

Central Humboldt Current Upwelling System IMMA

Summary, continued.

IMMA encompasses waters from the South American coast to the edge of the South Pacific trench, which reaches depths of 5000-6000m. It includes a total of seventeen marine mammal species that either breed and/or forage in the area. This area includes breeding and foraging grounds for marine otters and two pinniped species as well as foraging grounds for eight odontocetes and four mysticetes. Many of these represent distinct subspecies, subpopulations, or populations that are designated as 'Threatened' under national legislation in Peru and Chile as well as globally on the IUCN Red List of Threatened Species. These threatened species include Chile-Peru Southern right whales (Endangered – EN): Peruvian dusky dolphins (Vulnerable – VU); Peruvian fur seals (Vulnerable – VU) and Burmeister's porpoises (Near Threatened- NT). This area hosts the entire subpopulation of Peruvian fur seals and a large proportion of the marine otters in the region.

Description:

This IMMA extends from 13-24°S, from Cerro Azul in Peru down to Mejillones in Chile; and from the shoreline to the edge of the South Pacific trench (which reaches depths of 5000-6000m). The northern limit is defined by the foraging range of satellite tracked males of Peruvian fur seals (Cárdenas-Alayza 2021), and the southern limit on the existing Northern Chile Humboldt Current Upwelling System EBSA. As part of the Humboldt Current System, this area is dominated by strong upwelling that generates an important biomass of small pelagic fish that serves as prey for a series of marine mammal species (Bertrand



Area Size

286 227 km²

Qualifying Species and Criteria

South American fur seal – *Arctocephalus australis*

Criterion A; B (1); C (2); D (1)

Southern right whale – *Eubalaena australis*

Criterion A; C (1); D (1)

Dusky dolphin – *Lagenorhynchus obscurus*

Criterion A; C (1)

Marine otter – *Lontra felina*

Criterion A; B (1)

South American sea lion – *Otaria byronia*

Criterion B (2); C (2)

Burmeister's porpoise – *Phocoena spinipinnis*

Criterion B (2)

Marine Mammal Diversity

Criterion D (2)

Balaenoptera borealis, *Balaenoptera edeni*,
Balaenoptera musculus, *Balaenoptera physalus*,
Delphinus delphis, *Grampus griseus*,
Lissodelphis peronii, *Megaptera novaeangliae*,
Physeter macrocephalus, *Tursiops truncatus*

Summary

The central upwelling zone of the Humboldt current system extends from 13-24°S, from Cerro Azul in Peru down to Mejillones in Chile. The

et al., 2004). The area of south Peru - north Chile is characterised by a narrow continental shelf, reaching depths greater than 1000 m less than 50 km offshore (IMARPE, 2014). A shallow thermocline related to an upper minimum oxygen layer at similar depths of approximately 50-80m on average, constrains expansion of vertical habitat making the majority of prey more available to predators at <100m depth (Bertrand et al., 2010; Demarcq, 2009; Echevin et al., 2008). Off central Chile extending northward to 16°S in southern Peru, the oligotrophic subtropical gyre impinges on the coast, creating a narrow but productive coastal upwelling zone (Montecino & Lange, 2009).

The coast of the Antofagasta region has one of the most significant upwelling systems along the Humboldt Current in the SE Pacific. The two most important upwelling cells are part of the Mejillones Peninsula Upwelling System (MPUS, around 23°S). The most intense upwelling cells are present in the Mejillones Peninsula, where elevated primary and secondary productivity supports the presence of numerous upper-trophic level predators such as pinnipeds, sea birds, and cetacean species. The Peruvian anchovy (*Engraulis ringens*) is a keystone species for a wide variety of marine fauna in the region.

Recurring El Niño Southern Oscillation (ENSO) events take place at multi-annual intervals varying in intensity and duration. Warm El Niño events change prey availability and cause dispersal and declines in reproduction and survival of top marine predator populations in the area (Arias-Schreiber & Rivas, 1998; Oliveira et al., 2006, 2011, 2012). Extraordinary El Niño events caused 75-85% reductions in the Peru populations of South American fur seal and the South American sea lions based on documented mortality and dispersal of animals from traditional breeding sites (Oliveira et al., 2006, 2012).

