References

Anon. (1980), 'Recovery Round-up', *Corella* 4: 61-63.
Chandler, L. G. (1910), 'Notes on pardalotes', *Emu* 10: 113.
Disney, H. J. De S. (1974), *In* Lane, S. G. (ed.) Bird in the Hand. Bird-banders Assoc. of Aust., Sydney.
Gibb, J. A. (1957), 'Food requirements and other observations on captive tits', *Bird Study* 4: 207-215.
Green, R. J. (1980), Ecology of native and exotic birds in the suburban habitat. Unpublished Ph.D thesis, Dept. of Zoology, Monash University.
Hindwood, K. A. and E. Mayr (1946), 'A revision of the striped-crowned pardalotes', *Emu* 46: 49-67.
Howe, F. E. (1928), 'Notes on some Victorian birds', *Emu* 27: 264.
Ipsen, J. C. (1965), 'A note on the yellow-tipped pardalote', *Aust. Bird Bander* 3: 34.
Kershaw, K. A. (1966), Quantitative and dynamic plant ecology, Edward Arnold, London.
Kricher, J. C. (1975), 'Diversity in two wintering bird communities; possible weather effects', *Auk* 92: 766-777.
Lane, S. G. (1967), 'Habits of spotted pardalotes', *Aust. Bird Bander* 5: 27-29.
Lenz, M. (1981), 'Bird report. 1 July 1979 to 30 June 1980', *Canberra Bird Notes* 6: 3-42.
Marchant, S. (1973), 'Birds of the Caswell Drive area', *Canberra Bird Notes* 2(5): 2-16.
McGill, A. R. (1976), Review: 'Interim List of Australian Songbirds — Passerines', *Aust. Bird Bander* 14: 80-82.
Mees, G. F. (1965), 'The status of *Pardalotus ornatus* Temminck', *Emu* 65: 97-102.
Morris, A. K. (1967), 'Spotted Pardalote notes', *Aust. Bird-Bander* 5: 61.
Perrins, C. (1979), British Tits, Collins, London.
Pielou, E. G. (1977), Mathematical Ecology, Wiley, New York.
Rogers, A. E. F. (1977), 'N.S.W.) Bird Report for 1976', *Aust. Birds* 11: 81-103.
Salomensen, F. (1961), 'Notes on flowerpeckers (Aves, Dicaeidae). 6. The superspecies *Pardalotus striatus*', *Am. Mus. Novitt.* 2068.
Salter, B. (1969), Australian Native Gardens and Birds, Jacaranda Press, Brisbane.
Sedgwick, E. H. (1952), 'Bird life at Leonara, W.A.', *Emu* 52: 285-296.
Sedgwick, E. H. (1971), 'Movements of *Pardalotus substriatus*, Red-tipped Pardalote in Western Australia', *West. Aust. Nat.* 12: 1-4.
Sedgwick, E. H. (1977), 'Movements of the spotted pardalote', *West. Aust. Nat.* 13: 176.
Southwood, T. R. E. (1978), Ecological methods, with particular reference to the study of insect populations, 2nd (revised) edition. Chapman and Hall, London.
Storr, G. M. (1973), List of Queensland Birds, West. Aust. Museum. Spec. Publ. No. 5.
Thomson, A., Landsborough (Ed.) (1964), A New Dictionary of Birds, Nelson, London.
Waterman, M. H. and Condon, H. T. (1965), 'Banding of the yellow-tipped pardalote in South Australia', *Emu* 64: 298-301.
Woinarski, J. C. Z., C. W. Meredith and H. Parnaby, (1979), 'A mallee record of the spotted pardalote', *Aust. Bird Watcher* 8: 133.

