



MONITORING STUDIES OF SEABIRDS

BIOMASS HANDBOOK 19

**SCAR/SCOR/IABO/ACMRR
GROUP OF SPECIALISTS ON
LIVING RESOURCES OF THE SOUTHERN OCEANS**

MONITORING STUDIES OF SEABIRDS

BIOMASS Working Party on Bird Ecology

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FOREWORD

The purpose of these Handbooks is to disseminate existing information on methods relevant to BIOMASS in time for those methods to be put to use. They are therefore not intended to be definitive treatises, although in some cases this may well be so. Their primary purpose is to provide an early guide. The Handbooks will be reviewed as new information becomes available, and updated if required. A number of Handbooks are in preparation and will be issued as they are completed. The costs of preparation and distribution are subsidized by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA/NMFS). Copies are distributed to individuals whose names are included in the "BIOMASS Directory". The Technical Group on Methods is grateful to those who have volunteered to prepare these Handbooks for the use and guidance of their colleagues and to the CSIRO, Australia for their technical assistance. Our role is to identify the needs for Methods Handbooks and Leaflets and to arrange, if possible, for those needs to be met.

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This Handbook was compiled by members of the BIOMASS Working Party on Bird Ecology. Comments and requests for additional information should be sent to the secretary. The members of the Working Party on Bird Ecology are listed in Appendix 1.

PREFACE

The Working Party on Bird Ecology produced the basis for the information in this Handbook as an Annex to BIOMASS Report No. 8 - Antarctic Bird Biology.

Because of the practical importance of longterm monitoring studies of seabirds to the objectives of BIOMASS, it was thought useful to make information on the current situation more readily and conveniently available.

INTRODUCTION

A fundamental objective of BIOMASS is the development of management plans and strategies designed to promote and ensure rational commercial exploitation of marine living resources (especially krill, but also fish and squid) within the Southern Ocean system. Extensive harvesting of a resource by man will not only affect the status of exploited stocks but must inevitably be at the expense of other consumers.

Because Antarctic fisheries are in their infancy, it is not possible to determine the magnitude of these effects by evaluating catch statistics and fishery data. It is therefore important to determine the present status of populations of selected predator species, and to seek to correlate any subsequent changes in breeding numbers and reproductive performance with changes in abundance of prey stocks and especially those which may arise following the advent of commercial exploitation.

Seabirds are clearly the most convenient and accessible group with which to attempt to do this. Already for most Antarctic and sub-Antarctic penguins it has been possible to demonstrate, at some locations, increases in breeding population size over the last 20-30 years. These changes have been widely interpreted as due to the increased availability of krill to penguins following the large-scale reduction of baleen whale stocks. Had the population changes been smaller or data only available for a shorter period, however, it is doubtful whether most changes would have been noticed. To meet the present requirements it is therefore essential to establish a comprehensive system of detailed monitoring studies on a longterm basis. This also fulfils recommendation 24 of the BIOMASS Group of Specialists' Technical Group on Data, Statistics and Resource Evaluation.

AIMS

1. To establish a series of monitoring studies to provide regular information on breeding population size and aspects of breeding success on a longterm basis.
2. To ensure that these studies are conducted so as to provide prey population status indices which are potentially sensitive to possible changes in resource abundance.

SPECIES AND SITES

At XV SCAR in 1978 the subcommittee on Bird Biology presented an interim list of recommendations for longterm monitoring of selected seabirds at certain localities and specified intervals and requested information on such programmes involving these sites and species. On the basis of the information provided, a revision of current and recommended monitoring sites and species is presented in Table 1.

The criteria on which these recommendations are based are as follows:

- (a) Species that are the major component of bird biomass either in the Antarctic zone (Adelie Penguin), sub-Antarctic zone (Royal/Macaroni Penguin) or in a large, but more restricted area (Chinstrap Penguin on the Antarctic Peninsula), and which feed on krill.
- (b) Species that are major consumers of squid and hence probably important krill predators at the secondary level (e.g. King Penguin).
- (c) Species, with a small world population, which might be particularly vulnerable to prey stock changes (e.g. Wandering Albatross).
- (d) Sites at which relevant baseline data are already available or appropriate research being undertaken.
- (e) Sites which provide a good geographical change in latitude and longitude and which include those both near and far from areas likely to be subject to extensive exploitation.

