

Elizabeth Bay Optimisation Study

Specialist Report: Effects of proposed mining operations on coastal seabirds and shorebirds



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Executive Summary

This report assesses the avian component of biodiversity in the *Sperrgebiet* in general and at Elizabeth Bay in particular. Our findings for bird species, particularly threatened ones, are put in the context of the likely impacts that diamond mining has already had, and may have in future, at Elizabeth Bay and in the Diamond Area generally.

We find that the *Sperrgebiet* is home to 17 species of the 60 Namibian Red-listed birds and is thus a hot-spot of threatened species. Several of these species are nomadic migrants (the petrels and albatrosses) with low concentration in Namibian water. Of the remaining 12 species, eight are known to breed here and for several seabirds (penguins, three cormorants species, gannets and the Damara Tern) they have breeding strongholds in the *Sperrgebiet* that contribute significant numbers (> 5%) to the global population.

Of these, our review suggests that mining may be impacting the African Penguins on Possession Island and Damara Terns on the Elizabeth Bay mainland because both forage in the bay where visibility is impaired due to the occurrence of mining-related suspended sediment plumes. At least for the Damara Tern this has been associated with reduced foraging efficiency and prey yield in two studies. The Damara Tern may have declined by about 5-10 pairs since mining commenced and the Possession Island penguins have declined by about 31%.

A further negative effect - also linked to sediment smothering - has been confirmed by a reduction in the invertebrate fauna at Elizabeth Bay and a parallel decline in the once dense shorebird community since mining began. A control site at Grosse Bucht beach shows no such decline over the same period thus the effect is (i) localised but (ii) specific to conditions at Elizabeth Bay.

Given the area's newly acquired National Park status, its new offshore status as a Marine Protected Area and the potential negative effect that the mining sediment is having on two Red-listed bird species and migrant shorebirds, we conclude that increased efforts to prevent further reductions should be made. Reducing biodiversity of already compromised populations of threatened species within the newly proclaimed National Park is not compatible with the aims of the park or of Namibia's commitment to the Biodiversity Act of 1992. It is also at odds with Namdeb's otherwise sound environmental record in the protection of the *Sperrgebiet*.

We therefore recommend that sediment deposited into Elizabeth Bay from the mining is reduced or stopped entirely and, if feasible, is disposed of on land or out to sea.

CONSULTANT'S DECLARATION OF INDEPENDENCE

Dr Rob Simmons, Dr Jessica Kemper and Ms J Braby (doctoral candidate) are independent consultants to Pisces Environmental Consultants (Pty) Ltd and Namdeb. They have no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of these specialists performing such work.

1. INTRODUCTION

The Diamond Area of south-western Namibia, popularly known as the *Sperrgebiet*, covers ca. 26 000 km² and has been protected from outside influence since 1908 when the first diamonds were discovered near Lüderitz (Pallett 1995). Lying adjacent to a major boundary upwelling cell centred around Lüderitz (Shillington 2003), the oceanic environment is a cold, but nutrient-rich system that supports huge numbers of island-breeding seabirds that occur on Namibia's only islands as well as coastal shorebirds on the mainland (Sakko 1998). The richness in biodiversity at sea is matched by that on land where the Succulent Karoo biome of South Africa extends north into Namibia (Barnard 1998). It is this diversity that has resulted in the area recently (2009) acquiring National Park status to protect the terrestrial habitats, and marine protected areas to protect the near-shore environment. Diamond mining has occurred in the area since that time and inevitably some competition for space and resources occurs between the high species diversity and the mining industry. This report focuses on an assessment of mining in a now well-studied area - Elizabeth Bay - in the context of the birds in the *Sperrgebiet*.

Viable diamond deposits have recently been identified below the southern portion of the accreted Elizabeth Bay beach, about 30 km south of Lüderitz. The extension of mining operations to include this additional deposit would enable Namdeb to meet its objectives of acquiring maximum sustainability to 2020. The approach to mining this deposit will include modifications to the existing plant, and development of a wet infield screening plant (WIFS) about 1.5 km inland at a previously mined site. A dredger will be used to strip overburden material, which will be discharged onto the beach creating a seawall. The fines sediment will be released through existing pipelines into the sea within the bay. The new mining also necessitates the construction of a new seawater pipeline to the WIFS as well as the construction of a 5 km power line from the existing Elizabeth Bay treatment plant to the WIFS. This project has the potential of having various impacts on the affected environment, including its biodiversity. It directly affects about 2.6 km of shoreline in the central and southern portions of the bay. The area to be mined consists of sandy beach accreted during previous mining activities in the vicinity of Elizabeth Bay; some of the area is below the high water mark.

Mining activities will result in the removal of an estimated 15 - 20 million tons of overburden to a depth of 5 - 16 m (average 12 m); the removed overburden will partially be used to construct sea walls along the shoreline; fine tailings will be deposited in the sea.

2. TERMS OF REFERENCE

The terms of reference for the full EIA, as supplied by Namdeb to Pisces Environmental Services (Pty) Ltd, specifically for the avifaunal component were to:

- evaluate the potential effects of the proposed mining operations on coastal seabirds. This should include:

- a review of the current status of coastal seabird populations in the area around Lüderitz and Elizabeth bay, with comments on population trends over the past few decades. Particular reference should be made to penguins, cormorants, and other Red Data birds in and around the Possession Island Marine Protected Area, African Black Oystercatchers and other Red Data shorebird species, and Damara Terns.
- mapping of coastal seabird roosting and breeding sites in the project areas.
- mapping of recognised seabird feeding areas using the results of recent studies.
- a review of potential threats to coastal seabirds in southern Namibia, and the sensitivity of current populations to these.
- identification and assessment of all potential sources of risk to coastal and seabird populations of the proposed project and an evaluation of the environmental impacts associated with these risk sources. Appropriate management recommendations, mitigation measures and monitoring systems that can be implemented should the mining target area overlap with identified sensitive areas for seabirds.

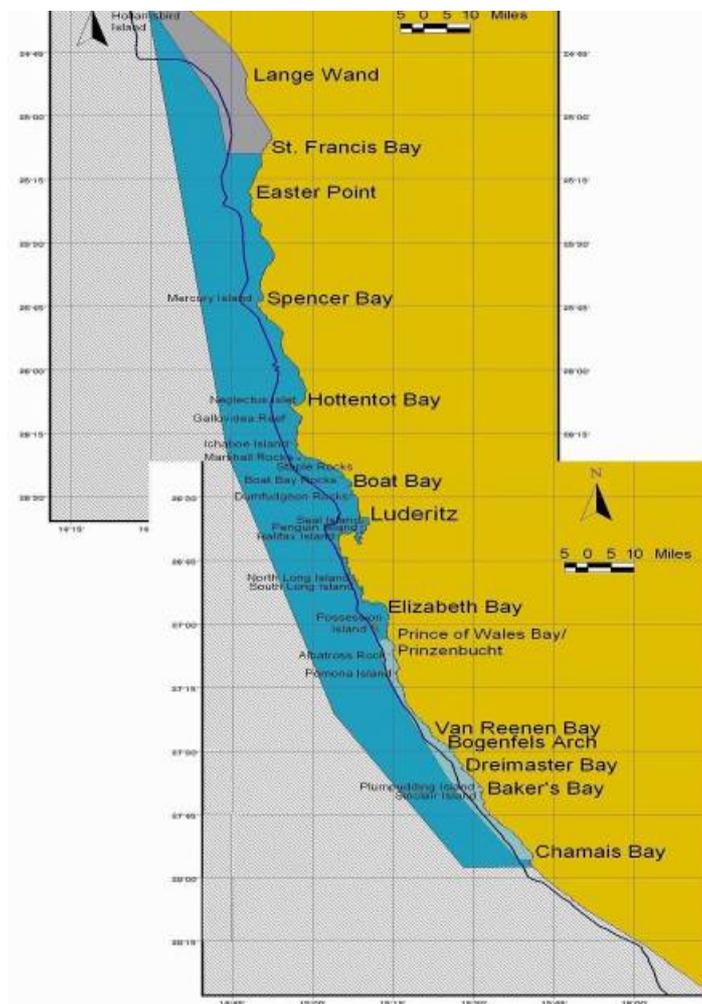


Figure 1: Outline of the Namibian Islands' Marine Protected Area (shaded dark blue). This includes a line-fish sanctuary near Hollamsbird Island (shaded grey) and a new lobster sanctuary between Prince of Wales Bay and Chameis (shaded light blue). After Currie *et al.* (2009)

3. STUDY AREA

The study areas comprised different regions for the different bird species considered. For the main Red-listed species (penguins, cormorants, gannets, terns) these birds have been studied on their Namibian breeding islands, including Possession Island, within the defined study area (Kemper 2006; Kemper *et al.* 2007). Damara Terns have been studied throughout Namibia but an intensive study of this Near Threatened bird has taken place in the Elizabeth Bay area and in all other colonies in the *Sperrgebiet* north and south of there (Braby 2009). Elizabeth Bay is one of three log-spiral bays on the southern Namibian coastline between the Orange River mouth and Lüderitz (Figure 2). The bay is about 4 km wide, with a rocky promontory known as Elizabeth Point forming the western arm, and rocky shores backed by sand dunes of the southern Namib Desert forming the eastern shoreline (Pulfrich *et al.* 2003). Possession Island, 8.5 km to the south of Elizabeth Point, offers the bay limited protection from the prevailing westerly to south-westerly Atlantic swells. Directly to the north-east of Elizabeth Bay is a channel comprised of salt pans and gravel plains, most of which have been significantly disturbed by diamond mining operations (Figure 3). To the south-east of Elizabeth Bay is an extensive area of sand dunes, which reach the shoreline on the eastern side of the bay.



