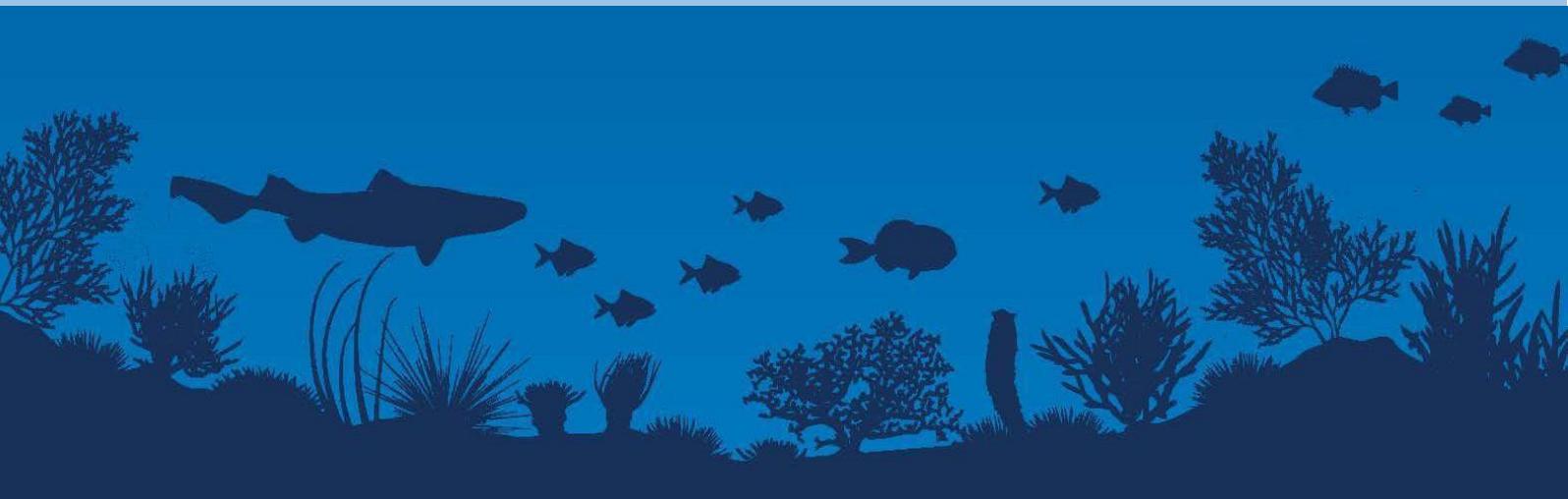


Eastern Pacific leatherback turtles (*Dermochelys coriacea*) movements and area-use in the South Pacific

A case study illustrating ecological connectivity in areas beyond national
jurisdiction



Eastern Pacific leatherback turtles' (*Dermochelys coriacea*) movements and area-use in the South Pacific

Authors

Sarah Poulin¹, Connie Y Kot¹, Jeffrey C. Mangel² and Joanna Alfaro-Shigueto², in collaboration with UN Environment Programme World Conservation Monitoring Centre

¹ Marine Geospatial Ecology Lab, Duke University

² ProDelphinus

Acknowledgements

This case study was developed by the Migratory Connectivity in the Ocean (MiCO) initiative. For further information on how migratory behavior of marine mammals, seabirds, sea turtles and fish connect the world, please see <https://mico.eco>. This publication has been prepared within the framework of the Global Environment Facility project entitled “Sustainable fisheries management and biodiversity conservation of deep-sea living marine resources and ecosystems in the Areas Beyond National Jurisdiction (ABNJ)” (referred to as the ‘ABNJ Deep Seas Project’) jointly implemented by the Food and Agriculture Organisation of United Nations (FAO) and United Nations Environment Programme (UN Environment). The authors are grateful to the Global Environment Facility (GEF) who financed this work.

For questions regarding this document, please contact:

Nina Bhola and Rachael Scrimgeour

UNEP-WCMC

Cambridge, United Kingdom

Citation

Poulin, Sarah; Kot, Connie Y; Mangel, Jeffrey C and Joanna Alfaro-Shigueto (2019). Case Study: Eastern Pacific leatherback turtles' (*Dermochelys coriacea*) movements and area- use in the South Pacific. Technical document produced as part of the GEF ABNJ Deep Seas Project. Cambridge (UK): UN Environment Programme World Conservation Monitoring Centre. 8pp.

Graphics

Cover: Graphics used with permission from the FAO/UN Environment Programme GEF ABNJ Deep Seas Project



© 2019 United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC).

