7 From the Past to the Future…

Namibia has an ancient, long coast; in fact, it is some 132 million years old and stretches over about 1,570 kilometres of shoreline. From a human perspective, little happened along the coast during most of these 132,000,000 years, and it is only in the past hundreds of thousands of years that human feet began to tread its sands.

More recent developments on the Namib coast in the last two centuries have been extremely patchy, both spatially and temporally. The spatial patchiness resulted from people settling in places with water, where natural harbours were available, and mineral deposits were found. These factors were so important in concentrating people that 98% of all coastal inhabitants now live in just five towns: Oranjemund, Lüderitz, Walvis Bay, Swakopmund and Henties Bay (see page 127). The remaining 2% live in a handful of small settlements, with the result that most of the coastline is uninhabited. This has protected the natural environment, much of which has remained unscarred by people, but it also means that much of the coast has little relevance or value to most people.

Below right: In 2000, only 5% of Namibia's population lived within 100 kilometres of the coast, compared to a world average of 39%.[1]

These houses belong to wealthy Namibians who use them as holiday or retirement homes, and/or investments. Thus a high proportion of upper income housing in Walvis Bay, Swakopmund, Wlotzkasbaken and Henties Bay is owned by absentee landlords who live inland. A variety of advantages and disadvantages are associated with the houses: they add to demands on water, power and land resources; the majority of houses are unoccupied for most of the year, but despite all of this, the vacant houses give important and new value to the coast.

Temporally, development has been sporadic, with surges of activity being followed by downswings and lulls. Onshore this is epitomised by the abandoned mine workings found in many places, and offshore by the separate rise and fall of whale, Pilchard, Anchovy, Orange Roughy, hake, lobster and crab catches. Even diamond mining, which has lasted more than one hundred years, has changed its focus over time: from the initial discoveries around Lüderitz, south to near Oranjemund, and presently to the offshore environment. Ghost towns have been left in its wake. One reason for these up- and downswings has been the largely exploitative nature of economic activities on the coast driven by the urge to profit from natural resources as rapidly as demands, supplies and a lack of competition allowed. By contrast, enterprises such as agriculture, manufacturing and services often have a longer term perspective than the harvesting of natural resources.

The population structure of the towns is also uneven, comprising far fewer young and older people than would be expected in typical communities. Most people who work at the coast were born elsewhere, reflecting the huge migration to the coastal towns during the past 30 years, largely by people seeking employment and cash incomes (see page 129). Ratios between males and females are likewise skewed because many more men than women are employed in the mining and fishing industries.

The great number of people living in shacks in informal settlements, such as the DRC on the outskirts of Swakopmund, are of little concern to most holiday makers and tourists because the slums are out of sight and out of mind.

Housing conditions vary enormously within each coastal town, reflecting inequalities among people. Large proportions of each town's residents live in informal shacks or low cost housing, while other parts of the same towns have become upmarket Riviera-style suburbs where wealthy people have invested surplus income in homes which are used only during holiday periods. These holidays provide yet another surge when local tourists flock to the coast. At these times all available accommodation – hotels, B&Bs and rental properties – at the coast is fully booked.

Many of the coastal commodities (including tourism) depend on international consumers. As an obvious consequence, economic activities are subject to external forces such as global recessions, demands for uranium and the affordability of long-haul tourism, for example. The 2008 economic slump caused the diamond mining giant Namdeb to halve its workforce, while low uranium prices during the 1990s and early 2000s caused Rössing Mine to consider closing down by 2007.[2] Conversely, renewed worldwide interest in nuclear energy has caused the price of uranium to skyrocket, while the demand for diamonds as symbols of wealth continues, despite a decline in 2008 and 2009. In addition, there is enough surplus cash around the world for tens of thousands of people to spend each year on international travel to Namibia and its spectacular coast. Here they enjoy good accommodation and food at relatively reasonable prices compared to Europe and the US, as well as sights and experiences not found elsewhere.

These are examples of economic influences, but the marine environment is also subject to large-scale natural environmental disturbances such as Benguela-Niños, sulphur eruptions, oxygen starvation and blooms of algae (as described in pages 42 to 44). Separately, and in combination, these conditions can have devastating effects on marine resources and, as a consequence, the fishing and mariculture industries (see pages 148 to 154).

It is the variety of external influences – economic, climatic, oceanographic and political – which have the greatest impact on Namibia's coast, while local processes tend to have less influence on events along this interface between the atmosphere, ocean and desert. This is a fundamental feature of the coast.

Another predominant characteristic is the strong difference between the marine and terrestrial environments. The land is often hot although temperatures vary significantly on a daily basis. By contrast, the marine environment is cold and maintains a relatively constant temperature throughout the year (see page 40). The land has a tiny productive biomass and relatively few species, but many are unusual and occur nowhere else in the world. The marine world, however, produces enormous volumes of biomass but has fewer species unique to this part of the world. Because of its productive biomass, Namibia has earned considerable revenue from whales, guano, fish and other marine harvests. Aside from diamonds (which were anyway carried ashore by marine currents), the terrestrial component of the coast has earned comparatively little for the country.

Perhaps curiously, management of the living coastal resources is split between two ministries: Fisheries & Marine Resources on the one hand and Environment & Tourism on the other. The marine side has received little formal conservation in terms of marine protected areas while the land has been extensively protected, partly through mining and nature conservation legislation but also as a simple consequence of its inaccessibility. Much of the coast is so hard to reach that only dedicated or foolhardy explorers, geologists, biologists and avid adventurers go there. Although most of the coastline is now protected, much of the protection was originally promulgated because there was no competition from ventures such as agriculture. There seemed little else to do with such large areas as those now in the Skeleton Coast and Namib-Naukluft Parks. In hindsight, this was a good environmental move but has constrained improvements to the value of the coast.

The low densities of desert plants and animals, and their generally slow rates of growth and reproduction, mean that losses can be significant and long lasting. It is for these reasons that the coastal desert is often described as being 'fragile'. Similarly, since many species are endemic (see page 81), environmental degradation – even at a local scale – can easily result in the global extinction of species. In addition, the coast harbours a rich archaeological heritage which tells of a history that is endemic to the coast.

For reasons of conservation protection or maintaining control over diamonds, the great majority of the coast has been, and remains out-of-bounds to most people.

