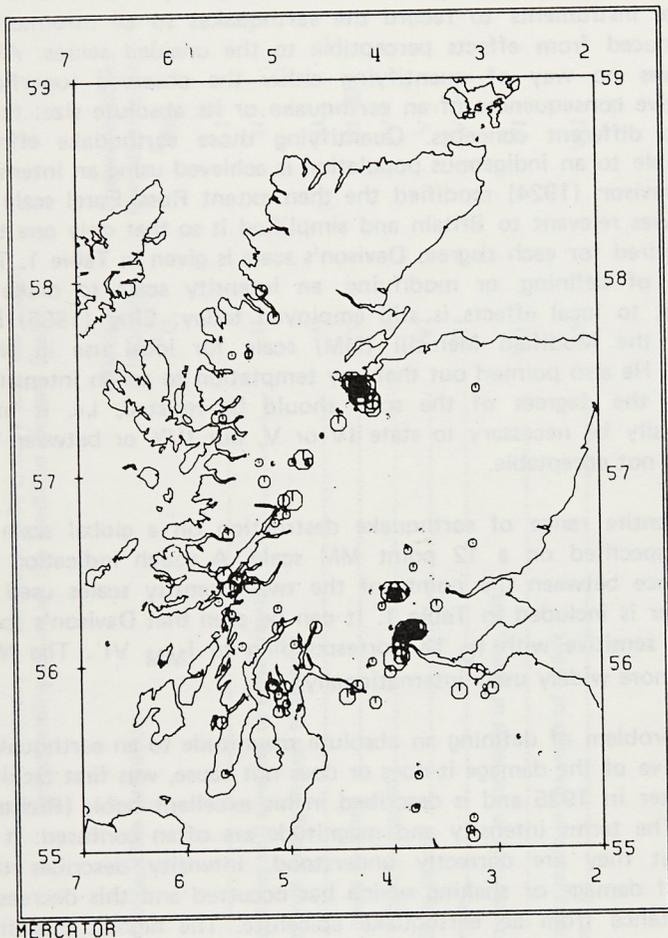
* In practice intermediate units are not used. In a published description the nearest whole unit would be assigned.

Two major problems existed in these early days. There were no adequate instruments to record the earthquakes so all information was deduced from effects perceptible to the unaided senses. Also, there was no way of quantifying either the observed superficial destructive consequences of an earthquake or its absolute size: these are two different concepts. Quantifying those earthquake effects perceptible to an indigenous population is achieved using an intensity scale. Davison (1924) modified the then extant Rossi-Forel scale so that it was relevant to Britain and simplified it so that only one test was required for each degree. Davison's scale is given in Table 1. The practice of defining, or modifying, an intensity scale to make it pertinent to local effects is still employed today; Eiby (1965) has adapted the Modified Mercalli (MM) scale for local use in New Zealand. He also pointed out that any temptation to assign intensities between the degrees of the scale should be resisted, i.e. it may occasionally be necessary to state IV or V, but IV½ or between IV and V is not acceptable.

The entire range of earthquake destruction on a global scale is usually specified on a 12 point MM scale. A rough indication of equivalence between the points of the two intensity scales used in this paper is included in Table 1. It can be seen that Davison's scale is more sensitive with $I_D IX$ corresponding to $I_{MM} VI$. The MM scale is more widely used internationally.

The problem of defining an absolute magnitude to an earthquake, irrespective of the damage it does or does not cause, was first tackled by Richter in 1935 and is described in his excellent book (Richter, 1958). The terms intensity and magnitude are often confused: it is vital that they are correctly understood. Intensity describes the degree of damage or shaking which has occurred and this decreases with distance from an earthquake epicentre. The highest intensity associated with a particular earthquake is often quoted and the area of greatest damage or highest intensity is sometimes referred to as the meizoseismal area. Magnitudes are now commonly used to compare earthquake size globally and are designed to be independent of variations in population density and structural engineering. A magnitude is determined using measurements taken from a seismogram generated by a seismograph system designed to respond to ground vibration. There are several magnitude scales, including the best known Richter scale, which are logarithmic. A noteworthy British earthquake with a magnitude of, say, 3.4 has about one hundred millionth of the energy of the famous San Francisco earthquake of April 18 1906 which had a magnitude of about 8¼.

6



MERCATOR

DAVISON INTENSITY ID			
	UP TO		3.00
,	3.00	TO	4.00
,	4.00	TO	5.00
,	5.00	TO	6.00
,	6.00	TO	7.00
,	7.00	TO	8.00
,	8.00	OR GREATER	

The historical distribution of earthquakes reported to have occurred in Scotland. Symbol size is proportioned to the maximum intensity attributed to each earthquake or shock on Davison's intensity scale, ID.

Figure 1

Davison produced a comprehensive catalogue of British earthquakes, to 1924, which tabulate the highest intensity attributed to each. These data were supplemented for Scotland by Dollar (1949). The general distribution of historical earthquakes in Scotland, based on these catalogues, is shown in Figure 1. It is interesting to see that some of the largest Scottish earthquakes have occurred near Inverness, the largest known events being August 13 1816, September 18 1901, August 16 1934. The first of these was the strongest known to Davison to be felt in Scotland and was felt about 180km away in Edinburgh and Glasgow. These larger earthquakes are few in number (Burton 1978b). It is apparent that many of these earthquake epicentres or positions are taken up by those of small earthquakes in swarms near to Comrie and Menstrie. Richter (1958) has defined an earthquake swarm as "a long series of large and small shocks with no outstanding principal event", and in Scotland, the only series to satisfy this criterion are those at Comrie, Menstrie and Glenalmond.

SWARMS IN SCOTLAND AND ASSOCIATED DEVELOPMENTS IN SEISMOLOGY

The swarms at Comrie, Menstrie and Glenalmond are separate phenomena, and at Comrie and Menstrie more than one swarm has been observed. These swarms, particularly those at Comrie, attracted much contemporary attention and might be considered a major stimulus to the historical development of British seismology.

The Comrie Swarms

Most of our information comes from Davison (1924). Four separate sequences of earthquakes are known to have occurred near Comrie. The first series is thought to have started on November 11 1788 with an earthquake felt at Comrie, Crieff and adjacent towns. This earthquake was listed by David Milne (1841). In the following year activity apparently increased: during May unusual rumbling noises were heard by some people in the neighbourhood of Killin; near the end of August two or three shocks were reported felt at Dundurn, Dunira Lodge and Comrie. Taylor (1794) provided a description of swarm activity, which is comparable with observations made today. The three strongest shocks in this first series were:

November 5 1789	17.57 h	:	estimated I_D V
November 10 1789	15.00 h	:	estimated I_D V
November 11 1789	morning	:	no estimated I_D

- 8 The disturbed area associated with the event of November 5 may have been as large as 650km^2 . November 10 was market-day in Comrie and "The hardware exposed for sale in the shops and booths shook and clattered, and the horses crowded together with signs of unusual terror". Although only six shocks were listed by Davison for this swarm, contemporary writings suggest that the number of slight shocks and earthsounds at Comrie probably amounted to several hundred. Only eight events were reported during the four years following this swarm.

In 1794 the second swarm began on September 28. There were eight foreshocks from September to December before the first principal event on January 2 1795, which was felt up to 32km from Comrie. Three weeks later one slight shock preceded the stronger and principal shock which occurred on March 12. This was felt at Comrie as two shocks about three seconds apart, and felt up to 45km . The modern interpretation is that one earthquake produced the two felt shocks; earthquakes are now known to generate seismic energy which can be transmitted as different types of elastic wave motion travelling with different velocities: thus one source can produce shocks separated by a few seconds. Following this earthquake sixteen aftershocks were noted during the following year, but between April 1796 and November 1800 only thirteen slight shocks were experienced.

A third swarm lasted from December 1800 to October 1802. The first principal earthquake took place on January 11 1801, being felt over an area of about 3900 km^2 . The second and strongest principal earthquake took place on September 7 with an I_D of VII. This event ranks as one of the three strongest Comrie earthquakes and was felt in Edinburgh and Glasgow, the total disturbed area exceeding 7750km^2 . The epicentre lay close to Comrie where slates fell from roofs and parts of stone dykes fell. Aftershocks followed, the fourth occurring on October 18 1802. Thirty-seven 'quiet' years then followed with only occasional slight shocks.

Near quiescence was followed by the fourth and major series during October 1839 to November 1848. During 1839 twenty-five foreshocks, commencing October 3, foreshadowed the strongest of all Comrie earthquakes. On the evening of October 23 this occurred about 1km north of Comrie, producing an I_D of VIII. The felt area was about 69000km^2 including most of the Scottish mainland. In the meizoseismal area of greatest damage chimneys were demolished and dry stone dykes were thrown down. Near Amulree, 16km north of

Comrie, fissures were opened in the ground, one being about 180m long. People were so frightened that many of them sat up all night. By July 30 1841 aftershocks numbered 140, when the second principal earthquake (again of estimated I_D VIII) of the swarm took place. Several chimneys and walls were damaged within an area of 17km^2 to the west north-west of Comrie. Aftershocks numbered 83 before, on January 14 1844, the third principal earthquake took place. The felt area exceeded 1300km^2 , and although the maximum intensity is unknown, the seismometer which had by now been placed in Comrie Church steeple registered a vertical motion of 9.5mm. Again there were aftershocks, 69 by November 23 1848.

Although from December 1848 up to 1979 the record of activity in this area only contained 31 slight shocks, it should be noted that, in Davison's opinion, the total number of earthquakes felt and mainly associated with the swarms must have exceeded 1000. Davison stated that no other district contributed so largely to his catalogue. Those earthquakes with reasonably well-known epicentres were clustered in a 3km^2 region which lies about 3km east and 1.5km north-west of Comrie. These earthquakes have for many years been assumed to be produced by movements on the Highland Boundary Fault, which passes about 1.5km south-east of Comrie and probably dips steeply north-west towards Comrie along a thrust plane; the faulting in this region is complex (Allan, 1940).

The Pre-1979 Menstrie Swarms Near the Ochil Hills

There have been many small earthquakes felt in the "Hillsfoot" villages to the south of the Ochil Hills and north of the River Forth. The first documented earthquake had an I_D of VIII during April 30 1736, and was colourfully described as "a terrible earthquake along the Ochil Hills in Scotland, which rent several houses and put the people to flight". On the following day there was another of similar intensity, but between then and 1900 there were only seven more smaller earthquakes.

Details of annual catalogues of British earthquakes since 1967 are given by Burton and Neilson (1978).

A major swarm of 191 occurred between September 17 1900 and October 24 1916. The highest intensity earthquakes were September 21 1905 ($I_D = VI$), October 20 1908 ($I_D = VII$) and May 3 1912 ($I_D = VII$), with felt areas of 2600, 2600 and 1550km^2 respectively. The

- 10 last appears to have been the strongest with an epicentre about 3km north north-west of Menstrie. The unusual characteristic of these stronger earthquakes is that they were of higher intensity than would be expected for their small felt areas. Other British earthquakes of maximum intensity VII would probably be associated with a felt area of order 77500km². The most intense Menstrie event was felt over 2600km².

Dollar (1949) noted two small shocks during 1916 to 1949, but from 1949 until 1969 there was no known activity (Tillotson, 1974) in the Ochils area. The modern radio-linked seismometer network LOWNET was commissioned by the Institute of Geological Sciences in 1969 (Crampin et al, 1970) and this has recorded a number of small earthquakes in the area, particularly around Glendevon.

The Glenalmond Swarm

There were no earthquakes documented for Glenalmond until LOWNET recorded two events in February and October 1970. These were felt in the village of Methven, as were nearly all the succeeding events. During 1971 there were six earthquakes in April and three in August. Because these earthquakes were recorded by LOWNET it is therefore possible to assign an instrumental measure of magnitude to each earthquake in addition to estimates of intensity derived from local reports. The first principal earthquake with Richter local magnitude $M_L = 2.6$ took place September 7 1971. Although this was felt in Perth as well as Glenalmond the highest Modified Mercalli intensity was $I_{MM} = IV$ ($I_D = V$). On November 5 1971 a similar earthquake occurred with magnitude $M_L = 2.5$ and this was followed by nine aftershocks during November. The subsequent history has been five earthquakes during 1972, two in 1973, one in 1974, and one with $M_L = 2.4$ on November 26 1975. This comparatively high magnitude event was reported as felt in Methven only; its epicentre being west of the previous events. There were four other earthquakes during 1978. Crampin et al (1972) noted that the source area for most of these events was 5km from the Highland Boundary Fault.

DEVELOPMENTS IN BRITISH SEISMOLOGY ASSOCIATED WITH SWARM ACTIVITY

In parallel with these major earthquake swarms in Scotland have been associated developments in seismology which highlight the importance of competent amateurs in local studies. For example, Davison completed his major work whilst employed as a

schoolmaster. This concept of the amateur observer has perhaps been taken furthest by the Chinese (Scholz, 1977) in their attempts to predict earthquakes using mass observation, by an unskilled local population, of environmental phenomena. Much of the Scottish swarm activity stimulated developments in the organisation of observational seismology in Britain, and also paved the way for practical developments in the monitoring of seismic activity using increasingly sophisticated instruments.

Comrie earthquakes were first documented during 1789 to 1791 by Rev. Taylor of Ochertyre near Comrie. The Rev Gilfillan at Comrie continued this work until 1826. The British Association for the Advancement of Science took note of the 1839 Comrie earthquake and set up a Committee whose purpose was to register the earthquakes of Scotland and Ireland. In practice the Committee's work was almost entirely confined to the Comrie tremors during 1841 to 1844. David Milne (afterwards Milne-Holme) was secretary and he published a series of articles on British earthquakes which initially drew largely from Gilfillan's diary of Comrie tremors. The second part of Milne's work included a report of the earthquake of October 23 1839, which was the most detailed description of any single British earthquake up to that time. After 1844 MacFarlane, the village postmaster, and Drummond, a shoemaker, provided observations of Comrie shocks. MacFarlane built pendulums for detecting the shocks and tracing the direction of movement. He also drew up an early intensity scale with ten degrees of shaking: the highest degree corresponding to the most severe effects caused by the earthquake October 23 1839, the lowest to a shock just felt.

A problem for this early Committee was the lack of both adequate equipment and expertise. Indeed, it fell to Milne to originate the word seismometer! However, Professor Forbes designed an inverted pendulum seismometer, and by 1840 three seismometers had been set up in the Comrie district. The first was installed in the steeple of Comrie Parish Church and was an inverted pendulum measuring 10 feet 8 inches (328cm) in length. The second was also an inverted pendulum, 39 inches (100cm) long, at Comrie House. A common pendulum was installed at Garrichrew, 3km from Comrie. Seven new instruments were constructed in 1841 and again local enthusiasm was most apparent. There were four inverted pendulums, two vertical seismometers consisting of a horizontal bar fixed to a wall by a strong flat spring and weighted at the other end, and an instrument consisting of four glass tubes filled with mercury, each tube slightly turned up at the end. This last device, and one vertical seismometer,

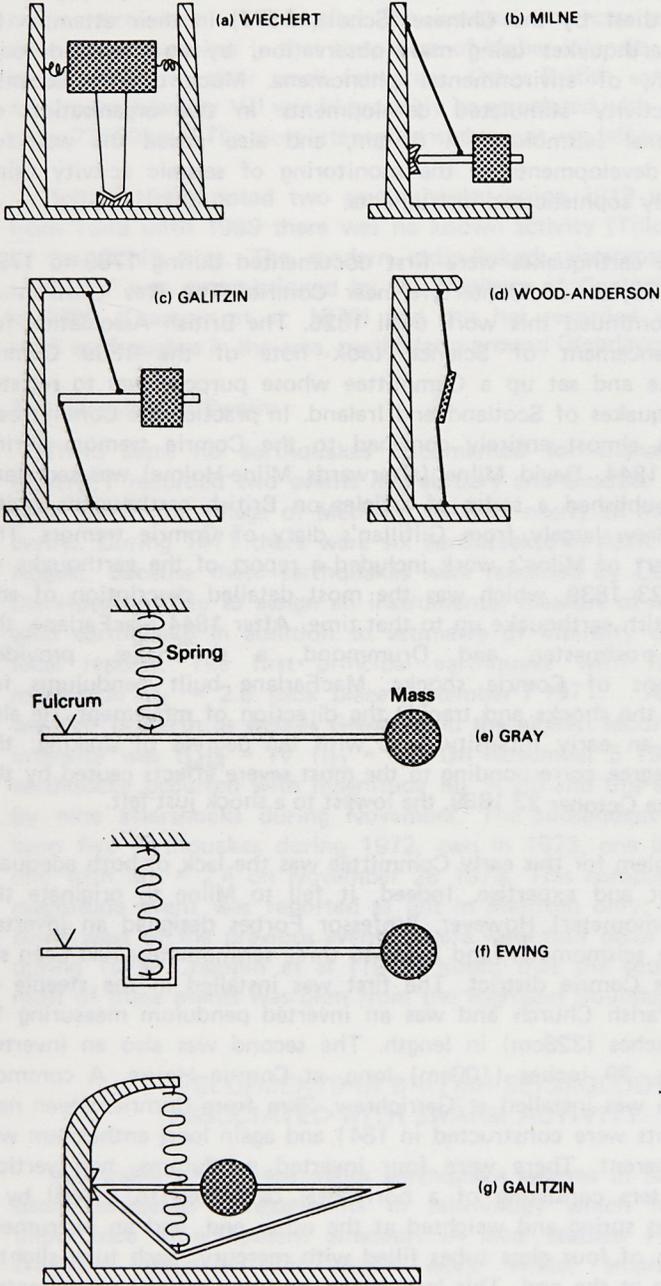


Figure 2 Various types of pendulum suspension incorporated into the classical horizontal (a to d) and vertical (e to g) seismometers. The pendulum mass is speckled in each suspension. (From John Milne, 1939).

were installed in MacFarlane's house in Comrie. Although most of these new instruments were installed around Comrie, interest was beginning to spread, and two instruments were installed at Kinlochmoidart in Argyll. Some of the various types of pendulum suspension which have been incorporated into classical seismometers are illustrated in Figure 2 which has been compiled from John Milne (1939 — Figures 16 and 17). Seismometers have become more sophisticated since these early days, but the fundamental principle remains unaltered. As Figure 2 illustrates, a pendulum mass is suspended from a frame and when an earthquake causes ground vibrations the inertia of the mass causes it to lag behind the motion of the frame. The relative motion between pendulum mass and frame is recorded as a seismogram by scratching a smoked sheet of paper, by ink on paper on a rotating drum, or photographically or recorded on a magnetic tape (Bolt, 1978). The seismometer and recording system constitute a seismograph. The pendulum principle is applied to record horizontal or vertical components of the ground shaking. Figures 2(a) — (d) illustrate horizontal pendulum suspensions where the mass swings from side to side, or rotates in the case of the Wood-Anderson suspension. Figures 2(e) — (g) show vertical pendulum suspensions where the mass moves up and down.

With decreasing swarm activity at Comrie interest waned and the Comrie Committee lapsed in 1876.

The Menstrie swarms occurred when it was possible for developments in seismology to be of a lasting and international character. They were catalogued by Davison; he and Professor John Milne were joint secretaries of the British Association for the Advancement of Science, Seismological Investigations Committee, and set up the first world network of seismographs. This Committee held its first meeting in 1896, and in July 1898 the first adequate seismograph was installed in the Coats Observatory, Paisley. The Royal Observatory Edinburgh installed its instrument in 1901. This was followed by installations at Eskdalemuir in 1907 and Aberdeen about 1926. One of these early seismograph systems can be seen in the Royal Scottish Museum Edinburgh, another is on display in the Science Museum London. Dollar (1949) continued Davison's work by cataloguing Scottish earthquakes after 1924, and by setting up the "British Earthquake Enquiry" in 1935.

This brings us to the modern era. In the early 1960s a large array of seismometers was installed by the United Kingdom Atomic Energy Authority at Eskdalemuir to help distinguish between earthquakes

14 TABLE 2 The parameters of earthquakes located by LOWNET in the Ochil Hills during 1969-78, prior to the swarm activity of 1979. Earthquake magnitudes M_L are estimated on the Richter Local Magnitude scale.

YEAR	DATE		TIME			LAT* NORTH	LONG WEST	MAG M_L
	d	m	h	m	s			
1969	22	02	18	11	24	56.11	3.98	
1969	04	06	17	37	15	56.13	3.89	1.3
1969	22	09	22	56	00	56.30	3.72	1.7
1969	22	09	03	36	10	56.14	3.65	1.6
1969	13	10	16	50	33	56.12	3.40	1.2
1969	22	10	15	29	56	56.22	3.85	0.6
1970	27	02	22	54	14	56.14	3.63	2.1
1971	22	01	08	38	38	56.13	3.82	1.4
1971	03	10	18	21	22	56.12	3.97	1.1
1971	03	10	19	14	27	56.15	3.93	0.7
1972	24	05	01	17	56	56.10	3.82	1.4
1972	08	07	22	40	53	56.09	3.51	1.2
1972	18	08	16	16	47	56.27	4.00	2.6
1972	18	08	23	03	34	56.29	3.99	1.7
1972	19	09	03	25	07	56.27	3.99	2.5
1972	31	10	04	57	03	56.17	3.71	0.6
1974	20	09	13	10	36	56.12	3.62	
1974	26	10	02	01	28	56.10	3.65	
1974	11	12	20	34	41	56.16	3.65	
1974	20	12	20	15	01	56.07	3.57	1.3
1974	20	12	20	21	30	56.13	3.63	1.4
1975	19	01	07	58	42	56.28	3.72	1.2
1975	12	02	21	59	42	56.12	3.53	0.7
1975	12	02	22	00	20	56.10	3.50	0.0
1975	12	02	22	00	51	56.10	3.50	0.2
1975	31	03	20	45	23	56.05	3.70	1.1
1975	08	04	02	03	45	56.07	3.67	1.0
1975	11	04	19	45	03	56.13	3.68	1.1
1975	29	05	19	04	36	56.23	3.65	1.0
1975	26	06	20	47	31	56.10	3.50	
1975	26	06	21	29	50	56.10	3.50	
1975	31	07	22	37	58	56.25	3.72	1.0
1975	25	09	19	57	47	56.10	3.83	0.5

* In tables 2, 3 and 4 decimal degrees are used.

YEAR	DATE		TIME			LAT*	LONG	MAG
	d	m	h	m	s	NORTH	WEST	M _L
1975	06	12	02	07	33	56.08	3.46	1.1
1976	17	01	00	51	47	56.15	3.62	1.3
1976	05	02	04	03	03	56.17	3.63	1.2
1976	03	03	20	46	01	56.15	3.64	1.7
1978	24	03	20	26	40	56.15	3.63	0.6
1976	31	03	00	10	01	56.15	3.64	1.2
1976	08	04	06	02	56	56.16	3.77	0.6
1976	21	04	22	12	43	56.14	3.63	0.9
1976	25	08	19	29	21	56.10	3.51	1.2
1976	27	08	00	00	19	56.18	3.72	1.2
1976	16	11	21	14	46	56.13	3.83	1.8
1976	22	12	19	07	39	56.15	3.62	0.6
1977	26	01	06	16	47	56.15	3.72	1.5
1977	24	02	23	05	28	56.10	3.60	0.6
1977	04	04	19	49	41	56.11	3.66	1.1
1977	19	04	21	32	48	56.16	3.50	0.3
1977	19	04	21	33	02	56.15	3.55	0.7
1977	20	04	04	16	05	56.11	4.04	0.3
1977	28	04	18	56	43	56.13	3.64	0.8
1977	03	06	01	27	22	56.11	3.81	2.6**
1977	21	06	20	39	10	56.13	3.67	0.7
1977	28	06	21	34	58	56.03	3.59	0.8
1977	08	07	17	06	41	56.10	3.81	2.0**
1977	26	09	19	42	07	56.14	3.87	1.4
1977	13	10	20	16	42	56.14	3.68	1.5
1977	27	10	01	00	38	56.16	3.64	0.8
1977	31	10	18	42	32	56.31	3.71	2.4
1977	01	11	13	35	00	56.11	3.99	2.3
1977	08	12	20	28	31	56.15	3.65	1.5
1978	10	03	04	37	56	56.15	3.67	1.1
1978	06	04	19	10	34	56.13	3.63	1.6
1978	19	04	09	20	10	56.17	3.76	
1978	12	10	19	54	05	56.24	3.74	1.6

** felt, Alloa area.

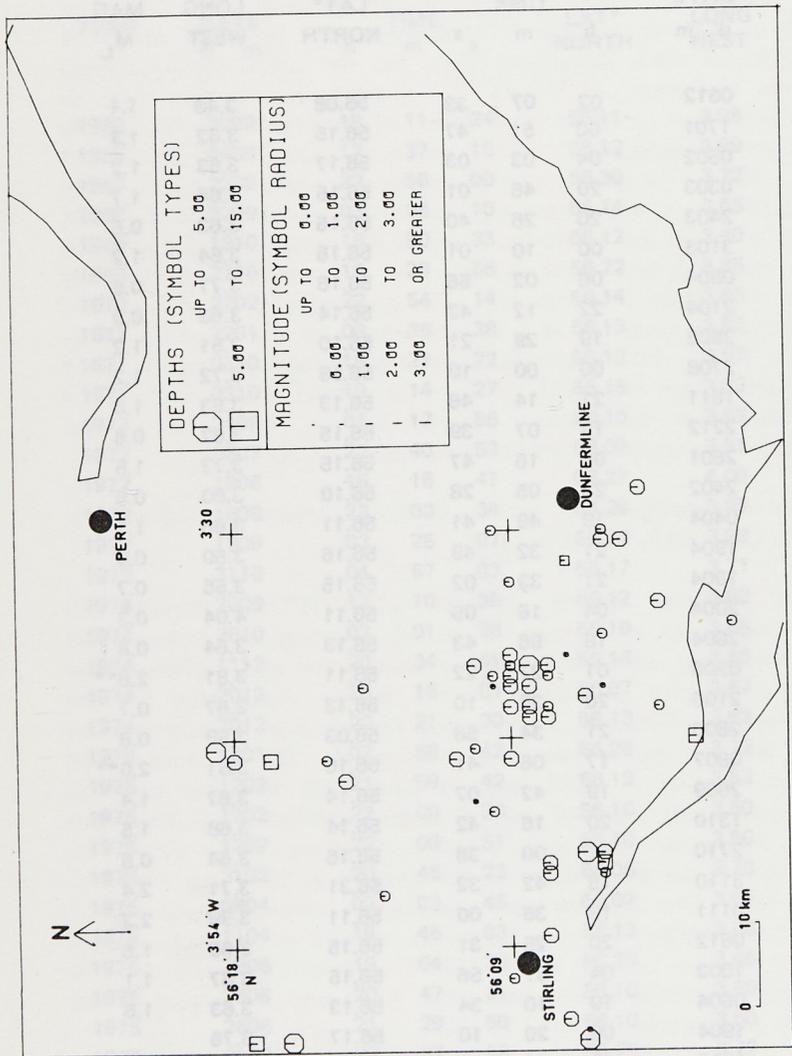


Figure 3 Earthquakes located, by LOWNET, in the Ochil Hills during 1969-78. Symbol size at each epicentre is proportional to the magnitude M_L on the Richter Local Magnitude scale.

and underground nuclear explosions at large distances. In 1967 installation of the Lowland Seismic Network (LOWNET) was begun by the Institute of Geological Sciences, and the stations were fully operational by 1969, and helped monitor the Glenalmond swarm during February 1970 to March 1972.

THE 1979 OCHIL HILLS SWARM

Since 1969 there have been tens of small earthquakes in the Ochil Hills area, background seismicity which in itself does not constitute a swarm. The parameters listed in Table 2 and plotted in Figure 3 were calculated by the Institute of Geological Sciences. The locations of earthquake foci were obtained instrumentally using seismic phase arrival time data read from LOWNET seismograms. Magnitude values are equivalent to the Richter Local Magnitude scale, although the seismometers in LOWNET are Willmore MK II's rather than Wood-Anderson's specified for California by Richter.

New swarm activity commenced on February 19 1979 with an earthquake of M_L 3.5 which to date has proved to be the largest in the series. The total number of earthquakes recorded now totals about 102 with 97 of these occurring during the three months of March, April and May following five in February. The parameters of these 102 earthquakes are listed in Table 2 and plotted in Figure 4; twelve have had a local magnitude of 1.0 or greater. The foci of many are extremely close together and cannot yet be distinguished.

The earthquake of February 19 alarmed many people. Reports from witnesses of this earthquake have allowed us to produce the macroseismic plot of intensities shown in Figure 5. Intensities have been assigned on Davison's scale which was largely designed to correspond to the earthquake effects felt and observed in this area. Indeed, this isoseismal map for the event of February 19 1979 shows considerable similarities to that drawn by Davison (1924) for the Menstrie earthquake of May 3 1912. Although the isoseismals of the recent earthquakes are of lower intensity, the general shape and location are similar. The different intensity isoseismals in Figure 4 are closer together in the south and more extended northwards. Epicentres based on macroseismic data are usually chosen as the centre of a particular isoseismal; often this corresponds to the centre of the highest intensity isoseismal, which can be perturbed or distorted by local soil conditions, and so for this recent earthquake the centres of isoseismals IV and V have been noted (Table 4) and are discussed later. A circle drawn through these two points labelled

18 TABLE 3 The parameters of swarm earthquakes during 1979 located by LOWNET in the Ochil Hills. Earthquake magnitudes M_L are estimated on the Richter Local Magnitude scale.

