





First record of the Banded Guitarfish, *Zapteryx exasperata* (Rhinopristiformes: Trygonorrhinidae), in central California, USA

RACHEL M. AITCHISON¹, GAMMON N. KOVAL², DAVID A. EBERT^{1,3,4}

¹ Pacific Shark Research Center, Moss Landing Marine Laboratories, 8272 Moss Landing Rd., Moss Landing, CA 95039, USA  <https://orcid.org/0000-0001-7964-0243> E-mail: rachel.aitchison@sjsu.edu

² Moss Landing Marine Laboratories, 8272 Moss Landing Rd., Moss Landing, CA 95039, USA  <https://orcid.org/0000-0003-3526-0737> E-mail: gammon.koval@sjsu.edu

³ Research Associate, Department of Ichthyology, California Academy of Sciences, 55 Music Concourse Dr., San Francisco, CA 94118, USA  <https://orcid.org/0000-0003-4604-8192> E-mail: david.ebert@sjsu.edu

⁴ Research Associate, South African Institute for Aquatic Biodiversity, Private Bag 1015, Grahamstown 6140, South Africa

Abstract

The recent ocean-warming events along the California coast have extended the northern range of several elasmobranch species. The Banded Guitarfish, *Zapteryx exasperata*, is a poorly known shallow-water batoid, typically found in warm-temperate to tropical waters of southern California, USA and the Gulf of California, Mexico. During a Baited Remote Underwater Video Station (BRUVS) survey in October 2020, an unusual batoid identified as *Z. exasperata* was observed at a depth of 2.5 m. This individual was within the Point Lobos State Marine Reserve in Monterey County, central California, extending its range by at least 260 km northwards. A key to the California species of guitarfishes and Thornback Ray is provided.

Key words: batoid, ray, elasmobranch, range extension, Pacific Ocean, Monterey Bay, climate change, BRUVS

Citation: Aitchison, R.M., Koval, G.N. & Ebert, D.A. (2021) First record of the Banded Guitarfish, *Zapteryx exasperata* (Rhinopristiformes: Trygonorrhinidae), in central California, USA. *Journal of the Ocean Science Foundation*, 38, 131–137.

doi: <https://doi.org/10.5281/zenodo.5807911>

Introduction

The Banded Guitarfish, *Zapteryx exasperata* (Jordan & Gilbert, 1880), is a poorly known batoid with prominent, dark, transverse, bands on its dorsal surface (Ebert 2003, Love & Passarelli 2020). A shallow-water species found from the intertidal zone to 200 m depth, it inhabits nearshore waters, rocky reefs, and sandy lagoons (Bizzarro & Kyne 2015, Ebert 2003, Kells et al. 2016). Banded Guitarfish are commonly caught in artisanal gillnet elasmobranch fisheries in the Gulf of California, Mexico, and data from fishery landings indicate that they exhibit seasonal migrations from nearshore waters in the spring and summer to deeper waters in the fall and winter (Blanco-Parra et al. 2009, Ramírez-Amaro & Galván-Magaña 2019). This species has been assessed by the International Union for the Conservation of Nature (IUCN) as Data Deficient (Bizzarro & Kyne 2015).

Zapteryx exasperata occurs from Jalama Beach in Santa Barbara County, California to Oaxaca, Mexico, including the Gulf of California (Love & Passarelli 2020). However, specimens south of Mazatlán, Mexico need to be distinguished from the Southern Banded Guitarfish, *Zapteryx xyster* (Jordan & Evermann, 1896), which appears to be the more common of these two species in that region. *Zapteryx xyster* reportedly occurs as far north as the central Gulf of California, but is most common from Mazatlán to Peru, and is often mistaken for *Z. exasperata* due to similarities in morphology (Castillo-Páez et al. 2017, González-Acosta et al. 2021, Ebert 2003). Misidentifications and taxonomic uncertainty have resulted in poorly defined distributions for both species and a taxonomic revision of this genus is likely necessary (Bizzarro & Kyne 2015, Kyne et al. 2021, Love et al. 2020).