J. C. Z. Woinarski,
Zoology Department, Monash University,
Clayton, Victoria 3168.

A. R. McEvey,
National Museum of Victoria,
Melbourne, Victoria 3000.

A Modified Penguin Stomach Tube

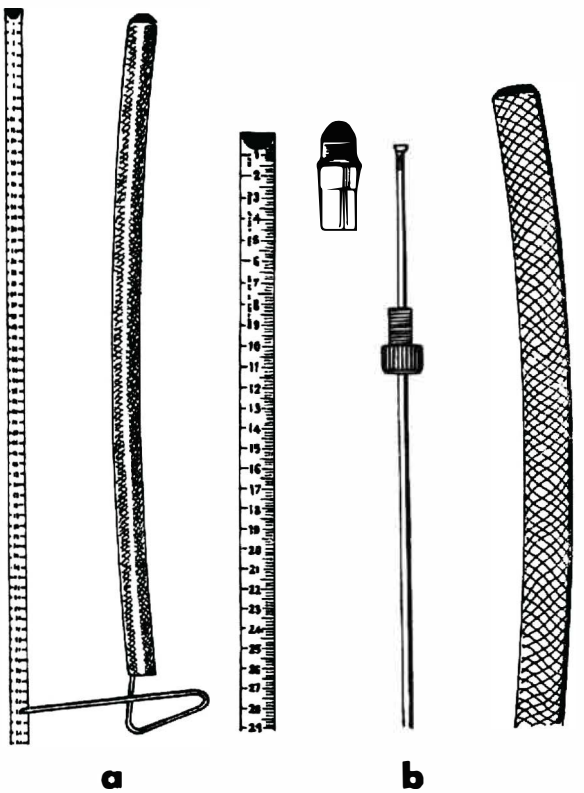
A. N. COWAN

Emison (1968) in his major study of the food of the Adelie Penguin *Pygoscelis adeliae* described his stomach tube for obtaining partial stomach contents samples in the living bird. Both he and later Paulin (1975) used this technique in the Ross Sea area. My own ornithological work at Casey, Antarctica (Cowan 1979a, 1979b, 1981) included a study of the food of the Adelie Penguin at the Windmill Islands as it seemed desirable to do a similar study in a different part of Antarctica, in order to compare food taken.

Methods

My familiarity with human endoscopic instruments suggested some modifications to Emison's design and these were incorporated into the instrument which was fabricated at the station by Egon Wehrle and which is shown in Figure 1.

The outer tube, instead of being rigid as in Emison's design, is of nylon-reinforced polythene tubing (Dunlop CS ¾" (20 mm) 250 PSI W.P.) which has an internal diameter of 19 mm and an external diameter of 26.5 mm. The introduced end is bevelled. A brass bullet-shaped obturator protrudes from the tip of the tube during introduction, making the operation easier and safer, and a rubber O ring sits in a groove in this obturator to form a good seal. The stainless steel handle wire (approximately 5 mm diameter) is attached to a threaded and knurled aluminium bolt by means of its hammered end and the aluminium bolt screws into the brass



● Figure 1. *a) Stomach tube showing stainless steel handle wire and bullet-shaped obturator at tip of tube. Scale in cm.*
b) Details of construction of stomach tube: (1) brass obturator, (2) threaded and knurled aluminium bolt, (3) nylon-reinforced polythene tubing. Scale in cm.

obturator. No doubt other corrosion-resisting metals would be satisfactory. The operator's end of the wire handle is bent into a convenient grip. Emison's pump had a rubber stopper fitting inside the tube and attached to a wire.

The birds were caught by means of a bag mounted on a wire hoop at the end of a long pole. Emison gives a good description of the technique of intubation; I shall only remark on the strength of these birds and on the amount of grip required of one's thighs in order to hold them still. The crucial need is to immobilise the flippers which, once freed, are used by the bird to quite surprisingly painful effect. Once the bird is secured, intubation is quite easy; a little human saliva makes a convenient lubricant. The hardest part of the procedure is the withdrawal of the handle which requires a hard pull at full arm stretch in order to suck up the semisolid stomach contents. At this point I always felt that an assistant would have made the task easier. On release the birds usually proceeded to feed their chicks with little delay, and seemed untroubled.

