

Appendix

Template for Submission of Scientific Information

to Describe Ecologically or Biologically Significant Marine Areas

*Note: Please **DO NOT** embed tables, graphs, figures, photos, or other artwork within the text manuscript, but please send these as separate files. Captions for figures should be included at the end of the text file, however.*

Title/Name of the area: Costa Rica Dome

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

Abstract (in less than 150 words)

The Costa Rica Dome is an area of high primary productivity in the northeastern tropical Pacific, which supports marine predators such as tuna, dolphins, and cetaceans. The endangered leatherback turtle (*Dermochelys coriacea*), which nests on the beaches of Costa Rica, migrates through the area. The Costa Rica Dome provides year-round habitat that is important for the survival and recovery of the endangered blue whale (*Balaenoptera musculus*). The area is of special importance to the life history of a population of the blue whales, which migrate south from Baja California during the winter for breeding, calving, raising calves and feeding.

Introduction

(To include: feature type(s) presented, geographic description, depth range, oceanography, general information data reported, availability of models)

Biological hot spots in the ocean are often created by physical processes and have distinct oceanographic signatures. Marine predators, including large pelagic fish, marine mammals, seabirds, and fishing vessels, recognize that prey organisms congregate at ocean fronts, eddies, and other physical features (Palacios et al, 2006). One such hot spot occurs in the northeastern tropical Pacific at the Costa Rica Dome.

The Costa Rica Dome was first observed in 1948 (Wyrski, 1964) and first described by Cromwell (1958). The dome has been observed and studied several times since the late 1950s, when a productive tuna fishery began to develop in the region (Fiedler, 2002), although full biodiversity surveys are still lacking. The Costa Rica Dome can be defined as a shoaling of the generally strong, shallow thermocline with cold nutrient-rich upwelling (Fiedler, 2002). With a mean position near 9°N, 90°W, the dome varies in size and position throughout the year. The upwelling of deep water at the Costa Rica Dome results in an area of high primary production detectable by remote sensing, which can be considered a distinct biological habitat. The area is heavily exploited by highly migratory marine predators such as tuna, dolphins, and cetaceans, in

particular endangered blue whales (Fiedler, 2002, Palacios, et al 2006). It is also part of the migratory corridor of a population of endangered leatherback turtles nesting in Costa Rica.

The feature description below reports on the physical oceanography of this unique area, and summarizes our current state of knowledge about its biological diversity. In particular, the feature description will show the importance of the Costa Rica Dome as year-round habitat for the endangered blue whale, where feeding, breeding and calving takes place. In addition, data on its importance as part of the migratory path for leatherback turtles is presented.

Location

(Indicate the geographic location of the area/feature. This should include a location map. It should state if the area is within or outside national jurisdiction, or straddling both. It should also state if the area is wholly or partly in an area that is subject to a submission to the Commission on the Limits of the Continental Shelf)

The Costa Rica Dome varies in size and position throughout the year but the mean position is near 9°N 90°W, at the end of a thermocline ridge which shoals from west to east across the Pacific, between the westward North Equatorial Current and the Eastward North Equatorial Countercurrent. This ridge and the dome extend below the thermocline, to a depth of more than 300m. The Costa Rica Dome is mainly located in the high seas, but also straddles the national waters of Costa Rica, Nicaragua, El Salvador, Guatemala and México. It is a distinct and highly productive biological habitat where phytoplankton and zooplankton biomass is higher than in surrounding tropical waters (Fiedler 2002). The dome forms near the coast in February-March before strengthening offshore between July and November and eventually diminishing by December-January (Saito et al, 2005; Hofmann et al. 1981).

Figure 1 (annex on maps and figures) shows the minimum and maximum extent and location of the Costa Rica Dome, including national EEZs and the high seas. A GIS shape file of the mean position of the Costa Rica Dome will be provided along with this submission.

Feature description of the proposed area

(This should include information about the characteristics of the feature to be proposed, e.g. in terms of physical description (water column feature, benthic feature, or both), biological communities, role in ecosystem function, and then refer to the data/information that is available to support the proposal and whether models are available in the absence of data. This needs to be supported where possible with maps, models, reference to analysis, or the level of research in the area)

1. Physical description

The Costa Rica Dome is created through an interaction between wind and currents. It is an area of open ocean with a core of 55,000 km² and a maximum extent of approximately 1,515,000 km² (see figure 1). The Dome has a mean position at 9°N, 90°W, about 300 km off the Gulf of Papagayo, between Nicaragua and Costa Rica. It is an area where cold water upwelling from the deep ocean rises to just below the warm tropical surface layer. Winds blowing through the gaps in the Central American cordillera, as well as ocean currents, push the warm water aside to allow for the rising of nutrient-rich cold water. The boundary between the warm surface water and cold

deep water (called a thermocline) forms a dome-like feature, and gave the area its name (Hofmann *et al*, 1981; Xie *et al*, 2005; Ballesterro, 2006; Kahru *et al*, 2007). The defining feature is the shallowness of the thermocline, which at the Costa Rica Dome, often reaches to within 10 to 15m from the surface, compared to 30–40m to the north and south (Wyrki, 1964; Fiedler, 2002). The Costa Rica Dome is the peak of a thermocline ridge that forms between the westward North Equatorial Current and the Eastward North Equatorial Countercurrent, and shoals gradually from west to east before dropping off sharply between the dome and the coast (Hofman *et al*, 1981; Fiedler, 2002, Xie *et al*, 2005, Ballesterro, 2006).

Because the Costa Rica Dome is formed by wind and currents, its position changes from year to year and is constantly moving. It is associated with a cyclonic circulation of surface currents and is seasonally affected by large- and coastal-scale wind patterns (Kessler, 2006). Surface winds and currents in the region of the Costa Rica Dome change seasonally as the intertropical convergence zone (ITCZ) between the trade wind belts moves north and south with the sun. The dome forms near the coast in February-March before strengthening offshore in July due to the development of upwelling caused by wind stress. The upwelling persists throughout the summer and early fall. In November, the upwelled region is released, due to decreasing winds, as a wave propagating to the west along the thermocline ridge. The Dome diminishes by December-January (Hofmann *et al*, 1981; Saito *et al*, 2005). Figure 2 depicts the annual cycle of the Costa Rica Dome.

The Costa Rica Dome is similar to other tropical thermocline domes in several respects: it is part of an east–west thermocline ridge associated with equatorial circulation, surface currents flow cyclonically around it, and its seasonal evolution is affected by large-scale wind patterns. The Costa Rica Dome is unique because it is also forced by a coastal wind jet (Fiedler, 2002).