Figure 2: The main localities in the *Sperrgebiet* mentioned in the text, and (inset) Possession Island and North Reef relative to Elizabeth Bay.

3.1 Approach to Study

The report is a review of all available information on seabird distribution, population sizes and trends, as well as foraging ecology and threats posed to seabird populations in Namibia. Ms Justine Braby contributed all relevant findings from the last 3 years of her doctoral thesis field work on Damara Terns and shorebirds in the *Sperrgebiet* (with a focus on Elizabeth Bay); Dr Jessica Kemper added her published and unpublished studies of the red-listed penguins, cormorants and gannets from data gathered by the Ministry of Fisheries and Marine Resources (MFMR), the African Penguin Conservation Project, as well as more generic work on population trends of these species in southern Namibia. Dr Rob Simmons collated these specialised studies and added his own published and unpublished work from the 1990s and early 2000s as well as overviews of all Namibia's red-listed birds. No additional field work was necessary for this evaluation. Dr. K. Ludynia, of the Animal Demography Unit, University of Cape Town, South Africa kindly allowed us use of the latest data on penguin foraging.

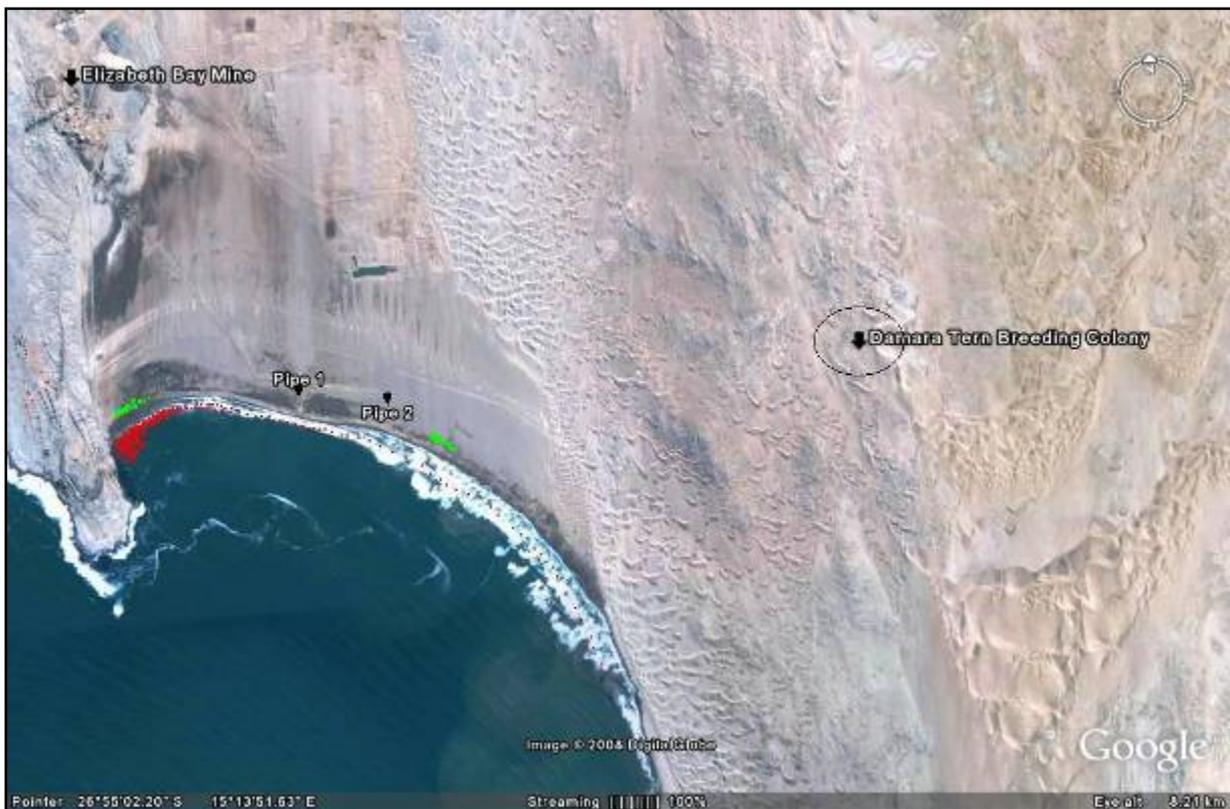


Figure 3: Detail of the Elizabeth Bay study area showing the present mine and location of the outlet pipes. The Damara Tern breeding colony and the foraging sites (red), and the roosting sites (green) of the Damara Terns are shown from 2007-2009 records.

3.2 Assumptions and Limitations

The data reviewed in this study of mining-effects on the Elizabeth Bay beach covers a much wider area in the *Sperrgebiet* than the Elizabeth Bay environment. We have jointly assessed all information from Namibian populations to look for local versus coastal-wide trends. Data collected before our specific studies was sometimes collected using different methods and by different

observers. This brings in certain errors that are difficult to control for. Where possible we have tried to standardize methodology, time of year, but observer bias cannot be standardized. Where some doubt is involved we have highlighted differences in opinion but have given the trend, even if exact figures remain doubtful. We can claim, however, comprehensive and up to date information.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 The Namibian Islands' Marine Protected Area (NIMPA)

In line with a commitment to an Ecosystem Approach to Fisheries, Namibia declared her first Marine Protected Area in February 2009. The Namibian Islands' Marine Protected Area (NIMPA) extends from Hollamsbird Island in the north to Chameis Bay in the South (Figure 1), from the low water mark of the coastline to an average of 30 km offshore (Currie *et al.* 2009). It includes all natural seabird breeding islands and rocks in Namibia, as well as Elizabeth Bay. One of the key aims of the NIMPA is the protection of threatened seabird populations, their breeding habitats and foraging requirements in Namibia, by limiting activities that pose a threat to these populations. Onshore mining activities, and in particular seawall erosion and sediment plumes from discharge pipes, were identified as a threat along the southern Namibian coast; a set of conditions are outlined in the NIMPA report (Currie *et al.* 2009) to minimize mining-related threats in the area. The conditions relevant to the proposed mining activities at Elizabeth Bay include:

- “No more than two active mining sites using seawalls at any given time in order to minimize the effect of seawall erosion...”
- “Minimize processing plant discharge points onto the beach or into the sea with the development of new mining activities within the MPA.” (Currie *et al.* 2009, pg 53).

In addition, the report recommends that between Prince of Wales Bay (about 18 km south of Elizabeth Bay) and Chameis Bay, settling pond systems are to be implemented to reduce discharge. These conditions are legally enforceable as per Government Gazette 4210 of 16 February 2009.

4.2 Possession Island

Most seabirds breeding in Namibia are confined to areas where they are safe from predation by terrestrial carnivores such as Brown Hyenas *Parahyaena brunnea* and Black-backed Jackals *Canis mesomelas*. This generally restricts breeding birds to islands, although some species may breed in small numbers on the mainland, e.g. Crowned Cormorants, Swift Terns and Hartlaub's Gulls (species latin names are given in Table 1). However, Damara Terns are an unusual species among those considered here in that they breed on the mainland in loose colonies and avoid predators through cryptic behaviour and colouration, and widely dispersed breeding.

Possession Island and adjacent North Reef are situated about 9 km south-west of central Elizabeth Bay (Figure 2). At 97 ha, Possession Island is the largest island along Namibia's coast. It is listed as a globally Important Bird Area (IBA) because of the diversity and number of breeding seabirds species,

including the threatened ones it supports (Simmons *et al.* 1998a). The seabird breeding islands closest to Possession Island are Halifax Island, another global IBA, *ca.* 40 km to the north and Pomona Island, nearly 20 km to the south.

4.3 Affected Areas on Land

Shorebirds (e.g. waders, herons, oystercatchers, flamingos) and Damara Terns that either feed along, or roost along the beach at Elizabeth Bay are those most likely to be affected by the proposed mining operations. To the south-east of Elizabeth Bay is an extensive area of sand dunes, which reach the shoreline on the eastern side of the bay. It is in within this area of *ca.* 1.5 km², approximately 2 km from the sea, that the Damara Terns breed (Figure 3, S26°54', E15°14'). The distance between the foraging ground and the nest area is 3 km. No mining activity is reported to involve any known breeding location.

This entire mainland area is also a globally Important Bird Area. It recently (2009) achieved National Park status - the *Sperrgebiet* National Park. To the north it borders on the Namib-Naukluft Park, which holds six globally threatened or near threatened species including an estimated 100 breeding pairs of African Penguin (Kemper *et al.* 2007) and 222 breeding pairs of Damara Tern (Simmons *et al.* 1998a).

4.4 Description of Seabird Species and their Breeding and Foraging Habitats in the Affected Area

This section gives a brief summary of the main seabirds breeding, foraging and roosting regularly in the vicinity of Elizabeth Bay (Simmons 2005; Kemper *et al.* 2007; Braby 2009), highlighting their distribution, local and global conservation status and threats (Kemper *et al.* 2007; Simmons & Brown in press), recent population estimates and trends (Kemper *et al.* 2007; Braby 2009), and their breeding and foraging requirements (Hockey 2005, and references therein). Additional references are listed in the text.

Red-listed species

All Red-listed species found breeding, foraging, or roosting in the *Sperrgebiet* are shown in Table 1. Among the 17 species present there are five species of albatrosses, petrels or giant-petrels recorded in the waters off Namibia's southern coast (Boyer & Boyer, in press). They are not considered further here because most do not venture into the area under consideration (bar the petrel and giant petrel), population numbers are poorly known and they do not breed in Namibian waters.

Of the remaining 12 species there are three species of cormorants, three species of Larids (terns or gulls), two flamingos, two waders (oystercatchers and plovers), and the African Penguin and Cape Gannet. We assess the populations and threats of the most important of these below - those that breed and have significant population presence in the *Sperrgebiet*.

