

Waders (Charadrii) and other birds on the Namib Coast: counts and conservation priorities

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ABSTRACT

Counts of waders (Charadrii) and other birds are given for a 300 km section of the coast-line of the Namib Coast, South West Africa, centred on Walvis Bay. A total of 170 000 birds (excluding cormorants) was counted in the summers 1976/77 and 1977/78. Waders totalled 83 069 of which 88,5 % were Palearctic migrants. The most abundant wader species were sanderling *Calidris alba* and curlew sandpiper *C. ferruginea*. Terns totalled 37 000 and flamingoes 38 000. The three most important localities were Walvis Bay lagoon, Sandvis and the coast between the Swakop River and Walvis Bay.

1 INTRODUCTION

Part of the coast-line of South West Africa is at present undergoing developments for industrial and recreational use with concomitant habitat alteration. The avifauna may be unable to adapt to these changes. This paper reports on counts of waders (Charadrii) and other birds on a section of the Namib coast of South West Africa. It identifies habitats containing major wader concentrations and makes recommendations for their protection. It forms a sequel to a survey of coastal wader habitats in the south-western Cape, South Africa (Cooper *et al.* 1976, Summers *et al.* 1977).

2 STUDY AREA AND METHODS

The coast-line of South West Africa is dominated by the Namib Desert and the Benguela upwelling system. This upwelling of cold and nutrient-rich water is a result of off-shore winds. The nutrients are the basis of the food chain in the study area, and are also ultimately the source of the large pelagic fishing industry at Walvis Bay (Stander 1963). The Namib Coast is an arid environment; precipitation at Walvis Bay averages 17 mm per year (Weather Bureau: Windhoek, pers. comm.). During December 1976 and January 1977 the Western Cape Wader Study Group, with the co-operation of the Division of Nature Conservation and Tourism of the South West Africa Administration, undertook an expedition to the Namib Coast of South West Africa, and did a near-complete census of all waders and other birds on the ca. 250 km coastline between Cape Cross (21°45'S, 13°50'E) and Sandvis (23°22'S, 14°20'E) (Map 1). All non-passerines present which are normally associated with an aquatic environment were counted, except cormorants, *Phalacrocorax* spp. common *Sterna hirundo* and Arctic terns *S. paridisea* were not identified separately, neither were Hartlaub's *Larus hartlaubi* and grey-headed gulls *L. cirrocephalus*. These two gulls breed in mixed colonies in the area (Cooper and Clinning pers. obs.) and have been known to interbreed (Sinclair 1977).

A report on this expedition has been produced (Underhill and Whitelaw 1977). In January 1978 further censuses by the Western Cape Wader Study Group extended the counted area 48 km northwards to Durissa Bay (21°17'S, 13°49'E), and a more comprehensive census of the birds in the southern part of Sandvis was undertaken. This area had not previously been censused effectively (Underhill and Whitelaw 1977). In addition the birds of the Walvis Bay harbour area were counted. A count of Elizabeth Bay (26°51'S, 15°11'E), made on 1 December 1977 by W. R. Siegfried during a coastal survey between Lüderitz (26°38'S, 15°10'E) and the mouth of the Orange River (28°38'S, 16°26'E), has been included.

All counts were conducted in midsummer (December – January) when large fluctuations in numbers of Palaearctic waders do not occur in southern Africa (Berry and Berry 1975; Pringle and Cooper 1975, 1977). Further evidence for this within the study area is provided by the fact that of 1 040 Palaearctic waders ringed on the 1976/77 expedition, 19 out of 21 retraps were made at the place of ringing. A turnstone *Arenaria interpres* moved 20 km northwards, and a curlew sandpiper *Calidris ferruginea* moved 80 km southwards, both over four-day periods (Underhill and Whitelaw 1977).

Palaearctic terns show a variation from year to year in the sizes and localities of the flocks (pers. obs.). Flocks of common/Arctic terns *Sterna hirundo* and *S. paridisaea* were present at Sandvis in January 1977, but were encountered north of Cape Cross in January 1978 when only a small number was seen at Sandvis.

Since the 1978 counts of terns are considered the more accurate, we have subtracted 15 000 common/Arctic terns from the totals given in tables 2 and 4. This was our estimate of a single large flock at Sandvis in 1977.

The open coast-line was divided into sections, mostly 5 km in length. These were surveyed for birds either from a four-wheel drive vehicle or on foot. Two 5 km sections were surveyed by both methods. Both the total number of waders and the species composition were independent of the census method (table 1). This indicates that counts made on foot and from a vehicle are comparable, and that there is no need to make corrections for the type of count made (Underhill and Whitelaw 1977).

3 RESULTS

Summarized results of counts from Durissa Bay to Sandvis show the estimate of the wader population to be 83 069 of which 73 526 (88,5 %) were Palaearctic migrants (tables 2 and 3). The most abundant species were sanderling *Calidris alba* (25 245) and

curlew sandpiper (23 192) which together account for 58,3 % of the wader population (table 3).

The non-wader population was estimated to be approximately 90 000 (table 2). Terns (37 000), flamingoes (38 000) and gulls (5 000) account for about 90 % of the non-wader population (table 2, with a treatment by species in table 4). The total population (excluding cormorants) in the study area in midsummer is about 170 000 birds (table 2). Berry (1976) found the population of Cape cormorants *Phalacrocorax capensis* in the area to fluctuate about a mean of one million birds.

The largest numbers of waders and other birds occurred at Walvis Bay lagoon (22°59'S, 14°31'E) (Fig 2) (29 533 waders and 19 818 non-waders totalling 49 351 birds), at Sandvis (map 3) (ca. 27 000 waders and ca. 33 000 non-waders totalling ca. 60 000 birds) and along the 30 km section of coast-line between the Swakop River (22°40'S, 14°30'E) and Walvis Bay (12 195 waders and 1 240 non-waders totalling 13 435 birds) (tables 3 and 4). Detailed counts for these three localities are given in tables 5, 6 and 7 respectively.

Counts at non-coastal localities are given in table 8. Significant numbers of birds occurred at Walvis Bay sewage works, 'Bird Paradise', (5 156 birds, including 2 420 lesser flamingo *Phoeniconaias minor* and 1 280 Cape teal *Anas capensis*), Swakopmund saltworks (5 941 birds, including 3 077 waders and 1 440 flamingoes) and pans near Cape Cross (6 794 birds, including 2 593 flamingoes and 2 187 black-necked grebe *Podiceps nigricollis*) (table 8).

