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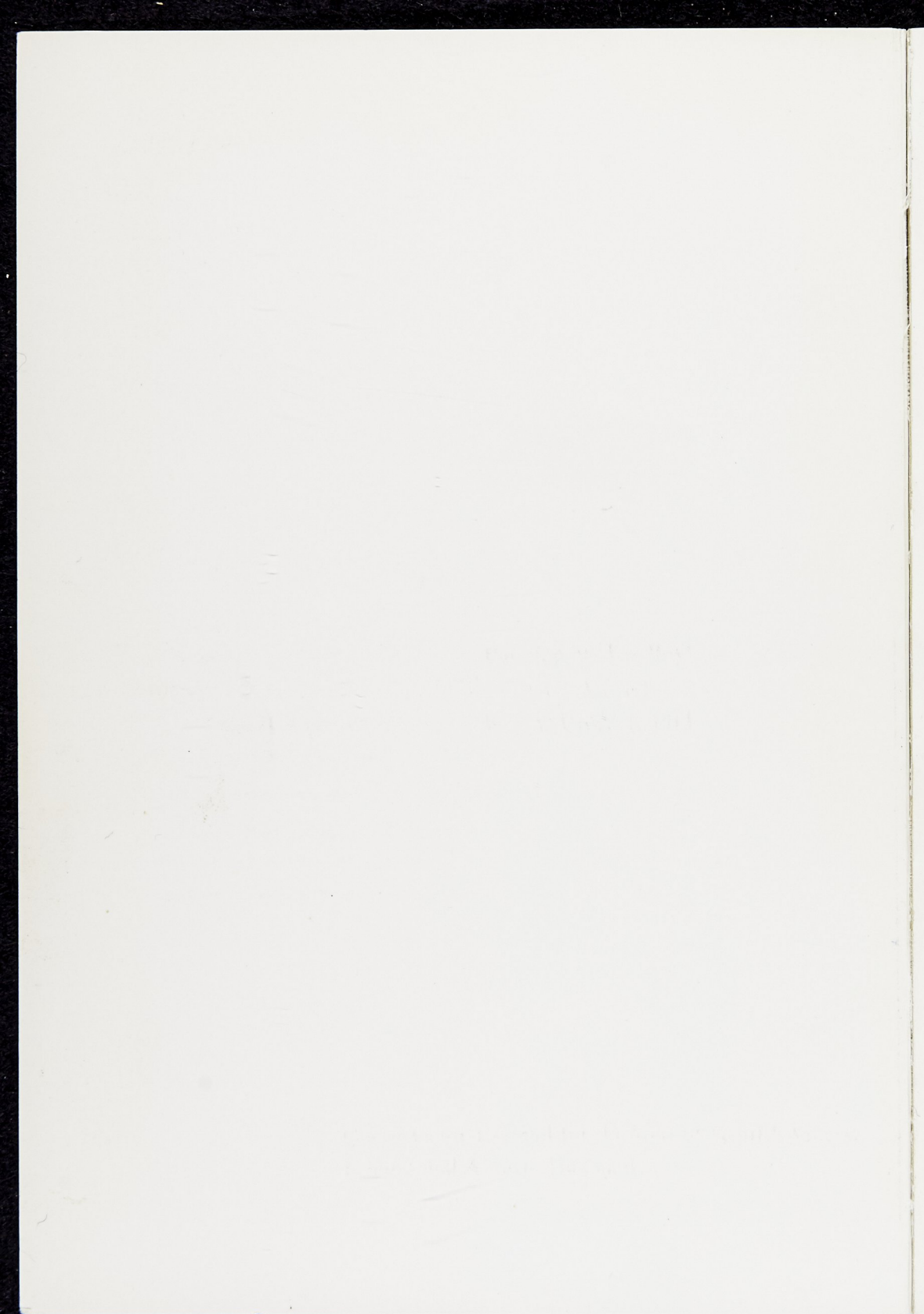
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- 2 Pressure gradients tended to be steep and westerly winds reached storm force in many places on the 6th and 7th. As the skies cleared on the 9th and 10th, temperatures fell sharply and isolated snow showers occurred in parts of the British Isles. For the first time in 1981, pressure began to increase over Scandinavia from the 12th which was to set the pattern of weather for much of the remainder of the month. Clear night skies over much of Britain resulted in frosts which were most severe in southern England. Cold continental air affected Britain after the 18th and by the 21st snow was spreading westwards affecting south-west Scotland. Most of Scotland, however, escaped the worst of the snow which was concentrated in Wales and the English Midlands. The weather was exceptionally cold on the 23rd and 24th. Minimum temperatures of -6.2°C and -7.0°C were recorded at Parkhead and Carim respectively. On the 23rd, daytime air temperatures at Carim rose to only -2.6°C . As pressure began to fall on the 25th, a fresh south-easterly wind developed which became strong by the 27th. Temperatures increased slightly and moderately heavy rain fell on the 28th.

March. Wet and mild.

As a decaying depression moved into continental Europe, Scotland experienced relatively strong and moist easterly winds on the 1st and 2nd. The month's lowest minimum temperatures were registered on the 5th, (-3.4°C at Parkhead and -5.0°C at Carim) as the skies cleared. Frontal troughs began to move north-eastwards on the 5th bringing some snowfall to central Scotland. The 5th and 6th together produced 42.4mm of precipitation at Parkhead. Many parts of the British Isles had one of their wettest days on the 7th at the beginning of a period dominated by strong S.SW winds and a series of frontal troughs crossing the country. Temperatures remained unseasonally high until the 14th when an area of high pressure developed to the west, bringing cooler N.NW airflow across Scotland. Amounts of showery precipitation were generally small, some occurring as snow or hail on higher ground. As the anticyclone drifted away southwards on the 18th, it was replaced by a cold westerly airstream bringing yet more snow to high ground. Snow affected much of Scotland again on the 20th while southern England basked in warm sunny weather. The extremely wet and windy weather which affected England and Wales on the 21st and 22nd did not affect Scotland where conditions remained calm, cold and relatively dry, although some snow fell on the 22nd which lay overnight. Temperatures increased sharply after the 23rd as a mild moist southerly airstream affected most of Scotland. The month's highest maximum temperatures were recorded on the 30th at both Parkhead (14.9°C) and Carim (11.2°C).

April. Cool and very dry.

April's weather was dominated by high pressure within the immediate vicinity of the British Isles with only rare incursions of frontal troughs. Total precipitation for the month was only 8.0mm at Carim and 14.3mm at Parkhead, and most of Scotland received less than 40% of the seasonal normal. A trough moved south-eastwards on the 4th bringing with it a small amount of rain but apart from this, the weather was relatively dry until the 10th. A complex area of low pressure and associated frontal troughs affected most of the British Isles after a sunny and exceptionally warm day on the 10th when temperatures rose to 17.2°C at Parkhead. Rain fell over most of Scotland on the 11th and 12th but the skies had cleared again by the 13th. With clear skies, night temperatures fell quickly, remaining only a little above freezing at Parkhead. Slight frosts were recorded at the upland site. The weather in Scotland began to turn colder as air from the Arctic Ocean flowed in from the north. By the 22nd, daytime temperatures had fallen from over 11.0°C on the 21st to less than 6.0°C. A minimum temperature of -7.0°C was reached at 03.00 on the 23rd at the Carim station. Snow fell over Scotland on the 23rd and 24th with some drifting over high ground in a strong E wind. A small depression and associated frontal troughs affected England and Wales on the 24th, 25th and 26th bringing heavy snowfall which caused widespread disruption. Early morning snow showers occurred on the 25th in central Scotland and by mid-day sunny intervals had developed. Cloud spread southwards on the 26th to affect most of Scotland bringing the wettest day of the month at Parkhead (6.0mm). The last four days of the month were, however, its warmest, daytime temperatures reaching 15.4°C on the 29th. Night temperatures, in contrast to a few days earlier, never fell below 9.0°C on the 29th and 30th.

May. Warm and relatively wet.

Cold northerly winds brought a cold start to the month with night frost but temperatures improved as a depression moved south-eastwards across Scotland on the 3rd and 4th. Rain fell on both days. The weather remained unsettled for several days as low pressure lingered to the SW of the British Isles. This migrated eastwards into continental Europe but pressure remained low over Britain. Coastal fog, which had been a feature of the weather from the 10th gradually affected inland areas. A series of frontal troughs crossed north-eastwards across Scotland after the 14th and rainfall was recorded on nine of the following ten days. Isolated thunderstorms occurred on the 15th and 17th and fog continued to

4. affect many areas. Low pressure stagnated over the British Isles after the 24th, and on the 26th and 27th thunderstorms occurred over central Scotland. Between 14.00 and 15.00 on the 27th, Abbotsinch recorded 25.2mm of rain "street lights came on, and there was much local flooding" (London Weather Centre Monthly Weather Summary). The Stirling area escaped the storms, only 4mm of rain being recorded at Parkhead, and 25mm at Carim. Fronts moving north-eastwards across Scotland on the 21st produced a mild but very wet end to the month.

June. Cool, dull and wet.

Rainfall was recorded on 13 out of the first 14 days as a succession of frontal troughs passed eastwards across Scotland after the 1st. High pressure became established to the west of the British Isles during the 15th which dominated the weather for the remainder of the month. Temperatures fell as NW winds brought cold air from the north Atlantic but precipitation was recorded on only four further days. The skies cleared briefly on the 21st and 22nd and daytime temperatures at last showed some sign that summer was round the corner, reaching 21.6°C at Parkhead on the 21st. (Carim 18.0°C). Clouds again became broken on the 27th and night-time temperatures fell sharply in the light northerly winds. Ground frosts occurred in some sheltered locations in Scotland. The last two days were again cloudy and relatively mild.

July. Dull and cool.

The weather remained cloudy with rain for the first nine days as cyclonic activity affected the whole of the British Isles. As pressure began to increase from the SW on the 8th, the skies cleared for a short time bringing the first warm weather. Although an anticyclone was always in close attendance, frontal troughs continued to bring cloud and rain although there were sunny intervals. The 10th was the month's wettest day producing 11.6mm at Parkhead and 14.5mm at Carim. As a ridge of high pressure extended northwards over the north Atlantic on the 14th air was brought in to Scotland from a more northerly quarter and daytime temperatures remained generally lower than the seasonal normal for the next ten days. It was particularly cold on the 22nd in rain-bearing northerly winds. There were, however, a few milder and sunny interludes during this period. By the 25th, a ridge of high pressure was moving across the British Isles and was to dominate the weather patterns for the remainder of the month, although a weak frontal trough brought some rain to northern Britain on the 28th. The weather was, however, drier and warmer and we at last experienced something approaching a

recognisable warm spell. Temperatures topped 20°C on the last six days of the month, reaching 22.3°C at Parkhead (18.5°C at Carim) on the 27th.

August. Warm and extremely dry.

High pressure to the south-west of the British Isles with ridges extending north-eastwards into the country dominated the weather patterns for most of the month bringing warm and dry conditions. Frontal troughs moving south-eastwards across Scotland between the 2nd and the 5th brought cloud and rain particularly on the 3rd but falls were very small (2.9mm at Parkhead and 4.0mm at Carim). There was widespread fog on the 5th and 6th but this tended to be confined to isolated coastal areas in Scotland. A cold front crossed Scotland on the 8th and 9th but failed to produce any rain in the Stirling area. While England remained sunny after early morning fog, Scotland experienced intermittent rain between the 10th and 13th as frontal troughs moved in from the west. After the 15th temperatures began to fall as cooler air came in from the NW. Night minimum temperatures fell unseasonably to below 6.0°C at Parkhead on the 16th and 17th as the skies cleared. General rain returned late in the afternoon on the 17th as clouds moved in from the west, and the next two days were cloudy and wet although rainfall amounts were still small (Parkhead 3.2mm, Carim 4.5mm on the 19th). Pressure began to increase from the SW after the 20th but the anticyclone which persisted over Britain from the 23rd to the end of the month brought much cloud and coastal fog. Daytime temperatures, however, exceeded 20°C on eight consecutive days until the 31st.

September. Warm at first, becoming wet and cold.

Pressure remained high over the British Isles for the first three days and the 2nd was pleasantly calm and clear. After early morning mist on the 3rd, clouds moved in from the west in the afternoon as the anticyclone drifted eastwards into continental Europe. Maximum temperatures remained high and on the 4th and 5th, overnight temperatures fell to only 13.1°C and 13.5°C at Parkhead (13.5°C at Carim). Pressure remained relatively high for several days and there were some spells of fine weather, sometimes after early morning mists. A deepening low approached Scotland from the west on the 8th becoming stationary to the north-west of the country. Rain and strong winds affected most of western Britain on the 10th but winds remained light and rainfall amounts small in the Stirling area. After the 10th, temperatures began to fall as the summer seemed to move quickly into autumn. The 12th and 13th were cloudy and dry but a

- 6¹ depression and associated fronts moved in rapidly from the west on the 14th and 15th bringing extensive rain. The pattern was now set for the remainder of the month as a succession of active depressions brought further cloud and rain, and occasionally strong winds. A particularly deep depression approached from the SW on the 19th, moving to a position off the coast of Norway by the 21st. Torrential rain fell in strong westerly winds overnight between the 19th and 20th. Gale damage and flooding were widespread. A little more than 30mm of overnight rain fell at Parkhead. The weather pattern was repeated between the 26th and 28th which resulted in another 36mm at Parkhead and an incredible 84mm at the Carim station for the three days. Over much of the British Isles, September's rainfall was double the normal.

October. Very cold, wet and windy.

Further very heavy rain fell as Low 'H' approached the British Isles from the SW in late September to become stationary over the Irish Sea by the 3rd. 56mm was recorded at Carim over the first three days, and 83mm at Parkhead. At the lowland station this is equal to the average rainfall for the whole month. Strong northerly winds affected much of Scotland on the 2nd and 3rd, with drifting snow in the mountains. The weather remained wet with occasionally strong W winds. A deep depression moved north-eastwards across the British Isles on the 8th which brought the wettest day of the month (Parkhead 16.4mm, Carim 21.0mm). As this moved away towards Norway, Scotland was affected by showery air from the Arctic Ocean. Some of these showers fell as snow in northern Scotland. As the low filled, a ridge of high pressure extended over Britain by the 14th and night temperatures fell sharply as the skies cleared. Minimum temperatures fell to -4.6°C on two consecutive nights at Parkhead (13th/14th and 14th/15th) while on the more exposed hill slopes of the Ochils, at Carim, they only reached -0.5°C , and -3.0°C . (This frost hollow effect in the Forth Valley will be discussed later in this bulletin.) Fresh W and SW winds returned to Scotland bringing 12mm of rain to Carim and a general respite from night frosts. Frontal troughs on the 22nd, 23rd and 24th brought further rain but frosts returned when night skies cleared. A deep depression moved eastwards from south of Greenland to affect the weather in Britain after the 26th. Rain was recorded on the next four days, the greatest amount falling on the 29th. Further frontal troughs crossed Scotland overnight between the 30th and 31st bringing fresh to strong relatively mild W winds.

November. Stormy at times. Highly changeable.

The month set the scene for the forthcoming winter as the weather was determined by oscillation between cold polar air from the north-west and warm tropical air from the south-west. Both daytime maximum and night minimum temperatures showed a wide range of variation. At Parkhead, the former varied between 4.1°C and 13.7°C, the latter between -2.3°C and +9.4°C. Cyclonic weather patterns continued to bring cloud and rain for the first 3 days. High pressure began to build from the south on the 4th and by the 5th an anticyclone lay over the British Isles. Night temperatures fell and frosts were recorded on three successive mornings at Parkhead, the 6th, 7th and 8th. As the anticyclone drifted eastwards fog affected Scotland on the 7th and 8th. A series of frontal troughs crossing Scotland during the evening of the 8th heralded a period of three exceptionally dry and mild days. On the 11th the maximum and minimum temperatures at Parkhead were unseasonally 13.7°C and 8.3°C respectively. Rain spread from the NW on the 15th at the beginning of a spell of unsettled weather which lasted until the end of the month. Vigorous depressions moved across the far north of Scotland on the 19th and 20th and again on the 23rd and 24th bringing gales and rain. The two storms were separated by yet another interlude of mild SW winds. The 19th was the wettest day of the month at both Parkhead (16.3mm) and Carim (23.5mm). Scotland and parts of northern England experienced some prolonged periods of snow during the second storm. By now it was clear winter had set in, and apart from one mild interlude on the 26th, low temperatures and snow over the north, and higher ground, dominated the Scottish weather for the remainder of the month.

December. Extremely cold with extensive snow.

The clear anticyclonic weather of late November was replaced by cloudy and milder conditions during the evening of the 2nd. Night temperatures, however, still fell below freezing. Showers fell in cool NW winds on the 5th and 6th occurring as snow in parts of Scotland. As the skies cleared late on the 7th, temperatures fell quickly and severe frosts were widespread. While pressure gradients remained slack and skies relatively clear, temperatures at night fell to -8.0°C or below on 4 consecutive nights. By the 12th slightly milder air affected Scotland but in the English Midlands temperatures fell to record breaking low levels. A daytime maximum of -14°C was followed by -25°C the following evening. Conditions were so severe that the BBC weather man had to have new temperature discs made before he could issue his forecast!! Heavy snow moved in from the

- 8 SW as an active depression approached from the W with associated frontal troughs. The snow had moved away by the 15th when the skies cleared and temperatures fell as polar air moved back into the British Isles. Daytime temperatures on the 15th never rose above -4.4°C . In the calm, cold air, temperatures fell below -14°C on two consecutive nights, the 16th/17th and 17th/18th. There were prospects of a thaw on the 19th as fresh southerly winds brought in much milder air but there was widespread snowfall on the 20th, the wettest day of the month (23.9mm at Parkhead). Snow turned to rain and conditions underfoot became extremely unpleasant. On the 22nd the skies cleared again as polar air returned. There were overnight frosts in the days before Christmas and snow showers affected many areas. Milder weather returned on Boxing Day but precipitation again occurred as snow and there were some moderately heavy falls in southern England. Snow turned to rain by the 29th and there were hopes of a continued thaw. How wrong can you be? It is unlikely that anyone can remember such cold weather during their lifetime — this was the coldest December since 1890 in many places.

CLIMATOLOGICAL AVERAGES FOR PARKHEAD

Climatological averages are usually taken over periods of 30 years in the case of temperature and 35 years in the case of rainfall. This is because, in Britain, there is a built-in year to year variation in all the parameters which we use to define climate. If we use too small a number of years our average may be biased by one extreme value. As there are only 11 years of records for Parkhead there is, therefore, considerable room for error in the calculation of averages. The table of climatological averages for this station should, therefore, be viewed with some caution (Table 5).

RESEARCH NOTES

The Effects of Elevation

(Figure 2)

Increasing surface elevation constitutes a particularly important control on patterns of weather and climate. Higher ground tends to experience lower temperatures, but higher rainfall and wind speeds. A comparison of the 1981 climatological data for Parkhead (35m) and Carim (332m) serves to illustrate the effect of surface elevation.

The Ochil site is clearly cooler than the University campus. Average difference in maximum temperature is approximately 3.5°C .

This represents a rate of change of temperature, or lapse rate of 11.8°C per 1000m. Average minimum temperature differences are considerably lower, reflecting not only a lower degree of atmospheric turbulence and greater atmospheric stability, but also strong topographic controls. Parkhead experiences a marked frost hollow effect in the low lying Forth valley and minimum temperatures are frequently less than those recorded at Carim. The average difference is approximately 1.3°C which represents a lapse rate of only 4.4°C per 1000m. During September and October 1981, temperatures were 'inverted' on several occasions.

The relationship between precipitation and surface elevation is considerably more complex and cannot be assumed to be uniform. Not only are the meteorological processes more complex but the raingauge also becomes subject to error in the more exposed upland areas where a large proportion of winter precipitation may occur as snow. However, by expressing Carim's recorded monthly precipitation as a percentage of that at Parkhead it is possible to obtain a crude comparison between the two. The overall figure is of the order of 140% which suggests an average annual total at Carim of approximately 1160mm.

Rainfall in the Stirling Area

In the latter part of the nineteenth century there were a number of rainfall observers in the Stirling area whose records were collated by Colonel Stirling of Gargunnock House and published in the annual *Transactions of the Stirling Natural History and Archaeological Society*. From an early group of 14 in 1894 the list grew to 24 by 1921 although not all were in the Forth Valley. The data from these stations, most of which have now closed, have provided a useful insight into rainfall variation in the Stirling area.

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- HARRISON, S.J. 1982. Rainfall in the Stirling area. *Forth Naturalist & Historian*.

Forth Valley Frost Hollow

Lower lying areas subject to the accumulation or 'ponding' of cold air draining from upper slopes, commonly referred to as frost hollows, are a well documented feature of local climate (Hawke 1944, Harrison and Currie 1979). The Forth Valley is no exception, and experiences inversions of temperature, when the valley floor becomes much colder than the surrounding hill slopes. These are particularly well developed when atmospheric pressure is high and

10 night skies clear during the winter months. Such conditions arose during December 1981 which provided the opportunity to carry out detailed observations.

By the late afternoon of the 11th, a ridge of high pressure developed over much of the British Isles. The air was generally calm and the skies cloud free for much of the following night resulting in very rapid heat loss from the already cold ground surface. (Temperatures in parts of the English Midlands had fallen to -20°C by early morning on the 12th). Temperatures were recorded every three hours along a north/south transect line across the Forth valley using a whirling psychrometer. By 18.00 on the 11th the frost hollow effect was already obvious but during the evening it intensified as temperatures in the middle of the valley fell to -14.8°C . The greatest temperature difference between hill slope and valley floor was recorded at 03.00. By 06.00 a down-valley wind had become established which mixed the air a little and tended to reduce very slightly the intensity of the frost hollow effect.

Note: This work was carried out by Miss R. Wallace as part of her B.Sc.(Hons) Environmental Science degree programme.

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HAWKE, E.L. 1944. Thermal characteristics of a Hertfordshire frost hollow. *Quart. Journ. Roy. Met. Soc.* 70, 23-48.
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Fogs in the Forth Estuary

It has been suggested that the Forth estuary has one of the highest incidences of coastal fog in Scotland (Dixon 1939), some of which are the spring and summer haars typical of the North Sea coast of Britain (Lamb 1943). The dependence of many fog forecasting models on temperature contrast between the lower atmosphere and the sea surface (for example: Noonkester 1979), when considered in conjunction with tidally controlled water temperature oscillation at the entrance to tidal inlets and estuaries (for example: Heath 1977), suggests that such control may extend to the formation of fogs in confined coastal waters. Alexander (1964) observed a tidal control of haar in the Eden estuary in Fife.

As part of an NERC funded project, visibility observations from Inchkeith lighthouse in the Forth estuary have been analysed and reveal a markedly greater frequency of fogs at certain states of the tide. The frequency of fogs at 10.00 and 16.00 GMT has been related

to coded data based on the timing of high tides. The dispersion diagram has been presented in circular rather than linear form (Figure 3). While fogs observed at 10.00 appear to occur most frequently on a falling tide, those at 16.00 are most frequent at high tide. The explanation for these apparent correlations lies in the complex heat and moisture balances in the estuary which are currently under investigation.

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TABLE 1
MONTHLY TEMPERATURES (STIRLING, PARKHEAD) 1981

	Mean °C Maximum	Diff. from Average	Highest Maximum	Lowest Maximum	Mean °C Minimum	Diff. from Average	Highest Minimum	Lowest Minimum	Mean °C	No. of Days ≤ 0°C	Mean Earth Temp. °C
January	* (7.2)	+1.3	(10.5)	(1.9)	0.7	+0.2	7.0	-4.5	3.5	16	3.1
February	* (6.3)	0	(11.0)	(2.3)	0.2	-0.5	6.7	-6.2	3.3	17	3.0
March	9.6	+0.9	14.9	4.4	2.8	+1.1	8.3	-3.4	6.2	5	4.7
April	12.5	+0.8	17.2	5.4	2.9	-0.2	9.6	-3.5	7.4	3	8.5
May	15.2	+0.1	19.7	7.2	6.7	+1.3	12.0	-1.9	10.9	3	11.6
June	16.8	-0.7	21.6	13.2	8.5	+0.5	13.3	3.0	12.6	0	15.2
July	18.6	-1.0	22.3	16.2	10.1	-0.4	14.6	6.6	14.3	0	16.1
August	19.6	+0.7	23.3	14.0	10.5	+0.6	15.9	5.4	15.0	0	16.6
September	17.2	+1.1	21.9	13.0	8.2	-0.2	13.4	2.5	12.7	0	14.3
October	10.4	-2.2	13.2	8.1	1.2	-4.4	10.3	-4.6	5.8	11	7.7
November	9.5	+0.7	13.4	4.1	2.5	+0.2	9.4	-2.3	6.0	10	6.1
December	2.7	-4.1	10.8	-4.4	-5.7	-6.9	2.5	-14.5	-1.5	29	N/A
Year	12.1	-0.1	23.3	-4.4	4.1	-0.6	15.9	-14.5	8.1	91	—

* Incomplete record: means estimated

TABLE 2
MONTHLY TEMPERATURES (OCHIL, CARIM) 1981

	Mean °C Maximum	Diff. Carim- Parkhead	Highest Maximum	Lowest Maximum	Mean °C Minimum	Diff. Carim- Parkhead	Highest Minimum	Lowest Minimum	Mean °C	No. of Days ≤ 0°C
January	3.4	-3.8	7.5	-2.0	-1.1	-1.8	6.0	-6.5	1.2	20
February	2.3	-4.0	8.5	-2.6	-1.8	-2.0	4.0	-7.0	0.3	23
March	5.3	-4.3	11.2	0.0	0.7	-2.1	5.6	-5.0	3.0	11
April	9.8	-2.7	14.5	0.8	0.6	-2.3	6.9	-7.0	5.2	15
May	12.4	-2.8	19.1	5.5	4.9	-1.8	9.0	-6.0	8.7	2
June	13.4	-3.4	18.0	10.5	8.0	-0.5	11.0	0.5	10.7	0
July	14.7	-3.9	18.5	11.0	8.1	-2.0	12.0	4.5	11.4	0
August	16.6	-3.0	20.5	11.0	9.7	-0.8	14.5	4.5	13.2	0
September	13.3	-3.9	18.0	8.0	8.1	-0.1	13.5	5.0	10.7	0
October	6.6	-3.8	9.5	3.0	1.2	0.0	5.0	-3.0	3.9	6
November	6.8	-2.7	10.8	1.0	2.1	-0.4	7.5	-4.0	4.5	8
December	NO DATA - STATION INACCESSIBLE									

TABLE 3
MONTHLY PRECIPITATION (STIRLING, PARKHEAD) 1981

	Total Precipitation (mm)	Difference from Average (1971-1981)	Greatest Fall in 24 Hours		Number of Days			
			Amount (mm)	Date	Precipitation Recorded	0.2mm or more	1.0mm or more	5.0mm or more
January	72.3	-25.8	14.8	18th	23	22	16	4
February	47.2	-20.9	18.6	2nd	13	13	6	4
March	125.8	+49.8	22.3	5th	23	19	16	7
April	14.3	-23.5	6.0	26th	6	6	4	1
May	60.7	+ 4.9	8.0	16th	19	19	14	5
June	63.6	+11.0	12.0	2nd	17	17	12	5
July	46.8	-13.7	11.6	10th	16	15	11	3
August	10.1	-47.2	3.2	19th	9	8	4	0
September	165.1	+81.2	31.3	20th	18	18	14	9
October	160.1	+77.0	66.2	1st	22	21	15	9
November	101.7	+ 1.8	16.3	19th	19	19	15	8
December	53.4	-30.1	23.9	20th	14	14	9	2
Year	921.1	+64.5	66.2	1st October	199	191	136	57