The marine environment, however, is distinguished by high rates of growth and reproduction. It has evolved in the presence of strong winds and currents, and recurrent changes to the chemistry, temperature, nutrients and oxygen concentration of its water. As a result, oceanic life has the capacity to regenerate and repopulate areas fairly quickly following disturbance, for example in areas where diamond mining has destroyed local habitats. Fish stocks are also expected to recover if excessive harvesting is curtailed. Nevertheless, the marine environment is susceptible to large-scale natural perturbations of which we have limited understanding.

This, in a nutshell, is what the coast of Namibia comprises: very different oceanic and terrestrial environments which have seen sporadic bursts of short-lived and localised economic activity.

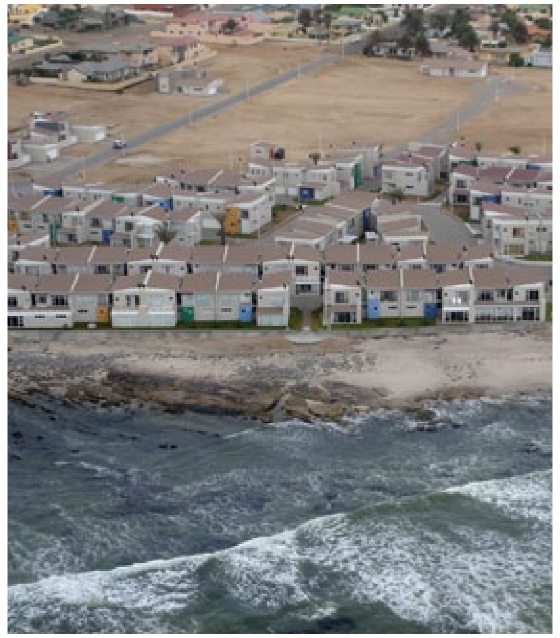
Moving ahead, while minding the potholes

The management and development of such an extensive coastal area where human activities and natural environments are so diverse is inevitably daunting. However, what is much more challenging is to promote appropriate development that brings long-term returns for Namibia's people in ways that maintain the life, diversity, habitats, culture and beauty of the coast. In particular, there is a need to add value to the coast by developing long term gains and options rather than satisfying short-sighted greed.

What are the major potholes, pitfalls or dangers? Although Namibia alone can have little impact on the degree of global warming, coastal towns and communities must prepare to deal with the effects of rising sea levels. Currently sea level is rising at around one to two millimetres per annum[3] but this is widely anticipated to increase significantly over the next 100 years.[4] The main threats are to infrastructure developed close to the coast. In particular, facilities at Walvis Bay harbour are vulnerable because the shape and size of Pelican Point is already undergoing changes (see page 57). With rising sea levels, the protective barrier now provided by the long sand spit may easily be breached, thus exposing the port facilities to the full impact of waves rolling in from the open ocean.

The impacts of swells, particularly strong ones in combination with spring tides entering the harbour will be significant, especially since Walvis Bay is Namibia's only deep-water harbour. Other low-lying infrastructure is likewise at risk. Indeed, large areas of both Walvis Bay and Swakopmund are close to sea level, unlike Henties Bay and Lüderitz where most developments are well above sea level. Much greater caution should be exercised everywhere before plans are approved for buildings near the shoreline.

As sea levels rise, infrastructure built low and close to the shore runs the increasing risk of being damaged by waves during spring tides and occasional swells.



Miners and prospectors often have free reign to excavate (top) and sample along prospecting lines (middle), with little legal or moral need to cover the scars that blemish the desert. However, some mining companies nowadays spend large sums of money to test methods and then to rehabilitate the landscape (bottom).

Mining has long been a mainstay of not only the coastal economy, but also that of Namibia as a whole, and there is potential for coastal mining to continue contributing to economic development. However, much prudence and precaution is needed before further mining ventures are permitted, given the abundant experience of poor practice by mining enterprises in the past. Namibia's coast is full of scars from mining activities that have served limited economic purpose. For example, most mines for tin, tungsten, amethyst and dimension stone have had short life-spans and produced few benefits, but have had significant environmental impacts (see pages 146 – 147).

A host of challenges are associated with most types of mining: air pollution, ground water contamination, noise pollution, visual scarring, habitat degradation, and increased urbanisation, for example. Demands increase for scarce resources such as water and electricity, the provision of which may exacerbate the challenges outlined above.

Many of the impacts are especially harmful in the fragile arid environments found along the coast, and mining in national parks – if it is to be allowed at all – needs particularly careful management. To everyone's credit in Namibia, a detailed strategic environmental assessment of uranium mining in the central Namib was completed in 2010.[5] Impacts should be reasonably contained if recommendations made in the report are correctly implemented. There have been other examples of mining companies requiring impact assessment. Some efforts have also been made to restore habitats, which all go some way towards balancing the many negative impacts of mining along the coast.

Furthermore, there is a need for greater transparency when new mining ventures are evaluated so that untoward practices do not escape scrutiny under the guise of being strategic in the national interest, or for other pretences.[6] Greater public disclosure will thus help ensure that new mines are indeed socially and economically beneficial, and that their benefits outweigh environmental and other costs. Likewise, if a mineral has sufficient value to be worth mining in an area with special environmental value, adequate resources must be dedicated specifically for mitigation and rehabilitation once the mining is completed. Procedures must be in place to ensure that the risks are understood, and that mitigation and rehabilitation actually happens.

Mining thus needs to be done for the right reasons, and it needs to be done responsibly to be of maximum and long lasting benefit. Existing legal loopholes in the various mining and environmental acts need to be closed to ensure compliance with the highest standards.[7]

Mining has driven much of the growth of towns along the coasts, and further urban growth is to be expected as a result of increased trade through Walvis Bay and tourism to all areas of the coast. This growth will make additional demands on

coastal infrastructure and services. Supplying enough water to the coast is already a challenge (see page 161). Although desalination is a technically viable option to provide more fresh water, it is expensive for domestic consumption.[8] Electricity is in short supply in Namibia as a whole, and new ways of generating power are extremely expensive too. Just as efforts should be made to find new sources of water and power, measures are likewise required to reduce consumption and manage demands.

What activities offer the best promise for development and wise management of the coast? Agriculture is difficult because of the lack of water and poor quality of the soils. Stretches of rivers suitable for crops and vegetables, such as just inland of the Swakop River mouth, are very limited along the coast. Mariculture has definite potential, and has been identified as a priority for development by the Ministry of Fisheries & Marine Resources. Oysters, abalone, seaweed and mussels are already being cultivated (see page 153).

