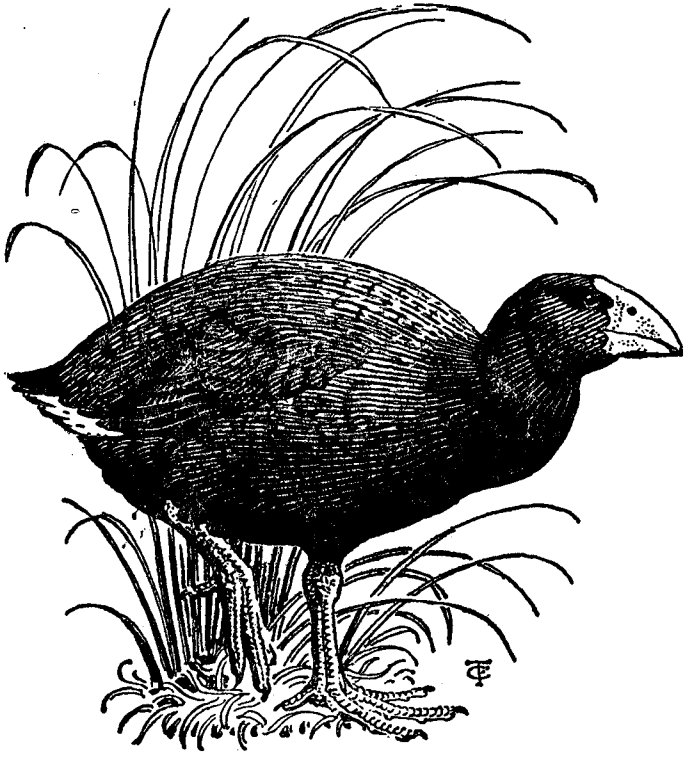
NOTORNIS

Journal of the Ornithological Society of New Zealand



Volume 21 Part 1 March 1974

OFFICERS 1973 - 74

President — Mr. F. C. KINSKY, National Museum, Private Bag, Wellington

Vice-President — Mr. B. D. BELL, Wildlife Branch, Dept. of Internal Affairs, Private Bag, Wellington

Editor — Mr. E. W. DAWSON, P.O. Box 8009, Wellington

Assistant Editor — Mr. A. BLACKBURN, 10 Score Road, Gisborne

Treasurer — Mr. H. W. M. HOGG, P.O. Box 3011, Dunedin

Secretary — Dr. J. A. FOWLER, "Manu Korero," 2/1030 Fergusson Drive, Upper Hutt

Members of Council:

Mr. A. BLACKBURN, 10 Score Road, Gisborne

Mr. F. H. BOYCE, 19 Marybank Road, Nelson

Mr. R. W. JACKSON, 9 Kenrick Road, Rotorua

Mrs. J. B. HAMEL, 42 Ann Street, Roslyn, Dunedin

Mr. D. V. MERTON, Wildlife Branch, Dept. of Internal Affairs, Private Bag, Wellington

Mrs. S. M. REED, 4 Mamaku Street, Auckland 5

Mr. R. R. SUTTON, Lorneville Post Office, Invercargill

Conveners and Organisers:

Beach Patrol: Mr. C. R. VEITCH, Wildlife Branch, Dept. of Internal Affairs, P.O. Box 2220, Auckland

Card Committee: Mr. B. D. BELL, Wildlife Branch, Dept. of Internal Affairs, Wellington

Librarian (and enquiries for back numbers): Mrs. H. R. McKENZIE P.O. Box 45, Clevedon

Nest Records: Mr. D. E. CROCKETT, 21 McMillan Ave., Kamo, Whangarei

Recording (including material for classified summarised notes): Mr. A. T. EDGAR, Inlet Road, Kerikeri

SUBSCRIPTIONS AND MEMBERSHIP

Annual Subscription: Ordinary membership, $4; Endowment membership, $5; Husband/wife membership, $6; Life membership, $80 (age over 30); Student membership (under age 21), 25% rebate off ordinary rate; overseas subscriptions, 50 cents extra.

Subscriptions are payable on a calendar year basis at the time of application for membership and on receipt of invoice each January. Prompt payment of subscription will ensure continued receipt of *Notornis*.

Applications for membership, changes of address and letters of resignation should be sent to the Hon. Treasurer.

[Registered with POHQ, Wellington, as a magazine]

CONTENTS

Printed by TE RAU PRESS LTD., Peel Street, Gisborne

INSTRUCTIONS FOR AUTHORS

INTENDING CONTRIBUTORS ARE ASKED TO REFER TO NOTORNIS 19 (1): 102-104, APRIL 1972, FOR FULL DETAILS CONCERNING THE PREPARATION OF MANUSCRIPTS SUBMITTED FOR PUBLICATION. Study these carefully and prepare your manuscript accordingly. Unless these requirements, briefly stated below, are followed, manuscripts will be returned without further consideration.

GENERAL — Let at least two other people read your manuscript before sending it in and heed their comments. Check that all editorial requirements have been met and that all pages, tables and figures have been included; wrap and pack securely (especially photographs) and send to: The Editor, *Notornis*, P.O. Box 8009, Wellington.

FORM — *Two copies required*, typed, double-spaced with wide margins, on heavy-weight paper.

ABSTRACT — Provide up to 150 words for any paper exceeding 1000 words.

UNITS, CONVENTIONS — Use metric conversions for all measurements. Follow N.Z. Government Printing Office Style Book for other conventions.

NOMENCLATURE — Follow the OSNZ Annotated Checklist (1970) unless otherwise explained. Give scientific and common names (spelt with initial capitals) at first mention.

ILLUSTRATIONS — Plan for legible reduction to 7″ x 4″ (18cm x 10cm) or 3½″ x 4″ (8.5cm x 10cm). Photographs must be on glossy paper with strong contrast.

TABLES — Type *cleanly* on electric typewriter (whenever possible) with new carbon ribbon on heavy paper. Indicate position of each in the text.

ACKNOWLEDGEMENTS — Make certain that anyone who is acknowledged as having " critically " read the manuscript has indeed done so.

REFERENCES — These *are* important. Check titles, dates, and pagination carefully and spell out in full, following examples given in issues of *Notornis* from March 1972 onwards. In text, cite as " Blackburn (1972) said . . ." or " . . . according to some observers (Kear & Burton 1971)."

ADDRESS — Full postal address of author to be given at end of paper.

PROOFS — Supplied only on request or at Editor's discretion. *They must be returned without delay.*

REPRINTS — Authors will get 25 free reprints (other than of Short Notes, etc.). *Additional reprints may be ordered at cost directly from the printers, Te Rau Press Ltd, P.O. Box 195, Gisborne,* after notification of acceptance of the manuscript.

CONTRIBUTIONS WILL BE ASSUMED TO BE READY FOR PUBLICATION AS RECEIVED. TYPESCRIPTS AND ILLUSTRATIONS NOT IN THE PROPER FORM WILL BE RETURNED TO THE AUTHOR.

Book reviews, short notes, and news items are especially welcome.

NOTORNIS
is the journal of the Ornithological Society of New Zealand (Inc.)
Editor: E. W. Dawson,
P.O. Box 8009,
WELLINGTON.

VOLUME 21 PART 1 MARCH, 1974

MOA AND MAN IN NEW ZEALAND*

By R. J. SCARLETT

ABSTRACT

Identifications of Moa bones from 25 North Island, 2 D'Urville Island, 38 South Island and 2 Stewart Island archaeological sites are tabulated.

In North Island sites the most widely represented genus is *Dinornis,* known from the north of the North Auckland peninsula to the Wellington area, followed in decreasing order of representation (though not necessarily of abundance at any one site) by *Pachyornis, Euryapteryx* and *Anomalopteryx.*

In South Island sites *Euryapteryx* is the predominant genus, followed in decreasing order of abundance by *Emeus, Dinornis, Pachyornis, Anomalopteryx* and *Megalapteryx. Dinornis,* common all along the South Island East Coast before the arrival of Man, is not known from archaeological sites on this coast north of Christchurch.

Man was probably responsible for the final extinction of at least the larger Moas, though natural causes may have contributed to a general decline in numbers.

The determination of Moa species, sometimes even of genera, from middens and other deposits associated with Man is often a long and wearisome process. The Moa-hunter Maori usually broke the bones, in order, presumably, to extract the marrow, or to utilise them for making tools and ornaments, so that the bones generally reach us as fragments. Skulls are seldom present (we know from finds at Shag River and Wairau Bar that it was usual to chop off the head and upper vertebrae and discard them before cooking the birds, and this may have happened miles from camp). In addition, the surface features of the bones have sometimes more or less disappeared through erosion. Moa, and other " Archaic " birds such as *Aptornis,* the big extinct Rail, and *Nesophalaris,* the extinct Coot, varied considerably in size and shape *within the species.* Added to this in the North Island

* The slightly revised. but not up-dated, text of a paper presented at the 39th ANZAAS Congress, Melbourne, 16-20 January 1967.

TABLE 1. Carbon fourteen age in years before 1950 (years B.P.) for archaeological sites containing Moa bone. (These figures have been brought up to date using the new half life value and have been corrected for secular variation following the Michael and Ralph method by B.G. McFadgen, pers. com. July 1973).

Archaeological Site Number	Site	Years B.P. (revised & corrected)	Approx. Date A.D.	Sample Reference No.
North Island				
N 40/3	Skipper's Midden, Opito	654 ± 50	1296	N.Z. 354
N 40/9	Sarah's Gully	621 ± 50	1329	N.Z. 357
N 40/9	Sarah's Gully	664 ± 50	1286	N.Z. 359
N 129/77	Ohawe	682 ± 59	1268	N.Z. 718
N 129/78	Te Rangatapu No.1	568 ± 56	1382	N.Z. 723
N 160/50	Paremata	547 ± 48	1403	N.Z. 510
South Island				
S 7/1	Heaphy River	573 ± 70	1377	N.Z. 509
S 29/7	Wairau Bar	824 ± 50	1126	N.Z. 50
S 29/7	Wairau Bar	922 ± 110	1028	Yale 204
S 84/76	Hamilton's, Redcliffs	1144 ± 65	806	N.Z. 438
S 84/77	Moabone Pt Cave, Redcliffs	660 ± 62	1290	N.Z. 437
S 136/1	Tai Rua, Otago	576 ± 32	1374	N.Z. 752
S 136/2	Teschemaker's, Ototara	561 ± 32	1389	N.Z. 560
S 140/2	Notornis Valley	347 ± 60	1603	N.Z. 51
S 143/1	Hawkesburn (early)	631 ± 60	1319	N.Z. 62
S 143/1	Hawkesburn (late)	446 ± 55	1504	N.Z. 59
S 146/2	Waimataitai	657 ± 30	1293	N.Z. 579
S 155/5	Shag River	795 ± 45	1155	N.Z. 605
S 155/5	Shag River	819 ± 56	1131	N.Z. 606
S 184/1	Pounawea (early)	631 ± 60	1319	N.Z. 57
S 184/1	Pounawea (late)	426 ± 60	1524	N.Z. 54
S 184/2	Hinahina	719 ± 75	1231	N.Z. 53
S 184/3	False Island	487 ± 60	1463	N.Z. 141
S 184/5	Papatowai (early)	744 ± 30	1206	N.Z. 134
S 184/5	Papatowai (mid.)	476 ± 50	1474	N.Z. 137
S 184/7	Tautuku	371 ± 80	1579	N.Z. 146

there was a wide range of small forms, often little known to the systematist. Comparative material is scarce, and I expect we may have to unite some forms now regarded as "species." Individual bones, particularly tibio-tarsi, are very similar, e.g. the upper size range of *Emeus crassus* and the lower range of *Euryapteryx gravis,* or the upper size range of the latter and the lower range of *Pachyornis elephantopus.* Considering all these points identification difficulties become obvious.

However, the bones are occasionally whole, or in large pieces, and even small fragments sometimes have distinguishing features, so that with time and patience one can identify most of the material with complete confidence, and the remainder, at least to genus, with a reasonable degree of certainty.

Whether one can distinguish between subfossil or fossil bone and bone that was fresh or "green" when used, is often questioned. Subfossil bone from loess, usually but not always from swamps, and often from caves, is more or less heavily mineralised. From sandhills it is almost invariably light, unless it has been lying in very damp sand. The degree of mineralisation is a very unreliable criterion of age, e.g. two bones from different parts of a Moa-hunter site at Tai Rua, Otago, one of which was heavily mineralised, the other light, were both dated by the collagen content to B.P. 576± 32, exactly the same age. What is characteristic of bone that was fresh at the time of breaking is the way it fractures, and the appearance when cut or sawn. Mr Les Lockerbie and I have, independently, experimented and proved this. The difference is hard to describe, but can be demonstrated.

In Tables 2 and 3, I have included only those sites where I am satisfied that the bones were from contemporaneously killed birds. I have examined almost all of the bones included in the tables, the exceptions being bones from three sites, from two of which the determinations are by Dr John Yaldwyn; through his courtesy I was able to examine bones from two other sites in the National Museum, Wellington. The other exception is the collection of bones made by Mantell at Ohawe (Waingongoro). The tables list the results from 25 North Island sites (including Great Barrier Island), 2 D'Urville Island, 38 South Island and 2 Stewart Island sites, where Man used the Moa for food and often for artifacts.

I have omitted the important inland site of Poukawa, Hawkes Bay, because although Man undoubtedly killed several genera of Moa there, he was probably not what we usually understand by a Moa-hunter Maori, and the site is much too controversial to be discussed in this paper.

I have grouped 4 pairs of "species," *Emeus crassus* and "*E. huttoni,*" *Megalapteryx didinus* and "*M. hectori,*" because I believe in each case that only one true, but variable, species existed, and *Dinornis giganteus* and "*D. hercules.*" The latter is a bow-legged little-known variant and probably only a form of *giganteus.* The 4th grouping is of *Euryapteryx gravis* and *E. haasti,* which cannot be

TABLE 2. Moa species from North Island archaeological sites.

Site		*Anomalopteryx didiformis*	*Euryapteryx curtus*	*Euryapteryx exilis*	*Euryapteryx geranoides*	*Pachyornis septentrionalis*	*Pachyornis mappini*	*Dinornis gazella*	*Dinornis struthoides*	*Dinornis novaezealandiae*	*Dinornis giganteus & D. hercules*
NORTH AUCKLAND											
	Ocean Beach, Whangarei Heads		x		x						
N 7 on 870 from 930-950	Doubtless Bay, dune midden		x								
N 30/5	Haratonga, Great Barrier Island				x?						
N 75/1	Tokoroa		x?								
N 6/4	Houhora	2	80	103	6				7		4
COROMANDEL PENINSULA											
N 44/2	Tairua				x	x	x	?	x	x	x
N 46/47/17	Jolly's Midden, Manukau Heads										x
N 40/2	Parker's Midden, Opito (a)			x	x				x?		
N 40/3	Skipper's Midden, Opito			x?					x		x
N 40/9	Sarah's Gully				?				x		x
N 40/6	Black's Midden, Mahinapua Bay			x	x						
	Whiritoa		x?				x		x	x	

TARANAKI											
	Rahotu Beach			x		x	x			x	
N 129/77	Ohawe (Buist)	x				x	x?	x		x	x
	Ohawe (Mantell)	x	x	x							
N 129/78	Te Rangatapu No.1 (Waingongoro)	x				x		x	x	x	
N 129/233	Te Rangatapu No.2 (Waingongoro)	x	x			x	x			x	
N 128/3	Kaupokonui	x		x	xr	x	x	x?			
HAWKES BAY											
	Limestone Rock-shelter, Puketitiri (a)			x?							
WELLINGTON											
N 160/50	Paremata (Sinclair) (b)	19	4	7		7		6			46
N 160/50	Paremata (Davidson) (b)	1	1	2		2		1+2?			17
	Akiteo										x
	Te Ika A Maru (c)					x?					?
N 164/2	Makara Beach (c)	x				x?					x
N 148/1	Foxton (d)					x					

TABLE 3. Moa species from D'Urville Island, South Island and Stewart Island archaeological sites.

D'URVILLE ISLAND, SOUTH ISLAND, STEWART ISLAND		*Megalapteryx didinus*	*Anomalopteryx didiformis*	*Emeus crassus* & *E. huttoni*	*Euryapteryx* new species	*Euryapteryx gravis* & *E. haasti*	*Pachyornis elephantopus*	*Dinornis* species	*Dinornis torosus*	*Dinornis robustus*	*Dinornis maximus*
D'URVILLE ISLAND											
S 103/3	Greville Harbour (c)	x								x	
	Omana, southern coast							x			
NELSON - TAKAKA											
S 14/1	Rotokura, Cable Bay	x?	x						x		
S 29/2	Tahunanui		x					larger species not determined			
S 9/13	Anapahi		x								
S 7/1	Heaphy River		x					x?			

MARLBOROUGH											
S 49/46	Oliver's, Kaikoura						1*				
S 29/8	Marfell Beach, Lake Grassmere						14*		40*	1*	
S 29/5	Mussel Point, Lake Grassmere						1*		1*		
	Cape Campbell								1*		
S 29/7	Wairau Bar						*x* a		*x*	*x* r	1
CANTERBURY											
S 103/1	Wakanui Creek, Ashburton						1*				
	Hikurangi, Banks Peninsula						1*				
S 94/30	Midden D, Tumbledown Bay, Banks Peninsula								1		
S 84/76	Redcliffs, Sumner	1*				3*	69*		54*	3*	
S 84/77	Moabone Point Cave, Redcliffs	3					*x* a		*x*		
S 84/46	Bromley						*x*				
S 62/1	Domain Stream, Hurunui						1*				
SOUTHLAND - OTAGO											
S 184/5	Papatowai (= McLennan R. = Tahakopa R.)	5	4	3	2(e) 1	44	366	72	157	23	2(f)

Table 3 continued.

		Megalapteryx didinus	*Anomalopteryx didiformis*	*Emeus crassus* & *E. huttoni*	*Euryapteryx* new species	*Euryapteryx gravis* & *E. haasti*	*Pachyornis elephantopus*	*Dinornis* species	*Dinornis torosus*	*Dinornis robustus*	*Dinornis maximus*
SOUTHLAND-OTAGO											
S 184/1	Pounawea	3	3(g)	20	10	36	14				1
S 184/3	False Island (Owaka)			6	3	1					
	Kaka Point, Port Molyneux			3		3					
S 184/6	King's Rock							1(h)	1(h)	1	
S 140/2	Notornis Valley	1*									
	Long Island, Dusky Sound					1*(i)					
S 143/1	Hawkesburn (Inland Otago)		7			104	7				
S 164/1	Little Papanui			3		4					2
	Anderson's Landing			3		3					1
S 164/20	Long Beach			4							
S 164/17	Kaikai's Beach					1					
S 184/7	Tautuku									1*(j)	
	Pleasant River			x?		x		x1			

S 155/2	Pleasant River Mouth						x				
S 155/7	Seacliff		1(k)						1		
S 136/1	Tai Rua				xr	x	x				
S 155/5	Shag River (l) (Shag Point)	2	5			3	88		4		
S 136/2	Teschemakers, Ototara						x				
S 146/2	Waimataitai Mouth, Katiki					x	x		x		x?
S 128/1	Waitaki River			1		18	64		22		
S 109/9	Shepherd's Creek II, Waitaki River						x				x
STEWART ISLAND											
S 189/4	Old Neck							44			
S 189/1	Native Island						1*				

Footnotes to Tables 2 and 3.

(a) *Dinornis*, but not certainly *D. struthoides*; (b) There was much more fragmentary material from Paremata which was un-identifiable; (c) Determinations by John Yaldwyn, *Dinornis hercules* at Makara and *Megalapteryx hectori* rather than *M. didinus* at Greville Harbour; (d) Other genera were present at Foxton but I have not seen them; (e) 2 sub-adult bones either *D. robustus* or *D. torosus*; (f) Shaft fragments of tibio-tarsi, probably *Megalapteryx*, but possibly *Anomalapteryx*; (g) Determinations as *Anomalapteryx* not quite certain; (h) *Dinornis maximus* or *D. robustus*; (i) 2 fragments of tibio-tarsi, one of femur. Probably of a 'haunch' taken to the site from elsewhere, e.g. Southland; (j) Associated femur, tibio-tarsus and tarso-metatarsus found in position of articulation; (k) Part of pelvis of *Dinornis*, probably *D. robustus*; (l) There are many more bones from Shag River which I have not seen.

TABLE 4. Sites at which Moa bone is present but has not been identified.

NORTH ISLAND

Various places at Tokerau Beach, Doubtless Bay, and Tom Bowling Bay, Northland, contain Moa bones and are probably eroded midden judging by the artifacts also found, but being in sand dunes the association is not certain.

Motutapu, Auckland, under the Rangitoto ash-shower of about A.D. 1200 (bone and eggshell).

Near Whangamata, Coromandel Peninsula.

Hotwater Beach, Coromandel Peninsula, two adjacent middens.

Robinson's site, near Hawera, Taranaki.

Near Arawhata Stream, Wairarapa, weathered out of sand with other midden material. Primary association with Man probable but unproved.

SOUTH ISLAND

S 111/1 Dashing Rocks, Timaru, Canterbury.

S 146/6 Matakaea, Otago.

separated unless the bills are present, and which I consider were subspecies.

With many of the South Island and a few of the North Island collections, I have counted the total number of identifiable bones or pieces of bone of each species, and have thus arrived at the proportions between each kind of Moa present. An "x" in the Tables indicates that the species is present at the site, an "a" indicates that it is abundant while an "r" indicates that it is rare. Where a figure is marked *, I have estimated the minimum number of *individuals* in the site.

In a few cases, either the proportion of the midden examined was very small, or I have not seen all the bones from the site, and cannot be sure I have a representative sample. Shag River is an example. It is a very large site, but I have handled comparatively few bones from it.

The greater part of the material consists of leg-bones, with a few skulls, pelves, vertebrae, etc. I have very occasionally included identifications of eggshell of *Euryapteryx gravis* and *Megalapteryx didinus*, the only kinds of which I can be certain.

The predominant genus in the South Island, present in 26 of the sites, and in some cases, e.g. Papatowai, Pounawea, Hawkesburn, and Wairau Bar, far more abundant than any other, is *Euryapteryx*. *Emeus* is present in 19 sites (and probably in 1 other), *Pachyornis* in 8, *Anomalopteryx* in 9, and a probable 10th, *Megalapteryx* in 5, and possibly in a 6th. *Dinornis* is not common, and no *Dinornis* of any of the three South Island species has been recorded further north, on the East Coast, than Redcliffs, near Christchurch, where it is very rare. In Moa-hunter times, the genus was more frequently found in Otago and Southland than elsewhere, but even there was uncommon. 15 *Dinornis* bones at Papatowai, as against 366 *Euryapteryx* illustrate the point. *Dinornis* is known sparsely from 14 South Island Moa-hunter sites, but before the arrival of Man was common all along the South Island East Coast, and, for example, is found well *below* the Moa-hunter stratum at Marfell Beach, Marlborough, but never in, or above the human occupation.

In the North Island, the *Dinornis* picture is very different. It was the predominant genus at Opito and Sarah's Gully, and present in all but one of the other Coromandel sites, it was comparatively common at Ohawe and Rangatapu (Waingongoro) in Taranaki, the second most common genus at Paremata, Wellington, and present in 17 of the 25 North Island sites so far investigated. At the recently excavated and most important North Island site, Houhora in North Auckland, the proportion of *Dinornis* bones was only 13 to 189 of *Euryapteryx,* but of the very many one-piece fish-hooks found there, many must have been made of *Dinornis* bone, thus raising the proportions considerably. I have not had time to study the multitude of small pieces of Moa bone from Houhora but doubt if they would much alter the general picture.

Of the other North Island Moa, *Pachyornis mappini* is present in 10, and probably 2 other sites, *Pachyornis septentrionalis* in 4 and a probable 5th, *Euryapteryx geranoides* in 10, and probably 3 more, *Euryapteryx exilis* in 5, *Euryapteryx curtus* in 8, with 2 more probable. Paremata, incidentally, contained a cut shaft section of a femur of *Euryapteryx gravis,* quite likely an importation from the South Island. *Anomalopteryx didiformis* is represented in 6, and probably in 7, North Island sites.

I have concluded, from a study of the proportionate distribution in various swamps or former lakes as well as in human sites, that the various " flocks " of Moa did not usually range widely. In the case of human sites I have allowed for the possibility that preference for one kind of Moa rather than another *may* have affected the selection. We still have insufficient dates to compare swamps and human sites, but two examples will illustrate the point. Glenmark Swamp and Pyramid Valley swamp, Canterbury, are 10 miles apart. At Glenmark all six South Island genera of Moa were recovered, at Pyramid Valley only the 4 larger genera. Marfell Beach and Wairau Bar Moa-hunter

sites in Marlborough are only 15 miles from each other. At Marfell Beach from the bones recovered I have estimated a minimum of 14 individuals of *Euryapteryx,* as against 40 of *Emeus.* At Wairau Bar the picture is reversed. *Euryapteryx* is overwhelmingly abundant, *Emeus* scarce. There is no reason to assume a big difference in age between Wairau Bar and Marfell Beach sites.

The chief emphasis of this paper is on the problem of identification of the Moa found in human association. I can deal only briefly with the question of the role of Man in their extermination and not at all with the reverse, the effect of Moa upon Man.

The reasons for the extinction of the Moa are controversial. My present opinion is that, in the South Island *Dinornis* and probably *Emeus* and *Pachyornis* were less in number when Man arrived (more than a thousand years ago) than they had been some centuries before, probably because the last climatic optimum for their flourishing (c. 6000 years ago) had passed (there seem to have been several such optima in their long history) and Man finished them off, taking several centuries to do so. By about 600 to 800 years ago *Euryapteryx* was still plentiful on Stewart Island and the South Island East Coast, but Man the destroyer eventually killed the last of this genus too by about 300 to 400 years ago. *Anomalopteryx* very probably still existed, at least in the Nelson-Takaka area, until less than 200 years ago. In my opinion *Megalapteryx* was probably alive in the Southern West Coast area until late last century, and there is a *very* slim chance that this little Moa may still exist in the wilds of Fiordland. In the central part of the North Island, the volcanic ash-showers must have had a good deal to do with lessening the numbers of the various species, although the late Bill Hartree and I found, in the hills of Hawkes Bay, ample evidence of re-colonization between the various eruptive periods. In both islands Man was still killing Moa 400-500 years ago, and must be held responsible for the extermination of at least the 4 larger genera.

In this short paper, it is not possible to do more than summarise, in three tables, the mass of evidence on which these conclusions are based. I will end by thanking Dr Roger Duff, the Director of the Canterbury Museum, for his encouragement of my studies, the Directors of Otago, National and Auckland Museums for the opportunity, always freely given, to examine material in their respective collections, and to express my great indebtedness to many archaeologist friends without whom this paper would have been impossible. I am especially indebted to Dr John Yaldwyn, National Museum of New Zealand, who revised my original manuscript and prepared it for publication. My thanks are also due to Mrs Rose-Marie Thompson and Miss Elaine Bardsley, DSIR, Wellington, who typed and arranged the tables.

Mr R. J. Scarlett,
Canterbury Museum,
Christchurch, 1

BIRD RECORDS OF THE 1971 - 1973 SNARES ISLANDS, NEW ZEALAND, EXPEDITION*

By DONALD S. HORNING, Jr. and CAROL J. HORNING

ABSTRACT

Seven species of birds are newly recorded from the Snares Islands, New Zealand. They include the Australian Gannet, White-faced Heron, White Heron, Eastern Bar-tailed Godwit, Skylark, Grey Warbler, and South Island Fantail. There are now 53 species recorded of which 22 are breeding on the islands. Records of 32 species include departure and arrival dates of some of the sea birds and observations of winter activities of other birds.

INTRODUCTION

The sixth University of Canterbury Snares Islands expedition extended from December 1971 to January 1973. Mr H. A. Best, who was with us on the 1970-71 expedition, and Mr K. J. Sainsbury completed the party for this expedition. We arrived at the Snares from Bluff, New Zealand, on 18 December 1971 aboard the FV *Sandra Kaye,* skippered by Mr Barry Davies. Messrs Best and Sainsbury left the islands aboard Mr A. J. Black's RV *Acheron* on 22 March 1972. We remained as the first scientific party to overwinter at the Snares Islands and left on 14 January 1973 aboard the *Acheron.*

Our comprehensive research programme included surveys of the terrestrial invertebrates and cryptogams, and studies of the breeding biology of the Buller's Mollymawk and Snares Crested Penguin. Additional observations were made on the activities of other birds. This paper includes seven species of birds not previously recorded from the Snares Islands, the seasonal departure and arrival dates of some of the sea birds, and observations on the winter activities and feeding of some species. Results of our breeding biology studies of the Buller's Mollymawk and Snares Crested Penguin and other notes on the Sooty Shearwater and Mottled Petrel will be incorporated into papers written by Dr J. Warham, University of Canterbury.

We are responsible for all the observations except those kindly furnished by Mr Best and Mr G. J. Wilson, of the 1970-71 expedition. Figure 1 indicates the localities that are mentioned in the text. The birds are listed to conform to the OSNZ (1970) Checklist.

* University of Canterbury Snares Islands Paper No. 17.

NOTORNIS 21: 13-24 (1974)

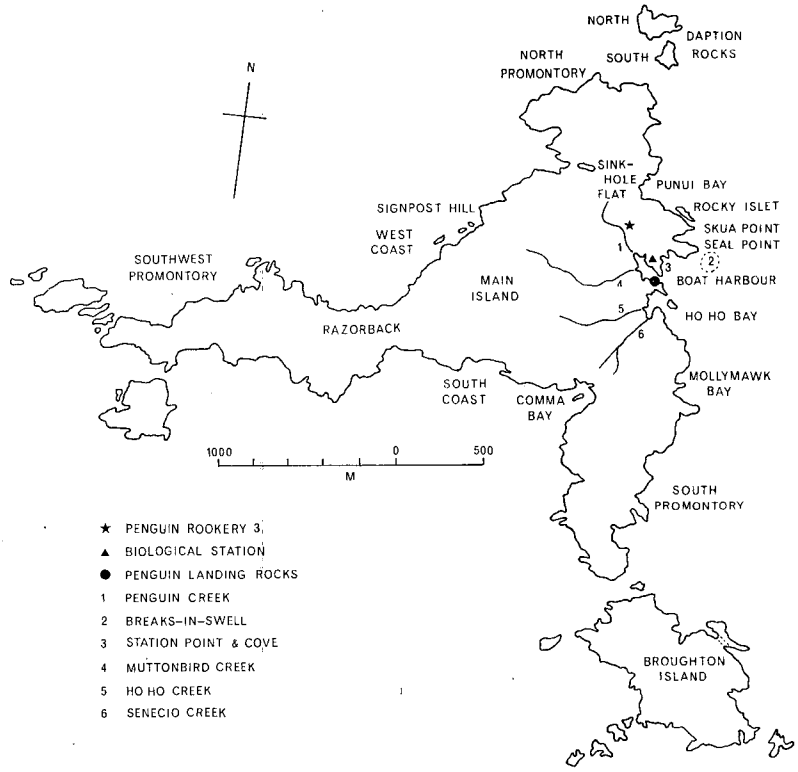


FIGURE 1 — The Snares Islands excluding the Western Chain and Vancouver Reef. Map based on 1967 RNZAF vertical photographs.

