SUCCESSFUL CONSERVATION MEASURES AND NEW BREEDING RECORDS FOR DAMARA TERNS *STERNA BALAENARUM* IN NAMIBIA

R.J. BRABY[1], ANAT SHAPIRA[2] & R.E. SIMMONS[3]

[1]Resource Management, Ministry of Environment & Tourism, P/Bag 5018, Swakopmund, Namibia
[2]Ben Gurion University, Beer-Sheva, Israel
[3]National Biodiversity Programme, Directorate of Environmental Affairs, Ministry of Environment & Tourism, P/Bag 13306, Windhoek, Namibia
(harrier@iafrica.com.na)

Received 19 February 2001, accepted 23 July 2001

SUMMARY

BRABY, R.J., SHAPIRA, A. & SIMMONS, R.E. 2001. Successful conservation measures and new breeding records for Damara Terns *Sterna balaenarum* in Namibia. *Marine Ornithology* 28: 81–84.

Damara Terns *Sterna balaenarum* nest at high densities on the central Namibian coast and overlap in both space and time with vacationing fishermen and quad bikers. This results in high non-hatching rates of up to 50% and reduced breeding success for the densest known colony of terns. In November 2000, information boards and a barrier preventing off-road vehicles from entering a Damara Tern breeding site near Swakopmund were erected. Comparisons between nesting density, hatching success and vehicles passes before and after these measures showed that nesting density increased slightly (12 to 15 nests/km^2/month), hatching success increased from 56% to 80% and vehicle passes dropped from 870 per month to zero. The overall result was a doubling of the number of chicks hatched in the study area. The success of this approach augurs well for similar approaches to other conflicts between semi-colonial coastal-breeding birds and visitors. New breeding records from southern Namibia and a nesting record from 11.5 km inland are also detailed in our attempt to elucidate the ecology and conservation of this rare seabird.

INTRODUCTION

Damara Terns *Sterna balaenarum* are mainly confined to the Namibian coast during breeding with about 98% of the population nesting between the Orange and Cunene River mouths (Crawford & Simmons 1997). Less than 125 pairs are suspected to breed in South Africa (Underhill 2000) where it is classified as Endangered (Barnes 2000). Originally designated a globally threatened species (Collar & Stuart 1985), re-assessments of the world population have put them at 13 500 individuals (Simmons *et al*. 1998) with no apparent decline. Namibian and global conservation assessments have thus down-listed this tern to Near Threatened (BirdLife International 2000, Simmons *et al*. in prep.).

During the course of re-assessing population estimates (Braby *et al*. 1992) and enacting conservation measures we found that: the largest and densest population of Damara Terns bred at Caution Reef just south of Swakopmund with a minimum 120 pairs breeding (Braby 1995); a large proportion of two-egg clutches occurred at Hottentot's Bay near Lüderitz (de Villiers & Simmons 1997); and the highest density of terns occurs in central coastal regions of Namibia, diminishing both to the north and south (Simmons *et al*. 1998). These are important findings in putting the value of conserving the Caution Reef colony into perspective.

CONSERVATION MEASURES

Despite their healthy population status, Damara Terns and humans continue to interact negatively on the Namibian coast and birds are subject to unnecessary mortality during breeding because of off-road driving by fishermen and quad bike enthusiasts (Clinning 1978, Braby 1995). This spurred the establishment of conservation measures to prevent further conflicts at the coastal resort of Swakopmund. These measures include a new 5-km barrier running parallel to the national road preventing off-road vehicles (ORVs) from driving across the colony, a series of information signs explaining that the fenced area is a Damara Tern breeding colony and signs requesting visitors to remain on designated tracks next to the beach. These came into effect in November 2000.

Our aim in monitoring the colony was to assess what effect, if any, the new barrier and interpretation signs had on (i) the number of vehicles crossing the colony, (ii) the hatching success of terns now protected from intense disturbance, and (iii) nesting density. Comparisons were made with data collected by RJB in 1995 and in 1997/98 by Reiss & Krueger (1998) on breeding parameters and ORV use before the barrier and signs were erected. We expected that the intensity of disturbance would change given that 29

vehicles per day passed through the breeding ground in 1995 (Braby 1995), and most people interviewed were unaware of any breeding terns (Reiss & Krueger 1998).

The conservation measures reported here are one part of a programme to understand Damara Tern ecology in Namibia and we thus report on the success of these measures as well as new distribution records from the southern Namibian coast and a new record for inland breeding.

