The locality is a small, exposed ocean island west of Bergen, Norway, called Kvannholmen (parish of Herdla), near the very top of which (height 23 m.) there is a group of quite good pot-holes. The one illustrated in Fig. 1 (p. 20) is 3·20 m. deep with a diameter of 1 m. Fig. 2 (p. 20) shows the location on the island, and Fig. 3 (p. 24) the position in relation to the surrounding country. Comment is hardly necessary; it will be seen that the location of the pot-holes is very easily explained by the old theory, but is in hopeless antagonism to Streiff-Becker's assumption. No sub-glacial stream could run across this island as long as there were excellent outlets just north and south of it—and besides, the main outlet goes north-west on the other side of the chain of islands.

The assumption that these pot-holes have been formed during an earlier glaciation and have remained while the drainage pattern has changed fundamentally, must be rejected as totally improbable. In late-glacial times the island was submerged and emerged again. We must assume that the erosion that is seen in Fig. 1 (front part of pot-hole broken away), and which has cut another hole in half lengthwise, took place during this period.

MS. received 17 *July* 1951

REPORT ON THE SNOW SURVEY OF GREAT BRITAIN FOR THE SEASON 1950–51

By E. L. Hawke *and* D. L. Champion

As in the previous few years, this report is based principally on returns furnished month by month by an able body of volunteer observers working in collaboration with the Society. There are now some 300 of these. About 50 per cent of them report from land stations well distributed over England, Wales and Scotland (with one representing the neighbourhood of the Mourne Mountains in Northern Ireland), the remainder from lighthouses, light-vessels and merchant ships voyaging in coastal waters. Important supplementary material comes from the serial publications of the Meteorological Office, Air Ministry, and from manuscript data kindly supplied by that Department. Further valuable sources of information are the logs and diaries of individual climbers and leaders of expeditionary parties who study mountain snow conditions as opportunity offers. On this occasion special tribute must be paid to the services of Mr. M. J. Wilkinson (Durham University Exploration Society), Mr. R. G. Sandeman of Crickhowell and Mr. T. J. Ransley of Fort William, the results of whose labours bulk largely in the report. To these gentlemen as well as to all other collaborators—the private observers, the Director of the Meteorological Office and his staff, the Elder Brethren of Trinity House with their lighthouse and lightship personnel, and the many shipping companies whose ships' reports help to extend the observational network around our shores—the directors of the Survey express their most cordial thanks for the assistance given them.

E. L. H.

Metric Equivalents of Inches and Feet

1 in.=0·025 m.	1 ft.=0·305 m.
3 in.=0·076 m.	2 ft.=0·609 m.
6 in.=0·152 m.	4 ft.=1·219 m.
100 ft.= 30·5 m.	2500 ft.= 762·0 m.
500 ft.=152·4 m.	3000 ft.= 914·4 m.
1000 ft.=304·8 m.	3500 ft.=1066·8 m.
1500 ft.=457·2 m.	4000 ft.=1219·2 m.
2000 ft.=609·6 m.	

In general measurements of snow-depth cited in this Report refer to 09·00 hr. G.M.T., or thereabouts.

SEPTEMBER 1950

Early in the fourth week of this rather cold and excessively wet month the season's first snowfall came to some of the higher Scottish mountains. Ben Nevis and Carn Mor Dearg were covered to below 3000 ft. from the *22nd* to *25th*, to below 3500 ft. on the *26th*, *27th* and *29th*, and to below 4000 ft. on the *30th*.

OCTOBER 1950

Fairly widespread snow showers developed over upland areas of Scotland, northern England and North Wales behind a cold front which passed eastward across the British Isles on the *8th*. A cover formed between 2000 ft. and 3000 ft. on many of the mountains from the *8th* to *12th*, and locally this extended to below 2000 ft. at times, particularly on the *10th*, when there was a depth of 0·5 in. at Lanehead (1500 ft.), Durham. Heavy drifting was reported from the Perthshire hills at unspecified heights above 1000 ft. during this period. Towards the close of the month an inflow of cold unstable air from northern Europe brought a spell of wintry weather with unusually keen frosts for the time of year. Squally showers of snow or sleet occurred over much of the country from the *26th* to *30th*, and on the *27th* and *28th* these penetrated to the extreme south of England, Falmouth and Margate being among the places affected. A cover became general above 2500 ft. on the mountains of northern England, Wales and central Scotland; in the Shropshire hills the snow line lay at about 1000 ft. on the *27th* and *28th*. On the latter date a depth of 2 in. was reported at the summit plateau (2300 ft.) of Pen Cerrig Calch, Breconshire. On Ben Cruachan, Argyllshire, the cover descended to below 1000 ft. on the *27th*. Ben Nevis was observed to be under snow to below 3500 ft. on ten days during the month, but only on the *10th* did the coating reach to below 2000 ft.

NOVEMBER 1950

This was a wet and rather cold month with a high prevalence of north-westerly winds. In southern and central England snow was restricted to light scattered showers, occurring chiefly on the *14th*, *15th*, *25th* and *29th*, but farther north substantial falls came frequently to upland districts. A cover was continuous to below 3500 ft. on Ben Nevis throughout the month; on Ben Wyvis and Ben Cruachan to below 3000 ft. from the *8th* onwards; on the Cairngorms to below 2500 ft. from the *9th* onwards; on Ben More to below 2500 ft. from the *11th* onwards; on the Cuillins (Skye) to below 3000 ft. from the *11th* onwards; and on the Snowdon and Carnedd ranges to below 3500 ft. from the *12th* onwards. At intervals after the *14th* the snow line descended to well below 1000 ft. in various parts of central Scotland and northern England, though on Ben Nevis it was never down to 1000 ft. The greatest depths of snow recorded at low and moderate levels were 4 in. at Fairburn (500 ft.), Ross and Cromarty, on the *17th* and *18th* and 7 in. at Elphin (571 ft.), Sutherland, on the *30th*. On the *25th* the layer of snow at 2700 ft. on the High Westmorland Fells was ascertained to be from 4 in. to 6 in. deep. The maximum reported number of days with falls of snow or sleet was 12 at Glen Livet (1050 ft.), Banffshire. In Northern Ireland, peaks of the Mourne Mountains above 2500 ft. were snow-capped from the *9th* to *17th* and again on the *24th*.