TABLE 4
MONTHLY PRECIPITATION (OCHIL, CARIM) 1981

	Total Precipitation (mm)	Greatest Fall in 24 Hours		Number of Days		
		Amount (mm)	Date	Greater than/ = 0.5mm	Greater than/ = 1.0mm	Greater than/ = 5.0mm
January	60.5	12.5	2nd	21	15	4
February	64.0	18.5	2nd	14	10	4
March	N/A	—	—	—	—	—
April	8.0	4.5	10th	6	4	0
May	97.5	11.5	31st	23	20	7
June	110.6	17.5	7th	N/A	—	—
July	71.5	14.5	10th	18	13	6
August	9.8	4.5	19th	N/A	—	—
September	256.0	66.0	26th	19	17	12
October	172.0	37.0	1st	19	17	12
November	116.5	23.5	19th	21	20	15
December	NO DATA — STATION INACCESSIBLE					

TABLE 5
CLIMATOLOGICAL AVERAGES FOR STIRLING (PARKHEAD)
UNIVERSITY OF STIRLING (1971-1981)

	Maximum °C Air Temperature	Minimum °C Air Temperature	Number of Days \leq 0°C	Earth (0.3m) Temperature (0900)	Total Precipitation (mm)	Number of Days with Precipitation
January	5.9	0.5	13	3.0	98.1	19
February	6.3	0.7	12	2.8	(68.1)	16
March	8.7	1.7	9	4.4	76.0	18
April	11.7	3.1	4	7.6	37.8	11
May	15.1	5.4	2	11.4	55.8	15
June	17.5	8.0	0	14.5	52.6	14
July	19.6	10.5	0	16.4	60.5	14
August	18.9	9.9	0	16.3	57.3	14
September	16.1	8.4	0	13.7	83.9	16
October	12.6	5.6	4	10.0	83.1	16
November	8.8	2.3	9	6.0	99.9	18
December	6.8	1.2	12	(3.8)	83.5	17
Year	12.2	4.7	65	9.2	856.6	188

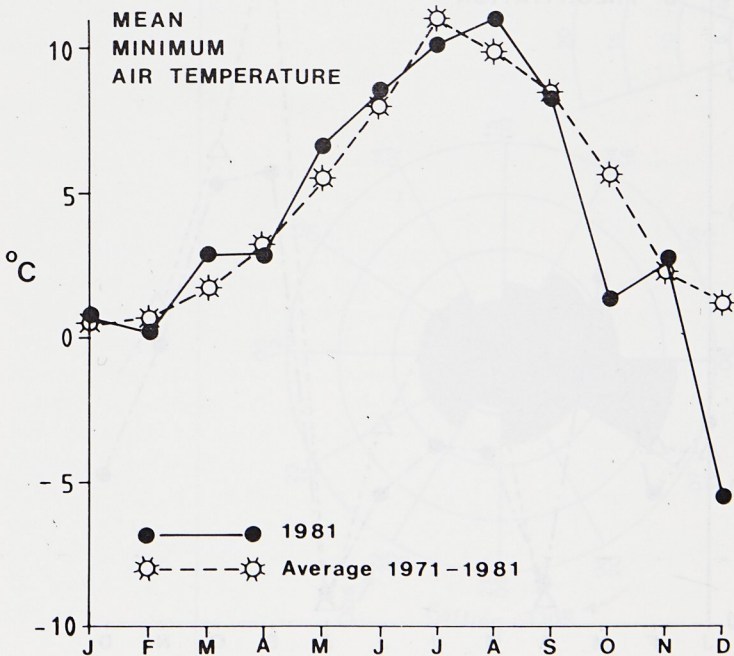
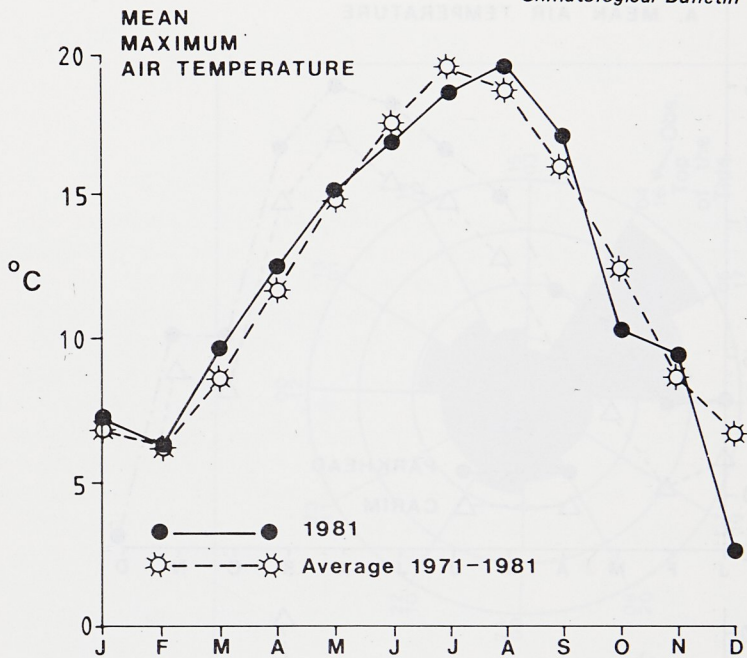


Figure 1 Temperatures — Parkhead

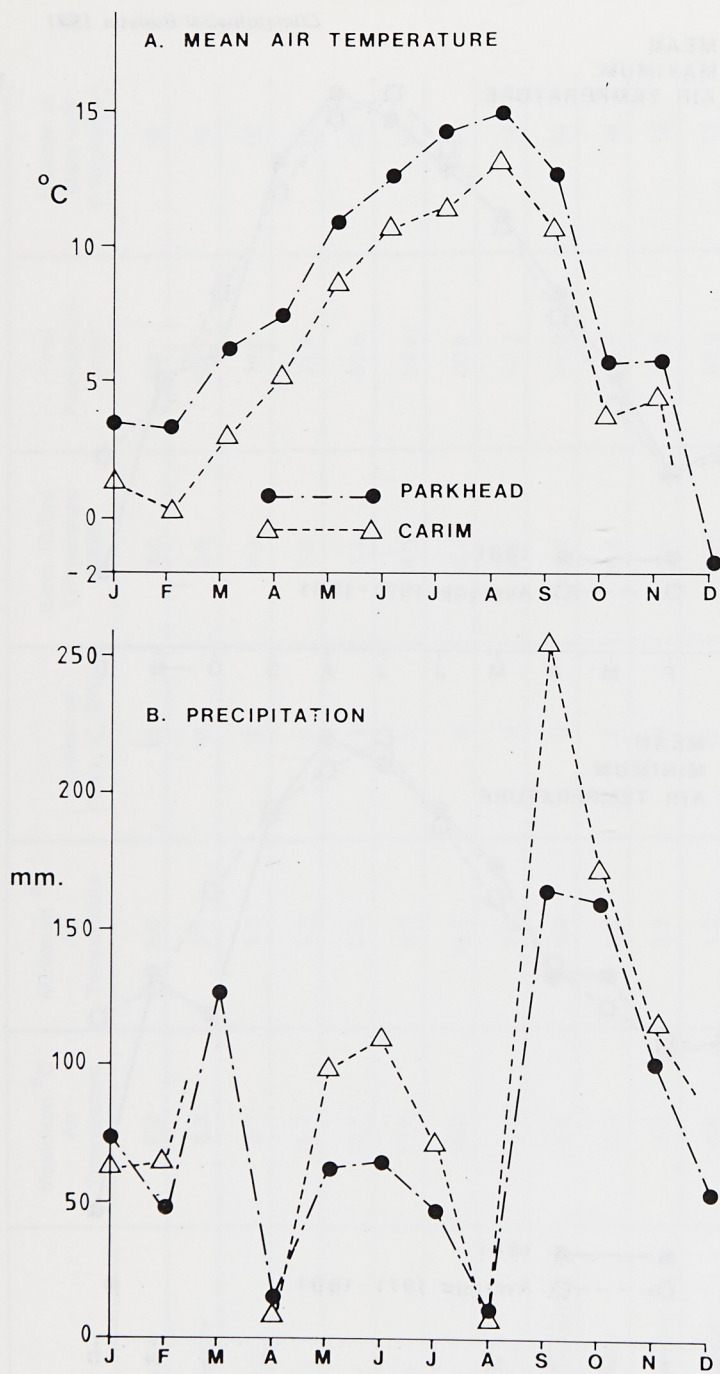


Figure 2 Elevation effects

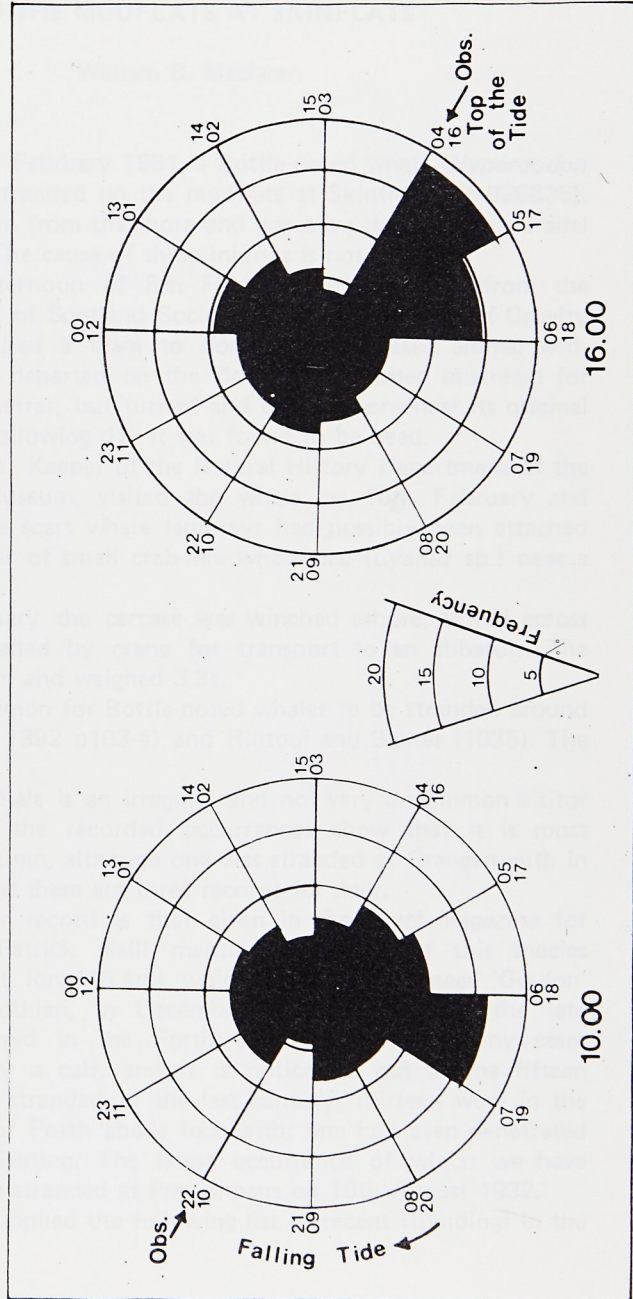


Figure 3 Frequency distribution of fogs: Inchkeith Lighthouse, Forth Estuary: 1969-80

MEAN JAN TEMPERATURE



Figure 2. Location effects.

NOTES ON A STRANDING OF A BOTTLE-NOSED WHALE
ON THE MUDFLATS AT SKINFLATS

19

William B. Maclaren

On Sunday 8th February 1981, a Bottle-nosed whale (*Hyperoodon ampullatus*) was stranded on the mudflats at Skinflats (NS 926835). The whale lay 40m from the shore and was alive despite four parallel cuts on its back. The cause of these injuries is not known.

During the afternoon of 8th February an Inspector from the Glasgow and West of Scotland Society for the Prevention of Cruelty to Animals organised a team to douse the distressed animal with water. The whale departed on the flood tide, cruised upstream for several hundred metres, but turned and came ashore near its original position. On the following day it was found to be dead.

Dr A. S. Clarke, Keeper of the Natural History Department of the Royal Scottish Museum, visited the whale on 10th February and found that it bore scars where lampreys had possibly been attached and also a number of small crab-like whale lice (*Cyanus* sp.) near a wound.

On 16th February the carcass was winched ashore, towed across the fields and loaded by crane for transport to an abattoir. The whale measured 6m and weighed 3.3t.

It is not uncommon for Bottle-nosed whales to be stranded around our coasts (Evans 1892 p103-4) and Rintoul and Baxter (1935). The latter reads —

'The Beaked Whale is an irregular and not very uncommon visitor to the Forth; the recorded occurrences show that it is most frequent in autumn, although one was stranded at Grangemouth in March 1894, and there are three records for July.

The only other record is that given in the *Scots Magazine* for 1808, where Patrick Neill mentions a Whale of this species twenty-one feet long (6.4m) which was stranded near 'Goulon' Point, East Lothian, in December 1807. Almost all the late specimens secured in the Forth were females, in many cases accompanied by a calf, and it is noticeable out of the fifteen Beaked Whales stranded in the last century, thirteen were in the upper reaches of Forth above Inchkeith; one had even penetrated as far up as Stirling. The latest occurrence of which we have record is of one stranded at Prestonpans on 16th August 1932.'

Dr Clarke has supplied the following list of recent strandings in the Forth area:

- 20 South Queensferry — 19th July 1951 8m long
 Grangemouth — 11th July 1969 6m long
 Torryburn — 14th July 1978 7m long and 4t weight

The frequency of the July records is odd as strandings are usually said to be commonest in late autumn and winter as in the Skinflats example here recorded, while the whales are on their way south from their winter quarters in the far north.

ACKNOWLEDGEMENTS

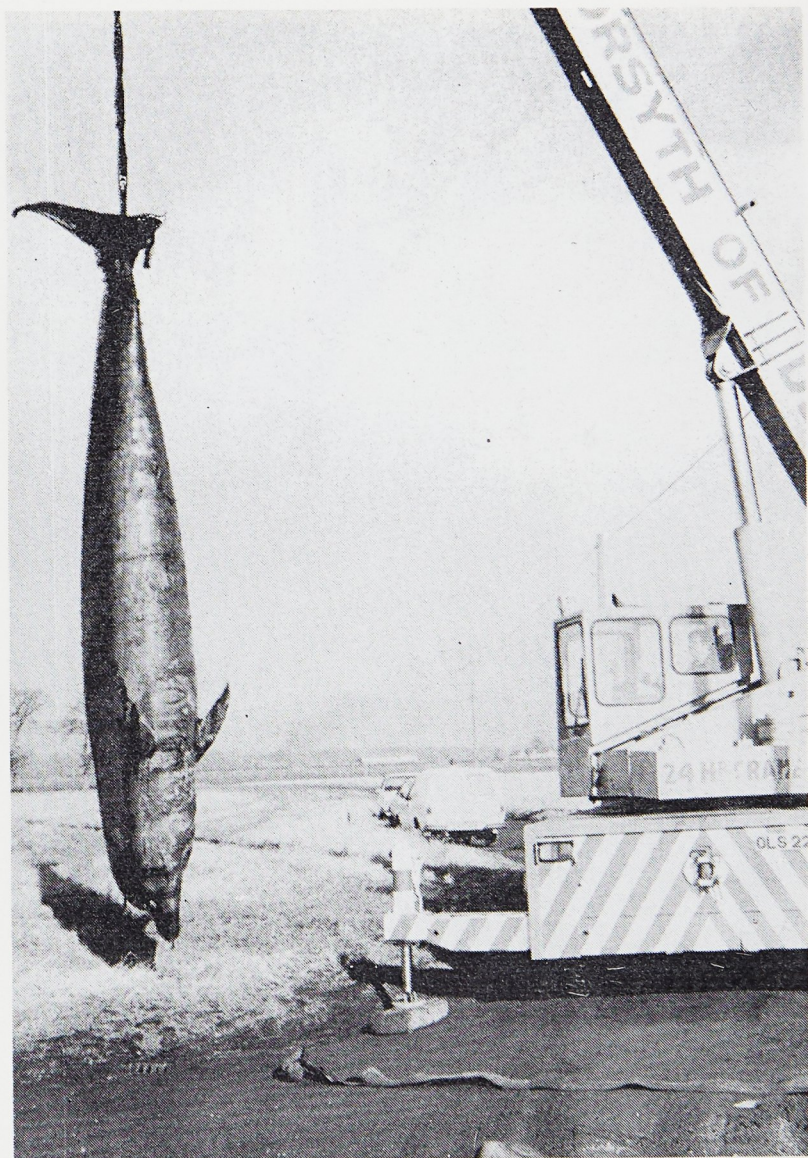
I should like to thank Dr A. S. Clarke of the Royal Scottish Museum, Edinburgh, for his help. The whale was first discovered by Mr D. Fleming who told me about it.

REFERENCES

- EVANS, W. 1892. Mammalian Fauna of the Edinburgh District. McFarlane and Erskine, Edinburgh.
RINTOUL, L. J. and BAXTER, E.V. 1935. A Vertebrate Fauna of Forth. Oliver and Boyd, Edinburgh.

APPENDIX

The Bottle-nosed whale belongs to the Odontoceti or toothed whales, a sub-order of the Cetacea. Of this sub-order the family Ziphiidae (beaked-whales) includes *Hyperoodon ampullatus* the species under consideration. Fully grown, the male may measure 10m and the female 8m. By far the most striking characteristic of the species is the bulging 'forehead' which is responsible for its common name.

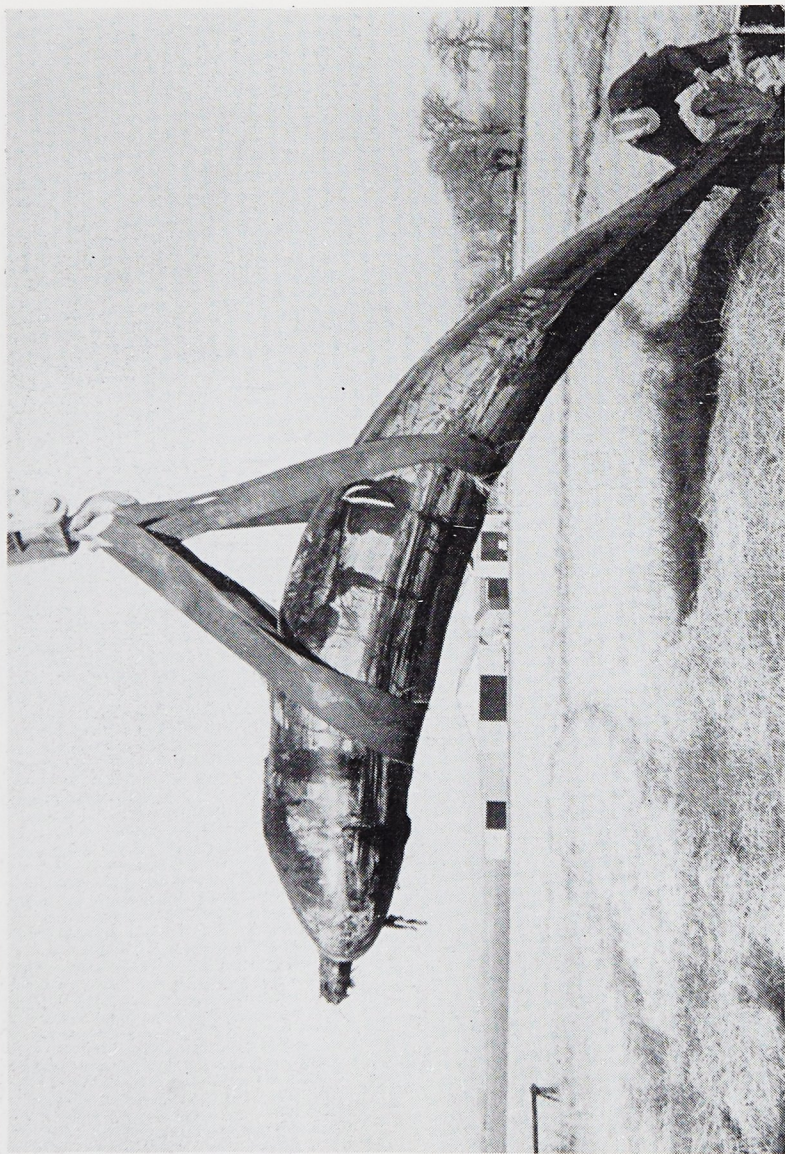




By courtesy of Falkirk Museum



By courtesy of Falkirk Museum



**FORTH AREA BIRD REPORT
(CLACKS, STIRLING, SOUTHWEST PERTH) 1981**

C. J. Henty
University of Stirling

The main features of the weather in 1981 were a very dry April followed by a dull and rather cool summer and an exceptionally wet autumn. Heavy rain and severe gales in late September caused widespread damage to trees and buildings. A very cold spell started in the second week of December and snow and hard frost continued unbroken well into 1982.

In the autumn more Barnacle Geese were recorded than is usual but the most remarkable wildfowl event was the appearance of a large party of Bean Geese at Carron Valley Reservoir in February. This area was also notable for numbers of Crossbills in early spring and strong evidence for successful breeding by Gadwall. In midsummer a pair of Ruddy Ducks appeared on the pool of Flanders Moss whilst another "first" for the area was a Crested Tit near Stirling in February. Stonechats remain scarce whilst there is a continuing and tantalising sprinkle of records for Kingfisher and Hawfinch.

I should like to remind contributors that records are welcomed for the whole of the Central Region excluding Loch Lomondside and Killin, a sketch map is available on application. The basic report for the Scottish Ornithologists' Club has to be produced by late February and only slight revisions can be made for the local report in the Forth Naturalist. Thus it is important that anyone with more than half a page of notes should send in as much as possible before Christmas of the year concerned and all other additional or brief notes are needed before the third week in January. This report does not include a lot of evidence on species such as Buzzard where the information came in too late to be assimilated — the existing report has been effectively written twice and a third edition is not feasible.

With the start of the winter atlas survey organised by the British Trust for Ornithology we should soon get more systematic evidence on the distribution of common species but I should like to emphasise that information on common or garden birds is very welcome.

An asterisk indicates where all records for a species have been quoted whilst the sections headed by C, S and SWP refer to notes for Clackmannan, Stirlingshire and southwest Perth respectively.

C. J. Henty

- 26 The following observers are referred to by initials in the report:

Mrs. E. Bear, W. R. Brackenridge, D. M. Bryant, R. L. Calder, P. M. Ellis, N. Faulkner, M. W. Fraser, J. Gearing, R. Gooch, Carron Valley Group*, C. J. Henty, D. Hickson, G. Jones, D. Kerridge, S. Macdonald, D. H. McEwen, J. Mitchell, A. Robertson-Durham, H. Robb, P. W. Sandeman, J. Simpson, J. Speakman, P. Tatner, Miss A. K. Turner, D. Thorogood.

*includes B. Broadley, J. G. Conner, J. M. Conner, A. Whitelaw, A. D. Wood, A. Young.

*RED-THROATED DIVER

S 1 at North Third Reservoir on 15th March (WRB), 1 probable on 8th (JM)

*BLACK-THROATED DIVER

S 2 at western loch on 11th April (DK)

GREAT CRESTED GREBE

S at Grangemouth, 380 on 3rd and 800 on 20th January, 230 on 14th and 250 on 16th September, 700 on 31st December (DMB,WRB,DK,DT)
At Carron Valley Reservoir, 6 on 12th April; 2 pairs in summer — 1y reared, c6 unsuccessful; 1 on 15th November (CVG)

CORMORANT

S Max. at Carron Valley Reservoir, 5 on 8th February and 18th October (JS,ADW,AY)

GREY HERON

S 18 at Carron Valley Reservoir on 16th November (AY)
SWP 20 pairs at Lake of Menteith (WRB)

MUTE SWAN

SWP 29 at L. Watston on 28th March (WRB)

WHOOPEE SWAN

C 39 at Gartmorn Dam on 11th January (WRB). 22 flew W at Dollar on 11th November (RG) — no resident flock in autumn (CJH)
S 48 (14 juv) at Stenhousemuir on 3rd January and 31 (8 juv) on 10th-14th November. 22 at Carse of Stirling on 27th March. 26 at Kippen on 4th January. At Carron Valley Reservoir, 15 on 15th and 19 (7 juv) on 21st February and 8th March. 1st of autumn, 4 at North Third Reservoir on 16th October (WRB, CVG, CJH, JG, ARD, PWS)
SWP 68 at Lecropt on 3rd January, 25 at Blairdrummond Moss on 28th and 30th March, 24 on 24th November. At Thornhill, 16 on 1st and 28th March, 23 on 2nd April; 44 (11 juv) on 25th October and 31 on 4th November (WRB, JG, PWS, DT)

BEAN GOOSE

S max. 73 at Carron Valley Reservoir 15th—22nd February (probably also on 8th) (WRB, JG, DT, ADW, AY)

PINK-FOOTED GOOSE

- SWP 2050 at Lake of Menteith on 21st and W. Flanders Moss on 24th January
1st at Ashfield on 28th September. 1800 at Blackdub on 13th December
(WRB,DK)

GREYLAG GOOSE

- S 1500 at Gargunnoch on 13th January (WRB)
- SWP 3500 at Cromlix on 1st January and 2000 at Blairdrummond on 5th
March; movement N at Strathyre on 9th April. 1300 at Thornhill on
7th November. Pairs at L. Venachar on 29th May and Lake of Menteith
on 4th April and 26th May (WRB,JG,DK)

*BARNACLE GOOSE

- S 15 at Skinflats on 16th and 17th October (JS,DHM). 1 with Greylags at
Gargunnoch on 6th February (JG)
- SWP 3 SW at Ashfield on 1st January. 3 at Blairdrummond on 28th March and
2 on 24th November. 8 at Thornhill on 6th and 6 on 8th November. 4 at
Blackdub on 29th September, 8 on 7th December and 6 at Lecropt on
13th (WRB,PWS,DT)

*BRENT GOOSE

- S 1 (pale bellied) at Skinflats on 25th September (DHM)

SHELDUCK

- S At Grangemouth, 1600 on 3rd and 1460 on 20th January. 1990 on 29th
August (WRB,DMB)

*GADWALL

- S Female anxious with duckling calls nearby at Carron Valley Reservoir
on 14th June (JMC,JGC). 2f at Skinflats on 17th October (DHM)
- SWP M at L. Watston on 18th October (DT)

TEAL

- C 200 at Gartmorn on 11th January. 350 Tullibody Inch — Cambus on
13th September (WRB,CJH,DT)
- S 500 at Grangemouth on 4th January and 258 on 10th December (DMB,
JG). 252 at Carron Valley Reservoir on 8th February and 744 on 18th
October (JS,ADW,AY)

PINTAIL

- S 80 at Grangemouth on 7th January (MWF)

*SHOVELER

- C 1 at Craigrie Pond on 16th August and 2 at Gartmorn on 29th September
(WRB)

POCHARD

- C 50 at Gartmorn on 11th January and 150 on 29th September (WRB)
- S 56 at Grangemouth on 7th January and 110 on 7th February (DMB,MWF)

TUFTED DUCK

- C 157 at Cambus on 15th December, hard frost (AKT)

*SCAUP

- C 1 at Gartmorn on 7th March (WRB)
- S F at Grangemouth on 18th January (DT)

28. GOLDENEYE

- S 73 at Carron Valley Reservoir on 18th October, 1 imm on 16th August (JS,ADW,AY)
- SWP 3(im) at Lake of Menteith on 2nd May. 1 at Blairdrummond GP on 25th May (WRB,DK)

*SMEW

- C F at Gartmorn on 11th January (WRB)

GOOSANDER

- C 35 at Tullibody Inch on 26th December (CJH)
- S 25 at Carron Valley Reservoir on 4th January (JS,ADW,AY)
- SWP 14 at L. Watston on 25th January (JG)

*RUDDY DUCK

- SWP Pair on Flanders Moss on 1st and 17th June, 30th July (WRB,DK)

HEN HARRIER

- S Seen above Gargunnoch in summer (DT)
- SWP Summer records: m in Menteith Hills on 4th April (DT). M on Flanders Moss on 17th June (WRB)

*GOLDEN EAGLE

- S 1 imm S over Airthrey on 13th December (WRB)

*MERLIN

- S 1 at Skinflats on 14th and 18th January, 1st February, 17th October and 31st December (DMB,DHM,JS,DT)
- SWP 1 at Thornhill on 18th January, Lecropt on 13th April, E. Poldar on 21st September (WRB,JG)

PEREGRINE

- C/S 6 autumn-winter from estuary (WRB,DHM,JS)
- 4 pairs (3Y, 1Y, failed, present)