YEAR	DATE d m	TIME			LAT NORTH	LONG WEST	MAG M_L
		h	m	s			
1979	1902	11	39	33	56.24	3.74	3.5
	1902	19	26	29	56.24	3.75	0.3
	2102	21	26	10	56.25	3.73	0.7
	2102	21	33	5	56.25	3.73	0.3
	2702	15	36	18	56.19	3.79	0.8
	1303	18	38	12	56.25	3.73	0.1
	1403	19	53	35	56.25	3.73	0.6
	1503	22	2	13	56.26	3.71	1.3
	1803	20	28	25	56.25	3.73	0.8
	1803	22	40	46	56.25	3.73	0.8
	1903	5	39	13	56.25	3.71	0.9
	2103	3	41	54	56.25	3.74	2.1
	2103	4	17	3	56.25	3.75	0.2
	2103	4	18	12	56.22	3.73	0.3
	2103	19	51	11	56.27	3.68	1.0
	2303	11	52	56	56.24	3.74	1.2
	2303	23	25	41	56.25	3.73	-0.6
	2303	23	26	9	56.25	3.73	-0.1
	2403	0	19	26	56.25	3.73	0.2
	2403	2	38	45	56.22	3.72	0.7
	2503	0	9	33	56.22	3.74	0.7
	2503	5	24	37	56.24	3.74	1.1
	3003	22	16	53	56.24	3.74	0.0
	3103	0	12	43	56.24	3.74	0.2
	3103	0	17	53	56.24	3.74	-0.1
	3103	0	19	60	56.24	3.74	-0.6
	3103	0	38	2	56.24	3.74	0.1
	3103	1	0	49	56.24	3.74	0.4
	3103	1	1	18	56.24	3.74	0.7
	3103	1	33	17	56.24	3.74	-0.1
	3103	1	34	19	56.24	3.74	-0.6
	3103	9	32	15	56.24	3.74	0.2
	3103	9	48	2	56.24	3.74	0.6
	3103	9	48	28	56.24	3.74	-0.3
	3103	9	48	48	56.24	3.74	0.2
	3103	11	9	17	56.24	3.74	-0.2
	3103	11	10	11	56.24	3.74	-0.2
	3103	15	51	48	56.24	3.74	-0.4
	3103	15	53	7	56.24	3.74	-0.1
	3103	17	15	14	56.24	3.74	0.5
	3103	19	21	34	56.24	3.74	0.7
	3103	9	48	51	56.24	3.74	0.5

YEAR	DATE		TIME			LAT	LONG	MAG
	d	m	h	m	s	NORTH	WEST	M _L
1979	31	03	11	8	48	56.24	3.74	0.4
	10	4	20	49	9	56.24	3.74	0.8
	20	4	5	57	57	56.24	3.74	0.4
	20	4	6	8	23	56.24	3.74	-0.5
	30	4	6	9	60	56.24	3.74	-0.3
	40	4	6	41	15	56.24	3.74	0.5
	60	4	19	3	28	56.24	3.74	1.3
	60	4	20	20	49	56.24	3.74	0.2
	70	4	3	24	55	56.24	3.74	0.5
	70	4	5	0	1	56.24	3.74	1.3
	12	04	4	57	17	56.23	3.74	2.0
	15	04	1	7	53	56.23	3.74	-0.1
	15	04	2	20	56	56.23	3.74	-0.3
	15	04	3	15	55	56.23	3.74	-0.3
	15	04	4	42	22	56.23	3.74	-0.2
	15	04	5	7	34	56.23	3.74	-0.2
	15	04	5	10	56	56.23	3.74	0.5
	15	04	5	11	13	56.23	3.74	1.1
	15	04	5	39	8	56.23	3.74	-0.2
	15	04	5	59	58	56.23	3.74	0.1
	15	04	13	32	11	56.23	3.74	0.3
	15	04	22	40	7	56.23	3.74	0.0
	15	04	22	53	23	56.23	3.74	0.1
	16	04	3	18	36	56.23	3.74	0.0
	16	04	18	4	3	56.23	3.74	1.1
	16	04	18	18	52	56.23	3.74	-0.1
	21	04	20	24	47	56.23	3.74	0.8
	21	04	23	10	3	56.23	3.74	0.8
	21	04	0	11	31	56.23	3.74	0.5
	21	04	0	22	24	56.23	3.74	0.5
	21	04	1	45	50	56.23	3.74	0.6
	21	04	18	31	36	56.23	3.74	0.6
	23	04	22	38	29	56.23	3.74	0.1
	25	04	6	17	14	56.23	3.74	0.6
	30	5	21	42	49	56.23	3.74	0.1
	40	5	1	33	27	56.23	3.74	0.1
	40	5	3	4	17	56.27	3.71	0.3
	40	5	3	16	25	56.27	3.71	0.3
	50	5	5	17	41	55.94	3.11	0.4
	60	5	15	38	43	56.27	3.71	0.0
	60	5	16	43	24	56.25	3.74	2.5
	60	5	16	49	36	56.25	3.74	0.1

20 TABLE 3 The parameters of swarm earthquakes during 1979 located by LOWNET in the Ochil Hills (continued).

YEAR	DATE d m	TIME			LAT	LONG NORTH	MAG M _L
		h	m	s			
1979	605	16	55	5	56.25	3.74	0.2
	605	17	3	56	56.25	3.74	-0.1
	605	17	5	57	56.25	3.74	-0.9
	605	17	8	19	56.25	3.74	-0.2
	605	17	16	46	56.25	3.74	0.6
	605	17	42	46	56.25	3.74	0.7
	605	18	9	23	56.25	3.74	0.8
	605	18	18	18	56.25	3.74	0.2
	605	18	55	47	56.25	3.74	0.1
	605	19	2	57	56.25	3.74	-0.2
	605	19	29	34	56.25	3.74	-0.3
	605	20	41	38	56.25	3.74	-0.3
	605	23	18	23	56.25	3.74	0.5
	705	4	30	23	56.25	3.74	0.5
	705	6	23	9	56.25	3.74	-0.1
	905	22	51	52	56.25	3.74	-0.2
	1005	2	6	21	56.25	3.74	0.7

TABLE 4 Ochil Hill earthquake of 1979 February 19, epicentres located using macroseismic and instrumental techniques.

(a) Instrumental Epicentre

Seismic Phases Used in Computation	Latitude (deg)	Longitude (deg)
P only	56.252	- 3.732
P and S	56.235	- 3.741

(b) Macroseismic Epicentre

Isoseismal from which Epicentre Estimated	Latitude (deg)	Longitude (deg)
I = V	56.177	- 3.715
I = IV	56.186	- 3.699

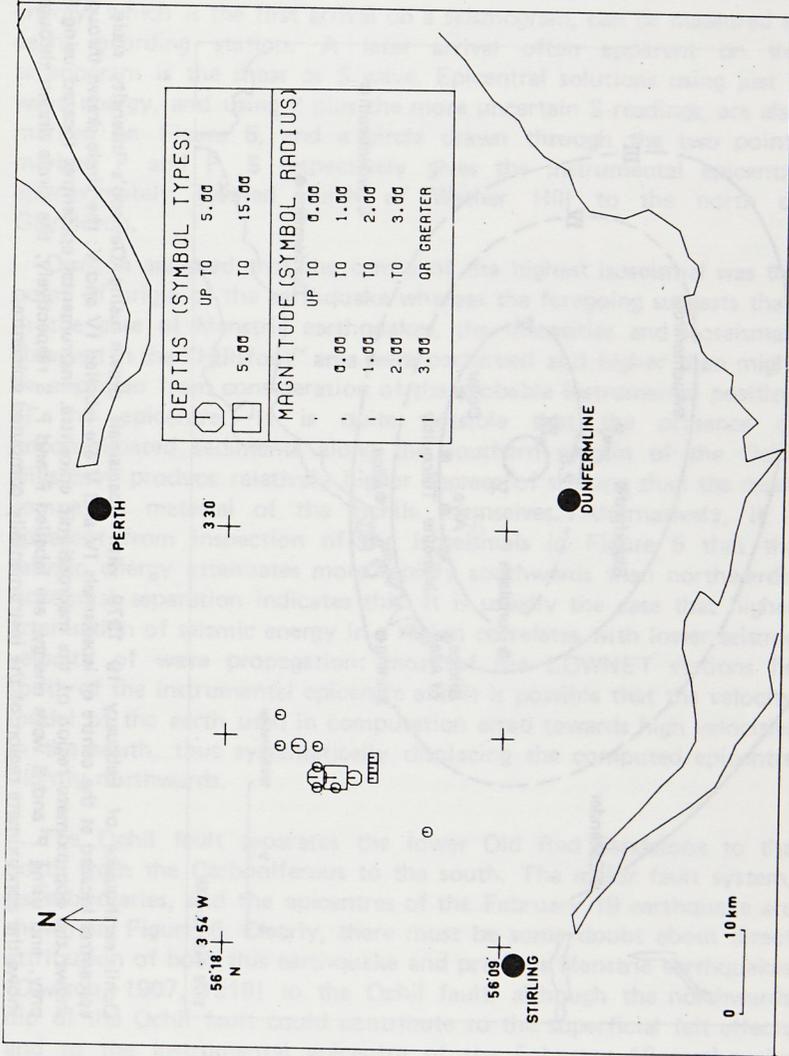


Figure 4 Swarm earthquakes during 1979 located by LOWNET in the Ochil Hills. Symbol size at each epicentre is proportional to the magnitude M_L on the Richter Local Magnitude scale.

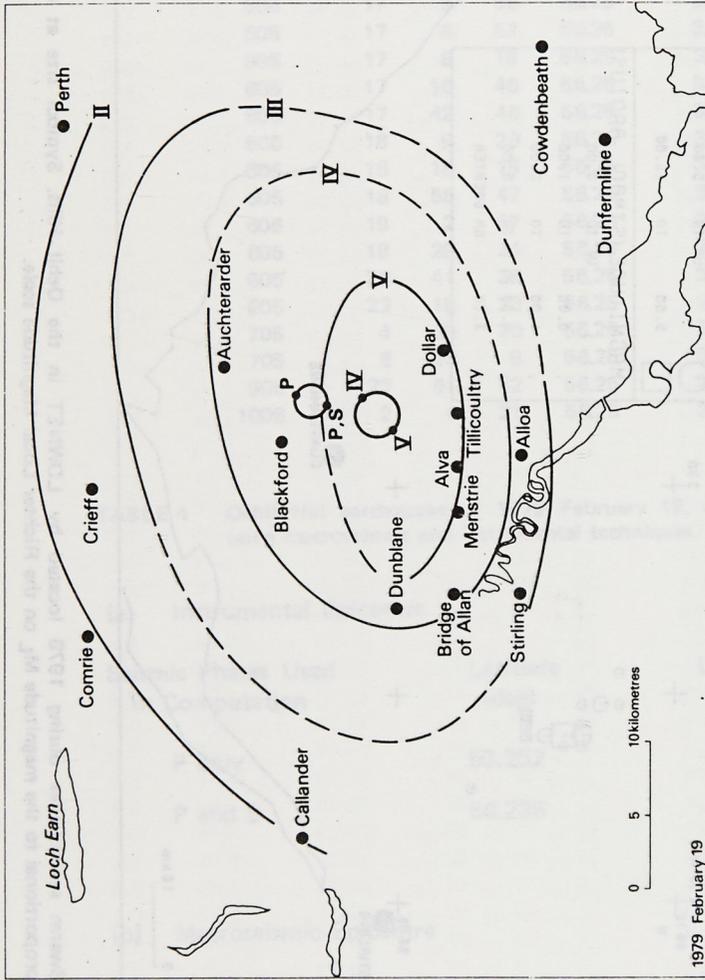


Figure 5

Ochil earthquake of February 19 1979 with isoseismals drawn using Davison's intensity scale. Macroseismic epicentres located at the centre of isoseismals IV and V are labelled IV and V; the circle drawn through these points shows the approximate region of the macroseismic epicentre. Instrumental epicentres located using P wave energy only, and using P and S wave energy, are labelled P and S respectively, the circle drawn through these points shows the approximate region of the instrumentally computed epicentre.

IV and V shows the macroseismic epicentre to occupy an approximate position in south Glendevon.

Analysis of the instrumental data provides the epicentral results in Table 4. Seismic energy travels as different types of wave motion through the earth and the arrival time of compressional or P wave energy, which is the first arrival on a seismogram, can be measured at each recording station. A later arrival often apparent on the seismogram is the shear or S wave. Epicentral solutions using just P wave energy, and using P plus the more uncertain S readings, are also marked on Figure 5, and a circle drawn through the two points marked P and P, S respectively gives the instrumental epicentre approximately located north of Wether Hill to the north of Glendevon.

Davison assumed that the centre of the highest isoseismal was the point of origin of the earthquake whereas the foregoing suggests that, in the case of Menstrie earthquakes, the intensities and isoseismals observed in the "Hillsfoot" area were perturbed and higher than might be expected from consideration of the probable instrumental position of the epicentre. It is quite possible that the presence of unconsolidated sediments along the southern margin of the Ochil Hills may produce relatively higher degrees of shaking than the more competent material of the Ochils themselves. Alternatively, it is apparent from inspection of the isoseismals in Figure 5 that the seismic energy attenuates more rapidly southwards than northwards; isoseismal separation indicates this. It is usually the case that higher attenuation of seismic energy in a region correlates with lower seismic velocity of wave propagation: most of the LOWNET stations lie south of the instrumental epicentre and it is possible that the velocity model of the earth used in computation erred towards high velocities in the south, thus systematically displacing the computed epicentre slightly northwards.

The Ochil fault separates the lower Old Red Sandstone to the north from the Carboniferous to the south. The major fault system, its subsidiaries, and the epicentres of the February 19 earthquake are shown in Figure 6. Clearly, there must be some doubt about direct attribution of both this earthquake and previous Menstrie earthquakes (Davison, 1907, 1916) to the Ochil fault, although the northwards dip of the Ochil fault could contribute to the superficial felt effects and to the instrumental epicentre of the February 19 earthquake being approximately 6km north of the main Ochil fault line.

Whatever the origin of these earthquakes, we know from the large

- 24 number of Ochil Hills' tremors observed on LOWNET during the earlier months of 1979 that this source produced estimates of magnitude which are lower in the near field compared to magnitudes determined from more distant stations. This may account for Davison's observation of the relatively small felt area of the earlier Menstrie events compared to their high intensities when contrasted with other British earthquakes. Clearly, these Ochil earthquakes are a potential source of further interesting local research.

ACKNOWLEDGMENTS

We are grateful to Jane Barker for guiding us to useful geological sources, and Matthew Armstrong for discussions on the Ochil Fault. This work was supported by the Natural Environment Research Council and is published with the approval of the Director of the Institute of Geological Sciences.

EDITORIAL NOTE

An earthquake, not related to the swarms discussed in this paper, was felt in Stirling, and many other places in southern Scotland, on December 26 1979. It is proposed to include a short paper on this event in Volume 5 of this journal.

REFERENCES

- ALLAN, D.A. 1940. The geology of the Highland Border from Glen Almond to Glen Artney. *Transactions of the Royal Society of Edinburgh* 60, 171-193.
- BALLORE, M. F. de MONTESSUS 1896. Seismic phenomena of the British Empire. *Quarterly Journal of the Geological Society*, 52, 651-668.
- BOLT, B.A. 1978. Earthquakes: a Primer. 241 pp. W. H. Freeman and Company, San Francisco.
- BURTON, P. W. 1978a. Assessment of seismic hazard in the UK. Proceedings of the conference "Instrumentation of ground vibrations and earthquakes", University of Keele, July 1977. Institution of Civil Engineers, London, 1978, 35-48.
- BURTON, P. W. 1978b. Perceptible earthquakes in the United Kingdom. *Geophysical Journal of the Royal Astronomical Society*, 54, 475-479.
- BURTON, P. W. and NEILSON, G. 1978. Annual catalogues and maps of British earthquakes recorded on LOWNET 1967-1976. Institute of Geological Sciences, Global Seismology Unit, Report No. 96.

- CRAMPIN, S., JACOB, A. W. B., MILLER, A. and NEILSON, G. 1970. The LOWNET radio linked seismometer network in Scotland. *Geophysical Journal of the Royal Astronomical Society*, 21, 207-216.
- CRAMPIN, S., JACOB, A. W. B., and NEILSON, G. 1972. The Glenalmond earthquake series, February 1970 — March 1972. *Nature*, London, 240, 233-236.
- DAVISON, C. 1907. The Ochil earthquakes of September 1900 to April 1907. *Quarterly Journal of the Geological Society*, 63, 362-374.
- DAVISON, C. 1916. The Ochil earthquakes of the years 1900-1914. *Proceedings of the Royal Society of Edinburgh*, 26 part III, 256-287.
- DAVISON, C. 1924. A History of British Earthquakes. 416 pp. Cambridge University Press.
- DOLLAR, A. T. J. 1949. Catalogue of Scottish earthquakes of 1916-1949. *Transactions of the Geological Society, Glasgow*, 21, 283-361.
- EIBY, G. A. 1966. The Modified Mercalli Scale of earthquake intensity and its use in New Zealand. *New Zealand Journal of Geology and Geophysics*, 9, 122-129.
- MALLET R. 1852—. Catalogue of recorded earthquakes from 1606 BC to AD 1850. *British Association Reports*, 1852, 1-176; 1853, 118-212; 1854, 2-326.
- MILNE, D. 1841—. Notices of earthquake-shocks felt in Great Britain, and especially in Scotland, etc. *Edinburgh New Philosophical Journal*, 31, 92-122, 259-309; 32, 106-127, 362-378; 33, 372-388; 34, 85-107; 35 (1843), 137-160; 36, 72-86, 362-377.
- MILNE, J. 1939. Earthquakes and Other Earth Movements. Seventh edition, revised by A. W. Lee. 244 pp. Kegan Paul, Trench, Trubrier, London.
- O'REILLY, J. P. 1884. Catalogue of the earthquakes having occurred in Great Britain and Ireland during historical times; arranged relative to localities and frequency of occurrence to serve as a basis for an earthquake map of the three kingdoms. *Transactions of the Royal Irish Academy*, 28, 285-316.
- RICHTER, C. F. 1958. Elementary Seismology. 766 pp. W. H. Freeman and Company, San Francisco and London.
- SCHOLZ, C. H. 1977. A physical interpretation of the Haicheng earthquake prediction. *Nature*, London, 267, 121-124.
- TAYLOR, Rev. R. 1794. An account of repeated shocks of earthquakes felt at Comrie in Perthshire. *Transactions of the Royal Society of Edinburgh*, 3, 240-246.
- TILLOTSON, E. 1974. Earthquakes, explosions and the deep underground structure of the United Kingdom. *Journal of Earth Sciences, Leeds*, 353-364.

26 WARTNABY, J. 1972. Seismological investigations in the nineteenth century, with special reference to the work of John Milne and Robert Mallet. PhD thesis, University of London.

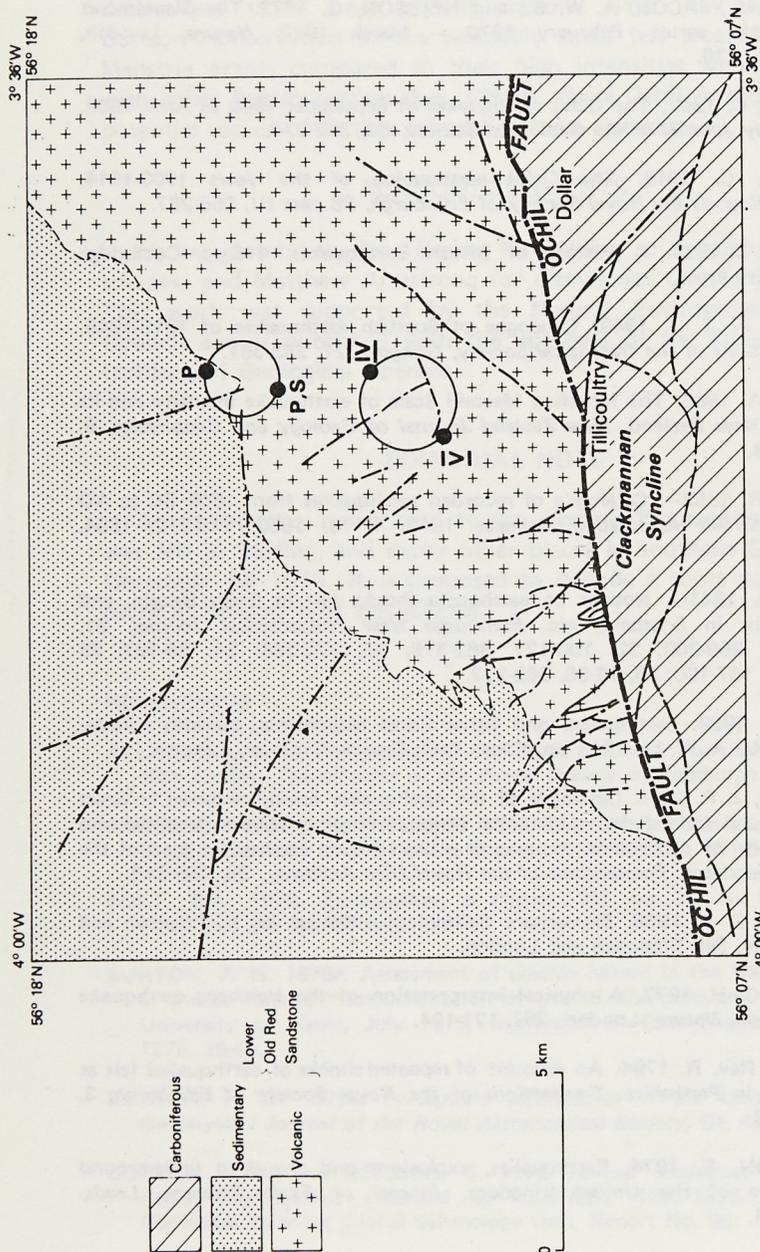


Figure 6 Major geological features of the Ochil Hills area (extracted from the Geological Survey of Great Britain (Scotland), Solid Edition, Sheet 39) in relation to the macroseismic and instrumental epicentres of the February 19 1979 earthquake. Epicentres are represented as described in the caption to Figure 5.

SOME ASPECTS OF THE CLIMATE OF CENTRAL SCOTLAND

27

J. S. Hopkins

Meteorological Office, Edinburgh

SUMMARY

Climatological data from a selection of stations in Central Scotland are quoted to show the variations in climate which can exist over quite small distances. Two long-term records of summer sunshine are presented to illustrate year-to-year variations and to emphasise the difficulties of identifying trends in climate from limited information.

DIFFERENCES IN SPACE

Table 1 shows a selection of summarised data from climatological stations in Central Scotland. These data can be used to demonstrate some of the complexities of local climate, and the consequent problems which have to be faced by the climatologist when he is asked to estimate climate characteristics at sites where no data exist.

Most of the stations in Table 1 have full records of daily temperature extremes over the 10 year period 1968-77, but values have been enclosed in brackets to indicate that estimation of one or two years' values has been necessary to complete the decade. Three of the stations are maintained by the Meteorological Office, and the remainder by other organisations who co-operate by sending their data to the Meteorological Office each month. Stations are inspected regularly by Meteorological Office staff and their data are subjected to rigorous quality-control checks to ensure that standards are maintained.

The mean annual maximum (and minimum) temperature shown is the average of the highest (and lowest) air temperatures attained in each of the 10 years, and the number of days of air frost is the number of occasions on which the daily minimum air temperature was below 0°C.

Looking first at the mean annual maximum temperatures, it can be seen that stations with the highest values (Stirling, Paisley, Coatbridge, etc.) are all some distance from the coast and so in general do not experience the moderating influence which sea breezes

28 can have on summer daytime temperatures. The lowest value (Earl's Hill) demonstrates the altitude effect on maximum temperatures, and comparison with the Stirling value implies a decrease of over 1°C per 100m increase in altitude.

Annual minimum temperatures are much more geographically complex. Lowest temperatures are achieved with light winds under clear skies, when heat can be lost readily by long-wave radiation from the earth's surface to space. Cold air is denser than warm air, so as the surface layer of air cools by radiation loss, it tends to flow down into any low-lying area, which accordingly experiences much lower temperatures than nearby elevated sites. Thus, the climatological station in the valley of the River Almond at Livingston experiences lower temperatures than other stations in Central Scotland, as does Kinross which is surrounded by hills.

It will be noted that the observing site at Paisley usually does not experience very low temperatures, largely because it is in the centre of an urban area. The urban fabric has a greater capacity than rural surroundings for heat absorption during the day and subsequent release at night and, also, the contribution of domestic and industrial heat in a densely-populated area is significant in keeping night-time temperatures up. It should be mentioned, however, that in weather conditions which are extremely favourable for night-time heat loss, temperatures can fall appreciably; a minimum temperature of -13.9°C was recorded at Paisley on the morning of 13th January 1979 — the lowest recorded there since 1895.

Surprisingly, the mean annual minimum temperature at Earl's Hill is of the same order as that measured at the two Stirling stations. In general, stronger winds at the hill-top level ensure that the surface layers of air are kept well-mixed with air from above, and so the persistent cooling of air near the surface is avoided. Also, when calm and clear conditions prevail, cold air can readily drain away down the hill, and so very low temperatures are unable to develop.

Coming now to the number of days of frost experienced at these stations, it can be seen at once that Earl's Hill has the highest frequency, as might be expected from its altitude, and Kinross also returns a high value, on account of its low-lying position relative to surrounding hills. The site at Paisley has only 35 days of frost on average, as a consequence of its urban surroundings.

It should be clear from the above discussion that variations of

climate can occur on any space scale. Proximity to the coast and topography determine the basic pattern of spatial variation, which can be depicted on a small scale map in a reasonably coherent way, but then there is a superimposed variation due to immediately-local topography and nature of terrain, which cannot be so depicted, even on a large-scale map, because of the sparse nature of the observing network. In a country as topographically complex as Scotland, the precision with which we can formulate a numerical description of the climate at any point is less than we would wish. To meet the continuing demand for advice on climate because of its relevance to agriculture, the construction industry and energy consumption, there is a continuing need for high quality data to be gathered from as wide a range of sites as possible, so that in time a better quantitative understanding can be achieved of the relationships between a site's climate and its geographical and physical characteristics.

DIFFERENCES IN TIME

Turning now to differences in weather experienced from year to year, sunshine records taken from Paisley and Edinburgh for the popular holiday months of June to August illustrate the nature of the data. These stations began to record durations of bright sunshine in 1885 and 1900 respectively, and so show well the year-to-year variability which is a characteristic of a mid-latitude maritime climate. Other weather elements, such as temperature and rainfall, exhibit similar year-to-year variations.

Given the large variability evident in Figure 1, it is clearly very difficult to identify 'trends' in the record. A limited study of the summer sunshine values at Paisley over the 4 year period 1974-77 (or at Edinburgh during the period 1973-76) might have led to the injudicious conclusion that the summer climate of Central Scotland was subject to a rapid year by year improvement, but a glance at the climatic history since the beginning of the century surely emphasises the impossibility of identifying trends possessing any predictive potential. For most planning purposes, it is valid to consider the values as a statistical sample conforming closely to a normal distribution. This distribution predicts that 4.6% of values can be expected to lie more than 2 standard deviations away from the mean; in the period 1901-79, 5 such values at Edinburgh (1911, 1955, 1976 sunny and 1912, 1931 dull) and 3 at Paisley (1919, 1955 sunny and 1912 dull) were observed compared with the 'expected' number of 3.6.

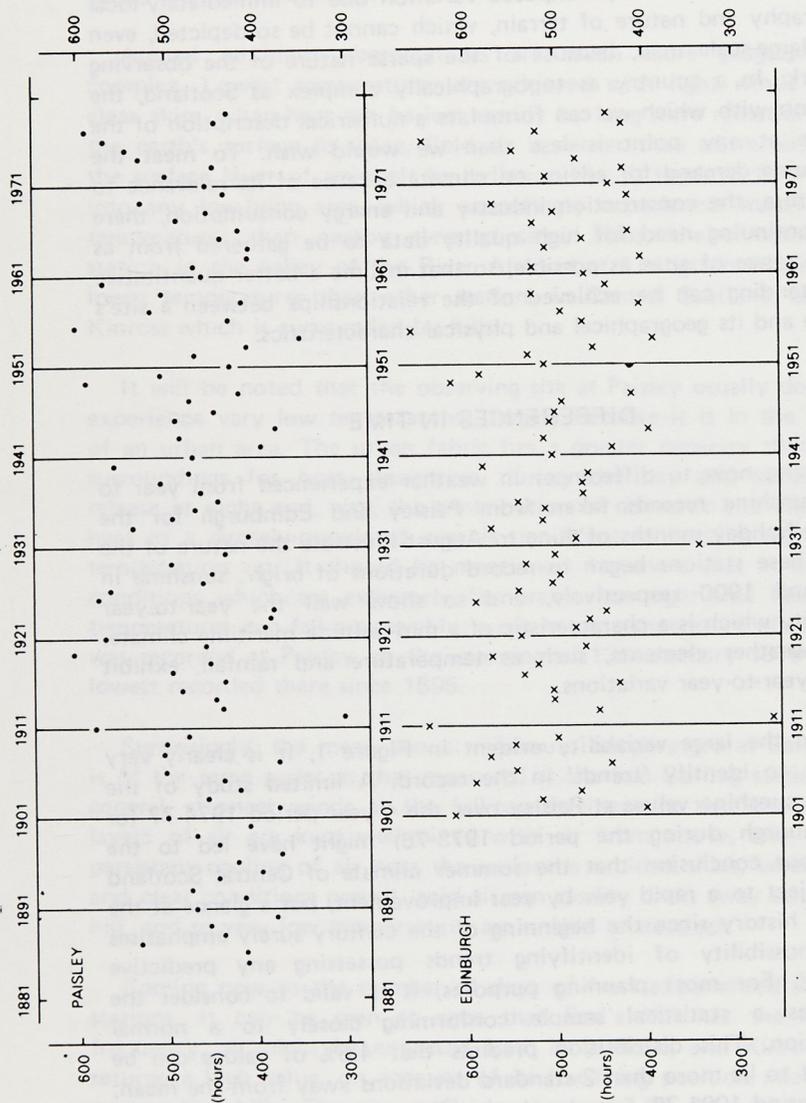


Figure 1 Durations of bright sunshine (hours) in the summer months (June to August) measured at Paisley (Coats Observatory) and Edinburgh (Royal Observatory, Blackford Hill).

Station	National Grid Reference	Altitude (metres)	Temperature ($^{\circ}\text{C}$) mean annual:		Annual mean no. of days with air frost
			maximum	minimum	
*Abbotsinch (Glasgow Airport)	NS 480 667	5	27.4	-8.9	59
Ardalnaig	NN 702 394	130	27.5	-6.8	54
Callander	NN 634 080	107	26.8	-8.5	73
Coatbridge	NS 712 643	78	(27.6)	-8.8	54
Drummond Castle	NN 841 177	113	(25.8)	(-9.1)	(76)
Earl's Hill	NS 725 882	335	24.7	-7.5	84
Falkirk	NS 902 820	3	26.5	-7.8	52
Glasgow (Springburn Park)	NS 608 686	107	27.1	-7.0	48
Kinross	NO 125 033	116	25.8	-10.5	82
Livingston	NT 035 659	125	(26.8)	(-11.0)	(74)
Paisley	NS 478 642	32	27.9	(-6.1)	35
Parkhead (Stirling University)	NS 812 972	107	(27.6)	(-7.5)	(53)
*Pitreavie	NT 117 848	40	25.9	-6.2	43
Perth	NO 101 239	23	27.1	-9.1	65
Sloy	NN 321 098	12	26.2	-7.1	41
Strathallan	NO 090 185	41	26.7	-8.4	61
Stirling	NS 786 925	38	28.1	(-8.0)	62
*Turnhouse (Edinburgh Airport)	NT 159 739	35	26.4	-9.3	58

*denotes Meteorological Office stations

TABLE 1 Temperature Data from Climatological Stations in Central Scotland

The reasonably high correlation between the two series (correlation coefficient of 0.78 over the period 1901-79) implies that the principal factor determining summer sunshine is a large-scale one affecting both Paisley and Edinburgh simultaneously. This can be identified as the presence or absence of persistent anticyclonic conditions giving clear skies over central Scotland. In the few years when conditions in the east and west are not similar (e.g. 1905, 1936, 1960, 1964, 1977), a secondary local factor can usually be recognised as overriding the primary one. For example, easterly winds from a cool North Sea may bring persistent seafog or *haar* to Edinburgh while Paisley experiences cloudless conditions.

A spell of a few years' weather particularly favourable for a specific activity may, paradoxically, result in economic loss in the longer term. It is clear from the nature of enquiries coming to the Meteorological Office that a series of mild winters or 'good' summers, for example, can lead to changes in procedure in practical fields such as the building industry and agriculture. It would seem that experience of a sequence of several mild winters in the early 1970s led to a relaxation by builders of precautions against frost damage to materials. Consequently, when winters became rather more severe again (1976/7 and subsequently), considerable losses were sustained because the relaxed protective measures proved inadequate. In agriculture, a run of sunny summers may perhaps lead farmers to expand grass/hay production in the expectation that the crop can easily be dried before storage. A subsequent return to average or dull summers may result in difficulties over crop drying and some consequent financial loss. In other words, the viability of a weather-sensitive enterprise may be dependent not only on the average conditions likely to be experienced but also on the variability from year to year.

THE FRESHWATER FISH FAUNA OF THE FORTH AREA

33

Peter S. Maitland

Institute of Terrestrial Ecology, Edinburgh

INTRODUCTION

The Forth area contains a great variety of freshwater habitats including most of the types occurring in the British Isles. Its running waters range from small burns which are common all over the area and usually drain, through numerous streams and small rivers, to the estuary of the Forth, or directly to the sea itself. The River Forth is one of the largest of Scotland's rivers and dominates the area discussed here. Standing waters range from small pools (which may be brackish in coastal areas), through numerous lochans and lochs to very large areas of water like Loch Leven and Loch Katrine, which are among the largest lochs in Great Britain.

In past papers dealing with the flora and fauna of the Forth area, a variety of boundaries have been chosen to define the area concerned, some authors choosing county boundaries, others watersheds or a combination of the two. In this account, the area dealt with is that under the present jurisdiction of the Forth River Purification Board (1976), and includes the total catchment of a watershed starting to the north of the Firth of Forth at Fife Ness and finishing to the south of the estuary at Reed Point.

The Forth area geographically includes parts of the three main divisions of Scotland — the Highlands, the Midland Valley and the Southern Uplands. In the Highlands, agricultural ground is confined mainly to the valley bottoms and fringes of the lochs; the human population is sparse and tending to decrease. In the Midland Valley the presence of the Forth estuary, the underlying carboniferous rocks (containing coal and iron) and the fertile agricultural soil have all combined to make this a very densely populated district. The Southern Uplands have weathered into rounded hills covered with grass in most places. Much of this land is used for sheep farming, though an increasing amount of the hill ground is being afforested. On the lower slopes more intensive agriculture is carried out. It is clear from the great variety of catchments available that the nutrient chemistry of the waters in the area will vary greatly from place to place.

