Seasonal abundance and the distribution of coastal birds on the northern Skeleton Coast, South West Africa/Namibia

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ABSTRACT

Densities of coastal birds along the northern Skeleton Coast, between March 1984 and August 1985 are given. Whitefronted plovers *Charadrius marginatus,* grey plovers *Pluvialis squatarola,* turnstones *Arenaria interpres,* sanderlings *Calidris alba* and curlew sandpipers *C. ferruginea* were the most abundant waders (Charadrii) and made up 92% of all shorebirds counted during the summer months. Only 3,8% of the Palaerctic waders overwintered on the northern Skeleton Coast during June/July 1985. Counts made in 1981 and 1984/85 show that shorebird and Palaearctic tern densities were 31,1% and 97,4% lower respectively in 1984/85. In the southern part of the study area the highest densities of shorebirds were concentrated on mixed shores of sand and rock and on sandy beaches with kelp wrack. In the north, beaches close to coastal wetlands supported the highest densities of shorebirds. The distribution of seabirds was patchy.

1 INTRODUCTION

In recent years summer surveys of coastal birds have been conducted along much of the South West African coast and at coastal wetlands (Whitelaw *et al* 1978; Cooper *et al* 1980; Hockey 1982; Ryan *et al* 1984). Ryan *et al* (1984) report on the distribution and abundance of birds along the entire Skeleton Coast during November and December 1981 and compare their results with data gathered from other areas in southern Africa.

This paper reports on the seasonal abundance and distribution of coastal birds on the northern Skeleton Coast over a period of 18 months, between March 1984 and August 1985. Factors influencing the spatical distribution of shorebirds within the study area are discussed.

The northern Skeleton Coast is bordered by the Hoanib River in the south and the Kunene river in the north (Fig. 1). Surveys of rocky shores (Penrith and Kensley, 1970) and sandy beaches (Tarr *et al* 1985) indicate that this area lies within a biogeographical transition zone. Kelp beds (*Laminaria schintzei*), associated with the cool temperate conditions created by the Benguela upwelling system, occur in the southern section of this area but are no longer noticeable 65 km north of Möwe Bay (pers obs.). The coast is backed by the dry and barren Namib desert and throughout the study area human disturbance is minimal.

This paper forms part of a study of the importance of stranded kelp to the shore ecology of South West Africa.

2 STUDY AREA AND METHODS

The study area was divided into 10 blocks based according to a ¼° square reference system (Fig. 1). The coastline of the northernmost ¼° square was divided into two blocks (9 and 10). Monthly coastal bird counts were made along the traversible 120 km between Möwe Bay (19° 23′S, 12°42′E) and False Cape Frio (18° 29′S, 12° 01′E) incorporating the five most southerly blocks of the study area. It was not possible to visit the northerly five blocks on a monthly basis but, whenever the opportunity arose, a count was made along the 131 km of coast between Angra Fria (18° 17′S, 12° 42′E) and the Kunene river mouth (17° 15′ S, 11° 45′E). All birds roosting or feeding on the shore between the primary dune hummocks and

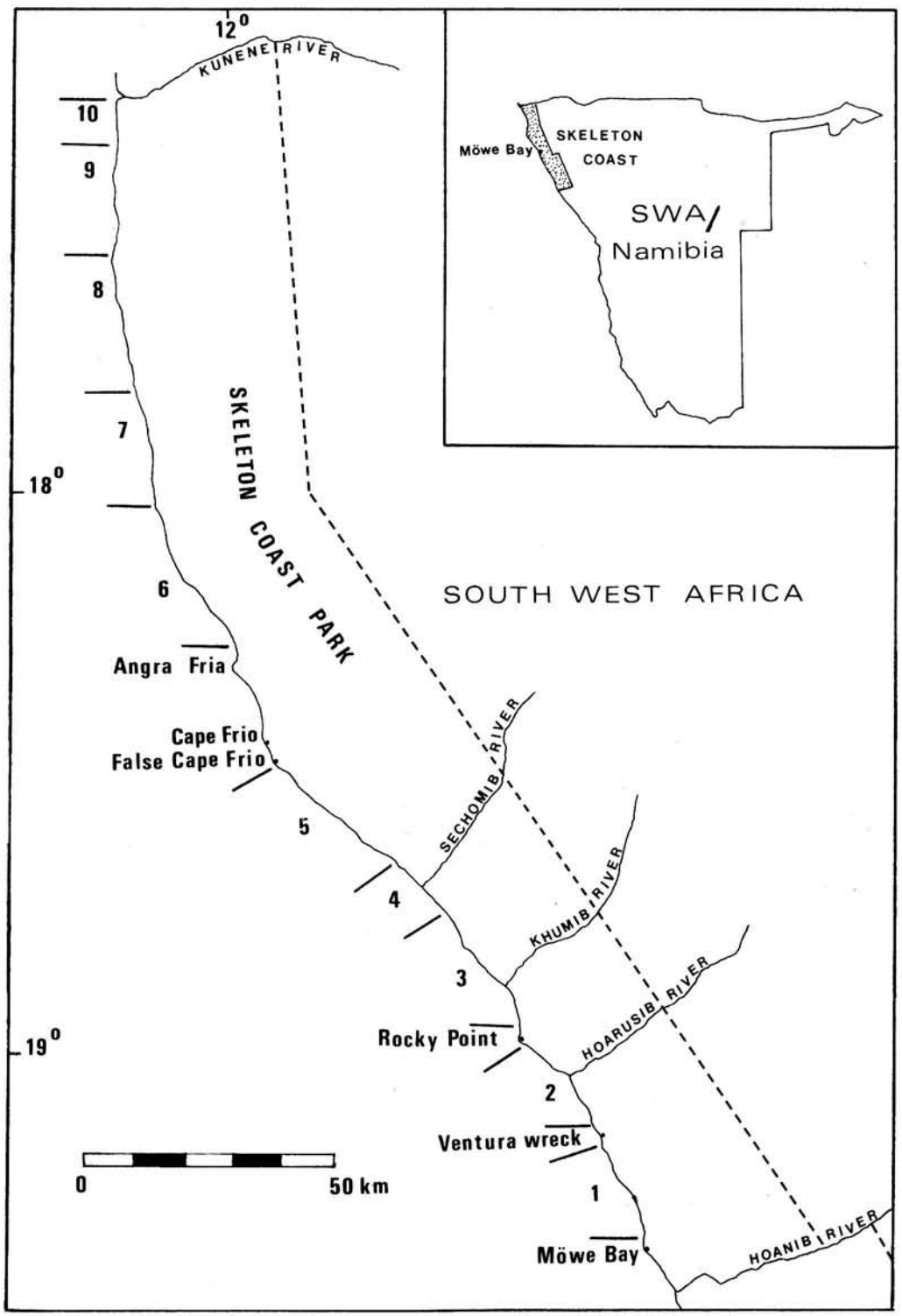

FIGURE 1: The northern Skeleton Coast SWA/Namibia, showing the 10 coastal blocks referred to in the text.