*CAPERCAILLIE

- SWP M on Flanders Moss 7th April (DK)

*RED-LEGGED PARTRIDGE

- SWP 1 at Lecropt on 28th May and 30th June (WRB,PWS)

*CORNCRAKE

- S 2 calling at Gargunnoch 25th May — 12th June (JG). 1 at Stirling 1st — 25th June (WRB)

COOT

- SWP 111 at Lake of Menteith on 18th January (JG)

OYSTERCATCHER

- S 892 on Forth estuary on 18th January (DMB). Spring: Gargunnoch 17th February; Airthrey mainly from 6th February, 1st on 8th January; 10 at Craigforth on 31st January (MWF,JG,DT)
- S 2 pairs (1Y, 3Y) at Carron Valley Reservoir (BB,JGC,JMC)
- SWP 1st at Ashfield on 10th February (WRB)

RINGED PLOVER

- S 3 or 4 pairs bred Carron Valley Reservoir, arrived 12th April (CVG)
- SWP Pair at Doune Ponds on 19th March (PWS)

GOLDEN PLOVER

S 675 on Forth estuary on 18th January (DMB)

GREY PLOVER

S 80 at Skinflats on 17th October (DHM)

LAPWING

S/C 750 at Airth shore, 450 at Black Devonmouth, 300 at Tullibody Inch on 13th September (DT)

KNOT

S At Grangemouth, 5400 on 20th January, 1st of autumn 5 on 6th August, 1350 on 18th December (DMB,WRB,DT)

*LITTLE STINT

S 6 at Grangemouth on 14th and 2 on 15th September (WRB,DHM)

CURLEW SANDPIPER

S at Grangemouth, 2 on 14th, 1 on 15th, 3 on 18th September (WRB, DHM,R.Shand)

DUNLIN

S At Grangemouth, 1600 on 18th January and 1200 on 25th November (GJ,DT)

*RUFF

S At Grangemouth, 7 on 14th and 6 (3m) on 18th September (DHM,WRB)
C 2 at Cambus on 31st July, 1 at Blackdevonmouth and 6 at Cambus on 13th September (WRB,CJH,DT)

JACK SNIBE

C 2 at Alva on 25th October and 1 on 25th December (CJH)
S 1 at Carron Valley Reservoir on 18th October (JS,ADW)
SWP Max. 3 at Doune Ponds 4th March—8th April, 1 on 20th October, 12th and 22nd November (WRB)

SNIBE

S Less common at Gargunnock with increased drainage (JG)

*BLACK-TAILED GODWIT

S at Grangemouth, 1 on 8th January, 3 on 7th and 1 on 21st February, 4 on 26th August, 3 on 17th October (DMB,WRB,MWF,DHM). 1 W over Airthrey on 13th March (MWF)

BAR-TAILED GODWIT

S 296 on Forth estuary on 20th January (DMB)

CURLEW

S 190 (roost) at Carron Valley Reservoir on 15th March (ADW,AY)

*SPOTTED REDSHANK

C 1 at Cambus on 2nd August (WRB)
S 1 at Kincardine Bridge on 21st February (WRB)

GREENSHANK

C At Cambus-Alloa, 1 on 31st July, 7 on 14th, 8 on 16th and 7 on 29th August (WRB,DDR,CJH)
S At Grangemouth, 1 on 9th January and 7th February; 1 on 15th July, 1 on 6th and 5 on 9th August (DMB,DT)

*GREEN SANDPIPER

- C 1 at Craigrie Pond on 29th and 2 at Cambus on 22nd August (WRB).
- SWP 1 at Dunblane on 14th, 2 at Blairdrummond on 25th August (WRB)

COMMON SANDPIPER

- S 1 at Airthrey on 12th April (MWF). 20 pairs at Carron Valley Reservoir, 2 on 11th April, last on 18th October (BB,CVG,AY)

TURNSTONE

- S 130 on Forth estuary on 20th January (DMB)

BLACK-HEADED GULL

- S 20000 at Skinflats roost on 19th October (JS). 175 pairs at Carron Valley Reservoir, little success (BB,JGC,JMC)
- SWP 200 pairs at Blairdrummond on 19th May (PWS)

COMMON GULL

- SWP 4 pairs at Blairdrummond on 19th May (PWS)

LESSER BLACK-BACKED GULL

- S 1 at Carron Valley Reservoir on 8th February (AY). 700 at Loch Coulter on 29th July (JS,ADW,AY)
- SWP 100 at Blairdrummond on 10th and 8 at L. Venachar on 29th November (WRB,GJ)

SANDWICH TERN

- S 100 at Grangemouth on 26th August (WRB). 1 heard over Stirling on 13th August (DT)

COMMON TERN

- S 1 pair bred at Carron Valley Reservoir (BB,JGC,JMC)

GUILLEMOT

- S At Skinflats, 13 on 19th and 10 on 25th October, 2 on 13th November (DJ,DHM,JS)

WOODPIGEON

- S 770 at Kippen on 3rd January (JG)

COLLARED DOVE

- SWP 36 at Bridge of Allan on 13th December (WRB)

LONGEARED OWL

- S 1 at Kippen on 27th May (A.B.Bailey)
- SWP 1 dead at Lecropt on 15th March (WRB). 1 ad and 2 juv at Lake of Menteith on 8th May (DK)

SHORTEARED OWL

- C 2 at Blackdevonmouth on 16th November (PME)
- S 1 at Grangemouth on 9th August, 17th and 25th October, 1st November and 10th December (DM,JG,JS,DT). 1 on Sheriffmuir on 5th October and 11th November (NF)

TAWNY OWL

- S Becoming uncommon at Gargunnock (JG)

SWIFT

- C 200 at Ben Cleuch on 21st June (WRB)

- S 2 at Stirling on 7th and 4 on 8th May, 1 at Kippen on 8th (WRB,DK,DT) 31
500 at Carron Valley Reservoir on 13th July (ADW,AY). 1 at Gargunnoch
on 3rd October (JG)

***KINGFISHER**

- C 1 at Crook of Devon on 5th and 6th February (DMB), 1 at Cambus on
16th August (EB,WRB,CJH,DK)
S 1 at Skinflats on 1st February (JS)
SWP Reports from Blairdrummond and Barbush (WRB)

SANDMARTIN

- SWP 40 at Barbush on 30th March (WRB)

SWALLOW

- S 1 at Carron Valley Reservoir on 12th April (ADW,AY). 1st at Airthrey
and Gargunnoch on 14th April, last on 4th October and at Stirling on
14th (MWF,JG,DT)
SWP 1 at Aberfoyle on 11th April (WRB)

HOUSE MARTIN

- S 1st at Airthrey on 17th and Kippen on 20th April; last at Gargunnoch
on 4th October (MWF,DK,JG)

TREE PIPIT

- S 1 at Carron Valley Reservoir on 11th and Airthrey on 13th April (MWF,
CVG)
SWP 2 at Dunblane on 14th April (WRB)

***WAXWING**

- S 7 at Stirling on 8th and 2 on 19th December, fed on cotoneaster (RLC)
5 at Kippen on 28th November
SWP 1 at Bridge of Allan on 9th and 15 at Callander on 28th November
(PWS)

REDSTART

- S Pair bred on scarp above Gargunnoch (PT)
SWP 2 at Menteith on 12th April (WRB). 32 pairs at nestbox colony (HR)

STONECHAT

- SWP M at Callander on 15th March. Several in Menteith Hills on 21st May,
pair feeding young on Flanders Moss on 17th June (WRB,DK,DT)

WHEATEAR

- S Frequent above Gargunnoch, 12 nests found along 4 km of escarpment
(PT)
SWP 2 in Menteith Hills on 4th April (PT)

RING OUZEL

- SWP 3 at Balquhiddel on 5th April (WRB)

FIELDFARE

- S 1st at Gargunnoch on 11th October (JG)

REDWING

- S 20 at Stirling on 4th October, 1st at Airthrey on 7th and Gargunnoch
on 11th (WRB,JG,GJ)

MISTLE THRUSH

S Singing at Airthrey on 22nd January (MWF). 47 at Touch on 22nd July (DK)

SWP 35 at Ashfield on 30th August (WRB)

SEDGE WARBLER

S 1st song at Airthrey on 6th May (MWF)

WHITETHROAT

S 1 at Carron Valley on 20th April (CVG)

BLACKCAP

S 1 at Airthrey on 17th April

CHIFFCHAFF

S 1st at Airthrey on 4th April (MWF)

SWP 1 at Barbush on 28th March (WRB)

WILLOW WARBLER

S Singing at Carron Valley on 10th and Airthrey on 11th April (CVG,MWF)

SWP 1st at Dunblane on 11th April (WRB)

PIED FLYCATCHER

C Male at Dollar on 20th April (WRB)

SWP 32 pairs at nestbox colony (HR)

LONGTAILED TIT

S 20 at Touch on 22nd February (DK)

SWP 17 at Lake of Menteith on 10th January (DK). 15 at Doune on 13th August (WRB)

CRESTED TIT

S 1 on Sauchie Craig on 21st February. Seen at edge of trees and on open ground for 10 minutes; characteristic trill, crest and reverse "C" mark on face clearly visible (RLC)

CARRION/HOODED CROW hybrids

SWP 1 at Lake of Menteith on 29th November (GJ). Frequent at Loch Katrine in spring (HR)

HOODED CROW

SWP Nest in Menteith Hills on 21st May (DK)

RAVEN

S 2 pairs present at 5 sites, only one probably nesting (JM)

SWP 15 at Thornhill on 15th November (DT)

TREE SPARROW

S 30 at Cornton on 5th January (PWS). 66 at Touch on 22nd February (JG)

CHAFFINCH

S 500 at Kippen on 20th January, 360 at Touch on 22nd February (JG)

BRAMBLING

SWP 1 at Lake of Menteith on 1st April (PWS). 10 at Bridge of Allan on 18th October (NF)

GREENFINCH

S 100 at Touch on 22nd February (JG)

GOLDFINCH

S 50 at Carron Valley on 8th April, pair bred (CVG)

SWP 45 at Ashfield on 4th October (WRB)

SISKIN

S 80 at Carron Valley on 4th January (JS) and 110 on 22nd February (WRB)
15-20 pairs by reservoir in summer (CVG)

LINNET

SWP 200 at Drip Moss on 16th November (JG)

TWITE

C 114 at Blackdevonmouth on 16th November (PME)

S 18 At Grangemouth on 9th January (MWF)

CROSSBILL

S 37 in Carron Valley Forest on 8th February, 40 on 11th April and 13th
July (CVG). Much song on 15th February (CJH)

SWP Party at Callander on 23rd July (WRB)

BULLFINCH

S 65 on Sheriffmuir on 25th January (DH)

HAWFINCH

SWP 2 at Dunblane on 11th January and 20th February (WRB)

SNOW BUNTING

SWP 22 at Grainston on 1st January (WRB)

YELLOWHAMMER

S 130 at Touch on 22nd February (JG)

J. Mitchell

34



Raven and young

by Don MacCaskill

THE DECLINE OF THE RAVEN AS A BREEDING SPECIES IN CENTRAL SCOTLAND

35

J. Mitchell
Nature Conservancy Council

INTRODUCTION

In 1981 a census of territory-holding Ravens *Corvus corax* in Central Scotland was organised to run concurrently with the national census of Peregrines *Falco peregrinus*. The object of the exercise was to determine how widespread was a suspected recent decline in the number of Ravens nesting in the region. The area covered by the survey corresponds with those parts of former Stirlingshire and south-west Perthshire south of Glen Lochy, Strath Fillan and Glen Dochart as shown on the OS 1" tourist map of *Loch Lomond and The Trossachs* (1967), plus an extension eastwards of the Fintry/Gargunnock Hills to Stirling. Most of the thirty known Raven territories listed in the appendix to this paper were checked either by Don and Bridget MacCaskill, Patrick Stirling-Aird or the writer. Limited field survey time in the spring of 1981 precluded lengthy searches for as yet unlocated alternative nesting sites in apparently unoccupied territories, but it is considered that the overall result obtained (see p2) represents an acceptably accurate picture of the Raven's current breeding status within the census area.

RECORDED HISTORY OF THE RAVEN IN CENTRAL SCOTLAND UP TO THE PRESENT DAY

The few local parish ministers who included zoology in their contributions to the first *Statistical Account of Scotland*, published in parts towards the end of the 18th century, all regarded the Raven as a fairly common bird. The previous forty years had seen the traditional cattle and goat economy of the southern highlands and fringing upland districts replaced by sheep farming on a large scale. On Loch Lomondside alone, well over 30,000 sheep were being pastured on the surrounding hills by the turn of the 19th century (*Statistical Account of Scotland* and county agricultural reports). It is almost certain that the Raven population responded to the increased food resources stemming from the introduction of high numbers of sheep, but in the process became increasingly the subject of the shepherds' disfavour. One parish minister's comment that the Raven

36 was exceedingly destructive to young lambs (Lapslie 1795) exemplified a growing hostility towards the species. The Raven's habit of occasionally taking the eggs or chicks of game birds also brought it into direct conflict with those engaged in establishing and maintaining the new grouse moors. By the end of the first quarter of the 1800s, persecution of the Raven by both shepherds and gamekeepers was a well established practice. In one year 1824-25, nearly 100 Ravens in the hills around Callander were destroyed (Rintoul and Baxter 1935). The ornithological literature for the region is sparse, but the continued harassment of the Raven comes through clearly enough : ... 'subjected to persecution' (Gray 1871) and 'a victim of the gameherds, and therefore scarce' (Cameron 1874). Records of bounties paid out on Raven corpses by the Breadalbane estate (part of which forms the northern portion of the present census area) show that 576 Ravens were killed in ten years between 1891 and 1901 (Harvie-Brown 1906). Commenting on the situation in the mid 1930s, Rintoul and Baxter (1935) concluded that Ravens in south-west Perthshire 'would be more numerous but for persecution,' from the fact they became temporarily much more common with the absence of gamekeepers during the First World War.

Although there are no locally-obtained figures available to support the supposition, it is assumed that the Raven population in Central Scotland eventually stabilised at a level compatible with territorial spacing and available food resources following a marked run-down in gamekeeping activities with the outbreak of the Second World War (see Ratcliffe 1962 for observations on Raven territory size and the general stability of the post-war population in Britain). Over the last fifteen years however, the collective notes of field workers in the region record a slow but steady disappearance of pairs of nesting Ravens. The 1981 census confirmed that thirteen of the thirty known Raven territories in the area were apparently deserted (see Appendix for survey results from individual territories), showing that the decline in the breeding population in Central Scotland is now in excess of one third. Apart from the thirteen territories apparently deserted by Ravens, five pairs of Ravens on territory showed no signs of having nested during the survey year.

The disappearance of nesting Ravens has not been evenly spread, the greatest effect of the decline being felt in the southern half of the region. In the early to mid 1960s, when the writer first began to extensively explore the southern foothills within the present census area, the Campsie Fells housed three pairs of nesting Ravens and the Fintry-Gargunnock-Touch Hills another two, rarely three, more pairs

(territories 1-6 in the Appendix). By the early 1970s, this discrete population of breeding Ravens had been reduced to a single pair. There have been no signs of a recovery in numbers on these hills since, and at the present time the one remaining pair are the only Ravens in the census area nesting south of the highland line.

EXAMINATION OF POSSIBLE CAUSES OF THE DECLINE IN NUMBERS OF NESTING RAVENS

1. Increased competition for nest sites from an expanding Peregrine population

The gradual decline of the Raven population in Central Scotland has coincided with the slow recovery of a depleted Peregrine population over approximately the same period (Mitchell 1979). However, although Ravens and Peregrines in the census area regularly utilise the same upland crags for nesting, in every case there are sufficient alternative nest sites available to accommodate both species. Since 1970, seven apparently deserted Raven territories have been occupied by Peregrines, but it should be noted that six of these were taken over after the Ravens had gone.

2. Large-scale afforestation resulting in removal of sheep stocks and loss of open habitat

Marquis *et al* (1978) have shown that afforestation of large areas of former sheepwalk in Southern Scotland inevitably led to a substantial depletion of the Raven's food, both natural and sheep carrion. Since 1960, the number of occupied Raven territories in this region has decreased by 45%.

With the exception of Loch Ard and Loch Achray Forests in the Aberfoyle district, forest development in the highland terrain of Central Scotland has tended to be of a linear nature along the sides of the glens, in contrast to the blanket afforestation that has taken place on the lower and more rolling hills of Southern Scotland. Vast tracts of the high mountainous ground remain unplanted. In an agricultural review of the Stirling Region (which covers a large part of the present Raven census area and the bulk of the afforestation), Matthews (1974) could find no statistical evidence of an overall reduction in the numbers of hill sheep. Accepting that the agricultural statistics are correct, sheep numbers in the Stirling Region between 1963 and 1973 actually went up by 8% against a national decline in sheep stocks of 11%. Localised removal of sheep as the

direct result of turning the ground over to forestry has of course occurred, but in the afforested highlands the loss of sheep as a food resource for the Raven may, in some cases, have been partially off-set by significant increases in the numbers of Red Deer *Cervus elaphus*. In Strathyre few deer were present prior to the lower sheepwalk being converted to forest. Since afforestation Strathyre's Red Deer population has steadily increased to several hundred beasts and Ravens have frequently been observed feeding on deer carrion (D MacCaskill pers comm.). There can be little doubt however, that the far reaching effects of extensive forestry operations in the region have contributed to the desertion of traditional Raven territories, and in a few instances may have been the principal factor involved.

3. Improvements in veterinary care for sheep resulting in lowered mortality and a reduction of sheep carrion on the hills

Post-war improvements in preventive medicine and in the efficiency of external dips have together markedly reduced losses of sheep through disease and other causes.

A more recent development is the practice of bringing the sheep off the hills in spring to lamb in specially prepared enclosures close at hand to the farm, thereby allowing the shepherds to make the most effective use of their time by 'looking after' rather than 'looking for' the ewes during this critical period. In consequence, losses in sheep and lambs have been further reduced and placenta are no longer so readily available to hill scavengers.

4. Susceptibility of Ravens to organo-chlorine insecticides used in sheep dips

Ingestion of poisonous substances used in sheep dips was investigated by Ratcliffe (1965), for as carrion eaters Ravens are exposed to the hazards of chemical contamination from the fleece and skin of treated animals. Although it was found that some Ravens were contaminated by organo-chlorine residues almost to the same degree as Golden Eagles *Aquila chrysaetos* and Buzzards *Buteo buteo*, there was evidence to suggest the Raven is less sensitive to these compounds than the raptors.

5. Increased use of poisoned baits for controlling numbers of foxes, crows, etc.

Prior to the game preservation era coming to an end, a variety of tactics were used against those birds and beasts considered to be 'vermin'. In the case of foxes, specific control was effected by annual

visits to the cubbing dens with terriers and guns. Today, the professional fox-catcher and gamekeeper have largely been replaced by the part-time gamekeeper and the 'do-it-yourself' farmer, many of whom do not have the time or skill to continue to control foxes by traditional means. The result has been increased reliance on the use of easily prepared poisoned baits, which can just as readily be taken by other carrion-eating animals. A survey by Brown *et al* (1977) found that the poisons most frequently (mis)used against foxes, crows, etc. are Mevinphos ('Phosdrin') — an organo-phosphorus insecticide available as an aphicide, Alpha-chloralose — a narcotic used mainly for the indoor destruction of rats and mice, and Strychnine — obtainable under licence only to kill moles.

Three dead Buzzards, picked-up during 1978-80 in the southern part of the census area and sent by the writer for examination to the Scientific Services section of the Department of Agriculture and Fisheries for Scotland, were all shown to have been killed by Alpha-chloralose. Analysis of the stomach contents of one bird revealed Alpha-chloralose present at the high level of 200 parts per million. The disappearance of the Buzzard from several once regular haunts in the Campsie and Fintry Hills during the last decade speaks for itself.

Ravens too can fall victim to poisoned baits, although, unlike Buzzards, the finding of their corpses is rarely reported. In ten confirmed incidents of Raven poisoning investigated by the Royal Society for the Protection of Birds, four involved Mevinphos, four Alpha-chloralose and two Strychnine (Cadbury 1980). On Speyside, Inverness-shire, the number of occupied Raven territories fell by 70% within eight years of the use of modern poisons on meat baits becoming common practice (Weir 1978).

6. Increased disturbance of nesting Ravens by recreational pursuits

There has been no noticeable large increase in the number of hill walkers during the most critical early weeks (February-March) of the Raven's breeding cycle. Few of the cliff faces used by nesting Ravens in the census area are suitable for rock climbing, the basaltic lavas of the southern foothills being particularly friable and treacherous.

CONCLUSIONS

No evidence has been forthcoming to connect the decline of the Raven population in Central Scotland over the last fifteen years with the resurgence of the region's Peregrine population, chemical

contamination originating from sheep dips, or increased recreational use of the hills. Conversion of sheepwalk to forestry has undoubtedly contributed to the abandonment of several Raven territories, but for the most part afforestation is being confined to the glens, leaving large areas of the higher ground unplanted and still tenanted by sheep. On the Campsie-Fintry-Gargunnoch Hills, where the decrease in the number of breeding pairs is most obvious, there has been virtually no recent afforestation in the once regular Raven territories. Major changes have taken place in methods of sheep husbandry and 'vermin' control, their effect on the Raven population warranting further investigation.

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The 1981 census of nesting Ravens in Central Scotland was a co-operative effort, and I am grateful to Don and Bridget MacCaskill, Patrick Stirling-Aird and several other observers for assisting with the field work and generously allowing me to use their results in the preparation of this account.

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APPENDIX

TERRITORY OCCUPATION BY RAVENS IN
CENTRAL SCOTLAND IN 1981

Based on the observers' past field notes and local information, number 6 is probably the only Raven territory within the census area not to have been regularly tenanted during at least the first ten years of the last quarter of a century.

Territory number	Field observation in 1981	Extent of afforestation within two km. radius of the nest/s	Past information
1.	Apparently unoccupied	Virtually none	Occupied up to the mid-1960s
2.	Apparently unoccupied	Virtually none	Occupied up to the early 1970s
3.	Pair with nest	None	
4.	Apparently unoccupied	None	Occupied up to the early 1970s
5.	Apparently unoccupied	Less than a quarter	Occupied up to the late 1960s
6.	Apparently unoccupied	One third	Nest in 1964. Pair present in 1965. Not regular
7.	Pair present	One quarter	
8.	Pair behaving as if in nest	Two thirds Some very recent	
9.	Pair with nest	One third	
10.	Pair present	Less than a quarter	
11.	Apparently unoccupied	None	Occupied up to the late 1960s

42	12.	Apparently unoccupied	Two thirds	Occupied up to the late 1960s. Unlocated alternative suspected
	13.	Single bird only	Less than a quarter	Pair still nesting in 1980
	14.	Pair with young	None	
	15.	Apparently unoccupied	One half	Pair still nesting in 1978. Single bird only in 1979
	16.	Apparently unoccupied	One half	Sheep ground also lost to reservoir. Site deserted before 1976
	17.	Probably occupied. Visit made too late in the season	None	Pair nested in 1980
	18.	Pair with nest	One third	
	19.	Pair with nest	One third	
	20.	Pair present	None	
	21.	Apparently unoccupied	One half	Occupied up to 1972
	22.	Apparently unoccupied	Two thirds	Occupied up to 1976
	23.	Apparently unoccupied	Less than a quarter	Occupied up to 1974
	24.	Pair present	None	
	25.	Pair present	One quarter	
	26.	Pair with nest	None	
	27.	Pair with nest	Less than a quarter	
	28.	Pair with nest	None	
	29.	Apparently unoccupied	None	Pair present in the early 1960s but gone by 1971
	30.	Pair with nest	Less than a quarter	

LEPIDOPTERA FROM THE PARISH OF MUCKHART,
SOUTH EAST PERTSHIRE
(CENTRAL REGION)

43

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The following list of lepidoptera is compiled from records between 1973 and 1978 (with a few 1980 additions) for the village of Pool of Muckhart and its environs in the county of Perthshire. The list is restricted to butterflies and the macrolepidoptera, the latter a somewhat artificial grouping of moths based largely on size. Identification of this group is greatly helped by the popular work of South (1961) and this was used as the principal reference work in this study. Checking of critical species against reference specimens and confirmation and identification by specialists has nevertheless been necessary.

The butterflies and day flying moths were all observed within three kilometres of the village. The night flying moths were recorded by regular trapping with a Robinson mercury vapour light trap, mostly between April and September although in 1976 and 1977 the trap was operated during all months of the year.

A total of 220 species was recorded during the survey; 10 butterflies, the remainder moths. The number of species is not very high but perhaps much as expected for an area at 150m above sea level without either natural woodland or a wide variety of habitats in the immediate vicinity. Gardens, arable and grazed farmland and small plots of planted woodland are the main vegetation types. A single species normally classified as rare was recorded, the Bedstraw Hawkmoth *Celerio (Hyles) gallii*. Surprisingly, three individuals were seen, two in 1973 when a widespread immigration into Britain occurred (de Worms 1975) and a single in 1976. Several species which are scarce in central Scotland were noted, including the Pale-lemon Sallow *Cirrhia ocellaris*, Great Brocade *Eurois occulata*, Double-lobed *Apamea ophiogramma*, Haworth's Minor *Celaena howorthii*, Brindled Green *Dryobotodes eremita* and Striped Twin-spot Carpet *Colystygia calicata*. Others at the northern edge of their range in Britain appeared to be more frequent than in earlier studies (i.e. Elephant Hawks *Deilephila porcellus* and *D. elpenor*). Also, an upland species, the Exile *Apamea exulis* was found at the southern limit of its range in Britain.

The principal list of lepidopteron species for the Stirling area is that of Coates (1968) supplemented by Thomson (1968). In the present study ten species were found additional to Coates' Stirlingshire and Perthshire list. These are the Golden Rod Brindle *Lithomoia solidaginis*, Dingy Shears *Apamea ypsillon*, Six spot Burnet *Zygaena filipendulae* (mainly coastal in Scotland but spreading inland), White line Dart *Euxoa tritici*, Tawny marbled Minor *Procyta latruncula*, Chestnut coloured Carpet *Thera cognata*, Suspected *Parastichtis suspecta* as well as Bedstraw Hawk, Exile and Pale-lemon Sallow mentioned above. Many of these do however appear on Christie and Christie's (1980) list for East Loch Lomondside.

The sequence of species in the list follows Heslop (1964) although the common names comply with South's usage (South 1961). An attempt has been made to describe the relative abundance of each species. Inevitably, because some moths are more attracted to light, estimates of relative abundance based on trap catches alone are bound to be inaccurate. However, comparisons between study areas are always possible and for this reason a rough quantitative index has been presented

1. Rare; not recorded every year.
2. Scarce; recorded every year but usually less than 5 per annum.
3. Frequent; recorded at rate of 5-100 per annum.
4. Common; more than 100 per annum.

The trap was operated for about half the nights each summer and once or twice a week in the years when trapping extended the year round.

