# Benguela Upwelling System

## General Information

## Summary

The Benguela upwelling system is bounded in the north and south by warm water current systems and characterized by very high primary production (>1000 mg C.m-2.day-1). This high biological productivity supports numerous commercial, artisanal and recreational fisheries. It includes important spawning and nursery areas for fish as well as foraging areas for endangered and threatened bird species. Another key characteristic feature is the diatomaceous mud-belt in the Northern Benguela. This includes regionally unique low oxygen benthic communities that depend on sulphide oxidising bacteria.

## Introduction of the area

The Benguela upwelling system is one of the four major eastern boundary upwelling systems in the world and includes the most intensive wind-induced upwelling cell in the world, at Lüderitz (Bakun 1996). It is globally unique in the sense that it is the only cold-water upwelling system bordered by warm-water systems in the north (Angolan Current system) and in the south (Agulhas Current system; Shillington et al., 2007).

## Description of the location

## EBSA Region

South-Eastern Atlantic

## Description of location

The Benguela Upwelling System extends from Cape Point in the south to the Angola-Namibia border (17°15'S) in the north, from the high-water mark of the south-west African coast to the offshore limit of the >1000 mg C.m-2.day-1 productivity threshold derived from the mean of the Vertically Generalized Production Model (VGPM) estimates of Global Ocean Productivity. There is a small extension of this area in the north outside the Angolan EEZ, which spans about 435 km north, at approximately 375 km offshore of the Namibian-Angolan border.

## Geo-Location

SEA\_43\_EBSA.geojson

## Area Details

## Feature description of the area

The Benguela upwelling system is a wind-driven upwelling system, bounded by warm-water systems in the north and the south. Strong equatorial wind stress induces Ekman offshore transport of surface water, which is replaced by cool, nutrient-rich subsurface water. The upwelling process leads to cool and nutrient-rich conditions in the surface layers of the water column. High primary productivity areas are found upstream of the upwelling cells, supporting high abundances of pelagic and demersal fish. Spawning and nursery areas of key pelagic species (sardine, anchovy and horse mackerel) are located within the system (Hutchings et al., 2009). The intensive Lüderitz upwelling cell acts as a barrier to the movements of several species and effectively divides the system into northern and southern components (van der Lingen et al., 2006). A characteristic feature of the northern Benguela system is the seasonally occurring low-oxygen water, at times leading to hydrogen sulphide events (Bartholomae and van der Plas 2007). The reoccurring hypoxic events can have detrimental effects on the biota, including lobster “walkouts” and fish die-offs. A striking feature of the northern Benguela system is the diatomaceous mud-belt on the inner continental shelf of Namibia, off Walvis Bay (Bremner 1980). The productivity of the environment and the abundant stocks of zooplankton and fish that they support in turn sustain abundant top predator populations, including 15 species of seabirds (9 of which are endemic) that breed in the region, several shorebirds species, the Cape fur seal, and several cetacean species – one of which is endemic to the Benguela current (Best et al., 1997, Best 2007, Crawford 2007, Kemper et al., 2007). Apart from productivity, the strong prevailing winds in the area also have a cooling effect that provides benign climatic conditions for land-breeding marine predators, such as seals and seabirds, with the system being characterized by numerous large seal and seabird colonies (Peard 2007). There are six confirmed coastal Important Bird Areas (IBAs) in the area (excluding Angola), four in Namibia and two in South Africa (BirdLife International 2013), and a further 12 marine or coastal IBAs that have been proposed for the system (6 in Namibia and 6 in South Africa; BirdLife International 2013). The area encapsulates important breeding and foraging areas for locally endemic breeding seabird species such as the African penguin (*Spheniscus demersus*), Cape gannet (*Morus capensis*), Bank cormorant (*Phalacrocorax neglectus*), the Cape cormorant (*P. capensis*), various tern and gull species, as well as important foraging areas for several non-breeding visitors to the area, including black-browed albatrosses, Atlantic (*Thalassarche chlororhynchos*) and Indian (*T. carteri*) yellow-nosed albatrosses, Corys shearwater (*Calonectris diomedea*) and white-chinned petrels (*Procellaria aequinoctialis*) (BirdLife International 2013). In South Africa, the system encompasses a key foraging area for populations of Southern right whales, *Eubalaena australis* (Best 2006) and Humpback whales, *Megaptera novaeangliae* (Barendse et al., 2011).

