

An Analysis of the Recoveries of British-ringed Fulmars

by M. A. Macdonald

It is well known that Fulmars from British colonies penetrate north to the Barents Sea and west to Newfoundland and Greenland. This paper investigates the marine range in relation to the age of the birds.

IN HIS MONOGRAPH Fisher (1952) collated all previously published observations of Fulmars *Fulmarus glacialis* at sea, together with a number of private records, and summarised the distribution in the North Atlantic. He also proposed that certain sea areas, specifically the Newfoundland Banks and the Varanger Fjord, might serve as nursery areas for Fulmars from Atlantic and east Arctic colonies respectively in their pre-breeding years (*loc. cit.* p. 447). Dott (1973) reviewed the scanty published records on the age of return of pre-breeding Fulmars to land, quoting the cases of five birds which returned to their natal island at between two and five years old.

Since the beginning of the BTO bird-ringing scheme over 24,000 Fulmars have been ringed in Britain, some 75% of them as nestlings. The recoveries of these birds of known age and origin provided an opportunity to describe their movements and distribution, and to examine the statements made by Fisher and Dott in so far as they apply to British birds.

This analysis was limited to the 300 recoveries of British Fulmars which had been notified to the BTO Ringing Office up to 18 June 1975. The sample contained 218 birds ringed as nestlings, 56 ringed as adults (where it was not stated explicitly, it was assumed that they were breeding), and 26 of unknown age and status (including those ringed as 'full-grown', 'post-juvenile' and Euring code 4).

The recoveries were first examined with a view to deriving information on distribution and mortality in relation to age and season. It proved impossible, however, to consider mortality with any confidence because of the great age-related differences in distribution and cause of recovery, and the potentially large biases associated with differences in the probability of recovery in different areas at different seasons. For these reasons only results bearing on the distribution of recoveries will be considered in depth.

All birds ringed as nestlings were arbitrarily assumed to have fledged on 1 September, and their ages at recovery were estimated to the nearest whole month from that date. Ages are quoted as 1st-year (up to one year after fledging), 2nd-year (between one and two years old), and so on.

RESULTS

Table I summarises the reasons for recovery in relation to age at that time. Man's trapping and shooting activities were responsible for 32% of all the recoveries. This was reflected in the high number from the Faeroes where fowling is still practised, and from the vicinity of those fishing-grounds where bird-catching is a widespread activity among fishermen of some nationalities. The importance of the latter source is indicated by a note accompanying one such return: "280

birds caught that morning, three of them ringed". Even if these were not all Fulmars the potential effect on the distribution of recoveries is obvious.

Table II indicates the pattern of recoveries over the year, again in relation to age. Birds found in August at less than one month old are included in the total for September. The fluctuations between months are difficult to interpret except in the case of the peak of recoveries of 1st-year birds in the month following fledging (during August and September many young appear on beaches, either dead or in poor condition, and are easily located by people), and the peak of recoveries of 5th-year and older birds in the breeding season (when they are on, or close to, land).

Geographical distribution of recoveries

For the purposes of this part of the analysis certain recoveries were omitted. They fell into four categories: all those for which the age at ringing was unknown; those for which the date or place of recovery was too imprecise to allow the degree of accuracy required in the analysis; those ringed as adults if they were found within 25 km of their breeding colony; and those less than one month old within 25 km of their natal colony.

TABLE I. CAUSES OF RECOVERY OF BRITISH-RINGED FULMARS IN RELATION TO AGE

	<i>Year</i>					<i>Age</i>	<i>Total</i>
	<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th+</i>	<i>Unknown</i>	
Found dead or injured	53	7	7	8	56	14	145
Trapped	17	15	13	4	28	1	78
Shot	4	8	1	—	6	—	19
Accident	1	1	—	—	6	5	13
Oiled	6	—	—	1	—	3	10
Controlled	—	—	—	1	14	—	15
Other	1	1	—	—	3	2	7
Unknown	4	—	2	1	5	1	13
							300