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LEPIDOPTERA

Papilionoidea

PIERIDAE

<i>Pieris brassicae</i>	Large White	2	Category 3 in 1976
<i>Pieris rapae</i>	Small White	3	
<i>Pieris napi</i>	Green-veined White	4	

SATYRIDAE

<i>Maniola jurtina</i>	Meadow Brown	3	
<i>Coenonympha pamphilus</i>	Small Heath	4	

NYMPHALIDAE

<i>Vanessa atalanta</i>	Red Admiral	2	Category 3 in 1976, only previous record in 1975
<i>Vanessa cardui</i>	Painted Lady	1	Many records in 1980, none previously
<i>Aglais urticae</i>	Small Tortoiseshell	3	

LYCAENIDAE

<i>Lycaena phlaeas</i>	Small Copper	3	
<i>Polyommatus icarus</i>	Common Blue	3	

Sphingoidea

SPHINGIDAE

<i>Laothoe populi</i>	Poplar Hawk	4	
<i>Celerio (Hyles) galii</i>	Bedstraw Hawk	1	Three records 18.7.73, 8.8.73, 21.8.76.
<i>Deilephila porcellus</i>	Small Elephant Hawk	3	

46	<i>Deilephila elpenor</i>	Large Elephant Hawk	3	
		Bombycoidea		
	NOTODONTIDAE			
	<i>Harpyia furcula</i>	Sallow Kitten	2	
	<i>Cerura vinula</i>	Puss Moth	2	
	<i>Chaonia ruficornis</i>	Lunar Marbled Brown	1	Single record 6.6.75
	<i>Pheosia tremula</i>	Swallow Prominent	3	
	<i>Pheosia gnoma</i>	Lesser Swallow Prominent	3	
	<i>Notodonta ziczac</i>	Pebble Prominent	3	
	<i>Notodonta dromedarius</i>	Iron Prominent	3	
	<i>Lophopteryx capucina</i>	Coxcomb Prominent	3	
	<i>Phalera bucephala</i>	Buff Tip	3	
	THYATIRIDAE			
	<i>Thyatira batis</i>	Peach Blossom	2	
	<i>Tethea duplaris</i>	Common Lutestring	1	Single record 15.8.76
	LASIOCAMPIDAE			
	<i>Poecilocampa populi</i>	December Eggar	3	
	<i>Lasiocampa quercus</i>	Oak Eggar	3	
	DREPANIDAE			
	<i>Drepana falcatoria</i>	Pebble Hook Tip	1	Single record 7.7.73
	ARCTIIDAE			
	<i>Nudaria mundana</i>	Muslin Footman	1	First record 3.7.76, category 3 in that year but probably under-recorded
	<i>Spilosoma lubricipeda</i>	White Ermine	4	
	<i>Arctia caja</i>	Garden Tiger	3	
		Psychoidea		
	ZYGAENIDAE			
	<i>Zygaena filipendulae</i>	Six-spot Burnet	2	
		Hepialoidea		

HEPIALIDAE

<i>Hepialus humuli</i>	Ghost Swift	3
<i>Hepialus fusconebulosa</i>	Map-winged Swift	3

Noctuoidea

NOCTUIDAE

<i>Euxoa nigricans</i>	Garden Dart	3
<i>Euxoa tritici</i>	White-line Dart	1 Single record 6.7.76
<i>Agrotis segetum</i>	Turnip Moth	3
<i>Agrotis exclamationis</i>	Heart and Dart	4
<i>Agrotis ipsilon</i>	Dark Sword Grass	3
<i>Lycophotia varia</i>	True Lovers Knot	3
<i>Graphiphora augur</i>	Double Dart	1
<i>Diarsia brunnea</i>	Purple Clay	2
<i>Diarsia mendica</i>	Ingrailed Clay	3
<i>Diarsia rubi</i>	Small Square-spot	3
<i>Ochropleura plecta</i>	Flame Shoulder	3
<i>Amathes glareosa</i>	Autumnal Rustic	3
<i>Amathes baja</i>	Dotted Clay	3
<i>Amathes c-nigrum</i>	Setaceous Hebrew	
	Character	3
<i>Amathes triangulum</i>	Double Square-spot	3
<i>Amathes sexstrigata</i>	Six-striped Rustic	3
<i>Amathes xanthographa</i>	Square-spot Rustic	3
<i>Axylia putris</i>	Flame Rustic	3
<i>Anaplectoides prasina</i>	Green Arches	2
<i>Cerastis rubicosa</i>	Red Chestnut	2
<i>Eurois occulta</i>	Great Brocade	1 First records in 1976, several individuals
<i>Euschesis comes</i>	Lesser Yellow	
	Underwing	4
<i>Euschesis janthina</i>	Lesser Broad	
	Border	4
<i>Noctua pronuba</i>	Large Yellow	
	Underwing	4
<i>Lampra fimbriata</i>	Broad-bordered	
	Yellow Underwing	2
<i>Pyrrhia umbra</i>	Bordered Sallow	2
<i>Mamestra brassicae</i>	Cabbage Moth	3
<i>Polia hepatica</i>	Silvery Arches	1 Single record 2.7.73
<i>Diataraxia oleracea</i>	Bright-line Brown-	
	eye	4
<i>Ceramica pisi</i>	Broom Moth	3

48	<i>Hada nana</i>	The Shears	3	
	<i>Hadena thalassina</i>	Pale-shouldered		
		Brocade	3	
	<i>Hadena bicolorata</i>	Broad-barred White	2	
	<i>Hadena bicruris</i>	Lychnis	3	
	<i>Hadena rivularis</i>	Campion	3	
	<i>Cerapteryx graminis</i>	Antler	4	
	<i>Orthosia gothica</i>	Hebrew character	4	
	<i>Orthosia stabilis</i>	Common Quaker	3	
	<i>Orthosia incerta</i>	Clouded Drab	3	
	<i>Leucania pallens</i>	Common Wainscot	3	
	<i>Leucania impura</i>	Smoky Wainscot	3	
	<i>Leucania comma</i>	Shoulder-striped		
		Wainscot	3	
	<i>Leucania lythargyria</i>	Clay	3	
	<i>Leucania conigera</i>	Brown-line Bright-		
		eye	3	
	<i>Stilbia anomala</i>	Anomalous	2	
	<i>Rhizedra lutosa</i>	Large Wainscot	3	
	<i>Arenostola pygmina</i>	Small Wainscot	3	
	<i>Caradrina morpheus</i>	Mottled Rustic	3	
	<i>Caradrina clavipalpis</i>	Pale Mottled Willow	3	
	<i>Apamea lithoxylaea</i>	Light Arches	3	
	<i>Apamea monoglypha</i>	Dark Arches	4	
	<i>Apamea crenata</i>	Cloud-bordered		
		Brindle	3	
	<i>Apamea sordens</i>	Rustic shoulder		
		Knot	3	
	<i>Apamea remissa</i>	Dusky Brocade	3	
	<i>Apamea secalis</i>	Common Rustic	4	
	<i>Apamea ophiogramma</i>	Double-lobed	1	Two records 27.7.75, July, 1976
	<i>Apamea ypsillon</i>	Dingy shears	1	Single record 30.8.76
	<i>Apamea exulis</i>	Exile	1	Single record 27.8.76
	<i>Procus strigilis</i>	Marbled Minor	3	
	<i>Procus latruncula</i>	Tawny Marbled		
		Minor	2	
	<i>Procus fasciuncula</i>	Middle Bared Minor	3	
	<i>Procus literosa</i>	Rosy Minor	1	First noted 1976, several individuals
	<i>Luperina testacea</i>	Flounced Rustic	3	
	<i>Euplexia lucipara</i>	Small Angle-Shades	3	

<i>Phlogophora meticulosa</i>	Angle-shades	1+ Probably under-recorded	49
<i>Petilampa minima</i>	Small Dotted Buff	3	
<i>Celaena howorthii</i>	Haworth's Minor	1	
<i>Hydraecia oculea</i>	Ear Moth	3	
<i>Hydraecia lucens</i>	Large Ear	3	
<i>Hydraecia crinanensis</i>	Crinan Ear	3	
<i>Gortyna micacea</i>	Rosy Rustic	4	
<i>Gortyna flavago</i>	Frosted Orange	2	
<i>Cosmia trapezina</i>	Dun-bar	3	
<i>Amphipyra tragopoginis</i>	Mouse	3	
<i>Rusina tenebrosa</i> (<i>ferruginea</i>)	Brown Rustic	3	
<i>Cryphia perla</i>	Marbled Beauty	1	Single record 9.8.7
<i>Apatele leporina</i>	Miller	1	Single record 1.7.73
<i>Apatele psi</i>	Grey Dagger	3	
<i>Apatele rumicis</i>	Knot Grass	3	
<i>Cucullia umbratica</i>	Shark	1	
<i>Lithomoia solidaginis</i>	Golden-rod Brindle	1	First record 15.8.76, several that year
<i>Xylena vetusta</i>	Red Sword-grass	1	Single record 8.5.73
<i>Bombycia viminalis</i>	Minor Shouldered Knot	3	
<i>Aporophyla lunula (nigra)</i>	Black Rustic	2	
<i>Allophyes oxyacanthae</i>	Green-brindled Crescent	3	
<i>Griposia aprilina</i>	Merveille-du-jour	1+	
<i>Eumichtis adusta</i>	Dark Brocade	1	
<i>Parastichtis suspecta</i>	Suspected	1	About five individuals around 9.8.76
<i>Dryobotodes eremita</i>	Brindled Green	1	
<i>Antitype chi</i>	Grey Chi	3	Including ab. <i>olivacea</i>
<i>Eupsilia transversa</i>	Satellite	1	
<i>Omphaloscelis lunosa</i>	Lunar Underwing	1	Single record 13.9.79
<i>Agrochola lota</i>	Red-line Quaker	3	
<i>Agrochola macilenta</i>	Yellow-line Quaker	3	
<i>Agrochola circellaris</i>	Brick	3	
<i>Anchoscelis litura</i>	Brown-spot Pinion	3	
<i>Atethmia xerampelina</i>	Centre-barred Sallow	3	
<i>Tiliacea citrigo</i>	Orange Sallow	3	
<i>Cirrhia lutea</i>	Pink-barred Sallow	3	
<i>Cirrhia icteritia</i>	Sallow	3	Including ab. <i>flavescens</i>

50	<i>Cirrhia ocellaris</i>	Pale-lemon Sallow	1	Two individuals in 1976, 18 and 21.6.76
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	<i>Conistra vaccinii</i>	Chestnut	2	
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HYLOPHILIDAE

	<i>Bena prasinana (fagana)</i>	Green Silver-lines	1	Single record from Dollar 29.6.76, another subsequently from Muckhart
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PLUSIIDAE

	<i>Euclidimera mi</i>	Mother Shipton	2	
	<i>Colocasia coryii</i>	Nut-tree Tussock	1	Single record 1.7.75
	<i>Plusia chrysitis</i>	Burnished Brass	3	
	<i>Plusia bractea</i>	Gold Spangle	3	
	<i>Plusia festucae</i>	Gold Spot	3	
	<i>Plusia jota</i>	Plain Golden-Y	3	
	<i>Plusia pulchrina</i>	Beautiful Golden-Y	4	
	<i>Plusia gamma</i>	Silver-Y	4	
	<i>Unca triplasia</i>	Spectacle	3	
	<i>Scoliopteryx libatrix</i>	Herald	1	
	<i>Hypena proboscidalis</i>	Snout	3	
	<i>Zanclognatha nemoralis</i>	Small Fanfoot	1	

Geometroidea

GEOMETRIDAE

	<i>Alsophila aescularia</i>	March Moth	2+	Probably under-recorded
	<i>Geometra papilionaria</i>	Large Emerald	2	
	<i>Sterrhia biselata</i>	Small Fan-footed		
		Wave	3	
	<i>Xanthorhoe designata</i>	Flame Carpet	3	
	<i>Xanthorhoe montanata</i>	Silver-ground		
		Carpet	4	
	<i>Xanthorhoe fluctuata</i>	Garden Carpet	3	
	<i>Colystygia pectinataria</i>	Green Carpet	3	
	<i>Colystygia calicata (salicata)</i>	Striped Twin-spot		
		Carpet	2	
	<i>Colystygia multistrigaria</i>	Mottled Grey	2	
	<i>Earophila badiata</i>	Shoulder-striped		
		Carpet	1	Single record 17.4.74
	<i>Anticlea derivata</i>	Streamer	1	Single record 19.5.80

Lepidoptera from Parish of Muckhart

<i>Perizoma alchemillata</i>	Small Rivulet	3	51
<i>Perizoma flavofasciata</i>	Sandy Carpet	2	
<i>Perizoma albulata</i>	Grass Rivulet	1+ Single record 17.7.75	
		Probably under-recorded	
<i>Euphyia bilineata</i>	Yellow Shell	3	
<i>Lyconometra ocellata</i>	Purple Bar	2	
<i>Ecliptopera silaceata</i>	Small Phoenix	3	
<i>Lygris prunata</i>	Phoenix	3	
<i>Lygris testata</i>	Chevron	3	
<i>Lygris populata</i>	Northern Spinach	4+	
<i>Lygris mellinata</i>	Spinach	2+	
<i>Lygris pyraliata</i>	Barred Straw	4	
<i>Cidaria fulvata</i>	Barred Yellow	3	
<i>Chloroclystra miata</i>	Autumn Green		
	Carpet	2	
<i>Dysstroma truncata</i>	Common Marbled		
	Carpet	3	
<i>Dysstroma citrata</i>	Dark Marbled		
	Carpet	4	
<i>Thera obeliscata</i>	Grey Pine Carpet	1	
<i>Thera cognata</i>	Chestnut Coloured		
	Carpet	2	
<i>Thera firmata</i>	Pine Carpet	2	
<i>Hydriomena furcata</i>	July Highflyer	3	
<i>Epirrhoe alternata</i>	Common Carpet	3	
<i>Epirrhoe tristata</i>	Small Argent and		
	Sable	3	
<i>Chesias legatella</i>	The Streak	3	
<i>Odezia atrata</i>	Chimney-sweeper	3	
<i>Anaitis plagiata</i>	Treble Bar	2	
<i>Ortholitha plumbaria</i>	July Belle	2	
<i>Oporina autumnata</i>	Autumnal Moth	2	Probably under-recorded
<i>Oporina filigrammaria</i>	Small Autumnal		
	Moth	2+	
<i>Oporina dilutata</i>	November Moth	2	Probably under-recorded
<i>Oporina chrystyi</i>	Pale November		
	Moth	2+	
<i>Operophtera brumata</i>	Winter Moth	3	
<i>Eupithecia pulchellata</i>	Foxglove Pug	3	
<i>Eupithecia centaureata</i>	Lime Speck Pug	3	

52	<i>Eupithecia absinthiata</i>	Wormwood Pug	1+ Probably under-recorded
	<i>Eupithecia goossensiata</i>	Ling Pug	1+ Probably under-recorded
	<i>Eupithecia vulgata</i>	Common Pug	3
	<i>Eupithecia castigata</i>	Grey Pug	1+ Probably under-recorded
	<i>Eupithecia icterata</i>	Tawny Speckled Pug	3
	<i>Eupithecia nanata</i>	Narrow-winged Pug	3
	<i>Eupithecia sobrinata</i>	Juniper Pug	1+ Probably under-recorded
	<i>Lomaspilis marginata</i>	Clouded Border	3
	<i>Deilinia exanthemata</i>	Common Wave	2 Probably under-recorded
	<i>Ellopiia fasciaria</i>	Barred Red	3
	<i>Campaea margaritata</i>	Light Emerald	3
	<i>Semiothisa liturata</i>	Tawny-barred Angle	3
	<i>Erannis aurantiana</i>	Scarce Umber	2+ Probably under-recorded
	<i>Erannis marginaria</i>	Dotted Border	2+
	<i>Deuteronomos alniaria</i>	Canary-shouldered Thorn	2
	<i>Selenia bilunaria</i>	Early Thorn	3
	<i>Selenia lunaria</i>	Lunar Thorn	2
	<i>Gonodontis bidentata</i>	Scalloped Hazel	3
	<i>Colotois pennaria</i>	Feathered Thorn	2
	<i>Crocallis elingaria</i>	Scalloped Oak	3
	<i>Opisthograptis luteolata</i>	Brimstone	3
	<i>Ourapteryx sambucaria</i>	Swallowtailed Moth	2
	<i>Phigalia pendaria</i>	Pale Brindled Beauty	Probably 2 under-recorded
	<i>Biston betularia</i>	Peppered Moth	3
	<i>Alcis rependata</i>	Mottled Beauty	3
	<i>Bupalus piniaria</i>	Bordered White	3
	<i>Lithina chlorosata</i>	Brown Silver-line	3
	<i>Chiasmia clathrata</i>	Latticed Heath	3

SOME INVERTEBRATES FROM BLAWHORN
MOSS NATIONAL NATURE RESERVE,
WEST LoTHIAN

J. M. Nelson
Nature Conservancy Council, Edinburgh

SUMMARY

Invertebrates were collected monthly, mainly in pitfall traps, on Blawhorn Moss, just north of Blackridge on the A89 Bathgate to Airdrie road. 102 species were identified and the number of each in the traps is given together with the month(s) of capture. Flies, spiders and beetles, in that order, were the most abundant categories captured.

INTRODUCTION

Blawhorn Moss is one of the best remaining examples of a habitat which was formerly widespread south of the Forth, but now due to reclamation only small pockets remain. In 1980 about half of the moss was donated by the National Coal Board Open Cast Executive to the Nature Conservancy Council and is now a National Nature Reserve. As little is known of the invertebrates of this type of habitat in Scotland, a preliminary survey was made in 1980 to identify some of the species living on the moss.

Blawhorn Moss (map reference NS 8868), a blanket mire with peat up to 7.5m deep and extending to 130 ha, lies in a slight depression about 10 km west of Bathgate at an altitude of 220m. Unsuccessful attempts have been made in the past to drain it but this has not stopped the active growth of a typical blanket mire flora. The dominant plants are heather (*Calluna vulgaris*), heath (*Erica tetralix*), deer grass (*Trichophorum cespitosum*) and cotton grass (*Eriophorum vaginatum*), while the abundance of cranberry is of local botanical interest. Frequent fires have controlled the development of tree cover and this probably influences the animals and plants present.

METHODS

Invertebrates were collected in two ways. Firstly pitfall traps in

the form of plastic beakers were sunk to their rims in the bog surface. These were almost filled with weak detergent solution, resulting in specimens coming into contact with the liquid being wetted and sinking. Ten of these traps, placed along a line at ten metre intervals, were operated on the moss for a week each month in 1980, the catch being collected by sieving and then stored in alcohol for identification. The second method of collecting was by using a sweep net with which mainly insects were swept from vegetation and water surfaces. This method could only be used in dry and relatively calm conditions which were encountered mainly in the spring months.

The number of individuals caught in pitfall traps depends largely on the activity of the species concerned and quantitative assessments of their abundance was therefore outwith the scope of this investigation.

RESULTS

In the following account the more frequently caught species are indicated. Attention is also drawn to those which from studies elsewhere in Britain (Pearsall 1950) might have been expected to occur but which were uncommon in the traps or not found at Blawhorn. A complete list of the species captured is given as an appendix.

One of the biological features of peatland communities is the virtual absence of earthworms, snails and slugs, though one slug, the large black *Arion ater*, which might be expected on the moss, was not found. Harvestmen (Opiliones) were very scarce in the trap collections though they can form a large portion of the catch on higher altitude moorland as in the Pennines. Spiders were numerous with the 25 species trapped belonging to five families, the large web-spinning species being absent. Crab spiders (Thomisidae) were scarce but wolf spiders (Lycosidae) were more frequently trapped probably due to their habit of running rapidly on the moss surface and consequently falling into the traps.

Most of the spiders taken belonged to the Linyphiidae, a large family of mainly very small spiders living on the ground where they usually spin a sheet web. Seventeen species were recorded from the traps.

Insects dominated the catch both as species and individuals. Few spring-tails (Collembola) were collected as most passed through the sieve used for separating the catch from the liquid in the traps. They were not identified though most were isotomids probably feeding on

micro-organisms and themselves an important source of food for spiders and predatory insects. Bugs (Hemiptera) of all kinds were very scarce. No butterflies were seen and the only moth, the common heath, was abundant.

Fourteen species of ground beetles (Carabidae) were recorded though mostly in small numbers, their larvae also being scarce. Few rove beetles (Staphylinidae) were taken, only one species *Olophrum piceum* being frequently trapped. Soldier beetle larvae (Cantharidae) were trapped in the spring and were probably those of *Cantharis paludosa* whose adults occurred later in the year. Only a single specimen of the heather beetle (Chrysomelidae) was trapped. This species is known to periodically ravage heather on grouse moors and its numbers may have been reduced by burning.

The ant *Myrmica ruginodis* was the most abundant species trapped and being carnivorous must have a significant effect on populations of other small invertebrates. Low numbers of parasitic species of Hymenoptera were taken but no bees or wasps.

More species of flies occurred than of any other group though few were abundant. The three species of crane fly (Tipulidae) caught were typical members of the moorland fauna. *Molophilus ater* is a well known food item of young grouse but the numbers of adults captured were low compared with sites in the Pennines at higher altitudes (Nelson 1971) and the absence of larvae from the catch suggests a low density at Blawhorn.

Very few biting midges (*Culicoides*) were taken and they were not found to be a nuisance when visiting the moor. Eight species of dolichopodids were captured, most being small with metallic coloration and found in damp situations. Hover flies (Syrphidae) were scarce, only two species being taken, one of which, *Melanostoma mellinum* was frequently swept. The larger sphaerocerids probably bred in cow dung on land adjacent to the moss and may have been hibernating on the moor as all were caught in the winter months. A tachinid fly (*Siphona* sp) was commonly swept and is reputed to parasitise crane fly larvae (Tipulidae). The yellow dung fly (Scathophagidae) was also caught in the same way but no related species were taken. A single female house fly (Muscidae) was taken and several other flies from the same family were abundant especially the horn fly (Muscidae) which is troublesome to sheep.

The results presented so far concentrate on the identity of the species trapped on the moss but information was also gained about the seasonal activity of the adults. It is difficult to be precise with the data available but as might be expected most species appear to be adult in the warmer months of the year. The ant *Myrmica ruginodis*

56. is a good example, being caught from April to October. It is more usual however for species to have a shorter adult life, for example the fly *Empis verralli* (Empididae) is on the wing only in May and June. Finally the spider *Centromerita concinna* and a small number of other species were active throughout the winter. Details of the seasonal activity of the species taken is given in the appendix.

DISCUSSION

The results are of a preliminary nature because while the trapping was on a regular basis sweeping could only be carried out when the weather was suitable. This rarely occurred during the summer visits to the site. Furthermore the moss was swept by a severe surface fire in early May which probably contributed to the small number of species (102) recorded. This number would increase considerably with further collecting, particularly by sweeping. A characteristic of many moorland invertebrates is that they are either adapted to survive fire by living in damp peat or bog moss or are sufficiently mobile to recolonise areas afterwards.

The species list shows considerable similarities to those from areas in the Pennines described by Pearsall (1950) and Nelson (1971). It is interesting to note the presence of montane species such as the ground beetles (Carabidae) *Pterostichus adstrictus* and *Trichocellus cognatus* and the flies *Dolichopus rupestris*, *Empis verralli* and *Coenosia trilineella* possibly near their lower altitudinal limits.

Blanket mire sites tend to be found in northern and western Britain and are generally extensive with a range of habitat diversity such as streams and vertical peat faces produced by erosion. This is not so at Blawhorn where the mire surface is relieved only by superficial man-made drainage runnels. These have a limited associated fauna such as the ephydriids and dolichopodid flies but most of the species recorded are associated with the mire surface. Some, such as dung-feeding species, may have moved in from surrounding pasture as the moss is ungrazed. None of the species found is rare as most blanket mire invertebrates appear to be widespread in suitable habitats in Britain. Though the Blawhorn fauna shows some affinity to that of the uplands, other features, such as the scarcity of crane flies and harvestmen, appear to be more characteristic of lowland mire sites. Before the invertebrates of Blawhorn Moss can be realistically assessed, however, more knowledge is required of other blanket mire sites in Scotland.

ACKNOWLEDGEMENTS

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I would like to thank the following specialists for their help with determinations: Dr M. L. Luff (Carabidae), Dr C. A. Collingwood (Formicidae), Dr R. H. L. Disney (Phoridae) and Dr P Merrett (some spiders).

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APPENDIX

This lists taxa taken at Blawhorn. The figures in brackets indicate the number of specimens taken and are followed by figures indicating the month(s) of capture. Nomenclature follows Locket, Millidge & Merrett (1974) for spiders and Kloet and Hincks (1964-78) for insects.

Material of all groups may be seen at the Nature Conservancy Council, 12 Hope Terrace, Edinburgh, except for the Phoridae which were given to Dr R. H. L. Disney.

OPILIONES (Harvestmen)

Nemastoma lugubre (Muller) (1) 4

Oligolophus tridens (Koch) (1) 8

PSEUDOSCORPIONES

Neobiscium muscorum (Leach) (1) 11

ARANEAE (Spiders)

Thomisidae (Crab spiders)

Xysticus cristatus (1) 8

Oxyptila trux (9) 4 6 7 8 9

Lycosidae (Wolf spiders)

- Pardosa pullata* (8) 4 6 7
Alopecosa pulverulenta (4) 6
Trochosa terricola (13) 4 9
Pirata piraticus (1) 6
 Theridiidae
Robertus lividus (1) 11
 Tetragnathidae
Pachygnatha degeeri (11) 3 4 7
 Linyphiidae
Ceratinella brevipes (1) 6
Walckenaera antica (2) 4 6
W. nudipalpis (1) 3
W. cuspidata (4) 4
Gonatium rubens (7) 3 9 11
G. rubellum (2) 8
Hypselistes jacksoni (8) 4 6 7
Oedothorax sp. (4) 4 6 8
Trichopterna menzei (2) 4
Erigone promiscua (4) 4
Centromerus dilutus (3) 3
C. sylvatica (1) 11
Centromerita concinna (36) 2 3 4 10 11 12
C. bicolor (6) 4
Oreonetides abnormis (3) 7 9
Bathyphantes gracilis (1) 6
Stemonyphantes lineatus (13) 3 6 10 11

INSECTA

- Collembola (73) 6 7 8 10
Plecoptera
 Nemoura cinerea (1) 5
Hemiptera
 Macustus grisescens (4) 6 7
 Kelisia vittipennis (1) 10
 Orthezia cataphracta (2) 4
Lepidoptera
 Ematurga atomaria Common heath moth (3) 5 6
Coleoptera (Beetles)
 Carabidae (Ground beetles)
 Carabus problematicus gallicus (1) 8
 C. problematicus gallicus larva (1) 10
 Loricera pilicornis (1) 1
 Patrobius atrorufus (2) 7 10

Bembidion aeneum (1) 3

Pterostichus adstrictus (1) 5

P. diligens (26) 3 5 6 7 8 9

P. niger (1) (8)

P. nigrita (14) 4 5 6 7

P. strenuus (1) 5

Agonum fuliginosum (10) 5 6 7 8

A. ericeti (8) 4 5 6 7 8 9

Trichocellus cognatus (7) 3 4 5 12

Bradycellus harpalinus (1) 8

B. ruficollis (11) 3 10 11 12

Hydrophilidae

Helophorus aquaticus (2) 3

Staphylinidae (Rove beetles)

Olophrum piceum (39) 2 3 4 9

Stenus flavipes (1) 4

Pselaphidae

Pselaphus heisei (7) 7 8

Cantharidae (Soldier beetles)

Cantharis paludosa (4) 5 6

Cantharid larvae (18) 2 3 4

Chrysomelidae

Lochmaea suturalis (Heather beetle) (1) 6

Curculionidae (Weevils)

Micrelus ericae (1) 6

Hymenoptera

Formicidae (Ants)

Myrmica ruginodis (387) 4 5 6 7 8 9 10

Diptera (Flies)

Tipulidae (Crane flies)

Tipula subnodicornis (8) 4 5 6

Pedicia immaculata (5) 6 8

Molophilus ater (3) 5 6

Ceratopogonidae

Culicoides sp (Biting midges) (5) 7

Chironomidae (31) 3 7 10 12

Camptochironomus tentans (3) 5

Mycetophilidae (11) 8 9 10 11

Cecidomyiidae (16) 7

Empididae

Platypalpus longicornis (1) 5

Empis verralli (1) 5

Dolichopodidae

- 60 | *Dolichopus rupestris* (2) 8
D. vitripennis (4) 7 8
Hercostomus aerosus (1) 7
Hydrophorus nebulosus (1) 3
Sellus notatus (2) 7
Campsicnemus alpinus (11) 8 9
C. loripes (2) 3 4
C. curvipes (2) 10
 Lonchopteridae
Lonchoptera furcata (2) 10 11
 Phoridae
Megaselia longicostalis (1) 9
M. pulicaria (1) 6
M. vernalis (1) 6
M. pumila (7) 3 4
M. pleuralis (1) 7
 Syrphidae (Hover flies)
Melanostoma mellinum (4) 5
Platycheirus clypeatus (1) 5
Syrphid larvae (2) 10
 Heleomyzidae
Heleomyza serrata (1) 4
 Sepsidae
Sepsis violacea (1) 7
 Sphaeroceridae
Copromyza atra (6) 4
C. nitida (3) 2 3
C. equina (1) 3
C. similis (1) 3
Leptocera ochripes (2) 3
L. pullula (1) 2
 Opomyzidae
Opomyza germinationis (6) 7
 Ephydriidae
Limnella quadrata (6) 3 7 8 9
 Chloropodidae
Oscinella frit (6) 5
 Tachinidae
Siphona sp (10) 5 7
 Calliphoridae
Bellardia agilis (2) 8
 Scathophagidae

Scathophaga stercoraria (Dung fly) (24) 5 6 7 8 9

Anthomyiidae

Pegohylemyia humeralis (1) 5

Paregle cinerella (2) 5

Nupedia aestiva (2) 5

N. infirma (1) 5

Muscidae

Musca domestica (House fly) (1) 5

Hydrotaea irritans (Horn fly) (19) 7 8 9

Helina fratercula (1) 7

Coenosia pulicaria (4) 5

C. trilineella (3) 8

THE TRUE BUGS (HETEROPTERA)
OF TENTSMUIR POINT, FIFE
James K. Campbell — Postscript

Resulting from a suggestion by J. A. Blair of Perth Museum, we append these notes for access to the two collections by J. K. Campbell and M. Smith reported in the above paper published in volume 5.