STUDY AREA AND METHODS

The main study area, Caution Reef (also known as Patrysberg), is situated about 8 km south of Swakopmund (22°44'S, 14°32'E) on Namibia's central coast. The original study area was about 2 km long, abutting the western edge of the main Swakopmund-Walvis Bay road and ran 1 km down to the sea. However, it became apparent that terns were breeding east of this road up to the high dunes about 600 m east (Braby 1995, P.G. Ryan & J. Cooper SAOS 1981 nest record cards). Searches were then initiated east and then north of this area up to the old railway line approximately 2 km south of Swakopmund. This new study area is separated from the Caution Reef site by 3.7 km, and comprised a series of complex barchan, linear, crescent and star dunes separated by gravel plains where the birds lay their eggs. The study area here was approximately 3.5 km^2 in extent and is known as the 'Horse Graveyard' site.

The habitat in Caution Reef is mainly open sandy plains with a raised gravel ridge running through the centre – preferred by nesting birds. Some areas have small vegetated hummocks but in general visibility is good. The beach was heavily used by tourists and frequented by Black-backed Jackals *Canis mesomelas* and Kelp Gulls *Larus dominicanus.* Habitat in the Horse Graveyard site is different in that visibility for nesting birds is blocked by the small (*c.* 3-m high) dunes and there is no direct access to the sea for fledging terns. Jackals and gulls seldom used this site but quad bikes were very common throughout the season.

Monitoring and nest finding began just after the peak in tourist traffic on 4 January 2001 and continued for one month until 5 February. Tourists typically begin to leave the area as schools resume from about 15 January – during the middle of Damara Tern egg-laying which extends for about five months (Simmons & Braine 1994, Braby 1995). Two observers searched the area by foot or from a vehicle and recorded all tern eggs and chicks and all vehicles crossing the study area. The study covered one month and since we wished to compare post-conservation breeding success with pre-conservation breeding success we used density estimates from the same month from previous years. All observations of breeding were entered on nest record sheets and are entered on Namibia's avifaunal data base (Jarvis & Robertson 1999). All positions of eggs and small chicks were recorded on a Garmin II Global Position System allowing the plotting of inter-nest distances and distance from the sea to within 10 m.

On two visits to Sylvia Hill, 270 km to the south (25°08.43'S, 14°51.43'E) in January 2000 and December 2000, all Damara Terns were recorded. One visit to the poorly known and virtually inaccessible Easter Cliffs (20 km south of Sylvia Hill) was also undertaken in December 2000 and new breeding sites recorded.

RESULTS AND DISCUSSION

Nesting density and success of nests

In 32 days of monitoring on the Caution Reef colony, 30 Damara Tern eggs or chicks were found in 2 km^2. This density of 15 nests/km^2/month is marginally higher than the nesting density found in 1995, when 12 nests/km^2/month were found (Table 1). It is also higher than any other site currently known.

Of the small sample of 15 eggs monitored to hatching in 2001, 11 hatched successfully, three did not hatch (parents still present but eggs cold) and one was assumed to have hatched (parents mobbing) but the chick was not found. No eggs were broken by ORVs or taken by jackals or gulls. Hatching success was thus 80% of 15 eggs with no apparent outside influence. This 20% failure contrasts with an average failure of 44% from two earlier studies in the same area – 38% of 120 eggs in 1994/95 and 50% of 24 eggs in 1997/98 (Table 2). A significant difference in hatching success ($\chi^2 = 4.67$, 1df, $P < 0.05$) was evident between undisturbed sites combined (successful eggs = 74%, n = 81) and disturbed sites (successful eggs = 60%, n = 144).

Disturbance from ORVs was also different between years. In 2001, no vehicles were recorded crossing the breeding area in the 32-day study period. By contrast an average of 29 vehicle passes

TABLE 1

Reproductive and breeding density statistics for intensively studied Damara Tern colonies in Namibia. Nesting density is given per month to permit comparisons of nest density between study areas with different sampling intensities

Nests studied	Study area (km^2)	Study period (months)	Nest density (nests/km^2/month)	Location	Source
62	44	3	0.5 nests/km^2	Möwe Bay	Simmons & Braine (1994)
120	2	5	12 nests/km^2	Caution Reef	Braby (1995)
48	2	2	12 nests/km^2	Caution Reef	Reiss & Krueger (1998)
30	2	1	15 nests/km^2	Caution Reef	This study
17	3.5	0.5	10 nests/km^2	Horse Graveyard	This study

occurred per day in 1995 (870 per month) when no barrier fence prevented off-road driving through the colony. A maximum of 63 passes in one day occurred during peak tourist activity between 24 December 1994 and 7 January 1995.