Although the southern extent of its distribution is uncertain, the northern limit of *Z. exasperata* has long been recognized as Jalama Beach, California. However, recent oceanographic warming events off southern California have extended the northern ranges for a variety of fishes of the Southern California Current System (Walker et al. 2020). Notable examples of elasmobranchs include the Whale Shark (*Rhincodon typus*), Whitenose Shark (*Nasolamia velox*), Smooth Hammerhead (*Sphyrna zygaena*), and Giant Manta (*Mobula birostris*) (Walker et al. 2020). Additionally, young-of-the-year White Sharks (*Carcharodon carcharias*) now seasonally inhabit Monterey Bay (Tanaka et al. 2021). Other records of elasmobranchs moving northward from southern California to central and northern California have not been as well documented.

During a recent survey in Carmel Bay, Monterey County in central California, an unusual batoid not previously known to occur in the Monterey Bay region was observed. This species was identified as *Z. exasperata* and represents a notable northern range extension of this species into the Monterey Bay region (Fig. 1).

Materials and Methods

As part of a statewide surf-zone monitoring project, 6 horizontal, purpose-built Baited Remote Underwater Video Stations (BRUVS) were deployed 50 m from each other along the shore, 15 m offshore of the breaking waves in Whaler's Cove, Point Lobos State Natural Reserve (36.51°, -121.93°). These BRUVS utilized GoPro cameras (©2020 GoPro) mounted to a 4.5 kg weight, with a soft-mesh bait bag, attached to a 1 meter pole. Each BRUVS contained 500 g of chopped, frozen, Market Squid (*Doryteuthis opalescens*). Once deployed, BRUVS were left to record footage for an hour before they were retrieved. While the BRUVS were recording, a series of environmental data values were recorded at the study site. Water temperature was recorded via handheld thermometer. A seawater sample was taken from the swash zone and salinity was measured using a handheld refractometer. Maximum and average wind speeds for three minutes were recorded using a handheld Kestrel 2000 Wind Meter (© 2020 KestrelMeters.com) held about 2 m from the substrate within the swash zone. Wave period and height were estimated by an experienced observer.

Results and Discussion

On 30 October 2020, a guitarfish with a distinctive banding pattern was observed interacting with a BRUVS deployed on sandy substrate at a depth of 2.5 m, 15 m from shore. The water temperature was 15° C with a salinity of 37 ppt. Wave height was estimated to be 0.1 m with an average period of 6 seconds. Northwest winds, which are typical for the Monterey Bay region, had an average speed of 1.7 m/s with a maximum of 4.1 m/s.

The specimen was identified as *Zapteryx exasperata* based on a series of characters: a single row of thorns along the back, prominent dark bands across the body, speckles on the ventral side, and a rounded caudal fin. The estimated size of the specimen was 100 cm and it was identified as female since no claspers were visible (Fig. 2).

This species can be distinguished from the Shovelnose Guitarfish, *Pseudobatos productus*, the only other guitarfish species in California, by the following characteristics: *Z. exasperata* has a disc length that is about equal to its width vs. a disc length that is much greater than its width in *P. productus*, as well as a dorsal surface with distinct transverse banding pattern vs. a mostly plain dorsal surface without a banding pattern. *Zapteryx*