As part of a current study of the nature and classification of freshwater ecosystems in Great Britain (Maitland 1979a), considerable data are now available on the numbers and distribution of standing and running waters (Smith and Lyle 1979). The information for the Forth area, which is made up of Hydrometric Areas 17, 18, 19 and 20, is discussed below. In addition to the conventional running and standing waters (the latter taken here to include reservoirs) the area also includes the estuary of the River Forth and the Union and part of the Forth and Clyde canals.

The ecology of the Forth estuary has recently been discussed by McLusky (1978), who notes that the estuary proper stretches for about 48 km from Stirling to Queensferry and is subject to regular tidal fluctuations, with a graduation of salinity from fresh to salt water. Various physico-chemical aspects of the estuary have been described by Collett (1971), Stout (1976) and others. It was formerly the site of several important fisheries (Thomas and Saville 1972), a number of which have declined or disappeared in recent years. The fish entrained at power stations in the estuary are at present being studied in some detail by the author and will be discussed in a future paper.

The total number of river systems and streams shown on the 1: 625,000 O.S. maps has been counted and tabulated by Smith and Lyle (1979). There are 13 1st order, three 2nd order, three 3rd order and one 4th order systems in the area making a total of 20 different running waters entering the estuary and sea within the Forth area. The more important of these are shown in Figure 1. Each of these systems is made up of several branches and there are 71 1st order, 19 2nd order, seven 3rd order and one 4th order streams, giving a grand total of 98 for the area as a whole — as shown on the 1: 625,000 maps.

The total number of lakes and reservoirs shown on the 1: 250,000 O.S. maps has also been counted and tabulated by Smith and Lyle (1979). The majority of these standing waters is small — 79 being less than 0.25 km² in surface area and only 36 greater than this. Of the larger waters, 13 are more than one km² and only three greater than four km². The total of 113 standing waters for the area as a whole does not include the very many waters less than five ha which occur throughout the area but are not usually shown on the 1: 625,000 maps.

The Forth and Clyde Canal runs from Grangemouth to Bowling, thus connecting the two large estuaries after which it is named, with a waterway whose total length is some 56 km (Lindsay 1968). The summit of this canal, which was opened in 1790, extends from Stockingfield to Castlecary at a height above sea level of about 47 m. There are 20 locks east of this and 19 west of this. The Union Canal, which connects Edinburgh with the Forth and Clyde Canal near Falkirk, was opened in 1822 and has a total length of 50 km. Both canals were closed to navigation in the early 1960's, and are now used mainly for recreation or to supply water for industry. The role of these canals in the dispersal of fish in Scotland is discussed below.

FISH

There is a considerable, but mainly scattered, literature dealing with various aspects of the fish fauna of the Forth area. Several valuable old accounts are available along with a few short notes concerning only one or a few species. The estuarine community has been discussed on a number of occasions. The definition of what constitutes a freshwater species of fish is always an arbitrary one and this account follows the list of freshwater species in the British Isles proposed by Maitland (1972).

The most valuable general accounts of the fish of the area are those of Parnell (1838) and Rintoul and Baxter (1935). Many older records for different parishes in the area can be found in the Old Statistical Account of Scotland (e.g. Dobie 1795) while some specific studies deal with only one loch (e.g. Burns-Begg 1874) or one species of fish (e.g. Calderwood 1921). There are a number of brief notes on the distribution or introduction of various species (e.g. Evans 1892). A total of 28 species occurs in the area, compared to 54 for the British Isles as a whole and 40 for Scotland. Nine of the Forth species are native and mainly estuarine, 16 are native and mainly or entirely freshwater in habit, while three species have been introduced from North America or mainland Europe.

Petromyzonidae

Petromyzon marinus Linnaeus, 1758. Sea Lamprey. This species was recorded by Parnell (1838) as being not uncommon above Alloa. The same comment is made by Rintoul and Baxter (1935) who

record it also near the mouths of the Rivers Almond and Esk, and off St. Abb's Head. However, there are no recent records and thus, as in many other parts of Britain and Europe (Maitland 1980), the sea lamprey may well be a rare species and no longer breeding in the Forth area.

Lampetra fluviatilis (Linnaeus, 1758). River Lamprey. Recorded by Parnell (1838) and Rintoul and Baxter (1935) as being frequent in the rivers of the Forth area, this species still appears to be a relatively common one there. Certainly considerable numbers have been recorded at Kincardine by Sharman (1963) and by the author (in 1979). These have included both transformed larvae migrating downstream in the spring to feed in the sea and mature adults migrating upstream in the autumn and winter to reach their spawning grounds by the spring.

Lampetra planeri (Bloch, 1784). Brook Lamprey. Parnell (1838) records this species as being 'occasionally met with' in the Rivers Forth, Teith and Allan. It is actually quite common over much of the Forth area and probably occurs in most of the larger unpolluted streams and rivers. Recent records by the author include specimens from the Gairney Burn (inflowing to Loch Leven) and the River Tyne near Haddington. Since it does not migrate to the sea, it is the only lamprey occurring above major obstructions and polluted stretches in rivers.

Acipenseridae

Acipenser sturio Linnaeus, 1758. Sturgeon. Occurring in Scottish waters only as a vagrant from adult stocks breeding elsewhere in Europe, this species is recorded by Parnell (1838) as being taken every few years in the salmon nets at Musselburgh or Queensferry. One specimen was recorded as far upstream as Alloa. There are no recent records for this species though it probably still occurs from time to time in the Forth estuary.

Clupeidae

Alosa alosa (Linnaeus, 1758). Allis Shad. This species was of rare occurrence in the Firth of Forth according to Parnell (1938) who recorded only two specimens, one from the salmon nets at Musselburgh the other 'along with herrings, at the mouth of the Firth'. There are no recent records.

Alosa fallax (Lacepede, 1803). Twait Shad. Commoner in the Forth area than the allis shad, this species is recorded by Parnell

38 1838) as entering the Firth of Forth in tolerable numbers towards the end of July 'and dozens are then taken in the salmon-nets, at almost every tide, but after August we lose sight of them until the following season'. There are no recent records.

Both species of shad are noted by Maitland (1979b) as becoming rarer in the British Isles, mainly due to pollution and river works.

Salmonidae

Salmo salar Linnaeus, 1758. Salmon. Although never regarded as one of the better salmon rivers, the River Forth has always had a reasonable population of salmon. The species was formerly much more widespread than at present, for instance Reid (1792) records it in the River Leven and Scott (1794) in the River Esk — in both systems the species is now absent due to pollution. Parnell (1838) describes the stake-net fishery on the Forth estuary as being most successful in July 'when it is not an uncommon occurrence to take from 50 to 80 (salmon) at each tide successively for a fortnight'. These fish went mainly to the Edinburgh market. This fishery still operates, but at a reduced level, and there is also a rod fishery on the River Tyne, the River Forth and some of its major tributaries. The maximum annual catch from 1952-60 was about 33,000 kg (1952); about 82% of this was taken by net and coble in the estuary or lower reaches of the Forth, about 12% by rod and line and about 6% by fixed engines on the coast (Thomas and Saville 1972).

Salmo trutta Linnaeus, 1758. Trout. Regarded by Parnell (1838) as a common species with several varieties, this is possibly the most abundant and widespread species in the Forth area, and occurs in most unpolluted waters where suitable spawning conditions are available, but not too many predators. Thus they occur in all the small highland burns and the many clean streams and rivers in the area, as well as many small lochs and all of the larger ones. The brown trout, *Salmo trutta fario*, occurs in most waters except the estuary, while the sea trout, *Salmo trutta trutta*, is found in the estuary and accessible streams. A very important sport fish, notable fisheries for brown trout exist at most of the large lochs in the Forth area, e.g. Lochs Leven, Carron, Menteith, Katrine, etc. The population in Loch Leven has been studied by Thorpe (1974) and others: the adult stock there between 1968 and 1972 ranged from 48,800 to 126,700 fish, with an annual production of 5,700 to 25,700 kg. In the Forth Fishery District as a whole, the maximum annual catch of sea trout from 1952-60 was about 4,300 kg (1955) (Thomas and Saville 1972).

Salmo gairdneri Richardson, 1836. Rainbow Trout. Introduced from North America about 1884 when a good breeding stock was established near Howietown (Maitland 1887), this species has been widely stocked in Scottish waters over recent years and occurs in a number of lochs in the Forth area. Rarely self-sustaining, these populations mostly require regular stocking in order to survive. This fish is also the principal species cultivated at several of the fish farms occurring in the Forth area. Fish recently stocked in the Lake of Menteith (Stuart 1968) have been recorded as spawning successfully there.

Salvelinus alpinus (Linnaeus, 1758). Charr. Found mainly in clear lochs in the highland area of Scotland, particularly the north-west, this species occurs in only a few waters in the Forth area. It was formerly common in Loch Leven (Burns-Begg 1874), but following the lowering of the water level there in 1830 the species disappeared. It was recorded in Loch Katrine by Calderwood (1921). It occurs too in Loch Lubnaig (Robertson 1794), where it is common and regularly caught by anglers. Records are also available from Lochs Achray, Vennachar, Doine, Voil and Dochart. Further verification of these would be useful. Though charr are rarely eaten now in Scotland there was formerly a tradition of doing so in the Forth area. Robertson (1794) in discussing the Loch Lubnaig charr says that 'when pickled are found to equal any from the lakes in the north of England'.

Salvelinus fontinalis (Mitchell, 1815). Brook Charr. This species was originally introduced to the British Isles from North America around 1869 and several fish hatcheries (including the one at Howietown) kept stocks during the late 19th century (Maitland 1887). Though few records are available it was probably stocked in a number of lochs in the Forth area, but the only known water where the species still exists is a small loch near Balquhiddy (D. L. Burkel pers. comm.). It was quite common here during the 1970s.

Osmeridae

Osmerus eperlanus (Linnaeus, 1758). Smelt. This species was formerly a common one in the Forth estuary and the lower reaches of rivers there. It is recorded from the River Almond by Wood (1791), while Parnell (1838) notes that it was abundant in the River Forth near Alloa. He describes it as being taken in great numbers, especially in autumn when the fish are small. Larger ones appear in the spring and in March ascend the river in shoals to spawn about 3 km below Stirling Bridge when 'every stone, plank, and post appears to be covered with their yellowish-coloured ova'. The smelt (or

sparling as it is sometimes called) was much esteemed as a luxury for the table and 'numbers are sent to the Edinburgh market where they receive a ready sale'. The population appears to have declined rapidly since that time, and though some were recorded by Sharman (1963) none have been recorded in any of the collections taken recently by the author.

Esocidae

Esox lucius Linnaeus, 1758. Pike. Rintoul and Baxter (1935) note that 'as long ago as 1521 John Major says pike were common in the Forth area' and during the late 19th Century contributors to the Old Statistical Account of Scotland recorded this species from Loch Leven (Smith 1793), Kilconquhar Loch (Pairman 1796), Loch Tilly (Reid 1792), Linlithgow Loch (Dobie 1795), the River Leven (Reid 1792), River Allan (Robertson and Stirling 1793), River Forth (Tait 1793), River Devon (Osburn 1795) and the River Teith (Robertson 1796). Parnell (1838) records it as a common species, mentioning its occurrence in Duddingston and Lochend Lochs and that it is 'frequently seen in brackish water' in the Forth estuary. It is still a common and widespread species in the area, especially in the lower-lying richer lochs, rivers and in the canal system.

Cyprinidae

Cyprinus carpio Linnaeus, 1758. Carp. Though originally an introduced species the carp is now common in many waters in the south of the British Isles. In Scotland, though it has been introduced on a number of occasions, populations appear only rarely to have become established. The species is not mentioned by Parnell (1838), but Rintoul and Baxter (1935) note that it was introduced to Duddingston Loch by the Earl of Abercorn before 1795. Populations are known to exist in a few waters in the Forth area (e.g. Danskin Loch), but the species is by no means common.

Tinca tinca (Linnaeus, 1758). Tench. Like the carp, this species is common in waters in the southern part of the British Isles but rare in the north. It has been introduced in a number of places in Scotland, but appears to have become established in only a few sheltered lochs. The tench is not mentioned by Parnell (1838) though Day (1880) mentioned that 'a few are found near Edinburgh'. Clarke (1900) notes that the ponds in Gosford Park hold this species and Rintoul and Baxter (1935) record that they were introduced to Gosford Park and to Pressmennan and Duddingston Lochs before 1795. There are only a few recent records — all from ornamental ponds on estates.

Phoxinus phoxinus (Linnaeus, 1758). Minnow. First mentioned in the area by Robertson (1794) and noted by Parnell (1838) as occurring in all Forth rivers, this species is still a widespread one and is found in most unpolluted streams and rivers and in those lochs which have suitable spawning grounds available — either on wave-washed shores or in tributaries. Campbell (1974) has made a study of the parasites of this species in Loch Leven.

Rutilus rutilus (Linnaeus, 1758). Roach. Parnell (1838) records that the only known locality in the area for this species was the Union Canal, while Rintoul and Baxter (1935) mention this site and Linlithgow Loch. Roach are still common in the Union and the Forth and Clyde Canals and have also been recorded in numbers in the lower reaches of the Rivers Almond and Tyne, in the Lake of Menteith (Stuart 1968) and in Humble Reservoir (Mills 1971). Two specimens were collected a number of years ago in Loch Leven, but the species does not seem to have become established there. The species is netted regularly in the River Tyne and large numbers are transported to England in order to stock coarse fisheries there.

Cobitidae

Noemacheilus barbatulus (Linnaeus, 1758.) Stone Loach. Noted by Parnell (1838) and Rintoul and Baxter (1935) as occurring in all Forth rivers, this species remains a common one in the area. It is found in considerable numbers in most running waters except those which are badly polluted or of difficult access in the highland areas. It also occurs in lochs with suitable spawning tributaries (e.g. Loch Leven). Recent records by the author are from the Rivers Tyne and Almond, the Water of Leith and the Gogar Burn.

Percidae

Perca fluviatilis Linnaeus, 1758. Perch. This is another widespread species recorded originally from many parts of the Forth area by contributors to the Old Statistical Account of Scotland e.g. in Linlithgow Loch, Dobie (1795). Parnell (1938) notes that it is of common occurrence, particularly in the Union Canal, Duddingston Loch and Lochend Loch. It is still a very abundant species, and several large populations exist e.g. that at Loch Leven which has been studied by Thorpe (1974). The adult population there in May 1970 was estimated to be 968,900 individuals with an annual production of 37,040 kg. Its parasites in Loch Leven have been studied by Campbell (1974).

42 Gobiidae

Pomatoschistus microps (Kroyer, 1840). Common Goby. The taxonomy of this species has only recently been clarified and so there are few older records available. It is probably common in the upper parts of most estuaries in Scotland, including the Forth, but little information on its status is available.

Anguillidae

Anguilla anguilla (Linnaeus, 1758). Eel. A common and widespread species recorded throughout the area by contributors to the Old Statistical Account of Scotland e.g. in Loch Leven by Smith (1793), and is noted by Parnell (1838) as being abundant in the Firth of Forth and in every river. Similar comments are repeated by Rintoul and Baxter (1935). The species was formerly so abundant at Loch Leven that it supported a local fishery at its outflow the River Leven: over 2,500 kg per annum were harvested from here between 1865 and 1872. Eventually the River Leven became so badly polluted that this population was completely eliminated: none were found in the loch or its tributaries during intensive studies there from 1965-75. However, recently, a few eels have been taken in tributaries to Loch Leven and the species may well be repopulating the catchment as the quality of water in the River Leven improves. It is widespread in most other parts of the Forth area, except where severe pollution occurs. The unusual eels recorded by Sandeman (1894) in a loch on the Isle of May appeared to have disappeared when the author sampled there in 1958 (Maitland 1967).

Gasterosteidae

Gasterosteus aculeatus Linnaeus, 1758. Three-spined Stickleback. Parnell (1838) and Rintoul and Baxter (1935) record this species as common throughout the Forth area, mentioning specifically Duddingston and Lochend Lochs and a number of coastal marshes, ditches and ponds. It is certainly still widespread throughout the lowland part of the Forth catchment and is one of the most abundant fish in many waters e.g. the canals, the Gogar Burn, the River Tyne, Loch Leven, etc. It is absent from much of the Highland area however, especially from the hill lochs and faster flowing burns. Its parasites in Loch Leven have been studied by Campbell (1974).

Pungitius pungitius (Linnaeus, 1758). Ten-spined Stickleback. Though often considered to be common in Great Britain this species is, in fact, very rare in the Forth area. Only one site is recorded by Parnell (1838) — a small stream west of Prestonpans. This record is repeated by Rintoul and Baxter (1935). It appears to be absent now from this stream and no other records are available from the area.

Serranidae

Dicentrarchus labrax (Linnaeus, 1758). Sea Bass. Primarily, as its name implies, a marine and estuarine species, this fish occasionally comes into fresh water. Parnell (1838) records it in the Firth of Forth, mainly in July and August when it was caught on lines and in the salmon nets at Queensferry. It was 'brought occasionally to the Edinburgh market and sold at a low rate'. Rintoul and Baxter (1935) note that it occurred as far up the estuary as Kincardine. It is probably still relatively common in the estuary, though the author has seen only one specimen (from Longannet) in recent years.

Mugilidae

Crenimugil labrosus (Risso, 1826). Thick-lipped Mullett. Parnell (1838) records this species as occurring regularly in the Firth of Forth, and Rintoul and Baxter (1935) note that it occurs annually in small numbers. It is caught regularly by anglers fishing in the vicinity of Cockenzie Power Station, and is occasionally entrained at the cooling water intake there.

Chelon ramada (Risso, 1826). Thin-lipped Mullett. Parnell (1838) quotes Neill as finding this species occasionally in the Firth of Forth, but says that it must be rare for he himself had never seen a single specimen. Rintoul and Baxter (1935) note it as an occasional visitor. Its present status is in some doubt for there are no recent records.

Cottidae

Cottus gobio Linnaeus, 1758. Bullhead. Probably a recent introduction to the Forth area, this species is not mentioned in any of the older references. It was first recorded in 1967 in the Gogar Burn and was subsequently studied there by Clelland (1971) and more recently by the present author (unpublished). It is now common in much of the Gogar Burn, the Water of Leith and the Union Canal in the Edinburgh area and seems likely to disperse further through the canal system.

Pleuronectidae

Platichthys flesus (Linnaeus, 1758). Flounder. A common estuarine fish which occurs regularly in accessible rivers and streams, and even in some lochs in Scotland, this species is recorded by many authors as being common in the Firth of Forth e.g. Henderson (1796) and Trotter (1796). It is caught frequently by anglers fishing in the area and is also entrained regularly at all power stations in the estuary.

DISCUSSION

Several species other than those listed above have been introduced unsuccessfully to the Forth area. An account of introduced species to the British Isles as a whole has been given by Wheeler and Maitland (1973). Nineteen species are discussed. Few of these exotics have ever been released in the Forth area but a number of species which formerly occurred only in England have been introduced from time to time. Thus Evans (1892) records that grayling *Thymallus thymallus* (Linnaeus, 1758) were introduced to Cobbinshaw Reservoir in 1877 and dace *Leuciscus leuciscus* (Linnaeus, 1758) to Linlithgow Loch in 1883. Neither introduction was successful.

During the period for which information is available it is clear that there has been a considerable deterioration in the quality of fish populations and communities in the Forth area. It is only recently that conditions have started to improve again, due mainly to the activities of the Forth River Purification Board. Existing human pressures on fresh waters in the area can be classified in four main categories: 1. Pollution, including domestic sewage and industrial effluents. 2. Water use, for water supply, hydro-power and recreation (e.g. boating, fishing, wildfowling, etc.). 3. Land use, especially for agriculture and forestry, both of which involve land drainage and the use of fertilisers and pesticides. 4. Fisheries themselves, which may involve poisoning native species and introducing others, together with the depletion of populations through angling and netting.

Due to one or a combination of the above pressures a number of dramatic changes have taken place in fish stocks in the area. Thus migratory fish (e.g. lampreys, salmon, sea trout and eels) have been completely eliminated from a number of river systems (e.g. the River Leven and the River Esk) by pollution. The enormous population of smelt which once existed in the estuary has now apparently disappeared, for reasons which are still uncertain. The ten-spined stickleback no longer occurs at the only recorded locality, and one of the few populations of charr in the area (at Loch Leven) has disappeared too.

In order to reverse this trend, a number of positive measures require to be taken if natural fish stocks and communities are to be restored in the Forth area. Firstly, present standards of water pollution control must be maintained and improved: the efforts of the Forth River Purification Board must be supported here. Secondly, unusual freshwater sites must be identified and protected. There is a

great deal of work to be done in this field throughout Scotland in order to establish priorities. Lastly, unique sites for fish species must be documented and possibly given special protection. The general principles behind conservation proposals of this type are discussed in some detail by Maitland (1979b).

ACKNOWLEDGEMENTS

I am grateful to the following for their help during the preparation of this paper: Mrs. S. Bailey-Watts, who extracted most of the early references from the (*Old*) *Statistical Account of Scotland*; Ms G. M. Dennis, who drew Figure 1; and Mrs. M. Wilson, who typed the manuscript.

REFERENCES

- BURNS-BEGG, R. 1874. *The Loch Leven Angler*. Barnett, Kinross.
- CALDERWOOD, W. L. 1921. *The Salmon Rivers and Lochs of Scotland*. Arnold, London.
- CAMPBELL, A. D. 1974. The parasites of fish in Loch Leven, Kinross. *Proceedings of the Royal Society of Edinburgh* 74, 347-364.
- CLARKE, W. E. 1900. The fishes of the Firth of Forth and its tributaries: species added since Dr. Parnell's 'essay' of 1837. *Annals of Scottish Natural History* 20, 8-17.
- CLELLAND, B. 1971. An Ecological Study of a Scottish Population of Bullheads. BSc thesis University of Edinburgh.
- COLLETT, W. F. 1971. The quality of the Forth estuary. *Proceedings of the Royal Society of Edinburgh* 71, 137-141.
- DAY, F. 1880. *The Fishes of Great Britain and Ireland*. Williams & Norgate, London.
- DOBIE, J. 1795. Parish of Linlithgow. *The Statistical Account of Scotland*, volume 14, 547-576.
- EVANS, W. 1892. The introduction of dace into Linlithgow Loch and of grayling into Cobbinshaw Loch. *Annals of Scottish Natural History* 1, 270-271.
- FORTH RIVER PURIFICATION BOARD. 1976. Annual Report 1976, 1-86.
- HENDERSON, J. 1796. Parish of Queensferry, West Lothian. *The Statistical Account of Scotland*, volume 17, 489-497.

- LINDSAY, J. 1968. The Canals of Scotland. David & Charles, Newton Abbot.
- McLUSKY, D. S. 1978. Ecology of the Forth estuary. *Forth Naturalist & Historian* 3, 10-23.
- MAITLAND, J. R. G. 1887. The History of Howietown. Guy, Stirling.
- MAITLAND, P.S. 1967. The aquatic fauna of the Isle of May, Fife, Scotland. *Transactions of the Dumfries and Galloway Natural History and Antiquarian Society* 44, 16-28.
- MAITLAND, P. S. 1972. A key to the freshwater fishes of the British Isles. *Scientific Publications of the Freshwater Biological Association* 27, 1-139.
- MAITLAND, P. S. 1979a. Synoptic Limnology: the Analysis of British Freshwater Ecosystems. Institute of Terrestrial Ecology, Cambridge.
- MAITLAND, P. S. 1979b. The status and conservation of rare freshwater fish in the British Isles. *Proceedings of the British Freshwater Fisheries Conference* 1, 237-248.
- MILLS, D. H. 1971. The growth and population densities of roach in some Scottish waters. *Proceedings of the British Coarse Fish Conference* 4, 50-57.
- OSBURN, W. 1795. Parish of Tillicoultry, Clackmannan. Statistical Account of Scotland, volume 15, 189-216.
- PAIRMAN, W. 1796. Parish of Ely, Fife. Statistical Account of Scotland, volume 17, 537-542.
- PARNELL, R. 1838. Fishes of the district of the Firth of Forth. *Wernerian Natural History Society* 7, 161-520.
- REID, J. 1792. Parish of Beath, Fife. Statistical Account of Scotland, volume 3, 233-235.
- RINTOUL, L. J. and BAXTER, E.V. 1935. A Vertebrate Fauna of Forth. Oliver & Boyd, Edinburgh.
- ROBERTSON, J. 1794. Parish of Callander. Statistical Account of Scotland, volume 11, 574-627.
- ROBERTSON, J. 1796. Parish of Lecropt, Counties of Stirling and Perth. Statistical Account of Scotland, volume 17, 45-60.
- ROBERTSON, J. and STIRLING, R. 1793. Parish of Dunblane, Perth. Statistical Account of Scotland, volume 7, 323-330.
- SANDEMAN, G. 1894. Some singular eels from the Isle of May. *Annals of Scottish Natural History* 14, 183.
- SCOTT, W. 1794. Parish of Dalkeith. Statistical Account of Scotland, volume 12, 18-27.

- SHARMAN, D. P. 1963. Fish catch at Kincardine power station. Unpublished Report, DAFS Marine Laboratory, Aberdeen.
- SMITH, A. 1793. Parish of Kinross, Fife. *Statistical Account of Scotland*, volume 6, 164-173.
- SMITH, I. R. and LYLE, A. A. 1979. The Extent and Distribution of Fresh Waters in Great Britain. Institute of Terrestrial Ecology, Cambridge.
- STOUT, H. P. 1976. Prediction of oxygen deficits associated with effluent inputs to the Forth Estuary. *Proceedings of the Institution of Civil Engineers* 61, 351-366.
- STUART, T. A. 1968. Studies on the Lake of Menteith. *Annual Report of the Freshwater Fisheries Laboratory, Pitlochry* 1968, 107-153.
- TAIT, C. 1793. Parish of Kincardine, Perth. *Statistical Account of Scotland*, volume 6, 477-505.
- THOMAS, H. J. and SAVILLE, A. 1972. The fisheries of the Forth-Tay estuaries. *Proceedings of the Royal Society of Edinburgh* B74(1/2), 171-188.
- THORPE, J. E. 1974. Trout and perch populations at Loch Leven, Kinross. *Proceedings of the Royal Society of Edinburgh* B74(3), 295-313.
- TROTTER, J. 1796. Parish of Prestonpans, East Lothian. *Statistical Account of Scotland*, volume 17, 61-88.
- WHEELER, A. C. and MAITLAND, P. S. 1973. The scarcer freshwater fishes of the British Isles. 1. Introduced species. *Journal of Fish Biology* 5, 49-68.
- WOOD, J. 1791. Parish of Cramond, Edinburgh. *Statistical Account of Scotland*, volume 1, 211-226.

KIDNEY VETCH IN THE STIRLING/CLACKMANNANSHIRE AREA? — The sole larval foodplant of the Small Blue butterfly (*Cupido minimus* Fuessly) is Kidney Vetch (*Anthyllis vulneraria*). There are old records of the butterfly from Bridge of Allan (Wingate, 1859. *Entomologist's Weekly Intelligencer* 6, 90) and Dollar parish (Mylne, 1845. *New Statistical Account of Scotland* vol 8 pp 89-90), but Kidney Vetch is not shown in the *Atlas of British Flora* to occur in these areas. Does anyone have any knowledge of the past and present occurrence of this plant in Stirlingshire or Clackmannanshire?

George Thomson, Humblesknow, Ramoyle, Dunblane.

- 48 AN OLD RECORD OF THE LARGE BLUE BUTTERFLY IN CLACKMANNANSHIRE.— The 'probable' extinction of the Large Blue butterfly (*Maculinea arion* L.) in Britain has become an extremely controversial issue since it was announced in September 1979 as it seems likely that this species is still to be found in the south-east of England. A number of letters in the national press telling of the butterfly in the most unlikely places (e.g. the Lothians!) and at the most impossible times add a touch of humour to the situation. Most of the Scottish reports almost certainly refer to the Common Blue butterfly (*Polyommatus icarus* Rott.). A little known and extremely interesting 'record' of the Large Blue in Scotland is that of Mylne from Dollar parish (*New Statistical Account of Scotland* 1845 vol 8 pp 89-90). Mylne includes the Common Blue in the same list. Although it seems unlikely that the Large Blue ever occurred in Scotland, it is interesting to note that the warm south-facing slopes of the Ochils would, in many ways, provide an eminently suitable habitat for the species.

George Thomson, Humblesknow, Ramoyle, Dunblane.

HAS THE ORANGE TIP BUTTERFLY ARRIVED YET? — In a paper in this journal (Thomson, 1976. *Forth Naturalist and Historian* 1, 89-105) I suggested that several butterfly species might return to areas from which they have been absent for over 75 years. One such butterfly is the Orange Tip (*Anthocharis cardamines* L.) which has in the last few years returned to the Borders (see Long, 1979. *Entomologist's Gazette* 29, 2-3) and Angus. If the momentum of this expansion of the Orange Tip's range continues, it could not be long before it is noted in south Perthshire, Stirlingshire or Clackmannanshire. I would be pleased to hear from anyone who sees the butterfly in these areas — with a specimen to confirm identification.

George Thomson, Humblesknow, Ramoyle, Dunblane.

STIRLING AND CLACKMANNAN BIRD REPORT 1978 49

C. J. Henty
University of Stirling

The winter was cold with snow in late January and mid February and this brought Snow Buntings to the low ground. March was wet and was followed by a cold and dry, but sunless, April which may have led to the rather tardy recorded arrivals of summer migrants. The late spring was dry, warm and sunny, probably a factor in the plague of Antler Moths (*Cerapteryx graminis* L.) on the high ground which was associated with very large influxes of nonbreeding Gulls, Starlings and Rooks to the tops of the Ochils. The weather became dull and cool in mid June and this continued for the rest of the summer except for a warm spell in the second week of July. However, despite the cool summer, there is no evidence of poor breeding success in insect feeding migrants such as the House Martin.

In autumn Curlew Sandpipers occurred in good numbers but the other less common waders were scarce whilst visible migration of small birds was widespread but unspectacular. October and November were notably mild, the latter the warmest for twenty years. Early December was wet but then turned cold and the year ended with snow and continuous sub-zero temperatures.

The comments made in previous years on the biases and limitations of this report still apply. Fourteen observers contributed directly to the records, this continues to be a very small proportion of the field experts in action locally. An asterisk indicates where the records printed seem to cover all the known occurrences of a species this year. In the systematic list: S = Stirlingshire and C = Clackmannanshire.

50 SYSTEMATIC LIST 1978

* RED-THROATED DIVER S - 1 at Skinflats on 1st March (DMB), 2 E over Stirling on 9th December (MB)

* BLACK-THROATED DIVER C - 1 at Gartmorn Dam on 27th March (CHN, IN).

LITTLE GREBE S - return to Airthrey on 9th March (MWF).

GREAT CRESTED GREBE S - Kinneil, 164 on 5th March, 49 on 7th August, 85 on 22nd September, 145 on 30th September (DMB).

C - 5 (probably breeding population) at Gartmorn Dam on 12th March, 10 on 17th December (CJH).

* SLAVONIAN GREBE C - 1 at Gartmorn Dam on 17th September (CJH, IN).

* MANX SHEARWATER S - 1 at Grangemouth on 17th September (DT).

* GANNET S - 1 at Grangemouth on 14th and 17th September (DMB, DT).

CORMORANT S/C - 345 on Forth Estuary on 10th January (DMB).

WHOOPEE SWAN S - max. 17 near Stirling on 16th March, last 10 on 29th (DT).

C - max. 89 (12 juv) at Menstrie on 19th November (CJH).

PINK-FOOTED GOOSE S - movements, 40 NW at Airthrey on 21st April, last over Airthrey 10 on 16th May, 20 SE at Myot Hill (Dunipace) on 1st October (CJH, MWF).

C - movements over Hillfoots, 12 E on 30th September, 100 W on 9th October, in November 87 SE on 8th, 53 + 46 + 61 E on 9th, 70 N on 17th, 50 W on 19th (MB, CJH).

SHELDUCK S/C - 2750 on Forth Estuary on 17th December (DMB).

S - 1355 (1236 in moult) at Kinneil on 8th August (DMB).

