

**The Implications of Ecotourism in the Gulf of California
on Whale Sharks (*Rhincodon typus*)**

Amanda Flannery
Miami University | Project Dragonfly
Independent Study Fall 2017
3 Credits

Introduction

Ecotourism, as defined by the International Union for Conservation of Nature (IUCN), is “environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features- both past and present) that promotes conservations, has low negative visitor impact and provides for beneficially active socio-economic involvement of local populations” (Leung, Spenceley, Hvenegaard, & Buckley, 2015). It began in the 1970’s as an untested idea in Kenya (Wood, 2002). Thresher (1981) demonstrated that the economic benefit of wildlife tourism in Kenya surpassed the economic benefits of hunting. In the early 1980’s, the ecotourism industry took off as scientists and filmmakers trekked to remote areas of the world to study rainforests and coral reefs (Wood, 2002). Today, ecotourism is rapidly expanding into a booming global industry (Orams, 1996). Tourists are expressing interest in the environment and wildlife, choosing more remote destinations to participate in these activities every year (Orams, 1996).

Charismatic animals have experienced rapid growth in interactive wildlife ecotourism (Orams, 1996). Shark ecotourism has been expanding globally for the last several decades (Cisneros-Montemayor, Barnes-Mauthe, Al-Abdulrazzak, Navarro-Holm, & Sumaila, 2013). The shark watching activities grossed 215 million USD in reporting countries in 2013 (Cisneros-Montemayor, et al., 2013). And the value of shark ecotourism is only increasing. It is estimated that within 20 years shark ecotourism will gross 785 million USD annually (Cisneros-Montemayor, et al., 2013). Today in Baja California Sur, Mexico alone, there are 83 boating licenses issued for approximately 130 certified whale shark tourism guides (J. Gittens, personal communication, November 13, 2017). As the shark ecotourism global economic value

increases, the value of landed sharks, that is sharks brought into port by recreational and commercial fisheries, has been steadily declining over the past two decades likely due to overfishing (Clarke, 2004).

The Allure of Whale Sharks

Whale sharks (*Rhincodon typus*) can reach a length of over 60 feet, making them the largest of the extant sharks and the largest fish in the ocean (Campagno, 2001; Skomal, 2016). These massive sharks are filter feeders, swimming slowly in subtropical and tropical coastal waters, and have a docile temperament (Martin, 2007). In whale shark hotspots, including Western Australia, Maldives, Belize, and Mexico, these sharks aggregate in large numbers (Martin, 2007) They are also classified as “Endangered” by the IUCN (Pierce & Norman, 2016). For these reasons, swimming with whale sharks has become a popular activity globally.

One of the most accessible places for swimming with whale sharks is in the Gulf of California. The Gulf is located between the peninsula of Baja California Sur and continental Mexico, which is easily accessible for North and South American tourists (Lluch-Cota et al., 2007). Whale sharks seasonally aggregate in several bays throughout the Gulf of California coinciding with plankton blooms (Martin, 2007). Whale sharks have also been observed feeding on coral spawn, snapper spawn, and the megalopa of terrestrial crabs within the region (Graham & Roberts, 2007; Heyman, Graham, Kjerfve, & Johannes, 2001; Martin, 2007). This seasonal predictability of whale shark aggregations within the region has led to a large ecotourism industry in Baja California Sur, Mexico.

The Negative Side of Ecotourism

While ecotourism has the opportunity to benefit local peoples and raise awareness for conservation issues, concerns have been raised over the potential impacts on the behavioral ecology of whale sharks from repeated exposure to tourists (Cisneros-Montemayor, et al., 2013; Orams, 1996). Several anti-predatory, evasive behaviors have been observed while snorkeling and diving with whale sharks. When these sharks are pursued by divers, they have been observed rolling onto their backs, a behavior known as “banking” (Martin, 2007; Quiros, 2007). Whale sharks have the thickest skin on earth, nearly 14 cm thick along their backs, which is studded with enameloid placoid scales (Kemp, 1999). It is thought that whale sharks bank when harassed by divers in order to protect potentially sensitive areas of their body (Quiros, 2007). These sharks have also been observed diving to the depths when harassed by divers (Martin, 2007).

The flashing strobe of underwater cameras also appear to affect whale sharks. Whale sharks have small eyes relative to their body size with a circular pupil (Martin, 2007). At distances of 3 meters or less, their eyes appear to follow divers in the water, indicating a limited visual acuity. However, when the strobe of an underwater camera fires near their head, their eyes have been observed rolling back into their sockets (Martin, 2007). The long-term effects of constant diver interactions on the health and behavior of whale sharks is currently unknown.