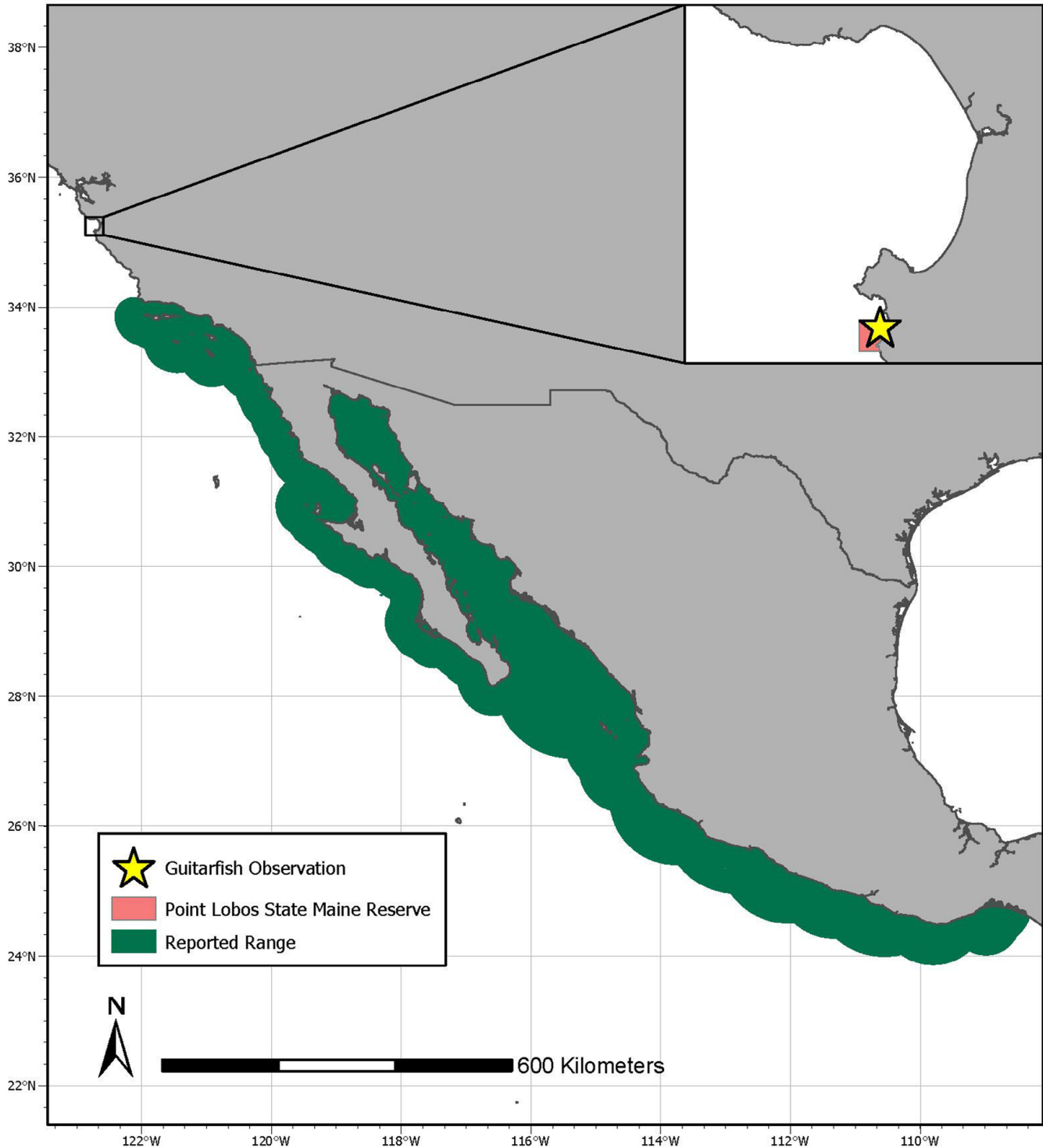


Figure 1. Map of *Zapteryx exasperata* observation indicated by a star in the inset (36.51°, -121.93°). The Point Lobos State Marine Reserve and reported range are designated in red and green, respectively.



Figure 2. Underwater images of *Zapteryx exasperata* in Whaler's Cove of Point Lobos State Marine Reserve interacting with a BRUVS. Distinguishing features shown in panel A: narrowly angular snout; B: speckles on the ventral side; and C: distinctive banding pattern and rounded caudal fin.

exasperata can also be distinguished from the morphologically similar Thornback Ray, *Platyrrhinoidis triseriata*, by having a wedge-shaped disc vs. a heart-shaped disc; an elongated narrowly angular snout vs. a short broadly rounded snout; and a single row of small thorns along the midback vs. one to three rows of large hook-like thorns along the midback.