## Feature conditions and future outlook of the proposed area

The northern Benguela ecosystem historically supported high pelagic catches. Overfishing and possible changes in the ecosystem have led to a decline in pelagic species, leaving the northern Benguela system in a “degraded” state with some evidence of “jellification” (Roux et al., 2013). This has been reflected in population declines in the breeding populations of several piscivorous predators in the northern Benguela, including the African penguin (Endangered) and Cape gannet (Vulnerable); the Bank cormorant (Endangered) has also declined drastically. The southern Benguela ecosystem appears to have been more stable, and the fish stocks appear to have benefited from relatively conservative fisheries management strategies implemented over the past several decades (Cury and Shannon 2004). Nevertheless, there have been recent shifts in the geographical distribution of important prey species in the Southern Benguela Current Ecosystem, most importantly eastward shifts in the distribution of the sardine (*Sardinops sagax*), anchovy (*Engraulis capensis*) and west coast rock lobster (*Jasus lalandii*) stocks since the 1990s (Roy et al., 2007, Cockroft et al., 2008, Coetzee et al., 2008). This has evidently had negative consequences for seabirds on the west coast of South Africa, with general declines in breeding populations of seabirds, including African penguin, Cape gannet and bank cormorant within the proposed area (Crawford et al., 2008a, b).

Diamond mining proliferates in the areas between 26 and 30°S, and further exploratory licenses are being awarded for diamond and other marine mining interests along the entire Namibian coast. Mining licenses and exploratory licenses for industrial minerals, such as phosphates, have also been awarded along the entire Namibian coast, and further applications for bulk commodity seabed mining are expected. Petroleum exploration and production are taking place within the Namibian and South African components of this area. The Bhubesi gasfield is under development in South Africa, and the Kudu gasfield in Namibia is earmarked to be developed within the next two years.

In Namibia, bottom-trawling is not permitted in waters shallower than 200 m, and in some areas in southern Namibia, not shallower than 300 m. Regular surveys to assess the biomass of commercially important fish stocks (sardine, horse mackerel, monkfish, hake) are conducted in Namibia. Namibia also has an oceanographic monitoring programme under which regular oceanographic monitoring surveys to collect data on temperature, salinity, oxygen, nutrients, phytoplankton and zooplankton are conducted. Monitoring lines are at latitudes 20°S, 23°S, 25°S, 26°S and 27°S. Similar environmental monitoring lines are also conducted in South Africa, e.g., the monthly St Helena Bay monitoring line (Hutchings et. al. 2012). Annual fish abundance/biomass surveys are conducted for commercially important demersal species (hakes) and small pelagic species (a recruitment survey in winter and a spawner survey in late spring- early summer).

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## Other relevant website address or attached documents

SEA\_43\_EBSA-GIS shapefile.zip (/api/v2013/documents/1F575688-670F-7A40-23DA-254E65611FF1/attachments/SEA\_43\_EBSA-GIS%20shapefile.zip)

## Status of submission

Areas described as meeting EBSA criteria that were considered by the Conference of the Parties

## COP Decision

dec-COP-12-DEC-22

## Assessment of the area against CBD EBSA criteria

C1: Uniqueness or rarity High

Justification

This area meeting EBSA criteria is the only eastern boundary upwelling system that is bounded by warm water systems in the north and in the south (Shillington et al., 2007, Hutchings et al., 2009). The broader area also includes some unique oxygen minimum zones with unique fauna and flora (Bartholomae & van der Plas 2007).