Criterion A: Species or Population Vulnerability

The Peruvian/Chilean subpopulation of South American fur seals (*Arctocephalus australis*) is relatively small, with ~3,700 reproductively mature individuals counted in the 2018-19 breeding season (Aguilar-Arakaki, 2021; Oliva et al., 2020). It has likely been reduced by at least two-thirds from its historical abundance and is listed as Vulnerable (VU) on the IUCN Red List of Threatened Species (Cárdenas-Alayza & Olivera, 2016) and as Endangered in Peruvian legislation (D.S. 014-2014-MINAGRI). The 1982-1983 El Niño resulted in the loss of the entire pup cohort, and the 1997-1998 El Niño caused the population to decline by at least 66% in two years (Cárdenas-Alayza & Olivera, 2016). Currently >50% of the entire population is found at only two sites in Peru, Punta San Juan and Punta Coles (Aguilar-Arakaki, 2021). The combination of competition for prey with fisheries (Majluf et al., 2002), El Niño, and other warming events (e.g., marine heat waves) have been increasing in frequency and duration (Pietri et al., 2021) limiting access to prey and hindering population growth (Cárdenas-Alayza et al., 2021). Marine otters (*Lontra felina*) are listed as Endangered (EN) on the IUCN Red List of Threatened Species (Valqui & Rheingantz, 2021). They are nationally listed as Endangered in Peru (D.S. 014-2014-MINAGRI) and Endangered according to the Chilean Regulation for the classification of the wild species in conservation categories (<https://clasificacionespecies.mma.gob.cl>). Historical decline is attributed to the pelt trade, as well as multiple current threats linked to habitat destruction and degradation. This includes competition for prey, incidental captures in fisheries and poaching (Valqui & Rheingantz, 2021), which in turn has increased population fragmentation (Medina-Vogel et al., 2008; Vianna et al., 2010). This IMMA fulfils the A1a (>0.5% of global population) for KBA criteria based on the

number of mature breeding individuals in the population of the endangered marine otters in the area (Ortiz-Alvarez et al., 2021; Valqui & Rheingantz, 2021).

The number of mature individual southern right whales (*Eubalaena australis*) off the coasts of Chile and Peru is estimated to be fewer than 50 and the same Chile-Peru subpopulation is listed as Critically Endangered (CR) on the IUCN Red List of Threatened Species (Cooke, 2018), and is listed as Endangered under the Chilean Regulation for the classification of the wild species in conservation categories (<https://clasificacionespecies.mma.gob.cl>).

Regarding the Peruvian subspecies of dusky dolphin (*Lagenorhynchus obscurus posidoni*), and the given the overlap with some of the most intensively fished

oceans in the world and that hunting and bycatch mortality rates are at least several thousand individuals per year, it is extremely likely that this subspecies is declining in abundance (Van Waerebeek et al., 1994, 1997, 1999). While there is no information on the abundance or estimates for this subspecies, it is thought that interactions with fisheries, mostly from bycatch and direct take for decades have seriously depleted this subpopulation particularly off Peru (Read et al., 1988; Van Waerebeek, 1994; Van Waerebeek et al., 1997, Mangel et al., 2010). The subspecies is listed as Vulnerable (VU) on the IUCN Red List because a 30% decline in abundance is inferred and suspected over a time period spanning both the past and the projected future, where threats (bycatch and hunting) have not ceased (Mangel & Alfaro-Shigueto, 2019).



Figure 1: South American fur seals (*Arctocephalus australis*) on the rookery. Photo credit: Thorsten Milse.

Criterion B: Distribution and Abundance

Sub-criterion B1: Small and Resident Populations

Coastal surveys in Peru indicate that 60% of Peru's marine otter population is presently concentrated on the southern coast between latitudes 14-18 (Ortiz-Alvarez et al., 2021). In Chile, marine otters have been reported in the coast of Iquique (Pavez et al., 2022) and Mejillones (Jorge Acevedo, unpublished data). The home range described for this species is less than 4.5 km. As such, the population is resident in the IMMA year-round, and affected by human use of the marine littoral zone (Medina et al., 2007).



