

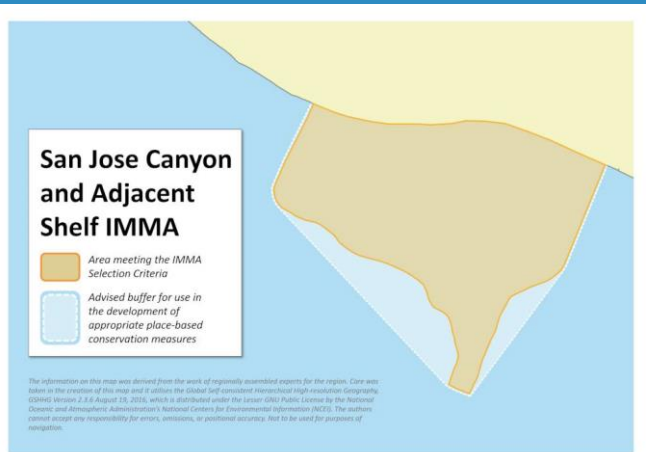
# San José Canyon and Adjacent Shelf IMMA

## Summary, continued.

coastal (*S. a. graffmani*) and offshore (*S. a. attenuata*) subspecies, spinner dolphins (*Stenella longirostris*) including the Central American (*S. l. centroamericana*) and Eastern (*S. l. orientalis*) subspecies, and common bottlenose dolphins (*Tursiops truncatus*), are the species most frequently observed in the area. Groups with calves, including neonates, of these species have been identified in the area, which also serves as a foraging area for several small cetaceans.

## Description:

This IMMA is in the southeastern portion of the Pacific coast of Guatemala. It forms part of the Eastern Tropical Pacific, an area considered one of the marine regions with the highest productivity in the world (Spalding et al., 2007). The bathymetry of the IMMA is quite variable, with flat sites that are a few meters deep, especially near the coast, and areas with steep slopes and depths of more than 6,000 m. The area also includes the continental shelf and the San José Canyon, which drops from 200 to 2,000 m (Ladd & Schroder, 1985) and extends out into the Middle America Trench (von Huene et al., 1985). It is 20-30 km wide and has a V-shaped cross-section (Ladd & Schroder, 1985). The canyon appears to be a feature that facilitates the transportation of nutrient-rich waters to nearby coastal areas; thus, attracting several cetacean species (Quintana-Rizzo et al., 2021). The IMMA includes four proposed marine protected areas (MPAs) that are under review. According to Ministerio de Ambiente y Recursos Naturales (MARN) and Programa de las Naciones Unidas para el Desarrollo (PNUD) (2018), from west to east, the



## Area Size

11 729 km<sup>2</sup>

## Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*

Criterion A; C (1, 3)

Pantropical spotted dolphin – *Stenella attenuata*

Criterion C (1, 2)

Spinner dolphin – *Stenella longirostris*

Criterion C (1, 2)

Common bottlenose dolphin – *Tursiops truncatus*

Criterion C (1)

## Marine Mammal Diversity

*Delphinus delphis*, *Grampus griseus*, *Orcinus orca*,  
*Pseudorca crassidens*, *Steno bredanensis*,  
*Balaenoptera edeni*

## Summary

The San José canyon and adjacent shelf IMMA is in Guatemala's Pacific waters. The site includes flat shallow areas, especially near the coast, as well as the San José Canyon that drops from 200 to 2,000 m and extends out into the Middle America Trench. This IMMA hosts important habitat for several cetacean species. Humpback whales from the Northeastern Pacific (*Megaptera novaeangliae kuzira*), Pantropical spotted dolphins (*Stenella attenuata*) including the

