

SCOTTISH BIRDS



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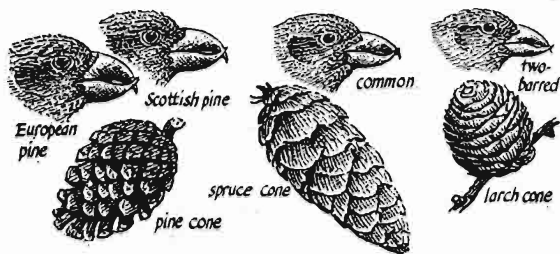
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THE JOURNAL OF THE SCOTTISH ORNITHOLOGISTS' CLUB



Volume 9 No. 1

Spring 1976

Edited by D. J. Bates

Editorial

BTO Ornithological Sites Register An article by Rob Fuller on this ornithological Domesday Book for the British Isles appears in the following pages. Scotland has many species and habitats of national and international importance. The apparent remoteness of many hills, glens and islands is no protection against the potential threats of their development as industrial sites, holiday resorts, motorways and so on. Data about good habitats must be readily available in the Register to meet these threats.

Many readers have already provided, or intend to provide, information about sites they know well, but many may be diffident about distant places they know less well, or even local sites, if they assume that there must be others better qualified to describe them. Unfortunately the better qualified, where they exist, are not necessarily inclined to put pen to paper, so the help of everybody, not just a few experts nor even BTO members, is needed here. If you are uncertain whether a site has already been documented, do ask the appropriate organizers. Again, if you are uncertain of the value of a site then document it. Superfluous data can be discarded later, gaps in our knowledge cannot be so easily filled.

This country was not covered by the original Domesday Survey—this time it will be! SOC members must ensure that Scotland with its prime sites gets prime coverage.

Scottish Birds The index and binding instructions for volume 8 will be published with the next issue. The 1975 Scottish Bird Report should appear in the autumn number. The ever increasing load of records, even though capably handled by Local Recorders and the compiler, Roy Dennis, seems to make the possibility of earlier publication remote indeed.

The first of a new feature of Current Notes appears at the end of this issue. These notes are not intended to replace or supplement the annual Bird Reports, but only to keep readers informed of recent bird news. Most of the information is sent to the editor by the Local Recorders, to whom observers are

asked to send items of interest at the end of each April, July, October and January.

Incidentally, it would help Local Recorders if all correspondents would either enclose a stamped addressed envelope if acknowledgment is required, or alternatively state that no reply is necessary.

Current literature Recent material of Scottish interest includes :

Asynchronous hatching and chick mortality in the Herring Gull *Larus argentatus*. J. Parsons, 1975. *Ibis* 117: 517-520. (Study on Isle of May).

BTO Ornithological Sites Register work in Scotland

ROB FULLER (National Organizer)

1976 is a vital year for this very important conservation project. All important sites for birds must be documented on Sites Register forms by the end of 1976. Therefore, all gaps in coverage must be filled without delay.

The map opposite shows the known situation in Scotland at the beginning of 1976. Black circles indicate sites for which completed Sites Register forms are held. *We do not yet have information for open circle sites—can you help by supplying details on the birds using any of these areas?* Information would also be welcomed for any other good bird sites not marked on the map.

It is generally the upland and more remote regions (particularly Argyll, Borders, the Grampians, Inner Hebrides, Lewis and Harris, Ross-shire and Sutherland) that need work most urgently. Even incomplete accounts of sites in these regions are valuable.

If you can help, please contact the appropriate Regional Organizer (see below) to ensure that there is no overlap with other observers. Register forms and instructions are also available from Organizers and forms should be returned to them *as soon as they are reasonably complete*.

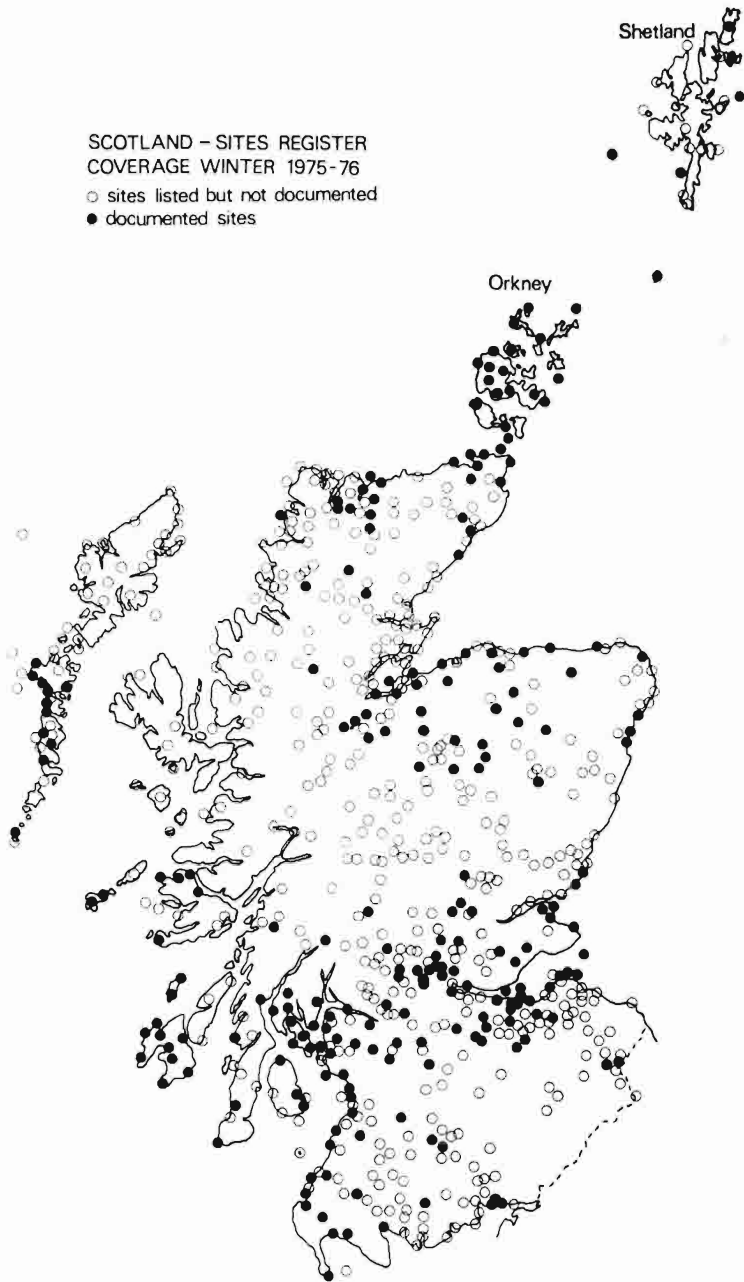
If there is no Organizer, write to: Sites Register, BTO, Beech Grove, Tring, Herts, HP23 5NR.

Sites Register Regional Organizers

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- Wigtownshire** R. C. Dickson, 3 Galloway Place, West Freugh, by Stranraer, Dumfries and Galloway.

Waterfowl at effluent discharges in Scottish coastal waters

B. POUNDER

The following report summarizes the results of a survey, instigated by the Research Committee of the SOC, locating outfalls of domestic sewage and industrial effluents into Scottish coastal waters, both those that are attractive and those that might become hazardous to wintering wildfowl concentrations.

Several recent reports have highlighted the importance of effluent discharge sites to wintering wildfowl (Thom 1969, Player 1970, 1971, Ballantyne 1973, Milne and Campbell 1973, Pounder 1974) and O'Connor (1974) has described an association between Kittiwakes* and an outfall in Northern Ireland. At several major outfalls enrichment of the local ecosystems by the organic matter in the effluents leads to increased supplies of the foods on which the birds depend, but such discharges also raise threats. Firstly the supply of enrichment is always liable to be cut off following intervention by River Purification Boards or local authorities or by the implementation of sewage treatment schemes. Secondly many important sites are in areas where large-scale industrial developments are likely in the near future. Thirdly the risk of toxic discharges is ever present.

Some of the most important industrial developments round the Scottish coasts are in connection with North Sea oil, for example, oilrig supply depots at Dundee, Montrose, Aberdeen and Peterhead, a tanker loading facility at Cramond in the Forth, and oil platform construction sites at Methil, Ardersier, Nigg Bay, the outer Clyde and possibly some sea lochs on the west coast. There is also a proposal for an oil refinery complex at Campbeltown (Kintyre) and interest in others at several sites on both the east and west coasts. Dunnet (1974) has described the total impact of oil developments on birds on the Scottish coasts, and the situation in 1974 regarding proposed developments in the Clyde estuary has been reviewed by the Scottish Wildlife Trust (1974).

Areas where major changes in sewage disposal methods will be implemented during the next few years involving full treatment, settlement or the combining of separate outfalls into single major outfalls discharging into deep water are at Leith, Grangemouth, Leven, St Andrews, Dundee, Invergordon, the

*Scientific names of birds are given in Appendix F.

Clyde (Leven Valley) and Ayr Bay (Irvine Valley). Many more schemes are under discussion and several are at the initial engineering consultancy stages. The Leith scheme is particularly important to Scottish ornithology. What will happen to the large proportion of the European population of Scaups and several thousands of Eiders, Goldeneyes and Pochards that feed off the present outfalls at Leith? It was questions such as this which led the Research Committee to instigate this survey.

Effluent discharges have a direct and immediately adverse effect on wildfowl only when they contain appreciable quantities of oil or toxic chemicals. However, indirect and less immediate effects are many and depend upon the complex interactions between the discharges and the food chains on which the birds depend. The following notes are intended to illustrate some of the more important effects of different categories of discharge.

Domestic sewage

It is estimated that on average, each person in the UK contributes about 40 gallons per day to the overall domestic sewage load. Thus the daily discharge from a town of 25,000 inhabitants will amount to approximately one million gallons, and should the town be situated on a coastal site, it is likely that this discharge will be made directly and without treatment to the sea. The reason for this is easy to understand if the enormous degree of dilution is considered. For example, the million gallons would occupy approximately the same volume as a million one-gallon cans which could be stacked in 100 layers with 100 cans along the side of each layer. Such a volume is insignificant when compared with the volume of water in even a small estuary. However, the biological effects of such a small volume need not be insignificant, especially when it is remembered that the discharge is made each day, and accompanied by the trade and industrial effluents from a wide variety of premises typical of a town of 25,000 people.

Domestic sewage discharges are sources of food for their local ecosystems and the food is suitable for many species of birds, either directly or after being processed through the different links in the food chains utilized by the birds, links that include worms, molluscs, crustaceans and fish. The most important processors are the bacteria which break down organic matter. These multiply in the presence of an enhanced supply of organic matter, and themselves provide food for higher levels in the food chain and also liberate essential minerals for the flora of the outfall environment. Most of the bacteria are aerobic, that is they convert organic matter to substances such as carbon dioxide, nitrates, sulphates and phosphates. In so

doing they remove dissolved oxygen from the water, and although this is rapidly replaced in a marine environment, it may become seriously depleted in the waters trapped within the bottom sediments with marked effects on the fauna living within the sediments.

Moderate discharges of domestic sewage increase the overall biomass in the outfall environment without having much effect on the variety of species. Such sites are good for birds since they supply a rich and varied amount of food. However, too large a discharge can cause an over enrichment and some species of the marine fauna can multiply and flourish at the expense of others. Such discharges are unable to support a wide variety of species but could well be attractive to a small number of species.

Under the most extreme conditions of deoxygenation, domestic sewage outfall sites might be unattractive to birds of any species, except perhaps gulls which can feed directly on solid matter in the discharges, and under such conditions the bottom fauna is often dominated by a few species of worms, particularly *Capitella capitata*. This worm, ragworms (Nereidae) and round worms (Nematoda) have been described by Player (1970) as features of the bottom sediments off the Leith outfalls in the Forth. An example of over-enrichment in the Clyde has been described recently by Perkins and Abbott (1972) in a study of dense summer growths of the green alga *Enteromorpha* on sand flats enriched by sewage treatment plant effluents. Respiration and the rapid initial decay of the algal mats depleted the sands of oxygen so that decay had to proceed by means of anaerobic bacteria (species able to exist in the absence of dissolved oxygen) which converted the organic matter to smelly sulphur compounds. Shellfish such as Cockles *Cerastoderma edule* and Tellins *Macoma balthica* moved upwards through the sulphide blackened sands into the more aerated surface layers where they would have suffered heavy predation, especially by waders such as Oystercatchers. Thus waders would have derived a temporary benefit followed by a longer term loss in food supply. In studies in the Ythan McLusky (1968) found that polluted black sediments did not support the burrowing crustacean *Corophium volutator*, one of the staple items in the diet of Redshanks. On the other hand, blackened faecal tumuli of lugworms are a common sight in the vicinity of sewage outfalls, so long-billed waders such as Curlews and godwits *Limosa* spp. should be assured of a supply of food on moderately polluted sand flats.

Player (1970, 1971) has demonstrated a direct correlation between the feeding habits of diving ducks in the vicinity of the Leith outfalls and the solid matter discharged in the

effluents, particularly seeds and barley husks. Seeds discharged from outfalls might be a very important item of food for a variety of wildfowl. They may be exotic varieties introduced into the sewers from kitchen sinks or varieties blown by wind on to the paved areas in cities and washed into sewers via rain water drains. Many forms of organic detritus must be attractive to Shore Crabs *Carcinus maenas* and other bottom-living small crustaceans which can be taken by diving ducks.

Trade and industrial effluents

These have varied biological effects, depending upon their magnitude and composition, and are best divided into a number of categories to simplify the discussion.

Food factory discharges Wastes discharged from food factories, milk processing plants, granaries, breweries and distilleries have the same overall effects as domestic sewage but in addition often contain matter that can be eaten directly by birds of several species. This has been noticeable in the Tay and in the South Esk at Montrose where large herds of Mute Swans feed on potatoes and other vegetable wastes throughout the winter (Pounder (1974). Tufted Ducks also rely upon potato wastes in the Tay during spells of cold weather. Eiders are known to feed on barley at waste heaps in the Ythan (Milne 1965), and the attraction of Goldeneyes to sites where barley is discharged has been discussed by Pounder (1976). Barley and grain husks might also be attractive to waders and dabbling ducks, and even to really marine ducks such as Long-tailed Ducks (Harrison 1919).

Discharges of distillery wastes are causing concern in several areas in Scotland and there have been attempts to reduce the number of complaints about the offensive smells by transporting liquid wastes by road tanker to coastal sites for discharge into the sea. The Buckie outfall has been used for this purpose. However, Banff County Council is taking action to stop both river and sea discharges in its area. In addition, the recent increases in world food costs are making it worthwhile for distillery companies to seriously consider converting their wastes into high protein animal foodstuffs and if this comes about, there will be a marked reduction in the amounts of man-made food supplies available to coastal bird flocks in several important areas.

Chemical effluents Large discharges of chemicals, including pharmaceuticals and oils, are generally toxic to marine life, either directly as in the case of substances such as sulphuric acid, cyanides and phenols (from gas works), or indirectly via the fractions which result from the partial breakdown of organic matter by bacteria. However, birds seem able to avoid

some of the grosser chemical effluents, even when these are discharged near important feeding areas, such as the inner Forth and the Mersey, and some of the more visually spectacular sources of pollution are known to have little adverse effects on their local environments. A good example of this last fact is provided by the steel complex at Workington (Perkins 1972).

Oil discharges are well known to be highly detrimental to diving ducks, but they also affect waders by killing off the fauna in the sediments on which the waders feed. However, oils are at least partially biodegradable under natural conditions and the effects of stranded oil are generally assumed to be relatively short lived. Unfortunately, oil slicks are often treated by chemical dispersal agents which can be much more toxic than the oil itself, and even the so-called non-toxic varieties might have long term biological effects because of damage to reproductive processes. This has been demonstrated for the common polychaetes *Cirrifurca tentaculata* and *Cirratulus cirratus* (George 1971) and is worthy of further study.

Two chemicals that have caused serious concern in recent years are DDE, a breakdown product of DDT, and the chlorinated biphenyls or PCBs which were used by a wide range of industries before being voluntarily restricted in the UK in 1971. The effects of DDE on predatory birds (including some sea birds) are well known by now in ornithological circles, and PCBs have been associated with the Irish Sea seabird wreck in 1969 (Holdgate 1971). The sources of DDE are widespread because of natural run-off from agricultural land. PCBs are thought to be derived from large outfalls of industrial effluents and sewage sludge dumping grounds. Both types of chemical are now widespread over the oceans, for example across the Atlantic and into the Arctic, and the maximum concentrations in sea birds are found in the larger gulls which feed off trawler wastes (Bogan and Bourne 1972). They must therefore be widespread in fish, and this must be of considerable importance to man as well as birds. Although much is now known about the toxicity of PCBs (e.g. Prestt *et al* 1970), many more side effects are likely to be discovered as time goes on. For example, Common and Roseate Terns that breed in Long Island Sound (New York) exhibit a statistically significant incidence of gross physical deformities, similar to those produced when PCBs are injected into chick embryos. The deformed terns are found to have relatively large concentrations of PCBs in their bodies (Hays and Risebrough 1972).

Perhaps as harmful as PCBs are the heavy metals contained in suspended matter discharged from many industrial outfalls.

These are toxic to many forms of marine life in only a few parts per million concentrations and are known to be widespread over large areas of inshore waters, particularly in the Irish Sea (where many could be derived from natural run-off from mineralized areas and old mine workings in North Wales), and off the Mersey (Abdullah *et al* 1972). High mercury levels have been reported in molluscs recently in the Tay (Jones *et al* 1973), and heavy metal pollution off the coast of South Wales is thought to be derived from the opposite shore of the Bristol Channel (Nickless *et al* 1972), a fact which is relevant to possible future conditions in the Forth. Although there is no direct evidence of heavy metal poisoning of sea birds, a long-term threat must be considered, especially because many marine animals taken by sea-birds as food are able to concentrate metals. The problem is aggravated by the development of resistance to heavy metal poisoning by some organisms, for example, tolerance to copper in the marine alga *Ecotarpus silicolosus* (Russell and Morris 1970) and in the very common polychaete *Nereis diversicolor* (Bryan and Hummerstone 1971).

The effects of heavy metals on the marine micro-fauna have been overlooked by many workers but they are possibly of great importance. For example, the larvae of Shrimps *Crangon crangon* and Shore Crabs are much less tolerant of mercury than the adults (Connor 1972), which are taken by several species of sea-birds and ducks, and fewer survive to maturity. Gray and Ventilla (1971) have shown that very small concentrations of heavy metals impair the growth of the bacterivorous sediment-living ciliate *Cristigera*. They point out that an adverse effect at such a low level in the food chain would cause marked changes to a whole ecosystem that depended upon it.

Seaweeds are affected by heavy metals, for example red algae (Rhodophyta) and kelps (Laminariaceae) (Bellamy *et al* 1967, Hopkin and Kain 1971, Edwards 1972) but it is not known how this might affect sea-birds. However, it is certain that seaweeds exert a large influence on the ecology of large areas of bottom sediments, especially by controlling the amount of light admitted to deep water and in the wide variety of fauna dependent on the environment afforded by the holdfasts. It is also known that Bladder Wrack *Fucus vesiculosus* can concentrate heavy metals (Bryan and Hummerstone 1973) and this could be passed on to Eiders and Pochards, both of which are known to eat wrack, though to an extent that is difficult to assess.

The effects of chemical pollution on fish life are important, especially to those species of birds that sustain themselves solely on a fish diet, for example, Cormorants, Shags and

terns. Unfortunately, most of the work has concentrated on determining toxicity levels under laboratory conditions which may not be directly applicable to the natural environment (Mawdesley-Thomas 1971).

Mine water discharges Mine water discharges into Scottish coastal waters should be relatively non-toxic because of the lack of mineralization in the strata through which the waters percolate. However, Scottish discharges are often heavily laden with silt and very ferruginous in some areas and the discharges can be lethal to the fauna of the discharge environment by smothering the bottom sediments.

Pulp mill discharges The suspended matter in pulp mill discharges can have the same smothering effect as the silt in mine waters, since although it is mostly organic (cellulose), biodegradation is very slow. The only information available for Scotland (Pearson 1970) has shown that as a result of good design to ensure efficient mixing between the discharges and the fast flowing tidal currents, there are no important biological effects in the Fort William area. There are no obviously deleterious effects in the inner Forth and in the Eden estuary at Guardbridge, despite frequent sightings in the latter area of coloured slicks washed over the flats on which large numbers of Shelducks and Wigeons feed.

Cooling water discharges Water drawn through the condensers of electricity generating stations at coastal sites warms up the immediate marine environment and the resulting biological effects could be large and complex. For example, since fishes are attracted to warm water which makes them more active, fish-eating sea birds should derive benefit. However, the increased metabolism in fishes following increases in the ambient temperature, combined with a parallel difficulty in abstracting oxygen from the haemoglobin in the blood makes even moderately small temperature rises potentially hazardous to several fish species (Clark 1969). Clark also points out that the seasonal migrations of fish, as well as the spawning habits of some fish and shellfish, are dependent on temperature. These high temperature problems are likely to increase when very high power nuclear stations become more common at coastal sites since these waste approximately 60% more heat than conventional stations of comparable size.

Scotland is fortunate in that most of her coastal generating stations are situated in areas where there is good water circulation and it is probable that the biological effects on the stations are more important than the effects of the stations on the local biology, particularly because of the tendency of Mussels *Mytilus edulis* to grow and flourish on the almost ideal substratum provided by the concrete walls of the cooling

ducts. The Mussel growths affect the water flow rates and block and damage the cooling tubes. Chlorination is often used to combat the Mussels but there have been no reports that this has caused any undesirable effects on the marine flora and fauna outside the immediate vicinities of the conduits.

The future for Scotland appears to present no problems from thermal pollution, despite a massive increase in electricity power generation planned for the next 20 years. Two large generating stations at Hunterston and Inverkip will increase the South of Scotland Electricity Board's capacity from 6,000 to 9,300 megawatts. These are already under construction and it is hoped to add another 7,000MW before 1990 by means of pairs of nuclear stations at Torness Point, Dunbar, and Chapel Donan near Girvan, and a gas/oil station at Carriden near Bo'ness.

Sludge dumping It is common practice for sludges from sewage settlement tanks to be dumped in deep water at sea and this will increase in Scottish waters during the next few years when plans for many of the currently untreated coastal discharges are completed. Dumping areas will almost certainly be developed off the Forth and Tay. Approximately one million tons a year are dumped in the Clyde, one mile south of Garroch Head, Bute, but a study of the bottom fauna in the area (Halcrow *et al* 1973) has not shown any important adverse biological effects outside the immediate dumping area. Similarly, no obviously important adverse effects have been reported from the Southampton sludge dumping ground off the Isle of Wight (Jenkinson 1972), nor in the outer Thames estuary (Shelton 1971). Unfortunately, sludge dumps are a cause for concern for they are often sources of heavy metal pollution, and PCBs in the Irish Sea are known to be derived, at least in part, from the Clyde dumping site (Holden 1970, Waddington and Best 1972).