Figure 2: Female South American fur seals (*Arctocephalus australis*) and pup. Photo credit: Joanna Alfaro Shigueto.

Sub-criterion B2: Aggregations

This IMMA contains a concentration numbering >90% of Peru's population of South American fur seals, estimated at $8,473.5 \pm 861.9$ (Aguilar-Arakaki, 2021) and >70% of the South American sea lion breeding population with an ca. 82,930 and 21,616 pup production in 2018 (IMARPE, 2019). Tagged fur seals from Punta San Juan (15°22'S) have been seen as far south as Iquique (20°13'S) and Antofagasta (23°39'S) in northern Chile in 1998 (Cárdenas-Alayza, 2012). The number of breeding colonies in Arica-Parinacota, Tarapacá and Antofagasta regions has increased from 7 to 33 for South American sea lions, and from 1

to 5 for Peruvian fur seals between 1996 and 2019 (Oliva et al., 2020). Furthermore, this IMMA likely fulfils the B2 criteria (>1% of co-occurring restricted species) for the selection of Key Biodiversity Areas (KBAs) based on the number of mature individuals of both Peruvian fur seals and South American sea lions in the area (Aguilar-Arakaki, 2021; IMARPE, 2019; Oliva, 2020). Finally, an important aggregation of Burmeister's porpoise has been documented in the region of Mejillones (Illanes and Garcia-Cegarra, 2022) with an estimated abundance of this species of 76.17 porpoises (CV = 58%) and with a density of 0.45 ind/km² (Illanes & Garcia-Cegarra 2022).

Criterion C: Key Life Cycle Activities

Sub-criterion C1: Reproductive Areas

Sightings of mother-calf pairs of Southern right whales have been documented in the bays along the south coast of Peru between 1987 and 2007 (Santillán et al., 2004; Van Waerebeek et al., 1992, 1998, 2008). According to Van Waerebeek et al., (2008), the compiled sightings provide evidence that this is an endangered native species to the South Pacific that is slowly recovering along its Chile-Peru range after the dramatic effects of whaling activities during the 19th century.

Sub-criterion C2: Feeding Areas

Peruvian dusky dolphins occur regularly in this region, and their foraging habitat is linked to the 200m isobath even during El Niño events (Llapapasca et al., 2018). Potential feeding is likely centred around upwelling zones in neritic waters (Van Waerebeek, 1997), overlapping with reported bycatch incidents and fisheries interactions (Van Waerebeek, 1992). Data from cruises demonstrate that dusky dolphins overlap mainly with pelagic-neritic prey species (e.g. Peruvian anchovy, silverside and mackerels) (Llapapasca et al., 2018; Hamilton et



Figure 3: Adult marine otter (*Lontra felina*) searching for food onshore in south Peru. Photo by Marco Cardeña.

al., 2008), which concurs with previous studies based on stomach contents, which showed that prey composition was predominated by anchovies (*Engraulis* spp.) (ca. 50%), slimtail lanternfish (*Lampanyctus parvicauda*) (ca. 25%), Inca scad (*Trachurus murphyi*) (ca 17.1%), and mote sculpin (*Normanichthys crockeri*) (ca 76.0%) (García-Godos et al., 2007).

Peruvian fur seals are nocturnal foragers that typically feed 200-300km from shore (Cárdenas-Alayza, 2021) and dive to depths of 11-30m (Trillmich et al., 1986). In the north of Chile, pelagic foraging was reported by juvenile male South American sea lions, with average dive depths of 30m (Hückstädt et al., 2014, 2016) ranging from 80 to 178km from shore (Cardenas-Alayza, 2021). In these areas, the combination of a narrow continental shelf (80km from shore) and shallow oxycline (50-80m) compress

the habitat for potential prey, forcing sea lions to the surface and allowing shallow foraging by predators (Bertrand et al., 2010).

