Methods for collection of sea-breeding data

By Ralph D. Morris
Department of Biological Sciences, Brock University,
St. Catharines, Ontario, Canada. L2S 3A1

SUMMARY: Some procedures for the systematic collection of breeding data from seabird colonies are presented. It is suggested that with proper care, interested resident naturalists can make a valuable contribution to existing knowledge of tropical seabird biology.

INTRODUCTION

Most long-term research programmes on the breeding biology of seabirds have been conducted at locations in temperate North America and Europe (eg: Lemmetyinen, 1972; Nisbet and Drury, 1972; Morris et al. 1977). Although some work has been done in tropical locations (eg: Schreiber and Ashmole, 1970; Brown, 1973), there remains a need for the regular and systematic collection of data from such sites. Interested, resident naturalists in Trinidad and Tobago are in an ideal geographic position to investigate on an annual basis, certain aspects of the breeding biology of seabird species which nest on the offshore islands. The purpose of this paper is to present some of the procedures used during such an investigation.

COLONY LOCATIONS

The largest concentrations of colonial nesting seabirds in the offshore waters of Trinidad and Tobago are on Little Tobago, St. Giles (Melville) Island and Soldado Rock (see ffrench, 1973). Sooty Terns *(Sterna fuscata)* and Noddy Terns *(Anous stolidus)* nest at all three sites while Brown Boobies *(Sula leucogaster)* nest at two (Little Tobago and St. Giles). In addition, Laughing Gulls *(Larus atricilla)* nest on Little Tobago and Red-footed Bobbies *(S. sula)* nest on St. Giles. Large numbers of Frigate Birds *(Fregata magnificens)* nest on St. Giles while an occasional nest has been found on Soldado Rock (R. ffrench, pers. comm.). Little Tobago and Soldado Rock are the most readily accessible islands whereas landing on the St. Giles is possible only at certain times of the year, and then with difficulty.

ACCESS PERMISSION

The three sites noted above are all protected bird sanctuaries and special permission is required for boat landing and any work done while there. Such permission is obtained through the office of the Conservator of Forests, Ministry of Agriculture and will normally be granted if the investigator can provide a reasonably justified series of objectives relating to his work. These regulations aside, the careful definition of objectives and of the procedures to realize them is a usual prelude to any systematic field work and should therefore be worked out well in advance of the actual collection of data.

DATA COLLECTION PROCEDURES

Study Area Selection:

A first visit to a large seabird colony is always memorable and may result in considerable confusion on the part of the investigator unless he has a clear idea of his objectives. Whereas in small colonies it is often possible to record information on all nests within a major nesting site, the numbers of breeding pairs in large colonies may be in the thousands and it is necessary therefore, as a first step, to select a well-defined study area within the larger colony. This is done with several factors in mind.

The study area must be representative of the entire colony so that information collected from it gives an accurate picture of the breeding patterns of the larger unit. Nest density, clutch size ratio, age and/or experience of the parents, vegetation type, substrate type and the time of nest start may all influence the subsequent reproductive success of a given set of nests. Some care should be taken therefore to ensure that, as much as possible, the site selected takes account of these factors.

Many seabird species initiate nesting at a "central" nucleus site which then expands outward as more pairs complete their nests and produce eggs. Whether or not it is possible to determine the pattern of nest site selection will, of course, depend on the regularity of visits by the investigator to the colony. If the pattern is unknown, it is a good practice to select a study area which is rectangular rather than square so that the middle and edge portions of the colony will be included. The total number of nests within the area selected should not be less than 100.

Colony visits:

Visits by an investigator to the colony selected for study should be as frequent as possible. The ideal visitation rate is daily; however, this is rarely possible unless the investigator is living either at the colony site or close to it. Every field biologist must balance the cost of infrequent visits (in terms of data lost) against his other responsibilities and recognize that the breeding activity of the birds continues in his absence. This results in an increasingly cumbersome set of assumptions which become more numerous as the time interval between his visits increases. No matter how frequent the visits, eggs may be laid and lost and chicks may hatch and disappear in his absence. Therefore, a regular pattern of visits to the colony during the breeding season is essential for the collection of meaningful data.

Nest Marking:

All nests within the study area are marked and numbered for later recognition. This may be done by painting numbers on rocks adjacent to the nest or preferably, with the use of numbered wooden markers inserted into the substrate close to the nest. I have found that ordinary wooden tongue depressors serve the purpose well if they are firmly fixed into the ground and if the vegetation growth is minimal. Larger stakes are necessary if vegetation growth around the nest is extensive.

Egg Marking:

Each egg is marked as it is found in the nest. This permits an investigator to follow the fate of each egg during the course of incubation. Eggs are marked on the shell either with a soft-lead pencil or with non-toxic 'Magic-Markers'. Some care is necessary here as the egg-shell of smaller species is relatively fragile and punctures or cracks may result if too much pressure is used. Marks made by both types of marking devices tend to fade after several days and must be replenished at least every two weeks until hatching.

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If the species being studied lays more than one egg in a clutch, it is very useful to determine (if possible) the laying order within a clutch as this may influence the subsequent hatching success. Therefore, single eggs in a nest should be numbered "1" with subsequent eggs numbered sequentially as they are laid. If the order of the next two eggs is unknown, they should be given separate letters (eg: A and B). If a completed 3-egg clutch is found on the first visit, each egg should be given separate letters.

If vernier calipers are available, the maximum length and maximum width of each egg should be measured to the nearest 0.1 mm. It is known (for example) that in Laughing Gulls, first eggs in a 2-egg clutch are significantly longer and wider and hatch better than second eggs (Morris, unpubl. data). Therefore, even if laying order is unknown, the size of each egg may indirectly provide the information required.