TABLE II. SEASONAL DISTRIBUTION OF RECOVERIES OF BRITISH-RINGED FULMARS IN RELATION TO AGE

	<i>Year</i>					<i>Age</i>	<i>Total</i>
	<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th+</i>	<i>Unknown</i>	
Sept	45	4	1	5	7	—	62
Oct	9	2	2	—	1	4	18
Nov	3	1	2	—	2	—	8
Dec	1	1	2	—	6	1	11
Jan	3	—	1	—	4	1	9
Feb	2	1	—	—	8	—	11
Mar	1	4	2	—	7	1	15
Apr	6	2	1	2	12	3	26
May	6	4	2	3	19	6	40
Jun	4	4	1	2	15	3	29
Jul	3	1	2	—	24	4	34
Aug	3	5	6	3	12	3	32
Unknown	—	3	1	—	1	—	5
							300

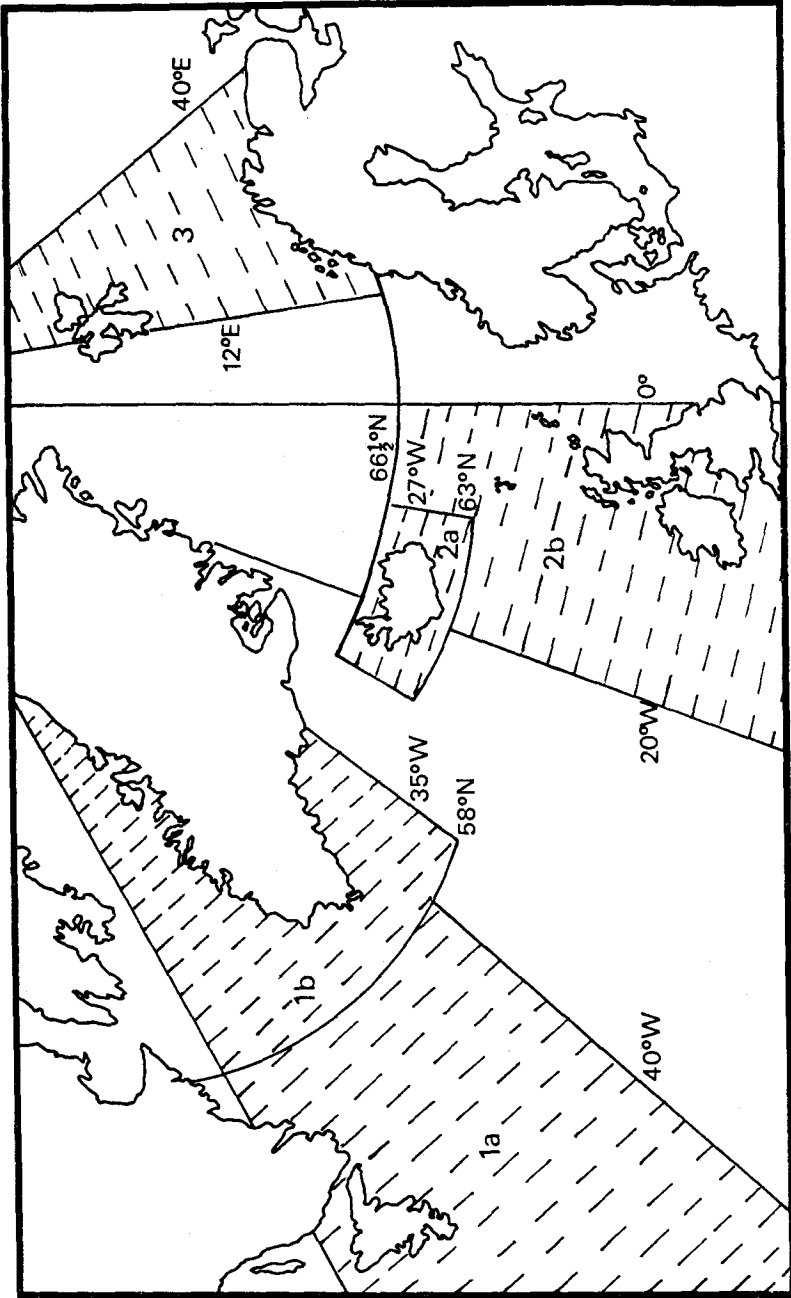


Figure 1. The sea areas used in the analysis of Fulmar recoveries.

The remainder were plotted on outline maps, one for each age class. They fell naturally into three clearly separated sea areas, two of which could be split further into two parts. These are shown in Figure 1. For convenience the distribution of recoveries will be described with references to these areas. Area 2a was separated mainly to emphasise the scarcity of recoveries from Iceland and Icelandic waters.