This observation of *Z. exasperata* in shallow water in October contrasts with previous observations of females migrating to deeper waters in the fall and winter in the Gulf of California (Blanco-Parra et al. 2009, Villavicencio-Garayzar 1995). This individual was also active during the afternoon which differs from previous observations of *Z. exasperata* resting in caves or under ledges during the day (Ebert 2003). Geographic variation in behavior and life history have been observed in other batoids, including the Largetooth Sawfish, *Pristis pristis*, and Cownose Ray, *Rhinoptera bonasus* (Kyne et al. 2021, Neer & Thompson 2005). These observations may reflect geographic variation in these features.

Although Kells et al. (2016) report the range of *Z. exasperata* as central California to Mazatlán, Mexico (Fig. 1), no sightings north of Jalama Beach, California have been reported. This sighting is the first record in the Monterey Bay area, representing a northern range extension of almost 260 km and confirming the occurrence of the Banded Guitarfish in central California. In addition, this is the first observation of *Z. exasperata* inside a marine protected area, the Point Lobos State Marine Reserve (Bizzarro & Kyne 2015).

The Gorgona Guitarfish, *Psuedobatos prahli*, is another eastern Pacific guitarfish that recently had a notable range extension. The geographic range of *P. prahli* was documented as from the Gulf of Tehuantepec in southeastern Mexico south to northern Peru, but it has recently been expanded to include the peninsula of Baja California (Rutledge 2020). Documentation of species ranges is essential for implementing effective conservation strategies, especially since guitarfishes are among the most threatened groups of sharks and rays, due to their slow growth, low fecundity, and being an important target of fisheries worldwide (Dulvy et al. 2021, Jabado 2018, Moore 2017). Additional research into the biology, ecology, and population status of species such as *Z. exasperata* and *P. prahli* is necessary to improve conservation efforts and assess changes due to changing climate and oceanographic conditions.

BRUVS are becoming an increasingly popular sampling method to assess fish abundances and assemblages given their low cost, low risk to personnel, and non-destructive nature (Whitmarsh et al. 2017). They are also a form of non-extractive sampling, which is crucial when sampling sensitive areas such as MPAs (Cappo et al. 2006). BRUVS are also capable of documenting larger mobile species that can evade capture during seine-net surveys (Lowry et al. 2012, Murphy & Jenkins 2010). For chondrichthyans especially, BRUVS can improve our understanding of faunal associations, critical for implementing effective conservation and management strategies as well as MPA design and development (Bruns & Henderson 2020, Osgood et al. 2020). BRUVS can also detect species beyond their range, as in this report.

Key to the California Guitarfishes and the Thornback Ray

- 1a. Head and pectoral fins forming a heart-shaped disc; one to three rows of large hook-like thorns along midback; short broadly rounded snout; first dorsal fin closer to caudal fin than pelvic fins Thornback Ray, *Platyrrhinoidis triseriata*
- 1b. Head and pectoral fins forming a wedge-shaped disc; a single row of small thorns along midback; snout pointed; first dorsal fin closer to pelvic fins than caudal fin 2
- 2a. Disc length greater than width; dorsal surface usually plain, occasionally with dark spots but without prominent dark bands Shovelnose Guitarfish, *Pseudobatos productus*
- 2b. Disc length about equal to width; dorsal surface with prominent dark bands across back Banded Guitarfish, *Zapteryx exasperata*

Acknowledgments

The authors sincerely thank Chris Lowe for confirming our identification, as well as Scott Hamilton and Jenny Dugan for providing feedback. In addition, the authors would like to thank Lauren Parker, Justin Gill, Alexandra Stella, and Joseph Silva (Moss Landing Marine Laboratories, San Jose State University) for their assistance in sampling. Funding for this project was provided by the California Ocean Protection Council and California Sea-Grant (R/MPA-44) as part of the Phase 2 MPA monitoring program for sandy beaches and surf zones.

