

# Scottish Birds



The Journal of  
The Scottish Ornithologists' Club

*Volume 3 No. 3*

*Autumn 1964*

Reprinted 1980

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THE JOURNAL OF THE SCOTTISH ORNITHOLOGISTS' CLUB

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Edited by A. T. MACMILLAN with the assistance of D. G. ANDREW and T. C. SMOUT. Business Editor, T. C. SMOUT. Cover Design (Leach's Petrel) by LEN FULLERTON. *Published quarterly.*

## Editorial

**George Waterston.** It is almost impossible to look at any important development in Scottish ornithology in recent years and not find George Waterston deeply involved in it—the great progress of the Scottish Ornithologists' Club, the creation of a bird observatory on Fair Isle, the consolidation of the activities of the R.S.P.B. in Scotland, investigations of Rooks and Gannets, the operation of the Protection of Birds Act 1954, or the introduction of the ordinary public to the Speyside Ospreys. If a delegate to an ornithological congress or a representative on an international council or an advisory committee is needed the first person to be suggested is George. If a radio programme about birds is wanted, or comment on some ornithological topic for the press, it is the same story. It is very pleasant to record that a vast amount of hard work in these and other fields has been rewarded with a richly merited O.B.E. At the S.O.C. annual conference in October club members will have a chance to pay their own tribute to this remarkable ornithologist when he is recommended for election as an Honorary President of the club.

**Dr David Armitage Bannerman.** Dr Bannerman is another of our Honorary Presidents who was in the news recently. His achievements have been the subject of previous comment in these columns, and his tremendous output of sumptuous and authoritative bird books speaks itself of the great breadth of his ornithological experience and knowledge. At the Glasgow University Commemoration Day ceremony in June Dr Bannerman was presented with the honorary degree of Doctor of Laws, a well deserved tribute to an outstanding ornithologist of our times.

**Gannets.** The unexpected but most welcome arrival of Bryan Nelson's paper from the Galapagos (covered with a gay montage of Ecuadorian stamps) means that we have held over some other items for future numbers. There is a great deal of

original work behind this survey of Gannet behaviour and biology, and parts of it are appearing in print for the first time. We are including an unprecedented number of plates in support of the paper because they illustrate and amplify the text so well—a function which we feel is important for photographs which we use in *Scottish Birds*.

**Scottish Wildlife Trust.** The formation of the Scottish Wildlife Trust was announced to the press in April. This new body has its office at 21 Regent Terrace, Edinburgh, and the trustees include prominent naturalists from all parts of Scotland and a wide variety of interests. The trust's work will be complementary to that of existing conservation bodies. It will be concerned with, for example, the increasing threats to mammals and birds, and to areas of botanical or geological interest, posed by such developments as housing, industrial expansion, new roads, and water and electricity schemes.

The Scottish Wildlife Trust will fill a niche similar to that occupied by the English and Welsh county naturalists' trusts. In Scotland the population is more scattered, and pressure on the countryside has been less obvious, so that the growth of the county naturalist movement south of the border has not been reflected here. The national approach now seems an excellent opportunity for us to catch up, and also more appropriate for the special problems of thinly populated areas. We hope to publish a paper about naturalists' trusts in a future number of the journal, and the subject is on the programme for the coming S.O.C. Conference in Dunblane.

**Oil pollution.** We were pleased to read in the press that another step was being taken to reduce pollution of the sea and beaches with oil. The big British oil companies, with 60% of the world's tanker fleet, will no longer discharge the residues from the tanks of their ships into the sea; instead these will be added to the next cargo. The reason why this has not been done before seems to be that these residues attract extra dues on the return trip of the empty tankers through the Suez Canal.

**Assisted passage.** When the hold of the *Trinculo* was battered down in Newfoundland on 22nd December 1963 an immature Double-crested Cormorant was evidently shut in on top of the cargo of iron ore. Seven days later it was found thin but alive when the hatches were opened in Glasgow. It was taken to the museum to be identified, and is now there permanently, having died shortly after. This bizarre episode differs rather from the usual accounts of land birds taking a lift on the decks of transatlantic liners.

## Some aspects of breeding biology and behaviour of the North Atlantic Gannet on the Bass Rock

J. B. NELSON

(Plates 8-15)

### Background

The Bass Rock (56° 04' N, 2° 38' W) in the Firth of Forth and the Gannets to which it gives the specific name *Sula bassana* are one of the major bird attractions in Scotland. It seems fitting that the present study of the Gannet—the first relatively long-term one—should be carried out on the famous Bass, even though the St Kildan group and Ailsa Craig have larger Scottish gannetries. This paper aims to give a general account of some of the results, as one in a series describing current ornithological research in Scotland. It is not intended to include detailed evidence, and fuller accounts of behaviour and ecology will be found elsewhere (Nelson 1963a & b, 1964a & b, and in prep.). There are four main sections:

1. Morphology and voice
2. The Bass gannetry
3. Behaviour
4. Breeding biology

There are in Britain no large and accessible bird colonies free from human disturbance and its attendant site desertion, egg loss and chick mortality, and it is difficult or impossible to allow accurately for these factors when calculating breeding success and interpreting ecological findings. Disturbance also affects behaviour, influencing the length of the pre-laying period and other aspects of breeding behaviour, and increasing general wariness. So it was extremely valuable to live at the breeding colony throughout each season, ensuring that the observation group was undisturbed by visitors; and we were privileged to have a permanent base on the Bass for three years from 1961 to 1963 from February/March to October/November each season. A similar but shorter study on boobies *Sula* spp., now being carried out, also on an undisturbed island (in the Galapagos), should provide many interesting comparisons.

The Bass is composed of hard, igneous rock, forming the final link in a series of volcanic outcrops stretching across the Lothians. It is about a mile round the base, 340 ft high, and bluntly conical with a planar area of about seven acres, and rises practically sheer for 250-300 ft on all sides except the south-facing slope. Superficial subsoil permits a luxuriant growth of grasses (genera *Holcus*, *Bromus*, *Deschampsia*, *Poa* and *Tridactyla*). Other common plants are *Lavatera ar-*

*borea*, *Beta vulgaris*, *Silene maritima*, *Melandrium rubrum*, *Taraxacum officinale*, *Urtica dioica*, *Carduus* spp., *Rumex* spp., *Lamium album*, *Lamium purpureum* and *Cochlearia officinalis*. There are no trees or shrubs, except for an elder tree growing among the battlements. The tree-mallow, however, grows six to eight feet tall and provides dense cover for many migrants.

We lived in a hut on the south face of the Bass in the ruins of the 15th century chapel, which in turn is probably sited on the 7th century cell of St Baldred. The thick walls shielded us from the full force of many westerly gales, though it was still necessary to secure the hut roof with strong cables. Although the water is now reckoned unsafe for drinking, the old well near the summit of the rock presumably supplied the garrison during the long period when the fortress proudly flew the Scottish Lion and defied the many English attempts to take it. Presumably even Edward I, Hammer of the Scots, hammered in vain on the Bass. The rock functioned as a military establishment from about the 12th century until 1694. In that year the three Jacobite officers who, together with friends and supporters had held the Bass from 1691, finally surrendered, but on their own terms. Many a Covenanter was imprisoned there in the 17th century and not all of them found it a harsh punishment. Several recorded appreciation of the solitude and bracing air, though others suffered in the damp, gloomy cells and more than one died. The walls could tell some stories, and the long and involved historical associations of this battlemented and impregnable fortress, no less than its bird life, contributed to the pleasure of living there.

Those who, though necessarily, visit such a place during calm summer weather miss the most evocative experiences and also valuable opportunities for observing the effects of extreme conditions on the birds. It is when the rock lies besieged by the full fury of a grey north-easterly gale with spray rising more than a hundred feet, or bulks against the black clouds of a thunderstorm, lit by streaks of lightning and glistening wet, or even more rarely lies snow-covered, with every empty Gannet nest frozen rock-hard, that the full attraction of its wild nature may be felt. There are many remoter Scottish isles, but the Bass has a special flavour of its own and its fascination grows with familiarity.

### Introduction

North Atlantic Gannets belong to the family Sulidae, which, besides the three closely related forms (South African, Australasian and North Atlantic Gannets—often put in the genus *Morus*), also contains six species of pan-tropical boobies.

For many reasons the Gannet is particularly suitable for long-term ecological study. Its population trends are more

accurately known than those of any other colonial seabird (Fisher & Vevers 1951); it is a specialised fish-eater; forms dense, permanent breeding colonies, and permanent pairs with conspicuous nests to which it remains largely faithful throughout its long breeding life. It also shows several factors associated with large size (*e.g.* longevity, deferred maturity, single-egg clutch), contrasting admirably with the small, short-lived species with larger clutches on which much of the important ecological work has been done. Further, it is perhaps unique in combining two significant features: it is virtually without predators today, man excepted; and the present study shows that it seems rarely, if at all, to suffer food shortage. This is particularly notable since much evidence indicates that a wide range of colonial seabirds, and especially their young, suffer from often severe food shortage. We have found that the Red-footed Boobies *Sula sula* on Tower Island are often unable to feed their young adequately and these show frequent and extensive weight losses and periods of slow or no growth. The growth of White Booby *Sula dactylatra* chicks on the Galapagos is also very erratic. The Gannet is much more successful in rearing chicks to fledging.

The Gannet's behaviour also has many advantages for study; the birds are bold, with relatively slow and distinct movements which are easily broken down into their components; and they nest in dense groups, so that quantitative behaviour observations are readily made. Further, most existing accounts contain factual mistakes, and none gives an account of function, motivation or the evolution of behaviour, though Warham (1958) gives an excellent description of some Gannet behaviour patterns.

**Methods of study.** 171 adult Gannets were ringed with individual combinations of plastic self-coloured chicken rings, which kept their colour well and were rarely lost, and with British Trust for Ornithology rings. Young were marked with combinations indicating the year and in some cases the area from which they fledged.

Systematic observations were mainly made from two hides on a group of about 250 nests and sites (a site being a small fixed area, defended but without nest material; the spot upon which the nest will be built) on steeply sloping ground facing north-west (plate 8). The birds soon became used to the hides, although early in the season we often crawled the last hundred yards across the hill on our stomachs.

### **Morphology and voice**

**External sex differences.** Gurney (1913) and later authors give adequate descriptions of the structure and plumage of adult Gannets, but say nothing about external sex differences.

The male Gannet is usually larger than the female, in con-

trast to the closely related boobies, where the difference goes the other way. Although boobies may show sex differences in the colour of the bill and soft parts there are no such differences in the Gannet, nor in the lines on the bill. There are also no differences in iris colour, as there are in some boobies, and the body plumage of the sexes is identical. However, two morphological features—head colour, and the colour of the lines on the webs and tarsi—may be used with fair reliability.

**Head colour.** Both sexes show some shade of yellow on the head and neck, ranging from pale yellow to deep orange-brown—sometimes well marked as early as the second year, when the rest of the plumage is extremely immature. In both sexes the colour is less intense very early in the breeding season, deepens, and then tends to fade again, particularly in the female, which almost invariably becomes spotty and untidy about the head and occasionally turns completely white. Males sometimes become spotty, but usually keep a smooth, glossy appearance. The female's change is not due to the male's constant biting (as suggested in Fisher & Lockley 1954) since unmated females showed it. Moulting is probably responsible for the spotty appearance but not for the paling.

Despite both the variability and seasonal change, within any pair the darker bird (if there is one) will generally be the male. At one stage in the breeding season this difference becomes extremely marked, but by October the female is darkening again. Colour-ringed pairs occasionally showed the male darker than the female one year and vice versa the next.

Striking facial patterns and contrasting head colour are common in the Sulidae, although only the Gannet has a conspicuous yellow head (the white phase of the Red-footed Booby often has a pale yellow head, but the White Booby, though most similar to the Gannet in general appearance, does not show a trace of yellow).

Conspicuous physical features of animals have often developed in association with signal movements, whose value in communication is thereby enhanced—speculae-touching movements in duck display (Lorenz 1941) are a well known example. The Gannet's yellow head colour, together with the striking pattern of lines on the beak, pigmented facial soft parts, and blue orbital ring, may be suspected of serving a signal function. Much of the Gannet's social signal behaviour (as also that of other Sulidae) employs conspicuous head movements, in all of which the face and head are involved in exhibition, presentation or withdrawal. The colour and face pattern may therefore emphasise these movements as signals. Since these physical characters only develop fully with sexual maturity, and during the long period of deferred maturity the Gannet successfully carries on all non-breeding activities,



their use in these contexts is precluded.

**Colour of lines on webs.** On the Gannet's blackish feet and tarsi are striking greenish lines, following the toes and fusing on the tarsi. In spite of great variation in the shade of green, and some overlap between the sexes, the male's web lines were almost always more yellow and the female's more bluish-

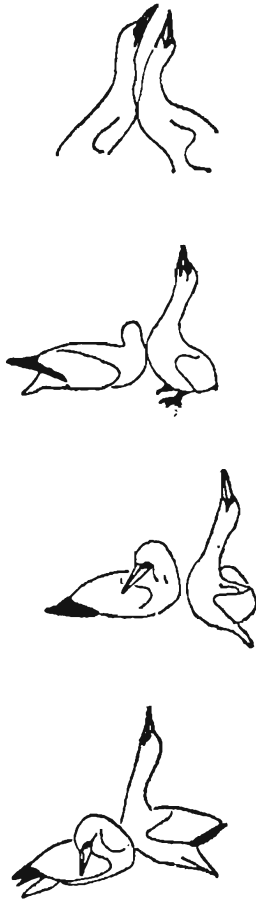


FIG. 1. Gannets changing over at the nest: they perform mutual meeting ceremony, and the departing bird sky-points before moving off.

green. In extreme cases, even single birds could be sexed by this character, as confirmed by their subsequent behaviour.

Slow raising of the feet, showing off the web lines, accompanies the striking pre-movement posture (plate 15b and fig. 1) for which sky-pointing is a good descriptive name. This

posture has often been interpreted as an appeasement posture that reduces the likelihood of a bird being attacked as it passes through crowded nesting ranks on its way to a take-off position, and it seemed plausible that the exaggerated raising of the green-lined feet emphasised this signal function. Indeed it has been quoted as a beautiful behavioural adaptation for nesting in dense groups. My evidence does not support this interpretation of sky-pointing, and it seems that it may synchronise change-over, preventing both partners from leaving the nest simultaneously by clearly signalling impending departure. This is important, since unguarded eggs are lost through gull predation or other Gannets stealing nest material. However, sky-pointing occurs in many contexts and either has some function other than co-ordination of change-over or has evolved in this context and become frozen into others (see later). In any case, whatever the function, the lines evidently serve to exaggerate the web movements and therefore have signal value.

A further web character, helpful in determining the status of individuals, is that birds newly arrived at the breeding colony as site-establishing males or prospecting females often have pale grey webs and tarsi, whereas older birds have much darker ones.

**Voice.** The Gannet has a very limited vocabulary compared, for example, with the gulls and perhaps even the Guillemot *Uria aalge*, though not in comparison with some other Pelecaniformes. It shows no sex-difference in voice recognisable to my ears, in strong contrast to the White Booby, in which differences in the structure of the syrinx produce a thin piping from the male and a loud call from the female (Murphy 1936). Even the Red-footed Booby shows a slight difference in timbre between the sexes. However, individual qualities of voice enable Gannets to recognise mates and neighbours as they fly in, and chicks also recognise their parents' voices. Male Gannets are more vocal than females, giving the aggression/fear call more readily when approached.

The main call is a strident, far-reaching *urrah rah rah* used by both sexes at about four syllables per second when flying in to the site. The pace of the syllables accelerates, their amplitude increases, and just before touch-down the pitch is slightly raised in a final shout, which tails off as the bird lands. The landing call is not given when landing to gather nest material or indeed at any spot other than the site. Much the same call is given by both sexes during bowing (see later), usually between 10 and 25 separate calls in 4 to 10 seconds, and mutual fencing (see later), where it rises and falls in pitch and amplitude according to the intensity of the display. During aggression (adult fights, threats, male attacks on

females, or adult attacks on chicks) the call is often given, particularly during spurts of renewed aggression.

