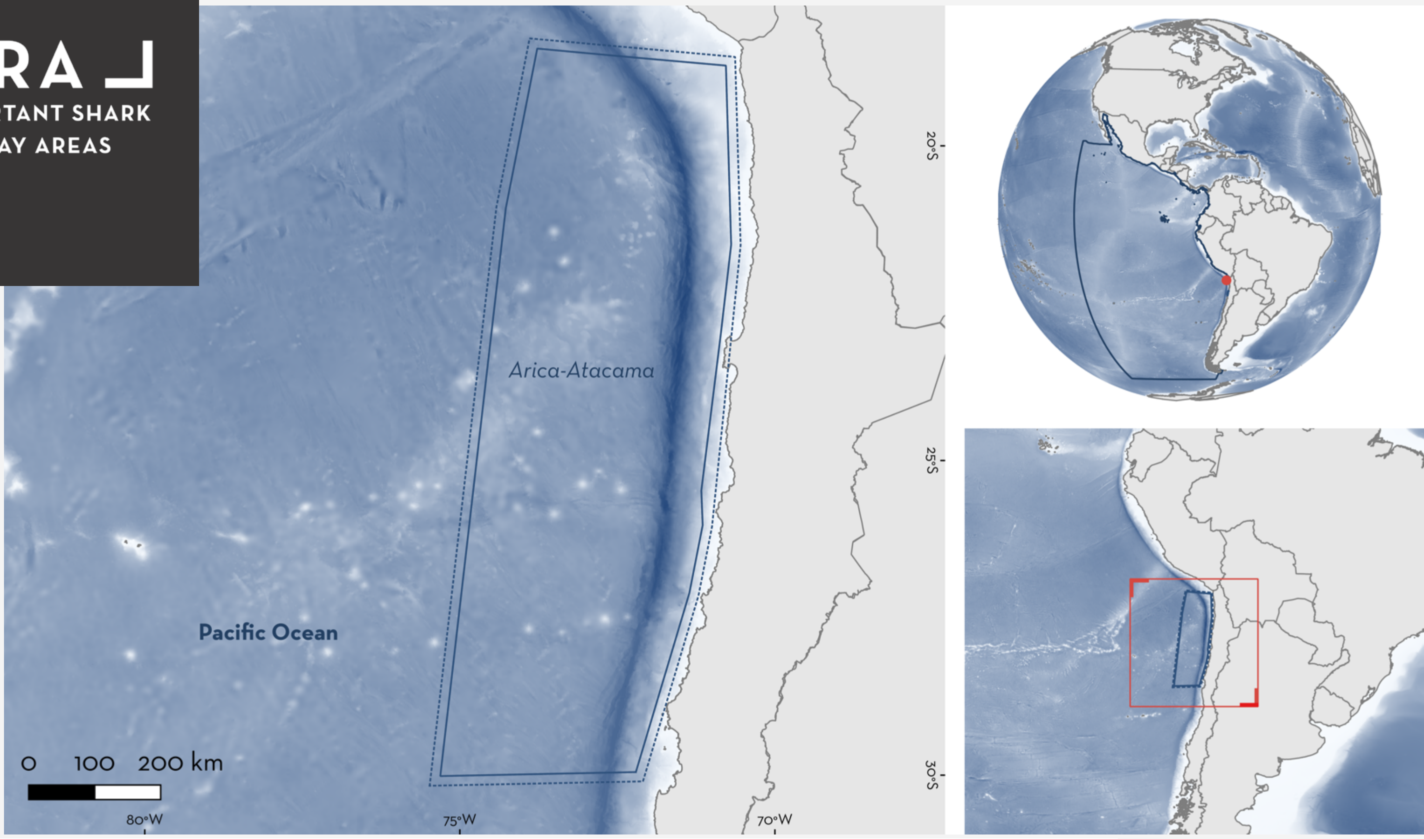
ISRA
IMPORTANT SHARK AND RAY AREAS



Blue lines indicate the area meeting the ISRA Criteria; dashed lines indicate the suggested buffer for use in the development of appropriate place-based conservation measures

ARICA-ATACAMA ISRA

Central and South American Pacific Region

SUMMARY

Arica-Atacama is located in northern Chile within the Humboldt Current Upwelling System along a 1,200 km stretch of coastline. This area overlaps with an Ecologically or Biologically Significant Marine Area, the Northern Chile Humboldt Current Upwelling System, which is characterised by a dynamic and highly productive ecosystem. Most of the biological production within the area is restricted to a very narrow continental shelf, where upwellings may occur year-round, even during El Niño conditions. The main habitat encompassed in this area are epipelagic waters. Within the area there are: **threatened species** (Shortfin Mako *Isurus oxyrinchus*) and **reproductive areas** (e.g., Blue Shark *Prionace glauca*).