Detailed counts for the 5 km sections into which the coast between Cape Cross and Sandvis was divided are given in Underhill and Whitelaw (1977). Counts made north of Cape Cross are shown in table 9, and the Elizabeth Bay census is in table 10. Table 11 shows wader densities on open shore-line for the most abundant species (birds per kilometre).

4 DISCUSSION

Walvis Bay lagoon, Sandvis and the 30 km of coast-line between the Swakop River and Walvis Bay account for 82 % of the wader population within the study area (table 4). Two non-coastal localities, Walvis Bay sewage works and the pans near Cape Cross, are important to certain species. The conservation of these localities is discussed below.

"The Ramsar Convention on Wetlands of International Importance, Especially as Waterfowl Habitat" (Carp 1972, Smart 1976) produced criteria to be used in assessing the value of wetlands as habitat for birds. Pertinent criteria are that a wetland of international importance should support more than 20 000 waders, or at least 1 % of the total world population of a single species. These criteria apply to both Walvis Bay lagoon and Sandvis.

4.1 Walvis Bay lagoon

The area below high water mark of the Walvis Bay lagoon falls under the administration of the South African Railways and Harbours, who have leased part of the southern section to a salt manufacturer. It supports 30 000 waders, 88 % of which are Palaearctic migrants, 17 000 flamingoes, and 574 white pelicans *Pelecanus onocrotalus* (table 5). Both species of flamingo and the white pelican are considered rare and vulnerable species in the Republic of South Africa (Siegfried *et al.* 1976). The total world population of the chestnut-banded plover *Charadrius pallidus* is not known, but the 2 000 found here probably comprise more than 1 % of the entire population (table 5). The importance of Walvis Bay to this species was noted by Finch-Davies (1919) who commented on Fisher's sand-plover, the former name of this species: 'This little sandplover, which is usually considered rare, is exceedingly common here, and I have secured five at one shot'. The rarity of this species elsewhere is partly borne out by the total of only 135 birds counted in the south-western Cape (Summers *et al.* 1977).

A road, built in 1971, around the present perimeter of the lagoon has resulted in the formation of barren dry salt flats in an area which was formerly inundated at spring high tides. Thus an area which compared with the very rich tidal salt flats at the southern end of Sandvis (count area D, table 6) has been destroyed as wader habitat. Wind-blown sand is increasingly being deposited in the remaining lagoon area. Map 2 shows the original boundary of inundation (Government Printer 1944) and the present boundary. Extensive salt-works development is presently taking place in the cut-off area (labelled F on Fig 2). Although this may lead to the recreation of wader habitat, the effect of the discharge of saltworks' 'bitters' (highly concentrated solution of salts which remain dissolved after the sodium chloride has crystallized out) needs to be carefully monitored, since discharge areas do not support birds (pers. obs.).

4.2 Sandvis

Sandvis enjoys protection as part of the Namib Desert Park, administered by the Nature Conservation and Tourism Division of the South West Africa Administration. However, there is no guarantee that this protection is absolute, as is evidenced by the granting of mineral prospecting concessions within the Park. No casual visitors are allowed into the Sandvis area, and anglers require permits to fish along the beach which lies within the Park and immediately to the north of Sandvis.

Sandvis supports *ca.* 27 000 waders, 83 % of which are Palaearctic migrants, and 14 000 flamingoes (table 6). 2 600 chestnut-banded plovers here are probably well in excess of 1 % of the total population of this species (table 5). Sandvis supports 360 white pelicans,

making it an important feeding area for this species. White pelicans were reported breeding until 1947 but no longer do so (Hoesch and Niethammer 1940, Rand 1952, Berry and Berry 1975). Caspian terns *S. caspia*, a rare and vulnerable species in South Africa (Siegfried *et al.* 1976), breed in small numbers (Underhill and Whitelaw 1977, Clinning 1978a).

The northern third (areas A and B, map 3) was censused for birds monthly between July 1970 and June 1972 (Berry and Berry 1975). Our census figures for the comparable area (areas A and B, table 6) are generally consistent with theirs. Sandvis is steadily undergoing changes. At the turn of the century it was a deep water harbour, nowadays, at low tide, there are extensive areas less than one metre deep (Kensley and Penrith 1977). Of the three major lagoons on the western coast-line of southern Africa, Sandvis is the only one comparatively free from pollution threats. Langebaan lagoon (33°05'S, 18°03'E), in the south-western Cape, South Africa, opens into Saldanha Bay, a major ore loading terminal and a potential industrial growth point (Siegfried 1977). Walvis Bay is the major port for South West Africa, is a major fishing industry centre and the lagoon contains extensive salt-works. During 1977 and 1978 the bay was used as a haven for unemployed oil tankers. A major pollution incident is more likely to occur at Langebaan lagoon or Walvis Bay than at Sandvis.

4.3 The coast between the Swakop River and Walvis Bay

The 30 km of coast between the Swakop River and Walvis Bay deserves special attention. It supports a total of 12 195 waders in summer (table 7), 98 % of which are Palaearctic migrants, and approximately 3 000 waders in winter (Clinning, pers. obs.). This represents a summer density of 407 birds per kilometre, of which 400 are Palaearctic migrants (table 11). This section of coast-line has large off-shore kelp beds composed of *Laminaria pallida*, and a mixture of rocky and sandy shores. In the south-western Cape, South Africa, mixed shores adjoining kelp beds support a much higher density of waders than other beaches (Summers *et al.* 1977). This area is exceptionally rich in waders compared with the rest of the coast-line surveyed (table 11). Very low densities prevail (with a few isolated exceptions) between the mouth of the Kunene River (17°15'S, 11°45'E) and Durissa Bay and from Sandvis to Oystercliffs (25°20'S, 14°47'E) (Clinning, pers. obs.). The 3 km beach at Elizabeth Bay (table 10) had a wader density of 175 birds per kilometre, a figure many times higher than that which prevailed on the remainder of the coast between Lüderitz and the mouth of the Orange River, which is considered to be a generally poor wader habitat. This beach contained much washed up kelp and large kelp beds occur off the northern part of the bay (W. R. Siegfried, pers. comm.). The average wader density on mixed shores on the west coast of

the south-western Cape, South Africa, (the richest shore type in the area) was 78,5 birds per kilometre (Summers *et al.* 1977). The highest individual densities (219,5 over 4,4 km at Kommetjie (34°08'S, 18°20'E) and 198,5 over 5,9 km at St. Helena-baai (32°46'S, 18°02'E)) are in fact only approximately half the density sustained over the 30 km between the Swakop River and Walvis Bay.