An alarm version of the same call is very loud and staccato, repeated three or four times on a slightly descending scale and graded according to the degree of fright (e.g. slight for an attack by a Herring Gull *Larus argentatus*; great for a close approach by man).

During take-off and sometimes after a hop or run a soft *oo-ah*, attenuated, sometimes disyllabic and lower on the second syllable, is uttered. This groan is invariably accompanied by sky-pointing, and because it is usually heard just as the bird steps off the ledge in a contorted position with neck stretched and tail acutely depressed, it has been suggested that it results from this physical distortion—perhaps through ejection of air from the thoracic air sacs. However, it can be produced in various normal positions and in ordinary flight and may be completely absent in urgent departures. It is certainly produced voluntarily.

The only other sound differing much from the harsh *rah* call is an oft-repeated grunt rather like a soft Raven's croak, made by birds in fast, level flight. It is rare and seems not to have been previously recorded.

The absence of a complicated vocabulary is probably correlated with the relatively large number of visual signals, though perhaps these are mainly required by the combined effects of high aggression and dense colonial nesting, which make clear communication imperative.

**Immature stages.** The Gannet takes four or five years to attain full adult plumage, though immature birds return to the breeding colony and all stages may be seen from May onwards around the Bass. Moulting during immaturity is complicated and each year-group shows much variation.

During their first year, counting from the August or September in which they fledge, young Gannets may retain practically the full juvenile plumage (plate 9a). This varies considerably, but is normally black above, finely speckled with white, and slaty-grey below, also finely spotted with white and lighter in average tone. The spots are not uniform in size or density. Along the leading edge of the wing from the carpal joint to the elbow they are fine and densely distributed, whilst on the wing-coverts, scapulae and mid-back regions they are larger and fewer. On the head, chin, throat and lores they are extremely fine and densely packed, becoming larger and fewer on the upper breast and underparts. Individuals vary in the size, density and whiteness of their spots and in the shade of the background feathers. Some are almost coal-black, with conspicuous white spots, whilst others are a beautiful silvery grey and extremely pale beneath.

By at least the August after fledging, when they were about one year old (first summer plumage by Witherby's terminology in *The Handbook of British Birds*), I saw individuals completely brown except for a variable amount of whitish ventral surface. Head, neck and upperparts were indistinguishable from the juvenile stage except that the dark-grey/black had become slightly browner, possibly due to fading of the melanin. Some birds, probably starting within three weeks of fledging, progressively lose many or all dark feathers on the head, neck and underparts, usually with a paling of the breast, belly and often the forehead, leaving a brownish thigh patch, chin, throat and pectoral band. A few individuals even become noticeably paler on the dorsal surface (plate 9b).

The second-year plumage (plate 10a) increases the amount of variability already found in the first—a phenomenon probably associated with the pattern of moult in Sulidae, in which two or more cycles of feather replacement may be in progress simultaneously. The most juvenile form of two-year-old has a conspicuous paling of the upper and median wing-coverts, showing as a white shoulder patch and leading edge. The V-shaped upper tail-covert patch (always pale even in a juvenile) extends in area. Some birds retain brown speckles on the thighs, and on the nape and sides of the neck, which is also the area to which the chick down clings most tenaciously. The dorsal plumage may remain entirely dark brown except for the shoulder patch. Despite the retention of brown on the head these birds may show some yellow, the blue bill of the adult, and conspicuous web lines—factors possibly associated with the considerable amount of precocious sexual activity shown by immature Gannets. Other two-year-olds may be completely white on head and underparts, with many white feathers encroaching onto the secondary coverts, scapulars and mid-back feathers (plate 10b), though primaries and secondaries remain black/brown.

The third-year plumage is the first to show adult flight feathers (secondaries and rectrices) intermixed with dark ones (plate 11a, b). The whole dorsal surface becomes boldly and variably patterned black and white. The head may be white or yellow. Possibly white-headed birds are females, and certainly the paler of two immature birds forming a temporary pair in the 'clubs' is usually a female. Three-year-old females sometimes form more permanent associations with four-year-old or five-year-old males, but I have not recorded one breeding. A chick colour-ringed in 1960 and seen in 1963 still retained many black secondaries and tail feathers, and three black scapular feathers symmetrically disposed on each wing.

The fourth-year or sub-adult plumage (plate 12a) may show several dark secondaries and/or one or more dark rectrices (usually central), or may be almost adult. Gannets may breed

in this plumage and even retain some of it in their fifth year. One breeding male kept two black secondaries and a distinctive squeaky voice for three successive seasons! Moulting apparently proceeds symmetrically, though not necessarily by a complete annual cycle of feather replacement.

### The Bass gannetry

The Bass colony has increased steadily during this century. Fisher and Lockley (1954) discuss the spectacular fluctuations of world Gannet numbers in the 19th century, describing the decrease from 1834 to 1894, probably due to human predation, and the equally dramatic upward trend which began towards the end of the century and seems to have continued ever since, giving a total increase on the east side of the Atlantic from 70,000 to 82,000 pairs between 1939 and 1949 (Fisher & Vevers 1951).

Rintoul and Baxter (1935) trace the first reference to probable Bass Gannets to Beowulf, who in the 6th century mentioned Gannets in the North Sea. G. Waterston in Bannerman (1959) gives an admirable account of the main historical references to the Bass colony, and organised the 1949 count, which showed a total of 4,820 nests.

We estimated the Bass population in June 1962. The three most important points which emerged were that the colony had increased significantly since 1949; that figures could be obtained for the number of non-breeding birds, thus separating them from the 'breeding power' of the colony; and that figures could also be obtained for the proportion of nests which would, at the time of the count, be occupied by pairs (long-term records from the observation colony showing this to be about 15%). This third point is important in calculating the number of nests (and hence breeding pairs) as against the number of individuals. Nests as such are often impossible to count, and therefore the total number of individuals was first estimated and allowance made for the above factors.

The non-breeders are of great interest and have often been noticed at the Bass (Gurney 1913) and elsewhere, though their status has been conjectured rather than investigated. Boyd (1961) quotes Martin's (1703) description of these as "a barren tribe of Solan Geese that never mix among the rest that build and hatch." Non-breeders on the rock in the middle of the breeding season fall into two categories: (a) young adults or slightly immature birds with established sites but no egg or chick: except when partnering an experienced bird Gannets establish sites and form pairs for all or part of a season prior to that in which they first lay; (b) adults and a large number of more immature birds which settle in 'clubs' on unoccupied parts of the rock, according to wind direction, but have no permanent sites.

Category (a) birds hold sites not only on the outer fringe of established areas but also squeezed between established pairs; the actual breeding population is therefore less than would appear from a superficial examination. Also, for all practical purposes, it may be taken that pairs having once bred do not regularly thereafter have non-breeding years. Only long-term observations would show that such years *never* occur, but in the observation colony all but six pairs (three in each year) bred in two successive years, so the issue is thus not complicated by such a further category of non-breeders. Therefore birds without chicks by early August belong either to categories (a) or (b) or are failed breeders. About 20% of birds in the colony were estimated to be category (a) non-breeders, allowance having been made for the proportion of failed breeders.

For the entire rock a maximum of 8,200 pairs was obtained, excluding non-breeders and immatures without sites, with a minimum estimate of 7,700. Of these approximately 1,100 were counted twice owing to the presence of both members of a pair, and a further 1,400 represent site owners with no egg or chick, giving a corrected maximum figure for *breeding pairs* of some 5,700. However the correction factors are themselves estimates. If the feasible maximum and minimum values for these are taken into account the final corrected figure is  $5,200 \pm 700$  breeding pairs.

For an understanding of Gannet population dynamics and breeding behaviour it is important to consider the availability of nest sites. The Gannet's notable aggression in site establishment (see later) might imply strong competition and possible shortage of suitable breeding sites. However there is at present no such shortage on the Bass Rock; some areas now unoccupied once held nesting Gannets, as also did the Isle of May nearby. Other unoccupied areas can hardly lack subtle requirements we are unable to discern. The enormous variation (in physiography, aspect, distance from cliff edge, angle of slope, nearness to other nesting masses, etc.) of areas which *are* colonised indicates the Gannet's adaptability. The social tendency causes some seabirds to concentrate in areas already colonised and ignore others, but with Gannets there is apparently a plentiful supply of unused sites immediately bordering existing colonies. In fact the observation colony, in three successive years, extended into virgin territory in this way. Of course, social nesting does not necessarily derive from shortage of sites but may offer certain advantages, such as less danger from predators. In Gannets this tendency leads to a slow, consolidated extension, which may seem like an adaptation to overcome site shortage (since suitable breeding *stacks* are limited) but it is at least doubtful whether the British Gannet population has ever seriously approached sat-

uration level. Ashmole (1963), discussing tropical seabirds, suggested that direct competition for food around the breeding colony could act on younger and therefore less experienced birds by prohibiting them from attempting to breed when, so to speak, it would be 'useless.' However, this explanation has some weaknesses, and relevant information from the present study, though admittedly limited, does not support it.

The question of the non-breeding adult population thus becomes even more intriguing. The birds are apparently not prevented from breeding by food shortage; as a good indication of the ease with which they find food, we did not record a single case of chick starvation in three seasons (except where one parent disappeared), and we showed that Gannets could even rear healthy twins instead of the normal single chick. If, as is also probable, extra nesting sites are readily available, non-breeders present a problem. Wynne-Edwards' (1962) interpretation of this type of observation—that it is the manifestation of a tendency for the organism to control its own recruitment rate by withholding breeding effort when necessary—could clearly apply to the above case. The social mechanisms apparently required by this interpretation (exclusion of younger birds by older, etc.) seem, however, not to exist in the Gannet, though territorial fighting is very strict. As already mentioned, it is not necessary for a new breeder to find a place within any conventional limits of the colony as defined at any particular time.

A group at the base of the east cliffs displacing Shags *Phalacrocorax aristotelis* is a straightforward example of interspecific competition in which the smaller and less aggressive species is failing to resist encroachment. Interspecific competition becomes of interest when two species are in genuine conflict. On the Bass, however, neither the Shag nor the Herring Gull (which is losing ground on the fringe of the observation colony) effectively competes. Morton Boyd (pers. comm.) considers that the Fulmar *Fulmarus glacialis* may, in at least one gannetry, successfully do so, and Fisher records competition between Guillemots and Gannets on Noss (Fisher & Venables 1938). Though not British seabirds, Red-billed and Yellow-billed Tropic Birds *Phaethon aethereum* and *Ph. lepturus* are probably the best example of interspecific competition for nesting sites significantly influencing breeding success (Stonehouse 1962). These belong to the same order as the Gannet.

**Tendency to return to natal colony.** The observation colony shed light on the interesting tendency of birds to return to breed in the area of origin—well known in many animals whose life history involves migration or dispersion. Although colonising new areas and reclaiming lost breeding ones obviously require some individuals to pioneer, the tendency to

return has been assumed to hold for the Gannet. So far, though, there have been no methodical attempts to discover what proportion of ringed nestlings do eventually breed in other colonies. Fisher and Venables (1938) decided that the increase on Noss between 1914 and 1918 could be accounted for only by colonisation from outside, and all new gannetries must be started by such pioneers. The nearest colony which could have provided the Bempton (Yorkshire) pioneers is the Bass, more than 150 miles to the north.

By colour-ringing chicks and recapturing ringed adults breeding for the first time we discovered not only that they tend to return to the same geographical location—the Bass colony—but even to the small area or ledge where they were born. The return tendency could clearly be advantageous in several ways. The individual's own existence proves at least that successful breeding was, and probably is, possible there. Wynne-Edwards (1962) has also emphasised the potential value to the species of evolving local populations genetically adapted to the particular environment, which may differ significantly from other areas within the species' range.

The Needle, an isolated and inaccessible stack on the south-west side of the Bass, is of particular interest with respect to the returning tendency. In 1961 it held 35 nests and 35 sites, the latter mostly on tiny projections or pointed pinnacles. By 1963 only two of these sites had accumulated nest material; many of them could never do so, and several had been abandoned. Since sites were available elsewhere on the Bass it is inconceivable that these birds were forced to use such unsuitable spots. It seems more likely to be a rather unusual demonstration of the tendency of the Needle offspring to return there and, in the absence of convenient ledges, attempt colonisation of highly unsuitable niches.

Despite the attraction exerted by other nesters, Gannets maintain individual territories (the areas immediately around the nests), resulting in a characteristically regular dispersion within the group (plate 8). It is important that Gannets *should* be capable of breaking away from an established group and, though unusual, I have recorded a nest with egg 30 yards from the nearest occupied nest. An investigation of typical nest-spacing showed that 72% of 408 inter-nest distances (from centre to centre) measured between 2 ft and 2 ft 6 in.

**Annual return to breeding colony and duration of stay.** Adult Gannets may be present at the Bass from before the end of January to November, and good numbers were there throughout the mild winter of 1934-35 (Robinson 1935). Birds first landing in early January or even December stay only a few hours and may then be absent for many days.

**Pattern of recolonisation.** The first area to be recolonised on



the Bass each year was a band running at mid-cliff level around the rock, though extending up into a pocket on the north face and towards the top of the west and south-west faces. Later arrivals spread above and below this band, and the upper breeding limits on flatter ground were repopulated by established birds up to six weeks later than the first areas. Superimposed on this distribution were the effects of age and sex, old males returning first (though in several instances the members of old pairs were first seen within 24 hours of each other).

Newly-returned Gannets show great wariness and occasional panics, which may plausibly be supposed to result from the Gannet's fear of land on first returning from long periods at sea, and it may be that the areas first repopulated are the safest and provide the easiest take-off. No early birds occupy sites far from the cliff edge and most are actually on ledges. Areas first reoccupied are also probably the oldest-established on the rock, although of course containing only the same proportion of old birds as any area colonised for more than a few Gannet generations. Coulson and White (1960) recorded in a Kittiwake *Rissa tridactyla* colony that birds returning first belonged to the densest parts, and suggested a cumulative effect of social stimulation carried over from year to year. Gannets, however, nest at a fairly uniform density except in fringe areas.

**Return and weather.** The date of return is largely independent of weather. For example, birds returned in the last quarter of January 1963 when the severe weather was at its worst. They remain on their sites for a spell, regardless of conditions, leave again, and gradually build up periods of attendance.

Weather records for the Bass were examined in detail for the latter half of February and the whole of March 1962 for a correlation between weather and the number of Gannets on the rock. It was clear that adverse conditions had little if any effect on the birds present *at the time*. Fluctuations in numbers could not be accounted for by temperature, wind direction, wind force, or visibility (Snow (1960) correlated the return of Shags to Lundy with the mean temperature of the surrounding sea).

However it seemed possible that the effect of weather on fishing conditions could be influential. Strong winds and low temperatures tended to be followed by a decrease in numbers, even though these conditions no longer obtained. It may be that birds leaving the colony during or after gale-force winds were forced to spend longer fishing, and the rate of departure could then exceed that of arrival. However, the decreases were often rather more dramatic than such a gradual process

would produce. The colony density fluctuates widely, not only in January and February, but up to the third week of April. As late as the second week of April, 75% of areas occupied by established birds, mostly experienced breeders, were suddenly depopulated. Such decreases were not merely correlated with the absence of good landing conditions; sudden increases even occurred during icy gales with sleet and snow. Sometimes the emptying was due to the simultaneous departure of males which had attended their sites for two or three days without the female appearing.

The effect of bad weather on early Gannet attendance is clearly complicated by other factors, and it may safely be said that the most extreme conditions cause little discomfort at the breeding station. Whether its effect on attendance is mediated through its influence on fishing conditions, or whether it is merely a relatively weak factor superimposed on physiological states (to which, of course, day-length changes and temperature probably contribute) remains to be shown. It may be added that Guillemots, Kittiwakes and Fulmars appear far more immediately susceptible to unpleasant conditions before laying, and unlike Gannets vacate their ledges at such times.