Due to upwelling, surface waters at the Costa Rica Dome are lower in temperature and higher in nitrate and chlorophyll than surrounding areas, resulting in high levels of primary production (Broenkow, 1965; Chavez & Barber, 1987; Fiedler, 2002, Vilchis *et al*, 2006). Upwelling areas such as the Costa Rica Dome can thus create unique, highly productive regions, making the oceanic habitat of the eastern tropical Pacific more heterogeneous and productive than other tropical oceans (Kessler 2002, Fiedler 2003, Ballesteros & Coen 2004; Vilchis *et al*, 2006). Dense populations of phytoplankton thrive in persistent upwelling regimes, and enhanced chlorophyll levels at the Costa Rica Dome (associated with relatively higher biomass of phytoplankton and high nutrient levels) are visible in satellite imagery (see figure 2). The coupling between sea level anomaly and a chlorophyll-a anomaly in the Costa Rica Dome is tighter than has been previously recorded anywhere in the world ocean (Kahru *et al*, 2007). Zooplankton biomass is increased here and, perhaps consequently, abundance of at least two cetacean species is markedly higher in the vicinity than in the surrounding tropical waters (Au and Perryman, 1985; Reilly and Thayer, 1990; Fiedler, 2002; Ballance *et al*, 2006).

Upwelling associated with the cyclonic circulation, combined with the presence of a seasonally predictable strong and shallow thermocline, make the Costa Rica Dome a distinct biological habitat, where phytoplankton and zooplankton biomass are higher than in surrounding tropical waters. The physical structure and biological productivity of the dome affect the distribution and feeding of whales and dolphins, probably through forage availability (Fiedler, 2002).

2. Biological communities

The highly productive Costa Rica Dome provides habitat for abundant communities of phytoplankton and zooplankton, which in turn provide a source of food for squid, commercially important tunas and cetaceans, including the endangered blue whale. In addition, there is evidence of the Costa Rica Dome being part of a migration corridor for leatherback turtles. This section will discuss the current state of knowledge about biodiversity at the Dome, with in-depth sections describing the importance of the Dome to blue whales and leatherback turtles.

The phytoplankton community at the Costa Rica Dome has been studied by at least Li *et al* (1983), Franck *et al* (2003) and Saito *et al* (2005). Each of these studies found that the phytoplankton community was dominated by a population of the cyanobacteria *Synechococcus* with cell numbers more than an order of magnitude higher than in other oceanic environments. Saito *et al* (2005) also hypothesized that there may be a unique water column chemical signature that allows *Synechococcus* instead of larger eukaryotic phytoplankton to bloom. Their studies found higher than usual concentrations of natural cobalt ligands, and the flux of high cobalt into surface waters. The chemical attributes of the cobalt measured were highly unusual, and its source is not understood (Saito *et al*, 2005).

The abundant phytoplankton growth supports higher-than-usual abundances of zooplankton at the Costa Rica Dome. An important component of the zooplankton community at the Costa Rica Dome consists of dense patches of euphausiids (krill) at various depths. These patches are of importance to the distribution of blue whales, with the total acoustic scattering from patches being a key feature in predicting blue whale proximity (Matteson, 2009).

A high abundance of jumbo flying squid (*Dosidicus gigas*) has been reported around the Costa Rica Dome, and has been the target of commercial fisheries. It is likely that the higher chlorophyll-a concentrations found in the Costa Rica Dome may lead to a favourable feeding ground for jumbo flying squid and the oceanographic conditions in the area may retain them there. Similarly large yellowfin tuna (*Thunnus albacares*) are common around the Costa Rica Dome and likely also feed there (Ichii *et al*, 2002). The Costa Rica Dome area consequently supports a commercial tuna fishery (Yamagata, 1992, Fiedler, 2002, FAO, 2005). While seabird data is lacking from the area, thermocline topography is likely a key variable in predicting distribution and abundance of seabirds in this area, probably due to its influence on the availability of seabird prey (Vilchis *et al*, 2006).

The Costa Rica Dome is significant for cetaceans, particularly blue whales and short-beaked common dolphins. Both of these species are found in great abundance at the Costa Rica Dome, likely due to the availability of food (euphausiids for blue whales and mesopelagic fishes and squids for the dolphins) (Ballance *et al*, 2006). The body of research related to the Costa Rica Dome as habitat for blue whales is extensive, and is summarized below. Less information is available on dolphin species beyond the short-beaked common dolphin (*Delphinus delphis*) and pantropical spotted dolphin (*Stenella attenuata*), although cruise reports from the area contain sightings of a number of dolphin species as well as other cetaceans, such as humpback whales (*Megaptera novaeangliae*) (Hoyt, 2009). Additionally, a study based on extensive delphinid sighting data and modelling of dynamic environmental and fixed geographic variables predicted that the Costa Rica Dome would be one of the areas with highest delphinid densities in the eastern tropical Pacific Ocean (Ferguson *et al*, 2005). Figure 3 shows a map of dolphin sightings from the eastern tropical Pacific, with concentrations apparent in the Costa Rica Dome area.

Further field research would be required to develop a fuller list of cetacean and other diversity in the area.

A. Blue whale habitat

The Costa Rica Dome is notable for being a unique year-round habitat for the blue whale (*Balaenoptera musculus*). The blue whale is the largest animal ever to have lived, and is classified as an endangered species on the IUCN Red List, but may in fact meet the criterion for critically endangered (Reilly et al, 2008). There are nine distinct blue whale populations in the world (classified by song, McDonald et al, 2006). The Eastern North Pacific blue whale population, estimated at approximately 3000 individuals, represents the largest remaining blue whale population on earth (Calambokidis and Barlow 2004). For a portion of this blue whale population, the Costa Rica Dome provides an area for feeding, mating, breeding, calving and raising calves (Mate et al, 1999; Hoyt, 2009; Hoyt and Tetley 2011). It may be an important habitat for the survival and recovery of this population (Matteson, 2009), and forms a key component in a network of blue whale habitat sites, several of which have already been partially protected off the California coast and in the Gulf of California, off México. However, most blue whale habitat in the eastern North Pacific has no formal protection.