Table III gives the number of recoveries of each age class in each area. It is important to note that comparison is permissible only between age classes within an area, and not between areas within an age class. The figures do not represent relative densities or numbers in different areas since the probability of recovery will certainly vary from one area to another. It is considered a safe assumption that it will not vary with age. Table III shows that birds in their first to third (to a lesser degree fourth) years are distributed generally in all three major sea areas, while older birds are virtually confined to area 2b (North Sea and eastern North Atlantic).

The occurrence of recoveries varied seasonally within the different areas (Table IV), but only in area 1b (Greenland), and area 2b (the Faeroes) was there suggestion that Fulmars might be absent for some of the year. No recoveries were received from Greenland between November and March, while those from the Faeroes fell into two groups: January to April, and August to September. However

TABLE III. DISTRIBUTION OF FULMAR RECOVERIES IN RELATION TO AGE AND BREEDING STATUS

Age	Sea Area (see Figure 1)							Total
	1a	1b	1a+1b	2a	2b	2a+2b	3	
0-3 months	2	-	2	-	29	29	-	31
4-6 months	1	-	1	-	6	6	-	7
7-9 months	6	-	6	-	6	6	2	14
10-12 months	3	-	3	-	5	5	-	8
All 1st-year	12	-	12	-	46	46	2	60
2nd-year	5	4	9	-	18	18	3	30
3rd-year	6	2	8	-	12	12	3	23
4th-year	1	1	2	-	13	13	-	15
5th-year +	-	-	-	-	60	60	1	61
Adults	-	-	-	1	28	29	1	30
Totals	24	7	31	1	177	178	10	219

TABLE IV. SEASONAL PATTERN OF FULMAR RECOVERIES WITHIN SEA AREAS

Area	1a	1b	2 (except Faeroes)	Faeroes	3
Jan	1	-	6	1	-
Feb	-	-	5	3	-
Mar	3	-	9	2	1
Apr	2	-	12	7	-
May	5	-	24	-	1
Jun	3	1	14	-	2
Jul	3	1	20	-	-
Aug	1	2	19	4	2
Sep	-	1	27	5	2
Oct	2	1	10	-	-
Nov	3	-	3	-	-
Dec	1	-	3	-	1

since six of the seven Greenland birds and 21 of the 22 Faeroe birds were either trapped or shot it is impossible to be sure whether an absence of recoveries reflects a real absence of Fulmars, or merely seasonal variation in hunting pressure. Comments by A. Reinart and the late Kenneth Williamson (pers. comms.) on the following seasons in the Faeroes suggest that the latter almost certainly applies there.

There were too few recoveries from Newfoundland waters to confirm Fisher's (1952) suggestion that Fulmars are absent from the seas south of that island for part of the summer.

Movements of adults from breeding places

Thirty adults were recovered more than 25 km from their colonies. The distances between colony and recovery point are given in Table V. The winter recoveries averaged 748 km from the colonies (35–2,800 km). Those which occurred in summer (May to August) averaged 375 km (35–810 km). The difference was just significant by the Mann-Whitney test ($P < 0.05$). However, these distances should not be interpreted as the mean distances travelled by Fulmars on feeding trips. Since all the recoveries at sea were reported from fishing-boats they will to a large extent reflect the distribution of fishing-fleets. It is clear that throughout the year adults do travel several hundred kilometres from their colonies, and that they may move farther in winter than in summer.

TABLE V. DISTANCES (KM) MOVED BY ADULT FULMARS BETWEEN THEIR COLONIES AND THE POINT OF RECOVERY IN WINTER AND SUMMER

	25- 100	101- 200	201- 300	301- 400	401- 500	501- 600	601- 700	701- 800	801- 900	1000- 2000	over 2000
Winter	2	—	1	—	—	4	—	2	—	1	1
Summer	2	4	2	2	4	2	2	—	1	—	—

Return of pre-breeding Fulmars to land

Thirty-three recoveries of birds of known age were of individuals found alive on land (including birds which had been trapped or shot). All records involving birds washed up on the shore were excluded because a high proportion are likely to refer to individuals which died at sea. The two recoveries of breeding birds were also omitted.

The ages of the 31 other birds at recovery are shown in Table VI. They included birds between their second and seventh years, with the mean and mode falling in the fifth year. It is important to note that 18 of this sample were shot or trapped in the Faeroes, but since none ringed as adult was trapped (suggesting that birds on feeding trips do not occur there), and no significant difference exists between the ages of birds recovered in the Faeroes and in Britain, their inclusion is valid.