Methods and results

Details of individual outfalls are presented in the appendices. They were derived from a number of different sources—River Purification Boards and their annual reports, local authorities, engineering consultants, and the general technical literature on the water pollution subject. Water pollution is sometimes a sensitive subject, and further, since technical difficulties make it impossible to vouch for the accuracy of effluent discharge data, it was thought best not to cite the individual sources of information. In the great majority of cases, the official bodies and individuals approached for information gave all the help they could and only two bodies declined to assist on legal grounds.

The discharge rates in the tables are in most cases estimates, and in the case of tourist areas, for winter periods only. Many are based upon the average discharge per person assumed by the different local authorities, which appeared to vary between 30 and 50 gallons a day. Rainwater discharges via sewers are not included. The Biological Oxygen Demands (BOD) and Suspended Solid (SS) figures, where given, are useful for comparative purposes only. Obviously they vary from day to day and it is not known how far from the outfalls or under what conditions they were deduced. Sewage discharged into tidal waters is often regarded as weak, average or strong according to the following criteria :

BOD (milligrams per litre)	
Weak	Less than 200
Average	200 - 400
Strong	More than 400

It is interesting that the BOD values off the large sewage works outfalls in the Clyde are comparable with or less than values estimated for localities such as Arrochar or Tarbet.

Volunteer helpers who responded to a request for assistance in *Scottish Birds* and many others recruited by Local Recorders and Regional Organizers for the National Wildfowl Count Scheme were asked to count wildfowl in the vicinities of outfalls on or near the middle Sundays of November 1973 and February 1974. It was left to the counters' experience and judgement to interpret what was meant by 'vicinity'. Wildfowl only were counted in order not to ask too much of the counters, and to take advantage of the National Wildfowl Counts which would have been carried out on those dates in any case. Out of 210 forms sent out for distribution to counters, 172 were returned completed. The forms contained the outfall locations, and included spaces for the wildfowl counts, count dates, weather and tide conditions, flock locations in relation to the outfalls and general notes. The counters were also asked if the results were typical for their sites and whether local fresh waters were frozen.

The counts were carried out in a variety of weather conditions during the middle of November 1973 and February 1974. There was a cold spell during November but the remainder of this particular winter was exceptionally mild. Not all the counts in one month were made on the same day and this introduced a source of error in that some birds might have been counted more than once at different sites. In some cases more than one count was available for a particular site, usually with a few days separating the counts. Maximum counts were used when such choices were available.

Primary sites

Counts at the primary outfall sites are shown in table 1, which illustrates the importance of the Forth, particularly the south shore off Edinburgh and to the west, and the results are summarized in column A of table 2. The percentages in this column show the importance of these primary outfall sites to Scaups, Goldeneyes and Eiders, which together made up 85.8% of the total. A similar result is shown in column B but Mallard and Wigeon numbers are more important at the secondary sites and cause the percentages of the diving ducks to be somewhat less than in column A. Column C illustrates the quite different distribution of species feeding in clean waters and this is at first sight rather surprising since there can be no lack of food at Tynninghame and in the Eden estuary for diving ducks. Both areas possess extensive Mussel beds.

A particularly surprising result in table 1 is the large numbers of wildfowl, particularly Shelducks, in the Bo'ness-Grangemouth area, which from the data given in appendix A might be expected to be one of the most highly polluted estuarine areas in Scotland. Unfortunately, the composition of the petrochemical industry discharges is not known. Unless they are made up mostly of water (which is quite probable), the effluents must have some biological effects on the intertidal sediments on which the Shelducks feed. However, these effects must do little harm to the food chains utilized by *Hydrobia*, a small snail which is the staple diet of Shelducks, and it is even possible that hydrocarbon effluents, if they are indeed discharged in significant quantities, are of benefit to the food chain following processing by bacterial breakdown. It does not follow that petrochemical complexes elsewhere would not have an adverse effect on wildfowl since so much depends upon exactly what is discharged and the hydrological conditions in the vicinities of the outfalls.

Numbers of Pochards in table 1 are small but it is thought that the flock that roosts on Duddingston Loch, Edinburgh, and which numbers several thousand at times, feeds by night at outfalls in the Forth (Player 1970, Ballantyne 1973).

The most important by far of the sites in table 1 is Seafeld, Leith, from which most of the wastes of Edinburgh are discharged and which is obviously of prime importance to Scaups, Eiders and Goldeneyes, in addition to being attractive to Long-tailed Ducks and Great Crested Grebes. The Scaups and Goldeneyes often mass amongst the gulls right at the outfall outlet when feeding but the Eiders tend to remain a little further distant. It is very difficult to assess the true sizes of the Scaup and Goldeneye flocks, not only because of the dense concentrations in which they feed, but also because when disturbed or

when weather conditions make it necessary, the birds fly to other outfall sites as far as Levenhall a little to the west.

In addition to the wildfowl flocks that winter in the immediate vicinity of the Seafield outfall, there are others, particularly the flocks of several hundred scoters and Long-tailed Ducks further downstream off Gullane, that might be indirectly dependent upon the discharges because of enrichment of the sea bed and it is interesting that a similar situation obtains on the other side of the Forth off the Fife coast. Here the big Methil-Leven outfall discharges a large volume of domestic sewage, trade and distillery wastes, and supports other large flocks of Goldeneyes and Scaups (as well as Pochards on occasions and Tufted Ducks during cold weather periods) and Mallards that feed at the outlet of the River Leven, and a little downstream in Largo Bay is another concentration of scoters and Long-tailed Ducks.

The most important site in the north is the Cromarty Firth at Dalmore where Mute and Whooper Swans feed over stony mud flats over which distillery wastes are discharged, and Invergordon where Mute Swans mass at the outfall in addition to a large flock of Goldeneyes. Distillery wastes are also discharged at Invergordon, and since the domestic sewage load must be small relative to that in the Forth and Tay for example, the distillery wastes must be the important factor in attracting the Goldeneyes to the site. However, the Invergordon outfall poses some questions, for example, why do the Goldeneye flocks contain so few adult males (quite unlike the situation elsewhere on the east coast) and if distillery wastes are indeed the important factor, why do the Goldeneyes show so little interest in other distillery waste discharge areas, particularly at Dalmore, only a few minutes flying time away?

Some of the sites included in table 1 are considered to be of importance despite the relatively low counts obtained during this survey. For example, 250-300 Goldeneyes are usually resident at Alloa but there was disturbance during the survey. Similar numbers of Goldeneyes have also been common off the outfall at Stannergate, Dundee (F5, M10), during several recent winters but numbers were low during the mild seasons of 1972-3 and 1973-4. The Stannergate is also important for Tufted Ducks and Mute Swans when a vegetable food processing factory at the site is in operation. Vegetable wastes have supported herds of swans in excess of 100 during recent winters and flocks of 200 to 300 Tufted Ducks in cold weather, rising to 800 to 900 when inland waters were frozen. One of the Inverness outfalls (at Clachnaharry) is also important to Tufted Ducks in cold weather, and is included in table 1 on this account. The Dundee outfall at the mouth of the Dighty (M11) regularly supports several hundreds each of Mallards and

Table 1. Wildfowl counts at large outfall sites where there is a correlation between bird numbers and effluent discharges

Outfall Sites (See appendices for codes)	Levenhall- Musselburgh (M1)		Seafield (M2, M3)		Bo'ness- Grangemouth (I4-I8)		Kirkcaldy		Methil- Leven (M8)		Invergowrie (M9)		Dundee (Stannergate) (F5, M10)	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	40	—	20	9	—	—	—	—	—	—	—	—
Mallard	70	80	—	—	152	107	15	—	408	185	400	400	—	—
Teal	—	—	—	—	6	2	10	—	—	—	—	—	—	—
Wigeon	—	—	—	—	250	19	—	—	—	—	—	—	—	—
Pintail	—	—	—	—	24	66	—	—	—	—	—	—	—	—
Scaup	500	11000	11000	3000	—	1	—	—	150	850	—	—	—	—
Tufted Duck	—	—	—	—	—	—	50	—	—	250	—	—	236	71
Pochard	—	—	30	—	—	—	25	—	50	—	—	—	—	—
Goldeneye	160	1030	1600	1300	13	—	765	355	500	850	—	—	—	—
Long-tailed Duck	50	21	—	—	—	—	—	—	50	45	—	—	—	—
Common Scoter	—	—	—	—	—	—	5	11	50	192	—	—	—	—
Eider	1800	6400	200	200	—	—	—	4	3003	904	—	—	—	—
Red-breasted Merganser	2	8	—	—	30	17	—	—	33	7	—	—	—	—
Shelduck	—	—	—	—	1295	1020	—	—	—	—	—	60	—	—
Mute Swan	—	10	—	—	—	1	4	—	—	—	—	—	39	29
Whooper Swan	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals	2582	18549	12870	4200	1790	1242	874	370	4244	3283	400	460	275	100

WATERFOWL AT EFFLUENT DISCHARGES

Table 1 (Continued)

Outfall Sites (See appendices for codes)	Dundee (Dighty) (M11)		Inverness (3 sites)		Dalmore (Cromarty)		Invergordon (M16)		Islay (F17)		Cardross- Craigendoran (S9-S12)		Totals	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	—	—	—	—	—	—	—	—	—	—	60	9
Mallard	164	168	—	20	—	—	—	—	159	24	25	58	1393	1042
Teal	9	4	—	6	300	—	—	—	140	12	—	—	465	24
Wigeon	60	30	—	—	250	200	—	—	647	300	165	22	1372	571
Pintail	—	—	—	—	—	—	—	—	—	—	—	—	24	66
Scaup	—	—	35	—	—	—	—	—	—	1000	500	118	12803	15351
Tufted Duck	—	—	68	30	—	2	—	—	—	—	—	—	354	353
Pochard	—	2	—	—	—	—	—	—	—	—	12	—	117	2
Goldeneye	230	57	35	368	—	14	350	700	15	1	22	50	3690	4725
Long-tailed Duck	—	—	—	—	—	—	—	—	—	—	—	—	100	66
Common Scoter	10	25	—	—	—	—	—	—	—	—	—	—	65	228
Eider	900	600	—	—	—	—	—	—	141	77	1500	707	7544	8892
Red-breasted Merganser	6	10	—	—	—	—	—	2	14	3	27	3	112	50
Shelduck	—	—	—	—	4	90	—	—	6	19	—	12	1305	1201
Mute Swan	—	—	6	21	85	87	73	21	5	2	76	—	288	171
Whooper Swan	—	—	—	—	—	10	—	—	40	—	—	—	40	10
Totals	1379	896	144	445	639	403	423	723	2167	938	1945	852	29732	32761

Table 2. Average Nov.-Feb. count totals at primary outfall sites (A), all outfall sites (B) and at two unpolluted sites (C) to illustrate the species distribution (D). (Numbers in brackets express counts as percentages of the column totals)

	A (Data from Table 1)	B (Data from Tables 3-8)	C Data for Eden Estuary and Tynninghame*	D Percentages at primary outfall sites ($100 \times A/B$)
Mallard	1218 (3.9)	3464 (6.9)	265 (10.0)	35.3
Teal	245 (0.8)	680 (1.4)	210 (8.0)	36.0
Wigeon	972 (3.1)	6736 (13.5)	1167 (44.2)	14.4
Shelduck	1253 (4.1)	2578 (5.2)	940 (35.6)	48.6
Scaup	14077 (45.6)	14604 (29.3)	0 (0.0)	96.4
Goldeneye	4208 (13.6)	5580 (11.2)	5 (0.2)	75.4
Eider	8218 (26.6)	14922 (29.9)	34 (1.3)	55.1
Tufted Duck	354 (1.2)	382 (0.8)	1 (0.0)	92.7
Great Crested Grebe	35 (0.1)	75 (0.2)	0 (0.0)	46.7
Red-breasted Merganser	81 (0.3)	362 (0.7)	0 (0.0)	22.4
Mute Swan	230 (0.7)	475 (1.0)	19 (0.7)	48.4
Totals	30891	49858	2641	

*R. W. J. Smith (Tynninghame), I. Cumming (Eden).

Goldeneyes and a flock of Eiders which appears to have been increasing in size during the past few seasons. The Goldeneyes and some of the Mallards feed with gulls in the sewage slicks but the Eiders feed a little distance away in an area where some of the sewage is known to settle, and which contains a rich fauna of worms and crustaceans. The Eiders rarely feed over a dense and extensive Mussel bed only 0.5km to the west of their feeding area.

The sites at Loch Indaal (Islay) and Dalmore (Cromarty Firth) are special in that they do not possess large outfalls of domestic sewage. However, they are both distillery sites and large grain discharges are likely at both places.

Secondary sites

It would be impracticable to include counts of wildfowl at all the sites visited during the survey. The results are therefore summarized in tables 3 to 8 and are amplified as follows.

Table 3. Summaries of counts at all outfall sites : Forth, south shore

Primary outfalls (See appendices for codes)	St Abbs- Dirleton (I1, F1)		Levenhall- Corstorphine* (I3, M1-M5)		Bo'ness- Kennet Pans (I4-I10, F2-F4, S2-S4, M6)		Totals	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
No of sites visited	9		10		11		30	
Great Crested	—	—	50	60	20	9	70	69
Grebe	—	—	—	—	—	—	—	—
Mallard	6	2	82	148	238	171	326	321
Teal	—	—	—	—	6	2	6	2
Wigeon	16	9	—	—	250	57	266	66
Pintail	—	—	—	—	24	66	24	66
Scaup	—	—	12200	14000	—	—	12200	14000
Tufted Duck	—	—	50	6	—	—	50	6
Pochard	—	—	40	10	—	—	40	10
Goldeneye	27	10	1990	2806	188	139	2205	2955
Long-tailed Duck	1	36	50	21	—	—	51	57
Common Scoter	—	—	—	18	—	—	—	18
Velvet Scoter	—	—	—	—	—	—	—	—
Eider	32	103	2900	6600	—	—	2932	6703
Red-breasted	—	—	—	—	—	—	—	—
Merganser	4	—	—	12	30	17	34	29
Goosander	—	—	—	—	—	—	—	—
Shelduck	—	8	—	—	1329	1082	1329	1090
Mute Swan	2	4	—	36	—	22	2	62
Whooper Swan	—	—	—	—	—	—	—	—
Totals	88	172	17362	23717	2085	1565	19535	25454

*This outfall serves Corstorphine

Table 4. Summaries of counts at all outfall sites : Forth, north shore

Primary outfalls	Kincardine-Torryburn		Dalgety-Wellesley Colliery		Methil-Largo Bay		Elle-Craik		Totals	
	(C3, C4, M7)		(I11, I14, +Kirkcaldy)		(C5, M8)					
No. of sites visited	10		9		4		5		28	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	—	—	5	3	—	—	5	3
Mallard	37	9	15	—	408	185	63	15	523	209
Teal	—	—	10	—	—	—	—	—	10	—
Wigeon	162	20	—	—	—	—	—	—	162	20
Pintail	—	—	—	—	—	—	—	—	—	—
Scaup	—	—	—	—	150	850	—	—	150	850
Tufted Duck	—	—	50	—	—	250	—	—	50	250
Pochard	—	—	25	—	50	—	—	—	75	—
Goldeneye	—	—	765	355	500	890	—	—	1265	1245
Long-tailed Duck	—	—	—	—	50	45	—	—	50	45
Common Scoter	—	—	5	11	50	192	—	—	55	203
Velvet Scoter	—	—	—	—	—	—	—	2	—	2
Eider	—	—	—	4	3000	904	35	65	3035	973
Red-breasted Merganser	—	13	—	—	33	7	—	—	33	20
Goosander	—	—	—	—	—	—	—	—	—	—
Shelduck	—	—	—	—	—	—	—	—	—	—
Mute Swan	—	—	4	—	—	—	—	—	4	—
Whooper Swan	—	—	—	—	—	—	—	—	—	—
Totals	199	42	874	370	4246	3326	98	82	5417	3820

Firth of Forth (tables 3 and 4) In addition to the primary sites included in table 1, a large number of sewage outfalls discharge into the inner Forth, particularly to the west of Kin-cardine Bridge, and along the Fife shore. The domestic sewage outfalls are mostly small but numerous, and there is a number of industrial discharges (see appendices). This makes it difficult to associate particular outfalls with particular duck flocks and the problem is aggravated by the existence of ash pan areas into which power station wastes are dumped. These are attractive roosting areas. Goldeneyes are numerous at sites polluted by domestic sewage, and dabbling ducks and Shelducks occur on polluted mud flats. However, it is not known if there is any correlation between the dabbling duck feeding areas and sewage discharges. A number of the counters pointed out that *Zostera* was common wherever Wigeons were found feeding.

St Andrews to Montrose (table 5) The St Andrews area is very important to wintering wildfowl but only the small numbers shown in the table appear to be associated with sewage outfalls. The large numbers of Mallards and Common Scoters (several hundred of each) that winter in St Andrews Bay are well away from sources of pollution, as are the Wigeons and Shelducks (over 1,000 of each) in the Eden estuary.

Further north at the mouth of the Tay there are Eider flocks numbering up to 20,000 in early winter and approximately 15,000 in late winter but these cannot be affected by sewage borne pollution. The same is true of a flock of Goosanders (several hundred) that feeds between the Tay Bridges, but both these and the Eiders are extremely vulnerable to the effects of oil discharges from sewer outfalls. The geography of the Tay is such that oil slicks can become trapped in the estuary for several days at a time and Greenwood and Keddie (1969) have described the high mortality among Eiders that can result from even moderate oil discharges.

The Montrose Basin counts present problems of interpretation. The Shelducks feed near an outfall from which domestic sewage and distillery wastes are discharged and also near a rubbish dump from which much organic matter must be leached out by rain. Swans also feed here and, until the commencement of harbour developments at Montrose, on vegetable wastes discharged from a food processing factory. However, during the past two winters the swans have deserted the factory site in favour of the Basin proper where they divide their time between the polluted area and the unpolluted area in the north-west corner. The Wigeons feed near the polluted area, but not so near that a direct correlation between their food chain and effluent discharges can be assumed.

Table 5. Summaries of counts at all outfall sites : St Andrews to Montrose

Primary outfalls (See appendices for codes)	St Andrews		Wormit- Tentsmuir		Dundee- Monifieth		Carnoustie Arbroath M11)		Montrose Basin (I15, F6)		Totals	
	1		2		4		2		2		11	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	—	—	—	—	—	—	—	—	—	—
Mallard	—	—	400	500	564	568	150	200	100	50	1214	1318
Teal	—	—	—	—	9	4	—	—	30	—	39	4
Wigeon	—	—	250	120	60	30	200	200	2000	1100	2510	1450
Pintail	—	—	—	—	—	—	—	—	—	100	—	100
Scaup	—	33	—	—	—	—	—	—	—	—	—	33
Tufted Duck	—	—	—	—	236	71	—	—	—	—	236	71
Pochard	—	—	—	—	—	2	—	—	—	—	—	2
Goldeneye	17	28	—	—	230	57	25	32	4	5	276	122
Long-tailed Duck	—	—	—	—	—	—	—	—	—	—	—	—
Common Scoter	—	7	—	—	10	25	—	—	—	—	10	32
Velvet Scoter	—	—	—	—	—	—	—	—	—	—	—	—
Eider	17	32	—	—	900	5000	60	180	30	360	1007	5572
Red-breasted Merganser	—	—	—	—	6	10	—	—	—	—	6	10
Goosander	—	—	—	—	2	18	—	—	2	1	4	19
Shelduck	—	—	20	60	—	60	—	—	150	230	170	350
Mute Swan	—	—	—	—	39	29	—	—	138	120	177	149
Whooper Swan	—	—	—	—	—	—	—	—	—	—	—	—
Totals	34	100	670	680	2056	5874	435	612	2454	1966	5649	9232

North-east coast (table 6) Apart from the sites included in table 1 and a food processing plant discharge at Peterhead that supports a small but regular flock of Goldeneyes, the only important site in this section is the Dornoch Firth (Edderton) where there is an important Wigeon concentration and one of the few flocks of Scaups outwith the Forth. Domestic sewage discharge into the firth must be relatively small, but there is probably a considerable load of distillery effluents, much of which probably settles in Edderton Bay where the Scaups feed. These discharges may or may not be beneficial to the Wigeons.

A possibly important site that might have been missed during the survey is Burghead on the Moray Firth (F11) where there is a large maltings. Large numbers of Goldeneyes have been reported at this site (D. M. Bryant, pers. comm.).

North and west coasts (table 7) With the exception of Loch Indaal, Islay, nothing of importance was found along the coast-line from Embo in the north-east to Fort William in the west, and even the distillery sites on Skye and the fish offal at Mallaig appeared not to attract diving ducks.

South-west coasts (table 8) It was unfortunate that no returns were obtained from the Clyde estuary sites which would have made an interesting comparison with the Forth, nor from the unpolluted Solway coast. The Clyde results in table 8 were obtained from the BTO Birds of Estuaries counts from which it appeared that the biggest duck flocks were in the Cardross-Craigendoran area where large quantities of sewage treatment plant effluents occur. From the Clyde to Stranraer, the situation was similar to that at small sites in the Forth in that Eiders and Goldeneyes were found feeding in the vicinities of outfalls of domestic sewage. It was perhaps fortunate that no large flocks were found in the north end of Ayr Bay where large quantities of chemical and industrial effluents are discharged from the Irvine and Garnoch Valley outfalls.