- WIGEON S/C – 244 on Forth Estuary on 10th January (DMB). **51**
S – 1st of autumn, 1 at Grangemouth on 16th August (DMB).
C – 254 at Gartmorn Dam on 15th January (CJH).
- * GADWALL S – 1 at Skinflats on 5th March (DMB).
- TEAL C – 363 at Tullibody Inch on 17th December (CJH).
- * GREEN-WINGED TEAL S – 1 near Stirling on 19th February (DT).
- MALLARD S/C – 1053 on Forth Estuary on 17th December (DMB).
C – at Gartmorn Dam 930 on 15th January and 1531 on 17th December (CJH).
- PINTAIL S – max 63 at Grangemouth on 5th March, 1st of autumn 2 at Kinneil on 14th September (DMB).
- SHOVELER S – 4 at Grangemouth on 16th August (DMB).
- POCHARD S – spring movement, 20 at E. Grangemouth pools on 5th March (DMB).
C – 45 at Gartmorn Dam on 15th January (CJH, IN).
- TUFTED DUCK S – Breeding population 8m and 4f at Airthrey on 10th May (CJH).
C – max 167 at Gartmorn Dam on 15th January (CJH, IN).
- * LONG-TAILED DUCK C – 1 at Gartmorn Dam from 15th October, 2 on 17th December (CJH, IN).
- GOLDENEYE S – 73 (20m out of 65) at Cambuskenneth on 14th February, floating ice on river (CJH).
C – 35 at Gartmorn Dam on 12th March (CJH).
- RED-BREASTED MERGANSER S/C – 250 on Forth Estuary on 10th January (DMB).
- GOOSANDER S – 5 at Cambuskenneth on 18th February (CJH).
C – on R. Devon, pair at Alva on 11th February (CJH) and 1 at Muckhart on 27th October (DMB).

- 52 * HEN HARRIER S — 1 on Gargunnocks 27th August and 6th September, 1 Sheriffmuir on 6th and 8th September (CJH).

SPARROWHAWK S/C — most records September, a few late spring — early summer, including 2 within Stirling town. 1 at Blairlogie on 27th April flew alongside a car at 60 kph (CJH).

- * BUZZARD S — 1 at Airthrey on 14th May (DMB) but no evidence of breeding.

KESTREL C — max 7 Ben Ever on 3rd September. Male chasing Starlings at 500m on Alva Moss on 6th July. 1 hovered over Tillicoultry main street on 26th November (CJH).

- * MERLIN S — 1 at Larbert on 2nd February and 1 at Arnprior on 30th April (DT).
1 chasing Sparrowhawk near Slamannan on 7th October (CJH).
Male at Grangemouth on 5th March (DMB). Pair on Sheriffmuir on 28th April (MWF).

- * PEREGRINE S — on Ochils, immature male chasing Starlings on 15th June and 1 on 17th August (CJH). 1 at Airthrey on 2nd December (DMB).

RED GROUSE C — breeding, several pairs with 9 cheepers on high mosses of Ochils.
2 in thick snow at 540m on Menstrie Moss on 4th January (CJH).

BLACK GROUSE S/C — in June, widespread but sparse in the Ochils in young plantations and rush beds (CJH).

PARTRIDGE S/C — breeding, highest in Ochils at 330m, also 2 in 1 — 2m plantation at 220m.
C — 16 at Blairlogie on 8th October, 10 on Colsnaur at 360m on 4th January, thick snow and hard frost yet birds flew on up the ridge (CJH).

PHEASANT C — breeding, highest in Ochils at 240m in 1 — 2m spruce (CJH).

- * WATER RAIL C — 1 at Alva on 11th and 18th February, on sewage stream during hard frost (CJH).

- * CORNCRAKE S — 1 calling in summer near Gargunnoch (per H. Robb). **53**
- MOORHEN C — 1 almost albino at Gartmorn on 3rd December (RD).
- COOT C — 233 at Gartmorn Dam on 17th December, albino there through year (CJH, IN).
- OYSTERCATCHER S/C — max 1385 on Forth Estuary on 30th September and 1397 on 17th December (DMB).
S — spring return, at night over Airthrey on 25th February (MWF).
C — spring return, at night over Alva on 27th and Muckhart on 28th February (DMB, CJH).
- RINGED PLOVER S/C — max 108 on Forth Estuary on 25th February and 226 on 30th September (DMB).
- GOLDEN PLOVER S/C — winter max 4027 on Forth Estuary on 10th January (DMB).
- GREY PLOVER S/C — winter max 43 on Forth Estuary on 17th December (DMB).
- LAPWING S/C — winter max 2559 on Forth Estuary on 10th January (DMB).
- KNOT S/C — winter max 6055 on Forth Estuary on 25th February (DMB).
- * LITTLE STINT S — Kinneil, 1 on 10th, 14 on 14th and 7 on 17th September (DMB, DT).
C — 2 at Blackdevonmouth 14th September (DMB).
- * CURLEW SANDPIPER S — Kinneil, 2 on 10th, 28 on 14th, 1 on 22nd, 39 on 30th September (DMB, DT).
- DUNLIN S/C — autumn max 1110 on Forth Estuary 30th September, winter max 6080 on 10th January (DMB).
- RUFF S — few, 7 on 5 days Grangemouth-Kinneil between 7th August and 14th September (DMB, DT).

54

SNIPER S/C — winter max only 9 on Forth Estuary on 10th January, 15 at Kinneil on 14th September (DMB).

C — hard frost max at Alva, on spring, 11 on 12th February and 14 on 2nd December, few there in heavy snow (CJH).

WOODCOCK C — 3+ roding at Wood Hill (Alva) on 27th March with 2 or 3 diving together at great speed with rapid "twisick" calls (CJH).

* BLACK-TAILED GODWIT S/C — Forth Estuary (W. Fife), 9 Torry Bay on 1st October (DMB).

BAR-TAILED GODWIT S/C — max 380 on Forth Estuary on 30th September and 238 on 17th December (DMB).

WHIMBREL S — 6 singles at Grangemouth — Kinneil between 1st July and 14th September (AM, DMB).

CURLEW S/C — breeding, in Ochils mainly on rough grass and heather but also in ½-1m conifer plantations (CJH).

max on Forth Estuary, 801 on 17th December and 1040 on 30th September (DMB).

S — first of spring over Airthrey on 27th February (MWF).

3 flying S (high, calling) Queen Elizabeth Forest on 5th August (CJH).

C — 190 at Kennetpans on 7th January (CJH).

* SPOTTED REDSHANK S/C — 1 on Forth Estuary on 10th January (DMB).

REDSHANK S/C — max on Forth Estuary 2200 on 30th September and 2411 on 17th December (DMB). Inland in winter: 1 W at Airthrey (Stirling) on 18th and 1 on Devon at Alva (Clack) on 29th December (DMB, CJH). Spring return, 2 Sheriffmuir (Bridge of Allan) on 9th April (AM). 2 over Airthrey on 4th May (MWF).

GREENSHANK S/C — 5 on Forth Estuary on 30th September (DMB).

S — 11 on 7 days at Grangemouth — Kinneil between 7th August and 30th September (DMB, AM). 1 over Airthrey on 4th May (MWF).

GREEN SANDPIPER C — 1 at Cambus on 22nd April. 1 at Kennet Pans on 16th August (CJH).

COMMON SANDPIPER S/C — breeding, highest in Ochils at 380m, limit of medium sized burns (CJH). **55**
S — 1st, 1 by River Forth — Allan on 22nd April (AM).

ARCTIC SKUA S/C — 5 singles on Forth Estuary between 8th August and 24th September (DMB, DT).

* GREAT SKUA S/C — 2 on Forth Estuary on 24th September (DMB).

* LITTLE GULL S — 1 at Kinneil on 22nd July (DMB).
W. Fife: 1 at Longannet on 30th September (DMB).

BLACK-HEADED GULL C — 760 over Ochils (500 Ben Cleuch, 260 Glensherup) on 17th June during plague of Antler Moths (CJH).

LESSER BLACK-BACKED GULL C — 1200 on Ben Cleuch on 17th June, plague of Antler Moth caterpillars (CJH).

HERRING GULL C — 400 on Ben Cleuch on 17th June, with LBBG (CJH).

* ICELAND GULL S — 1 at Stirling on 9th March (DMB).

COMMON TERN S — 42+ nests at Grangemouth Docks on 1st July (DMB).

COMMON/ARCTIC TERN S — 250 at Kinneil on 22nd July (DMB).

(FERAL) ROCK DOVE C — 250 on stubble at Alva on 18th February, hard frost (CJH).

STOCK DOVE C — max 8 at Longcarse on 17th December (CJH).

WOODPIGEON S — max 1000 at Sheriffmuir on 24th December including an erythristic bird (AM).

C — highest in breeding season at 380m in low plantations in Ochils (CJH).

COLLARED DOVE C — continued colonisation in Alva — 1 pair in west end (CJH).

- 56 * SHORTEARED OWL S/C — no records, though much suitable habitat covered (CJH).

SWIFT S — 1st, 1 at Bridge of Allan on 28th April and 2 at Stirling on 9th May (DMB, DT). Last, 1 near Bridge of Allan on 11th September (CJH).

C — 82 over Ben Cleuch on 17th June, evening groups over Alva, 26 on 29th July and 27 on 7th August (CJH).

- * KINGFISHER S — 1 at Falkirk on 22nd December (DF).

GREEN WOODPECKER S — 2-3 pairs west of Falkirk (R. Ellis) — regular here since 1967 (DF).

- * GREAT SPOTTED WOODPECKER S/C — no records.

SKYLARK S — abundant and singing on Sheriffmuir on 26th March (CJH).

C — 450 on stubble during blizzard at Alva on 11th February (CJH).

SANDMARTIN S — 1st, 5 at Airthrey on 3rd April (DMB).

SWALLOW S — 1st, 1 at Airthrey on 19th April, last at Polmont on 24th October (DMB).

HOUSE MARTIN S — 1st at Airthrey on 19th April (DMB).

C — last at Alva on 28th October (A. Henty).

Movement, 4 high to SW at Kennetpans on 12th October (CJH).

MEADOW PIPIT S — arrival, frequent on Sheriffmuir on 26th March (CJH).

Small movements between S and W at Myot Hill in October on 1st and 8th, Slamannan on 7th, Stronend on 8th, and Bridge of Allan on 10th October (CJH).

Perth: 100 at Easter Row (Dunblane) on 8th September (CJH).

GREY WAGTAIL C — winter, 1 during hard frost at Alva on 11th and 18th February (CJH).

PIED WAGTAIL S — at Airthrey, 34 on 15 September and 60 on 9th October (DMB, CJH).

WREN S/C — up to 480m in Ochils plantations in June (CJH).

REDSTART S/C — no breeding records. 1 at Muckhart on 18th and 19th August (DMB).

STONECHAT S — a few breeding records; 1 at Sheriffmuir on 9th May and 3 on Dumyat on 13th June (CJH).

C — few in Ochils - pair above Dollar on 4th June; singles in Alva gorse on 18th, 24th March and 30th July (CJH).

WHEATEAR S/C — widespread in Ochils June/July (CJH).

FIELDFARE S — spring, 200 at Sheriffmuir on 29th April (DT), last on 4th May (AM).

1st in autumn, 3 at Airthrey on 12th October, movements to SW between 16th and 21st November (CJH).

C — winter, 60 + 150 at Alloa on 17th December, 140 at Alva on 10th December (CJH).

REDWING S/C — 180 to S and W at Clackmannan, Alva and Airthrey on 12th October. 24 birds per hour crossing the moon on the evening of 12th October were probably mainly this species (CJH),

S — 1st of autumn, 2 Slamannan on 7th October (CJH).

MISTLE THRUSH S — max 9 at Airthrey on 15th September.

C — winter, 3 at Longcarse on 17th December (CJH).

GARDEN WARBLER S — breeding, 2 singing near Airthrey in May and June (CJH).

WOOD WARBLER S — 1st at Mine Wood (Bridge of Allan) on 5th May (AM).

CHIFFCHAFF S — 1 at Airthrey on 2nd April (AM).

WILLOW WARBLER S/C — in Ochils, present in June in highest plantations at 570m (CJH).

SPOTTED FLYCATCHER S — 1st at Airthrey on 25th May (DMB).

* GREAT GREY SHRIKE S — 1 at Stirling on 19th March (Miss N. M. Smith).

* JAY S/C — no records.

ROOK S/C — post-breeding flocks on high ridges of Ochils, 450 on 17th and 550 on 26th June, 200 on 6 July (CJH).

C — Rookeries, nest numbers: Menstrie 196 on 6 May (169 in 1977), also outlier of 3 nests at Middletonkerse. 155 at Gartmorn Dam on 12th March (only 7 here in 1975 census and none mentioned in habitat survey a year or two before). New colony: 14 at Balquharn on 6th May (CJH). 112 at Arndean (Dollar) on 16th April (DMB) — not in 1975 census but possibly overlooked.

JACKDAW S/C — with Rooks on Ochils on 26th June and 6th July (CJH).

CARRION CROW C — 55 at Alva on 9th April, feeding in newly harrowed field. Bird with white wing stripe at Alva on 29th December. 2 on Maddy Moss on 14th January — very scarce in interior of Ochils in winter (CJH).

* RAVEN S — 2 at Dumyat on 19th October (DMB).
C — 2 on Ben Cleuch on 14th January (CJH).

STARLING S — on Ochils ridges, 600 (85% juveniles) on 15th June and 2000 on 26th June.
C — 2300 on roost flight to Kincardine Bridge on 7th January. 1500 at Menstrie on 4th February (CJH).

HOUSE SPARROW C — partial albino at Alva from January to March — same female seen in December 1977 (CJH).

TREE SPARROW S — 16 at Bridge of Allan 22nd April (AM).
C — 6 feeding at sheep troughs at Alva on 10th January and 11th February (CJH).

CHAFFINCH S — 175 at Airthrey on 7th and 28th February
1st song at Bridge of Allan on 18th February (AM). Movement to S at Myot Hill (Dunipace), 26 on 1st and 54 on 8th October (CJH).
C — flock of 14m and 14f, at Alva on 10th January (CJH).

GOLDFINCH S — largest flocks, 12 at Dunipace on 1st October (CJH).
40 at Skinflats on 10th January (MWF).

* BRAMBLING C — 1 at Muckhart on 27th November (DMB).

SISKIN S – 40 at Falkirk on 23rd December (DF).

LINNET S/C – not above 250m in Ochils in summer (CJH).

TWITE S – 80 at Skinflats on 13th January (MWF).

REDPOLL S/C – up to 540m in plantations in Ochils in June (CJH).

SNOW BUNTING S – 50 in stubble above Bridge of Allan between the 16th and 18th February (D.A.F. Ballingall). 10 flying E at Airthrey on 23rd February (DMB). 10 at Skinflats on 10th January (MWF).

C – in Ochils, 130 on 4th and 65 on 14th January, 7 (last) on 7th March (CJH). On low ground, 6 during blizzard, with Skylarks on stubble, at Alva on 11th February, heard there on 18th February (CJH).

YELLOWHAMMER C – breeding, in 1-2m spruce up to 250m in Ochils (CJH). 1 in garden (1st in 10 years) during heavy snow at Alva on 31st December (CJH).

CORN BUNTING S – albino singing near Abbey Craig during spring (K. Bailey).

ADDENDUM

Species that occur regularly in the area but for which no notes are published this year.

Heron, Greylag Goose, Mute Swan, Common Gull, Barn Owl, Tawny Owl, Dipper, Dunnoek, Robin, Whinchat, Blackcap, Whitethroat, Goldcrest, Treecreeper, Longtailed Tit, Coal Tit, Blue Tit, Great Tit, Magpie, Bullfinch, Reed Bunting.

CONTRIBUTORS

D.A.F. Ballingall, K. Bailey, M. Brazil, D. M. Bryant, R. Dalziel, R. Ellis, D. Fleming, M. W. Frazer, C. J. Henty, A. Mitchell, I. Nicoll, Miss N. M. Smith, D. Thorogood, Miss A. Turner.

C. J. Henty

University of Stirling

The severe winter weather that started in December, 1978 continued throughout the early part of 1979 with repeated heavy snow and almost continuous frost until late February. Lochs and reservoirs were frozen throughout this period and large numbers of dabbling and diving ducks appeared on the Forth, especially near Tullibody Inch. The counts and estimates at this site vary somewhat and, after discussion with Dr. Bryant, I have quoted some of the consistent but possibly conservative counts. It is notable that no large numbers of duck, and especially few Tufted Duck, were to be found at Kennetpans so that this classic hard weather resort has not been outstanding for ducks for at least the last ten years. There were few other reports of special events during the hard weather, though this may represent lack of observer activity more than anything else. April continued the cold tradition and there were no reports of summer migrants arriving early, although most such species were in good numbers when they did appear. An exception was the Sedge Warbler which was decidedly scarce over a large area. On June 2nd the Stirling branch of the SOC organised a partial repeat of the bird count along the River Devon with the particular object of seeing if resident species were in smaller numbers than in 1977. This was notably true for riparian species such as Moorhen, Grey Wagtail and Dipper, and small softbilled species such as the Robin also showed a decrease.

Although that June census day was hot and sunny the rest of the summer was decidedly cool and wet. There is some evidence that Pied Flycatchers and Hawfinches breed more regularly around Stirling than the isolated proven cases suggest whilst the breeding status of Jay and Great Spotted Woodpecker remains obscure. Inland in autumn more Hen Harriers were seen than usual and the October movement of thrushes was particularly large, although other passerine migrants were in normal numbers or somewhat reduced.

This report has been compiled in an unusual rush to meet a special publication deadline so that the selection of records has not received the attention that I would have wished. I hope that contributors will excuse any inconsistencies in the use of their data, however, almost

everything has been entered into the master file. There are from time to time problems in deciding on the acceptability of reports of uncommon and undistinctive species, especially when the observer is not very well known to me. Often there are no details of the identification points, thus I hope no-one will object if I request such details. Whilst the points to be written down could be found in any guide to birdwatching I think it is worth making some general comments about assessing them, since it is the experience of all recorders that under some conditions any bird can be mistaken for almost anything else. The first thing is to check carefully that every feature noted is consistent with the identification suggested and also whether all characteristics that ought to have been seen were in fact noted. Next, it is vital to be sure that all other possibilities have been excluded, not only may there be many other species where particular plumages may be confusable due to age, moult or wear, but people often overlook the effects of peculiar behaviour, lighting or posture and the fact that they are more likely to meet variant individuals of common species than rather similar rarities. I doubt if any honest, experienced birdwatcher cannot recall several embarrassing misidentifications that they have made and a self critical attitude against slaphappy observation is not easy to maintain. Some years ago I was shown notes on a possible Redbacked Shrike that did not in fact exclude either Fieldfare or a cock Kestrel and this illustrates a very common feature, many records are unacceptable because they are not positively convincing even though it may not be possible to show they are actually mistaken. So, please, if you think you have seen a species that is unusual or even just out of your experience first write down all the details and then discuss the record with me or other members of the branch. Rapid notification of some unusual occurrence can often lead to confirmation by another observer.

Rather few records include any mention of habitat or behaviour and I would welcome more detail if it seems appropriate. There is an encouraging increase in the amount of information coming in so that in 1980 it would be very helpful if observers with more than a few records could send me their data for the first part of the year in October or November so that I have more time to enter, digest and maybe discuss it.

In this and the 1978 report the term "Forth estuary" replaces the "upper Forth" of previous reports; the same area is meant (i.e. the stream and banks of the Forth upstream of Bo'ness as far as Stirling) but I have been asked to make the usage consistent with that of various ecological projects.

Bird reports have recently been recommended to use the Voous order of species; the change is irritating, but to help comparison with other reports it has been adopted here.

An asterisk (*) indicates that all the records received have been listed individually. In the systematic list, S=Stirlingshire and C=Clackmannanshire.

SYSTEMATIC LIST 1979

RED-THROATED DIVER* S — 1 at Skinflats January-February and 1 seen oiled on 25th February (DMB, DF).

LITTLE GREBE S/C 2 pairs Cocksburn Res on 12th June, 6 on 14th August including 1 on nest; ad with 4 young at Devilla on 4th August, 14 at Airthrey until 20th October, 2 at Kippenrait Res on 23rd October, 1 at Grangemouth Docks 28th November-26th December (WRB, MWF, DM).

GREAT CRESTED CREBE S/C — 2 pairs at Carron Valley Res on 15th August, 4 at Peppermill Dam on 24th March and 6 on 4th August, probably 2 pairs at Gartmorn Dam — 3 young on 7th June, 8 ad with 1 youngster on 5th July; Forth Estuary, max 166 on 19th February and 190 on 9th September (DMB, WRB, DM, IN).

FULMAR* S — 2 at Skinflats on 22nd April, 1 at Airthrey on 25th April (DMB).

GANNET* S — 1 dead imm at Skinflats on 22nd April (DMB).

CORMORANT S — 1 at Airthrey on 15th December, 2 at Carron Valley Res on 23rd November and 6 on 15th December (WRB, MWF).

MUTE SWAN S — Brood of 8 reared at Airthrey, up to 11 through autumn (DMB, MWF, CJH).

WHOOPEE SWAN S — 42 (6 juv) at Blairlogie on 3rd February. Max 44 at Kippen on 10th February, fewer March and present to 15th April. Max 78 at Kildean on 10th February, still 37 on 13th April. At Skinflats from 11th November to 26th December, max 56 on 16th December (CJH, AMcl, DM, PWS, DT).

C — 1st 14 ad on ley grass at Menstrie on 20th October (CJH).

PINK-FOOTED GOOSE S — 100 at Skinflats on 13th April, last heard at Airthrey on 3rd May (MWF, AMcl).

C — 65 E at Tillicoultry on 3rd February and 25 E at Alva on 12th April. 300 at Muckhart and heard at Alva on 3rd October (DMB, CJH).

WHITE-FRONTED GOOSE S — 18 W at Airthrey on 15th December (MWF).

Grey Goose, ANSER Sp. C — 70 W at Alva on 1st January, 50 W on 15th April, 11 + 8 E on 21st September (CJH).

BARNACLE GOOSE* S — 5 at Skinflats on 7th October (DMB).

BRENT GOOSE* S — 1 at Tullibody Inch on 4th February, 5 (light bellied) on Forth Estuary (at Torry Bay, Fife) on 28th January (JHI).

SHELDUCK S/C — Forth Estuary: 2140 on 28th January, 320 on 14th March, c.900 mid November, 2800 on 29th December (DMB, DF, AMcl).

S — 12 pairs at Skinflats on 15th April (AMcl), pair at Airthrey on 18th May (DMB). Kinneil moult flock: 2710 on 9th August, 2000 there on 20th September (DMB, WRB).

C — 70 at Tullibody Inch on 25th January, 40 at Kennetpans on 21st January (CJH): numbers are always much lower above Kincardine Bridge. At Gartmorn Dam 26th April — 8th May but no proof of breeding (IN).

WIGEON S/C — Forth Estuary, 775 on 28th January (DMB).

S — Few inland, e.g. 5 at Carron Valley Res on 23rd November (WRB).

C — 198 at Kennetpans on 25th February (DF).

GADWALL* S — 1 m at Airthrey on 30th November to 14th December (DMB, MWF). Pair at Skinflats on 28th January (DF).

TEAL S — 91 at Skinflats on 18th February (DF), 100 at Carron Valley Res on 23rd November and 15th December (WRB).

C — 466 at Tullibody Inch on 25th January, 175 at Manorneuk on 27th January (CJH).

MALLARD S/C — 3760 on Forth Estuary on 28th January (DMB).

S — 4 pairs at Loch Elrig on 16th April (AMcl), 200 at Skinflats

64 on 6th January (DF), 244 at Carron Valley Res and 157 at Loch Coulter on 15th December, 100 at North Third Res on 15th August (WRB), 291 at Airthrey on 26th September (MWF).

C - 640 at Gartmorn Dam on 14th January (IN), 1605 at Tullibody Inch on 4th February (DMB), 220 at Kennetpans on 27th January and 110 on 25th November (CJH, AMCl).

PINTAIL S - Skinflats, January-March and November-December, max 80 on 6th and 25th February (DMB, DF, AMCl, DM), 15 m out of 28 on 9th December (AMCl).

SHOVELER* S - 3 at Airthrey on 12th April, 2 at Skinflats on 20th May (DMB), 2 at E Grangemouth on 19th August and 4 on 26th August (DT).

C - Pair at Gartmorn Dam on 19th May (AKT).

POCHARD S - 2 pairs at Airthrey on 21st April, max 27 on 8th October (MWF). 50 at Cambuskenneth on 30th and 31st January (PWS), 54 at Skinflats on 18th February (DF), 29 at Carron Valley Res on 23rd November (WRB).

C - 316 at Tullibody Inch on 4th February (DMB). 40 at Gartmorn Dam on 18th November (IN), 1 on 7th and 14th June (IN).

TUFTED DUCK S - 4 pairs at Loch Elrig on 16th April (AMCl). Female with 10 young at Airthrey on 20th July and 6 juveniles on 18th August (DMB, CJH). 6 young at Cocksburn Res on 12th July (WRB). Callendar Park (Falkirk), 9 young on 24th June, 6 well grown young in July (RD). 66 at Airthrey on 21st April and on 13th December (MWF). 150 at Carron Valley Res on 7th September and only 3 on 15th December (WRB). 50 at Loch Coulter on 20th September, 46 at North Third Res on 15th December (WRB). 30 at Cambuskenneth on 30th and 31st January (PWS) and 53 on 18th November (AKT).

C - 750 at Tullibody Inch on 4th February (DMB) but only 6 at Kennetpans on 27th January (CJH), 160 at Gartmorn Dam on 19th March and 133 on 16th December, few breeding pairs (IN): 20 young on 26th July; 60 in May-June, 340 on 23rd August (IN).

SCAUP S/C - 157 on Forth Estuary on 28th January (DMB). Up to 15 in autumn (on 6th October) at Kinneil (DMB, DT).

S - 1 at Airthrey on 26th September (MWF).

LONG-TAILED DUCK* C – 1 at Gartmorn Dam on 23rd October and 16th December, 2 on 18th November (IN).

GOLDENEYE S – 720 on Forth Estuary on 25th February, mainly below Kincardine Bridge (DMB). 29 at Gartmorn Dam on 16th December, pair on 5th and 12th July (IN).

C – 40 (4m) at Manorneuk on 27th January (CJH), 80 at Kennetpans on 29th December (DMB). 29 at Gartmorn Dam on 16th December, pair on 5th and 12th July (IN).

RED-BREASTED MERGANSER S/C – Forth Estuary, 380 on 25th February (DMB), scarce above Kincardine Bridge, e.g. 8 at Kennetpans on 2nd December (AMcl).

GOOSANDER S – 20 at Stirling on 30th and 31st January (PWS), max 8 on North Third Res, Carron Valley Res and Loch Laggan, October-December (WRB).

C – 22 at Glendevon Res on 13th October, 62 at Tullibody Inch on 24th February (DMB).

GOSHAWK* 1 in east of area on 27th August.

HEN HARRIER S – 4 in Carron Valley/Kippen 27th September – 24th October. 1 on Dumyat on 5th December (DMB, DT, CJH).

C – Ringtail at 500m in Balquharn Glen on 13th January (CJH): very scarce in Ochils in winter.

SPARROWHAWK S/C – records throughout area; male chased Pied Wagtail through people at Airthrey on 10th December (MWF).

BUZZARD* S – 1 at Airthrey on 17th May, 1 at Gargunnoch on 15th December (DMB, WRB).

C – 1 at Forestmill on 18th February, 1 on Dumyat on 20th May, 1 at Muckhart on 18th November and 1 on 9th December (DMB).

More spring records than usual but no sign of breeding.

GOLDEN EAGLE* S – 1 near Pendreich (Bridge of Allan) on 23rd September (CJH).

MERLIN S/C – Records throughout area February and 23rd October – 29th December (DMB, WRB, DF, CJH, JHI, AMcl, DT).

66 PEREGRINE S/C — 19 records, 6, January-February; 6, April; 6, August-September; 1, November (DMB, WRB, DF, AMcl, CJH, JM, JHI, GIJ). None bred, pair at regular site, singles at two occasional sites.

MOORHEN S — Only 1 at Airthrey on 17th January after weeks of hard frost (CJH).

C — A club survey of the R Devon on 2nd June showed very few compared with 1977.

COOT S — Few breeding at Airthrey but many young seen (CJH). 30 at Carronmouth on 3rd January, hard weather (DF).

C — 50 on Gartmorn Dam in spring, 127 on 16th September (IN).

OYSTERCATCHER S/C — 1st inland in spring heard at night over both Stirling and Airthrey on 19th February and over Alva on the 27th (MWF, CJH, DT).

Forth Estuary, max of 1710 on 28th January and 1065 on 7th October (DMB).

RINGED PLOVER Skinflats, under 10 in February, 307 on 20th May. 210 at E Grangemouth on 17th August (DMB, DF, DM).

GOLDEN PLOVER S/C — 2830 on Forth Estuary on 7th October (2500 at Skinflats). 500 at Airth on 8th November; 200 near Stirling 29th September — 10th October (DMB, AMcl, DT).

GREY PLOVER S — Up to 35 at Skinflats in February — over half the total on Forth Estuary and 22 on 6th October. 23 at E Grangemouth on 2nd December (DMB, DF, AMcl).

LAPWING C — Club survey showed usual numbers in Devon Valley on 2nd June.

S — No large flocks reported in early winter. 12000 on Forth Estuary on 7th October — 5000 at Skinflats. Up to 850 around Stirling in November, 1000 at Kincardine Bridge on 25th November and 2nd December (DMB, WRB, DF, AMcl, DT).

KNOT S/C — 8950 on Forth Estuary on 28th January, 3000 at E Grangemouth on 18th February; 400 at Skinflats on 18th April. 1st of autumn — 40 at E Grangemouth on 29th July (DMB, AMcl).

SANDERLING* S — Grangemouth area, 2 on 27th May, 2 on 9th August and 5 on 17th August (DMB).

LITTLE STINT* S — 3 at E Grangemouth on 7th October (DMB).

CURLEW SANDPIPER* S — Grangemouth area 3 on 26th August, 15 on 9th September, 2 on the 20th and 1 on 7th October (DMB, WRB, DT).

DUNLIN S/C — Forth Estuary — 4800 on 28th January, 2180 on 7th October.

S — 2050 at Skinflats on 15th May, 720 near Kincardine Bridge on 18th November (DMB, AMcl).

RUFF S — 1 at E Grangemouth on 11th August (DMB), 1 on 19th August and 2 on 26th August (DT).

SNIFE S/C — Concentrated at marshy springs in hard weather, e.g. 10 at Airthrey on 9th and 7 at Alva on 2nd February.

S — Displaying over Loch Elrig on 16th April (CJH, AMcl).

JACK SNIFE* C — Kennetpans. 1 on 25th February, singles shot on 27th and 29th December (per JHI).

BLACK-TAILED GODWIT* S — Grangemouth area — 3 on 16th February, 4 on 29th July, 3 on 12th and 26th August and 5 on 7th October (DMB, DF, DT).

BAR-TAILED GODWIT S/C — Forth Estuary — 395 on 28th January, 300 on 20th September and 410 on 7th October (DMB, WRB).

WHIMBREL* S/C — Heard over Alva on 12th May and Airthrey on 14th, 1 at E Grangemouth on 14th. In the last ten years there have been only two other spring records.

Forth Estuary: 1 on 19th July and 2 on 29th and 3 on 17th August, 4 at E Grangemouth on 19th August (DMB, MWF, CJH, DT).

CURLEW S/C — 1610 on Forth Estuary on 7th October (DMB).

S — 102 at E Grangemouth on 19th February, 400 on 20th September and on 18th November (DMB, WRB, DF, AMcl).

68 SPOTTED REDSHANK S - 1 at Grangemouth on 11th August and 1 on 26th (DMB, WRB, DT).

REDSHANK S/C - 1790 on Forth Estuary on 28th January and 2650 on 7th October (DMB).

S - Still 200 at Skinflats on 13th April.

C - Club survey found good numbers in Devon Valley on 2nd June.

GREENSHANK S/C - Forth Estuary - wintering birds on 8th February and 16th December; other records total 25 between 5th August and 5th October with 1 on 15th November (DMB, WRB, DM, DT, SM, AW).

GREEN SANDPIPER S - 1 at East Grangemouth on 26th August (DT).

COMMON SANDPIPER S - 2 at Airthrey on 10th May. In autumn many records on Forth Estuary 19th July - 26th August, including 6 at Grangemouth on 19th August (DMB, WRB, DF, DM, DT).

C - Club survey found good numbers along River Devon on 2nd June.

TURNSTONE S/C - Forth Estuary, 128 on 28th January (DMB).

LITTLE GULL* S - 1 dead adult at Skinflats on 25th February and a live immature on 20th May (DMB, DF).

ARCTIC SKUA S - 1 at E Grangemouth on 19th August (DT).