Early evidence of the importance of the Costa Rica Dome as blue whale habitat came from whale sightings by scientists onboard research vessels (e.g. Wade & Friedrichsen, 1979; Reilly & Thayer, 1990). Reilly and Thayer (1990) analyzed the distribution of blue whales from sightings made during research cruises in the eastern tropical Pacific, discovering that over 90% of the sightings were made in just two locations: along Baja California and in the vicinity of the Costa Rica Dome. Later satellite tracking studies have linked the Baja California population of blue whales to those sighted at the Costa Rica Dome, indicating that the Costa Rica Dome may be a calving/breeding area for North Pacific blue whales (Mate *et al.*, 1999, Branch et al, 2007). Satellite tracking and modelling studies by Bailey et al (2009) resulted in maps that tracked the migration and foraging behaviours of blue whales between Baja California and an area west of the Costa Rica Dome, proposing that the Costa Rica Dome may represent an important migration corridor for the whales, and noting possible foraging behaviour linked to enhanced euphausiid standing stocks in the area (Bailey et al, 2009; Reilly and Thayer, 1990; Fiedler, 2002; Ballance et al, 2006). Figure 4 provides a map showing blue whale migratory routes from Baja California to the Costa Rica Dome resulting from the Bailey et al (2009) study.

Research results have also shown that Costa Rica Dome site is occupied by blue whales year round (Reilly & Thayer, 1990; Calambokidis and Barlow, 2004), suggesting either the presence of a resident population or that both northern and southern hemisphere whales visit, with temporal overlap. If a resident population is present, it is not known whether it might be a distinct, non-migratory population segment or whether some individuals may choose not to migrate every year (Calambokidis and Barlow, 2004). It has also been suggested, but not confirmed, that at least some blue whales may originate from the southern hemisphere (e.g. off Chile), migrating across the Equator to the Costa Rica Dome (IWC, 2008). The source of the year-round population is still unknown and subject to further research.

Studies of blue whale migrations between Baja California and the Costa Rica Dome and its vicinity have provided new insight into blue whale behaviour. The commonly-held view of blue whale (and other large baleen whale) life strategy has been that it consist of seasonal migrations

between productive, high latitude feeding grounds in the summer and unproductive, low-latitude breeding grounds in the winter, where feeding does not take place (Mackintosh 1965; Bailey, 2009). However, blue whales have been seen routinely feeding at the Costa Rica Dome (Hoyt, 2009; Mate *et al*, 1999, Reilly and Thayer, 1990). Because of the high productivity and standing stocks of the Costa Rica Dome, Reilly and Thayer (1990) hypothesized that blue whales may select low latitude sites that permit foraging. This hypothesis has been strengthened by the study of other similar blue whale populations around the world, leading to a suggestion that some populations of blue whales may use an alternative life strategy by selecting and exploiting predictable productive areas located in low- and mid latitudes, which are most conducive to feeding success (Rasmussen *et al*, 2007). The high productivity of the Costa Rica Dome may allow blue whales to feed during their winter calving/breeding season, unlike gray whales (*Eschrichtius robustus*) and humpbacks (*Megaptera novaeangliae*) which fast during that period (Mate *et al*, 1999). A study of blue whale migratory and foraging behaviours between Baja California and the Costa Rica Dome (Bailey *et al*, 2009) also indicated the whales may forage year-round. Matteson (2009) confirmed that feeding takes place at the Costa Rica Dome through collection of fecal samples from whales in the area. She also suggested that while foraging during the winter reproductive season is not typical of baleen whales, year-around foraging may be an important element in the survival and recovery of blue whale populations.

B. Eastern Pacific leatherback turtle post-nesting migration corridor, pelagic dispersal and nursery habitats, and linkage to interesting habitats and nesting beaches

Leatherback turtles (*Dermochelys coriacea*), classified as critically endangered on the 2010 IUCN Red List of Threatened Species, are the widest-ranging marine turtle species, and are known to migrate across entire ocean basins. (Bailey *et al*, 2012). The Costa Rica Dome and the surrounding area may be an important migratory path for a population of endangered leatherback turtles nesting in Costa Rica and may also provide critical habitat for neonate turtles. Populations of leatherback turtles in the eastern Pacific have declined by >90% during the past two decades, primarily due to unsustainable egg harvest and fisheries bycatch mortality (Spotila *et al*. 2000). While research and conservation efforts on nesting beaches are ongoing, relatively little is known about the eastern Pacific leatherback populations' oceanic habitat use and migration pathways. Continued and rapid declines of this critically endangered population underscore the urgent need to develop conservation strategies across all life stages.

Shillinger *et al*, (2008) analyzed the largest multi-year satellite tracking data set for leatherback turtles from their largest nesting colony at Playa Grande, Costa Rica. Their study describes the migrations, habitats, and dispersal of female leatherbacks, and the predictable effects of ocean currents on their migration. After completing nesting, the turtles headed southward, traversing the dynamic equatorial currents with rapid, directed movements. In contrast to the highly varied dispersal patterns seen in many other sea turtle populations, leatherbacks from Playa Grande traveled within a persistent migration corridor from Costa Rica, past the equator, and into the South Pacific Gyre, a vast, low-energy, low-productivity region. The migratory path of the turtles is shown in figure 5 in the annex. The turtles' migration took them between the southern edge of the Costa Rica Dome and the Costa Rica Coastal Current. They then crossed the energetic flow along the southern edge of the Costa Rica Dome between 8 °N and 6 °N on a SE heading. Once outside the Costa Rica Dome, they turned WSW before continuing westward aided by the South Equatorial Current. This study indicates that the Costa Rica Dome is part of the migratory

corridor of the leatherback turtle, and that the oceanographic features in this area play a role in this migration.

Shillinger *et al.* (2012) hypothesize that the Costa Rica Dome region may also provide critical habitat for neonate leatherback turtles, whose post-hatchling departure routes link coastal Mesoamerican nesting beaches to pelagic nursery habitats. Their study investigated leatherback hatchling dispersal from four Mesoamerican nesting beaches (Barra de la Cruz, Mexico: 15.88 N, 95.98 W; Playa Chacocente, Nicaragua: 11.58 N, 86.28 W; Playa Grande, Costa Rica: 10.38 N, 85.98 W; and Playa Carate, Costa Rica: 8.48 N, 83.48 W) using passive tracer experiments within a regional ocean modelling system (ROMS). The region offshore of the Pacific coast of Mesoamerica is characterized by dynamic ocean conditions. Wintertime winds through coastal mountain gaps contribute to the development of large-scale anti-cyclonic eddies within the Gulfs of Tehautepec and Papagayo; intense and stable features that can last for up to six months and propagate more than 2000 km offshore from the continental margin, transporting nutrient-rich coastal waters and organisms into the ocean interior. The evolution of tracer distribution from each of the nesting beaches showed the strong influence of eddy transport and coastal currents. Modeled hatchlings from Playa Grande, Costa Rica, were most likely to be entrained and transported offshore by large-scale eddies coincident with the peak leatherback nesting and hatchling emergence period (see figure 6). Shillinger *et al.* posit that these eddies potentially serve as 'hatchling highways', providing a means of rapid offshore transport away from predation and a productive refuge within which newly hatched turtles can develop. The results from their model support the hypothesis that hatchling leatherbacks emerging from nests in late winter at Playa Grande and other Mesoamerican nesting beaches can be rapidly and efficiently transported offshore within Papagayo eddies. Because turtles face increased predation risk near the beach, quick offshore transport is likely to increase the probability of survival. Moreover, these eddies provide a productive refuge within which newly hatched turtles can develop

