ASSOCIATIONS BETWEEN SEABIRDS AND CETACEANS IN THE AUSTRALIAN SECTOR OF THE SOUTHERN INDIAN OCEAN

C.L. HODGES[1] & E.J. WOEHLER[2]

[1]*Port Elizabeth Museum, Marine Mammals, P.O. Box 13147, Humewood 6013, South Africa*

[2]*Australian Antarctic Division, Channel Highway, Kingston, Tasmania 7050, Australia*

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SUMMARY

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Associations between seabirds and cetaceans were recorded from ANARE and resupply vessels in the Southern Indian Ocean, 1981-1990. A total of 1394 seabirds of *c.* 16 taxa was observed in association with 193 individual cetaceans of *c.* five taxa. The most frequently recorded species were prions *Pachyptila* spp., shearwaters *Puffinus* spp., Snow Petrels *Pagodroma nivea*, terns *Sterna* spp., Killer Whales *Orcinus orca* and Minke Whales *Balaenoptera acutorostrata*.

INTRODUCTION

Associations between seabirds and cetaceans are geographically widespread and taxonomically diverse (Evans 1982, Enticott 1986), however, the ecological significance of such associations remains contentious. Although most associations appear to be opportunistic (Evans 1982), several studies suggest that seabirds can benefit from the activities of cetaceans. Cetaceans may be used as agents for raising inaccessible plankton (Routh 1949); provide food in the form of faeces (Routh 1949, Evans 1982); regurgitate, reject or incidentally spill prey items (Clarke *et al.* 1981, Clarke & Prince 1981, Martin 1986, Ridoux 1987) and increase accessibility of prey by panicking or stunning schools and driving them to the surface (Au *et al.* 1980, Evans 1982, Martin 1986).

Records of seabirds accompanying nonfeeding cetaceans (Martin 1986, Ridoux 1987) and the provision of additional food resources by feeding cetaceans suggest that associations are sometimes formed deliberately and not merely as a result of a concentration of shared prey. Studies of seabirds in the Bering Sea indicate that the diets of at least nine species of birds are supplemented by an association with foraging Grey Whales *Eschrichtius robustus* and that benthic organisms brought to the surface by these whales may periodically support several hundred thousand birds (Harrison 1979).

Seabird-cetacean associations have been reviewed by Evans (1982). Griffiths *et al.* (1982), Best *et al.* (1984), Enticott (1986), Martin (1986), Ridoux (1987), Cockcroft *et al.* (1990) and Williams *et al.* (1990) have since contributed to existing records. In this paper, we report sightings of seabird-cetacean associations in the Australian sector of the Southern Indian Ocean.

METHODS

Seabird data were recorded from Australian National Antarctic Research Expeditions

(ANARE) and resupply vessels in the Southern Indian Ocean from 60-160°E and 40-69°S. Records were collected during 1981 to 1990 following methods prescribed by the BIOMASS Working Party on Bird Ecology (1982). Details were recorded on 10-minute observation sheets as described by Woehler (1987) and seabird-cetacean associations noted.

In this paper we define an association as the presence of a seabird in the immediate vicinity of a cetacean. All 10-minute sheets (40 354 records comprising 323 870 birds of 57 taxa: Woehler *et al.* 1990) were examined for associations and data presented in a format following Enticott (1986).

RESULTS

Details of seabird-cetacean associations

A total of 1394 individual seabirds of *c.* 16 taxa was observed in association with 193 individual cetaceans of *c.* five taxa (Tables 1, 2 and 3). Details of the associations and the abiotic conditions recorded during observation periods are presented in Table 1.

Seabird frequency and abundance

The seabird taxa most frequently recorded in association with cetaceans were prions *Pachyptila* spp. (n=153, 33%), shearwaters *Puffinus* spp. (n=888, 33%), Snow Petrels *Pagodroma nivea* (n=206, 20%) and Antarctic/Arctic Terns *Sterna* spp. (n=8, 20%) (Table 3). The most abundant associating seabird taxon was shearwaters (64%) (Table 3). The highest number of seabird species observed in association with a single group of cetaceans was eight; and the largest association was 354 seabirds with 45 Longfin Pilot Whales *Globicephala melaena* (Table 1).