The effects of ecotourism on whale sharks goes beyond diver interactions. Whale sharks also encounter boats on a regular basis due to this booming industry. Whale sharks have been observed diving immediately following the ignition of in-board motors (Martin, 2007). It is theorized that the sharks are affected by the low frequency, low Hertz noises of the in-board motors (Martin, 2007). Whale sharks have the largest inner ear structure of any organism, and

while their hearing capabilities remain untested to date, it is thought that they are most sensitive to low Hertz, low frequency sounds (Martin, 2007).

In recent years boating traffic has increased in the Gulf of California, the number of observed boating related injuries have also increased. Nearly 70% of all whale sharks present with boating related injuries in the Gulf (Nelson & Eckert, 2007; Ramírez-Macías, Vázquez-Haikin, & Vázquez-Juárez, 2012). These negative interactions with boating traffic may disrupt mating behaviors, migration routes, and even access to important feeding grounds (Martin, 2007).

Embracing Conservation Initiatives

At present, Mexico is looking to improve the whale shark ecotourism industry for the health and safety of tourists, company owners, and the sharks. In 2002, an experimental code of conduct for diver and boating interactions was implemented in Bahia de los Angeles. The code of conduct was developed following a photo identification study of whale sharks in the region over several seasons and a survey given to tourism owners on their daily operations and interactions with the sharks and has continued to be updated based on carrying capacity studies (Cárdenas-Torres, Enríquez-Andrade, & Rodríguez-Dowdell, 2007). For example, the code of conduct provides two sets of guidelines, one for divers and another for boat operators. The code originally mandated that divers maintain at least a 1m distance from the animal; but in 2016 the code was amended to 2m from the head and 3m from the tail, with absolutely no touching of the sharks (J. Gittens, personal communication, November 13, 2017). In 2003 the code of conduct was accepted by both the ecotourism industry and local government which formally incorporated the code of conduct into permits issued to tour operators (Rodríguez-Dowdell,

Enríquez-Andrade, & Cárdenas-Torres, 2007). Today, the code of conduct extends beyond Bahía de los Angeles as the industry standard throughout Baja California Sur.

In La Paz Bay, tourist operations and boat operators are required to participate in the Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT) training seminar every year (J. Gittens, personal communication, September 19, 2017). This 4 day seminar is geared towards increasing conservation education and reinforcing safety protocols for sustainable ecotourism. The seminar concludes with an in-water boating practical where boat operators are required to maintain a distance of 5m from any shark, and only one boat at a time may approach a single shark (J. Gittens, personal communication, September 19, 2017). Divers and boat operators are also not to restrict any natural movements or behaviors in any way (Cárdenas-Torres, et al., 2007).

Conclusion

While the long-term effects of the ecotourism industry in the Gulf of California on whale shark population is unknown, locals and the government are making strides to improve industry practices for a more positive experience for tourists and sharks alike. Through the exposure to these incredible animals, tourists are made aware of the need for conservation of the region and the endangered whale sharks. Locals in multiple industries benefit from the boom in tourism. However, the significant number of individuals presenting with boat strike injuries suggests there is still room for improvement before the ecotourism industry lives up to the IUCN standard of ecotourism.