The sample was ejected into a plastic screwtop jar. Emison placed his samples directly into formalin in the field. This might inhibit digestion, but the low ambient temperatures were probably effective in this regard, and formalin was not available. Of course, the stomach contents had inevitably undergone some digestion between swallowing and extraction, a time interval which was unknown and perhaps considerable. On return to the station, the contents of the jar were poured into water on a shallow white tray and the formed elements picked out and placed in 70% alcohol.

Results

There were 28 samples of which 27 were collected from birds at the colonies at Shirley (15), Odbert (5) and Wilkes (7); one consisted of specimens netted in the shallows at the Casey boat landing for comparison. All localities are within one km of the mainland coast and adjacent to extensive shallow water in which the birds appeared to do most of their hunting; during our boat travel we rarely saw them far offshore. Dates of collection were between 30 December 1977 and 25 January 1978.

The samples were examined by Dr J. Lowry, Curator of Crustacea, The Australian Museum, Sydney. His finding are shown in Table 1.

Discussion

These finding are broadly similar to those of Emison and of Paulin, both of whose studies showed euphausids as the chief food, with some fish and amphipods. *E. superba* is generally absent from the Ross Sea (Marr 1962, Hedgpeth 1969); Paulin found none, while Emison found a few, around one percent. All other euphausids in both these studies were *E. crystallorophias*. It is clear that *E. superba* is relatively common in the coastal waters around Casey (110°E).

Reilly and Kerle (1981) studied Gentoo Penguins *Pygoscelis papua* at Macquarie Island but

TABLE 1

Analysis of Adelie Penguin stomach samples. All samples also contained a proportion of unidentifiable material, and several stones were present.

Location	Dates of collection	Number of samples	Contents	Number of samples in which found
Shirley Island	30.12.77	7	*Euphausia crystallorophias*	5
	5. 1.78	8		
			E. superba	3
			Euphausia sp.	3
			Euphausiacea sp. indeterminate	2
			Amphipoda:	
			Hyperoche sp. (Hyperiidae)	1
			Orchomene sp. (Lysianassidae)	1
			Paramaera walkeri (Eusiridae)	1
Casey boat landing	10. 1.78	1	*P. walkeri*	1
Wilkes	14. 1.78	7	*E. crystallorophias*	3
			E. superba	4
			Euphausia sp.	1
			Fish fragments	1
			Fish bones	1
Odbert Island	23. 1.78	4	*E. crystallorophias*	4
	25. 1.78	1	*Euphausiacea* sp. indeterminate	1
			Fish bones	1
			Fish vertebrae	2
			Fish fragments	1

failed to retrieve any specimens using Emison's stomach tube. Paulin gave no details of the devices used; presumably they were modelled on Emison's description.

References

Cowan, A. N. (1979a), 'Giant Petrels at Casey, Antarctica', *Aust. Bird Watcher* 8(2): 66-67.

Cowan, A. N. (1979b), 'Ornithological Studies at Casey, Antarctica', *Aust. Bird Watcher* 8(3): 69-90.

Cowan, A. N. (1981), 'Size Variation in the Snow Petrel *Pagodroma nivea*', *Notornis* 28: 169-188.

Emison, W. B. (1968), Feeding Preferences of the Adelie Penguin at Cape Crozier, Ross Island. *In* Austin, O. L. (ed.), Antarctic Bird Studies: pp. 191-212. American Geophysical Union, Washington D.C.

Hedgpeth, J. W. (1969), Introduction to Antarctic Zoogeography. *In* Bushnell, V. C. (ed.), Folio 11, Antarctic Map Folio Series. American Geographical Society, New York.

Marr, J. W. S. (1962), 'The Natural History and Geography of the Antarctic Krill (*Euphausia superba* Dana)', *Discovery Reports*, Vol. 32: 33-464.

Paulin, C. D. (1975), 'Feeding of the Adelie Penguin *Pygoscelis adeliae*', *Mauri Ora* 3: 27-30.

Reilly, P. N. and J. A. Kerle (1981), 'A Study of the Gentoo Penguin *Pygoscelis papua*', *Notornis* 28: 189-202.

Alan N. Cowan,
6a Vancouver Street,
Red Hill, A.C.T. 2603.