Discussion

The results of this survey amply illustrate the importance of sewer outfall sites to diving ducks, particularly Scaups, Eiders and Goldeneyes and probably also to Pochards if the Duddingston flock does indeed feed off the Leith outfalls at night. Several outfalls also appear to be of great importance to Mute Swans. During recent winters Eiders have shown a clear and documented tendency to forsake their Mussel bed feeding areas for sites near large outfalls of domestic sewage in the Forth, where they appear to be feeding on worms that concentrate in large numbers in soft substrata enriched by sewage-born organic detritus (Player 1970, 1971). Player also showed that Scaups in the Forth fed on worms associated with

Table 6. Summaries of counts at all outfall sites : north-east coast

Primary outfalls (See appendices for codes)	Stonehaven- Fraserburgh		Fraserburgh- Inverness		Cromarty Firth (Dalmore- Invergordon)		Dornoch Firth (Edderton Bay)		Totals	
	(C7, F9, F10, M12-M14)		(F11, F14, M15)		(M16, F21)					
	14		12		2		2		30	
No. of sites visited	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	—	—	—	—	—	—	—	—
Mallard	—	22	107	20	—	—	300	310	407	352
Teal	—	—	10	9	300	—	440	215	750	224
Wigeon	—	—	175	24	250	200	4200	500	4625	724
Pintail	—	—	—	—	—	—	55	170	55	170
Scaup	—	—	35	—	—	—	100	270	135	270
Tufted Duck	—	—	68	30	—	2	—	—	68	32
Pochard	—	—	—	—	—	—	—	—	—	—
Goldeneye	5	49	87	438	350	714	10	—	452	1201
Long-tailed Duck	412	19	—	—	—	—	2	—	414	19
Common Scoter	3	—	—	—	—	—	—	—	3	—
Velvet Scoter	—	—	—	—	—	—	—	—	—	—
Eider	1746	969	—	—	—	—	—	—	1746	969
Red-breasted Merganser	5	2	—	—	—	2	—	—	5	4
Goosander	—	—	—	2	—	—	—	—	—	2
Shelduck	—	—	—	—	4	90	67	121	71	211
Mute Swan	—	—	6	21	158	108	8	8	172	137
Whooper Swan	—	—	—	—	—	10	—	—	—	10
Totals	2171	1061	488	544	1062	1126	5182	1594	8903	4325

Table 7. Summaries of counts at all outfall sites : north and west

Primary outfalls (See appendices for codes)	Embo-Thurso (C8)		Scapa Bay (F15, F16)		Islay (Loch Indaal 17)		Fort William- Lochgillhead (I16)		Totals	
	No. of sites visited		1		1		11		24	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	—	—	—	—	—	—	—	—	—	—
Mallard	—	—	—	—	159	24	12	8	171	32
Teal	—	—	—	—	140	12	—	17	140	29
Wigeon	—	—	—	—	647	300	260	28	907	328
Pintail	—	—	—	—	—	—	—	—	—	—
Scaup	—	—	—	—	1000	500	—	—	1000	500
Tufted Duck	—	—	—	—	—	—	—	—	—	—
Pochard	—	—	—	—	—	—	—	—	—	—
Goldeneye	70	55	1	—	15	1	47	62	133	118
Long-tailed Duck	18	15	40	57	—	—	—	—	58	72
Common Scoter	—	—	—	—	—	—	—	—	—	—
Velvet Scoter	—	—	—	—	—	—	—	—	—	—
Eider	12	7	20	20	141	77	171	36	344	140
Red-breasted Merganser	—	6	6	7	14	3	—	—	20	16
Goosander	—	—	—	—	—	—	—	—	—	—
Shelduck	—	—	—	—	6	19	—	—	6	19
Mute Swan	—	—	—	—	5	2	24	—	29	2
Whooper Swan	—	—	—	—	40	—	—	—	40	—
Greylag Goose	—	—	—	—	112	160	—	—	112	160
Barnacle Goose	—	—	—	—	4-5000	—	—	—	4-5000	—
Totals	100	83	67	84	6279- 7279	1098	514	151	6960- 7960	1416

Table 8. Summaries of counts at all outfall sites : south-west

Primary outfalls (See appendices for codes)	Inner Clyde		Irvine-Troon- Ayr		Loch Ryan- Luce Bay- Kirkcudbright Bay		Totals	
	(S5-S12, M17, M18)		(I17-I19,F20, M19-M21)					
No. of sites visited	11		4		3		18	
	Nov	Feb	Nov	Feb	Nov	Feb	Nov	Feb
Great Crested Grebe	3	—	—	—	—	—	3	—
Mallard	571	527	647	256	2	2	1220	785
Teal	120	34	—	—	2	—	122	34
Wigeon	758	305	32	—	1289	40	2079	345
Pintail	180	140	—	—	—	54	180	194
Scaup	118	—	—	—	—	70	118	70
Tufted Duck	—	—	—	—	—	—	—	—
Pochard	12	—	—	—	—	—	12	—
Goldeneye	229	494	196	166	25	78	450	738
Long-tailed Duck	—	—	—	—	—	—	—	—
Common Scoter	—	—	—	—	—	—	—	—
Velvet Scoter	—	—	—	—	—	—	—	—
Eider	3272	1743	900	500	3	6	4175	2249
Red-breasted Merganser	136	106	8	11	273	12	417	129
Goosander	—	—	—	—	—	—	—	—
Shelduck	106	1671	—	—	—	133	106	1804
Mute Swan	100	14	—	—	65	36	165	50
Whooper Swan	4	—	—	—	—	—	4	—
Totals	5609	5034	1783	933	1659	431	9051	6398

areas polluted by domestic sewage and on barley, while Goldeneyes were found to contain seeds (mostly exotic varieties that could only have entered the river via sewers) and barley. Despite the small samples used in Player's research, his results are consistent with observations elsewhere, such as the Eiders off the large outfall near Monifieth in the Tay, Scaups at distillery discharge sites in the Dornoch Firth and on Islay, and Goldeneyes that flock to almost any outfall of domestic sewage and particularly to those that include distillery or maltings effluents in their discharges. Small crustaceans normally make up an important part of the diet of Goldeneyes (Olney & Mills 1963, Madsen 1954) and the dense concentrations of many species of these animals that feed on the detritus in bottom sediments near sewer outfalls must be an added attraction to Goldeneyes.

It is interesting to speculate on the reaction of these diving ducks when the east coast sewage treatment plans are completed, since the environmental changes will be sudden and the birds will have little time to adapt to more natural conditions which they may well be no longer equipped to exploit. Many of the young birds probably know of no other wintering environment and it is important to realize the extent to which their feeding habits will have to change. For example, the Duddingston Pochard flock is probably the only marine feeding flock of this species in Europe; Pochards normally only venture to salt water when forced to do so by freezing conditions inland. Scaups and Goldeneyes are normally highly predatory ducks that feed on bivalves such as Mussels, small gastropods, and in the case of Goldeneyes, small crustaceans. Player (1970) considers that both species are now almost entirely vegetarian in their winter quarters in the Forth. However, adapt the birds must when the time comes and there is fortunately no lack of suitable alternative sites around the Scottish coasts. For example, despite the large numbers of Eiders at the major outfall sites, there are other large or larger flocks along both rocky and sandy shores, and where Eiders are able to find food, so too must Scaups and Goldeneyes since Mussels and the other fauna associated with Mussel beds are important to all three species under natural conditions.

It is obviously in the long term interest of these diving ducks to vacate the major outfall sites and other areas close to centres of large-scale industrialization. Indeed, it is difficult to understand how the Scaups at Leith have managed to survive in the area for so long, having narrowly escaped an oiling disaster in 1970 (Editorial, *Scot. Birds* 6: 1-2). Scaups are not even safe on Islay where a relatively small oil discharge in October 1969 might have had serious consequences had the

wintering flock been present at the time (Ogilvie and Booth 1970). Eiders, Goldeneyes, Pochards and Mergansers are also very vulnerable in the inner Forth because of the dense concentrations they maintain in highly dangerous areas. However, in the case of Eiders in the Forth, a major kill would not be too serious to the Scottish breeding population as a whole since large flocks winter elsewhere, but this is certainly not true in the Tay where oil pollution is a constant and very real threat to a significant proportion of the Scottish breeding population. Toxic discharges in the Forth could have a doubly serious effect on Pochards and Goldeneyes because of the unbalanced male:female ratios. The Forth Pochard flocks contain a marked excess of male birds and adult males made up 60% to 65% of the Goldeneye flocks counted during this survey. Unbalanced sex ratios have been noticed in Goldeneye flocks in other coastal areas in Scotland, particularly at Invergordon where adult males are in a marked minority.

Tufted Ducks are much less vulnerable when feeding at out-fall sites, since they only move to these areas in large numbers when inland waters are frozen. However, Thom (1969) recorded flocks of up to 2,000 in the Kennet Pans area in the Forth during spells of freezing weather and these are the very periods when the birds will be in relatively poor condition and hence more likely to succumb to the effects of toxic wastes.

Mallards and Mute Swans are relatively omnivorous and adaptable and appear to be little affected by toxic discharges including oil. Mallards do not figure prominently in reports of birds killed by oil, despite the dangerous areas in which many of them feed, while swans, although frequently affected by oil (for example in the Cromarty Firth during this survey), have great powers of recovery, probably because they are able to come ashore where they are always able to find food and shelter of some sort.

It is difficult to see what correlation, if any, there is between the large concentrations of Wigeons and Shelducks counted in this survey and effluent discharges. Wigeons feed over *Zostera* beds and on swards of the salt marsh grasses, such as *Agrostis* spp, and seeds probably make up an important part of their diet. If so, moderate degrees of pollution from domestic sewage could be to their benefit. It is also likely that Wigeons take grain. Shelducks have much more specialized feeding habits and appear to be very much dependent upon the small snail *Hydrobia ulvae* found in intertidal flats. To what extent *Hydrobia* are dependent on or affected by sewage is not known. What is clear from the results of this survey is that flocks of Wigeons and Shelducks winter in polluted waters particularly where distillery effluents are present (such as the

Cromarty and Dornoch Firths) although other large flocks are equally happy to remain in clean areas. It appears that current pollution loads are having no detrimental effects on these species.

It is difficult to draw any conclusions regarding scoters and Long-tailed Ducks. Scoters are reported to depend heavily on Mussels for food (Madsen 1954) so might be expected to mass at outfalls where Mussels flourish. However, they do not and appear to remain relatively well offshore in areas such as Spey and Burghead Bays and the mouth of the Dornoch Firth (Milne and Campbell 1973), off Aberlady Bay and in St Andrews Bay. All these areas are supplied with very large amounts of river borne organic detritus suitable for the development of extensive sub-littoral faunas (but probably not including Mussels) and while most of the organic matter must be of natural origin or from agriculture, it might be significant that with the exception of St Andrews Bay (where scoter numbers seem to have decreased during recent years) these areas are also enriched by distillery and maltings wastes.

Long-tailed Ducks are more omnivorous than scoters and eat a variety of animal food including almost any species of mollusc of suitable size, crustaceans and even rock pool fishes such as Sea Scorpions *Cottus bubalis* and gobies *Gobius* spp (Madsen 1954, Stoner 1934). Thus they should be well able to exploit sewer outfall sites but although they were recorded in large numbers at such places in this survey, they do tend to keep further away from the pipe outlets than species such as Goldeneye. This is very noticeable near Leven and Leith. It is interesting that both Leven and Leith are sources of barley which Long-tailed Ducks are known to take (Player 1970, Harrison 1919) and so is Burghead Bay where Milne and Campbell (1973) recorded a flock of about 1,000 Long-tailed Ducks which were stated as sometimes feeding closer inshore than the scoters.

Although the west coast coverage for this survey was relatively poor, the results clearly indicate that the west coast holds much smaller numbers of wildfowl than the east coast, a point stressed by Thom (1969). However, it is significant that one of the most important sites is in the Clyde at Dumbarton and a little to the west, very similar both in geography and in sewage load to important wildfowl areas in the inner Forth. This area is mentioned several times in Thom's review. Perhaps the most hazardous area to wildfowl on the west coast is Ayr Bay because of the large amounts of chemical and industrial effluents discharged from near Irvine, the presence of the Clyde sludge dumping ground to the north and also the tanker traffic to and from the outer Clyde terminals.

Fortunately there are few ducks in the area but there might be a connection between the effluent discharges and the fact that maximum numbers of dead auks were recorded in Ayr Bay in Stewart's (1970) review of the Scottish aspects of the 1969 Irish seabird wreck. However, it must be stressed that many other factors could be involved, not least being the relative ease of finding and recording dead birds along this section of the coast.

It might appear from this report that the bulk of wildfowl wintering along the Scottish coasts are only to be found in polluted areas. However, with the exception of Goldeneyes, Scaups and to a certain extent Eiders, this is not the case. Unfortunately, it is not possible to present a valid comparison between the numbers of wildfowl in polluted and unpolluted areas, especially as sea ducks such as scoters and Long-tailed Ducks do not feature in the National Wildfowl Counts, and many flocks of Mallards roost in large numbers on the sea off a number of wide sandy bays. The Mallards in St Andrews Bay and Lunan Bay alone must number well over 1,000 and flocks of several hundred Wigeons are common on the sea near Montrose. Any comprehensive survey of the total numbers of wintering wildfowl along the Scottish coasts would have to include these marine areas in addition to other well-known areas such as the Solway coast and Nigg Bay in the north-east.

Acknowledgments

It is unfortunately not possible to acknowledge personally all those willing helpers who did the real work of this survey—the foot-slogging, counting and organization in the field, much of which entailed considerable expense. On behalf of the SOC, many thanks to you all. I must also thank the many people in public authorities and industry for their assistance in providing details and locations of the outfalls, and others not directly involved in the survey who nonetheless were willing to provide so much information. Particular thanks must go to J. Ballantyne, R. W. J. Smith and A. J. Prater and also to the members of the SOC Research Committee and its chairman Andrew T. Macmillan for their assistance with the drafts of this report.

Summary

A general review of some possible effects on wildfowl and shore birds of domestic sewage, trade and industrial wastes discharged into coastal waters is given as an introduction to the results of a survey in November 1973 and February 1974 of wildfowl numbers in the vicinities of sewer outfalls along the Scottish coast. Details of the major outfalls are included.

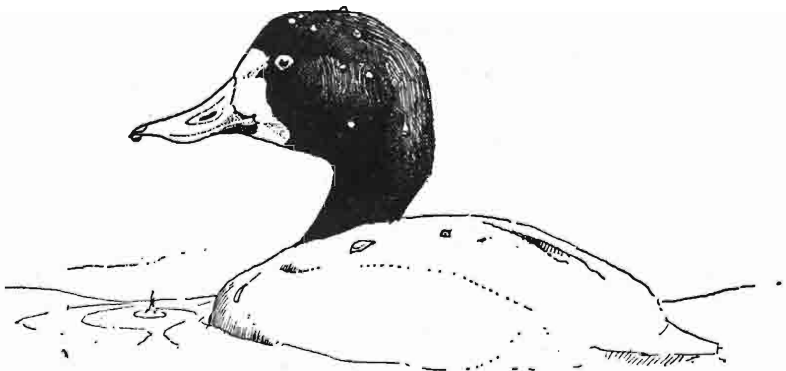
The results of the survey demonstrate the importance of large effluent discharge sites particularly to Scaups, Eiders, Goldeneyes and Mute Swans. The largest flocks of diving ducks were found in the inner Forth, particularly along the south shore where the bulk of the Scaups and Goldeneyes were located in waters polluted by large volumes of untreated domestic sewage and trade wastes including grain. Goldeneyes and Eiders were also found at almost every other large

outfall of domestic sewage visited during the survey with the Golden-eyes feeding close up to the pipe outlets and the Eiders some little distance away. Large concentrations of Mallards, Wigeons and Shelducks were found in both heavily polluted and clean areas and appear to be suffering little if any harm. However, all large concentrations of wild-fowl, including the more marine species such as scoters and Long-tailed Ducks which feed downstream of the effluent discharges in the Forth, are very vulnerable to transient discharges of toxic matter from sewage outfalls and particularly to oil, some of which is known to be derived from these sources.

References

- ABDULLAH, M. I., ROYLE, L. G. & MORRIS, A. W. 1972. Heavy metal concentrations in coastal waters. *Nature* 325: 158-160.
- BAILLANTYNE, J. 1973. Report on estuary bird counts in the Firth of Forth October 1972-March 1973. (Unpublished).
- BELLAMY, D. J., BELLAMY, R., JOHN, D.M., & WHITTICK, A. 1967. Some effects of pollution on coastal marine macrophytes on the N.E. coast of England. *Br. Phycol. Bull* 3: 409.
- BOGAN, J. A., & BOURNE, W. R. P. 1972. Organochlorine levels in Atlantic seabirds. *Nature* 240: 358.
- BRYAN, C. W., & HUMMERSTONE, L. G. 1971. Adaptation of the polychaete *Nereis diversicolor* to estuarine sediments containing high concentrations of heavy metals. 1: General observations and adaptation to copper. *J. Mar. Biol. Ass. U.K.* 51: 845-863.
- BRYAN, C. W., & HUMMERSTONE, L. G. 1973. Brown seaweeds as an indicator of heavy metals in estuaries in S.W. England. *J. Mar. Biol. Ass. U.K.* 53: 705-720.
- CLARK, J. R. 1969. Thermal pollution and aquatic life. *Sc. Am.* 220: 18-26.
- CONNOR, P. M. 1972. Acute toxicity of heavy metals to some marine larvae. *Mar. Poll. Bull.* 3: 190-192.
- DUNNET, G. M. 1974. Impact of the oil industry on Scotland's coasts and birds. *Scot. Birds* 8: 3-16.
- EDWARDS, P. 1972. Cultured red algae to measure pollution. *Mar. Poll. Bull.* 3: 184-188.
- GEORGE, J. D. 1971. The effects of pollution by oil and oil dispersants on the common intertidal polychaetes *Cirratulus tentaculata* and *Cirratulus cirratus*. *J. App. Ecol.* 8: 411-420.
- GRAY, J. S., & VENTILLA, R. J. 1971. Pollution effects on macro and mei-fauna of sand. *Mar. Poll. Bull.* 2: 39-43.
- GREENWOOD, J. J. D., & KEDDIE, J. P. F. 1969. Birds killed by oil in the Tay estuary, March and April 1968. *Scot. Birds* 5: 189-196.
- HALCROW, W., MACKAY, D. W., & THORNTON, I. 1973. The distribution of trace metals and fauna in the Firth of Clyde in relation to the disposal of sewage sludge. *J. Mar. Biol. Ass. U.K.* 53: 721-733.
- HARRISON, J. M. 1919. Long-tailed Duck feeding on grain. *Brit. Birds* 13: 85-86.
- HAYS, H., & RISEBROUGH, R. W. 1972. Reported in *Mar. Poll. Bull.* 3: 4.
- HOLDEN, A. V. 1970. Source of polychlorinated biphenyl contamination in the marine environment. *Nature* 228: 1220-1221.
- HOLDGATE, N. W. 1971. The seabird wreck of 1969 in the Irish Sea. N.E.R.C. Report. London.
- HOPKIN, R., & KAIN, J. M. 1971. The effects of marine pollutants on *Laminaria saccharina*. *Mar. Poll. Bull.* 2: 75-77.
- JENKINSON, I. R. 1972. Sludge dumping and benthic communities. *Mar. Poll. Bull.* 3: 102-105.
- JONES, A. M., JONES, K., & STEWART, W. D. P. 1972. Mercury in marine organisms of the Tay region. *Nature* 238: 164-165.
- MADSEN, F. J. 1954. On the food habits of diving ducks in Denmark. *Dan. Rev. Game Biol.* 2: 157-166.

- MAWDESLEY-THOMAS, L. E. 1971. Toxic chemicals - the risk to fish. *New Scientist* 49(734): 74-75.
- McLUSKY, D. S. 1968. Some effects of salinity on the distribution and abundance of *Corophium volutator* in the Ythan. *J. Mar. Biol. Ass. U.K.* 48: 443-454.
- MILNE, H., & CAMPBELL, L. H. 1973. Wintering sea-ducks off the east coast of Scotland. *Bird Study*, 20: 153-172.
- NICKLESS, G., STENNER, R., & TERILLE, N. 1972. Distribution of Cd, Pb, and Zn in the Bristol Channel. *Mar. Poll. Bull.* 3: 188-190.
- O'CONNOR, R. J. 1974. Feeding behaviour of the Kittiwake. *Bird Study* 21: 185-192.
- OGILVIE, M. A., & BOOTH, C. G. 1970. An oil spillage on Islay in October 1969. *Scot. Birds* 6: 149-153.
- OLNEY, P. J. S., & MILLS, D. H. 1963. The food and feeding habits of Goldeneye in Great Britain. *Ibis* 105: 293-300.
- PEARSON, T. H. 1970. Effects of pulp mill effluents on the fauna of sea lochs. *Mar. Poll. Bull.* 1: 92-94.
- PERKINS, E. J. 1972. Effects of steel works effluents. *Mar. Poll. Bull.* 3: 86-88.
- PERKINS, E. J., & ABBOTT, D. J. 1972. Nutrient enrichment and sand flat fauna. *Mar. Poll. Bull.* 3: 70-72.
- PLAYER, P. V. 1970. The food and feeding habits of diving ducks at Seafield, Edinburgh. Thesis, Edinburgh University.
- PLAYER, P. V. 1971. Food and feeding habits of the Common Elder at Seafield, Edinburgh, in winter. *Wildfowl* 22: 100-106.
- POUNDER, B. 1974. Wildfowl and pollution in the Tay estuary. *Mar. Poll. Bull.* 5: 35-38.
- POUNDER, B. 1976. Wintering flocks of Goldeneyes at sewage outfalls in the Tay. *Bird Study* (In press).
- PREST, I., JEFFRIES, D. J., & MOORE, N. W. 1970. Polychlorinated biphenyls in wild birds in Britain and their toxicity. *Env. Poll.* 1: 3-26.
- RUSSELL, G., & MORRIS, Q. P. 1970. Copper tolerance in the marine fouling alga *Ecotarpus siliculosus*. *Nature* 228: 288-289.
- SCOTTISH WILDLIFE TRUST 1974. Where in the Clyde estuary? *Scottish Wildlife* 10(2): 10-13.
- SHELTON, R. G. J. 1971. Sludge dumping in the Thames estuary. *Mar. Poll. Bull.* 2: 24-27.
- STEWART, A. G. 1970. The seabird wreck - autumn 1969. *Scot. Birds* 6: 142-149.
- STONER, C. R. 1934. Long-tailed Duck feeding on Sea Scorpion. *Scot. Nat.* No. 205: 50.
- THOM, V. M. 1969. Wintering duck in Scotland 1962-68. *Scot. Birds* 5: 417-466.
- WADDINGTON, J. I., & BEST, G. A. 1972. PCBs in the Clyde. *Scottish Wildlife Trust Newsletter* 22: 28.



SCAUP by Keith Brockle

Appendices

Key to abbreviations :

SS—suspended solids in milligrams per litre

BOD—biological oxygen demand in milligrams per litre

Mg/d—millions of gallons per day

NA—not available.

Appendix A. Details of large industrial outfalls (code I)

Code	Grid ref. (where known)	Outfall	Discharge rate (Mg/d)	Notes
I1		White Sands	NA	Cement works.
I2		Prestonpans	3.5	Ferruginous mine water.
I3		Gas Board	2.0	Gas work & ink industry wastes.
I4	NS963813	Grangemouth	1.0	Petrochems (settled).
I5	NS958813	Grangemouth B.P.	4.7	Petrochems.
I6	NS953805	Grangemouth B.P.	1.1	Petrochems.
I7	NS953822	Grangemouth B.P.	10.0	Petrochems & proteins (chemical flocculation & settlement).
I8	NTO19822	Grangemouth I.C.I.	4.5	Drugs & dyes.
I9	NS919889	J. A. Weir	1.5	Paper (partial filtration).
I10	NT131823	Inveresk	3.5	Paper.
I11	NT281895	Seafeld Coll.	4.3	Mine water.
I12	NT310937	Frances Coll.	2.5	Mine water.
I13	NT338961	Michael Coll.	3.0	Mine water.
I14	NT368987	Wellesley Coll.	0.8	Mine water.
I15	NO718569	Montrose	NA	Pharmaceutical.
I16		Annat	0.2	Paper.
I17	NS318355	Ayr Bay	NA	Organic chemicals.
I18	NS313359	Beechams	0.5	Pharmaceuticals.
I19	NS274395	Stevenston I.C.I.	1.0	Nylon works.