References

- Bizzarro, J.J., & Kyne, P.M. (2015) *Zapteryx exasperata*. The IUCN Red List of Threatened Species 2015: e.T60177A80673370. <https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T60177A80673370.en>.
- Blanco-Parra, M., Márquez-Farías, J.F., & Galván-Magaña, F. (2009) Reproductive biology of the banded guitarfish, *Zapteryx exasperata*, from the Gulf of California, México. *Journal of the Marine Biological Association of the United Kingdom*, 89 (08), 1655–1662 <https://doi.org/10.1017/S0025315409990348>
- Bruns, S. & Henderson A.C. (2020) A baited remote underwater video system (BRUVS) assessment of elasmobranch diversity and abundance on the eastern Caicos Bank (Turks and Caicos Island); an environment in transition. *Environmental Biology of Fishes*, 103 (9), 1001–1012. <https://doi.org/10.1007/s10641-020-01004-4>
- Cappo, M., Harvey, E. & Shortis M. (2006) Counting and measuring fish with baited video techniques-an overview. *Australian Society for Fish Biology Workshop Proceedings, Hobart, Tasmania*, 1, 101–114.
- Castillo-Páez, A., Sandoval-Castillo, J., Corro-Espinosa, D., Tovar-Ávila, J., Blanco-Parra, M., Saavedra-Sotelo, N.C., Sosa-Nishizaki, O., Galván-Magaña, F. & Rocha-Olivares, A. (2017) Cutting through the Gordian knot: unravelling morphological, molecular, and biogeographical patterns in the genus *Zapteryx* (guitarfish) from the Mexican Pacific. *ICES Journal of Marine Science*, 74 (6), 1630–1638. <https://doi.org/10.1093/icesjms/lsx021>
- Dulvy, N.K., Pacoureau, N., Rigby, C.L., Pollom, R.A., Jabado, R.W., Ebert, D.A., Finucci, B., Pollock, C.M., Cheok, J., Derrick, D.H., Herman, K.B., Sherman, C.S., VanderWright, W.J., Lawson, J.M., Walls, R.H.L., Carlson, J.K., Charvet, P., Bineesh, K.K., Fernando, D., Ralph, G.M., Matsushiba, J.H., Hilton-Taylor, C., Fordham, S.V. & Simpfendorfer, C.A. (2021) Overfishing drives over one-third of all sharks and rays toward a global extinction crisis. *Current Biology*, 31, 1–15. <https://doi.org/10.1016/j.cub.2021.08.062>.
- Ebert, D.A. (2003) *Sharks, Rays, and Chimaeras of California (No. 71)*. University of California Press, Berkeley & Los Angeles, CA, USA, 297 pp.
- González-Acosta, A.F., Monsalvo-Flores, A.E., Tovar-Ávila, J., Jiménez-Castañeda, M.F., del Carmen Alejo-Plata, M. & La Cruz-Agüero, G. (2021) Diversity and conservation of Chondrichthyes in the Gulf of California. *Marine Biodiversity*, 51 (3), 46. <https://doi.org/10.1007/s12526-021-01186-9>
- Jabado, R.W. (2018). The fate of the most threatened order of elasmobranchs: Shark-like batoids (Rhinopristiformes) in the Arabian Sea and adjacent waters. *Fisheries Research*, 204, 448–457. <https://doi.org/10.1016/j.fishres.2018.03.022>.
- Jordan, D.S. & Evermann, B.W. (1896) The fishes of North and Middle America: a descriptive catalogue of the species of fish-like vertebrates found in the waters of North America, north of the Isthmus of Panama. *Government Printing Office*, 42, 1241–2183.
- Jordan, D.S. & Gilbert, C.H. (1880) Description of a new species of ray, *Raia Rhina*, from the coast of California. *Proceedings of the United States National Museum*, 3 (141), 251–253.
- Kells, V., Allen, L.G. & Rocha, L.A (2016) *Field Guide to the Coastal Fishes: From Alaska to California*. Johns Hopkins University Press, Baltimore, MD, USA, 376 pp.
- Kyne, P.M., Charvet, P., Areano, E.M., Avalos, C., Cevallos, A., Espinoza, M., González, A., Herman, K., Mejía-Falla, P.A., Morales-Saldaña, J.M., Navia, A.F. & Velez-Zuazo, X. (2020) *Zapteryx xyster*. The IUCN Red List of Threatened Species 2020: e.T60178A124448370. <https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T60178A124448370.en>
- Kyne, P.M., Oetinger, M. & Feutry, P. (2021) Life history of the Critically Endangered largetooth sawfish: a compilation of data for population assessment and demographic modeling. *Endangered Species Research*, 44, 79–88. <https://doi.org/10.3354/esr01090>