CRITERIA

Criterion A – Vulnerability; Sub-criterion C1 – Reproductive Areas

CHILE

0–40 metres

498,647 km²

DESCRIPTION OF HABITAT

Arica-Atacama is located in northern Chile within the Humboldt Current Upwelling System along a 1,200 km stretch of coastline. This area partially overlaps with an Ecologically or Biologically Significant Marine Area (EBSA) known as the Northern Chile Humboldt Current Upwelling System and is situated within the Humboldt Current Large Marine Ecosystem (CBD 2017). The area encompasses the Arica, Iquique, Antofagasta, and Atacama regions of Chile. This upwelling region of northern Chile is recognised as a dynamic and highly productive ecosystem (Alheit and Bernal 1993). One of the prominent features of this area, compared to other eastern boundary currents, is that most of its biological production appears restricted to a very narrow band of continental shelf, within which a coastal upwelling takes place (Fonseca and Farias 1987). This area has received increasing attention in the last decade, motivated by studies indicating that upwellings may occur year-round (Fonseca and Farias 1987). This permanent upwelling produces continuous primary production and secondary production of zooplankton throughout the year (Escribano and McLaren 1999), even under abnormally warm conditions of El Niño (Ulloa et al. 2001).

Because of diminished offshore advection and the presence of retention areas resulting from circulation during upwelling, production and abundance of plankton in the nearshore zone of Antofagasta may be enhanced by plankton remaining aggregated near the shoreline (Escribano and Hidalgo 2000; Marin et al. 2001). Circulation in the nearshore area may exhibit a complex interaction between major currents and variability of winds during upwelling (Marin et al. 2001). Such interaction might give rise to a variety of physical structures near the coast, including the cold-upwelling plumes, highly advective areas, and zones of particle retention (Marin et al. 2001; Giraldo et al. 2002). Together they may act as an efficient mechanism to maintain plankton populations within inshore waters (Marin et al. 2001; Escribano et al. 2002; Giraldo et al. 2002). The additional fertilising effect of large inputs of nutrients from winter runoff and rivers also contributes to year-round productivity (CBD 2017).

This Important Shark and Ray Area is delineated from surface waters to a depth of 40 m in pelagic waters based on the maximum depth range of the habitat used by the Qualifying Species.

ISRA CRITERIA

CRITERION A – VULNERABILITY

One Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™ regularly occurs in the area. This is the Endangered Shortfin Mako (Rigby et al. 2019).

SUB-CRITERION C1 – REPRODUCTIVE AREAS

Arica-Atacama is an important reproductive area for two shark species. Within the area, neonate, young-of-the-year, and juvenile Shortfin Mako and Blue Shark are reported (Bustamante and Bennett 2013; Doherty et al. 2014; IFOP 2018, 2019) from fishery-dependent data (catch-per-unit-effort [CPUE] and size-frequency data). Overall, along the coast of Chile, the highest captures (volume), fishing effort, and fishing yields for both species are within this area, and where 95–100% of captures from these species are juveniles (IFOP 2018, 2019). In 2019, the smallest Blue Shark individual measured 79 cm total length (TL) and 92 cm TL for Shortfin Mako; thus, likely young-of-the-year animals for both species.

Between 2005–2010, 4,202 Blue Sharks (75% juveniles) and 1,748 Shortfin Makos (93% juveniles) were sampled (Doherty et al. 2014). Here, the mean CPUE (sharks/1,000 hook-hours) was 33.2 ± 35.6 SD (range: 0–295; total sets: 618) between March and November, and 3.0 ± 20.7 SD (range: 0–256; total sets: 402) from December to February revealing high seasonality of these catches. The mean size was 130.7 cm TL for Blue Shark and 132.6 cm TL for Shortfin Mako with smaller sizes around the size-at-birth for both species (Doherty et al. 2014). There was a significant effect of depth on Blue Shark and Shortfin Mako CPUE observed in this area with a restricted depth range between 6–12 m (Bustamante and Bennett 2013). This is similar to studies from the eastern North Atlantic (Maia et al. 2007) and northeast Pacific (Sepulveda et al. 2004; Nosal et al. 2019) where immature, including young-of-the-year, Shortfin Mako and Blue Shark mostly occupy the upper 40 m of the water column. In the north of Chile, the upper 30 m of the epipelagic zone is rich in small scombrid and carangid fishes (Alegría 1995; Zuleta 2005) that are a major component of the diets of small-sized Shortfin Makos (López et al. 2009) and Blue Sharks (López et al. 2010).