DECEMBER 1950

The year ended with a month of notable severity. Over Great Britain as a whole it was the coldest December since 1890, the general level of mean temperature being subnormal to the extent of 5° or 6° F. (2·8°–3·4° C.). There were repeated invasions of arctic air, most of it approaching from north-west via the east coast of Greenland and arriving in an unstable condition. As a result, snowfalls were more frequent than in any month since February 1947. No part

of the country appears to have escaped them altogether. Chew Mount (1600 ft.), Yorkshire, and Ushaw (594 ft.), Durham, both had snow or sleet on 22 days, and a number of stations in Scotland and North Wales, including one or two below 500 ft., on 20 days. Over much of Scotland above the 1000 ft. level and also at Balmoral (927 ft.), Aberdeenshire, a snow cover persisted through the entire month; in northern England as well as in Wales some of the mountains were continuously coated to below 2500 ft. At Felixkirk (540 ft.), Yorkshire, snow lay on 26 days, at Macclesfield (500 ft.), Cheshire, on 24 days, at Driffield (65 ft.), Yorkshire, on 22 days, at Princetown, (1359 ft.) Devon, and Rothamsted (420 ft.), Hertfordshire, on 21 days. Average depths of between 9 in. and 12 in. occurred very commonly from time to time, even at low levels, extending as far south as the Isle of Wight on the *15th*; among the greatest accumulations notified were 24 in. at Clawddnewydd (998 ft.), Denbighshire, on the *4th*, 20 in. at Dalwhinnie (1176 ft.), Inverness-shire, on the *3rd*, 15 in. at Minterne (800 ft.), Dorset, on the *13th*, and 14 in. at Glen Shiel (500 ft.), Ross and Cromarty, on the *5th*, at Scarborough (118 ft.), Yorkshire, and Lowestoft (82 ft.), Suffolk, on the *16th*, and at Chew Mount on the *31st*.

The month was a fairly quiet one, gales and high winds being much less frequent than usual. In consequence of this the snow did not drift seriously in most districts and except in parts of the Scottish Highlands there appears to have been little dislocation of traffic at any time. The maximum depths of drifting reported from stations contributing data to the Survey were 12 ft. on the *5th* between Dalwhinnie and Struan, where the road became blocked for a distance of three miles, 5½ ft. on the *16th* at Aberglanherin (1250 ft.), Radnorshire, 5 ft. on the *18th* and *19th* at Whipsnade (720 ft.), Bedfordshire, and 4 ft. on the *17th* at Bwlchgwyn (1267 ft.), Denbighshire. Because of rapidly decreasing temperature in the unstable arctic air within the first 2000 ft. above the ground the distribution of snowfall varied markedly at places not more than a few miles apart but differing by several hundred feet in altitude. For example, whereas Tavistock at 457 ft. on the western fringe of Dartmoor had snow or sleet on only 4 days and a cover on only 2 days, the corresponding frequencies at Mary Tavy (855 ft.), four miles to north-east, were 13 and 17 days respectively. Similarly in Bedfordshire, Dunstable at 516 ft. reported "snow lying" on 13 mornings, Whipsnade at 720 ft., three miles to southward, on 20. On Ben Nevis the snow cover extended to base level from the *1st* to *6th* and *12th* to *19th*. A party of five who ascended the mountain on the *13th* were swept down by an avalanche for 300 yards. In mid-December ice covered some 7 or 8 square miles of the salt-water Loch Etive (Argyllshire) above Taynuilt, and at times during the month parts of the Caledonian and Forth–Clyde canals were reported to be frozen over.

January 1951

During the first three days of 1951 there was no break in the rigorous weather which had ruled through December. Small depressions passing directly across Britain brought widespread snowfalls, and in many districts these added substantially to the thickness of the layer already on the ground. Above the 500 ft. level average depths of 9 in. to 12 in. were common as far south as Hertfordshire. Below 1000 ft. the deepest covers reported were 14 in. (with drifts to 5 ft.) at Chew Mount on the *1st* and *2nd* and 13 in. at Strinesdale (791 ft.), near Oldham, on the same dates. The whole month was marked by generally unsettled weather. Temperature slightly exceeded the average in the eastern and south-eastern counties of England but was subnormal elsewhere—to the extent of about 2° F. (1·1° C.) in the east and north of Scotland. After the *3rd* there was little snow in the southern half of England. Farther north, however, several fairly heavy falls came with the arctic air which from time to time engulfed Britain in the wake of vigorous Atlantic depressions skirting the north-western seaboard. Such falls were particularly rife in western Scotland from the *9th* to *15th* and again during the last few days of the month. In Renfrewshire undrifted snow lay 14 in. deep on the *10th* and *11th* at South Moorhouse Waterworks (750 ft.)

and from 10 in. to 12 in. deep at Uplaw Moor (510 ft.) on the *10th*, *11th* and *15th*. On the *27th* Glen Shiel had a 10 in. cover. A continuous coating to below 1500 ft. was observed on Ben Wyvis all through the month, and to below 2000 ft. on the Fannich Hills, while on many other mountains the snow line remained persistently at 3000 ft. or lower.

As in December, the general speed of the wind was subnormal and gales seldom occurred, so that few regions experienced drifting of much severity. Below 1300 ft. the maximum reported frequency of days with falls of snow or sleet was 18 at Bwlchgwyn and of days with snow lying 24 at Balmoral. On the *5th* and *6th* it was observed from Wrexham that a more extensive cover existed in the lowlands than on the mountains: this was attributed partly to the prevalence of fog over the plains and in the valleys and partly to the fact that drifting at high levels had left large upland tracts so thinly coated with snow that they were quickly laid bare by the thaw which was in progress.

At a number of low-lying places, chiefly on or near the south and east coasts of England, and also at Colonsay Island, Inner Hebrides, the month passed without snow or sleet.