RECORDS

YELLOW-EYED PENGUIN *(Megadyptes antipodes)*

None of these birds have been recorded from the Snares Islands. We did not see any during this expedition despite searching penguin landing areas on the east side of the main island throughout the year. It is possible that they do visit the islands but such visits must be very rare.

SOUTHERN BLUE PENGUIN *(Eudyptula m. minor)*

One bird was first heard calling during the last week in September. The calls were heard periodically in the late evening and the bird was captured and identified on 29 November with the aid of Falla, Sibson & Turbott (1970). Calling continued during December and early January, generally from the same area in the *Olearia lyallii* forest near the Biological Station. Its short series of calls of only a few seconds duration prevented finding the bird again or its probable burrow.

SNARES CRESTED PENGUIN *(Eudyptes pachyrhynchus atratus)*

The last adult was seen on 28 May 1972 at the penguin landing rocks on the south side of Boat Harbour. The first observed returning male of the 1972-73 season was sighted on 20 August, but one bird was heard calling on 18 August. The mean arrival date for males was about 1 September. The first female was seen on 30 August, and the mean female arrival date was about 9 September. The first egg was seen on 18 September, and it hatched on 26 October. Chicks began to appear at the sea rocks on 9 January 1973. In 1972, nearly all of the chicks had left the rocks by the end of January, the same time reported by Warham (1967).

BULLER'S MOLLYMAWK *(Diomedea bulleri)*

The first fledgling known to leave the islands flew from Mollymawk Bay on 22 August. The last adult was seen on the South Coast on 23 October, and the last fledgling was seen at Punui Bay on 27 October. More than 90 per cent of the birds had left by 15 October.

Between 3 and 10 August, 858 fledglings were banded in the more accessible areas of the main island, including all of the promontories. It was apparent from a recheck of all the banding areas during the following months that less than 2 per cent of the banded birds were lost to predators such as Southern Skuas *(Stercorarius skua lonnbergi)*, Giant Petrels (*Macronectes* spp.), storms and other causes. By considering all the inaccessible birds and those on Broughton Island, it is estimated that 1000 to 1200 fledglings left the islands.

In the 1972-73 season, the first adult was observed on a nest on 9 December on the South Coast. The first egg of the 1971-72 season was noted on 5 January at Mollymawk Bay, and it hatched on 11 March. The first egg of the 1972-73 season was found on 31 December in the same colony.

SALVIN'S MOLLYMAWK *(Diomedea cauta salvini)*

Mollymawks larger and differently marked from the Buller's were fishing off Breaks-in-Swell in late October. These birds were identified on 4 November as Salvin's Mollymawks by a close-up sighting from a dinghy on a trip to Broughton Island. Regular sightings were then made at Breaks-in-Swell until early December. Fleming & Baker (1973) estimated more than 1000 pairs of these birds were on three islets of the Western Chain on 2 December 1972.

SOUTHERN GIANT PETREL *(Macronectes g. giganteus)* and NORTHERN GIANT PETREL *(M. g. halli)*

Most of the Giant Petrels that we saw during the expedition were *M. g. halli.* Two different white birds of *M. g. giganteus* made short visits. An almost entirely white one cruised the area between Signpost Hill and the north side of the Southwest Promontory for at least six days in May. The second white bird, which had some dark feathers on the body and neck, fed on a dead penguin in September at Station Cove.

Macronectes numbers fluctuated throughout the year, although a few were always present. The highest numbers were seen in January 1971, 1972 and 1973 when flocks of 100-125 were in the Ho Ho Bay-Station Cove area. This was during the time that the penguin chicks departed. Numbers dropped in February, but 40-50 appeared in early May when the young *Puffinus griseus* flew. The population stayed near this level throughout the winter but dropped to about 10 after the Buller's Mollymawk chicks left in September.

Giant Petrels frequently were found in mollymawk colonies, even in those colonies well into the forest. They were often interrupted while eating freshly killed chicks, but none was ever seen making a kill. Wounds on surviving attacked chicks indicated that a blow on the head from the *Macronectes* bill may be the usual method of attack. Several small Buller's Mollymawk colonies lost every chick to Giant Petrels and Southern Skuas.

Warham (1967) found no signs of Giant Petrels breeding on the main island though he stated "They could have done so on Broughton Island." We spent 4 and 20 November exploring Broughton Island and saw no Giant Petrel nests. We believe that they do not nest at the Snares Islands.

FIGURE 2 — Northern Giant Petrel *(Macronectes giganteus halli)* accepting fish from D. S. Horning, Boat Harbour, Snares Islands, 6 October 1972.

Photo: Carol J. Horning

The Giant Petrels normally were very shy but one bird showed some unusual behaviour on 6 October. A female *M. g. halli* (det. Dr J. Warham from a colour slide) swam to the boat landing while fish were being cleaned. It came out onto the rocks and sat down at the feet of DSH and began to eat the fillets (Fig. 2). It accepted several bits of fish from our hands and stayed with us about 15 minutes until all the fish were cleaned. The bird then re-entered the water and was harassed for several minutes by three or four young sea lions porpoising around it in the confined area. It then swam out of Boat Harbour with another Giant Petrel. At no time did this bird show fear of us.

SNARES CAPE PIGEON *(Daption capensis australis)*

Hundreds of these petrels were seen during the expedition. Their numbers did not fluctuate noticeably throughout the year, which may indicate that there is no winter exodus. From a dinghy in August, many birds were seen flying and resting on the cliffs at North Promontory and North Daption Rock where they are known to nest (G. J. Wilson pers. comm.). They were frequently seen at the mouth of Boat Harbour, in Ho Ho Bay, and at Breaks-in-Swell, which is a favourite year-round feeding area for these birds.

MOTTLED PETREL *(Pterodroma inexpectata)*

No birds were heard calling as they flew overhead at night after mid-April, but some continued to come ashore to feed their young. The last chick was seen on 8 June near the Biological Station. The characteristic " ti, ti, ti " call was first heard again on 24 October, and one burrow was found cleaned out a few days later. A bird on an egg was seen on 7 December in an open nest partially covered with *Asplenium obtusatum* and *Poa astonii* on a rock face at the upper supralittoral zone.

BROAD-BILLED PRION *(Pachyptila v. vittata)*

Warham (1967) stated that live birds had not been seen at the Snares Islands, though skeletal remains had been found. On 2 February 1971, three live birds were found by G. J. Wilson in a southeast-facing rock crevice on Rocky Islet. On 9 March 1972, at least three live birds were seen at the same place. Several fresh skulls, bones, and many feathers were found as castings in Skua middens on the Southwest Promontory Razorback on 3 August. One Skua casting containing an almost entire skeleton of this prion was found on the south side of Station Cove on 29 September. One dead fledgling or adult was found in a *Hebe elliptica* bush in front of a rock crevice about 40 m above mean sea level (MSL) on the southeast side of the Razorback. One dead 2-5 day old chick, possibly of this species, was found nearby.

Prions, probably both Fairy *(Pachyptila turtur)* and Broad-billed, were seen flying near and over the main island during most

months. It is most probable that some birds of these two species stay in the Snares Islands area throughout the year.

SOOTY SHEARWATER *(Puffinus griseus)*

No adults were heard calling or seen flying after 27 April and the last known adult was seen on 17 May when a banded bird, Z-5461, was found. The last chick was seen at the summit of Signpost Hill on the morning of 29 May. About 50 birds were flying over the island during the evening of 11 September. But several burrows freshly cleaned out by these shearwaters were seen on the West Coast on 8 September. Judging by the quantity of birds arriving each evening, nearly all of them had arrived by the end of the first week in October.

Many small *Poa tennantiana* plants in the forest were chewed down to their bases by these birds after their arrival. We observed that they cut the leaves and took them into their burrows. Grass clippings were seen in more than a dozen burrows and clipped *Poa* clumps were found in the forest all over the main island. This is another animal influence, besides trampling and burrowing, that may explain the paucity of herbs and grasses within the *Olearia* forest at Snares Islands.

SOUTHERN DIVING PETREL *(Pelecanoides urinatrix chathamensis)*

The last bird that we saw of the 1971-1972 season was seen during the night of 23 April. Hundreds of birds were flying around Breaks-in-Swell on 25 August. Freshly excavated burrows were first noticed on 27 August in the open *Olearia* forest near the southeast margin of Sinkhole Flat. Their calls were heard the next evening, and the first bird was seen ashore on 1 September. A few days later several groups of birds were calling around the Biological Station and continued to do so for several weeks.

AUSTRALIAN GANNET *(Sula bassana serrator)*

One bird was observed for more than ten minutes on 8 December while it was flying around Breaks-in-Swell. It was feeding amongst rafts of other seabirds including the Salvin's Mollymawk. It glided just above the sea surface and made five dives, the highest one was from about 15 m. It was once within 10-15 m of the east end of Seal Point. It then flew east and finally disappeared. The wind on 7 December was ENE force 6 (Beaufort scale), NNW at the time of observation, and force 6 NW the following day. This is a new Snares Islands record.

PIED SHAG *(Phalacrocorax v. varius)*

Shags were seen many times throughout the expedition. Two birds spent much of the winter perched together on an up-ended *Senecio stewartiae* tree at the south side of Boat Harbour. A third

one was often seen in the Ho Ho Bay area. Other birds were noted off Broughton Island and along the east side of the South Promontory in November.

One shag frequently was found standing amongst the penguins at their landing area on the south side of Boat Harbour. It stayed with the penguins until they left in May and was found amongst them again soon after the penguins came back in late August.

There may have been a breeding pair of Pied Shags present during the expedition but no nests were found.

WHITE-FACED HERON *(Ardea novaehollandiae)*

The first Snares Islands sighting of this species was of one bird flying north over Seal Point about 14 February. Most additional sightings were made at the penguin landing rocks on the south side of Boat Harbour, but birds were seen at Ho Ho Bay and north to Seal Point. Two birds were twice seen flying together. These birds were not seen after 22 March. On 27 October, a dead adult female was found at the forest edge on the penguin landing rocks on the south side of Boat Harbour. This was preserved as a voucher specimen, and is deposited in the National Museum (DM-17264).

WHITE HERON *(Egretta alba modesta)*

One bird was seen on 24 April sitting on the penguin landing rocks at the south side of Boat Harbour, conspicuous because it was taller than the nearby penguins. Shortly after the bird was sighted, it flew north over Seal Point and disappeared. While in flight its general body colour, long black trailing legs, and the double crook in its neck made its identification positive, despite the heavy rain and easterly wind. This is a new Snares Islands record.

MALLARD *(Anas platyrhynchos)* and GREY DUCK *(A. superciliosa)*

Most of the birds seemed to be Grey Ducks but two male Mallards were seen once on 26 April.

There were 30-40 birds at Snares during some of the year. When we first arrived, a female and six ducklings were swimming in Boat Harbour. Red-billed Gulls *(Larus novaehollandiae scopulinus)* were observed diving at the ducklings and they disappeared within a week.

Ducks were often flushed from marshy clearings. In July, 11 flew from a marsh above Sinkhole Flat. One female with 11 ducklings was found walking in the forest near a small stream southwest of Sinkhole Flat on 19 December 1972. Eight ducks and about 25 ducklings were seen on 27 December 1972 in Muttonbird Creek Valley.

During the winter large patches of *Callitriche antarctica* (starwort) were eaten by ducks. One was once seen feeding on a marine green alga (*Ulva* sp.) at the edge of Boat Harbour at low tide.

AUSTRALASIAN HARRIER *(Circus approximans gouldi)*

A single harrier flew up and down Penguin Creek Valley on 28 September. The next day it was flushed from the clearing east of Penguin Rookery 3. This bird spent several hours a day cruising over open areas in view of the Biological Station. The last sighting was on 4 October.

EASTERN BAR-TAILED GODWIT *(Limosa lapponica baueri)*

On 28 October one specimen was seen in an inland 12 x 40 m grassy-swampy clearing. The next sighting was 5 November at the edge of the *Olearia lyallii* forest near the Biological Station. About 20 more sightings of this bird were made on the north and south sides of Boat Harbour. The last sighting was on 13 January 1973.

The Godwit was most often seen feeding amongst *Callitriche antarctica* mats in small drainages at the edge of the *Hebe elliptica* zone at Station Cove. It also fed in the eulittoral zone abive *Durvillea antarctica,* wading in shallow pools in the upper eulittoral, and on the supralittoral rock zone. It was also seen in the *Olearia* forest probing bare peat and cracks in rotten logs, feeding in a similar habitat and manner to that of the Snares Islands Snipe. This is a new Snares Islands record.

SNARES ISLAND SNIPE *(Coenocorypha aucklandica huegeli)*

In daylight, snipe were most audibly active during light rains and just after heavy ones. But they generally were more active at night. The last known chick (newly hatched) of the 1972 season was found on 4 May following its parent amongst the *Poa tennantiana* tussocks near Signpost Hill.

A forthcoming paper on the Snares Island Snipe by Dr Warham will include our sightings of the colour banded birds.

SOUTHERN SKUA *(Stercorarius skua lonnbergi)*

These birds were present throughout the year. It was expected that they would depart during the winter months because they are known to leave other southern islands then. Although there was a drop in numbers after the departure of the Sooty Shearwater chicks in May, about half the summer population of nearly 100 birds remained around the islands. The numbers increased again in early September when Diving Petrels were once again abundant.

Skuas frequently were found in the forest interior. Some had middens on hilltops under the *Olearia.* They seldom flew in the dense forest, but if flushed, they managed to get aloft after breaking through the canopy. One pair may have had a nest in the forest near the West Coast, because the area was strongly defended by up to six birds.

Mollymawk chicks apparently were killed by skuas. No skua was seen making a kill, but they were often in the mollymawk colonies

with Giant Petrels. It is possible that the petrels killed the larger chicks and the skuas only ate their leavings. However, it seems highly likely that small mollymawk chicks were killed by skuas because Giant Petrels were not seen in the colonies before June.

The earliest skua egg was found on 3 October but most nests did not have two eggs until early November. There were at least 30 nesting pairs of skuas on Main and Broughton Islands.

Nest areas were defended vigorously not only by the nesting pair, but also by other skuas. Attacks on us were usually made from behind. Apparently a bird would drop its feet to deliver a blow on the backs of our heads. Most attacks consisted of repeated attacks by two to eight birds. This made tussock country travel more than usually uncomfortable during the nesting season, especially when we were hit by banded birds.

SKYLARK *(Alauda a. arvensis)*

Three birds were seen on 14 February by H. A. Best flying high above an inland grassy clearing north of Penguin Creek. On 14 April, three birds were seen by DSH over a grassy clearing as they were flying south high over the forest. This is a new Snares Islands record.

GREY WARBLER *(Gerygone igata)*

One bird was sighted on 9 July at the Biological Station. Other sightings revealed several birds, probably fewer than 15, in the same area. They were also seen and heard regularly in the Muttonbird Creek Valley, Ho Ho Bay area, and on Skua Point. No birds were seen or heard after the first week in October, indicating that they did not become established. This is a new Snares Islands record.

They were seen feeding mainly at the branch tips of *Hebe elliptica.* Their food was primarily several species of flies (midges, scavenger flies and blowflies), but they were also feeding on aphids, small beetles and parasitic wasps.

SOUTH ISLAND FANTAIL *(Rhipidura f. fuliginosa)*

One pied phase bird was seen near the mouth of Muttonbird Creek (CJH) on 24 March. This bird was carefully compared with the descriptions of fantails given by Falla, Sibson & Turbott (1970). Regular sightings of at least every 15 days were made until 7 September, after which it was not seen. Favoured areas for the bird were in the *Olearia* forest in Muttonbird Creek Valley, in the *Olearia* and *Senecio stewartiae* near the margin of Ho Ho Bay, and nearly half way up Penguin Creek Valley. Sightings were also made at Comma Bay and along the South Coast on the west side of the island. Food seemed to be principally the blowfly, *Calliphora huttoni,* and other flying insects, hawked amongst the trees in a manner similar to that of the

Black Tit *(Petroica macrocephala dannefaerdi)*. Several times Black Tits were seen chasing the Fantail out of their territories. This is a new Snares Islands record.

SILVEREYE *(Zosterops lateralis)*

These birds are common (Warham 1967) and were seen in large numbers throughout the year. One pair was seen gathering nest material (mop strings) in late September. No nests were found until 30 November, when two were discovered in *Hebe elliptica* on Skua Point. The accessible nest contained three chicks, which flew on 4 and 5 December. The second nest was in an impenetrable thicket and could not be examined. Chicks were seen being fed in *Olearia* trees in early November.

The principal foods of the flocks seen in the winter were aphids, psyllids, and small flies found on the terminal buds of *Hebe* and *Senecio,* and amongst the leaves of *Olearia.* They frequently were seen drinking sweet sap from a crack in a dying *Olearia* on Station Point. The chicks were also fed larger flies and small moth larvae.

BLACKBIRD *(Turdus merula)*

The usually very shy blackbirds were common throughout the year in all forested areas of the main island. They were seen feeding on insects on the peat and often picked blowfly maggots from bird carcasses (they never ate the carcass itself).

These carcasses were a good source of insects for all of the insectivorous birds. Three ten-day dead Sooty Shearwaters were completely dissected and all of the blowfly *(Calliphora huttoni)* larvae were extracted. There were 5080, 6112, and 9685 last instar maggots respectively in the three birds.

CHAFFINCH *(Fringilla coelebs gengleri)*

These birds were not as common as the other finches. The first male was seen on 12 August, following a day of northerly winds. Females may have been at Snares earlier, but they were not definitely identified until after the arrival of this male.

The largest flock, two males and four females, was around the Biological Station during September, and a female appeared in the Ho Ho Bay area several times during this month. A single male was singing near the mouth of Muttonbird Creek on 12 December. We found no evidence that these birds breed at the Snares Islands.

GREENFINCH *(Carduelis chloris)*

Individuals and small flocks were seen for about a week at a time during April, October, November, and December. They seemed to appear and disappear with storms and they are not permanent residents.

GOLDFINCH *(Carduelis carduelis britannica)*

These birds apparently were brought to the Snares by northerly gales. The first two were seen on 12 April. One of them was found dead within an hour of the first sighting and the other one was not seen after that day. On 25 April a flock of five was found. Later in the day a dead bird was discovered at the weather station clearing. A single bird spent several days in May pecking at *Poa annua* seeds around the huts. No more birds were seen until October, when there were apparently separate arrivals of one, three, and about 15. Several Goldfinches flew across Broughton Island when we were there on 4 November. One was seen with the newly arrived Greenfinches on 5 December and several appeared on 11 January after a day of NE and NW gales. They do not nest at Snares at present.

REDPOLL *(Acanthis flammea)*

These finches were numerous around the Biological Station and Boat Harbour areas but they were not seen or heard anywhere else on the islands. They most commonly fed on the seeds of *Poa annua* but they also fed on small insects, such as aphids, from the foliage of *Hebe elliptica.*

HOUSE SPARROW *(Passer domesticus)*

Warham (1967) noted two males and one female near the Biological Station. He stated " it will be interesting to see how the birds fare now that the castaway hut has been recovered and offers no nesting sites." Two males were seen by H. A. Best in January 1972. However, no others were seen and there is no evidence that they presently breed at the Snares Islands.

DISCUSSION

Warham & Keeley (1969) suggested that the origin of the Snares Islands finches is Australia. They believed that the Snares Islands are in the right direction to assist dispersal from Tasmania and Southern Australia during gale-force westerlies. They supported their hypothesis by an increase in the variety of European passerines, the Australian Tree Martin, and wading birds of probable Australian origin during the 1968-69 summer.

We believe that many stragglers sighted at Snares may have come from New Zealand. We noted that finches often arrived after a gale-force northwesterly if the wind backed easterly. Finches also arrived during northerly or northeasterly winds. The arrival of finches is soon noted at Snares because there is a large *Poa annua* sward at the Biological Station, where they feed on the seeds of this grass. The finches generally do not remain more than a few days at Snares. Several were found dead within hours of their arrival. The Grey Warbler and the South Island Fantail undoubtedly came from New Zealand.

Warham & Keeley (1969) stated that of 45 species of birds present, 23 species were believed to breed at the Snares Islands.

The seven newly recorded birds, Australian Gannet, White-faced Heron, White Heron, Eastern Bar-tailed Godwit, Skylark, Grey Warbler and South Island Fantail have not been observed to nest at Snares. We found 21 species currently breeding on the islands, not including the Mallard Duck whose breeding status is unknown. The newly reported Fulmar Prion *(Pachyptila crassirostris)* (Fleming & Baker 1973) nests on the Western Chain. Hence there are 22 breeding species, and 53 bird species have been recorded at the Snares Islands.

ACKNOWLEDGEMENTS

The expedition was supported by the Nuffield Foundation and the University Grants Committee, supplemented by University of Canterbury Department of Zoology funds. We are most grateful to the Timaru Milling Co. Ltd. and Mr R. O. Hooker, T. J. Edmonds, Ltd. for their support. We thank Mr Barry Davies and Mr A. J. Black who provided transportation to and from the Snares Islands. Professor G. A. Knox and Drs R. S. Bigelow and J. Warham, University of Canterbury, and Mr C. J. R. Robertson, Wildlife Service, Department of Internal Affairs, kindly reviewed the manuscript.

LITERATURE CITED

FALLA, R. A.; SIBSON, R. B.; TURBOTT, E. G. 1970. A field guide to the birds of New Zealand and outlying islands. 2nd ed. 256 pp. London: Collins.

FLEMING, C. A.; BAKER, A. N. 1973. The Snares Western Chain. Notornis 20 (1): 37-45.

OSNZ 1970. Annotated checklist of the birds of New Zealand. (The Checklist Committee, F. C. Kinsky, Convener), Ornithological Society of N.Z., Inc. 96 pp. Wellington: A. H. & A. W. Reed.

WARHAM, J. 1967. Snares Islands birds. Notornis 14 (3): 122-139.

WARHAM, J.; KEELEY, B. R. 1969. New and rare birds at Snares Islands during 1968-69. Notornis 11 (4): 221-224.

Dr Donald S. Horning, Jr.
Mrs Carol J. Horning
Department of Zoology
University of Canterbury
Christchurch, New Zealand.

HABITAT SELECTION AND FEEDING PATTERNS OF BROWN TEAL (Anas castanea chlorotis) ON GREAT BARRIER ISLAND*

By MILTON W. WELLER
Iowa State University

A study of habitat selection and feeding behaviour of Brown Teal *(Anas castanea chlorotis)* was conducted on Great Barrier Island from 7 to 14 February 1973. In the Port Fitzroy area, teal fed almost exclusively in the tidal estuaries. Feeding was tide-regulated, and foods seemed to be invertebrates selected on a declining tide. During high tide, teal usually roosted in the shade of trees.

At several sites on the eastern part of the island, teal fed in slow-moving freshwater streams or brackish lagoons. In addition to dabbling and upending, teal dived regularly and efficiently. By a creek at Whangapoua Beach, most of 112 teal fed in the uplands either by probing in grass or by grabbing insect larvae from forbs. Teal also fed in the uplands at night.

Brown Teal are very adaptable in feeding sites and fill the niche of both aquatic dabbler and ground-feeder. They are most abundant in estuarine situations, and the survival of the species depends upon protection of suitable habitats. Intensive human use of estuaries on the mainland probably is responsible for the drastic decline of the species.

INTRODUCTION

The New Zealand Brown Teal *(Anas castanea chlorotis)* is among the rarer waterfowl of the world (Williams 1964; International Council for Bird Protection 1971). Once widespread in a variety of " swampy streams and ponds and tidal creeks shaded by trees " (Falla, Sibson & Turbott 1967), the major remaining population is on Great Barrier. Lesser numbers also occur on Little Barrier Island near Auckland, in estuaries on the Coromandel Peninsula and throughout Northland, Stewart Island, and the Invercargill district (McKenzie 1971; 1972).

Remarkably little seems to have been published on the species in recent times, but its restricted status is well recognized. Bell & Brathwaite (1964) conducted the most extensive survey on Great Barrier Island, and provided a summary of the general habits of the species there. A rearing programme has been conducted by the New Zealand Wildlife Service at the Mt Bruce Game Farm, and birds have been successfully introduced on Kapiti Island near Wellington.

* Journal Paper No. J-7682 of the Iowa Agriculture and Home Economics Experiment Station, Ames. Project No. 1969.

During the post-nesting period in February of 1973, I studied the feeding behaviour and food selection of Brown Teal. Because collection of birds was inadvisable, I concentrated on habitat use and patterns of feeding. The major objective was to describe the species' niche with the intent of finding ecological patterns that might aid in conserving the species. Field work was sponsored by National Science Foundation Grant GV 21491.

STUDY AREA AND METHODS

Although I spent about 4 days in search of Brown Teal in the Oban area (Half Moon Bay) on Stewart Island, I saw no birds there. Roy H. Traill, a resident naturalist who knows the bird well, had seen only one pair several years earlier, and had no recent reports. Although McKenzie (1972) noted Brown Teal at Lake George near Riverton, I found none there in late January.

Brown Teal were studied on Great Barrier Island where they are common, reasonably tame and appreciated and protected by the residents. I spent 8 days in the Port Fitzroy area, but also visited several other estuaries and beaches on the east side of the island.

Procedures involved recording of numbers, activities and distribution of Brown Teal in each habitat utilized. When possible, feeding sites were examined to determine availability of potential food items. When tide-related feeding became obvious, intensity of use was related to tide by periodic censuses and qualitative description of tide levels.

HABITAT

The northern part of Great Barrier Island is abrupt on the western side, but has extensive flatlands on the east. The Port Fitzroy area is dominated by woodland and scrub with small clearings near the settlement (Fig. 1). The only level areas are tidal flats of estuaries (Fig. 2) well inside the narrow bays. Three of four estuaries which held teal in the Port Fitzroy area (Table 1) were formed by small streams only 6 to 10 ft. wide and a few inches to a foot deep. All were rapidly moving streams with a high rate of fall until reaching a short flood plain above tidal level. Bottom substrates of the tidal bays graded from silt and sand to gravel of ½″ to 2″ diameter to rocks of 6″ to 10″ (Fig. 2).

On the east side of the island, streams also were responsible for the three major habitats seen, but they differed in that extensive sand beaches and pounding surf had formed barrier beaches of various degrees, creating either partly or fully closed lagoons. The result of this sand barrier at Whangapoua Beach was a slow-moving, pond-like stream edged with emergent sedges and grasses. This stream was undoubtedly enriched by cattle and sheep manure, and had pools deepened by cattle trampling.

TABLE 1

NUMBERS OF BROWN TEAL SEEN ON GREAT BARRIER ISLAND, February 7-14, 1973

Location	Water Type	Max. No.	Date
Port Fitzroy Settlement	Estuary & tidal flat	29	7-14 Feb 1973
Port Fitzroy Forestry Camp	Estuary & tidal flat	5	7&13 Feb 1973
Karaka Bay	Estuary & tidal flat	10	8 Feb 1973
Whangapoua Beach	Freshwater stream	112	9 Feb 1973
Kaitoke Beach	North stream	39	10 Feb 1973
	South stream	3	10 Feb 1973
Harataonga Bay	Brackish ponds	46	10 Feb 1973
TOTAL TEAL OBSERVED		244	

FIGURE 1 — View of Port Fitzroy. Trees along shore provide roosting sites during the day. Teal moved to roost or into grassy uplands at night.

At Harataonga Bay, a barrier beach had walled off an oxbow pond complex at the terminus of a sizable stream. This water is brackish, however, because of infiltration of sea water at high tide; emergent sedges and grasses survive mostly along the edge of the stream. Two large, slow-moving streams at Kaitoke Beach also are influenced by a barrier beach and perhaps by tide levels. The northern stream has extensive silt-sand shores, which were favoured feeding sites by Brown Teal.

FIGURE 2 — Brown Teal feeding or loafing on tidal flat at the head of Port Fitzroy.

FEEDING BEHAVIOUR

Marine situations:

In three tidal flats where streams emptied into the sea, Brown Teal fed exclusively by dabbling in very shallow water. Many walked along the water's edge and dabbled with neck outstretched on silt flats, or in silt between rocks (Fig. 3). Others swam in shallow water dabbling with the bill or entire head under water. Occasionally, teal walked and dabbled in the stream where it spread over gravel at low tide. It was obvious that small food items were taken, but no plant material was evident. Invertebrates present were hermit crabs, clams, amphipods, isopods and caddis-like larvae in cases.

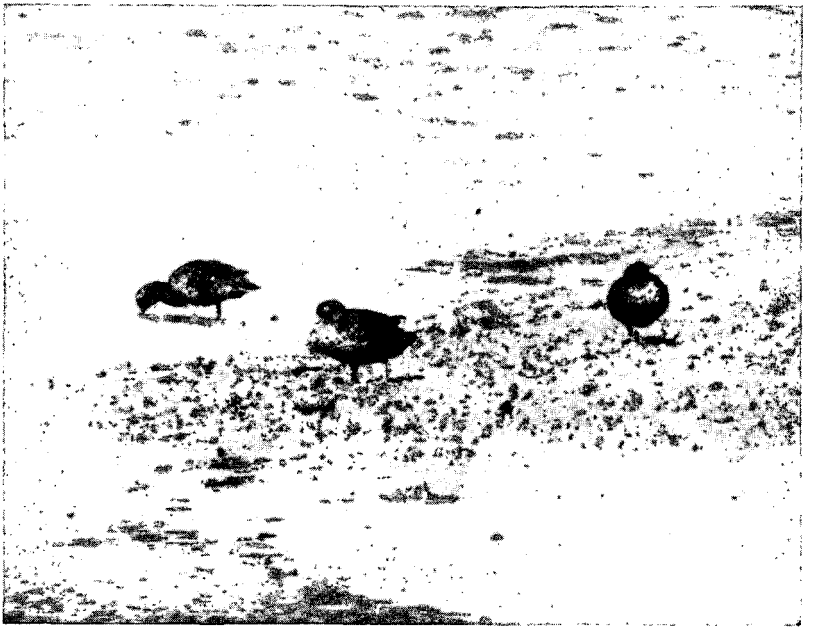


FIGURE 3 — Typical feeding and loafing postures in Port Fitzroy.