A subsequent study by Bailey *et al.* (2012) mapped tracking data for leatherback turtle populations throughout the Pacific Ocean. Turtles tagged at Playa Grande, Costa Rica, are shown to migrate through the Costa Rica Dome and its surrounding area (see figure 7). The study also found that in the eastern Pacific, tagged turtles often exhibited behaviour related to searching for food in areas of upwelling, likely because such areas increase transport of nutrients and consequently prey availability (Shillinger *et al.* 2011, Bailey *et al.* 2012). Further research is required to fully understand turtles' response to oceanographic conditions.

In order to ensure that management and conservation efforts within the Costa Rica Dome region are meaningful for leatherbacks, improved and sustained conservation and management of Mesoamerican nesting beaches and interesting habitats (ranging to ~ 100 km from the coast) is essential. During the nesting season, adult female leatherback turtles nest multiple times and occupy coastal marine habitats near their nesting beaches. Shillinger *et al.* (2011) characterized the interannual variability of high-use internesting habitats used by 44 (out of 46 total) female leatherback turtles that were satellite-tagged at Playa Grande, Costa Rica, from 2004 to 2007. Although the core 25% utilization distribution (UD) remained predominantly centered within the marine protected area, Parque Nacional Marino Las Baulas (PNMB), there was considerable interannual variation in the shape and area of the larger utilization distribution (UD) polygons, which was driven by variability in the thermal environment (Figure 8). The authors observed interannual variation in turtle swimming speeds and distance traveled from the nesting beach as well as significantly deeper and longer dive durations to cooler temperatures during 2007, perhaps in response to the warming trend from the south driven by the strong Costa Rica Coastal

Current. This research suggested that interannual changes in oceanographic conditions, even at small or local scales (e.g. interesting region), can influence the behavior and distribution of interesting leatherback turtles. Taken together with the findings from Shillinger et al. (2008, 2010, and 2012), these results validate the importance of PNMB as a critical habitat for interesting leatherback turtles, but also suggest that an expansion of Parque Nacional Marino Las Baulas (PNMB) is warranted. This expansion should consider the influences of regional environmental variation on the near-shore turtle movements and behaviors of interesting turtles, as well as opportunities for integration of conservation and management connectivity (i.e. migration corridor and putative hatchling dispersal habitats) with other life-history stages (hatchling and post-nesting dispersal) for this same population of leatherback turtles.

Feature condition and future outlook of the proposed area

(Description of the current condition of the area – is this static, declining, improving, what are the particular vulnerabilities? Any planned research/programmes/investigations?)

While the Costa Rica Dome varies in extent and location annually, it is a persistent and predictable feature, supporting high biological productivity. Sufficient biodiversity data are not available to be able to provide information about trends in the Costa Rica Dome. As the feature description above indicates, the area is important for the endangered blue whale and may be an important migratory corridor for the critically endangered leatherback turtle.

It is likely that the greatest vulnerability to cetaceans and sea turtles in the area comes from commercial fisheries and ship traffic, particularly from ship strikes and noise associated with ship traffic. The Costa Rica Dome is an important pelagic fishery area, particularly for tunas and squids (FAO, 2005) and is also likely traversed by ship traffic to and from the Panama Canal. Interactions with fisheries are believed to be a major cause of mortality for adult leatherback turtles, which is of particular concern in the Pacific Ocean, where they have been rapidly declining (Bailey et al, 2012). It is conceivable that commercial tuna fisheries in the area may take leatherback turtles as by-catch, while ship noise may be associated with chronic stress in whales (Rolland et al, 2012). In addition, Loss of the Costa Rica Dome through overfishing or other threats could mean the disappearance, displacement or marginalization of this population of blue whales currently known to be increasing (Hoyt, 2009).

In regards to planned research programmes, the National Marine Fisheries Service (NMFS) of the US National Oceanic and Atmospheric Administration (NOAA) may have additional cruises planned for the area as part of their ongoing ENP tuna/dolphin research.

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 communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X
<i>Explanation for ranking</i>					
While other tropical thermocline domes exist in the world, created by a combination of current flow and large-scale wind patterns, the Costa Rica Dome is unique because it is also forced by a coastal wind jet. On a global scale, the Costa Rica Dome is a unique blue whale habitat providing for a year-round population. It is also unique because it is the only known thermocline dome in the world where blue whales feed and breed, and that has a strong relevance to cetacean diversity.					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.				X
<i>Explanation for ranking</i>					
The Costa Rica Dome is of vital importance for blue whales as habitat for feeding, breeding, calving and raising calves. All life history stages of blue whale can be found at the Costa Rica Dome. In addition, there is connectivity between the Costa Rica Dome and Baja California habitats for a single population of blue whales. Leatherback turtles in coastal Costa Rica are also connected to the Costa Rica Dome through their migration pathways and the region may also provide critical habitat for neonate leatherback turtles.					
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
<i>Explanation for ranking</i>					

<p>The Costa Rica Dome may provide essential habitat for the endangered blue whale, and be an important component of the migratory corridor of the critically endangered leatherback turtle as well as possible critical habitat for neonate leatherback turtles. Recovery of populations of both of these animals may depend on their ability to utilize the Costa Rica Dome area and its resources. This is particularly true for the blue whale, given that the eastern North Pacific blue whale population is the only one in the world that has been shown to be recovering. Thus, hope for the recovery of blue whales in the North Pacific and worldwide may depend on the eastern North Pacific population.</p>					
<p>Vulnerability, fragility, sensitivity, or slow recovery</p>	<p>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.</p>				<p>X</p>
<p><i>Explanation for ranking</i></p> <p>Loss of the Costa Rica Dome through overfishing or other threats could mean the disappearance, displacement or marginalization of the North Pacific population of blue whales currently known to be increasing. Blue whales are presumed to have low population birth rates as do other whales, but the details are not well known. The Costa Rica Dome may be an important area for blue whales because it is a warmer-water tropical calving and nursing ground, as well as, crucially, a place where new mothers can continue feeding. In addition, leatherback turtles (and other sea turtles) are susceptible to being caught as by-catch in tuna longline fisheries, which exist in the area.</p>					
<p>Biological productivity</p>	<p>Area containing species, populations or communities with comparatively higher natural biological productivity.</p>				<p>X</p>
<p><i>Explanation for ranking</i></p> <p>Satellite data and in situ measurements show that the Costa Rica Dome is an area of high primary productivity, leading to high zooplankton biomass, which in turn supports an abundance of at least two cetacean species.</p>					
<p>Biological diversity</p>	<p>Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.</p>	<p>X</p>			
<p><i>Explanation for ranking</i></p> <p>There is evidence from research cruises that other apex predators are found at the Costa Rica Dome, including short-beaked common dolphins and pantropical spotted dolphins, but overall biological diversity is yet to be comprehensively described.</p>					
<p>Naturalness</p>	<p>Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.</p>	<p>X</p>			
<p><i>Explanation for ranking</i></p>					