It should be noted that there are at present actively monitoring programmes on species not indicated in Table 1, e.g. on Emperor Penguin at Adelieland, Black-browed and Grey-headed Albatrosses at South Georgia.

TABLE 1. Location of populations of indicator species selected for monitoring together with status of monitoring programmes.

Species	Location	Responsible country	Status
Wandering Albatross	Iles Crozet	France	Recommended
	Marion Island	South Africa	Active
	Gough Island	South Africa	Active
	South Georgia	U.K.	Active
	Macquarie Island	Australia	Active
	Campbell and Auckland Islands	New Zealand	Recommended
King Penguin	Iles Crozet	France	Recommended
	Kerguelen	France	Recommended
	Marion Island	South Africa	Active
	South Georgia	U.K.	Active
	Macquarie Island	Australia	Active
Adelie Penguin	Cape Crozier	U.S.A.	Recommended
	Palmer Station area	U.S.A.	Active
	Point Thomas, King George Island, South Shetlands	U.S.A./Poland	Active
	Cape Bird	New Zealand	Recommended
	Signy Island	U.K.	Active
	Harmony Point, Nelson Island, South Shetlands	Chile	Recommended
	Baileny Islands	New Zealand	Recommended
	Mawson and Casey areas	Australia	Recommended
	Enderby Land	Australia, South Africa	Recommended
	Mawson and Casey areas	Australia	Recommended
	Enderby Land	Australia, South Africa	Recommended
	Adelieland	France	Recommended
	Syowa Station	Japan	Active
Royal/Macaroni Penguin	Bird Island, South Georgia	U.K.	Active
	Macquarie Island	Australia	Active
	Marion Island	South Africa	Initiated
	Ile de la Possession	France	Recommended
	Kerguelen	France	Recommended
Chinstrap Penguin	Dream Island, Antarctic Peninsula	U.S.A.	Active
	Point Thomas, King George Island, South Shetlands	U.S.A./Poland	Active
	Harmony Point, Nelson Island, South Shetlands	Chile	Active
	South Orkney Islands	U.K.	Initiated
	South Georgia	U.K.	Initiated
	Signy Island	U.K.	Active

GENERAL PRINCIPLES

In the present context there are essentially three types of monitoring study that may be undertaken:

(a) **Breeding numbers**

Counts of the number of breeding pairs of a species at a particular site, repeating such counts at a similar date (normally as soon after egg laying as possible) in succeeding seasons.

(b) **Breeding success**

Annual counts of pairs breeding, eggs hatched and chicks fledged.

(c) **Detailed breeding performance**

Periodic weighing of large samples of chicks of known age to determine population mean growth rates, complemented by the collection of data on meal size and feeding frequency.

Type (a) studies represent the minimum requirement for a monitoring programme.

Type (b) studies enable data on breeding performance to be compared with any available information on the status of appropriate prey stocks.

With type (c) studies, the information on feed size, feeding frequency and growth rate forms a potential index of the status of prey stocks. Although this is the most useful type of study, it must be emphasized that it required very careful planning, large samples of birds and extensive field manpower.

It is recommended that:

1. Each type of study should:
 - (a) be conducted using separate colonies, or separate areas of large colonies (if the use of suitable photographic techniques is feasible, it may be possible to conduct type (a) and (b) studies at the same colony).
 - (b) have appropriate control colonies or areas established to assess the effect of the monitoring disturbance.

2. All studies should be given a regular long-term commitment (at least 20 years).
3. Studies should be established in areas free from other disturbance. Wherever possible, the sites should be clearly marked and access restricted to the monitoring visits. It may be desirable to investigate the possibility that once the monitoring work is established, some sites should be proposed as Sites of Special Scientific Interest. It is also important to consider whether these restrictions on land-based disturbance should be complemented by the establishment at some sites, designed to serve as control experiments, of a ban on fishing for krill within the foraging range of breeding penguins. This topic needs further investigation.
4. Study colonies or areas of large colonies should be selected bearing in mind that:
 - (a) breeding success may be influenced by:
 - (i) colony size - large colonies tend to have better success;
 - (ii) nest position - birds at the centre of colonies have greater success;
 - (b) a nearby vantage point may permit photographs to be taken and enlargements used to make counts, thus reducing disturbance to a minimum.
5. Suitable ground-controlled aerial photographic techniques should be developed to minimize monitoring disturbance.
6. As the age of breeding birds also influences reproductive success, studies should ideally be conducted or established at colonies containing a substantial proportion of known-age birds.
7. The quantitative composition of the diet of the species monitored at each site should be determined and data on inter- and intra-season variations obtained. This work should not be carried out in the actual colonies selected for monitoring.
8. Counts should be made on approximately the same data each season, whenever possible.
9. As physical environmental conditions are important variables influencing changes in size or success of a breeding population (e.g. by causing direct mortality in cold weather, or acting indirectly by causing poor feeding conditions, or delaying onset of breeding), attention should be given to keeping a basic record of the principal meteorological phenomena.
10. Interpretation of results is likely to be greatly assisted by conducting monitoring studies on several species in the same general area.