The Port Fitzroy population consistently numbered 23 to 29 birds during observations from 7 to 14 Feb 1973. Feeding seemed tide-regulated but during my period of study, tidal regimes changed little; low tides occurred shortly before sunrise and just before sunset. A general relationship is evident between numbers of ducks present and low tide levels (Fig. 4), but the relative nature of the tide measurements preclude statistical correlations.

During daylight high tides, Brown Teal were rarely visible on the usual feeding areas (Figs 5 & 6). Departure from the area both in morning (Fig. 5) and in evening (Fig. 6) usually occurred after the tide started to rise. As the tide declined about 1/5 to 1/4 in early afternoon, birds moved toward the feeding areas (Fig. 6) by swimming from sheltered shorelines. On some days, teal flew from some distance out in the bay and landed near the feeding sites, swimming the remainder of the way. By the time the tide level was 1/3 down, the entire population had moved to the feeding area (Fig. 6). Also by this time, a few birds already were loafing at the water's edge. The percentage of the population that loafed remained fairly constant, however, suggesting that this pattern resulted from alternate feeding and resting periods.

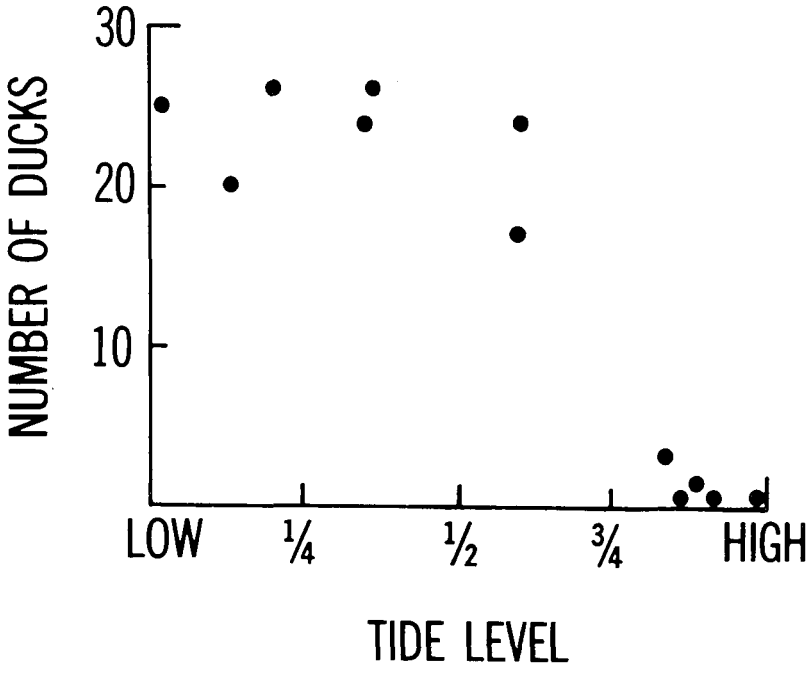


FIGURE 4 — Relationship between numbers of birds on the Port Fitzroy tidal flat and the general tide level, 11 February 1973.

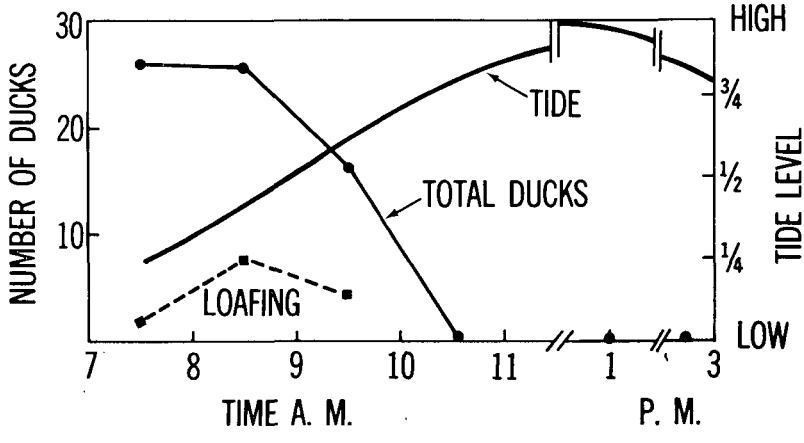


FIGURE 5 — A comparison of numbers of ducks loafing of the total observed as related to tidal levels early in the day, Port Fitzroy, 11 February 1973. All nonloafing birds were actively feeding.

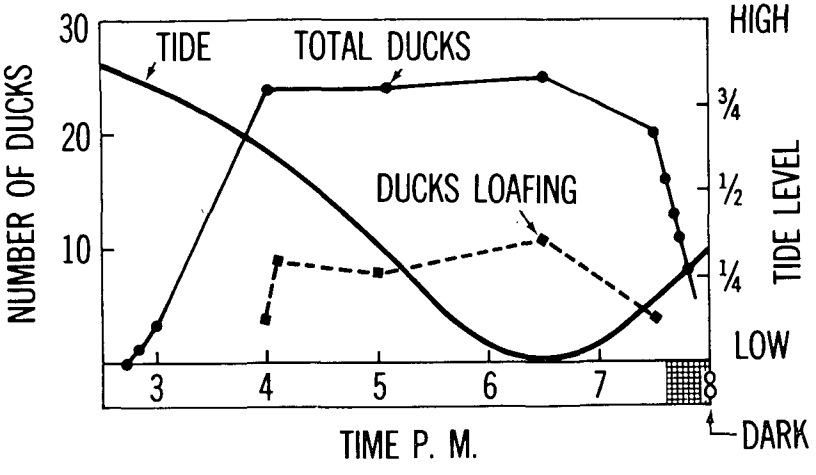


FIGURE 6 — A comparison of numbers of ducks loafing to the total observed as related to tidal level and sunset, Port Fitzroy.

Teal obviously moved to the feeding flats as the tide declined less than 1/4 (Fig. 6), whereas they left the area in the morning when the tide had risen to 1/3 to 1/2 of full (Fig. 5). Presumably, the need for food or the availability of food organisms prompted a move earlier on a falling tide, whereas teal left more casually after feeding during the morning low tide.

Freshwater and brackish ponds and lagoons:

In deeper, slow moving or stationary water, Brown Teal fed by skilful dives, by upending, or by dabbling in emergent grasses and sedges along the edge of ponds or streams. In only one instance was depth of diving established as about 2 ft by the presence of cattle standing in the stream pool. Invertebrate organisms seen in freshwater or brackish areas were: fairy shrimp, snails, isopods, water boatman and fish.

Terrestrial feeding:

It is well known that teal come on shore at night to feed (Falla, Sibson & Turbott 1967), but nothing is known of their foods. After their evening feeding at marine sites, teal moved toward, but did not all remain at their usual daytime roosting sites. Instead, some moved upland into grassy fields. I was unable to study their behaviour at such times because they usually were disturbed by a flashlight, but some individuals did probe in the grass. At least three residents reported that Brown Teal frequently were encountered in the grass outdoors at night. Two persons reported that teal came to gardens regularly, and one thought they fed on snails there.

Less well known is that Brown Teal also may feed in the uplands during full sunlight. At the Mabey Farm at Whangapoua Beach, most of the 112 Brown Teal seen initially were loafing on shore or in the stream pool under the shade of a large tree. Some of these ducks moved out in the stream to dabble and dive. Eventually, small groups of 5 to 20 birds moved upland in mid-afternoon and probed vigorously in the grass (Fig. 7). I was unable to find anything but flies and small butterflies in the grass, but teal fed in this fashion for over ½ hour, making it clear that suitable food was present. One flock of 20 was feeding with two domestic chickens on the lawn of the Mabey home while people walked within 30 yards of them.

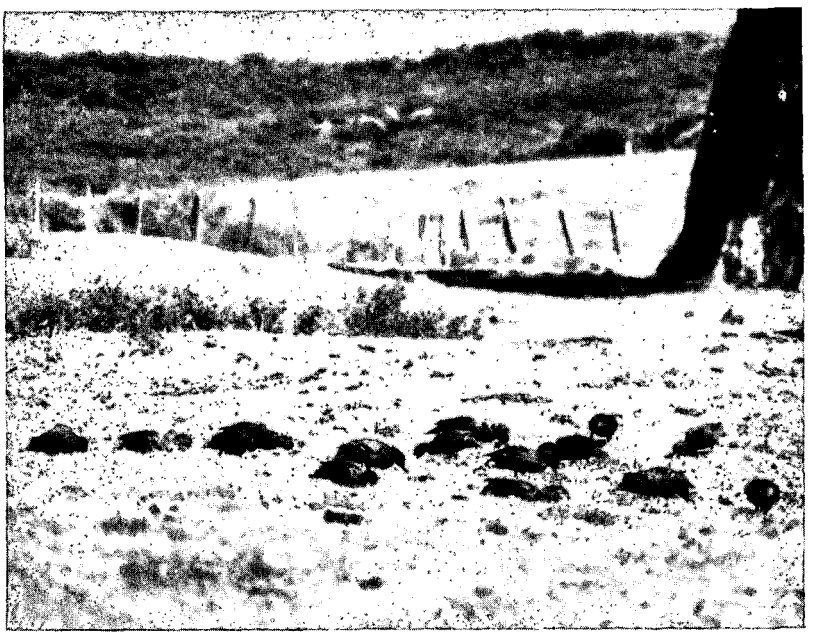


FIGURE 7 — Flock of Brown Teal feeding in grass during mid-afternoon. F. Mabey Farm, Whangapoua Beach, 9 February, 1973.

At least seven other Brown Teal fed by examining the tops of legumes 15″ to 24″ tall (Fig. 8). The teal occasionally jumped up with outstretched neck to grab at the tops of these plants. Examination of some of these plants showed unidentified caterpillars about ¾″ to 1″ long.

FIGURE 8 — Two teal search for insect larva on legumes. F. Mabey Farm, Whangapoua Beach, 9 February 1973.

Collection of actively feeding birds would be essential to document the implied food utilization noted here. I saw no evidence of use of aquatic plants, but Brown Teal show great adaptability to aquatic and terrestrial invertebrates. In this way, Brown Teal, not only fill the usual niche of dabbling ducks, but also fill the ground-feeding niche normally filled by quail or pheasants.

ROOSTING BEHAVIOUR

Light-controlled rhythmicity of roosting movements by ducks is well known in several North American species (Hein & Haugen 1966). Brown Teal feeding on tidal flats at Port Fitzroy moved to roost sites by swimming, or occasionally by flying, as tide levels increased either during the day or at dusk.

During the day, teal loafed on trunks of overhanging trees, often 10 or 15 ft above the water. Others sat on gravel shoals or rocks, but some teal may have been in the uplands and were not found. Most teal moved more than 50 yards from the major feeding zone at the head of Fitzroy Bay. Teal did not move up the creek, possibly because it was too shallow to swim easily. By the aggressive behaviour of birds on loafing sites toward encroaching birds, it is probable that roosting sites are defended. Moreover, two birds were prevalent and may have represented mated pairs.

About ½ to ¾ hour before darkness, ducks swam to open water and then toward favoured roosting sites along the shore. Some individuals flew several hundred yards down the bay. Figures 5 & 6 suggest that birds departed from the feeding area at lower tide levels at dusk (Fig. 6) than during daylight hours (Fig. 5), although feeding conditions were still optimal. Unfortunately, these are only suggestions because the methodology and the tidal regimes studied did not produce the most clear-cut results. Further study would be essential to clarify this point. Whether birds returned to feed at night is unknown, but some teal did move past roosting sites and into uplands where they presumably fed.

POTENTIAL PREDATORS

Brown Teal are beautifully camouflaged in the dark, reddish-brown or black rocks of tidal areas, and immobile or loafing ducks are difficult to discern. Local residents indicated that ducklings are taken by eels in freshwater situations and by Harriers *(Circus approximans)*. On only one occasion was a Harrier seen circling near flocks of Brown Teal in the uplands. There was alertness by the teal, but no panic. Earlier, some teal had flown from the uplands to the pond, and although the Harrier may have been responsible, no direct attacks or investigating swoops were seen.

HABITAT PROTECTION AND CONSERVATION OF THE SPECIES

The drastic decline of Brown Teal in New Zealand probably is a result of habitat loss as Williams (1964) suggested. Although the species seemingly used a variety of wetlands over an extensive area of New Zealand (McKenzie 1971), it is obvious that the species has adapted to estuarine habitats on both the North and South Islands. It is these areas where the species is most abundant, and industrial and residential development of such estuarine areas is prevalent in New Zealand as in the rest of the world. The resulting disturbance and pollution could affect breeding success and the suitability of feeding areas for the Brown Teal. As with several other rare New Zealand birds, offshore islands now are the major refuge of the Brown Teal, but even on the mainland, a protected few estuaries still harbour healthy populations.

The programme by the New Zealand Wildlife Service to rear and release Brown Teal should be continued. Its success will be influenced, however, by the availability of suitable habitats protected from siltation, pollution and disturbance. The population on Great Barrier undoubtedly is the largest and presently most secure. But increased sewage and agricultural development could modify the estuarine lagoons, the quantity of food resources available and breeding success of local populations. Impoundment of streams to create permanent water basins might be highly detrimental to the production

of food organisms that teal use. Both habitats and teal populations should be monitored regularly to prevent loss of this last major population of Brown Teal.

LITERATURE CITED

BELL, B. D.; BRATHWAITE, D. H. 1964. The birds of Great Barrier and Arid Islands. Notornis 10 (8): 363-383.

FALLA, R. A.; SIBSON, R. B.; TURBOTT, E. G. 1967. A field guide to the birds of New Zealand. Boston: Houghton Mifflin Co. 254 pp.

HEIN, D.; HAUGEN, A. O. 1966. Illumination and Wood Duck roosting flights. Wilson Bulletin 78 (3): 301-308.

INTERNATIONAL COMMISSION FOR BIRD PROTECTION. 1971. Red data book, Vol. 2: Aves. Morges, Switzerland: International Union for Conservation of Nature.

McKENZIE, H. R. 1971. The brown teal in the Auckland Province. Notornis 18: 280-286.

McKENZIE, [H.] R. 1972. In search of birds in New Zealand. 256 pp. Wellington: A. H. & A. W. Reed.

WILLIAMS, G. R. 1964. Extinction and the Anatidae of New Zealand. Wildfowl Trust Annual Report 15: 140-146.

Milton W. Weller,

Department of Zoology and Entomology,
Iowa State University,
Ames, IA 50010
USA

ADELIE PENGUINS AND LEOPARD SEALS: ILLUSTRATIONS OF PREDATION — HISTORY, LEGEND AND FACT

By ELLIOT W. DAWSON

ABSTRACT

The often-told story of the antics of Adelie Penguins fearful of entering water where Leopard Seals may be lurking is recounted and reinterpretations of this behaviour pattern are discussed. Few observations have been made of the methods used by the seals in capturing penguins and only one illustration of a 'near miss,' a penguin that had escaped although with some injury, seems to have been published. Birds badly injured seen at Cape Adare in 1965 are illustrated and discussed in relation to the particular conditions at this site, the history and geographical setting of which is outlined. Accounts of predation by Leopard Seals, as given in the literature, are detailed and commented upon in the light of the casual observations at Cape Adare and of recent field work in the U.S. Antarctic Research Programme. Observations of such predation are shown to have been by good fortune rather than by deliberate intent. Physical conditions of ice, tides and local geography, as well as the numerical abundance of seals and the proximity of their breeding and foraging areas to the penguin rookeries are important but may vary in significance. The effect of Leopard Seal predation on the overall mortality of populations of both young and adult penguins is considered negligible in relation to the numerical size of their rookeries.

INTRODUCTION

The Leopard Seal is well known as an enemy of the Adelie Penguin. Many people who have seen neither animal in the wild have read the often quoted story describing the behaviour of Adelie Penguins about to enter the water from an ice floe but suspicious of the presence of a lurking Leopard Seal. It has been repeated in various forms many times in popular accounts of penguins. For example, *Purnell's Encyclopedia of Animal Life,* edited by Maurice Burton, tells it to the general reader —

> " There is a story of Adelie penguins which seems to credit them not only with a high level of intelligence but with a selfishness that is rivalled only by the most callous of humans. The story as usually told is that the penguins will go to the edge of the ice, line up along it and then push one of their number into the water. If that one comes to the surface again all go in, because they know there are no leopard seals about. If the unfortunate one that has been ducked does not surface, they know a leopard seal has eaten it and all turn round and walk away, postponing their fishing until later.

NOTORNIS 21: 36-69 (1974)

" On the face of it this seems too extraordinary a story to swallow, and yet it has been reported again and again even by serious zoologists. It seems the story was brought back by the early Antarctic explorers and particularly by Ponting, the photographer on Scott's expedition to the Antarctic, who lectured widely on his return."

[Burton 1968. 16-17]

Similarly, Sparks & Soper (1968: 122-123), in their popular book *Penguins,* recount how — " It was a source of constant amusement to the early chroniclers of penguins to watch them line up on the shores near their rookeries waiting to enter the water. As more penguins jostled at the back of the group, one placed at the front would ultimately overbalance and dive into the sea below, its progress being keenly followed by all those left ashore. If all was well, they would quickly follow." The authors embellished their remarks with Robert Gillmor's sketches of a Gentoo leaping on to an ice floe ahead of a Leopard Seal (p. 116) and of a seal catching a Chinstrap Penguin (p. 123). Yet another version, that given in the magazine *Birds of the World,* edited by John Gooders, is:

" The only real natural danger to adult adelies is the leopard seal. These large predators lurk beside the ice floes waiting for penguins to take to the water . . . the moment of entry is fraught with danger. A group of adelies will stand on an ice flow peering into the sea jockeying for position, but trying not to be first one in. Eventually one bird slips in and the others watch intently to see his fate; if all is clear they promptly follow."

[Gooders 1969: 9]

Many other popular books of the sort such as Berrill's *Wonders of the Antarctic* (1958: 30, 35) repeat the essentials of this story. It is interesting to note that even quite recently the story of the hesitant Adelies has been given anew to a fresh audience from an " old hand " (Priestley 1962: 134).

Children's books, in particular, have developed the legend in quite a fascinating way. Allen Chaffee's *Penn, the Penguin* (1934: 11-12, fig. on p. 13) described and illustrated an attack on the adventurous little " Penn." Richard and Florence Atwater (1938) gave us a delightful comment from their " Mr Popper " —

" ' Penguins are very intelligent,' continued Mr Popper. ' Listen to this, Mamma. It says here that when they want to catch some shrimps, they all crowd over to the edge of an ice bank. Only they don't just jump in, because a sea leopard might be waiting to eat penguins. So they crowd and push until they manage to shove one penguin off to see if it's safe. I mean if he doesn't get eaten up, the rest of them know it's safe for them to jump in.'

' Dear me ! ' said Mrs Popper, in a shocked tone. ' They sound to me like pretty heathen birds.' "

[Atwater & Atwater 1962 ed.: 13]

Patricia Lauber (1958: 46; 1964: 43) gave yet another account —

> " Fear of sea leopards probably explains an odd Adelie custom. No bird wants to be first into the water. Instead, all the Adelies line up. They elbow and push one another, dodging and crowding. Finally one penguin is shoved into the water. If nothing happens, all the others dive in. If the victim is seized by a sea leopard, the others wait awhile. Then they again begin elbowing and shoving until another bird is pushed in to test the safety of the water."

And Margaret Rau (1968: 33) discussed the Leopard Seal as an enemy of the King Penguin, with appropriate illustrations (p. 34), and added her version of the story —

> " They love the ocean, but before going into it they spend a lot of time running around on the ice shelf daring one another to take the first dive. No one wants to be number one, and for a very good reason — a sea leopard may be lurking below. Finally one of the Adelies finds the courage to take the plunge, or else he is pushed in by his fellows. If no sea leopard appears, the others dive in eagerly after him."

Ross Hutchins (1969: 40), in his beautifully illustrated adventures of " Adelbert," an Adelie Penguin, said his piece also —

> " Before going into the sea they usually stood at the edge of the ice, as if afraid of the water. They tried to push each other in. They were afraid to jump in the water because hungry leopard seals, or sea leopards, were sometimes found there. After the first penguin had entered the water, the rest knew it was safe, so they all hopped off the ice and swam away."

Jane Tompkins (n.d.) devoted a whole chapter (pp. 77-84) to the encounter of " The Penguin Twins " with the ferocious sea-leopard " lurking out of sight at the edge of the ice shelf."

Finally, Richard Penney (1970), noted for his scientific work on penguins including prey/predator relationships (see Penney 1962, Penney & Lowry 1967), has written his own children's book in which the story again appears, making an interesting comparison with his own scientific conclusions on the same phenomenon (cf. Penney & Lowry 1967) and perhaps indicating a moral somewhere regarding how one relates science to the eager and retentive mind of a child —

> " Then she goes to an ice cliff. Many female penguins stand at the edge. They push and shove. Suddenly one jumps into the water. The others jump too. There is danger below the cliff. Leopard seals wait in the sea. They eat penguins when they jump in. Most of the penguins get away."
>
> [Penney 1970: 33]

Of writers of popular accounts, apart from Penney with his extensive field experience, Kooyman (1965: 59) is perhaps the only one who has provided some verification by his own eye-witness description of happenings at Cape Crozier during the 1961/62 summer.

This story, frequently attributed in its popular appeal to Herbert Ponting, pioneer photographer of the Antarctic (and of elsewhere, Arnold 1969), who lectured widely on his polar experiences, was probably first noted by Borchgrevink (1901: 228-229) who wintered at Cape Adare although he did not relate the hesitant behaviour to lurking predators but rather " just like some people before going into cold water." The story became established in the literature by Levick's (1915) classic report on penguin studies at Cape Adare made while surgeon/naturalist of the northern party of the British Antarctic (" Terra Nova ") Expedition of 1910-13 in which he has written much of penguin play and behaviour. Levick's (1914) popular book, *Antarctic Penguins,* remains a basic source of information on the habits of the Adelie Penguin, many of the original observations appearing in new forms from later writers (e.g. Barrett 1948: 41; Lauber 1958: 43-44). Although Levick made a notable career elsewhere (Anon. 1956), it is a matter of regret that he did not continue in the field of natural history. Ponting himself did not mention such behaviour in his own narrative of this expedition *The Great White South,* and, indeed, he stated that he saw a Leopard Seal on only one occasion during his time at Cape Evans (Ponting 1921: 200). Considering how much time Ponting spent photographing on ice floes, his single record illustrates how infrequently the seals may be seen even by those who have specially set out to study them, as will be shown later when discussing recent results of such projects.

Observations and interpretations by more recent workers (Penney 1962; Penney & Lowry 1967) suggest that, although some kind of " mutual stimulation " or " interstimulation " takes place amongst the assembled penguins, it is not necessarily such an anthropomorphic event as Burton, Sparks & Soper and others have led us to believe, and Penney (1962: 21) pointed out that it may not even be directly related to the presence of a would-be predator.

Stonehouse (1968: 56-60) has also reinterpreted the story, making the point — " Entering the water is far more of a business for penguins than one might expect in such highly aquatic animals," and he commented on the oft-told story in this way — " Like so many other penguin yarns, it is a good story but untrue. It invests penguins with an experimental approach to problems (and a cheerful cynicism) far beyond their mental capabilities."

He believed that the first plunge is an entirely voluntary act and part of the general play of bathing behaviour indulged in by penguins irrespective of the presence of a predator, although a general reluctance to enter the water evident especially in winter from May to early November is attributable to a fear of lurking Leopard Seals. Frequent " panics " without apparent reason (as will be familiar to those who know the behaviour of colonially-nesting terns and gulls) brought the penguins ashore in a rapid scramble, and Stonehouse found that he could bring the birds out of the water by clapping his hands in imitation of the alarm signal of flippers beating on the water. In summer, " when the leopard seals are away breeding on the pack ice,"

the birds played freely without frequent alarms and experimental clapping had no effect although any dark object in the surf was still " an effective bogey-man." These seasonal differences in appearances of the Leopard Seals, as alleged by Stonehouse, are important in relating to field studies concerned with the contribution of Leopard Seal predation to mortality rates in penguin rookeries and will be discussed later.

Levick (1914, 1915) and Murphy (1936) also described the " play " of penguins and Perry (1973) has recently given a readable summary of the different sorts of swimming behaviour based on earlier accounts. In fact, Levick's original observations on which the now classic story of the Adelies on the ice edge was developed suggested play rather than deliberate " heathen " behaviour, as the children's " Mr Popper " might have called it —

> " The reluctance shown by each individual of a party of intending bathers to be the first to enter the water may partly have been explained when, later on, we discovered that a large number of sea-leopards were gathered in the sea in the neighbourhood of the rookery to prey on the penguins . . . It seemed to me then, that all the chivvying and preliminaries which they went through before entering the water, arose mainly from a desire on the part of each penguin to get one of its neighbours to go in first in order to prove whether the coast was clear or not, though all this manoeuvring was certainly taken very lightly, and quite in the nature of a game."
>
> [Levick 1914: 83-84]

Unlike the story itself, however, reports of actual instances of such predation are not so easily found in the literature. Indeed, few accounts exist of the methods used by Leopard Seals in catching and consuming their prey. Sladen (1957; 1958: 68) was very fortunate in being able to film an attack by a Leopard Seal but only one pictorial illustration seems to have been published of one of the " near misses," a penguin which had escaped the clutches of the Leopard Seal (Kooyman 1965: photo. on p. 63).

Until recently, the best account of penguin predation by the Leopard Seal was that of Levick (1915) based on his observations at Cape Adare while a member of the Northern Party of Scott's expedition:

> " When they are hungry, the Sea-leopards swallow the penguins whole, feathers and all, but when they are well fed they skin them first. This they do by seizing the bird by the feathers and shaking it from side to side till a large portion of the skin comes away, when they drop this, take a fresh hold, and tear another piece off, and so on till, at any rate, the greater part of the skin and feathers is removed from the body.
>
> " It is evident that sometimes a penguin escapes, as occasionally we saw them making their way along the ice-foot, terribly injured, and these generally had the skin of the whole of their breasts peeled away and hanging from them like an apron, and their breast-muscles were bared and bleeding."
>
> [Levick 1915: 75-6]

Such a phenomenon I also observed at Cape Adare in 1965 while participating in the joint New Zealand - United States Ross Sea - Balleny Islands Expedition aboard the USS *Glacier*. Because I believed that such a sight would have been an everyday occurrence to biologists working in or near large penguin colonies, I desisted from writing up my notes on this quite gruesome spectacle. To my surprise, however, I found that none of the New Zealand penguin biologists of my acquaintance had seen the results of such Leopard Seal behaviour. Now, deliberate studies of the roles of Leopard Seal and Adelie Penguin in prey-predator relationships are being undertaken (Muller-Schwarze 1971, 1972; Muller-Schwarze & Muller-Schwarze 1970, 1972; NSF 1973: 44, 78; Hofman *et al* 1973), and I propose to illustrate here my own record of the Leopard Seal's " ones that got away " as seen at Cape Adare, as well as describing more fully the setting of these observations and some sidelights on the history of the locality itself. In addition, this is a timely opportunity for reviewing and commenting upon what has been published regarding Leopard Seal-penguin relationships.

CAPE ADARE AND ITS PENGUINS

Cape Adare, as Reid (1962: 98) has already rightly pointed out, " must vie with Ross Island as the most historical place in the Antarctic." It was visited for three hours early in the morning of 24 January 1895 (although Borchgrevink, in his version, gave the date at 23 January 1894) by a party from the whaler *Antarctic,* led by H. J. Bull, the men ever to set foot on the Antarctic Continent (see Bull 1896) and among whom was C. E. Borchgrevink. He returned with his own experition in 1899 in the *Southern Cross* to become the first to winter-over in the Antarctic, landing again at Cape Adare on 17 February 1899 and remaining until 28 January 1900 (see Borchgrevink 1901; Bernacchi 1901; and note on last survivor, Hugh Blackwall Evans, now in his 100th year, Anon. 1973*a:* 192-3. Edward Wilson, naturalist and surgeon of the *Discovery* and *Terra Nova* expeditions, visited Ridley Beach for six hours on 9 January 1902 (see Wilson 1907b; Wilson 1966) with a party from the *Discovery* Expedition in which was included Louis Bernacchi who knew the place well from his long stay there as meteorologist of the *Southern Cross* Expedition of 1898-1900. The relief ship *Morning,* under Lt W. Colbeck, RNR, who had also been a member of Borchgrevink's expedition, called at Cape Adare on 8 January 1903 to collect a message cylinder left by the *Discovery* party in one of the huts. Such was the means of telling of a safe arrival at each stage of an expedition in those days, a far cry from the daily " Sitrep " sent from the *Glacier* ! Later, in 1911, Scott's Northern Party, under Lt Victor Campbell, from the British Antarctic Expedition in the *Terra Nova* (see Ponting 1921: pl. CXVII, and Priestley 1962: fig. opp. p. 134), wintered at Cape Adare from 18 February 1911 to 3 January 1912 during which time Levick made his observations on the penguins. The main hut built by Borchegrevink's party is still standing and is in excellent condition

with its contents frozen but intact. His stores hut nearby is now unroofed but the walls, stoutly constructed from Norwegian pine logs in interlocking Scandinavian style, are still upright and sound. The *Terra Nova* hut, in contrast, is unroofed and almost flattened with its four walls splayed out and interior open to the weather (Fig. 1). At the time of our visit, 70 years after Borchgrevink, in January 1965, thousands of Adelie Penguins with fledging young were gathered in " creches " in and around these huts and over a mass of boxes of stores, including wine bottles, ammunition, foodstuffs, and other miscellaneous equipment left behind by both the *Southern Cross* and *Terra Nova* Expeditions, with even a mound representing the 10 tons of coal listed by Borchgrevink (1901: 252-253) which might baffle future geologists. A fortunately short-lived wind storm across the pebbly beach flat, while we sheltered in Borchgrevink's store hut, served to remind us of the harrowing experiences narrated by Borchgrevink (1901) in his account of the winter stay. Readers should contrast the view of the *Southern Cross* huts in winter (Borchgrevink 1901: 122) with my illustrations of summer conditions (Fig. 1).