breaking waves were counted from a slow moving vehicle at spring low tide. In the first two blocks the substrata on which the shorebirds were encountered was recorded. Kelp gulls (*Larus dominicanus*) were often observed feeding on the shore and were thus grouped with the shorebirds and not the roosting seabirds. Common terns (*Sterna hirundo*) and Arctic terns (*S. paradisaea)* were not counted separately.

The average density of stranded kelp plants. block $^{-1}$ was estimated by marking out 1 km long plots in the five most southerly blocks and counting and weighing all freshly stranded kelp plants within these plots on a monthly basis between March 1984 and August 1985. A ground patrol was conducted in order to map the shoreline between Möwe Bay and the Kunene River mouth.
All seasons referred to in the text are austral.

3 RESULTS

Blocks 1 to 10 are described in Table 1. The densities (birds. km $^{-1}$) of the more abundant coastal birds encountered between Möwe Bay and False Cape Frio for the period March 1984 to August 1985 (excluding April and August 1984) are depicted in Table 2. During this period four counts were completed between Angra Fria and the Kunene River mouth. These results are depicted in Table 3. Figures in these tables have been corrected to one decimal place and all positive densities of $< 0{,}1$ birds. km^{-1} have been assigned a value of 0,1.

3.1 Coastal bird abundance and distribution

3.1.1 Seasonal variations

Whitefronted plovers (*Charadrius marginatus*) were the only resident (non-migratory) waders encountered during all seasons throughout the study area. Their numbers were variable and seemingly unrelated to season (Table 2). These birds were often observed feeding on terrestrial insects behind the primary dune hummocks. (pers. obs.). McLachlan *et al.* (1980) state that wind direction may play an important role in determining whether whitefronted plovers feed intertidally or behind the dunes. Although the prevailing wind on the northern Skeleton Coast is south-westerly occasional easterly winds occur. During the coastal count done in July 1984 a strong easterly wind blew south of the Sechomib River and appears to have forced out large numbers of whitefronted plovers from behind the dunes, resulting in unusually high densities recorded in blocks 1, 2 and 3 (Table 2). Because the whitefronted plover is a resident species, these high numbers are probably a close reflection of the total population of these brids for that area (McLachlan *et al* 1980).

Of the 11 species of Palaearctic waders observed during the course of this study, grey plovers (*Pluvialis squatarola*), turnstones (*Arenaria interpres*), curlew sandpipers (*Calidris ferruginea*) and sanderlings (*C. alba*) were found to be the only common summer visitors to the northern Skeleton Coast (Tables 2 and 3). These four species, together with white-fronted plovers constituted on average, 92% of the total number of shorebirds counted in blocks 1 to 5 during the summer months. Although not often encountered elsewhere, little stints (*C. minuta*) were observed in comparatively high numbers on the beaches in the vicinity of the Kunene River mouth during January 1985 (Table 3). Bartailed godwits (*Limnosa lapponica*), curlews (*Numenius arquata*), knots (*C. canutus*) and ringed plovers (*Charadrius hiaticula*) were observed infrequently and in low numbers.

The abundance of Palaearctic waders on the northern Skeleton Coast showed marked seasonal fluctuations (Fig. 2). Numbers increased from September to November when, migrating birds returned from their breeding grounds in the Arctic and northern temperate regions. Thereafter there was a steady decrease until February when numbers were reduced by 25%. During March and April a second peak in the Palaearctic wader population occurred when birds formed large flocks before migrating north. By June 1985 the total Palaearctic wader population between Möwe Bay and False Cape Frio had decreased by 95,7%. Between January and July 1985 the total number of Palaearctic

TABLE 1: A detailed description of the 10 blocks which constitute the study site.

BLOCK	1	2	3	4	5	6	7	8	9	10
Distance (km)	24	20	31	15	30	36	32	31	22	10
% Mixed shotre of sand and rock	66	33	27	1	1	22*	4*	40*	23*	23*
% Sandy Beach	34	67	72	99	99	78	96	60	77	77
% Rocky Shore	0	0	1	0	0	0	0	0	0	0
Average density of stranded Kelp (plants/km)	150	120	50	0,5	0,5	–	–	–	–	–
Average wet mass of stranded kelp (kg/km)	134,2	98,9	34,8	0,3	0,28	–	–	–	–	–

* Sandy beaches with isolated rocky outcrops.

waders between Angra Fria and the Kunene River mouth decreased by 98,5%. Thus, although Ryan *et al.* (1984) mention that large numbers of Palaearctic waders may overwinter on the Skeleton Coast, only 59 individuals were counted along the traversible 251 km between Möwe Bay and the Kunene River mouth during July 1985.

Kelp gulls (*Larus dominicanus*) were the only shorebirds other than waders" that were present in all blocks during all seasons, although their numbers fluctuated seasonally (Tabels 2 and 3). The abundance of these birds on the northern Skeleton Coast increased noticeably during April and May. During these two months in 1983 their numbers reached 1500 and 1221 respectively for the area between Möwe Bay and False Cape Frio (Skeleton Coast Park unpubl. data). The lowest counts for kelp gulls in this area were recorded during their breeding season in mid-summer, when the majority of these birds are believed to mi-

TABLE 2: Densities (Birds km^{-1}) of the most abundant coastal birds recorded between Möwe Bay and False Cape Frio for the period March 1984 – August 1985.