Table 1. Summary of all Namibian Red-listed bird species recorded in the *Sperrgebiet* or offshore with their Namibian and global IUCN Red-listing classification (from Kemper *et al.* 2007; Simmons & Brown in press).

| SPECIES | Namibian | Global |
|--|-----------------|-------------------------|
| African Penguin <i>Spheniscus demersus</i> | Endangered | Vulnerable |
| Atlantic Yellow-nosed Albatross <i>Thalassarche chlororhynchos</i> | Endangered | Endangered ¹ |
| Bank Cormorant <i>Phalacrocorax neglectus</i> | Endangered | Endangered |
| Black-browed Albatross <i>Thalassarche melanophrys</i> | Endangered | Endangered |
| Cape Gannet <i>Morus capensis</i> | Endangered | Vulnerable |
| Caspian Tern <i>Sterna caspia</i> | Vulnerable | Vulnerable |
| Greater Flamingo <i>Phoenicopterus ruber</i> | Vulnerable | Near Threatened |
| Lesser Flamingo <i>Phoenicopterus minor</i> | Vulnerable | Near Threatened |
| Hartlaub's Gull <i>Larus hartlaubii</i> | Vulnerable | Least Concern |
| White-chinned Petrel <i>Procellaria aequinoctialis</i> | Vulnerable | Vulnerable |
| African Black Oystercatcher <i>Haematopus moquini</i> | Near Threatened | Near Threatened |
| Cape Cormorant <i>Phalacrocorax capensis</i> | Near Threatened | Near Threatened |
| Chestnut-banded Plover <i>Charadrius pallidus</i> | Near Threatened | Least Concern |
| Crowned Cormorant <i>Phalacrocorax coronatus</i> | Near Threatened | Least Concern |
| Damara Tern <i>Sterna balaenarum</i> | Near Threatened | Near Threatened |
| Northern Giant-Petrel <i>Macronectes halli</i> | Near Threatened | Near Threatened |
| Shy Albatross <i>Thalassarche cauta</i> | Near Threatened | Near Threatened |

*In the IUCN scheme Endangered is a more extinction-prone class than Vulnerable, and differences between Namibia and global classifications are the result of local population size, and the extent and duration of declines locally.

¹. May move to Critically Endangered if mortality from long-lining does not decrease.

African Penguin

These flightless birds are endemic breeders to Namibia and South Africa with a 2009 global population of *ca.* 25 000 breeding pairs. The Namibian population is considered “specially protected” and is listed as Endangered; the IUCN global status is expected to be upgraded from Vulnerable to Endangered during 2010, following large-scale declines of the South African population in the last six years. Numbers continue to decline across the entire species’ breeding range.

In Namibia, the population of African Penguins has decreased from *ca.* 49 000 breeding pairs estimated in 1956 to 4 500 pairs in 2009, a 91% decline at a rate of 4.4% per year since the first comprehensive census was done in 1956 (Figure 4a). Possession Island supported the largest breeding colony in 1956, with an estimated 23 000 breeding pairs. In 1991, when large-scale mining operations commenced at Elizabeth Bay, 700 pairs bred at Possession Island. Since then the colony there decreased to 360 pairs in 2000 and marginally increased again to 480 pairs in 2009 (Figure 5a). This constitutes a decrease of 31% since mining began. Possession Island currently supports the fourth-largest African Penguin breeding colony in Namibia, after Mercury, Halifax and Ichaboe islands.

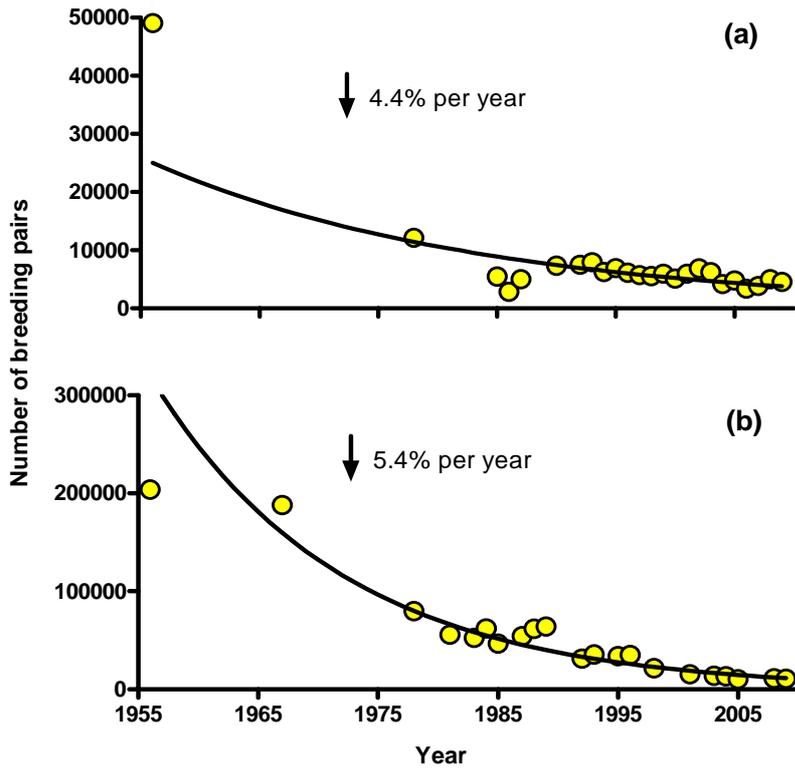


Figure 4: The decline in breeding pairs of (a) African Penguins (b) Cape Gannets in Namibia since 1956.

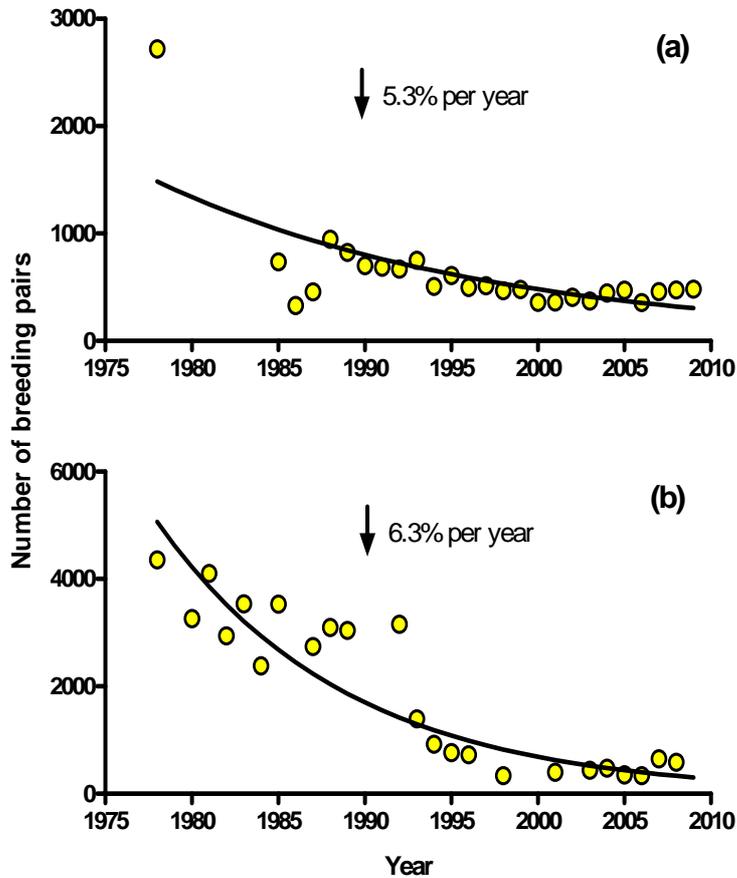


Figure 5: Declines in (a) African Penguins and (b) Cape Gannets at Possession Island (including North Reef) since 1978.

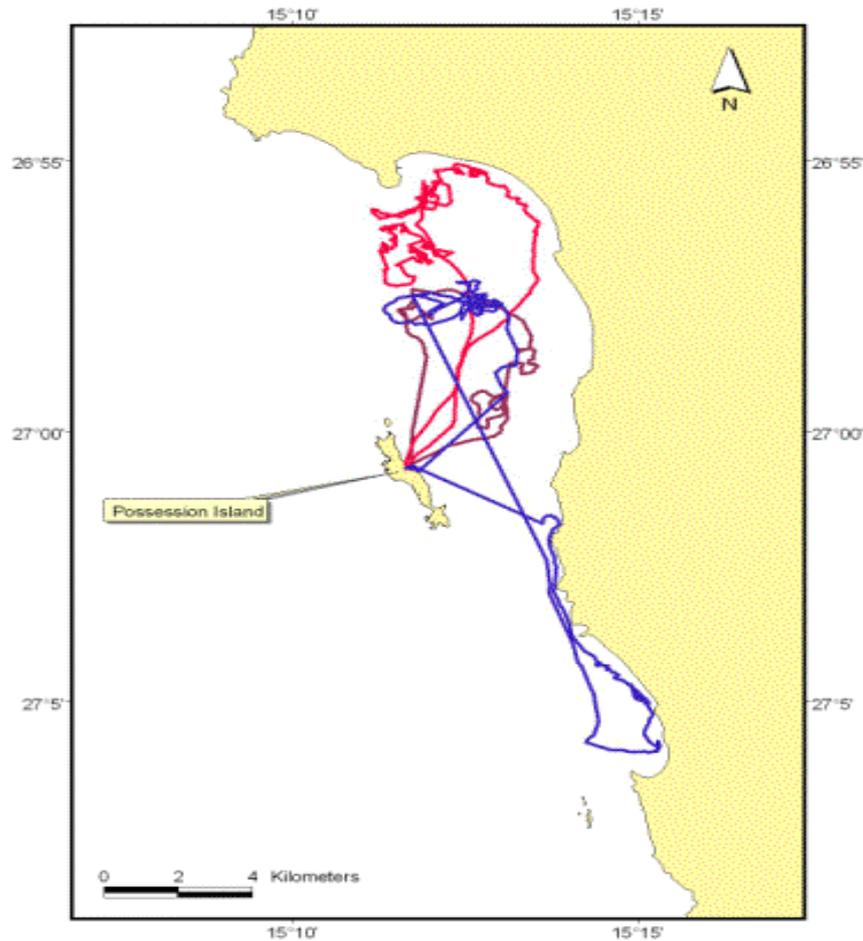


Figure 6: Foraging tracks of three African Penguins from Possession Island, Namibia, March 2005. Each colour represents a single foraging trip (map and data courtesy of Dr. K. Ludynia).