Appendix B. Electricity generating station cooling water discharges (code C)

Code	Grid ref. (where known)	Outfall	Discharge rate (Mg/d)	Notes
C1		Cockenzie	750	
C2	NT310740	Portobello	144	
C3	NS923850	Kincardine	600	
C4	NS971856	Longannet	1728	
C5	NT382003	Methil	66	Includes ash transport water.
C6	NO425307	Dundee	NA	
C7		Peterhead	NA	
C8		Dounreay	NA	

Appendix C. Food and agricultural waste discharges (code F)

Code	Grid ref. (where known)	Outfall	Discharge rate (Mg/d)	Notes
F1	NT945645	Eyemouth	0.12	Domestic & shellfish processing wastes.
F2	NS787955	Stirling	0.01	Agricultural (settled).
F3	NS789964	Stirling	0.02	Pig farm wastes (filtered & settled).
F4	NS844940	Cambus	3.2	Distillery (cooling).
F5	NO433309	Dundee	NA	Potato wastes.
F6	NO712573	Montrose	NA	Vegetable wastes.
F7	NJ947055	Aberdeen	NA	Fish wastes.
F8	NJ949052	Aberdeen	NA	Fish wastes.
F9	NJ970130	Murcar	0.7	Slaughterhouse.
F10	NK114386	Bullars of Buchan	small	Distillery.
F11		Burghead east	0.15	Maltings.
F12		Buckie	0.10	90% pot ale, 10% spent lees. (Pot ale to be reduced by 30%).
F13		Sandend	0.015	Distillery.
F14		Boyndie	NA	Distillery & hospital.
F15	HY434088	Scapa	NA	Distillery.
F16	HY438088	Scapa	NA	Milk processing.
F17		Islay	NA	Distillery.
F18	NS397751	Clyde	6.0	Distillery, BOD 220, SS 250.
F19	NS299760	Clyde	0.8	Edible oils.
F20	NX186994	Girvan	NA	Distillery, BOD 205, SS 136.
F21	NH666687	Dalmore	NA	Distillery.

Appendix D. Sewage treatment works discharges (code S)

Code	Grid ref. (where known)	Outfall	Discharge rate (Mg/d)	Notes
S1	NS953797	Polmonthill	0.2	
S2	NS902820	Falkirk	2.5	30% distillery, food, tar, metals & general engineering industry wastes.
S3	NS861912	Cowie	NA	Domestic & tile works wastes.
S4	NS836924	Fallin	NA	Domestic wastes & mine water.
S5	NS536664	Shieldhall	35	Domestic & food, chemical, metals & general engineering industry wastes, BOD 150.
S6	NS476708	Dalmuir	55	Domestic & food, distillery, chemical, metals & general engineering industry wastes, BOD 150.

Appendix D (Continued)

S7	NS406754	Dumbarton E	1.5	Domestic & engineering industry wastes, BOD 200.
S8	NS375755	Dumbarton W	0.3	Domestic, BOD 160.
S9	NS313812	Craigendoran	0.15	Domestic, BOD 150.
S10	NS460729	Old Kilpatrick	0.2	Domestic, BOD 150.
S11	NS445737	Bowling	0.1	Domestic, BOD 150.
S12	NS345773	Cardross	0.06	Domestic, BOD 150.
S13	NX972754	Creetown	0.3	From Newton Stewart.
S14	NY191644	Dumfries	2.5	Domestic.
S15		Annan	NA	

Appendix E. Mixed domestic-industrial discharges of more than 1.0 Mg/d

Code	Grid ref. (where known)	Outfall	Discharge rate (Mg/d)	Dominant non-domestic wastes
M1	NT361733	Levenhall	1-15	General trade wastes.
M2	NT288758	Seafield	17.0	Brewing, hospital, BOD 1200, SS 900.
M3	NT282765) NT281766)	Water of Leith	19.3	Brewing, distillery, paper, tanning, BOD 270, SS 250.
M4	NT253772	Trinity	2.0	Food, fish, BOD 530, SS 400.
M5	NT229775	Corstorphine-Granton	12.3	Paper, hospital, tanning, BOD 310, SS 430.
M6	NS809935	Stirling	1.0	20% agriculture, textiles & general engineering (settled: biological treatment to be implemented).
M7	NT127804	Dunfermline	4.5	25% textiles & rubber (screened & settled).
M8	NO384000	Leven	10.0	70% distillery, paper, poultry & general engineering. (Treatment proposed).
M9	NO351301) NO370293)	Invergowrie	3.8	70% general engineering.
M10	NO434309	Dundee	1.85	40% general engineering.
M11	NO490319	Dundee	2.4	20% general engineering.
M12	NJ974053	Aberdeen		Paper, general engineering.
M13		Peterhead	NA	Fish, vegetables.
M14		Fraserburgh	NA	Fish.
M15	NH665470) NH660472) NH645466)	Inverness	NA	Distillery, general engineering. (To be made redundant).
M16	NH708683	Invergordon	NA	Distillery, general engineering.

Appendix E (Continued)

M17	NS374744	Vale of Leven	1.5	Distillery, metals industry, BOD 125, SS 150
M18	NS335743)	Port Glasgow	11.0	Sugar, heavy engineering, BOD 250.
	NS230772)			
M19	NS272401	Garnoch Valley	2.5	24% pharmaceuticals, BOD 320, SS 140.
M20	NS303377	Irvine	1.2	17% general engineering.
M21	NS317353	Irvine Valley	5.0	24% general engineering.

Appendix F. Scientific names of birds mentioned in text

Great Crested Grebe	<i>Podiceps cristatus</i>
Cormorant	<i>Phalacrocorax carbo</i>
Shag	<i>P. aristotelis</i>
Mallard	<i>Anas platyrhynchos</i>
Teal	<i>A. crecca</i>
Widgeon	<i>A. penelope</i>
Pintail	<i>A. acuta</i>
Scaup	<i>Aythya marila</i>
Tufted Duck	<i>A. fuligula</i>
Pochard	<i>A. ferina</i>
Goldeneye	<i>Bucephala clangula</i>
Long-tailed Duck	<i>Clangula hyemalis</i>
Velvet Scoter	<i>Melanitta fusca</i>
Common Scoter	<i>M. nigra</i>
Eider	<i>Somateria mollissima</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Goosander	<i>M. merganser</i>
Shelduck	<i>Tadorna tadorna</i>
Greylag Goose	<i>Anser anser</i>
Barnacle Goose	<i>Branta leucopsis</i>
Mute Swan	<i>Cygnus olor</i>
Whooper Swan	<i>C. cygnus</i>
Oystercatcher	<i>Haematopus ostralegus</i>
Curlew	<i>Nunentus arquata</i>
Redshank	<i>Tringa totanus</i>
Kittiwake	<i>Rissa tridactyla</i>
Common Tern	<i>Sterna hirundo</i>
Roseate Tern	<i>S. dougallii</i>

Bede Pounder, 64 Forfar Road,
Dundee, Angus.

The seabirds of Shetland in 1974

M. P. HARRIS

(Plates 1 - 8)

Introduction

In the nineteenth century many of the larger birds of Shetland were severely persecuted and their populations declined. With protection from 1885 most species have gradually increased (Bourne and Dixon 1974). In addition the Fulmar*, now by far the commonest bird, colonized the islands, perhaps after a change in its food and/or the birds' increased tolerance of warmer water (Fisher 1952, Wynne-Edwards 1962). Deliberate human depredations on seabirds are now exceptional although numbers are killed accidentally during fishing. In future, the exploitation of North Sea oil with its inevitable disruption of the environment is certain to have a great influence on the seabirds of the area.

Although the literature contains general impressions by reliable observers and even a few counts of the seabirds in the nineteenth and early twentieth centuries (Baxter and Rintoul 1953, Venables and Venables 1955), the first detailed counts for the commoner species, such as Fulmar and Gannet, were in the early years of this century (Harvie-Brown 1912, Fisher and Vevers 1943). Recently an increasing interest in seabirds and an awareness of their vulnerability to pollution resulted in Operation Seafarer—a detailed survey in 1969 and 1970 of all Britain's seabirds by many observers for the Seabird Group (Cramp, Bourne and Saunders 1974). Unfortunately no repeat counts were possible due to observer shortage for the large areas covered so the accuracy of the Seafarer counts cannot be assessed.

In 1974 the Nature Conservancy Council commissioned the Institute of Terrestrial Ecology to design a monitoring scheme suitable for detecting changes in the seabird colonies of national importance in Shetland. This paper reports on the results of my survey of the main Shetland seabird colonies and includes an assessment of the accuracy that could be achieved by the methods described.

Methods

All major and many minor seabird colonies were visited between 10th June and 12th July 1974, when virtually all birds would have laid and few young have fledged. In most

*Scientific names are given in the species list under Methods below.

areas all seabirds were counted, but in a few places where this was not practicable, well defined sample areas were covered. The majority of counts were made from the land and with care it was possible to cover the majority of cliffs. In a few places these counts were supplemented by others done from the sea but such estimates are considered far less reliable than those from the land.

Observations were made through binoculars or telescope from as near to the birds as possible without disturbing them. During much of the time I had an assistant who counted the extremely numerous Fulmars while I concentrated on the other species. These counts were marked directly onto a 1:10,000 map. When faced with a large or difficult cliff, or at colonies where counts were to be replicated, I took Polaroid photographs of the cliff and marked on them at the time the areas counted with the totals of birds in each area. Such marked prints are needed for reliable replication of results. At the end of each day counts were totalled following the areas delimited in Seafarer. Where there was the possibility of confusion, adjoining areas were lumped. The individual area counts, with the relevant times and other details, are deposited with the Nature Conservancy Council and only summaries are presented here.

All comparisons made throughout this paper are between my counts and the raw Seafarer data taken from the cards completed by the observers. In 1974 the weather was good so that error due to counts being made in windy or uncomfortably wet conditions can be discounted. In many of the Seafarer counts the weather was bad and several of the counters remarked on the dubious accuracy of counts.

Each species poses a different problem in counting and the units usually counted are shown below. Criteria are the same as in the Seafarer counts and it is especially important that the same methods are used in future years. Earlier counts were sometimes expressed in different units and, rather than compound inaccuracies by converting these to the units used in 1974, these units are kept in the tables. Unless specifically stated the units used throughout this paper are as follows.

FULMAR *Fulmarus glacialis*. Only birds sitting tight on places where nesting was possible (= apparently occupied nest-site) were counted and then only one bird per site. This abundant species was not counted in all areas.

GANNET *Sula bassana*. All pairs with nests were counted. The total must have included an unknown proportion built by adult-plumaged non-breeders.

CORMORANT *Phalacrocorax carbo*. Occupied nests were counted.

SHAG *P. aristotelis*. Where possible occupied nests were counted but many large colonies were in inaccessible boulder beaches and here all adults seen were counted.

GREAT SKUA *Stercorarius skua*, ARCTIC SKUA *S. parasiticus*. Pairs that showed annoyance or injury-feigning when an observer passed close were counted. No serious attempt was made to census skuas and the results are minimal. So many skuas nest inland that counts made only near the coast are misleading.

GREAT BLACK-BACKED GULL *Larus marinus*, LESSER BLACK-BACKED GULL *L. fuscus*, HERRING GULL *L. argentatus*. Where birds occurred in small numbers direct counting of pairs was possible but large colonies were watched from a distance and the size estimated by a combination of the numbers of adults present and their distribution on the ground. Numbers of non-breeders must have been included and the results should be treated with caution.

KITTIWAKE *Rissa tridactyla*. All pairs with nests were counted. These must include some non-breeders.

ARCTIC TERN *Sterna paradisaea*. The figures are little more than general impressions of the sizes of colonies and must be treated with caution. A few COMMON TERNS *S. hirundo* occurred in some colonies.

RAZORBILL *Alca torda*, GUILLEMOT *Uria aalge*. Counts were of individual adults present on the breeding ledges at defined times of day. Birds ashore on sea-rocks and on the sea were counted separately.

BLACK GUILLEMOT *Cephus grylle*. A total count of birds on land and on the sea.

PUFFIN *Fratercula arctica*. The totals are of all birds on land and on the sea at defined times of day. In a few places it was possible to estimate roughly the numbers of burrows.

MANX SHEARWATER *Puffinus puffinus*, and STORM PETREL *Hydrobates pelagicus* were not considered.

The colonies covered were chosen to give a good geographic spread and to include as high a proportion as possible of Shetland's cliff-nesting seabirds. My coverage of the population of each species varied as follows. The percentage in brackets was the proportion of the Shetland population of that species to be expected in those areas that I censused in 1974, according to the Seafarer census of 1969/70. Thus my coverage was complete for the Gannet (100%) since I visited the only two

colonies then in Shetland, and was lowest for the Black Guillemot (19%) since the areas I visited held only 19% of the population according to Seafarer. In between were Kittiwake (76%), Razorbill (52%), Shag (44%), the larger gulls (21-24%), Fulmar (23%). A figure of 11% for Guillemot underestimates my coverage for if the more realistic total of 33,37,000 Guillemots of Foula is used instead of the 1969 estimate of 5,000 birds, the percentage cover is increased to over 50%.

Sources of error The number of seabirds at a colony depends on the time of day, season, weather, availability of food and previous breeding and mortality affecting recruitment.

Auk populations are the most difficult to count. Nests or eggs are usually hidden so that the observer has to count individual birds. Previous results show that the number of individual Guillemots can vary by 40% with a constant number of nests (Harris 1965) and counts of Razorbills by a factor of three within a single day during incubation (Lloyd 1973). With Puffins the numbers present may vary by a factor of a thousand and within one day making single counts useless. Thus samples based on counts of individuals are obviously unsatisfactory but are the best that can be made if time available is limited.

Even in the case of birds with obvious nests, such as Kittiwakes, there is variation in the number of nests during a season. Failed breeders leave the colony and non-breeders build nests late. Nests with young may join together so that two nests appear as one, or young birds may leave their nests before they can fly and form groups, for example Shags and Cormorants.

Several workers (especially R. Broad, T. Birkhead, C. Lloyd (1975)) are studying the fluctuations in the numbers of auks at colonies but it is not yet possible to interpret counts in terms of breeding pairs nor even to say when counts are best undertaken. There may well be no best time so it is desirable that a series of counts be made at each colony throughout the breeding cycle. Failing that, six to ten counts are needed in a single month to attain an accuracy of at least 10%.

Checks during the 1974 research The only test of accuracy possible was a test of consistency. I frequently made two or three counts within a ten minute period and, although consistency varied slightly from place to place and species to species, my differences were normally less than 5%. I had time to visit 17 areas on more than one day. Fifty-one replicate counts were done later on different days and table 1 shows that the variation between counts was far in excess of 5% in all four species considered. There is no doubt that the variation is



PLATES 1-8. The seabirds of Shetland in 1974 (pages 37-68). *Photographs by M. P. Harris.*

PLATE 1. Gannets, Kittiwakes and Gulllemots, looking south from Charlie's Holm, NOSS, 21st June (p. 54). Notice the dense pack of Guillemots in the lower centre.



PLATE 2. Guillemots and Kittiwakes on the east side of Cradle Holm, Noss (p. 54). This colony is completely invisible from the land.

PLATE 3 (opposite). Guillemot colony below Compass Head. Note the non-breeding or off-duty birds on the lower rocks. There are 887 birds visible on the photograph among the boulders. In the field the number was put at 1,100 (table 2, p. 49).





PLATE 4. Part of the east face of Skerry of Eshaness from the sea on 7th July. On the whole face 1,200 Kittiwake nests and 2,300 Guillemots were counted in the field; the corresponding figures from photographs are 1,069 and 1,885. The field counts on 22nd June 1969 were 2,300 and 3,500 respectively (table 2, p. 49; table 6, p. 54). Colonies like this are difficult and counts in anything but the calmest conditions are worthless.

PLATE 5 (opposite). Moo Stack off Eshaness. On 17th June there were 161 Kittiwake nests and 54 Guillemots whereas enlargements of this photograph show only 118 and 38 respectively (table 2, p. 49; p. 53).

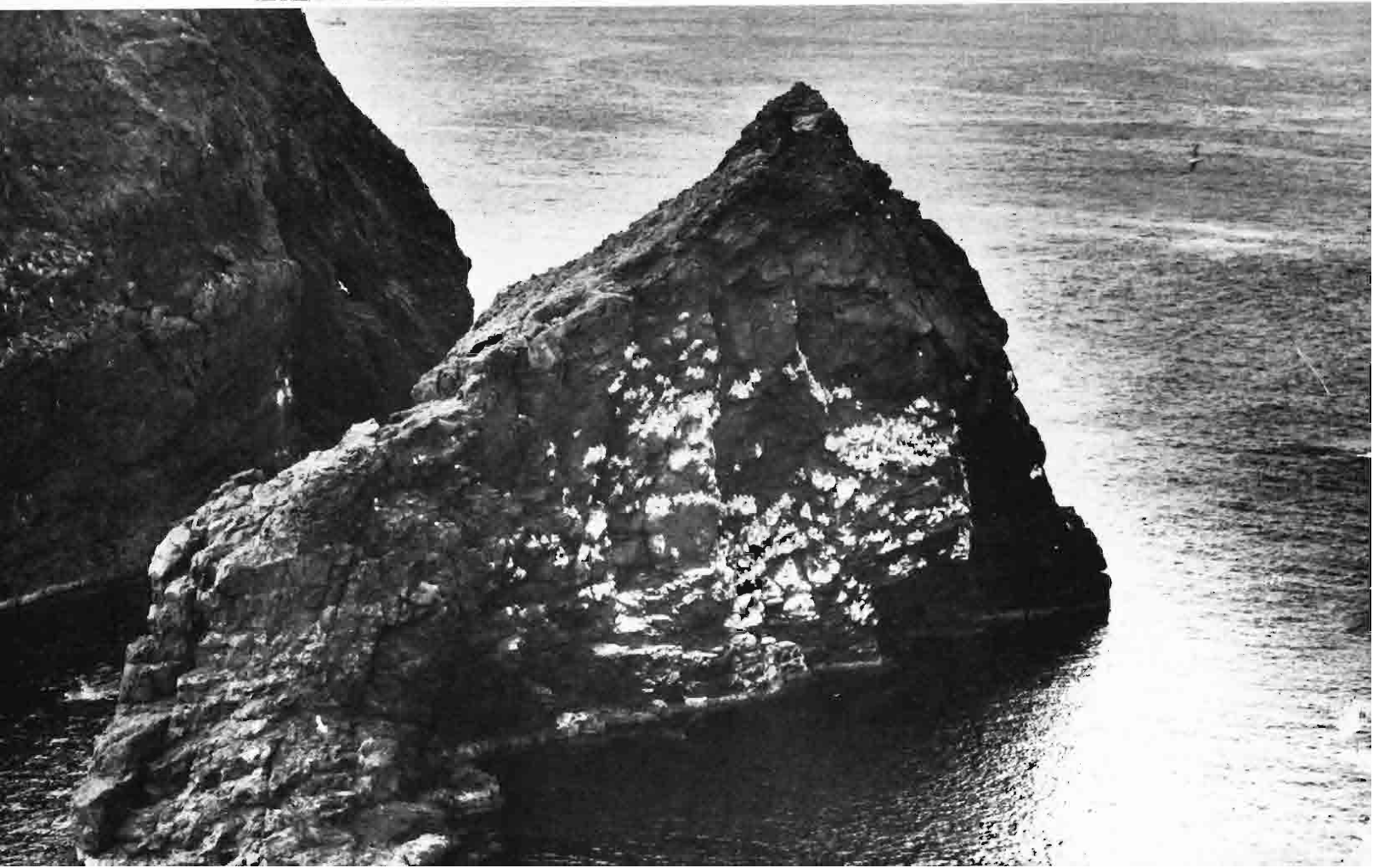




PLATE 6. A virtually uncountable Guillemot colony among boulders west of Sandy Head, Foula, from the sea, 3rd July (p. 57).

PLATE 7 (opposite). The Cormorant colony near Braewick. On 7th July there were 21 occupied nests (p. 62).



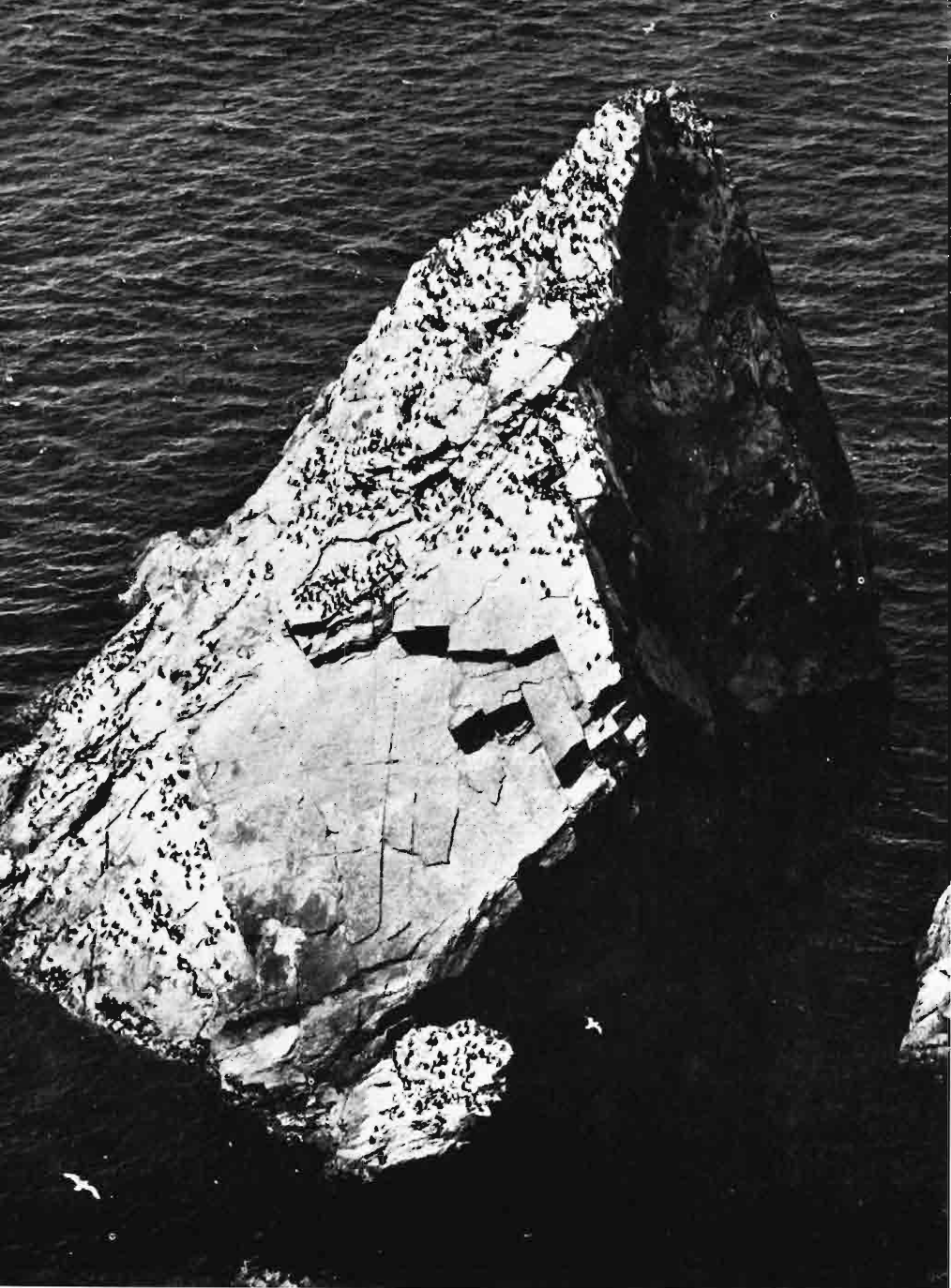


PLATE 8. Guillemots on the main stack in Broad Geo, Sumburgh Head, 25th June.
The maximum count here was 1,500 birds (p. 50).