The UNEP-WCMC is the specialist biodiversity centre of the UN Environment Programme, the world's foremost intergovernmental environmental organization. The Centre has been in operation for 40 years, combining scientific research with practical policy advice.

Distribution: This publication may be reproduced for educational or non-profit purposes without special permission, provided acknowledgement to the source is made. Reuse of any figures is subject to permission from the original rights holders. No use of this publication may be made for resale or any other commercial purpose without permission in writing from the UN Environment Programme. Applications for permission, with a statement of purpose and extent of reproduction, should be sent to the Director, UNEP- WCMC, 219 Huntingdon Road, Cambridge, UK.

Disclaimer: The contents of this report do not necessarily reflect the views or policies of the UN Environment Programme, contributory organizations or editors. The designations employed and the presentations of material in this report do not imply the expression of any opinion whatsoever on the part of the UN Environment Programme or contributory organizations, editors or publishers concerning the legal status of any country, territory, city area or its authorities, or concerning the delimitation of its frontiers or boundaries or the designation of its name, frontiers or boundaries. The mention of a commercial entity or product in this publication does not imply endorsement by the UN Environment Programme.

Partners involved in the GEF ABNJ Deep Seas Project are:



Introduction

Leatherback turtles (*Dermochelys coriacea*) are highly mobile species that migrate across entire ocean basins. Pacific leatherbacks form two distinct breeding population groups with different migration patterns (Bailey et al. 2012). In the eastern Pacific, nesting populations are found along the coasts of Central America, while western Pacific populations nest primarily in the Solomon Islands, Papua New Guinea, and Papua Barat, Indonesia (Dutton et al. 1999, 2007). Historically, both populations have been robust, but because of their long migrations and relatively long life cycle, they are highly sensitive to several anthropogenic stressors. These populations are currently in decline and listed as “critically endangered” on the International Union for Conservation of Nature (IUCN) Redlist (Tiwari et al. 2013).

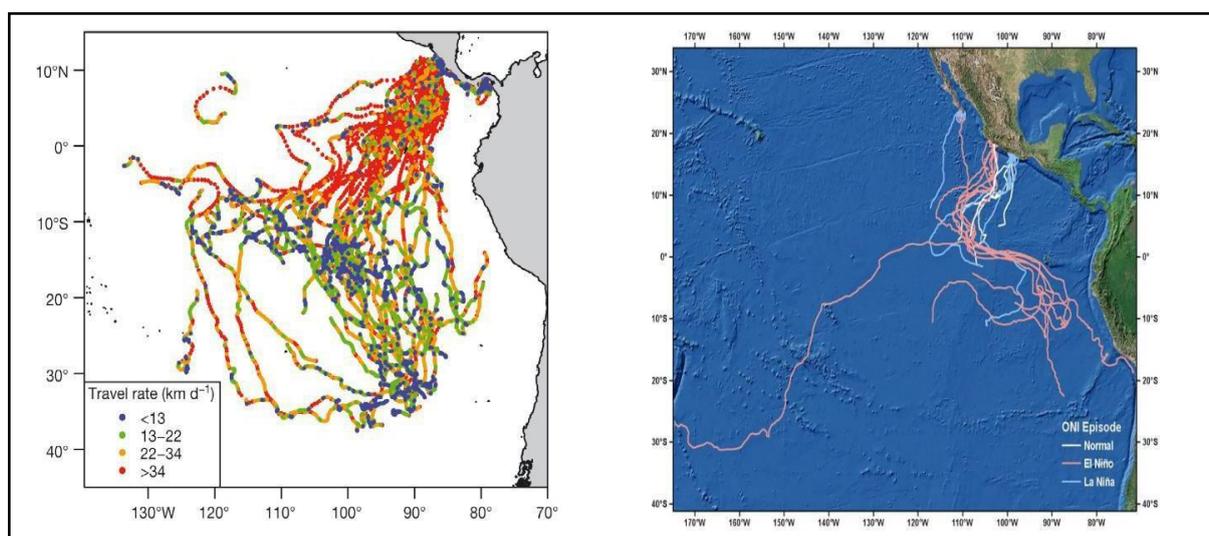


Figure 1 (Left) reprinted from Shillinger et al. 2011: Post nesting movements of females from Costa Rica nesting beaches ($n = 46$). (Right) reprinted from Schick et al. 2013: Post nesting movements of females from Mexico nesting beaches ($n = 15$)