Ten kilometres north of Walvis Bay is an off-shore guano platform on which white pelicans and cormorants breed (Rand 1952; Berry 1974, 1975). On 2 January 1977, 100 adult white pelicans and 60 chicks, many of which were close to fledging, were observed. On 11 January 1978 minima of 298 adult pelicans and 81 large chicks were counted on the platform from the shore. This guano platform is one of four known regular breeding sites of the white pelican in southern Africa and the only known one in existence on the South West African coast (Cooper, pers. obs.). Approximately 100 – 150 crowned cormorants *P. coronatus* breed below the platform (Berry 1974) and feed off the coast between the Swakop River and Walvis Bay (pers. obs.). This species is considered 'rare and vulnerable' in South Africa (Siegfried *et al.* 1976). This section of the coast of South West Africa is also by far the most accessible to the public. A tarred coastal road links Swakopmund and Walvis Bay. The most significant human activity along the coast is recreational angling. This in itself causes little disturbance to the birds, except that anglers collect for bait shore animals that are also taken by waders. However, many four-wheel drive vehicles are used on the beach itself and cause considerable disturbance to the birds, especially in summer, the main tourist season, when the entire beach is covered by deep vehicle tracks (pers. obs.). Since there are access roads to the major recognised angling spots, total prohibition of vehicles along the beach on this section of coast should be enforced, and should cause little or no hardship to anglers and other tourists. If necessary, further access roads could be provided. Before 1 September 1977 the area was controlled by the Nature Conservation and Tourism Division of the South West Africa Administration. The Department of Nature and Environment Conservation of the Cape Provincial Administration, South Africa, is now responsible for the administration of this area, and should patrol it. The South West Africa Administration permits no overnight camping and this prohibition should continue. No further provision of recreational facilities should take place along this section of coast.

4.4 Non-coastal localities

The Walvis Bay sewage works is the most important freshwater habitat within the study area. Its greatest ecological significance is as a source of fresh water for flamingoes, which can be observed flying between the sewage works and the nearby Walvis Bay lagoon.

It also supports 53 % of the ducks and geese in the study area (tables 2 and 8). It is intended to start purifying and recycling water and control will change hands from the Walvis Bay Municipality, which proclaimed the area a municipal nature reserve, 'Bird Paradise', to the Department of Water Affairs. It is recommended that provision be made for the retention of some of the present evaporation ponds.

The pans near Cape Cross are of importance to the black-necked grebe. More than half (2 187 out of 4 264) (tables 3 and 8) of the black-necked grebes observed occurred there. This species is apparently a migrant to the coastal region from inland (Berry and Berry 1975). Since this area is apparently suitable for development as a salt reclamation works, it is recommended that no such development be permitted. The area has already been given out to mining concessions.

The Damara tern *S. balanaerum* is considered a rare and vulnerable species in South Africa (Siegfried *et al.* 1976). Its distribution, numbers and conservation in the area surveyed are discussed by Frost and Shaughnessy (1976) and Clinning (1978b).

The Caspian tern bred in a colony of 30 – 35 pairs at the Swakopmund salt works in 1975 and 1976 but not since, apparently due to disturbance by mammalian predators (Clinning 1978a). The Swakopmund salt works also supports the northernmost known breeding colony of Hartlaub's gulls. On 17 May 1978 there were 75 pairs attending nest scrapes on a small island in one of the pans (Cooper and Clinning, pers. obs.). When such colonies occur care must be taken to reduce disturbance of the breeding birds to a minimum.

5 CONSERVATION PRIORITIES

The conservation priorities may be summarised as:

5.1 Walvis Bay lagoon

- (a) Protection from further encroachment by roads and salt-pans that reduce the tidal area.
- (b) Protection from the side-effects of development: salt-works' 'bitters', fishing industry effluents and litter.
- (c) Registration with the Ramsar Convention as a "Wetland of International Importance".

5.2 Sandvis

- (a) Maintenance of present conservation status, continuing to enforce controlled public access.
- (b) Registration with the Ramsar Convention as a "Wetland of International Importance".

5.3 The coast between the Swakop River and Walvis Bay

- (a) The area should be patrolled by the Department of Nature and Environmental Conservation of the Cape Provincial Administration, South Africa.
- (b) Prohibition of vehicles driving along the beach. If necessary, more access roads should be provided.
- (c) Maintenance of the present ban on overnight camping.
- (d) Nature conservation needs should be given equal priority with tourist and recreational needs in this area.
- (e) Strict control of bait collecting, according to existing legislation.

5.4 Non-coastal localities

- (a) Preservation of some evaporation ponds at the Walvis Bay sewage works.
- (b) No further development in the pans near Cape Cross and the Swakopmund salt works should be permitted.

6 CONCLUSIONS

The breeding grounds of many of the Palaearctic waders present on the South West African coast during the northern winter are protected. Cooper *et al.* (1976) note vast nature reserves in Greenland (70 000 000 ha) and in the Taimyr Peninsula, U.S.S.R. (1 200 000 ha), which cover much of the breeding grounds of the turnstone, ringed plover *Charadrius hiaticula*, grey plover *Pluvialis squatarola*, curlew sandpiper, little stint *Calidris minuta*, sanderling and bartailed godwit *Limosa lapponica*.

Certain feeding areas used during migration have already been conserved. Iran, which lies on the migration route of the curlew sandpiper (Elliott *et al.* 1976) and of several other species (Summers and Waltner 1978), has registered 1 357 550 ha of wetlands under the Ramsar Convention (Smart 1976). The Palaearctic migrants spend up to eight months of their annual cycle in the southern hemisphere, and fidelity to the non-breeding areas has been established for most species (Elliott *et al.* 1976, Summers and Waltner 1979). Even though the birds are not breeding, they face several stress periods: recovery from migration, a complete feather moult, and the acquisition of adequate fat reserves for the return flight. Furthermore, young birds of several species spend their first two years in the southern hemisphere (Elliott *et al.* 1976, Summers and Waltner 1979). Thus the value of nature reserves in Greenland, U.S.S.R., Iran and elsewhere is reduced unless similar and adequate reserves are created throughout the southern hemisphere. South West Africa and South Africa have international responsibilities to conserve Sandvis, Wal-

vis Bay lagoon and the coast between the Swakop River and Walvis Bay as nature reserves.