The bulk of J. K. Campbell's material was stored in alcohol and is deposited with the Nature Conservancy Council, 12 Hope Terrace, Edinburgh. Critical species verified by A. R. Waterston are dry-mounted and in the collection of the Royal Scottish Museum, Chambers Street, Edinburgh.

Smith's collection is dry-mounted and in Dundee Museum, Albert Square, Dundee. There are some 1500 entomological specimens (336 species of Coleoptera, 48 of Hemiptera, Heteroptera) collected during 1963-7.

Dundee Museum also has a collection of mixed samples (20 tubes) of aquatic invertebrates with a few Odonata specimens collected by J. K. Campbell in 1978 at Tentsmuir (enquiries to the Keeper of Natural History).

EDUCATION IN BOTHKENNAR
Andrew Bain — corrigendum

Corrigendum

p102 line 32

F N H 5

The line commencing 'that was devoted...' has lost a significant phrase and should continue '... in a thoroughgoing Scottish way to the *eradication of human error rather than to the encouragement of the human potential for good*'.

HOVERFLIES OF THE STIRLING AREA

63

Iain MacGowan
University of Stirling

INTRODUCTION

The family Syrphidae forms one of the largest and best known of all the Dipteran families. Its members include many large and strikingly coloured flies which can be seen commonly in gardens or on any country walk in the summer months. The males of many species can often be seen hovering motionless in the air in woodland glades or over flower heads, a trait which has given the family its common name of hoverflies.

In the British Isles approximately 260 species of hoverfly have so far been recorded and of these about 160 have been found in Scotland. The family is biologically diverse and there is a correspondingly wide range of external morphological features. Some species are large, brightly coloured mimics of bees and wasps whilst others are small, secretive flies which are almost entirely black. The feature which all these species have in common is the characteristic pattern of the veins on the wings. In the majority of hoverflies a fold in the wing membrane forms a false vein or *vena spuria*, this is not found in any other group of flies. The veins also form a false margin to the hind edge of the wing, a point which aids quick identification of the family.

The mode of development within the family Syrphidae varies greatly. The larvae of the sub-family Syrphini feed on aphids and are of considerable economic importance in helping to control these agricultural pests. The larvae of the sub-family Cheilosini mainly develop within plants or fungi whilst the larvae of the Eristalini develop in rich mud or decaying organic matter. The larvae of the sub-family Volucellini lead a rather unusual existence as scavengers in the nests of bumble bees and social wasps. Certain species such as *Xylota* and *Criorhina* need mature woodland which can provide rot-holes in trees or decaying wood for their larvae to develop in. The only species which conflict with man's interest to any extent are *Merodon equestris* the Narcissus Bulb Fly, and *Eumerus* spp the Small Bulb Flies. The larvae of these species, as their name implies, live inside bulbs and can at times be a serious pest to horticulturists. On the positive side most adult hoverflies visit flowering plants to feed on pollen and nectar and by doing so are important factors in the cross pollination of plants.

PREVIOUS RECORDING

The first attempt to survey the species of Syrphidae present in the area was carried out by P. H. Grimshaw who published "Diptera Scotica" from 1904 to 1910 in the *Scottish Naturalist*. Part III of "Diptera Scotica" was entitled The Forth District and in it Grimshaw listed ninety species of Syrphidae which had been taken in the Forth catchment area. Although the names of several species and views on their taxonomic status have changed since that time he records ten species which have not been found in the present survey. They are:

<i>Paragus tibialis</i>	<i>Platycheirus perpallidus</i>
<i>Pipizella virens</i>	<i>Scaeva selentica</i>
<i>Xanthandrus comtus</i>	<i>Metasyrphus nitens</i>
<i>Dasysyrphus lunulatus</i>	<i>Melangyna guttata</i>
<i>Helophilus trivittatus</i>	<i>Xylota coeruliventris</i>

Most of these species are uncommon in Scotland as a whole or are restricted to types of habitat which are not to be found within the present survey area. Of local interest Grimshaw records *Sphegina clunipes* from Bridge of Allan and Dollar, and *Eristalis horticola* and *Xylota coeruliventris* from Forestmill. This is the only record of *X.coeruliventris* from the area although one was taken near Aberfoyle in 1981.

In 1910 A. E. J. Carter published a list of Diptera collected in Perthshire and in 1913 a further list of Perthshire Diptera from the Aberfoyle district. In these two lists he records fifty-six species of hoverflies five of which are not recorded in this present list. They are:

<i>Paragus tibialis</i> (the same specimen as cited by Grimshaw)
<i>Cheilosia antiqua</i>
<i>Cheilosia longula</i>
<i>Chrysotoxum bicinctum</i>
<i>Microdon mutabilis</i>

Cheilosia antiqua could well turn up in the present survey area but the other species are much more uncommon.

By comparing the present list of species with those made almost seventy years ago it can be seen that despite man's interference from pesticides and agricultural improvement, and by his increasing use of land for industrial purposes and housing, the number of hoverfly species to be found in the area has not changed to any great extent. The disappearance of habitat due to draining or tree felling however has probably caused a reduction of the total numbers present in many species.

In more recent times T. H. Pennington captured a specimen of *Eriozonea syrphoides* in the Carron Valley among the Campsie Hills.

This species is relatively new to Britain and seems to be spreading quickly, it is usually to be found in conifer plantations. It was first seen in the Carron Valley in 1972 and has been recorded several times since then. There must be a possibility of this species turning up in other coniferous plantations in the area.

THE SURVEY AREA

All of the records listed in this paper are from the 10 kilometre National Grid squares NS89 and NS99 apart from one or two named records from Glendevon (NN90). The area comprises most of the Clackmannan District and an eastern part of Stirling District. The area forms a wedge between the north bank of the River Forth and the Ochil Hills.

Most hoverflies are woodland or woodland edge species and can be commonly found feeding on plants such as Umbelliferidae, Compositae and many garden flowers. Some species however are confined to a specific habitat type such as coniferous plantations, moorland, marshes or coastal sites. Within the survey area there are many belts of deciduous woodland with more extensive stands on the Abbey Craig, the Hermitage Woods at Airthrey and on the Wood Hill between Alva and Tillicoultry. There are also small areas of coniferous plantation scattered here and there, with the larger plantations being around Forest Mill, Gartmorn Dam, between Tillicoultry and Dollar, and north-east of Bridge of Allan. Although conifer plantations are by no means a natural habitat they do possess their own characteristic hoverfly fauna. The slopes of the Ochil Hills provide a large area of rough grazing which is characterised by the presence of *Platycheirus clypeatus*, *Platycheirus angustatus* and *Melanostoma mellinum* the latter species being found to over 2,000ft. The main rivers are the Devon and the Black Devon. The Devon in particular has much damp pastureland along its banks and some marshland although unfortunately this is fast disappearing due to drainage. The largest areas of still water are Gartmorn Dam and Airthrey Loch. Airthrey Loch in particular is a very interesting site, it is a rich lowland loch, a feature uncommon in Scotland, and hence attracts some of the rarer still-water species.

All the records which were used to make up the species list were collected between 1978 and 1982 and unless stated are all my own records. The nomenclature used in the list is taken from Kloet and Hinks (1976).

CONCLUSION

From the results of this present survey it would appear that for a relatively agricultural and urbanised area there is still a diverse hoverfly fauna present. This is mainly due to the varied habitat types which still occur throughout the area. The presence of a relatively large amount of mature deciduous woodland is obviously a major factor in determining the species diversity as is the presence of a eutrophic body of water such as Airthrey Loch. In some ways this area is almost a frontier zone with influences being felt from both the north and the south. *Eristalis rupium* and *Sphaerophoria philanthus* are examples of the northern influence whilst *Parhelophilus versicolor* and *Anasimyia transfuga* are predominantly southern species.

I am sure that more species will be added to this list in the future but I hope that the present list gives an indication of the status of hoverflies in the area at the present time.

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SPECIES LIST

Syrphini

Many of the members of this sub-family have yellow and black abdominal markings similar to those of the social wasps (*Vespa* sp.). The members of the nominate genus *Syrphus* are perhaps the commonest and best known of all the hoverflies.

Syrphus ribesii Linnaeus)

Very common. Occurs in most habitat types. May-September.

Syrphus torvus Osten-Sacken

Very common. One of the first hoverflies of the spring. March-September.

Syrphus vitripennis Meigen

Common. May-August.

Epistrophe eligans (Harris)

Uncommon. Usually to be found hovering in woodland glades. May.

Epistrophe grossulariae (Meigen)

Very common. Woodland edge. June-September.

Metasyrphus corollae (Fabricus)

Common. Often in gardens. July-September.

Metasyrphus latifasciatus (Macquart)

Uncommon. The only records are from damp pasture beside the River Devon. June-July.

Metasyrphus luniger (Meigen)

Common. Occurs in most habitat types. April-October.

Scaeva pyrastris (Linnaeus)

Uncommon. A migrant species, occurring in varying numbers in different years. August-September.

Dasysyrphus albostratus (Fallen)

Uncommon. This species is bivoltine. May and July-August.

Dasysyrphus tricinctus (Fallen)

Common. A spring species of deciduous woodland. April-May.

Dasysyrphus venustus (Meigen)

Common. A spring species of deciduous woodland. April-June.

Leucozona glaucius (Linnaeus)

Common. Woodland edge. July-September.

Leucozona laternarius (Muller)

Uncommon. Woodland edge. July-August.

Leucozona lucorum (Linnaeus)

Common. Deciduous woodland. May-August.

Melangyna arctica (Zetterstedt)

Uncommon. A spring species often in coniferous woodland. May-June.

Melangyna compositarum (Verrall) and *Melangyna labiatrum* (Verrall)

According to Speight (1975) these two species cannot be satisfactorily separated using present keys. Common. July-August.

Melangyna lasiophthalma (Zetterstedt)

Common. A spring species often to be found on willow catkins. 44 were counted one morning "sunbathing" on tree trunks at Airthrey. March-May.

Melangyna quadrimaculata (Verrall)

Rare. Usually on willow catkins. April.

Melangyna umbellaterum (Fabricius)

Uncommon. June-July.

Melangyna cincta (Fallen)

Common. Woodland edge. May-August.

Parasyrphus lineolus (Zetterstedt)

Uncommon. Often among conifers. May-August.

Parasyrphus mallinellus (Collin)

Rare. Only found in conifer plantations N.E. of Bridge of Allan. May.

Parasyrphus punctulatus (Verrall)

Common. A spring species usually in deciduous woods. April-May.

Parasyrphus vittiger (Zetterstedt)

Uncommon. Woodland edge and scrub. May-August.

Didea fasciata Macquart

Rare. Deciduous and coniferous woodland edge. May-July.

Metasyrphus annulipes (Zetterstedt)

Rare. Only one record; Airthrey 17 July 1980 deciduous woodland.

Meliscaeva auricollis (Meigen)

Rare. A species of coniferous woodland. August.

Meliscaeva cinctella (Zetterstedt)

Very common. Woodland edge. May-September.

Episyrphus balteatus (Degeer)

Very common. A migrant species. July-October.

Sphaerophoria menthastris (Linnaeus)

Common. Prefers damp meadows. May-August.

Sphaerophoria philanthus Meigen

Uncommon. An upland species, prefers drier areas such as moorland. May-August.

Chrysotoxini

Large, well marked species with characteristically long antennae.

Chrysotoxum arcuatum (Linnaeus)

Common. Deciduous woods. May-August.

Bacchini

Small, very elongate species.

Baccha elongata (Fabricius)

Common. Mature deciduous woodland. May-August.

Melanostomatini

Small species with yellow or silver abdominal markings. The males of the genus *Platycheirus* have characteristic flattened front tarsi or tibiae.

Melanostoma mellinum (Linnaeus)

Common. Found in all habitats. April-August.

Melanostoma scalere (Fabricius)

Very common. Occurs almost everywhere. April-August.

Platycheirus albimanus (Fabricius)

Very common. Occurs almost everywhere. April-September.

Platycheirus angustatus (Zetterstedt)

Uncommon. A grassland species, occurs on the slopes of the Ochils. June-August.

Platycheirus clypeatus (Meigen)

Very common. Meadows. May-August.

- 70 *Platycheirus fulviventris* (Macquart)
Rare. A species of marshy areas, Airthrey Loch and banks of River Devon. May-June.

Platycheirus immarginatus (Zetterstedt)

Rare. May-July.

Platycheirus manicatus (Meigen)

Common. Woods and pasture. May-August.

Platycheirus peltatus (Meigen)

Common. Woods and pasture. May-August.

Platycheirus scambus (Staeger)

Uncommon. In damp areas. June-August.

Platycheirus scutatus (Meigen)

Common. Often in gardens. April-September.

Platycheirus tarsalis (Schummel)

Common. A spring species. April-May.

Pyrophaena granditarsa (Forster)

Common. Damp pasture. June-August.

Pyrophaena rosarum (Fabricius)

Rare. Damp pasture. Only recorded from Dollar and Logie. July-August.

Pipizini

Inconspicuous, dark coloured species of mature deciduous woodland.

Pipiza fenestrata Meigen

Rare. Only recorded from Airthrey woods. May.

Pipiza luteitarsis Zetterstedt

Uncommon. Only recorded from Airthrey woods. May.

Pipiza noctiluca (Linnaeus)

Rare. Airthrey woods and the Wood Hill, Alva. May-June.

Neocnemidon vitripennis (Meigen)

Rare. Only one record; Airthrey woods. May 1981.

Cheilosini

Members of the genus *Cheilosia* are for the most part entirely black but some have red, white or orange body hairs. *Rhinghia* and *Ferdinandea* are by contrast quite colourful.

Cheilosia albipila Meigen

Rare. Only one record; Gartmorn Dam. 23 May 1980.

Cheilosia albitalarsis Meigen

Common. Usually associated with damp pasture. May-June.

Cheilosia bergenstammi Becker

Common. Woodland edge. May-July.

Cheilosia fraterna (Meigen)

Common. May-June.

Cheilosia grossa (Fallen)

Uncommon. A spring species. In 1980 and 1981 several males were caught in the 40 foot suction trap in the gardens at Airthrey. This would indicate that this species tends to fly high and does not often occur at ground level. April.

Cheilosia honesta Rondani

Rare. Only one record; Tillicoultry. May 1980.

Cheilosia illustrata (Harris)

Very common. Woodland edge. June-August.

Cheilosia paganus (Meigen)

Common. April-July.

Cheilosia proxima (Zetterstedt)

Common. May-August.

Cheilosia scutellata (Fallen)

Uncommon. July-August.

Cheilosia variabilis (Panzer)

Common. Usually in deciduous woodland. May-July.

Cheilosia vernalis (Fallen)

Rare. Airthrey and Tillicoultry. May-July.

Portvenia maculata (Fallen)

Uncommon. Always found in company with Wild Garlic (*Allium ursinum*). May.

Rhingia campestris Meigen

Very common. Meadows. The larvae develop in cattle dung. May-August.

Ferdinandea cuprea (Scopoli)

Uncommon. Mature deciduous woodland. May-July.

Chrysogasterini

Small, mainly black flies frequenting damp areas.

Chrysogaster hirtella Loew

Uncommon. Damp pasture. May-June.

Chrysogaster solstitialis (Fallen)

Common. Often on Umbelliferidae in the Autumn. August-September.

Lejogaster metallina (Fabricus)

Uncommon. Damp pasture. June.

72 *Orthonevra spendens* (Meigen)

Uncommon. May-August.

Brachyopa scutellaris Robineau-Desvoidy

Rare. Only one record; Airthrey woods. 12 May 1982.

Sphegina clunipes (Fallen)

Common. Flies low among thick vegetation. April-July.

Neoascia aenea (Meigen)

Rare. Only one record; Airthrey Loch. May 1981.

Neoascia dispar (Meigen)

Rare. Only recorded from Airthrey Loch. June.

Neoascia podagrica (Fabricius)

Common. Thick undergrowth and damp pasture. May-September.

Eumerini

The 'small bulb flies'.

Eumerus tuberculatus Rondani

Common. Often in gardens. May-June.

Volucellini

Large flies whose larvae live in the nests of Bumble-bees and wasps.

Volucella bombylans (Linnaeus)

Rare. Only one record; Dollar. July 1978.

Volucella pellucens (Linnaeus)

Common. Woodland edge. June-August.

Sericomyiini

Large, handsome flies with either thick pubescence or bold abdominal markings.

Sericomyia lappona (Linnaeus)

Uncommon. Mainly in spring and early summer. May-June.

Sericomyia silentis (Harris)

Common. To be found in many types of habitat. June-September.

Arctophila fulva (Harris)

Rare. Only one record; Tillicoultry. 24 August 1980.

Xylotini

Large flies with gold, red or orange areas on the abdomen in the common genus *Xylota* and thick pubescence in *Criorhina*.

Xylota segnis (Linnaeus)

Very common. Deciduous woodland. May-August.

Xylota sylvarum (Linnaeus)

Uncommon. Deciduous woodland. June-August.

Xylotomima lenta (Meigen)

Rare. Only one record; Wood Hill, Alva, July 1979.

Syrirta pipiens (Linnaeus)

Very common. This species can be found almost everywhere. April-September.

Criorhina berberina (Fabricius)

Rare. Only one record; Gartmorn Dam, July 1979. F. Rennie.

Criorhina floccosa (Meigen)

Rare. A species of old deciduous woodland. Only recorded from Airthrey woods. May-July.

Merodontini

Commonly known as the Narcissus Bulb Fly this species can be a pest to horticulturists.

Merodon equestris (Fabricius)

Common. In gardens and woods. Several colour varieties have been recorded. May-August.

Eristalini

This sub-family contains some of the larger species which mimic bees.

Helophilus hybridus Loew

Uncommon. Always near water. May-September.

Helophilus pendulus (Linnaeus)

Very common. Occurs in most habitat types. April-October.

Anasimyia lineata (Fabricius)

Rare. Only recorded from Airthrey Loch. May-June.

Anasimyia transfuga (Linnaeus) (See note)

Rare. Only recorded from Airthrey Loch. May.

Parhelophilus versicolor (Fabricius)

Rare. The first Scottish record of this species was from Airthrey Loch in 1981. May-June.

Eristalis abusivus Collin

Uncommon. Damp pasture. June-August.

Eristalis arbustorum (Linnaeus)

Very common. April-September.

Eristalis horticola (Degeer)

Common. May-August.

Eristalis intricarius (Linnaeus)

Common. April-August.

74 *Eristalis nemorum* (Linnaeus)

Uncommon. Seems to prefer damp areas. May-June.

Eristalis pertinax (Scopoli)

Very common. Occurs in most habitats. April-November.

Eristalis rupium Fabricus

Rare. An upland species recorded from Glendevon and Airthrey. June-July.

Eristalis tenax (Linnaeus)

Common. March-October.

Eristalinus sepulchralis (Linnaeus)

Rare. Only recorded from Gartmorn Dam and Airthrey Loch. June.

Myathropa florea (Linnaeus)

Common. May-October.

Note: *Anasimyia transfuga* (Linnaeus) has now been recognised as being a mixture of two species (Speight 1981). *Anasimyia contracta* (Claussen and Torp) is the species which has been recorded in the survey area.

NOTES ON THE FUNGI OF OCHTERTYRE MOSS

75

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INTRODUCTION

This paper is a continuation of my account of the fungi of Stirlingshire (Watling 1980) and uses the same sources of nomenclature and arrangement of species.

Ochertyre Moss, between Stirling and Thornhill (National Grid Reference 720950) has stands of Birch (*Betula* spp.), with and without Willows (*Salix caprea* or *S. cinerea* or both) and Scots Pine (*Pinus sylvestris*), both scattered and in rows. There are fine *Sphagnum* carpets which form fringes around, or completely fill former cut-out areas of peat.

The following records of fungi are compiled from visits to Ochertyre Moss in September and October of 1969-71 and 1980.

NOTES ON SOME RUSTS AND SMALL ASCOMYCETES

Although the aged Birches at Ochertyre are heavily attacked by the birch polypore, *Piptoporus betulinus*, regeneration appears to be active; the saplings are invariably, however, attacked by the rust-fungus *Melampsorium betulinum*. Two other rusts are worth noting, one, *Kuhneola uredinis* is widespread in the thickets on Bramble (*Rubus fruticosus*), but the second *Milesina kriegleriana*, a parasite of the Buckler Fern (*Dryopteris dilatata*) is less common. Also in a mixed thicket of Bramble and Rhododendron along the roadside the mould *Pycnostysanus azaleae* can be found fruiting on dead flower and leaf-buds of *Rhododendron*. The small fruiting head of this fungus is on a dark stalk and infected buds appear minutely spiky; one can easily see how the name 'Pin-cushion fungus' arose. Also on the Buckler Fern was the recently described, tiny discomycete (Ascomycotina) *Pseudopeltis filicinum*; Ochertyre Moss is apparently the first British station from which this fungus has been recorded.

It is always a delight to find in the autumn the 'vegetable caterpillar', (*Cordyceps* spp.) a name given to those ascomycetes which so much resemble 'fairy club fungi' (*Clavaria* and *Ramaria*) that they are frequently confused with them. *Cordyceps* spp. are usually insect parasites but a few grow on subterranean fungi. *C.*

- 76 *ophioglossoides*, one such species, has been found several times at Ochertyre and digging for its host (in the leaf litter) brought about the discovery of two false truffles *Elaphomyces muricatus* and *E. variegatus*. The only other ascomycete of note is *Neobulgaria lilacina* which has been recently found on old fallen conifer wood.

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ANNOTATED SPECIES LIST

Hymenomycetes

AGARICALES

- + *Agaricus arvensis*
margin of Birch wood.
- + *Agrocybe erebia*
margin of plantation amongst *Rhododendron*.
- + *Amanita fulva*
- + *A. rubescens*
Armillaria ostoyae (Romagn.) Herink
on old Birch stump; characterised by chocolate-brown scales on cap, ring and stem and overall pinkish buff tinge. (Not in Dennis et al. 1960.)

Boletus holopus

amongst *Sphagnum* in wet boggy places under Birch. A common bolete north of the Tay, becoming less frequent southwards; changes characteristically blue-green at the base of the stem when damaged.

+ *B. scaber*

in dry areas under Birch; *B. holopus* differs in its pale almost white cap, and preference for wet places.

+ *B. variegatus*

under scattered trees and along rides in plantations; a common member of planted coniferous woods and the native Caledonian forest.

Boletus sp.

reduced to a yellow amorphous mass by the mould *Sepedonium chrysospermum*.

+ *Collybia cirrhata*

in moss-bed, perhaps urination spot of small mammal. Differs from + *C. cookei*, not recorded from Ochtertyre, in the lack of a yellow, hard sclerotium attached to the stem-base; *C. cookei* grows on putrescent toadstools.

C. palustris

in huge troops in *Sphagnum* causing bleached areas of moss. Very common almost throughout the year.

Cortinarius paleaceus

common in damp places under Birch and Willow.

+ *C. semisanguineus*

under Scots Pine; characterised by the blood-red gills contrasting with the tawny cap and stem.

Deconica (a genus now universally placed in *Psilocybe*)

see + *Psilocybe coprophila*.

Galerina calyptrata

in moss-cushions on acidic soil.

+ *G. hypnorum*

on mossy stumps, in moss-cushions etc; differs from *G. calyptrata* with which it has been confused in the past by the brighter colours and several distinctive microscopic characters.

+ *G. paludosa*

in *Sphagnum* either in clearings in woodland, floating sheets of *Sphagnum* or beds in cut-outs. A very characteristic member of the bog-flora, recognised by the small, white ring-zones on the stem and rather purplish date tinges to the cap.

78 *G. sphagnum*

in *Sphagnum* in clearings in woodland. Differs from *G. paludosa* in orange-brown cap-colour; a third member of the *Sphagnum* group has not been found at Ochertyre but might be expected (*G. tibiicystis*) and it differs in the stem being pubescent with small tibiiform hairs. See *Psathyrella sphagnicola* below.

- + *Gomphidius rutilus*
under Scots Pine.

- + *Gymnopilus penetrans*
widespread on woody debris under conifers; often in small troops.

- + *Hygrophoropsis aurantiaca*
widespread under trees, in clearings and along rides; often on more acidic soils.

Hygrophorus unguinosus

field margin; characterised by glutinous, grey cap and stem.

- + *Hypholoma fasciculare*
on stumps of Birch and Willow; + *H. capnoides* which has a mild taste and more ochraceous not sulphur-yellow cap might be expected under the Scots Pines, but has not yet been recorded.

- + *H. udum*
on peaty soil; a characteristic member of upland moorlands, accompanied by *Mycena uracea*; see below.

Inocybe longicystis

under Scots Pine.

- + *I. napipes*
a small species characteristic of wet areas under Birch and Willow.

- + *Laccaria laccata*
widespread.

L. proxima

widespread; differs from *L. laccata* generally in its larger size and its more scurfy-shaggy stem, and always by its broadly ellipsoid basidiospores. *L. laccata* has globose or only faintly subglobose spores. *L. proxima* might be distinguished in the field by its strong smell of radishes, but this must be tested more fully before being used as a field character.

- + *Lactarius helvus*

in huge troop under Scots Pine; a large 'milk-cap' with strong smell of curry-powder or spice especially when drying. The cap

is rather velvety to the touch and the 'milk' more like clear polystyrene glue.

+ *L. rufus*

widespread under Scots Pine in dry and wet areas. One of the few mycorrhizal fungi found on the floating *Sphagnum* beds but undoubtedly mycorrhizal with nearby Scots Pine.

+ *L. tabidus*

under Birch, characterised by white milk-like fluid which exudes from the gills when broken and gradually turns yellow when wiped on a handkerchief, and the rugulose smooth cap. Under the microscope the outermost layer of the cap is composed of rounded cells.

+ *Marasmius androsaceus*

on Scots Pine needles in huge troops.

+ *Mycena epipterygia*

widespread in troops under Scots Pine and amongst long grass under Birch; characterised by the lemon-yellow or greenish yellow, sticky stem and pewter-grey cap.

+ *M. fibula* (*Omphalina fibula*)

in moss cushions.

+ *M. galericulata*

on Birch stumps.

+ *M. galopus*

on leafy debris; widespread. This species is one of the major decomposers of fallen leaves in northern woodlands.

+ *M. leptcephala*

amongst grass, characterised by its so-called 'nitrous' smell — resembling the smell of swimming baths.

+ *M. sanguinolenta*

on both leafy and conifer debris; characterised by the production of a blood-coloured fluid on breakage.

+ *M. swartzii* (*Omphalina swartzii*)

on mossy carpets in clearing.

M. uracea

amongst collapsed Heather (*Calluna vulgaris*) plants; a typical member of the moorland flora.

Naucoria cephalascens

under Willows in moist hollow. First collected in 1959 from Dawlish Warren, Devon amongst *Scirpus* on marshy ground or in dried-up pool near Willows; this is apparently a rather

- 80 uncommon, small, brown and insignificant toadstool.