TABLE VI. AGE OF RECOVERY OF PRE-BREEDING FULMARS ON LAND (SEE TEXT)

	1st	2nd	3rd	4th	5th	6th	7th
Faeroes	—	—	2	3	11	1	1
Britain	—	1	—	2	4	2	4
Total	0	1	2	5	15	3	5

DISCUSSION

The distribution at sea, and movements to and from land, of British Fulmars as revealed by ringing may be summarised as follows. After fledging some birds move from British waters into the Atlantic Ocean, Norwegian Sea, and European Arctic waters (north Norwegian Sea, Barents Sea and White Sea), a few reaching the western Atlantic off Newfoundland within three months. In the second year they penetrate to waters south and west of Greenland.

This wide distribution is maintained through the second and third years, but begins to contract during the fourth year when most birds return to land as pre-breeders. British Fulmars in their fifth and later years are confined to the eastern Atlantic, the North Sea, and the European Arctic. The contraction of range at sea of 4th-year and older birds, and the age of birds recovered alive on land, confirm the conclusions of Dott (1973) and are consistent with the age at first breeding (between the sixth and twelfth years) given by Dunnet (1975).

The interpretation of the discontinuous distribution of the recoveries at sea is rather more difficult. As mentioned earlier, the source of those recoveries inevitably results in a bias toward major fishing areas. The picture is further complicated by the fact that continental fishermen report recoveries more often than British ones (perhaps because they catch more), so the probability may differ depending on the origin of the fleets in any area. For these reasons it is impossible to regard an absence of recoveries as an indication of the absence of Fulmars. For example, only one recovery was received from the Minch, between the Scottish mainland and Outer Hebrides, where large numbers of Fulmars certainly occur and feed (T. Dixon, pers. comm.). It is also impossible to estimate the relative numbers in the different areas from the numbers of recoveries.

These uncertainties make an examination of Fisher's (1952) hypothesis of the existence of 'nursery areas' difficult. His conclusion that the Fulmars in the western Atlantic are largely young birds is supported, and in fact the recoveries suggest that all the British birds there are pre-breeders.

Although he did not state so explicitly, Fisher's implication was that all or most pre-breeding Fulmars moved to nursery areas soon after fledging and remained there until their return to land. The point to be settled, then, is whether the pre-breeding birds are restricted to certain defined zones when at sea, or are dispersed over all the Atlantic north of about 45°N. If the former is true then the North Sea and Norwegian Sea, and European Arctic waters, must be added to the list of nursery areas used by British Fulmars. If the alternative is true the spread of recoveries must be deemed to represent only those areas where certain fishing-fleets occur within the range of the Fulmar, where the coastline is sufficiently populated to produce reports of ringed birds on beaches, and where the Fulmar is shot or trapped as in the Faeroes and Greenland.

Fisher's maps of the seasonal distribution do in fact show that throughout the year, but especially between May and October, Fulmars are present all over the North Atlantic. He gave no information about their origin or numbers, but it seems unlikely that British birds are not included in view of the distribution of recoveries reported to date.

Although it is impossible to make categorical statements, it seems that while certain areas within the range of the Fulmar are frequented mainly or only by pre-breeders, it is premature to postulate that pre-breeders are restricted to these

zones. With our present knowledge a more economical hypothesis would be that the birds are widely (but not necessarily evenly) distributed over their range during their first three years. Later, when breeding age approaches and the Fulmars become more attached to land, their range is necessarily more restricted. The conflict between these hypotheses will only be resolved when the age, status, and origin of the birds in the Atlantic between 20° and 40°W are determined.

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SUMMARY

Examination of 300 recovery records of Fulmars ringed in Britain allowed the distribution and movements of birds of known age to be described. Biases in the methods of recovery made estimation of mortality impossible. Soon after fledging, birds disperse from British waters to the western North Atlantic, Norwegian Sea, and European Arctic waters. In the fourth year, the distribution contracts, coinciding with the peak return of pre-breeding birds to land. Adults are restricted to the eastern North Atlantic, North Sea and European Arctic, moving several hundred kilometres from their colonies at all seasons.

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*M. A. Macdonald, Culterty Field Station, Newburgh, Aberdeenshire AB4 0AA.
(Present address: Department of Zoology, University of Cape Coast, Ghana.)*

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