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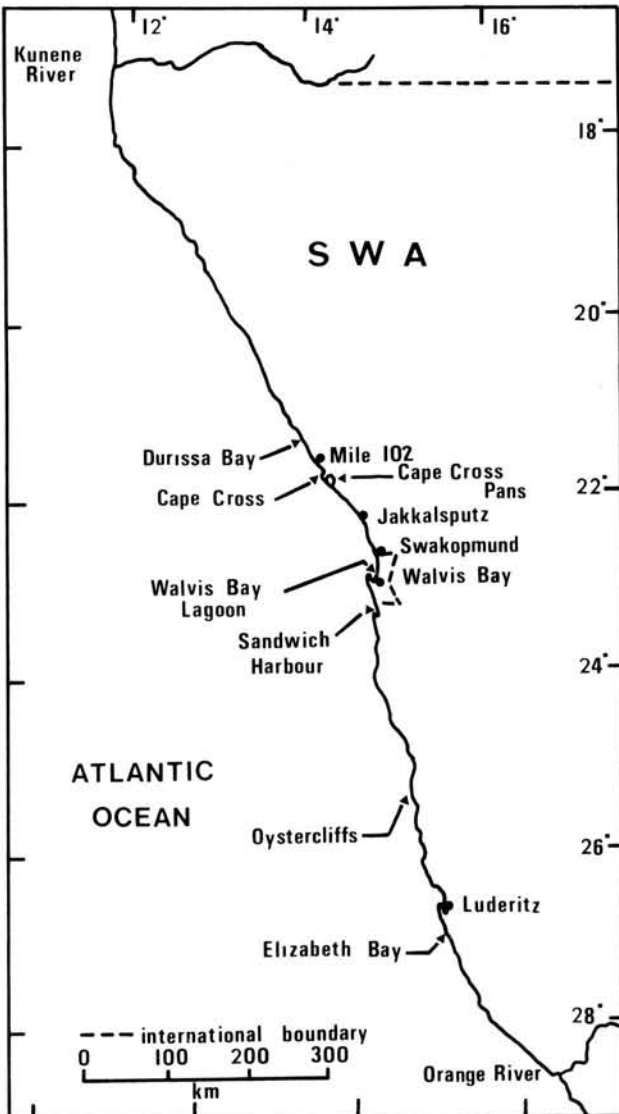
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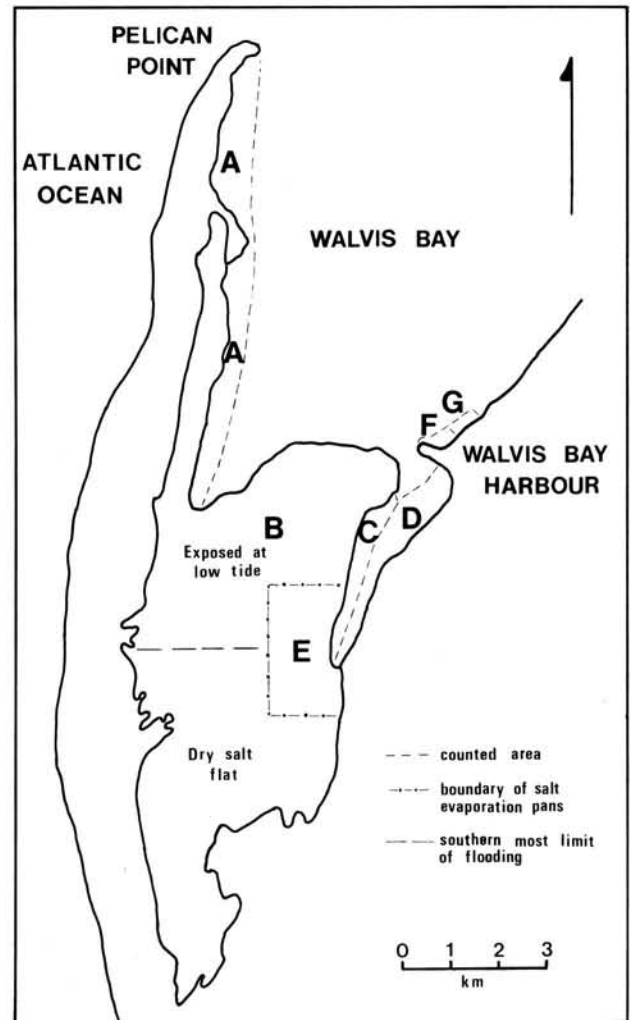
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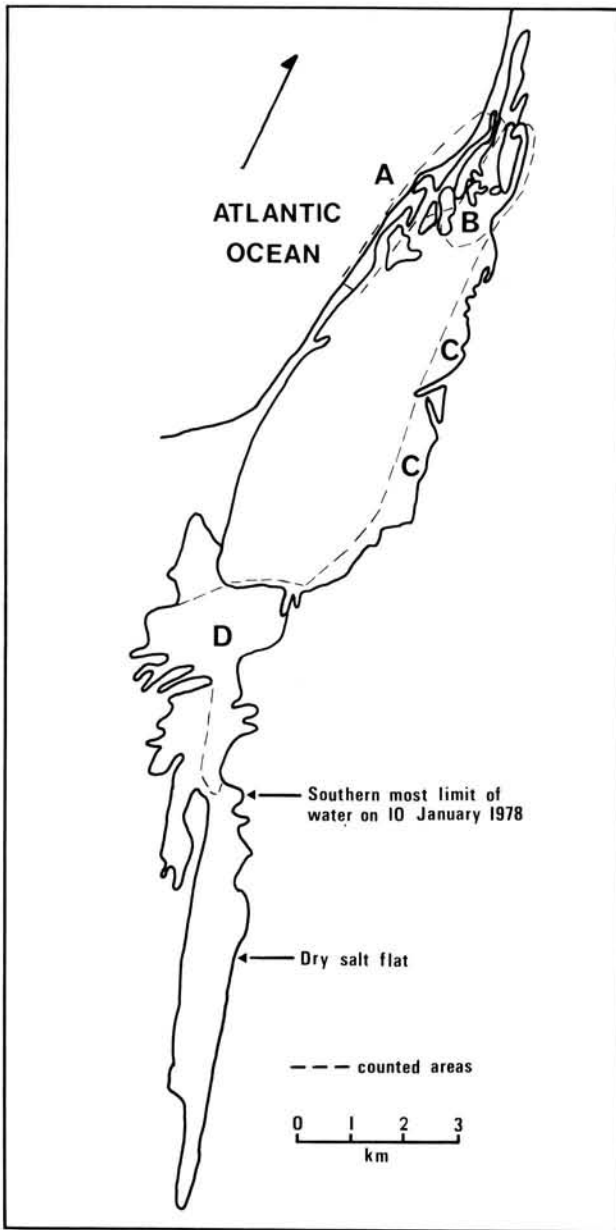
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MAP 1: The coast-line of South West Africa.