Criterion D: Special Attributes

Sub-criterion D1: Distinctiveness

Berta and Churchill (2012) strongly suggest that the Peruvian and northern Chilean fur seals represent an unnamed subspecies. Following this, Oliveira and Brownell (2014) and the IUCN Species Survival Commission Pinniped Specialists Group recognizes the Peru/north of Chile fur seal as an unnamed subspecies with the Peruvian Fur Seal as its English common name (Cárdenas-Alayza & Oliveira, 2016). In addition, a distinct genetic haplotype of dusky dolphins was reported for the Peru population (Cassens et al., 2004). Although most of the dusky dolphin populations are stable and not subject to

anthropogenic impacts, the Peru Chilean subspecies *L. o. posidonia* has been severely depleted due to a combination of natural and anthropogenic impacts affecting its genetic diversity (Mangel & Alfaro-Shigueto, 2019).

Sub-criterion D2: Diversity

The area of the central Humboldt current upwelling system hosts a diversity of over 17 marine mammals, many of which comprise distinct subspecies, subpopulations or populations for this area, including Peruvian dusky dolphins (Cassens et al., 2004), the Peruvian/Chilean subpopulation of South American fur seals (Cárdenas-Alayza & Oliveira, 2016), The Chile-Peru Subpopulation of southern right whales (Cooke, 2018) and Burmeister's porpoises (Rosa et al., 2005). This area includes breeding grounds for marine otters, and two pinniped species, as well as foraging grounds for 8 species of odontocetes (Llapapasca et al., 2018; Llapapasca & Quiñones, 2021; Santillán, 2021; Testino et al., 2019) and three mysticetes (Santillán, 2021). A few additional species are present in the area but their occurrence is unpredictable, such as for pilot whales (*Globicephala* sp.), Risso's dolphins (*Grampus griseus*), dusky dolphins, common bottlenose dolphins (*Tursiops truncatus*) and common dolphins (*Delphinus delphis*), sperm whales (*Physeter macrocephalus*), and sei whales (*Balaenoptera borealis*) (Bedriñana-Romano et al., 2022).

Supporting Information

Aguilar-Arakaki, R. 2021. 'Población del lobo fino *Arctocephalus australis* en la costa peruana en el periodo 2016-2019'. Bol Inst Mar Perú. 36(1): 188-204.

Arias-Schreiber, M. and Rivas, C., 1998. 'Distribución, tamaño y estructura de las poblaciones de lobos marinos *Arctocephalus australis* y *Otaria byronia* en el

litoral peruano, en noviembre 1996 y marzo 1997'. Inf. Progres. del Inst. del Mar del Perú 73, 17-32.

Bertrand, A., Ballón, M. and Chaigneau, A., 2010. 'Acoustic observation of living organisms reveals the upper limit of the oxygen minimum zone'. PLoS One 5.

Bedriñana-Romano, L., Zarate, P.M., Hucke-Gaete, R., Viddi, F.A., Buchan, S.J., Cari, I., Clavijo, L., Bello, R. and Zerbini, A.N. 2022. Abundance and distribution patterns of cetaceans and their overlap with vessel traffic in the Humboldt Current Ecosystem, Chile. Sci Rep 12, 10639 (2022). doi.org/10.1038/s41598-022-14465-7.

Cárdenas-Alayza, S. 2012. 'Prey abundance and population dynamics of South American fur seals (*Arctocephalus australis*) in Peru'. Master's Thesis. University of British Columbia.

Cárdenas-Alayza, S. & Oliveira, L. 2016. '*Arctocephalus australis* (Peruvian/Northern Chilean subpopulation)'. The IUCN Red List of Threatened Species 2016: e.T72050476A72050985. <https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T72050476A72050985.en>. Accessed on 10 June 2022.

Cardenas Alayza, S. 2021. 'Mécanismes de coexistence de deux espèces sympatriques d'otaries, *Arctocephalus australis* et *Otaria byronia*, à Punta San Juan, au Pérou'. Doctoral dissertation, Université de Montpellier.

Cárdenas-Alayza, S., Gutiérrez, D., and Tremblay, Y. 2021. 'Trends in sympatric otariid populations suggest resource limitations in the Peruvian Humboldt Current System'. Marine Environmental Research, 169, 105349.