FIGURE 1 — Adelie Penguin " creche " at Ridley Beach, Cape Adare, " Terra Nova " hut on left, " Southern Cross " huts on right, looking south into Robertson Bay on right, 25 January 1965.

Photo: F. O'Leary

Indeed such was the emotion and reverance generated in me, at least, in visiting this historically and physically stimulating Antarctic shrine of exploration that I must be allowed to digress and to recall Edward Wilson's own reaction which he so well described in his diary and illustrated so beautifully with his characteristic paintings which show, amongst other things, an Adelie Penguin creche alongside Borchgrevink's hut, just as we found a few weeks later in the season, together with views of the striking and long remembered profile of Cape Adare itself. His words sum up not only the emotions and impressions of a zoologist of 1902 but also those of another zoologist landing there 63 years later beholding the same sights with his own eyes but with a less facile pen and sketchbook.

" 9 JANUARY 1902

A day to be remembered, for we landed on Antarctic continent, at Cape Adare, Camp Ridley, where Bernacchi had lived so long with Borchgrevink. About 5 pm we at last rounded Cape Adare and could see past two rocks (the " Sisters ") the flat triangle of shingle on which stood the huts of the *Southern Cross* Expedition and some millions of the Adelie Penguins. Such a sight ! There were literally millions of them. They covered the plain which was nearly 200 acres in extent, and they covered the slopes of Cape Adare above the plain, to the very top, and were [over 1000] feet up from the plain. The place was the colour of anchovy paste from the excreta of the young penguins. It simply stunk like hell, and the noise was deafening. There were a series of stinking foul stagnant pools, full of green confervae, and the rest of the plain was literally covered with guano. And bang in the centre of this horrid place was the camp with its two wooden huts, and a midden heap of refuse all round and a mountain of provision boxes, dead birds, seals, dogs, sledging gear, ski, snow shoes, flags, poles and heaven only knows what else."

[Wilson 1966: 93]

In 1956, attempts were made to land on Ridley Beach from the ice breaker USS *Edisto* but without success. Austin (1957) has related the dramatic events including a helicopter rescue in high winds during two attempts to get ashore on 9 and 10 February 1956. He had to content himself finally by viewing the penguin rookery through the ship's glasses. He estimated that there were " . . . at least 75,000 and perhaps more than 100,000 breeding pairs of Adelies " (Austin 1957: 19).

The next visitors known seem to have been a party from the U.S. icebreaker *Staten Island* which called at Cape Adare in January 1959 with Sir Raymond Priestley, last surviving member of Scott's Northern Party (see Priestley 1914, 1962) aboard. Dr D. C. Thompson (1959), now of the N.Z. Meteorological Service, has given an account of this historic visit, the first recorded landing since Priestley's own last day in January 1912. From 12 January to 3 February 1961, Brian Reid, now of the Wildlife Service of the N.Z. Department of Internal Affairs, accompanied by Dr Colin Bailey, made a survey of the penguin rookery (Reid 1962), having been landed from the icebreaker *Eastwind.*

A visit may have been made to Ridley Beach in 1962 during the " Topo West " tellurometric survey of northern Victoria Land carried out from Iroquois helicopters by the United States Geological Survey between 1 and 28 November 1962 (USGS 1963). At any rate, a Tellurometer Station was established at Cape Adare in 1961/62 (see topographical map NZMS 166, Sheet SR 59-60, 13). Later visitors to Cape Adare have been the joint U.S.-N.Z. Western Ross Sea and Balleny Islands Expedition in 1965 aboard the USS *Glacier* and a tourist party in 1971, led by the biologist Marie Darby, from the cruise ship *Lindblad Explorer.* In February 1973, S. Norman and L. K. Cairns landed from the USCGC *Burton Island* and made a preliminary survey of the condition and need for restoration of the historic huts (see Anon. 1973*b*: note — this account refers to a " New Zealand magnetic survey party " landing in 1964 but this may be a confusion with the 1965 USARP/NZARP Expedition of which no mention was made by the writer). Quartermain's (1963: 12-13, fig. 1; also 1960 etc.) account of these historic huts should be referred to by those wanting details of their history.

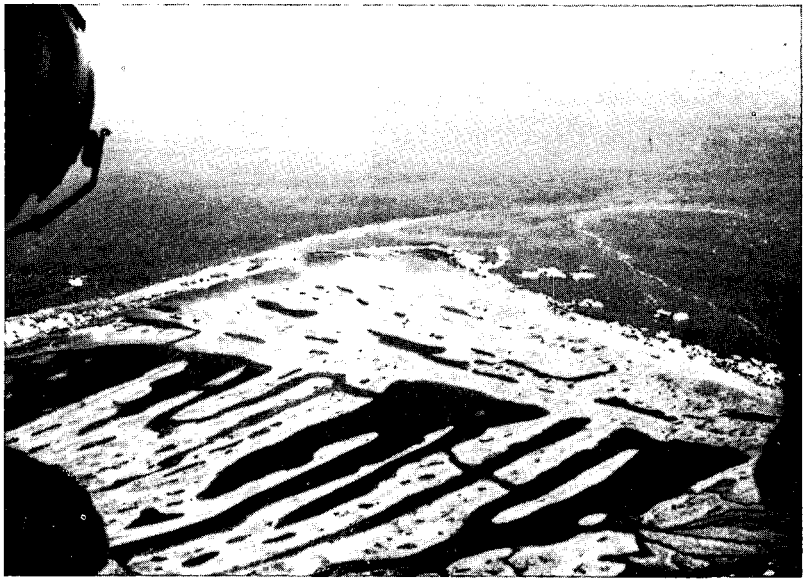


FIGURE 2 — Aerial view of Adelie Penguin rookery, Ridley Beach, Cape Adare. Historic huts lie inshore from single ice floe visible off western beach on left. The Scuba divers were off the point in the middle of the photograph and the Leopard Seal worked along the northern beach to the right of it, 26 January 1965.

Photo: E. W. Dawson

The flat area extending from Cape Adare itself to the west and forming a triangular projection of about a mile east to west and a mile and a half north to south extending into Robertson Bay (see Reid 1962: map 1, p. 99) is known as Ridley Beach originally named " Camp Ridley " from Borchegrevink's mother's maiden name. It lies, on an average, some 20 feet above sea level and consists of a stony, hummocky flat of narly 300 acres with many small ponds filled with thawing ice, mud and penguin debris and excreta during the summer and, as so well described by Wilson in 1902, Adelie Penguins cover the flat during their breeding season and provide a memorable sight especially from the air (Fig. 2).

No report has yet appeared on the ornithological work of the joint USARP/NZARP Expedition of 1965, apart from a short general narrative by Robertson (1965), so that the latest reliable figures for the Cape Adare Adelie Penguin populations are those of Reid (1962): breeding pairs at 289, 400 ± 3.0% with non-breeders representing nearly 20% of the breeding population, the estimated total population being (±3%) 695,000 birds. Levick (1915) estimated the population at 750,000 birds and Austin (1957) at 75,000 to 100,000 as listed by Taylor (1964: 561, table 1). Norman and Cairns (Anon, 1973*b*: 304) gave the number of penguins in February 1973 as 50,000 but it was said that in " November, nesting time, this figure could rise to more than 200,000." The estimates of Levick and Reid, both of whom were on Ridley Beach sufficiently long to make a detailed census, tally well enough to suggest that 700,000 birds live on this 300 acre flat in the season. These figures are important to recall if future investigators of Leopard Seal/penguin behaviour base themselves at Cape Adare and follow the techniques adopted by Hofman *et al* (1973: 196) at Palmer Station in which Adelie Penguin colonies " were censused to determine the number of penguins available as a potential food source for resident leopard seals."

THE VICTIMS OF PREDATION

The US/NZ Western Ross Sea - Balleny Islands - Macquarie Ridge Expedition, 13 New Zealanders and 8 American scientists aboad the icebreaker USS *Glacier* (Cdr (now Capt.) Vie J. Vaughan, USN), left McMurdo Sound on 10 January 1965 and reached Lyttelton by way of the islands on the western edge of the Ross Sea, the Balleny Islands and zigzagging across the submarine ridge to the north to Macquarie Island and across the Campbell Plateau east of the Auckland Islands to New Zealand on 5 March (see Quartermain 1965; Forbes 1965). During this time two days were spent in Robertson Bay, an indentation beyond the western edge of the Ross Sea formed, on the east, by the Adare Peninsula ending in Cape Adare and on the west by the Pennell coast of Victoria Land (see topographic map NZMS 166/SR 59-60, 13 Cape Adare, 1:250,000, 1st ed. Nov. 1968), lying some 500 miles to the north of the United States and New Zealand bases in McMurdo Sound. On 25 January 1965, the ship's helicopters were kept busy

ferrying geologists and surveyors along the western coast as far as Flat Point and south to Duke of York Island. The ornithologists of the expedition also participated in these flights trying to locate and count penguin colonies. At the same time marine biologists aboard the *Glacier* trawled in Robertson Bay at stations, including a repeat of Station 220 occupied by the *Terra Nova* on 3 January 1912 on the day of departure of the Northern Party from Cape Adare, while others went ashore on Ridley Beach to collect marine invertebrates in company with entomologists who searched hopefully for Antarctic insects. On this day I was ashore from 1330 to 2113 and explored a good part of the shoreline of Ridley Beach as well as traversing much of the larger colony of Adelie Penguins occupying the flat above the beach. Next day, 26 January, a three-man diving team was put ashore on the northern edge of Ridley Beach to search for marine algae (see Zanefeld 1968) and I went with them from 0800 to 1030 to cover the coastline towards Cape Adare itself. Later in the morning I was able to fly over Ridley Beach and the long promontory of Cape Adare and make a photographic record of the penguin nesting area and the shoreline (Fig. 3).

Not long after being set ashore from the helicopter I was wandering along the strand line searching for marine invertebrates when I met the algologist of our expedition, Dr Jacques S. Zanefeld,

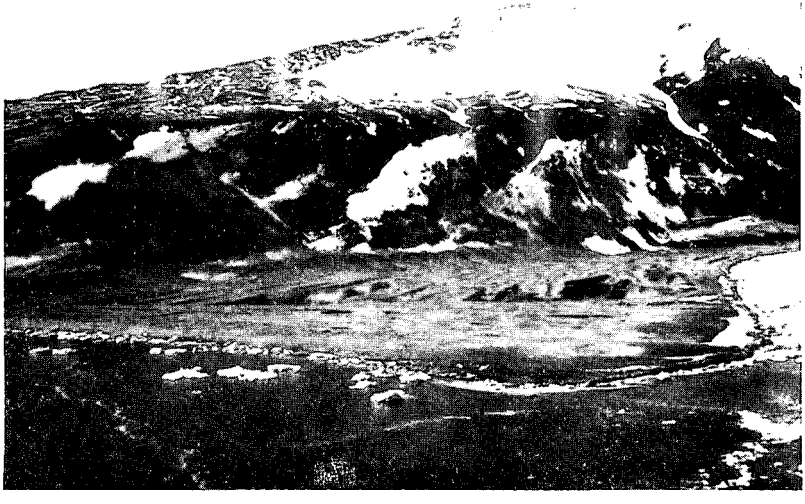


FIGURE 3 — Aerial view of coastline of Ridley Beach towards Cape Adare showing northern beach along which the Leopard Seal worked, 26 January 1965.

Photo: E. W. Dawson

FIGURE 4 — Side view of Adelie Penguin injured by Leopard Seal, fledging chick in background, Ridley Beach, Cape Adare, 26 January 1965.

Photo: E. W. Dawson

FIGURE 5 — Frontal view of Adelie Penguin injured by Leopard Seal, Ridley Beach, Cape Adare, 26 January 1965.

Photo: E. W. Dawson

of Old Dominion College, Norfolk, Virginia, with his two assistants, Jim Curtis and Jack Fletcher, struggling out of the surf laden with their scuba gear. They had been diving for seaweeds amongst the ice floes when they sighted a Leopard Seal, and, not wanting to provide a practical test of the alleged aggression of Leopard Seals towards Man, they fled from it as best they could. Moving along the water's edge, I met many groups of penguins coming equally rapidly out of the water, and I noticed, in particular a solitary bird walking out of the surf as my colleagues had but looking much more the worse for wear than they had done (Figs 4-5). The penguin was exactly as Levick had described in 1915 — " terribly injured . . . the skin of the whole of their breasts peeled away and hanging from them like an apron, and their breast muscles were bared and bleeding."

The penguin on Ridley Beach was indeed a gruesome sight, with a deep cut on the breast laying bare the sternum with streams of blood creeping over the otherwise uniformly white shirt front of the Adelie, a much more striking impression of injury than the blood-stained front sometimes seen which is caused by abrasion in travelling over rocky surfaces as Wilson (1907b: 41, fig. 34) has illustrated and quite different from the sort of injuries due to landslides described by Levick (1914: 103).

FIGURE 6 — Ice floes stranded along northern edge of Ridley Beach, Cape Adare, 26 January 1965.
Photo: E. W. Dawson

FIGURE 7 — Adelie Penguin with back injuries from Leopard Seal, Ridley Beach, Cape Adare, 26 January 1965.
Photo: E. W. Dawson

There were quite a number of ice floes close in to this gently sloping beach or stranded on it (Fig. 6), around which the Leopard Seal was seen swimming. Penguins were either clambering on to the floes or coming on shore in a steady stream giving some impression of the sort of " panic " which Stonehouse (1968: 59) has described. The surf was low and the sea generally calm and undisturbed except for some current movement, visible from the air (Fig. 2) at the NW tip of Ridley Beach. One other similarly injured penguin was seen after a little search (Fig. 7). This bird had its cut on the opposite side of the body, and, like the first bird (Fig. 8), appeared to be shunned by its neighbours, standing on its own away from the general group. The bird was seen at about 0930 on what was a bright, sunny morning, but one wondered how long this unfortunate bird would survive. Anthropomorphically feeling for the bird's condition, one admired the stoical expression it bore. However, as it moved up at a good walking-speed to the stony flat above Ridley Beach, nearby penguins stood back and once or twice formed a circle around it, seemingly disconcerted by its appearance, an interesting reaction recalling Murphy's (1936: 401) remark that " Sick or wounded penguins are never molested by their fellows " (cf. also Levick 1914: 105). Perhaps, following Murphy's and earlier remarks on the indifference of Adelies in seeing their fellows being killed, one might have expected not even so passive a rejection of the injured bird by its fellows.

FIGURE 8 — Injured Adelie Penguin shunned by its fellows, Ridley Beach, Cape Adare, 26 January 1965.
Photo: E. W. Dawson

STUDIES OF LEOPARD SEAL PREDATION

Irrespective of behaviour related to predation on penguins, there is relatively little known about the life-history and habits of the Leopard Seal which is a wide-ranging, circum-Antarctic breeding species straggling north to the coasts of South America, South Africa, Australia and New Zealand (Scheffer 1958: 120-121, fig. 11; King 1964: 168, map 23). Many writers have stated how infrequently Leopard Seals are encountered and, hence, observations and studies of the species have been quite limited. It is interesting to note some figures of observations of this animal, " swift and crafty, graceful beyond any other antarctic seal, and a devourer of penguins both along the coast of their breeding grounds and in the pack-ice " (as Murphy 1936: 414 called it) as they have been recorded in narratives of some of the well known expeditions.

Edward Wilson, reporting on the collections made by the *Southern Cross* Expedition, said (Wilson 1902: 71-72) — " Leopard-Seal was nowhere, and at no time, common. Two young ones were captured in the pack-ice on January 3rd. A male was killed at Cape Adare on December 22nd, and another was seen and successfully photographed [see photo, on p. 26, taken from Bernacchi 1901]by Mr Bernacchi, also at Cape Adare. They are therefore obviously rare at all times, though widely distributed." Bernacchi (1901: 206), himself, noted that they were " exceedingly scarce " during his long stay at Cape Adare, only the four specimens discussed by Wilson (1902) and by Hanson (1902) having been met with. Wilson (1907a: 27, fig. 22; 1966: 91) later recorded how only one Leopard Seal had been seen from the *Discovery* during her passage through the pack into the Ross Sea in January 1902. On the homeward voyage only two more were seen, near the Balleny Islands on 1 March 1904 (Wilson 1907a: 27; Wilson 1966; 345). Rudmose Brown (1913: 192) also found the Leopard Seal a solitary animal during the Scottish National Antarctic Expedition aboard the *Scotia* — " Three were seen together on one occasion only, and we never saw more in company." It is not clear from Levick's (1915) account of Adelie behaviour how commonly he saw Leopard Seals during his 10 months at Cape Adare nor what the relative seasonal abundance was but he has mentioned (1914) " a large number . . . gathered in the sea in the neighbourhood of the rookery . . ." (pp. 83-84), " With dozens of their enemies about . . ." (p. 84) and " . . . there were always many about " (p. 87). His notes suggest that he was more fortunate than most other observers in his opportunities and certainly luckier than the *Southern Cross* party had been at the same locality. Hamilton (1939: 259) stated, similarly, from the *Discovery* investigations in South Georgia — " A most striking characteristic is the solitariness of its life." He remarked that one may meet only three or four seals in steaming 30 or 40 miles through the pack ice and thought 10 recorded in one day by Worsley to be " quite an exceptionally high number." Indeed, Bonner & Laws

(1964: 182) concluded that the Leopard Seal might be only a " little less rare " than the Ross Seal, a rarely seen but not uncommon species as we, ourselves, found in the Ross Sea in 1965. Scheffer (1958: 5, table 1) gave a world population estimate of 100,000 - 300,000 Leopard Seals, contrasting with the estimate of 2 - 5 million for the Crabeater, 200,000 - 500,000 for the Weddell Seal and 20,000 - 50,000 for the Ross Seal.

A number of early observers apparently confused the identity of the seals which they met with in the Antarctic ice. In fact, the first illustration made of a Weddell Seal was captioned " Sea Leopard of the Orkneys " by Weddell in January 1823 in his *Voyage towards the South Pole* (Weddell 1827). Wilson (1907a: 27) has pointed out already that both Borchgrevink and Bruce frequently confused Leopard Seals with Weddell Seals in their narrative of the *Southern Cross* and the *Scotia* cruises respectively especially referring to Bruce's observations of " a great host, moaning loudly." Rudmose Brown (1913: 192) repeated Bruce's estimate that " the crew of the *Balaena* [one of the three whalers of the Dundee whaling expedition of 1892/93 to Grahamland in which Bruce took part] killed fully a thousand during December, January and February." Moseley, on the *Challenger* Expedition, had similarly mistaken the identity of a herd of 400 seals at Kerguelen. Gain (1913: 48), zoologist of the second French Antarctic Expedition of 1908/10 included the Crabeater (or " heron seal " as he called it) and the Weddell Seal as formidable enemies which " take for their nourishment an ample supply of [Adelie] penguins." It is interesting also to read in the diary of Nicolai Hanson, ill-fated zoologist of the *Southern Cross* Expedition, how he learned to distinguish the various species of Antarctic seals as he encountered them (Hanson 1902). Indeed, Bowdler Sharpe in a postscript (p. 105) pointed out that although four species of seals have been identified from the *Southern Cross* collections apparently six species were recognised as different by Hanson. However, such zoologists as Edward Wilson (cf. Wilson 1966) who were able to collect and examine specimens as their ship worked through the ice, were left in no doubt what the species were and soon learned to recognise the Leopard Seal, as we did on our *Glacier* cruise after collecting a 14-foot specimen which, as Robertson (1965: 76) has related, " gave all members of the party and crew ample opportunity to see why this animal is entitled to a large amount of respect."

Although this review is of Leopard Seal predation, it should be mentioned that some other species of seals (although not the Antarctic species confused by the early observers) feed on penguins. Stonehouse (1967) has summed up most of what is known —

> " Fur seals (*Arctocephalus* sp.), sea lions of three genera, and phocid seals of five genera, inhabit penguin waters and nearly all, at one time or another, have been suspected of predation. The

only seal known to be a regular predator of penguins is the Leopard seal . . .

> Penguins do not feature among the main foods of fur seals . . . except on Campbell Island, where the New Zealand *Arctocephalus forsteri* takes Rockhoppers in quantity . . . and perhaps also at Macquarie Island where the same species is currently expanding and taking increasing numbers of Rockhoppers . . . At Gough Island, Swales . . . saw *A. t. tropicalis* snapping at penguins on the beach and harrying them in the water; at Macquarie Island Hooker's sea lion *Phocarctos hookeri* takes Gentoos on the beach and in the water . . ."
>
> [Stonehouse 1967: 171]

Maxwell (1967) made another summary of the feeding habits of other species of seal — The New Zealand Fur Seal, *Arctocephalus forsteri* (p. 43): "They also take Shags and Penguins, which they skin as do Leopard Seals"; Kerguelen Fur Seal, *A. t. tropicalis, A. t. gazella* (p. 46): "Both forms . . . are known to eat . . . Gentoo Penguins . . ."; the Southern Sea Lion, *Otaria byronia* (p. 61): "The food is similar to that of other species . . . and penguins"; the Australian Sea Lion, *Neophoca cinerea* (p. 65): ". . . the two staple ingredients of their diet are penguins and fish"; Hooker's Sea Lion, *Phocarctos hookeri* (p. 67): ". . . the sealions have been seen to chase and catch penguins which they take out to deeper water and tear apart." Conway (1971: 7-8) has since described the taking of Magellanic Penguins at Punta Tombo, Argentina, by Patagonian (= Southern) Sea Lions. Boswell (1972b) has brought together some recent observations of penguins as prey of the South American (= Southern) Sea Lion that "suggest the habit may be more frequent and widespread than the literature indicates." Rockhoppers, Gentoo and Magellanic Penguins are recorded as prey of sea lions and Boswell's (1972b) own observations and movie film (Boswell 1972a) of the taking of rockhoppers at Staten Island, Tierra del Fuego, have provided a most useful record of the behaviour of this species of seal which will be valuable for a direct comparison with Sladen's (1957) film of the Leopard Seal.

The pioneer work on the biology of the Leopard Seal was done during the *Discovery* investigations on South Georgia by Hamilton (1939), although Barrett-Hamilton (1902) had already provided a valuable report on what was then known, based on the *Southern Cross* collections, and including the discovery and investigation of the species, a detailed synonymy, description and discussion, to which Wilson (1907a: 26) later paid tribute. Further information on breeding, biology and population structure was given by Brown (1957) based on his 4-year study at Heard Island but, although he analysed stomach contents, no information was given about predatory behaviour towards penguins despite the length of his field operations. Kooyman (1965) has more recently provided a well-illustrated popular account of the

life and behaviour of the Leopard Seal at Cape Crozier in the Ross Sea. A particularly good brief summary has been given by Bonner & Laws (1964: 182-183) and the summaries compiled by Scheffer (1958: 120-122) and by King (1964: 70-71) indicate many of the gaps in our knowledge of this species of seal. Recent reports from participants in the United States Antarctic Research Programme show that the Leopard Seal is still a difficult animal to study in the field despite modern techniques, sophisticated equipment and greatly improved logistic support.

Even with the seeming rarity of the Leopard Seal and the early confusion with other Antarctic species, enough observations have been made of its association with penguins to build up a picture of its predatory behaviour in general terms. Perhaps the best overall impression at present available is that lucidly given by Richard Perry (1973) in his latest popular natural history book, *The Polar World*, in which he has devoted a chapter to " Penguins and their Enemies " based on many of the original accounts discussed here. Perry's book, despite the harsh criticism levelled at it by a recent reviewer (Fraser 1973), has a quality, rare in books of this sort, in that he documents his sources of information with a useful bibliography.

There is no doubt that penguins, Adelies, Chinstraps and other species including the Emperor, form a significant part of the diet of Leopard Seals at least at certain times of the year and in certain geographic localities according to the local conditions.

The Leopard Seal seen in the Ross Sea by Wilson on 7 January 1902 was shot, photographed, and preserved, as related in Wilson's diary (1966: 91), and was found to have a 3-foot skin of an Emperor Penguin in its gut. Rudmose Brown (1913: 193) stated — " the food of this seal seems to consist chiefly of penguins, which it chases with great ability under the surface of the water, and even catches on the ice." He recounted how he had seen a Gentoo Penguin seized by the leg from an ice floe in Scotia Bay (although Wilton in the Zoological Log (1908: 39) referred to this bird as a " black-throated penguin " i.e. an Adelie). Levick (1915: 75) cut open a Leopard Seal which he had shot at Cape Adare and " found its stomach distended by the carcasses of no fewer than eighteen penguins in different stages of digestion, whilst its intestines were stuffed with the feathers of many more." Murphy (1936) mentioned predation by Leopard Seals in the case of each of the several species of penguins discussed by him for South American waters, and a more recent comment was made by Strange (1973). Hamilton (1939: 260), recounting Ponting's story (1921. 200-201) of how he was pursued over the ice by an irritated Leopard Seal, supported Rudmose Brown's (1913: 193) observations in stating — " I have myself seen it run down and catch a ringed penguin in open water, an impressive demonstration of the speed of the mammal." He gave an analysis of the gut contents of 32 animals,

taken by various expeditions, in which penguin remains occurred in 8 cases. Seal carrion, fresh seal, squid, fish and crustaceans were also common. Bonner & Laws (1964: 183) called Leopard Seals "unselective predators of catholic tastes," based presumably on Hamilton's analysis. They also commented wisely — "There is a bias present, because most of the animals examined were taken in island groups at certain times of the year. More representative observations made in the pack ice and at other times of the year might show a greater proportion of fish and squid. The main point to make, however, is that the leopard seal, unlike other species, takes a great variety of prey, some of it very large." It is interesting, in passing, that the 9 cent stamp of the recently issued Australian Antarctic set depicts a Leopard Seal chasing a group of two species of fish, despite the strength of the legends about penguins (see Australian Post Office 1973).

Of more recent illustrations of predatory behaviour, since the observations given by Levick (1915), the outstanding one is undoubtedly that given by Sladen (1958) who filmed an encounter between a Leopard Seal and a Chinstrap Penguin —

> "On February 25th, 1951, our ship R.R.S. *John Biscoe* had anchored in Sandefjord Bay, Coronation Island, and I was one of a small shore party chosen to inspect the F.I.D.S. hut and depot there. On the way back to the ship, our life-boat was pushing slowly through a belt of thick brash ice, just off-shore from a large Chinstrap rookery, when a tail and two penguin feet attracted our attention. They were sticking out of the ice in a most unusual manner. Dominican Gulls were circling above, but they did not land on the object. Suddenly it disappeared under the ice as though something was tugging it from below. I had a cine-camera in my hands and was able to record what followed. A Leopard Seal's head shot out of the water and flung a part of the carcass away from it. Subsequent analysis of this film [see Sladen 1957] showed a very quick movement of the seal's head, first in extension and then flexion, flinging what appeared to be the skin forwards with great strength. Before the head disappeared beneath the ice, the mouth opened wide to swallow what appeared to be part of the body. The skin floated away, and the Gulls swooped lower. A few seconds later the seal's head came out of the ice again and, with wide open mouth and astonishingly quick action, swallowed the rest."
>
> [Sladen, 1958: 68]

Sladen noted also — "There are only a few records of Leopard seals actually seen killing penguins." A few other photographers have been almost as fortunate as Sladen in catching the Leopard Seal in the act and attention should be drawn to Curtsinger's (1969) illustration of a Leopard Seal at Cape Crozier mounting an ice floe on which a solitary Adelie is seen standing with its back to the would-be predator. Smith's (1969) colour photograph of a seal holding a successful catch is also quite remarkable.

Boswell's (1972a) film of a similar encounter of a Southern Sea Lion with Rockhopper penguins on Tierra del Fuego rivals Sladen's in its opportunism (see Boswell 1972b: 130-131).

Attempts are now being made to provide quantitative information on the numbers of Leopard Seals around penguin colonies and how they contribute to the overall mortality rates of both adults and chicks. It will be recalled that Levick (1915: 25) stated — " The sea-leopards congregate in the sea in the neighbourhood of the rookeries during the breeding-season, and *the number of adelies they kill and eat is almost incredible.*" [italics mine]. Sladen (1958: 5) said, in similar vein: " The only important predator at sea is the Leopard Seal. A study of available literature suggests that, like the Skua, the Seal's predation is selective, a healthy alert and experienced Adelie being able to outmanoevre the seal in the water. *The Leopard Seal takes a heavy toll of young when they enter the water.*" [italics mine].

There is, in fact, a great deal one would like to know about kill-rates, numbers and effects, if only to test the truth and significance of such a conclusion as reached by Levick. How significant is the toll taken by Leopard Seals in relation to other features of the ecology of penguins ?

The first quantitative study of Leopard Seal predation on penguins was made by Penney & Lowry (1967). Their conclusions are worth reiterating and discussing here since they place my own casual observations in perspective and they give a basis for comparison of results from later work (Muller-Schwarze 1971). Between 21 January and 16 February 1965, Penney and Lowry made regular observations along a 100 x 400 yard study area on a beach at Cape Crozier, Ross Dependency, part of a breeding colony of about 300,000 Adelie Penguins. Noting wind, surf, and ice conditions, numbers of birds seen caught, killed or injured, and the number of Leopard Seals seen in the area over 64¾ hours, they reached the following conclusions —

> " Active predation, involving up to four seals, was observed during 58% of the time with average kill rates of 0.61 birds/hour. Predation rates increased with the height of incoming waves and also when landing penguins were encumbered by floating ice on the beach. Time of day was not found to influence predation rates. When young penguins began their exodus from the rookery in January, seals no longer preyed on adults. Seasonal depredation from Leopard Seals on the Cape Crozier beaches approximates 5% of the breeding population. The predators are thought to be utilizing a temporary, but abundant food resource."

One of the particularly interesting features of their report is the comparison of predation on adult and young penguins in the course of the breeding season. After the movement of young birds of the year out of the colony (beginning 30 January), all the observed predation was on young birds and, despite the fact that the seals were

seen to find the chicks an easier prey, the observed hourly rate for chick predation was only half that for adults. Penney & Lowry explained this as being due to the greatly decreased movement by adult penguins to and from the rookery in the short time period of about one week during which the chicks depart to the sea. In the 26½ hours of observation of young penguins, there were also 6½ hours over which the numbers of chicks leaving the breeding area had reached very low numbers. Nevertheless, Penney & Lowry remarked — " Young penguins usually enter the water along with groups of adults, but due to their slow surface swimming, they become easy prey as they are outdistanced by the adults." They commented that their predation rates (30 kills of adults at 0.78 kills/hour and 9 kills of young at 0.34 kills/hour) are a little misleading." It is clear that the behaviour of the birds in the particular field conditions is a very necessary factor of interpretation of such statistics.