Understanding migratory ranges

Understanding the political biogeography of these highly threatened populations is especially important, as their management is jurisdictionally complex. Female eastern Pacific leatherback turtles show consistent post-nesting dispersal from their Central American nesting sites along a southward migratory corridor towards the South Pacific Gyre (Shillinger et al. 2011; Schick et al. 2013; Figure 1). Much of this population’s transit time is spent travelling through Ecuadorian waters around the Galapagos and on the high seas, governance is fragmented and largely consensus-based. Along the most southern parts of their tracks in the southeastern Pacific, changes in both horizontal and vertical movements suggest foraging behavior (Bailey et al. 2008; Shillinger et al. 2011). Leatherbacks in this offshore foraging area have been observed reaching average maximum depths over 600 m, mimicking the diel patterns of their prey of gelatinous zooplankton that move up to the epipelagic zone at night and return to the mesopelagic zone during the day (Shillinger et al. 2011).

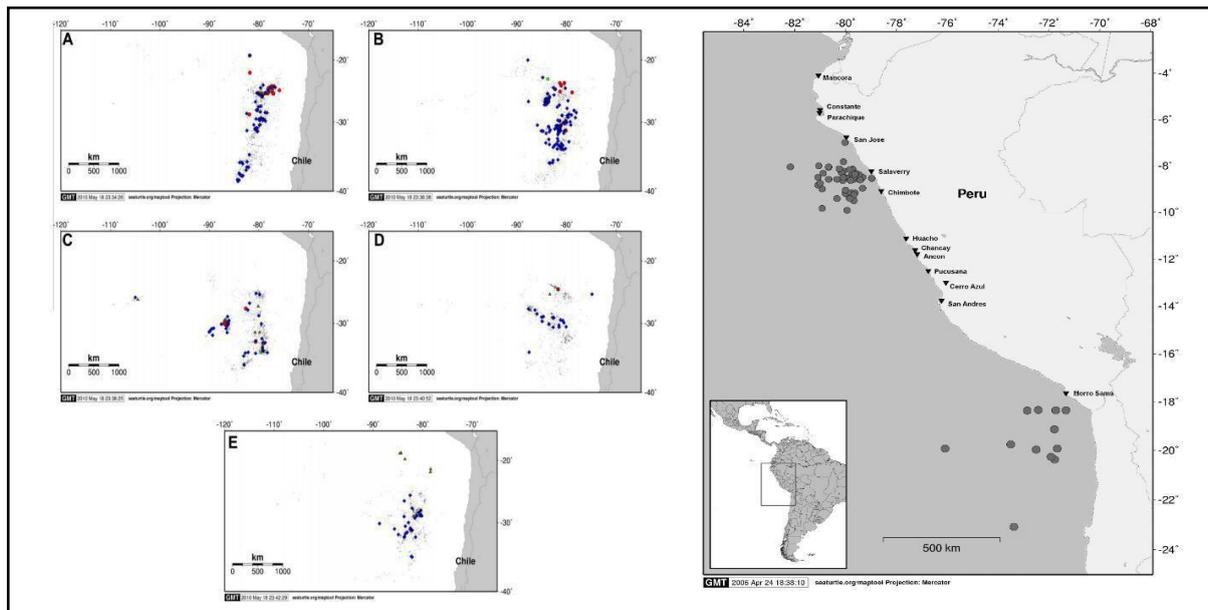


Figure 2 (Left) reprinted from Donoso and Dutton 2010: Locations of incidental catch of leatherbacks in Chilean fisheries (blue diamonds represent leatherbacks plotted by year). **(Right)** reprinted from Alfaro-Shigueto et al. 2007: Locations of incidental

However, these post-nesting tracking studies are just one glimpse into area-use by leatherbacks in the South Pacific. Fisheries data and published literature from fisheries indicate that South American coastal waters are also high-use areas for this population (Alfaro-Shigueto et al. 2007). Compared to other regions around the world, eastern Pacific leatherback sea turtle bycatch rates in net fisheries were among the highest (Wallace et al. 2013). fisheries bycatch records show that large leatherbacks, which are of high reproductive value to the population, make up a large majority of the Chilean longline bycatch with 284 caught between the years 2001-2005 (Donoso and Dutton 2010; Figure 2). Similarly, bycatch reports for the coastal waters off Peru contain high rates of leatherbacks as well (Alfaro-Shigueto et al. 2007; Figure 2). Therefore, the high rates of observation of leatherback bycatch both inside and outside of national jurisdiction need to be addressed through cooperative measures.