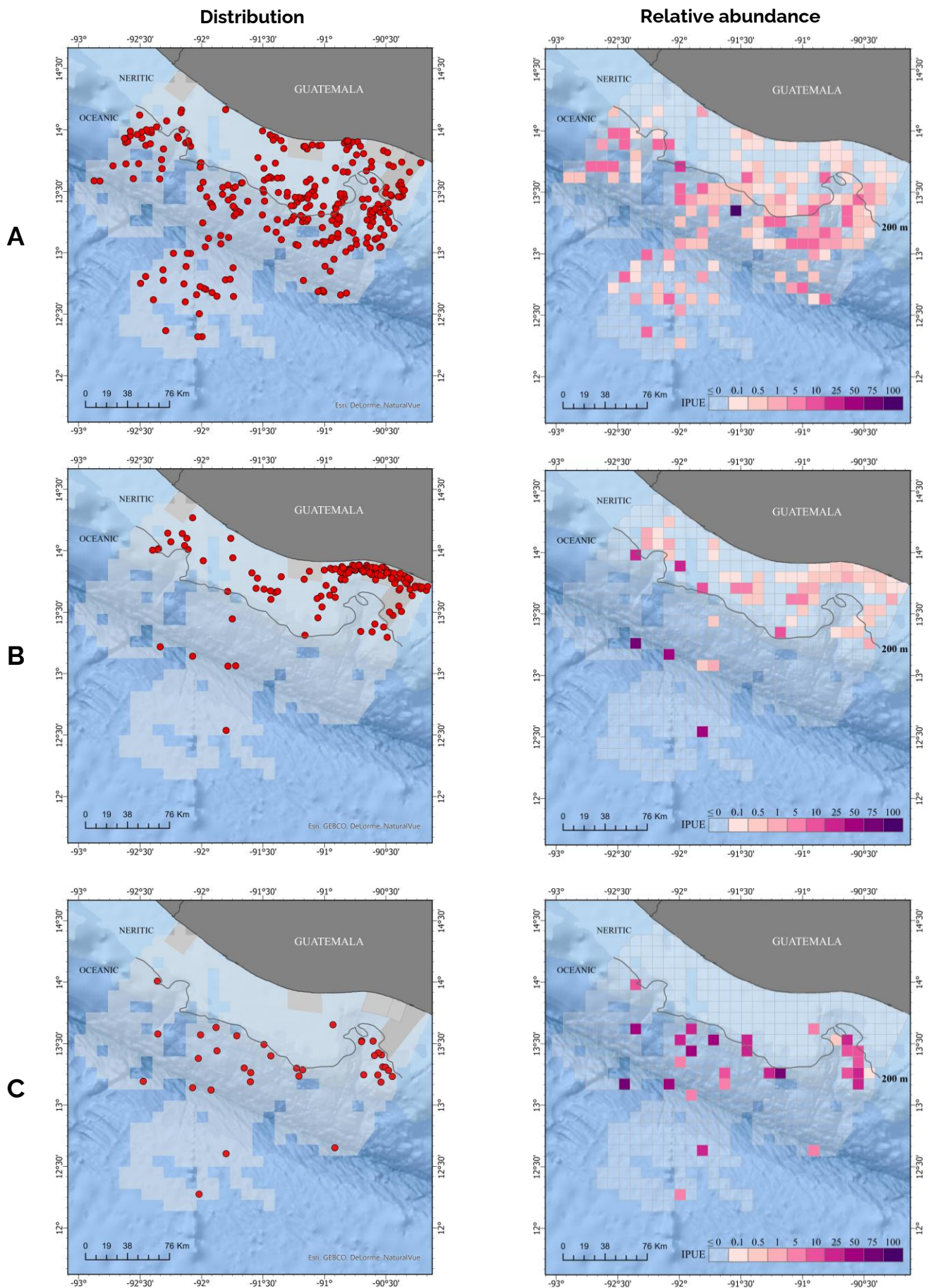


Figure 1: Sightings and relative abundance (individuals per survey effort) of the three most common Delphinidae species: (A) *Tursiops truncatus*, (B) *Stenella attenuata*, and (C) *Stenella longirostris* in the Guatemalan Exclusive Economic Zone. The 200 m isobath is also included. Reproduced from Quintana-Rizzo et al. (2021).

proposed MPAs are: (1) Sipacate-Naranjo (marine zone: 543.90 km<sup>2</sup>), (2) Monterrico (marine zone: 430.46 km<sup>2</sup>), (3) Hawaii (marine zone: 239.76 km<sup>2</sup>), and (4) Las Lisas (marine zone: 1,018.48 km<sup>2</sup>). It also includes the second largest commercial port in the Pacific waters of Central America, Puerto Quetzal (Comisión Centro Americana de Transporte Marítimo, 2021).