Penguins can travel long distances at sea, but tend to remain within their regions, *i.e.* Namibia, Western Cape or Eastern Cape, South Africa. Movements of mostly young, non-breeding, but sometimes also breeding penguins occur between breeding localities in Namibia, including between Possession and Halifax Islands. Breeding penguins tend to forage relatively close to their breeding locality. At Halifax Island, 37 breeding African Penguins fitted with GPS loggers between March 2006 and March 2010 provided detailed tracks of 51 foraging trips. These penguins travelled an average of 14 km away from the island (range 3 - 68 km). Birds fed in all direction from the island; trips tended to be longer and further from the island in years where local food availability was poor (MFMR and K. Ludynia unpubl.). Two of three African Penguins equipped with GPS loggers at Possession Island in 2005, foraged exclusively in Elizabeth Bay, while the third bird initially travelled south, then returned to Elizabeth Bay to feed (Figure 6). Feeding in Elizabeth Bay near the outflow pipes, where water is particularly turbid, may explain why penguins breeding at Possession Island fed mainly on fish larvae at the time. More recent data on penguin foraging ecology and diet are not available for these penguins.

African Penguins face a number of threats, including lack of good quality breeding habitat, oil pollution, human disturbance, predation by seals and Kelp Gulls, competition with other seabirds for space and food, and the effects of climate change (*i.e.* the direct and indirect effects of predicted increases in sea temperature and sea level). The most important current threat, however, is likely to be a lack of good quality prey. Energy-rich prey, such as sardine and anchovy are virtually absent from southern Namibia and prey is dominated by energy-poor pelagic goby, mostly north of Possession Island and by squid and fish larvae in the south, including around Possession Island (Ludynia *et al.* in prep., MFMR unpubl. data).

Cape Gannet

Cape Gannets are endemic breeders in Namibia and South Africa; they only breed on six islands, three of which are in Namibia (Mercury, Ichaboe and Possession Islands). During the last five decades the global population decreased from 250 000 breeding pairs to 150 000 pairs; in Namibia, numbers declined from 204 000 pairs in 1956 to about 11 000 pairs in 2009 (Figure 5b). The Cape Gannet is classified Endangered in Namibia, and globally Vulnerable. Possession Island supports a small, and therefore highly vulnerable colony of Cape Gannets. Numbers there have decreased from 4 300 pairs in 1956, to 3 150 pairs in 1992, and 580 pairs in 2008 (Figure 4b; MFMR unpubl. data) a decrease of 87% in 52 years, and a decrease of 82% since mining began at Elizabeth Bay. The population there has stabilised and marginally increased since 1998.

Cape Gannets may cover large distances (up to 3 300 km), but most remain within 540 km of their breeding colony (Grémillet *et al.* 2004). They feed by plunge-diving for fish. Cape Gannets have undergone a substantial shift in diet since the 1950s, from one dominated by sardine to one dominated by trawler-scavenged, energy-poor hake discards and saury at Ichaboe Island, while juvenile horse mackerel and juvenile snoek are predominantly caught at Mercury Island, close to the coast (Dundee 2006; Mullers 2009). GPS logger studies have shown that breeding Cape Gannets in Namibia may forage up to 325 km from their colony, if food availability is poor (Dundee 2006; Mullers 2009). Data on diet and foraging ecology are lacking for Cape Gannets breeding on Possession Island, because care is taken not to disturb the small colony there. It is, however, likely that Cape Gannets breeding there also scavenge on trawler discards from the hake fishing grounds situated offshore from Possession Island, but may also feed in Elizabeth Bay, if shoals of suitable prey are present.

Threats to Cape Gannets include low quality prey, drowning during longline and trawler activities, predation of fledglings by Cape fur seals, pollution (fuel and fish oil), human disturbance and lack of good quality nesting habitat.

Bank Cormorant

Bank Cormorants breed at 23 localities between Hollamsbird Island, Namibia, and Dyer Island, South Africa, usually in small numbers. Nearly 70% of the species currently breed on Mercury Island. Bank Cormorants are classified Endangered in Namibia and globally, following large-scale declines in population numbers, particularly in Namibia during the 1990s. The global population in 2007 was estimated at 2 829 breeding pairs, of which 2 527 pairs bred in Namibia. Although numbers at

Mercury Island have been increasing since the late 1990s and have been stable since 2004, the population in Namibia continues to decrease. Possession Island and North Reef used to support a small breeding population (157 pairs in 1978). Up to 15 pairs bred only at North Reef and up to 70 individuals roosted there during the last decade.

Bank Cormorants forage close to the shore or their breeding locality. At Mercury Island, breeding Bank Cormorants forage within 2 km of the coast and within 3 km of the island. There, they forage benthically, *i.e.* close to the sea floor, diving to an average depth of 30 m, feeding mainly on pelagic goby and small rock lobsters (*Ludynia et al.* subm.). Bank Cormorants need seaweed, including kelp, close to their breeding localities to construct their nests with.

Threats to the population are a lack of prey, oil pollution, poisoning from toxic blooms and the effects of climate change (*i.e.* the effects of predicted increases in sea temperature and sea level).

Cape Cormorant

Cape Cormorants regularly move between Angola, Namibia and South Africa. Numbers of breeding pairs vary greatly between years, because the species is particularly sensitive to fluctuating environmental conditions and may not breed, or may abandon breeding attempts, when conditions are poor. The species is classified Vulnerable in Namibia and globally, following a decline across its range from *ca.* 250 000 breeding pairs in 1978 to 100 000 pairs in 2005. During the last decade as many as 5 600 pairs or as few as 1 600 pairs breed on Possession Island; their appearance and disappearance is random and unpredictable. Thousands of Cape Cormorants may also roost on Possession Island, and smaller numbers may roost on the adjacent coastline, including the Elizabeth Bay beach and jetty.

Cape Cormorants forage up to 20 km offshore and up to 40 km from their breeding locality. Their diet in Namibia is dominated by pelagic goby. Other prey include small rock lobsters and juvenile horse mackerel, mullet and hake (MFMR unpubl.).

Main threats include a lack of food, avian cholera, human disturbance, oil and plastic pollution and predation of fledglings by Cape fur seals.

Crowned Cormorant

Crowned Cormorants breed at numerous localities along the coasts of Namibia and South Africa. Population trends are difficult to monitor because of the poorly defined breeding season, low site fidelity and possibly low breeding-locality fidelity, but overall the species appears to be stable. The species is listed Near Threatened in Namibia and Least Concern globally. Possession Island supports the second-largest Crowned Cormorant colony in Namibia, where up to 330 pairs may breed; during the last decade an average of 150 pairs bred there simultaneously. Up to 500 individuals may roost on the island; some individuals occasionally roost on the jetty at Elizabeth Bay.

Crowned Cormorants feed on klipvis and other benthic fish, crustaceans, molluscs and polychaete worms in shallow waters close to rocky shores and in kelp beds. Their main threats include human disturbance at breeding colonies, plastic and oil pollution, predation of nest contents by Kelp Gulls and predation of fledglings and adults by Cape fur seals.

Hartlaub's Gull

An endemic breeder in Namibia and South Africa, this species is listed as Vulnerable in Namibia and Least Concern globally. They usually breed opportunistically, often in close association with Swift Terns. They may breed on Possession Island in relatively large numbers in some years (e.g. 500 nests in 2008) and often roost there in large numbers (close to 1 300 individuals have been recorded). Hartlaub's Gulls may also roost on the beach and jetty at Elizabeth Bay. Hartlaub's Gulls forage on the water surface, behind trawlers and at rubbish dumps, feeding on fish, marine invertebrates and insects.

Main threats include predation by Kelp Gulls, lack of safe breeding habitat (disturbed by feral cats and dogs) and oil pollution.

Swift Tern

The subspecies *bergii* is an endemic breeder to Namibia and South Africa. While this species is not red-listed, large proportions of this subspecies breed in Namibia, including at Possession Island. Population trends are difficult to monitor because of poor site and locality fidelity; breeding is not attempted if conditions are poor. The overall population is thought to be stable. Possession Island is one of four localities in Namibia where more than 1 000 pairs of Swift Terns may breed; more than 2 400 pairs bred there in 2008. Large numbers of Swift Terns may roost on the island; small numbers may roost on the Elizabeth Bay beach and on the jetty.

Breeding Swift Terns forage close to their breeding locality, mostly by plunge-diving, feeding on small fish such as klipvis, pelagic goby, silverside and other species associated with shallow waters and kelp beds.

Main threats include human disturbance at breeding colonies, and chick predation by Kelp Gulls and predation by domestic cats and dogs at mainland breeding localities.