Although Penney & Lowry made counts of — " (1) Number of carcasses afloat; (2) Number of obviously seal injured penguins ashore; (3) Numbers of birds obviously injured before or during landing mishaps in heavy seas," their study was of kill rates based on either on kills actually seen or on carcasses afloat in the study area. They quoted W. Emison's observations of 23 January 1966 along 200 yards of beach in which 32 dead or injured birds were found in a 24 hour period. Of these birds, 5 were dead from ruptured stomach due to ice crushing, 14 had broken legs, 11 had seal wounds on the neck and 2 more had deep seal wounds on the abdomen. In contrast, Penney & Lowry found 12 adults in their study area with a serious injury due to ice buffeting, but only 2 birds with " obvious injuries from Leopard Seals." No photographs of dead or injured birds, from either ice or seals, were given.

A later quantitative study, and the only other one so far published in any detail, was made in 1969/70 in the same general area at Cape Crozier and has been reported on briefly by Muller-Schwarze (1970: 270-275, tables 1-2) in his long summary of post-1964 studies on the behaviour of penguins and seals in which only a few pages are devoted to Leopard Seal predation and the antipredator behaviour of the penguins. Over the summer of 1961/70, up to six Leopard Seals were seen simultaneously working along the beaches of Cape Crozier, patrolling at distances of 5 to 100 metres from the shore. Based on about 45 hours of observations in October to December 1969 (Table 1), it was found that the success rate of the seals' predation depended on environmental factors such as ice conditions or tide. More penguins were seen to be attacked or killed at low tide (40% success, 2.3 attacks per hour and a kill-rate of 1 per hour over 6 hours of observations) than at high tide (35% success, 1.3 attacks per hour and a kill-rate of 0.43 per hour over 15 hours) because when attacked, the penguins could not jump to safety on the 2-3 metres high overhanging

ice foot. Early in the summer (October to early November) when heavy and continuous ice covers the coastal waters, the seals have to push their way through the ice from below to attack the penguins (cf. Muller-Schwarze 1972: Fig. 8). Under such conditions the seals were found to be less successful, the frequency ot attacks being greater at 4.9 per hour but the success of 7.5% at a kill-rate of 0.37 per hour over 24 hours of observations. The kill-rates found by Muller-Schwarze (Table 1) were much the same as those found previously at Cape Crozier by Penney & Lowry (1967).

Muller-Schwarze also noted " peculiar temporal relationships between the activity times of the predator and their prey." His analysis of " Relations between the activity levels of leopard seals and Adelie Penguins at Cape Crozier in 1969 " (Table 2) shows that when most of the penguins (taken as 100%) were in the water, i.e. between 8 am and noon, the activity of the seals was only 52% (24 active, 22 resting). Conversely, at the time when most of the seals were active, between midnight and 4 am, only 25% of the penguins were in the water. Presumably these are cumulative totals derived from the observations of the " up to six " seals seen simultaneously during the summer. Such a tendency towards " nocturnal " activity (in the daylight of the Antarctic summer night!) has been shown also for the Weddell Seal which is not a predator of penguins. Muller-Schwarze suggested, however — " This apparent paradox can perhaps be interpreted as a different dispersion pattern for seals in the ocean, possibly in relation to dispersion of penguins." I am not sure that I understand what Muller-Schwarze meant by this, but he concluded — " At any rate, it shows how misleading any one parameter may be, if used alone." Nevertheless, such a demonstrated inverse relationship between levels of activity of predacious seals and their penguin prey become significant when attempts are being made to assess the likely effects of such predation an penguin populations.

DISCUSSION

Some consideration still needs to be made of the old story of the " callous " penguins as Burton called them. Following Levick's (1914: 74-78; 1915: 72) descriptions of the " play " of penguins at Cape Adare, Murphy (1936: 399) gave the clue for the interpretation of this spectacle by saying — " The sea and its ice are their playground. Here the bands of birds play tag [" touch-last " in Levick's terminology!] and also use the floes in the tideway as excursion boats. Sometimes they crowd on, amid much bantering, until the embarking of each new bird means the pushing off of another on the far side." Quite definitely more observations are needed of such play and how it varies especially according to the real or imagined presence of a predator. Patterns of behaviour of both adult and first-year birds might be able to be distinguished and lend themselves to a more precise ethological analysis as, indeed, Murphy (1936: 339) had hinted at when discussing Levick's " excellent records " from Cape Adare.

It is clear also that more observations are necessary of the predatory behaviour of Leopard Seals as well as of the antipredation measures taken by the penguins themselves, and how innate or learned such responses might be, not only under various physical conditions but also throughout the breeding season and in contrasting times of the year when both penguin and seal populations have moved away from the shore. For example, Stonehouse's (1968: 57, 60) comments on the differing behaviour of penguins according to the degree of patrolling of beaches by Leopard Seals in winter (when the seals were not breeding and more in evidence off the beaches) and in summer (when the seals were away on the ice and penguin behaviour was less interrupted by panics or alarms) may be true only for such lower latitude polar regions as South Georgia where he made these observations. It seems well established that Leopard Seals are found along the Antarctic coasts in numbers only in the summer and that they move further north towards the subantarctic islands in winter and spring with numbers building up to as much as 600 at places like Heard Island (Brown 1957). Little is known of their breeding areas, reproductive behaviour or the movements of non-breeders or immatures but the young are thought to be born on the pack-ice and some difference in dispersal of adults, juveniles and immatures might be suspected. Maxwell (1967: 97) noted: " The Leopard Seal does not migrate. Whilst many of the animals keep to the outer edges of the pack ice during the winter, others remain on the firm ice to the south, and still others stay near the sub-Antarctic islands such as South Georgia, St Paul and Macquarie."

Perhaps at Cape Crozier and at Cape Adare little or no activity of either seals or penguins would be seen by shore-based observers other than in summer when the penguins were breeding.

Interesting comparisons might be made with the habits and seasonal movements of such other seals known to feed on penguins to a marked extent, notably the South American or Southern Sea Lion (cf. Boswell 1972b).

The nature of the shores adjoining penguin rookeries seems to be specially significant. Although floes become stranded on the beach, Ridley Beach has a gradually sloping shore on the north side (where my observations were made — see Fig. 6) without any ice overhang or continuous ledge, other than on the derelict floes themselves, which would hinder penguins from coming ashore quickly. Hence one might expect some difference in behaviour and mortality rates between birds at Cape Adare and Cape Crozier. The Palmer Station area where the latest studies have been made doubtless has its own particular physical characteristics also.

The Leopard Seal is certainly a rarely observed animal, at least by comparison with the Weddell Seal, as a study of the literature

and one's own field experience show. Opportunities for seeing seals amid the pack ice may well have been no less in the days of slow-moving expedition ships than with the increased height and airborne facilities now available on the modern ice breakers. Information is still required about the locations of breeding areas of Leopard Seals, particularly in relation to food sources such as penguin rookeries and more details on seasonal dispersal would be welcome. Analyses of gut contents, especially from animals taken in the pack ice, need to be made whenever the chance arises and must be related to available food supply both geographically and seasonally. It is surprising, perhaps, that the Leopard Seals do not frequent the precincts of penguin rookeries in greater numbers, even allowing for their solitary nature, wide-ranging habits and " catholic tastes," when it would seem that a ready food supply awaits them with plenty for all comers. All of Penney & Lowry's study concerned the activities of only four seals even of they have been credited with disposing of 15,000 penguins between them. Kooyman's observations at Cape Crozier on 30 December 1964 were of only four seals also and in my own very brief observations of some 1½ hours on 26 January 1965 I saw only one Leopard Seal. Penney & Lowry (1967: 881) suggested that possibly the Leopard Seals which " predate at specific rookeries around Antarctica are pioneering individuals which have learned to capitalize on a temporary resource." Might we, therefore, expect to find a gradual increase in predation rates as these pioneers lead the way for future adventurous seals ?

In the case of the South American Sea Lion, Strange (*in* Boswell 1972b: 130) believes that " it is the odd rogue pushed out of a breeding harem which adopts this habit. I have yet to see a female or young seal taking penguins . . ."

If one takes statements that have been made by other observers or compilers one finds that such beliefs as " the number of adelies they kill and eat is almost incredible " (Levick 1915: 75), " What hope of escape has a Penguin when chased in the sea by one of these monsters ? " (Barrett 1948: 60), " The Leopard Seal takes a heavy toll of young when they enter the water " (Sladen 1958: 5), " . . . it appears that the largest numbers of penguins are killed at a time of the season when the young penguins are leaving the rookeries, and at other times comparatively few are taken " (Sladen 1958: 69), " Penguins seem to be the main prey, but other birds and seals are also consumed " (Walker *et al.* 1964: 1312), " Since there are almost 100,000 of these animals off the Antarctic coasts, they must take a considerable toll of penguins over the course of a year " (Sparks & Soper 1967: 123), or " . . . near Antarctic and sub-Antarctic islands they tend to feed mainly on penguins, especially those resident throughout the winter " (Stonehouse 1967: 171) cannot, even at the present time, be substantiated by the qualitative evidence available. Some

of the more positive information is, in itself, questionable or at least capable of varying interpretations according to particular field conditions and localities such as indicated by the " nocturnal " activity of Leopard Seals noted by Muller-Schwarze and the predation rates thought to be " a little misleading " found by Penney & Lowry.

The effects of Leopard Seal predation on penguin populations have been revealed to some extent by Penney & Lowry in their study at Cape Crozier. " Extrapolating " their records of 30 observed kills of adults over 38¼ hours and 9 kills of young seen over 26½ hours due to the activities of perhaps 4 seals, they conclude that 19 adult penguins are killed each day in the 100 yards of their study area. The West Rookery at Cape Crozier lies along 750 yards of beach and the nesting season lasts for some 15 weeks. They calculated, therefore, that the adult mortality would be about 15,000 birds which in a rookery of some 300,000 breeding birds would amount to a 5% mortality. Their estimate of chick mortality, based on an extrapolation giving a figure of about 860 chicks over a two-week period of going to sea, is also quite minor even if it is assumed that the " total production of departing chicks is probably one chick per breeding pair of adults." Nevertheless, these numbers indicate quite an active predation and an abundant food source for merely four Leopard Seals ! At Cape Adare the northern beach (Fig. 3), along the whole length of which penguins move to and from the sea, is much longer at some 1740 yards with over 700,000 birds nesting behind it. If four seals patrolled this beach throughout the season as at Cape Crozier the effects on both the adult breeding population and on the chicks would also be minimal, and, indeed, I saw much more evidence of mortality from other causes as I walked through the colonies. With a much longer shore line to patrol the seals might be no more of a menace than on a closely packed area but there is no evidence, unless one reads more into Levick's account than he might have intended, to suggest that the number of seals would be proportionate to the length of the shore.

My observations at Ridley Beach were made some days too early, before the bulk of the chicks had fledged and taken to sea (Fig. 8). It would be interesting to follow the predatory activities of the seals once the majority of the penguins were moving offshore particularly to see if the increasingly wide dispersal of the individual penguins makes them less attractive as prey. Penney & Lowry concluded that — " Cape Crozier offers a unique opportunity for further study of this predator-prey system with emphasis on both behaviour and population ecology throughout an entire season." However, if logistic support could be obtained equally readily for parties to work at the Cape Adare rookery, the geographic setting there is undoubtedly even better than the " unique opportunity " presented by the Cape Crozier rookery. From the northern edge of Ridley Beach with its gentle slope penguin traffic to and from the sea would be easily observed and on the eastern

beach with its steeper, ice-overhung shore, a contrast would be given (Fig. 3). The long promontory of Cape Adare rising some 4000 feet above the penguin colonies on the flat gives an unrivalled vantage point (Fig. 9) from which the movements of both seals and penguins could be followed with not only optical aids but also some of the telemetric devices tried recently by the USARP team at Palmer Station.

FIGURE 9 — Cape Adare and eastern end of northern part of Ridley Beach. The grave of Nicolai Hanson, zoologist of the "Southern Cross" Expedition, who died 14 October 1899, the day the penguins returned to the rookery, lies on the highest part of the promontory on the right. 26 January 1965.

Photo: E. W. Dawson

In conclusion, it is important to stress the point on which the present review of penguin/seal relationships is based, i.e. the role that chance or opportunity may play in allowing such biological phenomena as have been illustrated here to be seen in the field. This is well shown by the recent report of the USARP team from the University of Minnesota and Utah State University making "an integrated study" of the inter-relationships of leopard seals and Adelie penguins in the vicinity of Palmer Station on the Antarctic Peninsula (Hofman *et al.* 1973). "The study area was selected to provide contrast with sites on Ross Island, where most penguin-leopard seal interactions have been observed" but seal predation near Palmer Station appeared to be "less than might have been anticipated." With a great deal of expenditure in time and logistics, together with elaborate preparations and techniques involving underwater television, 16mm

movie photography and radio telemetry with seals previously caught and drugged, it must have been very disappointing for these investigators to have to report that —

> " Leopard seals were frequently seen patroling areas inhabited by penguins, but only two kills and three unsuccessful attempts were observed. Fecal analysis suggested that the primary food source of most of these leopard seals was krill. The early arrival of UNS *Mirfak* (February 6) resulted in the premature termination of the project before the Adelie fledglings entered the water. Predation may have increased when young birds left the rookeries, but the actuality remains an unknown."
>
> [Hofman *et al.* 1973: 197]

My brief visit to a similar penguin terrain gave me an opportunity of seeing and providing some illustrative evidence of such predation. It is a fine example of how fortunate one may be in seeing, quite casually, something that may be rarely encountered even by those who are able to spend considerable time over their observations.

ACKNOWLEDGEMENTS

This is an appropriate occasion on which to thank Lt Mike Meier, USN, Officer-in-Charge, Hutron Four (NAS, Lakehurst, N.J.), Detachment 88, USS *Glacier,* and his fellow helicopter pilots, Lts (JG) Ken Kleiber, Frank Lobb III and Fred Riddle Jr, for their particular part in the US/NZ Expedition of 1965. Without their special skill and friendly co-operation, this expedition could not have been the unqualified success that it was, and we are much indebted to them as well as to the rest of the ship's company, USS *Glacier.*

I am grateful to the Antarctic Division of the DSIR, Christchurch, for allowing me to use a photograph taken on the joint US/NZ Expedition of 1965 by Mr Frank O'Leary, the Official Photographer, to Miss Jennifer Early, School Library Service, National Library of New Zealand, for helping me to find my way about children's literature, to my neighbours Mr J. M. Cunningham and Sir Robert Falla for the use of their libraries and to Mr J. W. Brodie, Director of the New Zealand Oceanographic Institute, for reading my manuscript and suggesting some modifications which I have been glad to adopt.

LITERATURE CITED

ANON. 1956. Obituary: Commander G. Murray Levick, R.N. The Geographical Journal CXXII (3): 405-406 [see also The Times (London), 1 June 1956].

ANON 1973*a*. Hugh Blackwall Evans. The Geographical Journal 139 (1): 192-193.

ANON. 1973 *b*. New Zealand team works at oldest base in Antarctica. Antarctic 6 (9): 302-304, 1 fig.

ARNOLD, H. J. P. Photographer of the World. The biography of Herbert Ponting. Pp. 1-175, frontis, figs 2-77. London: Hutchinson & Co. (Publisher) Ltd.

ATWATER, R.; ATWATER, F. 1962. Mr Popper's Penguins. 112 pp., illus. New ed. London &c.: The Bodley Head [first publ. 1938, new ed. 1962, repr. 1965, 1968].

AUSTIN, O. L. JR 1957. Notes on banding birds in Antarctica, and on the Adelie Penguin colonies of the Ross Sea sector. Bird Banding XXVIII (1): 1-26, 1 map.

AUSTRALIAN POST OFFICE, 1973. New Antarctic definitive stamps. Philatelic Bulletin 21 (1): 7-13, illus.

BARRETT, C. 1948. The Penguin People, 64 pp., illus. Melbourne: Cassell & Company Ltd.

BARRETT-HAMILTON, G. E. H. 1902. Mammalia, Pp. 1-66, pl. I *in:* Report on the Collections of Natural History made in the Antarctic Regions during the Voyage of the " Southern Cross." Pp. 1-344, text illus., pls I-LIII. London: British Museum (Natural History).

BERNACCHI, L. 1901. To the South Polar Regions. Expedition of 1898-1900. Pp. xvi + 1-348, illus. London: Hurst & Blackett.

BERRILL, J. 1958. Wonders of the Antarctic. Pp. 1-96, illus. Kingswood, Tadworth (Surrey): The Worlds Work (1913) Ltd.

BONNER, W. N.; LAWS, R. M. 1964. Seals and sealing. Pp. 165-190, figs 1-21, pls 1-16 (Chapter X) *in:* PRIESTLEY, R., ADIE, R. J., & ROBIN, G. de Q. Antarctic Research. A review of British scientific achievement in the Antarctic. Pp. xii + 1-360, illus. London: Butterworth.

BORCHGREVINK, C. E. 1901. First on the Antarctic Continent, being an account of the British Antarctic Expedition 1898-1900. Pp. xv + 1-333, illus. London: George Newnes Ltd.

BOSWELL, J. 1972a. Wildlife Safari to the Argentina No. 6: Tierra del Fuego. Film, 16 mm, sound, colour, 25 min. Bristol: British Broadcasting Corporation.

BOSWELL, J. 1972b. The South American Sea Lion *Otaria byronia* as a predator on penguins. Bulletin of the British Ornithologists' Club 92 (5): 129-132, 1 fig.

BROWN, K. G. 1957. The leopard seal at Heard Island, 1951-54. Australian National Antarctic Research Expeditions, Interim Reports 16: 1-34, figs 1-9, tables 1-14.

BROWN, R. N. RUDMOSE 1913. The seals of the Weddell Sea: notes on their habits and distribution. Report on the Scientific Results of the voyage of S.Y. " Scotia " during the years 1902, 1903, and 1904 under the leadership of William S. Bruce. Vol. IV. — Zoology [Part XIII]. Pp. 185-200, pls I-IX.

BULL, H. J. 1896. The cruise of the " Antarctic " to the South Polar Regions. Pp. 1-243, frontis., 11 figs. London and New York: Edward Arnold.

BURTON, M. (ed.) 1968. Adelie Penguin. Pp. 15-16, 8 figs *in:* Purnell's Encyclopedia of Animal Life 1 (1). London: B.P.C. Publishing Ltd.

CHAFFEE, A. 1934. Penn, the Penguin. Pp. x + 1-103, illus. London: John Murray.

CONWAY, W. G. 1971. Predation on penguins at Punta Tombo. Animal Kingdom. Magazine of the New York Zoological Society. LXXIV (4): 2-8, 10 figs.

CURTSINGER, W. R. 1969. Leopard seal trying to catch Adelie Penguin on an ice flow near Cape Crozier. Antarctic Journal of the United States IV (4): cover photograph.

[FORBES, L. M.] 1965. New Zealand and United States Expedition to the Ross Sea, the Balleny Islands and the Macquarie Ridge, 1965. The Polar Record 13 (82): 52-54, 1 map.

FRASER, F. C. 1973. Book review. Polar Worlds. By Richard Perry . . . 1972. Journal of Natural History 7 (5): 599-600.

GAIN, L. 1913. The penguins of the Antarctic regions. Annual Report of the Board of Regents of the Smithsonian Institution . . . for the year ending June 30, 1912: 475-482, pl 1-9. [reprinted from La Nature, Paris, No. 2041, 6 July 1912].

GOODERS, J. (ed.) 1969. Adelie Penguins. Birds of the World. London: IPC Magazines Ltd. 1 (1): 7-9, illus.

HAMILTON, J. E. 1939. The Leopard Seal *Hydrurga leptonyx* (de Blainville). 'Discovery' reports XVIII: 239-264, text-figs 1-6, pls VII-XIII.

HANSON, N. 1902. Extracts from the private diary of the late Nicolai Hanson [with footnotes and post-script by R. Bowdler Sharpe]. Pp. 79-105 *in:* Report on the collections of natural history made in the Antarctic Regions during the voyage of the "Southern Cross." Pp. 1-344, text illus., pls I-LIII. London: British Museum (Natural History).

HOFMAN, R. J. *[REICHLE, R.; SCHMIDT, J.; GOFORTH, B.; MULLER-SCHWARZE, D.] 1973. Leopard seal study at Palmer Station. Antarctic Journal of the U.S. VIII (4): 196-197, 1 fig. *[additional authors listed in correction in Antarctic Journal of the U.S. VIII (6): 359].

HUTCHINS, R. E. 1969. Adelbert the Penguin. 64 pp., illus. Chicago &c.: Rand McNally & Company.

KING, J. E. 1964. Seals of the World. Pp. 1-154, frontis., text-figs 1-17, pls 1-14, tables 1-4. London: British Museum (Natural History).

KOOYMAN, G. L. 1965. Leopard Seals of Cape Crozier. Animals 6 (3): 58-63, 8 figs. London: Purnell & Sons Ltd.

LAUBER, P. 1958. Penguins on Parade. 64 pp., illus. New York: Coward-McCann, Inc.

LAUBER, P. 1964. Junior Science Book of Penguins. 64 pp., illus. London: Frederick Muller Ltd. [first publ. in the U.S.A., 1963].

LEVICK, G. M. 1914. Antarctic Penguins. A study of their social habits. Pp. x + 1-140, frontis., figs 1-74. London: William Heinemann.

LEVICK, G. M. 1915. Natural history of the Adelie Penguin. British Antarctic ("Terra Nova") Expedition, 1910. Natural History Report, Zoology I (2): 55-84, pls I-XXI, tables A-B.

MAXWELL, G. 1957. Seals of the World. Pp. xii + 1-154, frontis., pls 1-16. London: Constable & Company Ltd [World Wildlife Series 2].

MULLER-SCHWARZE, D. 1971. Behaviour of Antarctic penguins and seals. Pp. 259-276, figs 1-9, tables 1-2 *in:* QUAM, L. O. & PORTER, H. D. (eds) Research in the Antarctic. Pp. xvi + 1-768, illus. Washington, D.C.: American Association for the Advancement of Science (Publ. No. 93).

MULLER-SCHWARZE, D. 1972. U.S. Antarctic Research Program 1972-73. Planned field research projects. Leopard seal behaviour and predation. Antarctic Journal of the United States VII (5): 223.

MULLER-SCHWARZE, D.; MULLER-SCHWARZE, C. 1970. Anti-predator behaviour in Adelie Penguins. Antarctic Journal of the United States V (4): 124-126.

MULLER-SCHWARZE, D.; MULLER-SCHWARZE, C. 1972. Relations between leopard seals and Adelie Penguins, *in:* RONALD, K. (ed.) Symposium on the Biology of the Seal, held at the University of Guelph, Ontario, Canada, 14-17 August 1972, unpaged. [not seen].

MURPHY, R. C. 1936. Oceanic Birds of South America. Vol. I. Pp. xxii + 1-640, text-figs 1-61, pls 1-38. New York: The Macmillan Co. and The American Museum of Natural History.

NSF 1973. Report on United States Antarctic Research activities, 1972-73. United States Antarctic research activities planned for 1973-74. Committee on Polar Research Report No. 15 to SCAR. Pp. vi + 1-84. illus. Washington, D.C.: National Academy of Sciences. National Research Council.

PENNEY, R. L. 1962. Voices of the Adelie. Natural History (American Museum of Natural History, New York) 71 (8): 16-25, illus.

PENNEY, R. L. 1970. The Penguins are coming! A Science I Can Read Book, No. 65. A World's Work Children's Book. 64 pp., illus. Kingswood, Tadworth, Surrey; The World's Work Ltd. [first publ. in the U.S.A., 1969].

PENNEY, R. L.; LOWRY, G. 1967. Leopard seal predation on Adelie Penguins. Ecology 48 (5): 878-882, tables 1-5.

PERRY, R. 1972. The Polar Worlds. Pp. 1-316, illus. Being Vol. II of "The Many Worlds of Wildlife Series." Newton Abbott: David and Charles. [also published in New Zealand by A. H. & A. W. Reed, Wellington, *&c.*, 1973].

PONTING, H. G. 1921. The Great White South: or with Scott in the Antarctic. Pp. xxxvi + 1-306, pls I-CXXXII, 1 map. London: Gerald Duckworth & Co. Ltd.

PRIESTLEY, R. E. 1914. Antarctic Adventure. Scott's Northern Party. Pp. 1-382, frontis., text illus., 98 pls, 3 maps. London: T. Fisher Unwin.

PRIESTLEY, R. 1962. Scott's Northern Party. The Scott Memorial Lecture. The Geographical Journal CXXVIII (2): 129-142, 6 figs.

QUARTERMAIN, L. B. 1963. Two huts in the Antarctic. Pp. 1-85, figs 1-30. Wellington: Government Printer. [see also 1960, Historic huts. 7pp. Wellington: Department of Scientific and Industrial Research. Revised editions 1961, 1964].

[QUARTERMAIN, L. B.] 1965. Ross Sea Islands Survey. Antarctic 4 (2): 73-74.

RAU, M. 1968. The Penguin Book. 79 pp., illus. New York: Hawthorn Books, Inc.

REID, B. 1962. An assessment of the size of the Cape Adare Adelie Penguin rookery and skuary — with notes on petrels. Notornis 10 (3): 98-111, maps 1-2.

ROBERTSON, C. J. R. 1965. Ross Sea Islands Survey. Terrestrial biology. Antarctic 4 (2): 76-77, 1 fig.

SCHEFFER, V. B. 1958. Seals, sea lions, and walruses. A review of the Pinnipedia. Pp. x + 1-179, text-figs 1-15, pls 1-32, tables 1-3. Stanford University Press; Oxford University Press.

SLADEN, W. J. L. 1957. Adelie Penguins of the Antarctic. Film, 16 mm, sound, colour, 20 min. Produced by the New York Zoological Society. Distributed by McGraw-Hill Text-Films, New York. Photography and sound by W. J. L. Sladen on behalf of the Falkland Islands Dependencies Survey. Narrated by R. C. Murphy.

SLADEN, W. J. L. 1958. The pygoscelid penguins I. Methods of study. II. The Adelie Penguin *Pygoscelis adelie* (Hombron & Jacquinot). Falklands Islands Dependencies Survey. Scientific Reports 17: 1-97, text-figs 1-19, pls I-XII, tables I-XX.

SMITH, M. C. T. 1969. Colour photograph on pp. 1310-1311, Leopard Seal *in:* BURTON, M. (ed.) Purnell's Encyclopedia of Animal Life 3 (15). London: B.P.C. Publishing Ltd.

SPARKS, J.; SOPER, T. 1968. Penguins. Pp. 1-263, illus. Sydney and Melbourne: Angus & Robertson Ltd [first published in the U.K. in 1967 by David & Charles (Publishers) Ltd, Newton Abbott].

STONEHOUSE, B. 1967. The general biology and thermal balances of penguins. Pp. 131-196, figs 1-11, tables I-II *in:* CRAGG, J. B. (ed.). Advances in Ecological Research, Vol. 4. London: Academic Press.

STONEHOUSE, B. 1968. Penguins. Pp. 1-96, illus. The World of Animals series. London: Arthur Barker Ltd; New York: Golden Press.

STRANGE, I. J. 1973. Penguins of the Falklands. Pacific Discovery XXVI (3): 16-24, 12 figs.

TAYLOR, R. H. 1964. Adelie Penguin rookeries in the Ross Dependency. Antarctic 3 (12): 566-570, table 1, map.

THOMPSON, D. C. 1959. New Zealander accompanies veteran explorer to old camp, Cape Adare. Antarctic 2 (3): 112-113, cover photo.

TOMPKINS, J. n.d. The Penguin Twins. Pp. xii + 1-116, illus. London: Frederick Warne & Company, Limited.

USARP 1973-1974. Antipredator strategies of pygoscelid penguins. Dr. Dietland Muller-Schwarze and Christine Muller-Schwarze. P. 314 *in:* Planned field research projects. U.S. Antarctic Research Program, 1973-1974. Antarctic Journal of the U.S. VIII (5): 314-324.

USGS, 1963. Mapping. Antarctic mapping operations, 1962-63. United States Department of the Interior U.S. Geological Survey. Pp. 89-93, illus. *in:* Year in review. A report on United States Antarctic activities. Bulletin of the U.S. Antarctic Projects Officer IV (9): 11-148.

WALKER, E. P. *et al.* 1964. Mammals of the World. Vol. II. Pp. x + 647-1500, illus. Baltimore: The Johns Hopkins Press.

WEDDELL, J. 1827. A Voyage towards the South Pole, performed in the years 1822-24. [2nd ed.]. Pp. iv + 1-324, illus. London: Longman, Rees, *&c.*

WILSON, E. A. 1902. Notes on Antarctic seals. Collected during the expedition of the 'Southern Cross.' Pp. 67-78, pls II-VI *in:* Report on the Collections of Natural History made in the Antarctic Regions during the Voyage of the "Southern Cross." Pp. 1-344, text illus., pls I-LIII. London: British Museum (Natural History).

WILSON, E. A. 1907a. Mammalia (whales and seals). National Antarctic Expedition 1901-1904. Natural History. Vol. II. Zoology (Vertebrata: Mollusca: Crustacea). Pp. 1-69, text-figs 1-34, col. pls I, I-IV.

WILSON, E. E. 1907b. Aves. National Antarctic Expedition 1901-1904. Natural History. Vol. II. Zoology (Vertebrata: Mollusca: Crustacea). Pp. 1-121, text-figs 1-46, col. pls I-XIII.

WILSON, E. A. 1966. Edward Wilson. Diary of the Discovery Expedition to the Antarctic Regions 1901-1904. Edited from the original mss. in the Scott Polar Research Institute, Cambridge, by Ann Savours. Pp. 1-416, illus. London: Blandford Press.

WILTON, D. W. 1908. Pp. 1-45 *in:* WILTON, D. W., PIRIE, J. H. HARVEY, & BROWN, R. N. RUDMOSE. Zoological Log of "Scotia." Report on the Scientific Results of the voyage of S.Y. "Scotia" during the years 1902, 1903, and 1904, under the leadership of William S. Bruce. Vol. IV. — Zoology [Part I]. Pp. xv + 1-105, pls I-XXXIII, maps I-II.