C2: Special importance for life-history stages of species High

Justification

Spawning and nursery areas for pelagic species (sardine, horse mackerel, anchovy) occur within the area (Hutchings et al., 2009). This contributes to suitable conditions that sustain large land-breeding marine top predator populations (Best 1997, Peard 2007, Kirkman et al., 2011) and cetacean populations (Best et al., 1997), including summer foraging areas for populations of southern right whales and humpback whales (Best 2006, Barendse et al., 2011), and winter foraging areas for leatherback turtles (Harris et al., in review). The area also provides important oceanic foraging habitat for non-breeding seabird visitors to the area, including black-browed and Atlantic yellow-nosed albatross, the white chinned petrel and Cory’s shearwater species. There are four confirmed and 12 proposed IBAs in the Benguela Upwelling System (BirdLife International 2013).

C3: Importance for threatened, endangered or declining species and/or habitats High

Justification

Foraging and breeding habitat for several endemic species, including threatened seabird species such as the African penguin (Endangered), the Cape gannet (Vulnerable) the bank cormorant (Endangered) and several tern Sterna spp (Kemper et al., 2007), as well as foraging habitat for non-breeding seabird visitors to the area, including black-browed and Atlantic yellow-nosed albatross (both Endangered), the white chinned petrel (Vulnerable) and Cory’s shearwater. This is reflected in the fact that there are four confirmed and 12 proposed Important Bird Areas in the area meeting EBSA criteria (BirdLife International 2013). The Benguela Upwelling system is also an important foraging ground for Critically Endangered leatherbacks (Harris et al., in review).

C4: Vulnerability, fragility, sensitivity, or slow recovery Medium

Justification

Due to the purely wind-driven nature of the area meeting EBSA criteria, it is believed to be vulnerable to climate change (Hutchings et al., 2009). Furthermore, as is the case with most marine ecosystems, the biological characteristics of the area are governed by complex trophodynamics, and thus this area is also vulnerable to irresponsible and/or unregulated human practices such as overfishing (Roux et al., 2013) and industrial negligence and/or catastrophes that may lead to largescale pollution, which would perturb the biological equilibrium of the system (Wikipedia 2013). With interests and activity from the petrochemical and diamond mining industries on the rise within the area (i.e., along the Namibian and South African coasts – see second paragraph of “Feature condition and outlook” section”) the latter statement carries with it notable concern and thus justifies the medium rank for this EBSA criterion.

C5: Biological productivity High

Justification

The area incorporates the most intensive wind-induced upwelling cell in the world – located just off Lüderitz (Bakun 1996), and seven other upwelling cells (Hutchings et al., 2009). This is reflected in the very high productivity of the system (Bakun 1996), the abundance of fish stocks and higher trophic level species (van der Lingen et al., 2006), and the numerous commercial, artisanal and recreational fisheries it supports. The key highly productive fisheries include pelagic fisheries, demersal fisheries (including 2 species of hake *Merluccius* spp.), midwater purse-sein and demersal crustacean fisheries.

C6: Biological diversity Medium

Justification

The area constitutes a highly productive system that is, however, a diverse system when compared to other systems of similar scale, such as the Angola and Agulhas Current systems (Griffiths et al., 2010). The area comprises a rich diversity of land-breeding marine top predators (Payne and Crawford 1989, Best et al., 1997), and this justifies the medium rank for this EBSA criterion.

C7: Naturalness Medium

Justification

Over-fishing in the past, especially in the northern Benguela, mining and petroleum activities in areas of Namibia and the northern part of South Africa have had some impact within the described area. In addition, some pollution, especially industrial centres/harbours, oil spills, invasive species and altered freshwater outflows are pressures on the marine ecosystems and biodiversity within the area (van der Lingen et al., 2006, Griffiths et al., 2010, Sink et al., 2012). Despite these pressures there are many areas in good condition (Sink et al., 2012), and overall the region is considered to be in a moderately natural state.