**Duration of stay.** Some Gannets are present at the breeding colony from the end of January to November, though during February, parts of March and October, and November, visits may be intermittent. This period is between a third and two-thirds longer than in other British colonial seabirds (Shags excepted, since they often remain in the breeding area all the year). If measured in time actually spent at the breeding site the ratio is probably higher, since many of the early returners (Guillemot, Razorbill *Alca torda* and Fulmar, for example) desert the ledges even as late as May. Gannets which have bred at least once, spend about four months on the site additional to the time required for incubation (44 days) and feeding the young (94 days), giving an annual breeding cycle of some 9 to 9½ months.

Possibly Bass Gannets are now spending more of the year there than formerly. Older records, though vague, indicate a later return and earlier departure than at present. This trend could be related to the current expansion of the Bass colony, early returning birds running less risk of losing their sites. This in turn raises the question of why Gannets leave their nesting colonies at all. The answer probably does not lie in the weather nor in short daylight hours in winter (since the birds return in January anyway). It may be that their winter food occurs too far from land to make fishing trips practicable, particularly when there are no compelling reasons to journey back and forth. When fish do approach land in winter Gannets appear to have no hesitation in coming with

them. In Lerwick harbour in 1948 over 500 Gannets fished for coal-fish *Gadus virens* for several days (Kay 1948).

Adults apparently do not usually go very far south in winter, mainly dispersing into the North Sea and North Atlantic. However, one of my colour-ringed adult males was recovered in Senegal (reported recovery date 22nd April 1963) which is highly unusual for an adult Gannet. It had been killed by a native.

### Behaviour

Before considering Gannets in the circumscribed context of the breeding colony it is worth noting their habits beyond it. Ringing recoveries have shown that between the ages of 13 weeks and about 18 months to 2 years most North Atlantic Gannets live away from the breeding colony, mainly in waters south of Britain to the equator. The breeding colony only gradually becomes the focal point of their lives. Thus Gannets, two, three, and in many instances, four years old, only congregate relatively infrequently on the fringe of the breeding birds to rest, preen and take part in incipient breeding behaviour. Even during the year prior to first breeding (usually at five), they hold a site but may spend a considerable proportion of time away from it.

Besides nesting in dense colonies, Gannets fish in flocks, fly in skeins from the fishing grounds to the breeding station, collect nest material communally and gather as clubs. They also rest in aggregations on the sea, but are not evenly dispersed in these, and show little evidence of attraction towards each other. Although all these activities are in a sense social, one may draw a distinction, at least of degree if not of kind, between the Gannet's social relationships at and away from the breeding group, the latter showing fewer and simpler interactions. This point becomes particularly relevant when considering the evolution of colonial nesting and the more complex forms of social behaviour.

Thus the habit of fishing in flocks might be regarded as social behaviour, but, so far as can be seen from their methods of fishing, Gannets act as independent individuals brought together by a shoal of fish and by the stimulus of seeing other birds fishing.

Flying in skeins *back* to the breeding colony is such a regular habit that it must have advantages—probably each bird benefits from the updraught of the bird in front. Gannets do not often fly *from* the breeding station in skeins, probably because they are not heading for the same fixed point.

Communal gathering of nest material, as with Kittiwakes, is a regular habit, though not necessarily for the same reasons (in the Kittiwake it may be an anti-predator precau-

tion). Wind direction determines the general area, but birds clearly attract each other. However there is little interaction and on display between members of such a group and it is striking that they are entirely amicable to each other. I have even seen a bird snatch material from the beak of another without eliciting hostile behaviour.

The clubs show social behaviour of the complex kind shown by breeding birds—fights, threat displays, copulation, etc. The incipient sexual behaviour of both immature and adult club birds has already been commented on. At these gatherings even two-year-olds (though rarely one-year-olds) form temporary pairs, and show all the displays seen in breeding groups, though in less complete form. The individual distance between pairs is less, and also less regular than in a breeding colony, so that such gatherings have a dense and uneven appearance from afar. It is noticeable that birds of equal age, and therefore roughly similar plumage, tend to pair together. Although a sub-adult may form a temporary association with a three-year-old, it is unusual for an adult or sub-adult to do so with a two-year-old. The behaviour of club birds is altogether more tentative than that of birds establishing a proper site. Although young females regularly show the typical appeasement behaviour—facing-away from males—they also show aggression to them, as though their individual aggression, regardless of sex, has not yet been inhibited by sexual and fear tendencies. Further, males do not respond to this by attack, as they would in the breeding group, but by reciprocal menacing or even mild fleeing. Later on, however, the female's readiness to accept extremely severe attacks from the male without retaliation plays an important part in allowing pair formation.

Three-year-old birds may (rarely) copulate, but I have never seen a two-year-old mount. However, club sexual behaviour, like aggression, is atypical and disorganised. Females may reach out and perform a mutual display with one male whilst still part of a temporary pair formed with another! In all these instances, except the clubs, which form an intermediate category between the complex social behaviour in the breeding colony and the simple social relationships away from it, Gannets perform activities in groups. But pair contact is still limited to the site and it seems likely that the pair can never meet away from it except fortuitously. I doubt whether the pair remains together at all during the winter.

**The breeding colony.** A gannetry comprises a dense aggregation of highly aggressive individuals. Despite this the colony is usually orderly, and not a group of birds acting independently and fighting, stealing nest material, and so on, indiscriminately. To avoid wasteful strife and to coordinate

behaviour between members of a pair and between neighbours, so that the correct response to a given situation is made with a high measure of certainty, it is necessary to communicate by clear signals (Gannets, as we have seen, have a very limited vocabulary). Whilst this is true of colonial species in general, it is particularly important to the Gannet, which is unusually aggressive and fights frequently and severely (Nelson 1963a).

Ignoring for the moment the relevant question of what selective forces have favoured the evolution of such extreme aggression, one can at least see clearly that it concerns the establishment and maintenance of a nest site and pair. At 64% of sites whose progress we followed, at least one fight was involved during their establishment by the male, and of course this figure represents only a relatively small proportion of the actual number of fights. So far as females are concerned, more than 90% of all pairs whose formation we recorded involved more than one female, and most involved fighting.

Thus aggression is a conspicuous element in Gannet breeding behaviour and has had a striking effect on many aspects of its breeding biology. For instance, it has required the development of at least three appeasement postures; it has made it necessary for the chick to be guarded throughout the 13 weeks fledging period, thereby reducing the total 'fishing power' of the pair; it has precluded young from wandering in the period immediately before their first flight, thus denying them the short practice flights which probably all its relations, the boobies, have; it probably causes the death of some newly-fledged young (see later); etc.

Nevertheless an animal's behaviour in any given context cannot be dominated entirely by a single consideration. It must always be a compromise between various interests, none of which can completely overrule the rest. Thus aggression cannot develop as an isolated trait, but must be associated with an appropriate development of the fear response, to ensure, for example, that Gannets flee in situations in which it would be hopeless to fight. In a corresponding way morphological characters cannot develop independently—bright plumages used in display must develop only so far as consistent with the animal's need for camouflage, and so on. It is helpful before briefly describing Gannet behaviour, to emphasise this notable bias towards aggression and its concomitant effects, of which the following are examples:

1. Fighting and threat behaviour are much commoner in Gannets than in other members of the Sulidae.
2. Gannets have developed three appeasement postures, which reduce the likelihood of overt aggression between in-

dividuals. Appeasement postures are less conspicuous and frequent in the boobies.

3. Gannets have developed a special site ownership display (plates 13a, b), aggressively motivated, which most if not all boobies lack.

4. Whenever the pair meets on the site the male bites the female fiercely on the head or neck (plate 14a). No boobies do this.

5. Aggression between the sexes is such that Gannets have developed a conspicuous ceremony which pair members perform on meeting at the site (plate 14b), and which reduces tension and aggression between them. No boobies have developed a corresponding display to anything like the same extent.

6. During copulation the male bites the female severely (plate 15a). Booby males do not.

7. Owing to the menace of attack from neighbouring adults, Gannet young are constantly guarded throughout the long fledging period, whereas with the boobies, which show demonstrably less aggression, the chicks are not guarded.

Even within a family as well-knit and closely related as the Sulidae, therefore, we find striking evidence of the unequal development of aggression, which shapes Gannet behaviour so much more powerfully.

**Behaviour in the breeding colony.** After searching out an unoccupied site male Gannets spend a prolonged period just guarding it. If unchallenged for about three days their attachment strengthens and they may then be considered established and will fight in defence of the site. If in this time, however, they are seriously challenged, perhaps by the bird whose site they unwittingly usurped, they readily give way, thus avoiding needless strife.

Gannets defend their territory by fighting, threat behaviour, and a stereotyped site ownership display. Fighting (plate 12b) is bitter and damaging and carried out solely with the formidable beak, which grips the opponent around the head, neck or throat, or else interlocks with its beak. They also stab and shake each other. By strong pushing (not pulling) each attempts to dislodge the other from the disputed site. Considerable evidence suggests that Gannets were originally cliff-nesters, and it seems reasonable to suppose that their fighting method evolved in, and is primarily adapted to, this habitat. Opponents are readily dislodged from ledges, but when the fights occur on flatter ground, where Gannets now often nest, there is no such speedy solution, and fights often rage back and forth for up to two hours and lead to serious wounds. When fighting they are attacked by neighbours and

often sustain nasty wounds. However they usually ignore such punishment, and do not attempt to remain on the disputed site and thereby avoid it. Threat behaviour is used to maintain inter-nest distances and consists of a forward lunge with open beak, often with a twisting motion of the head, and a withdrawal which seems part of the movement, not a reaction to any behaviour from the neighbour. It is stereotyped and slightly exaggerated and to that extent ritualised. It grades through jabbing and gripping into overt aggression.

Whilst standing on the site, and in no other place, Gannets frequently perform a conspicuous display which I called bowing (plates 13a, b). This has been briefly described by other observers as solo-dancing wing-bowing, and curtseying, but nobody has described its function or motivation. Bowing birds begin by shaking their heads from side to side, open their wings a variable amount and make one to six (females average two, males three) sweeping downward movements of the head and neck, either to one side of and beyond the feet, or between them. After each dip the head is lifted and shaken from side to side. The bow is accompanied by aggressive calling and usually terminated by a sideways tail waggle. Immediately after the final dip the bill tip is pressed into the upper breast in a position which suggested the name, pelican posture.

It is not intended here to analyse bowing in detail. Although its form does not immediately suggest aggression it is, nevertheless, an aggressively motivated display whose function is to defend the nest or site by repelling potential intruders. It is commonest at those parts of the season when aggression is highest (as measured\* by the frequency of aggressive behaviour such as menacing) and is always shown by the victor of an aggressive encounter, never by the loser. Bowing is not performed merely during site establishment, but continues throughout the season, during which the male bows thousands of times.

Bowing is a convenient behaviour pattern from which to begin a general summary of Gannet behaviour, since two other important displays are modified versions of it, and the pelican posture itself occurs in several contexts apart from bowing.

Perhaps the most spectacular and commonly observed behaviour pattern is mutual fencing, which occurs when partners meet on the site. They stand breast to breast and, with head and bill inclined upwards and wings outspread, fence with their beaks, calling loudly (plate 14b). Occasionally they

\*The frequency throughout the season of all the main behaviour patterns was measured by systematic 5-minute counts of their occurrence in standard groups of birds.

reach down to the nest, so that the display rather resembles two individuals bowing, but slightly impeding each other. This behaviour shows elements of fear, aggression and sexual interest, and functions as a tension-reducing display in which the aggression engendered by the meeting of the pair on the site (which both members defend against all others) is dissipated without overt aggression. It is, of course, now well established that courtship behaviour in birds shows fear and aggression components besides the sexual tendency (see *e.g.* Tinbergen 1954).

During pair formation the male attracts the female to the site by another modified form of bowing. In this case the aggressive elements (which are the dipping movements derived

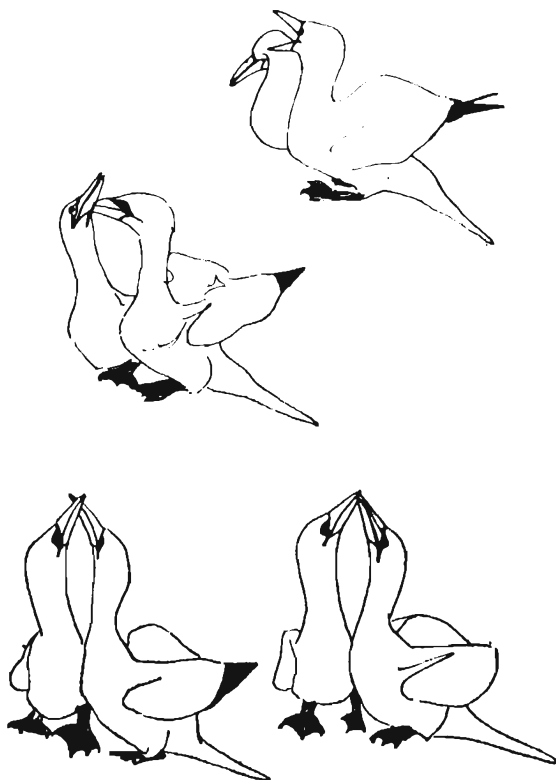


FIG. 2. Gannets meeting at their nest site: the male bites the female, who faces-away before beginning the mutual fencing display.

from aggressive nest-biting) are reduced, and the display consists mainly of head shaking, directed towards the female, with slight reaching movements and wings closed. It is silent.



When the female first steps onto the male's territory he often attacks her fiercely and she then shows a marked form of appeasement behaviour by quickly turning her nape to receive the male's bite (plate 14a and fig. 2). This facing-away behaviour was shown to be effective in permitting pair formation in cases in which the male's aggression would otherwise have prevented it. It is interesting that the Gannet has entirely separate and distinct ownership and advertising displays, whereas most species use the same behaviour (e.g. passerine song) both for attracting females and for repelling other males. This, together with the extreme aggression in defence of the site, prolonged seasonal attendance, and other factors, again emphasises the importance of the site in the Gannet's breeding biology.

As mentioned earlier, sky-pointing is a common and striking Gannet behaviour pattern, performed prior to flight or movement on foot, particularly away from the nest (plate 15b). I analysed 408 instances of this behaviour, recording the context and the effect on neighbours, so far as this could be determined. Without going into details it may be said that it did not appear to reduce the likelihood of the sky-pointing bird being attacked, and in fact was not used by birds making their way through nesting ranks, when it should have been if its function were to procure an unmolested passage. Instead such birds merely dashed with neck outstretched and inclined upwards to avoid bites. Nevertheless, such a conspicuous and bizarre behaviour pattern may well have a function in addition to facilitating change-over, and a more complete analysis must be attempted. It may be added that in some booby species this same behaviour pattern, or a modified form of it, is the male advertising display by which he attracts a female. Nevertheless it is probably derived from pre-flight behaviour (which it resembles in many particulars) and the advertising function developed from it by further elaboration.

The pelican posture (plate 13b), mentioned as part of bowing, is performed in a wide range of situations involving mixed fear and aggression, and by removing the bill from an attacking position probably reduces the chance of overt aggression. For example, it commonly follows threat behaviour between neighbours, which rarely leads to fighting. In more hostile encounters it is commoner in the inferior bird, if there is one.