Omphalina pseudoandrosacea

amongst *Sphagnum* in floating carpets; formerly confused with *O. ericetorum* but differs in the paler cap which rapidly becomes white, usually 2-spored basidia and lack of dark zone at top of the stem.

+ *O. ericetorum*

on wet mossy soil or logs, usually associated with the lichen *Botrydina vulgaris*.

+ *Paxillus involutus*

widespread throughout the area particularly on poorer soils.

Pleurotus cornucopiae

on old Willow trunk.

+ *P. ostreatus*

on fallen Birch.

Psathyrella sphagnicola

in *Sphagnum* carpet in damp hollows under Willow and Birch.

+ *Psilocybe coprophila*

on cattle dung; accompanied by the coprophilous pyrenomycetous ascomycetes *Coniochaeta hansenii*, *Delitschia consociata*, *Podospora curvula*, *P. decipiens*, *Sordaria superba* and *Sporormia intermedia*. *Saccobolus versicolor* (discomycetous) was also found and *Iodophanus carneus* an old weathered dung. (Keys to Fungi on Dung by M. Richardson and R. Watling is available from the British Mycological Society (Dr J. Stamps, Commonwealth Mycological Institute, Kew, Richmond, Surrey TW9 3AF price £1.00.)

Russula betularum

amongst leaves under Birch; recognised by the delicate stature, pale pink cap and white stem and gills. See *R. fragilis* below.

+ *R. claroflava*

in damp hollows and *Sphagnum* beds under Birch; a common widespread toadstool with bright egg-yellow cap, bright ochre spore-print and tendency to slowly turn grey when bruised or blacken with age.

+ *R. emetica*

in damp areas under pine, especially amongst *Sphagnum*. This is the true 'Emetic' with shiny red cap, pure white gills and white stem sometimes with a hint of the cap-colour. The cap often fades to yellow-white in spots where weathered. This species

has been frequently misidentified; any red *Russula* is often incorrectly called *R. emetica* by naturalists.

R. fragilis

in mixed woodland, edge of plantation. Formerly this name was used for the pink *Russula* of Birch woods but must correctly be used for a small purple (often with a tinge of olive-green at the centre) capped species.

+ *R. nigricans*

in dry, open area; recognised by widely spaced, thick, cream-coloured gills which redden on bruising and the blackening of the entire fruit-body with age.

+ *R. ochroleuca*

widespread; common in many different plant-communities. Our commonest *Russula*.

+ *R. paludosa*

during the autumn of 1980 this large, elegant species was found throughout the Moss under Scots Pine. Not a very common toadstool away from the remnant Caledonian forests.

Stropharia merdaria

on old manure by edge of field; this species often grows on dried-up sewage beds.

+ *S. semiglobata*

on dung; common.

Tricholomopsis decora

on pine stump; this is distinctly a northern fungus. It is not uncommon in the Highlands north of Dunkeld but is rare further south.

+ *T. rutilans*

on Scots Pine stumps; common throughout the British Isles.

Tubaria confragosa

an old Birch?/Willow? stump; a decidedly rare fungus which I have seen only once previously in Scotland (Aberdeenshire). Indeed so rare is it that Dennis et al state 'excluded pending clearer definition, not authentically British'.

APHYLLOPHORALES

+ *Coriolus versicolor*

widespread on stumps and fallen branches of birch along with the ascomycete *Hypoxylon multifforme*.

- 82 + *Gloeophyllum sepiarium*
on trunks of Scots Pine.
- + *Hirschioporus abietinus* (*Trametes abietina*)
in great quantity on the branches and debris which were left after trimming the main stems in the Scots Pine plantation.
- + *Hydnum repandum*
forming large fairy ring under Birch, almost concealed by vegetation.
- + *Piptoporus betulinus*
common on old Birch; the ascomycete *Hypocrea pulvinata* formed distinctive yellow pustules on the undersurface of old fruit — bodies.
- + *Thelephora terrestris*
on bare soil under Scots Pine; a characteristic mycorrhizal fungus in base-poor sandy soils.

Hymenomycetous Heterobasidiae

DACRYMYCETALES

- + *Dacrymyces stillatus* (*Dacrymyces deliquescens*)
on all kinds of woody debris; the perfect state is yellowish amber whilst the asexual stage is orange or reddish orange.
- + *Calocera cornea*
on very wet Birch.

Gasteromycetes

SCLERODERMATALES

- + *Scleroderma citrinum* (*Scleroderma aurantium*)
on sandy soil on banks.
- + *S. verrucosum*
on sandy soils with fairly high humus content. Differs from *S. citrinum* in smaller spores with spines and not crested reticulum, and formation of stalk.

THE EXTENT AND COMPOSITION OF NATIVE WOODLANDS IN CENTRAL REGION

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Richard Keymer
Nature Conservancy Council

WOODLAND HISTORY

The last ice age ended about 10,000 BC and was succeeded by conditions characteristic of tundra. Juniper (*Juniperus communis*) (Dony 1974) and crowberry (*Empetrum nigrum*) heaths were widespread interspersed with grass and sedge communities (Birks 1977, 1980 and Dickson 1977). Birch (*Betula pubescens*) expanded rapidly from the south forming open herb-rich birch-hazel (*Corylus avellana*) woods with willows (*Salix* spp) in wetter areas. By about 6,000 BC sessile oak (*Quercus petraea*) had reached Central Scotland and a mixed oak woodland developed with birch, ash (*Fraxinus excelsior*) wych elm (*Ulmus glabra*) and alder (*Alnus glutinosa*). Ash and wych elm would have occurred on the more fertile soils and alder on damper ground. Other species present would have included hazel, holly (*Ilex aquifolium*), aspen (*Populus tremula*), bird cherry (*Prunus padus*), blackthorn (*Prunus spinosa*), willows and rowan (*Sorbus aucuparia*). This mixed oak woodland reached its maximum about 4,000 BC when conditions for tree growth were more favourable than they have been since. It was the remains of this type of woodland that were found on the clay under the peat deposits in the Carse of Stirling when they were cleared during the late eighteenth century (Anderson 1967). About 3,000 BC there was a marked decline in the frequency of wych elm which may mark the beginning of human disturbance in the woodland. From about 2,000 BC the climate became cooler and wetter producing, in the uplands and on poorly drained ground, conditions more suitable for the growth of bog vegetation than woodland. The woodland cover of Central Scotland has therefore become gradually more open since about 3,000 BC.

THE EFFECT OF MAN

The effect of man on the woodland cover was probably of little consequence until the Bronze Age (1900 — 250 BC) when the availability of more efficient cutting tools and the establishment of

84 more permanent farming communities probably led to some clearance of woodland especially on light soils such as the tops of the andesite ridges bordering the Forth Valley. The advent of the Iron Age (250 BC) saw the construction of timber dwellings on a more extensive scale and attempts were probably made to fell the oak woodlands in the lowlands.

During the period following the departure of the Romans (446 AD) the south east of Scotland was gradually occupied by invading Scandinavian and Teutonic tribes who were accustomed to living in woodland. It was probably during this long period that the appearance of a great part of Scotland, mainly on the coastal lowlands and in the south changed from that of a land covered with a sheet of woodland enclosing scattered islands of cleared ground to that of a more or less open country with islands of woodland scattered through it (Anderson 1967). By the time of the Norman Conquest of England most of the woods seem to have been of small size except in the more remote hilly areas.

Around 1100 AD the attitude regarding the woods solely as sanctuaries for wild animals began to change as the economic importance of the forest for the feeding of deer and swine began to be appreciated. The ownership of the forest then became a matter of concern and the waste ground of the clans and tribes became the Royal Forest.

During the period of feudalism (from 1100 to 1400 AD) the process of clearing Scotland's forests went on more speedily than at any other time. A new rural economy based on intensive farming was beginning to become established which would displace the old economy based on hunting and fishing, grazing, and small scale often temporary arable units. The most important development during this period was the establishment of grazing on quite an extensive scale in the Southern Uplands which foreshadowed the much wider developments of the next two centuries. Considerable quantities of fuel were also required for the manufacture of salt; one of the greatest concentrations of salt works was on the land bordering the Forth east of Stirling.

The period from 1400 to 1600 AD was marked by increased deforestation and by large-scale conversion of woodland to pastoral and agricultural use. The devastation of the forests especially in the Central Lowlands continued to such an extent that the Scots Parliament passed legislation in an attempt to check the destruction and later to compel some replanting (Anderson 1967).

During the eighteenth and nineteenth centuries many woodlands in Central and Western Scotland were managed to produce charcoal for

iron smelting. In the sixteenth century laws were passed in England preventing the felling of woodland for this purpose and many iron-workers migrated to Scotland and Ireland. One of the best known furnaces was founded by the Lorn Furnace Company at Bonawe in 1753 which operated until 1873. With skilful management a woodland's production could be sustained; however in areas where there was no guaranteed continuity of supply less care would have been taken and the woodland would have been cleared with no thought as to its future. By the close of the seventeenth century the advantages of using coal instead of charcoal were apparent and iron smelting became centralised at factories such as the Carron Ironworks which were designed to use either coal or charcoal.

Until the late nineteenth century oak bark was the main tanning agent used in Britain, and tan-bark coppice was the predominant form in Scotland with oak providing both the coppice crop and the standard trees. Formal coppice management seems to have been limited before 1700 (Lindsay 1975) but thereafter the area of coppice expanded, the peak being reached between 1790 and 1815. After 1815 bark prices fell and by mid century had returned to their 1790 level.

On Loch Lomondside the woods were cut at irregular intervals from the late seventeenth century, probably a continuation from the time of the bloomeries. In 1735 the felling was put on a regular basis with a rotation period of 24 years. Because oak bark and timber were so valuable other tree and shrub species were removed, resulting in woods of more uniform species content. When coppice stools became worn out they were replaced using acorns or young oak from England usually of pedunculate (*Quercus robur*) rather than the native sessile oak. This system of management continued until the end of the nineteenth century; by the early 1920s the woods had been abandoned as productive coppice.

THE PRESENT STATE OF NATIVE WOODLAND

Woodland covers only 8% of Great Britain, a value which is less than any other European country and suggests that we have lost 90% of our woodland cover since Neolithic times. However well over 65% of our existing woodlands are not natural at all but have originated by planting since the seventeenth century. Woodlands originating before 1650 and surviving today in at least a semi-natural state comprise no more than 17% of our existing woodland cover (Peterken 1977).

In order to investigate the decrease in the extent of deciduous woodland in Scotland the Nature Conservancy Council (NCC) placed a contract with the Institute of Terrestrial Ecology (ITE) to survey the canopy composition of all deciduous woodlands greater than 5 ha in extent and marked with a deciduous tree symbol on the 7th Series 1:63,360 Ordnance Survey (OS) maps (Bunce 1979). When exotic conifers occupied more than 50% of the canopy the wood was considered lost. The survey was carried out from a distance using binoculars.

Using the OS maps as a basis for assessing past woodland cover the survey found that of the 3188 woods surveyed 752 (24%) had been lost and that the total area of deciduous woodland had decreased by 36% from 95,577 ha to 61,664 ha, just under 1% of the land area of Scotland. In addition the survey found that 52% of the woods surveyed (1465 woods) contained exotics indicating that less than half of the remaining native woods remain free of some planting within them. This figure would be further reduced if the figures for Scots Pine were considered.

The revision dates of the 7th Series OS maps range between 1954-1967 which should indicate that the decline of 36% has occurred over the past 20 years. However, the woodland symbols on these maps do not appear to have been updated where deciduous woods were converted to conifers and it is not possible to state with certainty when the calculated decrease has occurred.

The results of the survey were also compared with the 1947 Forestry Commission census of all woodlands over 5 acres (2 ha). At a superficial level it was found that the extent of deciduous woodland in Scotland had decreased by 58% from 145,323 ha to the 61,664 ha recorded during the ITE survey. This figure is probably an overestimate of the decrease and it must be treated with caution because of methodological differences between the Forestry Commission census and the ITE survey. Bearing this in mind the estimated decrease between 1947 and 1978 was taken to be 39%. While it may not have been possible to derive a precise measure of woodland change the trend is obvious. The main reason for the decline was shown to be the conversion of deciduous woodland to conifers.

Considering the data for Central Region the ITE survey identified 149 existing deciduous woods (3429 ha) and 54 lost woods (1301 ha) which indicates that the existing cover of deciduous woodland in Central Region is 1.3%. The use of OS maps to assess past woodland cover indicated that the extent of deciduous woodland in Clackmannan, Falkirk and Stirling Districts had decreased by 29%,

76% and 61%, respectively (see Table 1). Comparison with the 1947 Forestry Commission census at a superficial level indicated decreases of 76%, 66% and 37% in the old counties of Clackmannan, Perthshire and Stirlingshire.

A. Changes recorded during the Institute of Terrestrial Ecology's (ITE) Survey 1977-78.

District	Extent of deciduous woodland marked on the 7th Series OS maps and		
	present in 1977-78	not present in 1977-78	Decrease
Clackmannan	197	139	29%
Falkirk	588	139	76%
Stirling	2,644	1,023	61%

B. Changes recorded by comparing the results of the 1947 Forestry Commission (FC) Census with the results of the ITE Survey in 1977-78.

County	Extent of deciduous woodland recorded during the 1947 FC Census	Extent of deciduous woodland marked on the 7th Series OS maps and recorded as present in 1977-78	Decrease
Clackmannan	621	152	76%
Perthshire	21,639	7,323	66%
Stirlingshire	3,938	2,465	37%

TABLE 1 Changes in the extent of deciduous woodland in Central Region (ha).

Further information on the decrease in the extent of deciduous woodland can be obtained from work carried out by Dr Langdale-Brown at Edinburgh University as part of a contract placed by the Nature Conservancy Council to investigate the effect of modern agriculture on wildlife habitats (Langdale-Brown 1980).

This work involved measuring the extent of different habitats on aerial photographs flown by the Royal Air Force at the end of the second world war and comparing the results with the extent of these habitats measured on recent aerial photographs. However, as the object of the project was to investigate the effect of agriculture on wildlife habitats only the lowland agricultural area was investigated and the results are not comparable with the work described above.

In 1945 about 7% of the lowland agricultural area was covered in deciduous woodland and about 2% in coniferous woodland. Now the figures are 6% and 4% respectively. It is estimated that over this time there has been a net loss of about 13% of the area of deciduous woodland and that the extent of coniferous woodland has more than doubled. Conifer plantations have taken up more than 2000 ha of land since the end of the war largely on existing woodland sites and on agricultural ground. The deciduous woodland has been replaced by conifers and felled, often to allow conifer planting. Other losses have occurred due to non-agricultural developments.

WOODLAND TYPES

In order to discuss the range of variation present within the woodlands of Central Region it is necessary to classify the woodlands into a number of distinct types. This could be done on the basis of their geology, ground flora or canopy composition. Existing classifications have been based on the ground flora (Bunce and Shaw 1971) and the composition of the canopy (Peterken 1980). In this instance a simple classification based on the composition of the canopy has been produced. Where possible the comparative types from the other classifications have been given.

A. OAK WOODS

- A.1 These are largely acid western oak woods with a canopy of oak or of oak and birch. Many of these woods were coppiced in the past which often involved the selective removal of other species for which no use was available and has resulted in the formation of many almost pure oak woods. These woods are most frequent on the more acidic mica-schists and schistose grits north of the Highland Boundary Fault. The soil is generally acidic and shallow. The most abundant ground flora species are wavy hair-grass (*Deschampsia flexuosa*) bracken (*Pteridium aquilinum*), bramble (*Rubus fruticosus*), common bent (*Agrostis tenuis*), heather (*Calluna vulgaris*) and sweet vernal-grass (*Anthoxanthum odoratum*).

This type is similar to Bunce and Shaw's National Site Type (NST) 10 (wood sage *Teucrium scorodonia* — oak/birch type) and NST 15 (sweet vernal-grass — oak type) or to Peterken's Type 6A (acid sessile oak-birch woods).

- A.2 A variant of this type often occurs where there are burns flowing through a wood because alder and ash often grow by burns where more nutrients are available. This produces a more mixed wood similar to Bunce and Shaw's NST 12 (creeping buttercup *Ranunculus repens* — oak/alder type) or Peterken's Type 7A (acid alderwoods). The distinction between A.2 and C depends on whether alder is restricted to the sides of burns or whether it is spread over a wider area.
- A.3 Another variant occurs on more fertile soils where there may be a shrub layer of hazel under the oak. This would be equivalent to Peterken's Type 6Ah (the hazel variant of Type 6A above).
- A.4 In the south west of the Region there are a small number of woods on deeper soils more typical of southern oakwoods. These may be equivalent to Bunce and Shaw's NST 3 red campion *Silene dioica* — oak/ash type) and Peterken's Type 3D (western sessile oak-ash woods).

B. MIXED VALLEY WOODS

These woods occur largely on the more nutrient-rich old red sandstones, Scottish carboniferous limestones, calciferous sandstones and basaltic lavas in the south of the Region, although they also occur in northern oak woods where the nutrient status of the soil is enhanced by the reception of drainage water, unstable soil or surface streams. They often occur in valleys where there are deeper soils and they are more likely to have survived forest clearance. These woods are mixed, with ash, alder, wych elm, oak and birch present in the canopy and hazel and bird cherry occurring in the shrub layer. Alder does not occur on drier sites of this type in the south such as Abbey Craig. Because the majority of these woods occur in the south near the long established centres of population these woods are often planted in and indeed have often become policy woods. This type is similar to Bunce and Shaw's NST 11 (lady fern *Athyrium filix-femina* — oak/ash type), and to Peterken's Type 1D (western valley ash-elm woods).

C. MIXED ALDER WOODS

This type is similar to the last but occurs on wet sloping sites chiefly in the north of the Region. Ash, alder, oak and birch

are usually present with hazel often forming a shrub layer. Alder usually forms a relatively high proportion of the canopy and it is not restricted to the sides of burns. Soligenous mires are often present with species such as remote sedge (*Carex remota*), marsh thistle (*Cirsium palustre*), marsh hawk's-beard (*Crepis paludosa*), common marsh-bedstraw (*Galium palustre*), tufted hair-grass (*Deschampsia caespitosa*), creeping buttercup (*Ranunculus repens*), yellow pimpernel (*Lysimachia nemorum*) and bugle (*Ajuga reptans*).

This type is similar to Bunce and Shaw's NST 3 (red campion — oak/ash type) and to Peterken's Type 7D (north-western alderwoods), although this type was confined to unflushed slopes in oceanic situations.

D. ALDER WOODS

Alder rarely forms pure stands in sufficient density to be called a wood in the Region although there are examples at Glen Lochay, Glen Ample, Glen Finglas and Rednock Castle, while by Loch Dhu there is a very open alderwood at present regenerating well following a long period of grazing. This latter wood may develop into a mixed alderwood.

There appear to be no fen alderwoods (Type 7B of Peterken) present in the Region. This is a type of alderwood characteristic of the early stages of hydrosere succession on nutrient-rich fens.

E. BIRCH WOODS

Birch is an extremely frequent species and occurs in almost all the other woodland types as well as forming pure stands on its own. Naturally birch would not form climax woodland in the area except at high altitudes from where most woodland has long since been cleared. This implies that most birch woodland present today is of relatively recent origin and has arisen due to the excellent colonising ability of the species following the clearance of other woodland types or of other habitats. With the passage of time these woods will probably become more diverse as other species such as oak and rowan grow up among the birch. An example of this colonising ability is the presence of birch on raised peat bogs such as Dunmore Moss which in an undisturbed state would normally be too wet for birch to grow on. Man's activities may have provided more suitable conditions for the growth of birch by lowering the water table of the bog. The birch woods in the Region are probably similar to Bunce and Shaw's NST 16 (devil's-bit scabious *Succisa pratensis* —

birch type) and NST 13 (common tormentil *Potentilla erecta* — oak/pine type) and to Peterken's Type 12A (birch-rowan woods).

The examples of birch woods given in Appendix 1 are divided into upland (E1) and lowland (E2) woods as the former are less likely to be of secondary origin.

F. PINE WOODS

Pine (*Pinus sylvestris*) reaches its southern limit in the Region and there are only two native pinewoods at Coille Coire Chuilc and Glen Falloch (Steven 1959).

These are probably equivalent to Bunce and Shaw's NST 14 (heath grass *Sieglingia decumbens* — oak/pine type) and Peterken's Type 11A (rowan birch — pine woods).

G. JUNIPER WOODS

Juniper is only present as scattered bushes and thickets; it is nowhere continuous enough to be called a wood nor does it form an understorey in another woodland type.

Juniper was not included in either Bunce and Shaw's or Peterken's classification.

H. POLICY WOODS

This category includes the majority of the deciduous or mixed woodlands especially those on large estates or in the grounds of large houses in the south of the Region. Many of these were probably planted on open ground to establish woodland for agricultural or amenity purposes while others would have arisen by planting among other woodland types. The mixed valley woods in particular have often been modified in this way. In such woods one would expect to find oak, birch, ash and wych elm, however in a policy wood beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), larch (*Larix* spp.), Scots pine (*Pinus sylvestris*) and other exotic conifers are often found.

The ground flora of these mixed woods does appear to be reasonably distinctive and certain woods seem similar to Bunce and Shaw's NST 1 (bracken — oak/beech type) and NST 2 (ivy *Hedera helix* — oak/ash type) although owing to the different ways in which these woods have arisen a wide range of types are probably present. Peterken was not concerned with secondary woods of recent origin such as these.

It should be recognised that although classifications such as these produce different categories for the convenience of biologists there are usually no obvious boundaries present

between these categories on the ground. Indeed more than one category is often present, for example when an oak wood has a gorge running through it containing mixed valley woodland.

It is interesting to see how these woodland types fit into the picture of the distribution of major potential vegetation regions in Scotland produced by McVean and Ratcliffe (1962). They identified the region covering southern Scotland and the west coast as predominantly oak woodland with birch, ash, wych elm and alder while central Scotland was predominantly Scot's pine woodland with birch and oak. In fact all the types of woodland described above (types A-H) fit into the predominantly oak woodland region while the pinewoods (type F) fit into the predominantly pine woodland region. The differences between the types in the oak woodland region reflect the wide range of the nutrient status and wetness of the soils and of topography.

THE FUTURE OF NATIVE WOODLANDS

Once the main types of woodland have been recognised then the most interesting examples of these types should be identified and afforded whatever protection is possible. Certain types may be considered more significant than others. For example it has already been stated that most birch woods in the region are probably secondary and of less significance than mixed valley woods. Both ash and wych elm have relatively restricted distributions in Scotland and are only frequent in the lowlands, especially the Central Valley (Bunce 1979). Native pinewoods would probably be regarded as particularly significant because there are only two examples in the region.

The Nature Conservancy Council is responsible for identifying and seeking to protect the most interesting woods. This involves notifying these woods as Sites of Special Scientific Interest (SSSI) to the local planning authorities and the landowners. As a result the local authority must then consult NCC if an application for planning permission is made affecting a SSSI. However an application will only be made for activities requiring planning permission under the Town and Country Planning Acts such as new buildings and roads. Activities most likely to affect the future of woodland such as clearing, felling and replanting do not require planning permission therefore NCC may not be aware that the future of a wood is in jeopardy. Fortunately, at the present time a felling licence is required from the Forestry Commission before felling woodland and most

woodland owners would also apply for grant aid from the Forestry Commission before proceeding with restocking schemes. The Forestry Commission does consult NCC about applications for felling licences and grant aid for SSSIs. This arrangement alerts NCC to the possibility of seeking the co-operation of the owner in maintaining the nature conservation interest of his woodland. Achieving this objective does not preclude the harvesting of timber but would probably cause the owner to incur a considerable loss of revenue from the site because of restrictions on felling regimes and on the choice of species for replanting. This loss can be offset by grant aid from NCC under Management Agreements but the low level of compensation and the restrictions imposed may be unacceptable to many owners and increasingly NCC is being required to compensate the owner for the value of the timber that he has had to leave standing. Due to the limited funds allocated to nature conservation this is often not a practical option.

The decrease in the extent of native woodlands in recent years reflects the fact that they have ceased to play a significant part in the rural economy and are now of use only to provide shelter for grazing stock and for amenity and nature conservation purposes. The nature conservation organisations do not have the resources to buy all threatened woodland sites, therefore if native woodlands are to remain a significant feature of the landscape then either a new use must be found for their products or the amenity and nature conservation organisations must be able to offer more significant financial assistance to the landowners in return for retaining the woodlands for the community as a whole.

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APPENDIX

EXAMPLES OF WOODS ILLUSTRATING THE RANGE OF WOODLAND TYPES PRESENT IN CENTRAL REGION

(The majority of these woodlands are privately owned and access permission should be sought before visiting them.)

A1 Acid oak woods

- Cuilvona (NN 495018)
- Craigroyston South (NN 344020)
- Arrochymore (NS 411918)
- Pass of Leny (NN 595090)

- Drumore, Aberfoyle (NS 488988)
- Strone (NN 445105)
- A2 Oak woods with alder
 - Meall Dearg (NN 422104)
 - Glen Dochart (NN 470285)
- A3 Oak woods with hazel
 - Dunverig Wood (NS 528995)
 - Couligartan (NN 454013)
- A4 Southern oak woods
 - Blane Wood (NS 507852)
 - Drumore Wood, Killearn (NS 513862)
- B Mixed valley woods
 - Culcreuch (NS 620880)
 - Boquhan Glen (NS 669943)
 - Abbey Craig (NS 809955)
 - Wallstale (NS 766907)
 - Kippenrait Glen (NS 790994)
 - Dollar Glen (NS 962991)
 - Bracklinn Glen (NN 650080)
 - Glen Beich (NN 618255)
- C Mixed alder woods
 - Glen Lochay (NN 536353)
 - Camusurich (NN 627347)
 - Ardvorlich (NN 617227)
 - Edinchip (NN 582224)
 - Pollochro (NN 336127)
 - Conic Hill (NS 417916)
 - Gartfarran (NS 524958)
- D Alder woods
 - Glen Lochay (NN 505368)
 - Glen Ample (NN 601214)
 - Glen Finglas (NN 504110)
 - Rednock Castle (NN 600023)
 - Loch Dhu (NN 433042)
- E1 Upland birch woods
 - Coire Liath (NN 355190)
 - Monachyle Glen (NN 474238)
 - Glen Gyle (NN 364143)
- E2 Lowland birch woods

- 96 Murlaganmore (NN 543344)
Allt Breaclauch (NN 614335)
Glen Buckie (NN 535178)
Dalfoil (NS 573889)
Gribloch (NS 630913)
Trough (NS 664945)
Braes (NS 797850)
Dunmore Moss (NS 870895)
- F Pine woods
Coille Coire Chuilc (NN 330280)
Glen Falloch (NN 365230)
- G Juniper woods
Strathyre (NN 564173)
Bochastle Hill (NN 605083)
Cock Hill (NN 623063)
Arntamie (NN 558014)
Green Burn (NS 509948)
Lime Hill (NS 473963)
Touch Hills (NS 735920)
- H Policy woods
Kilmore (NS 532855)
Gribloch House (NS 640934)
Rednock (NN 592010)
Callander East (NN 640082)
Barr Wood (NS 795872)
Airthrey Woods (NS 813972)
Arnhall (NS 764990)
Westquarter (NS 927788)

IN SEARCH OF THE BUCHANAN FERN

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J. Mitchell and J. B. Mason

It was an article in *The British Pteridological Society Bulletin* that stirred our interest. After all, it is not every day of the week a fern totally unique in the world is discovered right beside your own doorstep. The botanists and gardeners caught-up in the wave of 'Pteridomania' or 'Fern Fever' that swept through Britain during the mid-19th century were not content with collecting and growing normal specimens, aberrations, some of which would be considered little more than monstrosities today, being much in demand. In just a few short years literally hundreds of varieties or 'sports' were described and named, although many of these have long since been forgotten. One notable exception is *Athyrium filix-femina* 'Victoriae' or Buchanan Fern, a particularly fine variety of Lady Fern, of which it was observed that 'no fern lover but desires to possess'.