MAP 2: Walvis Bay lagoon.



MAP 3: Sandvis

TABLE 1: Numbers of waders and other birds on two coastline sections surveyed on foot and by vehicle

Section Survey method Date	10–15 km south of Cape Cross		12–17 km north of Jakkalsputz	
	Foot 31 Dec. 1976	Vehicle 11 Jan. 1977	Foot 9 Jan. 1977	Vehicle 11 Jan. 1977
White-fronted plover	24	26	20	29
Turnstone	177	115	2	1
Grey plover	15	19	9	11
Curlew sandpiper	6	19	0	0
Knot	0	5	0	0
Sanderling	305	307	138	118
Total waders	527	491	169	159
White pelican	1	2	6	1
Kelp gull	7	40	23	22
Hartlaub's/grey-headed gull	0	60	7	0
Common/ Arctic tern	0	0	1	0
Sandwich tern	0	10	0	0
Total non-waders	8	112	37	23

TABLE 2: Summarized results: Numbers of waders and other birds between Durissa Bay and Sandvis

Area	Coastline between the Swakop River and Walvis Bay (30 km)	Remainder of the coastline between Durissa Bay and Sandvis (225 km)	Non-coastal localities	Sandvis	Walvis Bay lagoon	Total
Waders						
Non-Palaeartic	202	827	382	4 321	3 811	9 543
Palaeartic	11 993	8 834	4 728	22 249	25 722	73 526
Total waders	12 195	9 661	5 110	26 570	29 533	83 069
Non-waders						
Grebes and dabchicks	21	0	3 109	777	488	4 395
Pelicans	199	158	161	360	574	1 452
Flamingoes	100	68	6 778	14 100	16 792	37 838
Ducks and geese	1	11	2 364	482	0	2 858
Gulls	878	1 728	885	350	1 091	4 932
Terns	40	33 291	128	17 261	834	36 554*
Other species	1	4	144	150	39	338
Total non-waders	1 240	35 260	13 569	33 480	19 818	88 367
Total no. of birds	13 435	44 921	18 679	60 050	49 351	171 436

* 15 000 have been subtracted (see Methods)

TABLE 3: Numbers of waders counted between Durissa Bay and Sandvis

Area	Durissa Bay to 8 km north of Cape Cross	Cape Cross to 8 km north	Cape Cross to Jakkalsputz (63 km)	Jakkalsputz to the Swakop River (61 km)	Swakop River to Walvis Bay (30 km)	Pelican Point to Sandvis (53 km)	Walvis Bay lagoon	Sandvis	Non-coastal localities	Totals
Non-Palaeartic waders										
Black oyster-catcher <i>Haematopus moquini</i>	0	8	0	0	3	0	87	1	1	100
White-fronted plover <i>Charadrius marginatus</i>	45	44	219	407	194	104	1 099	800	147	3 059
Kittlitz's plover <i>C. pecuarius</i>	0	0	0	0	0	0	0	1	2	3
Three-banded plover <i>C. tricollaris</i>	0	0	0	0	0	0	0	19	35	54
Chestnut-banded plover <i>C. pallidus</i>	0	0	0	0	0	0	1 909	2 600	25	4 534
Blacksmith plover <i>Hoplopterus armatus</i>	0	0	0	0	0	0	0	0	4	4
Avocet <i>Recurvirostra avocetta</i>	0	0	0	0	5	0	716	900	117	1 738
Stilt <i>Himantopus himantopus</i>	0	0	0	0	0	0	0	0	51	51
Total	45	52	219	407	202	104	3 811	4 321	382	9 543
Palaeartic waders										
Turnstone <i>Arenaria interpres</i>	11	723	401	940	4 277	30	698	200	613	7 893
Ringed plover <i>C. hiaticula</i>	0	1	0	0	0	0	179	200	32	412
Grey plover <i>Pluvialis squatarola</i>	40	47	106	203	612	118	2 479	900	101	4 606
Curlew sandpiper <i>Calidris ferruginea</i>	0	7	24	131	3 089	8	9 312	8 300	2 321	23 192
Knot <i>C. canutus</i>	0	0	138	1	1 528	0	1 074	600	241	3 582
Little stint	0	0	0	2	6	0	598	1 700	746	3 052

Area	Durissa Bay to 8 km north of Cape Cross	Cape Cross to 8 km north	Cape Cross to Jakkalsputz (63 km)	Jakkalsputz to the Swakop River (61 km)	Swakop River to Walvis Bay (30 km)	Pelican Point to Sandvis (53 km)	Walvis Bay lagoon	Sandvis	Non-coastal localities	Totals
<i>C. minuta</i>										
Sanderling	280	1 760	985	1 152	2 206	1 630	8 281	8 800	151	25 245
<i>C. alba</i>										
Ruff	0	0	0	0	0	0	1	3	122	126
<i>Philomachus pugnax</i>										
Common sandpiper	0	0	0	5	4	0	4	1	7	21
<i>Tringa hypoleucos</i>										
Marsh sandpiper	0	0	0	0	0	0	0	0	12	12
<i>T. stagnatilis</i>										
Terek sandpiper	0	1	0	0	0	0	0	2	2	5
<i>Xenus cinereus</i>										
Greenshank	0	0	0	0	11	0	30	110	12	163
<i>T. nebularia</i>										
Wood sandpiper	0	0	0	0	0	0	0	0	6	6
<i>T. glareola</i>										
Bar-tailed godwit	0	6	15	13	177	1	603	1 400	60	2 275
<i>Limosa lapponica</i>										
Curlew	0	0	0	0	0	0	0	18	0	18
<i>Numenius arquata</i>										
Whimbrel	0	0	0	23	83	32	13	12	2	165
<i>N. phaeopus</i>										
Red-necked phalarope	0	0	0	0	0	0	0	3	0	3
<i>Phalaropus lobatus</i>										
Total	331	2 545	1 669	2 470	11 993	1 819	23 272	22 249	4 428	70 776
Unidentified waders	0	0	0	0	0	0	2 450	0	300	2 750
Total no. waders	376	2 597	1 888	2 877	12 195	1 923	29 533	26 570	5 110	83 069