## Criterion A: Species or Population Vulnerability

Humpback whales (*Megaptera novaeangliae*) that use the IMMA are part of the Central America distinct population segment (DPS), which is classified as 'Endangered' by the United States Endangered Species Act (81 FR 62260, September 8, 2016; Figure 2). The Central America DPS is one of 14 DPS for humpback whales around the world, and one of only four DPS listed as endangered (Bettridge et al., 2015). A DPS is made up of whales that share the same latitude breeding area but migrate seasonally to

specific mid-to high latitude feeding grounds that may differ among individuals (Bettridge, 2019). The Central America DPS is composed of whales that breed along the Pacific coast of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama (Bettridge et al., 2015; Curtis et al., 2022). This DPS wintering area is understood to extend into southern Mexico (Wade, 2016; Taylor 2021; Curtis et al., 2022).

The population estimate for the Central America DPS varies between 500-700 individuals depending on the mark-recapture method used (Calambokidis et al., 2008; Barlow et al., 2011; Wade, 2016). The population estimate for the combined Southern Mexico-Central America DPS is approximately 1,500 whales (Curtis et al., 2022). In comparison, the abundance of humpback whales off the United States West Coast, which includes some of the Central America DPS whales, is estimated to be 5,000 individuals (Calambokidis & Barlow, 2020).



Figure 2: A humpback whale (*Megaptera novaeangliae*) sighted in the Pacific coastal water of Guatemala. Photo credit: Ester Quintana-Rizzo.

## Criterion C: Key Life Cycle Activities

### Sub-criterion C1: Reproductive Areas

Four species have been documented in the IMMA with calves, including neonates and young of the year (for definition of terms: Wells et al., 1996): humpback whales, pantropical spotted dolphins (*Stenella attenuata*), spinner dolphins (*S. longirostris*), and common bottlenose dolphins (*Tursiops truncatus*) (Figure 3; Ortiz-Wolford, 2011; Quintana-Rizzo, 2012, 2019; Quintana-Rizzo et al., 2021). In the case of humpback whales, calves have been documented in 28% of the humpback whale groups observed between 2008 and 2022, and those groups were significantly larger than non-calf groups (Quintana-Rizzo & Calambokidis, 2017; Quintana-Rizzo, unpublished data). Singing, associated with humpback whale reproductive activity, was recorded in 88% of the acoustic stations within the IMMA in the 2008-2010 survey season, suggesting that the activity is very common (Quintana-Rizzo & Calambokidis, 2017).

Two subspecies of pantropical spotted dolphins (coastal: *S. a. graffmani* and offshore: *S. a. attenuata*) and spinner dolphins (Centro Americana: *S. l. centroamericana* and Eastern: *S. l. orientalis*) were also regularly observed in the IMMA with young of different ages; calf presence (including neonates) was observed in 55% and 100% of all observed groups in which calf presence or absence was documented, respectively. Calves were reported in 22% of observed bottlenose dolphin groups in which calf presence or absence was documented (small cetacean estimates based on combined unpublished data: A. Cabrera, V. Davila, J. Ortiz-Wolford, E. Quintana-Rizzo, pers.comm).