This quick survey of Gannet behaviour patterns would be incomplete without mention of that used to shake, settle and remove loose dirt, etc. from the plumage. The full procedure involves several distinct parts. First the tongue bone is depressed and the head and neck stretched forward and

upward as far as possible. Then the wings are flapped strongly and with increasing speed, and the head and neck, with feathers ruffled out, rotated violently around the horizontal axis. The body feathers are also fluffed out, and the process ends with a vigorous tail-waggle. Any tactile stimulus, such as rain, a neighbour's excreta, dirt, etc., or even the sight of one of these, will elicit this behaviour, which I termed rotary head shaking. There is a strong correlation between rotary head shaking and fear, alarmed birds performing it far more frequently than relaxed ones. This is probably due to the tactile stimulus from feather tightening, which itself results from fear or alarm. Frightened birds are sleek, with compressed plumage.

During copulation the male bites the female's head fiercely (plate 15a), a habit not found in other species of Sulidae and yet another example of the greater development of aggression in the Gannet. Copulation is strongly linked with nest building, as in many birds, and reaches a peak about two weeks before the egg is laid. During this period, also, the proportion of successful copulations reaches a peak (those in which ejaculation occurs can be distinguished from incomplete ones). It ceases immediately after laying but is as quickly resumed in the event of egg loss, even if this occurs after three or more weeks incubation. Gannets copulate about 200 times each season, with no marked diurnal rhythm. Boobies on the other hand copulate mainly in the early morning or evening and sometimes during the night.

Nest building and touching movements are extremely common as in most if not all Pelecaniformes, and also often occur as displacement reactions in conflict situations.

With the exception of preening, mutual preening between members of a pair (common in the Gannet), defaecating, incubation behaviour, and care of the chick, the above account mentions all the more obvious behaviour patterns which may be seen in a breeding colony.

It is interesting that up to the present I have never recorded mutual preening in the Red-footed Booby. This seems to be because of the absence in this species of any effective meeting ceremony which can channel the aggression engendered by pointing bills more or less at each other as mutual preening requires. Hence these boobies strictly avoid this, spending very little time together on the nest and avoiding coming face to face whenever possible.

### **Breeding biology**

Annual return to the colony has already been mentioned: this section deals with the egg, egg laying, incubation and chick.

**The egg.** 393 eggs weighed between 81 gm and 130 gm (mean weight 104.5 gm). This constitutes 3% to 3½% of the adult's weight. The shell is unusually thick for the size of the egg, possibly to withstand pressure from incubation underfoot against a relatively unyielding nest surface.

The egg is pale blue and translucent when laid, quickly turning white with an outer chalky layer which chips readily, producing a roughened surface. It becomes stained, and occasionally black and shiny as a result of transference of mud from the webs, and their polishing action when settling into position. During incubation eggs lose 9% to 13% of their weight.

Laying was seen on five occasions, on all of which the tail was depressed and guided the egg into the nest—important because the Gannet has a very poorly developed retrieving ability. In three cases the female crouched in a tense position with wings held up and out, tail raised and slightly to one side, and strong cloacal contractions. Once extrusion was preceded by ten tail erections, during the last four of which the female fell forward with one wing asprawl. In another instance the female fell forward as the egg emerged. The remaining occasions were less violent. The one accurately timed laying took two minutes. Eggs may be laid at any time of day and probably also at night.

Gannets attend their sites up to three months before laying, and during the final two or three weeks the nest is built, mainly of grass and seaweed though also of flotsam. An old report of Solan Geese greatly damaging corn fields in East Lothian may refer to gathering nest material.\* From time to time we noticed sudden accessions of straw, turning whole groups of nests yellow. Large nests are accumulated and added to throughout the season. At least one important function of such a nest is to raise the chick above the quagmire in wet conditions. Gannets excrete in two ways: either clear of the nest; or with depressed tail, when excreta is directed onto the sides of the nest. The latter is of great importance in cementing nests onto otherwise untenable sites.

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\*As the author is in the Galapagos we cannot contact him about this, but he may be referring to a quotation (*antea* 1: 429) from the *Haddingtonshire Courier* of 24th February 1911: "There have been many complaints concerning the damage that is being done by solan geese on East Lothian farms, and this season their depredations have been more than usually severe. They come from the Bass Rock and other natural habitats and settle in large flocks on the fields of winter wheat. . . ." We reproduced this from the *Haddingtonshire Courier* of 24th February 1961, where it had been reprinted. In fact it must refer to grey geese *Anser* sp., and not to Gannets, or else the writer has been muddled, as the note goes on to say that young clover plants are the birds' favourite morsel on grassland, that they favour particular farms, that they are difficult to shoot because they settle right in the middle of the fields and that the damage they do to the early stages of plant growth is incalculable.—ED.

The first eggs are normally laid at the end of March; and cold and wild weather, whilst possibly retarding the onset of laying to the first few days of April, has no marked effect. The last eggs are laid in late June, or very exceptionally in early July, and are either replacements or from first-time breeders. The spread of laying is thus considerable, covering some three months, though despite this the peak laying date is remarkably constant from year to year. During the three years study it fell within two or three days of 30th April. Laying is more closely synchronised in large groups than in small, at least partly because of greater social stimulation in the former. Two groups of 20 nests in the middle of a dense mass showed more-closely synchronised laying (*i.e.* spread over a shorter period), and also an earlier onset of laying, than an equivalent isolated group. There are two interesting problems posed by these facts:

1. What is the advantage of a constant peak laying date?
2. Why do Gannets have such a wide spread of laying—from March to June?

The first question is not easily answered. From the fledging success of 'early,' 'middle' and 'late' chicks it seems that no one part of the season has any significant advantage over the others. Apart from very late chicks all survive about equally well. This argues a relatively constant food supply throughout the long season. One might even suppose that it would be advantageous for Gannets to have a pretty constant and steady laying rate, lacking any real peak. This would spread the load on the food supply, an advantage if the latter *were* constant. However the very fact that the breeding season is confined to a certain period of the year suggests that food is more plentiful at that time. The Gannet's synchronised laying presumably fits with this. Also, of course, the limits of the breeding season are doubtless partly determined by weather, since Gannet chicks could probably not survive in most winters. Certain advantages of synchronised laying in some species (*e.g.* reduced time during which the young are exposed to predators) do not apply to the Gannet.

The second question is closely related to the first. If food supply is seasonal, but not markedly so, the wide spread of laying would be adaptive in ensuring that some young utilise the relatively plentiful supplies early and late in the season, whilst placing the main load (yet not too heavy) on the most plentiful supply. Also there are occasional severe storms in June or July which kill a number of chicks of an age too large to be covered by the parent, yet inadequately protected by feathers. If the majority of young were at this stage, high mortality could follow such a storm. A wide spread of laying dates avoids this possibility.

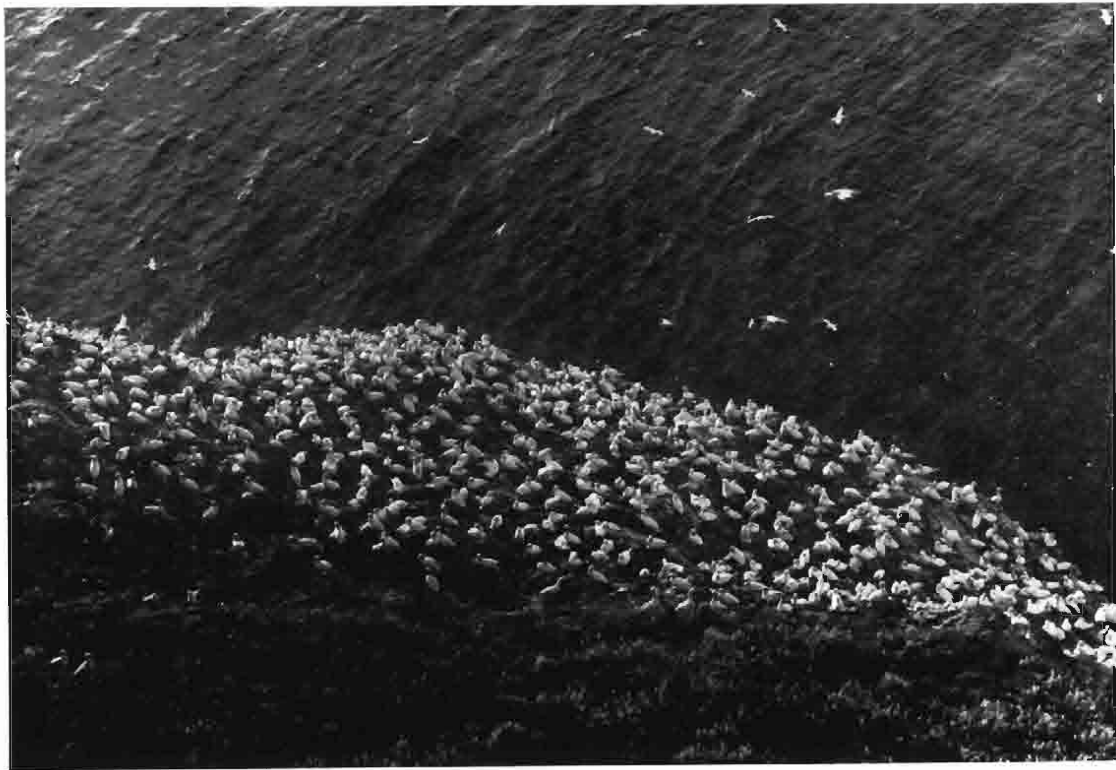


PLATE 8. Gannets on the Bass Rock in July, showing the observation group in which each nest and site was followed individually for three years. Note the regular spacing of the nests.

*Photograph by J. B. Nelson*



PLATE 9a. Fully grown 12-week-old Gannet chick, food begging. This picture illustrates the juvenile plumage.

*Photograph by J. B. Nelson*



PLATE 9b. Gannet in 1st-summer plumage (one year old).

*Photograph by J. B. Nelson*



PLATE 10a. Gannet in 2nd-summer plumage (2 years old): head may be yellow by now; bill attaining adult colour.

*Photograph by J. B. Nelson.*



PLATE 10b. Gannet in late-2nd-summer plumage: head entirely clear.

*Photograph by J. B. Nelson.*



PLATE 11a. Gannet in 3rd-summer plumage (3 years old).

*Photograph by J. B. Nelson*



PLATE 11b. Gannet in late-3rd-summer plumage.

*Photograph by J. B. Nelson*





PLATE 12a. Gannet in 4th-summer plumage (4 years old).

*Photograph by J. B. Nelson*



PLATE 12b. Gannets fighting. Note aggression of neighbours.

*Photograph by N. Tinbergen*



PLATE 13a. The head shaking phase of bowing—a site ownership display.  
*Photograph by J. B. Nelson*

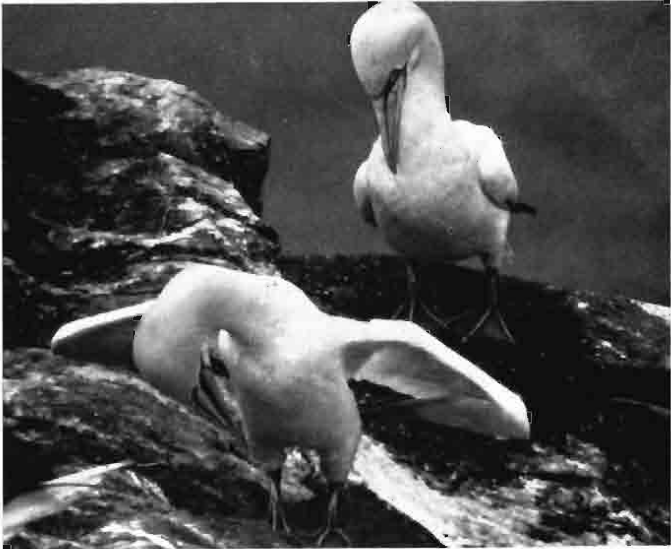


PLATE 13b. The dip of bowing. The bird behind is in the pelican posture.  
*Photograph by J. B. Nelson*



PLATE 14a. Male aggression towards the female takes the form of biting her when they meet at the nest or site; the female then faces-away. This display is a reliable means of sexing Gannets.

*Photograph by J. B. Nelson*

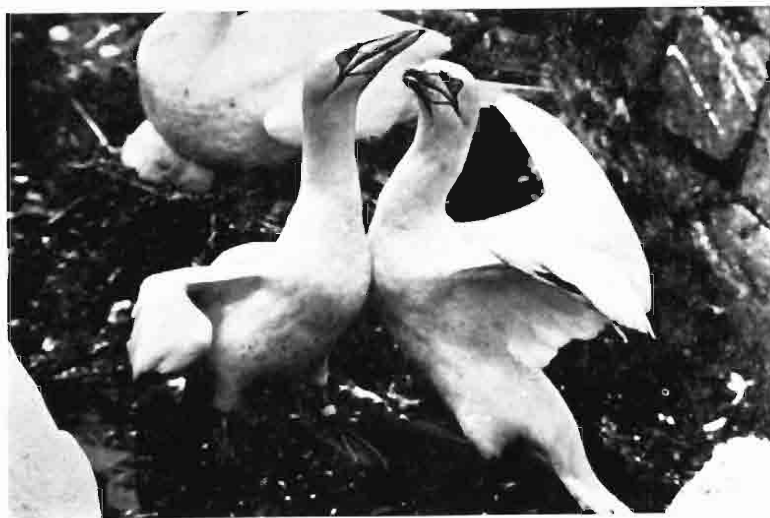


PLATE 14b. Mutual fencing—the Gannets' display on meeting at the nest.

*Photograph by J. B. Nelson*



PLATE 15a. Gannets copulating: the male bites the female's head.

*Photograph by J. B. Nelson*



PLATE 15b. Gannet sky-pointing: this posture precedes movement, usually away from the nest or site.

*Photograph by J. B. Nelson*

The date of egg laying becomes progressively earlier with age, and older females lay heavier eggs. There is also a correlation between the date of laying and nest size, early eggs tending to be in larger nests. As already mentioned, early eggs tend to be laid in large, dense breeding groups. Very early eggs, laid in late March or early April, are only found in nests near the cliff edge or on the cliff face.

Gannets invariably lay only a single egg, which they can replace at least twice if lost, usually requiring about a fortnight to do so, but those lost immediately after laying are more quickly replaced. After about a month's incubation they will not normally re-lay and, of course, eggs lost late in the season are less likely to be replaced than those lost early. The latest date of loss of an egg subsequently replaced was 21st May. Females breeding for the first time are less likely to re-lay than experienced females, but this is at least partly because their first eggs are laid comparatively late in the season.

The single-egg clutch raises several interesting points which I have discussed elsewhere (Nelson 1964a). There are certainly no grounds for supposing that Gannets are prevented from laying two or more eggs by the physiological strain of producing them, since the eggs are small in relation to the weight of the female. The widely accepted view developed by Lack (1954 & refs.) is that clutch-size corresponds to the number of young which the parents can feed adequately (i.e. with unimpaired chances of survival to breeding). The twinning experiments already mentioned (see also later) seem to conflict with this view, but of course do not in themselves disprove it. Wynne-Edwards' theory readily accommodates the twinning results, but poses problems regarding the mechanism of group selection.

**Incubation.** Gannets incubate by placing their webs on top of the egg, sometimes one overlapping the other. So far there has been no demonstration that the necessary warmth actually is transmitted by the feet, and Howell and Bartholomew (1962) have in fact suggested that in the Red-footed Booby it is not. However the feet do become noticeably warmer during incubation and show some vascularisation. It would be a simple matter, as Ian Pennie suggested (pers. comm.), to take small samples of web and, by histological examination, demonstrate vascularisation, and possibly oedema.

Both sexes incubate, though males take slightly longer duty spells. The average incubation period is 43.6 days and hatching success is 82% of all eggs laid (in the complete absence of human disturbance). When the egg pips it is transferred to the top of the webs, thus preventing the weakened shell from caving in and crushing the chick. In hot weather eggs may also be transferred, or even exposed entirely. It was

interesting to find that in most cases where inexperienced pairs failed to rear young, the failure occurred in the early stages of chick growth and was not due to inability to feed them. Thus in several cases the newly-hatched young were brooded incorrectly and trampled to death. The fledging period was no longer for chicks from inexperienced parents than for those from experienced ones, proving that there was no real difference in the amount of food given to them.

