# A METHOD OF COUNTING SEABIRDS FROM A MOVING VESSEL

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## INTRODUCTION

This paper describes a method of making observations of birds at sea from a moving vessel, which I developed in a mainly empirical way and have used many times in the last ten years, particularly on voyages from Cape Town to Marion Island and the Crozets, and from Cape Town to Tristan da Cunha and Gough Islands. The results of these observations will be published separately.

## METHODS

I consider the bridge is the best place to observe birds from a ship, facing the bow. By facing the bow, the exaggerated importance of birds which follow the ship is minimized, and more attention can be devoted to the species which are indifferent to ships, or even fly away from them when they come nearby, like some gadfly petrels or some shearwaters do. If the observer is not allowed to stay on the bridge, he should find a good observation point as near as possible to it. On large vessels, the bridge is too high to allow bird watching in good conditions, and the observer should find a suitable site below it.

During the course of the observations, the time is noted down every five minutes, and each bird seen in the meantime is recorded. If it cannot be identified to species with certainty, it is recorded as, for instance, "shearwater", "skua", "comic tern", and so on. Birds are usually detected with the naked eye, and eventually identified with binoculars. Attention is paid not to register the same individual several times during at least 10 consecutive minutes, but it is of course most of the time impossible to be quite sure that this has not happened, especially with large, powerful species like albatrosses *Diomedea* spp. which circle the ship. The results are thus expressed in terms of numbers of observations, or "contacts", and not in actual numbers of birds near the ship, per unit time. A flock of, say, y birds, is recorded as y contacts, and not just as one contact. Counting the birds during five minute intervals gives some indication about their distribution, i.e. whether it is uniform, random or clumped. If the observer wishes to note more in detail the distribution pattern of the birds, he may write his observations in the following way, for each five minute interval :

sp.a.: 1 + 3 + 12 + 7 + . . . ; sp.b.: 4 + 3 + 1 + . . . ;

each number between + signs indicating the number of birds in one group. But it should be pointed out there that it is often very difficult to tell whether some birds encountered at sea belong to one flock or not, mainly in the case of species which are attracted by ships.

In the observer's files, the results should be kept arranged by five minutes intervals, so that they can be worked out easily, but in publications it is often more convenient to use a longer time. It may of course be any multiple of five minutes, the whole watch lasting from half an hour to two hours. This way comparisons can be made with the results of other authors who used a similar method with a different interval. A ten minutes interval has already been used by several authors, such as Dunnet (1977) and Frost (1977), and figures on the standardized record card of SCAR. Of course, birds may be counted during ten minutes, or longer intervals, but this is less versatile and according to my experience is less easy than five minutes counts.

For publication results are expressed in terms of means per unit time, which minimize the importance of flocks, which can be very large in some gregarious species like the prions *Pachyptila* spp. and of occasional aggregations like temporary groups feeding on offal. Periods during which the operator has been disturbed for some reason (fire exercises, talkative passengers, etc.) should not be taken into account when calculating these means. An advantage of long watches is that they give increased chances to observe rarer species.

Yapp (1956) has shown that the density D of birds along a transect is related to the number z of contacts by unit time by the equation :

$$D = \frac{z}{2R(\bar{u}^2 + \bar{w}^2)^{\frac{1}{2}}}$$

where R is the detection radius of the species concerned, $\bar{u}$ its average speed and $\bar{w}$ the average speed of the operator. If n is the total number of birds seen during the time t, z = n/t, we may write :

$$n = 2DRt\sqrt{\bar{u}^2 + \bar{w}^2}$$

which emphasizes the importance of the speeds of the observer and of the birds, as well as that of the length of the watch on the number of contacts. The speed of the ship during each watch should be recorded.

Unfortunately we do not know the average speed of flying birds encountered during a watch. But we may assume that it is more or less constant within a species, so that direct comparisons between different watches are still feasible, provided that the speed of the ship does not vary much. When comparing the results of different watches when the speed of the ship was different, it should be remembered that the relation between z and D is not linear. Because of the absence of topographic and other obstacles, the speed of marine birds is probably much more constant than that of land birds. But comparisons between different species can only be tentative.

The effective radius R seems to be the greatest problem in estimating bird densities at sea. It is the maximum distance in which it is hoped to detect a bird of a given species. It is very difficult to measure, because it is highly variable, depending on a number of factors, such as the size and colour pattern of the bird and the weather. It could theoretically be determined statistically, for instance by comparing the number of sightings of a given species to the total number of birds observed at a given distance from the ship. Because the effective radius is so highly variable, it is not possible to assess an arbitrary exclusion limit distance from the ship, inside of which every bird is supposed to have been detected, and outside of which none is recorded, unless this distance is small, like 300 m from the ship as used by Frost (1977). Moreover, the appreciation of distance is very difficult as sea. Large, pale objects often look nearer than small, dark ones when they are at the same distance.

While working on raptors in southern France, G. Affre (*in litt.*) obtained reasonable results when he assumed that the effective radius was proportional to the dimensions (length and wingspan) of the birds. But it should be noted that almost all raptors in this part of the world are dark, or appear dark at a distance. For many species the effective radius can be roughly estimated, and a convenient solution could be to group the species into categories, such as "very conspicuous", "conspicuous", "not conspicuous". The absence of topographical features at sea makes effective radii much less variable than on land. The influence of meteorological conditions on the effective radius can be minimized by conducting watches when visibility is good.

Yapp's equation assumes that the birds fly on straight trajectories. This is approximately true on a large scale, and there should not be a very great error if the birds move on curves with very large radii. It is not true if the birds fly in sharp curves, or in large zigzags. Hence precautions are needed not to record the same individual more than once.

Watches should not be too long. The observer becomes tired and his observations become less accurate with time. My own experience suggests a rest after about two hours. On the other hand, the speed of the ship influences the maximum length of a watch. If it is over 16 - 17 knots, one hour seems to be a maximum, and longer watches should be divided into smaller ones, otherwise the transect would be exceedingly long and the operator becomes too tired, particularly when birds are numerous.

A good thing with fast moving ships is that they go faster than many species, while many other ones can just follow them, but cannot do it for very long and cannot circle the ship. This minimizes the risk of counting the same individual several times. But, on the other hand, species determination is then more difficult, and more birds are encountered, so that counting becomes more difficult.

Slow vessels (less than 7 - 8 knots) are not ideal for observing birds at sea, because many species which can fly fast circle around the ship again and again, making the count more and more uncertain. Under 4 - 5 knots, continuous counting may become impossible if birds are numerous. In this case another method is needed, such as counting every bird in sight every ten minutes, or making a ten minute count every hour on the hour of all birds around the ship, as suggested by Frost (1977).

Great caution should be brought to any "heterogeneity" which may be encountered, such as changes in the sea temperature, proximity to land or trawlers or bad weather, which may affect the density and specific composition of the bird populations. Such "heterogeneities" should be recorded, as well as the temperature of the sea and the position for each observation period, as already indicated by Frost (1977).

Observations of birds at sea may be made by a team of observers. In this case, an experienced "main observer" should keep the record and *detect the birds*. The "helpers" should make difficult species' identification (giant petrels, terns, etc.), following the birds with their binoculars, and count up birds in flocks, but not signal undetected birds.

It is not easy to write down observations in a clear and clean form when recording birds at sea. I advise observers to copy their notes soon after the watch is ended, so that they become easier to analyze later.

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