MONTH	March 1984					May 1984					June 1984					July 1984				
BLOCK	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SHOREBIRDS																				
RESIDENT WADERS																				
African black oystercatcher *Haemotopus moquini*																	0,2			
whitefronted plover *Charadrius marginatus*	1,2	0,5	0,9	0,2	0,3	3,2	1,5	1,3	0,8	0,8	2,1	0,6	0,5	0,3	0,1	7,8	3,3	2,9	0,6	0,1
TOTAL RESIDENT WADERS	1,2	0,5	0,9	0,2	0,3	3,2	1,5	1,3	0,8	0,8	2,1	0,6	0,5	0,3	0,1	7,8	3,5	2,9	0,6	0,1
PALAEARCTIC WADERS																				
grey plover *Pluvialis squatarola*	3,9	6,6	2,2	0,6	1,5	1,1	1,9	0,7	0,4	0,1	0,8	0,7	0,4		0,1	1,0	1,0	0,3		
turnstone *Arenaria interpres*	0,3	1,2				0,9										0,1				
curlew sandpiper *Calidris ferruginea*		0,1								0,1						0,1				
little stint *C. minuta*																0,1				
sanderling *C. alba*	11,8	17,3	6,6	11,7	13,3		q	0,1		0,1	0,1					1,1	0,4			
whimbrel *Numenius phaeopus*																				0,1
TOTAL PALAERCTIC WADERS	16,0	25,2	8,8	12,3	14,8	2,0	1,9	0,8	0,4	0,3	0,9	0,7	0,4	0	0,1	2,4	1,4	0,3	0	0,1
NON-WADERS																				
grey heron *Ardea cinerea*		0,1					0,1				0,1						0,1			
kelp gull *Larus dominicanus*	3,8	8,5	4,3	3,2	2,4	9,1	10,7	2,9	1,3	3,0	3,6	5,6	3,3	5,1	2,3	5,0	2,7	1,5	0,2	0,9
pied crow *Corvus alba*	0,1	0,3	0,2		0,1		0,2	0,1				0,2	0,5	0,2			0,4	0,5	0,1	0,1
Cape wagtail *Motacilla capensis*	0,2	0,7																		
TOTAL NON-WADERS	4,1	9,6	4,5	3,2	2,5	9,1	11,0	3,0	1,3	3,0	3,7	5,8	3,8	5,3	2,3	5,0	3,2	2,0	0,3	1,0
TOTAL SHOREBIRDS	21,3	35,3	14,2	15,7	17,6	14,3	14,4	5,1	2,5	4,1	6,7	7,1	4,7	5,6	2,5	15,2	8,1	5,2	0,9	1,2
SEABIRDS																				
white breasted cormorant *Phalocrocorax carbo*	4,3	1,0	0,4		0,5	0,2	0,3	0,3	0,2	0,1	3,8	0,5	2,3		0,5	2,0	0,2	0,6		0,1
Cape cormorant *P. capensis*	0,9	0,3	0,1		0,2	4,3	2,1	0,6		0,1	1,8	1,9	2,3	0,1	0,2	0,8	1,0	5,1	0,9	1,1
sandwich term *Sterna sanvicensis*			1,2	0,1	0,1	0,6	0,3	1,1	0,1	0,1										
common/Arctic tern *S. hirundo/paradisea*	0,2		2,8	0,1		0,2		0,7	0,2		0,1					0,8				
Damara tern *S. balaenarum*	6,5	0,1	3,6		1,4			0,8	0,5		0,2				0,1					
TOTAL SEABIRDS	11,9	1,4	8,1	0,2	2,2	5,3	2,7	3,5	1,0	0,3	5,9	2,4	4,6	0,1	0,8	3,6	1,2	5,7	0,9	1,2

MONTH	September 1984					October 1984					November 1984					December 1984				
BLOCK	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SHOREBIRDS																				
RESIDENT WADERS																				
African black oystercatcher *Haemotopus moquini*	0,2	0,1									0,3									
whitefronted plover *Charadrius marginatus*	5,0	1,6	1,0	0,5	0,3	3,4	1,5	1,0	0,4	1,0	1,3	1,3	0,9	0,1	0,2	2,6	1,7	0,7	0,1	0,1
TOTAL RESIDENT WADERS	5,2	1,7	1,0	0,5	0,3	3,4	1,5	1,0	0,4	1,0	1,6	1,3	0,9	0,1	0,2	2,6	1,7	0,7	0,1	0,1
PALAEARCTIC WADERS																				
grey plover *Pluvialis squatarola*	4,7	2,2	1,0	0,3	0,2	6,8	3,5	1,9	0,6	0,7	2,8	2,8	1,0	0,5	0,2	4,0	2,5	1,7	0,1	0,4
turnstone *Arenaria interpres*	8,4	1,4	1,1	0,2		6,5	0,4			0,1	0,5		0,1			0,5				
curlew sandpiper *Calidris ferruginea*	0,2	1,2		0,1		0,5	1,5		0,1		0,1	0,6	1,2			2,1	0,2	0,5		
little stint *C. minuta*																				
sanderling *C. alba*	5,5	6,6	5,6	1,8	4,1	8,3	15,3	8,9	4,9	0,3	15,5	24,2	8,8	9,6	1,2	13,5	18,0	9,1		1,1
whimbrel *Numenius phaeopus*		0,2					0,1			0,1	0,2	0,1	0,1		0,1	0,1				
TOTAL PALAERCTIC WADERS	18,8	11,6	7,7	2,4	4,3	22,1	20,8	10,8	5,6	1,2	19,1	27,7	11,2	10,1	1,5	20,2	20,7	11,3	0,1	1,5
NON-WADERS																				
grey heron *Ardea cinerea*												0,1								
kelp gull *Larus dominicanus*	2,3	1,6	0,9	0,5	0,7	2,2	2,4	0,6	0,1	0,7	0,5	0,4	0,7	0,7	0,2	0,8	0,1	0,3	0,9	0,2
pied crow *Corvus alba*		0,1	0,4	0,1	0,1		0,1	0,2	0,3	0,2	0,1	0,1	0,3		0,1	0,1	0,3	0,1	0,1	
Cape wagtail *Motacilla capensis*												0,1	0,1							
TOTAL NON-WADERS	2,3	1,7	1,3	0,6	0,8	2,2	2,5	0,8	0,4	0,9	0,6	0,7	1,1	0,7	0,3	0,9	0,4	0,4	1,0	0,2
TOTAL SHOREBIRDS	26,3	15,0	10,0	3,5	5,4	27,7	24,8	12,6	6,4	3,1	21,3	29,7	13,2	10,9	2,0	23,7	22,8	12,4	1,2	1,8
SEABIRDS																				
white breasted cormorant *Phalocrocorax carbo*	2,7	0,2	0,1		0,4	0,7	0,1	0,1		0,1	1,5	0,3	0,1	0,1	0,1	0,6	0,3	0,1		0,1
Cape cormorant *P. capensis*	0,3	0,6	0,2				0,2					0,3					0,2			
sandwich term *Sterna sanvicensis*	0,1	0,3	0,1		0,2	0,3	0,1				0,1				0,2					
common/Arctic tern *S. hirundo/paradisea*	0,3		0,9	0,2	0,3	0,6	0,2		0,2		1,6	0,1	0,3	0,1	0,1	0,1			0,1	
Damara tern *S. balaenarum*										0,1					11,7	0,1			0,1	
TOTAL SEABIRDS	3,4	1,1	1,3	0,2	0,9	1,6	0,6	0,1	0,2	0,2	3,2	0,7	0,4	0,2	12,1	0,8	0,5	0,1	0,2	0,1