February 1951

Bleak and continuously unsettled weather characterized this month. Over most of England and Wales and eastern Scotland there was a large excess of rain (it was the wettest February on record at many places in the London area and neighbouring counties), but in western and northern Scotland the general amount of precipitation did not differ much from the average. Intense depressions passed repeatedly over the British Isles and the adjoining sea areas, a majority of them bringing some snow to one district or another. On high ground in Scotland, Wales and northern England the falls were frequent and sometimes substantial or heavy. Braemar (1111 ft.), Aberdeenshire, reported snow or sleet on 23 days, Bwlchgwyn on 20, and Malham Tarn (1297 ft.), Yorkshire, on 19. A cover was maintained throughout the month to below 1500 ft. on the Cuillins in Skye, to below 2000 ft. on the Fannich Hills and Cader Idris, Merionethshire, and to below 2500 ft. on numerous other mountains in Scotland and North Wales. A depression which moved east-north-eastward from the mouth of the English Channel on the *17th–18th* was accompanied in the counties of Perthshire, Inverness-shire and Argyllshire by a long-lived drifting snowstorm said to have rivalled in some places the worst experienced during the previous twenty-five years. Through the effects of this blizzard a passenger train which left Glasgow for Fort William at about 16.00 hr. on the *17th* reached its destination 29 hours late, having become embedded and derailed in a drift some 600 ft. long and 12 ft. to 15 ft. deep at Corrour (1300 ft.), Moor of Rannoch. On roads in that neighbourhood several buses were stranded all night on the *17th–18th*. At levels around 1000 ft. in Iverness-shire, Aberdeenshire, Perthshire and Lanarkshire a number of stations had "snow lying" on 25 or 26 days during the month; in England the maximum reported frequency was 24 days at Malham Tarn, and in Wales 15 days at Bwlchgwyn. As a rule, the average depth of the layer did not exceed 6 in. to 8 in. at moderate altitudes, although Glen Shiel lay under 10 in. on the *18th*. Apart from the 12 ft. to 15 ft. accumulation already chronicled for Corrour on the *17th–18th*, the deepest drifts reported were on the hills above 1000 ft. near Blaircreich, Perthshire, where they attained 10 ft. on the *7th*. At Fairburn numerous power lines were brought down by a heavy fall of wet, clinging snow on the night of the *17th–18th*. At low levels in the southern half of England and in Wales February's snowfall was mostly in the form of passing showers which were seldom heavy. A majority of the stations in these areas came through the month without an appreciable cover.

March 1951

The weather pattern of March had much in common with February's. Mean temperature was generally 2° or 3° F. (1·1°–1·7° C.) short of the normal, while precipitation was again exces-

sive over England and Wales, though rather below average in western and northern Scotland. Snowfalls were frequent and sometimes heavy in many upland districts. Around the 1000 ft. and 1500 ft. levels they occurred on 21 days at Redmires (1127 ft.), Yorkshire, on 20 days at Chew Mount, and Malham Tarn, and at a number of stations, including Peebles (525 ft.), on 18 or 19 days. A cover persisted throughout the month to below 2000 ft. on Ben Nevis and the Fannich Hills, and to below 2500 ft. on Ben Wyvis, Ben More, the Cuillins, Cader Idris and some of the Westmorland Fells, while on many other mountains in Scotland, Wales and northern England the height of the snow line seldom exceeded 2500 ft. Near the 1000 ft. level Dalwhinnie had "snow lying" on 22 days and Braemar on 21. After a blizzard which came with an inflow of arctic air between the *9th* and *11th* the average depth of the cover reached 10 in. at Glen More, Inverness-shire, and 12 in. locally in Aberdeenshire and Banffshire. On the Cuillins there was drifting to 6 ft. on the *11th*. In northern and central Wales a layer of snow 6 in. or 7 in. deep was common at 800 ft. and above on the *12th* and *13th*. At the close of the month the higher Caernarvonshire mountains had been snow-capped continuously since mid-November—an occurrence believed by old folk in Capel Curig to be without parallel in their recollection. Early in March gullies high on the Brecon Beacons were encrusted with huge masses of ice. As during February, most of the snow in lowland England was of the shower type and seldom lay to any depth or for long at a time. There were, however, some substantial falls on the hills, even in the far south. The cover was 6 in. deep on the Cornish moors early on the *7th* and 3 in. deep between Guildford and Hindhead, Surrey, on the morning of the *10th*. On the *29th* western Dartmoor was coated to a depth of 4 in. to 6 in.

April 1951

This was yet another month of predominantly bleak and unsettled weather. The mean temperature was the lowest for April since 1922 in Scotland and since 1941 in England and Wales. Snowfalls were notably frequent. They occurred on 10 days as far south as Minterne, Dorset, on 16 or 17 days at a number of Scottish stations, including Nairn (20 ft.), and on 18 days at Glen Livet. Around the 1000 ft. level in Scotland a cover was reported on 9 mornings at Dalwhinnie, on 8 at Glen Livet, and on 6 at Glen Gavel (839 ft.), Lanarkshire. At Glen Ferness (700 ft.), Nairnshire, an average depth of 6 in. was observed on the *7th*. There was little relaxation of the severe weather which had prevailed since late autumn in high upland northern regions. Snow lay all through the month to below 1000 ft. on some of the mountains in Nairnshire, to below 2000 ft. on Ben Wyvis and the Fannich Hills, and commonly to below 2000 ft. as far south as the Westmorland Fells. Very exceptional conditions were found by a party which explored the upper Cairngorms between the *19th* and *24th*. Progress was difficult, even to experienced mountaineers. In several of the main corries the snowfields were estimated to be at least 30 ft. deep. On the *21st* the Pools of Dee, in the Lairig Ghru pass, were completely buried. On the cliffs extensive cornices had formed. Much of the snow was encrusted with frozen fog crystals, many of them 2 ft. long (Fig. 1, p. 38). On the *29th* only the topmost few inches of the Ben Nevis observatory ruins were showing above the winter accumulation of snow, believed to be then at about its maximum depth.

Between 04.15 hr. and 04.45 hr. on the *13th* saucer-shaped flakes with diameters up to 5 in. fell during a heavy storm of wet snow in the Berkhamsted district of the Chiltern Hills, 400 ft. to 600 ft. above sea-level. For the second year in succession the last week of April brought belated snow to the southern counties of England. On the *30th* there were light falls even in Cornwall, while in the south midlands Dunstable Downs, 700 ft. to 800 ft., had a 3 in. cover.