Damara Tern

Damara Terns occur as a breeding species from Angola to South Africa but with 98% of the breeding population present in Namibia (Simmons *et al.* 1998b). Mainland breeding colonies are found along the desert coastline of Namibia, with the largest breeding colonies in central Namibia (Braby *et al.* 2001), and lower numbers found north and south of there. The global population is estimated at 13 500 birds (*ca.* 5 000 pairs) (Simmons *et al.* 1998b). They are classified as Near Threatened both globally and in Namibia. Within the study area five breeding colonies are known (Chameis Bay, Marmora Pan, Elizabeth Bay, Grosse Bucht, and Hottentots Bay) (Figure 7). The colony at Elizabeth Bay was found in 1976 (Siegfried & Johnson 1977; Frost & Johnson 1976; Johnson 1979), another was

found at Hottentots Bay (Siegfried & Johnson 1977; de Villiers & Simmons 1997) and suspected at Grosse Bucht (Clinning 1978b; Williams & Meyer 1986). In a random survey by Simmons and Cordes (1998), colonies were confirmed at Grosse Bucht, checked at Elizabeth Bay and Hottentots Bay and new ones found at Marmora Pan and Chameis Bay. Intensive surveys of these colonies (bar Chameis that was flooded in 2007) during 2007-2009 found maximum numbers of 55 nests (Marmora Pan), 13 nests (Elizabeth Bay), 21 nests (Grosse Bucht), and 187 nests (Hottentots Bay) (Braby 2009). The estimated number of breeding pairs in the *Sperrgebiet* is 365, about 7% of the estimated Namibian and global breeding population.

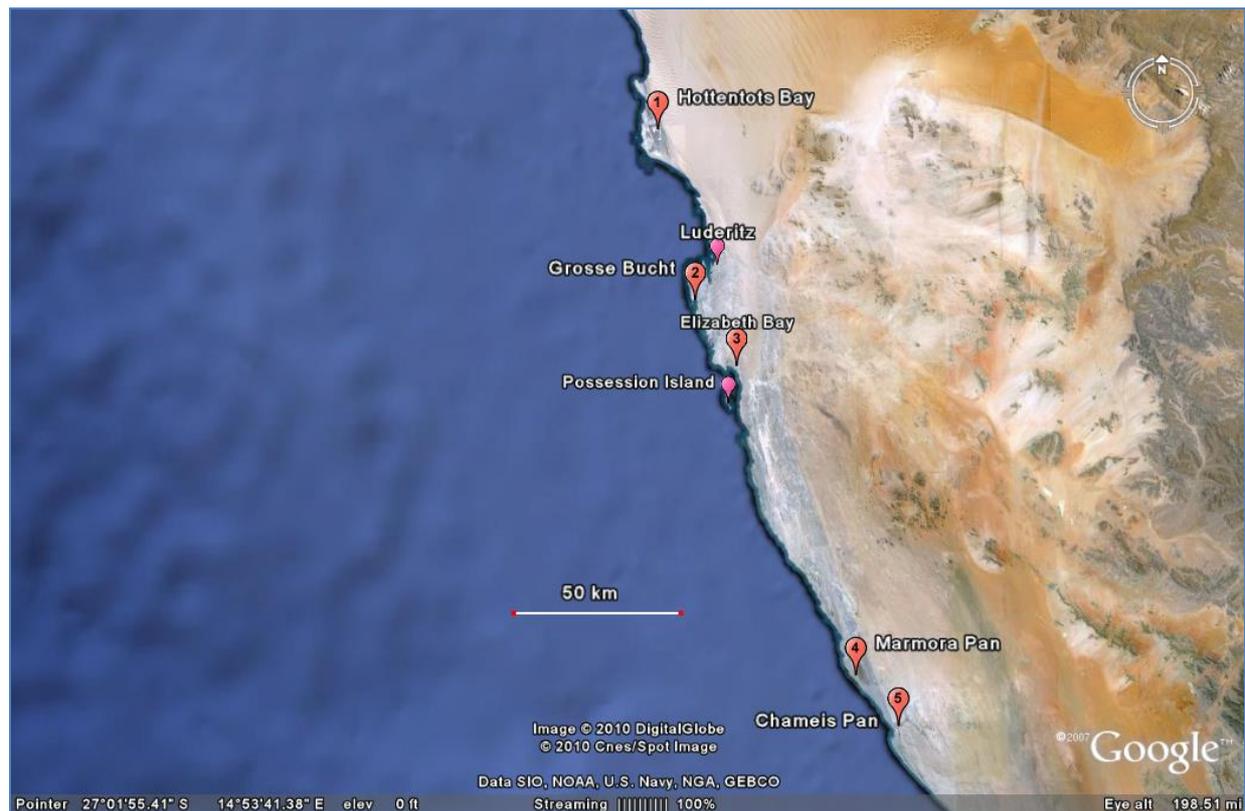


Figure 7: The five known colonies of Damara Terns in the *Sperrgebiet*. Four of the five have been intensively studied during 2007-2009 (Braby in prep).

Threats to Damara Terns are in order of severity: off-road vehicles causing disturbance in colonies, but also direct fatalities through crushed eggs and chicks (Braby 1995; Braby *et al.* 2002), increased jackal and gull densities around mainland seal colonies and line-fishermen along the shorelines, and housing development in prime coastal locations. A more long-term threat comes from the possible consequences of global warming reducing the winds driving the Benguela upwellings (IPCC 2001). This in turn will affect primary productivity and fish population available to all marine species (Roux 2003). The level of the threat, however, is hard to gauge and may eventually bring increased frequency of *El Niño* oscillations and higher productivity to the Benguela system. At Elizabeth Bay itself the Damara Tern colony appears to have decreased and the cause is suspected to be reduced fish availability arising from sediment-filled water (Simmons 2005). Because this is a threat specific

within the study area and sediment discharges into the bay will continue as a result of the proposed mining of the Southern Resource Area, we look at the data for this species closely.

The breeding colony of Damara Terns at Elizabeth Bay was first found by Frost and Johnson (1976) who conducted surveys of Damara Tern breeding sites in the *Sperrgebiet*. Five nests were found over 2 days in December 1976, on the gravel plains amongst the barchan dunes 1.5 km from the sea at Elizabeth Bay (Frost & Johnson 1976). Thirty adults and two juveniles were counted on the beach during this time. They estimated the population at 12 - 15 pairs, but suggested that this was an under-estimate. In December 1977, Siegfried and Johnson (1977) found ten nests over a longer searching period, and the possibility of an additional five nests. They estimated the breeding population to be 20 pairs. The colony size after two days of monitoring in December 1978, was estimated at 15 - 20 pairs (Johnson 1979), indicating relative stability over the three years. Two - seven pairs were estimated from nests and fledged young by Simmons (2005), who surveyed the breeding area for two days in December 1996 and three days in November 2002. Given a lack of other adult birds (that may have bred later), he suggested that there was a decline in breeding pairs. Following a short assessment of foraging yield of plunge-diving adults at Elizabeth Bay with that measured elsewhere (71% lower at Elizabeth Bay), he suggested the release of fine sediment into the bay was negatively affecting foraging success and thus breeding numbers (Simmons 2005). The breeding colony was relocated at the same location (S26°54', E15°14', Figure 8) in the breeding seasons of 2007, 2008 and 2009 (Braby 2009). Two full seasons monitoring (October - March 2007/2008, 2008/2009) yielded thirteen nests at Elizabeth Bay in the first season, and four in the second season. In the first season 4 of the 13 pairs successfully reared young, while none did so from the four nests in the 2008/2009 season.

The more than three-fold decline in nest number from the one season to the next was attributed to poor feeding conditions that year, and was indicative of decreased nest numbers across other colonies monitored in Namibia (Braby 2009; J. Braby unpubl. data). Poor feeding conditions can cause declines in breeding numbers and reproductive effort in other tern species (Nisbet 1978; Monaghan *et al.* 1989). The main cause of nest losses at the Elizabeth Bay breeding colony was attributed to Black-backed Jackal predation of eggs and chicks and Rock Kestrel *Falco rupicolus* predation of chicks (Braby 2009). The Elizabeth Bay Damara Tern population is currently estimated at *ca.*10 breeding pairs, a decline of about 5 - 10 pairs since pre-mining (Braby, in prep.). Follow-up work has confirmed that foraging success is significantly (and 21%) lower at Elizabeth Bay than Grosse Bucht (J. Braby, in prep.) and sediment discharge is significantly related to foraging success, but explained only 0.7% of the variation. Terns also avoided foraging in suspended sediment plumes around the outlet pipes (Figure 3).