The naturalness of the area needs to be further evaluated in view of fishing activities in the area during recent decades.

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
<i>Add relevant criteria</i>					
<i>Explanation for ranking</i>					

References

(e.g. relevant documents and publications, including URL where available; relevant data sets, including where these are located; information pertaining to relevant audio/visual material, video, models, etc.)

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Maps and Figures

Figure 1. Minimum and maximum location of the Costa Rica Dome, showing national EEZs and the high seas. The extent of the core of the Dome is approximately 55,000 km² and a maximum extent of approximately 1,515,000 km²

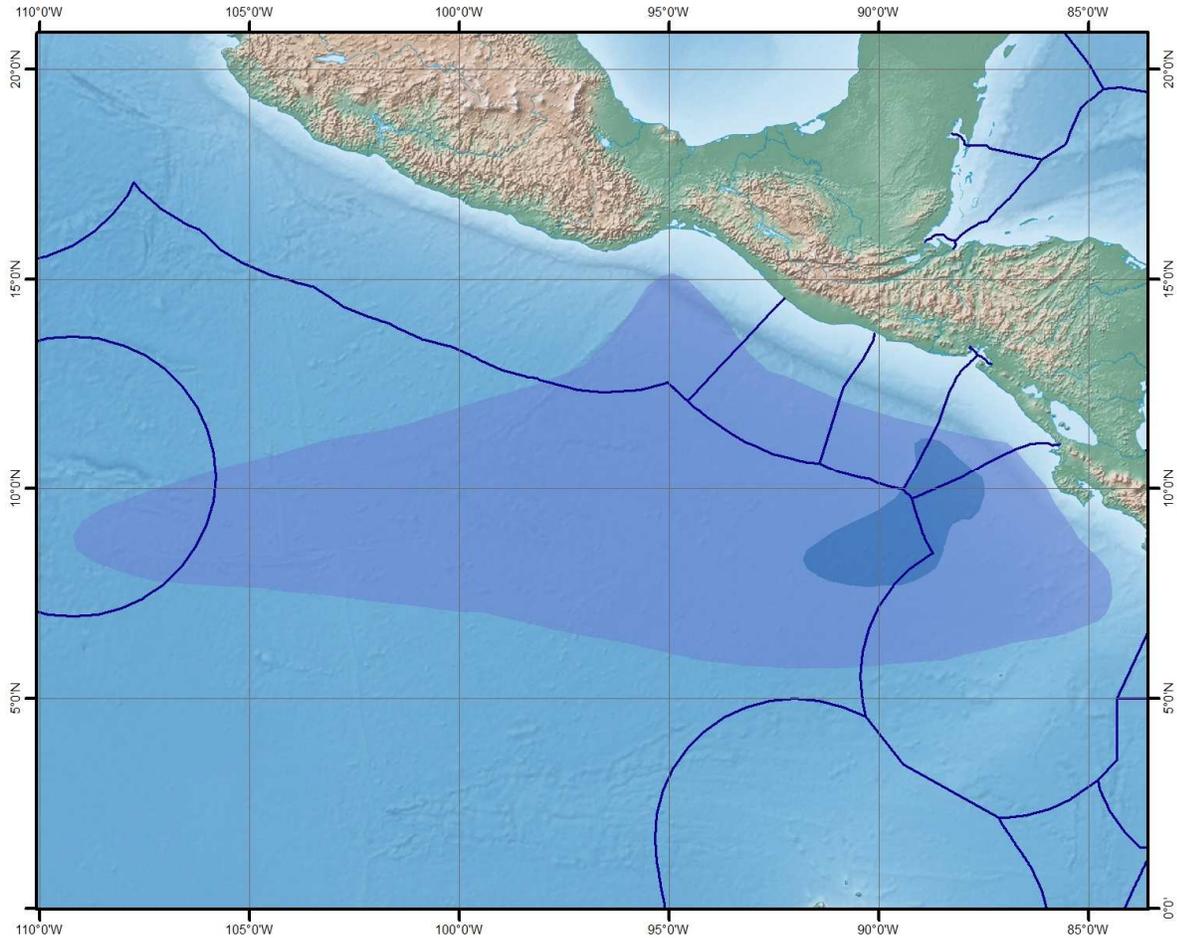


Figure 2: Monthly mean fields of SeaWiFS chlorophyll concentration in the region of the Costa Rica Dome. Note the annual cycle in location and magnitude of the Dome. Figure from Fiedler, 2002.