ZANEFELD, J. S. 1968. Benthic marine algae, Ross Island to Balleny Islands. Pp. 10-12 *in:* BALECH, E. *et al.* Primary productivity and benthic marine algae of the Antarctic and Subantarctic. BUSHNELL, V. C. & EL-SAYED, S. Z. (eds). Antarctic Map Folio Series, 10. Pp. 1-12, pls 1-15. New York: American Geographical Society.

E. W. Dawson,
N.Z. Oceanographic Institute,
DSIR,
Wellington

[A visit early in 1974 to Cape Adare by a party from the *Lindblad Explorer* has been reported on by Baden N. Norris who was appointed as a temporary ranger by the Lands & Survey Department to supervise tourist activities (see NORRIS, B. N. 1974. Antarctica's first burial in the 'banana belt.' The Press [Christchurch], 27 April 1974: 12, 2 figs.) — E.W.D.]

PRELIMINARY REPORT ON BIRD BANDING IN NEW ZEALAND 1972 - 73

By C. J. R. ROBERTSON

Wildlife Service, Department of Internal Affairs, Wellington

During the year ended 31 March 1973 a total of 29,680 birds were banded while 9,923 recoveries and 9,582, repeats received during the year were added to the records of the New Zealand Banding Scheme. Continuing progress has been made in the checks of data on computer files. During the year the incorporation of a series of programmes to deal with duplicate records caused by the rebanding of birds has caused some changes to be made in the recovery totals for some species. Seven new species have been included for the first time.

TABLE ONE — PROVISIONAL SUMMARY

Species Banded 1972-73	97
Total Species Banded	185
Species Recovered 1972-73	81
Total Species Recovered	130
Species with more than 10,000 Banded	20
Species with more than 1,000 Recovered	18
Percentage Recovered:	
Game Species	23.74%
Non-Game Species	11.20%
All Species	15.64%

Details of the numbers per species banded and recovered are shown in Table 2 while a selection of interesting age and distance recoveries is shown in Table 3.

The Wildlife Service provides the administrative structure for the National Banding Scheme and the Banding Office staff of three also undertake data processing and computer servicing for a steadily growing range of other biological data. Since 1967 a Banding Advisory Committee has provided useful advice on the policies of banding in New Zealand. Personnel include the Chairman and Secretary from the Wildlife Service, two appointed by the Ornithological Society of New Zealand, one appointed by the National Museum and one representing universities appointed by the Wildlife Service. The committee meets at least once annually or as the need arises.

The reporting of banding results has been fully discussed during the past two years and the following policy agreed upon:

(i) That recovery information should not be published in detail before banding operators have an opportunity to complete studies.

(ii) That a general report giving basic banding data and a selection of interesting recoveries shall be produced each year in *Notornis*.

(iii) Requests for the use of detailed banding data should be addressed to the Banding Officer, Wildlife Service, who shall consult with the banding operators concerned. In the event of any dispute the decision of the Advisory Committee shall be final and may include a time limit after which the information can be made generally available.

I continue to be indebted to banding operators for their co-operation and to my assistants G. Hatzakortzian, Mrs S. J. McKenzie and her replacement Mrs J. Llewellyn for their painstaking work; the Government Engineering Computer Centre (Ministry of Works) for the use of their facilities, maintenance of " BIRDBAND " and assistance with retrieval programmes; the Government Computer Centre for card punching and verification, and my other colleagues in the Wildlife Service for their assistance.

TABLE TWO
BANDING AND RECOVERY TOTALS

Number banded = New Birds Only ( ) Provisional Total Only.
Recoveries = Birds Recovered at least once. + = New Species 1972-73
Repeat = Extra Recoveries for birds recovered once.

SPECIES NAME Page 1	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL
North Island Kiwi	25	5	30	-	12	12	-	-	-
+ Yellow Eyed Penguin	0	17	17	-	1	1	-	-	-
Northern Blue Penguin	1176	124	1300	511	120	631	2303	177	2480
Southern Blue Penguin	223	47	270	17	6	23	2	1	3
White-flippered Penguin	1131	450	1581	116	19	135	14	12	26
Fiordland Crested Penguin	233	73	306	11	7	18	-	1	1
Snares Crested Penguin	642	151	793	133	-	133	23	8	31
Erect-crested Penguin	28	2	30	-	1	1	-	-	-
Wandering Albatross	1150	584	1734	70	-	70	86	2	88
Southern Royal Albatross	19062	99	19161	2209	9	2218	1441	117	1558
Black-browed Mollymawk	10042	0	10042	590	3	593	42	-	42
Grey-headed Mollymawk	3089	0	3089	509	1	510	137	4	141
Buller's Mollymawk	623	863	1486	269	2	271	100	2	102
White-capped Mollymawk	532	19	551	22	2	24	2	-	2
Light-mantled Sooty Albatross	349	1	350	24	1	25	1	2	3
Giant Petrel	891	68	959	152	31	183	59	34	93
Cape Pigeon	6784	4	6788	520	-	520	33	3	36
Grey-faced Petrel	13233	8	13241	277	2	279	51	1	52
White-headed Petrel	28	3	31	-	-	-	-	-	-
Kermadec Petrel	944	0	944	-	10	10	-	-	-
Pycroft's Petrel	209	6	216	20	1	21	42	-	42
Black-winged Petrel	2002	9	2011	-	-	-	-	-	-

SPECIES NAME Page 2	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL
Auckland Island Prion +	0	5	5	-	-	-	-	-	-
Fairy Prion	32831	245	33076	1211	19	1230	99	6	105
Black Petrel	38	41	79	2	5	7	-	-	-
Westland Black Petrel	358	56	414	3	6	9	-	-	-
Flesh-footed Shearwater	1541	86	1627	59	-	59	2	-	2
Buller's Shearwater	364	263	627	-	1	1	-	-	-
Sooty Shearwater	3108	617	3725	130	151	281	20	1	21
Fluttering Shearwater	980	75	1055	62	-	62	14	-	14
Hutton's Shearwater	291	59	350	3	-	3	-	-	-
N. Is. Little Shearwater	281	3	284	1	-	1	-	-	-
White-faced Storm Petrel	4191	332	4523	372	29	401	89	12	101
Black-bellied Storm Petrel	1	2	3	-	-	-	-	-	-
Diving Petrel	6330	130	6460	688	-	688	371	2	373
Australian Gannet	12347	56	12403	2006	24	2030	2965	465	3430
Pied Shag	129	0	129	34	1	35	6	1	7
Little Shag	19	1	20	2	-	-	-	-	-
Auckland Island Shag +	0	154	154	-	-	-	-	-	-
White-faced Heron	12	0	12	1	1	2	1	-	1
Black Swan	(26294)	621	(26915)	(5796)	268	(6064)	(2)	-	(2)
Canada Goose	(21943)	1200	(23143)	(12302)	656	(12958)	(8221)	466	(8687)
Paradise Duck	(15217)	3639	(18856)	(2660)	671	(3331)	(158)	103	(261)
Mallard	(52858)	3736	(56594)	(10333)	1478	(11811)	(1022)	921	(1943)

SPECIES NAME	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
Page 3	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL
Hybrid Mallard (Cross)	(1475)	45	(1520)	(347)	54	(401)	(3)	27	(30)
Grey Duck	(30527)	625	(31152)	(9257)	355	(9612)	(127)	139	(266)
Grey Teal	(841)	118	(959)	(111)	57	(168)	(31)	20	(51)
Brown Teal	71	4	75	5	1	6	-	-	-
N.Z. Shoveler	(167)	204	(371)	(18)	24	(42)	(3)	-	(3)
Blue Duck	(16)	47	(63)	(3)	16	(19)	(-)	4	(4)
N.Z. Scaup +	0	5	5	-	3	3	-	-	-
Australasian Harrier	1232	139	1371	328	27	355	142	16	158
N.Z. Falcon +	0	1	1	-	-	-	-	-	-
Partridge	(11718)	1042	(12760)	(905)	133	(1038)	(6)	1	(7)
Californian Quail	12035	103	12138	(112)	3183	3295	(1)	1998	1999
Pheasant	(45392)	203	(45595)	(3829)	163	(3992)	(8)	-	(8)
North Island Weka	2510	162	2672	112	4	116	52	1	53
Pukeko	839	115	954	(82)	8	(90)	(2)	3	(5)
Notornis	108	0	108	11	45	56	11	157	168
S. Is. Pied Oystercatcher	735	2	737	166	9	175	93	19	112
Variable Oystercatcher	125	0	125	53	10	63	69	24	93
Chatham Is. Oystercatcher	12	0	12	-	1	1	-	-	-
Black Oystercatcher	101	0	101	6	2	8	10	-	10
Spur-winged Plover	519	5	524	21	148	169	-	437	437
N.Z. Dotterel	47	2	49	4	-	4	8	-	8
Banded Dotterel	409	14	423	13	-	13	33	5	38

SPECIES NAMES Page 4	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL
N.Z. Shore Plover	46	8	54	-	21	21	-	6	6
Pied Stilt	279	9	288	8	-	9	-	-	-
Southern Skua	415	118	533	65	-	65	15	7	22
Antarctic Skua	2012	32	2044	798	37	835	616	116	732
Black-backed Gull	53216	2334	55550	3641	258	3899	127	7	134
Red-billed Gull	40237	1005	41242	11744	308	12052	10292	2171	12463
Black-billed Gull	26130	1837	27967	1892	109	2001	1349	6	1355
Black-fronted Tern	687	10	697	48	-	48	30	-	30
Caspian Tern	2127	200	2327	97	7	104	-	-	-
White-fronted Tern	15820	58	15878	502	13	515	9	1	10
Sooty Tern	14584	0	14584	143	1	144	-	-	-
New Zealand Pigeon	24	1	25	3	-	3	-	1	1
Rock Pigeon +	0	60	60	-	-	-	-	-	-
Kea	1032	4	1036	638	3	641	3137	9	3146
Shining Cuckoo	22	5	27	2	2	4	-	-	-
Morepork	26	0	26	7	2	9	19	10	29
N.Z. Kingfisher	110	17	127	14	1	15	4	1	5
N. Is. Rifleman	31	2	33	11	5	16	36	2	38
S. Is. Rifleman	201	20	221	33	-	33	4	-	4
Hedge Sparrow	1367	10	1377	328	5	333	578	1	579
Snares Is. Fernbird	50	31	81	-	-	-	-	-	-
Whitehead	39	1	40	10	9	19	4	18	22

SPECIES NAME Page 5	NUMBER BANDED			RECOVERIES			REPEAT RECOVERIES		
	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL	PREVIOUS	1972-73	TOTAL
Grey Warbler	241	37	278	22	8	30	34	17	51
N. Is. Fantail	141	19	160	25	9	34	62	6	68
Pied Tit	92	12	104	26	3	29	49	8	57
Chatham Is. Tit +	0	10	10	-	-	-	-	-	-
South Island Robin	200	142	342	4	60	64	-	-	-
Black Robin	9	4	13	-	-	-	-	-	-
Song Thrush	2137	29	2166	261	5	266	127	6	133
Blackbird	4236	126	4362	1085	6	1091	1358	42	1400
Silvereye	27681	4116	31797	3220	1116	4336	4966	1912	6878
Bellbird	967	37	1004	79	12	91	74	13	87
Tui	315	11	326	30	7	37	10	-	10
Yellowhammer	475	10	485	102	-	102	66	-	66
Chaffinch	1230	36	1266	224	6	230	397	7	404
Greenfinch	3070	194	3264	504	27	531	914	4	918
Goldfinch	1651	10	1661	62	-	62	15	-	15
Redpoll	4879	2	4881	1102	1	1103	3002	-	3002
House Sparrow	18515	677	19192	1846	38	1884	710	7	717
Starling	3080	1649	4729	287	24	311	30	6	36
Myna	1224	104	1328	294	3	297	125	-	125
N. Is. Saddleback	246	0	246	15	35	50	11	6	17
White-backed Magpie	48	3	51	13	-	13	23	-	23
Rook	957	0	957	259	1	260	102	-	102
75 Species NOT Banded or Recovered 1972/73	4048	-	4048	115	-	115	14	-	14
PROVISIONAL TOTALS	584305	29680	613985	86122	9923	96045	46214	9582	55796

TABLE THREE — A SELECTION OF INTERESTING RECOVERIES RECEIVED 1972-73

Page 1

AGE AT BANDING. P = CHICK/JUV. A = ADULT J = JUVENILE U = UNKNOWN

HOW RECOVERED. X = DEAD V = RELEASED ALIVE ≠ = BREEDING S = SIGHT U = UNKNOWN

SPECIES	BAND	BANDED LOCALITY, AGE AND DATE		RECOVERY LOCALITY, HOW AND DATE		AGE	DISTANCE
						Y.M.D.	
White-flippered Penguin	P-1554	Motunau Is.	P. 7.12.61	Motunau Is.	V. 27.12.72	11-0-20	
Fiordland Crested Penguin	J-355	Jacksons Head	A. 22. 8.66	Jacksons Head	V. 5. 2.72	5-5-14	
Snares Crested Penguin	J-907	Snares Is.	P. 28.12.71	Chatham Is.	V. 21. 2.73	1-1-25	871 ENE
Southern Royal Albatross	R-5728	Campbell Is.	P. 15. 8.65	Off Wilsons Prom. (Australia)	V. 2. 2.72	6-5-18	1454 WNW
" " "	R-22259	Campbell Is.	P. 10. 8.71	Huasco (Chile)	X. -. 1.72	0-5-?	5805 SE
Black-browed Mollymawk	M-26858	Campbell Is.	P. 31. 3.72	Tuamotu Archipelago	X. 26. 6.72	0-2-26	3714 ENE
" " "	M-27489	Campbell Is.	P. 8. 4.72	Tonga	X. 12. 7.72	0-3-3	2424 NNE
Grey-headed Mollymawk	M-26099	Campbell Is.	P. 25. 4.71	Great Exhibition Bay	V. 30. 5.71	0-1-4	1247 N
Bullers Mollymawk	M-14870	Snares Is.	A. -. 1.48	Snares Is.	V. 10. 2.72	24-0-?	
Fairy Prion	D-29149	Motunau Is.	A. 23.10.63	Motunau Is.	V. 27.12.72	9-2-4	
Buller's Shearwater	Z-17107	Poor Knights Is.	A. 3.12.64	Poor Knights Is.	V. 7. 1.73	8-1-4	
Sooty Shearwater	Z-144	Motunau Is.	A. 6.12.62	Motunau Is.	V. 27.12.72	10-0-21	
" "	Z-1030	Titi Is.	A. 3.12.69	La Jolla (U.S.A.)	V. 1. 6.72	2-5-28	6625 NE
Kermadec Petrel	E-36781	Meyer Is.	A. 19. 1.67	Meyer Is.	V. 11. 3.73	6-1-21	
Pycroft's Petrel	D-40178	Poor Knights Is.	A. 7.12.64	Poor Knights Is.	V. 1. 2.73	8-1-8	
White-faced Storm Petrel	C-4094	Motunau Is.	A. 23.10.63	Motunau Is.	V. 27.12.72	9-2-4	
Australian Gannet	M-14403	Cape Kidnappers	P. 19. 1.52	Herbertville	X. 15.10.72	20-8-26	73 SSW
Canada Goose	18-22039	Ellesmere L.	U. 10. 1.57	Ellesmere L.	V. 8. 1.73	15-2-4	
Black Swan	19-30389	Ellesmere L.	P. 26. 1.56	Ellesmere L.	V. 15. 1.73	16-11-19	
Paradise Duck	13-00028	Taihape Loc.	U. 23.11.61	Burkes Lagoon	V. 9. 1.73	11-1-16	120 NE
" "	13-17289	Lilburn Valley	P. 8.12.71	Manapouri	X. -. -.72	0-5-?	
Grey Teal	L-4295	Mount Bruce	P. 22. 3.69	Hawea L.	X. 6. 5.72	3-1-14	404 SW
" "	Z-4746	Mangere	P. 7. 5.71	Scargill	X. 17. 5.72	1-0-10	425 SSW
Grey Duck	17-3720	Whangape L.	P. 12. 2.61	Matamata Loc.	X. -. -.72	11-?-?	45 SE

Page 2

SPECIES	BAND	BANDED LOCALITY, AGE AND DATE		RECOVERY LOCALITY, HOW AND DATE		AGE	DISTANCE
						Y.M.D.	
Mallard	17-13570	Otamauri	A. 9. 1.62	Waipaoa R.	X. 7. 5.72	10-3-27	99 NE
"	17-73507	Tuakitoto L.	P. 29. 1.70	Horotiu	X. 17. 5.72	2-3-17	651 NNE
N.Z. Shoveler	S-56162	Waituna Lagoon	A. 7. 2.72	Whangape L.	X. 16. 5.72	0-3-7	715 NNE
" "	Z-171	Pukepuke L.	P. 8.12.71	Gore Loc.	X. 17. 5.72	0-5-8	505 SW
Australasian Harrier	13686	Seddon	P. 25. 2.62	Stoke	X. 20. 2.72	10-11-25	55 NW
Californian Quail	23384	Cairnmuir	A. 30. 7.56	Cairnmuir	X. 13. 8.63	7-0-13	
Notornis	18491	Takahe Valley	A. 21. 1.55	Takahe Valley	S. 4. 2.67	12-0-14	
S. Is. Pied Oystercatcher	K-3512	Heathcote R.	A. 16. 6.70	Lumsden	X. 18.11.72	2-5-3	261 SW
Variable Oystercatcher	K-4663	Waipu	P. 18. 1.71	Eastbourne	S. 29. 6.72	1-5-10	357 S
Spur-winged Plover	E-61262	Invercargill Loc.	P. 9.11.61	Invercargill Loc.	?. 27. 6.71	9-7-16	
N.Z. Shore Plover	C-16602	Mangere Is.	A. 5.11.70	Mangere Is.	V. 12. 2.73	2-3-8	
Antarctic Skua	L-11212	Hallett C. (Antarct)	P. -. 1.62	Hallett C. (Antarct)	V. 18. 1.73	11-0-?	
Black-backed Gull	S-1852	Rangitoto Is.	P. 20.12.59	Rangitoto Is.	X. 4. 1.73	13-0-15	
Red-billed Gull	E-76164	Kaikoura	P. 21.12.58	Kaikoura	V. 15.11.71	12-10-24	
" " "	E-78550	Kaikoura	P. 24.11.62	Onehunga	S. 22. 5.72	9-5-27	383 N
" " "	E-96981	Grassmere L.	P. 1.12.61	Kaikoura	V. 13.12.71	10-0-11	52 SSW
Black-billed Gull	E-7031	Wairau R.	P. 19.11.60	Banks Peninsula	S. 8.11.72	11-11-18	149 S
Caspian Tern	H-18667	Invercargill	P. 20.11.69	Ashley R.	X. (5.5.70)	0-5-13	305 NE
White-fronted Tern	7037	Clevedon	P. 12. 1.52	Ponui Is.	X. 31. 1.73	21-0-19	5 NW
Sooty Tern	D-9145	Raoul Is.	P. 20.12.61	Raoul Is.	V. 31.12.72	11-0-11	
Blackbird	D-42178	Christchurch	P. 29.11.65	Christchurch	X. 24.12.72	7-0-25	
Silvereye	A-29325	Lower Hutt	A. 20. 8.63	Lower Hutt	V. 16. 6.72	8-9-26	
House Sparrow	B-8740	Upper Hutt	P. 10. 1.64	Trentham	X. 14. 4.72	8-3-3	
" "	B-16254	Milford	A. 10.12.66	Milford	X. 18. 3.73	6-3-7	
Starling	D-57709	Milford	P. 9.12.66	Blockhouse Bay	X. 11.10.72	5-10-1	11 S
Myna	Y-140	Havelock North	P. 4. 4.66	Havelock North	X. 29. 1.73	6-9-26	
Rook	H-15183	Longlands Loc.	P. 27. 7.67	Longlands Loc	X. 18.11.72	5-3-23	8 W

SHORT NOTES

DECLINE OF PIPIT IN WAIRARAPA

A drastic decline in the numbers of the Pipit *(Anthus novaeseelandiae)* or Ground Lark, as it is often called, has occurred in the Wairarapa district in the last twenty years. After being one of the commonest native birds in the Wairarapa countryside the Pipit now is one of the scarcest. It is difficult to account for this decline, though several contributing factors are probably responsible.

In the decade 1920-1929 the Pipit was widespread on farm lands in the Wairarapa Valley and also in the hilly East Coast country, in the swampy pastures around Wairarapa Lake and on the ocean beaches, not to mention a sprinkling along the summits of the Tararua Mountains. In that period it could be seen on occasions in the suburban areas of Masterton borough as, for instance, Makora Road, 11 April and 20 December 1921; 26 April 1924; 2 April 1926. Near Fish Hatcheries, Pownall Street, 15 June 1924; Lansdowne, several, 18 March 1928. Likewise it was of frequent occurrence on the roadsides radiating from Masterton and it was most unusual at that period not to see the Pipit on a journey through the Wairarapa.

The Pipit continued to be widespread in the following two decades, being recorded as plentiful in many areas. It was during the 1950-1959 decade that a decline in the numbers of the Pipit became apparent. The decrease continued in the period 1960-1969, when only single birds were seen in localities which formerly held several.

The disappearance of the Pipit from some of its former haunts is best indicated by giving records of a specific area, such as the Mount Holdsworth Road, which to this day remains unsealed, has had the minimum amount of roadside spraying and has remained little changed for the past fifty years. There has been, however, a considerable increase in motor traffic in recent years and the area has been invaded by the Australian Magpie *(Gymnorhina tibicen hypoleuca)*, first recorded there on 3 June 1945. From 1921, when my records began, the Pipit could always be seen on this road. In 1934 there were at least three pairs but by 1961 the numbers had been reduced to a pair. Since 1966 not a single bird has been recorded, though the habitat remains suitable.

Another favoured locality in earlier years was the Kiriwhakapapa Road, also leading to the Tararuas. On 13 January 1946 as many as twenty were seen. Except for a single bird seen on 16 December 1966, none has been recorded since 1953.

Another indication of the decrease of the Pipit in the Wairarapa Valley is provided by records of roadside nests discovered when the sitting bird flew out on the approach of traffic. Eighteen nests were found in this way from 1935 to 1952, eleven of these being up to 1939, four in the 1940-1949 decade and three in the fifties to 1952, since when not a single roadside nest has been recorded nor has the bird itself been seen on these roads. The roads in question are: Weraiti Hill, Ngaumu, Gladstone, Cavelands, Te Whiti, Maungaraki, Rangitumau, Te Wharau (Hikorangi).

At present a few Pipits inhabit the Ruamahanga and other riverbeds but here, too, there has been a decrease in numbers. At Te Whiti, for instance, where formerly, 1937 to 1951, several were usually seen on or near the riverbed, now most visits fail to record the bird at all. The Pipit is sparingly distributed on the hilltops of the East Coast pastoral lands and along the sea beaches, perhaps most numerous in the latter areas. It has remained in small numbers on the Rimutaka Hill Highway.

Since the sealing of main roads, with an ever-increasing volume of motor traffic and faster speeds, it is likely that the habit of the Pipit in flying from its nest across the road in front of approaching vehicles has proved a fatal one. This, combined with the almost universal practice of Government and local bodies of spraying road verges for weed control, with consequent contamination of water tables; the greater destruction of roadside vegetation to improve visibility; more efficient farming methods and the increase of the Magpie which unfortunately is prone to snap up young birds found in its foraging in the Pipit's habitat have all contributed, it seems likely, to the decrease in the number of this ecologically valuable bird.

It should be stated that bird life generally in the Wairarapa has decreased considerably in the period under review to about only a quarter of its former numbers. The decrease has been particularly noticeable since the Second World War. Has a similar decrease in the numbers of the Pipit been recorded in other parts of New Zealand ?

R. H. D. STIDOLPH

120 Cole Street,
Masterton.

★

A FIJI BLACK-FACED SHRIKEBILL ANTING WITH A MILLIPEDE

On 11 November 1972, in rainforest about 300 metres above sea-level in southern Viti Levu, Fiji Islands, I saw a female Black-faced Shrikebill *(Clytorhynchus nigrogularis)* apparently " anting " with a millipede.

The bird was perched, low in the understorey, holding a small millipede (approx. 3cm long) crosswise in her bill. She repeatedly thrust her head under her wing and shook it about, as if preening violently. She then withdrew her head, thrust it under the other wing, and again shook it about. After she had done this several times she leant forward and transferred the millipede to her feet, holding it along the branch on which she was perched, and poking roughly at it with her bill. After several jabs she again took it cross-wise in her bill and recommenced thrusting it under one wing then the other.

This basic pattern was repeated three times, the shrikebill dropping the millipede into tangled undergrowth the third time she lifted it from her feet. She looked down at the spot where it fell, but made no attempt to retrieve it, and after a few seconds flew off through the forest, followed by a male Black-faced Shrikebill which had been preening and calling on a vine a few metres away.

Unfortunately I was unable to find the millipede amongst the dense tangle of fern into which it had fallen, so cannot offer an identification.

FERGUS CLUNIE

Fiji Museum,
P.O. Box 2023,
Suva, Fiji.

★

WASP STINGING A BELLBIRD

In early March 1973 on Hen Island I observed a juvenile Bellbird *(Anthornis melanura)* fall to the ground and lie there with very little movement. When I picked it up I observed a Tasmanian Wasp *(Polistes humilis)* stinging the bird on the right side of its rump. The bird was very drowsy but after being fed some honey water began to recover. Some ten minutes later it was looking quite bright but examination showed that its right side, particularly the leg, was still partially paralysed. However, half an hour after being rescued the bird had recovered sufficiently to fly away.

Dr J. C. Watt, Entomology Division, DSIR, Auckland, who identified the wasp for me added the following notes —

" It was apparently accidentally introduced from Australia and has been in the North Island for some years. The nest is a small inverted cone of greyish paper attached to the branches of trees or shrubs. Generally this wasp will only attack man when provoked. Thus, one would imagine that the Bellbird must have provoked it in some way."

C. R. VEITCH

Wildlife Service,
Department of Internal Affairs,
Box 2220,
Auckland

DECREASE OF GREY WARBLER

There has been a drastic decline in the numbers of Grey Warbler *(Gerygone igata)* recorded in my garden, compared with thirty years ago, although the environment has remained unchanged. In a daily record of all species seen in the garden over a twelve month period, the figures for May 1942 to April 1943 gave a total of 257 for the Grey Warbler whereas those for May 1971 to April 1972 gave the much reduced tally of 39. Now weeks may pass without a Warbler being recorded but thirty years ago it was a constant inhabitant and actually breeding. We do not use any sprays.

130 Cole Street,
Masterton

R. H. D. STIDOLPH

★

FERNBIRDS ON THE HILLS WEST OF DUNEDIN

There have been several uncertain reports of Fernbirds *(Bowdleria p. punctata)* on Flagstaff and Swampy hills on the western boundaries of Dunedin city, but they have never been confirmed.

On 24 June 1973 Mr Neil Henderson and others saw one Fernbird and heard two others along Burns Track at an altitude of about 1600′ (488m).

The general vegetation in the region consists of tussock *(Chionochloa rigida)* 1m high and scattered flax *(Phormium tenax)* 1.5m sometimes clumped. The flax bushes are about a metre apart with tussock between. Odd coprosma bushes *(C. rugosa* and *C. propinqua)*, Olearia, Hebe, Manuka (2m), Aciphylla, Gorse and Cassinia are sparsely scattered throughout.

Drainage is good, and the terrain generally dry except in one shallow valley where there are numerous patches of boggy ground. These wet areas are clothed with *Carex spp.* with scattered flax 2m high with Coprosma and occasional Hebes on firmer ground.

On each of two subsequent visits, 29 July and 4 August 1973, we saw one Fernbird in the wet area. Three others, however, were seen widely separated (over 1 mile apart) amongst the tussock and flax — one bird was seen at over 2000′ (610m) close to the summit of Swampy.

All the Fernbirds heard calling (a total of four) were tracked down and good views obtained of each. They appeared to be no different in colour or pattern from the birds RSG has seen at Tuakitoto.

The rolling and sometimes steep terrain covered with tussock and scattered areas of flax extends not only west towards Middlemarch but also north to the Shag Valley and south to the Maungatuas. It is likely that Fernbirds are scattered throughout.

Mrs J. B. Hamel suggests the possibility that Fernbird populations in tussock scrublands may be limited to higher altitudes e.g. over 1200′ (366m) where rainfall is in excess of 47″ (1193mm).

Fernbirds, rather than being isolated in pockets of relatively dense population in the lowland bogs and about the margins of lakes such as Lakes Waihola and Tuakitoto, may have therefore a more continuous distribution and a greater tolerance of harsher conditions in East Otago than we had previously assumed.

R. S. GRAY

4 Cairnhill Street,
Maori Hill,
Dunedin

B. WARBURTON

359 Malvern Street,
Woodhaugh,
Dunedin.

★

BRISTLE-THIGHED CURLEW RECORDS FROM THE KERMADEC ISLANDS

Prior to the two new records noted below, the only record of Bristle thighed Curlew *(Numenius tahitiensis)* in the New Zealand region is that of one sighted in August 1966 on Macauley Island (O'Brien 1966; Bell & Williams in press).

On 9 September 1972, during the combined Wildlife/Forest Service visit to Raoul Island, a visit was made to North Meyer Island. There the dried remains of a "Whimbrel" were found high on the rocks in a situation showing that the bird must have died on the island. These remains were later forwarded to the Dominion Museum and there identified by F. C. Kinsky as a female Bristle-thighed Curlew.

On 25 September 1972 an unusual Whimbrel was seen on the shores of Blue Lake, Raoul Island. At that time five Asiatic Whimbrel *(Numenius phaeopus variegatus)* were present on Raoul, and the unusual bird was observed to be a similar size but to have two obvious differences: Firstly, its voice, which I recorded as *krreeep* with a slightly rising cadence, had no similarity to the Asiatic Whimbrel's *ti-ti-ti-ti.* Secondly, the light (buff) tail coverts formed a band across the lower rump rather than the obvious blaze up the back of Asiatic Whimbrels.

On 30 September I was able to photograph this bird (see Fig. 1). Study, by F. C. Kinsky and myself, of this and other photographs and comparison with museum specimens and published descriptions (Peterson 1961; Matthiessen 1967) show two further diagnostic features:— Firstly, the back and wing coverts, as seen in the photograph,

FIGURE 1 — Bristle-thighed Curlew *(Numenius tahitiensis)* on the shore of Blue Lake, Raoul Island, 30 September 1972.