Literature Cited

- Campagno, L. J. (2001). *Sharks of the world: An annotated and illustrated catalogue of shark species known to date (Vol. 1)*. Food & Agriculture Org.
- Cárdenas-Torres, N., Enríquez-Andrade, R., & Rodríguez-Dowdell, N. (2007). Community-based management through ecotourism in Bahía de los Angeles, Mexico. *Fisheries Research*, 84(1), 114–118. <http://doi.org/10.1016/j.fishres.2006.11.019>
- Cisneros-Montemayor, A. M., Barnes-Mauthe, M., Al-Abdulrazzak, D., Navarro-Holm, E., & Sumaila, U. R. (2013). Global economic value of shark ecotourism: implications for conservation. *Oryx*, 47(3), 381–388. <http://doi.org/10.1017/S0030605312001718>
- Clarke, S. (2004). Understanding pressures on fishery resources through trade statistics: A pilot study of four products in the Chinese dried seafood market. *Fish and Fisheries*, 5(1), 53–74. <http://doi.org/10.1111/j.1467-2960.2004.00137.x>
- Graham, R. T., & Roberts, C. M. (2007). Assessing the size, growth rate and structure of a seasonal population of whale sharks (*Rhincodon typus* Smith 1828) using conventional tagging and photo identification. *Fisheries Research*, 84(1), 71–80. <http://doi.org/10.1016/j.fishres.2006.11.026>
- Heyman, W. D., Graham, R. T., Kjerfve, B., & Johannes, R. E. (2001). Whale sharks *Rhincodon typus* aggregate to feed on fish spawn in Belize. *Marine Ecology Progress Series*, 215(MAY), 275–282. <http://doi.org/10.3354/meps215275>
- Kemp, N. E. (1999). Integumentary system and teeth. In *Sharks, Skates, and Rays. The Biology of Elasmobranch Fishes* (pp. 43–68).
- Leung, Y. F., Spenceley, A., Hvenegaard, G., & Buckley, R. (2015). *Tourism and visitor management in Protected Areas: Guidelines towards sustainability*. Best Practice Protected Area Guidelines Series.
- Lluch-Cota, S. E., Aragón-Noriega, E. A., Arreguín-Sánchez, F., Aurióles-Gamboa, D., Jesús Bautista-Romero, J., Brusca, R. C., ... Sierra-Beltrán, A. P. (2007). The Gulf of California: Review of ecosystem status and sustainability challenges. *Progress in Oceanography*, 73(1), 1–26. <http://doi.org/10.1016/j.pocean.2007.01.013>
- Martin, R. A. (2007). A review of behavioural ecology of whale sharks (*Rhincodon typus*). *Fisheries Research*, 84(1), 10–16. <http://doi.org/10.1016/j.fishres.2006.11.010>
- Nelson, J. D., & Eckert, S. A. (2007). Foraging ecology of whale sharks (*Rhincodon typus*) within Bahía de Los Angeles, Baja California Norte, México. *Fisheries Research*, 84(1), 47–64. <http://doi.org/10.1016/j.fishres.2006.11.013>
- Orams, M. B. (1996). Using Interpretation to Manage Nature-based Tourism. *Journal of Sustainable Tourism*, 4(2), 81–94. <http://doi.org/10.1080/09669589608667260>
- Pierce, S. J., & Norman, B. (2016). *Rhincodon typus*. *The IUCN Red List of Threatened Species 2016*.
- Quiros, A. L. (2007). Tourist compliance to a Code of Conduct and the resulting effects on whale shark (*Rhincodon typus*) behavior in Donsol, Philippines. *Fisheries Research*, 84(1), 102–108. <http://doi.org/10.1016/j.fishres.2006.11.017>
- Ramírez-Macías, D., Vázquez-Haikin, A., & Vázquez-Juárez, R. (2012). Whale shark *Rhincodon typus* populations along the west coast of the Gulf of California and implications for management. *Endangered Species Research*, 18(2), 115–128. <http://doi.org/10.3354/esr00437>
- Rodríguez-Dowdell, N., Enríquez-Andrade, R., & Cárdenas-Torres, N. (2007). Property

- rights-based management: Whale shark ecotourism in Bahia de los Angeles, Mexico. *Fisheries Research*, 84(1), 119–127. <http://doi.org/10.1016/j.fishres.2006.11.020>
- Skomal, G. (2016). *The Shark Handbook: The Essential Guide for Understanding the Sharks of the World*. (2nd ed.). Kennebunkport, ME: Cider Mill Press.
- Thresher, P. (1981). The economics of a lion. *Unasylva*, 33(134), 34–35.
- Wood, M. E. (2002). *Ecotourism : Principles, practices , & policies for sustainability*. *The International Ecotourism Society*. Burlington, VT.
<http://doi.org/10.1079/9781845934002.0000>