grate to breeding grounds to the south of the Skeleton Coast Park (R. Loutit pers. comm.). A total of 48 birds was recorded between Möwe Bay and False Cape Frio in November 1981 (Ryan *et al.* 1984), 66 birds in November 1983 (Skeleton Coast Park unpubl. data) and 52 birds in December 1984.

Pied crows (*Corvus alba*), although not mentioned elsewhere as shorebirds, were often encountered during the course of this study (Tables 2 and 3). Their presence on the isolated northern beaches, sometimes as far north as Bosluisbaai (14 km south of the Kunene River mouth), indicates an independence from the human settlements with which they are often associated.

In recent years there appears to have been a decrease in the total abundance of shorebirds present on the northern Skeleton Coast (Table 4). The density of

TABLE 2 continued

MONTH	January 1985					February 1985					March 1985					April 1985				
BLOCK	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SHOREBIRDS																				
RESIDENT WADERS																				
African black oystercatcher *Haemotopus moquini*																0,1				
whitefronted plover *Charadrius marginatus*	2,0	1,2	1,3	0,6	0,4	2,2	1,1	0,5	0,8	0,2	2,8	3,1	1,2	0,7	0,3	2,8	1,3	0,6	0,3	0,2
TOTAL RESIDENT WADERS	2,0	1,2	1,3	0,6	0,4	2,2	1,1	0,5	0,8	0,2	2,8	3,1	1,2	0,7	0,3	2,9	1,3	0,6	0,3	0,2
PALAEARCTIC WADERS																				
grey plover *Pluvialis squatarola*	1,8	2,0	1,3	0,2	0,2	4,3	2,6	1,2	0,5	0,3	4,3	3,4	1,0		0,6	6,0	2,7	1,1	0,2	0,5
turnstone *Arenaria interpres*	1,2					2,3	0,3				6,3	0,2				7,0	1,2			
curlew sandpiper *Calidris ferruginea*	0,1	0,6	0,6		0,1															
little stint *C. minuta*												0,3								
sanderling *C. alba*	19,0	14,3	12,2	2,3	0,5	17,3	8,0	9,6		0,8	15,8	22,8	12,0	9,2	5,8	6,3	10,9	9,5	0,4	3,1
whimbrel *Numenius phaeopus*						0,1										0,1				
TOTAL PALAERCTIC WADERS	22,1	16,9	14,1	2,5	0,8	24	10,9	10,8	0,5	1,1	26,4	26,7	13,0	9,2	6,4	19,0	14,8	10,6	0,6	3,6
NON-WADERS																				
grey heron *Ardea cinerea*	0,1							0,1			0,1		0,1							
kelp gull *Larus dominicanus*	0,5	1,4	0,3	0,8	0,5	1,3	1,9	0,9	0,6	0,2	5,1	3,2	3,5	3,7	1,2	6,6	4,3	3,0	1,7	3,0
pied crow *Corvus alba*	0,1	0,1	0,1					0,1	0,1			0,1	0,1			0,1				
Cape wagtail *Motacilla capensis*								0,1												
TOTAL NON-WADERS	0,7	1,5	0,4	0,8	0,5	1,3	1,9	1,2	0,7	0,2	5,7	3,3	3,7	3,7	1,2	6,7	4,3	3,0	1,7	3,0
TOTAL SHOREBIRDS	24,8	19,6	15,8	3,9	1,7	27,5	13,9	12,5	2,0	1,5	34,9	33,1	17,9	13,6	7,9	29,0	20,4	14,2	2,6	6,8
SEABIRDS																				
white breasted cormorant *Phalocrocorax carbo*	1,6	0,2	0,1		0,3	1,2	0,5	0,1			0,8		0,4		0,1	3,3	0,1	0,2		0,1
Cape cormorant *P. capensis*			0,1				0,1	0,1			12,0	0,8	23,0	1,1	0,6	0,4	1,5	4,7	0,7	1,5
sandwich term *Sterna sanvicensis*											1,7					0,5	0,1			
common/Arctic tern *S. hirundo/paradisea*					0,1						8,3							13,3		
Damara tern *S. balaenarum*			0,1																	
TOTAL SEABIRDS	1,6	0,2	0,3	0	0,4	1,2	0,6	0,2	0	0	22,8	0,8	23,4	1,1	0,7	4,2	1,7	18,2	0,7	1,6

