Title/Name of the area:

Mozambique Channel

Presented by (*names, affiliations, title, contact details)*

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Abstract (*in less than 150 words)*

The Mozambique Channel can be characterized in its entirety as an EBSA, or can be broken down into sub-regions, each with their own particular significance. The ecology of the area is driven by the oceanography of strong eddies and mixing, producing a highly productive ecosystem that attracts a wide range of species, many of them threatened and endangered.

Introduction

The Mozambique Channel is bounded by the oldest coastlines and seabed of the Indian Ocean, and marks the 1st stages in the tectonic movements that created the ocean.

The eddy and gyre generation dynamics of the channel are unique globally, contributing to the western boundary currents in the Indian Ocean that play a role in the global conveyor belt of ocean circulation, and regulation of the climate system. Similar upwelling and turbulence features are produced on the Madagascar plateau, that feed into the southern Mozambique channel and thence into the Agulhas Current system. The geology and oceanography of the channel profoundly affect the ecosystem dynamics and habitats of the channel. The unique eddy dynamics of the channel and upwelling on the Madagascar Plateau contribute to the highly connected and highly productive shallow benthic and pelagic marine communities, affecting the productivity of coral reefs, planktonic and pelagic communities alike, and the behavior, spatial and temporal activities of species groups including large fish, marine turtles, seabirds and marine mammals.

Location

The Mozambique channel extends from about 12°N, where the Glorioso Front marks the transition from the South Equatorial Current to the waters of the channel, slightly N of Glorieuses island, to about 25°S at

a line stretching from the southern tip of Madagascar to Mozambique. It varies from approximately 800-900 km wide at its northern and southern ends, to a minimum of 400 km wide at about 16°S. The channel covers 13° of latitude and varies between 400-900 km wide, equivalent to almost 1 million km^{2} of ocean.

The Mozambique channel is entirely within the EEZs of the neighbouring countries, which include Mozambique, Madagascar, the Comoros, Tanzania and France.

Feature description of the proposed area

The oceanography of the Mozambique channel was unknown until ten years ago, when the existence of highly variable eddies several 100 km across, often in dipoles (an anticyclonic and cyclonic eddy pair) that formed in the region around the Comoros were discovered. As a result of vorticity imparted into the flow of the SEC as it flows around the tip of northern Madagascar, both cyclonic (clockwise) and anticyclonic (anticlockwise) eddies are generated. At times, a larger gyre is also formed that circulates around the Comoro islands. Further dynamism in these features is imparted by Rossby waves that cross the Indian Ocean, interacting with the narrow constriction of the channel at 16oS. Often eddies are generated in pairs that move southwards through the channel, and 6-8 pairs may be formed through the course of a year.

The consequences of eddy formation ramify throughout the channel, and at all levels of biological functions. Because water flows in all directions as a result of the eddies, genetic connectivity throughout the Mozambique channel is likely very high, particularly in the north, resulting in high retention and recruitment of larvae in pelagic and shallow marine ecosystems, and thereby high resilience of communities and populations. Due to the rotation of the eddies, they also result in down- and up-welling of water, and warmer and cooler temperatures in the centers of the eddies, and this transfers nutrients across the thermocline. Further, the eddies reach throughout the water column to at least 1000 m depth, and as these touch the continental shelves they draw nutrients off the slopes and into the water column. These eddy dynamics profoundly affect pelagic biological communities including phytoplankton, zooplankton, larger invertebrates, fish and marine mammals, and birds. While the full biological consequences of the eddy dynamics are not yet known these count as a unique oceanic system and likely to be critically important not only for the biology of species and ecosystem processes in the Mozambique channel, but also for fisheries and other economic uses.

Finally, the highly dynamic eddies and net current in the channel contributes about 50% of the water transported in the Agulhas current, forming a link in the chain of transport of water masses from the Pacific back to the Atlantic. This contribution of water from the Indian to the Atlantic oceans may be a significant factor in climate regulation on a planetary scale, and a justification for new research to address this question.