Although there is still uncertainty over the relative magnitudes of the impact from different fisheries on the population of eastern Pacific leatherback sea turtles, the waters off Peru and Chile are shown to be important foraging and migratory regions for these leatherbacks. In water satellite tagging efforts in Peru by the NGO ProDelphinus working with fishermen have begun to give us a glimpse of where the juveniles are spending their time. Use of horizontal migratory corridors by these tagged individuals show drastic differences from previously cited telemetry studies of post nesting females from Central America, beginning to introduce a more complete picture of the various movement patterns within this population (Mangel et al. 2018, unpublished data; Figure 3).

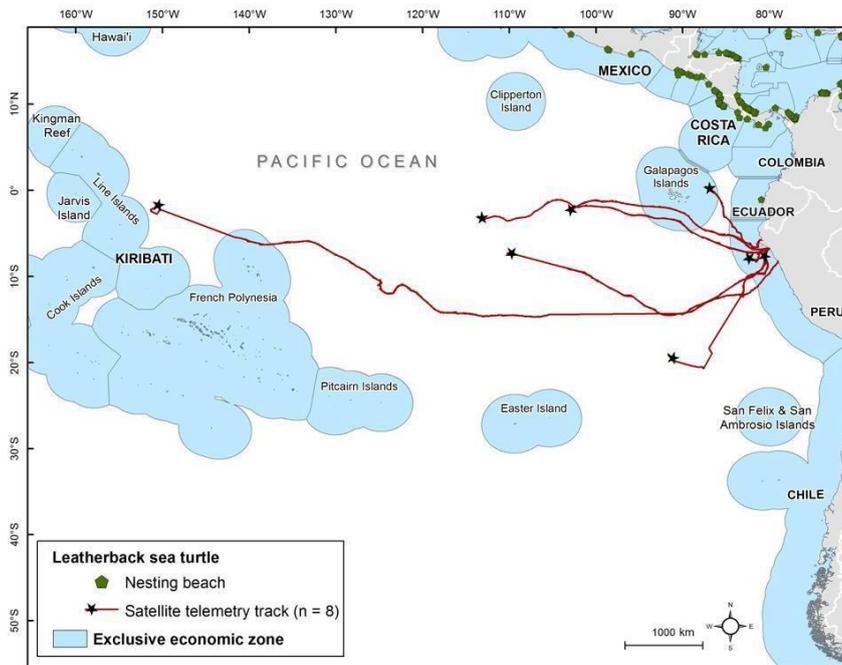


Figure 3 ProDelphinus, a Peruvian NGO, tracking data for eight juvenile leatherbacks tagged after being caught in nearshore waters of northern Peru in the gillnet fishery (Mangel et al. 2018, unpublished data) and reported leatherback nesting beaches (SWOT Report Editorial Team 2006 - 2019; Halpin et al. 2009; Kot et al. 2018). Stars represent endpoints of each track. Other data sources: exclusive economic zone (Flanders Marine Institute 2018); land (Global Administrative Areas 2015).

Connectivity between regions

The area-use patterns described in the literature summarized here connect life history stages of the eastern Pacific leatherback sea turtle population across EEZs in Central America (Mexico, Guatemala, El Salvador, Nicaragua, Costa Rica and Panama) to juvenile and adult foraging grounds in Peru and Chile, and migratory corridors through Colombia and Ecuador. Further, the tracking work on juveniles in Peruvian waters implies greater connectivity between national jurisdictions in Pacific South America and areas beyond national jurisdiction, including potential for connectivity between the eastern and western South Pacific. Conservation of this critically endangered population requires coordination among coastal states in Central and South America, as well as with governance frameworks with competency in areas beyond national jurisdiction (e.g., the South Pacific Regional Fisheries Management Organization [SPRFMO] and the Inter-American Tropical Tuna Commission [IATTC]).