Table 1. Replicate counts of seabirds in 1974

The difference between successive counts is expressed as a percentage of the lower of the two counts.

	Number of counts	Mean difference (\pm standard error)
Fulmar (sites)	6	7.1 \pm 2.1
Shag (nests)	12	25.7 \pm 6.2
Kittiwake (nests)	15	27.6 \pm 7.3
Guillemot (birds)	18	54.7 \pm 10.0

real, underlining the need for a series of counts at each colony before there can be hope of obtaining counts accurate enough to detect minor population changes.

Photographic counts Immediately after being counted, several colonies were photographed with a Mamiya Press Camera fitted with a 150mm lens and loaded with FP4 film. Full-plate prints were made of the 2 $\frac{1}{4}$ inch square negatives and the birds re-counted using a binocular microscope. The only species that can easily be counted are Kittiwakes and Guillemots, for other species tend to be hidden under boulders, in holes or by dense vegetation. All four photographic counts of Kittiwakes were lower than the field counts—by an average of 12% (table 2, plates 3-4). The main difficulty with the photographs was to separate a bird standing on a nest from one on a roosting rock. Possibly I was too conservative in my classification of the birds in the photographs. Most Guillemot counts from photographs were also lower—by an average of 17%—probably because it is

Table 2. Comparisons of counts of Kittiwake and Guillemot colonies in the field and from photographs

	Field count	Photographic count
Kittiwake (nests)		
No Ness	225	190
Dore Holm	344	318
Skerry of Eshaness	1200	1069
Moo Stack	161	118
Guillemots (individual adults on breeding ledges)		
Burravoe	129	99
Papa Stour (i)	227	187
Papa Stour (ii)	264	223
No Ness	123	129
Dore Holm	300	318
Moo Stack	54	38
Compass Head	1100	887
Sumburgh	1400	1106
Skerry of Eshaness	2300	1885

Note : the relatively few Razorbills are included with the Guillemot totals as it is impossible to separate them in photographs.

difficult to pick out birds facing inwards against a dark background.

The Moo Stack colony (at Esha Ness) was photographed from a distance of about 300 feet and then the colony counted immediately after from about 100 feet. The counts of both Kittiwakes and Guillemots from the resulting photographs were about 30% too low. This might well be the order of error involved in counting birds on photographs taken from the sea.

Monitoring by photographs is useful and enables later checks to be made on unexpectedly high or low counts which have to be made from the sea and cannot be easily replicated. Photographs also allow changes in the areas of cliffs occupied by birds, and sometimes even the density of nesting birds to be detected (Nettleship 1974). However, it would be unwise to compare counts made in this way with direct field observations. In my experience direct field counts are the most accurate.

Counts made from the sea Land counts are sometimes incomplete because stretches of cliff and the insides of caves may be hidden from view. These missing areas may be seen from a boat but this view in turn will overlook nests in narrow gorges, boulders at the bases of cliffs and high up on cliffs. Some of the Noss Fulmars were counted from the sea in 1969 and from the land in 1970 and the counts varied by a factor of 30. Land counts can be made and checked in relative comfort whereas sea counts are often made under difficult or rushed conditions. Sea counts of anything but the smallest colonies are always less accurate than land counts, and should be checked by photographs even then. For a complete census of large colonies, such as Noss and Foula, both land and sea counts are essential but the two counts are difficult to combine without missing areas or counting some ledges twice. Photography can go some way to overcoming these problems. For regular monitoring, land counts are to be preferred.

The colonies

The colonies counted are shown in fig. 1. All counts were used in the section comparing the 1969/70 and 1974 data but only the most important colonies are discussed below.

Sumburgh Head (table 3, plate 8). There are three complete surveys of this major seabird colony—a combined land and sea count by M. Carins in June/July 1967, the Seafarer counts in atrocious conditions on late dates of 10th and 14th July 1969, and mine on 25th and 26th June 1974. The three counts vary considerably and there is no consistency for any species. Many of the differences are presumably due to the differences in dates and techniques (for instance the 1969 sea count missed

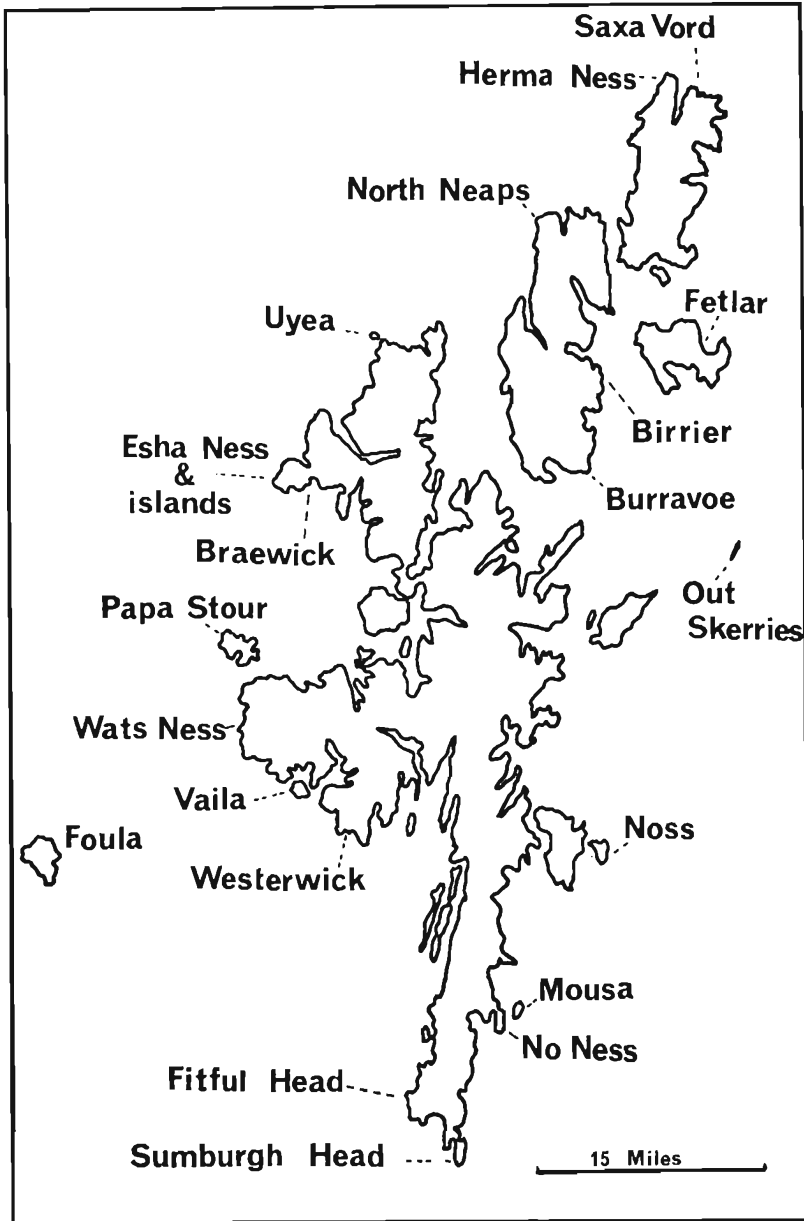


FIG. 1. Shetland seabird colonies (except Fair Isle) counted in 1974 and used in this analysis.

Table 3. The birds of Sumburgh Head

	1967	1969	1974
Fulmar (sites)	1250	2876	*
Shag (nests)	700	242	482
Great Black-backed Gull (pairs)	35	0	2
Lesser Black-backed Gull (pairs)	50	0	c.2000
Herring Gull (pairs)	125	50	130
Kittiwake (pairs)	550	1349	1778
Razorbill	400 pairs	61 pairs	819 birds
Guillemot	1750 pairs	578	c.7000
Black Guillemot	45 pairs	1 bird	12 birds
Puffin	1670 pairs	263 birds	4500-5500 birds

*present but not counted
1967 count by M. Carins.

two major Guillemot colonies and many of the larger gulls) but there have also been some apparently genuine increases, for D. Saunders (who made part of the 1969 count) is sure that the Guillemot and Kittiwake colonies were not as extensive in 1969 as in 1974. Guillemots had increased by some 6% between 1966 and 1967 (Carins) and this trend apparently continues.

Vaila (table 4). This island was counted on 13th June 1970 and 8th June 1974 and there is fair agreement except for apparent large increases in Shags and Great Black-backed Gulls. The single pair of Arctic Skuas in 1974 was apparently a new breeding species to the island but the long-standing colony of Cormorants formerly on Gaada Stack was deserted except for a single immature bird.

Table 4. The birds of Vaila

	1970	1974
Fulmar (sites)	1840	2388
Cormorant (nests)	28	0
Shag (nests)	53	91
Great Skua (pairs)	6	5
Arctic Skua (pairs)	0	1
Great Black-backed Gull (pairs)	49	125
Lesser Black-backed Gull (pairs)	0	10
Herring Gull (pairs)	141	188
Kittiwake (nests)	183	177
Arctic Tern (pairs)	1-9	82
Razorbill (birds)	14	72
Guillemot (birds)	350	436
Black Guillemot (birds)	31	26
Puffin (birds)	17	6

Papa Stour (table 5). The birds were first described by Raeburn (1891) who found Herring Gulls common though far outnumbered by Lesser Black-backed Gulls, Kittiwakes common but

Table 5. The birds of Papa Stour (including Fogla and Lyra Skerries)

These are incomplete counts but the same areas were covered each year.

	1969-70	1974
Fulmar (sites)	1479	1892
Shag (nests)	250	119
Great Skua (pairs)	6	*
Arctic Skua (pairs)	15	30
Great Black-backed Gull (pairs)	146	393
Lesser Black-backed Gull (pairs)	2	(
		(120
Herring Gull (pairs)	53	(
Kittiwake (nests)	749	226
Arctic Tern (pairs)	375	c.1000
Razorbill (birds)	20	10
Guillemot (birds)	1534	1814
Black Guillemot (birds)	14	23
Puffin (birds)	11-99	9

*present but not counted.

mainly on the main island cliffs, Guillemots abundant, but only one Fulmar and no Puffins.

The Seafarer estimate was an amalgam of two counts in two different years, the first on 14th-24th July 1969 excluding Razorbills and Guillemots, which were counted on 17th June 1970. My count was on 19th June 1974. The larger gulls, Arctic Terns, Arctic Skuas and Guillemots were all more numerous in 1974 than in 1969/70 whereas Shags and Kittiwakes appeared to have drastically declined. The differences in Shag counts may be an artifact due to some colonies being overlooked in the very numerous caves. Kittiwake nests on Fogla and Lyra Skerries, which were visible from the land, were counted in 1969, 1970 and 1974—the respective counts (Fogla + Lyra) for these years were 300 + 85, 115 + 106, 62 + 54, so there can be little doubt that there has been a decline.

Esha Ness (table 6, plates 4-5). There are three seabird colonies near Esha Ness: one just north of the lighthouse and two on the isolated Dore Holm and Skerry of Eshaness. All were counted on 21st-22nd June 1969 and 17th June and 7th July 1974—the former from the land, the latter two from a boat. The 1974 boat counts were later checked with photographs taken at the same time.

On the mainland there were many more Fulmars, Razorbills and Guillemots in 1974 than in 1969 but similar numbers of Kittiwakes. There was no such agreement in the two years' counts of the stacks; perhaps my Guillemot count was too late (7th July) to allow a meaningful comparison but the great differences in Kittiwake totals are worrying. The Skerry is difficult to count but there is no problem with Dore Holm for

Table 6. The birds of Esha Ness and islands

	Esha Ness		Dore Holm		Skerry of Eshaness	
	1969	1974	1969	1974	1969	1974
Fulmar (sites)	271	489	123	*	30	*
Shag (pairs)	1	5	0	0	0	0
Great Black-backed Gull (pairs)	0	10	0	*	0	0
Lesser Black-backed Gull (pairs)	2	0	0	0	0	0
Herring Gull (pairs)	16	20	0	0	300	*
Kittiwake (nests)	830	835	1000	344	2900	1200
Razorbill (birds)	10	38	0	5	100	few
Guillemot (birds)	171	464	900	300	3500	2300
Black Guillemot (birds)	0	13	0	0	0	0
Puffin (birds)	9	7	400	0	0	*

*present but not counted.

Note : in 1969 there were about 500 pairs of Kittiwakes reported from Isle of Stenness, in 1974 there were only roosting birds.

the birds are widely scattered. In 1969 the Isle of Stenness (between Skerry of Eshaness and the mainland) held about 500 nesting pairs of Kittiwakes while in 1974 I could find only roosting birds. Probably there has been a large decline.

Noss (table 7, plates 1-2). This is one of Britain's largest and most spectacular seabird stations. Unfortunately it is also one of the hardest to sample due to the high cliffs (The Noup is 594 feet), the relatively straight run of the eastern cliffs, and the nature of the rock. Much of the area is invisible from the land, the cliffs are too high and some of the ledges too deep for there to be any hope of an accurate estimate of populations from the sea. An accurate census might be possible from a carefully combined land and sea count using photographic techniques to prevent overlapping of counts.

Perry (1948) was the first to survey the birds of Noss and he also summarized past knowledge. The Seafarer survey on 3rd-7th July 1969 included a count of the main cliffs from the sea. Between 27th June and 17th July of the following year, J. den Held and M. Groenendaal repeated these counts from the land and den Held recounted the Gannets on 18th-21st July 1974. Considering the difficulties, there is fair agreement in some species but big discrepancies in the larger gulls (where one would have hoped for better agreement in consecutive years) and in the Fulmar. If the 1969 and 1970 Fulmar counts are broken down into approximately the same areas there is an even greater range of differences :

	1969	1970
North coast	1240	658
East coast	110*	3649
South coast	730	522

*sea count - rest from the land.

Table 7. The birds of Noss

	1946	1969	1970	1973	1974
Fulmar (sites)	1000+	2080	4839	*	*
Gannet	2600-3775 pairs	4300 nests	8181 adults	*	8093 adults
Shag (nests)	100+	141	130	*	*
Great Skua (pairs)	113	210	170	c. 225	242
Arctic Skua (pairs)	40	40	40	c. 39	44
Great Black-backed Gull (pairs)	135-150	304	210	c. 240	418 adults on Cradle Holm
Lesser Black-backed Gull (pairs)	c. 100	30	12	6	5
Herring Gull (pairs)	several hundred	500	415	c. 519	*
Kittiwake (nests)	declining	10510	10615	*	*
Arctic Tern (pairs)	*	10	0	45+	60+
Razorbill	less than 1000 pairs	3120 birds	1821 birds	*	*
Guillemot (birds)	huge colony, declining	24155	29311	*	*
Black Guillemot (birds)	*	52	85	*	*
Puffin (birds)	*	1100	1765+	*	*

*present but not counted.

Sources—Perry (1948), Seafarer, J. den Held, A. McLeod, P. Kinnear.

Presumably some of the variation will be due to differences in technique but the differences are so great that they may well have been genuine changes.

Comparisons of counts of adult Gannets in 1970 and 1974 show greater similarity :

Area	1970	July	June
		1974	1974
1	2470	2655	
2	2600	2670	
3	491	370	
4	2540	2325	1300 nests
		(= 1165 nests)	
5	80	73	23 nests
		(= 35 nests)	
Total	8181	8093	

While these last counts suggest that the Gannet population is relatively stable, a few new areas (such as The Rump, scree of Rumble Wick) have been colonized since 1972.

No Ness (table 8). This peninsula was counted from the land on 19th June 1970 and 26th June 1974 and from the sea on 10th July 1969. Some small sections of the cliff cannot be seen from the land and this could well explain the apparent small decline in Kittiwake numbers from 1,000 nests in 1969 to 901 in 1974. Conversely many Shags would certainly be invisible from the sea so it would be rash to assume that this species has greatly increased (30 to 159 nests). The disappearance of 570 pairs of Herring Gulls is a mystery.

Mousa (table 8). Between 9th and 16th June 1964 a party led by D. M. Turner Ettlinger visited the island and produced a report on the birds (NCC files). The only serious differences between

Table 8. The birds of Mousa and No Ness peninsula

	Mousa			No Ness	
	1964	1969	1974	1969/70	1974
Fulmar (sites)	*	235	313	1195	*
Shag (nests)	50-100	11	23	30	159
Great Skua (pairs)	16-27	12	*	0	5
Arctic Skua (pairs)	2-4	5	6+	0	3
Great Black-backed Gull (pairs)	3	6	2	3	14
Lesser Black-backed Gull (pairs)	50-100	43	80	1	0
Herring Gull (pairs)	many hundreds	50	68	700	130
Kittiwake (nests)	0	0	0	1000	901
Arctic Tern (pairs)	200-500	167	140	0	0
Razorbill (birds)	0	0	0	1-9	96
Guillemot (birds)	0	0	0	470	1024
Black Guillemot (birds)	12-20	96	33	2	17
Puffin (birds)	4-10	13	10	11-99	44

*present but not counted.

these figures and later ones are that Shags and gulls were then more common. However there were no detailed counts so perhaps the general impressions gained were slightly high.

Foula (table 9, plate 6). Foula is one of the most spectacular islands in Britain with cliffs rising to 1,220 feet and not falling below 500 feet for two miles. Difficulties in census work are great and, like Noss, it is unrealistic to hope for accurate estimates of some species such as Shag and Razorbill which nest in the boulder screes. Jackson (1966) made a general survey of the seabirds in the early 1960s; J. Holbourn put his native Foulan talents to good use to a full land and sea survey in 1968. The Brathay Exploration Group counted the birds in 1969, but so late in the season (3rd-24th July) that many of the birds must have left. They were also landbound and, as I discovered from 1st-3rd July 1974, many of the largest colonies are invisible from the cliff tops. The 1974 counts, including a circumnavigation, attempted to cover all the colonies of Kittiwakes, Guillemots and Razorbills.

The history of the Kittiwake is confused. In 1822 there was only a single colony on Foula (Jackson) whereas now there are many. Venables and Venables (1955) thought they were declining and today this is still the view of the local people who point to several colonies that were much larger in their

Table 9. The birds of Foula

	1960-62	1968	1969	1974
Fulmar (sites)	4-8000	60000 birds in March; 20000 pairs bred	very low order 5	*
Shag (pairs)	abundant	2500	very low order 4	abundant
Great Skua (pairs)	900	1100-1200	1776	2500
Arctic Skua (pairs)	130	120-150	100	200
Great Black-backed Gull (pairs)	15	?	15	c. 25
Lesser Black-backed Gull (pairs)	2-3	?	9	4
Herring Gull (pairs)	20	?	34	c. 30
Kittiwake (nests)	5-8000	5460	1206	3853+
Arctic Tern (pair)	100-300	200-300	262	c. 1800
Razorbill (birds)	large numbers	3000+	533	1720
Guillemot (birds)	large numbers	20-30000	c. 5000	33-37000
Black Guillemot (birds)	?	40	58	*
Puffin (pairs)	countless thousands	?50000	order 5	abundant

Notes : order 4 = 1000-9999 pairs, order 5 = 10, -99,999 pairs

Sources 1960-62 Jackson (1966), 1968 J. Holbourn, 1969 Seafarer, 1974 R. Broad, J. W. F. Davis, L. Johnston, R. Furness, Brathay Exploration Group, personal observation. *Present but not counted.

youth. However, Jackson estimated 5,-8,000 pairs in 1961 and Holbourn counted 5,460 occupied nests in late June 1968—a great rise over the perhaps incomplete 1959 counts of 1,631 nests in five colonies given by Coulson (1963). My count was lower than other recent figures (excluding the incomplete 1969 survey) but I would hesitate to read anything into this as, from conversations with J. Holbourn it is apparent that I missed a large Kittiwake colony at the Stab which is invisible both from the sea and cliff-top. In 1968 this had 1,200 pairs!

Guillemots have undoubtedly increased during the last decade and new ledges are being occupied every year. This could be true of Razorbills as Jackson noted very few on the eastern coast where I saw 428 birds ashore. However the island count was lower in 1974 than in 1968. Perhaps this is a return to a previous situation for in 1919 Greenaway (in Jackson) reported them as “fast increasing” in this area.

As with so many islands it is difficult to know the true status, or even the population trend, of the Puffin. It was thought to be increasing in the 1950s but suffered a decline in 1962 and 1963 (Jackson). Holbourn guessed at a maximum of 50,000 pairs in 1968. The Brathay report for 1971 reports a count of 2,000 pairs in July 1971 in an area where there were 6,157 pairs in 1969. However two islanders thought that the Puffins were more numerous in 1971! The species was abundant in 1974.

Herma Ness (table 10). There are three complete counts for the National Nature Reserve : 18th June-1st July 1965 (Dott 1967), 26th June-1st July 1969 (Seafarer) and 6th-11th June 1974. The counts exclude the birds on Vesta Skerry and The Rumlings (which had had c.600 pairs of Gannets, 127 Kittiwake nests and 220 Guillemots on the mainland side in 1974). The birds, spread along some seven miles of cliffs up to 500 feet high and on several stacks, are difficult to count. Even in good weather the 1974 single count took two man-weeks. Many of the boulder beaches are inaccessible and there can be little hope of obtaining good counts of Shags. In three geos it was possible both to count the birds and to search the boulders for nests. A total of 246 occupied nests were found where only 117 birds were seen. If this is a valid sample, the total Shag population would be about 1,900 pairs.

The Fulmar first colonized the area in 1897 and had increased to some 2,000 pairs by 1949 (Fisher 1952). This increase continues with the population increasing at 6% per year (fig. 2). A few pairs of Gannets were recorded nesting in 1917 and by 1949 3,150 pairs were visible from the land. In 1974 the population was estimated at 5,225 nests. There are no old counts

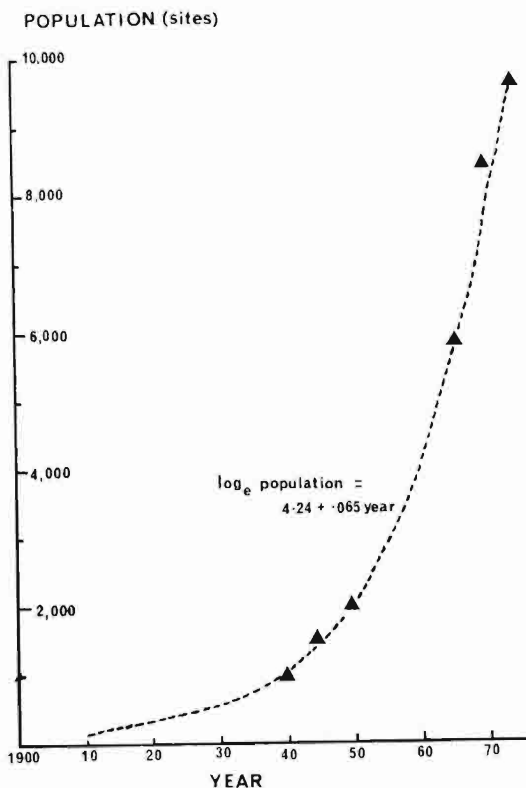


FIG. 2. The increase in the numbers of nest-sites of Fulmars at Hermaness National Nature Reserve.

of Guillemots but the population has apparently increased greatly in the last decade.