**The chick.** Gannets feed their young by regurgitation, the chick inserting its bill between the adult's mandibles and then pushing its head far into the parent's gullet. Food is transferred in large gobbets which make a conspicuous bulge as they travel up the adult's throat and down the chick's. Spilled food is usually eaten by the adults, even tiny fragments on bare back bones. By contrast, fish regurgitated by frightened adults is not normally eaten. When the chick is tiny the adult gently engulfs it with widely parted mandibles. The chick must then grope about inside, and frequently emerges with food piled on top of its head. At this stage the adult produces a semi-digested mess rather than large pieces, and apparently feeds the chick without receiving a specific begging stimulus. Feeding sometimes occurs even before the chick is free from the shell. A considerable amount of food is taken at a relatively early age.

From the age of about a month chicks are quick to pester a newly-arrived parent. The chick usually faces the adult and touches the tip of its beak (plate 9a) in a series of rapid, small-amplitude side to side movements. In low intensity begging small bouts of this activity are punctuated with long quiet spells. When the chicks become larger they importune vigorously. At the highest intensity of food begging (from five weeks onwards) they retract their necks and, with bill pointing upwards but not touching the adult's, perform a regular swaying head movement, accompanied by throat pulsations (the gular fluttering common to *Pelecaniformes*) and a rhythmic yapping noise, like a puppy. Usually, however, begging is merely a matter of following the tip of the adult's bill with its own, making quick stabbing and caressing movements (cf. mutual fencing).

The adult takes evasive action if unwilling to respond to begging, otherwise it remains motionless, bill inclined slightly upwards, and allows the chick to pester. A motionless adult stimulates the chick to intensify its efforts and is the adult's highest form of co-operation. All these forms of begging have a marked effect on the adult and at times cause violent regurgitating movements even when there is no food to be passed.

Rather surprisingly, adults are capable of producing food

even after a long spell on the nest and several prior feeds. This was sometimes shown by the visible signs of food-passing (chick-gulping, food spilling, etc.). On several occasions the adult which had been on duty fed the chick even though its mate had just arrived from a fishing trip.

Chicks are fed several times each day. By contrast the chicks of Red-footed Boobies and White Boobies may remain unfed for several days. Many species are well adapted to withstand these long periods of food shortage. Rice and Kenyon (1962) showed that the young of the Laysan Albatross *Diomedea immutabilis* could survive four to six weeks without food, and young Gannets can certainly survive a fortnight and probably much more (Booth 1881-87). Even a small chick (12 days) survived a further 12 days when one parent died and the other stayed on guard. A White Booby chick in the Galapagos survived over a month without significant weight increase, owing to aberrant feeding behaviour by its parents. It is clearly a valuable and common adaptation for seabirds, whose food supply may be erratic, to survive lean periods and to fatten up in good ones.

Fishing trips usually take 7 to 13 hours; trips of less than 3 hours or more than 24 are comparatively rare. The fishing range is at least 100 miles and very probably more. Adults fishing well north of Aberdeen and south of the Farnes are almost certainly Bass Gannets. Barlee (1956) timed Gannets flying round the Bass and estimated that a speed of 34-40 m.p.h. was leisurely flight and 50 m.p.h. could be achieved. From these figures it seems that the maximum fishing range could well be 400 miles—providing an impressively large food-gathering area.

The twinning experiments showed that Gannets were able to rear two chicks successfully in the year of the experiment. The twins fledged at approximately the same weight as normal single chicks, but took about four days longer to do so. Twins survived only if both were approximately the same weight and age when put together, otherwise the heavier took most of the food and eventually displaced the smaller. It was surprising, however, that the adults were capable of providing sufficient food to satisfy two young, particularly as these reach a weight of over 4,000 gm, one and a half times the weight of an adult. It seems from our present work in the Galapagos that Red-footed and White Boobies are incapable of supporting two chicks, and even single chicks frequently suffer from food shortage. The Gannet's position, therefore, seems exceptional and is to be further investigated. It is interesting that the rearing of a chick has no effect on the weight of adult Red-footed or White Boobies here. This goes some way towards suggesting that rearing twins would not deleter-

iously affect adult Gannets, and removes another possible reason for their apparently inexplicable failure to exploit their ability to rear twins.

The young are attended throughout the 94 days of their growth, except towards the end of the season, when parents are absent more often. Possibly as an adaptation to cliff nesting, chicks rarely wander at all from the nest, even on flat ground, in contrast to the three species of booby I have so far seen (Red-footed, White and Blue-faced *Sula nebouxii*), in which the young always wander extensively weeks before fledging. Of course the White Booby territories are much larger than those of the Gannet. The young share in defence of them and as soon as they are reasonably large can dispel intruding adults. This is never the case with Gannet chicks, which do not show aggression to intruding adults. Even the very closely related Australasian Gannet appears, from the account of Wodzicki and McMeekan (1947), to wander extensively in the pre-fledging stage. This poses an interesting problem, which I believe concerns greater adult aggression in the North Atlantic Gannet.

The juvenile Gannet fledges by irrevocably leaving the nest, without any previous exploration (Nelson 1964b). Usually it jumps off the cliff edge and flies straight out to sea. Once having alighted it is unable to rise again for some time (possibly two weeks or more) and does not return to the nest to be fed. By contrast most if not all booby species return for 7 to 9 weeks after their first flight, and continue to be fed regularly by their parents. Nor does the adult Gannet accompany the juvenile to sea. It must therefore acquire the art of plunging before it is weakened by starvation, and it can probably fast for some weeks after fledging. It is very fat when it leaves the nest, having been fed right up to the day and sometimes the hour of departure, there being no starvation period in the Gannet. Nevertheless there is a high mortality during this period, and the booby's habit of feeding the young after fledging is a significant difference which must greatly increase the survival rate of juveniles and so partly make up for the lower hatching success, etc. In the boobies all the factors so far mentioned reflect the erratic nature of their food supply (slow growth, post-fledging feeding, etc.), whereas the Gannet's food supply seems far more dependable.

An interesting phenomenon is the tendency for adults to attack newly-fledged juveniles on the sea, particularly in the early part of the fledging season. These attacks are sometimes severe and almost certainly lead, in at least a few cases, to the death of the juvenile, though I have never seen one killed outright. The habit is not of course confined to the Gannet (e.g. terns have it—Cullen 1956), but its attacks are more serious and persistent. Such attacks seem to be a further mani-



festation of unusually strong aggression, non-functional in this particular context but highly functional in the vital business of site establishment and maintenance.

The juvenile Gannet may appropriately be left swimming away from the nesting stack on its long journey south. It will return to the Bass probably in its second or third year and probably breed for the first time in its fifth year if it is one of the 30% or so that survive the first one or two years. However Gannets are long-lived, with a life expectation of about 16 years when adult (annual mortality of colour-ringed adults averaged only 6%).

**Summary.** It may now be helpful to attempt a simplified summary of the main points. The tendency to nest on isolated islands and cliffs may be an anti-predator device related to an earlier period in Gannet evolution, when mammalian predators such as wolf and brown bear may have been important. Aggression possibly developed in relation to site shortage, resulting from the need for this special habitat. Dense nesting and aggression have required the evolution of clear signal behaviour and we find that most Gannet behaviour patterns are well differentiated in form—even more so than in other members of the family. The behaviour appropriate to each situation is absolutely distinct, and some behaviour patterns have become more exaggerated and changed than in other members of the group. For example, boobies do not possess a ritualised form of menacing, a pre-flight posture, a special site ownership display, nor even such an exaggerated form of the rotary head shake. In the Gannet, aggression is not confined merely to site establishment and pair formation but also occurs in other contexts, and has required the development of various forms of appeasement behaviour.

Sites and mates are permanent, and having once bred Gannets do so annually thereafter. A single-egg clutch is almost or entirely invariable, and breeding success is extremely high. Starvation of chicks is very rare, and the extra burden of rearing two instead of one was carried with apparent ease by several experimental pairs. Together with a long pre-maturity period, which apparently often exceeds that physiologically necessary, and a proportion of adult non-breeders, the apparently unused food-gathering (*i.e.* chick-rearing) power is puzzling, and prompts careful consideration of Wynne-Edwards' stimulating hypothesis concerning the regulation of breeding effort by social mechanisms, thus preventing over-breeding and subsequent over-exploitation of food supply. The strong tendency for Gannets to form local populations, by their tendency to return to the area of origin, also fits with Wynne-Edwards' requirements. These population facts must, however, be recorded as *potentially* explicable on more ortho-

dox principles of natural selection, involving, perhaps, a more direct action of food on breeding success (see Ashmole 1963), though the mechanism of this action remains obscure. Further evidence, particularly long-term, is required. For instance, do twinned Gannet chicks survive less well than single chicks after fledging; is the subsequent fecundity of their parents reduced, perhaps by their earlier death; how does availability of food as measured by growth of young vary from year to year; how does breeding effort, measured in as many ways as possible, fit in with this, etc.? Perhaps the elimination of various alternatives is the best approach.

The morphological similarity of the sexes goes with shared site defence (fighting and display). Shared incubation and chick-rearing duties fit with the requirements of lengthy food foraging expeditions. The constant guarding of the chick and site throughout the 13 weeks fledging period, and the long period spent on the site before and after breeding, emphasise its importance, and also underline Gannet aggression, which does not allow chicks to be left unattended. In fact the entire system of behaviour in the colony may be helpfully regarded in relation to the central position of the nest site and associated aggression. More than this, aggression considered in the family as a whole seems a valuable key to an understanding of the omission, development or exaggeration of various behaviour patterns. It must, however, be functionally related to differences in site requirements, and presumably competition, in the different species.

All the behaviour described here may be seen from a suitable vantage point without disturbing the birds. A final practical point is offered concerning the effect of human disturbance on breeding Gannets. Displaced birds may well lose eggs or very small chicks to Herring Gulls. A simple precaution is to cover eggs loosely with nest debris. However it is usually unnecessary to put adults off their nests and they will withstand a very slow and cautious approach. It is best when ringing to work singly in a squatting position, move with exaggerated care, and avoid disturbing any chicks with feathers sprouting; those which wander from the nest are sometimes unable to get back, although they have a strong tendency to do so.

#### **Acknowledgments**

I am very grateful to Dr J. M. Cullen for extensive criticisms and suggestions during this work. I also profited much from conversations with Dr N. Tinbergen, F.R.S. My wife gave invaluable help in the field for three arduous seasons.

For permission to live on and study on the Bass, without which the work could not have been carried out, I owe Sir Hew Hamilton-Dalrymple a large debt.

In matters of boats, midwinter records of Gannets around the Bass, and practical aid on it, I am happy to acknowledge my debt to F. Marr and to the lighthouse keepers.

I gratefully acknowledge a Nature Conservancy scholarship which supported this work for two years, and a senior Zoological scholarship from the Carnegie Trust which financed the third year.

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## Short Note

### Snow and Ross's Geese in Scotland

Snow Geese in Britain always come under suspicion of having escaped from captivity, and regrettably it seems likely that the increased number of reports in recent years must be attributed to this cause (*antea* 2: 306). Nonetheless these conspicuous birds may be useful markers in flocks of wild geese to which they attach themselves, and as one can seldom be sure of their past history it seems worth continuing to record them. This omnibus note summarises the numerous and sometimes confusing reports for the winter of 1963-64.

A blue-phase Lesser Snow Goose which returned to the Libberton area for the fifth successive winter (see *antea* 1: 272, 386, 463, 501; 2: 204, 377, 434) was first seen on 5th October 1963. On 27th October it was closely compared with two Ross's Geese (see below), and it stayed in the area until 15th March (Sir R. Erskine-Hill). On 30th March what may from the description very well have been the same bird was seen with Pinkfeet near Caerlaverock, Dumfriesshire (J. H. Morgan, Miss M. Worswick).

During summer 1963 great interest was aroused by the discovery of a pair of white geese which had a nest and five eggs (unfortunately flooded later) among Grey Lag Geese in northern Iceland. They were carefully identified as Ross's Geese, and both had the stubby bill of this species. One was substantially bigger than the other, but the vegetation made it impossible to see whether they were ringed (Dr F. Gudmundsson).

There must be a strong probability, especially in view of later events, that these were the same two birds seen in Galloway in winter 1961-62 (*antea* 2: 306) and in Perthshire in 1962-63 (*antea* 2: 418). It may be added that the 1961-62 birds seem now to be accepted as large Ross's Geese by everyone involved, but that there is a view that the descriptions of the 1962-63 birds cannot easily be reconciled with such an identification. It will be recalled that in both instances the larger bird was ringed on the right leg and the smaller on the left.

The first white goose in autumn 1963 was seen on 27th September, when at least one flew high over Tayfield, Fife, with the big arrival of Pink-footed Geese at the time (*antea* 2: 486; 3: 36); it seemed as large as most of the Pinkfeet (Dr J. Berry). This could have been either a Snow or a Ross's Goose.

Next day, 28th September, two white geese arrived at Libberton, Lanarkshire, with the main body of Pinkfeet, and these were undoubtedly Ross's Geese—the same two noted above (the bigger ringed on the right leg and smaller on the

left). They remained together, and were substantially smaller than the Greater Snow Goose which visited the area until two years before (*antea* 2: 203). Really good views of them were obtained on 27th October and it was seen that they were definitely smaller than Pinkfeet and had little rounded heads, with smallish bills, bright pink except for a yellowish-white nail and a patch of grey at the base of the upper mandible. At this moment the Blue Goose (see above) walked right into the picture, providing a most valuable comparison. It was considerably larger and the pink on the legs and bill was much less bright; the head was flatter and the black lips on the longer and larger bill could be seen clearly, as well as the fact that the top of the base of the bill was definitely pink. It was a much more powerful-looking bird, and seemed to be wrenching tufts of grass out by the roots when feeding: the Ross's Geese were much tidier feeders (Sir R. Erskine-Hill).

In the same area three days later, on 30th October, these two birds were independently identified as Ross's Geese by the observer who tentatively suggested two years earlier that the Galloway birds might be Ross's (*antea* 2: 306). They were very similar to the birds he saw then, and which Hugh Boyd no longer considers too large for Ross's Geese, since the Wild-fowl Trust now has comparable birds at Slimbridge; the grey area (one quarter to one third) at the base of the bills was conspicuous, possibly more so than two years earlier. A detailed description agrees closely with that given above, and the high crowns were particularly noted, with the peak of the crown well forward and eyes rather close to the bill; the bill of the larger bird was at least a little shorter than an average Pinkfoot's and certainly stubbier-looking, while that of the smaller bird was distinctly shorter and stubbier (A. D. Watson).

The two Ross's Geese were seen in the area until 16th November (W. Brotherston, RE-H), and other reports of two white geese in Forth probably refer to the same birds, thus: near Dolphinton, Lanarkshire, with Pinkfeet for three or four days prior to 10th October, whence they flighted east in the evenings (J. Mackenzie per E. Douglas Home per Hon. H. Douglas Home per G. Waterston); Libberton area on 16th November (Mrs Young per W. Brotherston); fighting in to Gladhouse with Pinkfeet on the evening of 17th November (D. G. Andrew); flying east at Middleton Mains Farm, Midlothian, at 8.45 a.m. on 19th (R. Walker per WB), and shortly after 9 a.m. over Cousland, Midlothian, as if on the way to Aberlady, East Lothian (Miss M. Maxwell per WB); and on the sand bar at Aberlady with Pinkfeet on 24th November (J. Oliver; L. Young per WB).

The birds next appeared in north Fife with Pinkfeet at Dunbog on 14th December, and were again clearly identified as

Ross's Geese, the smaller size, neat round heads with distinct foreheads, and small bills, being noted among other points (T. Spence, Miss V. M. Thom). What were taken to be the same birds were examined again under good conditions at Castleton, Eassie, Angus, on 16th January by one of the same observers (VMT). So far, so good!