TABLE 4: Numbers of non-waders counted between Durissa Bay and Sandvis

Area	Durissa Bay to 8 km north of Cape Cross	Cape Cross to 8 km north	Cape Cross to Jakkalsputz	Jakkalsputz to the Swakop River	Swakop River to Walvis Bay	Pelican Point to Sandvis	Walvis Bay lagoon	Sandvis	Non-coastal localities	Totals
Great crested grebe	0	0	0	0	0	0	0	51	0	51
<i>Podiceps cristatus</i>										
Black-necked grebe	0	0	0	0	21	0	488	720	3 035	4 264
<i>P. nigricollis</i>										
Dabchick	0	0	0	0	0	0	0	6	74	80
<i>Tachybaptus ruficollis</i>										
White pelican	0	0	28	123	199	7	574	360	161	1 452
<i>Pelecanus onocrotalus</i>										
Cape gannet	0	0	1	0	0	0	4	3	0	8
<i>Sula capensis</i>										
Grey heron	0	0	1	0	0	0	26	60	14	101
<i>Ardea cinerea</i>										
Black-necked heron	0	0	0	0	0	0	0	2	0	2
<i>A. melanocephala</i>										
Little egret	0	0	0	0	1	0	7	50	3	61
<i>Egretta garzetta</i>										
Greater flamingo	0	0	0	48	100	0	7 192	6 100	1 970	15 410
<i>Phoenicopterus ruber</i>										
Lesser flamingo	0	0	1	19	0	0	9 600	8 000	4 808	22 428
<i>Phoeniconaias minor</i>										
Egyptian goose	0	0	0	0	0	4	0	9	48	61

Area	Durissa Bay to 8 km north of Cape Cross	Cape Cross to 8 km north	Cape Cross to Jakkalsputz	Jakkalsputz to the Swakop River	Swakop River to Walvis Bay	Pelican Point to Sandvis	Walvis Bay lagoon	Sandvis	Non-coastal localities	Totals
<i>Alopochen aegyptiacus</i>										
South African shelduck	0	0	0	0	0	0	0	0	1	1
<i>Tadorna cana</i>	0	0	0	0	0	0	0	20	114	134
Cape shoveler	0	0	0	0	0	0	0	15	3	18
<i>Anas smithii</i>	0	0	0	0	0	0	0	15	3	18
Red-billed teal	0	0	0	0	0	0	0	15	3	18
<i>A. erythrorhyncha</i>	0	0	0	7	1	0	0	400	2 114	2 522
Cape teal	0	0	0	7	1	0	0	400	2 114	2 522
<i>A. capensis</i>	0	0	0	7	1	0	0	400	2 114	2 522
Hottentot teal	0	0	0	0	0	0	0	0	10	10
<i>A. hottentota</i>	0	0	0	0	0	0	0	0	10	10
White-faced whistling duck	0	0	0	0	0	0	0	0	8	8
<i>Dendrocygna viduata</i>	0	0	0	0	0	0	0	0	8	8
Red-eyed pochard	0	0	0	0	0	0	0	2	4	6
<i>Netta erythrophthalma</i>	0	0	0	0	0	0	0	2	4	6
Maccoa duck	0	0	0	0	0	0	0	36	62	98
<i>Oxyura maccoa</i>	0	0	0	0	0	0	0	36	62	98
Purple gallinule	0	0	0	0	0	0	0	0	1	1
<i>Porphyrio porphyrio</i>	0	0	0	0	0	0	0	0	1	1
Moorhen	0	0	0	0	0	0	0	1	53	54
<i>Gallinula chloropus</i>	0	0	0	0	0	0	0	1	53	54
Red-knobbed coot	0	0	0	0	0	0	0	33	73	106
<i>Fulica cristata</i>	0	0	0	0	0	0	0	33	73	106
Arctic skua	0	0	0	2	0	0	2	1	0	5
<i>Stercorarius parasiticus</i>	0	0	0	2	0	0	2	1	0	5
Kelp gull	176	10	241	168	376	723	97	250	762	2 803
<i>Larus dominicanus</i>	176	10	241	168	376	723	97	250	762	2 803
Hartlaub's/grey-headed gull	0	1	222	186	502	0	994	100	123	2 128
<i>L. hartlaubi/cirrocephalus</i>	0	1	222	186	502	0	994	100	123	2 128
Sabine's gull	1	0	0	0	0	0	0	0	0	1
<i>L. sabini</i>	1	0	0	0	0	0	0	0	0	1
Caspian tern	0	0	0	0	1	0	31	10	4	46
<i>Sterna caspia</i>	0	0	0	0	1	0	31	10	4	46
Common/Arctic tern	29 700	1	0	0	3	0	317	17 000	45	32 066*
<i>S. hirundo/paradisaea</i>	29 700	1	0	0	3	0	317	17 000	45	32 066*
Sandwich tern	0	0	11	9	14	0	309	40	31	414
<i>S. sandvicensis</i>	0	0	11	9	14	0	309	40	31	414
Swift tern	0	1	0	2	7	0	150	0	20	180
<i>S. bergii</i>	0	1	0	2	7	0	150	0	20	180
Damara tern	36	2	48	29	15	1	25	60	24	240
<i>S. balaenarum</i>	36	2	48	29	15	1	25	60	24	240
White-winged black tern	0	0	0	0	0	0	0	150	4	154
<i>Chlidonias leucop-tera</i>	0	0	0	0	0	0	0	150	4	154
Black tern	3 200	0	0	0	0	2	2	1	0	3 205
<i>C. nigra</i>	3 200	0	0	0	0	2	2	1	0	3 205
Unidentified terns	0	0	0	249	0	0	0	0	0	249
Total no. non-waders	33 113	15	553	842	1 240	737	19 818	33 480	13 569	88 367