Most mariculture needs the sheltered waters of bays and ponds such as those found at Lüderitz, Walvis Bay and the salt pans near Swakopmund. Further developments might be possible in ponds that remain from diamond mining in the Sperrgebiet. However, all maricultural developments are expensive to establish and keep viable, and they require careful controls to prevent the accidental introduction of alien species. Chemical treatments to enhance production are also a danger to local environments.

Fishing is an obvious candidate for development, although the industry has a poor record for sustained, planned and managed harvesting (see page 148), let alone for further growth. Each bout of apparent over-exploitation has been followed by the resource collapsing, and cycles of boom and bust have been repeated over the years for different species of fish.

Two major problems remain before any serious thought should be given to expansion of fishing. The first is that despite considerable research throughout the Benguela Current, our understanding of factors that control fish populations is inadequate. Indeed, even the question of whether or not over-harvesting led fish stocks to collapse has yet to be answered definitively. In addition, the effects of other processes that influence fish populations, such as fluctuating sea temperatures and oxygen levels, are also poorly understood, especially when several factors may be operating in unison.

In short, our knowledge of biological processes and drivers in the Benguela Current must be enhanced. Until that happens, the second problem is likely to persist, which is the continued low numbers of commercial fish from populations that have collapsed. This is despite limits on harvesting that have been imposed through the setting of quotas, known as total allowable catches (TACs).

In addition to farming with oysters, mussels, seaweed and abalone, attempts are being made to start farms to produce rock lobster, scallops, clams and kob fish.[9]

Oil pollution, in particular from fishing vessels and passing ships, is a constant danger to coastal habitats everywhere. Exploration drilling is of low intensity in Namibia and takes place far offshore so any accidents caused by this industry are unlikely to have an impact on the coast[10]. Both Walvis Bay and Lüderitz have oil spill contingency plans and there is a national oil spill contingency plan. These must be constantly updated and regular exercises are put into practice to ensure that the plans can be implemented effectively when needed.

Above: Kudu gas is a possible major development that could take place in the future. The gas field is located some 180 kilometres west of Oranjemund in 170 metres of water on the edge of the continental shelf. No other oil or gas resources have been confirmed in Namibian waters to date, but other targets are also far offshore. The most likely use for the gas from Kudu will be to generate power but no definite plans are in place yet. Technical challenges such as its remote location make development of the gas field expensive, but the increasing shortage of electricity in southern Africa may make development of this resource more viable.

Below: Lions and whales are among the most magnificent consumers in the animal world, although they live in different places, consume prey in different ways and seldom meet. Occasionally they do come together, such as when a lion a feeds on a beached whale in the Skeleton Coast National Park.

Thus, since efforts to help stocks recover have not been successful, and our knowledge of factors controlling population dynamics is limited, expansion of the fishing industry would be unwise for the time being.

Considering the beauty and unspoiled character of much of the coast, tourism has a major role to play in its future development. Recent studies suggest that this sector, directly and indirectly, supports some 72,000 jobs nation-wide and that tourism could grow at about 7% per year over the next ten years.[11] By 2016, the travel and tourism economy is expected to contribute about 23% of Namibia's GDP, which is considerably more than mining now provides.

Compared with holiday destinations throughout the world, the Namibian coast has several comparative advantages. Few areas are as attractive to people who wish to visit unusual places or to 'get away from the madding crowd'. Moreover, the coast offers combinations of environments that are unscarred, remote, rugged and spectacular. Evocative names such as 'Skeleton Coast' and 'Sperrgebiet/the Forbidden Zone' are such good marketing tools that one could almost assume that they were coined for just that purpose. Most of the coast is presently not used for any specific purpose, and so there are no competitive enterprises.

Once the Sperrgebiet opens to tourism, visitors will be able to see fascinating relics of bygone diamond rushes and riches, as well as a diversity of succulent and other plants considered to be amongst the richest in the world. A variety of new and unique ventures could be developed, such as giving tourists the opportunity to dig for their own diamonds, and to explore the many interesting archaeological, geological and fossil sites in the area.

The ocean of sand that stretches several hundred kilometres between Lüderitz and Walvis Bay offers a multitude of attractions and experiences that would be hard to rival. Along with shipwrecks, visitors could see huge inselbergs marooned in the sea of sand, and a stark and energetic coastline whipped by waves and wind. Travelling across this land where the moulding of sand into dunes is akin to the water whipped into waves is an attraction in its own right.

Further north in the Skeleton Coast Park, dozens of unusual and captivating natural attractions are on hand, stretched out along a rugged shoreline of some 500 kilometres from the mouth of the Ugab River to that of the Kunene River, including rare opportunities of seeing desert lions feeding on a whale or seal carcass.

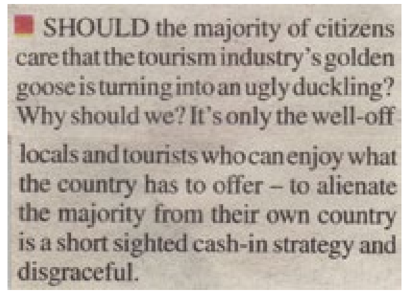
The idea of tourism on the coast is not new, of course. Tens of thousands of people visit Swakopmund, Walvis Bay, Lüderitz, Sandwich Harbour, Sossusvlei and Cape Cross each year. In addition, there is a concession camp for a few high paying, fly-in guests in the Skeleton Coast Park. Overland 4x4 excursions are offered along two routes through the Namib-Naukluft Park (see Figure 48).

The potential for more tourism has also been identified in several recent management plans,[12] which have particularly advocated the concept of high value eco-tourism along the coast. Under these plans, several more tourism concessions could be allocated so the number of high-paying visitors to select parts of the coast would increase several times. The environmental impacts would be minimal since this would be exclusive eco-tourism for very small numbers of visitors.

These plans cater for the top end of the market and provide few, if any, opportunities to ordinary Namibians to enjoy those distant destinations. Even middle-income earners are excluded, with the consequence that little is available anywhere within the coastal environment for the average Namibian or tourist to experience and learn about the desert environment. Moreover, most of the coast still remains off-limits, and these off-limit areas still offer no direct, visible or comprehensible value. This is not to belittle their important intrinsic values as wilderness areas for conservation, archaeological heritage, biodiversity and ecological functioning, as well as to future generations. But these values are seen, enjoyed or understood by very few people.

