



**PENGUIN
CENSUS
METHODS**

BIOMASS HANDBOOK 20

**SCAR/SCOR/IABO/AMCRR
GROUP OF SPECIALISTS ON
LIVING RESOURCES OF THE SOUTHERN OCEAN**

PENGUIN CENSUS METHODS

By

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 not intended to be definitive treatises, although in some cases they 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. Several Handbooks are in preparation, and will be issued as they become available. 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.

The members of the Group are:

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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 are listed in Appendix 1.

PREFACE

The information in this handbook has been drawn from Annexes in BIOMASS Report No. 8 and 18, Antarctic Bird Biology and Antarctic Bird Biology II.

1. INTRODUCTION

Penguins comprise more than 90 percent of the avian biomass in the Southern Ocean and have been singled out for particular attention during ISAS. Adelie penguins are the most numerous species in Antarctic regions and Royal/Macaroni penguins are similarly important in the sub-Antarctic.

At the subcommittee meeting on Bird Biology held in Pretoria, South Africa, in August 1979, it was agreed that ISAS should comprise two principal components:

1. A compilation of all existing published and unpublished information on the distribution and numbers of breeding populations of selected seabird species along the coast of Antarctica and on the sub-Antarctic islands.
2. This information should be upgraded by detailed field surveys aimed primarily at counting the breeding populations of Adelie and Royal/Macaroni Penguins along the coast of Antarctica and at the sub-Antarctic islands.

The overall objective is to produce comprehensive estimates of the total breeding populations of the Adelie and the Royal/Macaroni Penguins for all the Antarctic coastline and its offshore islands and for the sub-Antarctic islands, which may be used to derive estimates of the total populations of these species and the biomass of food they consume.

2. COUNTS

Numerical estimates may be of three kinds:

1. **NESTS.** The most accurate count of breeding pairs is that derived from a count of nests. This is usually carried out during incubation, but may also be made while chicks are still in the nest, before creches are formed. Such counts underestimate the number of breeding pairs by the number of breeding failures sustained between egg laying and the date of the count.

2. **CHICKS.** Late in the breeding season, the only counts possible are those of chicks. Most pygoscelid penguins raise one chick per pair per season, so a count of chicks gives a reasonable approximation to the original number of breeding pairs.

However, season-to-season variation in breeding success can often be considerable. For example (Yeates 1968) reports the breeding success in Adelie penguins at Cape Royds of 26, 47, and 68 percent in three seasons. Also, Macaroni penguins only raise approximately 0.5 chick per pair per season, so chick counts of this species may underestimate the breeding population considerably.

3. **ADULTS.** Many colony counts and estimates are expressed as the total number of birds or adults. These figures are difficult to interpret as they depend on the time during breeding season at which they were made. For some days prior to and until laying is finished, both birds of a pair will be present at the nest site; however, during incubation, it is more likely that only one bird will be present. A further problem with counts of 'birds' is that they may include individuals who are not breeding and this overestimates the true breeding population.

3. CENSUS TECHNIQUES

3.1 Aerial Photography (Helicopter and Fixed-Wing Aircraft)

This has the great advantage of permitting large areas to be covered in a short time. Its disadvantage is that it is usually impossible to determine the status (breeding, non-breeding, etc.) of all (and sometimes most) of the birds photographed. Where possible, therefore, some ground-truth data should be obtained for the colony or general area being investigated. Ideally, the ground-truth data should be counts of total birds and actual nests in an area of known dimension so the relationship between birds counted from a photograph and number of breeding pairs may be determined.

In conducting aerial photography, particular care should be taken to:

1. Allow proper overlap of photographs.
2. Ensure that all the colony is covered (where possible on a single frame).
3. Ensure that altitude, camera format, and lens focal length are recorded for vertical photography (to enable area calculation).
4. Choose appropriate lens, shutter speed, and film (to obtain sufficient detail to distinguish individual birds).
5. Ensure accurate and precise logging of all negatives and subsequent prints.

For colonies on steep slopes, oblique photography may be better than vertical photography.

With all photography from aircraft, great care must be taken to minimize disturbance. Different species of penguins have different responses to overhead disturbance, and within a species, the response may vary considerably between localities.

A minimum flight altitude of 300 m above ground level should be adopted (500 m for King and Emperor Penguins). Aircraft should halt their descent to this altitude at the first sign of disturbance.

3.2 Ground Counts

Small (tens) and medium-sized (hundreds) colonies of pygoscelid penguins can usually be tally counted directly (paint marking the birds already counted usually helps considerably in medium-sized colonies) without undue disturbance.