On the very same day they were seen at the same place by another experienced observer and closely observed with stand-telescope. Keeping together while feeding, they were appreciably smaller than the accompanying Pinkfeet, and one was ringed on the right leg and the other on the left (all points repeatedly noted elsewhere). The observer however, even when pressed, felt that they were not Ross's Geese but Lesser Snows—a matter he carefully considered on the spot—because neither had a high forehead and their bills were not small in relation to their heads, but were a conspicuous feature, altogether stouter than those of Pinkfeet and more like those of Greylag (both species being there for close comparison); no grey patches on the bills were seen. The birds were 2 miles further east on 25th January (Dr J. W. Campbell).

It seems impossible to reconcile this description with Ross's Geese, but it is equally hard to account for the similar strange combination of rings, similar behaviour by the birds, and no overlap of dates, if one supposes that this was a pair of Lesser Snow Geese.

There are only vague reports of two geese after this—two rumoured to be with Greylags near Meikleour, Perthshire, on 5th April (per I. McLachlan); two in the same area, mentioned by Colin Gibson (*Dundee Courier* 18.4.64); and two reported by A. Fraser near Bridge of Earn (*loc. cit.* 2.5.64).

Finally there are records of single Snow Geese (perhaps the same bird) in two areas; one with a medium-sized bill was seen on 8th March on the shore at Templehall, south-west of Kingoodie, Perthshire (H. Boase); the other, in the Bridge of Earn area of Perthshire, was reported with Pinkfeet and Greylag (but usually with the latter) by many observers between 25th March and 14th April, when it disappeared. There is some suggestion that it may have been in the area since New Year. It was noticeably smaller than a Greylag, about the size of a Pinkfoot, and VMT noted that it was distinctly leggier than the Ross's Geese, with a heavier all-pink bill and no striking forehead. Some observers considered that it was a Greater Snow Goose (others reported it as a Lesser) but it seems unwise to attempt a certain racial identification on the available evidence (A. R. H. Allan, Miss P. G. Baxter, Dr J. Berry, J. Forsyth, Dr D. Jenkins, I. McLachlan, Dr T. C. Smout, T. Spence, Miss V. M. Thom).

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## Current Notes

(Key to initials of observers: R. S. Baillie, G. H. Ballantyne, J. Ballantyne, Miss P. G. Baxter, H. Boase, G. Bowers, T. Boyd, W. G. Breed, W. Brotherston, W. Q. Brown, R. G. Caldow, Dr J. W. Campbell, H. J. Chandler, C. V. Chilcott, S. J. Clarke, J. L. S. Cobb, F. Colman, D. Coutts, C. N. L. Cowper, H. G. Cree, G. M. Crighton, Miss M. H. E. Cuninghame, W. A. J. Cunningham, G. Dick, R. C. Dickson, H. E. M. Dott, J. Dunbar, W. W. Dunn, W. Eddie, J. Edelsten, N. Elkins, Sir R. Erskine-Hill, T. H. Evanson, Miss W. U. Flower, H. A. Ford, M. Forrester, R. W. Forrester, T. Forsyth, H. Galbraith, I. Gibson, A. H. Hazell, J. A. D. Hope, K. Hoskins, D. C. Hulme, Miss H. Knight, Lt.-Col. W. M. Logan-Home, D. G. Long, A. Macdonald (AMcD), D. Macdonald, K. S. Macgregor, Mrs M. J. MacIntosh, W. McKie (WMcK), I. M. MacLean, Mrs M. J. C. Maclean, A. T. Macmillan, I. MacNally, A. MacRae (AMcR), R. W. Marriott, W. Matheson (WMT), R. Meekin (RMk), I. C. Munro, J. Murray, J. B. Murray, R. Murray (RMu), T. Nisbet, D. J. Norden, C. Ogston, D. W. Oliver, C. E. Palmar, Mrs E. F. Paterson, W. Porteous (WPt), J. Potter, A. Pringle, W. Pryde (WPD), A. Raffan, A. D. K. Ramsay, G. A. Richards, I. B. Roy, P. W. Sandeman, Dr J. G. Selwyn, M. Sinclair, D. Skilling (DSK), Dr J. A. Smith, Dr T. C. Smout, D. Stalker (DSt), D. M. Stark, J. H. Swan, C. Tait, I. Taylor, A. S. Temple, R. J. Tulloch, L. A. Urquhart, A. F. G. Walker, P. Walker, Dr R. S. Weir, T. Weir, G. White, M. G. Wilson, J. Woodward, W. Wyper, Mrs M. H. Young, I. Young, B. Zonfrillo.

Unless otherwise stated, all dates refer to 1964.)

### Distribution

Observations made before 16th February are not included in this section except to amplify more recent topics

Single **Red-throated Divers** on fresh water were at Threipmuir, Midlothian, on 18th April (TB), and Morton Lochs, Fife, on 24th May (CT). Once again a pair of **Great Crested Grebes** bred at the latter place (see 3: 84) and had two chicks from 16th June until at least 7th June (CVC, AMcD, CT).

The main passage of **Manx Shearwaters** at Elie Ness, Fife, was early in May, with over 200 per hour passing on 2nd (DWO); and in the Sound of Mull thousands were flying west on 5th, and smaller numbers on 12th and 15th (PW). Three **Fulmars** flying up the Tay above the railway bridge on 18th April were unusually far into the estuary (CVC). A blue-phase Fulmar was prospecting cliffs at Ardross, near Elie, on 24th May with seven normal birds (DWO).

In the Rires Forest area of Tentsmuir, Fife, **Herons** were found nesting in pines during May, and by 7th June this new heronry had two pairs sitting, but unfortunately a third nest and eggs had been blown down (CVC).

Broods of tiny **Mallard** ducklings at St Andrews on 19th and 20th April, and at Duddingston on 21st, are rather early (ATM). A drake **Garganey** was seen at Morton Lochs on 29th

March (CT), and there was a pair with Scaup at Carsethorn, Kirkcudbrightshire, on 25th April (JGS). In Renfrewshire a pair was seen at the edge of some reeds on 6th and 10th June (RGC, DSt, WUF), and a different bird at Paisley Moss, also on 10th (HG, IG, GW). A pair of **Gadwall** at Rowbank Reservoir on 5th April was just in Ayrshire, a county where they are not at all common (LAU). Over 370 **Long-tailed Ducks** were at Seafield, Leith, on 4th April (cf. 3: 86) (CT); and as late as 5th June a pair was courting off Elie Ness (DWO). A duck **Common Scoter** was inland on Kilconquhar Loch, Fife, on 11th April (DWO); and off Tentsmuir over 100 Common Scoters were seen on 14th June—a rather late date (CVC). At Seafield, Leith, **Eiders** reached a peak of 2,200 on 4th April (CT). Flocks of up to 40 **Red-breasted Mergansers** were already back on the sea off Tentsmuir as early as 21st-22nd June (CVC). Further **Smew** (see 3: 36, 86) were at:

Clickimin Loch, Lerwick, Shetland—red-head on various dates 1st Jan to 3rd Mar (DC, WPt).

Strathbeg, Aberdeen—3 red-heads 19th Feb (JF).

Dunalastair, Perth—drake 11th Apr (TW).

Rowbank Reservoir, Ayrshire end—red-head still 5th Apr (see 3: 36, 86) (LAU).

Hirsel, Coldstream, Berwick—2 drakes 5th-6th Mar (WQB).

At Gadloch, Lanarkshire, there was a pair of **Shelduck** on 24th April; one had been seen there four months earlier (3: 36) (WW).

Three free-flying and wary **Bean Geese** were carefully examined at the head of Loch Etive, Argyll, on 21st June, but the very strange date makes one wonder whether they were escapes (ICM). The latest flock of **Pink-footed Geese** reported in the spring was of 36 at the Loch of Strathbeg, Aberdeenshire, on 20th May (CO). A **Brent Goose** was at Tynninghame, East Lothian, on 12th April (TB, IBR); and in Shetland there were nine at Virkie on 10th May, and smaller numbers earlier (DC). A number of **Canada Geese** were reported at the end of April: one at Tynninghame on 25th (TF), three at Kingoodie, Perthshire, the same day (HB), an approachable pair at the Endrick mouth on 26th (HGC), and one at Clunie Loch, Perthshire, on 29th (HB).

A pair of **Mute Swans** at St Andrews on 31st May had an exceptionally large brood of nine small cygnets (ATM). A June **Whooper Swan** was with Mutes on the Dee in Aberdeen on 20th and 21st (WGB, RWM). Seven **Bewick's Swans** were still at Barr Loch (see 3: 87) on 16th February (RWF, WWD), and there were four at the Loch of Strathbeg on 19th (JE).

**Buzzards** in southern counties included seven soaring, diving and pursuing over Gartocharn, Dunbartonshire, on 25th March (TW), and three over Penpont, Dumfriesshire, on 7th June (WMcK). There was an **Osprey** at Sandwater, Shetland,



on 10th June (GB), and single birds (perhaps only one) at various localities in Forth and Tay: the first report is from Tentsmuir and the Eden estuary, where it perched on the same post as the bird reported in July and August 1963 (2: 487; 3: 42); it appeared on 27th and 28th April and then disappeared, but turned up again on 10th May and on 22nd June (CVC, THE); the other reports were from Eyebroughty, East Lothian, on 3rd May (MGW); near Kilconquhar, Fife, on 10th (DWO); and the Isle of May on 19th (CNLC).

There were definitely more reports of **Quail** than usual:

- Dornoch, Sutherland—calling briefly 14th, 17th and 24th June respectively in three fields within two miles of each other (DM).
- Glen Ey, Aberdeen—one 29th May (CO).
- Rannagulzion, Blairgowrie, Perth—one 8th-12th June (JWC).
- Bardowie, Milngavie, Stirling—one 21st June (RSB, CEP).
- Isle of May—one 20th May (AMcD).
- Aberlady, East Lothian—one 24th May (MGW).
- Hallyburton, Greenlaw, Berwick—one 24th June (DGL).

After sitting for about six weeks a hen **Pheasant** still had nine of its twelve eggs at an abandoned croft at Carloway, Lewis. No cock was seen. Eggs were introduced a few years ago on the island of Bernera, and escaped birds were seen for a year or two in spite of the weather, predators and shooting. Later they appeared across the water at Breascleit, where the cock birds were reported to have scared the wits out of an old woman, who took them for witches (WAJC).

Inland records of **Whimbrel** on spring migration are of single birds at Paisley Moss, on 26th April (HG) and Castle Semple Loch on 7th May (RGC), both Renfrewshire, and two at Peppermill, Fife, on 9th May (GD, JP). **Black-tailed Godwits** were reported from:

- Lewis—one near Stornoway 29th Apr; one Loch Stiapavat 4th May; one Stornoway 22nd May (NE).
- Hougharry, North Uist—one 10th June (WAJC).
- Strathbeg, Aberdeen—one 20th May (CO).
- Montrose Basin, Angus—two 3rd May (GMC, JD).
- Eden estuary, Fife—73 counted 2nd Apr (DWO).
- Cult Ness, Fife—one 29th Apr and 9th May (HJC).
- Tynninghame, East Lothian—one 17th May (RMu).
- Cobbinshaw, Midlothian—one 17th Apr (CT).
- Endrick mouth—two 26th Apr (HGC).
- Gadloch, Lanark—one 10th-15th May (FC, WW, BZ).

Single migrant **Wood Sandpipers** were at Gadloch, Lanarkshire, from 15th to 18th May (FC, WW, BZ); Paisley Moss, Lanarkshire, on 21st (HG, IG, RMk, GW); and Barvas, Lewis, on 27th (NE). No spring records of **Common Sandpipers** at Tentsmuir were known to Grierson (2: 146), but this year there was one at Morton Lochs on 16th April, two there on 7th May, and one on the east shore on 30th April (CVC). The first sandpipers of the year were seen at the usual time:

12 Apr—1 Tynninghame, East Lothian (TB, IBR); 1 Gladhouse, Midlothian (RMu).

13 Apr—1 Barr Meadows, Renfrew (HG, RMk).

16 Apr—1 Morton Lochs (CVC).

17 Apr—a few Tweedsmuir area, Peebles (HAF).

18 Apr—noted Gavinton, Berwick (DGL); pair Glen Lyon, Perth (PWS).

19 Apr—2 pairs Yetholm, Roxburgh (RSB); 1 Loch Garten, Inverness (HAF).

20 Apr—about 5 pairs near Yarrowfeus, Selkirk (JB).

Two **Greenshanks** at Tynninghame, East Lothian, on 21st June should probably be considered early autumn birds rather than late spring ones (TB). Three **Curlew Sandpipers** were at the Loch of Strathbeg, Aberdeenshire, on 20th May (CO). Two **Avocets** were seen on the beach at Cullivoe, Yell, from 22nd to 24th March, when one was killed, probably by a cat; the other left next day, and it, or another, was reported on Unst on 26th. There are several previous records for Shetland (RJT).

At the Lewis colony on 12th June it was estimated that there were 3/4 pairs of **Great Skuas** breeding and 40/50 pairs of **Arctic Skuas**—about the usual numbers (see 1: 124) (WW). As further indication of the spread of the Great Skua, though breeding was not established, one was seen on a suitable moor in North Uist on 11th June, and two visitors to North Rona were attacked by two pairs of birds answering the description of this bird (WAJC). There was one offshore at Tentsmuir, Fife, on 21st June—an odd date—and at least five Arctic Skuas too (CVC).

Of scores of **Lesser Black-backed Gulls** in Scapa Flow, Orkney, on 16th April, about one in five was of the Scandinavian form, as dark as Greater Blackbacks; and on 18th another Scandinavian bird was seen off the Cumbraes—evidently the first recorded in Bute (TCS). Immature or sub-adult **Glaucous Gulls** were reported at Ayr (2) on 29th February (RWF); Duddingston, Edinburgh, on 30th March (HAF); Barassie, Ayrshire, on 2nd-3rd April (GAR); and in the Eden estuary, Fife, on 20th June (TCS). Single sub-adult **Iceland Gulls** were in Aberdeen on 13th March, and nearby at Nigg Bay on 3rd May (RWM). **Little Gulls** were noted at:

Scapa Flow, Orkney—adult 16th Apr (TCS).

Nigg Lighthouse, Aberdeen—adult 15th Apr (AST).

Invergowrie Bay, Perth—15th Apr (29) (HB).

Kingoodie, Perth—Apr 16th (37), 26th (180), 28th (170), May 9th (28) (HB).

Tayport, Fife—7th Apr (22) (HB).

Tentsmuir (east shore), Fife—more than usual: March 23rd (3), 28th (30+), 29th (12), Apr 13th (6+), May 24th (one 1st-summer) (CVC).

Kilconquhar Loch, Fife—1st-summer birds: one 21st May (HGC), two 20th and 25th June (DWO).

**Kittiwake** colonies on the Eye peninsula in Lewis at

Sheshader (280 pairs) and Swordale Point (48) are additional to those listed by Coulson (*Bird Study* 10: 172) (NE).

There were two **Black Terns** at Morton Lochs, Fife, on 19th May (AMcD), and one was at Kinnordy, Angus, on 9th June (HB). At Linlithgow Loch, West Lothian, there were as many as 45 **Common Terns** on 26th May (TB). The first Common/Arctic Tern was at St Andrews, Fife, on 12th April (JLSC); a Common Tern was at Elie Ness, Fife, on 20th (DWO); and two were at Maidens, Ayrshire, on 26th (WPd)—normal dates. More **Roseate Terns** than usual were seen at Tentsmuir, with 18+ on 24th May, 10 next day, 20+ on 7th June, 8 on 14th, but all gone a week later (CVC); off Elie Ness this was the commonest tern by 24th May, with dozens there, and still the commonest, but in smaller numbers, on 11th June (DWO). The only arrival date given for **Little Terns** was 27th April, when four were at Tentsmuir (CVC). There were some very early **Sandwich Terns** among the first arrivals:

- 29 Mar—1 Joppa, Edinburgh (TCS); 2 Burntisland, Fife (GHB).
- 2 Apr—noted Barassie, Ayr (GAR).
- 4 Apr—4 Portencross, Ayr (RWF).
- 5 Apr—5 Dornoch, Sutherland (DM).
- 6 Apr—1 St Andrews, Fife (JLSC); and later 5 Tentsmuir 11th Apr (CVC); and passage of 30 per hour on 12th at St Andrews (JLSC).