Photo: C. R. Veitch

are more obviously speckled than those of Asiatic Whimbrels. Secondly, the streaking on the breast is less pronounced and does not extend as far down as that on Asiatic Whimbrels.

These diagnostic features, when added up, show that the bird in question was also a Bristle-thighed Curlew.

For future field identification, the voice and tail covert colour are the most noticeable diagnostic features of the Bristle-thighed Curlew. One further feature, not noted above, which can be useful in the field, is that the tail of the Asiatic Whimbrel is grey with black bars while that of the Bristle-thighed Curlew is rusty buff with black bars. Other features are ones of comparison and, therefore, of little use in the field in New Zealand.

LITERATURE CITED

MATTHIESSEN, P. 1967. *in:* STOUT, G. D. (ed.). The Shorebirds of North America. Pp. 1-270, col pls 1-32, text illus. New York: Viking.

O'BRIEN, J. F. 1966. Macauley Island Expedition. Unpublished report to Controller, Wildlife Service, Wellington. D.I.A. file 46/29/9.

PETERSON, R. T. 1961. A Field Guide to Western Birds. 2nd ed. Pp. 1-366, 1242 illus. Boston: Haughton Mifflin Co.

C. R. VEITCH

Wildlife Service,
Department of Internal Affairs,
P.O. Box 2220,
Auckland

FIRST BREEDING OF WOODSWALLOWS IN NEW ZEALAND

The arrival in mid-summer, 1971-72, of two species of Australian Wood-swallow at Naseby Forest, Central Otago, was previously reported by Darby (1972).

A diary of the daily movements, habits and any changes was kept by Mrs D. M. Shaw until 29 January 1973, since when it has been continued by Mr and Mrs A. Coster. The following changes have occurred since last published.

WHITE-BROWED WOOD-SWALLOW *(Artamus superciliosus)*

The remaining two males were present up till 20 October 1972 when the Shaws went on short leave. There was a wintry snowstorm on 26 October. No sightings were made on 28 October when they returned from leave.

On 14 November one bird (the one originally caught and banded) was sighted at 6.20 p.m. and pecked at bread thrown to it. On 17 November another joined it, both fed confidently on bread thrown on the lawn and have remained near the house ever since. (On 7 April 1973 the ventral chestnut colouring seemed paler than in January.)

MASKED WOOD-SWALLOW *(A. personatus)*

The mated pair were present until 27 July 1972. There was a period of heavy frosts at the time. About an inch of snow fell on 3 August and again on 26 October wintry conditions with snow prevailed. A similar day was experienced on 6 March 1973, and on 9 March about midday what is presumed to be the same two adult birds returned with two flying young. For about an hour there was much calling, chattering and general excitement between them and the White-browed. The adults fed on bread placed on a tree-stump in a field next to the house section and were very aggressive towards house sparrows, blackbirds and thrushes also attracted to the bread. The adults then fed the young in a nearby larch on what appeared to be blowflies. At this stage the young were adept fliers but did not seem to feed themselves. The plumage was much speckled with white dorsally (like winter starlings) and showed indistinct transverse barring ventrally (more towards the sides) reminiscent of immature Shining Cuckoo.

By 24 March the young were becoming more independent and on 25 March they fed with parents on lunch scraps about 40m from some boys. The family indulged in much aerial acrobatics during this period and when roosting hunched very tightly together on wires or branches, especially on cooler days. On 31 March, led by the White-browed, all came close to the house and fed from a bird-table near the section fence. They were now tolerant of sparrows but still aggressive to other species. By 2 April frosty weather was beginning, insects were fewer (particularly in the morning), and the birds became more dependent on bread and scraps. Meanwhile the feeding table was gradually being moved closer to the house for photography.

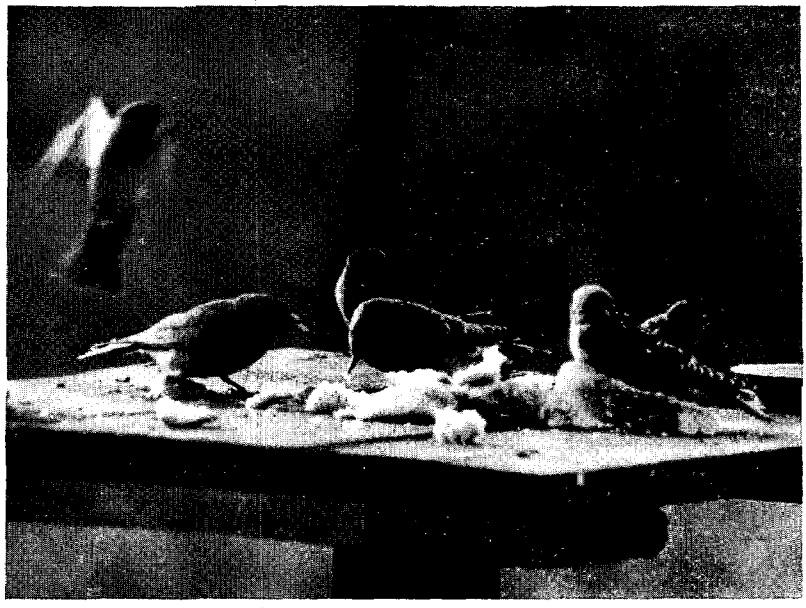


FIGURE 1 — Masked Wood-swallows feeding on bread with House Sparrows; adult female on the left and the two immatures (centre and right) with whitish barring and speckling on their dorsal surfaces. Naseby Forest, 7 April 1973.

Photo: P. Child

I visited the Costers on 7 April and observed and photographed all six birds from about 2 p.m. to 5 p.m. (Figs. 1 & 2). The afternoon was very mild and sunny with a slight southwest breeze. At 2 p.m. all six birds were roosting and preening high in *Pinus ponderosa* 20 m from the house, with occasional forays soaring effortlessly in thermals and probably catching airborne insects. The immatures were slightly smaller and noticeably slimmer than the parents. Their plumage patterns were alike, both closely resembling that of the adult female, except that the dorsal slaty-blue still showed a few white flecks on the outer wings and nape, the underparts were dusty-grey rather than silver-grey, and the dark facial markings were also more smoky than in the adult. There were no distinct colour delineations as in the male; this might suggest that both offspring are female.

The Masked continue to be more wary than the White-browed, and it is always the latter which leads the way to the feeding table.

Frequent rather harsh chitterings and the more typical Wood-swallow communication calls were characteristic of the family group, but no mutual preening or feeding of the young by the adults was observed by me.

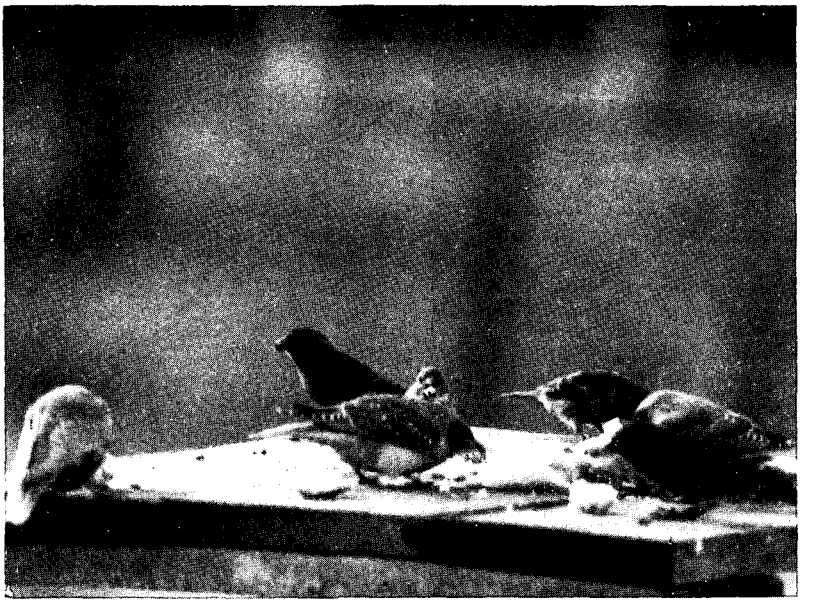


FIGURE 2 — The two immature Masked Wood-swallows feeding on bread with House Sparrows. On the extreme left is a male White-browed Wood-swallow. Naseby Forest, 7 April 1973.
Photo: P. Child

Observations and photographs were made in very good light at various places, down to a distance of 8 m at the bird-table.

We have no idea where the birds bred; no sightings were made elsewhere in the forest area or vicinity during their absence, but as the absence period lasted some six months it is obvious their nomadic habit could have taken them a long distance from Naseby. The clutch of two is typical of the species (Rowley *in* Frith 1969).

I am very grateful to the Shaws and the Costers for their hospitality and for access to their diary records.

LITERATURE CITED

DARBY, J. T. 1972. The Australian White-browed Wood-Swallow in New Zealand. Notornis 19 (2): 114-117, figs 1-2.

ROWLEY, J. C. R. 1969. Wood-swallows. Pp. 452-457, pl. XXXIII *in:* FRITH, H. J. (ed.). Birds in the Australian high country. Pp. 1-481, 1 text-fig., 4 maps, pls 1-13, col. pls I-XXXIV. Sydney, *&c.:* A. H. & A. W. Reed.

PETER CHILD

10 Royal Terrace,
Alexandra

THE ADAPTABLE HOUSE SPARROW

A Kowhai coming into flower in the garden on 18 October 1973 was the scene of much activity on the part of a group of House Sparrows *(Passer domesticus)*. They were feeding on the nectar but were not adopting the usual technique of the honeyeaters or the silver-eyes — they were taking a short cut to the nectar by piercing neat holes in the base of the flower. An examination of the flowers showed that the greater number had holes pierced in them. About half a dozen Sparrows could be seen in the tree during most of the day and this method of feeding continued for several days.

R. H. D. STIDOLPH

120 Cole Street,
Masterton

★

THE ROBIN AS A FIRE FIGHTER?

For a long time I have been curious about an observation which I made during a walk between Flora and Salisbury Hut in the vicinity of Mt Arthur east of Nelson. It was New Years Day of 1958 and we were on the track for Salisbury Hut. I had stopped to watch a South Island Robin and a Fantail when two deer stalkers came along and we talked for a while. They mentioned that the Robin was credited with putting out bush fires, and to demonstrate they put a lighted match on the track. The Robin immediately came up to the match, seized it in its beak and shook it out.

I imagine that the Robin was attracted to the bright light, picked the match up and, finding it was hot, shook it out, but I have often wondered if this behaviour has ever been reported in the literature.

WILLIAM J. BREED

Museum of Northern Arizona,
P.O. Box 1389,
Flagstaff,
Arizona 86001,
U.S.A.

LETTERS

APROPOS THE SOCIETY'S JOURNAL &c.

The Editor,
Sir,

In recent issues of *Notornis* the end pages have, in their Reviews, "From the Editor's Desk," Notes and News, "About Our Authors," and Letters to the Editor, provided some much needed lighter and informative alternative to the generally rather profound papers and provoked much lively discussion. Such matters are frequently kept out of the pages of scientific journals and published as separate newsletters (*vide* RAOU Newsletter, Royal Society of NZ Newsletter). This is a retrograde step divorcing ornithologists from ornithology and making something else to file and catalogue, a librarian's nightmare. I hope you will resist the temptation to follow suit.

Two matters in the September issue are to my mind worthy of comment. First the statement of the Council on its attitude towards conservation ("From the Secretary" — *Notornis* 20 (3): 288-289); that it will associate itself with and support conservation bodies while not normally taking independent action. This is eminently sensible: the Society should not get distracted from its main objects. It was formed primarily to study living birds in their natural state and used not to be concerned with (in other than an informative capacity) the protection or destruction of birds or their habitats, which are the function of specialist bodies. The restriction has however been dropped from the present constitution and therefore may not easily be debated again because the Annual General Meeting has now no power to direct the Council. It is thus right that the Council's recent decision should be promptly reported to members and that you should allow members the opportunity of publicly supporting it. I congratulate you on providing this opportunity in the columns of *Notornis*.

I am however devastated to learn (p. 299) that you have allowed yourself to be persuaded by "several long-standing members" to discontinue the feature "About our Authors." May I remind you that you are not subject to direction of the Council and that it is usual for ornithological journals to publish obituaries? But why should members learn of the interests and achievements of their fellow members only after their deaths?

J. M. CUNNINGHAM
("another long-standing member")

"Illawarra,"
5 Kotari Road,
Days Bay,
12 December 1973

NOTORNIS 21: 89-92 (1974)

The Editor,
Sir,

LIFE MEMBERSHIP

Some members who are paying $4 p.a. for their journal and other services feel that the Life Member is getting off with very much less, especially the earlier ones who receive the services for a very small fraction of the $4. This can be so if his Life subscription has not been invested and kept invested as capital. This ensures that when he dies, as he must, the interest on his subscription will continue. It will eventually wipe out the difference in cost of supply of journal, etc., when he was alive and from then on will be a permanent source of income. Since the year ending in 1969 Council has been using 10% of the Life Subscriptions Reserve Fund for current expenses, thus defeating the only way in which Life subscriptions can be made profitable. This is the less excusable since there is no real shortage of funds. The amounts deducted should be put back into the fund.

The reply I received to my protests to Council was that this deduction was " sound business practice." It definitely is not. Capital funds may be used for business extension but no business man would use them for current expenditure, nor should any society, more especiaaly where, as in this case, it is cutting off future income.

H. R. McKENZIE
(Past Hon. Treas. OSNZ)

P.O. Box 45,
Clevedon.
20 December 1973

★

The Editor,
Sir,

EMPLOYMENT OF BIOLOGISTS BY LOCAL AUTHORITIES

I note with interest the comment on local authorities employing biologists made in the review of " The Coastal Ecology of a Recreation Resource Area Kawakawa Bay to Miranda " published in *Notornis* 20 (3): 296-297, 1973.

I am a civil engineer with 21 years experience in both county and municipal local government. Hardly ever in that time have I found a professional officer in a situation where he can report as he feels. Usually the preparation of a report is influenced prior to completion or the report is completely suppressed. The local body I am employed by has recently retained both a consulting industrial chemist and a biologist to report on a major project. This, in my opinion, is the only method of obtaining unbiased information. This was borne out by the biologist, a university lecturer who would accept expenses only because he wanted it to be seen that the local authority was not influencing him. This is not to say that I don't admire the Auckland Regional Authority for breaking new ground. I, too, am enthusiastic about Miss Bacon's work. I believe part of the Kaipara Harbour is or has received a similar investigation by ARA staff.

L. HOWELL

11 Gardner Road,
Epsom,
Auckland 3.
28 December 1973

The Editor,
Sir,

PLUMAGE PHASES OF GIANT PETRELS

There is an error in a recent paper in *Notornis* (Hicks 1973) which should not be left uncorrected.

Referring to the giant petrels *Macronectes halli* and *M. giganteus,* Hicks states (p. 236) that Bourne & Warham (1966) suggested that dark phased individuals represent *M. halli,* and the white phase *M. giganteus.* This is incorrect. Bourne & Warham suggested that, while *M. halli* is monomorphic with only a dark plumage phase, *M. giganteus* is dimorphic with dark and white phases, the white phase representing only up to 15% of local breeding populations of *M. giganteus* and usually a much smaller proportion (Shaughnessy 1971). Dark phased *M. giganteus* become paler with increasing age than does *M. halli,* but to assume that all dark giant petrels seen at sea are *M. halli* leads to a false picture of their distribution.

REFERENCES

BOURNE, W. R. P.; WARHAM, J. 1966. Geographical variation in the giant petrels of the genus *Macronectes.* Ardea 54: 45-67.

HICKS, G. R. F. 1973. Latitudinal distribution of seabirds between New Zealand and the Ross Sea, December 1970. Notornis 20 (3): 231-250.

SHAUGHNESSY, P. D. 1971. Frequency of the white phase of the southern giant petrel, *Macronectes giganteus* (Gmelin). Australian Journal of Zoology 19: 77-83.

G. W. JOHNSTONE

Antarctic Division,
Department of Science,
568 St Kilda Road,
Melbourne,
Victoria 3004,
Australia
24 January 1974

★

The Editor,
Sir,

A FAREWELL FROM THE SECRETARY

Although it is perhaps not conventional for letters of resignation to be published in *Notornis* I feel that, under the circumstances, members are entitled to some explanation as to why the Secretary should resign after only a year's service.

I have been invited to apply for a lectureship in a new course in Environmental Science in Leicester and although it is by no means certain that I will get the position, it is an opportunity I feel I cannot let pass by.

Both my wife and I have made very many friends throughout the country by virtue of membership of the OSNZ and it is certainly not through any dissatisfaction with New Zealand or its people that

we take our leave; indeed it is with very mixed feelings that we do so and join the ranks of overseas members of the Society.

My forwarding address will be 211, Lexden Road, Colchester, England, and I will naturally be delighted to hear from any member.

J. A. FOWLER

" Manu Korero,"
2/1030 Fergusson Drive,
Upper Hutt
5 March 1974

★

ADDENDA ET CORRIGENDA

The review printed on pp. 284-285 of *Notornis* 20 (3), September 1973, was inadvertently separated from its introductory paragraph in " From the Editor's Desk " in *Notornis* 20 (2): 187, June 1973.

Classified Summarised Notes in *Notornis* 20 (4), December 1973:
p. 362, Wrybill line 5. For say read saw;
p. 368, Grey Ternlet, line 1, for Breet read Brett;
N.I. Kaka, line 1, for Parau read Parua;
p. 369, S.I. Kaka, line 7, for Patison read Paterson;
p. 372, Silvereye, line 4, for Nov 772 read Nov 72.

In A. J. Baker's " Genetics of plumage variability in the Variable Oystercatcher *(Haematopus unicolor)* " *Notornis* 20 (4): 330-345, December 1973, there has been an inversion of Figure 3. The corrections are — 1 and 2 should be reversed; 3 and 4 should be reversed; 5, 6 & 7 should be 7, 6 & 5; 8, 9 & 10 should be 10, 9 & 8.

We regret the omission of a line from the letter from Mr Nigel Penniket, " Birds in Exotic Forests " *Notornis* 20 (3): 283, September 1973. At the end of line 9 of paragraph 2, the words " of State forests and the ecological boundaries " [of exotic plantations] should be inserted. The alteration of the writer's sense was unintentional. We apologise.

★

NEW AND FORTHCOMING

Mike Imber has recently published " The food of Grey-faced Petrels (*Pterodroma macroptera gouldi* (Hutton)), with special reference to diurnal vertical migration of the prey." *Journal of Animal Ecology* 42 (3): 645-662, October 1973.

★

Allan Baker has more oystercatcher papers coming up — " Criteria for ageing and sexing New Zealand oystercatchers " in the *N.Z. Journal of Marine and Freshwater Research*, and " Melanin pigmentation in the dorsal plumage in New Zealand oystercatchers " in the *N.Z. Journal of Zoology*, Prey-specific feeding methods of New Zealand oystercatchers in *Notornis* as well as a contribution in the American journal *Evolution* and Ecological and behavioural evidence for the systematic status of New Zealand oystercatchers recently published in *Royal Ontario Museum Life Sciences Contributions*, No. 96.

★

F. C. Kinsky and P. C. Harper have produced an illustrated guide to the seabirds of the New Zealand Region due to appear as the next special issue of *Tuatara*, the journal of the Biological Society of the Victoria University of Wellington.

REVIEWS

The Fiat Book of Common Birds in New Zealand. Vol. 2. Mountain, bush and shore birds. By Janet Marshall, F. C. Kinsky, and C. J. R. Robertson. Pp. 1-96, pls 1-40. Wellington, *&c.:* A. H. & A. W. Reed. 1973. $1.95.

What's in a name? If you are just starting to watch birds, this is hardly the appropriate pocket guide for the common birds of mountain, bush and shore. Of the 49 species described, a mere dozen or so are widely enough distributed to deserve to be called " common " and of these some e.g. Pied Shag, Tui and Bellbird, are scarce or absent over very large areas. Thirteen species breed only in the South Island or further south; and even there, it is the reviewer's experience that a planned campaign, hard work and an element of luck are necessary in the search for Fiordland Penguin, Yellowhead and Rock Wren. Can it truly be said that Kaka, Falcon and Blue Duck are common, when your good keen ornithologist marks it as a red-letter day in his diary if he so much as glimpses any of them?

Of course the text belies the title. Sooner or later the writers' honesty is bound to shine through. Kotuku is described as " in small numbers throughout the country " and Royal Spoonbill as " less common than White Heron." Would it not be stretching the estimates to claim 150 White Heron, and 100 Royal Spoonbills for the whole country? Elsewhere, words such as " restricted," " confined " and the phrase " locally common " appear at suitable moments. That colourful yet self-effacing Australian emigre, the Black-fronted Dotterel, has topped the 500 mark and may be nearing the first thousand. But should it rightly be included? ? Even if the population of Wrybills is between 5000 and 6000 is it *sensu stricto* a common bird? How many New Zealanders have properly seen one or even have a chance of seeing one? Enough of this. Change the title to " Interesting or Characteristic Birds of N.Z." and grumbling will be muted.

The text is terse and generally sound. Doubtless following the Checklist of 1970, the Maori name of the Pied Shag is mis-spelt and the Little Shag's Maori name ends in a, not u. Perhaps the brilliant emerald green eye of the Little Black Shag deserves mention as a field character. Some purists may find it disconcerting to read under the description of the Banded Dotterel " size similar to Song Thrush." After all, shape and proportions do count for something. Does anyone nowadays ever hear the Brown Creeper called ' Pipipi ' ? Or has this become a " nomen obsoletum " ? Nor is the name Creeper above suspicion. In ornithology it carries with it nuances which conjure up a very different group of passerines. A prize should be offered to some imaginative observer who can coin an acceptable vernacular name for this unique " little brown job." The selection is somewhat uneven. Surely on grounds of distribution and abundance, Knot, Turnstone and even Arctic Skua or Red-breasted Dotterel have a stronger claim for inclusion than some of the favoured ones.

Charles Fleming has written a pithy foreword. Probing beneath the surface and viewing the New Zealand scene through the eyes of a palaeontologist to whom a million years are but as yesterday, he emphasises once again the antiquity and special character of our endemic species. But isn't his phrase " all the birds likely to be seen " unduly pessimistic ? If your budding birdwatcher is on the coast, surely much depends upon where he is and when. Between Kaipara Harbour in summer and Otago Peninsula in winter the differences are more obvious than the similarities.

After the promise of the first volume, the illustrations are disappointing. They are boldly statuesque, but hardly inspired, smacking more of the museum specimen and the midnight oil than of the mountain air and the wind off the sea. In too many the essential ' jizz ' is quite missing; but they will be helpful to uncritical beginners. If this booklet is a subtle experiment in marketing motorcars, let us have more of them. But its readers must revise their ideas of the common meaning of " common." A final tag is irresistible.

Fiat iustitia, ruat caelum.

R. B. S.

★

An undescribed extinct fish-eagle from the Chatham Islands, by C. J. O. Harrison & C. A. Walker. *Ibis* 115 (2): 274-277, text-fig. 1, pls 6-7, April 1973.

When Henry Ogg Forbes left New Zealand he took with him a large collection of bird bones which found a home in the British Museum of Natural History. For many years they remained untouched, but Elliot Dawson, working through them in 1961, found bones of an undescribed bird of prey. These (three tarso-metatarsi, two pelves, and a scapula) were considered by Dawson to be of the genus *Haliaeetus,* the Sea Eagles, but no further description was given by him. The present authors have diagnosed the bones as belonging to the related Fish-Eagles, *Ichthyophaga,* " because of the position of the outer proximal foramen."

The new bird is named *Ichthyophaga australis* — this is a welcome change from the *chathamensis* and *chathamica* used as a trivial name for so many of the Chatham Islands birds.

Detailed measurements are given for all the bones, but the scapula is not figured. Throughout the paper, in reference to the tarso-metatarsi, " left " and " right " are transposed*. As Colin Harrison (pers. comm.) comments " It is a pity we could not have left it. A fish-eagle with the feet on backwards would have been more efficient at scooping up prey."

The bird must have been rare when alive, as no examples have yet turned up among the Canterbury Museum collections, including the many thousands collected in the Chatham Island dunes by the reviewer and others during last December and January.

*[But see " Corrigenda " issued with *Ibis* 115 (3), July 1973 — Ed.]

R. J. S.

Bibliography of N.Z.A.R.P. Publications 1956-1972. Compiled by Patricia N. Coates. 70 pp. [Christchurch]: Antarctic Division, [N.Z.] Department of Scientific and Industrial Research, 1973.

From the very beginning of the new era of Antarctic exploration and research, from the time of the IGY and the dash to the Pole, New Zealand has played a leading role in the Far South. As political owner of the Ross Dependency, New Zealand has been host to the innumerable United States servicemen and scientists who have based themselves over the years at McMurdo Sound and whose doings are well chronicled in the *Bulletin of the Antarctic Projects Officer* and the *NSF Antarctic Record* now merged as the *Antarctic Journal of the United States.* The enquirer, accordingly, has little difficulty in finding out what research is being done under United States' auspices in the Antarctic. The *Antarctic Bibliogrpahy,* prepared by the Library of Congress, completes the picture and gives classified lists of what research has been published and where. Now we have a fine summary of the New Zealand contribution to Man's knowledge of the Antarctic.

The late Mr Les Quartermain, the noted Antarctic historian, compiled on several occasions a bibliographical gathering of research done by New Zealanders in the Antarctic under the title " Publications resulting from work done under the aegis of the New Zealand Antarctic Research Programme " and these lists were published in the *N.Z. Journal of Geology and Geophysics* from 1963 to 1968. The present publication by the Antarctic Division of the D.S.I.R. gives a list, arranged chronologically, under wide subject headings, of all publications resulting from New Zealand activity in the Antarctic from 1956 to 1972 and will have supplements added on an annual basis. The Bibliography includes biology, cartography, expedition reports and narratives, geology, ice and snow, logistics, medicine and physiology, meteorology, oceanography, physics, political geography and general topics. The diversity of the less easily classified topics is shown by the inclusion of articles on bread making in the Antarctic (in the *N.Z. Baker & Confectioner*), climbing techniques *(N.Z. Alpine Club Bulletin),* Antarctic photography *(Canterbury Mountaineer)* and adventures *(Boys' Brigade News).* Most of the items listed, however, have been published in scientific journals.

Ornithologists interested in the Antarctic fauna will find this a handy reference work since not only will they have a listing of all the papers resulting from New Zealand work on birds but they will also have available the background information on the expeditions and field parties concerned. Maps of the Antarctic published by New Zealand are listed and quite an amount of ancillary reference material can be found.

In the section entitled " Biology " 69 articles dealing with birds are listed, the first (in 1959) being an article in *Notornis* by Dr H. J. Harrington on a newly-discovered Emperor Penguin rookery at Coulman Island. The particular value of this new Antarctic Division publication is that it gathers together references to articles in widely scattered journals, although, admittedly, many of them would be known already to any well-read New Zealand ornithologist. Of the 69 items on birds, places of publication include: *Antarctic* (the publication of the N.Z. Antarctic Society), 17; *Notornis,* 8; *Ibis,* 7; *Records of the Dominion Museum,* 5; *N.Z. Journal of Science,* 5; *Condor,* 2; *Emu,* 2;

Nature, 2; *Tuatara* (Biological Society of Victoria University of Wellington), 2; *Ardea,* 1; *Journal of Natural History,* 1; and so on. Not only does this Bibliography bring together the publications of some (e.g. Ian Spellerberg) who have spread their papers, often on a single species (e.g. MacCormick's Skua), over many journals (e.g. Spellerberg in *Antarctic, Ardea, Condor, Emu, Ibis, Notornis* and *American Veterinary Medicine Association*), but it also draws attention to some obscurely published papers, e.g. " Observations at an Adelie Penguin rookery " by R. H. Taylor in *Zool, Rev. Przegl.* Zool. 4: 303-6, 1961, written in Polish ! Others, such as that entitled " Terrestrial Biology " by C. J. R. Robertson in *Antarctic* 4: 76-7, 1965, and dealing with birds and mammals seen during the Ross Sea-Balleny Islands Expedition of 1965, might otherwise be difficult to find because of their generalised titles. Similarly " The Long Hot Summer " (*Antarctic* 4: 440-3, 1967) and "Strange doings at Cape Bird " (*Antarctic* 5: 456-8, 1970) might not suggest any relevance to ornithology. On the other hand, Mr F. C. Kinsky's contribution on birds seen on the Balleny Islands during the 1964 Reconnaissance Expedition, published under the general name of the expedition with two other authors (T. Hatherton and E. W. Dawson) in *N.Z. Journal of Geology and Geophysics* 3: 164-79, 1965) is not listed under " Biology " but under " Expeditions " (entry 361) and there are probably quite a number of similar instances.

Nonetheless, this is a useful compilation and a credit to the Antarctic Division of the D.S.I.R. if only that it shows the taxpayer what he has been getting for his money. Even the most parochial of us could not fail to be impressed by the Antarctic as a field of interest: 796 publications from the N.Z. Antarctic Research Programme of 1956 to 1972, is a good effort by anyone's standards !

E. W. D.

★

Avian Anatomy — Integument. By Alfred M. Lucas and Peter R. Stettenheim. U.S. Department of Agriculture. Agriculture Handbook 362. Two vols. 750 pp., 422 illus. Washington, D.C. 1972. US$16.25.

Some 30 years ago the late Professor Edward Percival made pioneer studies on the feathers of New Zealand birds (" The juvenile plumage of some birds and an interpretation of its nature." *Trans. Roy. Soc. N.Z.* 72 (1): 6-20, 1942) but, despite the interest of his work and his continued stress on feather study in his own teaching, this field has been neglected locally until the very welcome examination of the filloplumes of seabirds by M. J. Imber (*N.Z. Jl mar. freshwat. Res.* 5 (3 & 4): 396-403, 1971). With the increasing introduction of ornithological topics into graduate research in New Zealand universities, attention ought to be drawn to feathers and feathering of birds as a field of study which could be developed particularly well under New Zealand conditions. With the quite necessary restrictions on collecting of live specimens and the controlled retention of Beach Patrol remains, feathers form a distinctive and peculiar material for study.