MONTH	May 1985					June 1985					July 1985					August 1985				
BLOCK	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SHOREBIRDS																				
RESIDENT WADERS																				
African black oystercatcher *Haemotopus moquini*																				
whitefronted plover *Charadrius marginatus*	2,2	1,7	0,6	0,4	0,4	1,9	1,0	0,6	0,3	0,1	1,5	0,2	0,5	1,5	0,3	3,0	1,3	1,0	0,7	0,2
TOTAL RESIDENT WADERS	2,2	1,7	0,6	0,4	0,4	1,9	1,0	0,6	0,3	0,1	1,5	0,2	0,5	1,5	0,3	3,0	1,3	1,0	0,7	0,2
PALAEARCTIC WADERS																				
grey plover *Pluvialis squatarola*	4,7	2,5	0,9	0,3	0,6	0,8	1,0	0,2		0,1	1,0	0,5	0,1		0,1	0,3	0,3	0,1	0,2	
turnstone *Arenaria interpres*	10,2	0,3	0,1			0,6					0,1					0,6	0,1			
curlew sandpiper *Calidris ferruginea*					0,2															
little stint *C. minuta*																				
sanderling *C. alba*	1,0		0,5		3,0	0,1		0,5			0,2				0,2					
whimbrel *Numenius phaeopus*	0,2	0,1									0,1					0,1				
TOTAL PALAERCTIC WADERS	16,1	2,9	1,5	0,3	3,8	1,5	1,0	0,7	0,0	0,1	1,4	0,5	0,1	0,0	0,3	1,0	0,4	0,1	0,2	0
NON-WADERS																				
grey heron *Ardea cinerea*	0,1	0,1									0,1					0,1				
kelp gull *Larus dominicanus*	12,6	7,5	4,0	2,7	3,0	7,4	4,9	1,6	0,5	1,6	4,9	3,1	1,9	0,8	1,8	3,4	4,3	1,0	0,9	0,8
pied crow *Corvus alba*		0,1	0,1				0,1		0,1		0,3	0,3	0,5				0,2	0,1		
Cape wagtail *Motacilla capensis*	0,1		0,1				0,1													
TOTAL NON-WADERS	12,8	7,7	4,2	2,7	3,0	7,4	5,1	1,6	0,6	1,6	5,3	3,4	2,4	0,8	1,8	3,,5	4,5	1,1	0,9	0,8
TOTAL SHOREBIRDS	31,1	12,3	6,3	2,8	7,2	10,8	7,1	2,9	0,9	1,8	8,2	4,1	3,0	2,3	2,4	7,5	6,2	2,2	1,8	1,0
SEABIRDS																				
white breasted cormorant *Phalocrocorax carbo*	3,0	0,1	0,6		0,1	0,4	0,7	0,3	0,1		2,8	0,2	0,4		0,1	0,6	0,2	0,1		
Cape cormorant *P. capensis*	250,0	70,0	10,6	0,1		0,1	0,2	0,1	0,1		1,0	0,8	0,4		0,1	2,4	0,4	0,3	0,1	0,1
sandwich term *Sterna sanvicensis*			0,2																	
common/Arctic tern *S. hirundo/paradisea*	0,8		0,1	3,5	0,1															
Damara tern *S. balaenarum*																				
TOTAL SEABIRDS	253,8	70,1	11,5	3,6	0,2	0,5	0,9	0,4	0,2	0	3,8	1,0	0,8	0	0,2	3,0	0,6	0,4	0,1	0,1

TABLE 3: Densities (birds km^{-1}) of coastal birds observed between Angra Fria and the Kunene mouth.

MONTH	July 1984					September 1984					January 1985					July 1985				
BLOCK	6	7	8	9	10	6	7	8	9	10	6	7	8	9	10	6	7	8	9	10
SHOREBIRDS																				
RESIDENT WADERS																				
African black oystercatcher *Haemotopus moquini*																	0,1	0,1		
whitefronted plover *Charadrius marginatus*	0,2	0,2	0,2	0,4	1,8	0,7	0,3	0,4	0,4	0,9	0,6	0,3	0,1	0,8	0,7	0,4	0,3	0,5	0,5	0,7
TOTAL RESIDENT WADERS	0,2	0,2	0,2	0,4	1,8	0,7	0,3	0,4	0,4	0,9	0,6	0,3	0,1	0,8	0,7	0,4	0,4	0,6	0,5	0,7
PALAEARCTIC WADERS																				
grey plover *Pluvialis squatarola*					0,3	0,2	0,5	0,5	0,4	0,8	0,2	0,1	0,2	0,1	0,3					
turnstone *Arenaria interpres*						0,1	0,5	0,1	0,1	0,1										
curlew sandpiper *Calidris ferruginea*					1,5															
little stint *C. minuta*															12,0					
sanderling *C. alba*			0,2			1,2	5,3	2,0	1,1	1,9	2,1	0,8	2,2	0,9	20,4	0,1			0,2	
whimbrel *Numenius phaeopus*			0,1	0,1		0,1														
TOTAL PALAERCTIC WADERS	0	0	0,3	0,1	1,8	1,6	6,3	2,6	1,6	2,8	2,3	0,9	2,4	1,0	32,8	0,1	0	0	0,2	0
NON-WADERS																				
grey heron *Ardea cinerea*																				
kelp gull *Larus dominicanus*	0,7	0,3	0,3	1,0	0,2	0,2	0,3	0,5	0,4	0,7	0,8	0,1	0,3	0,1	0,6	0,8	0,8	0,5	0,9	0,5
pied crow *Corvus alba*	0,1		0,1	0,1			0,1	0,1	0,1					0,1		0,1				
Cape wagtail *Motacilla capensis*																				
TOTAL NON-WADERS	0,8	0,3	0,4	1,1	0,2	0,2	0,4	0,6	0,5	0,7	0,8	0,1	0,3	0,2	0,6	0,9	0,8	0,5	0,9	0,5
TOTAL SHOREBIRDS	1,0	0,5	0,9	1,6	3,8	2,5	7,3	3,7	2,5	4,4	3,7	1,3	2,8	2,0	34,1	1,4	1,2	1,1	1,6	1,2
SEABIRDS																				
white breasted cormorant *Phalocrocorax carbo*	1,5	0,8	0,1	0,4	0,8		0,7	0,1	0,2	0,2	0,1	0,1		0,1	1,4	0,8	0,5	0,1	0,1	
Cape cormorant *P. capensis*	3,4	0,1	0,1	0,1	1,5	0,1	1,1	0,4	0,5	0,5					1,8	0,1	3,1	2,4		11,6
sandwich term *Sterna sanvicensis*						0,3		0,2	0,1	0,1								0,1		
common/Arctic tern *S. hirundo/paradisea*	0,1					0,6	0,1	1,7												
Damara tern *S. balaenarum*								0,1	0,1	0,1	0,4	0,4	0,4	0,7	16,1					
TOTAL SEABIRDS	5,0	0,9	0,2	0,5	2,3	1,0	1,9	2,5	0,9	0,9	0,5	0,5	0,4	0,8	19,3	0,9	3,6	2,6	0,1	11,6

TABLE 4: Shorebird abundance on the northern Skeleton Coast during November 1981 and November 1984.

	NOVEMBER 1981		NOVEMBER 1984	
	Angra Fria to Rocky Point	Rocky Point to Hoanib River	False Cape Frio to Rocky Point	Rocky Point to Möwe Bay
Distance (km)	87,4	65,1	76	44
Number of Birds	1086	2076	623	1114
Density (birds/km)	12,4	31,9	8,2	25,3

shorebirds recorded between Möwe Bay and False Cape Frio during November 1984 was 31,1% lower than that recorded by Ryan *et al* (1984) for the same period in 1981.