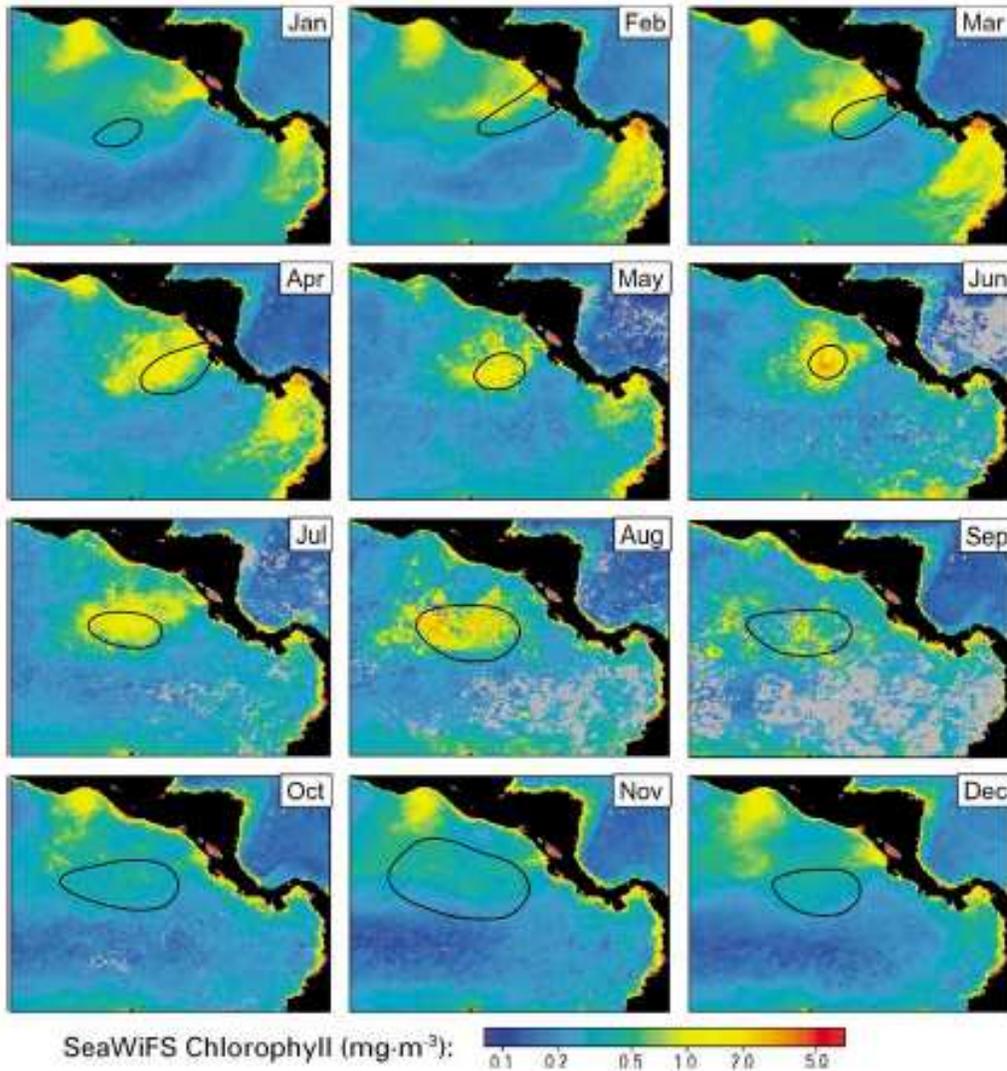


Figure 3: Sighting locations of common dolphins (*Delphinus delphis*) and spotted dolphins (*Stenella attenuata*) from research and tuna vessels in the NOAA/NMFS/SWFSC sightings database (1971–1999). Figure from Fiedler, 2002.

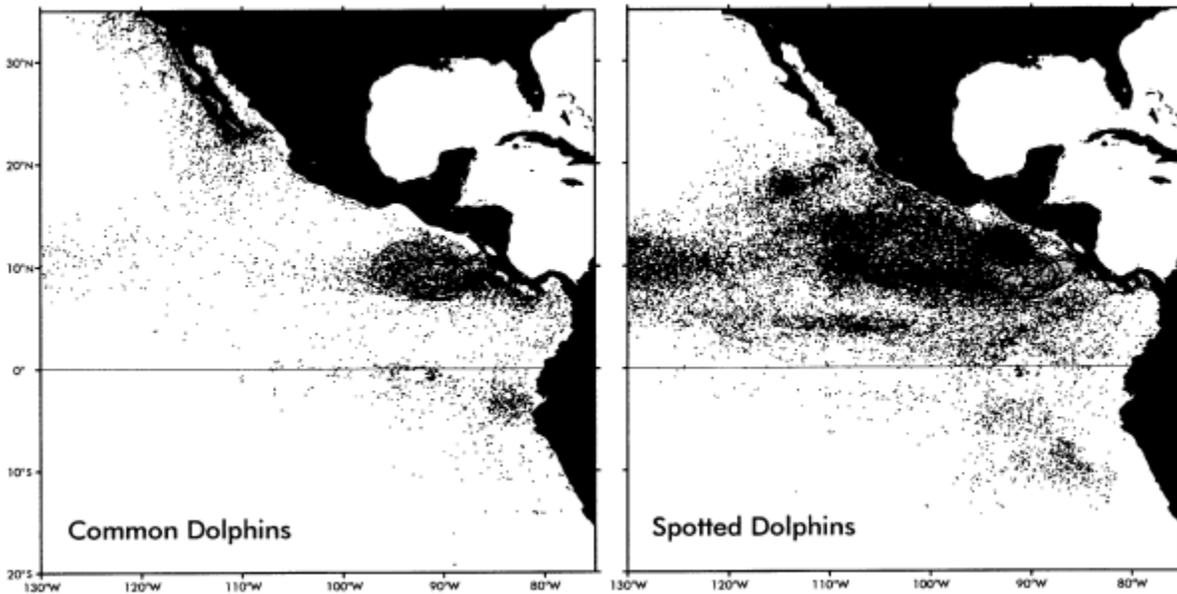


Figure 4: Individual tracks for 92 tags on blue whales deployed between 1994 and 2007. The Costa Rica Dome is shown as white contour. From Bailey *et al.*, 2009.