The interaction of waters of the East Madagascar Current flowing southwards and over the Madagascar Plateau results in highly dynamic and productive coastal and offshore upwellings. Due to the continuity of the Madagascar Plateau with Madagascar island, and similar turbulent interactions between the geology and ocean currents at northern and southern tips of the island, this Plateau is used here to extend what is normally considered as the Mozambique channel boundary farther south, beyond the tip of Madagascar. Turbullent currents and upwelling waters from the Madagascar Plateau flow into the southern part of the Mozambique Channel, interact with the waters here (and hence may also influence channel dynamics farther north when carried north in eddies), and the two merge to form the Agulhas Current off South Africa. To capture these interactions, the Mozambique Channel as described here, includes features of the oceanography of the Madagascar Plateau.

Over an evolutionary timescale, the geology and oceanography of the Mozambique channel may have played a key role in driving the evolutionary dynamics of the Western Indian Ocean, maintaining and accumulating species in the northern Mozambique channel in a biodiversity center second in absolute numbers to the Coral Triangle region, but with a unique evolutionary history and genetic diversity.

Genetic connectivity in the Mozambique channel show several overlapping patterns – one of high mixing from north to south and distinct from points farther north (coelacanth), and one showing a barrier at the narrow constriction of the channel, showing southern and northern populations (green turtle). Corals show highest diversity, and indications of high connectivity in the northern Mozambique Channel.

Fish: the highest fish diversity in the WIO, with high abundance found in deeper waters such as the St Lazarus bank.

Turtles: notable nesting site for greens and hawksbills and foraging ground for olive ridleys, loggerheads and leatherbacks.

Marine mammals: important humpback whale mother/calf nursing zone.

Sharks and Rays: a superlative reef shark site between Vamizi/Metundo islands shows the influence of variable currents in aggregating the sharks, and in protecting them from use.

Birds: high densities of migrating crab plovers, and breeding populations of varied birds on remote islands and rocks.

Feature condition and future outlook of the proposed area

Threats: the Mozambique channel is bordered by long coastlines and nations with growing and active fishing fleets, and the increased understanding of productivity in the channel will undoubtedly lead to increased and targeted exploitation of fisheries and other living resources. Extraction for genetic resources is growing, reflecting the high genetic diversity in the channel, as are threats of mineral, oil and gas extraction, and climate change.

Management: at the level of the channel, and with respect to oceanographic processes, management within the channel is nascent. Individual countries have taken steps towards site-based management in MPAs (Mozambique and Madagascar in coastal MPAs, France in whole-EEZ MPAs in Mayotte and Glorieuses) requiring additional instruments relevant to ICZM, EEZ and fisheries instruments to regulate threats sufficiently to meet WH designation for individual sites, or the channel as a whole. The Nairobi Convention is the prime convention relevant to marine and coastal management, that all countries bordering the channel are party to.

Assessment of the area against CBD EBSA Criteria

(Discuss the area in relation to each of the CBD criteria and relate the best available science. Note that a candidate EBSA may qualify on the basis of one or more of the criteria, and that the boundaries of the EBSA need not be defined with exact precision. And modeling may be used to estimate the presence of EBSA attributes. Please note where there are significant information gaps)

CBD EBSA Criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		Don't Know	**Low**	**Some**	**High**
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or				**X**

	communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				
See above description on oceanography/biogeography, for unique geomorphological and oceanographic features					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.			**X**	
Fish: the highest fish diversity in the WIO, with high abundance found in deeper waters such as the St Lazarus bank. *Turtles: notable nesting site for greens and hawksbills and foraging ground for olive ridleys, loggerheads and leatherbacks.* *Marine mammals: important humpback whale mother/calf nursing zone.* *Sharks and Rays: a superlative reef shark site between Vamizi/Metundo islands shows the influence of variable currents in aggregating the sharks, and in protecting them from use.* *Birds: high densities of migrating crab plovers, and breeding populations of varied birds on remote islands and rocks.*					
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.				**X**
Many threatened and endangered species (turtles, mammals, birds), centre of diversity for corals. See also above.					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				**X**
Coral reefs, highly susceptible and fragile to global warming					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				**X**
Mesoscale dynamics of the mozambique channel drive highly productive pelagic communities, mobile with the eddies as they move through the channel					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				**X**
Highest diversity of coral reef species and coral habitats, and likely highest diversity in the WIO of different marine (benthic and pelagic) habitats, with high genetic diversity					

Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			**X**	
Some areas are remote and have suffered less impact from human-induced disturbance, but as a whole, region-scale vulnerability is high.					