What is proposed here, however, is an expansion of tourism on a significant scale along the whole coast. This offers the best, perhaps only sustainable, option of giving real value to large areas of the coast. And in doing so, the very attributes of the environment for which tourists would pay (and many of us hold to be important) will prove capable of delivering economic benefits as great as, and probably greater than, the alternative short-lived ventures that damage and scar the coast.

For protected areas to be used for economic gain requires major shifts in the mindsets of conservation, coastal and park managers. This has not been a popular idea. Indeed, most national parks in Namibia have few facilities for visitors, and quite a number have no facilities for people at all! The private sector, by contrast, has recognised the demand and opportunity for tourism, with the consequence that hundreds of private ventures now offer wildlife-based and other 'eco-tourism' on freehold and communal land. Remarkably, many visitors to Namibia's parks visit them from private facilities outside the parks because there is no accommodation in the parks or because the accommodation is shoddy or over-priced in comparison.



SHOULD the majority of citizens care that the tourism industry's golden goose is turning into an ugly duckling? Why should we? It's only the well-off locals and tourists who can enjoy what the country has to offer – to alienate the majority from their own country is a short sighted cash-in strategy and disgraceful.

I STRONGLY agree with Jevison. The tourism industry does not cater for Namibians, only for foreigners, however we are encouraged to support the industry. We understand it is a booming industry in Namibia but the Ministry of Tourism should really look into creating a (special) price for Namibians. I also want to know why does NWR have such high prices?

SMS notes to The Namibian newspaper in 2011.

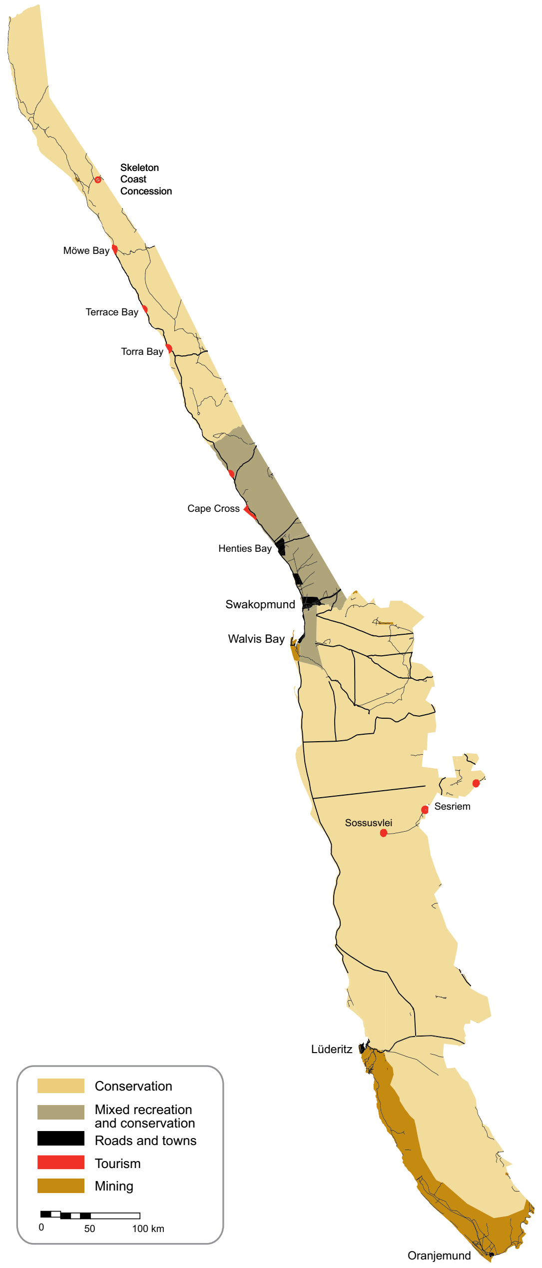


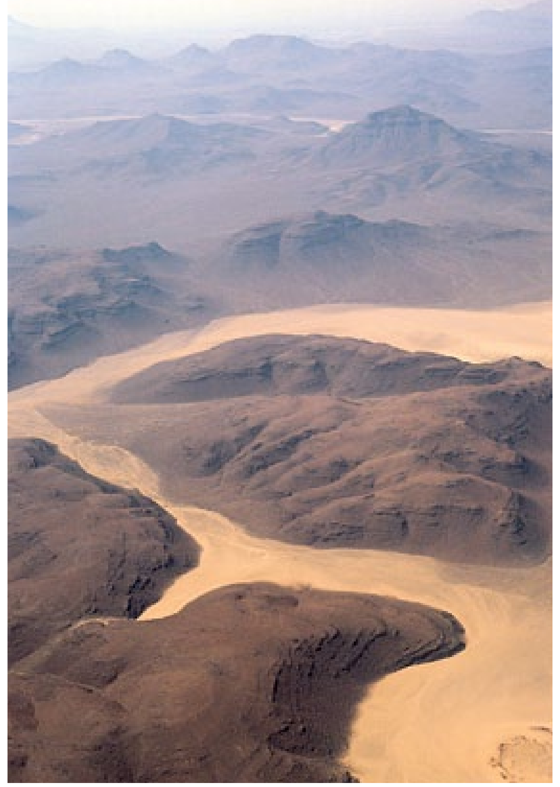
Figure 51. Human impacts on the terrestrial coast. The beige expanses have been protected but not used for any particular purpose. Prior to the proclamation of Dorob National Park in 2010 the central coastal area was a multiple-use recreation and conservation area and was not formally protected.

A change in mindset from protectionism to sustainable use for economic benefit occurred in Botswana, where the government manages the Okavango Delta as a commodity for wildlife and tourism. To obtain the best returns in the public interest, private entrepreneurs and communities are encouraged to run, and profit from, tourism ventures. Although attractions in the Delta differ from those along the Namibian coast, both have intrinsic qualities that are suited for tourism in significant ways. Botswana went ahead to capture that economic value; managers of protected areas along the Namibian coast could do the same.

In a much smaller, and admittedly more robust area, 60 to 70 tourism camps and lodges in the Delta offer services that attract some 50 thousand visitors each year, directly and indirectly providing about 5% of Botswana's Gross Domestic Product (GDP) and 40% of employment in northern Botswana.[13] If Namibia is bold and seriously seeks economic value from its coast, a hundred or more lodges and camps could be provided.