Cassens, I., Van Waerebeek, K., Best, P.B., Tzika, A.,

- Van Helden, A.L., Crespo, E.A., & Milinkovitch, M.C. 2005. 'Evidence for male dispersal along the coasts but no migration in pelagic waters in dusky dolphins (*Lagenorhynchus obscurus*)'. *Molecular Ecology*, 14(1), 107-121.
- Cooke, J.G. 2018. '*Eubalaena australis* (Chile-Peru subpopulation)'. The IUCN Red List of Threatened Species 2018: e.T133704A50385137. Doi: 10.2305/IUCN.UK.2018-1.RLTS.T133704A50385137.en. Accessed on 10 June 2022.
- Cooke, J.G. 2018. '*Balaenoptera borealis*'. The IUCN Red List of Threatened Species 2018: e.T2475A130482064. <https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2475A130482064.en>. Accessed on 10 June 2022.
- Demarcq, H. 2009. 'Trends in primary production, sea surface temperature and wind in upwelling systems (1998–2007)'. *Progress in Oceanography*, 83(1-4), 376-385.
- Echevin, V., Aumont, O., Ledesma, J., and Flores, G. 2008. 'The seasonal cycle of surface chlorophyll in the Peruvian upwelling system: A modelling study'. *Progress in Oceanography*, 79(2-4), 167-176.
- García Cegarra, A.M., Castro, C., and Van Waerebeek, K. 2021. 'Feeding of humpback whales in low latitudes of the Southeast Pacific Ocean'. *Neotropical Biodiversity*, 7(1), 421-430.
- García-Godos, I., Van Waerebeek, K., Reyes, J.C., Alfaro-Shigueto, J. and Arias-Schreiber, M. 2007. 'Prey occurrence in the stomach contents of four small cetacean species in Peru'. *Latin American Journal of Aquatic Mammals* 6(2): 171-183.
- Hamilton, T.A., Redfern, J.V., Barlow, J., Ballance, L.T., Gerrodette, T., Holt, R.S., Forney, K.A. and Taylor, B.L. 2008. 'Atlas of Cetacean sightings from the Southwest Fisheries Science Center Cetacean and Ecosystem Surveys: 1986-2005'. NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-440.
- Hevia-Álvarez, K.A. 2013 'Áreas dealimentación de lobo marino común *Otaria flavescens* en la zona norte de Chile'. Tesis para optar al título de Ingeniero Ambiental. Universidad de Valparaíso, Chile.
- Hückstädt, L., Tift, M.S., Riet-Sapriza, F., Franco-Trecu, V., Baylis, A.M.M., Orben, R.A., Arnould, J.P.Y., Sepúlveda, M., Santos-carvalho, M. and Burns, J.M. 2016. 'Regional variability in diving physiology and behavior in a widely distributed air-breathing marine predator, the South American sea lion (*Otaria byronia*)'. *Journal of Experimental Biology* 2019:2320–2330.
- Hückstädt, L.A., Quiñones, R.A., Sepúlveda, M. and Costa, D.P. 2014 'Movement and diving patterns of juvenile male South American sea lions off the coast of central Chile'. *Marine Mammal Science* 30:1175–1183.
- Illanes, S. and García-Cegarra, A.M. 2022. 'Abundancia, distribución y uso de hábitat de la marsopa espinosa (*Phocoena spinipinnis*) en la Bahía de Mejillones'. XLI Congreso Ciencias del Mar, Concepción; AM García-Cegarra (CIFAMAC) – unpublished data.
- IMARPE, 2014. 'Libro de Oro: 50 Años del IMARPE'. Callao, Peru.
- IMARPE, 2019. 'Anuario Científico-Tecnológico IMARPE'. Callao, Peru.
- Llapapasca, M.A. and Quinones, J. 2021. 'Modelos de hábitat potencial de odontocetos teutogagos

(*Grampus griseus* y *Globicephala* spp) en el ecosistema norte de la Corriente de Humboldt'. Boletín del Instituto del Mar del Perú 361, página 224-238.