BLACK-HEADED GULL S - 50 pairs at Loch Elrig on 16th April. 150 pairs at Loch Carron, none at N Earlsburn (35 in 1978, robbed), 1000 at Skinflats on 18th November (AMcl, G. Scott, D. Holmes).

LESSER BLACK-BACKED GULL S - 1st at Stirling on 7th March, last on 8th November. 50 at Loch Elrig on 16th April (AMcl, DT).

HERRING GULL S - 1500 at E Grangemouth on 11th November (AMcl).

GLAUCOUS GULL* S - 1 imm at E Grangemouth on 29th July (DMB).

GREAT BLACK-BACKED GULL S — 145 at E Grangemouth on 11th November (AMcl).

KITTIWAKE S — 200 at Skinflats on 11th February and 100 on 20th May (DMB).

COMMON TERN S — 1st of summer at Carronmouth on 7th May, last on 3rd September. 60 birds reared 50 young (DM).

LITTLE TERN* S — 3 at E Grangemouth on 29th July (DMB).

LITTLE AUK* S — 1 found long dead at Skinflats on 20th May (DMB).

LONGEARED OWL* S — 1 at Kippen on 6th December, mobbed by crows (WRB).

SHORTEARED OWL S/C — none in summer in Ochils.

S — 4 in January, February, December; 5 at Skinflats on 1st January and 1 on 13th April (WRB, AMcl, DT).

SWIFT S/C — 1st, 3 at Dollar and 3 at Airthrey on 9th May, 100 at Gartmorn Dam on 19th May, 120 over Ben Cleuch on 3rd July. Few at Stirling after 13th August; last at Alva on 20th August (DMB, WRB, CJH, AKT).

KINGFISHER S/C — Summer, none at Barbush or on River Devon during club survey.

S — 1 at Polmont February to 15th March; at Airthrey from 31st October to 18th December (DMB, WRB, MWF, AKT).

GREEN WOODPECKER S — 4 pairs Slamannan to Muiravonside. 1 at Bridge of Allan on 11th January, digging in snow in garden.

C — 1, in thick snow at 250m, Balquharn on 13th January (CJH, AMcl, PWS).

SAND MARTIN S — 4 at Bridge of Allan on 11th April, 30 on 13th. A late and poor breeding season.

C — 26 burrows by River Devon, Menstrie — Tillicoultry 2nd June. Last, 20 at Gartmorn on 16th September (DMB, WRB, AKT, CJH).

- 70 SWALLOW S — 1st, 2 at Airthrey on 12th April. Laying 1 or 2 weeks late (AKT).
C — 100 at Gartmorn on 2nd August. Almost white bird at Tillicoultry on 22nd September. Last, 4 at Dollar 15th October (DMB, CJH).
- HOUSE MARTIN C — 1st, 2 at Muckhart on 29th April. At nests Alva on 9th May (DMB, CJH).
- GREY WAGTAIL S — Single winter record, at Grangemouth on 6th January (AW, SM).
C — On 2nd June the survey found few on the River Devon compared with 1977.
- DIPPER S — 2 in February and until 16th March on Westquarter Burn, Polmont (DF).
C — Greatly decreased on River Devon during club survey on 2nd June.
- WREN S — Few birds singing in breeding season (WRB).
C — Club survey found only a quarter of 1977 numbers on River Devon on 2nd June.
- REDSTART S — Only 2 records, Skinflats on 26th August, W Flanders Moss on 23rd September (WRB).
- WHINCHAT S — Last at North Third Res on 20th September (WRB).
- STONECHAT* S — None on Sheriffmuir (WRB, CJH).
C — Pair above Alva (gorse) on 10th August, no juveniles (CJH).
- WHEATEAR S — Last at E Grangemouth and Loch Coulter on 20th September (WRB).
- FIELDFARE S — 250 at Skinflats and 50 at Maddiston (Falkirk) on 15th April (AMcl). 1st of autumn, 7 SW at Myot Hill (Dunipace) on 20th October, 2000 SW at Bridge of Allan on 22nd October (CJH).
- REDWING S — Last, 12 at Skinflats on 13th April (AMcl). 1st of autumn, 80 at N Third Res on 10th October. 360 at Auchenbowie (Dunipace) and 40 at Airthrey on 18th October. Hundreds moving SW and S over Carron Valley, Bridge of Allan and Muckhart on 20th-23rd October (DMB, WRB, CJH).

MISTLE THRUSH S/C — Up to 4 in Hillfoots during January and February. 14 at Alva on 2nd August, 16 at Bridge of Allan on 22nd October and 9 with Redwings at N Third Res on 10th. Very few in east Stirling in November/December but 15 at Kippen on 6th December (WRB, CJH, AMcl).

SEDGE WARBLER S — 1st at Airthrey 15th May. Generally scarce (WRB, MWF).

C — Club survey found only one eighth of 1977 numbers in Devon Valley on 2nd June.

GARDEN WARBLER S — Good numbers in CBC plot near Falkirk (AMcl).

WILLOW WARBLER S — 1st, 3 at Skinflats on 15th April. Good numbers in Falkirk CBC plot (AMcl).

C — Club survey found this the 2nd commonest species in Devon valley on 2nd June, numbers as in 1977.

PIED FLYCATCHER* S — 1 singing at Airthrey on 3rd July (MWF).

GREAT TIT S — Singing at Airthrey during hard frost on 9th February (CJH).

C — Club survey found only half the 1977 numbers in Devon valley.

GREAT GREY SHRIKE* S — 1 at Carron Valley Res on 4th March (DF).

JAY S/C — 11 records (none east of Stirling), from 23rd September (WRB, AMcl, et al), 1 at Airthrey on 5th November (DMB).

MAGPIE S — Widespread around Falkirk, up to 12 in winter (AMcl). Several pairs stayed during building of housing estate at Stirling, now scavenge round and puncture plastic waste bags (DT). 5 at 210m on steep rocky ground, Dumyat, on 19th August (CJH).

ROOK C — 209 nests at Menstrie on 15th April, slightly more than 1978 (CJH).

RAVEN* C — No signs breeding. 3 at Craig Leith on 1st August, 2 at Kings Seat Hill on 16th December (CJH, AMcl).

- 72 HOODED CROW*** S – 1 at Slamannan in mid August (Mr. J. Murphy).
- HOUSE SPARROW** C – Albinistic female at Alva on 21st and 28th January (CJH).
- TREE SPARROW** S – 3 families at Arnprior in early August (WRB).
C – 5 at Kennetpans on 29th July (DMB).
- CHAFFINCH** S – Only 20 at Airthrey on 29th January during snow, good breeding numbers on CBC plot near Falkirk (CJH, AMcl). 90 S at Myot Hill (Dunipace) on 20th October.
C – Club survey found this the commonest species in the Devon Valley on 2nd June, numbers similar to 1977.
- BRAMBLING*** C – 150 at Muckhart on 9th December (DMB).
- GREENFINCH** C – 30 by R Devon at Alva on 2nd August (CJH).
- GOLDFINCH** S – Pair nested Brightons (Falkirk) (AMcl).
C – Max flock 12 by Forth at Manorneuk on 27th January (CJH).
- SISKIN** S – Parties of 30 and 55 in Carron Valley spruce on 26th February (CJH).
- REDPOLL** C – Small colony in birch/willow near Blairhall on 2nd June. 80 at Gartmorn on 16th September (CJH).
- TWITE** S – 17 W at Stronend on 6th October (CJH).
C – 30 around poultry houses by Forth, Manorneuk, on 28th January. 40 at Blackdevonmouth on 18th November (CJH, AMcl).
- CROSSBILL** S – 30 near Buchlyvie on 10th March. Numerous in Carron Valley Forest; 2 on ground 4th March apparently picking grit. 6 over Airthrey on 15th June; 5 S Kilsyth Ridge on 20th October (WRB, DF, CJH, S. Proctor).
- HAWFINCH*** S – 1 at Bridge of Allan on 1st March and 16th December (Mr and Mrs Thomson).
- SNOW BUNTING*** S/C – No records early in year despite hard weather.
S – Male at E Grangemouth on 7th October (DMB).
C – 1 on Whitewisp Hill 16th December (AMcl).

YELLOWHAMMER C — 90 on stubble by Alva on 14th January 73
(CJH).

REED BUNTING C — 10 with Yellowhammers near Alva on 14th
January (CJH).

CORN BUNTING S — Bred at Skinflats, a few through year
(AMcl).

Albino singing near Blairlogie in summer (2 km from 1978 record)
— pinkish yellow bill and legs, faint fawn tinge round face and on
back (CJH).

ADDENDUM

Also recorded : Heron, Red Grouse, Black Grouse, Partridge,
Pheasant, Common Gull, Stock Dove, Wood Pigeon, Collared Dove,
Tawny Owl, Barn Owl, Great Spotted Woodpecker, Skylark, Meadow
Pipit, Rock Pipit, Cuckoo, Sandwich Tern, Guillemot, Razorbill, Song
Thrush, Ring Ouzel, Starling, Spotted Flycatcher, Dunnock, Robin
Blackcap, Chiffchaff, Whitethroat, Goldcrest, Treecreeper, Long
Tailed Tit, Coal Tit, Blue Tit, Bullfinch, Carrion Crow, Jackdaw.

CONTRIBUTORS

This report has been compiled from records submitted by:

D. M. Bryant, W. R. Brackenridge, R. Dalziel, D. Fleming, M. W.
Frazer, C. J. Henty, J. H. Isom, S. MacDonald, A. McIver, G. T.
Jamieson, D. Matthews, J. Mitchell, I. Nicoll, P. W. Sandeman, Miss
A. K. Turner, D. Thorogood, A. Wood.



Walter Joynson of Kinlochard (1913-73)
Photo by John B. Murray

PEREGRINES AND MAN IN THE STIRLING REGION

75

J. Mitchell
Nature Conservancy Council

SUMMARY

The account traces the long association of the Peregrine *Falco peregrinus* with man in the Stirling region, from the earliest records of the 13th century to the present day. Originally held in high esteem as a sporting bird, the advent of intensive grouse rearing during the 19th century resulted in the Peregrine being considered little more than vermin to be ruthlessly destroyed. Recent years have seen the restoration of its former status as one of the most cherished members of our avifauna. Ironically, it was during this latter period that the very survival of the species in Britain was inadvertently threatened through secondary poisoning following the post-war introduction and widespread use of organochlorine agricultural pesticides. Following a reduction in the use of these pesticides, field monitoring has shown that the number of potential breeding pairs in the Stirling region is probably higher now than at any time since the early 19th century when persecution of birds of prey began. The stability of the present population level is still, however, delicately balanced.

The charisma of the Peregrine has attracted and held the interest of falconers and other *Falco peregrinus* enthusiasts in the Stirling region for at least 700 years. Written records date back to the 13th century when the flying of trained Peregrines at herons and other game-birds was still the privilege of the Court, and Alexander III kept some of his falcons at Dunipace, near Falkirk. While residing at Stirling Castle, James IV flew his hawks over nearby Flanders Moss. A long-deserted Peregrine eyrie on Abbey Craig overlooking the town was one of the first breeding sites to be named in the early literature, and it was here and at Craigleith above Alva that Mary Queen of Scots had young falcons obtained on her return from France in 1561 (Ritchie 1920, Fleming 1934, Rintoul and Baxter 1935). Despite this long association of the art of falconry with the immediate Stirling area, it was not until the 19th century with its revolution in public transportation that the distribution of Peregrine eyries throughout the region began to be revealed. The opening-up of the southern highlands by road, steamer and finally rail is a separate subject in itself, but these events are so closely linked with the exploration of the area by natural historians that a short resume would not be out of place.

At the turn of the 19th century the arterial system of roadways

76 through the southern highlands, based on former military causeways along Loch Lomondside in the west and Strathyre/Glen Ogle in the east, were in a bad state of repair. Although the *Road Repair Act* 1814 made effective provision for the maintenance of the old military roads, both Dunbartonshire and Perthshire elected to opt out for a number of years, thereby avoiding commitment to a major share in the expense. For the long distance traveller the early lead taken by Stirlingshire in road improvements was nullified the moment the county boundary was reached. It is perhaps not surprising with such difficulties being faced by vehicular traffic, that the few published references made to outlying Peregrine eyries about this time can all be attributed to resident parish ministers. But the re-modelling of Dunbartonshire and Perthshire's dilapidated military causeways into relatively fast 'turnpike' roads was eventually undertaken, and this greatly facilitated travel throughout the south-west highland area. Apart from road improvements, the introduction of a passenger steamer on Loch Katrine in 1843 effectively linked the northern end of the new Duke's Road over the Trossachs to the former military road through Glen Arklet to Inversnaid, with its ferry across Loch Lomond to the Tarbet — Crianlarich turnpike and steamer services to all points north and south. A wooden paddle steamer had been operating on Loch Lomond as early as 1817, but with the opening in 1850 of the last stretch of the Caledonian and Dunbartonshire Railway between Glasgow and Balloch pier, the gateway to the southern highlands in the west was opened wide. No one reading through the transactions and proceedings of local natural history societies during the mid-Victorian period can fail to detect the stimulating influence on field activities generated by the coming of the railway. The most important single development was undoubtedly the completion of the Callander and Oban line as far as Crianlarich and Tyndrum by 1873, thus offering a regular and dependable service along the eastern side of the southern highlands to naturalists and field sportsmen from Glasgow and Edinburgh alike. The earlier opening of the Forth and Clyde line between Stirling and Balloch in 1856 and the initial stretch of West Highland line from Glasgow to Crianlarich by 1894 completed the railroad circuit. Even with all those improvements in travel, to those of us accustomed to the advantages of direct travel by motor vehicle, the few recorded visits to Peregrine eyries during this period still have the ring of minor expeditions. A round trip to an eyrie in the vicinity of Ben Lomond made by the curator of Stirling's Smith Institute in the late 1880s (Sword 1894), accomplished partly by rail and partly by steamer, took him the best part of 24 hours --- a journey that could be undertaken by car today

in a quarter of the time. Difficult times indeed, yet thanks to the careful records left by parish ministers, visiting naturalists and at least one local-name-conscious ordnance survey officer, well over half of the traditional Peregrine sites referred to in this paper can be traced back to the last century.

The locations of Peregrine eyries in the Loch Lomond – Loch Katrine area appear to have been well known by the second half of the 19th century, principally due to the untiring efforts of Glasgow-based banker/amateur ornithologist Robert Gray (Gray 1864 and 1871). Regretably, little of this hard-won information has been passed down, for this was the age of the bird-skin collector with flourishing taxidermists' businesses in Glasgow, Edinburgh and Perth (see Herriot 1968), and Gray prudently avoided identifying extant sites by name in his published work. Throughout the 1800s and early 1900s much of the suitable upland ground in the region was given over to the intensive rearing of Red Grouse *Lagopus lagopus*, and several writers --- Feilden (1867a), Harvie-Brown (1867), Cameron (1874) and Buchanan (1880) --- comment on the persecution of birds of prey during this extended period of what Cameron aptly described as 'lagopomania', when estates competed with one another to bring record numbers of birds in front of the sporting guns. The first *Wild Birds Protection Act* of 1880 belied the title as far as the Peregrine was concerned, as its prohibitory clauses did not extend to land owners and occupiers, or anyone else they cared to authorise. Following several amendments designed to strengthen the principal act, a bill was passed through Parliament in 1894 that gave powers to the newly established county councils to apply for local protection orders on specific birds and their eggs. The response from the various local authorities was initially rather piecemeal, but following a request from the Secretary for Scotland for greater uniformity by adjoining counties, the Peregrine was given full statutory protection during the breeding season in Stirlingshire and Perthshire from 1898. Even so the law was largely ignored, and the well preserved remains of a gin-trap cairn above one regularly occupied breeding cliff and a 'keeper's dry-stone hide immediately below another bear silent witness that the systematic trapping and shooting of Peregrines continued as before. On the collectors part, the early-Victorian passion for the stuffed-specimen case was gradually replaced by the birds-egg cabinet, and Col. H.W. Feilden (who as a subaltern was stationed at Stirling Castle) gives a graphic account of an assault on a Peregrine eyerie in a successful bid to obtain a coveted prize (Feilden 1867b). Most of the many clutches of Peregrine eggs that must have been collected during this period have long since mouldered into dust, but housed in the Royal Scottish Museum, Edinburgh, are two

surviving sets taken locally (... and quite illegally) by the late Sir Maurice Denny of Clyde ship-building fame. As a national sport 'hawking' in Britain all but vanished from the end of the 17th century with the introduction of portable firearms, but the enthusiastic individual falconer never quite disappeared -- and neither did the enterprising man on the spot prepared to assist him lay hands on the desired birds. At one regular site over-shadowing the now closed Callander and Oban Railway line, the taking and selling of Peregrine eyasses (young taken from the nest for training) was looked on as a seasonal perquisite by the company's plate-layers. Since 1954 the taking of young Peregrines has been controlled by a licencing system, such licences being granted only to experienced falconers at the discretion of the Advisory Committee on the Protection of Birds in Scotland to the Scottish Home and Health Department.

With a gradual change in emphasis from grouse shooting to deer stalking, the break-up of several sporting estates and the acquisition of large holdings in the area by the Forestry Commission, the pendulum of fortune began to swing once more in the Peregrine's favour. In common with all avian and mammalian predators of game, the Peregrine undoubtedly benefitted from the run-down in 'keeping activities during the Second World War (1939-1945), and unlike many coastal counties in Britain, Stirlingshire and Perthshire were not affected by *The Destruction of Peregrine Falcons Order 1940* (see Treleaven 1977 for a copy of the order). Under the order an estimated 600 full-grown Peregrines, in addition to many eggs and unfledged young, were destroyed in the United Kingdom in an attempt to minimise the loss of service carrier pigeons during the national emergency (Ferguson-Lees 1951). Paradoxically, it was homing pigeon interests that led to the first national field survey of the distribution and numbers of the Peregrine in Great Britain. An anti-Peregrine campaign conducted in the pages of *The Racing Pigeon* culminated in an editorial headed 'Down with the Peregrine' on 24th October, 1959 that alleged it was responsible for the deaths of some 100,000 valuable racing birds annually, and called for concerted action to have the Peregrine removed from the list of fully protected species under the *Protection of Birds Act 1954*. The allegations made by the pigeon fanciers were challenged by the Royal Society for the Protection of Birds, who similarly urged its own membership to lobby their respective members of parliament and for other conservation organisations to make representations to the Secretary of State pressing for the retention of the Peregrine's fully protected status. These conflicting claims and counter-claims -- echoes of an earlier skirmish between the two opposing factions in 1925 (see Sheail 1976) -- resulted in the Home Office requesting the Nature

Conservancy to initiate an enquiry into the distribution and numerical status of the Peregrine in Britain and to provide a factual report on the extent of their predation on homing pigeons. In turn, the British Trust for Ornithology (BTO) accepted an invitation from the Nature Conservancy to carry out a grant-aided survey, appointing Dr. D.A. Ratcliffe as national organiser. The field work for the national Peregrine survey was undertaken during the breeding seasons of 1961 and 1962, when it was found that far from being 'a comparatively common bird' as stated in *The Racing Pigeon*, half of over 500 traditional territories visited were apparently deserted and only a quarter of the territories still occupied were producing young (Ratcliffe 1963). In the above national enquiry report and subsequent papers (Ratcliffe 1970 and 1973), Dr. Ratcliffe presented convincing evidence to connect the unprecedented decline in Peregrine numbers and breeding success with the contamination of its prey species following the post-war introduction and widespread use of persistently toxic organochlorine agricultural pesticides. Apart from the greater chance of premature death in both young and old birds, the mechanisms involved in the decline included a reduction in egg-shell thickness with an associated increase in frequency of clutch depletion as a result of parental damage, and a higher percentage in the number of pairs non-breeding or producing infertile eggs.

The 1961/62 national survey was essentially a co-operative venture, relying heavily on background information and assistance from amateur field workers throughout Britain. In the Stirling region, (which for the purposes of this paper covers only those parts of former west Stirlingshire and south-west Perthshire shown on the OS 1" tourist map *Loch Lomond and The Trossachs* (1967)), a preliminary list of local Peregrine sites was forthcoming from falconers, notably Alastair McArthur for the west, the late Walter Joynson for the south and Phillip Glasier for the north and east. Additional site localities were provided by Pat Sandeman, who for seven years (1950-1956) had extensively covered the southern highlands for an annual investigation into the breeding status of the Golden Eagle *Aquila chrysaetos* (see Sandeman 1957), bringing the known total of potentially active territories in the area to 16. Field work by Dr. Ratcliffe and others showed that of 11 territories surveyed, nine (82%) were occupied by one or more birds. Unfortunately only a few of these sites were visited more than once in either season, so that the information available on breeding success is too incomplete to draw definite conclusions. The writer's personal records for the region, which date from 1965, suggest the lowest ebb in breeding success occurred in 1967 when only two young falcons fledged from five occupied territories examined. Breeding success

80 began to slowly improve from 1968, almost certainly as the result of a reduction on the use of organochloride pesticides, so that by 1971 when a repeat national Peregrine survey was organised by the BTO (see Ratcliffe 1972), 11 (85%) of 13 territories visited in the region were found to be occupied by one or more birds of which seven successful pairs reared a minimum of 16 young.

In 1974, the writer's annual sample census of Peregrine eyries was adopted as a Nature Conservancy Council (NCC) project. With more field work time, gradually improving local knowledge and contacts, the number of known Peregrine territories within the Stirling region had increased to 20 by 1978 when a complete survey of every site proved possible. The bulk of the field work that year was carried out under NCC licence by Don MacCaskill, John Mason, Patrick Stirling-Aird and the writer, the results supplemented by additional records contributed by several other observers. Of the 20 territories examined, 18 (90%) were occupied by pairs, from which nine successful pairs reared a total of 22 young (note: the figure given does not include two young taken by falconers under Home Office licence). Of the remaining territories, one appeared to be held by a single bird and the other was apparently deserted (see Appendix I for territory and breeding site descriptions, and Appendix II for the 1978 individual territory records). Although breeding success in 1978 left much room for improvement, it is probable that Peregrine numbers in the Stirling region were higher than at any time since the early 19th century, when the development of intensive game rearing began 150 years of relentless persecution of this most spectacular of birds.

What of the Peregrine's future in the region? Today, not only have many of the former grouse moors gone over to deer stalking or the production of conifers, changing attitudes have resulted in a pair of Peregrines in occupation on a sporting estate being more often considered of considerable interest, rather than vermin to be destroyed at the first opportunity. Unlike the Lake District and other over-visited parts of Britain, modern leisure activities have had little effect on the tenability of Peregrine territories in the Stirling region. Several sites have popular footpaths winding past the foot of the breeding cliff, but although the occupying pair may protest noisily on occasions, none have been deserted. At least two of the breeding sites are included in published rock-climbing guides, but to date only one alternative cliff (see Appendix I) has been more or less abandoned through constant use. Completely unanticipated was the appropriation in 1975 of two breeding cliffs as launching sites for the seemingly suicidal sport of 'Hang-Gliding'. The vulnerability of Peregrines to excessive disturbance was explained to the participants and they do not appear to have utilised either cliff since. In the

Stirling region, the collecting of Peregrine eggs for the specimen cabinet is virtually a thing of the past, but eyasses are still occasionally taken (both legally and illegally) for falconry and/or breeding purposes. However, compared with natural mortality of young Peregrines, which in their first year may exceed half the annual output (see Lindberg 1977 for review of continental and north american data), the small number taken over the last few years is probably not significant. The only apparent threat to the region's Peregrine population is the continuing risk of exposure to culminative poisoning through regular feeding on prey affected by agricultural pesticides. Regular sampling of Peregrine eggs in Britain has shown an analysis that the degree of organochlorine contamination decreased following the introduction of restrictions on the sale and use of pesticides incorporating Dieldrin or DDT, and systematic field observations confirmed that the Peregrine's breeding success and population numbers responded accordingly. The best available figures on Peregrine mortality/recruitment in Britain, based partly on Peregrine ringing data and partly on life-tables of commoner birds of prey such as Kestrel and Buzzard, indicate a minimum annual requirement of at least 1.2 young per potential breeding pair to maintain the population level (D.A. Ratcliffe and C.J. Mead pers. comm.). From 1973-1977 inclusive, the monitored territorial pairs in the Stirling region reared a mean annual brood size of 1.8 young over the five year period. This small but regular surplus of young each year has led in turn to a gradual re-occupation of vacant ancestral sites, and the dispersion of some potential colonists further afield. Of seven recoveries to date from some 50 Peregrines ringed as young birds in the study area between 1968-1977, four were reported outwith the region, the furthest near an unoccupied site in the Cheviot Hills, Northumberland. Possibly as a combined effect of an unseasonably cold spring with the chemically impaired breeding ability of the parent birds, the mean brood size per territorial pair in 1978 dropped to just over 1.2 young -- the critical threshold of productivity below which it is considered the present high number of pairs holding territories may not be maintained. Following an even less favourable spring in 1979, the field survey results showed a small but further reduction in the overall production of young. Although the low output of offspring in both years is probably within the range of normal variation, it does suggest that the Peregrine's status in the Stirling region is still finely balanced, and even a minor resurgence in the local use of organochlorine agricultural pesticides could again tip the scales, resulting in another slow but steady decline in the population unless supported by immigration from elsewhere.

I would like to take this opportunity to acknowledge the support given by the Nature Conservancy Council (SW Region, Scotland) with the annual survey of Peregrine eyries in the Stirling region. Also the many friends who have assisted in one way or another, and trust they will forgive me for not mentioning them individually by name. The field work was made possible through the courtesy extended by private landowners and tenants, the Lower Clyde Water Board and the Forestry Commission. Special thanks are due to Dr. Derek Ratcliffe (Chief Scientist -- Nature Conservancy Council) for much helpful discussion and encouragement over the years, and for his valued comments on the draft of this paper. Finally, it gives me particular pleasure to dedicate the account to the late Walter Joynton (see Plate), *Fauconnier extraordinaire*, whose name will long be associated with the finest traditions of falconry as practised for centuries in the British Isles.

REFERENCES

- BUCHANAN, J. H. 1880. List of the birds which have been observed in the Parish of Callander, Perthshire. *Proceedings of the Royal Physical Society of Edinburgh* 5, 52-62.
- CAMERON, W. 1874. Birds of Balquhider. *The Scottish Naturalist* 2, 8-10.
- FERGUSON-LEES, I. J. 1951. The Peregrine population of Britain. *Bird Notes* 24, 200-208, 309-315.
- FEILDEN, H. W. 1867a. Nesting of the Peregrine falcon. *The Zoologist* 2 (2nd Series), 702.
- FEILDEN, H. W. 1867b. Nesting of the Peregrine in Stirlingshire. *The Zoologist* 2 (2nd Series), 790-791.
- FLEMING, A. 1934. Falconry and Falcons. London.
- GRAY, R. 1864. 'The Birds of Loch Lomond,' in Maclure and Macdonald's Illustrated Tourists Guide Book to the Trossachs, Loch Lomond, etc. (Editor W. Keddle), Glasgow.
- GRAY, R. 1871. The Birds of the West of Scotland. Glasgow.
- HARVIE-BROWN, J. A. 1867. Collected observations on the birds of Stirlingshire. *The Zoologist* 2 (2nd Series), 884-908.
- HERRIOT, S. 1968. British Taxidermistists - a Historical Directory. Leicester.

- LINDBERG, P. 1977. Banding of Peregrines *Falco peregrinus* in Sweden (Preliminary report) in Pilgrimsfalk -- Report from a Peregrine Conference held at Grimso Wildlife Research Station, Sweden, 1-2 April 1977 (Editor P. Lindberg) pp. 39-42. Stockholm.
- RATCLIFFE, D. A. 1962. Breeding density in the peregrine *Falco peregrinus* and Raven *Corvus corax*. *Ibis* 104, 13-39.
- RATCLIFFE, D.A. 1963. The status of the Peregrine in Great Britain. *Bird Study* 10, 56-90.
- RATCLIFFE, D. A. 1970. Changes attributable to pesticides in egg breakage frequency and eggshell thickness in some British birds. *Journal of Applied Ecology* 7, 67-115.
- RATCLIFFE, D. A. 1972. The Peregrine population of Great Britain in 1971. *Bird Study* 19, 117-156.
- RATCLIFFE, D. A. 1973. Studies of the recent breeding success of the Peregrine *Falco peregrinus*. *Journal of Reproduction and Fertility* (Supplement) 19, 377-389.
- RINTOUL, L. J. and BAXTER, E. V. 1935. A vertebrate fauna of Forth. London.
- RITCHIE, J. 1920. The Influence of Man on Animal Life in Scotland. Cambridge.
- SANDEMAN, P. W. 1957. The breeding success of golden eagles in the southern Grampians. *The Scottish Naturalist* 69, 149-152.
- SHEAIL, J. 1976. *Nature in Trust -- The History of Nature Conservation in Britain*. Glasgow and London.
- SWORD, J. 1894. The bird collection in the Smith Institute. *Transactions of the Stirling Natural History and Archaeological Society* 16, 139-204.
- TRELEAVEN, R. B. 1977. Peregrine -- the Private Life of the Peregrine Falcon. Penzance.

TERRITORY/BREEDING SITES OF THE PEREGRINE IN THE STIRLING REGION

The territorial and breeding site requirements of the Peregrine in Britain have been described in general terms in numerous publications, and in detail by Ratcliffe (1962). Only local points of interest are therefore considered below.

In the Stirling region the Peregrine is essentially an upland species during the breeding season, and recorded nest sites range from 245m to 655m above sea level, with an overall mean height of approximately 470m OD. The linear distance between adjacent breeding pairs extends from two km to eight km, depending to some extent on the availability of suitable breeding cliffs, giving a mean distance between pairs of 5.1 km. Probably all of the pairs have more than one breeding cliff within their individual territories, the greatest recorded distance between alternative sites being 4.8 km, but most are much less. By far the majority of the cliffs utilised by Peregrines are sufficiently high and sheer to necessitate rope-work for eyrie examination. In almost every case several alternative eyries have been recorded at each breeding site, the maximum being nine different ledges in one stretch of cliff over 14 seasons. Apart from one territory, there appears to be little competition for breeding sites with the earlier nesting Golden Eagle, there being only seven known potential breeding pairs in the study area.

APPENDIX II

TERRITORY OCCUPATION AND BREEDING SUCCESS OF THE PEREGRINE IN THE STIRLING REGION DURING 1978

Note: Two very old territories, with no record of occupation since they were first mentioned at the turn of the 19th century, have not been included in the list below. An additional territory was recorded for the first time in 1979.

- | | |
|-------------|--|
| Territory 1 | Pair in occupation. Bred. but eyrie failed at the egg stage. |
| Territory 2 | Pair in occupation. Bred successfully, 3 young reared. |

- Territory 3 Pair in occupation. No evidence obtained of breeding.
- Territory 4 Territory apparently unoccupied (Last recorded occupied by a breeding pair in 1962, and only the occasional single bird seen since).
- Territory 5 Pair in occupation. Bred successfully, 2 young reared.
- Territory 6 Pair in occupation. Bred successfully, 4 young reared.
- Territory 7 Pair in occupation. No evidence obtained of breeding.
- Territory 8 Pair in occupation. Bred, but eyrie failed at the egg stage.
- Territory 9 Pair in occupation. No evidence obtained of breeding.
- Territory 10 Pair in occupation. Bred successfully, 2 young reared.
- Territory 11 Pair in occupation. Bred successfully, 3 young reared.
- Territory 12 Pair in occupation. Bred successfully, 3 young reared.
- Territory 13 Pair in occupation. Bred successfully, 2 young reared.
- Territory 14 Pair in occupation. No evidence obtained of breeding.
- Territory 15 Pair in occupation. Bred, but eyrie failed at the egg stage.
- Territory 16 Pair in occupation. Bred successfully, 2 young reared.
- Territory 17 Pair in occupation. Bred successfully, 1 young reared.
- Territory 18 Pair in occupation. No evidence obtained of breeding.
- Territory 19 Pair in occupation. No evidence obtained of breeding.
- Territory 20 Territory apparently occupied by only a single bird (Breeding pair in occupation in 1979).