May 1951

Wet and rather dull weather ruled in England and Wales, but in Scotland the month was dry, with abundant sunshine in the west and north. Once again temperature was generally sub-

normal. Until the *16th* occasional snow showers were fairly common on high ground, reaching as far south as Dartmoor on the *2nd*, *8th* and *16th*. Below the 1000 ft. level a cover was reported on two mornings at Peebles and Glen Gavel. At greater heights snow was observed to be lying throughout the month to below 2500 ft. on the Fannich Hills and upper Cheviot peaks, and to below 3500 ft. on Ben Nevis and the Cairngorms. Other mountains still held extensive drifts of great depth. On Carnedd Llewelyn, for example, there was a half-mile-long bed of compacted snow some 15 ft. deep on the *31st*. The higher slopes of Helvellyn provided good ski-ing on many days—a rare happening there in May. Hill farmers in northern England sustained heavy losses of livestock through the persistently severe weather. Late in the month sheep and lambs lay in piles of hundreds awaiting burial on the High Furness Fells and the Cumbrian Range.

SUMMER 1951

So large and deep were the snowfields which had accumulated on northern mountains during the winter and spring that many of them survived, in part, most if not all of a moderately warm summer. Early in June the summit cover on Ben Nevis was up to within 4 ft. or 5 ft. of the observatory roof level, while cornices over the Tower and Gardyloo Gullies were estimated to be 10 ft. to 12 ft. thick. Snow showers came to Nevis on *June 17th*. By mid-July the topmost area of the mountain was clear of cover, but extensive drifts remained round the edge of cliffs near the North-east and Observatory Buttresses, as well as at the head of the gullies just mentioned. Late in August substantial accumulations of snow held out on the east and north-east slopes of Aonach Mor and Aonach Beag, around 3500 ft. to 4000 ft. On the *31st* an isolated patch was observed at about 3000 ft. in a deep east-facing gully on the south ridge of Creag Mheagaidh, above Loch Laggan. On *September 16th*, when the first snow showers of autumn were reported at the summit of Ben Nevis, the larger of the two chief beds remaining in Coire na Ciste had an approximate length of 225 ft., an average breadth of 90 ft., and a maximum thickness of at least 8 ft.; its base was discharging small "icebergs" into the lochan, which it partly covered.

The usual summer expedition to the Cairngorms was made by the Durham University Exploration Society from *July 12th* to *30th*. Snow-beds at high levels were found to be of much greater extent and depth than in the Julys of recent years. The largest patch observed, at about 4000 ft. on the eastern flank of Ben Macdhui (Fig. 2, p. 38), was very deep at many points; the lowest patch, at less than 2000 ft. near the Derry Burn, disappeared during the third week of July. Of the fairly numerous patches in Corrie Etchachan, however, several lasted through the period of the party's stay. In one of these, (*a*) on an incline of about 25° facing south, and in another (*b*) on a steep (70°) slope facing north-east at an altitude of 3550 ft., measurements of ablation (plus settling) were undertaken. At (*a*) the general decrease in the depth of the snow ranged from 8 in. to 5 in. per day between *July 15th* and *July 29th*, totalling 7 ft. 9 in. during the fortnight. At (*b*), where observations did not begin until *July 19th* and could not be maintained regularly, the decrease amounted by the *28th* to 4 ft. 10 in. At both sites the daily average of ablation and settling combined was thus approximately 6 in. Air temperatures at a meteorological station near the bank of Loch Etchachan (3100 ft.) varied from a maximum of 65° F. (18·3° C.) on *July 21st* to a minimum of 36° F. (2·2° C.) early on *July 23rd*. A severe thunderstorm during the evening of the *22nd* gave 1·30 in. of rain and necessitated evacuation of the party's upper camp; but this sudden load of water does not appear to have accelerated the melting of the snow at any observation point. Typical "concave honeycomb" structure was noticed in the under side of ablation patch (*a*).

Above 2500 ft. in the northern Pennines a number of snow-beds survived throughout June. One of these, on the north-west slope of Cross Fell, measured about 96 ft. in length by 34 ft. in breadth and had a maximum depth of 6 ft. on *June 30th*. This bed was still in existence on *July 9th*. Slight snow occurred at Alston (1071 ft.), Cumberland, on *June 6th* and *11th*.