I have no faith in our or the previous counts of Puffins, but my general impression is of an enormous colony. There are also very large numbers on the other side of Burra Firth and the whole area probably supports a population running into six figures. Anyway, it is in the same class as the colony on St Kilda. There is no evidence that the population has increased greatly as many previous visitors to the area have remarked on the enormous numbers of Puffins. Many Razorbill colonies are hidden from view and the variations shown in the three counts are meaningless. Skuas were the subject of a special survey by the University of East Anglia Exploration Group—the large increases noted are to be documented in detail by them.

Table 10. The birds of Herma Ness

	1965	1969	1974
Fulmar (sites)	5880	8491	9669
Gannet (nests)	3450	3618	5225
Shag	315 birds	887 pairs	691 birds
Great Skua (pairs)	286	300	800
Arctic Skua (pairs)	113	30	70
Great Black-backed Gull (pairs)	?	6	17
Herring Gull (pairs)	?	46	53
Kittiwake (nests)	3303	4831	3952
Razorbill (birds)	780	2144	1102
Guillemot (birds)	8730	15983	18228
Black Guillemot (birds)	15	20	15
Puffin	8690 prs	c.15000 birds	abundant

Notes: the 1974 counts exclude c.600 pairs of Gannets, 127 Kittiwakes and 220 individual Guillemots visible on the mainland side of Vesta Skerry and The Rumbings. Data for 1965 from Dott (1967) and the 1974 skua figures were by the University of East Anglia Exploration Group.

Cramp *et al* (1974) gave 5894 pairs for the Gannet population in 1969 but this includes a partial aerial survey so this is not directly comparable with the above.

Fair Isle The seabirds are monitored annually and R. Broad will produce his results separately. However, in sample areas Fulmars have increased from 4,109 sites in 1969 to 4,586 in 1974, Kittiwakes from 597 nests in 1966 to 1,530 in 1974, and Guillemots from 190 birds in 1966 to 1,070 in 1974.

Out Skerries (table 11). The counts are the results of a visit on 24th July 1970 and all-season surveys of the four main islands by I. Robertson in 1973 and 1974. Fulmars and Kittiwakes have increased. Perhaps the most revealing factor is the difference a resident experienced ornithologist finds

Table 11. The birds of Out Skerries

	1970	1973	1974
Fulmar (sites)	58	159	184
Shag (nests)	53	91	70
Great Black-backed Gull (pairs)	24	9	6
Lesser Black-backed Gull (pairs)	8	20	33
Herring Gull (pairs)	121	77	116
Kittiwake (nests)	98	*	151
Arctic Tern (pairs)	701	570	635
Razorbill (pairs)	40	18	18
Guillemot (pairs)	14	*	25
Black Guillemot (pairs)	37-42	69	69
Puffin (pairs)	290	207	222

*present but not counted.

between consecutive annual surveys. Although the numbers involved are small, the percentage changes are great.

Comparisons of 1969/70 and 1974 data For each species each 1974 count was compared with the corresponding 1969/70 count. All the counts were used except for areas where counts were incomplete or not comparable, such as where the number of nests is given in one year and the number of birds seen is given the next. In most cases there was close agreement (significant correlation coefficient in table 12) but not for Herring and Lesser Black-backed Gull and Black Guillemot. In only two species (Fulmar and Great Black-backed Gull) did the 1974 results differ significantly from the Seafarer results when the data for each species were examined by the method of paired comparisons (Bailey 1959). It is, however, impossible to know whether the other populations have remained stable or whether the counts are too inaccurate to pick up any changes. My own opinion based on knowledge of the birds, the colonies and the fact that virtually all were single counts, is that it is more likely to be the latter.

Table 12. Comparison of the 1969/70 and the 1974 counts

	Number of counts	Correlation coefficient	't' value by method of paired comparisons
Fulmar	80	.889*	2.31*
Shag	36	.827*	1.36
Great Black-backed Gull	39	.930*	2.47*
Lesser Black-backed Gull	10	-.033	1.36
Herring Gull	62	.152	.33
Kittiwake	50	.332*	1.53
Razorbill	43	.380*	.16
Guillemot	58	.680*	1.80
Black Guillemot	40	-.005	.13
Puffin	33	.428*	.48

Note: In most species there was a significant correlation (* $P < .05$) between the 1969/70 and 1974 counts but only in Fulmar and Great Black-backed Gull were there significant population changes.

Species List

Fulmar Significantly more birds were counted in 1974 (fig. 3) than in 1969 or 1970. Obviously the past increase continues. It is gratifying that counting such an ill-defined unit as an apparently occupied nest-site can consistently show a regular trend.

Gannet The population of Noss appears to have remained stable, although a few new areas have been colonized, whereas that on Herma Ness has slightly increased.

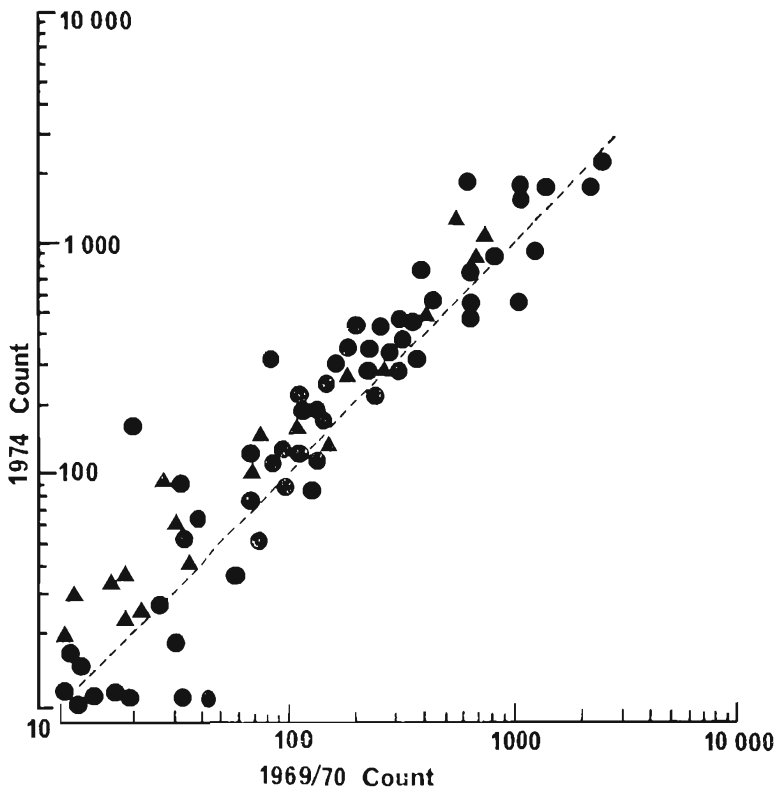


FIG. 3. The relationship between the 1969/70 and 1974 counts of Fulmars plotted on a log scale. The 1969-74 comparisons are marked by circles, the 1970-74 comparisons by triangles. The dotted line is the the line of no change. Plots above this line indicate that the 1974 count was higher than the 1969/70 count. There is a good correlation between the two sets of counts and there has been an undoubted increase (see table 12).

Cormorant Only the Heads of Grochan colony (Braewick, plate 7) was as large as in 1969 (20-21 pairs). Two other colonies (Vaila, Houlls-nef on Unst) were extinct and the fourth (near Westerwick) had moved stacks and declined from 35 to 6 pairs.

Shag There was no significant difference between years but any increase or decrease would have had to be very great to be detected as there are errors inherent in counting a species nesting in caves and under boulders. I have doubts about the counts on several grounds. Firstly, they were obtained by several different methods; the accuracy depends on the keen-

ness of the observer for climbing up and down cliffs or the nerve and skill of the boatman in going into difficult geos and caves. Secondly, in some areas I do not believe that accurate counts are possible. Thirdly, the species has a prolonged breeding season that, when linked with the wide range of counting dates, makes for low accuracy.

Great Skua and Arctic Skua No detailed counts were made. However, notes were kept when birds were seen and the large colonies on Noss, Herma Ness and Foula were censused by P. Kinnear, the University of East Anglia Expedition and Brathay Exploration Group respectively. All colonies have increased since 1969 and many new areas have been colonized.

Great Black-backed Gull The 1974 counts were significantly higher than those of previous years and the species has doubtlessly increased. This conforms to the pattern throughout Britain (Cramp *et al.* 1974).

Herring Gull and Lesser Black-backed Gull The Seafarer counts and my own were not significantly correlated. This could indicate that there have been large and erratic changes but more likely underlines the inadequacy of counts. In the sample areas Lesser Black-backed Gulls had increased from 43 pairs to 266 but most of this was due to c.200 pairs nesting high up on the east side of Sumburgh Head in 1974 where none were recorded in the 1969 sea-count. Carins noted 50 pairs in 1967.

Kittiwake There have been some undoubted changes—a new colony at the site of a previous roost at Wats Ness, increases on Out Skerries, Fair Isle, west coasts of Sumburgh, Yell (Blo Geo and Ern Stack held 167 nests in 1969, 219 in 1974), Fetlar (280 in 1969 to 399 in 1974), and decreases on Papa Stour and the rocks of Esha Ness. Fig. 4 suggests an overall decline but the trend is not significant.

In theory this species can be counted accurately but in practice it is difficult to make complete counts because parts of colonies may be invisible from the land and it is difficult to count crowded colonies from a boat.

Arctic Tern Although most tern colonies are easily found, they are difficult to count without causing unacceptable disturbance. Most 1969/70 counters estimated their accuracy as $\pm 10-20\%$; I did not check my counts but I think that they were less accurate than this. However, there were apparently 13 increases and six declines.

Razorbill Since the preferred nesting sites are out of sight in cracks or boulder fields it is rarely possible to count incubating birds. Counts of other birds include many non-breeders and are difficult to interpret (Lloyd 1973).

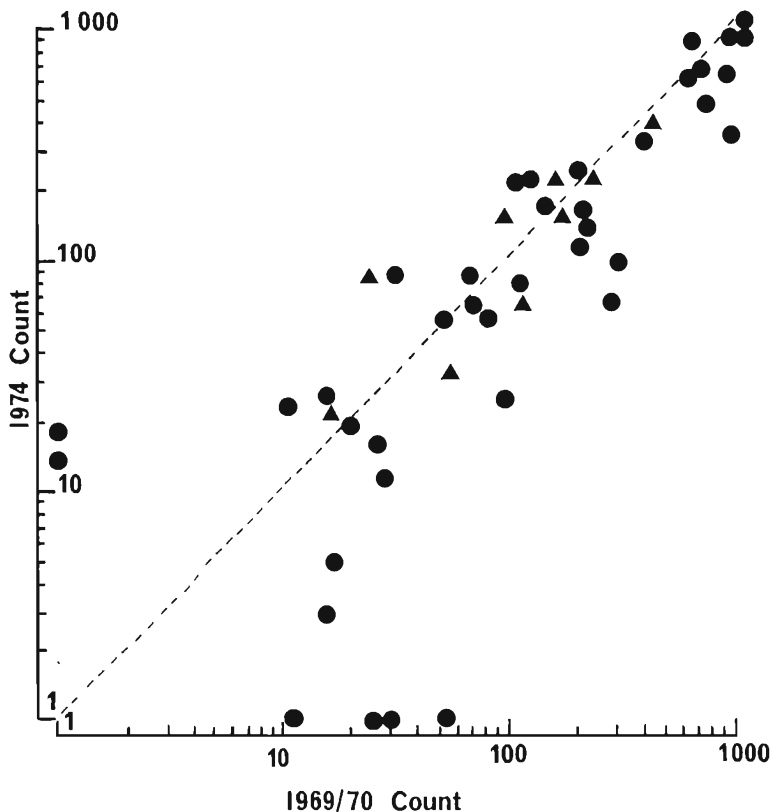


FIG. 4. The relationship between the 1969/70 and 1974 counts of Kittiwake nests. There is a good correlation between the two sets of points but there is no significant difference between them and the no change (dotted) line.

Guillemot No overall significant trend was evident in the results, possibly due to both the difficulty of counting birds on crowded ledges (one Noss ledge has at least 700 birds standing shoulder to shoulder) or deep caves (Foula caves may hold 10,000 birds (J. Holbourn pers. comm.)) and to the large fluctuations and numbers of birds attending colonies. A detailed examination of the individual count shows that all easily counted colonies counted during the egg or early chick stage appear to have increased. There have been massive increases on Fair Isle and Sumburgh, and the colonies on Foula are expanding. The only colonies where the 1974 figures were lower than Seafarer were Dore Holm and Skerry of Eshaness, which I visited late in the season, and Saxa Vord and Fitful Head

which are difficult to count. The counts to date will enable large population changes to be detected but not measured. Minor changes (perhaps less than 30%) would certainly be overlooked.

Black Guillemot Counts of pairs displaying under the cliffs prior to nesting may be meaningful but later counts such as those to date give only the most approximate idea of population size and nothing on possible changes.

Puffin Counts of birds are of little use for monitoring purposes for small numbers seen during a single or even a few visits do not necessarily even mean a small colony. Annual counts of occupied burrows in permanently marked areas are the only accurate ways of detecting population changes and these are only just beginning to produce results. There is no evidence that the populations are declining.

Conclusions

The seabird populations of Shetland appear to be in a healthy state. The data collected in 1974 add little to the distributions mapped during Operation Seafarer in 1969/70. However, the fact that no replicate counts were made in 1969/70 and few in 1974 makes statistical treatment of the actual counts difficult. Fulmars and Great Black-backed Gulls have increased, but for Herring and Lesser Black-backed Gulls and Black Guillemots there are no significant correlations between the two sets of counts. In the other species there are differences between the counts but the wide variation prevents trends being apparent.

The present level of monitoring is probably sufficient to detect only the most dramatic changes in populations. I have no series of regular Shetland counts from which to predict how many times each colony should be counted so as to arrive at a mean number of birds or pairs present during the period covered with any degree of accuracy. However, there are a few such auk counts from Pembrokeshire and Co. Kerry (table 13). These colonies were counted more or less daily during June and early July. All counts were in the middle of the day when the numbers of auks attending colonies are reasonably constant (Lloyd 1973, Birkhead in prep). The numbers of counts that have to be made to predict the mean with a known error with 95% confidence are presented in the table. The three least variable Guillemot counts were made during a month when the weather was unusually constant and Birkhead (pers. comm.) thought that the low variation in the counts was atypical. Judging from these figures at least ten counts of colonies of at least several hundred individuals must be made before we can hope for 10% accuracy. Fewer

Table 13. The calculated numbers of counts of Razorbills and Guillemots that need to be made to predict the mean number found by near-daily counts in June and early July. All counts near midday.

Species	Colony	Date	Mean count (birds)	Number of counts	Standard deviation	No. of counts for accuracy of			Source
						±5%	±10%	±20%	
Razorbill	Pembrokeshire	1st-30th June	66.3	30	11.8	52	14	4	Lloyd (1973)
Guillemot	Pembrokeshire	1st-30th June	39.9	30	4.6	23	6	2	Lloyd (1973)
Guillemot	Pembrokeshire	1st-30th June	38.9	25	5.9	38	10	3	Harris (1965)
Guillemot	Pembrokeshire	1st-30th June	523.9	29	32.2	7	3	1	Birkhead (pers. comm.)
Guillemot	Pembrokeshire	1st-30th June	107.9	29	8.7	11	3	1	Birkhead (pers. comm.)
Guillemot	Pembrokeshire	1st-30th June	327.6	29	24.2	10	3	1	Birkhead (pers. comm.)
Razorbill	Co. Kerry	22nd June-7th July	29.0	15	8.2	148	37	9	P. G. H. Evans (pers. comm.)
Razorbill	Co. Kerry	22nd June-7th July	26.7	15	9.3	261	65	16	P. G. H. Evans (pers. comm.)
Guillemot	Co. Kerry	22nd June-7th July	19.9	16	8.4	324	81	20	P. G. H. Evans (pers. comm.)
Guillemot	Co. Kerry	22nd June-7th July	157.9	13	17.9	24	6	2	P. G. H. Evans (pers. comm.)

Note : No. of counts calculated by $\frac{t^2 \times \text{variance}}{L^2}$ where L is the accuracy required.

counts would probably be needed for other species, except Puffins for which counts of birds are of little value.

Lloyd and Birkhead are attempting to refine the counting of seabirds and to relate the counts to the number of breeding pairs in the colony. It may be that a higher degree of accuracy could be obtained by making a series of counts during some specified phase of the breeding cycle. Lloyd (1975) has found that for Razorbills and Guillemots ten counts of birds present between 08.00 and 12.00 hours during the chick stage predicted the mean with an accuracy of 5-14% and 6-8% respectively. The disadvantage of this is that the timing of the breeding varies greatly between colonies and years so that several preliminary visits have to be made before it is obvious when the counts should be made. For convenience, counts during a particular calendar period are to be preferred. The preliminary conclusions of these two workers are that each colony must be treated separately but that differences between patterns of attendance are likely to be smaller between years than between colonies. Several weeks or months of study are needed at any colony before it can be decided how and when counts should be made and how they might relate to the breeding population. Although the remote and large colonies have great attractions for ornithologists, these are difficult to count accurately and are not suitable for monitoring. Attention must be centred on accessible colonies that can be visited regularly.

Acknowledgments

My largest debt is to the observers who took part in the Seafarer survey. I trust that they and the organizers of the survey, who allowed me to use the original data, will see my remarks on the value of the counts as being constructive and not destructive. D. Saunders who undertook much of the 1969/70 field work has clarified many points. Many people (especially members of the University of East Anglia Exploration Group) helped with the field work or supplied counts; they are acknowledged in the text. R. Tulloch, L. Johnston, P. Kinnear and other members of the Shetland Bird Club put their knowledge at my disposal. Drs D. Jenkins and I. Newton improved the manuscript with criticism.

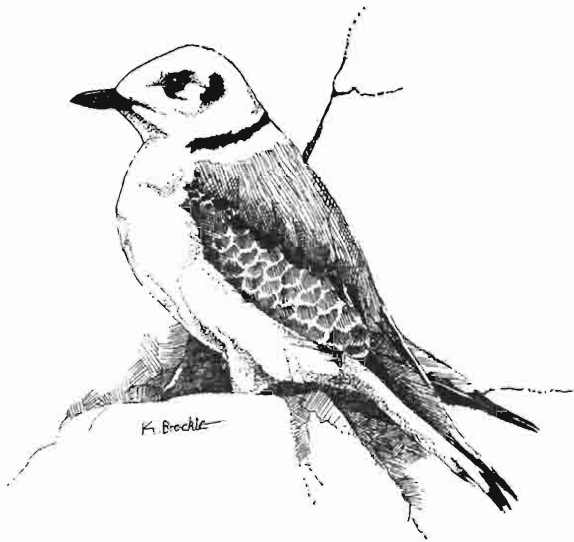
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References

- BAILEY, N. T. J. 1959. *Statistical Methods in Biology*. London, English Universities Press.
- BAXTER, E. V. & RINTOUL, L. J. 1953. *The Birds of Scotland*. Edinburgh and London, Oliver and Boyd.
- BOURNE, W. R. P. & DIXON, T. J. 1974. The Seabirds of the Shetlands. In *The Natural Environment of Shetland*, ed. R. Goodier, 130-144. Edinburgh, Nature Conservancy Council.
- COULSON, J. C. 1965. The status of the Kittiwake in the British Isles. *Bird Study* 10: 147-179.

- CAMP, S., BOURNE, W. R. P., & SAUNDERS, D. 1974. *The Seabirds of Britain and Ireland*. London, Collins.
- DOTT, H. E. M. 1967. Numbers of Great Skuas and other seabirds of Hermaness. *Scot. Birds* 4: 340-350.
- FISHER, J. 1952. *The Fulmar*. London, Collins.
- FISHER, J., & VEVERS, H. G. 1943. The breeding distribution, history and population of the North Atlantic Gannet (*Sula bassana*). *J. Anim. Ecol.* 12: 173-213.
- HARRIS, M. P. 1965. Some observations on a small Guillemot colony. *Nature in Wales* 9: 139-141.
- HARVIE-BROWN, J. A. 1912. The Fulmar: its past and present distribution as a breeding species in the British Isles. *Scot. Nat.* 1912: 97-102, 121-132.
- JACKSON, E. E. 1966. Birds of Foula. *Scot. Birds* 4: 1-60 (special supplement).
- LLOYD, C. 1973. Attendance at auk colonies during the breeding season. *Skokholm Bird Observatory Report* for 1972: 15-23
- LLOYD, C. 1975. Timing and frequency of census counts of cliff-nesting auks. *Brit. Birds* 68: 507-513.
- NETTLESHIP, D. N. 1974. A recent decline of Gannets, *Morus bassanus*, on Bonaventure Island, Quebec. *Can. Wildl. Ser., Studies on seabirds*, rep. 28.
- PERRY, R. 1948. *Shetland Sanctuary*. London, Faber and Faber.
- RAEBURN, H. 1891. The birds of Papa Stour, with an account of the Lyra Skerry. *Zoologist* (3rd series) 15: 126-135.
- VENABLES, L. S. & VENABLES, U. M. 1955. *Birds and Mammals of Shetland*. Edinburgh and London, Oliver and Boyd.
- WYNNE-EDWARDS, V. C. 1962. *Animal Dispersion in Relation to Social Behaviour*. Edinburgh and London, Oliver and Boyd.

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KITTIWAKE by Keith Brockie

Short Note

Buzzard taking Manx Shearwater at night

On 3rd September 1973 on the Isle of Canna, Inverness-shire, at 18.00 BST we observed a Buzzard *Buteo buteo* feeding on a young Manx Shearwater *Puffinus puffinus*. Presumably the bird had been unable to get back to its burrow during the night and was hiding amongst the vegetation when the Buzzard caught it.

That night at midnight RLS and P. MacKinnon flushed a Buzzard off a freshly killed and decapitated young shearwater some 200 yards from the first kill. The body showed no signs of rigor mortis and it appeared that it had been killed only minutes before we arrived on the scene, for the severed head was lying by the body and both were still bleeding.

Buzzards regularly roost on the cliff above the shearwater slopes. However, as it was a dark night with thick cloud cover and no moon it is interesting to speculate how the Buzzard located the shearwater. At this time of year many young shearwaters are sitting at the mouths of their burrows exercising their wings before their flight to the sea. The Buzzard must have either picked out the shearwater in the flashes from a nearby lighthouse, which we were unable to do, or located it by the noise of its wings flapping, a method used by us to find young birds.

Although Manx Shearwaters are often taken by Buzzards and also by Golden Eagles *Aquila chrysaetos* and Peregrines *Falco peregrinus*, this is apparently the first record of a raptor being observed to take one at night.

ROBERT L. SWANN, ALAN F. LEITCH.

Obituary

EDDIE BALFOUR

Eddie Balfour died suddenly in August 1974 while returning from a ringing expedition on Gairsay. He was the finest Orcadian ornithologist there has ever been and a world authority on his beloved Hen Harriers. It was my good fortune to succeed him as RSPB Representative in Orkney when he retired in 1974 and I soon discovered that he was a very different character from the seemingly rather withdrawn person I had met at conferences at Dunblane and elsewhere. It is so often true that a very modest and shy person can give an altogether misleading

impression on casual acquaintance. He could be an immensely entertaining companion and his knowledge of the plants and rocks, of Orkney folk-lore and custom, when added to that of birds, could make a day in the field or an evening with him an immensely rewarding and memorable experience.