- Love, M.S. & Passarelli, J.K. (2020) *Miller and Lea's Guide to the Coastal Marine Fishes of California, 2nd Edition*. University of California Agriculture and Natural Resources, Publication 3556, Davis, CA, USA, 419 pp.
- Lowry, M., Folpp, H., Gregson, M., & Suthers, I. (2012) Comparison of baited remote underwater video (BRUV) and underwater visual census (UVC) for assessment of artificial reefs in estuaries. *Journal of Experimental Marine Biology and Ecology*, 416–417, 243–253. <https://doi.org/10.1016/j.jembe.2012.01.013>
- Moore, A.B.M (2017) Are guitarfishes the next sawfishes? Extinction risk and an urgent call for conservation action. *Endangered Species Research*, 34, 75–88. <https://doi.org/10.3354/esr00830>
- Murphy, H.M. & Jenkins G.P. (2010) Observational methods used in marine spatial monitoring of fishes and associated habitats: a review. *Marine and Freshwater Research*, 61 (2) 236–252. <https://doi.org/10.1071/MF09068>
- Neer, J.A. & Thompson, B.A. (2005) Life history of the cownose ray, *Rhinoptera bonasus*, in the northern Gulf of Mexico, with comments on geographic variability in life history traits. *Environmental Biology of Fishes*, 73, 321–331. <https://doi.org/10.1007/s10641-005-2136-5>
- Osgood, G.J., McCord, M.E. & Baum, J.K. (2020) Using baited remote underwater videos (BRUVs) to characterize chondrichthyan communities in a global biodiversity hotspot. *PLoS One*, (14)12: e0225859. <https://doi.org/10.1371/journal.pone.0225859>
- Ramírez-Amaro, S. & Galván-Magaña, F. (2019) Effect of gillnet selectivity on elasmobranchs off the northwestern coast of Mexico. *Ocean and Coastal Management*, 172, 105–116. <https://doi.org/10.1016/j.ocecoaman.2019.02.001>
- Rutledge, K.M. (2020) First record of Gorgona guitarfish (*Pseudobatos prahli*) off the Baja California peninsula with updated key to the guitarfishes of the North Eastern Pacific. *Journal of Fish Biology*, 98 (2), 583–586. <https://doi.org/10.1111/jfb.14585>
- Tanaka, K.R., Van Houtan, K.S., Mailander, E., Diaz, B.S., Galginaitis, C., O'Sullivan, J., Lowe, C.G. & Jorgensen, S.J. (2021) North Pacific warming shifts the juvenile range of amarine apex predator. *Scientific Reports*, 11, 3373. <https://doi.org/10.1038/s41598-021-82424-9>
- Villavicencio-Garayzar, C.J. (1995) Reproductive biology of the banded guitarfish, *Zapteryx exasperata* (Pisces: Rhinobatidae), in Bahía Almejas, Baja California Sur, Mexico. *Ciencias Marinas*, 21 (2), 141–153. <https://doi.org/10.7773/cm.v21i2.991>
- Walker Jr., H.J., Hastings, P.A., Hyde, J.R., Lea, R.N., Snodgrass, O.E. & Bellquist, L.F. (2020) Unusual occurrences of fishes in the Southern California Current System during the warm water period of 2014–2018. *Estuarine, Coastal and Shelf Science*, 236, 106634. <https://doi.org/10.1016/j.ecss.2020.106634>
- Whitmarsh, S.K., Fairweather, P.G. & Huvaneers, C. (2017) What is big BRUVver up to? Methods and uses of baited underwater video. *Reviews in Fish Biology and Fisheries*, 27 (1), 53–73. <https://doi.org/10.1007/s11160-016-9450-1>