Chick Marking:

Ideally, all chicks are leg-banded with official numbered bands (obtained from the United States Fish and Wildlife Service) as they hatch so that their fledging success may be followed more accurately. In addition, the bands provide a permanent record which is carried with the bird when it leaves the colony and band returns from around the world provide information on migratory and other movement patterns. Finally, birds banded as chicks can be identified should they return to their natal colonies as breeding adults.

It is normally not possible for non-professionals to obtain banding permits and supplies. However, useful information can still be collected from chicks between the time of hatching and fledging. The chicks of most seabird species will remain at or close to the nest site when approached, and normally will move only a few feet away to hide in adjacent vegetation cover. The nests should be approached with caution and every effort made to identify chicks with their proper nests in order to record post-hatch survival for each nest. If possible, a chick may be captured on each visit and weighed by placing it carefully in an appropriate size, cotton bag. Field scales are available from local suppliers for this purpose.

As the procedures for counting and handling chicks may cause considerable damage to the colony (see below), they should be conducted only with extreme caution. It is usually possible to obtain an estimate of the number of chicks which fledge from the study area by counting the chicks through bionoculars from a distance. This latter procedure is recommended for most general studies.

Data Recording and Analysis:

Careful and complete records must be kept on all information collected from the study area. Small, hardcover notebooks, preferably treated to prevent water damage, are ideally suited for this purpose. Clip-boards may also be used in the field and the data transferred to permanent record books upon return. All notes and records should be taken in pencil (rather than ball-point or ink) to avoid record losses through rain or spray damage. Separate records should be kept for each nest and its contents. It is often useful to maintain a file of 5" x 8" cards for each study area, with all records for each nest recorded on a separate card.

The analysis of data can become rather complex; however, useful conclusions can be drawn from the basic records outlined above. By combining all the data collected from a given study area, one can readily calculate the hatching rate (eggs hatched per egg laid) as a measure of pre-hatch mortality and the fledging rate (chicks fledged per egg hatched) as a measure of post-hatch/pre-fledge mortality. The overall reproductive success is recorded as the number of chicks fledged per egg laid which includes both of the above loss components (see the paper by Morris in this volume). If the species being studied lays a clutch of more than one egg, separate calculations may be made for each clutch size.

GENERAL SUGGESTIONS

The potential for personal enjoyment in a study of this nature is substantial. In addition, if an investigator brings a level of motivation and rigour to the task, he may be in a position to contribute meaningful, new (or corroborative) knowledge to the breeding biology of seabirds in tropical nesting areas. Thus, the rewards will almost certainly justify the work involved (which is often considerable).

I would be remiss if several notes of caution stated elsewhere (Morris, 1976) were not repeated here. The responsibility of an investigator to the birds themselves is considerable and every effort must be made to avoid interference with their breeding activity, regardless of the data lost by doing so. Colonial seabirds can tolerate a certain amount of human activity within their colonies. However, extended periods spent in the study area can cause a great deal of disturbance with the possibility of substantial losses of both eggs and chicks. This problem is particularly acute in tropical areas where the heat of the sun can addle eggs and kill chicks within a matter of minutes.

The incubating or brooding adult bird provides the only readily available source of shade for the eggs and young chicks. It is essential therefore, that data collection from the study area take place *only* in the early morning or late afternoon. Furthermore, the amount of time spent in the colony on any one visit should *never* exceed one hour.

It is usually possible to work through a study area surrounded by a constant diameter circle of space devoid of adult birds. This implies that adults will return to their nest sites shortly after the investigator has moved on to new nests. Should the birds not return to their nests within a few minutes after disturbance, the investigator should work the area in several short time periods rather than spend the whole of the visit in the study area.

Finally, in those seabird species which nest on the ground in large groups (eg: Laughing Gulls), the colony should *not* be entered during the final phase of the breeding season. At this time, substantial numbers of large, mobile chicks are present. Movement through the area by an investigator will cause chicks to scatter throughout the colony, dispersing from their nest sites for considerable distances. Although chicks are usually able to find their way back, they are frequently attacked by neighbouring adults as they intrude through adjacent nesting territories and considerable mortality may occur. These reasonable precautions will reduce the chances of disruption to the annual recruitment of chicks on which each species depends for its continued survival.

ACKNOWLEDGEMENT

Mr. R. ffrench suggested that I write this article in the hope that it may stimulate interested local naturalists to undertake their own studies on a regular baiss. I share with him an optimism for the fruition of this objective.

LITERATURE CITED

Brown, W.Y. 1973. The breeding biology of Sooty Terns and Brown Noddies on Manana or Rabit Island, Oahu, Hawaii. Unpubl. PhD thesis, Univ. Of Hawaii.

ffrench, R.P. 1973. Guide to the birds of Trinidad and Tobago. Livingston Publ. Co., Pennsylvania. 470 pp.

Lemmetyinen, R. 1972. Growth and mortality in the chicks of Arctic Terns in the Kingsfjord area, Spitsbergen in 1970. Ornis Fenn. 49: 45 — 52.

Morris, R.D. 1976. The brids of paradise island. Trinidad-Naturalist 1 (3): 29 — 36.

Morris, R.D., R.A. Hunter and J.F. McElman. 1977. Factors affecting the reproductive success of Common Tern *(Sterna hirundo)* colonies on the lower Great Lakes. In press, Can. J. Zoology.

Nisbet, I.C.T. and W.H. Drury. 1972. Measuring breeding success in Common and Roseate Terns. Bird-Banding 43: 97 — 106.

Schreiber, R.W. and N.P. Ashmole. 1970. Sea-bird breeding seasons on Christmas Island, Pacific Ocean. Ibis 112: 363 — 394.