SUMMARY

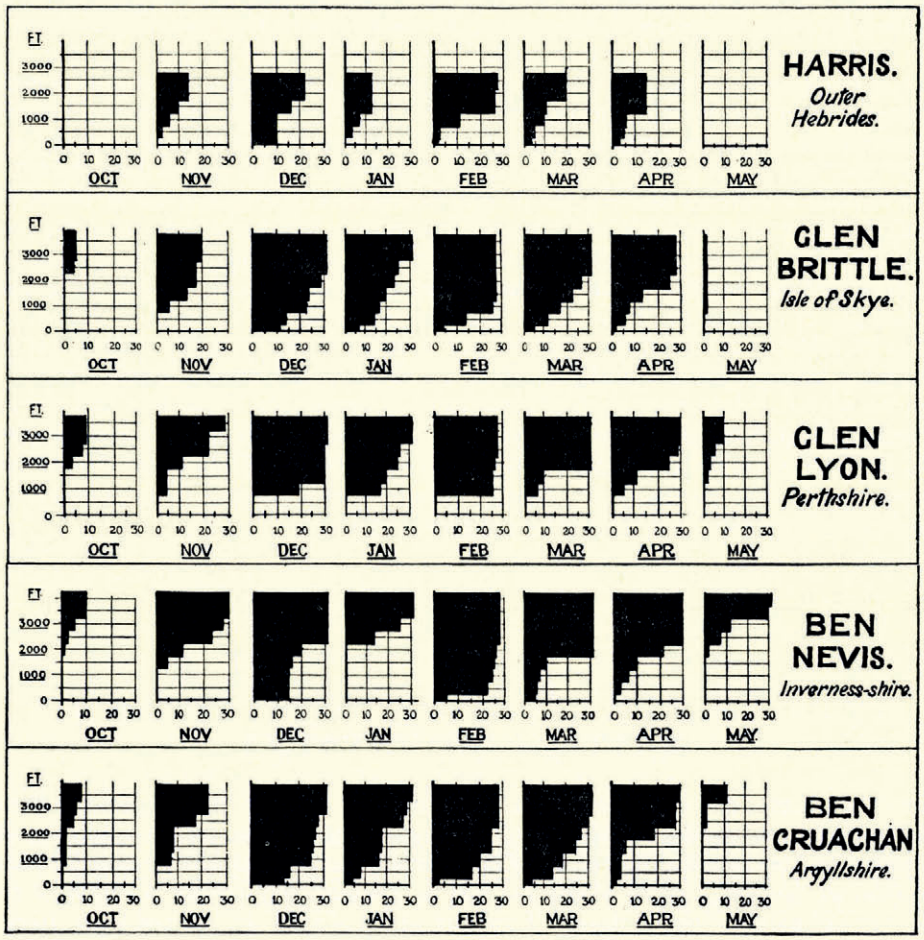
The 1950–51 season was one in which increase of altitude had a more than usually dominant effect on the frequency and intensity of British snowfall. Pressure distribution was such as to produce repeated incursions of air from the vicinity of Greenland; this air, though gaining warmth from the sea in its lowest layers, retained much of its original cold at no great height. Dalwhinnie, not far above the 1000 ft. level, had a mean temperature of 32·4° F. (0·2° C.) from November to April and one of 35·2° F. (1·8° C.) from October to May. Owing to the instability of the arctic air, snow was abnormally prevalent over northern upland regions and in the absence of protracted mild spells it lay for an exceptionally long period. Unofficial reports that some hillside farms in the Scottish Highlands were never free from cover between late October and late May are probably accurate. At several stations near the 1000 ft. level in that area days with snow lying were decidedly more frequent in 1950–51 than in the memorably severe 1946–47 season: Dalwhinnie, for example, had 102 such days in 1950–51 against 83 in 1946–47. Away from the northern uplands the 1950–51 record fell far short of that achieved by 1946–47 in this respect. Observations from the ten representative stations at altitudes between 400 ft. and 1200 ft. (five in England, one in Wales, four in Scotland) that have been used for inter-seasonal comparisons in these reports since the post-war re-institution of the Survey give an average of 54 days with snow lying from September 1950 to May 1951. Corresponding figures for the same nine months were 66 in 1946–47, 26 in 1947–48, 13 in 1948–49, 15 in 1949–50. To sum up: British snowfall during the 1950–51 season may be classed as excessive in the northern uplands, and as rather heavy on many other tracts of high ground, but as mostly moderate in the lowlands. No corner of the country appears to have come through the period under review without snow or sleet, though the Scilly Isles and parts of the south-western English mainland were always free from cover. It was for frequency of snow and its long persistence on the mountains rather than for outstanding individual storms that the season was remarkable. On the latter count the mid-February blizzard in the western Scottish Highlands should perhaps be singled out for special mention.

E. L. H.

NOTE ON DURATION OF SNOW COVER ON BRITISH MOUNTAINS

IT is with satisfaction that we are now able to include data for Ben Nevis (4406 ft.) from daily observations taken at Banavie. On all ground above about the 2000 ft. level the duration of snow cover appears to have exceeded that of any of the previous four seasons. On the same five mountain groups (two in Scotland, two in Wales and one in England) the average duration of cover at 2500 ft. was 146 days, against 91 days in the severe winter of 1946–47. All mountains from South Wales to the north of Scotland had "snow lying" in every month from November to April. Diagrams showing the distribution of snow cover relative to height for ten stations are given on pages 32 and 33. In the Harris Hills the snow line reached sea-level on 16 days during the season, and the summits above 2500 ft. were covered for 27 days in February. As seen from Glen Brittle, the Cuillins had "snow lying" in every month from October to May. At 3000 ft. the cover was continuous from *November 11th* to *April 29th*. The snow line was down to 1500 ft. throughout February and fell to sea-level on 28 days during the season, with a maximum of 11 days in December. In Glen Lyon the snow line was down to 2000 ft. in every month from October to May, and at 3000 ft. the peaks were continuously capped from *December 9th* to *May 10th*. Throughout March

the snow line was down to 2000 ft. On Ben Nevis a cover was reported in every month from September to May, the snow line reaching sea level on 23 days, with a maximum of 14 days in December. Throughout March the mountain was continuously under snow down to 2000 ft. and at and above 3500 ft. the cover was continuous from *October 30th* to *May 30th*, a total of 213 days. On Ben Cruachan there was a cover in every month from October to May, the snow line falling to sea level on 21 days, with a maximum of 13 in December. Down to 2500 ft. the cover was continuous throughout February, and the twin summits were under snow continuously from



December 8th to *May 11th*. Ben More, Isle of Mull, was snow-free in October and May; but the snow line reached sea-level on 24 days during the season, with a maximum of 10 days in December. Cover was continuous throughout December, February and March down to 2500 ft. The Paps of Jura, as observed from Colonsay, had snow cover in each month from November to April; but at no level was it continuous throughout any month, the maximum duration on the summits being 26 days in April. The snow line fell to sea-level on 7 days during the season.

South of the Scottish border, at High Close in the Lake District, no snow cover was observed in October or May. Nevertheless the cover was of considerable duration, being continuous on the