Appendix 2: Blog Posts

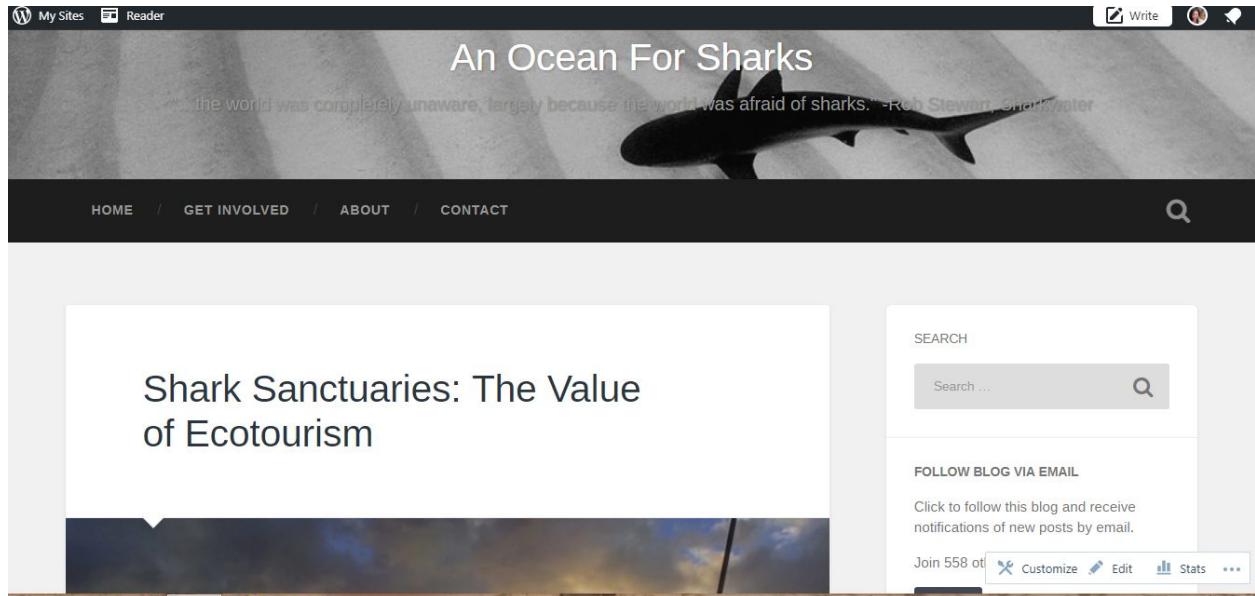


Figure 1. Shark Sanctuaries: The Value of Ecotourism blog post published on November 5, 2017 at 8:00am CST.

This blog post reflected the opening content of my paper. Covering topics from the history of ecotourism, charismatic animal wildlife tourism, the global shark ecotourism, and the creation of shark sanctuaries around the world.

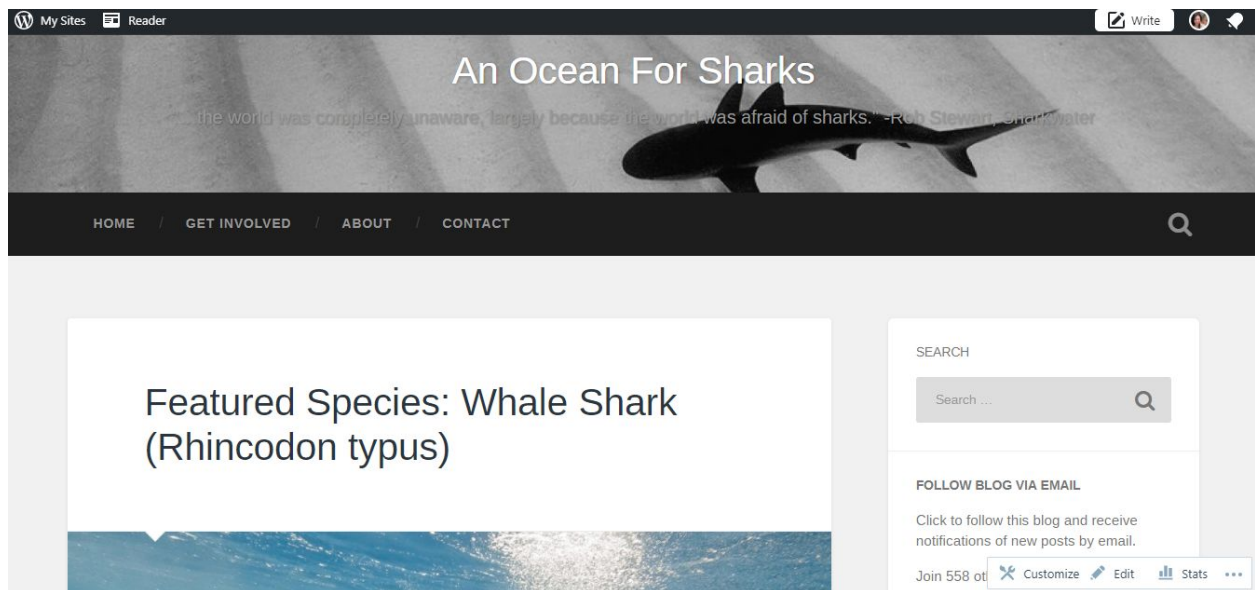


Figure 2. Featured Species: Whale Shark (*Rhincodon typus*) blog post published on November 10, 2017 at 8:00am CST.