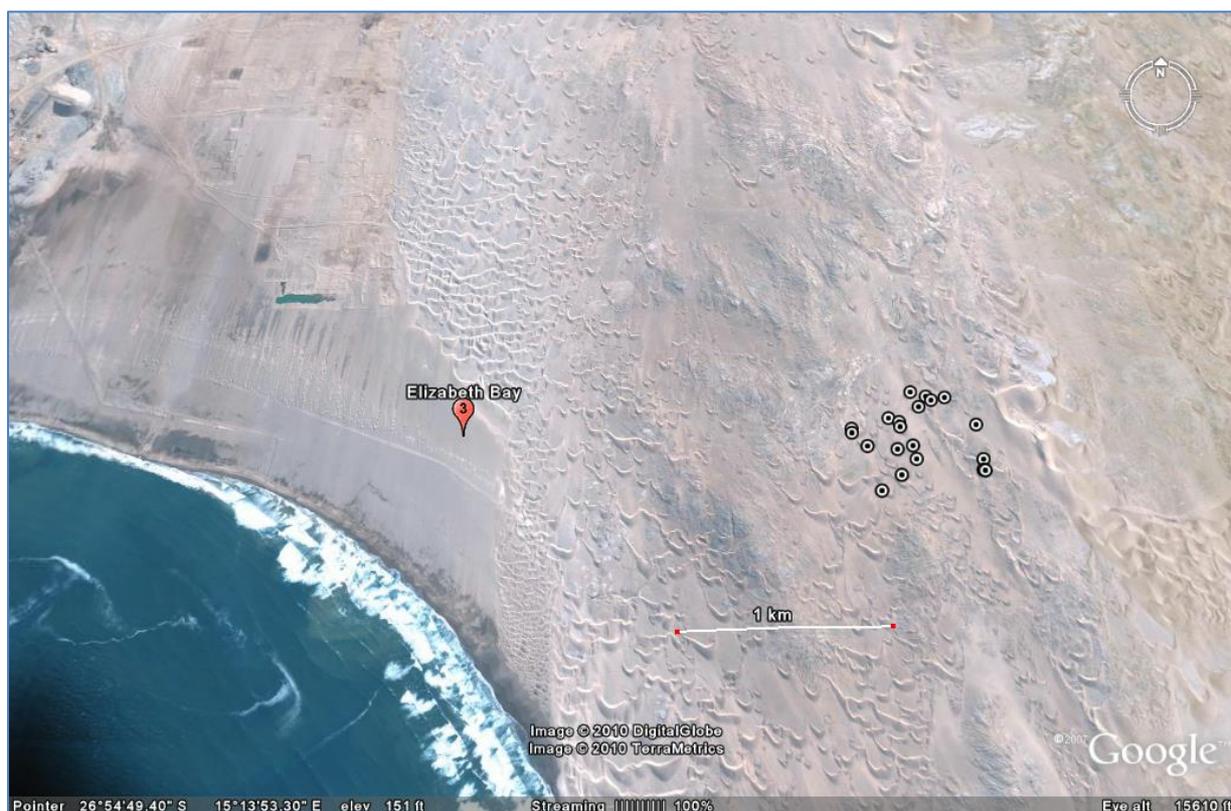


Figure 8: Google Earth® image of all Damara Tern nests found in the *Sperrgebiet* in 2007-2009 in relation to the Elizabeth Bay shoreline (Braby in prep).

This result is in line with fish surveys undertaken by Clark *et al.* (1998) who found reduced abundance (two fold lower) and biomass (three fold lower) in Elizabeth Bay surf-zone fish relative to those in Grosse Bucht and Second Lagoon (Table 2). Although surf-zone fish were *ca.* 3-fold more abundant in the sediment plumes in Elizabeth Bay than in clear water there (121 fish/haul) (Table 2), overall abundance was still less than the control sites (186 fish/haul). Since Damara Terns rarely plunge-dive into sediment-filled water at Elizabeth Bay (Figure 3) or elsewhere (Simmons & Braine 1994), fish in the plume are not available to terns. Essentially this means that both abundance *and* availability of fish are reduced for Damara Terns at Elizabeth Bay and this may explain both the reduced plunge-diving success and the reduction in nesting pairs.

Table 2: Results from Clark *et al.* (1998) who sampled surf-zone fish at Elizabeth Bay and control sites at Grosse Bucht and Second Lagoon.

| Surf-zone Fish Catches | EBay | Grosse Bucht |
|------------------------------|------------------------|--------------|
| Max. Biomass (kg/haul) | 15 | 45 |
| Numbers (fish/haul) | 84 | 186 |
| Numbers in plume (fish/haul) | 46 (clear) 121 (plume) | 186 (clear) |

Elsewhere in the affected area, only three nests have been recorded on Possession Island and two were unsuccessful (MFMR unpubl. data).

Globally, Damara Terns have shown a gradual decline, with former colonies disappearing from near Cape Town and from just north of both Swakopmund and Walvis Bay (Vincent 1946; R. Braby pers. comm.; Braby *et al.* 2009). So while the reduction or disappearance of individual colonies seems insignificant in the global context, the cumulative effect is greater and is cause for concern.

4.5 Other Seabird Species occurring regularly in the Study Area

White-breasted Cormorant

Small numbers may roost on Possession Island or on the jetty at Elizabeth Bay. The species is currently not threatened.

Kelp Gull

Large numbers breed at Possession Island (up to 2 400 pairs), where they are considered a threat to other breeding seabirds, particularly African Penguins, Cormorants and Swift Terns. The species is currently not considered threatened. Kelp Gulls feed opportunistically on a range of items, including fish, rock lobsters, mussels, bird and mammal carcasses, and rubbish from human settlements.

Caspian Tern

The southern African population of this world-wide species is considered a subspecies (*Sterna caspia caspia*) and isolated from other populations. In Namibia it is a red-listed species and found in pockets at the Orange River Mouth (max. 44 birds), Sandwich Harbour (max. 181 birds) and Walvis Bay (max. 229 birds), with the total population estimated between 150 and 600 birds. It is rare but regular in the *Sperrgebiet* and may breed there.

Threats occur in the form of terrestrial predation by dogs, jackals and humans (Clinning 1978a), which reduce breeding success and disturb breeding colonies. Other threats listed by du Toit *et al.* (2003) include climate change raising sea levels and flooding breeding islands, followed by tourism, research, and chemical pollution impacting breeding success.

Other terns

Sandwich Tern, Common Tern, Arctic Tern and Black Tern occasionally roost on Possession Island and forage in the waters close to the island.

Coastal Shorebirds

A suite of migrant and resident shorebirds numbering about 13 600 birds use the coastal beaches (and rocky headlands) in the *Sperrgebiet*, at a density of *ca.* 30 birds/km of shoreline (Simmons & Cordes ms). These include birds such as waders, oystercatchers, egrets and flamingos. These birds have been assessed in several areas throughout the *Sperrgebiet* and found to occur at lower density inside

diamond areas (14 birds/km) than outside (39 birds/km) (Simmons & Cordes ms). The trends were similar, in the same habitats inside and outside the mining areas. Species richness was also slightly lower inside (16 species) than outside (21 species) mining areas. At Elizabeth Bay intermittent shorebird surveys in December-January between 1977 and 2009 indicate a steep four-fold decline in shorebird density (but not species richness) over the last three decades (Simmons 2005; J Braby unpubl.). A comparable study at the Grosse Bucht's south-facing beach showed no such decline in counts done at similar times of year (Figure 7). A possible reason for the decline at Elizabeth Bay is the smothering of food sources and change in sand particle size on the prograded beach (Pulfrich *et al.* 2003; 2008) reducing food availability for surface-probing waders (Simmons 2005).

The greatest declines were seen in the Turnstone (decline from over 200 to an average of 2) and Sanderling (decline from over 300 to 70) from 1977 to present day (Figure 9). Turnstone feed on molluscs while Sanderlings feed on sandy shorelines by surface probing. The overall declines in abundance of invertebrate macrofauna on the Elizabeth Bay beach can explain the decline in these species.

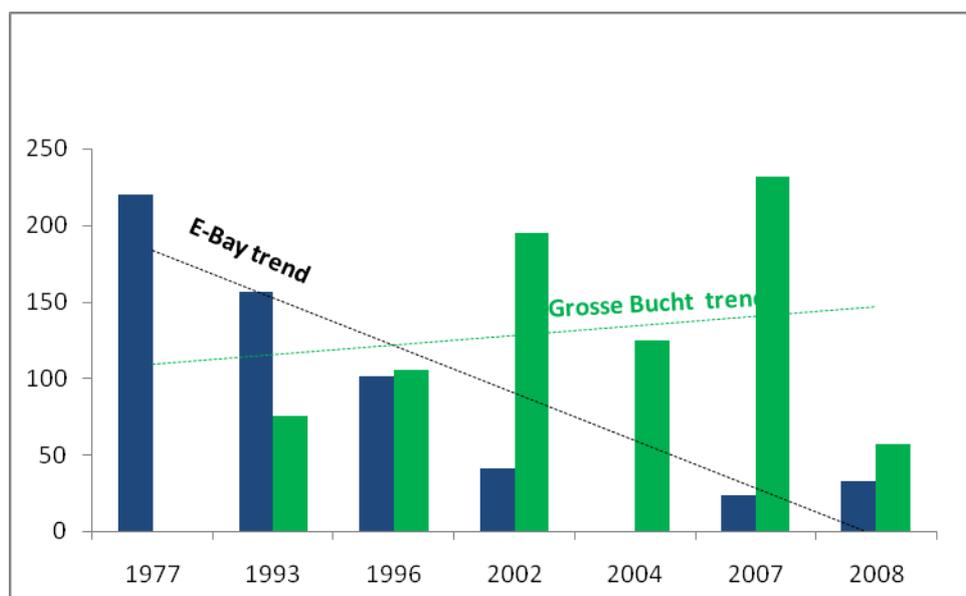


Figure 9: Density of shorebirds at Elizabeth Bay relative to Grosse Bucht, 1977 - 2008.