86 PROBABLE BREEDING OF THE COMMON CROSSBILL IN THE E. STIRLINGSHIRE PART OF THE FORTH FAUNAL AREA –

On 12th April 1979 I saw a pair of Common Crossbills (*Loxia curvirostra*), a red male and an olive-green female, perched at the top of a larch tree in the Auchentroig section of Loch Ard Forest to the east of Drymen Road Cottage. Three other crossbills flew overhead, calling. On visiting the site three days later a red male and an immature bird appeared near the top of a spruce tree bordering the Water Board road, affording quite close views. The young bird was very heavily streaked underneath from chin to vent, the markings on the flanks being virtually black against the off-white ground colour. The head feathering looked scruffy and ruffled and, whereas the crossed mandibles of the red male could be discerned with binoculars, it required confirmation by telescope that the two tiny points of the young bird's mandibles were, in fact, crossed. The male then dropped down out of view, but shortly reappeared with another young bird to join the first one. This second young bird, very similar in all features to the first, was much more active. On one occasion, the newcomer actually dropped on to the back of the red male, forcing it to move along the branch so that it itself could alight. It then begged food with flattened body and quivering half-open wings. Unfortunately its foreparts, as also the head and neck of the red male, were obscured behind the stem and a branch of the tree making it impossible to see if any food was in fact regurgitated from the old bird to the young one. All three birds then dropped out of view.

Coning has been exceptionally good in the Auchentroig plantation during 1979, and feeding Crossbills were first detected there on 10th March by Mrs J. Proctor (J. Mitchell *pers. comm.*). In the previous two years, Common Crossbills have been reported breeding in the Stirling region at the Garadhban Forest (*Loch Lomond Bird Report* 1977 p9) and Loch Achray Forest (*Forth Naturalist and Historian* 1977 p70) in the west Stirlingshire and south Perthshire portions respectively.

Robert G. Caldwell, 63 Southwold Road, Ralston, Paisley

R. Cook

INTRODUCTION

In addition to the native species and established introductions that comprise the bulk of any local flora, there is a third category of plants, members of which are known as 'casuals' or 'adventives'. These species are characterised by their sporadic occurrence and their association with human activity. They may in time become colonists and together with a selection of native and naturalised species come to constitute a wider class of plants, generally known as 'weeds'. In botanical recording 'weeds' tend to be neglected, but without their inclusion any description of the local flora must remain incomplete. Part of this neglect arises from the popular idea that 'weeds' are dull and uninteresting, a mistaken concept which hopefully, the following notes will help to dispel. In this paper plant names in English are mainly those recommended in Dony et al. (1974); Latin names, other than those marked * are taken from Clapham et al. (1962).

During the warm summer of 1977 an eruption of unusual plants occurred in the village of Menstrie, on a piece of derelict land (Grid reference NS 850970) situated behind the hotel on the main Hillfoot's road and opposite to the entrance of the former primary school. At this time, the square-shaped area which occupied about 0.5 hectare dropped abruptly from the public road on its northern edge, continued in a gentle slope and ended up more or less level. The sandy soil appeared to be well-drained and contained large amounts of pebbles, along with scattered fragments of concrete and asphalt.

In early summer, the upper part of the site was dominated by hedge mustard (*Sisymbrium officinale*), a plant which is not uncommon in the neighbourhood. In the few open spaces between the plants and on the lower ground there appeared over one hundred other species of flowering plants. The majority of these grew locally on similar pieces of waste ground and by road-sides. Of the remaining species however, twenty-six were considered interesting and unusual enough to merit separate comment.

The first group of plants comprises thirteen species, all of which are native to Britain but uncommon, rare or not to be found elsewhere in the neighbourhood of Menstrie.

Wild mignonette (*Reseda lutea*) was represented by a few scattered individuals. This species is uncommon in Scotland and no recent records exist for Upper Forth. (Descriptions of the distributions of species are mainly based on Clapham et al. (1962), Perring and Walters (1962) and Fitter (1978); Upper Forth is defined here as that area within the watershed of the River Forth above Grangemouth/Bo'ness.) Equally interesting was the presence of hairy buttercup (*Ranunculus sardous*). Formerly this plant occurred in several locations throughout central and southern Scotland but since 1930 only a few scattered records have appeared and none of these has been from the central area. Several specimens were found and the occurrence of this species elsewhere in Menstrie suggests that locally it may be under-recorded. Three or four plants of henbane (*Hyoscyamus niger*) were found in flower and the presence of the readily identifiable, persistent fruiting capsules indicated that the species had been present during the previous year. Henbane is uncommon in Scotland and apparently there is no earlier record for Upper Forth. Fool's parsley (*Aethusa cynapium*) was present as a few scattered specimens. These appeared to belong to a dwarf variety which grew to a height of 20-30cm in contrast to the plants of more robust stature recently found growing in a hedgerow to the east of the village.

A particularly interesting group of plants comprised giant bellflower (*Campanula latifolia*), field penny-cress (*Thlaspi arvense*), dwarf mallow (*Malva neglecta*), hare's-foot clover (*Trifolium arvense*) and knotted clover (*Trifolium striatum*). All five species were included in a list of Menstrie plants compiled at the beginning of this century by a local botanist, Rev. James Couper (1901). Today, none of the species is common in Menstrie. The first three are widely distributed throughout Scotland. Knotted clover however is confined to a few localities, including some in Upper Forth.

In Scotland, poppies (*Papaver* sp.) favour an easterly distribution and do not occur with regular abundance in Upper Forth. Thus it was interesting to find the two most widespread species, the common poppy (*P. rhoeas*) and the long-headed poppy (*P. dubium*) along with a third less familiar species, the prickly poppy (*P. argemone*).

Rough marsh-mallow (*Althaea hirsuta*) completes this group of plants. Four or five individuals of this attractive species were found. Thought to be native in only one or two localities in southern England, this mallow occurs uncommonly elsewhere, as a casual. Apparently it is previously unrecorded in Scotland.

ALIEN SPECIES

Scattered over most of the site were conspicuous patches of fodder vetch (*Vicia villosa*, sub-species *villosa*) a species of central and southern Europe which also occurs in west Asia and west Africa. The plant superficially resembles tufted vetch (*V. cracca*) although this particular variety was easily distinguished by its strikingly white wings. Another species, belonging to the same family but only represented by a single individual was crown vetch (*Coronilla varia*). This plant has a native distribution similar to that of *V. villosa* but it is naturalised in a number of localities throughout Britain. It is uncommon in Upper Forth but has been recorded in the past from Skinflats.

One or two individuals of ribbed melilot (*Melilotus officinalis*) and white melilot (*M. alba*) rose conspicuously above the other vegetation. Surprisingly these escaped picking and flowered well into the autumn. Both species are naturalised in southern England and occur as weeds throughout their native range which extends across Europe to China and Tibet. They are uncommon in Upper Forth. Growing amongst the grass and hedge mustard on the steeply sloping part of the site were several scattered specimens of ternate-leaved cinquefoil (*Potentilla norvegica*). Scottish records for this species, which is a native of eastern Europe and northern Asia, with a sub-species in North America, are mainly confined to the central area, where it is uncommon.

American wintercress (*Barbarea verna*), true to its botanical name was one of the first plants on the site to come into flower. This is not a native American species but a plant which has its origins in the western Mediterranean region. It is rarely recorded in Scotland.

One of the most unusual species belonging to this group of aliens was the annual labiate, dragonhead (*Dracocephalum parviflorum* *), a lemon-scented plant with light blue flowers on short dense spikes, growing to a height of about 30cm. The plant, which superficially resembles a hemp-nettle (*Galeopsis* sp.) occurred abundantly. Forty

to fifty species belong to this genus, all natives in temperate Eurasia except for *Dracocephalum parviflorum* which grows on rocky calcareous soils over a wide area of North America! Apparently the only other recent British record for this species was from Cambridgeshire in 1970.

Even more uncommon, was the record for scentless-mignonette (*Reseda inodora**) represented by a single bushy specimen. Superficially resembling wild mignonette (*R. lutea*) the native range of this species extends through south-east Europe to Russia and west Asia. No other recent records are known in Britain for this species. The non-typical anthers in this particular specimen made identification of this rare species difficult.

Material from Menstrie, representing both *Dracocephalum parviflorum* and *Reseda inodora* has been deposited in the Herbarium of the British Museum.

GARDEN ALIENS

The final group of plants comprises five alien species which are frequently to be found growing in gardens. The first two, sweet alison (*Lobularia maritima*) and candytuft (*Iberis umbellata**) are both annuals, natives of southern Europe and not often recorded as casuals in Scotland. Only one or two individuals were present on a well-drained part of the site. Several opium poppies (*Papaver somniferum*) were found growing along the northern margin. This species, with large pale purple flowers is found most frequently on the east coast and increases in abundance towards the south of England. It is a native of central Europe and Asia. An orange hawkweed, known as fox-and-cubs (*Hieracium aurantiacum*), also from central Europe and often found on railway banks was present as a few scattered specimens. The most attractive species in this group, common evening-primrose (*Oenothera biennis*) was represented by a single plant. *Oenothera* is an almost exclusively American genus although this species is established in Europe and New Zealand.

DISCUSSION

The sudden appearance of this unlikely collection of plants is perhaps puzzling until the history of the site and the nature of the species are considered.

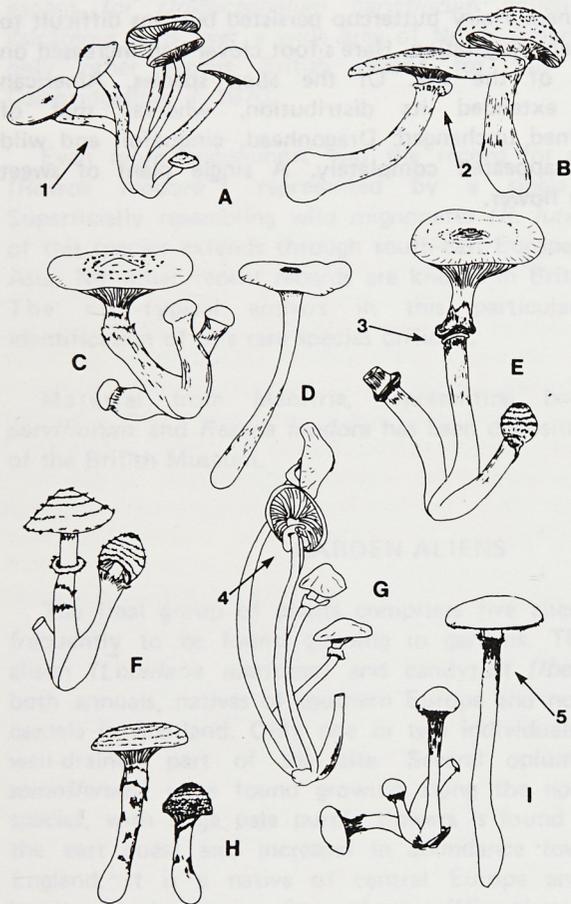
During this summer (1979) only a few straggly specimens of fodder vetch remained. Hairy buttercup persisted but was difficult to find amongst the rank vegetation. Hare's-foot clover had increased on the stonier areas of the site. Of the alien species, American wintercress had extended its distribution, whereas that of fox-and-cubs remained unchanged. Dragonhead, cinquefoil and wild mignonette had disappeared completely. A single plant of sweet alison was found in flower.



British records of *Androsace*
 H. A. *obovata*
 G. A. *ovata*
 F. A. *ovata*
 E. A. *ovata*
 D. A. *ovata*
 C. *Androsace ovata* (see text)
 B. A. *polytricha*
 A. A. *obovata*

1. Ring absent, at most replaced by a few fibrous bracts
 2. Ring with small scales towards margin
 3. Double ring with scales at margin on upper ring and roll of floccose
 material making up lower ring
 4. Membranous cuticle ring
 5. Filamentous to fibrous cotton-like ring

Figure 1



British species of *Armillaria*

- B. *A. polymyces*;
- D. *A. ectypa*;
- F. *A. ostoyae*;
- H. *A. obscura*;

- A. *A. tabescens*;
- C. *Armillariella bulbosa** (see text);
- E. *A. mellea*;
- G. *A. nigritula*;
- I. *Armillaria* sp. B.

1. Ring absent, at most replaced by a few fibrillose flecks;
2. Single ring with small scales towards margin;
3. Double ring with scales at margin on upper ring and roll of floccose material making up lower ring;
4. Membranous cuff-like ring;
5. Filamentous to fibrillose cobweb-like-ring.

During this summer (1979) only a few straggly specimens of fodder vetch remained. Hairy buttercup persisted but was difficult to find amongst the rank vegetation. Hare's-foot clover had increased on the stonier areas of the site. Of the alien species, American wintercress had extended its distribution, whereas that of fox-and-cubs remained unchanged. Dragonhead, cinquefoil and wild mignonette had disappeared completely. A single plant of sweet alison was found in flower.

Little has been published since the 1930s on the larger flora of the Strathclyde area. The dearth of information is regrettable and the Board of the Journal is anxious to remedy this.

These records are based on visits between 1960 and 1973, mostly in late September or early October, around Brigs of Allan.

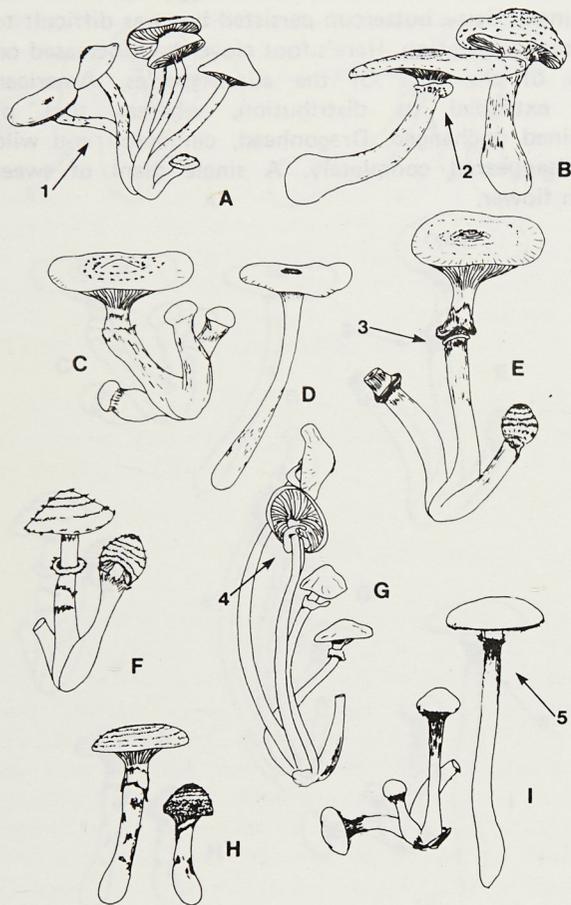
ANNOTATED CHECK-LIST

The majority of the plants are British. The check-list covers the vascular plants, algae, fungi, lichens, bryophytes, ferns, lycophytes, gymnosperms, angiosperms, and some other groups. It includes a few species which are not native to the area.

The names of the plants are given in the Check List of Christensen (1960), Corner (1950), Davis (1959), Jones et al. (1960), Donk (1956), Palmer (1969) and Page (1973) issued by the British Mycological Society.

Species which are not recorded in the Check List are given in the alternative names from the literature. The names from the Check List are given in the alternative names from the literature.

For a number of years the names of the plants in the Check List have been given in the alternative names from the literature. The names from the Check List are given in the alternative names from the literature.



British species of *Armillaria*

- B. *A. polymyces*;
- D. *A. ectypa*;
- F. *A. ostoyae*;
- H. *A. obscura*;

- A. *A. tabescens*;
- C. *Armillariella bulbosa** (see text);
- E. *A. mellea*;
- G. *A. nigritula*;
- I. *Armillaria* sp. B.

1. Ring absent, at most replaced by a few fibrillose flecks;
2. Single ring with small scales towards margin;
3. Double ring with scales at margin on upper ring and roll of floccose material making up lower ring;
4. Membranous cuff-like ring;
5. Filamentous to fibrillose cobweb-like-ring.

LARGER FUNGI OF THE STIRLING AREA

95

Roy Watling
Royal Botanic Garden, Edinburgh

INTRODUCTION

Little has been published, beyond the list of Crockart (1978), on the larger fungi of the Stirling district. With the background of this dearth of information I have been encouraged (by the editorial board of this journal) to compile my records for the area.

These records are the result of several half-day collecting trips between 1966 and 1972, mostly in late September or early October, around Bridge of Allan.

ANNOTATED SPECIES LIST

The majority of the records are of larger fungi (Basidiomycotina). The species are arranged alphabetically within each of the orders Agaricales, Aphyllophorales, Auriculariales, Dacrymycetales, Tremellales, Lycoperdales, Phallales and Sclerodermatales. Accompanying many of the species records are notes which sometimes include a few associated ascomycete fungi.

The names of the fungi follow those of the Check Lists of Christiansen (1960), Corner (1950), Dennis (1978), Dennis et al (1960), Donk (1966), Palmer (1968) and Pegler (1973) adopted by the British Mycological Society.

Species prefixed with + are included in Lange and Hora (1965); where the Check List names differ from those of Lange and Hora the alternative names from their book are given in parenthesis following the names from the Check List.

For a number of species associations with trees are noted and in the list and discussion English names only are used for these trees: Ash (*Fraxinus excelsior*), Beech (*Fagus sylvatica*), Sweet Chestnut (*Castanea sativa*), Elder (*Sambucus nigra*), Elm (*Ulmus glabra*), Larch (*Larix europea*), Oak (*Quercus* sp.), Pine (*Pinus* sp.) and Sycamore (*Acer pseudoplatanus*).

AGARICALES

- + *Agaricus langei*
- + *Agrocybe erebia*
in shrubbery by Airthrey Castle accompanied by + *Otidea onotica* (*Peziza onotica*).
- A. semiorbicularis*
on lawns, fruiting bodies observed in Spring.
- + *Amanita citrina*
- + *A. fulva*
- + *A. muscaria*
- + *A. rubescens*
- + *A. mellea*
included under this name are also *Armillariella polymyces* and *A. ostoyae*: see appendix.
- + *Boletus badius*
- + *B. chrysenteron*
often reduced to a distorted mass by the asexual stage of *Apiocrea chrysoasperma*.
- + *B. elegans*
under Larches.
- + *B. scaber*
under Birches.
- Cantharellula umbonata*
on lawn by Airthrey Castle.
- + *Clitopilus prunulus*
- Collybia atrata*
on site of old bonfire; accompanied by *Anthracobia macrocystis*, *Peziza petersii* and *P. praetervisiva*, and *Tricharina gilva*.
- + *Collybia confluens*
- + *C. peronata*
amongst leafy material.
- Conocybe pseudopilosella*
- Coprinus angulatus*
on site of old bonfire; see *Collybia atrata* for accompanying ascomycetes.

+ *C. disseminatus*

+ *C. domesticus*

on old wood springing from a fluffy to velvety vegetative stage called *Ozonium auriconum*.

C. lagopides

on site of old bonfire; see *Collybia atrata* for accompanying ascomycetes.

+ *C. micaceus*

on old stumps.

+ *C. plicatilis*

on lawn by Airthrey Castle.

+ *Crepidotus mollis*

on old branches, probably of Ash.

Cyphellopsis anomala

on old wood.

+ *Cystoderma amianthinum*

on lawn by Airthrey Castle.

Dermoloma cuneifolium

on lawn by Airthrey Castle.

Entoloma jubatum (Rhodophyllus jubatus)

in grassy area under Beech.

Galerina clavata

in moss, on lawn by Airthrey Castle.

+ *G. hypnorum*

in moss cushions, in woodland.

+ *G. mutabilis (Pholiota mutabilis)*

in caespitose groups on stumps.

+ *Gymnopilus junonius*

in group, base of old stump.

+ *G. penetrans*

on twigs of coniferous trees.

+ *Hygrophoropsis aurantiaca*

amongst leafy debris at edge of conifer plantation.

Hygrophorus ceraceus

on lawns by Airthrey Castle.

+ *H. conicus*

edge of lawn in shade of trees by Airthrey Castle.

- H. fornicatus*
on lawns by Airthrey Castle.
- H. lacmus*
on lawns by Airthrey Castle.
- H. laetus*
on mossy, more acidic, areas of lawn by Airthrey Castle.
- H. marchii*
on lawns by Airthrey Castle.
- H. obrusseus*
on lawns by Airthrey Castle.
- + *H. pratensis*
on lawns by Airthrey Castle.
- + *H. psittacinus*
on lawns by Airthrey Castle.
- H. russocoriaceus*
on lawns by Airthrey Castle; characterised by its very pleasant, sweet aromatic odour.
- H. unguinosus*
on lawns by Airthrey Castle.
- + *Hypholoma fasciculare*
on old stumps.
- + *Inocybe fastigiata*
amongst leafy debris.
- + *I. geophylla*
both the pale type variety and the lilac variety (var. *lilacina*) have been found at the edge of the woodland.
- + *Laccaria laccata*
widespread.
- + *Lactarius blennius*
under Beeches.
- + *L. pyrogalus*
- + *L. quietus*
under Oaks.
- + *L. rufus*
under conifers.
- L. serifluus*
under Oaks.

- + *L. subdulcis*
under Birches.
- + *L. tabidus*
under Beeches; characterised by white, milk-like fluid which exudes from the gills and gradually turns yellow when wiped on a handkerchief and the rugulose, smooth cap.
- + *Lyophyllum connatum*
in huge caespitose clumps on path.
- + *Marasmius oreades*
on lawns; widespread.
- + *M. rotula*
on hardwood twigs.
- + *Mycena acicula*
on woody debris.
- + *M. alcalina*
in clusters on conifer stump.
- + *M. fibula* (*Omphalina fibula*)
on lawns by Airthrey Castle accompanied by *O. swartzii*.
- M. floridula*
in mossy, more acidic, areas of lawn by Airthrey Castle.
- + *M. galericulata*
on several hardwood stumps; on one occasion accompanied by + *Xylospheera polymorpha* (*Xylaria polymorpha*).
- + *M. galopus*
on leafy debris; widespread. The white form, often called var. *alba*, was also recorded; it is probably worth specific rank. Var. *nigra* is synonymous with *M. leucogala*: see below.
- + *M. haematopus*
on Oak stump and attached to large branches festooned with + *Bulgaria inquinans*.
- + *M. leucogala*
on site of old bonfire; see *Collybia atrata* for accompanying ascomycetes. Like *M. galopus* in possessing white, milk-like fluid when broken but differs in very dark cap and stem.
- + *M. sanguinolenta*
on leafy and conifer needle debris.
- + *M. swartzii* (*Omphalina swartzii*)
on lawns by Airthrey Castle.

- 100 + *Nolanea icterina* (*Rhodophyllus icterinus*)
edge of lawn; characterised by dirty lemon-yellow colours
and odour of burnt sugar.
- + *N. sericea* (*Rhodophyllus sericeus*)
widespread on lawns.
- + *N. staurospora* (*Rhodophyllus staurosporus*)
widespread on lawns and in woodland areas.
- + *Oudemansiella mucida*
on Beech.
- + *O. radicata*
around base of Beeches.
- + *Panaeolina foenicicii* (*Panaeolus foenicicii*)
in troops in grass on path.
- + *Panaeolus rickenii*
in grass by path.
- + *P. semiovatus*
on cow dung; accompanied by *Ascobolus albidus* and
A. stictoides, *Coprobria granulata*, *Sporormia intermedia* and
Zygospermella insignis.
- P. sphinctrinus*
on cow dung; see *P. semiovatus* for accompanying ascomycetes.
- + *Panellus stipticus*
on old stump accompanied by + *Xylosphaera hypoxylon*
(*Xylaria hypoxylon*).
- + *Pholiota carbonaria*
on site of old bonfire; see *Collybia atrata* for associated
ascomycetes.
- + *P. squarrosa*
on stump.
- + *Pleurotus dryinus*
on dead, standing tree.
- + *P. cervinus*
on hardwood stumps.
- P. nanus*
on soil at lane-side, accompanied by + *Aleuria aurantia*
(*Peziza aurantia*).
- Pseudohiatula tenacella*
on conifer-cones.

- + *Psilocybe semilanceata*
on lawns, throughout Stirling University Campus.
- + *Russula atropurpurea*
under Oaks.
- + *R. cyanoxantha*
under Oaks.
- R. fellea*
under Beeches.
- R. nigricans*
under Oaks.
- + *R. ochroleuca*
under various broad-leaved trees; widespread.
- + *R. xerampelina*
in mixed woodland.
- + *Stropharia aeruginosa*
in field amongst stubble.
- + *S. semiglobata*
on weathered dung.
- Tricholoma argyraceum*
under broad-leaved trees.
- + *T. ustale*
under Beeches.
- + *Tricholomopsis rutilans*
on conifer stump.
- + *Tubaria furfuracea*
in group on woody and herbaceous debris.

APHYLLOPHORALES

- + *Bjerkandera adusta* (*Gloeoporus adustus*)
on fallen Beech accompanied by + *Bulgaria inquinans*.
- Clavaria amethystea*
edge of lawn by Airthrey Castle.
- Clavulinopsis fusiformis*
on lawns by Airthrey Castle accompanied by + *Cordyceps militaris* springing from a buried moth-pupa.

- C. helvola* (*Clavaria helvola*)
edge of lawns by Airthrey Castle.
- C. pulchra*
- + *Clavulina cristata* (*Clavaria cristata*)
in mixed woodland.
- + *C. rugosa* (*Clavaria rugosa*)
- + *Coriolus versicolor* (*Trametes versicolor*)
widespread; on hardwood branches, stumps, etc.
- Datronia mollis*
forming resupinate sheets on Beech trunks accompanied by
Cyphellopsis anomala.
- + *Daedalea quercina*
on old Oak stump with + *Ascocoryne sarcoides* (*Coryne sarcoides*).
- + *Fistulina hepatica*
on Sweet Chestnut.
- Ganoderma adspersum*
on Beech, accompanied by + *Xylosphaera hypoxylon* (*Xylaria hypoxylon*); formerly confused with + *G. applanatum* which although widespread is less common.
- + *Heterobasidion annosum* (*Fomes annosus*)
on old conifer stump.
- + *Hirschioporus abietinus* (*Trametes abietina*)
in great quantity on Larch branches.
- + *Meripilus giganteus* (*Grifola gigantea*)
base of old Beech stump.
- Phlebia gigantea*
on old Pine stump.
- + *Piptoporus betulinus*
on Birches; parasitised by *Hypocrea pulvinata*.
- + *Polyporus squamosus*
on both Elm and Sycamore, on the latter accompanied by
asexual stage of + *Nectria cinnabarina*, and + *Ascocoryne sarcoides* (*Coryne sarcoides*).
- + *Pseudotrametes gibbosa* (*Trametes gibbosa*)
on Beech stump.
- + *Schizopora paradoxa* (*Irpex obliquus*)
on fallen branches of Oak; very common and widespread.

Stereum gausapatum
on branches of Oak.

- + *S. hirsutum*
on various hosts; on fallen branches and twigs.
- + *Tyromyces stipticus* (*Leptoporus stipticus*)
on old stump.

Hymenomycetous heterobasidia

AURICULARIALES

- + *Hirneola auricula-judae* (*Auricularia auricula*)
on Elder.

DACRYMYCETALES

- + *Calocera cornea*
on Sycamore branch accompanied by *Xylosphaera longipes* and *Oribilia xanthostigma*.
- + *C. viscosa*
on conifer stumps.
- + *Dacrymyces stillatus* (*Dacrymyces deliquescentis*)
on old wood.

TREMELLALES

- + *Pseudohydnum gelatinosum*
on old conifer wood.

Gasteromycetes

LYCOPERDALES

- + *Lycoperdon pyriforme*
base of old stump.

- + *Phallus impudicus*
amongst leaf-litter and twiggy debris under bushes.

SCLERODERMATALES

- + *Scleroderma citrinum* (*Scleroderma aurantium*)
edge of sandy path.
- + *S. verrucosum*
edge of woodland; distinguished from *S. citrinum* not only microscopically but by the large pseudorhizal base.

DISCUSSION

None of the fungi so far listed from the Stirling area by Crockart (1978) or in this paper are particularly rare. Perhaps the most interesting are *Nolanea icterina* and *Pseudohydnum gelatinosum* which are not all that common in Scotland. The record of *Fistulina hepatica* 'Beef steak fungus' on a solitary Sweet Chestnut, planted in the grounds of Airthrey Castle, is to my knowledge an indication of this fungus at or near its northerly limit. Oak is the usual host whereas records on Chestnut are rather uncommon. *Pleurotus dryinus* another lignicolous toadstool although widespread is infrequent in Scotland.

The ascomycete *Zygospermella insignis* is rather rare in the British Isles; it should be looked for more often accompanying coprophilous agarics.

The variability of the collections of *Armillaria mellea*, 'Honey fungus' from Stirling added to my curiosity of this toadstool and along with other Scottish collections has allowed me to formulate my ideas on its classification. Although only one name is found in the Check List of British agarics and boletes at least five British species of *Armillaria* are known, all previously lumped under the single name. Three are to be found around Airthrey Castle: *Armillaria mellea* sensu stricto and the recently described *Armillariella polymyces*

(Secretan) Singer & Clemencón and *A. ostoyae* Romagnesi. The last two species have not been placed as yet in *Armillaria* although *Armillariella* is undoubtedly a synonym of *Armillaria*.

ACKNOWLEDGEMENT

I am indebted to M. J. Richardson for confirming the identity of some of the coprophilous ascomycete fungi mentioned.

REFERENCES

- CHRISTIANSEN, M.P. 1960. Danish resupinate Fungi, part II. *Dansk Botanisk Arkiv* 19, 63-388.
- CORNER, E. J. 1950. A Monograph of Clavaria and Allied Genera. University Press, Oxford.
- CROCKART, I. B. 1978. Preliminary list of fungi in the Stirling district. *Forth Naturalist and Historian* 3, 78-80.
- DENNIS, R. W. G. 1978. British Ascomycetes. J. Cramer, Vaduz.
- DENNIS, R. W. G., P. D. ORTON and F. B. HORA 1960. New check list of British Agarics and Boleti. *Transactions of the British Mycological Society* 40, Supplement.
- DONK, M. A. 1966. Check list of European Hymenomycetous Heterobasidiae. *Persoonia* 4, 145-335.
- LANGE, M. and HORA, F. B. 1965. Collins Guide to Mushrooms and Toadstools, 2nd edition. Collins, London.
- PALMER, J. T. 1968. A chronological catalogue of the literature of the British Gasteromycetes. *Nova Hedwigia* 15, 67-178.
- PEGLER, D. N. 1973. The Polypores, 2nd edition. British Mycological Society, London.

The enigma of the Honey Fungus – *Armillaria mellea*.

The taxonomic and nomenclatural confusion surrounding the genus *Armillaria* dates back over 100 years. The inability of taxonomists to agree on the limits and type species for the genus and the nomenclatural controversy over the correct generic name has engendered confusions for pathologists and all interested in toadstools.

There is little doubt this confusion has hindered the progress of pathological studies with members of this widely distributed and economically important genus. Perhaps the confusion over the genus is equalled only by the indecision as to the true limits of the 'Honey fungus', *Armillaria mellea*. As long ago as 1788 Bolton described several distinct entities but because mycologists recognised a so-called continuous variation subsequent waves of confusion have sunk all the names into one polymorphic species *A. mellea*. A recent resurgence of interest in the problem has again shown that several taxa are present but this time the data is being carefully integrated with experimental studies.

In Edinburgh much interest has been taken in the *Armillaria mellea* complex as it is implicated in the death of many ornamentals, especially rhododendrons of which we have many at the Royal Botanic Garden, of trees both conifers and broad-leaved species and of vegetables. It is also recorded as a saprophyte breaking down woodland debris and under special conditions as a mycorrhizal agent and as shown more recently it is capable of attacking young growing toadstools and converting them into puff-ball like fruiting bodies.

What part of the spectrum of the old polymorphic *Armillaria mellea* is involved and can distinct morphological characters be correlated with a certain life-pattern or particular method of exploiting the eco-system? Undoubtedly in the British Isles we have several quite distinct taxa and in a pilot scheme designed for members of the British Mycological Society these entities were introduced. This pilot scheme was successful in that it brought to light many untapped sources of information. Based on these facts the following key is offered as there is no doubt that the majority of species will be finally found in the Stirling area. As indicated earlier at least three have already been found, and around Edinburgh two of the other taxa in the key have been located.

FIELD KEY

(All species except *Armillaria* sp. A are illustrated in Figure 1)

1. Spore print white. *Armillaria* sp. A.

Spore print not pure white but cream-colour or ivory, darkening on drying. 2.
2. Veil present as a univocal membrane and in mature basidiocarps only evident as scales on the cap and on the stem from mid-way to base. 3.