What makes this variety so aesthetically appealing to the fern enthusiast is its elaborate, yet perfectly symmetrical, design. Each one of the long, slender pinnae (side branches) is divided into two and the pair set almost at right angles, which, together with their opposite partners on the other side of the rachis (stem), form a diagonal cross. On the original specimen the pinnules (branchlets) of each pinna repeated the process, but this additional character seems to be absent in most of its descendants. Apart from the delicate lattice-work pattern formed by the overlapping pinnae, each one of the divided branches is completed by a pendulous tassel at its tip. It should be added that the illustration of the two pressed fronds (Plate) does not do justice to the three-dimensional effect produced by each pair of divided pinnae being joined to the stem at a twisted angle. Since the fern was first taken into cultivation, a small number of different forms have been developed.

The story begins on Loch Lomondside in the summer of 1861, when an Edinburgh student by the name of James Cosh chanced upon a tall and striking variety of Lady Fern while enjoying a botanical ramble in the neighbourhood of Drymen. The precise spot where Master Cosh found the fern has never been disclosed, but a combination of clues would seem to pin down the locality to beside the former east gate to Angle Plantation near Coldrach Farm, Stirlingshire. According to E. J. Lowe, author of a classic two volume treatise on native ferns published a few years later, Cosh left the plant undisturbed until 1863 when it was dug-up and transferred to the gardens of Buchanan Castle nearby. This uncharacteristic act of

- 98 leaving an exceptionally good 'find' *in situ* for two years, at a time when fern-hunters were rapaciously scouring the countryside in force, seems not to have been questioned until 1895 when C. T. Druery was gathering material on fern varieties for one of his many publications. Being a relative of the estate factor, Druery experienced no problems in tracing and being introduced to the tenant of Coldrach Farm, who had actually been present when Cosh discovered the plant 34 years earlier. Just as Druery had suspected, Cosh, along with a Mr Connon — the head gardener at Buchanan Castle, had returned with spades *the very next day*. The fern was divided, part going to the castle gardens as stated by Lowe, the rest being taken to Edinburgh where it was apparently distributed amongst Cosh's friends.

Two and a half years after the fern had been collected, a few fronds were sent by head gardener Connon to *The West of Scotland Horticultural Magazine*, the editor of which suggested the variety be named 'devaricata' or 'deflexa'. However, fronds from Cosh's share of the plant had already fallen into the hands of John Sadler at the Royal Botanic Garden, Edinburgh, who in turn passed on a specimen to the leading authority on fern varieties, Thomas Moore. Moore pronounced it to be 'a queen amongst Lady Ferns' and patriotically dubbed it 'Victoriae'. It first appeared under this name in a list of 240 described forms of Lady Fern compiled by Patrick Neill Fraser for his *British Ferns and their Varieties* printed privately at Edinburgh in 1865.

As to what eventually happened to the portion of fern dispatched to Edinburgh is uncertain, but something of the early history of the rest of the plant has been passed down. From Druery's and other naturalists' accounts of visits to the grounds of Buchanan Castle in the 1890s it is known that Connon's share of the fern was split in two, one half planted in the walled garden and the other with native and exotic species in a rockery built around a rustic well. Also that it was being propagated by means of spores and small plants made available for sale under the name 'Buchanan Fern'. Thereafter the trail grows cold until sometime in the 1920s, when John Mason (grandfather of one of the present authors) established a small nursery just off Drymen Square. Amongst the range of plants listed in the nursery catalogue were offsets of the Buchanan Fern. About 1950, Mr. Mason's stock of Buchanan Fern was disposed of to a nurseryman in Fife, but not before one good root had been transferred to a son's garden in the neighbouring village of Gartocharn, where the clump still flourishes to this day. The fate of the two large specimens at Buchanan Castle is a mystery, but they may have found their way into local gardens together with other choice items from the fernery when the castle and grounds were

converted into a military hospital for the duration of the Second World War. 99

Although *Athyrium filix-femina* var. 'Victoriae' can apparently still be purchased through some nurserymen's catalogues, we were keen to find out how many gardens in the district still contained the fern originating from Buchanan Castle. Response to a poster displayed in local post offices and branch libraries was encouraging, but almost all of the cultivated Lady Ferns brought to our attention proved to be varieties other than 'Victoriae'. Two more Buchanan Ferns did come to light however, both in Drymen and ironically right under our noses all of the time. The first to show up was in a garden on the Gartmore Road. Due to changes in occupancy of the house the source of the plant could not be ascertained, but it is suspected that it came from Mason's nursery.. The second clump is known to have been obtained from Buchanan Castle about 1910, although it had moved addresses on two occasions before finally being transferred to a garden in Charles Crescent.

We feel certain that there are further specimens of Buchanan Fern awaiting rediscovery in some of the older gardens in the Drymen area — it is even possible that the original plants from the castle still survive. In addition to the three well established clumps turned up by our enquiry, as from now *Athyrium filix-femina* var. 'Victoriae' can be found in two other local gardens. No prizes offered for guessing the identity of the new proud owners of this 'Queen amongst Lady Ferns'.

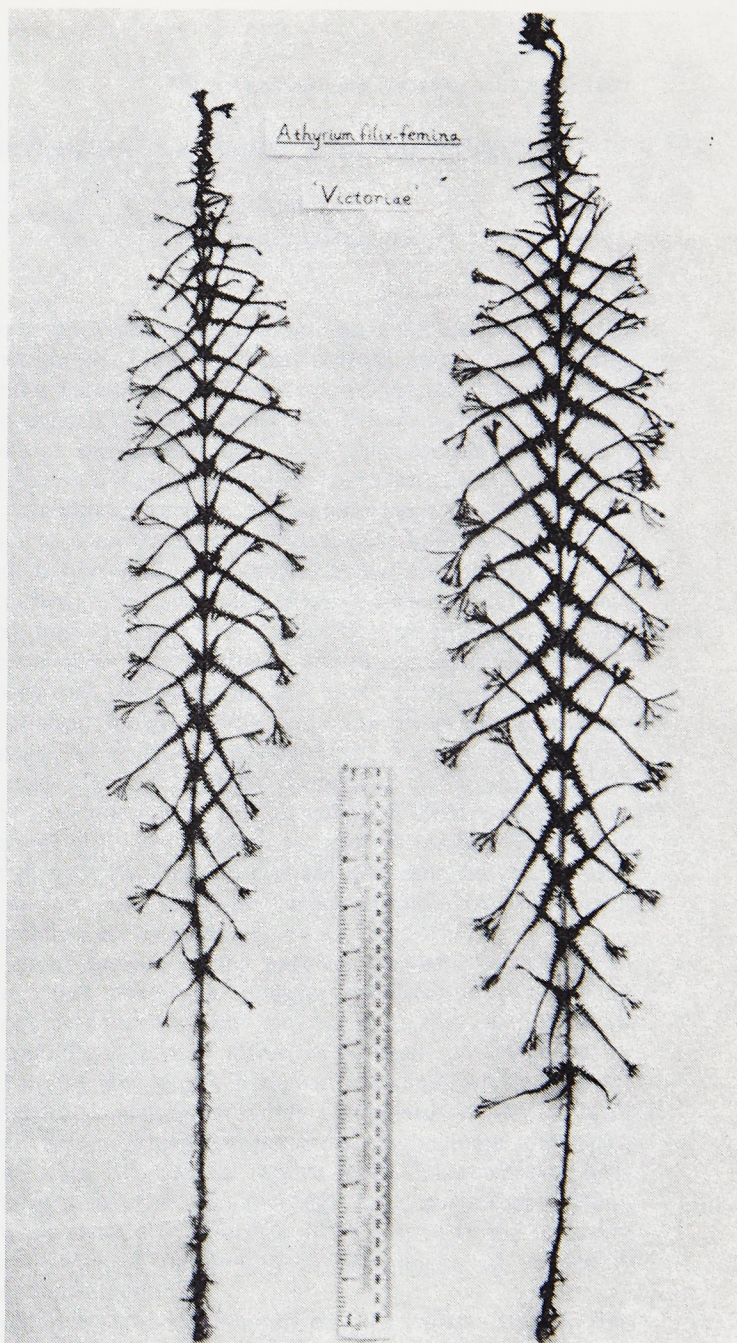
ACKNOWLEDGEMENTS

We are very grateful to the residents of Drymen and district who patiently permitted us to wander through their well kept gardens in search of the Buchanan Fern. Especial thanks are due to J. W. Dyce of the British Pteridological Society for his invaluable help in piecing together the historical background to our quest.

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Buchanan Fern (*Athyrium filix-femina* var. 'Victoriae') Photo: J. Mitchell

RECONSTRUCTING FORMER BIRD COMMUNITIES

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My concern in this note is to consider how far, and how reliably, we may reconstruct the birdlife of past periods and account for the changes that have taken place. The first point to emphasise is that in an historic and densely-settled country like Britain man has long been the chief modifier of birdlife, that is of the absolute and relative abundance of species. Human influence has been direct, and it has been indirect through effects on the environment. In 1981 it was astonishing to find a report that ecologists have still not fully taken this point, and to have it put forward as something novel (Tittensor 1981). Little reflection on economic history is needed for the many ways in which human activity is likely to have affected different species to become apparent. This is of course the case everywhere in the world where man has settled; the trick is to document the ornithological changes independently and relate them to the principal human influences, rather than arguing wholly from human activities which 'must' have affected birdlife. There is a great temptation to extrapolate the presumed mix and density of birds from modern information about habitat preferences and historical information about changes in habitats. Data on modern bird censuses and data on past changes in land use are both easier to come by than direct historical information about birds.

Hard data about birdlife in the past are plentiful enough in an absolute sense, but they are patchy and scattered about in innumerable obscure sources. For any one locality or period or species (or even family) the information may be exiguous or non-existent. Perhaps the largest body of numerical information for parishes in England is contained in the churchwardens' accounts of money paid for 'vermin' killed and presented for payment under pest control statutes from the time of Henry VIII. These accounts have never been fully published or analysed (but see Elliott 1936). Nevertheless, while there are inevitable difficulties in trying to codify them, they do contain a national total of millions of reasonably precise and dated observations.

From approximately the seventeenth century we also start to find reports by individual naturalists. By the nineteenth century many naturalists were banded together in county and national societies and other networks, and this generated more published records. Comparatively few of the resultant observations are both voluminous

and precise, and too many suffer from the equivalent of the ultimate sin of museology — they lack a provenance. The egg collections and collections of stuffed specimens of Victorian times are particularly errant in this respect; often one simply does not know where the eggs or specimens were taken.

The historical literature does however occasionally contain a gem, the classic being the eighteenth-century *Journals of Gilbert White* edited by Johnson (1970). Although even with White's *Journals* there are the standard problems of interpreting diary entries, of knowing just what was and was not consistently included, much may be derived from them. There are also some well-known contemporary printed sources in which birdlife is here and there described, such as the Statistical Accounts for Scotland, to mention a single example. Among documentary sources, estate game books sometimes contain reasonably consistent data; access to them is however not guaranteed, and I heard recently of one estate in the north of Scotland which would not let someone who had analysed the bags take the graphs away from the office. Wildfowling records are generally much sparser than game books, but some do exist and extracts have been published, such as those from Peter Hawker's early-nineteenth century diaries (Parker 1931).

All in all we have to be grateful for any reasonably precise record we can find in historical sources. Patchy is perhaps too kind a word for any cross-section of former birdlife that might be constructed from the assortment of observations. The lace curtain formed of hard data of these kinds has all sorts of holes in it. Often the only groups of birds covered are game, wildfowl, and 'vermin' (including birds of prey). Thus hard data are not only expensive in time spent searching through miscellaneous sources, and the searches are frequently 'fishing expeditions' without much of a catch, at the end of the day what is trawled up tends to be unrepresentative. Contemporary comment, rather than actual observation, does occasionally make it possible to identify certain changes in abundance and proposed reasons for them. As an instance, Rev. R. P. Carrington, Rector of Bridford, Devon, on the edge of Dartmoor, made notes in 1838-41 on land reclamation and decreases in the abundance of some species to demonstrate that 'the increase of population and the clearing of land greatly influenced the habits of birds' (Gotto 1936). But here we are already straying from 'hard' data which are locality and date specific.

Soft data are cheaper to come by, at least when they are generated in our own day. I refer here to accounts built up by extrapolating from lists and counts of species observed today, or recently, in given types of habitat. Thus we might say that because

the Stone Curlew *Burhinus oedichemus* was commoner in the mid-twentieth century on chalk downland than on arable land, the species 'must' have been a relatively common one in previous centuries before so much of the down grass was ploughed. This is of course plausible and stray old records even seem to confirm it. But there are not many such records and we do not truly know what the Stone Curlew's past status was; the inference may be one of the harder of the 'soft' inferences about a former status.

Clearly habitats are malleable. We have evidence on the big swings in agricultural land use over the past two or three centuries, and less reliably, or at any rate in less detail, for much longer. The central variable has been the extent, or proportion, of arable land. The main influence on this has been the changing level and structure of prices for farm products. Relative prices, or more correctly the expected profits for which they are to some extent a proxy, are what induced farmers and other occupants of the land to alter its use. Of course we also need to know what techniques of farming were adopted, for there are many different crop mixes and husbandry methods that were used on the sown arable. Overall we do indeed know something of the changes that have taken place historically in the extent, nature and intensity of agricultural land use, through historical research quite unconnected with any interest in natural history. Since birdlife differs according to land use, and in a general sense modern bird distributions are known, ecological history can be made to be in principle a derivative of economic history. The root explanation of ornithological change is seen in this fashion to lie in the social sciences, not in the natural sciences.

This is certainly so. Man is the dominant animal and has for a very long time arranged the environment around him, as well as impacting directly on other species, so as greatly to affect their life chances. The danger to which I am alluding arises from generalising about the presence or abundance of other organisms solely from considerations of the suitability of the habitats and other effects we know to have been produced by human action, but where we do not have direct data about those other organisms. In practice an ecological historian would derive his account of the past from a mixture of the two sorts of data. In so doing it is easy to go wrong (in terms of what is later found out) without an immense, loving and detailed knowledge of landscape history and the habitat preferences of each species. Further, there are likely to have been second order effects which are hard to allow for. By this I imply that whereas some immediate repercussions of changes in land use are not difficult to envisage, say the decrease of certain species, one has to be very sure that the same economic and agricultural changes have not led to compensating

alternative niches elsewhere in the vicinity. 'Woodland' species certainly increased with the cutting of the North American forests, presumably because there was a big increase of scrub, secondary woodland, and 'edge' (Jones 1974). The dangers of arguing from the general to the particular and back again are however real ones. Endless searching for scraps of hard data is always needed. For instance, without good hard data one might well have come up with the surmise that the Wood Pigeon *Columba palumbus* increased in numbers with the increase of fodder crops and copses and shelter belts (it is an edge nester and likes the ecotone), and indeed nineteenth-century notes support this interpretation. But without specific comment by still-earlier naturalists would one have guessed that the Wood Pigeon was once rare enough to bring in, if not the eighteenth-century equivalent of 'twitchers', at least the gawpers?

There is just enough hard information to couple with the land-use and agricultural history of lowland England for the following scheme to be built up:

The late seventeenth-century saw the start of extensive, permanent ploughing of grasslands on the chalk and limestone uplands and some light sandy lowland soils. Conversely the clay vales, which had been crucial in the production of wheat, tended to go down to permanent pasture on which bullocks and sheep were fattened. The mileage of hedgerows was multiplied (by a large factor) with the enclosure of common land and open fields. There are shreds of direct observation to support the effects one might imagine on the light-soiled uplands: a decrease in the numbers of several ground-nesting grassland species. The changes elsewhere are difficult to relate to ornithological evidence, there is so little of it. Modern analogy suggests what may have happened: counts in the remarkable open fields surviving at Laxton, Nottinghamshire, and on neighbouring enclosed land show a much higher density and number of passerine songsters on the latter, suggesting the direction of change when the enclosure hedges were set (Moore 1967). In some vale districts orchards also expanded during the late seventeenth and early eighteenth-centuries, and the vermin kills of the time accounted for vast numbers of Jays and Bullfinches, as well as many Red Kites and Buzzards probably exterminated as potential threats to poultry and lambs (Jones 1972).

In a second phase of the extension of tillage, from the middle of the eighteenth-century, cereal, clover and turnip cultivation intensified. A parallel increase in the numbers of Wood Pigeons and House Sparrows *Passer domesticus* may be detected in documentary and printed sources. At the same time reclamation and drainage schemes kept up a countervailing pressure on grassland and wetland

species, the decrease of the Great Bustard *Otis tarda* being a case in point. The picture is less clear in Scotland and would warrant a detailed search in local records. The land use changes took place in two directions at once. Between 1750 and 1825 there were developments like those in England, with a 40 per cent expansion of the farmed area and a rise of 100 per cent in productivity. However former arable land at high altitudes was abandoned to upland grass and moor (Parry 1980). The ornithological implications await assessment.

All told, it seems likely that intensive farming, a near-maximum in the cultivated area, a dense rural population, game preservation, and recreational shooting and egg collecting, meant that man exerted his greatest pressure on birds historically in Britain about 1870, just before the Great Arable Depression began once again to shrink the extent of land under the plough and shift population rapidly to the towns. This cannot be demonstrated from ornithological data; it is an ecological inference derived from economic history.

The counterpart of arable slump in Britain was the expansion of arable acreages overseas, in the newly-settled grasslands of the temperate zone. This synchronised ploughing and burning of grassland and forest around the world was on a truly massive scale, involving gains of hundreds and thousands per cent in the arable acreage of several countries between 1870 and 1910. Because it is thought to have released more carbon dioxide into the atmosphere than the burning of fossil fuels during the twentieth-century, this has been called the first and most significant of man's modifications of the environment at the global level (Wilson 1978). Considering that in the United States, Canada, Australia, Argentina and Uruguay alone some 105 million additional hectares were ploughed up in the space of forty years (Grigg 1974; 1980), we may equally anticipate that there were massive effects on birdlife. The fragments of documentation I have examined in the United States and Australia suggest just what one would expect, that is to say, striking decreases in the (larger) species of open grassland and an increase in 'pest' species associated with cereal monoculture. If anyone is looking for a topic in macro-ecological history, here it is, with the added advantage of the comparative approach that some of the inferences and ideas of where to search for evidence will surely be transferable between countries.

Data are scarce and will remain so, compared with the probable scale of the land use impact. Yet everything is relative and it is surprising and a little disappointing to a historian to find that most ecological reconstructions relate to prehistoric times. It is inconceivable that prehistoric man had as dramatic, intricate or indeed recoverable an effect on birdlife as historic man had.

Nevertheless, while the alteration of habitats in historical times is quite well attested and contemporary sources permit some of the effects to be described, the full story — and I emphasise story — can only be told if the gaps are filled by extrapolating from modern censuses of various habitats, region by region and country by country. I have stressed the quite different quality of the two types of evidence. The gaps are huge and the pitfalls of extrapolation are many. The danger is of assuming that birds are as malleable as land use. In reality some poorly understood genetic constraints seem to limit their adaptability (see Murton 1971). An example is the Chaffinch, which has decreased on farmland where there are few spring caterpillars to be found, but lacks the innate capacity to adjust by breeding in late summer when food would be available for its nestlings. What has happened to the Chaffinch is thus difficult to deduce from changes in land use pure and simple; in a sense the species has overreacted to the spread of intensive husbandry. There is therefore a special and unexpected need for caution. Perhaps it may be suggested that published extrapolations from land use history-cum-modern bird censuses should be distinguished (by italic type?) from reconstructions based on hard historical evidence. Extrapolations are not science fiction, but they are not quite scientific history either.

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R L S AT BRIDGE OF ALLAN

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David Angus

We must remember that in the 1850's the village, once a mere clachan, was burgeoning into the popular, prosperous spa that made it the Queen of Scottish Watering Places in the late 19th century. In 1848 the railway extended itself past Bridge of Allan, and increased its accessibility. It lay within an hour's run of Edinburgh and Glasgow.

Both Mrs. Stevenson and Louis were subject to spells of illness. Mother and son shared a pulmonary weakness. It is doubtful if 'the waters' could have helped either of them, but the mild climate, the sheltered setting, the beautiful rural situation — the village was much smaller and more rural then than now — all beckoned invitingly to the family plagued by the wind and the rain and the cold of Auld Reekie. In Bridge of Allan there were good hotels and a multitude of gracious, well-appointed lodging-houses; villas with spacious walled gardens: there was room there for several branches of a family to come at the same time to the same place, so that children who were kin could play and adventure together in new and fascinating surroundings. We find that usually other members of the large Stevenson and Balfour families were in Bridge of Allan at or about the time when Tom Stevenson, his wife and son were there, in lodgings not far away.

For another account of Stevenson's many visits to the village, the reader should consult Canon J A MacCulloch's *R L Stevenson and the Bridge of Allan* (Smith, Glasgow, 1924); but here is the story in outline, with some speculations of my own.

R L S was first taken to 'the Bridge' at the age of 2½, for a visit which lasted five weeks. We do not know where he stayed, exactly, but it was in lodgings in the village, which in those days meant at Carse level.

Mrs Stevenson's diary, on which we must draw frequently (it is now in the Beinecke Stevenson Library at Yale), tells us that the infant Lou was taken to church at Logie Kirk, where he saw two babies 'having their faces washed' (being christened), and to the Free Church, which either meant the newly-erected Chalmers Church or the old Free Kirk of 1844-53, in Keir Street. His placidity and good behaviour in church evoked general admiration.

The trio were back in 1857 for about a month, in April and May. As often happened, they could not find lodgings immediately, and put up at the Queen's Hotel for a few days, until they could find

108 a place. They struck lucky, for they found themselves soon in Mrs Haldane's lodgings, Viewforth House. This stands at the head of the Well Brae, or the U P Brae as it was called after a church at the foot of it — the United Presbyterian Church, now vanished.

Mrs Stevenson thought Viewforth 'a delightful house', and evidently they all did, for they returned on three occasions in the next three years, for prolonged stays, sometimes with relatives. Viewforth, now a nursing-home, was and is a large dignified residence with an elevated garden near the edge of the raised beach that marks the southern boundary of the plateau which was then called Upperhill. The garden, smaller then than now, became little Lou's happy hunting-ground. When his aunt, Mrs Jane Warden, found him playing there with his toy gun, he told her gravely that he was 'hunting blawboks'. Blawboks are a species of African deer — the word is Dutch — and he had heard of their being hunted in a novel which he had just had read to him — *The Young Jaegers* by Mayne Reid. Lou was already an outdoor boy, already infusing a scene with an imagination fed by fiction and romance.

The 1858 visit commenced less happily. It began in early May, and as usual the family proceeded first to the Queen's. But this time Lou was ill when he arrived there, and during the five-day stay at the hotel, a local doctor, Alexander Paterson, was called. He diagnosed bronchitis.

It is worth pausing here for a moment to study Paterson, who became one of the place's great champions and leading lights: a J P, a distinguished botanist and horticulturalist with an international reputation, an antiquarian and collector, and the Medical Officer of Health until his death in 1898. He was a natural leader, a fiery and muscular Christian who rode a terrifying horse called 'Satan', and became father-figure to the entire neighbourhood. The Paterson Clock stands as a memorial in his adopted town, a few yards from the site of his first house in 'the Bridge', at The Cross.

I know that, till to-morrow I shall see the sun arise,
No ugly dreams shall fright my mind, no ugly sight my eyes.

But slumber hold me tightly till I waken in the dawn,
And hear the thrushes singing in the lilacs round the lawn.

It was probably during convalescence that Louis was sent on errands to Farie's the Chemists; and if he did visit the shop for the first time on this occasion, and alone, it must have been a traumatic experience. In an autobiographical fragment *Memoirs of Himself*, written in San Francisco in 1880 but not published (at his own request) until after his death, Stevenson wrote as follows:

- 'Fairy, the hunchback druggist of Bridge of Allan, was a
- terror to me by day and haunted my dreams by night . . .'

It is interesting that he spells the name FAIRY. Gilbert Farie occupied the shop in Henderson Street still operating as Gray's the Chemists.

From the Queen's Hotel, the sick boy went with his parents to Miss Robertson's Lodgings or Kenilworth House, in Kenilworth Road, Upperhill. The Stevensons were there for 11 days. Lou's favourite playmate, his golden-haired cousin Henrietta Traquair, also from Edinburgh's New Town, appears to have been with Balfour relatives in Mineral Bank House nearby, on the north side of Henderson Street. Possibly her brother Willie was there too.

Finally the Stevensons moved on once more to Viewforth, where they spent a month.

Kenilworth appears to be the setting of the poem 'A Good Boy' in *A Child's Garden of Verse*, which (as we know from a letter he wrote to Henrietta in 1883) was inspired by Bridge of Allan —

I woke before the morning, I was happy all the day,
I never said an ugly word, but smiled and stuck to play.

And now at last the sun is going down behind the wood,
And I am very happy, for I know that I've been good.

My bed is waiting cool and fresh, with linen smooth and fair,
And I must off to sleeps-in-by, and not forget my prayer.

In the 1850's, Farie was not only the spa's pharmacist; he was also its publicist. *Farie's Guide to Bridge of Allan*, written and published by himself, went into three editions in a few years, and he appears to have handled all the Bridge's advertising and publicity for a time. In addition, and perhaps most importantly, he was sole housing manager, which meant that all the multifarious letting of rooms and houses must be done through him. It was a position of unique power in the growing boom town which (he claimed) 60000 visitors came to per annum. Farie was a leading citizen, a most useful and able man, involved in laying on musical concerts, founding the Rifle Volunteers during the Crimean War, and the early agitation to have the village made a burgh.

Nevertheless the boy Stevenson hated and feared him. In the *Memoirs of Himself* Stevenson claimed that despite his terror, he always used 'a child's friendliness' towards Farie when that 'poor, vain man' deigned to notice him. Be that as it may, if we look at 'Robin and Ben', one of the poems called Moral Tales in the little book, *Moral Emblems*, which he and his step-son 'published' in the

- 110 early 1880's, we find a dialogue between Robin, a pirate (evidently R L S) and Ben, a greedy and unscrupulous apothecary (almost certainly Gilbert Farie as R L S saw him). The setting of the poem is Wales, but everything else suggests the continuation of a childish revulsion into adult life, and indeed a desire to transfer that revulsion to young Lloyd Osborne. The poem is too lengthy to quote in full, but here is one section. Ben is speaking —

Yet I nor sought nor risked a life;
I shudder at an open knife;
The perilous seas I still avoided
And stuck to land whate'er betided.
I had no gold, no marble quarry,
I was a poor apothecary,
Yet here I stand, at thirty-eight,
A man of an assured estate.

'Well', answered Robin — 'well, and how?'

The smiling chemist tapped his brow.
'Rob', he replied, 'this throbbing brain
Still worked and hankered after gain;
By day and night, to work my will,
It pounded like a powder mill;
And marking how the world went round
A theory of theft it found.
Here is the key to right and wrong.
Steal little but steal all day long;
And this invaluable plan
Marks what is called the Honest Man.
When first I served with Doctor Pill,
My hand was ever in the till;
Now that I am myself a master
My gains come softer still and faster.
As thus: on Wednesday, a maid
Came to me in the way of trade;
Her mother, an old farmer's wife,
Required a drug to save her life.
'At once, my dear, at once,' I said,
Patted the child upon the head,
Bade her be still a loving daughter, —
And filled the bottle up with water.

'Well, and the mother?' Robin cried.

'O, she' said Ben, 'I think she died.'

Later, Gilbert Farie, I think, became Edward Hyde in *Jekyll*

and Hyde. If you examine the book carefully, you find that Hyde was deformed in some unspecified way, and at one point appears as a hunchback. Jekyll, by the same token, was Dr. Paterson; Stevenson's description of Jekyll applies exactly to Paterson — 'a large, well-made, smooth-faced man . . . with something of a slyish cast, perhaps, but every mark of capacity and kindness'.

The 1859 visit was spent entirely at Viewforth, and lasted some three weeks in June and July, before the family moved on to a tour of the rest of Perthshire, Bridge of Allan being in that county then. Mrs Stevenson's diary gives no other details of this sojourn at the spa. The boy R L S wrote his own account of the entire holiday, called *Travels in Perthshire* — or rather he dictated it to his mother, and added his own illustrations. The manuscript, never published, was sold in 1914.