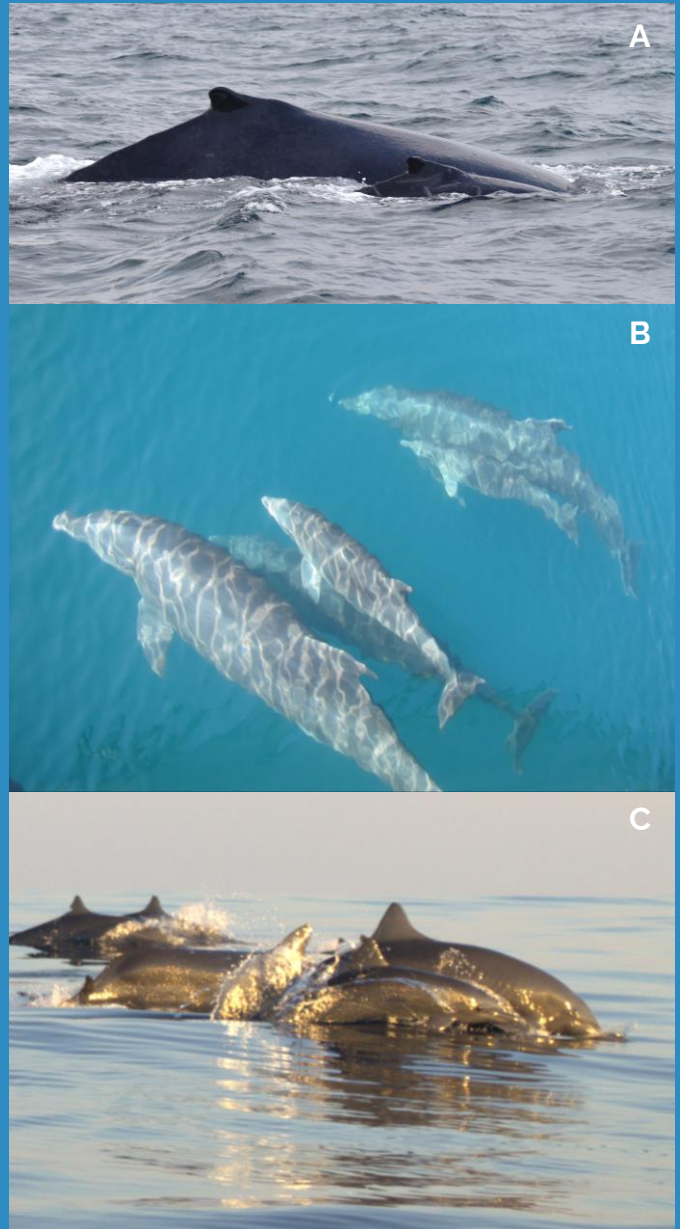


Figure 3: Mothers and calves of different species (A: *Megaptera novaeangliae*, B: *Tursiops truncatus*, and C: *Stenella longirostris*) swim near the Pacific coast of Guatemala. Photo credit: A: Ester Quintana-Rizzo, B: Rosa Jiménez, and C: Andrea Cabrera.



Figure 4: An acrobatic *Stenella attenuata* swims in the Pacific coastal waters of Guatemala. Photo credit: Ester Quintana-Rizzo.



Figure 5: Groups of *Stenella longirostris* observed off the Pacific coast of Guatemala. Photo credits: Jennifer Ortiz, Vanessa Dávila and Andrea Cabrera.

### Sub-criterion C2: Feeding Areas

The offshore waters of Guatemala are characterized by seasonal eddies that function as retention mechanisms for planktonic organisms, which serve as food sources for first-order consumers and consequently generate food for higher trophic

predators (Ehrhardt & Fitchett, 2006; Acosta-Pachón et al., 2017). Submarine canyons, such as the San José Canyon, serve as conduits for the transport of deep, nutrient-rich waters to the continental shelf waters of coastal ecosystems (Fernandez-Arcaya et al., 2017; Santora et al., 2018).

Spinner and spotted dolphins have been observed feeding in the IMMA. A high percentage of spinner dolphin groups (70%) have been observed feeding, while only 20% of spotted dolphin groups were involved in this activity. Spinner dolphin groups were larger, with groups of up to approximately 2,000 individuals (mean  $\pm$  standard error =  $585 \pm 129$ ; Figure 5) while the largest spotted dolphin group was 55 ( $19 \pm 3$ ). Feeding in both species was typically observed near the San José Canyon, along the 200 m isobath (near the continental shelf edge), and the Middle America trench. These are likely areas of high productivity where dolphins concentrate to feed (estimates based on combined unpublished data: A. Cabrera, V. Davila, J. Ortiz-Wolford, E. Quintana-Rizzo).