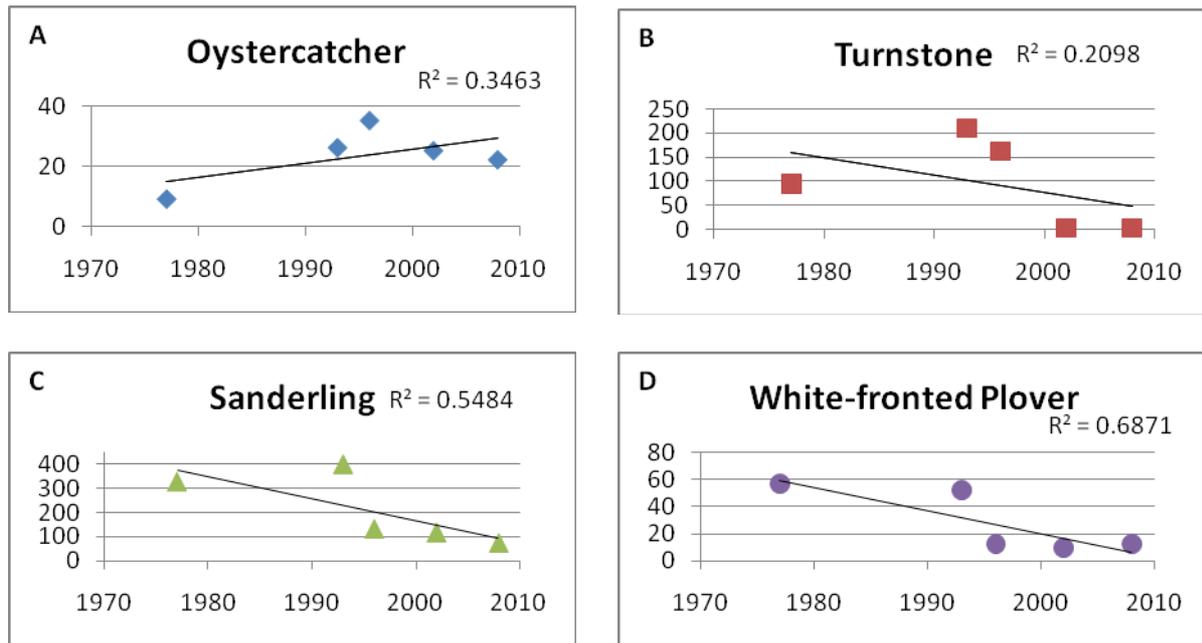


Figure 10: Changes in numbers of selected shorebirds along the E-Bay beach (1977 - 2008), from Simmons (2005, J Braby unpubl data). Trendlines are indicated.

African Black Oystercatchers

Among the resident shorebirds there are two red-listed species - the African Black Oystercatcher and the Chestnut-banded Plover - both classified as Near-Threatened. (The plover occurs in low numbers and a few pairs breed on Hottentots Bay pan (J. Braby; R. Simmons pers.obs.), so it is not considered further here). Recent apparent increases in the oystercatcher's southern African population is reflected in an increased estimate of 1 840 birds in Namibia by 2002 (Simmons *et al.* ms) representing about 38% of the world population (Hockey *et al.* 2005). A large proportion (minimum *ca.* 500 birds) is found on the Namibian islands. The largest of these is Possession Island with a present (2010) estimated mean of 340 birds (MFMR unpubl. data). This increase elsewhere in Namibia is reflected in an apparent increase in oystercatchers on the Elizabeth Bay beach since 1977 (Figure 9a). The numbers of birds recorded in low-mid tide counts in the November-January surveys were 9 (1977), 26 (1993), 35 (1996), 25 (2002), 22 (2008) (Simmons 2005; J. Braby unpubl. data). The number of birds recorded over the past 20 years (22-35 birds) suggests some stability in recent decades.

There are few threats to this species other than disturbance by humans on its mainland breeding sites. Birds breeding on Namibian islands may be displaced by seals or other breeding birds but there populations appear to be increasing too.

5. IDENTIFICATION AND ASSESSMENT OF RISK SOURCES, RECOMMENDED MITIGATION MEASURES AND MANAGEMENT ACTIONS

This review of seabirds and shorebirds in the *Sperrgebiet*, and Elizabeth Bay in particular, indicates that in general Namibia's islands-nesting birds have declined substantially and many are now red-listed species. Given that the Namibian islands support large proportions of the remaining breeding populations and the largest of these - Possession Island - lies adjacent to Elizabeth Bay, indicates that careful consideration must be given to any actions that may influence these populations.

The areas affected directly by the proposed mining activities in the Southern Resource Area are currently not in a pristine state, relative to the surrounding coastal and marine environments. Intensive dry-mining activities at Elizabeth Bay since 1991 have resulted in the severe accretion of the beach at Elizabeth Bay, sediment deposits on rocky shore areas, and high water turbidity, particularly around the tailings discharge outlets. The assessment of any potential impacts and their significance on the proposed mining activities are therefore made relative to an already degraded environment.

5.1 Direct loss of foraging and breeding habitat in the area to be mined (Elizabeth Bay beach)

Nature of Impact - Shorebirds - mainly migrants from the Palearctic - have decreased four-fold since they were first monitored in 1977. Since the beach has grown in size since the first shorebird surveys, this cannot be attributed to reduced area for roosting or feeding (Figure 3). Reduction of food resources is the most likely explanation - for beach birds and for those foraging inshore. Disturbance and beach removal will exacerbate this, but could help restore the beach to its original state with proper management.

Extent - Local; along the Elizabeth Bay beach over 5.3 km, and within the bay. For Damara Terns roosting occurs at the north-west end of Elizabeth Bay (Figure 3).

Duration - Long-term to Very Long/Permanent; depending on the natural restoration rate.

Intensity - Medium; continued smothering is likely to occur with dredging and discharge.

Probability - Definite - planned approach of mining.

Status of Impact - Negative.

Degree of Confidence - High (based on before and after monitoring data to date).

Significance - High; for shorebirds, given that all mined beaches sampled along the 380 km shoreline show reduced abundance and diversity of birds.

Mitigation - To reduce the impact a reduction or cessation of the dumping of the sediment slurry into Elizabeth Bay marine environment is the recommended action. If feasible, these fines could be discharged onto the salt pan behind the Elizabeth Bay beach at various locations. A second option is to deposit the slurry through a pipeline further out to sea. The placing of such an outlet pipeline, however, needs to be carefully considered, to ensure that it is not in a key seabird foraging area or other important biodiversity hotspot.

5.2 Decrease of foraging habitat and associated food source and roost sites available to seabirds

Nature of Impact - Inundation of rocky shore areas and potential reduction of kelp bed area from re-depositing sediments eroded from seawalls may (and has) reduce(d) the available foraging habitat and associated food source of several seabird species, particularly Bank Cormorants, Cape Cormorants, Crowned Cormorants and Damara Terns. On the mainland, migrant and resident shorebirds have shown a four-fold reduction in three decades and here it is virtually certain that reduced food resources are the reason since the area available has actually increased. Kelp beds are also of significantly lower density within Elizabeth Bay than elsewhere (EBOS proceedings p14). This *may* affect the density of beach birds - if the Elizabeth Bay beach itself shows decreasing trends in drift kelp abundance - because sandy beaches with kelp wrack in mined areas hold on average 18 birds/km and those without kelp hold 8 birds/km. Foraging sites for Bank and Crowned Cormorants are also likely to be degraded.

Extent - Local; the seawall will extend for roughly 2.6 km along the beach.

Duration - Long-term to Very Long/Permanent; depending on the natural restoration rate.

Intensity - Medium; rocky shore community structure and extent of kelp beds is likely to change.

Probability - Definite; as this is part of the planned mining approach.

Status of Impact - Negative.

Degree of Confidence - High.

Significance - The presence of rocky shores and kelp beds closer to Possession Island and North Reef (around the island and reef as well as along the coastline north of Elizabeth Bay Point and south of the planned mining area) should ensure that foraging habitat for birds breeding and feeding in this area are, on the whole, not significantly affected. This assumes that shore-based mining activities further south, e.g. at Bogenfels, or operations associated with the planned Inner Shelf Mining Project in the area, will not negatively affect additional rocky shores and kelp beds or will not delay the natural restoration rate of the affected area.

Mitigation - The (legally enforceable) recommendations in the NIMPA report (Currie *et al.* 2009) need to be taken cognizance of. Seawall construction at Elizabeth Bay needs to be coordinated with that elsewhere in NIMPA to ensure that no more than two seawalls are active at any one time within NIMPA. In addition, seawalls should be constructed and maintained in such a way as to minimise erosion. The natural beach profile should be restored as much as possible after mining operations have been completed. Beach mining should avoid the favoured roosting areas of the Damara Terns at the north-west end of the bay and the foraging areas in the same area (Figure 3).

Monitoring Recommendations - A shorebird monitoring programme (including feeding yield assessments) should be continued at Elizabeth Bay and control sites, e.g. Grosse Bucht and/or 2nd Lagoon to assess the effects of mining operations, and the effects of sediment accretion on shorebird diversity and abundance. The extent of kelp on the beach should also be quantified (from historical aerial photos) and compared with present. The use (or avoidance) of Elizabeth Bay inshore environment by foraging cormorants (and penguins) should be studied by GPS loggers.

5.3 Change in foraging habitat and behavior of seabirds due to the discharge of fine tailings from Treatment Plants into the marine environment and resulting suspended sediment plumes

Nature of Impact - Owing to a combination of (a) the down-scaled dry-mining operations at Elizabeth Bay and (b) the planned increase of Southern Resource Area activities, overall fines discharge are predicted to decrease from the levels when Elizabeth Bay dry mining operations were running at peak capacity. Seabirds forage by sight and therefore need clear water to locate their prey. Damara Terns in two surveys (Simmons 2005; Braby 2009) showed avoidance of the suspended sediment plumes around the pipes. In addition, surf-zone fish biomass (and abundance) is lower in Elizabeth Bay relative to control sites (Clark *et al.* 1998). The avoidance of turbid water combined with reduced fish abundance at Elizabeth Bay is likely to negatively affect feeding efficiency of seabirds.

Extent - Site-specific to Local; considering the size of the bay, greatest turbidity will largely be concentrated around the discharge pipelines and up to 200-500 m westwards. Depending on wind and sea conditions turbid water plumes could extend beyond the bay and therefore pose localised threats to the foraging ecology of seabirds feeding in the area.

Duration - Long-term; depending on the duration of mining activities.

