THE WINTER DIET OF THE GREAT-WINGED PETREL *PTERODROMA MACROPTERA* AT SUB-ANTARCTIC MARION ISLAND IN 1991

JOHN COOPER[1] & NORBERT T.W. KLAGES[2]

[1]*Animal Demography Unit, Department of Zoology, University of Cape Town, Rondebosch, 7701, South Africa (John.Cooper61@gmail.com)*
[2]*53 Clarendon Street, Mount Pleasant, Port Elizabeth, 6070, South Africa*

Received 11 June 2008, accepted 24 December 2008

SUMMARY

COOPER, J. & KLAGES, N.T.W. 2009. The winter diet of the Great-winged Petrel *Pterodroma macroptera* at sub-Antarctic Marion Island in 1991. *Marine Ornithology* 37: 261–263.

The diet of winter-breeding Great-winged Petrels *Pterodroma macroptera* was studied at sub-Antarctic Marion Island, Prince Edward Islands, southern Indian Ocean in August–October 1991 by multiple stomach flushing of weighed chicks after parental feeding. The Great-winged Petrel at Marion Island may be described as a cephalopod specialist, because squid formed the larger part of the diet in terms of diversity, frequency of occurrence and contribution by mass, and were the largest prey items taken. Fish and crustaceans formed relatively minor parts of the diet. These findings are broadly in accord with those of three previous quantitative studies at the same and other localities.

Key words: Great-winged Petrel, *Pterodroma macroptera,* cephalopods, Marion Island, diet

INTRODUCTION

Seabirds are important "top predators" in the Southern Ocean, and the diets of many have been studied, often as part of the work of the Scientific Committee for the Conservation of Antarctic Marine Living Resources (CCAMLR Ecosystem Monitoring Program 1992). Most dietary studies have concentrated on surface-nesting seabirds, especially penguins and albatrosses, and less is known about the diets of the suite of burrowing petrels of the families Procellariidae, Hydrobatidae and Pelecanoididae (e.g. Marchant & Higgins 1990, Williams 1995, Cherel & Klages 1998, Brooke 2004), most probably because of increased difficulty of study. A notable exception is for the Crozet Islands, where the diets of breeding burrowing petrels were comprehensively studied in the early 1980s (Ridoux 1994).

This pattern of study has been followed at the Prince Edward Islands, southern Indian Ocean, with relatively few dietary studies having been conducted on the burrowing seabirds (Cooper & Brown 1990). Only one study has been published on the diets of the three species of burrowing gadfly petrels *Pterodroma* spp. breeding at the Prince Edwards (Schramm 1986). Here, we detail the winter diet of the Great-winged Petrel *P. macroptera* from samples collected from chicks in 1991 on Marion Island, Prince Edward Islands.

METHODS

Occupied burrows of Great-winged Petrel were marked with numbered stakes and fitted with removable observation plugs (Sinclair 1981, Schramm 1983) in the vicinity of the meteorology station at Transvaal Cove, Marion Island (46°53′S, 37°52′E) during 1991 as part of a study of the improvement in breeding success following the eradication of feral cats *Felis catus* (Cooper *et al.* 1995). From 27 August until 24 October 1991, 17 burrows were visited at irregular intervals in the evenings and later at night, and any chicks that had gained at least 10 g because of a parental feed over this time period were subjected to multiple stomach-flushing. Chicks were flushed only at intervals of 10 or more days, with a range of one to five times per chick. Stomach contents were drained, weighed and stored deep frozen. Samples were sorted and prey items identified and measured by NTWK in South Africa. The collection and analytical methods followed are described in detail by Cooper *et al.* (1992).

RESULTS

Fifty samples were collected from 17 chicks with pre-feed masses varying from 280 g to 910 g (mean: 575 ± 135 g, n = 50). Mean mass of chicks after feeds was 619 ± 130 g (range: 340–920 g). The greatest mass gain recorded was 90 g (mean: 40 ± 21 g). The drained mass of samples ranged from 14.5 g to 99.1 g (mean: 41.7 ± 19.0 g). Based on mass gains, the average drained chick meal represented 7.0% of pre-feeding body mass (maximum: 28.6%).