A **Little Auk** was seen in Scapa Flow, Orkney, on 16th April (TCS). Early in June a pair of **Black Guillemots** was showing strong interest in an inaccessible crevice on Little Cumbrae, where the species is not known to breed (WUF).

A mysteriously tame **Turtle Dove** appeared in Bowmore, Islay, in the first week of May, and was later joined by another, both being still there on 8th June; and two were seen near Port Ellen, Islay, on 3rd June (HK). There was one near Morton Lochs—a new species for Tentsmuir—on 13th May and 7th June (CVC); two at Earlsferry, Fife, on 23rd May (DWO); and one at Loch Killin, nine miles ENE of Fort Augustus, Inverness-shire, on 30th May (LM). Records of **Collared Doves** are being accumulated meantime.

A very early and somewhat mysterious **Cuckoo**, which never called, was reported from Balfroon, Stirlingshire, on 29th March, 5th and 11th April (JBM); more normal birds were heard near Girvan, Ayrshire, on 19th April (WPd); Staffin, Skye, on 23rd (MJCM); and Walkerburn, Peeblesshire, on 25th (JB).

A **Little Owl** was seen near Glencaple, Dumfriesshire, on 23rd February (AFGW); there are several previous Solway records (e.g. 2: 248) but there is a suggestion that others have never been published.

**Swifts**, with several April dates, were well up to time:

- 27 Apr—1 Leith Walk, Edinburgh (MGW).

28 Apr—1 near Howgate, Midlothian (RHH); 1 Gladhouse, Midlothian (HAF).

29 Apr—1 Elio, Fife (DWO).

30 Apr—2 reports Kirkcaldy, Fife (GHB, DWO); 1 Glasgow W.2 (HGC).

1 May—1 Dumfries (DSk); 1 Gadloch, Lanark (BZ).

2 May—1 Lendalloch, Ayr (RWF); 3 Possil Marsh, Glasgow (RSB).

3 May—1 Barns Ness, East Lothian (CT); 4 moving west Gullane, East Lothian (MGW); 4 Stockbridge (JHS), and 5 Dean Valley, nearby, in Edinburgh (JADH); 3 Morton Lochs, Fife (CVC); 1 Montrose, Angus (GMC, JD).

A **Green Woodpecker** in a new Dunbartonshire locality (see 2: 261, 346, 445) was seen and heard at Arrochar on 5th April. Previously one was heard but not seen on 6th October 1961 at Inveruglas on the west side of Loch Lomond, this being earlier than the first modern published record for the county (see 2: 261, 346).

With a single exception the first **Swallows** were distinctly late:

11 Apr—1 Hermiston, Midlothian (TF).

15 Apr—1 Tentsmuir (CVC); 1 Kingoodie, Perth (HB).

16 Apr—1 Kilconquhar, Fife (DWO).

17 Apr—2 Cupar, Fife (DWO).

18 Apr—1 near Stranraer, Wigtown (JM); noted near Gavinton, Berwick (DGL); 1 Aberlady (JADH); 1 Colinton, Edinburgh (ATM); 1 Skinflats, Stirling (IT).

19 Apr—a few Rescobie, Angus (GMC, JD); noted Muir of Ord, Ross (DCH).

20 Apr—1 near Ayr (JM); 2 Morton Lochs (CVC); 1 Beauly, Inverness (AMcR).

By contrast, **House Martins** were definitely early:

17 Apr—1 Tweedsmuir, Peebles, and 1 St Mary's Loch, Selkirk (HAF).

18 Apr—3 Glen Clova, Angus (CVC).

19 Apr—noted Girvan, Ayr (WPd).

20 Apr—6 Kilconquhar, Fife (CT).

21 Apr—1 Balornock, Glasgow (BZ).

22 Apr—3 Cupar, Fife (DWO).

23 Apr—1 Yetholm, Roxburgh (RSB); 4 Haddington (AMcD).

The first **Sand Martins** were very late indeed:

11 Apr—1 Kilconquhar, Fife (DWO).

15 Apr—2 Cupar, Fife (DWO).

17 Apr—4 Kingoodie, Perth (HB).

18 Apr—several near Stranraer (JM); 3 Leadburn, Midlothian (JHS); 1 Staffin, Skye (MJCM).

19 Apr—about 100 Rescobie, Angus (GMC, JD).

20 Apr—3 Yarrow, Selkirk (JB); noted St Andrews (JLSC); 5 Morton Lochs (CVC); 7 Loch Garten (HAF).

In Ayrshire there was a **Hooded Crow** at Beith on 5th April (BZ). In Ross-shire there was an exceptional party of at least 28 **Long-tailed Tits** on 3rd June in birches by the River Carron (DM).

A late **Fieldfare** near Brechin on 14th May had damaged its

wing and could not fly properly (JD). The first **Ring Ouzels** were perhaps a bit late, as the only March reports were of five at Whiteside Law in the Moorfoots, Midlothian, on 27th (WB); one on the Braes of Balquhiddel, Perthshire, on 28th (PWS); a cock at Closeburn, Dumfriesshire, on 29th (JHS); and two cocks in the Sma' Glen, Perthshire, the same day (PGB).

The first **Wheatears** were also a bit late, with none until the last week of March:

25 Mar—pair Dunure, Ayr (GAR).

26 Mar—2 cocks Glenkilm, near Dumfries (DSk).

27 Mar—1 Stornoway (IMM).

28 Mar—4 Moorfoots, Midlothian (WB); cock Black Hill, Pentlands, Midlothian (HEMD); 1 Braes of Balquhiddel (PWS); 3 Island Roan, Sutherland (DMS).

29 Mar—cock Tynninghame (TB); 2 cocks Sma' Glen (PGB); 1 Rannoch Moor (JW); more than one Carloway, Lewis (WAJC).

The first **Whinchats** were quite early, with single cocks on 20th April at Thornhill, Dumfriesshire (JHS); and Blackford Glen, Edinburgh (HEMD). One was noted at Girvan on 22nd (WPd); and other April records included one at Boat of Garten on 27th, and three at Hillend, Edinburgh, on 29th (HAF). Two cock **Redstarts** were at Yetholm, Roxburghshire, on 21st April (RSB); there were three birds at Loch Vaa, Aviemore, next day (HAF); and there was a cock at Dunkeld, Perthshire, also on 22nd (JADH). These dates are normal or slightly late. A hen at Morton Lochs on 6th May is the first recorded there (see 2: 163) (CVC). A cock **Black Redstart** was seen regularly on Earlsall Moor, Tentsmuir, Fife, from 29th March to 1st April (CVC); and there was a hen in Leith Docks on 18th April (CT).

First dates for **Grasshopper Warblers** were normal:

26 Apr—1 Barr Loch, Renfrew (LAU); 1 Endrick mouth (MF per HGC).

27 Apr—1 Kilconquhar Loch, Fife (RSW).

2 May—1 Cumledge, Duns, Berwick (DGL); 1 Cramond (RMu); now 4 Endrick mouth (WE, DJN).

4 May—2 Roslin, Midlothian (ADKR).

In East Lothian this species was unusually numerous, with at least six at Saltoun, three at Ormiston and one at Aberlady (KSM). It is difficult to know whether chance records of this species indicate any change in status, but one at Dunwan Dam, Renfrewshire, on 12th June was the first heard there in twelve years of regular visits (LAU); other reports referred to two singing 2 miles south of Linlithgow, West Lothian, on 1st June (EFP, MHY); and two singing near Brechin (JD). Only two **Sedge Warblers** were recorded in April:

26 Apr—2 Barr Loch, Renfrew (LAU).

27 Apr—1 Kilconquhar Loch, Fife (RSW); and 28th (DWO).

2 May—1 Morton Lochs, Fife (CVC); 1 Possil Marsh, Glasgow (RSB).

3 May—1 Walkerburn, Peebles (JB); 1 St Abbs, Berwick (RSB); 1 Montrose, Angus (GMC, JD).

Single hen **Blackcaps**, evidently wintering birds, were at Manderston on 1st April (per SJC), and at fat at Edrom from 7th to 10th (WML-H), both Berwickshire; and the one in Inverness (see 3: 91) was last seen on 10th (MJM). Two cocks at Gavinton, Berwickshire, on 22nd April (DGL), and one at Gartocharn, Dunbartonshire, on 26th, arrived about the usual date (HGC). A nest with 5 eggs at Kilconquhar on 12th May seems to be the first breeding record for the eastern part of Fife (DWO). First reports of **Garden Warblers** are of single birds at Buchanan Castle, Stirlingshire, on 2nd May (DJN); and at Cumledge, Berwickshire (DGL), and Loch Tay on 9th (PWS). At least 11 in song at Kinnaird Park, Brechin, Angus, indicate a good population there (GMC, JD); and one sang in Stornoway again (see 2: 492) from 15th to 25th June (NE). The first **Whitthroats** were very late, with no April dates:

2 May—Cumledge, Berwick (DGL); Kilconquhar, Fife (DWO).

3 May—1 Blackford Hill, Edinburgh (HEMD).

6 May—East Lothian (AMcD); St Andrews (MHEC); cock Kingoddie, Perth (HB).

The first proof of breeding in Stornoway Woods (see 2: 95) was supplied by a pair rearing 5 young this year (NE). There were two early records of **Willow Warblers** in song, followed after a considerable gap by a great flood of reports:

6 Apr—1 Lendalfoot, Ayr (RWF); 1 Botanic Gardens, Glasgow (RSB).

15 Apr—Gartocharn, Dunbarton (TW).

16 Apr—1 Fairmilehead, Edinburgh (HAF).

17 Apr—1 Tweedsmuir, Peebles (HAF); 1 Poolewe, Ross (TCS).

18 Apr—several near Stranraer (JM); many Dumfries area (DSk); Girvan (Wpd); Gavinton (DGL); 1 Walkerburn, Peebles (IB); 1 Dolphinton, Lanark (MHEC); 1 Royal Botanic Garden (IHS) and 1 Colinton, Edinburgh (ATM); 1 Rothes, Moray (AP); 1 Staffin, Skye (MICM); Stornoway (NE).

19 Apr—lots Yetholm (RSB); 3 Kilconquhar (DWO); 1 Loch Garten (HAF); Muir of Ord, Ross (DCH).

There were only two March reports of **Chiffchaffs**: single birds in Dansholm Park, Glasgow, on 26th (RSB), and Stornoway Woods on 28th (NE, IMM, WMT). One sang all June in Stornoway Woods but breeding was still not proved (see 2: 350) (NE). More than one **Wood Warbler** at Loch Tay on 9th May is the only first date reported (PWS).

The first **Spotted Flycatcher** was noted at Roslin, Midlothian, on 7th May (ADKR), and one was at Fortingal, Perthshire, on 9th (JW); while the first cock **Pied Flycatcher** was seen at Courance, Lockerbie, Dumfriesshire, on 26th April (JHS). A hen was seen in the centre of Edinburgh in the Royal Botanic

Garden on 13th May (JHS). The first **Tree Pipits** arrived at the normal time:

20 Apr—cock Courance, Lockerbie (JHS).

22 Apr—Dunkeld, Perth (JADH).

26 Apr—Duns (DGL); 1 Kilconquhar (DWO).

30 Apr—1 Royal Botanic Garden, Edinburgh (JHS); Muir of Ord, Ross (DCH).

According to *Birds and Mammals of Shetland* **White Wagtails** are common on spring migration (earliest date 10th April) and **Pied Wagtails** are very occasional visitors. This year *alba* Wagtails were noted up to 33 days earlier; one at Seafield, Lerwick, on 8th March (GB); one in the first week of March, two on 28th, and four (Pied) on 30th, in Unst (MS per RJT); and one Pied at Mid Yell on 28th March (RJT). In view of the early dates these may all have been Pied Wagtails. Another Pied Wagtail was at Stornoway on 15th, 23rd and 30th March, but this race breeds there though it does not overwinter (NE, IMM, WMt). Migrant **White Wagtails** were reported in small numbers in various places between 12th April, when two were at Tynninghame (TB, IBR), and 14th May. "**Yellow**" Wagtails were reported at Skinflats, Stirlingshire, on 1st March (IT); Unst (2) on 30th (MS per RJT); Aberlady (♀) on 25th April (TB, HEMD); and West Barns, East Lothian (♀), on 3rd May (CT). A pair of *flavissima* was back at Hilda Marshes, Glasgow, on 7th and 19th May but could not compete with the bulldozers (see 2: 493) (FC).

A **Great Grey Shrike** was still at Barr Loch (see 3: 91) on 8th March (RWF, WWD) and 4th April (RCD); others were at Balfron, Stirlingshire, on 11th March (JAS); Aberlour, Banffshire, on 5th and 6th April (AP, AR); and Tentsmuir Point (first record for Tentsmuir) on 7th April (CVC).

There are further records of **Hawfinches** in the Edinburgh Royal Botanic Garden: two on 22nd April, and a cock on 5th and 6th May (see 2: 91) (JHS). Some southern records of **Crossbills** refer to a hen at Courance, near Lockerbie, on 30th May (JHS); three in Devilla Forest near Bogside, Fife, on 11th April (GD, JP); two cocks and two hens near Brechin in Kinnaird Park—where there was a nest in 1963 (2: 478)—on 12th April (JD); and at least two cocks and two hens at the head of Glen Clova, Angus, on 18th April (CVC).

Two rather late **Snow Buntings** were on the Ythan, Aberdeenshire, on 19th May (CO). A pair of **Tree Sparrows** was feeding well-fledged young at Kinaldie Station on 28th May, but while there do not seem to be any Aberdeenshire breeding records this one cannot be taken as conclusive, as the site is only 8 miles from the county boundary (CO). A count of 30 at Montrose on 3rd May was high for the area (GMC).

*Earlier observations—before 16th February 1964*

The **Greenshank** at Libberton, Lanarkshire, on 9th February (3: 88) evidently wintered by the Clyde, being noted on various dates from 14th November 1963 to 15th February 1964 (RE-H). The **Great Spotted Woodpecker** at Morton Lochs on 1st January (3: 90) was not the first as one was seen there on a telegraph pole on 2nd March 1963 (DWO). A winter **Blackcap** was seen at Thurso, Caithness, on 2nd January (KH), and a winter **Chiffchaff** in conifers near Thornhill, Dumfriesshire, on 23rd (JY).

## Obituary

CHARLES J. INKSTER

With the death of Charlie Inkster in his ninetieth year the Scottish Ornithologists' Club has lost an Honorary Member well known to all birdwatchers visiting Shetland. He devoted nearly all his life to bird protection, and was appointed R.S.P.B. Warden in the island of Yell over forty years ago.

His loss is a very personal one to me as I have known him since my boyhood days when I first visited Shetland, and in 1955 had the honour of presenting him with the R.S.P.B. Bronze Medal for his meritorious services to the Society. He was always there on the pier at Mid Yell to greet visiting birdwatchers and entertain them with cups of tea at his home at Reafirth.