Cetacean frequency and abundance

The most frequently recorded cetaceans observed in association with seabirds were Killer Whales *Orcinus orca* (27%) and Minke Whales *Balaenoptera acutorostrata* (27%) (Table 2). The most abundant associating cetacean taxon was Killer Whales (65%), including a pod of 74 Killer Whales that was observed with three Southern Giant Petrels *Macronectes giganteus* and 50 Wilson's Storm Petrels *Oceanites oceanicus* (Table 1).

DISCUSSION

Although associations between birds and mammals have been well documented (e.g. Rand 1954, Dean & MacDonald 1981), seabird-cetacean associations are rarely observed (Enticott 1986, present study). Of the 40 354 records of birds collected in the present study, only 28 (0.07%) were made in association with cetaceans. The rarity of whale sightings in the Southern Ocean (Parker 1978, C.L. Hodges *et al.* unpubl. data), difficulties in observing whales from survey vessels (Best 1982), lack of experience with identification by observers (i.e. n=11 "unidentified whales") and restriction of ship track (i.e. ships of opportunity) all contribute to the low incidence of recorded associations.

Evans (1982) suggested that associative behaviour between seabirds and cetaceans could be predicted on the basis of the diets of the two taxa, and that most associations were probably opportunistic or incidental as a result of common prey. However, associative behaviour observed in the African sector of the Southern Ocean (Enticott 1986) indicated that only 8% (n=2) of the 25 records were of feeding associations. Seabirds that actively join and follow schools of nonfeeding cetaceans appear to form associations deliberately rather than opportunistically (Martin 1986). In this study, less than 50% (n=7) of sightings were of feeding associations.

Killer Whales were recorded in association with 11 species of seabirds. Associative behaviour with Blackbrowed Albatrosses *Diomedea melanophrys*, giant petrels *Macronectes* spp., Pintado or Cape

TABLE 1

DETAILS OF ASSOCIATIONS BETWEEN SEABIRDS AND CETACEANS OBSERVED IN THE AUSTRALIAN SECTOR OF THE SOUTHERN INDIAN OCEAN, 1981-1990

No.	Vessel[a]/ Voyage	Date	Position	Time (GMT)	Sea state	Temp(°C) air	Temp(°C) sea	Wind Dir.	Wind Force[b]	Weather Cloud[c]	Weather Precip.	Seabirds (taxa & nos)	Cetaceans (taxa & nos)	Seabird behaviour relative to cetacean
1.	ND/03	6 Dec 1984	64 43S, 73 01E	0830	smooth	-1.5	-0.7	70	4	pc	nil	2 Snow Petrels	3 Minke Whales	flying above
2.	ND/05	29 Dec 1984	56 33S, 111 40E	0030	calm	4.0	-	-	0	pc	nil	4 prions	3 unid. whales	flying above
3.	ND/05	29 Dec 1984	56 39S, 111 02E	0230	calm	3.8	-	-	0	pc	nil	*c.* 300 shearwaters 53 prions 1 Whiteheaded Petrel	*c.* 45 Longfin Pilot Whales	sitting on water & foraging above
4.	ND/05	6 Jan 1985	66 50S, 63 22E	1430	smooth	1.0	-	190	4	cl	nil	*c.* 200 Snow Petrels	*c.* 20 Killer Whales	sitting on water & foraging
nearby														
5.	ND/05	10 Jan 1985	64 37S, 67 55E	1230	calm	1.5	-	-	0	pc	nil	1 Whitechinned Petrel 1 prion	1 unid. whale	flying above
6.	ND/07	20 Feb 1985	66 47S, 71 45E	0530	moderate	-4.5	-	110	4	cc	nil	*c.* 80 prions	*c.* 25 Killer Whales	following
7.	ND/07	4 Mar 1985	63 54S, 90 49E	1300	slight	-1.2	-	270	2	cc	nil	*c.* 250 shearwaters	1 unid. whale	following
8.	IB/03	17 Dec 1985	52 53S. 110 59E	2120	calm	2.2	3.4	330	1	cc	nil	20 shearwaters	3 unid. whales	sitting on water & foraging
nearby														
9.	ND/01	27 Dec 1985	47 10S, 141 02E	0705	moderate	11.7	-	315	5	pc	nil	70 Whitechinned Petrels 4 Wandering Albatross 18 shearwaters 2 Blackbellied Storm Petrels 1 Salvin's Albatross 1 Blackbrowed Albatross 3 Pintado Petrels 1 Southern Giant Petrel	*c.* 7 Killer Whales 1 Sperm Whale	foraging above
10.	IB/01	19 Oct 1986	53 58S, 128 00E	0800	slight	3.0	4.0	40	3	cc	nil	*c.* 300 shearwaters	2 unid. whales	following
11.	IB/01	22 Nov 1986	63 34S, 107 58E	0210	-	-1.0	-2.0	20	3	cc	snow	5 Antarctic/Arctic Terns 4 Snow Petrels	1 Minke Whale	foraging above
12	ND/02	11 Nov 1987	65 04S, 75 46E	1335	-	-	-	-	-	-	-	2 Antarctic/Arctic Terns	1 Minke Whale	following
13.	ND/02	12 Nov 1987	64 05S, 75 06E	1105	-	-	-	-	-	-	-	1 Antarctic/Arctic Tern 2 Antarctic Petrels	1 Southern Bottlenose Whale	foraging above
14.	LF/04	15 Dec 1988	60 41S, 107 29E	0230	slight	-	-	180	4	cc	nil	*c.* 15 prions	1 unid. whale	following
15.	IB/03	21 Jan 1990	65 25S, 109 20E	1110	calm	-0.2	-	-	0	cc	snow	3 Southern Giant Petrels *c.* 50 Wilson's Storm Petrels	4 Minke Whales 74 Killer Whales	foraging above