This post focuses on the ecology and biology of the whale shark as a species including their reproduction methods, feeding behaviors, and seasonal aggregations.

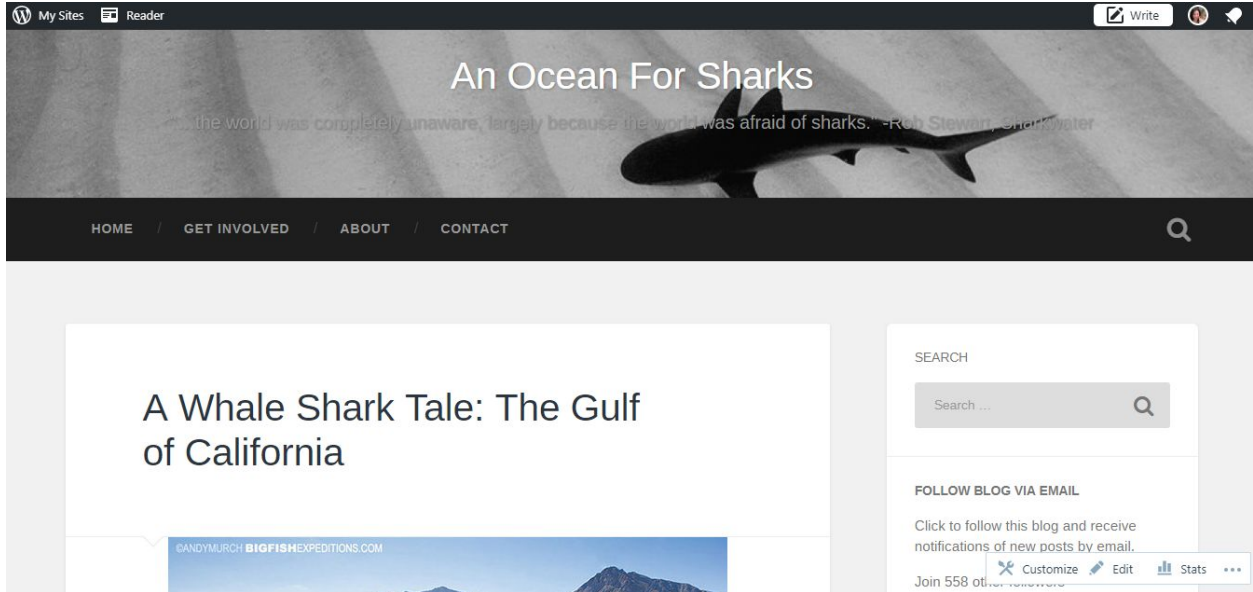


Figure 3. A Whale Shark Tale: The Gulf of California blog post published on November 13, 2017 at 8:00am CST.

This post reflects the second half of my paper. Reviewing ecotourism in the Gulf of California and the potential effects of irresponsible ecotourism on the sharks.