Cape and whitebreasted cormorants (*Pharlocrocorax capensis* and *P. carbo*) were the only seabirds observed throughout the year but their abundance was variable and their distribution patchy (Tables 2 and 3). Cormorants feed predominently on dense shoals of pelagic fish (Shannon 1983) and Cape cormorants undergo periodic migrations up and down the South West African coast (Berry 1976). Berry (1976) mentions further that post breeding migrations of Cape cormorants may occur with large scale dispersal of immature birds. This species breeds in South West Africa between late dispersal of immature birds. This species breeds in South West Africa between late September and March (Berry 1976) and this, together with the fact that dense concentrations of pilchard are predicted to occur close to shore in the vicinity of Möwe Bay and the southern Skeleton Coast during the autumn and winter (Boyd and Cruikshank, 1983), may explain the unusually large flocks recorded in May 1985 when more then 7000 birds were counted in blocks 1 and 2.

In 1984 Pelaerctic terns arrived on the northern Skeleton Coast during September and November (Table 2). Thereafter there was a steady decrease in numbers until February 1985 when no common, Arctic or Sandwich terns (*S. sandvicensis*) were recorded in the study area. Numbers once again increased during autumn when the birds gathered in large flocks before migrating northwards to their breeding grounds.

3.1.2 Geographical variations

There is a clear spatial distribution pattern of whitefronted plovers on the northern Skeleton Coast. On average, 66% of all birds counted between Möwe Bay and False Cape Frio occurred in blocks 1 and 2, whereas between Angria Fria and the Kunene River mouth, 20% of all birds counted occurred in the 10 Km stretch south of the Kunene River mouth.

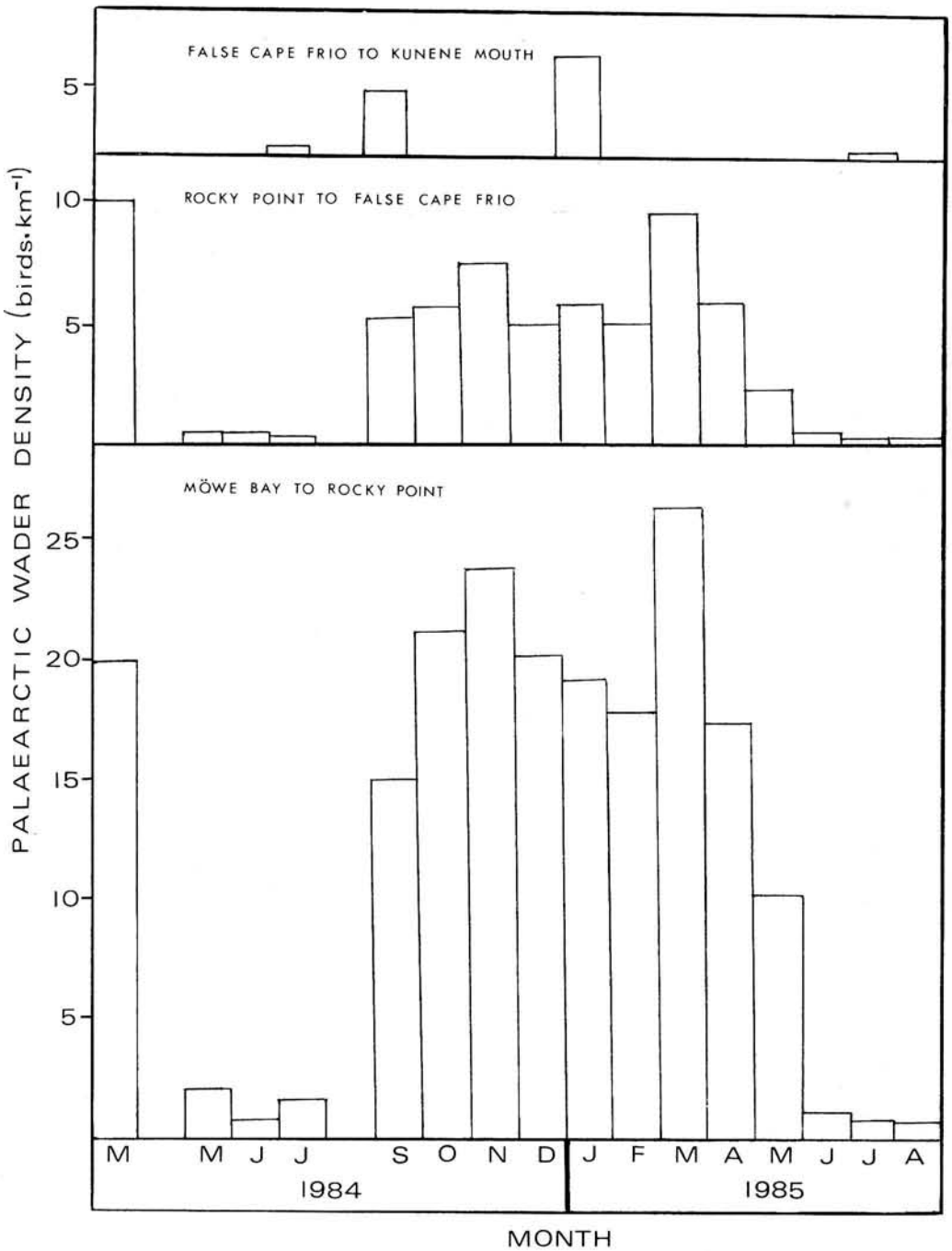

FIGURE 2: Densities (birds, km -1) of Palaearctic waders on the northern Skeleton Coast (March 1984-August 1985). Blank spaces indicate months in which no data was gathered.

In July 1985 two African black oystercatchers (*Haematopus moquini*) were observed 85 km north of Angra Fria. Although three birds have been recorded from Angola (P.A.R. Hockey pers. comm.) these birds are infrequently encountered on the Skeleton Coast and, within this area, have previously been recorded only as far north as Rocky Point (Ryan *et al* 1984), 190 km south of the July 1985 record.

As with whitefronted plovers there is a clear spatial distribution pattern of migrant waders on the northern Skeleton Coast (Fig. 2). On average, 61% of all birds counted between Möwe Bay and the Kunene River mouth were recorded between blocks 1 and 2. Despite the generally low numbers of waders north of Rocky Point, large numbers were sometimes encountered within 10 km of the Kunene River mouth (Table 3).