Intensity - Low to Medium; depending on whether there are any cumulative effects from other mining activities in the bay (e.g. the proposed Inner Shelf dredge-mining operations).

Probability - Definite; as this is part of the planned mining approach.

Status of Impact - Negative.

Degree of Confidence - Medium; more details on feeding habitats are needed in key areas.

Significance - Medium; due to the extent and intensity of the impact.

Mitigation - If feasible fines discharged from the existing pipelines, should be placed on the mainland (pan) at different places, or further out to sea to remove them from the bay. Cumulative effects from (a) present discharge pipelines and (b) through dredging activities associated with the proposed Inner Shelf Project, should be reduced as far as possible. We suggest a short-term experimental phase that (i) allows deposits to be made on the salt pan - in 5-10 locations (and concurrently in the bay if these locations do not spread and dissipate as expected) to determine how the fines are dispersed, and (ii) a pipe due west of the present mine to take the sediment slurry directly to the sea adjacent to rocky shores where deposits can be taken north by the strong Benguela current.

Monitoring Recommendations - The foraging ecology of key seabirds breeding at Possession Island, particularly that of African Penguins bears further investigation. A monitoring project, using GPS logger technology, combined with diet and breeding success studies, should be initiated to principally investigate (a) their use of Elizabeth Bay as a key foraging area and (b) the effect of turbidity on their foraging behaviour there. If the sediment is placed elsewhere a study of Damara Tern foraging yield, dive success and use of the bay for foraging should be undertaken and compared with data presently collected.

5.4 Bird Strikes on additional Power Line

Nature of Impact - Large un-maneuverable species tend to be killed by powerlines more often than any other species (Jenkins *et al.* 2010). Such birds are rare in the study area but both species of flamingo occur in small numbers and Great White Pelicans may move through these areas irregularly.

Extent - Local.

Duration -Long-term; while powerlines exist.

Intensity -Low to Medium.

Probability - Probable, but low; depends entirely on flight lines used by large birds (unstudied).

Status of Impact - Negative.

Degree of Confidence - Medium; large birds such as bustards are regularly killed by impacting powerlines but occur infrequently in the *Sperrgebiet*. Night-flying flamingos passing through the area may, however, be affected.

Significance - Low to Medium; due to limited extent of powerlines.

Mitigation - Placement of powerlines parallel to the coastline (presumed flight line) and avoiding natural corridors will reduce impacts. Where crossing of flight line is unavoidable bird flappers on the lines are a necessity.

Monitoring Recommendations - Initiate monitoring of bird mortalities resulting from collisions with power lines in Elizabeth Bay, with a control area for existing lines in the *Sperrgebiet*. Give special attention to night-flying flamingos, pelicans if they occur, and flocks of shorebirds.

5.5 Disturbance caused by noise from blasting operations

Nature of Impact - Some blasting is envisaged to break apart cemented materials during ore extraction. Depending on the intensity and frequency of blasting, the associated noise may cause a disturbance to Cape Cormorants and African Black Oystercatchers breeding at Possession Island, and Damara Terns breeding on the mainland particularly during the initial settling and incubation periods. At worst, birds could abandon their nests; even brief abandonment may lead to nest content predation by Kelp Gulls on Possession Island.

Extent - Site-specific to Local; depending on the magnitude of the blasting operations.

Duration - Short-term.

Intensity - Low - Medium; depending on the intensity and frequency of blasting and its effect on seabirds breeding on Possession Island.

Probability - Improbable to Probable; depending on the intensity and frequency of blasting and its effect on seabirds breeding on Possession Island.

Status of Impact - Negative.

Degree of Confidence - Low.

Significance - Low to Medium; depending on the intensity and frequency of blasting and its effect on seabirds breeding on Possession Island.

Mitigation - The reactions of breeding Cape Cormorants and African Black Oystercatchers (thought to be most sensitive to noise disturbance) to blasting operations should be initially monitored, in consultation with MFMR's researcher technicians on Possession Island. If deemed problematic, attempt to minimise blasting during the Cape Cormorant (incubation peak: Nov-Dec) and African Black Oystercatcher breeding seasons (incubation peak Jan-Feb).

Monitoring Recommendations - Initial monitoring of potential changes in bird behaviour, including the incidence of nest abandonment, during blasting operations.

5.6 Accidental collision of birds because of artificial light sources on the shore during mining operations

Nature of Impact - Bright lights tend to confuse seabirds flying at night, and seabirds and passerines are drawn to lights in foggy weather. Any lights set up along the area to be mined, close to the shore, could lead to collisions of seabirds (particularly Damara Terns that can forage nocturnally, and cormorants) with tall structures, such as the dredger or other mining equipment.

Extent - Site-specific.

Duration - Long-term; depending on the duration of mining activities.

Intensity - Low.

Probability - Improbable.

Status of Impact - Negative.

Degree of Confidence - Low.

Significance - Low.

Mitigation - If possible, keep any lights at the shoreline off at night, and shield them to project the light downwards only.

Monitoring Recommendations - None necessary.

5.7 Increased risk of pollution involving seabirds, including entanglement in artificial materials, ingestion of human refuse and risk of oiling

Nature of Impact - Artificial materials (e.g. plastics, ropes etc.) discarded during mining and treatment operations can pose an entanglement or ingestion threat, particularly to cormorants, which often use artificial materials for nest material. Human refuse may encourage Kelp Gulls to forage at the mining and/or treatment site. Oil pollution (fuel or hydraulic fuel) from accidental spillage during dredger or treatment operations may cause the oiling of birds if not contained immediately.

Extent - Site-specific.

Duration - Long-term; until the end of mining operations.

Intensity - Low to Medium; even minor spills can have major consequences.

Probability - Improbable to Probable.

Status of Impact - Negative.

Degree of Confidence - High.

Significance - Medium to High; depending on the nature and extent of the pollution.

Mitigation - A suitable refuse containment and removal system must be put in place and staff must be trained in proper refuse disposal. A detailed and implementable oil/chemical spill contingency plan must be drawn up, and equipment to deal with spills need to be available at short notice and able to be deployed effectively. In the case of seabirds being oiled or oiled seabirds being found, the seabird section at MFMR should be contacted.

Monitoring Recommendations - Any signs of pollution must be monitored and remedial action must be taken.

5.8 Destruction of suitable habitat in the footprint of the new WIFS plant 1.5 km inland

Nature of Impact - The plant is to be sited on an already mined area 1.5 km inland thus original habitat is likely to have been compromised already. The footprint, and the powerlines feeding it will be the biggest factors impacting birds in the region.

Extent - Local.

Duration - Long-term; depending on the duration of mining activities.

Intensity - Low; for the footprint (see 5.4 above for powerline impacts)

Probability - Improbable.

Status of Impact - Neutral.

Degree of Confidence - High.

Significance - Low.

Mitigation - Actively remove any Pied Crows that nest on the infrastructure - as predators of Damara Terns introduced artificially they require special attention. Remove all infrastructure at the end of the mining to prevent their further use by destructive species commensal with man.

Monitoring Recommendations - Assess use of infrastructure by crows and jackals.

6. CONCLUSIONS AND RECOMMENDATIONS

This assessment of the avian component of the biodiversity of the *Sperrgebiet* in general and the Elizabeth Bay environment in particular, shows that it is home to no less than 17 species of Namibian Red-listed birds (of 60 classified as such) and is thus a hot-spot of threatened species. Several of these species are nomadic migrants (the petrels and albatrosses) with low concentration in Namibian water. Of the remaining 12 species, eight are known to breed in the area (with the Caspian Tern and Chestnut-banded Plover likely to breed as the 9th and 10th species). More importantly, several of the seabirds (the African Penguin, three cormorants species, the Cape Gannet and the Damara Tern) have breeding strongholds in the *Sperrgebiet*, contributing significant numbers (> 5%) to the global population.

Of these, our review suggests that mining-related sediment discharges may be impacting the African Penguins on Possession Island and Damara Terns on the Elizabeth Bay mainland because both forage in the bay where visibility is impaired as a result of suspended sediment plumes. At least for the Damara Tern this has been associated with reduced foraging efficiency and prey yield in two studies. Both red-listed species have declined in these areas (the penguin by *ca.* 31% of the breeding pairs and the tern by *ca.* 5-10 pairs) since mining began in 1991. The reduced visibility and the lower surf-zone fish abundance and biomass in Elizabeth Bay may help explain the compromised foraging of the Damara Tern.

A further negative effect - also linked to sediment smothering - has been confirmed by a reduction in the invertebrate fauna at Elizabeth Bay (Pulfrich *et al.* 2008) and a parallel decline in the once dense shorebird community since mining began (Simmons 2005). The control site at Grosse Bucht beach

showed no such decline in the same period showing that mining impacts are (i) localised and (ii) specific to conditions at Elizabeth Bay.

Given the area's newly acquired National Park status, its new offshore status as a Marine Protected Area and the negative effect that the mining-related sediment is having on two Red-listed bird species we conclude that increased efforts to prevent further reductions should be made. Reducing biodiversity of already compromised populations of red-listed species within the newly proclaimed national park is not compatible with the aims of the park or of Namibia's commitment to Biodiversity Act of 1992. It is also incompatible with Namdeb's otherwise sound environmental record in protection of the *Sperrgebiet*.

We therefore strongly recommend that sediment deposited into Elizabeth Bay is reduced or prevented from entering the bay. Previously, practical ideas how to do so were published (Simmons 2005) and these were presented and discussed by other consultants with Namdeb (A. Burke pers comm.). Legal requirements may now require Namdeb to enact such measures.

Given the overwhelming evidence that invertebrates, migrant shorebirds and breeding red-listed species have declined in and around Elizabeth Bay we recommend that Namdeb reviews its mining approach, and sediment discharge in particular, to address the problems.

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