

HATCHING SUCCESS OF THE SHORT-TAILED SHEARWATER *Puffinus tenuirostris* IN TWO TASMANIAN COLONIES

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INTRODUCTION

The Short-tailed Shearwater *Puffinus tenuirostris* is a colonially nesting seabird exhibiting one of the best documented cases of an invariable and highly synchronized breeding season. The breeding biology is well known from a number of studies, including a long-term study at a single colony in Bass Strait (Bradley *et al.* 1991). Egg-laying is constant from year to year and 85 per cent of eggs are laid between 23 and 28 November, with extremes of egg-laying from 20 November to 3 December (Serventy 1963). Only a single egg is laid and is not replaced if lost. The egg is incubated by both male and female parents in alternate shifts, and hatching occurs from mid-January (Serventy 1967). The chick is brooded for the first 2-3 days after hatching and is then left unattended during the day (Fitzherbert 1985).

Although overall reproductive success in the Short-tailed Shearwater has been well documented (e.g. Bradley *et al.* 1990; Wooller *et al.* 1990), relatively little is known about the hatching success in this species. Hatching success is likely to be an important variable influencing reproductive success and survival in K-selected seabird species, such as the Short-tailed Shearwater, which has a long incubation period. As part of a blood sampling programme, we monitored hatching success of breeding shearwaters in two Tasmanian colonies in a single nesting season.

METHODS

Sixty nesting burrows were individually marked in each of two colonies at Cape Queen Elizabeth, Bruny Island (43°14'S, 147°25'E) and Cape Direction (43°06'S, 147°25'E) in south-east Tasmania. Only burrows which were short enough to reach the occupants and in which an egg was present on the first visit were selected. The colony at Cape Queen Elizabeth was visited on five occasions — 4, 13 and 21 December 1992, 29 January and 7 February 1993. The Cape Direction colony was visited four times — on 7, 15 and 24 December 1992, and 2 February 1993. On each visit the presence or absence of each adult, the egg or a hatched chick was noted.

RESULTS

Details on the hatching success at both colonies are presented in Table 1. In one burrow at Cape Queen Elizabeth, the egg was cold and no adult was incubating on 13 December. However, on 21 December the egg was being re-incubated and was subsequently successfully hatched. Thirty-nine eggs had hatched by 29 January at Cape Queen Elizabeth and three chicks were being attended by an adult at this time. The remaining 36 chicks were not being brooded. Three eggs were still being incubated on 29 January and on 7 February, one egg had hatched and the other two had been abandoned. At Cape Direction 45 eggs had hatched by 2 February and no chicks were being attended by an adult.

DISCUSSION

Hatching success at Cape Queen Elizabeth was estimated at 93 per cent, 95 per cent and 92 per cent in three consecutive seasons, and 68 per cent and 59 per cent at Hunter Island and Clifton Bluff, respectively, by Naarding (1980, 1981), and was based on chick occupancy in late January. The lower hatching success rate at the latter two colonies was attributed to a higher level of predation, mainly by feral cats (Naarding 1980). On Fisher Island, 25–83 per cent (mean 61%) of all eggs laid resulted in fledged young (Serventy and Curry 1984) and almost all young hatched are raised successfully to fledging (Wooller *et al.* 1988). These values therefore represent a lower estimate of hatching success at the Fisher Island colony. At Great Dog Island, Meathrel *et al.* (1993) recorded a hatching success of 55 per cent in a single season, with a large percentage of burrows that either collapsed or were empty. Hatching success at both Cape Queen Elizabeth and Cape Direction, in the 1992/93 season, are comparable with previous estimates for this species and represent minimum values since predation of some chicks may have occurred in the days between hatching and checking the contents of the burrows.

The reduced hatching success at Cape Queen Elizabeth relative to previous estimates may reflect an increased predation pressure at this colony in recent times. At both colonies, the majority of burrows which did not contain a chick appear to have suffered from predation of either the egg or the newly hatched nestling. Feral cats represent the major predation pressure on both adults and chicks and few colonies are completely

free of cats (Naarding 1980). Predation appears to have been a significant cause of mortality at Cape Queen Elizabeth since carcasses of dead adults were a common sight during this study.