References

- Alfaro-Shigueto, J., P. H. Dutton, M.-F. Van Bresseem, and J. Mangel. 2007. Interactions between leatherback turtles and Peruvian artisanal fisheries. *Chelonian Conservation and Biology* 6:129-134.
- Bailey, H., S. R. Benson, G. L. Shillinger, S. J. Bograd, P. H. Dutton, S. A. Eckert, S. J. Morreale, F. V. Paladino, T. Eguchi, and D. G. Foley. 2012. Identification of distinct movement patterns in Pacific leatherback turtle populations influenced by ocean conditions. *Ecological Applications* 22:735-747.
- Donoso, M., and P. H. Dutton. 2010. Sea turtle bycatch in the Chilean pelagic longline fishery in the southeastern Pacific: opportunities for conservation. *Biological Conservation* 143:2672-2684.
- Dutton, P. H., B. W. Bowen, D. W. Owens, A. Barragan, and S. K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). *Journal of Zoology* 248:397-409.
- Dutton, P. H., C. Hitipeuw, M. Zein, S. R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbesy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the western Pacific. *Chelonian Conservation and Biology* 6:47-53.
- Flanders Marine Institute. 2018. Maritime boundaries geodatabase: maritime boundaries and exclusive economic zones (200NM), version 10. Available online at <http://www.marineregions.org>. Accessed: December 5, 2018. <https://doi.org/10.14284/312>
- Global Administrative Areas. 2015. GADM database of Global Administrative Areas, version 2.8. Available online at: <http://www.gadm.org>. Accessed December 5, 2018.
- Halpin, P. N., A. J. Read, E. Fujioka, B. D. Best, B. Donnelly, L. J. Hazen, C. Kot, K. Urian, E. LaBrecque, and A. Dimatteo. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22:104-115.
- Kot, C. Y., E. Fujioka, A. D. DiMatteo, B. P. Wallace, B. J. Hutchinson, J. Cleary, P. N. Halpin, and R. B. Mast. 2018. The State of the World's Sea Turtles Online Database: Data provided by the SWOT Team and hosted on OBIS-SEAMAP. Oceanic Society, Conservation International, IUCN Marine Turtle Specialist Group (MTSG), and Marine Geospatial Ecology Lab, Duke University. <http://seamap.env.duke.edu/swot>.
- Mangel, J., J. Alfaro-Shigueto, S. Pingo, and A. Jimenez. 2018, unpublished data. Peru leatherback tracking project. ProDelphinus. Available at [seaturtle.org/STAT](http://www.seaturtle.org/STAT) (http://www.seaturtle.org/tracking/?project_id=958) and OBIS-SEAMAP (<http://seamap.env.duke.edu/dataset/1334>).
- Schick, R. S., J. J. Roberts, S. A. Eckert, P. N. Halpin, H. Bailey, F. Chai, L. Shi, and J. S. Clark. 2013. Pelagic movements of Pacific leatherback turtles (*Dermochelys coriacea*)

highlight the role of prey and ocean currents. *Movement Ecology* 1:11.

Shillinger, G. L., A. M. Swithenbank, H. Bailey, S. J. Bograd, M. R. Castelton, B. P. Wallace, J. R. Spotila, F. V. Paladino, R. Piedra, and B. A. Block. 2011. Vertical and horizontal habitat preferences of post-nesting leatherback turtles in the South Pacific Ocean. *Marine Ecology Progress Series* 422:275-289.

SWOT Report Editorial Team. 2006-2019. SWOT Report Volumes I-XIV. *The State of the World's Sea Turtles*. Arlington, VA and Ross, CA.

Tiwari, M., B. P. Wallace, and M. Girondot. 2013. *Dermochelys coriacea* West Pacific Ocean subpopulation. The IUCN Red List of Threatened Species 2013: e.T46967817A46967821. <http://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T46967817A46967821.en> .

Wallace, B. P., C. Y. Kot, A. D. DiMatteo, T. Lee, L. B. Crowder, and R. L. Lewison. 2013. Impacts of fisheries bycatch on marine turtle populations worldwide: toward conservation and research priorities. *Ecosphere* 4:1-49.

ABNJ DEEP SEAS PROJECT

The Sustainable Fisheries Management and Biodiversity Conservation of Deep Sea Living Resources in Areas Beyond National Jurisdiction Project (ABNJ Deep Seas Project for short) is a five-year project supported by the Global Environment Facility, and implemented jointly by the Food and Agriculture Organization of the United Nations, and the United Nations Environment Programme. The UN Environment Programme project component is executed through the UN Environment Programme World Conservation and Monitoring Centre.

The Project is designed to enhance sustainability in the use of deep-sea living resources and biodiversity conservation in the ABNJ through the systematic application of an ecosystem approach. It brings together over 20 partners who work on deep-sea fisheries and conservation issues in the ABNJ globally. The partnership includes regional organizations responsible for the management of deep-sea fisheries, Regional Seas Programmes, the fishing industry and international organizations.

The Project aims to:

Strengthen policy and legal frameworks for sustainable fisheries and biodiversity conservation in the ABNJ deep-seas;

Reduce adverse impacts on VMEs and enhanced conservation and management of components of EBSAs;

Improve planning and adaptive management for deep-sea fisheries in ABNJ; and develop and test methods for area-based planning.

The ABNJ Deep Seas Project started in September 2015 and is one of four projects under the **GEF Common Oceans Programme**.

More information is available from www.commonoceans.org