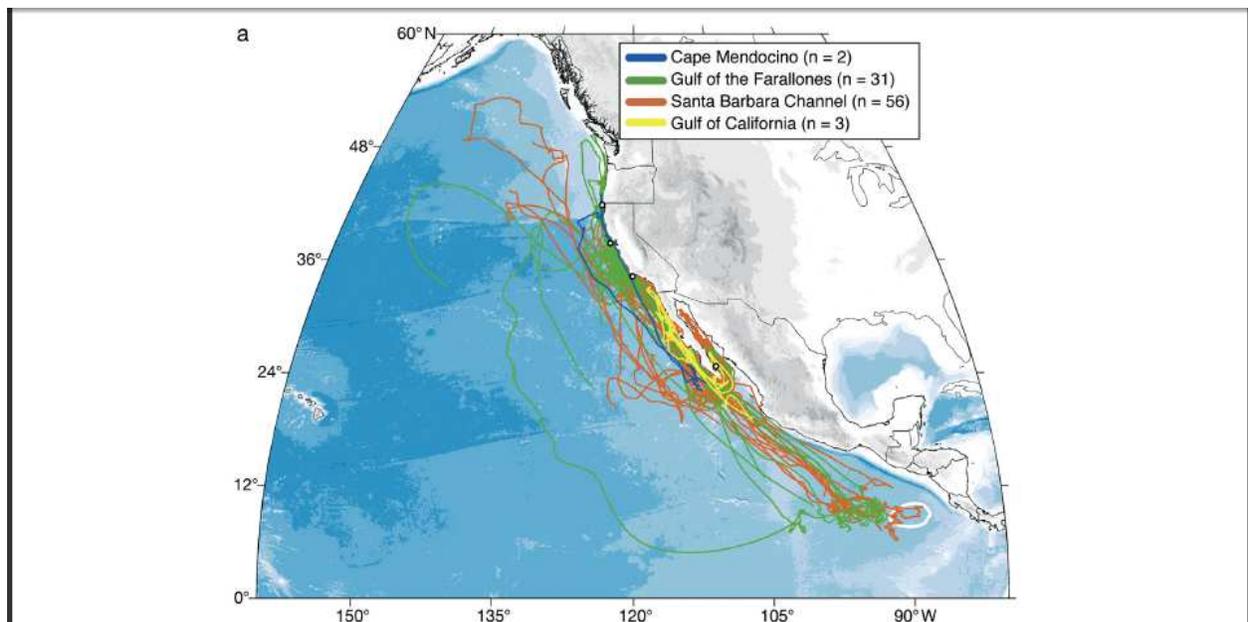


Figure 5: Leatherback turtle migrations. Figure A shows a schematic of turtle migration corridor through the equatorial current system, based on the 75% home-range utilization distribution contour. Figure B shows a combined utilization distribution by eastern Pacific leatherback turtles from all tracking data (for years 2004, 2005 and 2007). Note the presence of the Costa Rica Dome in the high utilization area. From Shillinger *et al*, 2008.

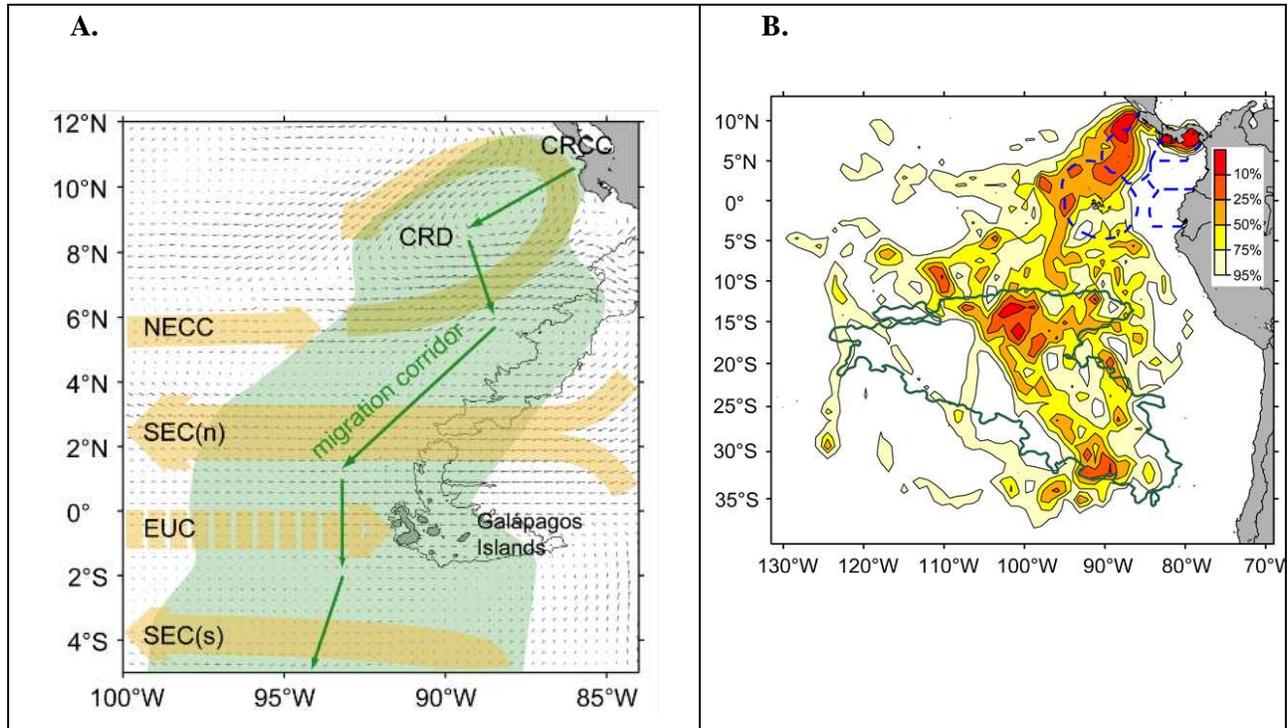
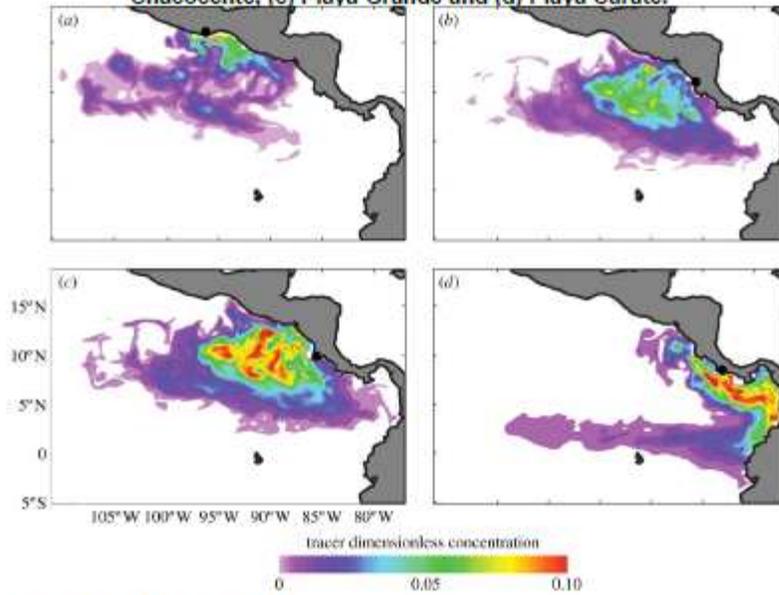


Figure 6: The likely transport of hatchlings from nesting beaches based on tracer releases. From Shillinger et al, 2012.

Long-term (2000–2008) mean tracer concentration at 1 June based on continuous tracer releases between 15 January and 15 April from nesting beaches at (a) Barra de la Cruz, (b) Playa Chacocente, (c) Playa Grande and (d) Playa Carate.