Large pygoscelid penguin colonies (unless divided into many subcolonies) and most crested penguin colonies are more difficult to count directly. It is often preferable to make sample counts (breeding pairs per unit area) and determine the overall colony area.

3.3 Negative Information

In addition to completing the census card, an additional log must be kept of areas investigated where no bird colonies exist. This log should record some indication of the suitability, or otherwise, of the area for penguin colonization. This should be recorded on a census card in a separate log or entered on a map of the area, which should be submitted with the cards.

3.4 Satellite Imagery

Existing satellite imagery is not suitable for the current ISAS requirements. However, this method may become available in the future.

4. PENGUIN CENSUS CARD

To facilitate collecting and processing penguin census data, the BIOMASS Working Party on Bird Ecology has devised a standard record card and provided instructions for its use. The card is intended to be used by both naive and experienced observers and to enable persons other than those who recorded the information to extract and interpret it.

5. INSTRUCTIONS FOR COMPLETING ISAS CENSUS CARD FOR PENGUINS IN COLONIES

1. *Observer.* Full name and affiliation (institute, country, etc.).
2. *Species.* Details for one species only per card. If more than one species is present in a colony, complete a separate card for each species. General information may be recorded on the first card only, if the cards are consecutively labelled; e.g., 21a, 21b, 21c, etc.; and stapled together.
3. *Locality.* Use the area name. Local or unofficial names must be in inverted commas.
4. *Coordinates.* Latitude and longitude given in degrees and minutes (preferably to the nearest 10 minutes).
5. *Trip Number.* Assign a consecutive number to each colony observed on a given trip.
6. *Date.* Day, month, year.
7. *Time.* The starting time of each survey period, preferably recorded as Greenwich Mean Time (GMT). Failing this as local time, and note deviation from GMT. Use 24 hour clock. Indicate which convention is being used.
8. *Colony Name.* Allocate a name or number to the colony so that it may be identified during successive visits.
9. *Topography and Substrate.* Circle all categories occurring in area colonized. Specify any others that occur.
10. *Mode.* Specify mode of survey; e.g., helicopter, fixed-wing aircraft, ship, ground, other (state).
11. *Method.* Specify method used; e.g., visual, photographic, other (state).
12. *Camera Format.* 35 mm, 120 mm, etc. (state).
13. *Focal Length/Lens.* Record in mm.
14. *Distance.* State whether flight altitude determined from barometer or altimeter. For on-ground observations, state height above and/or distance from colony in meters.
15. *Aspect.* State whether vertical or oblique.
16. *Photograph Serial Number.* Record this so that cards may be matched later with photographs.
17. *Categories Observed.* Enter numbers counted for each of the categories listed. If not counted, ring those categories which occurred at time of census.
18. *Count.* State whether estimate or actual count.

19. *Percent Accuracy.* Specify estimated accuracy preferably in 5-percent units.
20. *Map.* Use the reverse of the card to sketch a map of the area showing extent of colony. Indicate direction of photograph or observation. Record map number and scale.
21. *Sample Count Numbers.* If census was based on extrapolation of sample counts, state total area of colony, area of subsection sampled and number of birds in area(s) sampled.
22. *Notes.* Include here any factors which affected census; e.g., weather, topography. Add any other relevant observations.
23. Do not forget to record negative information in some way, e.g., on a card or map that can be submitted with the cards.

**APPENDIX 1. NAMES AND ADDRESSES OF MEMBERS OF THE
BIOMASS WORKING PARTY ON BIRD ECOLOGY**

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Mount Desert Island Biological Laboratory
Salisbury Cove
Maine 04672, U.S.A.

FIELD RECORD FOR CENSUS OF PENGUIN COLONIES										Card No.															
1. Observer		2. Species								Office Use Only															
3. Locality		4. Lat. N S		4. Long. E W		5. Trip No.		6. Date D / M / Y		7. Time															
8. Colony Name		9. Topography Beach Slope		Flat Other		9. Substrate Sand Shingle		Boulders Cliffs		Ice Others															
10. Mode		11. Method		12. Camera Format		13. Focal Length		14. Distance		15. Aspect															
22. Notes		17. Categories Observed								18. Count		19. % Accuracy													
		1. Nests & eggs 2. Nests & chicks 3. Nests & adults 4. Chicks 5. Breeding adults 6. Non-breeding adults 7. Moulting adults 8. Other								<table border="1"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> </table>												20. Map No.		20. Map Scale	
		21. Sample Count Numbers								Area Colony		Area Sampled													
										Number of Birds		<table border="1"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> </table>													