[a] Vessels: *Nella Dan* (ND), *IceBird* (IB) & *Lady Franklin* (LF)

[b] Wind force: Beaufort scale

[c] Cloud: clear (cl), partly clouded (pc) & continuous cloud (cc)

TABLE 2

TOTAL NUMBER OF CETACEANS RECORDED IN ASSOCIATION WITH SEABIRDS

Seabird taxa	Cetacean taxa: Minke Whale	Sperm Whale	Killer Whale	Southern Bottlenose Whale	Longfin Pilot Whale	Unidentified whales
Wandering Albatross (WA) *Diomedea exulans*	-	1	7	-	-	-
Blackbrowed Albatross (BBA) *D. melanophrys*	-	1	7	-	-	-
Salvin's Albatross (SA) *D. cauta salvini*	1	1	7	-	-	-
Southern Giant Petrel (SGP)	4	1	81	-	-	-
Macronectes giganteus	4	1	81	-	-	-
Antarctic Petrel (AP) *Thalassoica antarctica*	-	-	-	1	-	-
Pintado Petrel (PP) *Daption capense*	-	1	7	-	-	-
Snow Petrel (SP) *Pagodroma nivea*	4	-	20	-	-	-
Prions (Psp) *Pachyptila* sp.	-	-	25	-	45	5
Whiteheaded Petrel (WHP) *Pterodroma lessonii*	-	-	-	-	45	-
Whitechinned Petrel (WCP) *Procellaria aequinoctialis*	-	1	7	-	-	1
Shearwaters (SWsp) *Puffinus* sp.	-	1	7	-	45	6
Wilson's Storm Petrel (WSP) *Oceanites oceanicus*	4	-	74	-	-	-
Blackbellied Storm Petrel (BBSP) *Fregetta tropica*	-	1	7	-	-	-
Antarctic/Arctic Tern (A/AT) *Sterna* sp.	2	-	-	1	-	-
Total No. of individual whales	9	1	126	1	45	11
Frequency of occurrence (%)*	26.7	6.7	26.7	6.7	6.7	40.0
Relative abundance (%)**	4.7	0.5	65.3	0.5	23.3	5.7

* Calculated as: No. associations recorded for each species X 100%
Total no. associations recorded