The conservation measures implemented just before breeding were highly successful. This was evident from the lack of human-related mortality in 2001, hatch failure halving from an average 44% to 20% and density of nests increasing slightly following the reduction of off-road driving and an increase in awareness. By combining the increased density with the increased hatching success we can calculate that the conservation measures virtually doubled Damara Tern breeding production at Caution Reef (6.7 chicks vs 12 chicks hatched/km^2/month). Interviews of 52 vacationers by RJB also found that all of them were aware of breeding terns in 2001, in contrast to the majority who were unaware in 1997/98 (Reiss & Krueger 1998). We suggest that other rare coastal birds with clumped breeding dispersions (e.g. African Black Oystercatchers *Haematopus moquini*), might benefit by preventing ORVs from entering breeding areas together with interpretation signs explaining why.

Disturbance of breeding Damara Terns was suggested by Simmons *et al*. (1998) as a reason for the dearth of breeders in otherwise suitable habitat in the high security Diamond Area of south-western Namibia and at Elizabeth Bay. In that study only one breeding bird was found in over 100 km of habitat traversed day and night by heavy trucks, while the 20-pair tern colony at Elizabeth Bay had declined to two pairs. The evidence presented here that vehicle traffic reduced hatching success and nesting density of terns adds credibility to the idea (disbelieved by environmental officers in the diamond area) that disturbance may be the principal factor limiting Damara Tern breeding in south-western Namibia. The reduction of mining activity there over the next five years will offer an ideal test of this hypothesis.

In the Horse Graveyard site (3.5 km^2), 17 eggs or chicks were found. Because breeding was initiated later than at the Caution Reef site and monitored for only 18 days, only 11 eggs were followed; the fates of six were known since the others did not hatch during the period of study. Six hatched and one chick died within a day. Breeding density at this site was slightly lower than at the undisturbed Caution Reef site (Table 1). Disturbance from quad bikes at this site was intense with bikes criss-crossing the area daily. There is insufficient data to compare hatching success in this disturbed site with Caution Reef and further monitoring is needed. However, we know that requests to quad bikers to stay out of the area were ignored and the only reason any eggs or chicks survived was that bikers tended to use the dunes while the terns nested on the intervening gravel plains.

Breeding at Easter Cliffs

Breeding terns have not previously been found at Easter Cliffs in the southern Namib sand sea even though sightings are known from bird atlas data (Crawford & Simmons 1997). On 18 December RES discovered a nest on the open grey gravel plains opposite Easter Point about one kilometre from the sea. The single egg was placed in a small patch of sand on a small rocky plateau at 25°17.598'S, 14°49.035'E. At least four other birds (some carrying fish) were seen heading inland farther south (Oyster Cliffs) into habitat comprising open gravel plain surrounded by dunes studded with blue marble. Along 7.8 km of beach back to Sylvia Hill, eight Damara Terns were observed foraging at low tide in the shallow rocky waters. The total number of terns between Oyster Cliffs and Sylvia Hill is estimated at 20 pairs.

Inland breeding

Damara Terns lay their eggs on open sand and gravel plains, or salt pans several kilometres from the ocean in an attempt to avoid jackals that patrol coastal areas (Simmons *et al.* ms). The average nest-to-coast distance varies greatly with Möwe Bay nests ranging from 90 m to 8 km inland, averaging 5.4 km from the coast (Simmons & Braine 1994). In December 2000 whilst travelling through the southern Namib dune streets (kilometre-wide, flat sandy plains, bounded by linear dunes tens of kilometres long), RES encountered a breeding Damara Tern on an egg at 25°12.919'S, 14°54.859'E. The egg was placed directly on sand on a wide plain 11.5 km from the nearest coast. Since Damara Terns were only observed foraging near the Easter Cliffs colony (south-west of here) and not directly perpendicular to this nest (i.e. Sylvia Hill) the distance to the nearest foraging grounds was probably about 18 km – a 36 km round-trip. We do not know the success of this nest but no breeding was apparent one year later. This is the farthest inland that a Damara Tern has been known to attempt breeding.