### Sub-criterion C3: Migration Routes

Large-scale movements of humpback whales to this IMMA have been confirmed with photographic identification and/or satellite tagging (Curtis et al., 2022; Mate et al., 2018; Quintana-Rizzo & Calambokidis, 2017). Humpback whales make extensive seasonal migrations between high latitude summer feeding grounds and low latitude wintering grounds. Winters are spent mating and calving in warm sub-tropical waters, with an annual migration back to colder waters to feed (Modest et al., 2021). In the northern hemisphere, their breeding and migratory corridors include the Pacific continental shelf off Central America. During their migration to/from Central America, whales use the waters of the IMMA (Quintana-Rizzo, 2019).

Evidence suggests a dual functionality of the IMMA for humpback whales. The low resightings rate of some individuals suggests that they use the IMMA as a migration route and/or a steppingstone on their migration routes, while the presence of whales with calves including neonates (Quintana-Rizzo pers. comm., Quintana-Rizzo & Calambokidis, 2017) suggests that other whales use it for reproductive activities. Resightings between the IMMA and other areas in Central America suggest that individual whales visit multiple sites within a breeding season (Quintana-Rizzo & Calambokidis, 2017). It also highlights the interconnectivity of the different sites and that this IMMA serves as a migratory corridor for the species.

## Supporting Information

Acosta-Pachón, T.A., Martínez-Rincón, R.O. and Hinton, M.G. 2017. 'Habitat preferences of striped marlin (*Kajikia audax*) in the eastern Pacific Ocean'. *Fisheries Oceanography* 26:615–624. doi: 10.1111/fog.12220.

Barlow, J., Calambokidis, J., Falcone, E.A., Baker, C.S., Burdin, A.M., Clapham, P.J., Ford, J.K.B., Gabriele, C.M., LeDuc, R., Mattila, D.K., Quinn, T.J., II, Rojas-Bracho, L., Straley, J.M., Taylor, B.L., Urbán R., J., Wade, P., Weller, D., Witteveen, B.H. and Yamaguchi, M. 2011. 'Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies'. *Marine Mammal Science* 27:793–818. doi:10.1111/j.1748-7692.2010.00444.x.

Bettridge, S. 2019. Reviewing and Designating Stocks and Issuing Stock Assessment Reports under the Marine Mammal Protection Act Procedure 02-204-03. U.S.: National Oceanic and Atmospheric Administration (NOAA). Available at: [https://www.fisheries.noaa.gov/national/laws-and-](https://www.fisheries.noaa.gov/national/laws-and-policies/policy-directive-system)

[policies/policy-directive-system](https://www.fisheries.noaa.gov/national/laws-and-policies/policy-directive-system).

Bettridge, S., Baker, C.S., Barlow, J., Clapham, P.J., Ford, M., Gouveia, D., Mattila, D.K., Pace, R.M. III, Rosel, P.E., Silber, G.K. and Wade, P. 2015. Status review of the humpback whale (*Megaptera novaeangliae*) under the Endangered Species Act. U.S.: National Oceanic and Atmospheric Administration (NOAA). Available at: [www.nmfs.noaa.gov/pr/species/Status%20Reviews/humpback\\_whale\\_sr\\_2015.pdf](http://www.nmfs.noaa.gov/pr/species/Status%20Reviews/humpback_whale_sr_2015.pdf).