Serventy and Curry (1984) found that unhatched or deserted eggs were as common as the disappearance of the egg or chick from the burrow. A relatively large number of eggs also failed to hatch at Cape Queen Elizabeth. Unhatched eggs may have been either infertile, or abandoned due to disturbance of the incubating bird during burrow inspection (Serventy *et al.* 1971), depletion of energy reserves or death of one or both parents, or behavioural traits of the parents associated with a lack of breeding experience such as incubation attentiveness, pair-bond strength and co-ordination of incubation schedules (Meathrel *et al.* 1993).

The single chick hatched at Cape Queen Elizabeth after 29 January represents an extreme of incubation length and hatching date. Incubation lasts for 52–55 days (Serventy 1967). However, the Cape Queen Elizabeth egg was incubated for a minimum of 58 days, assuming that it was laid on 3 December and hatched on 30 January. Most eggs hatch between 10 and 23 January (Serventy and Curry 1984), but hatching may continue until 29 January (Lill and Baldwin 1983). This study has extended this date to at least 30 January.

Hatching success in the Short-tailed Shearwater shows considerable variation both between colonies and years indicating that the incubation period is important in determining overall reproductive success and mortality. More detailed investigations are necessary to establish the importance of the various factors influencing hatching success.

TABLE 1

Hatching success and the fate of unhatched eggs of Short-tailed Shearwaters breeding at Cape Queen Elizabeth and Cape Direction in 1992/93.

	Colony	
	Cape Queen Elizabeth	Cape Direction
No. burrows	60	60
No. eggs hatched (%)	40 (67%)	45 (75%)
Abandoned eggs	9	2
'Empty' burrows ¹	11	13

¹'Empty' burrows refers to burrows that contained neither an unhatched egg or a chick.

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BOOK REVIEWS

Co-operative Mechanisms for the Conservation of Albatrosses
R. Gales, 1993.

Government Printer, Hobart. 132 pp.

This report was commissioned by the Australian Nature Conservation Agency, Canberra, from where copies may be obtained. An account is given of the status of each of the 14 species. Three factors became apparent to the author.

1. There is an alarming paucity of information regarding such basic parameters as size of breeding populations and demographic data.
2. For species where population size has been monitored, many of the populations are showing dramatic declines in numbers.
3. Direct mortality associated with fishing practices represents the major threats to the survival of albatrosses.¹

Direct mortality associated with commercial fishing is reported for 12 of the 14 species of albatrosses. The future of albatrosses is bleak unless there is a co-operative effort by all nations involved to develop and apply measures to reduce this mortality. Albatrosses are not the only seabirds killed, but they like others with a low productive rate (the Wandering Albatross only breeds every second year and does not commence to breed until over 10 years old) are highly vulnerable.

Any persons concerned about the status of albatrosses should read this report.

M. D. Murray, Pymble

Review and Analysis of Albatross Banding Data held by the Australian Bird and Bat Banding Schemes

H. Battam and L. E. Smith, 1993.

Australian National Parks and Wildlife, Canberra. 163 pp.

This report (Research and Consultancy Agreement No. 138) gives recovery data for Wandering, Black-browed, Shy, Yellow Nosed, Grey-headed and Light-mantled Albatrosses banded on various islands in the Southern Ocean. More detailed data is given from the study of the Wandering Albatross which commenced in 1956 off the New South Wales coast at Bellambi. Over the last 20 years, a decline in numbers has occurred and immature and young birds are now rarely seen. Reasons for the decline are discussed. Information on the Japanese long-line fishing effort in the Tasman Sea is given. This is a report which all concerned with the declining status of albatrosses should read.

M. D. Murray, Pymble

Atlas of the Southern Hemisphere Albatrosses

W. L. N. Tickell, 1993. 9 pp.

A series of 10 maps is presented of the Southern Hemisphere centred around Antarctica with the oceans divided into a 5 by 5 degree grid, shaded to indicate that the albatross species has been sighted in the grid. The breeding islands of each species are marked. Maps are given for *Diomedea exullans*, *D. epomophora*, *D. melanophrys*, *D. chrysostoma*, *D. chlororhynchus*, *D. bulleri*, *D. cauta*, *Phoebastria fusca* and *P. palpebrata*. The maps are produced on A4 paper and are obtainable from the author (Department of Zoology, University of Bristol, Bristol, BS8 1UG, UK).

M. D. Murray, Pymble