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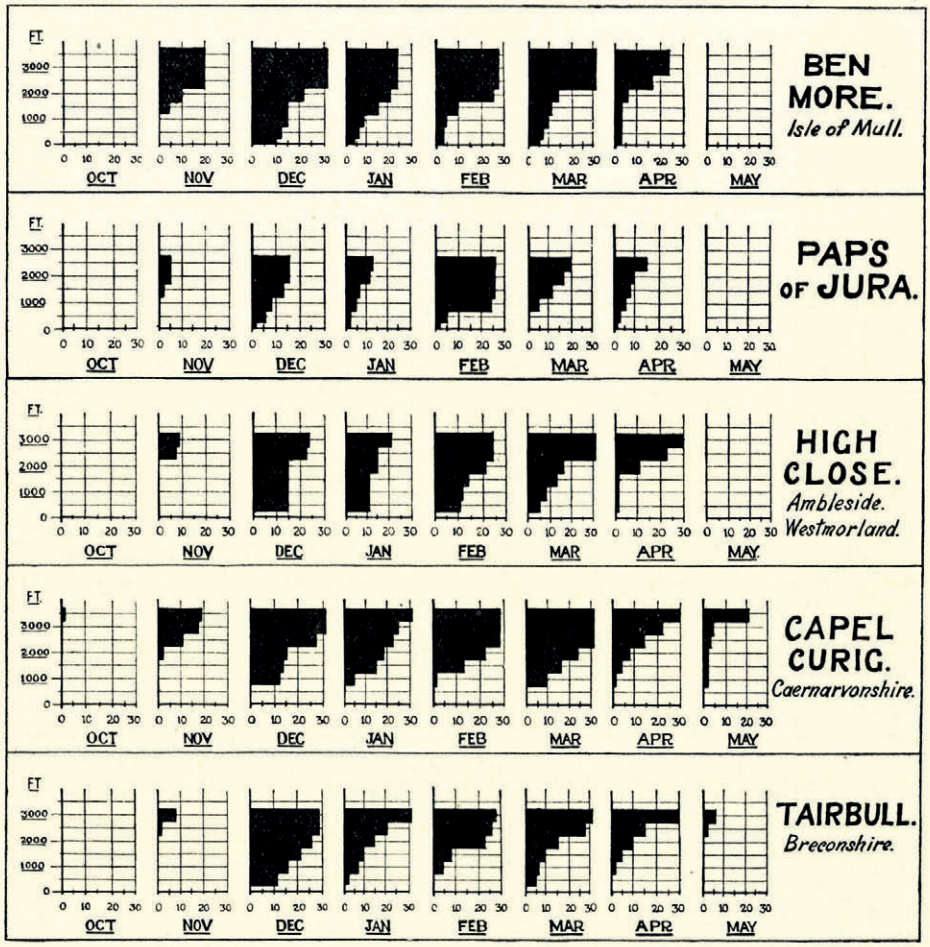
summits above 2500 ft. from *February 6th* to *April 30th*. The Caernarvonshire mountains, as observed from Capel Curig, had some snow cover in every month from October to May. The snow line was down to 2500 ft. throughout February and March; and the extreme summits were under snow continuously from *November 12th* to *May 21st*. The Brecon Beacons, as observed from Tairbull, were snow-free in October, but some cover was present in every month from November to May. The snow line was down to 500 ft. on 18 days during the season, and the summits were under continuous cover from *December 3rd* to *May 6th*.



Curves showing the total duration of cover at all levels throughout the season at six representative stations appear in Fig. 1, p. 34. The duration reached a total of some 230 days on the summit of Ben Nevis: 150 days of cover was exceeded on the upper levels at all the stations except High Close in the Lake District.

Continuous records from a number of mountain stations during the past five seasons have made it possible to summarize graphically the average monthly distribution of snow cover in height and time for five representative mountain groups, as shown in Fig. 2, p. 35. It will be seen that the maximum duration of cover occurred in February at all five stations. More than 75 per cent

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of the possible duration was observed in January and February at the two Scottish stations, below 3000 ft. in the Cuillins and down to about 2200 ft. in Glen Lyon in February. On the average, Meall Ghaordie (3407 ft.) was snow-capped on nine days out of every ten in February.

It would seem that the average duration of snow cover on the Brecon Beacons down to about 2000 ft. in February exceeds that at similar levels on Bow Fell in the Lake District, despite the higher latitude of the latter.

It will be of interest to note what modification of these diagrams will be brought about in future years, when there may be sufficient data to allow the production of similar diagrams of the "normal" distribution of snow cover.

D. L. C.

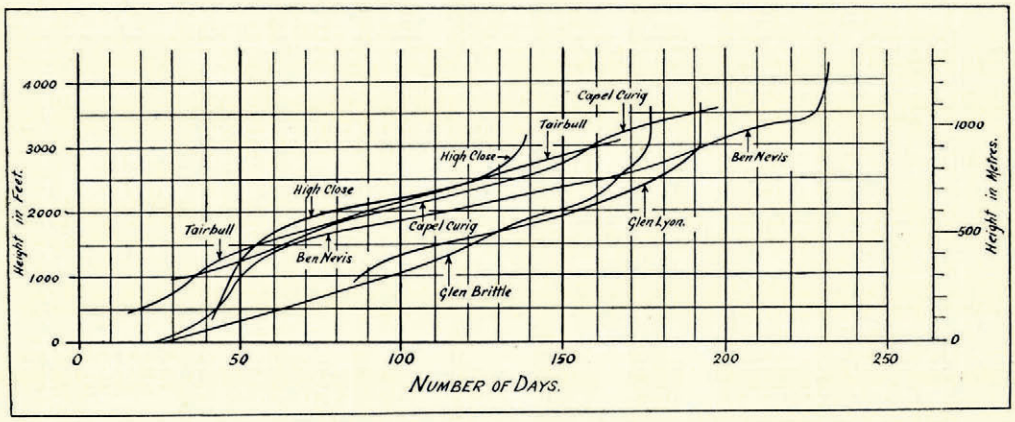

Fig. 1 (see text p. 33)

SNOWFALL IN BRITISH COASTAL WATERS

DATA of snowfall in coastal waters have been much increased through the courtesy of the Elder Brethren of Trinity House, all of whose lighthouses and lightships are now observing for the Society. A number of shipping companies have permitted their ships' masters to take part in the Survey.

No snowfall at sea was reported during September. The first fall of the season was recorded at the *Humber* and *Dowsing* lightships on *October 28th.*

In November snowfalls were reported from *Barrow Deep* lightship on the *4th*, *Morecambe Bay* lightship on the *13th*, and *Bull Point* lighthouse, Devon, on the *14th.*

Snowfalls at sea were most widespread in December, when 84 lighthouses and lightships reported them on one or more days. No snow at all throughout the season was observed at the *Longships* lighthouse, off Cornwall, and at the *Caskets* lighthouse, Alderney. *Wolf Rock*, *Bishop Rock*, *Eddystone*, *Hanois*, *Guernsey* and *Serk* lighthouses each reported only one day of snowfall throughout the season, all occurring in December. The greatest number of snow-days was reported from *Cromer* lighthouse, a total of 37, of which 15 were in December. In December the heavier falls came generally during the six days *3rd* to *5th* and *13th* to *15th*. *St. Mary* lighthouse and *Haisbro'* lightship observed heavy falls on the *14th* and *15th*; *Cross Sand* lightship had heavy snow for 4 hours on the *5th*, and again from 18.45 hr. to midnight on the *15th*. *Corton* lightship reported thick snowfalls on the *4th* and *5th*, *Mid Barrow* lightship heavy snow showers on the