Calambokidis, J. and Barlow, J. 2020. Updated abundance estimates for blue and humpback whales along the U.S. West Coast using data through 2018. U.S.: National Oceanic and Atmospheric Administration (NOAA). Available at: <https://repository.library.noaa.gov/view/noaa/27104>

Calambokidis, J., Falcone, E.A., Quinn, T.J., Burdin, A.M., Clapham, P.J., Ford, J.K.B., Gabriele, C.M., LeDuc, R., Matilla, D., Rojas-Bracho, L., Straley, J., Taylor, B.L., Urbán, J., Weller, D., Witteveen, B., Yamaguchi, M., Bendlin, A., Camacho, D., Flynn, K., Havron, A., Huggins, J., Maloney, N., Barlow, J. and Wade, P.R. 2008. SPLASH: Structure of populations, levels of abundance, and status of humpback whales in the North Pacific. Washington US: Cascadia Research.

Comisión Centro Americana de Transporte Marítimo. 2021. Istmo Centroamericano movimiento de carga, buques y contenedores. Boletín Trimestral Cuarto Trimestre 2020, 2021. Cifras Preliminares. 26 pp.

Curtis, K.A., Calambokidis, J., Audley, A., Castaneda, M.G., De Weerd, J., García Chávez, A.J., Garita, F., Martínez-Loustalot, P., Palacios-Alfaro, J.D., Pérez, B., Quintana-Rizzo, E., Ramírez Barragan, R., Ransome, N., Rasmussen Urbán, J., Villegas Zurita, F., Flynn, K., Cheeseman, T., Barlow, J., Steel, D. and Moore, J. 2022. Abundance of humpback whales (*Megaptera*

*novaeangliae*) wintering in Central America and southern Mexico from a one-dimensional spatial capture-recapture model. U.S.: National Oceanic and Atmospheric Administration (NOAA). Available at: <https://doi.org/10.25923/9ccq1-rx80>.

Ehrhardt, N.M. and Fitchett, M.D. 2006. 'On the seasonal dynamic characteristics of the sailfish, *Istiophorus platypterus*, in the Eastern Pacific Off Central America'. *Bulletin of Marine Science* 79:589–606.

Fernandez-Arcaya, U., Ramirez-Llodra, E., Aguzzi, J., Allcock, A.L., Davies, J.S., Awantha, D., Harris, P., Howell, K., Huvenne, V., Macmillan-Lawler, M., Martín, J., Menot, L., Nizinski, M., Puig, P., Rowden, A., Sanchez, F. and Van den Beld, I. 2017. 'Ecological role of submarine canyons and need for canyon conservation: A review'. *Frontiers in Marine Science* 4:1–26. [doi.org/10.3389/fmars.2017.00005](https://doi.org/10.3389/fmars.2017.00005).

Ladd, J. and Schroder, S. 1985. 'Seismic stratigraphy of the continental shelf offshore Guatemala: Implications for vertical tectonics related to subduction'. *Journal of Manufacturing Systems* 1:173–203. [doi.org/10.2973/dsdp.proc.84.140.1985](https://doi.org/10.2973/dsdp.proc.84.140.1985).

Mate, B.R., Palacios, D.M., Baker, C.S., Lagerquist, B.A., Ladd, M., Follett, T., Steel, D., Hayslip, C.E. and Winsor, M.H. 2018. Humpback whale tagging in support of marine mammal monitoring across multiple navy training areas – Final Report for Feeding Areas off the US West Coast in Summer-Fall 2017, Including Historical Data from Previous Tagging Efforts. San Diego California, U.S.: Department of the Navy Cooperative Agreement. Available at: [https://www.navy-marine-species-monitoring.us/files/5716/6023/3260/Mate\\_et\\_al\\_2018b\\_Humpback\\_Whale\\_Tagging\\_US\\_West\\_Coast\\_Summer-Fall\\_2017\\_Final\\_Oct2018.pdf](https://www.navy-marine-species-monitoring.us/files/5716/6023/3260/Mate_et_al_2018b_Humpback_Whale_Tagging_US_West_Coast_Summer-Fall_2017_Final_Oct2018.pdf).

Ministerio de Ambiente y Recursos Naturales (MARN) y Programa de las Naciones Unidas para el Desarrollo (PNUD). 2018. Sistematización y aportes del Proyecto Conservación y Uso Sostenible de la Biodiversidad en Áreas Protegidas Marino-Costas. Guatemala: PNUD.