Similarly, in 2005 and 2010 between January and February, 1,153 Blue Sharks and 1,241 Shortfin Makos were collected from 178 longline sets, with a predominance of small immature sharks (Bustamante and Bennett 2013). Blue Shark and Shortfin Mako were not caught in 23% and 9% of sets, respectively. However, the CPUE (sharks/1,000 hook-hours) ranged from 0–230 for Shortfin Mako and 0–662 for Blue Shark. These values are high compared to similar studies in other regions for these species (Doherty et al. 2014). For example, in Mexican Pacific (Velez-Marin and Marquez-Farias 2009; Smith et al. 2009), and Papua New Guinean (Kumorum 2003) fisheries, less than one shark per 1,000 hook-hours are captured (Bizarro et al. 2009). For Blue Shark, the mean CPUE (sharks/1,000 hook-hours) was 18.4 in the North Atlantic (Campana et al. 2005), 5.5 in Australian waters (Stevens 1992), and 15 in New Zealand waters (Francis et al. 2001). For Shortfin Mako, in the Caribbean and the Gulf of Mexico values oscillated between 3.5 and 11.9 (Cramer 1996) while in the North Atlantic values were between 0.1 and 1.1 (Beerkircher 2005).

Overall, no gravid females were observed for Blue Shark with mature ova found in 8.4% of the female sharks caught (Bustamante and Bennett 2013). For Shortfin Mako, mature ova were found in a single specimen (Bustamante and Bennett 2013). Sex ratio had non-significant deviance from 1:1 for both species. For Shortfin Mako, size of males captured in 2005 presented a mean ± SD of 121.9 ± 23.7 cm TL, while for males was 122 ± 25.4 cm TL. The smallest individual measured 66 cm TL (size-at-birth of Shortfin Mako is 65–70 cm TL; Duffy and Francis 2001; Maia et al. 2007). There was also a predominance of the smaller size classes (70–100 cm TL) in both years for female Shortfin Makos. Sharks between 60 and 70 cm TL are likely to be young-of-the-month, while sharks between 100 and 120 cm TL are likely to be young-of-the-year. For Blue Shark, in 2005, the mean size was 133.1 ± 35.4 TL cm and 152.7 ± 48.6 TL cm for males. In 2010, mean size ranged 139.0 ±27.5 cm TL for females and 151.3 ± 43.3 cm TL for males. The smallest individual measured 52 cm TL (size-at-birth for Blue Shark is 35–60 cm TL; Clarke et al. 2015). Other less recent surveys also assessed the size-frequency of Blue Shark and Shortfin Mako from fisheries off these four political regions between November 2000 and August 2001 and found that most individuals were juveniles with the presence of neonates (Acuña et al. 2001).

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QUALIFYING SPECIES

Scientific Name	Common Name	IUCN Red List Category	Global Depth Range (m)	ISRA Criteria/Sub-criteria Met								
				A	**B**	**C1**	**C2**	**C3**	**C4**	**C5**	**D1**	**D2**
SHARKS												
Isurus oxyrinchus	Shortfin Mako	EN	0–888	X		X						
Prionace glauca	Blue Shark	NT	0–1,000			X						

SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
SHARKS		
Alopias vulpinus	Common Thresher	VU
Carcharhinus brachyurus	Copper Shark	VU
Carcharhinus falciformis	Silky Shark	VU
Galeorhinus galeus	Tope Shark	CR
Lamna nasus	Porbeagle	VU
Sphyrna zygaena	Smooth Hammerhead	VU

IUCN Red List categories: CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern; DD, Data Deficient.

SUPPORTING INFORMATION

There are additional indications that this area is important for juvenile Blue Shark and Shortfin Mako. In Chile, of the few fisheries that record these two species in their landings, the artisanal and industrial longline fisheries are the largest and both share a common fishing area in the Chilean Exclusive Economic Zone (Lamilla et al. 2010). Blue Sharks, caught as bycatch in both fisheries, are the most frequently captured (59% of total catch) in the industrial swordfish fishery (Acuna et al. 2001), and comprise 45–55% of the catch in the artisanal fishery.

Furthermore, between 1997–2010, Blue Shark was the most captured species followed by Shortfin Mako in Peruvian fisheries (Gonzalez-Pestana et al. 2016). Peru is amongst the top seven most important shark and ray fishing nations in the world (Dulvy et al. 2017). Their highest landings for these species are in Ilo, southern Peru (62% of total landings for Blue Shark and 84% of total landing for Shortfin Mako), located close to the Chile-Peru boarder. Between 1996–2018, most individuals sampled here (6,626 Blue Sharks and 3,033 Shortfin Mako) were juveniles (Pérez-Huaripata et al. 2021). Also, there is evidence that the Peruvian shark fleet that lands in southern Peru operates off northern Chile (Doherty et al. 2014).

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