Needless to say, effective environmental safeguards are needed if tourism is to be developed substantially. Neglecting safeguards would wreck the very assets that the opportunity depends upon. It would also be morally irresponsible to destroy assets that belong to future generations, and to destroy or degrade life unnecessarily.

Opportunities to enhance values are not confined to economics, however. The more people know about the Namibian coast, the more aesthetic and popular appeal it will have. Likewise, allowing people to appreciate the marvels of the desert and sea will help to build a community of people in Namibia and across the world who hold the Namibian coast to be special and valuable. It is these people who will be the ultimate, staunch guardians of the coast.



A final observation ...

Proposals to give the coast value fit very well with the recent development of conservancies along the eastern edge of the northern half of the coast (Figure 52). The conservancies have the deliberate purpose to allow local residents to benefit financially from wildlife and tourism. Residents were denied those rights, opportunities and values until the passing of enabling legislation in 1996.

If protected areas along the northern coast were given similar purpose to that of neighbouring conservancies, it is easy to imagine how that whole north-western area of Namibia could benefit from the economies of scale and options that come from such a large expanse used for common purpose. The importance of this for environmental conservation is immense, since profits and value will only be achieved if natural resources are managed in ways that keep them healthy and natural.

There is a multitude of great spectacles on offer along the Namibian coast, all worth savouring and honouring.

There is a stark, telling contrast between the free flight of flamingos and free swirl of dune sand (above) and the many rigid graves that lie along the Namibian coast; not human graves but those of failed ventures. Many of them were well-intentioned but ill-conceived, while other endeavours have been productive but short-lived enterprises. However, many ventures have been pure scams, such as this one, the remains of an oil rig abandoned here once the proponent of the scam had fleeced investors of millions of dollars. This is but one of the many skeletons that litter the Namibian coast.

Pieces of the coast have been set aside for conservation from time to time ever since the proclamations of Game Reserve Numbers 2 and 3 in 1907. Most recently, the Sperregebiet National Park was proclaimed in 2008, the off-shore Marine Protected Area in 2009 and the Dorob National Park in 2010. These new proclamations are noteworthy because they include the first formal protection for any part of Namibia's marine environment, and they mean that there is a continuous zone under conservation management between the Kunene and Orange Rivers (Figure 52). In total, Namibia's coastal protected areas now cover 97,600 square kilometres.

The scale of this conservation area becomes even more impressive if it is linked to the Iona National Park in Angola and the Richtersveld National Park in South Africa. Suggestions have been made to proclaim this whole area as one park, perhaps to be known as Namib-Skeleton Coast National Park. That would be one of the largest parks in the world.

Such a development would partially mirror a parallel development in the marine environment. This was the move by Angola, Namibia and South Africa, as the three countries washed by the waters of the Benguela Current, to establish the Benguela Current Commission (BCC). To quote the BCC website: 'This is the first commission in the world to be based on the Large Marine Ecosystem approach to ocean governance. It provides a platform for Angola, Namibia and South Africa to introduce an integrated, multi-sectoral approach to managing the Benguela Current Large Marine Ecosystem.'

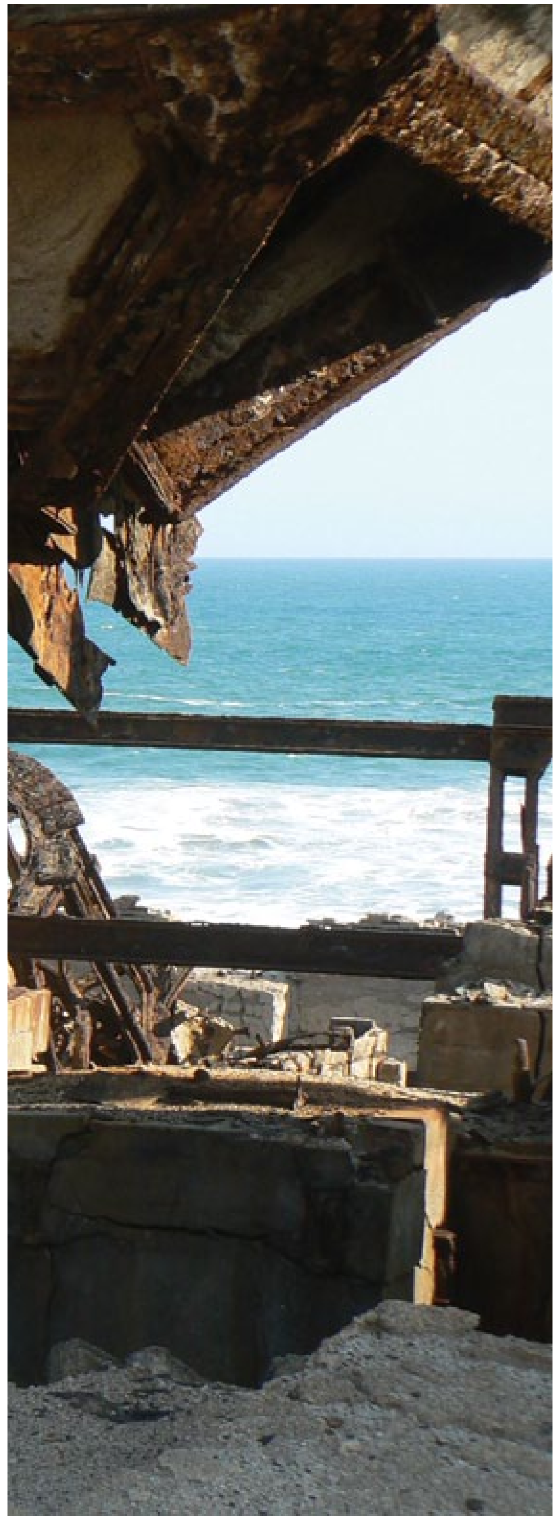
Economic interests drive much of the need for the Benguela Current Commission, but at least the drivers and boundaries are clear, which makes congruence between the three countries more possible. If this Commission can enhance the sustainable harvesting of marine resources and if value can be attached to the resources of the desert, the coast will then consist of parallel environments used and managed for the benefit of all. And by all, we mean people, birds, seals and lichens, to name just a few of the beneficiaries of the Namibian coast.

One way that local residents can benefit from conservation and tourism is to provide them with rights to harvest wildlife sustainably and to earn revenue from visitors. Such rights are provided through conservancies elsewhere in Namibia, and could be provided to other communities living alongside the coastal parks.