METHODS AND TECHNIQUES

On the basis of information provided on methods and techniques currently being used in monitoring studies on the selected species, the following comments and recommendations are made:

Wandering Albatross

The breeding population of this species has been declining over recent years at Macquarie Island and South Georgia, although there is no evidence that this is related to changes in prey stocks in the vicinity of the breeding sites.

1. Counts of breeding birds should be made as soon after egg-laying as possible (end of January).
2. Counts of chicks hatched should be made in early April.
3. Counts of chicks that will fledge should be made by about mid-November.
4. As the species breeds biennially, if successful, it is:
 - (a) important to ensure that counts are made in successive seasons;
 - (b) useful to establish what proportion of birds failing in one season breed in the next.

King Penguin

Most breeding populations of this species have increased in recent years, in some cases substantially (e.g. a four-fold increase since 1936 at South Georgia).

1. Current breeding biology information is inadequate to determine the precise nature of breeding periodicity. As breeding is also poorly synchronized, it is impossible at present to obtain sufficiently accurate data to make monitoring studies on an annual basis worthwhile.
2. Mid-March is probably the best time for counts, as at the Indian Ocean islands early breeders are brooding small chicks and late breeders incubating, while at South Georgia there will be a mixture of incubating and brooded adults and also well developed chicks.
3. Aerial photographic census techniques are ideal for this species which breeds on large expanses of level ground, providing adequate ground data can be obtained for

calibration purposes. Flying altitudes of approximately 500 m probably represent the best compromise between minimizing disturbance and maintaining adequate resolution.

Adelie Penguin

This species has increased in numbers in the more northerly parts of its range (e.g. South Orkney Islands) but insufficient evidence is presently available for Antarctic continent colonies to assess the situation there.

1. Counts of breeding pairs should be made, as soon after egg-laying as possible, on an annual basis.
2. When counts of chicks near fledging time are required, the colony chosen should be well isolated from others to prevent the chicks joining those from other colonies in a single creche.
3. If photographic census techniques cannot be used, small colonies can probably be counted individually without undue disturbance. Large colonies would need to be estimated by some kind of subsample counting techniques (see Royal/Macaroni Penguin).

Chinstrap Penguin

This species has increased dramatically in both breeding range and numbers over the last 30 years. At a South Orkney Island site, its rate of increase has been three times that of Adelie Penguin over the same period. The procedure outlined above (1-3) for the Adelie Penguin should be followed.

Royal/Macaroni Penguin

1. Counts of breeding pairs should be made, as soon after egg-laying as possible, on an annual basis.
2. At some localities, this species breeds in large colonies on flat ground. Vertical aerial photography (at approximately 300-500 m) is probably most suitable both for calculating the overall area of the colony and for obtaining enlargements of photographs from which breeding densities in sample areas can be determined.

3. More typically, however, the vast colonies are situated on steep slopes. Oblique photography may be appropriate in these circumstances.
4. For accurate monitoring it is recommended that:
 - (a) the area of the colony be determined by a plane table survey and subsequent planimetry;
 - (b) for counting purposes a belt transect, not less than 5 m wide and divisible into contiguous quadrants of not less than 25 m² in area, be established from edge to edge across a colony. The transect line should be permanently marked;
 - (c) a subsequent count of chicks hatched should be made by a similar belt transect positioned on the opposite side of the line of permanent markers from that used to determine the number of breeding pairs.

INFORMATION EXCHANGE

It was proposed that reports on active monitoring studies should be submitted to the Working Party on Bird Ecology for circulation in advance of each meeting of SCAR.