From the basis of an obviously happy marriage he was much involved with many aspects of the life of his parish and county. He was Chairman of his local Community Association, interested in football, tennis and music, was a founder-member of the Orkney Field Club and its Chairman since 1970. The range of his interests and the respect with which he was held was movingly demonstrated at his funeral when the church was packed.

Together with the late George Arthur he was vigorous in protecting birds and particularly the birds of prey; the richness of the moorland bird community in Orkney must owe a great deal to the work they undertook. In 1937 he became an Honorary Watcher for the RSPB and in that year started keeping written records of the birds he saw. Although it is perhaps a shame that more of his vast knowledge was not published, he contributed regular nature notes to a local paper and, for a time, to *The Scotsman*. Some of these notes show that he could write beautifully when the mood took him, as when he described some of the smaller islands as places where 'Eiders nested under an umbrella of screeching terns' and the final sentence of his book on Orkney birds is as fine and concise a statement on the need for the conservation of nature as you will find anywhere—'As we are part of nature and depend on nature for our existence we should respect and cherish it'.

He contributed papers on the Hen Harrier and other birds to *Ibis*, *Bird Study*, *Bird Notes* and *Scottish Birds* and his paper *Breeding birds of Orkney* (*Scot. Birds* 5: 89-104) was an important and valuable summary of what must always be a changing community and the first published since David Lack's paper in *Ibis* in 1942-43. But there was still no authoritative and up-to-date statement on the general status of Orkney's birds. There was only Buckley and Harvie-Brown's classic work *A Vertebrate Fauna of the Orkney Islands* published in 1891 and a less satisfactory book by Omand *How to know the Orkney Birds* published in 1925. Then in 1972 Eddie Balfour's *Orkney Birds—Status and Guide* was published by Senior of Stromness and the gap was filled. This book is essential reading for anyone visiting Orkney to see its birds and for anyone wishing to know about them.

In 1954 he became a paid employee of the RSPB and in the following year was appointed as the Society's full-time Orkney

representative. This gave him the freedom to acquire an unrivalled knowledge of the birds around him and to devote more time to his study of the Hen Harrier. This study continued for 43 years and was the longest study of a bird of prey population anywhere in the world. At the time of his death he was working on a major paper with Dr James Cadbury and I hope this will be published before too long—it would be a tragedy if all this accumulated knowledge was not made widely available.

DAVID LEA.

Review

Waterfowl Populations in Denmark 1965-1973; a Survey of the Non-breeding Populations of Ducks, Swans and Coot and their Shooting Utilization (Danish Review of Game Biology Vol. 9 no. 1). By Anders Holm Joenson. Denmark, Vildtbiologisk Station, 1974. Pp 206; numerous maps, graphs and tables. 24 x 17 cm. No price.

This publication presents the voluminous results of three surveys made in the period 1965-1973. The main survey comprised monthly (September to April) ground counts in selected places, aerial surveys of coastal and offshore waters, and, on nine occasions, combined ground and aerial surveys designed to estimate the size and distribution of the entire waterfowl population. The second survey, of the annual kill by sportsmen, was based on the official bag-record: Danish sportsmen have to supply bag records as part of the licensing system. It was supplemented with information from questionnaires completed by sportsmen and with game dealers' statistics. The third survey, primarily concerned with diving ducks, was of age and sex-composition of shot and oiled birds. The limitations of the techniques involved are discussed and full details of the analyses given in a section which should be useful to others engaged in similar work elsewhere.

The results of the surveys are generally presented in two ways, firstly in a chapter on the status of the various individual species, secondly in a chapter on the main waterfowl haunts. In each the presentation is clear and succinct. A relatively brief final chapter comes to some general conclusions.

Denmark is an important waterfowl area in the non-breeding season, particularly for moulting aggregations of sea ducks. Furthermore, over 60,000 Danes shoot ducks. The information presented here is thus of more than local importance. Those who are seriously involved in the academic study of wildfowl, in their conservation, or in shooting them will find this book of interest and value.

Taken at a single sitting, the volume of information presented is rather too much for the mental digestion, but this is a book at which the wildfowl enthusiast will wish to keep nibbling.

J. J. D. GREENWOOD

Letter

Sir,

The Flanders Moss Lesser Black-backed Gullery

I suspect that Andrew Macmillan was not responsible for the heading to his note on this subject (8: 281), which would locate this breeding colony in Stirlingshire instead of South Perthshire.

His surmise that the colony was long-established by 1935 can be confirmed by some very precise historical information which seems to have been widely overlooked and which may therefore be worth quoting here. The author is Oswin A. J. Lee, one of the pioneers of bird nest photography, whose four volume work *Among British Breeding Birds in their Nesting Haunts* was published in Edinburgh 1897-9. In vol. 1 he provides a photograph of a Lesser Black-back's nest at Flanders Moss taken on 10th May 1893 and comments in the accompanying text as follows :

"Some of these colonies of Lesser Black-headed Gulls increase very rapidly. I remember a pair of these birds taking up their quarters on Flanders Moss in the valley of the Forth in the spring of 1880; in 1885 we found twenty-one pairs breeding there, in 1891 seventy-six nests were found, and on my revisiting the colony in 1893 I found a hundred and thirty-four nests of this species containing three eggs each; this increase went on in spite of the war waged against them by the keepers, who took the eggs and trapped and shot as many old birds as possible. The destruction of fish in the neighbourhood must have been very great, as beside these birds there was a colony of Black-headed Gulls—some eight hundred pairs—not half a mile distant, and almost every nest had the remains of one or two small trout or parr beside it . . . The Lesser Black-backed Gulls choose a dry part of the moor for their colony, which is somewhat scattered, placing their nests among the long heather and dwarf bog-myrtle some distance from the large colony of Black-headed Gulls, who seem to prefer the lower and more swampy part of the moor. The nests were usually placed on some bare patch beside a large tuft of heather or bog-myrtle, and were somewhat bulky structures of soft moss and small bits of dead grass . . . Often when I was examining a nest, the owner would eject a fish or two from its stomach in a vain attempt to scream loud enough to drive me away. Some of these fish must have weighed nearly five ounces, and were generally half digested, having little skin on them."

DOUGAL G. ANDREW.

(The editor was responsible for the incorrect letter heading

Gulls breeding inland in Stirlingshire. Andrew Macmillan's letter was written in response to a short note in a previous issue entitled *Gulls breeding inland in Aberdeenshire* and a heading incorporating the county was chosen by me for the sake of consistency. Being unfamiliar with the area, I looked up Flanders Moss in Johnston's *Gazetteer of Scotland* (1973) which gives the location as Stirlingshire, south of the Forth. I have since checked the one-inch Ordnance Survey map, which shows two distinct Flanders Mosses, on either side of the Forth in both counties.—ED.)

The Scottish Ornithologists' Club

Revenue Account for the year ended 30th June 1975

	Year to 30/6/75	Year to 30/6/74
INCOME		
Subscriptions received for year	£6258	£4715
Income Tax recovered on covenanted subscriptions	1009	643
Dividends and Interest received (gross)	367	308
Surplus on Bookshop (sales £20864)	5271	3313
Sale of "Scottish Birds"	437	260
Sundry sales less sundry purchases	39	22
Donations received	21	20
Gain on redemption of investment	—	56
	<u>£13402</u>	<u>£9337</u>
EXPENDITURE—		
Branch expenses including lectures	£574	£551
Travel expenses of Council members and of delegates to conferences	261	265
Secretarial and Editorial services	8086	5742
Office expenses	1427	1103
Scottish Centre for Ornithology and Bird Protection :		
Club's share of running expenses	760	1150
Cost of books purchased for Library	126	128
Cost of publishing "Scottish Birds" (less advertising revenue £567)	1573	1420
Honorarium to Compiler of 1974 Scottish Bird Report	£100	
Less Contribution from "Scottish Birds" Appeal Fund	100	
	<u>—</u>	<u>—</u>
Net cost of Annual Conference	69	40
Subscriptions paid	69	48
	<u>£12945</u>	<u>£10447</u>
Excess of Income over Expenditure	457	(1110)
	<u>£13402</u>	<u>£9337</u>

Balance Sheet as at 30th June 1975

	Year to 30/6/75	Year to 30/6/74
Accumulated surplus as at 30th June 1974	£2988	£4098
Add : Excess of Income over Expenditure	457	(1110)
Accumulated surplus as at 30th June 1975	<u>£3445</u>	<u>£2988</u>

(Note : £1000 of this surplus is earmarked for the House Fabric Fund.)

Made up of :

Cash in hand and Bank current accounts	£515	£229
Cash in Building Society	8	1655
Bookshop stock at valuation	5353	2330
Tie and badge stock at valuation	191	82
Debts due to Club	1376	879
Sum due from Endowment Fund	33	—
Night store heaters—Cost	£465	
Less depreciation	465	
	—	90
Addressing machine—Cost	£530	
Less depreciation	430	
	100	200
Investments at cost as below	2406	2406
	<u>£9982</u>	<u>£7871</u>

Less :

Life Membership Fund	£1200	£875
Subscriptions paid in advance	18	45
Debts due by Club	3451	2193
Sum due to Endowment Fund	—	242
"Scottish Birds" Appeal Fund	1513	1120
Sum earmarked for Library binding	167	167
Balance of Royal Society Grant to Library	188	188
Sum raised for purchase of Projector	—	53
	6537	4883
	<u>£3445</u>	<u>£2988</u>

Investments as at 30th June 1975**Safeguard Industrial Investments Ltd.—**

	Market Value	At cost	At cost
875 Ord. shares of 25p each	£394	£508	£508
£950—6½% Treasury Loan 1976	921	846	846
£1300—British Electricity 3% Guar. Stock 1974/77	1209	952	952
	<u>£2524</u>	<u>£2406</u>	<u>£2406</u>

ENDOWMENT FUND

(The free income of which is available for the advancement of ornithology)

Revenue Account for the year ended 30th June 1975

	Year to 30/6/75	Year to 30/6/74
INCOME—		
Interest and Dividends received (gross)	£401	£260
EXPENDITURE—		
Grants at detailed in Report of Council	160	384
Excess of Income for the year	<u>£241</u>	<u>(£124)</u>

Balance Sheet as at 30th June 1975

Endowment Fund as at 30th June 1974	£2791	£2519
Add: Legacies received during year	500	100
Donations received during year	18	172
	<u>3309</u>	<u>2791</u>
Accumulated Revenue as at 30/6/74	810	684
Add: Excess of Income for year	241	(124)
	<u>4360</u>	<u>3351</u>
Add: Grant made in 1972 refunded	—	250
	<u>£4360</u>	<u>£3601</u>

Made up of :

Investments at cost as below	£3011	3011
Edinburgh Building Society Deposit Accounts :		
Capital Account	786	—
Revenue Account	796	—
Royal Bank of Scotland Ltd., Deposit Account	—	718
Due by Club's General Funds	—	242
	<u>£4593</u>	<u>£3971</u>
Less: Grants allocated but not yet paid	200	370
	<u>£4393</u>	<u>£3601</u>
Less: Due to Club's General Funds	33	—
	<u>£4360</u>	<u>£3601</u>

Investments as at 30th June 1975

	Market Value	At cost	At cost
1952 Units of Equities Investment			
Fund for Charities	£2069	£1000	£1000
£1140 5% Exchequer Stock 1976/78	972	1000	1000
£440 8½% Conver. Unsecured Loan Stock 1993/98			
British Printing Corporation	198	441	441
500 St Andrew Trust Ltd., Ordinary 25p	475	570	570
	<u>£3714</u>	<u>£3011</u>	<u>£3011</u>

HOUSE FABRIC FUND

Summary of Accounts for year to 30th June 1975

	Year to 30/6/75	Year to 30/6/74
RECEIPTS—		
Balance as at 30th June 1974	£12	£40
Year's rent from Major A. D. Peirse-Duncombe	312	—
Rent from Squadron Leader Greig (12.11.73 to 15.6.74)	—	130
Year's rent from British Council for Rehabilitation of Disabled	140	140
Grants from S.O.C. Revenue Account	100	500
Miscellaneous Interest	10	5
	<u>£574</u>	<u>£815</u>
EXPENDITURE—		
Repairs and Maintenance	£103	£456
Property Burdens	£578	
Less contributions from Tenants	244	
	<u>334</u>	<u>314</u>
Insurance	34	33
	<u>£471</u>	<u>£803</u>
On deposit with Edinburgh Building Society	103	12
	<u>£574</u>	<u>£815</u>

EDINBURGH, 21st October 1975.—I have audited the foregoing Revenue Accounts for the year to 30th June 1975, and the Balance Sheets as at that date. I have accepted as correct Subscriptions and other receipts shown as received in the Books and the value placed on the Bookshop Stock. Subject to this I certify that in my opinion the foregoing accounts are correctly stated and sufficiently vouched.

(Signed) ARTHUR WALKER,
Chartered Accountant.

REPORT OF COUNCIL

Your council submits the following report for the year 1974/75 :

Membership At the end of this session the club had 2516 members, a net loss of 135 during the year; four members transferred to life membership, and 346 new members joined, including 53 junior members and 51 children nominated under the new family membership arrangements. A table of membership is given below. Included in the total of ordinary members are 155 who elected to pay the reduced rate for old age pensioners. Family membership is counted as two ordinary members in the table, and children nominated by parents with family membership are shown separately, as no extra subscription is paid for them; 12 previously subscribed as junior members.

Year to 30 June	1970	1971	1972	1973	1974	1975
Honorary	5	5	5	4	4	4
Life	9	10	14	14	18	22
Ordinary	1849	1889	2054	2230	2312	2175
Junior	286	282	298	312	317	252
Nominated children	—	—	—	—	—	63
	<u>2149</u>	<u>2186</u>	<u>2371</u>	<u>2560</u>	<u>2651</u>	<u>2516</u>
Change	±92	±37	±185	±189	±91	—135

This net loss, the first since 1959, may be attributed to the increase in subscription rates which applied this session, with more members than usual resigning or letting their subscriptions lapse. Enquiries have been put in hand to find out how much of this may arise from any failure to provide what members want rather than outside factors, and it is hoped this will be useful for the future.

There was a most encouraging response to the request for those with deeds of covenant to consider changing them to the new subscription rate, and over a hundred members signed covenants for the first time. The number of covenants rose from 482 to 566, representing 659 members. Deeds of covenant make a very real contribution to the club's funds, and this year the SOC was able to reclaim £1009 of tax.

Death With great regret council records the death during the year of Eddie Balfour, local recorder for Orkney. An obituary will be published in *Scottish Birds*.

Secretarial staff Owing to the continued increase in bookshop sales it became necessary to appoint an additional part-time assistant, and Mrs P. A. Mottershead came temporarily from January to March 1975, when Mrs H. L. Harper joined the staff. Mrs Irene Waterston was unable to devote sufficient time to work in the library, and as a temporary measure Mrs Daphne Peirse-Duncombe was appointed assistant librarian from April 1975.

Wigtown Group An application from Angus Maciver to start a group in the Wigtown area was approved by council. It is eight years since a new group of the club was formed, and it is hoped that this one will both attract new members and encourage existing members who live too far from Ayr and Dumfries to be able to attend meetings of those branches. The group held its first meeting early in autumn 1975.

Branches At all branches the usual summer and winter excursions were arranged, and a full programme of winter lectures covered a wide range of topics. The Dumfries and Stirling branches again organised weekend excursions to the Solway goose grounds and Argyll respectively. Council wishes to record its appreciation to the many speakers and excursion leaders who give their time so freely for the enjoyment of members.

Annual conference After thirteen years at Dunblane the annual conference, faced with greatly increased hotel charges, moved to the University of Stirling. About 260 members and guests attended the 27th conference and 38th annual general meeting of the club in the last weekend of January 1975. Numbers were lower than usual, reflecting some trepidation about student accommodation and the changed time of year. Those who were there agreed that the weekend was as enjoyable as ever, although a significant number would have preferred the usual date at the end of October, which unfortunately is not possible at a university. Investigations are being made to see if a different venue at reasonable cost can be found for late October.

Stanley Cramp opened the Saturday morning with a talk on 'The Seabirds of Britain and Ireland' and this was followed by Bobby Tulloch who spoke on 'Shetland: the Birds and the Oil'. On Sunday morning there was a departure from recent practice when five short talks were given on ornithological research in Scotland. Bede Pounder spoke on the results of the club's Effluent Enquiry, of which he was the organiser, and was followed by four speakers from Aberdeen University—Sandy Anderson on Fulmars, Dr Harry Milne on Eiders, Dr Bryan Nelson on Gannets, and Dr Iain Patterson and Shelducks. These contributions were very well received and provoked lively discussion. An informal account of the conference has been published in *Scottish Birds* 8 : 328.

'Scottish Birds' David Bates took over as editor of the journal in August 1974, inheriting a regrettable production backlog which was aggravated by problems with the 1973 Scottish Bird Report. To bring publication up to date it was decided to combine the spring and summer 1975 numbers, which meant that only three issues (including the 1973 Scottish Bird Report) appeared for the year. To balance this, a supplement on 'The Birds of the Isle of May' by Dr W. J. Eggeling was published, and council gratefully acknowledges a grant for this from the Baxter Trust.

'Scottish Birds' Appeal Fund Another raffle was held, raising a further £362 for the fund, and council thanks those who generously gave prizes or supported the appeal by buying tickets.

In recognition of the tremendous amount of work put into the Scottish Bird Report by its compiler, Roy Dennis, council decided that an honorarium of £100 should be paid to him from the fund, and the first payment is provided in the accounts for the year.

Conservation issues Last year the club supported the Royal Society for Protection of Birds and the Scottish Wildlife Trust in a petition against an order sought by McDermott (Scotland) to set up a harbour authority at Ardersier, Inverness-shire. The petition was withdrawn after the company agreed to consult with the Nature Conservancy Council at least six weeks before any dredging, harbour work or further development in the area was undertaken.

The club supported the RSPB this year in opposition to the proposal to establish an oil refinery at Nigg, Easter Ross, in view of the threats this posed for birdlife in the area. The outcome of the public local enquiry is not yet known.

In September 1974 a notice was published stating that, on the recommendation of the Advisory Committee on the Protection of Birds for Scotland, the Secretary of State for Scotland proposed to remove protection from Greylag and Pink-footed Geese by transferring them to the second schedule of the Protection of Birds Act 1954 in six Scottish counties. The club and many other organisations and individuals lodged formal objections to this proposal. Because of the number and strength of the objections the Secretary of State again consulted the Advisory Committee, which withdrew its recommendation. Further investigations are to be carried out by the Department of Agriculture and Fisheries for Scotland into practicable and economically worthwhile methods of crop protection.

Fieldwork Dr Malcolm Castle accepted council's invitation to become Scottish organiser for the British Trust for Ornithology's 1975 National Survey of Rookeries in Britain. Many members took part in this survey, submitting their findings to local organisers throughout Scotland. Council wishes to thank them all for their efforts, and in particular Dr Castle, for the very considerable amount of work he did, and the local organisers. A copy of the Scottish data will be kept in the club's reference library.

The SOC's Effluent Enquiry, organised by Bede Pounder, has been completed and the results are being written up for *Scottish Birds*. The Redwing Breeding Survey and Crow Hybrid-Zone Enquiry are continuing.

Members also helped with other projects, including the Ornithological Sites Register (BTO), Wildfowl Counts (Wildfowl Trust), Beached Bird Survey (RSPB), Estuaries Enquiry (BTO), Common Bird Census (BTO) and Great Crested Grebe Breeding Survey (BTO), the Club's 1973 enquiry into this species having now been written up in *Scottish Birds* 8 : 151 by the organiser R. W. J. Smith.

Research During the year both council and the management committee gave much time and thought to the possible development of research and discussion groups within the branches and elsewhere and the encouragement of cooperative ornithological research work. This is still under consideration, particularly the degree to which the club should attempt to direct current trends in these directions, but council intends to publish a policy statement as soon as possible.

Area boundaries During the year the research committee considered the treatment of records in relation to the new Scottish regional boundaries. A report has been submitted to council and it is planned to publish its recommendations in *Scottish Birds*.

Endowment Fund Four grants from the endowment fund totalling £160 were approved by council during the year. £50 was given to the University of East Anglia Shetland Expedition 1975 to continue important Skua and Puffin population studies begun in 1973; the grant was later refunded voluntarily when the expedition was abandoned following the tragic death of one of its members. £50 was given to the Highland Ringing Group to buy a canon net; the group will submit reports of its research which will be kept in the club library. It is normally a condition of a grant that reports will be provided, for publication in *Scottish Birds* where appropriate. R. L. Swann and others have carried out research on the Manx Shearwater and Shag population on Canna and have monitored the seabird populations there for a number of years; £35 was granted towards the cost of this year's work; £25 was given to P. Fisher towards the costs of a party which surveyed colonies of breeding skuas on the mainland of Shetland and on some of the small offshore islands; the work was to complete a survey started in the summer of 1974.

During the year legacies of £250 each from the late Henry Boase and the late Andrew Rankine, as mentioned in last year's report, were received by the endowment fund. Council gratefully acknowledges these legacies and commends this longterm means of supporting Scottish ornithology to members who may be able to help in this way.

Scottish Centre As in past years, many visitors from home and abroad called at the Scottish Centre for Ornithology and Bird Protection in Edinburgh for advice and information about birdwatching in Scotland, and there were also many postal enquiries. Informal discussion groups met regularly in the centre during the winter, and there were meetings of the Fair Isle Bird Observatory Trust, the Scottish Committee of the RSPB, the Isle of May Bird Observatory and Field Station Committee, and the Aberlady Bay Nature Reserve Biological Committee, as well as the SOC council and committee meetings.

At the end of the year under review a bad outbreak of dry rot was found, affecting the basement library and store and the ground floor offices of 21 Regent Terrace. Work on eradication and reinstatement is taking place and a full report will be given next year. Considerable disruption of the working conditions is being suffered with fortitude and good grace by the secretarial staff. Everyone has to work in the club's reference library, and the basement extension to the library will be closed for some months.

Library Increased use was made of the reference library during the year by both members and non-members of the club. Council again thanks all those who donated books, journals and reprints.

Bookshop Book sales continued to increase in volume as well as value, which was nearly seventy-five percent greater than last year, totalling over £20,000. This represents a very considerable increase in the work of ordering, invoicing and packing, and, as already noted, another member of staff was taken on part-time from January 1975. Because of the greatly increased postal rates a nominal sum now has to be added to small orders to help meet these costs, but other orders continue to be sent post paid. Council thanks the Scottish Wildlife Trust for inviting the club to display books at its conference at Battleby, Perthshire, in September, and again thanks the British Trust for Ornithology for allowing the club to arrange a book display at its annual conference in December.

Club projector Council is most grateful to Mrs Peirse-Duncombe and Mrs Maxwell Hamilton who, with other helpers, organised another coffee morning in Edinburgh and again raised over £50. With money raised in earlier years this enabled the club to purchase a carousel slide projector.

Club representation The SOC continued to be represented on the British Section of the International Council for Bird Preservation by Sir Landsborough Thomson; Dr George Waterston, who had represented the club for many years, tendered his resignation as he could no longer travel to meetings, and Frank Hamilton was elected in his place. Council wishes to record its gratitude to Dr Waterston for his work on the British Section of the ICBP and for representing the club for so long. Dr R. S. Bailey continued to represent the club on the Duck Working Group of the International Wildfowl Research Bureau.