I would guess that in 1859 Lou's legs, longer and stronger, carried him at least as far as the cave beside the Allan, now known as Stevenson's Cave. In his twenties he was drawn back there more than once. Here he is, writing from Dunblane to his friend Charles Baxter in March 1872 —

'I came yesterday afternoon to Bridge of Allan, and have been very happy ever since, as every place is sanctified by the eighth sense, Memory. I walked up here this morning (three miles, tu-dieu! a good stretch for me), and passed one of my favourite places in the world, and one that I very much affect in spirit when the body is tied down and brought immovably to anchor on a sickbed. It is a meadow and bank on a corner on the river, and is connected in my mind inseparably with Virgil's *Eclogues*, *Hic corulis mistos inter consedimus ulmos*, or something very like that, the passage begins (only I know my short-winded Latinity must have come to grief over even this much of quotation); and here, to a wish, is just such a cavern as Menalcas might shelter himself withal from the bright noon, and, with his lips curled backwards, pipe himself blue in the face, while Messieurs les Arcadiens would roll out those cloying hexameters that sing themselves in one's mouth to such a curious lilting chant.

In such weather one has the bird's need to whistle; and I, who am specially incompetent in this art, must content myself by chattering away to you on this bit of paper. All the way along I was thanking God that he had made me and the birds and everything just as they are and not otherwise, for although there was no sun the air was so thrilled with robins and blackbirds that it made the heart tremble with joy, and the

leaves are far enough forward on the underwood to give a fine promise for the future.'

Almost three years later he wrote this to another close friend, Mrs Frances Sitwell. (The month was February) —

'On Friday I went to Bridge of Allan. A beautiful clear sunny winter's day, all the highland hills standing about the horizon in their white robes. It was not cold. I went up my favourite walk by the riverside among the pines and ash-trees. There is a little cavern here, by the side of a wide meadow, which has been a part of me any time these last twelve years — or more. On Friday it was wonderful. A large broken branch hung down over the mouth of it, and it was all cased in perfect ice. Every dock-leaf and long grass, too, was bearded with a shining icicle. And all the icicles kept dropping, and dropping and dropping, and had made another little forest of clear ice among the grasses and fallen branches and dockens below them. I picked up one of these branches and threw it on the ground; and all the crystal broke with a little tinkle, and behold! a damp stick.'

Long before this the cave — actually the adit of a mine that was never made — must have acted as a focus for Lou's childish imagination. Much transformed, it was to become Ben Gunn's cave in *Treasure Island*.

If 1859 was arguably the year of the cave, I think 1860 was the year of the island — or perhaps of two islands. This visit was to be a long one, of two months. It commenced again with a week at the Queen's; then came three weeks at Viewforth and finally a month at Mine Cottage (now Minewood Cottage), in Abercromby Drive. Henrietta Traquair stayed with the family for a time when they were at Viewforth.

I have mentioned two islands. One was the islet near the confluence of Allan and Forth. the first island he ever stood upon, which he described in an essay *Memoirs of an Islet* and also in *Kidnapped* where it sheltered David Balfour and Alan Breck as they waited to cross the Forth —

In Allan Water, near by where it falls into the Forth, we found a little sandy islet, overgrown with burdock, butterbur and the like low plants, that would just cover us if we lay flat. Here it was we made our camp, within plain view of Stirling Castle, whence we could hear the drums beat as some part of the garrison paraded. Shearers worked all day in a field on one side of the river, and we could hear the stones going on the hooks and the voices and even the words of the men talking. It behoved to lie close and keep silent. But the sand of the little

isle was sun-warm, and green plants gave us shelter for our heads, we had food and drink in plenty; and to crown all, we were within sight of safety.

David Morris wrote a book — *Robert Louis Stevenson and the Scottish Highlanders* (Eneas Mackay, Stirling, 1929) — in which he argued that Stevenson could have gathered much of the material he used later in *Kidnapped* in or about Bridge of Allan. Certainly in 1881 he contributed to a correspondence in the *Stirling Observer* about Rob Roy's son, whom he wrote into the novel.

Another, larger, island, where Allan meets Forth, may originally have served as a play-ship for Lou, floating in an imaginary anchorage. Counterparts of features in the text and map of *Treasure Island* are to be seen on the landscape round the carse. There is a theory that, when planning the novel in Braemar in 1881 — or rather when drawing the original map, which his publishers lost — R L S, as it were, turned his childhood fantasy outside in, so that the features around 'the anchorage' were transferred on to the ship, which then became an island — as indeed it really was. Similarly, features around Stevenson's Cave were transferred inside the cave, e.g. ferns, water, wood, etc.

There are two crosses, marking treasure-caches on the map in the novel. In reality, one seems to indicate the garden at Viewforth, and the other the Fairy Knowe. The Knowe, as well as being a celebrated viewpoint, was recognised as possibly an archaeological site, but it was not excavated until 1868, when a 'dig' was carried out under the supervision of Sir James Alexander of Westerton and Dr Alexander Paterson. It was discovered to be a Stone Age burial. But before 1868 we may be sure a great treasure was considered as amongst the possibilities. Perhaps in Sir James Alexander we have the original of Squire Trelawney, and in Dr Paterson we have Dr Livesey. Who can say?

If Paterson befriended Stevenson, he may well have planted some of the seeds of *Treasure Island* in that fertile imagination. Paterson grew tropicana in his garden, and may have mentioned that the Forth Valley was once a great inlet of the sea.

At the end of June 1860 Louis certainly had renewed contact with Dr. Paterson, for the family, with some relatives, took part in one of the annual excursions to the top of Dumyat organised by Paterson. This hilarious affair is best described in the poem R L S and his mother wrote at Mine Cottage that evening. It ends —

At length we reached the lower ground

And saw the donkey safe and sound

They ne'er had stirred from the green mound

Where they did feed

The weary mounted, off we go
In jovial humour — no one slow
Excepting Tom — (who croaks you know)
At ilka job

Mine Cottage reached, we close the door
And climb Dumyat o'er and o'er
While even Thomas stops to bore
For denner's dished

Our meal weel ended we have writ
All our adventures small and grit
Let Tom beat us if he sees fit
That's — if he can

In 1861 and 1862 came two brief, little-known and not very important visits; one was to Louis Villa (now Ferguslea) in Henderson Street, and the second to the Royal Hotel. Bad weather marred and curtailed these visits, and a five-year gap ensued.

But in 1867 the Stevensons risked another long stay, of six weeks, in March and April. They stayed at Darnley House in Henderson Street.

Sometime during this stay Louis and Charles Stevenson, his eleven-year-old cousin, walked down to the confluence of Allan Water and the Forth and carved their initials on trees there — I suspect the trees which acted as foremast, mainmast and mizzenmast on the original *Hispaniola*. Perhaps even then Louis was mourning his childhood. Many years later Charles took his own son, David, down to look for the trees and the carvings, but both had vanished downstream, victims of erosion. (Half the old island is now gone and the other half is part of the river bank.)

On the 4th of March, 1872 (by which time he was studying for the law, having given up engineering), Louis came over alone and spent one night at Bridge of Allan, presumably at the Queen's. But the next day he walked up by the Allan to Dunblane. There he spent at least a month in semi-rural retirement, staying in a hotel. He had just been ill, and indeed he was ill again during his time in Dunblane. On other days he wandered down the banks of the Allan and wrote verses, including the celebrated Lallans poem *Ille Terrarum*, about his beloved summer haunt Swanston. This last he evidently wrote along the Darn Walk.

In the very last week of 1872 and the first three weeks of 1873 Louis and Bob Stevenson, his artist cousin and a great crony, had an odd little holiday at the Queen's Hotel. Again R L S had been ill, and

the visit was to help with his recuperation — or that was the intention. But things did not really improve until Louis spent some time at Great Malvern with his mother shortly afterwards.

In Bridge of Allan for four weeks Bob and Louis shared the room on the first floor, N E corner. It was a cold room and the weather could not have helped. In a letter to his mother Louis makes no mention of having been out. Evidently the two young men could spend whole days in their room, Bob painting by the window and Louis presumably writing. As we learn from a letter to Charles Baxter, Louis at this time felt very ill and depressed — he believed he was about to die — but he says nothing of this in a cheerful-sounding letter to his mother. Instead he describes the subject of Bob's current painting — 'a bit of wet road at the corner of the bridge, with our window-frame and the golden bird on the top of the hotel door lamp.' He writes of 'two girls in blue, who sit and sew all day long in the recess of a bow window' in the house opposite the hotel. These were, as Stevenson suspected, two daughters of Peter Jaffray the plumber, whose shop was evidently on the ground floor of the house. The girls were then in their early teens. One became a milliner.

Later in that letter R L S describes 'the lighthearted if somewhat vulgar circle in the billiard-room' (now a lounge). 'There is' (he continues) 'the doctor' (presumably Dr Paterson), 'there is Mr Anderson, with his slavish reproduction of all Mr John Brand's witticisms, there is Mr John Brand, the funny man — licensed, none others are genuine — himself, with his old billiard-room jests ... Then there is Mr Brand's lantern, and his highland cloak, and the tale of how he, John Brand, right royally attired in the garb of old Gaul, presented a nosegay to the Queen of the Netherlands. And then there are musty traditions of former memorable scores, and games and players; and sad feeble gossip about the freemasons.'

'Mr Anderson' was Alexander Anderson, who had become landlord of the Queen's not long before; 'John Brand' may have been Jim Brand (R L S perhaps misheard the Christian name). His grandson until recently owned a newsagent's shop on the site of the Jaffray house and shop, opposite the hotel. The Dutch queen had come to Keir House on a private visit two months before, and the nosegay was probably presented when she inspected Keir Mains Farm — Brand had previously been employed in Keir estate land, though he was now with the gas-works. The nosegay was probably a tactful way of defeating agricultural odours.

I like to think that there may be an echo of the billiard-room circle in the short story *The Body-snatcher* that R L S wrote in 1881 at Kinnaird Cottage, near Pitlochry. At the beginning of that grisly

tale we find a company of four in an English inn — not playing billiards but gossiping and drinking. One is the author (and Stevenson almost certainly made himself a temporary member of 'the circle', because he played billiards soon afterwards at Malvern); one is the landlord; one is a character known as 'The Doctor', dressed in a remarkable cloak; and one is the village undertaker — a macabre touch in keeping with the tale. In Stevenson's words, 'The Doctor's blue camlet cloak was a local antiquity, like the village spire.' It does look as if the doctor and Jim Brand were combined to form the fictitious Dr Fettes.

Stevenson's last recorded visit to Bridge of Allan came in 1875, the year of his graduation from Edinburgh University. His father had been ill, and was still not well. He spent some time at Bridge of Allan recuperating, taking exercise and fresh air and probably medicine. His law student son came over twice in January to join his parents for a day or two. These were fleeting 'duty' visits. The only event of mild interest during them was a visit paid to the recently-opened Smith Institute in Stirling, one wet Saturday afternoon. In February Stevenson went again, not this time to see his parents. He did not even stay overnight, but went directly up the Darn Walk for the last time to Dunblane, where he stayed for a night or two (this is the walk described in the letter to Mrs Sitwell).

The final visit came in June, while he was studying for his final law examination. On Wednesday the 23rd Tom Stevenson had gone to Bridge of Allan alone, still apparently convalescing. Next day Louis went over to see how he was getting on at the Queen's. On the Friday Mrs Stevenson records in her diary — 'Tom and Lou both come home because Bridge of Allan is empty.'

Bridge of Allan, of course, was far from empty, but perhaps she meant there was no-one there they knew. It must be said that after January 1873 Stevenson seems to have had little or no interest in staying in Bridge of Allan. He travelled much — in pursuit of health, literary success, a wife — and perhaps there was neither time nor opportunity.

But there is a good deal of evidence in his writing that Bridge of Allan frequently visited him. I find echoes of the place, or features of it, in such stories as *Thrawn Janet*, *When the Devil was well*, *The Isle of Voices* and *The Beach of Falesa*, as well as the South Seas ballad, *The Feast and the Famine*. Take, for instance, Stevenson's masterly tale in Scots of witchcraft and demonic possession, *Thrawn Janet*. Part of it is set in an old Pre-Reformation burial-ground.

'Abune Hanging Shaw, in the bield o' The Black Hill, there's a bit enclosed grund wi an iron yett, an' in seems, in the auld days,

that was the Kirkyard o' Ba'weary, an' consecrated by the Papists before the blessed licht shone upon the Kingdom.'

At Logie we have an old Kirk and Kirkyard of Pre-(and Post)-Reformation times, also in the bield (shelter) of the Black Hill, with an 'iron yett', and looming above it the Carlin's Craig where the witches are said to have danced lang syne, with the Devil presiding. The reader will recall, I am sure, the eager elder who shot the Devil there with a silver tester, only to find in the morning it was a goat. That incident, with a warlock instead of witches dancing on a rock, is at the heart of Stevenson's other Scots masterpiece *Tod Lapraik* in *Catriona*.

Stevenson was always a great dreamer, and he said there was one valley he went on dreaming about all his life. Well — it might have been Colinton Dell, it might have been Glencorse, or the Mill Glen at North Berwick. But what is the betting that it was — Glen Allan?

ACKNOWLEDGEMENT

Illustrations 'Stirling Castle' and 'Cave' are by courtesy of J. Smith and Son (Glasgow), publishers of J.A. MacCulloch's *R.L. Stevenson and the Bridge of Allan*. 1927.



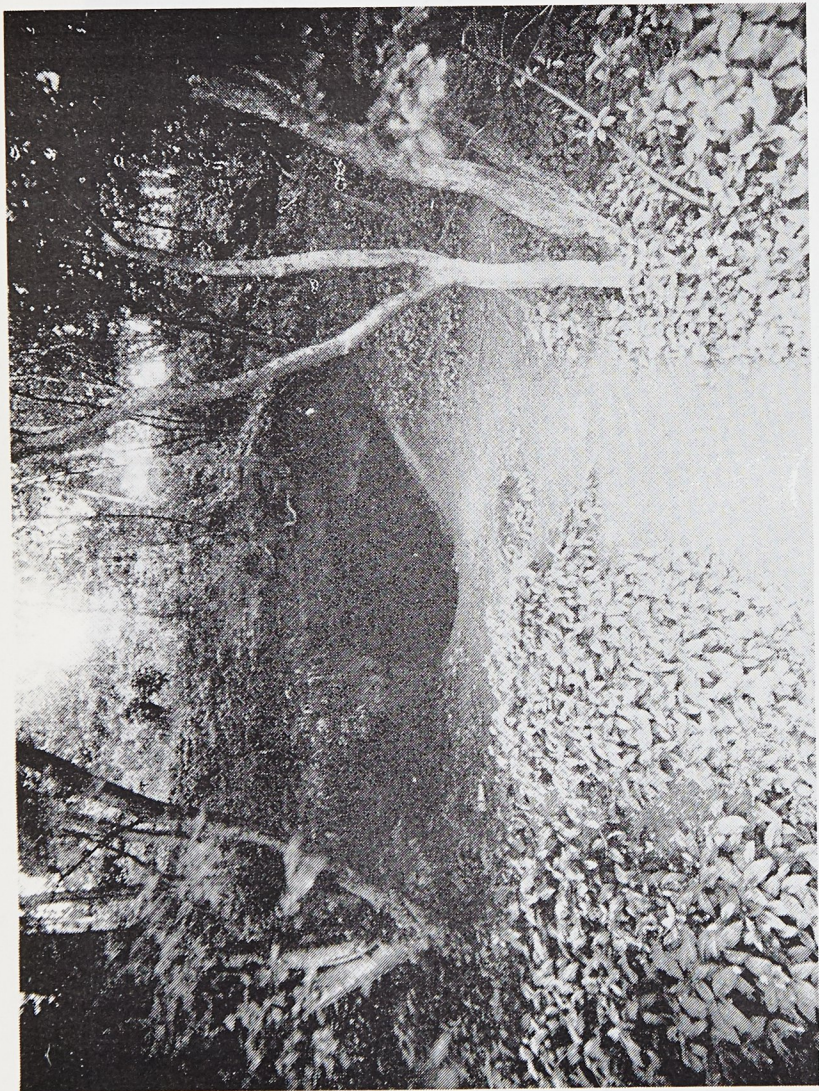
Viewforth House



Kenilworth House



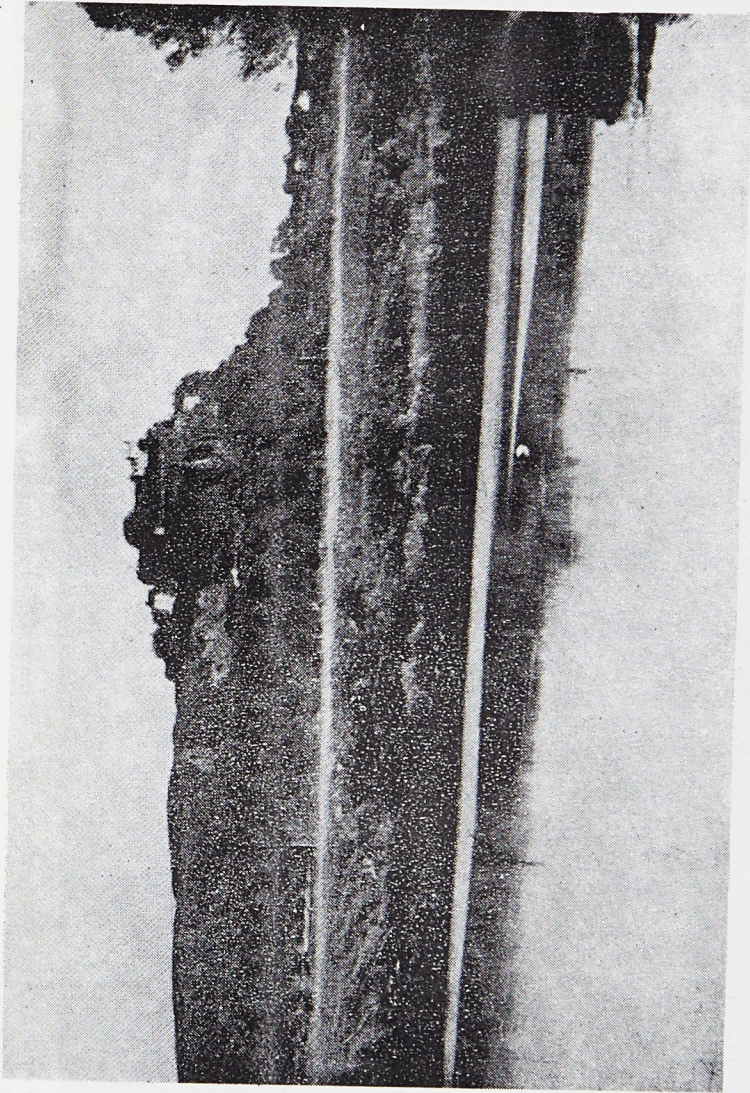
Paterson — self portrait



THE CAVE BY ALLAN WATER.

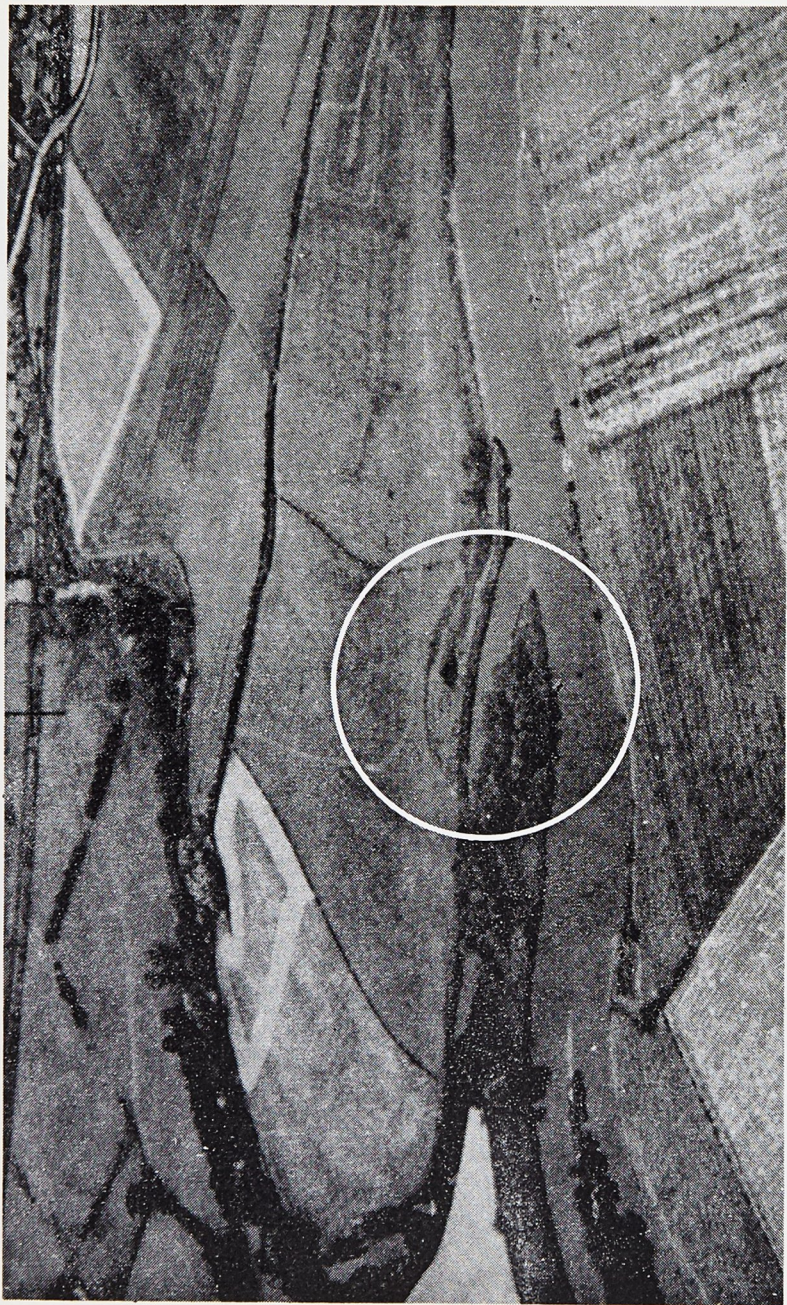
[From Photograph by G. J. Hughes, F.R.P.S.]

"A little cavern, by the side of a wide meadow, which has been a part of me any time these last twelve years—
or more." "Such a cavern as Menalcas might shelter himself withal from the bright noon." R.L.S., in letters,
of 1872 and 1875.



[From Photograph by G. J. Hughes, F.R.P.S.]

STIRLING CASTLE AND THE FORTH FROM THE ISLET IN ALLAN WATER.
"In Allan Water, near by where it falls into the Forth, we found a little sandy islet. . . . Here it was we made our camp, within plain view of Stirling Castle." *Kidnapped*, chap. 26.



Confluence of Allan and Forth from the air. Marked is what remains of the islet that may have been the one featured in RLS's *Treasure Island*.



Minewood Cottage



Darnley House



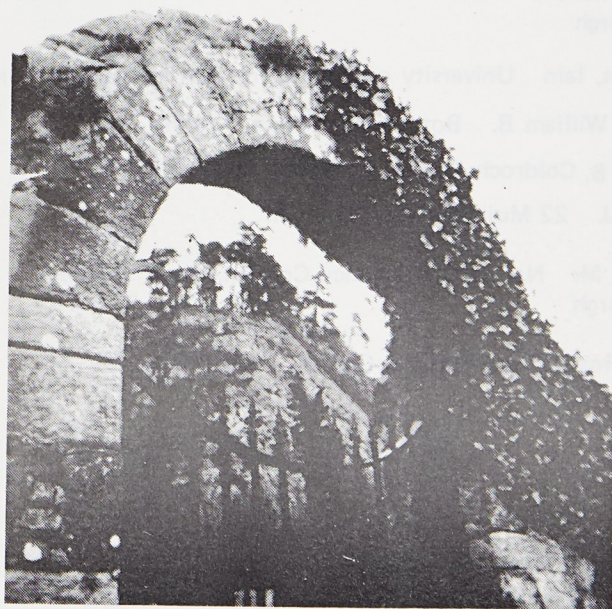
Treasure Island



Treasure Island — lagoon



Logie Kirkyard



Logie Kirkyard Gateway

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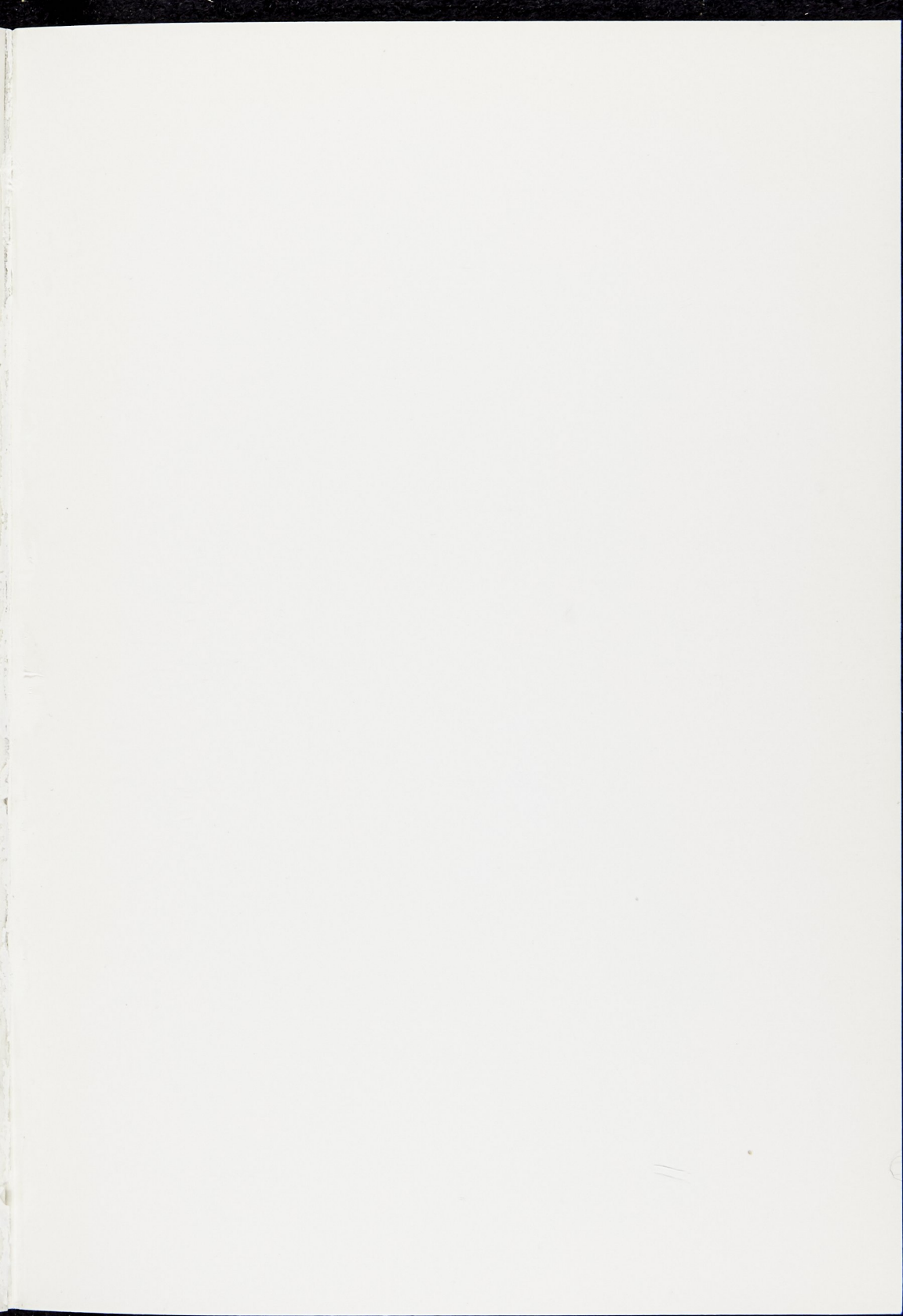
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