Veil present both as partial and universal membranes leaving both scales and ring on stem, and scales on cap. 4.
3. On wood, in small groups; cap with scales at centre and distributed towards margin. *A. tabescens*

On boggy soil, amongst rushes and sedges, often at margins of areas of water filling with sediment; cap lacking distinct scales, being replaced by hairy roughenings. *A. ectypa*
4. Universal veil sulphur or greenish yellow to lemon chrome, leaving olivaceous or golden tinted scales on cap and yellowish floccules on underside of ring, but rarely as brownish scales at margin of ring. *A. mellea*

Universal veil on underside of ring brown, buff, sepia or grey, but never bright yellow, leaving brown scales at most flushed olivaceous or ochraceous on cap. 5.
5. Ring whitish grey with sepia or hazel scales on underside of ring and on lower part of stem and scurfy greyish to brownish scales on cap. 6.

Ring with vandyke brown or rust-tawny scales on cap and ring. 8.
6. Ring with whitish or mouse to dove grey to silvery scales on underside and on lower part of stipe, and fibrillose to scurfy whitish or pale grey scales on pileus. Spore-print distinctly cream-coloured; pileus mottled with ochraceous colours. *Armillaria* sp. B.

Ring with sepia or hazel scales on underside of ring and on lower part of stem. 7.

- 108 7. Stem robust, clavate with sepia or hazel scales; cap honey or pinkish-brown with scurfy greyish to brownish scales. Spore print ivory but cream-coloured on drying; veil well-developed forming a distinct ring. *A. polymyces*

Stem long, slender, clustered with reddish brown or wine-coloured silky sheen; cap dark-coloured, vandyke to umber brown. Spore print pale cream-colour; veil lanose.

A. nigritula

8. Cap and gills with distinct pinkish cinnamon-colour; vandyke brown or chocolate brown scales on stem and at margin of ring forming a fan-like pattern. *A. ostoyae*

Cap and gills darker brown with more ochraceous colours; dark brown scales on cap, stem and below ring.

A. obscura

NOTES ON NOMENCLATURE

When two or more names are applied to the same organism, they are termed synonyms although generally speaking the word is restricted to those names which are replaced by the valid name i.e. that name published in accordance with the International Code of Botanical Nomenclature.

When an organism is described in a particular genus and later found not to belong to that genus it must be transferred to its correct place in classification even if this means the erection of a new genus. On transferring the organism to the second genus the action involves the making of a new combination. The new combination is composed of a binomial i.e. the original specific (second) name of the organism (epithet) joined to that of the new generic name. The name which was used as a basis of the combination is called the basionym. If an appropriate genus already exists then a combination is made under that generic name. In some early books animals and plants were often referred to by using three names; such names are called trinomials but in botany these names are not accepted by international agreement.

Fries in 1821 published a book entitled *Systema Mycologicum* and in it offered the name *Agaricus melleus*. Fries' description was based on a beautiful plate by Vahl which was published in *Flora Danica* (1766). *Systema Mycologicum* is accepted as the starting

point book for most groups of fungi; this means that names published earlier than 1821 are not acceptable for use. Fries also used therein the generic name *Agaricus* for the majority of gilled-fungi, but since that date the genus has been dissected considerably to form several now familiar genera many of which appear in the attendant list. *Agaricus melleus* was transferred to the genus *Armillaria* in 1857, a name Fries had used in 1821 as a subdivision of *Agaricus* circumscribing the group containing *A. melleus*.

Thus *Agaricus melleus* Vahl ex Fries is considered the basionym of *Armillaria mellea*, the presently accepted name. The authors' names following a species reflect the history of that species, thus Vahl described the fungus and Fries validly published it, hence the linking of the authors by 'ex'. Staude was the first author to use the genus *Armillaria* so his name is incorporated into the citation thus *Armillaria mellea* (Vahl ex Fries) Staude.

This same fungus has been placed in the genus *Clitocybe* by some authors particularly the French. This procedure although with some merit cannot be sufficiently supported on taxonomic grounds. Thus *Clitocybe mellea* (Vahl ex Fries) Ricken is a synonym of *Armillaria mellea* where Ricken was the first author to place the species in *Clitocybe*.

Other authors have placed *A. mellea* in the genus *Armillariella* as *Armillariella mellea* (Vahl ex Fries) Karsten where Karsten was the combining author. This procedure is not acceptable from a nomenclatorial point of view.

A genus by definition must be based on what is termed the type-species. For *Armillaria* and *Armillariella* this happens to be the same species and therefore as the former was published earlier than *Armillariella*, *Armillaria* is considered valid and therefore must stand. In the key I have used 'A' to denote the genus as any species described in *Armillariella* must ultimately be transferred to *Armillaria*.

These new combinations will be presented elsewhere but the changes which are required cover *Armillariella obscura* (Pers. ex Secretan) Romagnesi, 1970; *A. ostoyae* Romagnesi, 1970 and *A. polymyces* (Pers. ex S F Gray) Singer & Clemencon, 1972.

Agaricus melleus bulbosus Barla, described in 1887 (*Bull. Soc. Mycol. Fr.* 3, 143) has been transferred to *Armillariella* by Romagnesi (1973) as *A. bulbosa* (Barla) Romagnesi and has been

110 found near Kirkcaldy on Birch. However, there is some difficulty in typification of this taxon as Barla's name is a trinomial and as pointed out above is therefore invalid. It would run-out in the key above close to *A. mellea* but differs primarily in its shorter stem and more cottony veil. A second, probably also quite distinct species and which occurs only in spring, has been found in the vicinity of Glasgow. I have not had the opportunity to study this fungus in detail.

Armillaria sp. A, which differs from all other British species in possessing a pure white spore-print, is not figured as more representative collections require to be analysed. It marries the clustered graceful form of *A. tabescens* (A) with the small cap-scales of *A. obscura* (H). It grows on birch and the ring is ornamented beneath with umber to Vandyke brown scales distinctly yellow at their very base. Although a distinct taxon it remains to be seen whether the colour of the spore-print is constant and therefore a key-character. Some evidence suggests the first shed spores in mass are white, but subsequent ones are pale cream-colour! *A. nigrifula* P D Orton (in press Notes from the Royal Botanic Garden, Edinburgh) is only known from the British Isles.

REFERENCES FOR APPENDIX

- BOLTON, J. 1788. An History of Funguses Growing about Halifax. J. Brooks, Huddersfield.
- FRIES, E. M. 1921. Systema Mycologicum, Gryphiswaldiae. E. Maritius.
- ROMAGNESI, H. 1970 and 1973. Observations sur les Armillariella (I) and (II), *Bulletin Trimestriel de la Societe Mycologique de France* 86, 257-265 and 89, 195-206.
- SINGER, R. and CLEMENCON, H. 1972. Notes on Leucosporus and Rhodosporus European agarics. *Nova Hedwigia* 23, 305-344.
- VAHL, M. 1766. In Flora Danica, t 901-1260. N. Moller, Risbenhavn.

TOWARDS A HISTORY OF THE LABOUR
MOVEMENT IN STIRLINGSHIRE, 1789-1922

James D. Young
University of Stirling

Until the past two centuries, as traditional historiography shows, "the poor" could be neglected most of the time by their "betters", and therefore remained largely invisible to them, precisely because their active impact on events was occasional, scattered, and impermanent. If this has not been so since the end of the 18th century, it is because they have become an institutionally organised force.

Hobsbawm (1964)

The publication, Ian MacDougall's *Catalogue of some Labour Records in Scotland and some Scots Records outside Scotland* (Scottish Labour History Society, Edinburgh, 1978, 598pp. £11.50), provides us with an opportunity to review his important bibliographical guide to Scottish labour history. It also raises a host of methodological and conceptual problems for the historian who wants to use it as a guide to the history of the labour movement in Stirlingshire. As the brain-child of the tireless Ian MacDougall, a dedicated scholar who has often single-handedly carried the burden of collecting Scottish labour records since the formation of the Scottish Labour History Society in 1964, this massive bibliography of five hundred and ninety-eight pages represents a colossal achievement of industry, scholarship and imagination. However, it is of limited value to the historian who tries to use it as an index to the formation of class and the emergence of modern working-class consciousness in Stirlingshire. As the Scottish Labour History Society has concentrated most of its resources on gathering records at the expense of developing or at least encouraging general and/or comprehensive interpretations of Scottish labour history, bibliographical literature sharpens rather than helps to solve existing methodological and conceptual problems. I owe this insight and criticism to Dr. Ken Logue, secretary of the Workers' Educational Association in Edinburgh.

As an index to the emergence of the labour movement in Stirlingshire from the late 18th century, Ian MacDougall's massive bibliography would not help the apprentice researcher to reconstruct a social picture of ordinary 'proletarian' life. It is not simply that the bibliography offers very few clues to the intense class consciousness

of some plebeian — and later proletarian — radicals in Stirlingshire between the outbreak of the French revolution in 1789 and the general election of 1922 when the Scottish labour movement achieved a dramatical electoral breakthrough in Parliamentary terms. It is not just that this scholarly, brilliant and tantalising bibliography chronicles the rise and fall of local friendly, co-operative and temperance societies — the static or contingent rather than the *dynamic* organisations thrown up by a minority of plebeian radicals — outside the framework of interpretative studies. The real problem is that this welcome bibliography will not in itself help us towards a specific identification and explanation of 'the distinctive cultural environment' or 'the cross-currents of race and religion and the Scottish attitudes to work and life' alluded to by James Jack, S. G. E. Lythe and William H. Marwick in their stimulating foreword; for in Stirlingshire as in the other industrialised counties of Scotland the absence of adequate local histories or accessible local newspapers only too easily reinforces the *impression* fostered by the men of the Scottish Enlightenment of the uniquely 'temperate', 'docile', 'uninflammable' and 'inarticulate' plebeian Scot stuck in the Kailyard.

This is not to criticise the admirable, dedicated and solid scholarship of Ian MacDougall. It is rather to introduce some of the complex problems involved in preparing the groundwork for a history of the labour movement in the county of Stirling at a moment when the condition of Scotland question has been more sharply focused by the Devolution crisis. In the land of the 'democratic intellect', where critical thought has usually been discouraged, the Scottish possessing classes have been history-conscious rather than socially aware. The writing of Scottish history has always been a very political business, partisan, lop-sided and 'operational' or 'relevant' to immediate problems. This was not only evident in the major writings of the men of the Scottish Enlightenment; but later on it coloured and reduced the third edition of William Nimmo's *History of Stirlingshire* to the level of a moralistic Presbyterian tract.

The Presbyterianism was real, tangible and influential in Stirlingshire on the eve of the 'take off' into industrialisation in the late 18th century. As a powerful and authoritarian Presbyterian Church played a major role in facilitating the process of industrialisation in what was a very backward country (Young 1979 chapter 1), it is not surprising that the experience of the local plebeians was coloured by their immediate milieu. By focusing on the less dynamic elements of the formation of class the *Catalogue of some Labour Records in Scotland and some Scots Records outside*

Scotland exaggerates the influence of the local temperance, friendly and death and benefit societies. But a major problem confronting the historian of the local experience is the need to identify periods or stages — and the interrelationships between these stages — within the dynamic of capitalist economic development.

I 1789-1850

Any attempt to conceptualise and chronicle the history of labour in Stirlingshire between 1789 and 1922 — and we have deliberately chosen dynamic years of change, challenge and discontinuity — must take account of such problems as periodisation, the absence of interpretative studies of Scottish labour history and the context in which an industrial society developed or was imposed from above on Scotland as a whole. In this essay the emphasis will be on fracturing historical time and compensating for the absence of interpretative local histories by raising new questions of conceptualisation. Nevertheless periodisation, though not treated as a fetish, will not be altogether ignored; and for reasons of analytical convenience we will look at the period from 1789-1850, the mid-Victorian period and finally the period from 1880-1922 when the Scottish labour movement developed a sustained challenge to the established social order of industrial capitalism.

However, though there is a need for periodisation, it ought to be emphasised that an account of the constant factors in the culture of the Scottish — and Stirlingshire — working class between 1789 and 1922 will throw light on the inability of local historians to conceptualise the local experience in relation to the complex aspects of the condition of Scotland question. First, the problem of mass drunkenness developing side-by-side with the emergence of a labour movement consistently committed to temperance, self-help and the pursuit of learning raises a host of conceptual problems. Second, the excessive emphasis in our local history books on the role of the landed families in the industrial county of Stirling raises even bigger questions about the origins of Scottish industrial capitalism. And thirdly the problem of understanding the dynamic role of plebeian and later working class radicalism in Stirlingshire raises the questions of 'proletarian' nationalism and the appalling social conditions engendered by the advent of industrial capitalism.

If the Scottish Industrial Revolution came out of the cauldron of Carron iron works, the surviving evidence suggests that the

114 pre-industrial plebeian labour movement was much stronger in Stirling than in the town of Falkirk. As the vast expansion of the productive forces of a rising bourgeois society was an essential pre-condition for fundamental political change, the new industrial concentration at Falkirk was, as John Stewart (1940 p109) put it, 'the energising agent and the developing stimulant which ultimately awakened the town out of its slumber as a rural market town'. Moreover, the bairns of Falkirk soon displayed their passionate sympathy for 'the radical side of politics' (Stewart 1940 p123) but in the appalling social conditions that marked the formative stage of industrialisation in Stirlingshire the 'proletarians' were rendered somewhat 'inarticulate' by a repressive provincial elite who repudiated the democratic process.

Cradled in Falkirk, the Scottish Industrial Revolution was an incredibly brutal, disruptive and — for the emerging 'proletariat' — disorienting process. But in addition to the existing local friendly, temperance and death and benefit societies, a primitive or early underground labour movement crystallised in the form of artisans' trade unions. Already outlawed under common law as early as 1776, Scottish trade unions amongst colliers and other proletarian occupations were forced into clandestine activity and evidence of their existence is hidden or locked up in the justiciary records in the Scottish Records Office in Edinburgh.

Moreover, the existence of a labour movement in Stirlingshire between 1789 and 1850 cannot be understood in isolation from the contours and peculiarities of Scottish capitalism. Whilst the two major towns in Stirlingshire — Falkirk and Stirling — only expanded and acquired a viable economic base with the growth of the textile industry after the Union of 1707, the making of urban Stirlingshire rested on the more substantial town of Falkirk being 'thirled to local mineral resources'. This is admirably summed up by Adams (1978):

'Carron was soon the largest foundry in Europe. A new settlement sprang up at Stenhousemuir, and Larbert changed from a small agricultural hamlet to an industrial town; the two towns housed 1,200 men working at Carron. Thereafter the local iron works was limited by the inadequacies of the transport system and the new settlements developed on out-of-the-way sites close to pockets of iron ore and coal.'

But if urban expansion was stimulated by the opening of the Forth and Clyde canal and its branch, the Monkland canal, the Scots' failure to develop an adequate canal system slowed down the process of industrialisation (Adams 1978 p109). Indeed, in a number of

books and pamphlets which appeared in the 1780's and 1790's, David Loch appealed to the Scottish landed families to facilitate the growth of industry and manufacturing by building more canals.

In contrast to Dalkeith, where 'the whole village' belonged to and depended on 'the providence and protection' of the Duke of Buccleuch for its development as a manufacturing centre (Loch 1783 p6), Falkirk owed its process of expansion and urbanisation to the growth of Carron iron works.

'By the great canal going so near Falkirk, and the Carron iron works being established there, the number of people increases daily' (Loch 1783 p15).

However, if Falkirk was *the* centre of rapid industrialisation where an already declining textile industry rested on a mere one hundred and twenty looms in 1783, the textile industry in Stirling possessed one hundred and sixty looms, thirty stocking frames and seventeen carpet looms. In the late 18th century the early 'labour movement' was, however, much more active in Stirling than in Falkirk; and, though the first glimpse that we get of the wretched plebeian women who lived alongside 'the banditti' and petty criminals might not seem to augur well for the birth of political protest, the plebeian weavers in the much less socially disrupted communities in and around Stirling were more active and vocal than their counterparts in Falkirk (Statistical Account 1792 vol IX pp620-1,631).

This development is less surprising than it might seem to be at first sight. As Stirling was a royal burgh where a section of the mercantile bourgeoisie supported the agitation of Thomas Muir of Huntershill for Parliamentary reform, a branch of the Friends of the People was formed by solid, respectable citizens who belonged to the 'middle ranks'. While the Stirling branch of the Friends of the People was led by their secretary, Alexander M'Gibbon, the Friends of the People in Falkirk were conspicuous by their absence (see the letter from Alexander M'Gibbon, secretary of the Stirling branch of the Friends of the People *Caledonian Mercury* 10th December 1792). Although a burgh of regality from 1646, Falkirk played an unimportant role in the Scottish economy before the advent of Carron iron works; and in 1783 'the estate of Falkirk was obtained by Forbes of Callendar, who straightway applied to the Court of Session for a division of Falkirk Muir, and secured it all with the exception of thirty-one acres' (Johnston 1922 p165). But if the rising

116 order of industrial capitalism was beginning to break the chains of the past, the forces of Scottish feudalism probably played a much more important role in the process of industrialisation than the mercantile bourgeoisie.

Moreover, if the social and economic backwardness of Scottish society as a whole inhibited the advent of an autonomous, self-conscious bourgeoisie, Scottish civil society was ruled by a provincial elite of farmers, merchants and landed aristocrats whose world-view was essentially a feudal one. Thus we require to sketch in this general backcloth to the emergence of a labour movement in Stirlingshire before we can distinguish between the early Scottish and English labour movements. Though the concealment of the activities of the early trade unions 'under a disguise of friendly societies' occurred in both England and Scotland, Raymond Postgate minimised the cultural influence of Presbyterianism on the rules of the Falkirk builders' trade unions — rules excluding anyone "defiling themselves with unclean women", or "committing adultery or being guilty of any lewd, obnoxious or disloyal practices" — when he tended to interpret them as just a 'disguise' for militancy (Postgate 1922 pp17-18). In contrast to the English artisans, too, the Scots were already in the 18th century practising and preaching temperance and self-help as well as Jacobinism (Hobsbawn 1964 p103).

Before the Parliamentary reform crisis of 1831-1832 the nucleus of the labour movement in Stirlingshire was formed by artisans, weavers and a few merchants. Indeed, if 'far too many men and women' in Europe were still beasts of burden in the late 18th century or, in Voltaire's phrase, 'two-footed animals' (Gay 1970 vol 2 pp517-518), social conditions, though pretty appalling in Stirling, were much worse in Falkirk. The best index to the vicious, dehumanising and deadening social conditions in Falkirk is the Parish burial register. In the late 18th century the registration of burials was generally confined to cases where the mortcloth was hired; and vagabonds were often thrown into lime-pits without their deaths being recorded. During the decade from 1820 to 1830 there are many references in the Falkirk burial register to a 'still-born child', a 'stranger's child', a 'soldier's child', a 'lost child', a 'collier's child', a 'tinker's child' and an 'illegitimate child'. Such children, being mostly unknown, did not have their names recorded in the burial register, and many of them were buried in the 1st or 2nd Parish Relief Church (Falkirk Parish Burial Register, Registry House, Edinburgh).

As the vicious social conditions that were engendered by rapid urbanisation and industrialisation in Falkirk created much greater social dislocation than occurred in Stirling, it was the traditional or pre-industrial workers who provided the nucleus of the Stirlingshire labour movement. Far from quelling the revolt of the minority who had been inspired by the egalitarian message of the French revolution, the suppression, victimisation and transportation of Thomas Muir and the other middle-class leaders of the Friends of the People led a cadre of Jacobins to set up branches of the United Scotsmen in Falkirk, St. Ninians, Stirling and Cambusbarron. The only solid evidence of their activities before they were caught by the authorities cannot be found outside of the justiciary records. Committed to censorship as a part of its conscious role in Scottish politics, the press did not generally report the activities of the plebeian radicals.

In 1798 William Craig, a merchant in Falkirk, and Robert Gray, his half-brother who worked as a weaver in Airdrie, were accused of sedition because of the secret oaths they had taken to agitate for Parliamentary reform; but there is no evidence of the Falkirk factory workers being involved in any of these activities. In fact Craig's contacts were among the Jacobin weavers in Culross and Dunfermline, not among the workers at Carron iron works who lived in Larbert and Stenhousemuir. The United Scotsmen were much stronger in the villages of St. Ninians, Cambusbarron and the town of Stirling than they were in Falkirk or any of the surrounding villages. In Stirling the 'seditious' members of the United Scotsmen had joined the Stirling volunteers in order to win soldiers over to the side of the people; and in April, 1798, Robert Jeffray, a weaver in Cambusbarron, proposed a toast in a public house: 'The Old Dog's head to be cut off, the Bitch hanged, and all the whelps drowned', thereby meaning death and destruction to the King, Queen and Royal family. Such toasts were described as commonplace in the villages in and around Stirling, and Jeffray got off with a very light sentence of three months in jail (Scottish Record Office JC26/294). But the suppression of the United Scotsmen meant that there was very little open plebeian political activity until the Radical war of 1820 erupted.

The development of capitalism in Scotland had been a very abrupt, rapid and forced phenomenon. As Rosalind Mitchison put it: 'Scotland packed into about thirty years of crowded development between 1750 and 1780 the economic growth that in England had

spread itself over two centuries' (Mitchison 1970 p345). One important consequence of this was that the surviving Jacobite sentiments delineated by James Hogg in his massive book, *The Jacobite Relics of Scotland* coalesced with the new-fangled Jacobin sentiments stimulated by the French revolution. Scottish nationalism was far from dead in the consciousness of the early labour movement; and one of the first signs of the coalescence of Jacobitism and Jacobinism in Stirlingshire came in 1814 when thousands of working people gathered at the field of Bannockburn to celebrate the Battle of 1314 (*Edinburgh Evening Courant* 30th June 1814). By 1820, when there were a few signs of the factory workers in Carron being involved in the agitation leading to the Radical war of 1820, Jacobin activists all over Scotland were waiting for the French to assist them to set up a Scottish government. As the *Dundee Advertiser* (4th April 1820) put it:

The Radicals they say, have great numbers of pikes, and are not without muskets. They have got four pieces of cannon. They have received considerable sums of money, as well as arms, from persons unknown. They affirm, in utter ignorance we daresay of the character of Mr. Kinloch, that he has returned from the Continent, with a great number of officers formerly in the pay of Bonaparte, who, disgusted with the Bourbons, and despairing of improvements at home, have come over for the purpose of leading the Radicals. Among the number is Marshall MacDonald — a descendant of the Stuarts, whom they intend to place upon the throne of his ancestors. French gold they say is circulating. A French vessel has landed a cargo of arms and stones on the coast of Ayrshire, which has been intrusted to the Radicals of the interior.

In any case the Radical war of 1820 was a much more important political event than the skirmish described in William Nimmo's *History of Stirlingshire* published in 1880; and before the leaders of the central committee of the Union societies — an organisation modelled on the United Scotsmen — were arrested on the eve of the Radical rising, a spy planted by the authorities reported that some of the workers at Carron iron works had sent a delegate to central committee meetings in Glasgow (Scottish Record Office RH2/4 vol 131). It is also possible that factory workers at Carron had been planning to play a major role in the Radical war by making carronades without the knowledge of the management. At the end of December 1819, major-general Bradford informed Lord Sidmouth, the Home Secretary in Whitehall, that cannon could not be made at Carron without the knowledge of the management (Scottish Record Office RH 2/4 vol 128), but after the premature rising at the beginning of April 1820, the *Dundee Advertiser* (21st April 1820) carried the following report: 'About sixty carronades, and a

considerable quantity of ammunition, were lately brought down from Carron, and safely lodged in Leith Fort, beyond the reach of the radicals'. The brutal repression of the radicals and the execution of John Baird and Andrew Hardie at Stirling Castle for their role in the premature rising following the first general strike of Scottish workers in Britain marked the end of the first phase of the history of the local labour movement.

The brutality with which the Radical movement was put down in 1820 became an ineradicable part of the oral history of the Stirlingshire – and Scottish – labour movement (*Falkirk Herald* 5th and 12th June 1889). Moreover, trade unionism was illegal in Scottish society; and in the 1820s and 1830s repeated attempts were made by the authorities to uncover secret combinations of colliers and other workers.

What happened in Stirlingshire cannot be understood without reference to the wider Scottish experience. While some artisan trade unions were tolerated because they operated under the disguise of friendly and death and benefit societies, the factory hands and the colliers in Stirlingshire were not allowed to organise openly. Yet they did form clandestine organisations from time to time; and the only knowledge we have of them survives in the justiciary records. Combinations or early trade unions existed amongst the colliers in diverse parts of Stirlingshire; and in 1825 nine delegates from the different collieries owned by the Duke of Hamilton were arrested by Sheriff MacDonald at the Redding, Falkirk, when they tried to set up a county federation of colliers (*Caledonian Mercury* 9th and 23rd April 1825). Then in 1828 the Sheriff of Stirlingshire felt compelled to break-up the secret combinations of colliers employed by the Duke of Hamilton at the Redding colliery by arresting them at work (Scottish Record Office RH 24/76). The feudal outlook of the Scottish justiciary was defended in the House of Commons after Sheriff Archibald Alison told a Parliamentary Select Committee on Combinations of Workmen that the Scots could not afford the luxury of democracy or the rule of law as they had 'not been habituated to the enjoyment of wealth and to the long enjoyment of liberal institutions which the English have' (Parliamentary Papers 1838 vol VIII pp179-80).

As the Scottish mercantile bourgeoisie was too weak to liberate itself from the coercive feudal domination of the industrialising landowners, the absence of an autonomous, self-conscious bourgeoisie

120 committed to freedom of speech, freedom of assembly and the rule of law shaped the formation of the labour movement. This is why combinations of factory workers were stamped out whenever they made an appearance; and political organisation amongst the plebeian artisans and factory workers were usually discouraged. The infrequency with which the early labour movement appears in a Scottish press committed to political censorship cannot be understood without integrating this general backcloth into our analysis. Perhaps we would not even know very much about the role of the factory workers employed at Carron iron works during the Parliamentary reform crisis of 1831-1832 if the politically Liberal Scottish press had not had a strong motive for using the plebeian or emerging Stirlingshire 'proletariat' as a battering ram with which they could secure Parliamentary representation for a weak but rising bourgeoisie.

In 1831 a mass plebeian or 'proletarian' movement arose to agitate for Parliamentary reform. In a whole number of ways this new political movement of the labouring poor displayed a class consciousness and awareness of their independent identity. Sympathetic to this movement as the *Stirling Journal* was, it still could not refrain from criticising the 'strong language' of the Falkirk foundry workers. As the militancy and first signs of the Carron factory workers' independent political identity emerged and coincided with the Scottish nationalist sentiments displayed on one of their banners — Good Lords, pass the Bill, or in spite of your order, the blue bonnets perchance may march over the border (Stewart 1940 p124) — the *Stirling Journal* (3rd November 1831) and the middle-class Liberals began to incorporate this movement into the Liberal Party.

The Scottish nationalism of the plebeian or emerging 'proletarian' movement presented the Liberals of the 'middle ranks' with a real dilemma. As they were bound to encourage this movement if they were going to gain their objective of Parliamentary representation, they were delighted by the thousands of people who came into Falkirk in May 1832, to demand a reform of Parliament. Although they already wanted to bring these dissident plebeian elements into the Liberal Party, they were not insincere when they praised 'the speech of James Walker, a common workman at Carron, who would have convinced any but idiots that he was fitter to be Prime Minister than the Duke of Wellington' (ibid 10th May 1832). But they were much less happy when tailors, bakers, cabinet makers and foundry

workers marched through Falkirk in August 1832, to articulate their Scottish nationalism as well as the demand for Parliamentary representation for male workers. One working man, who evoked the memory of William Wallace, said: 'Scotland, though a poor and not powerful kingdom, had by its moral energies baffled the mightiest hosts' (ibid 16th August 1832). Yet they needed the plebeian and 'proletarian' radicals; and, when the Duke of Montrose and Sir Archibald Edmonstone threatened to evict their tenants who did not vote for the Tory candidate, the Liberals in the 'middle ranks' were happy to encourage the plebeian non-electors who formed themselves into political unions in Stirlingshire (ibid 23rd July 1832). A really independent political labour movement with its own distinctive identity and programme did not appear until the emergence of the Chartist movement.

Active, spontaneous and influenced by the political conflicts of the past, the plebeian opposition to the landed aristocracy in the period 1830-1832 was tied to the liberalism of the rising middle class. With a weak middle class still struggling for political hegemony within a milieu in which feudal attitudes were dominant, it is scarcely conceivable that the 'working class' could have evolved its own class identity without the bitter disillusionment that they experienced at the hands of the middle-class Liberals. The end of the plebeian cum-middle-class alliance was obliquely hinted at in a report in the *Stirling Journal* (19th July 1832) after the results of the general election were known:

"It seems that the friends of reform were afraid that the town of Falkirk and its important populous suburbs, included within the limits of the burgh, would turn tail upon the popular member, as being under the thumb of Mr. Forbes, the Tory Superior. These are not times, however, in which the people are lightly to traffic in votes; and accordingly we were not surprised at the manly stand which Falkirk has exhibited."

As working people were now being told that the only real people who counted for anything were the small number of enfranchised 'middle class' electors, the plebeians soon turned to Chartism.

Though there are only a handful of references in the local press to Chartist activity in Stirlingshire, it is clear that local Chartism articulated a new social awareness amongst labouring men and women. The advent of the class identity of working men and women in Stirlingshire in the 1830s and 1840s was forged in bitter conflict with the rising middle class or bourgeoisie. In Falkirk the

petty-minded, tight-fisted social mentality of the middle class electors who were enfranchised under the first Reform Act of 1832 was reflected in their subsequent refusal to tolerate a democratically elected Town Council. Once enfranchised themselves, this numerically small group of electors was determined to keep the municipal administration of the town within their own grip. As they were not prepared to spend anything like an adequate amount of money on municipal affairs, the terrible problems of inadequate housing, lighting and health provisions contributed to the political discontent which found expression in Chartism.

When Abram Duncan, a moderate Chartist leader, told working-class Chartists in the town of Denny that their enemies were lawyers, grocers, doctors, clergymen and schoolmasters except for 'the right-minded' schoolmasters who were soon deposed by the clergy, he was articulating as well as reinforcing the new class identity of working men and women (*Stirling Journal* 5th June 1840). In March 1848, there were 'Chartist' disturbances and riots in Falkirk, and three hundred middle-class citizens rallied to the call to protect law and order by volunteering to be sworn in as special constables. Though the rioting had occurred amongst Irish railway labourers and local foundry workers who were unemployed, the authorities were terrified by the presence of the unruly colliers just outside Falkirk (Scottish Record Office AD 58/48/74). At a time when the Chartists called public meetings by circulating handbills, the middle-class Liberals approved of 'the energetic steps' which had been taken to repress rioting in the county of Stirling (*Stirling Journal* 21st April 1848). A large Chartist demonstration at Bannockburn in April 1848 gave the local Chartists the opportunity to evoke the name and example of Sir William Wallace, but in contrast to the past much more emphasis was now being put on the need for maximum unity of the working classes in Scotland, England and Ireland (*ibid* 28th April 1848). The formative stage of the labour movement in Stirlingshire had come to an end.

II THE MID-VICTORIAN PERIOD

Though a distinctive Scottish working-class identity was evident in the mid-Victorian period (Young 1974 pp68-127), the corresponding history of the labour movement in Stirlingshire can be summed up as one of hiatus or stops and starts. In so far as the *Stirling Journal* and the *Falkirk Herald* serve as an index to the activity of the local

labour movement, there is some evidence of trade unions functioning as death and benefit societies. But they did not usually take part in political activity except at general elections; and they made no attempt to secure the election of working men to the School Boards set up under the first 'compulsory' Education Act (1872) until the early 20th century.

In contrast to the experience in other parts of industrial Scotland the labour movement in Stirlingshire was much less submerged in the Liberal Party. In Stirling the labour movement was so small that it could not possibly hope to influence community life; and in Falkirk the trade unions, though somewhat stronger, were alienated from Liberalism for a variety of reasons. Though the foundry workers and miners in and around Falkirk were the best organised, most militant and politically conscious workers in the county, they were often regarded by the artisans as socially inferior. After 1832 the £10 voters enfranchised under the first Reform Act refused to tolerate any reform of municipal government in Falkirk (Stewart 1940 p143); and in 1835 the annual expenditure on municipal affairs was only £174 in contrast to the £421 spent on local government in the smaller community of Dysart (Parliamentary Papers 1836 vol XXIII p84). The large number of working people who demonstrated for the reform of local government in Falkirk on a properly democratic basis in 1850 certainly developed their own sense of class identity by opposing Whigs and Tories alike. This conflict was described in the third edition of William Nimmo's *History of Stirlingshire* (vol 1 p267):

An hour prior to the meeting, a large body of workmen marched in procession through the streets to the music of the instrumental bands, carrying at the same time banners and flags with certain stirring watchwords inscribed thereon: 'Taxation without representation is tyranny, and ought to be resisted'. 'No vote, no tax'. 'Let the Whigs of 1850 fulfil their promise of 1830'. 'The proletarians are determined to be free'.