Modest, M., Irvine, L., Andrews-Goff, V., Gough, W., Johnston, D., Nowacek, D., Pallin, L., Read, A., Tyson Moore, R. and Friedlaender, A. 2021. 'First description of migratory behavior of humpback whales from an Antarctic feeding ground to a tropical calving ground'. *Animal Biotelemetry* 9:42. [doi.org/10.1186/s40317-021-00266-8](https://doi.org/10.1186/s40317-021-00266-8).

Ortiz-Wolford, J. 2011. 'Comportamientos de socialización y alimentación de tres especies de delfines (*Tursiops truncatus*, *Stenella longirostris* y *Delphinus delphis*) en el Cañón de San José y la Fosa Centroamericana – Pacífico Este de Guatemala'. Tesis Licenciatura. Guatemala: Universidad de San Carlos de Guatemala.

Quintana-Rizzo, E. 2012. Estado y ecología de las poblaciones de cetáceos en el Océano Pacífico de Guatemala. Guatemala: Consejo Nacional de Ciencia y Tecnología.

Quintana-Rizzo, E. 2019. 'Distribución y abundancia de ballenas en Guatemala con énfasis en el comportamiento de las ballenas jorobadas (*Megaptera novaeangliae*)'. En C. Kraker, A. P. Calderón and A. A. Cabrera (eds). *Perspectivas de investigación sobre los mamíferos silvestres de Guatemala*. pp. 247–261. Guatemala: Asociación Guatemalteca de Mastozoólogos.

Quintana-Rizzo, E. and Calambokidis, J. 2017. 'Resighting patterns and behavior of humpback whales sighted in a Tropical breeding ground off Guatemala', paper delivered at the 22<sup>nd</sup> Biennial

Conference on the Biology of Marine Mammals, Halifax, Canada, 23-27 October 2017.

Quintana-Rizzo, E., Cabrera, A.A., Ortiz-Wolford, J. and Dávila, V. 2021. 'Spatial distribution and abundance of small cetaceans in the Pacific waters of Guatemala'. *Frontiers in Marine Science* 8:1-18.  
doi: 10.3389/fmars.2021.674134.

Taylor, B.L., Martien, K.K., Archer, F.I., Audley, K., Calambokidis, J., Cheeseman, T., De Weerd J., Frisch Jordán, A., Martínez-Loustalot, P., Ortega-Ortiz, C.D., Patterson, E.M., Ransome, N., Ruvelas, P. and Urbán Ramírez, J. 2021. Evaluation of humpback whales wintering in Central America and southern Mexico as a demographically independent population. U.S.

Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-655.  
doi.org/10.25923/sgek-1937.

Santora, J.A., Zeno, R.A., Dorman, J.G. and Sydeman, W. 2018. 'Submarine canyons represent an essential habitat network for krill hotspots in a large marine ecosystem'. *Scientific Reports* 8:1-9. doi: 10.1038/s41598-018-25742-9.

Spalding, M.D., Fox, H.E., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A. and Robertson, J. 2007. 'Marine ecoregions of the world: A bioregionalization of coastal and shelf areas'. *BioScience* 57:573-583.  
doi: 10.1641/B570707.

von Huene, R., Fiesen, W. and Blome, C. 1985. '18 Igneous and sedimentary rocks recovered during deep sea drilling project site surveys off Guatemala'. In Institute of Oceanography (ed.) Initial Report, Deep Sea Drilling Project 84. pp. 619-624. Washington: Deep Sea Drilling Project.

Wade, P.R. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas – revision of estimates in SC/66b IA21, paper delivered at the IWC Scientific Committee Annual Meeting 2017.

Wells, R.S., Bassos, M.K., Urian, K.W., Carr, J.W. and Scott, M.D. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida, 1990-1994. U.S.: National Oceanic and Atmospheric Administration (NOAA). Available at: <https://repository.library.noaa.gov/view/noaa/8530>



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