Figure 52. Much of the northern coastal area adjoins conservancies and a tourism concession, creating a massive area managed for conservation. While residents of conservancies and the concession benefit from wildlife and tourism, few people obtain any value from the formally protected area. The map also shows the extent of a proposed linear, contiguous Namib-Skeleton Coast National Park which will create a massive area under conservation management. This will include the Iona National Park in Angola, the Richtersveld National Park in South Africa, while also linking to the newly established Marine Protected Area off the southern coast of Namibia.

Key points

- Compared to other coasts, Namibia's coast is largely unspoilt because the great majority of its relatively small population is clustered in five towns.
- Most economic developments grew rapidly but were then followed by substantial declines, as epitomised by many abandoned mines (including guano), and rises and falls of catches of whale, Pilchard, Anchovy, Orange Roughy, Hake, West Coast Rock Lobster and crab.
- The majority of coastal commodities are used by international consumers, particularly diamonds, uranium, fish and tourist facilities. Economic activities are thus subject to external forces, while local economic forces have less influence along the coast.
- The low densities of desert plants and animals and their generally slow rates of growth mean that damage and losses can be long lasting. Most marine life, however, is characterised by high rates of reproduction and can regenerate fairly quickly following disturbance.
- Sea level rise due to global warming threatens infrastructure close to the coast, especially when swells occur in combination with spring tides. Walvis Bay and Swakopmund are at greatest risk. Careful planning is required to minimise future losses.
- What activities offer the best promise for adding long-term value to the coast without incurring substantial environmental and social costs?
  - Mining is certain to deliver more economic benefits to Namibia. However, prudence is necessary before further ventures are permitted, given the long history of poor practice by mining enterprises. Mining needs to be done for the right reasons in ways that maximise long-lasting benefits.
  - Mariculture has definite potential through the further development of farms for high-value products such as oyster, abalone, seaweed and mussels.
  - Fishing can be developed, but a much better understanding of factors that control fish populations is needed before this industry can expand.
  - Tourism can add significant worth, especially by developing the industry in geographical areas which now offer no direct, visible or comprehensible values to the majority of Namibians.
- By shifting from protectionism to the promotion of economic benefits in conjunction with environmental safeguards, many more people will be able to enjoy the marvels of Namibia's coast. This will have the further advantage of creating a new generation of coastal custodians, who fully appreciate the value of Namibia's coast and its resources.



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7. Historical accounts and boundaries for conservation areas were obtained from the following sources:
   - Berry HH, 1997. Historical review of the Etosha region and its subsequent administration as a national park. *Madoqua* vol. 20 (1):3-12 and personal communications.
   - Bridgeford P. 2008. One hundred years of conservation: From Game Reserve No. 3 to Namib-Naukluft Park. *Namibia Scientific Society Journal* vol. 56.
   - Information in the park profiles issued by the Ministry of Environment and Tourism http://www.met.gov.na/dpwm/parkprofiles.htm.
   - Government gazettes.
8. Game Reserve 1 was situated around the Mangetti area and lasted until Etosha Game Park came into existence, when it was deproclaimed. Some sources give the area of Game Reserve No. 3 as 10,000 square kilometres.

Chapter 2: Weather and Water

1. http://en.wikipedia.org/wiki/oceanography.
2. Air movement is affected by the Coriolis force which is driven by the rotation of the earth. Air currents are deflected to the right in the northern hemisphere and to the left in the southern hemisphere.
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31. In 2006 NamPort had a turnover of nearly N$292 million and paid N$14.9 million in tax. NamPort web site http://www.namport.com.

32. NamPort web site http://www.namport.com.

33. The only difference between tourism and other exports is that the customer comes to Namibia to buy the commodity that he or she wants rather than the commodity being packaged and sent to the customer in a foreign country.

34. Same as 24 above.

35. Same as 1 above.

36. Same as 24 above.

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PHOTO AND IMAGE CREDITS

Chapter 1

Pg 4, Spencer Bay, J. Mendelsohn
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GLOSSARY

A

- **anti-cyclone** – areas of high atmospheric pressure from which winds spiral outwards in an anti-clockwise direction in the southern hemisphere
- **aquifer** – a porous and permeable rock that holds and can supply water to boreholes
- **aragonite** – a carbonate mineral with the same composition as calcite, $CaCO_3$, it often forms close to the surface and makes up the shell material of corals and many bivalves
- **aridity** – a condition where available water is limited thus limiting the growth of plants and animals

B

- **barchan dune** – crescent shaped sand dune that lies transverse to the wind direction
- **Benguela-Niño** – a southward invasion of warm, salty water from the Angola current
- **benthic** – the lowest level of a water body and which includes the sediment surface
- **biodiversity** – the diversity of plant and animal life in a particular habitat
- **biogenic sediments** – sedimentary deposits derived from biological material
- **biomass** – the total mass of living organisms in a biome
- **biome** – a major ecological community, extending over a large area and usually characterised by a dominant vegetation

C

- **calcrete** – sedimentary rock cemented by calcium carbonate (calcite). Often forms a resistant surface layer
- **climate change** – the long term change in weather patterns over decades, centuries or millennia. Specifically in this book it refers to change brought about by the actions of man
- **continental shelf** – the gently sloping extension of the continent that would be exposed in glacial maxima and extending to the point where the gradient steepens. This is different to the legal definition used in the United Nations Conference on the Law of the Sea by which countries can claim extended territorial rights
- **Coriolis force** – the tendency for a current or wind to drift sideways from its course due to the rotation of the Earth; in the case of the southern hemisphere this is to the left
- **cyanobacteria** – bacteria that obtain their energy through photosynthesis

D

- **Damara orogen** – the name given to a belt of deformed and metamorphosed rocks formed during the collision of ancient continents around 550 million years ago
- **demersal fish** – fish that live on or near the bottom of a water body, and contain little oil (one to four percent of body weight), whereas pelagic fish fillets can contain up to 30 percent
- **demography** – the study of the characteristics of a population
- **diatoms** – a widespread group of unicelled algae with hard bivalve shells composed mostly of silica. Most diatoms can perform photosynthesis. They make up a large portion of marine plankton and are an important food source for many aquatic animals
- **dimension stone** – rock selected for its textural characteristics and cut to size and shape to be used in building work
- **dinoflagellates** – minute single-celled aquatic organisms which are one of the main components of plankton. They have characteristics of both plants and animals, such as two flagella – long whip-like growths which allow them to move - and a hard cellulose covering. Blooms of dinoflagellates are the cause of red tides
- **dolomite** – mineral composed of calcium magnesium carbonate $CaMg(CO_3)_2$. A rock composed dominantly of this mineral is referred to by the same name
- **dyke** – igneous intrusion that cuts discordantly across older beds