A total of 40 samples (80%) contained crustacean remains; fish were found in 46% and squid in 74% of samples. The only other item identified was a nematode weighing 0.8 g, thought to be a gut parasite. By non-reconstituted mass, crustaceans on average made up 1.0 g (2.5%); fish, 15.2 g (38.7%); and squid, 23.1 g (58.7%). The balance of total mass (2.5 g) was non-drained stomach oil. Most prey items were considered to be too highly digested to be counted accurately, and so a numerical breakdown of diet is not presented.

In two cases, seven taxa of crustaceans could be identified only to the species level (Table 1). Measurable crustacean prey ranged in size from an unidentified amphipod with a total length of 10 mm to a *Campylonotus capensis* with a carapace length of 35 mm,

a *Nematocarcinus* sp. with a carapace length of 45 mm and six gammarid amphipods *Eurythenes* sp. (total lengths: 14–29 mm).

Six taxa of fish were identified, but only two to the species level (Table 1). Measurable fish of three taxa (*Diaphus ostenfeldi,*

TABLE 1
Identified taxa in the diet of Great-winged Petrels *Pterodroma macroptera* at Marion Island, winter 1991

Taxon	Size[a]		Estimated mass (g)
Crustaceans	**Carapace length (mm)**	**Total length (mm)**	
Amphipoda			
Eurythenes sp.		23.1±4.8 (14–29; 6)	
Hyperiella sp.		16	
Gammaridae		23.1±4.8 (14–29; 6)	
Decapoda			
Campylonotus capensis	35		
Nauticaris marionis	12		
Nematocarcinus sp.	45		
? *Pasiphaea* sp.	—		
Fish	**Otolith diameter (mm)**	**Estimated body length (mm)**	
Diaphus ostenfeldi	8.2 (3)	111.6	11.3
Gymnoscopelus sp.	5.2	124	22
Lampanyctus australis	3.3 (3)	104.7	10.0
Lampanyctus sp.	—		
Melamphaes sp.	—		
Myctophidae	—		
Cephalopods	**Lower rostral length (mm)**	**Estimated dorsal mantle length (mm)**	
Alluroteuthis antarctica	0.8 (2)	24.5 (2)	1.6 (2)
Ancistrocheirus lesueurii	3.6	105	79
Brachioteuthis sp.	3.9±0.4 (3.6–4.6; 5)	95.8±8.4	12.0±2.0
Chiroteuthis sp.	4.4 (3.0–6.1; 3)	120 (85–161)	52 (15–103)
Cycloteuthis akimushkini	9	279	480
Discoteuthis laciniosa	3.8 (3.4–4.2; 2)	104 (96–111)	67 (52–81)
Discoteuthis sp.	4.3	113	85
Galiteuthis glacialis	3.8 (2.7–4.8; 2)	204 (159–249)	55 (14–96)
Gonatus antarcticus	6.2±1.1 (5.0–8.8, 110	310±48 (258–386)	256±153 (110–528)
Histioteuthis atlantica	4.3 (3.8–4.8; 2)	82 (71–93)	146 (108–184)
Histioteuthis eltaninae	3.0 (2.6–3.4; 2)	53 (44–62)	64 (45–83)
Histioteuthis meleagroteuthis	4.2 (3.2–4.7; 3)	79 (57–91)	138 (72–176)
Histioteuthis sp.	2.2±1.2 (1.0–3.9; 6)	36±26 (9–73)	43±43 (5–114)
Mastigoteuthis sp.	3.8 (3.5–4.0; 3)	108 (100–115)	55 (44–65)
Octopoteuthis sp.	3.9 (3.8–3.9; 2)	66 (65–67; 2)	27 (26–27)
Taonius pavo	7.0±1.1 (5.4–7.7; 4)	417±66 (319–461; 4)	159±48 (88–192)
Taonius sp.	6.2 (5.3–7.0)	366 (313–418)	121 (85–156)
Teuthowenia megalops	4.3	188	63

[a] Mean ± standard deviation (range; n).

Lampanyctus australis and *Gymnoscopelus* sp.) ranged from 94 mm to 124 mm in estimated total length, with an estimated mass of 9–22 g (n = 7).