How I wish I had written down all the fascinating stories he used to tell of the old days—such as travelling by the North of Scotland boat from Mid Yell to Leith when he was 18 years of age at a total cost of 12s 6d steerage. He often told stories about the Sea Eagles in Yell, and told me about the clergyman mentioned in the Venables' book *Birds and Mammals of Shetland*, p. 201, who robbed the Erne's nest on the Egg on the west side of Yell. His name was Sorby and he came from Derby. He got one addled egg in the nest, but was subsequently "given away" by someone who assisted him in the climb to the eyrie, and fined £5 in the Sheriff Court in Lerwick and ordered to forfeit the egg. It was not until two years later that it was discovered that he had substituted a Golden Eagle's egg instead, and had retained the egg of the White-tailed Eagle! Another of his stories concerned a former Laird of Muness who got a man to rob an Erne's nest. He descended the cliff on a rope in the dark "so as not to see the awful drop into the sea." He was rewarded with a poke of meal.

Charlie vividly remembered seeing young Sea Eagles on the



wing in his youth, and "hearing the auld bird barking like a dug." He once saw four eagles in the air at one time.

We mourn the loss of a very good friend and a real character.

GEORGE WATERSTON.

## Reviews

**The Life of Birds.** By J. C. Welty. Illustrated by N. Tolsor. British edition. London, Constable, 1964. Pp. xiii + 546; 129 line drawings, 99 half-tones, and 90 maps, charts and diagrams. 84/-.

This compendious volume presents an admirably full account of the present state of knowledge in the field of bird biology. It is intended for the general student rather than the specialist, but the author points out that some prior knowledge of biology will be necessary for the reader to cope with the more complex passages. The three major sections of the book deal with the anatomy and physiology of birds, their behaviour and breeding biology, and their ecology and distribution. There are also chapters on migration and orientation, flight, and the origins and evolution of the group. Such a large scope being covered within a single volume, it is not surprising that the author makes many generalisations. These are, however, backed by numerous examples, many of which come from the European literature, although the book is of American origin. A bibliography of some 800 titles is included, but it is perhaps a pity that there is no author index for ease of reference. The text is liberally illustrated with tables, maps and diagrams as well as fine photographs, mostly by G. R. Austing and Eric Hosking.

The most unfortunate aspect of this book seems to be uncertainty on the part of the author as to the nature of his audience, leading to a patchiness both in style and degree of complexity. Certain sections, such as that on moult and plumage, cover the ground fully and give a detailed account of terminology. In other places, the use of complex nomenclature is avoided to such an extent that lucidity suffers. In the chapter on the regulation of numbers, for instance, there is no clear statement of the difference between density-dependent and density-independent factors, so that one is left with the impression that anything which kills birds will also regulate their numbers. Some of the author's remarks on the origins of adaptations are also rather worrying: to state that vultures have been 'compelled' to feed on carrion because their feet have become weak, is hardly justified!

By and large, however, these criticisms result from the author's efforts to simplify his subject. Many ornithologists will find this book most useful, as I did, in giving them an insight into those branches of their subject with which they are unfamiliar.

P. J. B. SLATER.

**Birds' Nests and Eggs. Instructions to Young Ornithologists, V.** By C. J. O. Harrison. London, Museum Press (Brompton Library series), 1964. Pp. 130; figures and 17 photographs. 15/-.

Five of the six chapters are about eggs.

First there is an introductory chapter dealing with the evolution of the

avian egg; the author asks himself the question, "Why an egg at all?", and provides a very reasonable answer, showing that the light aerodynamic structure of the bird prohibits the carrying of its young. Production and construction of the egg are explained, and consideration is given to the abnormalities that sometimes occur.

Then the structure of the egg is described in more detail; the functions of the various layers and the manner in which they are formed are shown. The deposition of the colouring of the egg and its probable evolution are discussed. Various arguments concerning the factors controlling clutch size—such as mortality rate, capacity of ovary, size of egg, availability of food, and so on—are put forward, but most questions are unanswered and one is left with the lame but obvious conclusion that each factor must contribute to some degree. Mimicry amongst the eggs of brood parasites is a subject raising more unsolved problems.

So also is the development of the young chick within the shell. The life history of the domestic hen is known in minute detail, and is very well described. However, many breeding birds are very difficult to study and little is known about their eggs. The author hopefully leaves his problems with the reader.

The final chapter regrets man's age-old weakness for collecting eggs, and encourages instead the collection of observations, preferably on B.T.O. nest record cards.

The one chapter on nests lists the various classes of nests from the most primitive to the most sophisticated, tracing their evolution, and showing how they are adapted to the needs of their owners. This chapter again demonstrates the main weakness of this book, that too often the young ornithologist is instructed merely to find out for himself. Another weakness is that the author talks down to his audience, but maybe very young ornithologists will not notice this.

DAVID MERRIE.

**Fresh Water Birds.** Ten 2" x 2" colour slides by Eric Hosking. Notes by Eric Herbert. Diana Wylie Ltd, London. 27/6.

**Sea Birds.** Ten 2" x 2" colour slides and notes by Eric Herbert. Diana Wylie, London. 27/6.

These sets of colour transparencies come in a plastic "Viewpack", making it very easy to locate any particular slide. A small booklet accompanies each set and although not above criticism provides a simple and interesting commentary on the birds.

The colour reproduction is very much more faithful than it was on earlier sets a few years ago. The photographs are of a high standard and the general presentation is most attractive. The freshwater birds (by Eric Hosking) are, however, distinctly more pleasing than the seabirds, some of which have been photographed against the light. A slide devoted solely to a tern chick would have been better replaced with one of a species not featured—such as the Gannet, which surely has been left out because the photographer had no picture of it rather than from choice.

Copyright in the pictures is reserved for the photographers, which leaves one wondering what use is to be made of them. As they are so obviously extremely suitable for educational purposes and lecturing it is a pity that no guidance is given on whether such use is allowed or not.

ANDREW T. MACMILLAN.

**Flying Free.** By Reidar Brodtkorb. With foreword by Seton Gordon and postscript by P. W. Sandeman. London, Methuen, 1964. Pp. 134; 33 photographs. 12/6.

This is a short simply-written account of the author's efforts to protect White-tailed and Golden Eagles in Norway, garnished with pictures of birds and people. It is spiced with tales of exciting and at times highly unorthodox rescues of captive eagles, the successful introduction of one of these birds to a wild life in Scotland providing an extra interest for local readers.

ANDREW T. MACMILLAN.

**Also received:**

**Varda: the Flight of a Falcon.** By R. Murphy. Illustrated by K. Shackleton. British edition. London, Cassell, 1964. Pp. 151; line drawings. 21/-.

**The Summer of the Falcon.** By Jean C. George. British edition. London, Dent, 1964. Pp. 153; line drawings. Paperback. 12/6.

### Requests for Information

**Collared Doves.** A detailed account of the spread of this species in Britain is being prepared for publication in *British Birds* before next breeding season. Anyone who has records not already published or sent to *Scottish Birds* should write at once to Robert Hudson, B.T.O., Beech Grove, Tring, Hertfordshire. With a few exceptions Collared Doves remain scarce and sparsely distributed in most areas. At the time of writing no records at all are known for ten Scottish counties (Banff, Bute, Caithness, Clackmannan, Dunbarton, Kinross, Kirkcudbright, Peebles, Selkirk, West Lothian), and there is no certain proof of breeding for a further fourteen (Angus, Fife, Inverness, Kincardine, Lanark, Nairn, Orkney, Perth, Renfrew, Roxburgh, Shetland, Stirling, Sutherland, Wig-town). In many of the remainder they are known in only one or two places. In addition to all records of migrant or resident Collared Doves, information is also wanted about autumn and winter flocks, habitat preference, and nesting sites.

**Caithness checklist.** The Caithness Group of the S.O.C. are preparing a county checklist of the birds, and would welcome details of any records, new or old. These should be sent to the Group Secretary, D. M. Stark, 2 Harland Road, Castletown, Thurso, Caithness.

## Official Section

### THE SCOTTISH ORNITHOLOGISTS' CLUB SEVENTEENTH ANNUAL CONFERENCE

HOTEL DUNBLANE, PERTHSHIRE

23rd to 25th October 1964

#### Friday 23rd October :

- 5 to 7.30 p.m. Conference Office in the Hotel Dunblane opens for and members and guests to register, collect name cards and  
8.30 to 9.30 p.m. Annual Dinner tickets.  
6.15 p.m. Meeting of Council.  
8 to 9 p.m. FILM AND SLIDE PROGRAMME in the Ballroom. At 9 p.m. excursion leaders will describe places to be visited on Saturday and Sunday afternoons.  
9.30 p.m. to midnight Lounges available for informal discussions and refreshments (late licence).

#### Saturday 24th October :

- 8.45 to 9.15 a.m. Conference Office opens for registrations.  
9.20 a.m. Official Opening of the Conference in the Ballroom. ADDRESS OF WELCOME by David J. Grant Esq., Provost of Dunblane.  
9.30 a.m. LECTURE, "Conservation" by Dr W. J. Eggeling (Conservation Officer, Scotland, The Nature Conservancy), followed by discussion.  
11 a.m. INTERVAL for coffee and biscuits.  
11.30 a.m. ILLUSTRATED TALK, "Portuguese Sanctuary" by M. D. England.  
1 to 2 p.m. INTERVAL for lunch.  
2 p.m. EXCURSIONS by private cars leaving the Conference Hotel car park. Details will be posted on the Conference notice board.  
3 p.m. MEETING for R.S.P.B. members in the Ballroom.  
6 p.m. 28th ANNUAL GENERAL MEETING OF THE CLUB in the Ballroom.  
BUSINESS :  
(1) Apologies for absence.  
(2) Approval of Minutes of 27th Annual General Meeting of the Club held in Dunblane on 26th October 1963 (see "Scottish Birds" 2: 502-503).  
(3) Report of Council for Session 27.  
(4) Approval of Accounts for Session 27.  
(5) Appointment of Auditor.  
(6) Election of Hon. President: the Council recommends that George Waterston be elected an Honorary President of the Club.  
(7) Election of new members of Council: the Council recommends the election of H. A. Maxwell (Inverness) and R. T. Smith (Lockerbie) to replace George Waterston and A. D. Watson who are due to retire by rotation.  
(8) Any other competent business.  
7.30 for 8 p.m. ANNUAL DINNER in the Diningroom of the Hotel Dunblane (dress informal).

**Sunday 25th October :**

- 9.30 a.m. LECTURE, "Progress and Prospects in Nature Conservation" by A. E. Smith (Advisory Officer for County Naturalists' Trusts), followed by discussion.
- 11 a.m. INTERVAL for coffee and biscuits.
- 11.30 a.m. FILM, "Conservation in a Desert Country" (filmed in Jordan by Eric Hosking, George Shannon and Sdeuard Bisserot) introduced in person by I. J. Ferguson-Lees.
- 1 to 2 p.m. INTERVAL for lunch.
- 2 p.m. EXCURSIONS by private cars leaving the Conference Hotel car park.

**Conference Office**

Outwith the registration hours the Conference Office will also be open at intervals during the weekend for members to see the exhibits. Paintings by Donald Watson will be on view; these are the originals of the illustrations from "The Oxford Book of Birds" by Donald Watson and Bruce Campbell which will be published in October. It is hoped also to have advance copies of the book on view.

A selection of new ornithological books from the S.O.C. Bird Bookshop will be displayed for purchase or orders. R.S.P.B. literature, Christmas cards, garden bird equipment, and gramophone records, will be on sale, and also a selection of B.T.O. literature and Christmas cards.

**Film and Slide Programme**

The programme from 8 to 9 p.m. on Friday evening is intended to give members and guests an opportunity of showing any new 2" x 2" slides or 16 mm films they have taken. These must however be submitted beforehand to the Conference Film Committee, and should be sent, **by 9th October at the latest**, to the Club Secretary, 21 Regent Terrace, Edinburgh 7. The slides should be titled and sent with a few notes on what will be said about them, to enable the Committee to make a selection and to form a good programme. It will not be possible to show material which has not been received by this date.

**INFORMATION**

(1) **Hotel Reservations.** All reservations must be made direct. Owing to the shortage of single rooms, members are urged to make arrangements to share a room with a friend.

(2) **Conference Post Card.** It is essential that members intending to be present should complete the enclosed printed post card and send it to the Club Secretary **not later than 19th October**. Because of limited seating accommodation, the Council regrets that members may invite only one guest each to the Annual Dinner.

(3) **Registration.** Everyone attending the Conference must register (10s each) at the Conference Office on arrival (for opening times see Programme). Members wishing to attend only the Annual General Meeting do not require to pay the registration fee, which covers morning coffees and incidental expenses.

(4) **Annual Dinner.** Tickets for the Annual Dinner (price 21s inclusive of red or white wine or fruit cup, and of gratuities) should be purchased when registering. Members and guests staying in the Conference Hotel, who will pay for the Annual Dinner in their inclusive hotel account, are asked to obtain a dinner ticket from the Conference Office, as all tickets will be collected at the Annual Dinner. No payments should be made in advance to the office in Edinburgh.

(5) **Other Meals.** Dinner on Friday evening is served in the Conference

Hotel from 6 to 10 p.m. Non-residents will be able to obtain lunch in the Conference Hotel on Saturday and Sunday but are asked to inform the Hotel Reception Desk in good time.

(6) **Swimming Pool.** The indoor swimming pool in the Conference Hotel will be available during the weekend at no extra charge.

(7) **Excursions.** Members are asked to provide cars if possible and to arrange to fill their passenger seats; to avoid congestion in the car park the minimum number of cars will be used. Petrol expenses should be shared. The following maps cover the area: O.S. 1" Old Edition 62, 63, 66 and 67; New Edition 53, 54, 55, 60 and 61. Members wishing to go out on their own are particularly asked not to go in advance of led excursions to avoid disturbing the birds.

#### **Hotel Accommodation in Dunblane**

DUNBLANE HOTEL HYDRO (Tel. 2551). Special Conference charge: £6, 10s 0d (or £3, 5s 0d per day) inclusive of service charge. Details as follows: accommodation and all meals from Friday dinner to Sunday luncheon, after-meal coffees, afternoon tea and biscuits on Saturday, and the Annual Dinner (inclusive of wines or soft drinks).

Residents for less than one full day will be charged as follows: bed and breakfast 35s, luncheon 13s 6d, dinner 17s 6d.

STIRLING ARMS HOTEL (Tel. 2156). Bed and breakfast from 25s.  
\*THE NEUK PRIVATE HOTEL, Doune Road (Tel. 2150). Bed and breakfast 19s 6d to 21s.

\*SCHIEHALLION HOTEL, Doune Road (Tel. 3141). Bed and breakfast 18s 6d to 21s.

¶ARDLEIGHTON HOTEL (Tel. 2273). Bed and breakfast 15s to 17s 6d.

\*These hotels are situated some distance from the Conference Hotel.

¶Sited near the Conference Hotel gates.

#### **Hotel Accommodation in Bridge of Allan**

ALLAN WATER HOTEL (Tel. Bridge of Allan 2293). Bed and breakfast 38s 6d to 43s 6d.

ROYAL HOTEL (Tel. Bridge of Allan 2284). Bed and breakfast 36s.

Members with cars who have difficulty in obtaining single rooms in Dunblane should find the above two hotels in Bridge of Allan have ample single accommodation. The distance from Dunblane is about 3 miles.

#### **SUBSCRIPTIONS, COVENANTS AND BANKER'S ORDERS**

Your subscription for the new session is now due and should be sent at once with the enclosed form to the Club Secretary or paid to Branch Secretaries. The winter number of the journal will only be sent to paid-up subscribers.

If you pay Income Tax at the full rate and have not already signed a seven-year Deed of Covenant, this is a way you can help club funds at no extra cost to yourself, as the tax we are allowed to reclaim on a subscription of 25s is nearly 16s. If only 50% of our members signed Covenants the club would gain an annual income of over £500, which could be used to give increased services through the journal and other publications, Conferences and lectures, more reference books for the Library, and in many other ways. May we invite you to use the enclosed form, which should be sent on completion to the Secretary, who will forward a Certificate of Deduction of Tax for signature each year.

A Banker's Order is also enclosed for the use of members who find this a more convenient way of paying the annual subscription; this should be returned to the Secretary and not to the bank.