E

- **Ekman Transport** is the resulting motion of water interacting with the forces of Coriolis, wind and drag between layers of water
- **El Niño-Southern Oscillation (ENSO)** - El Niño is the irregular warm water current that flows south along the west coast of South America. The Southern Oscillation is the atmospheric equivalent and is a large scale atmospheric change in the south east Pacific and Indian Oceans
- **endemic (and endemism)** – indigenous to a specific region or environment and not occurring naturally anywhere else
- **ephemeral** – a natural event such as a river flood that only occurs for a very short time
- **estuary** – a coastal body of water fed by a river but with a connection to the sea
- **Exclusive Economic Zone (EEZ)** – the marine area over which a coastal state has special rights to the exploitation of resources

F

- **foraminifera** – oceanic protozoa with shells of calcite, $CaCO_3$ and usually smaller than 1millimetre

G

- **geodes or druses** – a type of cavity commonly found in volcanic rocks in which well formed crystals can develop
- **glauconite** – blue-green mica mineral formed in shallow marine environments and found as small, rounded pellets
- **global warming** – warming of the earth caused by the actions of man
- **Gondwana** – single, ancient land mass made up of present day Africa, India, Australia, South America, Madagascar, Antarctica and New Zealand
- **guyot** – an undersea volcanic mountain with a flat top

- **gypcrete** – sedimentary rock cemented by hydrated calcium sulphate $CaSO_4.2H_2O$. Often forms a surface layer
- **gyre** – a very large rotating ocean current, the rotation being caused by the Coriolis Effect, but the water flows are also often pushed along by prevailing winds

I

- **igneous rock** – rock formed from the solidification of magma
- **inselbergs** – an isolated mountain that rises significantly above the surrounding plain
- **Inter-Tropical Convergence Zone (ITCZ)** - the area encircling the earth near the equator where winds originating in the northern and southern hemispheres come together

K

- **kimberlites** – explosive volcanic pipes which contain an assemblage of minerals, including occasionally diamonds, that indicate an origin deep within the mantle

L

- **Last Glacial Maximum (LGM)** – a time period in Earth's history when thickness and extent of glaciers is at a maximum. Sea levels would be at their lowest in this time as the sea water is held in the ice. The last glacial maximum occurred around 20,000 years ago
- **linear dune** – ridge of sand that is much longer than it is wide
- **linear oasis** – generally a long oasis along an ephemeral river
- **longshore drift** – movement of material/sediment parallel to the shore and driven by the wind
- **LOW [Low Oxygen Water]** – depletion of oxygen in the water column to the point where it is detrimental to the health of organisms

M

- **mangroves** – trees that grow in coastal saline environments in tropical and sub-tropical areas
- **mantle** - region forming the main bulk of the earth. It lies between the crust and the core at depths of about 40km to 2,900 kilometres
- **marine** – relating to the sea
- **meta-sediments** – sediments that have been metamorphosed, i.e. subjected to heat and pressure, generally during the collision of tectonic plates
- **methane hydrates** – methane, CH_4, gas trapped within an ice crystal; also known as "fire ice"

P

- **Palaearctic** - a zoogeographical region consisting of Europe, Africa north of the Sahara, and most of Asia north of the Himalayas
- **pegmatite** – a very coarse grained igneous rock
- **pelagic fish** – those fish that live and feed away from the bottom in the open water column rather than in waters adjacent to land
- **perennial** – lasting a long time, generally more than a year
- **permafrost** – that portion of the Earth's surface that is permanently frozen
- **phosphorite** – a sedimentary rock enriched in phosphate minerals
- **phytoplankton** – microscopic plant life that floats free in the sea, mainly single-celled algae and cyanobacteria. Phytoplankton form the beginning of the food chain for aquatic animals
- **plankton** – the small or microscopic plant (phytoplankton) and animal (zooplankton) organisms that float or drift in great numbers in fresh or salt water especially at or near the surface

R

- **Red Data species** – species that are listed in the IUCN Red List of Threatened Species. This is the world's most comprehensive inventory of the conservation status of plant and animal species. Species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation
- **rhyolite** – a fine-grained volcanic rock containing quartz and feldspar
- **riparian vegetation** – the plant life along a river course

S

- **seismic sensors** – sensors used to detect artificially induced sound waves and used to understand the structure of rocks lying below the surface

T

- **terrestrial** – relating to the land
- **terrigenous sediment** – sedimentary deposits derived from the erosion of the land, for example sandstone, shale
- **tonne** - a mass equivalent to 1,000 kilograms whereas one ton is 2,000 pounds (lbs) (USA) or 2,240 pounds (UK)
- **transverse dune** – strongly asymmetrical sand dune elongated perpendicular to the direction of the prevailing wind

U

- **upwelling** - the wind driven motion of deep, cold, dense water to the surface often bringing with it abundant nutrients

Y

- **yardang** – a sharp, keel-like ridge of rock formed by wind scour

Z

- **zooplankton** – a collective name for minute marine animal life which floats feely in the sea, and which consists mainly of small crustaceans (such as copepods and krill), rotifers and fish larvae