Seventeen taxa of squid were recognized, of which 11 could be identified to species (Table 1). Specimens of the squids *Taonius pavo* with a dorsal mantle length (DML) of 461 mm and an estimated (reconstituted) mass of 192 g, *Cycloteuthis akimushkini* (DML: 279 mm; estimated mass: 480 g) and *Gonatus antarcticus* (DML: 386 mm; estimated mass: 528 g) were the largest cephalopods recorded. The two smallest squids (both *Alluroteuthis antarcticus*) had estimated masses of 1.6 g (DML: 24.5 mm).

DISCUSSION

The diet of the Great-winged Petrel at Marion Island in 1991 was broadly similar to that shown during previous quantitative studies undertaken on the species [Marion Island in 1979 (Schramm 1986); Ile de l'Est, Crozet Islands in 1981 (Ridoux 1994); and off New Zealand (Grey-faced Petrel *P. m. gouldi*; Imber 1973)]. The contribution of fish in the diet by mass does vary across studies (28% in New Zealand waters, 4% at Marion Island in 1979, 4.2% at the Crozets). These differences might be at least partially explained by differences in sampling and analytic methods. However, it is clear that the species is a cephalopod specialist—as it seems are all gadfly petrels studied (Brooke 2004)—with squid forming the larger part of the diet in terms of diversity, frequency of occurrence, relative abundance and contribution by mass. Squid were also the largest prey items identified.

ACKNOWLEDGEMENTS

We thank Andre Marais for collecting the diet samples, often under adverse conditions, and Keith Spencer for help with the sorting of prey specimens. Charles Griffiths helped with identifications of crustaceans. Avian research conducted at Marion Island in 1991 by the FitzPatrick Institute, University of Cape Town formed part of the South African National Antarctic Programme, with logistic and financial support from the South African Department of Environmental Affairs and Tourism.

REFERENCES

BROOKE, M. 2004. Albatrosses and petrels across the world. Oxford, UK: Oxford University Press.

CCAMLR (COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES) ECOSYSTEM MONITORING PROGRAM. 1992. CCAMLR Ecosystem Monitoring Program: standard methods. Hobart, Australia: CCAMLR.

CHEREL, Y. & KLAGES, N.[T.W.] 1998. A review of the food of albatrosses. In: Robertson, G. & Gales, R. (Eds). Albatross biology and conservation. Chipping Norton, Australia: Surrey Beatty and Sons. pp. 113–136.

COOPER, J. & BROWN, A.C. 1990. Ornithological research at the sub-Antarctic Prince Edward Islands: a review of achievements. *South African Journal of Antarctic Research* 20: 40–57.

COOPER, J., FOURIE, A. & KLAGES, N.T.W. 1992. The diet of the White-chinned Petrel *Procellaria aequinoctialis* at sub-Antarctic Marion Island. *Marine Ornithology* 20: 17–24.

COOPER, J, MARAIS, A.v.N., BLOOMER, J.P. & BESTER, M.N. 1995. A success story: breeding of burrowing petrels (Procellariidae) before and after the extinction of feral cats *Felis catus* at Subantarctic Marion Island. *Marine Ornithology* 23: 33–37.

IMBER, M.J. 1973. The food of Grey-faced Petrels *Pterodroma macroptera gouldi* (Hutton), with special reference to diurnal vertical migration of their prey. *Journal of Animal Ecology* 423: 645–662.

MARCHANT, S. & HIGGINS, P.J. 1990. Handbook of Australian, New Zealand and Antarctic birds. Volume 1A. Ratites to petrels. Melbourne, Australia: Oxford University Press.

RIDOUX, V. 1994. The diets and dietary segregation of seabirds at the Subantarctic Crozet Islands. *Marine Ornithology* 22: 1–192.

SCHRAMM, M. 1983. The breeding biologies of the petrels *Pterodroma macroptera, P. brevirostris* and *P. mollis* at Marion Island. *Emu* 83: 75–81.

SCHRAMM, M. 1986. The diet of chicks of Great-winged, Kerguelen and Soft-plumaged Petrels at the Prince Edward Islands. *Ostrich* 57: 9–15.

SINCLAIR, J.C. 1981. Techniques for observing Subantarctic petrels at the nest. *Cormorant* 9: 67–72.

WILLIAMS, T.D. 1995. The penguins. Oxford, UK: Oxford University Press.