Fluctuations in the geographical distribution of kelp gulls occurred. During April and May, when these birds are most abundant, the majority (between 66% and 80%) of all kelp gulls counted south of False Cape Frio were found in blocks 1 and 2. For the remaining months their distribution was patchy.

On average 62,2% of all shorebirds counted occurred between Möwe Bay and Rocky Point although this

area constitutes only 17,5% of the entire shoreline surveyed.

It appears that the majority of Palaearctic terns spent the summer of 1984/85 to the south of the study site. Whitelaw *et al* (1977) state that the size and locality of Palaearctic tern flocks show variations from year to year, and it is interesting to note that the numbers of these birds recorded between Möwe Bay and False Cape Frio during November 1984 were a mere 2,6% of the 2424 birds counted in the area by Ryan *et al* (1984) for the same period in 1981.

The rare Damara tern (*S. balaenarum*) breeds on the Skeleton Coast during the summer months (Clinning 1978; Skeleton Coast Park unpubl. data) and in November 1984 a flock of 350 birds was seen just north of False Cape Frio. Although very few birds were encountered between Möwe Bay and False Cape Frio during the following summer months and no birds were counted during the autumn of 1985 (Table 2), a flock of 161 was seen at the Kunene River mouth during January 1985. Damara tern breeding records between False Cape Frio and Terrace Bay (80 km south of Möwe Bay) during the 1985 breeding season dropped by 88,8% from that of the previous year (Skeleton Coast unpubl. data). Breeding numbers in the southern Skeleton Coast were also reported to be considerably lower than in the previous year (R. Loutit pers. comm.). These observations suggest that the majority of Damara terns possibly bred in the far northern areas of the Skeleton Coast Park and possibly along the southern Angolan coast during this period.

Greater and lesser flamingoes (*Phoenicopterus ruber* and *P. minor*) were often observed on the beach in the nearby vicinity of the Hoarusib River mouth (block 2) and nine greyheaded gulls (*Larus cirrocephalus*) were observed during July 1984 in block 9 and 10. Flocks of great white pelicans (*Pelecanus onocrotalus*) were often seen on the northern bank of the Kunene River mouth (pers. obs.) although only four birds (one in block 10 and three in block 1) were counted within the study area between March 1984 and August 1985. 30 Caspian terns (*Hydroprogne caspia*) were observed in block 10 during January 1985 but were not recorded elsewhere on the northern Skeleton Coast during the course of this study.

3.2 Habitat-type variations in shorebird distribution and relationship with stranded kelp

Summers *et al* (1977) and Griffiths *et al* (1983) mention the importance of stranded kelp for waders in the western Cape and Figure 3 depicts the marked drop in both average shorebird density and the presence of stranded kelp north of Rocky Point. On sandy beaches the presence of decomposing kelp attracts a large variety of air-breathing arthropods (Griffiths and Stenton-Dozey 1981). Surveys conducted on the Skeleton Coast showed that the southern beaches, which receive a constant supply of kelp wrack, support a biomass of potential prey organisms that is 74% higher than beaches in the far north which are devoid of stranded kelp (Tarr *et al* 1985).

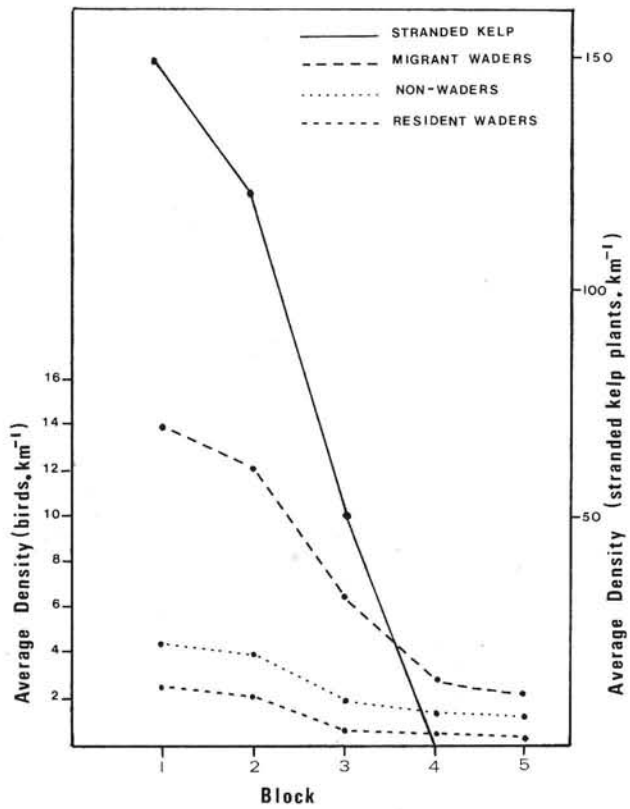

FIGURE 3: Average shorebird and stranded kelp densities recorded in five blocks on the northern Skeleton Coast between Möwe Bay and False Cape Frio (March 1984 — August 1985).

The majority of the five most abundant shorebird species counted between Möwe Bay and Rocky Point were observed on mixed shores of sand and rock (Table 5). These mixed shores may be described as sandy beaches which extend down to a rocky platform. Kelp, which grows on the infratidal fringe of the rocky substratum is stranded along the driftline of the beach, and at low tide both the beach and part of the rocky platform are exposed making a large variety of prey organisms potentially available to shore-feeding birds. Similar observations of waders and their distribution on mixed shores have been made in the southwestern Cape (Summers *et al* 1977) and on the Namib coast, South West Africa (Whitelaw *et al* 1978). A survey of a typical mixed shore north of Möwe Bay showed that five of the eight intertidal prey species present on the sandy beach were dependent to a large degree on decomposing kelp (J.G. Tarr unpubl. data). North of Rocky Point the occurrence of mixed shores of this type drops noticeably, eventually giving way to long sandy beaches with occasional areas of isolated rock.

Cape wagtails (*Motacilla capensis*) together with tractrac chats (*Ceromela tractrac*) and European swallows

TABLE 5: Composition (percent) of five major shorebird species based on average abundance on three shore types for the area between Möwe Bay and Rocky Point.

	Mixed shores of Sand and Rock	Sandy beaches with kelp wrack	Sandy beaches without kelp wrack
white fronted plover	66,1	23,2	10,7
sanderling	93,5	4,9	1,6
grey plover	83,4	12,2	4,4
turnstone	97,3	1,9	0,8
kelp gull	43,3	42,2	14,5

(*Hirundo rustica*) have been observed on Skeleton Coast beaches feeding in the vicinity of decomposing kelp (pers. obs.) and pied crows, although usually found in the vicinity of Cape fur seal (*Arctocephalus pusillus*) carcasses, were also observed pecking amongst stranded kelp plants and the flotsam and jetsam present along the sandy beach driftlines.