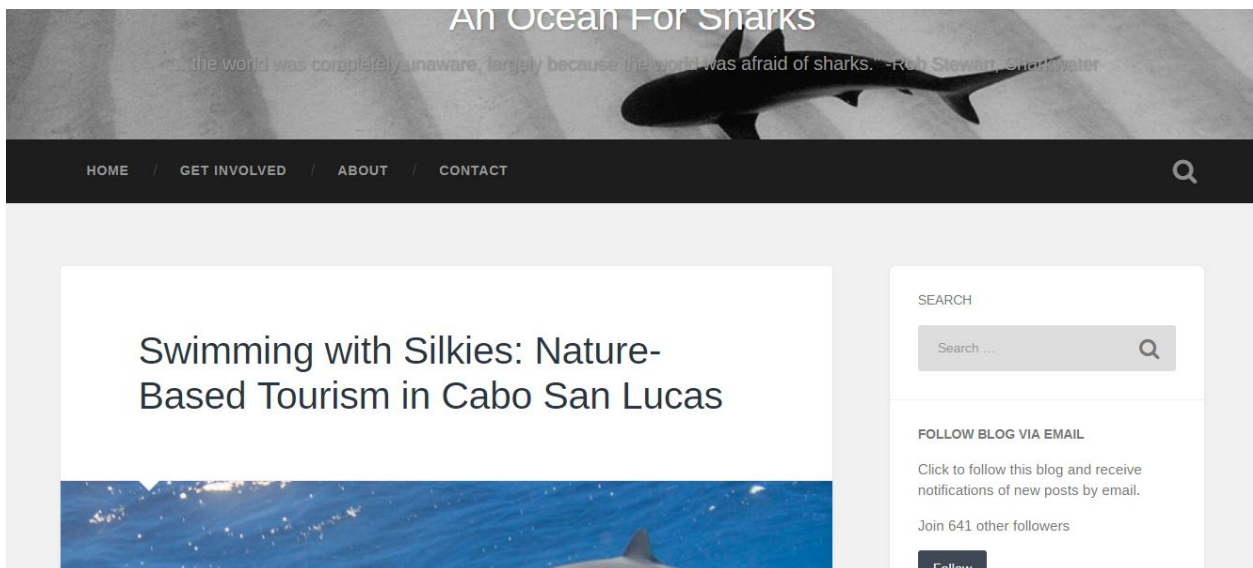


Figure 4. Swimming with Silkies: Nature-Based Tourism in Cabo San Lucas blog post published on November 27, 2017 at 8:00am CST.

While this post does not include whale sharks (as I hadn't yet seen any), it does focus on shark tourism within the Sea of Cortez. I include many photos and a video of my experience with the nature-based tour company and address why they fail to meet the IUCN standard of ecotourism.

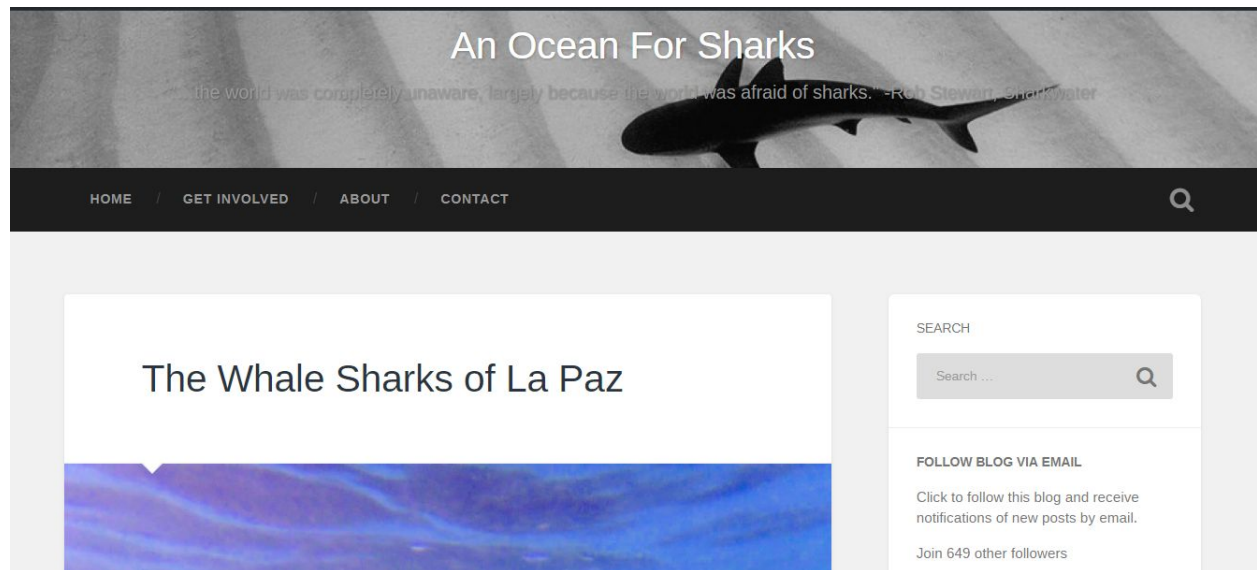


Figure 5. The Whale Sharks of La Paz blog post published November 29, 2017 at 8:00 am CST.

This blog post pulls together my background research of ecotourism practices in the bay of La Paz, Baja, as well as my personal experiences. This post features many photos of the sharks I encountered in the bay as well as a video of a vertical feeding whale shark that humbled me.