LATIN NAMES

!nara - *Acanthosicyos horridus*
abalone - *Haliotis midae*
aardvark - *Orycteropus afer*
African black oystercatcher - *Haematopus moquini*
African elephant - *Loxodonta africana*
African penguin - *Spheniscus demersus*
African river prawn - *Macrobrachium vollenhovenii*
albacore - *Thunnus alalunga*
alfonsino - *Beryx splendens*
ana tree - *Faidherbia albida*
anchovy - *Engraulis capensis*
bank cormorant - *Phalacrocorax neglectus*
Barlow's lark - *Certhilauda barlowi*
bat-eared fox - *Otocyon megalotis*
bearded goby/Pelagic goby - *Sufflogobius bibarbatus*
Benguela long-billed lark - *Certhilauda benguelensis*
bigeye tuna - *Thunnus obesus*
bitter bush - *Pechuel-Loeschea leubnitziae*
black-backed jackal - *Canis mesomelas*
black-necked grebe - *Podiceps nigricollis*
black rhinoceros - *Diceros bicornis*
blacktail - *Diplodus sargus*
Blainville's beaked whale - *Mesoplodon densirostris*
blue shark - *Prionace glauca*
blue whale - *Balaenoptera musculus*
bottlenose dolphin - *Tursiops truncatus*
boxthorn - *Lycium* spp.
Bradfield's Namib day gecko - *Rhoptropus bradfieldi*
brown hyaena - *Hyaena brunnea*
bushman's candle - *Sarcocaulon* spp.
camelthorn - *Acacia erioloba*
Cape anchovy - *Engraulis capensis*
Cape cormorant - *Phalacrocorax capensis*
Cape fur seal - *Arctocephalus pusillus*
Cape gannet - *Morus capensis*
Cape hake - *Merluccius capensis*
Cape Horse Mackerel - T*rachurus capensis*
Cape John Dory - *Zeus capensis*
Caspian tern - *Hydroprogne caspia*
chacma baboon - *Papio ursinus*
chestnut-banded plover - *Charadrius pallidus*
copper shark - *Carcharhinus brachyurus*
crowned cormorant - *Phalacrocorax coronatus*
Damara tern - *Sterna balaenarum*
dassie rat - *Petromus typicus*
deep-sea red crab - *Chaceon maritae*
deep-water Cape hake - *Merluccius paradoxus*
dentex - *Dentex* spp.
desert plated lizard - *Angolosaurus skoogi*
dollar bush - *Zygophyllum stapfii*
dune lark - *Certhilauda erythrochalamys*
dusky dolphin - *Lagenorhynchus obscurus*
dusky kob - *Argyrosomus coronus*
elephant's foot - *Adenia pechuelii*
European oyster - *Ostrea edulis*
fin whale - *Balaenoptera physalus*
galjoen - *Dichistius capensis*
ganna - *Salsola* spp.
gemsbok - *Oryx gazella*
Gewürzdolde - *Marlothiella gummifera*
ghost crab - *Ocypode cursor*
giraffe - *Giraffa camelopardalis*
Gray's lark - *Ammomanes grayi*
greater flamingo - *Phoenicopterus roseus*
greater kudu - *Tragelaphus strepsiceros*
great white pelican - *Pelecanus onocrotalus*
great white shark - *Carcharodon carcharias*
green turtle - *Chelonia mydas*
grey-headed gull - *Larus cirrocephalus*
halfmens - *Pachypodium namaquanum*
Hartlaub's gull - *Larus hartlaubii*
hawksbill turtle - *Eretmochelys imbricata*
Heaviside's dolphin - *Cephalorhynchus heavisidii*
Hoesch's toad - *Poyntonophrynus hoeschi*
Horse Mackerel - *Trachurus capensis*
humpback whale - *Megaptera novaeangliae*
jacopever - *Helicolenus dactylopterus*
kelp - *Laminaria pallida*
kelp gull - *Larus dominicanus*
kingklip - *Genypterus capensis*
klipspringer - *Oreotragus oreotragus*
krimpvarkie - *Aloe erinacea*
leatherback turtle - *Dermochelys coriacea*
lesser flamingo - *Phoenicopterus minor*
lion - *Panthera leo*
living stones - *Lithops* spp.
loggerhead turtle - *Caretta caretta*
longfin tuna - *Thunnus alalunga*
marbled rubber frog - *Phrynomantis annectens*
mesquite - *Prosopis* spp.
monkfish - *Lophius vomerinus and L. vaillanti*
mussel - *Mytilus galloprovincialis*
mustard bush - *Salvadora persica*
Nama padloper - *Homopus solus*
Namaqua barb - *Barbus hospes*
Namaqua chameleon - *Chamaeleo namaquensis*
Namib dune gerbil - *Gerbillurus tytonis*
Namib golden mole - *Eremitalpa granti*
Nile crocodile - *Crocodylus niloticus*
Nile soft-shelled terrapin - *Trionyx triunguis*
olive ridley turtle - *Lepidochelys olivacea*
orange roughy - *Hoplostethus atlanticus*
orca (killer whale) - *Orcinus orca*
ostrich - *Struthio camelus*
Pacific oyster - *Crassostrea gigas*
pencil bush - *Arthraerua leubnitziae*
Péringuey's adder - *Bitis peringueyi*
periwinkle - *Littorina* spp.
pilchard - *Sardinops ocellata*
plough snail - *Bullia* spp.
porcupine - *Hystrix africaeaustralis*
reed - *Phragmites australis*
rock hyrax - *Procavia capensis*
Rüppell's korhaan - *Eupodotis ruppelli*
Sesfontein-aalwyn - *Aloe dewinteri*
shallow-water hake - *Merluccius capensis*
shortfin mako shark - *Isurus oxyrinchus*
shovel-snouted lizard - *Meroles anchietae*
silver kob - *Argyrosomus inodorus*
smooth-hound shark - *Mustelus mustelus*
snoek - *Thyrsites atun*
southern African sardine - *Sardinops sagax*
southern bottlenose whale - *Hyperoodon planifrons*
southern right whale - *Eubalaena australis*
sperm whale - *Physeter macrocephalus*
spotted gulley shark - *Triakis megalopterus*
spotted hyena - *Crocuta crocuta*
springbok - *Antidorcas marsupialis*
swift tern - *Sterna bergii*
swordfish - *Xiphias gladius*
tamarisk - *Tamarix usneoides*
tractrac chat - *Cercomela tractrac*
welwitschia - *Welwitschia mirabilis*
wild tobacco - *Nicotiana glauca*
warty gracilaria - *Gracilaria gracilis*
web-footed gecko - *Palmatogecko rangei*
west coast rock lobster - *Jasus lalandii*
west coast sole - *Austroglossus microlepis*
west coast steenbras - *Lithognathus aureti*
white-breasted cormorant - *Phalacrocorax lucidus*
white-fronted sandplover - *Charadrius marginatus*

Rugged, sometimes bleak or forbidding, and largely uninhabited, the Namibian coast is a fascinating and complex mix of richness and paucity. The warm and dry Namib Desert stands in stark contrast to the cold waters of the Benguela current which is so biologically productive. In combination, the ocean and desert provide a harsh and spectacular environment that remains largely pristine.

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