4 DISCUSSION

Ryan *et al* (1984) compare the Skeleton Coast north of Angra Fria with the Natal coast of South Africa. Both areas are characterized by long stretches of sandy beach, a low abundance of potential prey organisms, low shorebird densities and the presence of ghost crabs (*Ocypode* sp.) (Dye *et al* 1981, Ryan *et al* 1984, Tarr *et al* 1985). Ghost crabs are predatory scavengers and are believed to compete indirectly with shorebirds for food resources (Bally 1981, Ryan *et al* 1984). On the Skeleton Coast *O. cursor* and *O. africana* are seldom observed south of Rocky Point (pers. obs.). However, during the summer of 1984/85 small numbers were seen on the beaches near the Uniab River mouth (R. Loutit pers. comm.), approximately 110 km south of Möwe Bay, their accepted southerly range (Kensley 1970).

The relatively high numbers of shorebirds in the vicinity of the Kunene River mouth may be explained by the fact that this is the only perennial river on the entire Skeleton Coast. Large flocks of waders gather on the mud flats in the vicinity of the river mouth during the summer months and it can be expected that these birds will sometimes feed on the nearby beaches. This idea is supported by the fact that little stints, which are primarily a species of estuaries, lagoons and vleis (Summers *et al* 1977) are periodically seen in high densities on the beaches of block 10 but are seldom encountered elsewhere on the Skeleton coast.

The northernmost limit of the Benguela upwelling system is believed to be in the vicinity of Cape Frio (Nelson and Hutchings 1983). With respect to shorebird density the area between Rocky Point and Angra Fria may be considered as a transitional zone between the Benguela influenced, cool temperate, southern areas of the South West African and western Cape coasts, and the area north of Angra Fria which is comparable to the sub-tropical Natal coast (Ryan *et al* 1984). In the southwestern Cape a similar transitional zone, marked by the approximate dividing line of the influence of the Agulhas and Benguela currents, occurs between Cape Point and Cape Agulhas (Summers *et al* 1977).

Thus, the northern Skeleton Coast may be divided into three areas with respect to shorebird abundance and distribution: a southern area supporting a mean summer density of 24 birds. km^{-1}; the area between Rocky Point and False Cape Frio which supports a mean summer density of 7,4 birds. km^{-1}; the area north of Angra Fria (excluding block 10) which supports a mean summer density of 2,5 birds. km^{-1}. It appears that the geographical distribution of shorebirds is primarily determined by the availability of food and that the presence of stranded kelp and the nature of the substratum are the two most important factors which determine the abundance of potential prey organisms available to shore-feeding birds.

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6 REFERENCES

BALLY, R
1981: The ecology of three sandy beaches on the west coast of South Africa. PhD. *Thesis.* University of Cape Town.

BERRY, H.H.
1976: Physiological and behavioural ecology of the Cape cormorant *Phalacrocorax capensis. Madoqua* **9**(4): 5—56.

BOYD, A.J. and CRUICKSHANK, R.A.
1983: An environmental basin model for west coast pelagic fish distribution *S. Afr. J.Sci.* **79**: 150—161.

CLINNING, C.F.
1978: The biology and conservation of the Damara tern in South West Africa. *Madoqua* **11**: 31—39

COOPER, J., ROBERSON, H.G. and SHAUGHNESSY, P.D.
1980: Waders (Charadrii) and other coastal birds of the Diamond Coast and the islands of South West Africa. *Madoqua* **12**(1): 51—57.

DYE, A.R., McLACHLAND, A. and WOOLDRIDGE, T.
1981: The ecology of sandy beaches in Natal. *S. Afr. J. Zool.* **16:** 200—209

GRIFFITHS, C.L. and STENTON-DOZEY, J.
1981: The fauna and rate of degradation of standed kelp. *Estuar. Coastal Shelf Sci.* **12**: 645—653

GRIFFITHS, C.L., STENTON-DOZEY, J and KOOP, K.
1983: Kelp wrack and the flow of energy through a sandy beach ecosystem. In: McLachlan and Erasmus (eds). *Sandy Beaches as Ecosystems.* W. Junk. The Hague.

HOCKEY, P.A.R.
1982: Waders (Charadrii) and other coastal birds in the Lüderitz region of South West Africa. *Madoqua* **13**(1): 27—34.

KENSLEY, B.
1970: Some decapod Crustacea from northern South West Africa including a new species of *Hippolyte. Cimbebasia* **1**(8).

1974: Aspects of the biology and ecology of the genus *Tylos* Latriell *Ann. S. Afr. Mus.* **65**: 401—471.

McLACHLAN, A., WOOLDRIGE, T., SCHRAMM, M. and KUHN, M.
1980: Seasonal abundance, biomass and feeding of shorebirds on sandy beaches in the eastern Cape, South Africa. *Ostrich* **51**: 44—52.

NELSON, G. and HUTCHINGS, I.
1983: The Benguela upwelling area. *Prog. Dceanogr.* **12**: 333—356.

PENRITH, M.L. and KENSLEY, B.
1970: The constitution of the fauna of rocky intertidal shores of South West Africa. Part 11. Rocky Point. Cimbebasia **1**(10): 243—268.

RYAN, P.G., COOPER, J. and STUTTERHEIM, C.J.
1984: Waders (Charadrii) and other coastal birds of the Skeleton Coast, South West Africa. Madoqua **14**(1): 71—78.

SHANNON, L.V.
1983: Benguela ecosystem. *S. Afr. J. Sci.* **79**: 137—140.

SUMMERS, R.W., COOPER, J. and PRINGLE, J.S.
1977: Distribution and numbers of coastal waders (Charadrii) in the southwestern Cape, South Africa, summer 1975/76. *Ostrich* **48**: 85—97.

TARR, J.G., GRIFFITHS, C.L. and BALLY, R.
1985: The ecology of three sandy beaches on the Skeleton Coast, South West Africa. *Madoqua* **14**(3)

WHITELAW, D.A., UNDERHILL, L.G. and CLINNING, C.F.
1978: Waders (Charadrii) and other coastal birds on the Namib Coast: counts and conservation priorities. *Madoqua* **11**(2): 137—150.