*15 000 have been subtraced (see Methods)

TABLE 5: Numbers of waders and other birds in Walvis Bay lagoon

Area	A	B	C	D	E	F	G	Totals
Date	5 Jan 1977	5 Jan 1977	5 Jan 1977	5 Jan 1977	(Walvis Bay salt works) 5 Jan 1977	(Commercial harbour) 17 Jan 1978	(Fishing harbour) 18 Jan 1978	
Black oyster-catcher	87+	0	0	0	0	0	0	87
White-fronted plover	81	71	719	187	35	6	0	1 099
Chestnut-banded plover	2	561	385	941	20	0	0	1 909
Avocet	27	20	242	27	400	0	0	716
Turnstone	563	31	1	0	0	9	94	698
Ringed plover	12	10	131	21	5	0	0	179
Grey plover	473	1 062	893	9	1	24	17	2 479
Curlew sandpiper	1 743	1 080	3 611	2 396	477	0	5	9 312
Little stint	0	1	111	401	85	0	0	598
Knot	695	335	2	42	0	0	0	1 074
Sanderling	5 795	1 245	965	263	12	0	1	8 281
Ruff	0	0	0	0	1	0	0	1
Common sand-piper	0	0	0	0	0	2	2	4
Greenshank	10	4	2	3	11	0	0	30
Bar-tailed godwit	19	135	55	389	0	5	0	603
Whimbrel	1	0	0	0	0	7	5	13
Unidentified waders	2 000	0	40	410	0	0	0	2 450
Total waders	11 508	4 555	7 157	5 089	1 047	53	124	29 533
Black-necked grebe	351	0	35	65	0	37	0	488
White pelican	2	7	500	22	43	0	0	574
Cape gannet	4	0	0	0	0	0	0	4
Grey heron	1	0	2	0	21	0	2	26
Little egret	0	0	0	1	6	0	0	7
Greater flamingo	1 543	362	4 221	1 066	0	0	0	7 192
Lesser flamingo	1 393	834	2 665	4 708	0	0	0	9 600
Arctic skua	2	0	0	0	0	0	0	2
Kelp gull	69	11	5	3	0	2	7	97
Hartlaub's/grey-headed gull	154	0	2	54	0	665	119	994
Caspian tern	18	8	3	1	0	1	0	31
Common/Arctic tern	17	18	71	82	0	83	46	317
Sandwich tern	34	48	1	55	0	109	62	309
Swift tern	98	1	4	4	0	15	28	150
Damara tern	4	4	13	4	0	0	0	25
Black tern	2	0	0	0	0	0	0	2
Total non-waders	3 692	1 293	7 522	6 065	70	912	264	19 818
Total no. of birds	15 200	5 848	14 679	11 154	1 117	965	388	49 351

+ On 17 Jan 1978 44 Black oyster-catchers and one European oyster-catcher *Haematopus ostralegus* were present.

TABLE 6: Numbers of waders and other birds at Sandvis

Area	A	B	C	D	Estimate +
Date	7 Jan 1977	7 Jan 1977	7 Jan 1977	10 Jan 1978	
	Waders				
Black oyster-catcher	0	1*	0	0	1
White-fronted plover	177	0	170	104	800
Chestnut-banded plover	0	70	4	797	2 600
Kittlitz's plover	0	1	0	0	1
Three-banded plover	0	19	0	0	19
Avocet	18	585	129	129	900
Turnstone	1	3	0	72	200
Ringed plover	0	28	6	111	200
Grey plover	63	356	453	16	900
Curlew sandpiper	228	1 561	276	2 406	8 300

Area Date	A 7 Jan 1977	B 7 Jan 1977	C 7 Jan 1977	D 10 Jan 1978	Estimate +
Little stint	0	4	3	512	1 700
Knot	17	522	33	0	600
Sanderling	776	0	695	2 918	8 800
Ruff	0	0	0	3	3
Terek sandpiper	0	0	0	0	2
Common sandpiper	0	1	0	0	1
Greenshank	5	43	50	6	110
Bar-tailed godwit	713	121	455	26	1 400
Curlew	0	18	0	0	18
Whimbrel	0	9	1	0	12
Red-necked phalarope	0	0	0	0	3
Unidentified waders	0	0	0	5 350	—
Total waders	1 998	3 342	2 275	12 450	ca.27 000
Non-waders					
Great crested grebe	10	6	34	1	51
Black-necked grebe	635	46	32	0	720
Dabchick	0	4	2	0	6
White pelican	47	122	139	49	360
Cape gannet	3	0	0	0	3
Black-necked heron	0	2	0	0	2
Grey heron	0	38	18	2	60
Little egret	0	28	19	0	50
Greater flamingo	2 115	163	2 225	1 073	6 100
Lesser flamingo	122	590	329	4 906	8 000
Egyptian goose	0	5	4	0	9
Cape shoveler	0	15	5	0	20
Red-billed teal	0	15	0	0	15
Cape teal	8	145	215	6	400
Red-eyed pochard	0	2	0	0	2
Maccoa duck	0	32	4	0	36
Moorhen	0	1	0	0	1
Red-knobbed coot	0	23	10	0	33
Arctic skua	0	0	0	1	1
Kelp gull	58	24	13	100	250
Hartlaub's/grey-headed gull	58	22	17	3	100
Caspian tern	2	0	0	0	10
Common/Arctic tern	15 000	0	120	35	17 000
Sandwich tern	0	3	21	1	40
Damara tern	18	11	14	9	60
White-winged black tern	0	1	90	26	150
Black tern	0	0	0	1	1
Total non-waders	18 076	1 298	3 311	6 213	ca.33 000
Total no. of birds	20 074	4 640	5 586	18 663	ca.60 000

- * On 10 January 1978 six black oyster-catchers and one European oyster-catcher were present
- The estimate is based on the assumption that area D forms 67% of the available habitat for birds on the southern salt flat. Unidentified waders in area D have been allocated to the smaller waders in the proportions: White-fronted plover 3%, chestnut-banded plover 16%, little stint 12%, sanderling 36% and curlew sandpiper 33%. The proportions are derived from counts made in area D in 1977 and 1978. Estimates are given to two significant figures.