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Figure 7: Switching state-space model (SSSM)-derived daily positions for 135 tracks on Pacific leatherback turtles, color coded by tagging location and overlaid on bathymetry. From Bailey *et al*, 2012. Tracks in brown belong to turtles tagged at Playa Grande, Costa Rica, and are shown to migrate through the Costa Rica Dome and its surrounding area.

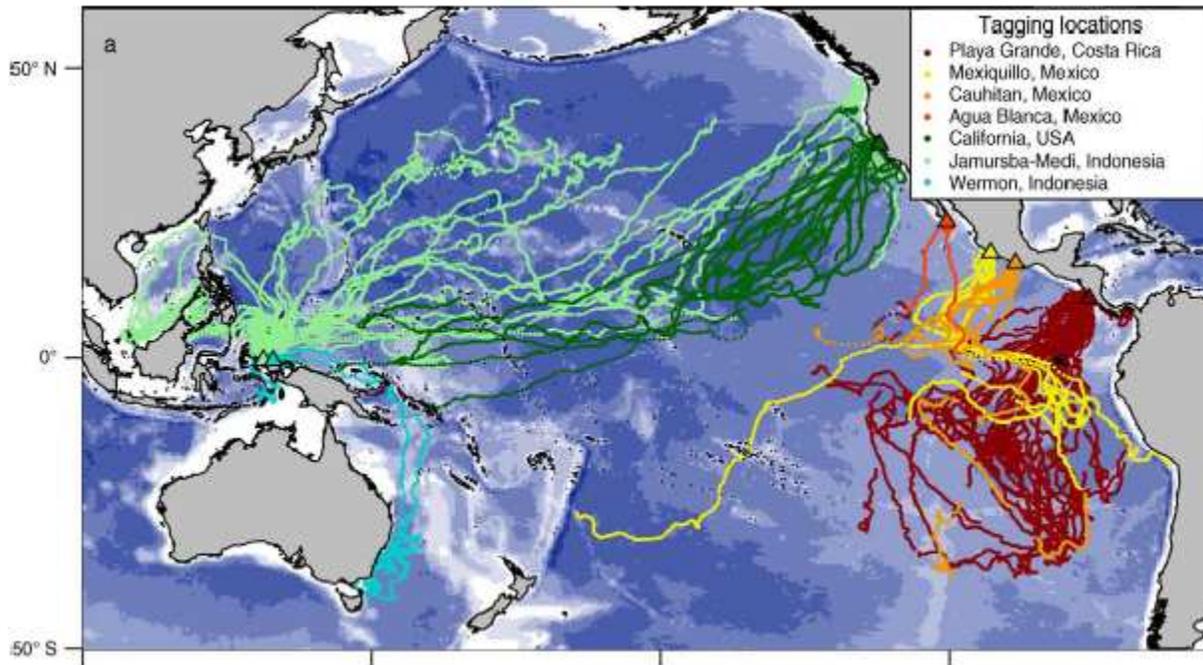
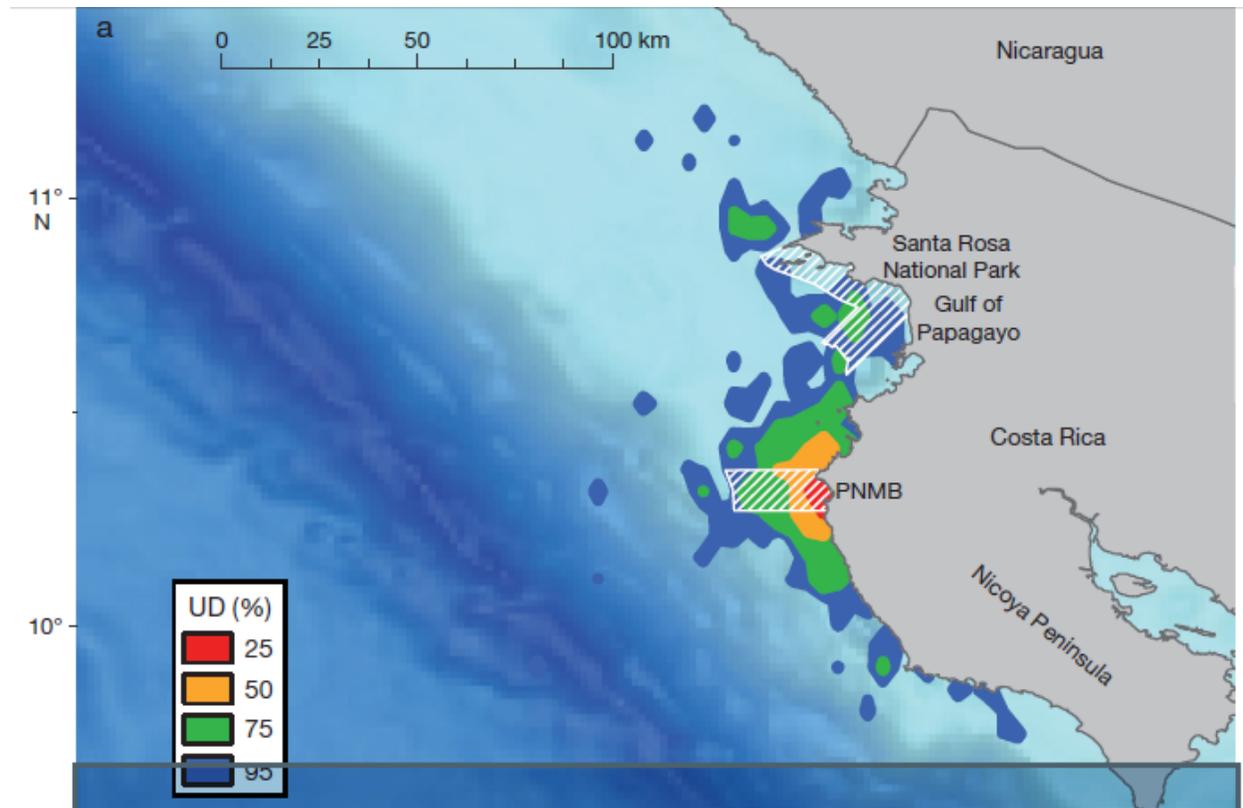


Figure 8: *Dermochelys coriacea*. Utilization distribution (UD) of interesting region occupied by 46 leatherback turtles during (a) all years combined. Polygons bordered and cross-hatched in white are Playa Grande National Marine Park (PNMB) and Santa Rosa National Marine Park (PNMSR).



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Permission has been received from the authors of the maps and figures used in this submission. In addition, Drs. Shillinger, Bailey and Hoyt have reviewed the submission and their input has been incorporated.