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5th and *16th*, and *South Goodwin* lightship heavy falls on the *15th*. *Beachy Head* lighthouse reported 5 hours' continuous fall, and the *Owers* lightship frequent periods of heavy snow on the *15th*. Heavy snow showers fell as far west as the *Shambles* lightship on the *15th* in the English Channel, and were also observed on that day from *Scarweather* lightship in the Bristol Channel. The depth of the snowfall on the *14th* and *15th* on the island was given as about 3 inches by the *Skokham*

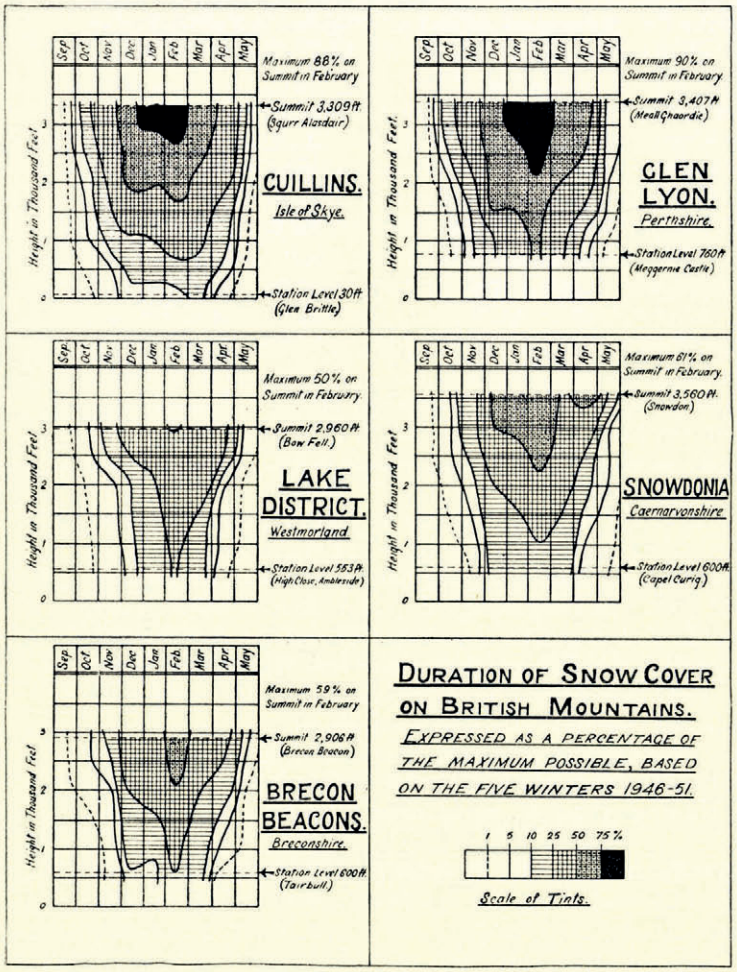

Fig. 2 (*see text p. 33*)

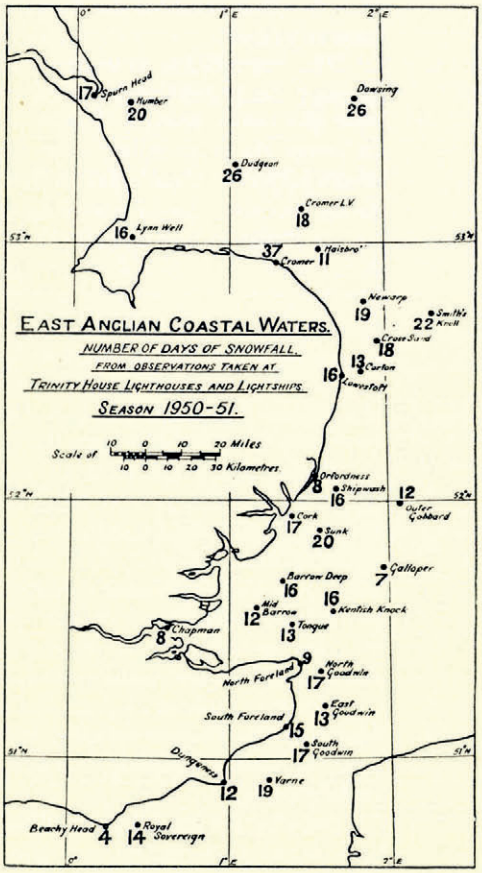

Fig. 3 (*see text p. 36*)

lighthouse. The M.V. *Crombie* reported snow showers off the east coast between Orfordness and Southwold on the *5th*, and heavy snow showers off the north-east coast between *Longstone* and *Coquet* lighthouses on the *14th*.

In January scattered showers of snow were reported from all coasts, mainly light and of brief duration; but *Cross Sand* lightship observed short heavy falls on the *1st*, and at *Corton* lightship, about 9 miles to the south-west, there were large flakes from 18.00 hr. to 18.30 hr. on the same day. *The Galloper* lightship experienced a heavy fall, and *Mid Barrow* lightship a very heavy fall from 12.30 hr. to 15.00 hr. on the *1st*.

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Snowfalls off our coasts in February were again distributed widely. The *Humber* and *Dowsing* lightships reported heavy squalls of snow on the *17th*. On the *22nd* the *East Goodwin* lightship observed heavy snow for one hour, and the *South Goodwin* heavy snow showers. The M.V. *Lochee* met with heavy snow flurries in the North Sea 17 miles S.E. from Spurn Head on the *7th*, and the M.V. *Gannochy* heavy snow showers on the *1st* off the Lincolnshire coast. Sleet showers were encountered on the same day by the S.S. *Fulham IV* off the Norfolk coast near Sheringham. Snow showers were reported on the *17th* by the S.S. *Bestwood* 5 miles from *Haisbro'* lightship, by the S.S. *Heyshott* between the *Cromer* and *Dudgeon* lightships, and by the M.V. *Crombie* off Flamborough Head.