The advent of a new era of railway building in Stirlingshire had created a greatly increased outlet for coal and iron products. Moreover, Stirlingshire's geographical position, the expanding railway system and the waterways enabled local entrepreneurs to make use of indigenous coal and iron ore. The town of Stirling was in the process of becoming a residential and administrative centre, a military depot and the market town of 'a rich and extensive farming area' with a larger population than Falkirk (Rennie and Gordon 1966 p170).

124 Lacking an industrial base or a clearly identifiable proletariat, the labour movement in Stirling was composed of small groups of loosely organised farm labourers and miners. In 1867 farm labourers were organised for a very brief period; but the Stirlingshire miners were the only workers who managed to keep their trade unions functioning on anything like a permanent basis. In Slamannan in 1867 the Sir John de Grahame Lodge of the Free Colliers decided to transform themselves into a trade union with the emphasis on the death and benefit aspects of their activity (*Glasgow Sentinel* 2nd March 1867); and in 1874 the Stirling miners took the advice of Alexander MacDonald, the Liberal-Labour member of Parliament, not to support the revolt of the rank-and-file miners in Lanarkshire to struggle against a wage reduction in the face of the opposition of the Scottish Miners' Federation (*Hamilton Advertiser* 20th June 1874).

But if the mid-Victorian period was, as E. J. Hobsbawm put it, 'a black one' for the Scottish proletariat, the working people in Stirlingshire did not altogether accept the social values of capitalist society. Quite apart from the poaching activities of the miners, the Irish immigrants in Stirlingshire (as elsewhere in Scotland) practised their own beliefs at a time when leading figures in the local Educational Institute of Scotland divided working people into artisans and 'the hewers of wood and the drawers of water' (*Stirling Journal* 11th June 1880). Racial tension between the indigenous workers — and particularly the artisans — and the Irish immigrants certainly vitiated the solidarity which was essential for a strong labour movement; but the indigenous miners with their 'primitive' socialistic attitudes towards poaching and the Irish immigrants' oppositional Christian social attitudes were already articulating and foreshadowing the later socialism of the Scottish working class between 1880 and 1922. As Father Anthony Ross (1978) puts it:

Members of the subculture, if not too debilitated by hunger and disease, will tend to assert their identity by acts of violence against property or persons associated with the dominant sections of society. Petty theft is criminal in the eyes of capitalist society, but not in the light of traditional Christian teaching if the alternative is starvation.

Not only did the survival of pre-industrial social values come into conflict with the values of industrial capitalism, but the new economic order also influenced the quiescence of the local labour movement. The paradox, if there is one, sprang from the economic reality which impinged *differentially* on the social outlook of labouring men and women who belonged to varying occupational groups.

Just as the mid-Victorian years represented a transitional period in the development of the labour movement in Stirlingshire, so was the economy of the county also undergoing a transformation. While the growth of population and the beginning of heavy industry foreshadowed what Henry Hamilton characterised as the second stage of the Scottish Industrial Revolution (Hamilton 1966 p11), there was a very profound sense in which feudal attitudes were still inhibiting the emergence of a fully industrialised society. Most of the early 19th century opposition to industrialisation had certainly been severely weakened; and, though the 'rigid sects' of Presbyterian dissenters who had objected to the mechanisation of agriculture on the theological ground that the 'winds' for winnowing grain should be 'raised by God alone' had been silenced, there was still some opposition to industrialisation.

However, if the new economic order of industrial capitalism was responsible for the quiescence of many labouring men and women, class conflict was not altogether absent. In the village of Camelon there was a bitter strike of nailers in 1853 (*Falkirk Herald* 8th December 1853); and in 1856 the Scottish miners' strike against a wage reduction led to the eruption of great violence in the villages in and around the Redding Muir. In the month of May the militant miners in the Redding burnt the effigies of blacklegs, special constables were beaten up, and several regiments of troops were rushed to the Falkirk area (Love 1928 pp32-36). Unsuccessful as the miners' strike was, it kept them alienated from the middle classes as well as the landed aristocracy.

In contrast to other countries which were undergoing a similar process of industrialisation, Scotland was still in 1850 a country where, in Henry Buckle's phrase, 'the authority of the priesthood' had not been weakened by the rise of the commercial classes. Stirlingshire conformed to the general Scottish pattern. In fact the Presbyterian clergymen and the civil magistrates possessed enormous power over the commonalty, and in Stirling in 1816 or 1817 the ongoing political arguments were about theological questions rather than the social problems engendered by filthy, insanitary towns.

A difference about the authority of the civil magistrate to check heresy has recently produced a schism among the burghers. Such as deny it are said to be of the "new light" (Nimmo 1817 p338).

Even later on the possessing classes were unable to face the social reality of their own society; and when a third and revised edition of

- 126 William Nimmo's *History of Stirlingshire* was published in 1880 the peculiarly hallucinatory character of Scottish historical writing was revealed yet once again. I have borrowed this formulation from Williams (1977 p166).

The most important consequence of the history-consciousness of the Scottish possessing classes was the absence of any awareness of the social consequences of rapid and ongoing industrialisation. As they could not reach a *modus vivendi* with their own history, they were unable to account for the serious social problem of mass drunkenness. In response to the accusation that 'Scotland was drinking itself to death' in the mid-Victorian period, the author who revised and updated Nimmo's *History of Stirlingshire* could only counter the accurate observations of English writers by asserting that Stirlingshire was 'by no means as black as it ha(d) been painted in the sweeping assertion from the south'. By ignoring the question of the much greater consumption of alcohol in Scotland than elsewhere in the United Kingdom, English social criticism was met by making the irrelevant point that the earliest temperance societies in Britain had been formed in Falkirk (Nimmo 1817 vol 2 pp377-339). The 'history-conscious minds' of the Scottish possessing classes prevented them from developing any social awareness of the very tangible problems existing in their own society; and, though the temperance advocacy of the labour movement was induced by habitual mass drunkenness, the temperance emphasis of the local labour movement kept it isolated from an unruly and rumbustious proletariat.

Founded in 1866 to campaign for manhood suffrage, the Scottish National League was numerically small and uninfluential within Stirlingshire. With one branch in Stirling but no branches in or around Falkirk, the political institutions for integrating working-class radicalism into the Liberal Party did not exist. As James Merry, the left-wing Liberal candidate in the Falkirk burghs in the general election of 1868, was also an important and particularly rapacious coalowner, he was opposed by Scottish miners' leaders like Alexander MacDonald. As the miners and ironmoulders in Stirlingshire opposed Merry at the same time as his candidature was supported by the organised artisans, a bitter split developed within the local labour movement (*Dunfermline Press* 29th August and *Falkirk Herald* 22nd August 1868). The most important consequence of these splits and divisions was that the politically conscious elements in the working class stood aloof from middle-class Liberalism in the mid-Victorian period.

A steady growth of population in Stirlingshire as a whole between 1880 and 1922 was an important ingredient in pushing the local labour movement into the forefront of the Scottish struggle for better living conditions. As the population of Falkirk began to exceed the population of Stirling in 1891 (Rennie and Gordon 1966 p318), it is not surprising that the labour movement was now to play a dominant role in national working-class politics. The causal connections between the growth of industry, population and politics are hinted at by Ian H. Adams when he says: Rapid growth also occurred in Falkirk where the population rose from 9,547 in 1871 to 17,282 in 1891. Nineteen foundries had been established in or near the burgh, and three more were under construction. The period was one of immense boom but wages never rose high enough to enable the working man to pay an adequate rent. No workers' houses had been erected for many years, so that overcrowding was excessive (Adams 1978 p96). But if appalling conditions gave the main impetus to the workers' political discontent, the local trade unions previous lack of involvement with middle-class Liberalism was also important in prodding it so far to the left in Falkirk and the surrounding mining villages.

Not surprisingly the first sign of the militancy of the new labour movement in Stirlingshire came in the general election of 1885. When John G. Weir stood as an independent Labour candidate in the Falkirk burghs, he attracted bitter hostility from the local Liberals. Supported by the local ironmoulders' trade union, the Stirlingshire miners, the Highland Association and the Scottish Land Restoration League, he was attacked by the *Falkirk Herald* (9th December 1885) for attempting to set 'class against class'. Unsuccessful in the election campaign, he nevertheless set the future pattern of working-class demands by campaigning for a Scottish Parliament, a reform of the land laws and legal protection for trade unions. Moreover, a whole number of new trade unions were formed amongst ironmoulders, miners and artisans in the 1880s; and the local labour movement's early commitment to political action before the Falkirk Trades Council was formed in 1890 met some, if not substantial, resistance from working men. A minority of miners in Falkirk, for example, objected to the trade unions supporting John G. Weir in 1885 as they believed that trade unionism ought to be non-political (*Falkirk Herald* 5th December 1885).

R. Chisholm Robertson was largely responsible for the formation of the Central Ironmoulders Association in Falkirk in April 1889, and he was criticised in the Glasgow Trades Council for helping to form a new organisation in opposition to the Associated Society of Ironmoulders of Scotland (Minutes of Glasgow Trades Council 17th April 1889). The Central Ironmoulders' Association was a local rather than a national organisation, and, in contrast to the semi-skilled members of the Associated Society of Ironmoulders of Scotland, the members were predominantly unskilled workers (Marwick 1967 p62). Then in March, 1890, the Stirlingshire miners set up a committee to organise support for a Labour candidate in the Stirlingshire constituency at the next general election (*North British Daily Mail* 28th March 1890), and Robertson and James Roden, the Roman Catholic miners' agents, appealed to the trade unions in Falkirk to form a Trades Council. The organisations of the Falkirk Trades Council was immediately undertaken by the Central Ironmoulders' Association (*Falkirk Herald* 26th April 1890).

The *Falkirk Herald* (30th April 1890) aided and encouraged the formation of a Trades Council, and the editor wrote thus:

Among other acquisitions, Falkirk is to have a Trades Council. The institution, I am persuaded, will be a useful one, that is, if properly conducted: and of that, I think, there need be no fear.

The miners, ironmoulders and ironmoulders' labourers formed the backbone of the Falkirk Trades Council, and they were joined by the printers, brickmakers, plasterers and joiners. A dramatic breakthrough came in September when the Trades Council organised a mass demonstration to agitate for a legal eight hour day, payment of M.P.s and independent Labour representation. The demonstration was attended by five thousand working people (ibid 17th September 1890).

Although the editor (ibid 3rd September 1890) made no secret of the Liberals' preference for the old rather than the new unionism, he had no hesitation in supporting the railway workers' agitation against the long hours of labour they had to work (ibid 8th October 1890, A. Signalman 'Long hours on the Railway'). Then when the Trades Council opted for socialism and the class struggle, the editor of the paper found the Council's first annual report a 'significant document' in 'fervid phraseology'. The Council had accomplished much work, whatever value might be placed on this work, and having overcome many obstacles, was 'marching onward in the great social warfare

between capital and labour'. But not content with confining its attention to working class welfare, the Trades Council had, in the editor's view, fostered unreasonable discontent and was seeking to promote 'class ascendancy'. It had become a political institution holding extreme views unrepresentative of the majority of working men, and this was quite a different thing from protecting the interests of the working classes. If working men sought a political role, it must be exercised in a community, not a class interest (ibid 30th January 1892). Nevertheless the *Falkirk Herald* continued to adhere to trade unionism as a form of self-help which was allegedly compatible with *laissez-faire* individualism.

As Stirling increasingly became an administrative and market town, the gap between the numerically small and weak labour movement there and the comparatively large, articulate and aggressive labour movement in Falkirk widened. The town motto is: 'Better meddle wi' the deil, than wi' the bairns of Falkirk'. Much as the *Falkirk Herald* and the local middle-class Liberals disapproved of the Trades Council's political activity, the growth of socialist sentiments was now irreversible. A branch of the marxist Social Democratic Federation (SDF) was formed in 1900; and a branch of the Independent Labour Party (ILP) already existed in 1910. In 1900 William Gee, the Scottish organiser of the SDF wrote: 'Falkirk possesses a people who are exceptionally sympathetic towards the socialist movement, and the membership of the branch could be increased tenfold (*Justice* 14th July 1900).

But the temperance and self-help traditions of the Scottish labour movement kept the militants isolated from the majority of working people; and this isolation contributed to the socialists' failure to muster very much electoral support in general elections before the outbreak of the First World War. The local labour movement was now supported by such Roman Catholic priests as Canon Grady (*Falkirk Herald* 10th January 1891); and, though 'a conspicuous characteristic' of the 1890s, 1900s and 1910s was the frequency of the struggles between capital and labour, drunken riots and racial tension erupted again and again. In these circumstances many of the local socialists like John Carstairs Matheson became more and more sectarian even before they left the SDF to form a Falkirk branch of the Socialist Labour Party (SLP) and the more 'moderate' members of the SDF in Falkirk got into trouble with the authorities for running guns to the Russian revolutionary socialists in 1905 (Lee and Archibold 1935 pp151-153).

Except for the occasionally militant activities of the miners and the farm labourers in and around Stirling from 1880 onwards the major activities of the labour movement in Stirlingshire were increasingly focused by the trade unionists and socialists in Falkirk. Thus in 1912, and in spite of the formation of the breakaway SLP in 1903 and the emergence of a branch of the ILP, John Maclean received so much support from the Falkirk branch of the SDF that he described Falkirk as a stronghold of socialism (*Justice* 8th June 1912). And in July 1914, using his pen-name John Gael, he reported that 'Gael's comrades on the Falkirk School Board — McPherson and Primrose — had obtained free books, the abolition of home lessons and the restriction of corporal punishment' (ibid 25th June 1914). These developments were to foreshadow the giant steps that the labour movement would take between the outbreak of the First World War and the big electoral breakthrough in 1922.

The Stirling Trades Council was not formed until 1908 (*Stirling Journal* 14th February and 13th March 1908). A small organisation consisting of bakers, carters and — later on — miners, it did not put up a candidate for the Stirling School Board until January 1914 (ibid 24th January 1914). In the Stirlingshire miners' strike of 1912, the local middle classes' hostility to the militancy of the mining families was articulated in the opposition to the miners' leaders demands for the feeding of their starving children by the School Boards under the Act of 1908 (ibid 14th and 21st March 1912). Forced by its manifold weaknesses to keep a low profile, the Stirling Trades Council restricted its political activities to protesting against the appalling housing conditions in the town until the local branch of the ILP affiliated its membership when the Trades and Labour Councils were formed in January 1914 (ibid 21st March 1912 and 24th January 1914).

On the eve of the First World War the temperance, self-help and Presbyterian orientation of the local labour movement was still the predominant one, and workers' respectability and 'social pride' still inhibited many working men and women from joining trade unions. For example, in 1896 the president of the Falkirk Trades Council bemoaned their failure to establish a branch of the Women's Protective and Provident League because they had begun 'too low down the social scale' (*Falkirk Herald* 18th January 1896); and the profiles of the Stirlingshire trade union leaders in the *Falkirk Mail* (1913 passim) hinted at the social distance between the labour movement and the vast majority of the unorganised men and women.

Nevertheless there can be no doubt that the anti-militarist and socialist propaganda of the pre-war years was of vital importance in assisting the mass radicalisation of the local working class during and after the war.

The social world of the pre-war labour movement in Stirlingshire was one in which the possessing classes victimised socialists and trade unionists with impunity. In contrast to Stirling, where organised labour was numerically and ideologically weak, the activists in Falkirk were articulate, aggressive and confident. Dismissed from their employment in 1904 by the head of an engineering firm who was also a supporter of Henry George the American radical, a number of trade unionists were reinstated after the intervention of the Falkirk branch of the SLP. In 1902 a report of the Falkirk branch of the SDF's opposition to the celebrations of the final British victory in the Boer War was a portent of the anti-war agitation that was expressed during the war itself. As the local secretary put it in *The Socialist* (September 1902):

While on all sides of the street Capitalism was decked in a horrible array of all possible and impossible colours, there was projected from the windows of the SDF a transparency of five feet, giving the statistics of deaths in wars, deaths in concentration camps, the number of paupers, the number of unemployed in Britain, the famine deaths in India, and the famine deaths, emigration and evictions in Ireland.

But if victimisation and notions of working-class respectability inhibited the growth of local trade unions, the secretary of the General Iron Fitters' Association argued (in its Report December 1910 p2) that the migratory nature of labour in Stirlingshire also retarded trade union stability and growth. 'We are situated between two great industrial centres, and Falkirk is a resting place for the worker in search of work'.

As happened elsewhere in Scotland the labour movement in Stirlingshire grew and expanded dramatically as a direct result of the war. Branches of the ILP proliferated in every part of the county, the women who engaged in war work were organised on a proper basis, and the trade unions grew in strength, confidence and militancy. Though they were not so strong as the dissidents in Glasgow, anti-militarism and pacifism were active and articulate in the towns and villages of Stirlingshire. In the early years of the war members of the ILP organised anti-war meetings which were addressed by such figures as John Maclean and James Ramsay MacDonald, and towards

the end of the war the General Iron Fitters' Association (ibid December 1910 p2) waged a strike in Falkirk against 'an attempt by the military to hustle many of our members into the army'. But the most tangible evidence of the radicalisation of the Stirlingshire working class was seen in the tremendous 'explosion' of votes cast for labour and socialist candidates in the general election of 1918.

At the end of the First World War working men and women in Stirlingshire were in an aggressive and truculent mood. In 1921 the *Falkirk Mail* (10th July 1921) reported that 'there is one neighbourhood where one is struck by the frequency with which the children warble the words of the socialist song "The Red Flag"'. But if there was some doubt about what this was the portend of before the general election of 1922, the first concrete evidence of mass disaffection came during the miners strike in 1921 when it was revealed that the Stirlingshire Miners' Association had £23,000 in their funds. Instead of making immediate use of these funds to feed their hungry children as would have happened in the past, they forced the authorities to feed miners' children by waging a successful 'strike of school children' (*Stirling Journal* 21st April 1921). One of John Maclean's lieutenants – Peter Marshall, a tutor in the Scottish Labour College – addressed mass socialist and trade union meetings in Falkirk, and, though 'plain-clothes police were present', some of the speakers urged the workers to set up 'Soviets or unofficial workers' committees'. In any event the coal mines in the county were flooded, and the presence of the middle-class volunteer corps who were set up to protect property and law and order actually intensified the violence and conflict between the police and the strikers (*Falkirk Mail* 9th and 16th April 1921).

But though the possessing classes in Stirlingshire were aware of the new mood of aggression and discontent of working men and women who had come out of a bitter, bloody and disenchanting war, they were caught unawares by the socialists' dramatic election gains in 1922. In Stirlingshire the three socialist candidates – Thomas Johnston, West Stirlingshire, J. MacNeil Weir, Clackmannan and East Stirling and Hugh Murin, Stirling and Falkirk – were elected with big majorities, and the Liberals and Tories immediately came out of their defeat with a new determination to turn back the socialist tide. They did not, however, seek an explanation of the socialists' unexpected success in appalling social conditions, but in the nature and intensity of socialist activity. As one defeated candidate put it (ibid 18th November and *Stirling Journal* 23rd November 1922):

'They have weekly meetings in every nook and cranny of the country. In some places they have only a handful of adherents, but no place is too small for them to establish a branch of the ILP. They never miss an opportunity to retail their literature, and their speakers are ever ready to explain to, aye, and even educate the most illiterate in the branches of their propaganda which open out Utopian avenues'.

So in 1922 as in 1789 the experience of working men and women in Stirlingshire was one of upheaval, mass poverty and disenchantment with the established social order, and by breaking some of the chains of the past when they voted for Labour and socialist candidates they displayed their willingness to take a leap into an uncertain future of change, discontinuity and struggle.

ACKNOWLEDGEMENTS

I wish to dedicate this essay to my friend, James Dick, who lives in Airth, Stirlingshire. This excursion into local history was suggested by Dr. John Elliott, Stephen McGrail, John Grierson and Robert Kennedy, and I thank them for their interest and encouragement.

REFERENCES

- ADAMS, I. H. 1978. *The Making of Urban Scotland*. London.
- GAY, P. 1970. *The Enlightenment, an Interpretation*. 2 volumes. London.
- HOBBSBAWM E. J. 1964. *The Age of Revolution*. New York.
- JOHNSTON, T. 1922. *The History of the Working Classes in Scotland*. Glasgow.
- LEE, H. W. and ARCHIBOLD, E. 1935. *Social Democracy in Britain*. London.
- LOCH, D. 1793. *A Tour through most of the Trading Towns and Villages of Scotland*. Edinburgh.
- MARWICK, W. H. 1967. *A Short History of the Labour Movement in Scotland*. Chambers, Edinburgh.
- MITCHISON, R. 1970. *A History of Scotland*. London.
- NIMMO, W. 1817. *History of Stirlingshire*. 2 volumes.
- NIMMO, W. 1880. *History of Stirlingshire*, 3rd edition, 2 volumes, edited H. Adams. Glasgow.
- POSTGATE, R. 1922. *The Builder's History*. London.

- 134 RENNIE, R.C. and GORDON, T.C. 1966. The Third Statistical Account of Scotland, County of Stirling and County of Clackmannan. Collins, Glasgow.
- ROSS, A. 1978. The development of the Scottish Catholic community 1878-1978. *Innes Review* XXIX(I), 39.
- STEWART, J. 1940. Falkirk its Origins and Growth. Falkirk.
- WILLIAMS, G. A. 1977. Goya and the Impossible Revolution. London.
- YOUNG, J. D. 1974. Working Class and Radical Movements in Scotland and the Revolt from Liberalism 1866-1900. PhD thesis University of Stirling.
- YOUNG, J. D. 1979. The Rousing of the Scottish Working Class. Croom Helm, London and McGill Queen's University Press, Montreal.

INSTRUCTIONS FOR AUTHORS

TITLE

The title of the paper should be short and meaningful.

A summary or abstract if given should follow, preceding the text.

TEXT

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 italics e.g. Latin names of species or titles of publications, should be underlined.

Citations in the text are to be given by first author's name followed by year e.g. Jones (1978); (Marwick 1967 p62); Smith (1973), Brown (1975) and Gray (1978). Similarly for sources or notes such as newspapers or archive citations e.g. (*Stirling Journal* 26th April 1890); (ibid 10th May 1890); (Scottish Record Office AD 58/48/74). Double brackets are to be avoided.

Metric measurements should be used with accepted international abbreviations, such as g (grams), mm (millimetres), ha (hectares), min (minutes), etc. Approximate non-metric equivalents may be added in brackets if necessary. Abbreviations should be given in the forms: i.e., pers. comm., ibid, e.g., etc., viz. Acronyms like RSPB should have the first mention in full and avoid punctuation e.g. UNESCO, ILP, BTO, PhD not I.L.P., U.N.E.S.C.O., Ph.D.

Whole numbers below eleven should be in word form (ten). Footnotes should be avoided.

Acknowledgements should precede the references. Appendices, addenda, errata should follow the references.

FIGURES, TABLES AND PLATES

All illustrations should first be provided as photocopies and the originals made available after the paper has been accepted.

Text figures should be adequately prepared for reproduction with lines sufficiently black. No drawing should be so large that it must be reduced to less than one-third of its original size.

The dimensions of the printed text page (excluding running head) are 170 x 102mm (6 $\frac{3}{4}$ x 4in), and the full page size 210 x 148mm (8 $\frac{1}{4}$ x 5 $\frac{7}{8}$ in i.e. A5), should be borne in mind.

Lettering, numerals, etc., should be carefully drawn in black ink or inserted with transfer lettering or stencils. Legends for figures should be given on separate sheets, not inserted in the figures.

Tables should be set out on separate sheets and given separate concise legends.

136

Plates/photographs should be on smooth-surfaced paper, preferably not glossy, and edges must be trimmed square. It is very important that the background be of uniform tone and free from blemishes.

All figures, tables and plates are numbered in Arabic numerals in the form: Figure 1 etc., and referred to thus in the text. The position of each figure, table or plate relative to the text should be indicated in the margin.

REFERENCES

References should be listed alphabetically by author. Authors' names are capitalized. The full title and year of the work must be given. Titles of papers, but not of books, are decapitalized. Titles of journals should be given in full in italics with volume number and inclusive pagination. References to books should, if possible, include the publisher and place of publication. Citations in the text are to be given as described above under TEXT.

Examples of references:

MARSHALL, S.M. NICHOLS, A.G. and ORR, A.P. 1939. On the growth and feeding of young herring in the Clyde. *Journal of the Marine Biological Association of the United Kingdom* 23, 427-455.

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

PROOFS

Proofs should be corrected and returned *with the original manuscript* within ten days. After acceptance of the paper by the Editorial Board there should normally be no text or illustration changes. Changes in context at this time may be charged to authors.

Enquiries and offers of papers to:

Lindsay Corbett, Secretary,

The Library, University of Stirling,

Stirling, FK9 4LA

Tel. (0786) 3171.

Full name, address and telephone details should be provided with the paper.

AUTHORS' ADDRESSES

Paul W. Burton and Graham Neilson, Institute of Geological Sciences,
Murchiston House, West Mains Road, Edinburgh

Robert G. Caldow, 63 Southwold Road, Raiston, Paisley

Robert Cook, 23 Victoria Terrace, Menstrie

C. J. Henty, Department of Psychology, University of Stirling

J. S. Hopkins, Meteorological Office, 231 Corstorphine Road,
Edinburgh

Peter S. Maitland, Institute of Terrestrial Ecology, 78 Craighall Road,
Edinburgh

John Mitchell, Nature Conservancy Council, The Castle, Loch
Lomond Park, Balloch, Dunbartonshire

George Thomson, Humbleknow, Ramoyle, Dunblane

Roy Watling, Royal Botanic Garden, Edinburgh

James D. Young, History Department, University of Stirling

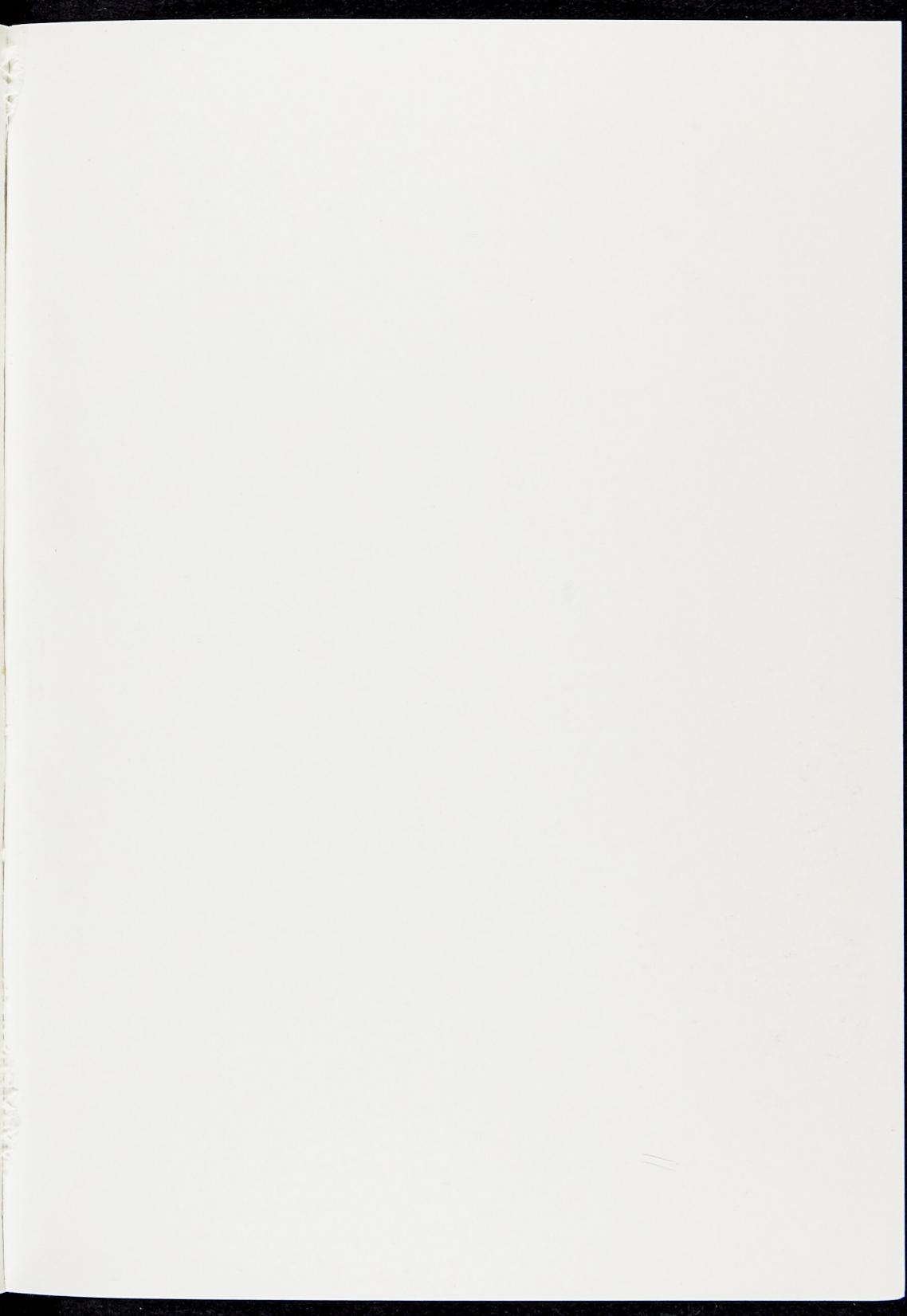
...the ... of ... in ... of ...

REFERENCES

AUTHORS' ADDRESSES

... the ... of ... in ... of ...

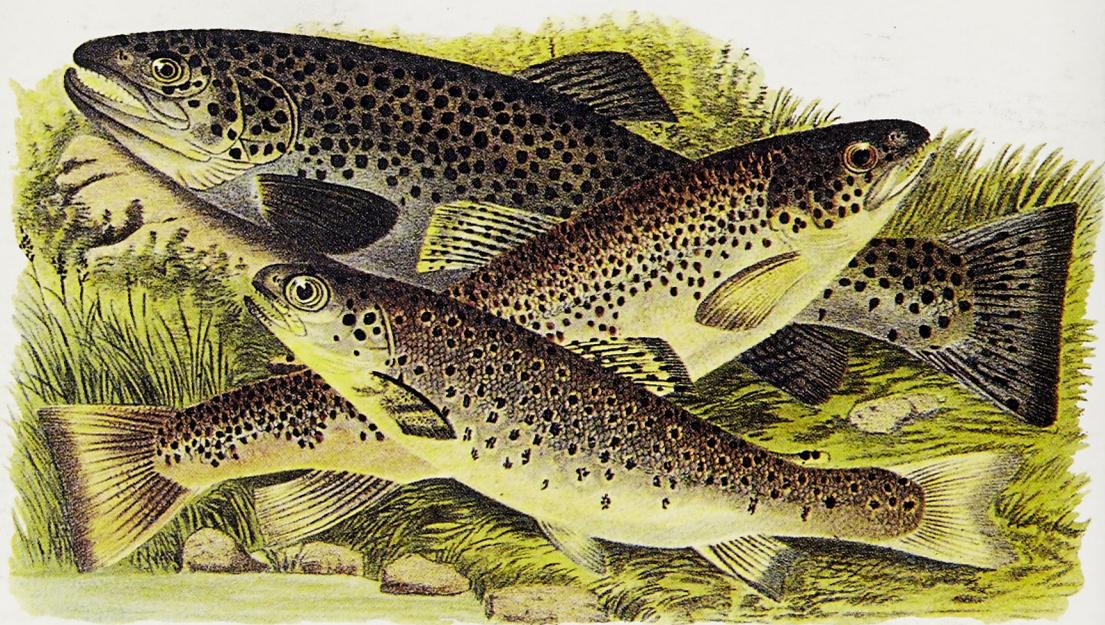
... the ... of ... in ... of ...



the Forth
Naturalist



Historian



£1.50