Llapapasca, M.A., Pacheco, A.S., Fiedler, P., Goya, E., Ledesma, J., Peña, C. and Vásquez, L. 2018. 'Modeling the potential habitats of dusky, commons and bottlenose dolphins in the Humboldt Current System off Peru: The influence of non-El Niño vs. El Niño 1997-98 conditions and potential prey availability'. *Progress in Oceanography*, 168, 169-181.

Majluf, P., Babcock, E.A., Riveros, J.C., Schreiber, M.A. and Alderete, W. 2002. 'Catch and bycatch of seabirds and marine mammals in the small-scale fishery of Punta San Juan, Peru'. *Conservation biology*, 16(5), 1333-1343.

Mangel, J. and Alfaro-Shigueto, J. 2019. '*Lagenorhynchus obscurus* ssp. *posidonia*. The IUCN Red List of Threatened Species 2019: e.T134820643A151580809'. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T134820643A151580809.en>. Accessed on 10 June 2022.

Mangel, J.C., Alfaro-Shigueto, J., Van Waerebeek, K., Cáceres, C., Bearhop, S., Witt, M.J. and Godley, B.J. 2010. Small cetacean captures in Peruvian artisanal fisheries: High despite protective legislation. *Biological Conservation* 143(1): 136-143.

Medina-Vogel, G., Merino, L., Monsalve, R. and Vianna, J. 2008. 'Coastal-marine discontinuities, critical patch size and isolation: implications for marine otter conservation'. *Animal Conservation*, 11 57-64.

Medina-Vogel, G., Boher, F., Flores, G., Santibañez, A., and Soto-Azat, C. 2007. 'Spacing behavior of marine

otters (*Lontra felina*) in relation to land refuges and fishery waste in central Chile'. *Journal of Mammalogy*, 88(2), 487-494.

Montecino, V. and Lange, C.B. 2009. 'The Humboldt Current System: Ecosystem components and processes, fisheries, and sediment studies'. *Progress in Oceanography*, 83(1-4), pp.65-79.

Oliva, D., Durán, L.R., Sepúlveda, M., Cárcamo, D., Pizarro, M., Anguita, C., Santos-Carvallo, M., Canto, A., Herrera, P., Muñoz, L., Orellana, M. and Vásquez, P. 2020. 'Estimación poblacional de lobos marinos e impacto de la captura incidental'. Informe Final Proyecto FIP 2018-54, 184 pp + Anexos.

Oliveira, L.R., Arias-Schreiber, M., Meyer, D. and Morgante, J.S. 2006. 'Effective population size in a bottlenecked fur seal population'. *Biological Conservation*, 131(4), 505-509.

Oliveira, L.R. 2011. 'Vulnerability of South American pinnipeds under El Niño southern oscillation events'. *Global warming impacts-case studies on the economy, human health, and on urban and natural environments*, 237-252.

Oliveira, L.R., Fraga, L.D. and Majluf, P. 2012. 'Effective population size for South American sea lions along the Peruvian coast: the survivors of the strongest El Niño event in history'. *Journal of the Marine Biological Association of the United Kingdom*, 92(8), 1835-1841.

Oliveira, L.R. and Brownell Jr, R.L. 2014. 'Taxonomic status of two subspecies of South American fur seals: *Arctocephalus australis australis* vs. *A. a. gracilis*'. *Marine Mammal Science*, 30(3), 1258-1263.

Ortiz-Alvarez, C., Alfaro-Shigueto, J. and Mangel, J.C. 2021. 'Insights into marine otter (*Lontra felina*) distribution along the Peru coastline'. *Marine Mammal*

Science, 37(3), 993-1007.

Pavez, G., Vergara, I., Weymann, M., Ruiz de Gamboa, M., Wistonn, H., Ismael, H. and Valdivia, M. 2022. 'Abundancia relativa y patrones de actividad del chungungo (*Lontra felina*) en la Región de Tarapacá, norte de Chile. XLI Congreso de Ciencias del Mar, 23 al 27 de mayo de 2022, Concepción, Chile.

Pietri, A., Colas, F., Mogollon, R., Tam, J. and Gutierrez, D. 2021. 'Marine heatwaves in the Humboldt current system: from 5-day localized warming to year-long El Niños'. *Scientific Reports*, 11(1), 1-12.