The distribution of snowfall at sea in March seemed to follow a similar pattern to that of January. *Longstone* lighthouse reported snow on 14 days during the month. The *Dowsing* lightship observed heavy squalls of snow on the *26th*, and similar conditions prevailed at the *Dudgeon* lightship, about 40 miles to the south-west. There were heavy snow showers on the *29th* at the *Smith's Knoll* lightship, and on the *24th* at *Cross Sand* and *Corton* lightships, the latter noting large flakes between 14.45 hr. and 15.15 hr. The *Tongue* lightship observed a heavy squall of snow for 20 minutes, and the *North Goodwin* a very heavy squall for two hours on the *24th*. The S.S. *Fulham IV* reported very frequent snow and sleet squalls between Hartland Point and Trevose Head on the *7th*, two hours' heavy snowfall off Bridlington on the *24th*, and heavy snow from 10 miles S.E. of Tynemouth to Derwenthaugh on the *25th*. The S.S. *Cerne* encountered slight snowfall 3 miles east of Southwold on the *29th*, and on the previous day the M.V. *Samuel Clegg* met with intermittent snow showers between 22.20 hr. and 22.50 hr., 15 to 20 miles S.S.E. from the *Humber* lightship. The S.S. *Bestwood* encountered heavy snow squalls in the Thames estuary eastwards from the *Chapman* lighthouse on the *24th*.

During April the snowfall in coastal waters was again mostly in light scattered showers. There were a few heavier falls, however, the *Humber* lightship reporting very heavy squalls of snow and hail from the east-south-east on the *14th*, but 60 miles farther out to the east the *Dowsing* lightship observed only slight snow and sleet. The *Dudgeon* lightship also recorded snow on this date. The *Nab* lighthouse reported squalls of sleet and show on the *29th*, and the *Smalls* lighthouse experienced a 30 minutes' snow squall on the *30th*, which day gave a slight fall on *Skokham*, 20 miles to the east, but none at the *South Bishop* about the same distance to the north-east. *St. Bees* lighthouse, Cumberland, had its last snowfall of the season on the *7th*.

The S.S. *Fulham IV* recorded heavy snow showers during the afternoon of the *7th* in the Sea Reach of the Thames estuary, and at the same time the S.S. *Arthur Wright* in the North Sea, near the *Goereg* lightship, lat. 51° 52′ N., long. 3° 34′ E., experienced heavy sleet with thunder and lightning.

Snowfall during May was observed at five stations, viz., *Strumble Head* lighthouse, *St. Goven* and *Scarweather* lightships in the Bristol Channel, *Longstone* lighthouse, Northumberland, and *Round Island*, Scilly Isles.

Summary

East Anglian Area. The distribution of snow-days in this area for the season, together with that at lighthouses on adjacent shores, is shown in Fig. 3, p. 35. Among the lightships it will be seen that the maximum frequency of 26 days occurred at the *Dudgeon* and *Dowsing*, and the minimum at the *Galloper*. In the approaches to the Thames there is an area extending from the *North Goodwin* to the *Shipwash* lightships where the frequency exceeded 15 days, reaching a maximum of 20 days at *Sunk* lightship.

To the seaward of this area the frequency fell off to 7 days at the *Galloper* lightship; and landward it decreased to 9 days at the *North Foreland*, and 8 days at the *Chapman* lighthouse. Northeastward from Lowestoft the frequency of snow-days increased from 13 at *Corton* to 22 at *Smith's*

Knoll lightships. Off Cromer there was a patch of lower frequency, with 11 days at *Haisbro'* lightship. The much smaller number of snow-days at *Beachy Head* lighthouse than at the *Royal Sovereign* lightship is probably due to the shelter afforded the former by the high cliffs below which it is situated.

Bristol Channel Area. Fig. 4, below, shows the distribution of snow-days in this area. Here there was a band of low frequency across the channel from *Lynmouth Foreland* to *Nash Point* lighthouse, with 3 days' and 6 days' duration respectively. Generally the number of snow-days

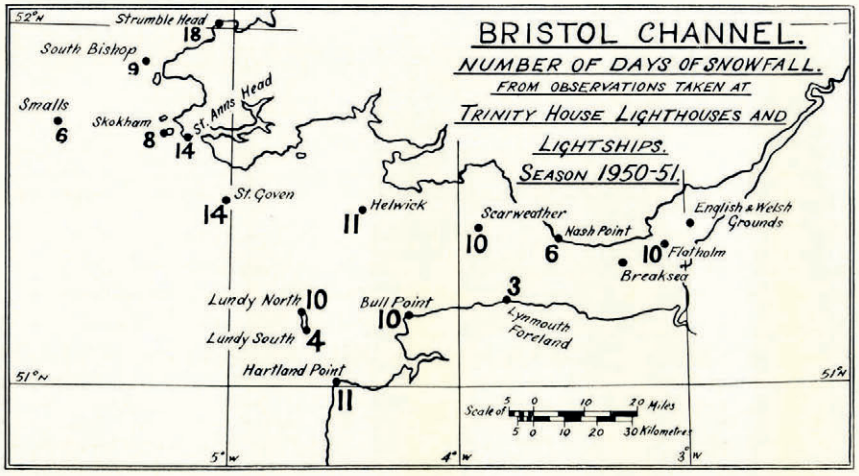

Fig. 4

in the Bristol Channel was 10 or 11; but *Lundy North* shows a curious contrast with *Lundy South*, the former lighthouse recording 10 and the latter only 4. On the northern shore, at the mouth of the channel, there was a patch of higher frequency, with 14 days at *St. Anns Head* lighthouse and *St. Goven* lightship. Westward the number falls off to 6 at the *Smalls* lighthouse.

English Channel. Down channel from the east, the total number of snow-days fell off from 19 at the *Varne* lightship to 7 at the *Needles* lighthouse, 2 at *Portland Bill* and *Portland Breakwater* lighthouses, and only one at *Eddystone* lighthouse, but increased again to 7 at the *Lizard* lighthouse.

Caernarvon Bay. In this area the number of snow-days for the season varied from 8 at *Bardsey* to 23 at *South Stack* lighthouse, other stations in the bay reporting 10 or 12.

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A note on the snow-bed in y Ffos Ddyfn (N. Wales) is given on p. 65.

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Fig. 1. Fog rime overlying snowfield in Corrie an t' Sneachda, Cairngorms, 19 April 1951

Photograph by R. G. Sandeman

Fig. 2. Snowfield on east face of Ben Macdhui, late July 1951

Photograph by courtesy of Durham University Exploration Society

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