TABLE 7: Numbers of waders and other birds between the Swakop River and Walvis Bay

Black oyster-catcher	3	Black-necked grebe	21
White-fronted plover	194	Pelican	199*
Avocet	5	Little egret	1
Turnstone	4 277	Greater flamingo	100
Grey plover	612	Cape teal	1
Curlew sandpiper	3 089	Kelp gull	376
Little stint	6	Hartlaub's/grey-headed gull	502
Knot	1 528	Caspian tern	1
Sanderling	2 206	Common/Arctic tern	3
Common sandpiper	4	Sandwich tern	14
Greenshank	11	Swift tern	7
Bar-tailed godwit	177	Damara tern	15
Whimbrel	83	Total non-waders	1 240
Total waders	12 195	Total no. of birds	13 435

* includes 100 chicks

TABLE 8: Numbers of waders and other birds at non-coastal localities

Area	Walvis Bay sewage works 'Bird Paradise'	Swakop River mouth	Swakopmund sewage works	Swakopmund salt works	Pans near Cape Cross	Pan at Mile 102	Totals
Date	2 Jan 1977	30 Dec 1976	30 Dec 1976	1 Jan 1977	11 Jan 1977	12 Jan 1978	
Waders							
Black oyster-catcher	0	0	0	1	0	0	1
White-fronted plover	0	16	5	98	28	0	147
Kittlitz's plover	2	0	0	0	0	0	2
Three-banded plover	10	7	18	0	0	0	35
Chestnut-banded plover	0	0	0	25	0	0	25
Blacksmith plover	1	0	3	0	0	0	4
Avocet	33	3	1	77	3	0	117
Stilt	45	0	0	6	0	0	51
Turnstone	2	3	44	478	13	73	613
Ringed plover	1	14	11	3	3	0	32
Grey plover	13	0	0	63	15	10	101
Curlew sandpiper	99	63	66	1 496	597	0	2 321
Knot	0	0	0	236	5	0	241
Little stint	82	42	44	368	210	0	746
Sanderling	5	2	0	127	11	6	151
Ruff	31	0	56	18	17	0	122
Common sandpiper	3	0	4	0	0	0	7
Marsh sandpiper	2	1	0	9	0	0	12
Terek sandpiper	2	0	0	0	0	0	2
Greenshank	1	0	0	10	1	0	12
Wood sandpiper	2	0	4	0	0	0	6
Bar-tailed godwit	0	0	0	60	0	0	60
Whimbrel	0	0	0	2	0	0	2
Unidentified	0	0	0	0	300	0	300
Total waders	334	151	256	3 077	1 203	89	5 110
Non-waders							
Black-necked grebe	228	0	0	620	2 187	0	3 035
Dabchick	66	0	8	0	0	0	74
White pelican	123	0	0	38	0	0	161
Grey heron	13	0	0	1	0	0	14
Little egret	0	0	0	3	0	0	3
Greater flamingo	304	0	8	500	1 158	0	1 970
Lesser flamingo	2 420	10	3	940	1 435	0	4 808
Egyptian goose	48	0	0	0	0	0	48
South African shelduck	1	0	0	0	0	0	1
Cape shoveler	108	0	6	0	0	0	114
Red-bill teal	0	0	1	2	0	0	3
Cape teal	1 280	10	73	233	518	0	2 114
Hottentot teal	10	0	0	0	0	0	10
White-faced whistling duck	8	0	0	0	0	0	8
Red-eyed pochard	3	0	1	0	0	0	4
Maccoa duck	59	0	3	0	0	0	62
Purple gallinule	0	0	1	0	0	0	1
Moorhen	30	0	23	0	0	0	53
Red-knobbed coot	67	0	6	0	0	0	73
Kelp gull	42	0	0	415	292	13	762
Hartlaub's/grey-headed gull	5	0	81	37	0	0	123
Caspian tern	3	0	0	0	1	0	4
Common/Arctic tern	0	0	0	0	0	45	45
Sandwich tern	0	0	0	31	0	0	31
Swift tern	0	0	0	20	0	0	20
Damara tern	0	0	0	24	0	0	24
White-winged black tern	4	0	0	0	0	0	4
Total non-waders	4 822	20	214	2 864	5 591	58	13 569
Total no. of birds	5 156	171	470	5 941	6 794	147	18 679

TABLE 9: Estimated numbers of waders and other birds on the coast-line between Durissa Bay and Cape Cross, 12 January 1978*

White-fronted plover	59
Turnstone	120
Grey plover	63
Curlew sandpiper	1
Sanderling	816
Terek sandpiper	1
Unidentified	1
Total waders	1 061
Hartlaub's/grey-headed gull	1
Kelp gull	186
Sabine's gull	1
Common/Arctic tern	29 700
Damara tern	36
Black tern	3 200
Total non-waders	33 124
Total no. of birds	34 185

* Estimates are based on a survey of 62 % of the coast-line

TABLE 10: Elizabeth Bay: Numbers of waders and other birds, 1 December 1977

Black oyster-catcher	9
White-fronted plover	57
Grey plover	38
Turnstone	94
Sanderling	327
Total waders	525
Kelp gull	136
Total non-waders	136
Total no. of birds	661

TABLE 11: Densities of some species of waders (birds/km) on the open coast-line between Durissa Bay and Sandvis.

Area	Durissa Bay to 8 km north of Cape Cross (48 km)	Cape Cross to Jakkalsputz (63 km)	Jakkalsputz to the Swakop River (61 km)	Swakop River to Walvis Bay (30 km)	Pelican Point to Sandvis (53 km)
White-fronted plover	1,0	3,5	6,7	6,5	2,0
Turnstone	0,2	6,4	15,4	142,6	0,6
Grey plover	0,8	1,7	3,3	20,4	2,2
Curlew sandpiper	0	0,4	2,1	103,0	0,2
Knot	0	2,2	<0,1	50,9	0
Sanderling	5,9	15,6	18,9	73,5	30,8
Bar-tailed godwit	0	0,2	0,2	5,9	<0,1
Whimbrel	0	0	0,4	2,8	0,6
All Palaearctic waders	7,0	26,5	40,5	399,8	34,3
All non-Palaearctic waders	1,0	3,5	6,7	6,7	2,0
All waders	8,0	30,0	47,2	406,5	36,3