Sharing experiences and information applying other criteria (Optional)

Other Criteria	**Description**	**Ranking of criterion relevance** (please mark one column with an X)			
		Don't Know	**Low**	**Some**	**High**
Add relevant criteria					
Explanation for ranking					

References

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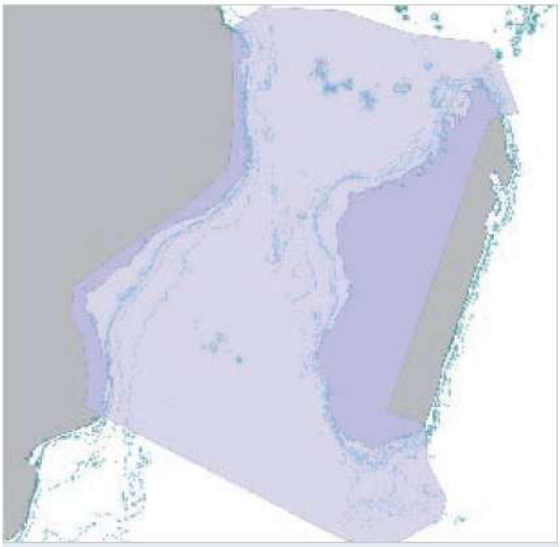
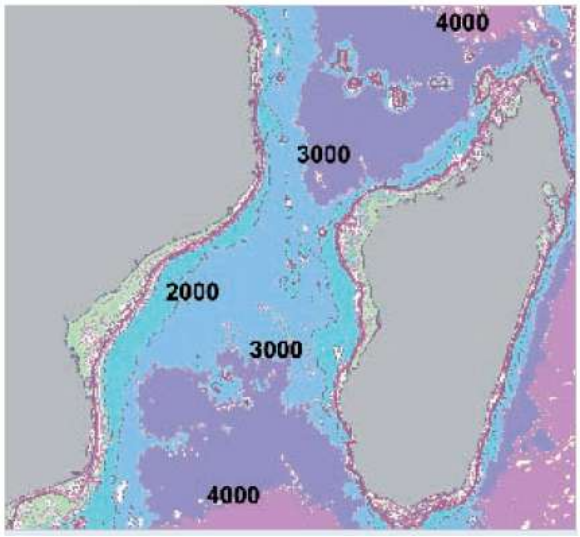
Maps and Figures

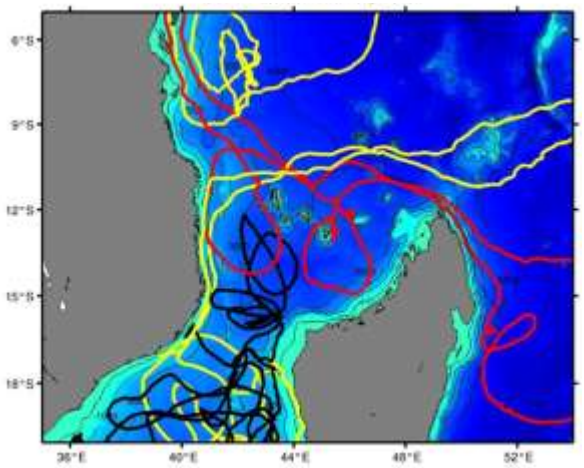
Figures below can be provided in higher resolution.



The Mozambique Channel. ©David Obura



Depth in the Mozambique channel, showing the major transitions from 2000 m in the mid-point of the channel down to >4,000m towards the basins to the north and south. ©David Obura



Connectivity patterns in the northern Mozambique channel, showing drifter paths that move across the entire channel, and both north and south out of the northern channel region. Source: Roman, unpubl.

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Text is from a soon-to-be published UNESCO World Heritage report: Assessing Marine World Heritage from an Ecosystem Perspective: The Western Indian Ocean, by David Obura, Julie Church, Catherine Gabrié.