This monumental, two-volume work, expensively produced but made available at cost by the U.S. Government, may not become as well known as it deserves to be simply because it appears as one of those drab covered North American government serials often relegated

to library stack rooms. However, it will serve as a basic and well illustrated reference for all who want to know what is known about the external covering of birds. The volumes on " Integument " are but the first of a massive, ambitiously-planned series designed to encompass the following organ systems: integumentary, skeletal, muscular, vascular, nervous, respiratory, digestive, excretory, reproductive and endocrine. The project is being undertaken by the Avian Anatomy Project, Poultry Research Branch, Animal Science Research Division, Agricultural Research Service, of the United States Department of Agriculture in collaboration with the Department of Poultry Science, Michigan Agricultural Experiment Station, College of Agriculture and Natural Resources, of the University of Michigan. The size and complexity of the whole projected work is, indeed, only matched by the titles of its sponsors. The user is assured from the start that the coverage and significance of the treatise extends far beyond poultry science, although, basically, the volumes of the series will be centred on the chicken and other domestic birds. We recall the words of W. K. Parker some 80 years ago — " The Common Fowl will always be a convenient and useful bird to the biologist . . . he who knows the Fowl well is ready-prepared to interpret the structure of all kinds of birds."

The chapters of " Integument " include, in Vol. 1: 1. Topographic Anatomy; 2. Principles of Pterylosis [the arrangement of feathers in definite areas of growth]; 3. Pterylosis and Ptilosis [= plumage irrespective of pterylosis] of Domestic Birds; 4. Moults and Plumages of Domestic Chickens; 5. Structure of Feathers; 6. Shape, Structure, and Feathers of Domestic Birds. In Vol. 2 the chapters are: 7. Growth of Follicles and Feathers. Colour of Feathers and Skin; 8. Feather and Apterid Muscles; 9. Microscopic Structure of Skin Derivatives. (This is the first study that includes not only the skin but all its derivatives such as the comb, wattles, earlobe, cere, beak, sternal bursa, scales, spur, oil gland, caruncle, etc.); and 10. Techniques. (This is a particularly useful section giving the techniques developed in these studies and including anaesthesia of birds, pterylosis plotting methods, collection of data on moulting, application of X-ray techniques, preparation of skeletons, study methods for feathers, tissue techniques and methods for effective illustrations). Over 900 references to literature are listed with an extensive index running to 30 pages.

Attention must be drawn, however, to a companion work — " The feathers and plumage of birds " by A. A. Voitkevich, 1966 (translated by Scripta-Technica from " Pero Ptitsy ") Pp. xviii + 1-335, 73 figs. London: Sidgwick & Jackson. This book, retailing at $11.15 in New Zealand, gives many European references not found in the American bibliography and will need to be consulted by users of " Avian Anatomy " who are more concerned with other species.

Avian Anatomy — Integument is a fundamental work which must be strongly recommended even if its price dictates that only University and Government Department libraries can afford it. Its usefulness is not limited to the Academic. Quite a number of amateurs will want to dip into it, now that they know of its existence, and who knows, the study of " pterylography " may yet have the place in New Zealand which it rightly deserves !

E. W. D.

The Emu. Journal of the Royal Australasian Ornithologists' Union. Supplement to Vol. 73 (Pp. 203-255). "Invited Papers on Ornithology in Australasia: Practice, Prospects and Progress." November 1973. A$3.25.

New Zealand membership of the RAOU is minimal, standing at less than a dozen. And this is to be regretted if only because more New Zealand ornithologists are not able to avail themselves of the opportunity of reading and enjoying such general reviews of their subject as is presented, for instance, within this special supplement to *The Emu*. It is true, I know, that *The Emu* is received by 8 libraries throughout New Zealand (Auckland, 2; Wellington, 4; Christchurch, 1; Dunedin, 1) but those who want to read it casually must make an effort to do so. I am told that the lack of New Zealand interest in the RAOU is a reflection of what prospective members would get for their money — essentially four issues of *The Emu* (and a *Newsletter*) at A$10.00 per year and of which the New Zealand content may be quite slight. Perhaps the sole incentive for joining the RAOU is to get *The Emu* but a consumer analysis would not rate it as a "best buy" for a New Zealander. The 1973 quarterly issues contained 40 papers and shorter notes but only one of these is directly concerned with New Zealand birds and perhaps only half a dozen others are of interest to New Zealand readers. The content and scope of *The Emu*, a journal of "Australasian" ornithology is in itself a topic for consideration and examination by two of the authors of papers in this Supplement, of whom more anon. Indeed, the New Zealand percentage of these "Invited Papers" on ornithology in "Australasia" illustrates this common feature although it does not make the subject matter any the less interesting or important. The overall impression left after reading this Supplement is, at least to this reviewer on the east side of the Tasman, of a satisfaction, albeit smugness, which we might have about New Zealand achievements so modestly listed by C. A. Fleming in his short review of New Zealand ornithological organization and administration. We (in the form of the Ornithological Society of N.Z.) seem to have led "Australasia," if not the world, in so many aspects of organization of co-operative schemes and recording methods in addition to providing and maintaining a relatively cheap, well illustrated and generally readable journal including the novel feature of "Classified Summarised Notes." It is, nonetheless, regrettable that New Zealand examples and references could not have been used even by way of comparison in the strictly Australian articles.

The President of the RAOU, Mrs Pauline Reilly, introduces this appraisal, initiated by the Editor and endorsed by Council, of the present state of "Australasian ornithology [which] is in a period of change." It is said that it "indicates our awareness for a broader outlook." How broad it may be is best shown by some controversial suggestions put forward in Allan McEvey's article concerning the potential of *The Emu* as a widely-based journal of ornithology in greatest possible coverage of the term (which might even allow one to mention spiders or animals other than birds!). Mrs Reilly's three page introduction tells us in summary the notable points made by each contributor, at least as she sees them, and interposes her own beliefs here and there. She concludes with an invitation that might well be taken up by New Zealand readers concerned not only with

the development of ornithology in " Australasia " but more specifically with the newly proposed role of the RAOU, and of its journal, as seen by its Council: " We hope that after reading the papers and meditating on the implications, people will be prepared to comment constructively. . . . Hopefully, we shall be able to publish both comment and further papers in occasional supplements, but this of course will depend on the response we receive. We trust that this present attempt will be of value to ornithology, perhaps even beyond Australasia. We have aimed to show that we are concerned to see a happy union of professional and amateur talent and to co-operate, not compete, with other bird societies."

Certainly " this present attempt " is of value and readers will have to meditate on the implications as Mrs Reilly suggests. There is much to inform, to stimulate, to provoke and to be grateful for, even if one constantly regrets that " Australasia " is too often synonymous with Australia not only in the RAOU's composition but throughout the pages of most of the contributions.

The Supplement is made up as follows: D. L. Serventy — " Organization and administration of ornithology (4 pp.); C. A. Fleming — " Organization and administration of ornithology in New Zealand " (2½ pp.); M. G. Ridpath — " Co-ordinated research overseas " (3½ pp.); S. J. J. F. Davies — " Application of co-ordinated research on birds to Australian conditions " (5 pp.); R. M. Lockley — " Bird observatories and field study centres " (8 pp.); D. Purchase — " The significance and limitations of field notes " (4½ pp.); D. D. Dow — " Publication and ornithology " (7 pp.); J. A. Keast — " The role of the museum in ornithology " (6 pp.); A. R. McEvey — " The metaphysic of orinthology " (8 pp.).

D. L. Serventy traces the evolution and particular development of scientific societies and makes an illuminating comparison of ornithological societies in the United Kingdom and Australia. He looks to future needs in Australian ornithology in proposing an organization corresponding to the Royal Society for the Protection of Birds and the British Trust for Ornithology and he predicts the growth and fulfilment of the RAOU itself, especially related to the developing of an Australian Institute of Field Ornithology. Finance, as always, would seem to be a major obstacle but the right man in the job is stressed by Serventy as fundamental. C. A. Fleming outlines, in a similar way, the growth of New Zealand societies involved with ornithology including the transferring of ornithology from the pioneer New Zealand Institute, later the Royal Society of N.Z., to those concerned with protection and conservation of birds and their haunts and to Government Departments, Museums, and University departments. Local groups of ornithologists which led to the formation of the Ornithological Society of New Zealand are discussed but the achievements of the OSNZ itself are baldly stated in 8 lines of text! How much we can bask in the glory of those pioneers who founded the OSNZ as well adulate the many members who have worked in so many ways to allow the author to say — " The Society has thrived, unchallenged as the leading New Zealand body in its field [stated by Fleming, echoing the original Marples-era constitution, to be " to encourage, organize and carry out studies by field work on living birds in their natural state on a national scale "], supported by members from all other organizations — societies, government agencies, museums."

M. G. Ridpath discusses co-ordinated enquiry in ornithology, i.e. the voluntary gathering of information by many observers scattered over a wide area. He gives a good account of such activities run by the British Trust for Ornithology and in the United States and leaves it " to the reader himself to judge the relevance of their experience to Australian ornithology in 1973." He makes two important points, amongst others: " Co-ordinated investigations depend entirely upon the ornithologists who gather the data. The project stands or falls on their interest and enthusiasm, both of which depend largely on the feed-back they get from the organizer." It pleases us to read — " A good example of feed-back is provided by Bull's (1971) report on progress of the New Zealand mapping scheme . . ." He concludes with a theme found in several other articles in this Supplement: " Finally, and most important of all, the results must in due course be published. Organizers have varied considerably in the speed with which they have published their final reports. The sooner people read what their efforts have shown the more likely they are to help future enquiries."

Stephen Davies follows by describing how such enquiries have been used in Australia and discusses their future. He writes of the importance of good leaders for such projects and makes the point, stressed by other contributors, that a " project is only ' successful ' if it leads to one or more significant published papers that answer the question posed at the outset." He notes also: " One factor in making co-ordinated birdwatching projects successful is that many people enjoy helping each other." He argues " that the Field Investigation Committee [of the RAOU] should spend more time looking for good leaders and helping them to develop co-ordinated projects suitable to their field of study than in looking for suitable co-ordinated projects as such." Once again, we in New Zealand can show a certain satisfaction that we have found both suitable projects and good leaders with a minimum of effort or organization. Perhaps like Mrs Beecher Stowe's Topsy, they just " grow'd " as the need came. Davies goes on to discuss the sorts of co-ordinated projects — short-term, long-term, and perpetual — and gives Australian examples of each. Once again the importance of publication is stressed in his concluding paragraph: " Rapid publication of results is a tremendous stimulation to collaborators."

R. M. Lockley writes on bird observatories and field study centres. From time to time the idea of the establishment of a national bird observatory or of regional study centres has been put forward in New Zealand. Lockley's account of the history, scope, organization and problems of observatories and study centres in Britain, based on his own pioneer work and wide experience, will be of considerable interest particularly when related to the idea that even where there are many less migrant species there can still be much study of residents and of the plants and animals occurring in the vicinity of such stations.

D. Purchase's contribution on field notes might well be essential reading for all of us. This is something we need not feel smug or satisfied about. Even Homer nods. The basic quality, expressed by David Lack in his " Hints on research for bird watchers " (*Bird Study* 7: 9-20, 1960) and emphasized by Purchase, which is needed in our recording is *integrity*. A multitude of sins of both commission and ommission may be made by the recorder of field notes, as Purchase demonstrates, and it is good to remind ourselves that honesty is not

a matter of degree. Purchase stresses particular points in both *inaccurate* and *inadequate* recording of data, but, more importantly perhaps, he asks us " to remember that no matter how accurate and plentiful are the data that have been collected they are of little use to Australian ornithology unless they are eventually published." He concludes — " It makes no difference whether the data are collected and published as part of a co-operative research project; the main thing is ensure that they are published so that the time and effort put into their collection are not wasted."

Pleas for the establishment of a Rarities Committee and the need for urgency and high endeavour in producing a Checklist will further convince New Zealand readers that our Australian friends may well look to our example.

Douglas Dow continues the theme of the necessity of publication with his " Publication and ornithology." He gives a valuable discussion of the kinds of ornithological publications dealing especially with the notions of " scientific " and " popular " writing, the problems of editors and referees, style and language, illustrations and the mechanics of publishing, and he concludes with an interesting personal assessment of the Australian publications in the field of ornithology. He analyzes the need in Australia for national and regional journals and especially for " a journal of high quality specializing in field identification and distribution." " Likewise," he says, " we have no journal to turn to for systematic and detailed summaries of the distribution of species." He would also like to see — " An important contribution that could be made by some regional journals might be a critically edited annotated annual list of species." It is a pity that Dr Dow's examination was limited to Australian matters. We would have been interested to see where *Notornis* fitted into his scheme of evaluation but to this reviewer at least, who might well be biased, it seems that the New Zealand journal combines useful features of a national and a regional, a scientific and a popular journal, an organ both of an ornithological society and of ornithology itself, and our " Classified Summarised Notes " provide a fine example of the annual list desired for the Australian scene by Dr Dow.

Allen Keast gives a timely and valuable analysis of the role of the museum in ornithology derived from his own wide experience in this topic. Traditionally in New Zealand, as in many other countries, ornithology, both professional and amateur, has been based on the museum, largely because museums are not only repositories of collections and the public displays arising from them but also that in New Zealand the four metropolitan museums have boasted professional ornithologists on their staffs who have guided local groups and individuals with their personal expertise and field experience. The research role of museums is now more complicated and much more work is now being done in universities and government departments in New Zealand and in Australia also according to Keast. Rather than have competition, it is time for museums in New Zealand (as in Australia) to examine their traditional role, especially their major responsibility of acquiring and curating collections. Keast gives some pertinent views on the morality of collecting which will bear consideration by those involved both in collecting itself and in regulating and policing such collecting.

Much of Keast's commentary is directly relevant to the New Zealand scene where collecting, often in quantity, may be just as necessary as in Australia and for the same reasons which he details. The role of the contemporary museum in public education (the major role in this reviewer's opinion) is stressed. Keast feels that " today's Australian museum ornithologist should concentrate, more than anything, on field-based, functionally orientated approaches, using statistical tools, voice and other analyses, as well as studies of skins and skeletons, in his taxonomic work." This, of course, suggests that museum ornithologists must be highly academically qualified, which has not always been the tradition of the good field naturalist and museum man. Ornithology will have to become much more of a Science if the criterion is sought in terms of expenditure, if Keast's wish comes true. There is a view, however, that research in natural history in museums in financially-limited countries such as New Zealand might well be less ambitious and that more concentration might be put on displaying what professional scientists employed by other institutions are doing. The museum ornithologist might become, then, a populariser, organiser, display director and translator of research. Does one judge the " success " of a museum by its public galleries and popular handbooks or by the output of scientific papers by its " curators " ? With the limited number of openings in New Zealand for museum ornithologists (or for professional ornithologists at all), Keast's suggestion for the Australian future is applicable here also: " . . so much work needs to be done on the taxonomy and evolution of Australian birds that every effort should be made to persuade ornithologists at overseas museums and universities to carry out research in Australia." I have long been an advocate of Research Associates attached to New Zealand museums and I would have been glad if Keast had talked of their feasibility and obligations in the Australian scene at least.

Professor Keast's contribution to the Supplement will be read with great interest by all concerned with where museums find their place in ornithology.

Perhaps the most fascinating (and certainly the most provocative) of all the contributions is Allan McEvey's scholarly but controversial treatment of ornithology as a branch of zoology fostering a basic " spirituality," as he calls it, a contribution which will appeal to those of us who see more in a bird than a warm-blooded vertebrate with an external covering of feathers. Mr McEvey, noted museum worker and bibliographer, one-time President of the RAOU and still deeply concerned about its role, will probably have few followers for his radical propositions which deserve a long review themselves so much are they worth " meditating on." For those readers who might be frightened away after the first half page, I say read on. There are important issues considered here and a quiet tolerance will show that Mr McEvey's thoughts are worth setting against the New Zealand and our traditional, " suburban " attitudes to our chosen interest of ornithology.

The Supplement is a milestone in the history of the RAOU and even if we, as kindred souls across the Tasman, are disappointed in the lack of New Zealand mention or of examples of what we may feel proud to have achieved or even a view of how we appear to

those across the sea, we must congratulate those responsible in the RAOU and regard this as a valuable document on which to develop the future of ornithology in the *Australasian* Region. It is, indeed, an important assessment.

E. W. D.

★

AUCKLAND REGIONAL AUTHORITY REPORTS

The report referred to in the review of " The Coastal Ecology of a Recreation Resource Area Kawakawa Bay to Miranda " (*Notornis* 20 (3): 287, line 1, Sept. 1973) is entitled: " A Recreation Resource Area Kawakawa Bay to Miranda " 95 pp., 24 figs, 13 pls, June 1972, prepared by Michael B. Elliot, Michael R. Simister, and Marjorie R. Bacon, Planning Division, Auckland Regional Authority. It gives a detailed analysis of physical factors, ecology (including marine and bird life), cultural factors and the demand for and present activities in recreation. The section " Ecology " (pp. 29-51), consisting of " Marine Life " (pp. 31-39) and " Bird Life " (pp. 43-51) is " an abstract from a detailed report which will be published separately." This is the report reviewed in *Notornis*. Those who want more details of the non-biological aspects of this study are advised to obtain the earlier report which is also available from the ARA, Private Bag, Auckland.

★

Have you seen " Sea and Ice: a naturalist in Antarctica " by L. J. Halle, Houghton Mifflin Co., Boston, 1973 ? The ecology of Campbell Island and the Royal Albatrosses of Taiaroa Head are discussed amongst other illustrations of the natural history of the Antarctic and Subantarctic including further observations of Leopard Seal predation on Adelie Penguins at Cape Crozier (cf. article in this issue of *Notornis,* pp. 36-69).

★

Two of our members, Mr H. F. Heinekamp and Dr G. W. Ramsay, have prepared a comprehensive report on the treatment of oiled sea birds — " Interim report on oiled sea-birds, presented to the Nelson Section, Royal Forest and Bird Protection Society, November 1973," 8 pp. A copy of this most useful and important report is in the library of the OSNZ and we hope that it will become widely known about since rescue of oiled sea birds could well become a real problem in New Zealand waters.

ABOUT OUR AUTHORS

" RONALD JACK SCARLETT was born at Stoke, Nelson, in 1911, and prefers to be called Ron. His father was a sawyer and he was largely brought up round sawmills. Although his work keeps him city-bound he is essentially a countryman and happiest when travelling in the bush, tramping dunes looking for bones, digging moa bones from a swamp or just generally living in the country.

After attending six different primary schools he worked on farms, in a sawmill, as a labourer, a golf greenkeeper, gardener. gold-miner and later at trucking in a coalmine. He began a degree course at Canterbury University College when he was almost 27, completing his B.A. some years later. He then studied Anthropology at Otago under Dr. Skinner, and did a course in Bibliography and Librarianship under John Harris. During his varsity days in addition to the gardening and labouring chores common to students in need of funds for living, he was for a time a printer's salesman and also made sweets, including probably the strongest peppermints in New Zealand.

From his youth (when he formed a collection of fossil shells) he had always been interested in natural history, and when invited by Dr Roger Duff, now Director of Canterbury Museum, to participate in the excavation of Moa skeletons at Pyramid Valley, North Canterbury, he accepted with enthusiasm. Ron Scarlett worked with Jim Eyles, now Director of the Nelson Museum, for three months in the " big dig " of 1949, and has excavated there many times since. In his student days and afterwards, he gave voluntary assistance whenever possible to Canterbury Museum. He joined the staff as Recorder of Collections at the beginning of 1950, and became Osteologist some years later. He enjoys the bone work so much that he says he has no intention of retiring until told to do so.

His other interests include archaeology for which he trained under Jack Golson, and he has done some archaeological work in Australia, New Guinea and the Solomon Islands, as well as a considerable amount in many parts of New Zealand. He was first editor of the N.Z. Archaeological Society's Newsletter and has been a Council member and Vice-President of that Society. He belongs to numerous scientific societies and has published 18 scientific papers. Speleology, book collecting, philately, a cigarette card collection and listening to music from folk songs and good jazz to classical, satisfactorily fill the remainder of Ron Scarlett's time. He could be said to be a man of many parts."

[Reprinted, with permission, from " Who you should know — 8 " by Wendy Carnegie & Beverly Macpherson, AGMANZ News 4 (4): 74-75, 1973].

DONALD S. HORNING is at present Senior Lecturer in Zoology at the University of Canterbury. He and his wife CAROL come from the Pacific Northwestern United States. Don received his Ph.D. in Systematic Entomology from the University of California in

1969. He was the Oregon State Survey Entomologist before being appointed Visiting Lecturer at the University of Canterbury in March 1970. He immediately began a survey of the Tardigrada (Water Bears) of New Zealand, and has travelled the country's back roads from Cape Reinga to Bluff searching for the lichens and mosses in which these microscopic animals live. Don has also collected Tardigrada and other invertebrates from the Chathams, Open Bay, Auckland and Snares Islands, as well as Stewart Island and Antarctica.

Carol received a B.A. in Psychology and Education from Whitman College in Washington in 1957. She has taught primary school for 13 years in the United States, France and also briefly in Christchurch before the 1971 Snares Expedition. She accompanies Don wherever she can and has become an expert field assistant, technician and general dogsbody.

They spent two months at Snares in early 1971 and returned for a 13 month stay, leaving the islands in January 1973.

MILTON W. WELLER is Professor-in-Charge, Fisheries and Wildlife Section, Iowa State University, Ames, Iowa. He gained his Ph.D. from the University of Missouri in 1956. Professor Weller teaches ornithology and wildlife ecology and his major research interests are in the biology of waterfowl. He became especially interested in Southern Hemisphere forms through work in Argentina. Recent publications include — Ecological studies of Falkland Islands' waterfowl. *Wildfowl* 23: 25-44, 1972. Lately, he has been investigating ecological adaptations of the ducks of austral islands, and was a member of the Auckland Islands expedition in 1972-73 (see Robertson, C. J. R. 1973. International expedition's scientific studies on Auckland Islands. *Forest and Bird* November 1973: 22-27). His study of the Auckland Island Teal or Flightless Duck (see Weller, M. W. 1973. Waterfowl in the Auckland Islands. *Antarctic Journal of the United States* VIII (4): 188-190) was followed by a brief study of the Brown Teal because the latter is the presumed ancestor of the flightless form.

ELLIOT DAWSON is a marine zoologist with the New Zealand Oceanographic Institute, Wellington, and specialises in the Brachiopoda or lamp-shells, following the tradition of his former teachers Professor E. Percival and Professor R. S. Allan. He has worked extensively in the seas of the New Zealand Subantarctic and the Antarctic and organised several research cruises of HMNZS *Endeavour* which also took him to the islands of the South Pacific as leader of the DSIR Eclipse Expedition in 1965 and of the Royal Society Cook Bicentenary Expedition in 1969. He has, since then, become interested in the descriptive ecology of corals and coral reefs of the Southwest Pacific and looks forward to further field work in the Cook Islands and Tonga. Recently he attended the Second International Symposium on Coral Reefs held aboard the cruise ship *Marco Polo* which sailed through the entire 1,200 mile length of the Great Barrier Reef of Australia with field excursions to several notable reefs and islands allowing, incidentally, an introduction to Queensland bird life especially Masked Plovers and Sunbirds.

Early experiences in collecting bird bones from schoolboy archaeological digs and in the Pyramid Valley moa swamp led him

to want to know more about living birds and their ways by joining the OSNZ which he did in 1948, being RR for Canterbury during his student days. He says he owes his realisation that birds do more than have bones to the friendship of the late Ray Jacobs, M.B.E., former Chief Preparator of the Canterbury Museum, with whom he spent many hours while playing truant from cricket and the like at his school over the fence. Interest in the dispersal movements of Black-billed Gulls to the river banks of central Christchurch involved him as one of the first operators under the Society's ringing scheme in 1950. Later he had some success in tracing movements of White-fronted Terns across the Tasman.

He has enthusiasms for, amongst other things, bird bones, Black-billed Gulls, criminology, church architecture, the Imperial Regiments of the Maori Wars, islands and peoples of the Pacific, and clay pipes from archaeological sites. He also edits *Notornis.*

CHRIS ROBERTSON was introduced to readers in *Notornis* for March 1972. He has since visited the Auckland Islands and the Chatham Islands in the course of his studies on albatrosses. He is also the co-author of *The Fiat Book of Common Birds in New Zealand,* the second volume of which in reviewed in this issue of *Notornis.*

BARRIE HEATHER, author of " The Black-fronted Dotterel in the Wairarapa " published in *Notornis* for September 1973, was originally a product of the King's College Bird Club. He has, therefore, a built-in interest in New Zealand birds seen as a whole and in their world context, and is particularly keen on waders, terns, petrels and offshore islands. He has served the Society as RR for Southland 1960-63, as editor in the regular editor's absence abroad, as a member of Council 1964-69, and as author of *A Biology of Birds.* He notes further about himself: " Has been keen on banding and beach patrols. Has a soft spot for Wrybills, SIPO, and the neocolonial Spur-winged Plover and, lately, Black-fronted Dotterel. Is a bore on these topics. Hates the Sparrows that roost on his window ledges. Keen on encouraging amateur projects and would like to see the day when habitat for shore and swamp birds be deliberately created as part of public parks and public works."

GEOFFREY R. F. HICKS, author of " Latitudinal distribution of seabirds between New Zealand and the Ross Sea, December 1970 " published in *Notornis* for September 1973, has now been at Victoria University for six years, gaining his B.Sc. (Hons.) in Zoology in 1972. He is at present at the VUW Marine Laboratory at Island Bay working towards his Ph.D. on the population structure and ecophysiology of some meiofaunal marine Copepoda.

He was a member of the N.Z. Oceanographic Institute's 1970-71 expedition to the Antarctic (from which the data for his paper were collected) which studied the hydrobiological variations in McMurdo Sound. His part in this work entailed the study of zooplankton and their relationships with the sub-ice hydrology.

Mr Hicks and his wife took part in an expedition to the Poor Knights Islands during last November where they worked with Peter Harper on the nest distribution and breeding behaviour of Buller's

Shearwater, the results of which we hope to read in *Notornis*. At the Poor Knights he was able to indulge in his other interests of Scuba diving and photography.

Ornithologically, he says that he " is particularly stimulated by the contribution and interplay of biotic and abiotic factors in the distributional control of seabirds."

JEAN-FRANCOIS VOISIN, author of " Notes on the Blue-eyed Shags " published in *Notornis* for September 1973, was born in 1941 in Rouen, France. He writes: " I was educated at Lycee Corneille in Rouen and then went to University to study biology, the first year in Rouen and the rest in Paris. After having gone through the " Licence " (equivalent to a Bachelor's degree), I went through a first-degree doctorship, the " Doctorat de Troisieme Cycle," on the biology of surface-nesting petrels of the Possession Islands in the Crozet group. Now I am working on a second thesis (" Doctorat d'Etat ") on the biology and biogeography of grasshoppers and locusts of the mountains of Central France.

" Even though I am officially attached to the Laboratory of Zoology of the Ecole Normale Superieure, Paris, I, like many young French researchers, have no position in scientific research and must earn a living as a private school teacher. Recruitment in French research posts was drastically reduced after the troubles which shook France in 1968 while I was serving my time in the Army.

" When I was a small child I developed a strong inclination toward Nature, perhaps partly because of the beautiful holidays which I spent with my grandparents in the country of Central France. In course of time this inclination became more specialized, and I am now most interested in birds, mammals and insects — I have always enjoyed travelling and have been over most of Europe, but especially Scandinavia which I visit almost every year with my wife and children. I have been to Spitzbergen three times, and I took the opportunity of my one year long stay at the Crozets to visit Kerguelen, Reunion and Madagascar. As well as travel, I am also very fond of languages. Norwegian is almost my second vernacular and I like English because of its conciseness and suppleness.

" I got married in 1967 and my wife is an ornithologist also, working on herons and geese at the Museum d'Histoire Naturelle in Paris."

REGIONAL REPRESENTATIVES

FAR NORTH:
NORTHLAND: } D. E. Crockett, 21 McMillan Ave., Kamo, Whangarei

AUCKLAND: Mrs. S. Reed, 4 Mamaku Street, Auckland 5

SOUTH AUCKLAND: Mrs. Beth Brown, 39 Red Hill Rd., Papakura

WAIKATO: D. Wilkins, 163 Newcastle Road, Dinsdale, Hamilton

BAY OF PLENTY: R. M. Weston, 250 River Road, Kawerau

VOLCANIC PLATEAU: R. W. Jackson, 9 Kenrick Road, Rotorua

GISBORNE/WAIROA: A. Blackburn, 10 Score Road, Gisborne

TARANAKI: R. W. Wheeler, 307a Carrington Street, New Plymouth

MANAWATU: Dr I. G. Andrew, 6 Eton Place, Palmerston North

HAWKES BAY: N. B. Mackenzie, Wildlife Trust, Main Road, Westshore, Napier

WAIRARAPA: Miss H. Cook, 15 Wallace Street, Featherston

WANGANUI: Michael O'Shea, 29 London Street, Wanganui

WELLINGTON: Dr. J. A. Fowler, " Manu Korero," 2/1030 Fergusson Drive, Upper Hutt

NELSON: F. H. Boyce, 19 Marybank Road, Nelson

MARLBOROUGH: J. A. Cowie, P.O. Box 59, Kaikoura

CANTERBURY: J. R. Jackson, 103 Linwood Avenue, Christchurch

WEST COAST: Vacant

OTAGO: Mrs. J. B. Hamel, 42 Ann Street, Roslyn, Dunedin

SOUTHLAND: R. R. Sutton, P.O., Lorneville, Invercargill

———★———

LITERATURE AVAILABLE

From all bookshops:

Annotated checklist of the birds of New Zealand. (OSNZ) $4.95

A field guide to the birds of New Zealand, by R. A. Falla, R. B. Sibson and E. G. Turbott, 2nd rev. ed. $5.00

From B. D. Heather, 10 Jocelyn Crescent, Pinehaven, Upper Hutt:

A biology of birds, by B. D. Heather. $1.33

From B. A. Ellis, 44 Braithwaite Street, Wellington 5:

Field guide to the waders, by H. T. Condon & A. R. McGill. 75c

The following are available from Mrs. H. R. McKenzie, P.O. Box 45, Clevedon:

Back numbers of Notornis at 75c (Vols 2-13) and $1 per part (Vols 14-19). Complete sets available.

OSNZ Library catalogue, 70 pp. 50c

Banding reports, Nos 8-14, 50c each.
Nos 1-7 are incorporated in early issues of Notornis.

Kermadec Expedition, 1964, by A. T. Edgar. 45c