Read, A.J., Van Waerebeek, K., Reyes, J.C., McKinnon, J.S. and Lehman, L.C. 1988. 'The exploitation of small cetaceans in coastal Peru'. *Biological Conservation*, 46(1), 53-70.

Reyes, J. 2009. 'Ballenas, delfines y otros cetáceos del Perú'. Una fuente de información. *Squema ediciones*.

Rosa, S., Milinkovitch, M.C., Van Waerebeek, K., Berck, J., Oporto, J.A., Alfaro-Shigueto, J., Van Bressemer, M.F., Goodall, R. and Cassens, I. 2005. 'Population structure of nuclear and mitochondrial DNA variation among South American Burmeister's porpoises (*Phocoena spinipinnis*)'. *Conservation Genetics* 6: 431-443.

Santillán, L., Roca, M., Apaza, M., Oliveira, L.R. and Ontón, K. 2004. 'New record of mother-calf pair of southern right whale, *Eubalaena australis*, off the Peruvian coast'. *Latin American Journal of Aquatic Mammals*, 83-84.

Trillmich, F., Kooyman, G.L., Majluf, P., and Sánchez-Griñan, M. 1986. 'Attendance and diving behavior of South American fur seals during El Niño in 1983'. In: *Fur Seals: Maternal Strategies on Land and at Sea*. Gentry RL, Kooyman G (eds) Springer-Verlag, Berlin,

p 153-167.

Valqui, J. and Rheingantz, M.L. 2021. '*Lontra felina*'. The IUCN Red List of Threatened Species 2021: e.T12303A95970132. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T12303A95970132.en>. Accessed on 10 June 2022.

Valqui, J. 2012. 'The marine otter *Lontra felina* (Molina, 1782): 'A review of its present status and implications for future conservation'. *Mammalian Biology*, 77(2), 75-83.

Van Waerebeek, K.V., And, J.R. and Aranda, C. 1992. 'Southern right whales (*Eubalaena australis*) off southern Peru'. *Marine Mammal Science*, 8(1), 86-88.

Van Waerebeek, K. and Read, A.J. 1994. 'Reproduction of dusky dolphins, *Lagenorhynchus obscurus*, from coastal Peru'. *Journal of Mammalogy*, 75(4), 1054-1062.

Van Waerebeek, K., Van Bressemer, M.F., Félix, F., Alfaro-Shigueto, J., García-Godos, A., Chávez-Lisambart, L. and Bello, R. 1997. 'Mortality of dolphins and porpoises in coastal fisheries off Peru and southern Ecuador in 1994'. *Biological Conservation*, 81(1-2), 43-49.

Van Waerebeek, K., Van Bressemer, M.F., Alfaro-Shigueto, J., Sanino, G.P., Montes, D. and Ontón, K. 1999. 'A preliminary analysis of recent captures of small cetaceans in Peru and Chile'. International Whaling Commission, Scientific Committee Document SC/51/SM17, Cambridge, UK.

Van Waerebeek, K., Santillán, L. and Suazo, E. 2009. 'On the native status of the southern right whale *Eubalaena australis* in Peru'. *Bol. Mus. Nac. Hist. Nat.(Santiago)*, 58, 69-76.

Vianna, J.A., Ayerdi, P., Medina-Vogel, G., Mangel, J.C., Zeballos, H., Apaza, M. and Faugeron, S. 2010. 'Phylogeography of the marine otter (*Lontra felina*): historical and contemporary factors determining its distribution'. *Journal of Heredity*, 101(6), 676-689.

Acknowledgements

We would like to thank the participants of the 2022 hybrid IMMA Regional Expert Workshop for the identification of IMMAs in the South East Tropical and Temperate Pacific Ocean. Funding for the identification of this IMMA was provided by the Global Ocean Biodiversity Initiative funded by the German government's International Climate Initiative (IKI). Support was also provided by Whale and Dolphin Conservation, the Promar Foundation, and the Tethys Research Institute.



Suggested Citation: IUCN-MMPATF (2023) Central Humboldt Current Upwelling System IMMA Factsheet. IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, 2023.

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