Acknowledgments In conclusion council wishes to record its sincere thanks to all those not specifically mentioned above; to the staff for all the devoted work that goes to ensure the smooth running of the SOC; to all those who have given time and help to the club in many ways, by acting as local recorders, serving on committees, organising activities, and by helping at conferences and meetings; and to those who have been able to help financially, especially in these difficult times of rampant inflation, by donations and by signing deeds of covenant.

For the Council,

GEORGE WATERSTON, President.

THIRTY-NINTH ANNUAL GENERAL MEETING OF THE CLUB

The Thirty-Ninth Annual General Meeting of the Club was held in the University of Stirling on Saturday 24th January 1976 at 5.30 p.m. In the absence through illness of the President, Dr George Waterston, Andrew T. Macmillan, Vice-President of the Club, presided over an attendance of about 140 members.

Apologies Apologies for absence were received from Dr D. A. Bannerman, Lt Col J. P. Grant, M. K. Hamilton, A. G. Stewart and Dr and Mrs George Waterston.

Minutes The Minutes of the Thirty-Eighth Annual General Meeting, held in the University of Stirling on 25th January 1975, were approved and signed.

Report of Council The Report of Council for Session 38 was adopted. The Chairman commented on a number of items. He had written to about

200 members whose subscription had lapsed, and just over 50 had replied; of these about half had renewed their membership, while almost all the others confirmed their satisfaction with the Club but gave personal reasons for not renewing their subscriptions. With a view to increasing membership, a letter was being sent with the March/April issue of *Birds* to all RSPB members in Scotland inviting them to join the Club, and the Chairman suggested that Branches might like to consider other ways of enrolling members to help offset rising costs.

Eradication of the dry rot at 21 Regent Terrace would cost about £3000. So far about £400 had been donated towards this, and the entire proceeds of the raffle would also be used to help pay the bill. Some Branches had already held fund raising events, and others were planned; Council was extremely grateful to all the members concerned and asked all Branches and individuals to consider fund raising events to help pay off this large sum.

Accounts In the absence of the Hon. Treasurer, his report on the Accounts for the year ended 30th June 1975 was read by the Secretary. The Accounts were approved.

Appointment of Auditor After more than 25 years as the Club's Auditor, Mr Arthur Walker C.A. had retired; a letter of thanks had been sent to him for his work on the Club's behalf during this time. Mr Robert Caven C.A., a partner in the same firm, had agreed to become Auditor, and he was duly elected for the ensuing year.

Election of new Office Bearers and Members of Council In the absence of any other nominations, the Council's recommendations for the following elections were approved :

President : Andrew T. Macmillan to succeed Dr George Waterston who had completed his term of office.

Vice-President : Miss Valerie M. Thom to succeed Andrew T. Macmillan.

Council Members : A. Anderson, Dr J. J. D. Greenwood and Miss N. J. Gordon to succeed Miss V. M. Thom, and Dr Ian Newton and N. Picozzi who were due to retire by rotation.

Young Member : The Chairman announced that Council had coopted Iain Gibson as the Young Member to succeed T. C. Johnson-Ferguson who was due to retire after serving for two years. He thanked all the retiring members for their service to the Club.

Honour The Chairman reported with pleasure that Sir Charles G. Connell, one of the Club's Honorary Presidents, was to be awarded an Honorary Degree by Dundee University later in the year for his contribution to conservation in Scotland.

Annual Conference The meeting was asked for views on the date and place of the Conference. October would still be preferred if a suitable location could be found, but not if this meant a significant increase in cost; and a show of hands indicated a considerable majority of those present in favour of Stirling University in January rather than April or early September. Branches would be asked for their members' views to guide Council for the future.

Winter Rook Roost Survey Mr J. H. B. Munro, who had organised this Club Survey, reported that it had now been completed and the results published in *Scottish Birds*. There were still a few roosts to be recorded and he asked to be informed if these were found. He thanked all those who had helped him with the survey.

Nature Conservancy Council Dr J. Morton Boyd, Director of the Nature Conservancy Council in Scotland, said that the Council could provide money for organisations and individuals who could undertake work on behalf of the Nature Conservancy Council where it did not have the means of carrying out that work with its own staff. He invited the Club

and its members to consider whether any of their activities might qualify for a grant.

Death An obituary of Alastair Macdonald had been published in *Scot. Birds* 8 : 385; but the meeting recorded its appreciation of all the work he had done for the Club, particularly at Conferences and during the SOC Bird Study Cruise in 1966.

Vote of Thanks The Meeting closed with a warm vote of thanks to the Chairman by Dr I. T. Draper, who said that Dr George Waterston had hoped to propose the vote himself but regrettably had been unable to do so; he thanked the Chairman for so efficiently taking the Chair, once again for the whole Conference.

COUNCIL AND OFFICIALS OF THE CLUB FOR SESSION 39

Hon. Presidents : David A. Bannerman, O.B.E., LL.D., Sc.D., F.R.S.E.; Sir Charles G. Connell, W.S.; Sir Arthur B. Duncan; W. J. Eggeling, C.B.E., B.Sc., Ph.D., F.R.S.E.; George Waterston, O.B.E., LL.D., F.R.S.E.

President : Andrew T. Macmillan, C.A.

Vice-President : Miss Valerie M. Thom.

Hon. Treasurer : Maxwell K. Hamilton, C.A.

Hon. Treasurer House Fabric Fund : D. G. Andrew, W.S.

Secretary and Treasurer : Major A. D. Peirse-Duncombe.

Deputy Secretary and Librarian : Mrs George Waterston.

Manager, Bird Bookshop : D. J. Bates.

Membership Secretary : Mrs R. D. Smillie.

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SUMMER EXCURSIONS

Important Notes

1. Members may attend excursions of any Branch in addition to those arranged by the Branch they attend regularly.

2. Where transport is by private car, please inform the organiser if you can bring a car and how many seats are available. All petrol expenses will be shared.

3. Please inform the organiser in good time if you are prevented from attending an excursion where special hire of a boat or bus is involved. Failure to turn up may mean you are asked to pay for the place to avoid additional expense for the rest of the party.

4. Members, friends and visitors attending any Club excursion do so at their own risk. Neither the Leader nor the Club can be held responsible for any accident or injury on an excursion.

5. Please bring meals as indicated (in brackets) below.

ABERDEEN

The Aberdeen Branch will hold a number of excursions during the summer. For details please contact the Branch Secretary, Miss F. J. Greig, 22 Loanhead Terrace, Aberdeen AB2 4SY (tel. 0224 28479). Please send s.a.e. if writing.

AYR

Wednesday 19th May BLARQUHAN (by kind permission of Mr J. Hunter Blair). Leader : R. H. Hogg. Meet Wellington Square, Ayr, 6 p.m. or Kirkmichael main street, 7 p.m.

Saturday 19th June AILSA CRAIG. Leader : Dr M. E. Castle. Meet Girvan Harbour, 10 a.m. Numbers strictly limited. Cost £2.75 per person. Send cash and s.a.e. with booking to J. Miller, 7 Kirkhill Crescent, Prestwick, Ayrshire KA9 2DF (lunch and tea).

Sunday 5th September ENDRICK MOUTH, LOCH LOMOND. Leader : Dr R. Hissett. Meet Wellington Square, Ayr, 9.30 a.m. or at letter box by gate to Reserve, 11 a.m. (lunch and tea).

DUMFRIES

Sunday 2nd May CAPENOCH GROUNDS (by kind permission of Mr John Gladstone) and TYNRON. Leader : Brian Turner. Meet at Water-side Mains, Keir, 1.45 p.m.

Sunday 6th June SOLWAY BANK, CANONBIE (by kind permission of Major Brian Johnson-Ferguson). Leader : Mrs D. L. Johnson-Ferguson. Meet at Chapelknowe village, 2 p.m.

Sunday 4th July MULL OF GALLOWAY. Meet at Mull Lighthouse, 1 p.m. (lunch and tea).

Sunday 29th August ABERLADY BAY, EAST LOTHIAN. Leader : William Austin. Meet at Timber Bridge, Aberlady Bay, 1 p.m. (lunch and tea).

DUNDEE

All excursions by private car (lunch and tea). Further information from Mrs A. Noltie, 14 Menteith Street, Broughty Ferry, Dundee DD5 3EN (tel. 0382 75074). Please send s.a.e. if writing.

Saturday 15th May ABERLADY BAY, EAST LOTHIAN. Leader : Mrs J. A. R. Grant. Full details from Mrs Noltie.

Sunday 13th June CRAWTON. Leader : B. Pounder. Depart City Square, Dundee, 9 a.m.

Saturday 10th July LOCH ORDIE AREA. Leader : B. Lynch. Depart Dudhope car park, Dundee, 9 a.m.

Sunday 15th August LOCH INSH. Leader : P. N. J. Clark. Details from Mrs A. Noltie.

Saturday 4th September WEST HAVEN. Leader : J. Rodgers. Depart Dudhope car park, Dundee, 9 a.m.

EDINBURGH

Saturday 1st May ABERLADY BAY NATURE RESERVE. Leader : K. S. Macgregor. Meet Timber Bridge, 2.30 p.m. (tea).

Wednesday 19th May BLACKFORD HILL. Leader : Dr L. L. J. Vick. Meet Blackford Pond 7 p.m.

Sunday 23rd May THE HIRSEL, COLDSTREAM (by kind permission of Lord Home). Excursion by coach leaving Edinburgh from square behind National Gallery at 10 a.m. **Applications by 1st May**, with coach fare of £1.85 and s.a.e. to J. B. Murray, Woodlea, 49 Lochend Road, Edinburgh EH6 8DQ (tel. 031-554 1934) (lunch and tea).

Saturday 5th June POWDERMILL GLEN, ROSLIN. Leader : G. L. Sandeman. Meet in car park of Pay 'n Take Furniture Warehouse, Roslin, 2.30 p.m. (tea).

Saturday 26th June ISLE OF MAY. Leader and organiser : J. M. S. Arnott. Excursion by coach leaving Edinburgh from square behind National Gallery at 8.30 a.m., returning approx. 7 p.m. **Applications by 30th May**, with coach and boat fare of £3.50 and s.a.e. to J. M. S. Arnott, East Redford House, 133 Redford Road, EH13 0AS (tel. 031-441 3567) (lunch and tea).

Sunday 18th July BASS ROCK (by kind permission of Sir Hew Hamilton-Dalrymple). Leader : T. E. Brand. Numbers limited. Meet North Berwick harbour 2 p.m. for 2.15 p.m. departure (there will be no waiting for late comers). **Applications by 26th June**, with boat fare of £1.10 and s.a.e., to R. J. E. Whitworth, 6 Charteris Court, Longniddry, East Lothian (tel. Longniddry 52101) (tea).

Sunday 5th September ABERLADY BAY NATURE RESERVE. Leader : K. S. Macgregor. Meet Timber Bridge 2 p.m. (tea). (NOTE early time because of tide).

GLASGOW

Sunday 23rd May INCHCAILLOCH, LOCH LOMOND. Woodland birds. Leader : Neil Brooks. Party restricted to 20. Applications to leader (tel. 041-956 5179 evenings only). Meet McFarlane's Boatyard, Balmaha, 10.30 a.m. (lunch).

Sunday 6th June INVERRNAID. Hill and woodland birds. Leader : Bob Lambie. Applications to leader (tel. 041-644 3902 evenings only). Meet Aberfoyle car park, 10 a.m. (lunch). Strong footwear recommended.

Saturday 3rd July BASS ROCK (by kind permission of Sir Hew Hamilton-Dalrymple). Seabirds. Leader : Dr Ivan Draper. **Applications by 26th June**, with boat fare of £1.10 and s.a.e., to Dr Draper, Otter's Holt, 37 Drumbrook Road, Strathblane, Glasgow G63 9DG. Meet North Berwick harbour, 11.45 a.m. (lunch and tea).

Sunday 11th July AILSA CRAIG. Seabirds. Leader : David Clugston. Full details from leader (tel. Bredilind 3483 evenings only). Restricted numbers.

Sunday 5th September ISLE OF MAY. Migrants. Leader : Ron Forrester. Applications to leader (tel. 041-776 3557 evenings only). Meet Anstruther pier, 11 a.m. (lunch and tea).

Sunday 12th September ABERLADY BAY, EAST LOTHIAN. Migrants and flowers. Co-leaders : Russell Nisbet (birds) and Kathleen Calver (botany). Applications to Miss Calver (tel. 041-334 5813). Meet Aberlady Bay car park, 11.30 a.m. (lunch and tea). (NOTE Car park permits are required for Aberlady Bay car park; these can be obtained (free) from East Lothian District Council, Department of Leisure, Recreation and Tourism, District Offices, Haddington, East Lothian, stating name, address and car registration number).

Sunday 26th September BARASSIE FLATS. Waders. Leader : Hector Galbraith. Applications to leader (tel. 041-887 5499 evenings only). Meet Troon Station car park, 11 a.m. (lunch and tea). Wellington boots advised.

When making any application or enquiry by post please enclose s.a.e. and advise the leader if a car seat is available.

INVERNESS

The Inverness Branch will hold a number of excursions during the summer. For details please contact the Branch Secretary, W. G. Prest, 70 Culloden Road, Balloch, Inverness IV1 2HH (tel. 046 372 412). Please send s.a.e. if writing.

ST ANDREWS

Sunday 27th June ISLE OF MAY. Full details from Miss M. M. Spires, Greenacre, 87 Hepburn Gardens, St Andrews, Fife (tel. St Andrews 2418 evenings only). Applications close on 22nd May. Meet Anstruther harbour, 11.45 a.m. (lunch and tea).

Saturday 17th July KILCONQUHAR LOCH (by kind permission of Elie Estates). Meet North Lodge 2.30 p.m. (tea).

STIRLING

The Stirling Branch will hold a number of excursions during the summer. For details please contact the Branch Secretary, Dr D. M. Bryant, Biology Department, University of Stirling, Stirling FK9 4LA (or tel. 025 981 432 evenings or weekend). Please send s.a.e. if writing.

The Branch hopes to organise a weekend excursion to an island off Argyll in June. The party will possibly land on Lunga and camp on the island over the Saturday night. Numbers will be limited to about a dozen. Detailed arrangements from the Branch Secretary.

WIGTOWN GROUP

The Wigtown Group will hold excursions during the summer. For details please contact the Group Secretary, A. Maciver, 1 Colt Houses, Penninghame, Newton Stewart, Wigtownshire (tel. 0671 2464). Please send s.a.e. if writing.

NEW GROUP IN NEW GALLOWAY

The Council of the Club announces the formation of a new Club Group in New Galloway. The Group is about halfway between the Dumfries Branch and the Wigtown Group, which was formed in 1975 (see *Scot. Birds* 8 : 338), and will hold informal meetings throughout the year. Information about winter meetings will be published in the Syllabus of Lectures sent to all members each September, but full details can be obtained from the Group Secretary, Mrs K. C. R. Halliday, 'Dalveen', New Galloway, Kirkcudbrightshire (tel. New Galloway 234).

DRY ROT - 21 REGENT TERRACE

Members were advised in *Scot. Birds* 8 : 391 that the proceeds of this winter's raffle would be put towards the cost of eradicating the dry rot in 21 Regent Terrace. The very excellent sum of £655 was raised from the sale of tickets (not 'over £700' as was unfortunately announced in error at the Annual Conference); from this £37 has to be deducted for expenses (£28 printing, £5 postage and £4 purchase of books for prizes) leaving a total of £618 to help pay for the restoration bill of just under £3000.

The Club is very grateful to all those who helped to raise this sum, either by buying tickets or donating prizes, and in particular wishes to thank all those who sold the very large number of tickets. Any member who wishes to receive a list of winning ticket numbers should write to the Club Secretary enclosing a stamped addressed envelope.

In addition, at the time of going to press in early February, over £400 had been donated directly or through fund raising efforts. Contributions to help pay for the very large bill will still be very welcome and should be sent to the Club Secretary who will acknowledge all donations.

SCOTTISH BIRDS - BINDING

Details of binding Volume 8 will be given in the Index to that Volume which will be published with the summer 1976 number of *Scottish Birds*.

RAFFLE PRIZE

The winner of the second prize in the raffle has most generously returned it so that more money can be raised to help pay for the dry rot bill. After consulting the donor, the pair of velvet curtains, 2½ widths x 96" long, in Pimento and ready to hang, will be sold by postal offer. They are valued at more than £70 and will go to the person who makes the highest offer over £35.

Envelopes, which must be marked 'Curtains', should be addressed to 'Major A. D. Peirse-Duncombe, Secretary, Scottish Ornithologists' Club, 21 Regent Terrace, Edinburgh EH7 5BT'. They will be held until 11 am on Wednesday 12th May 1976 when the Secretary will open them and announce the winner.

Requests for Information

Gulls nesting on buildings An important effect of the rapid population increase in gulls has been the extensive use of buildings as nesting sites; this habit has been reported in five species in Britain and Ireland, the main species involved being the Herring Gull. The distribution and number of gulls that have taken up this habit has altered greatly since the last census in 1969-70 by Stanley Cramp. The BTO therefore proposes to update this census in 1976.

Counts of gulls nesting on buildings frequented by human beings (preferably done during the last three weeks of May), stating numbers of nesting pairs, species, location and when the count was made would be very much appreciated. Additional information, such as records from previous years, date chicks first seen, any control measures implemented or details of sites etc. would also be very welcome. Records to and further information from Pat Monaghan, Department of Zoology, University of Durham, South Road, Durham DH1 3LE.

Breeding of the Ring Ouzel The analysis of 408 BTO Nest Record Cards for the Ring Ouzel in *Bird Study* 22: 1-8 (March 1975) and an article in *BTO News* 75: 6-7 (September 1975) revealed some interesting facts and emphasized the need to analyze more Nest Record Cards for this species. Roger Durman of 21 Lovedale Road, Balerno, Midlothian, and I are interested in this species and either of us would be grateful to have further

breeding data. At the same time we should like to encourage more people to send Nest Record Cards to the BTO for any Ring Ouzel nests they find. Bill Robson, The Ings, Banks Lane, Appleby, Cumbria CA16 6RA.

Current Notes

These notes include unchecked reports and are not intended as a permanent record. Please send items of interest to Local Recorders at the end of January, April, July and October.

Last autumn was outstanding for rarities, mainly from America in September and Asia in October. Fair Isle took a lion's share with **Laughing Gull**, **Hermit Thrush** and 2 **Tennessee Warblers** from America and **Siberian Rubythroat**, 4 **Lanceolated Warblers** and **Pechora Pipit** from Asia. Other Americans included **Pied-billed Grebe** on Carlingwark Loch (Kirk), **Lesser Golden Plover** at Caerlaverock (Dumf), several **Buff-breasted Sandpipers**, and a **Bobolink** at Out Skerries (Shet). From Asia came **White's Thrush** to Whalsay (Shet), **Red-tailed Wheatear** to Isle of May, an inland **Pallas's Warbler** to Killichoran by L Rannoch (Perth) and **Citrine Wagtails** to Whalsay, Fair Isle and Tynninghame (E Loth).

In winter there were many **Red-throated Divers** near the Ythan (Aber) with 250 on 11 Jan and 315 on 15 Feb. In March 100+, thought to be mainly this species, roosted in Gullane Bay (E Loth). **Grebe** numbers rose in Feb in Gosford and Gullane Bays to 41+ **Red-necked** and 99 **Slavonian**. A wintering **Spoonbill** at L Fleet (Suth) was captured in poor condition in Jan. Two **Surf Scoters** were there (one later left) and singles were at Murcar (Aber) and Burghead (Moray). **King Eiders** were reported from Shet (2) and the regulars again at Culross (Fife), seen by many SOC Conference visitors, and at L Fleet until it or another appeared at Lossiemouth (Moray) in Feb. A **Brent Goose** was at Strathbeg on 4 Jan and 11 **Bean Geese** flew in from the sea near the Ythan on the 11th. An immature **Greater Snow Goose** that wintered near L Eye (E Ross) had good credentials, being accompanied on arrival in autumn by **Greenland White-fronts**. Besides the usual **Bewick's Swans** at Caerlaverock there were 7 near Castle Douglas and 7 at Abernethy (Perth). A **Rough-legged Buzzard** was reported from Glentrool (Kirk). The **Lesser Golden Plover** wintered at Caerlaverock and a **Common Sandpiper** at Aberdeen on 27 Jan was also unusual. During easterly gales in early Feb 3 **Grey Phalaropes** sheltered at St Monance (Fife), another at St Andrews, and one was later reported from Berwick-upon-Tweed; there was also a small wreck of **Little Auks** on the east coast and one bird inland at Doune (Perth). A **Ring-billed Gull** was identified at the Ythan estuary in Feb. SOC Conference visitors from Caithness were irritated by missing a **Ross's Gull** at Thurso that weekend. A week later a **Brünnich's Guillemot** was found dead a few miles away at Reay. A **Sandwich Tern** was in Dalgety Bay (Fife) on 2 Jan. The only **Snowy Owl** reported south of Shetland was from Dunblane (Perth) on 30 Dec and the only **Shore Lark** from Burghead in Feb. A late **Swallow** was near Ardwell (Wig) on 11 Dec and winter **Blackcaps** and **Chiffchaffs** were found near the east coast with up to 5 **Chiffchaffs** in Shet. The autumn **Waxwings** had mostly gone by New Year but some returned in Feb. The largest **Snow Bunting** flock reported was 500 at Sandwick (Shet) on 22 Nov.

With fine weather in early March a **Chiffchaff** at Dalgety on the 2nd may have been a migrant and 3 early **Garganeys** arrived at Aberlady (E Loth) on the 3rd.

S.O.C.

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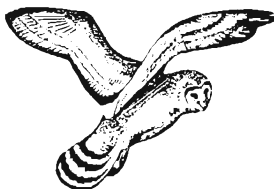
The aims of the Club are to (a) encourage and direct the study of Scottish ornithology; (b) co-ordinate the efforts of Scottish ornithologists; (c) encourage ornithological research in Scotland; (d) hold meetings at which Lectures are given, films exhibited and discussions held, and (e) publish information regarding Scottish ornithology.

There are no entry fees for Membership. The Annual subscription is £3.00, or £1.00 in the case of Members under twenty one years of age or Students under 25, who satisfy Council of their status as such at the times at which their subscriptions fall due. The Life subscription is £75. Family Membership is available to married couples and their nominated children under 18 at an Annual subscription of £4.50, or a Life subscription of £112.50. 'Scottish Birds' is issued free to Members but Family Members will receive only one copy between them. Subscriptions are payable on 1st October annually.

'Scottish Birds' is the Journal of the Club. Published quarterly it includes papers, articles and short notes on all aspects of ornithology in Scotland. The Scottish Bird Report is published in the Journal.

Application for Membership form, copy of the Club Constitution, and other literature are obtainable from the Club Secretary, Major A. D. Peirse-Duncombe, Scottish Centre for Ornithology and Bird Protection, 21 Regent Terrace, Edinburgh, EH7 5BT (Tel. 031- 556 6042).

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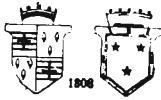
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