TABLE 2

Hatching success of Damara Terns under different conditions of disturbance by humans

Source	No. of eggs with known fate	Hatching success (%)	Human-induced mortality[a] (%)	Colony – disturbance
Braby 1995	120	62	5	Caution Reef – high
Reiss & Krueger 1998	24	50	13	Caution Reef – high
This study	15	80	0	Caution Reef – reduced[b]
Simmons & Braine 1994	66	72	0	Möwe Bay – none[c]

[a] directly crushed or taken by humans. Does not include jackals and gulls being attracted by humans to these areas.
[b] Caution Reef protected for the first time from off-road vehicles and quad bikes.
[c] outside any tourist area and uninhabited.

We conclude that barriers preventing off-road driving across Damara Tern colonies in central Namibia almost doubled the number of chicks hatched, and is a highly effective means of promoting successful breeding of terns. As such it may prove useful in other areas of conflict between coastal vacationers and coastal breeding birds.

ACKNOWLEDGEMENTS

We are grateful to the Swakopmund branch of the Wildlife Society of Namibia for funds to run a motorbike for research purposes to AS and to Desert Explorers for the hire of the motorbike. We thank Justine and Nicole Braby for assistance in finding and monitoring tern nests in the Swakopmund colonies.The erection of the signs and the barrier was funded by the Danish Government's DANCED programme of coastal zone management, with contributions from the Des and Jen Bartlett fund and the Namibia Nature Foundation. Phil Hockey, Rob Crawford, Bruce Dyer and John Cooper made several useful comments on the draft manuscript.

REFERENCES

BARNES, K.N. (Ed.) 2000. The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. Johannesburg: Birdlife South Africa.

BIRDLIFE INTERNATIONAL. 2000. Threatened birds of the world. Barcelona & Cambridge: Lynx Edicions & BirdLife International.

BRABY, R. 1995. Effects of human disturbance on Damara Tern breeding success in the central Namib. Unpubl. report. Swakopmund: Ministry of Environment & Tourism.

BRABY, R., BRABY, S.J. & SIMMONS, R.E. 1992. 5 000 Damara Terns in the northern Namib Desert: a reassessment of world population numbers. *Ostrich* 63: 133–135.

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

COLLAR, N.J. & STUART, S.N. 1985. Threatened birds of Africa and related islands. The ICBP/IUCN Red Data Book, Part 1. Cambridge: International Council for Bird Preservation and International Union for Conservation of Nature and Natural Resources.

CRAWFORD, R. & SIMMONS, RE. 1997. Damara Tern *Sterna baleanarum*. In: Harrison, J., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J. & Brown, C.J. (Eds). The atlas of southern African birds. Johannesburg: BirdLife South Africa. pp. 480–481.

de VILLIERS, D. & SIMMONS, R. 1997. The high incidence and origin of two-egg clutches in a Damara Tern colony in south-western Namibia. *Madoqua* 19: 111–113.

JARVIS, A.M. & ROBERTSON, A. 1999. Bird data in Namibia – a model for biodiversity information system development: avifaunal database manual. Research Discussion Paper 33. Windhoek: DEA, Ministry of Environment & Tourism.

REISS, L. & KRUEGER, L-A. 1998. Monitoring of the Damara Tern (*Sterna balaenarum*) near Swakopmund, Namibia, during the 1997/1998 breeding season. Unpubl. report for the Ministry of Environment & Tourism, Windhoek, Namibia

SIMMONS, R. & BRAINE, S. 1994. Breeding, foraging, trapping and sexing of Damara Terns in the Skeleton Coast Park, Namibia. *Ostrich* 65: 264–273.

SIMMONS, R.E., CORDES, I. & BRABY, R. 1998. Latitudinal trends, population size and habitat preferences of Damara Terns *Sterna balaenarum* on Namibia's desert coast. *Ibis* 140: 439–445.

SIMMONS, R.E. & HEBER-PERCY, R. & BRABY, R.J. ms. Geographic variation in the breeding of Damara Terns in the Namib Desert: effects of predators and upwellings. Unpubl. report. Ministry of Environment & Tourism, Windhoek.

SIMMONS, R.E., BROWN, C.J. & WILLIAMS, A.J. in prep. Birds to watch in Namibia: a Red Data List. Windhoek: National Biodiversity Programme, Ministry of Environment and Tourism.

UNDERHILL, L.G. 2000. Damara Tern *Sterna balaenarum*. In: Barnes, K.N. (Ed.). The Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. Johannesburg: Birdlife South Africa. pp. 45–47.