** Calculated as: Total no. of individual for each species X 100%
Total no. seabirds recorded

TABLE 3

TOTAL NUMBER OF SEABIRDS RECORDED IN ASSOCIATION WITH CETACEANS

Cetacean taxa	Seabird taxa*													
	WA	BBA	SA	SGP	AP	PP	SP	Psp	WHP	WCP	SWsp	WSP	BBSP	A/AT
Minke Whale *Balaenoptera acutorostrata*	-	-	-	3	-	-	6	-	-	-	-	50	-	7
Sperm Whale *Physeter macrocephalus*	4	1	1	1	-	3	-	-	-	70	18	-	2	-
Killer Whale *Orcinus orca*	4	1	1	4	-	3	200	80	-	70	18	50	2	-
Southern Bottlenose Whale *Hyperoodon planifrons*	-	-	-	-	2	-	-	-	-	-	-	-	-	1
Longfin Pilot Whale *Globicephala melaena*	-	-	-	-	-	-	-	53	1	-	300	-	-	-
Unidentified whales	-	-	-	-	-	-	-	20	-	1	570	-	-	-
Total Nos of individual seabirds	4	1	1	4	2	3	206	153	1	71	888	50	2	8
Frequency of occurrence (%)**	6.7	6.7	6.7	13.3	6.7	6.7	20.0	33.3	6.7	13.3	33.3	6.7	6.7	20.0
Relative abundance (%)**	0.3	0.1	0.1	0.3	0.1	0.2	14.8	26.7	0.1	5.1	63.7	3.6	0.1	0.6

* see Table 2 for explanation of taxon codes

** see Table 2 for explanation of calculations

Petrels *Daption capense*, Blackbellied Storm Petrels *Fregetta tropica* (Enticott 1986, Ridoux 1987, Williams *et al.* 1990), Whitechinned Petrels *Procellaria aequinoctialis* (Ridoux 1987, Williams *et al.* 1990) and Wilson's Storm Petrels (Ridoux 1987) have been recorded previously. Association with Wandering Albatrosses *Diomedea exulans*, Salvin's Albatrosses *D. cauta salvini*, Snow Petrels, prions and shearwaters add to these existing records. Analysis of feeding associations between seabirds and Killer Whales around Iles Crozet (Ridoux 1987) suggested that giant petrels and Pintado Petrels were opportunistically attracted to foraging whales due to an immediate availability of food on the sea surface. In contrast, Whitechinned Petrels and Blackbrowed Albatrosses were observed with a similar frequency whether whales were feeding or not. Observations indicate that the latter species are able to follow whales for long distances and expect to encounter floating debris (Ridoux 1987).

Pilot whales have been previously recorded in association with at least 20 seabird species (Wynne-Edwards 1935, Watson 1978, Evans 1982, Enticott 1986, Cockcroft *et al.* 1990). Here we document a pod of Longfin Pilot Whales (*c.* 45 individuals) with prions, shearwaters and a Whiteheaded Petrel *Pterodroma lessonii*. Associative behaviour with prions and Whiteheaded Petrels add to existing records.

The Southern Bottlenose Whale *Hyperoodon planifrons* was recorded foraging in association with Antarctic Petrels *Thalassoica antarctica* and terns. Associative behaviour with Manx Shearwaters *Puffinus puffinus* and Northern Gannets *Sula bassana* has been recorded for its northern relative *Hyperoodon ampullatus* (Evans 1982).

Evans (1982) noted the absence of seabird-Sperm Whale *Physeter macrocephalus* associations in the North Atlantic Ocean and suggested that associations were more likely to occur in the Southern Ocean where Sperm Whales are in sufficient numbers to provide more than an occasional food source for seabirds. Studies in the Southern Ocean have indicated that Blackbrowed, Wandering and the Greyheaded *Diomedea chrysostoma* Albatrosses feed on deep water squid that may be regurgitated by surfacing Sperm Whales (Clarke *et al.* 1981, Clarke & Prince 1981). Here we record foraging associations between Sperm Whales and Blackbrowed, Wandering and Salvin's Albatrosses.

Surveys in the North Atlantic Ocean (Evans 1982) and the Southern Ocean (Enticott 1986, present study) indicate that Minke Whales were one of the most frequently recorded cetaceans observed in association with seabirds. Feeding associations were observed with giant petrels, Snow Petrels, Wilson's Storm Petrels and terns. Associative behaviour with Snow Petrels (Enticott 1986) and terns (Routh 1949, Enticott 1986) have been recorded previously.

Data indicate that most species of seabirds commonly observed in the Australian sector of the Southern Indian Ocean (Woehler *et al.* 1990) have been recorded in association with cetaceans. Notable exceptions include the Lightmantled Sooty Albatross *Phoebetria palpebrata*, Antarctic Fulmar *Fulmarus glacialoides* and Blue Petrel *Halobaena caerulea*. Rarer taxa, including Antarctic/Arctic Terns and Salvin's Albatross were also documented in association with cetaceans. Further research examining associative and non-associative behaviour, feeding and non-feeding associations, diets of associating taxa and prey abundance is required in order to determine which seabird species associate more frequently with cetaceans and what benefits are derived from the association.

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