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ENVS 192 Paper

1. Part I: General Introduction to Sea Turtles

Modern day sea turtles emerged in the cretaceous period. Two families, the Cheloniidae and Dermochelyidae, have persisted today (Lutz & Musick, 2003, p. 8). There are seven species of sea turtles today, six of which belong to the Cheloniidae family and one belonging to the Dermochelyidae. The Cheloniidae family is characterized by a hard carapace shell, which is made up of smaller scutes. They also have beaks, non retractable heads, and non retractable flippers (Lutz & Musick, 2003, p. 9). The different species within this family vary by their number of prefrontal and lateral scutes, overall size, beak size, as well as their diets. The six species of sea turtles that fall into the Cheloniidae family are: Loggerhead (*Carreta carreta)*, Green (*Chelonia mydas)*, Hawksbill (*Eretmochelys imbricata)*, Kemp's Ridley (*Lepidochelys kempii)*, Olive Ridley (*Lepidochelys olivacea*), and the Flatback (*Natator depressus*). (Eckert, Bjorndal, Abreu-Grobois, & Donnelly, 1999, p. 1). The one modern day sea turtle that belongs to the Dermochelyidae family is the jellyfish eating Leatherback (*Dermochelys coriacea*). They are characterized by "leathery, scuteless black or spotted carapace, posteriorly pointed with prominent longitudinal ridges; carapace length to about 180 cm; all oceans, temperate or tropical" (Eckert, Bjorndal, Abreu-Grobois, & Donnelly, 1999, p. 3). The leatherback sea turtle was the most abundant on the Pacuare Nature reserve, the site of the BIOMA research program that I participated in in the summer.

2. Part II: Sea turtles and Society:

Sea turtles and people have intersected in many different ways throughout history. Economically, sea turtles have been sources of food and tourism. According to the WWF, "Marine turtle tourism brings in almost three times as much money as the sale of turtle products such as meat, leather and eggs" (Troëng, S., & Drews, C., 2004). Sea turtles are worth a lot more alive than dead. However, people around the world make their livelihoods off of poaching turtles and their eggs. The Pacuare Nature reserve has been dedicated to justly transitioning people away from poaching and towards conservation by hiring the poachers to conduct the night patrols and help monitor the nesting sites.

In 2015, a video of a straw being removed from a sea turtle's nose went viral (Robinson & Figgener, 2015). This video sparked a movement against plastic straws, and helped bring awareness to the levels of plastic pollution in the oceans. Because people care about the safety of turtles, many are dedicated to consuming less single-use plastic products. Due to their popularity amongst people, sea turtles have long been the face of marine conservation. Dr. Jack Fraiser would call them a "flagship species", meaning they serve a large social importance for people. Other flagship species include mega-vertebrates such as lions, tigers, and pandas (Fraiser, 2004, p. 15). Sea turtles inspire people to care about the environment; and because humans have such control over environmental quality, they serve an important role in their ecosystems.

3. Part III: Ethical Conservation Strategies Regarding Leatherback Hatchlings:

While at the Pacuare Nature reserve, I noticed that we were highly manipulating the nesting and hatching process in the name of conservation by removing the eggs from the natural nest and bringing them to a hatchery. Once they hatched, we would take

measurements of every turtle. Then, we would assist the hatchlings by bringing them closer to the ocean in a bucket. When do people have a right to intervene? What are the ethics of human management and manipulation of wild spaces? One environmental ethical framework is contractualism: "The social contracts will determine the actions that are proper in any given context. One can evolve faith that binds parties to a contract about environmental care in such a matter that no one is worse off with every body improving to some extent" (Gupta, A, & Sinha, R, 2002, p. 2). Humans have certainly brought harm to the leatherback sea turtle populations, thus breaking this social contract. So, people have a right to intervene because humans have already negatively disrupted the natural nesting process. This help would be mitigation to hopefully mend the social contract that people have with the leatherbacks and the environment. People also only have the right to intervene if everyone is better off because of it.

There is evidence to suggest that bringing the leatherback eggs to a hatchery at the Pacuare Nature Reserve increases their chances of survival, both with the censuses disrupting poaching and with giving the eggs a better chance of hatching. When the monitoring project slowed due to COVID, people were able to measure the impacts human intervention had on the leatherback nesting process. They found that poaching quadrupled in 2020 with the lack of censuses (Quesada-Rodríguez, Orientale, Diaz-Orozco, & Sellés-Ríos, 2021). This shows that human intervention in terms of patrolling the beach has helped protect the leatherback species against poaching, which fulfills the social contract to the environment. They also measured the hatching success of eggs that were in their original location, relocated nests, and the hatching success of eggs in the hatcheries. They observed in 2020 that nests in hatcheries had the highest hatching success rate, followed by the relocation zone. In situ (original position) nests had the lowest success rate in 2020 Also, despite having less participants, there was the highest contact with leatherbacks, likely due to less time spent on educational outreach. (Quesada-Rodríguez, Orientale, Diaz-Orozco, & Sellés-Ríos, 2021). Despite the eggs being translocated, the hatcheries seem to improve the egg's chances of survival. So, it is in the best interest of conservationists to continue bringing as many eggs to hatcheries as possible. The question then goes to the benefit of the educational outreach, as it appears to slow down the researchers and reduce the contact with turtles. Going along with the framework of contractualism, the turtles aren't inherently worse off if their nests are left in the spot they intended them to be, as that's what would happen if people were absent from Pacuare altogether. While less nests would have the opportunity of being moved to the hatchery, the benefit of educational outreach transcends this cost. The visits of tourists and students funds the research at Pacuare, and further inspires people to care about leatherbacks and conservation.

It's also important to continue researching and monitoring to make sure that the conservation efforts only help the environment. Different conservation techniques have been phased out due to them actually causing harm to the leatherback populations. For example, "removing sea turtle eggs from the beach to incubation boxes placed within protective storage was an accepted management practice for many years until the effect of incubation temperature on sex was determined. As a result, an unnatural preponderance of male turtles may well have been produced" (Richardson, J. I. 1999 p.19). Leaving the eggs in the sand leaves the temperature of the eggs up to nature, which shouldn't harm their species.

All in all, due to the negative effects that years of poaching has had on the leatherback populations, people have a right to intervene. If following the ethical framework of contractualism, people need to make sure their intervention improves the leatherbacks and other organisms without placing unnecessary harm on anyone. With hiring poachers to do conservation work, improving hatching success of the nests, and providing positive educational opportunities, the Pacuare nature reserve is ethically intervening with the natural nesting process. Also, by allowing all of the hatchlings to make it to the ocean and re-burying the excavated eggs, the Pacuare nature reserve is not taking any food away from the leatherback's natural predators.

4. Part IV: Recommendations:

While researching ethical conservation strategies, I learned that people used to take eggs to incubation instead of hatcheries. When I was at Pacuare, my group leader Perrine was talking about how there is concern that male leatherback turtles are becoming increasingly rare due to the rise in global temperatures, because only eggs in cooler sand become males. If this is the case, it seems like it would be in the best interest of Pacuare to intentionally move some clutches to a cooler incubation area to ensure that male leatherback sea turtles are hatching. I understand that it's incredibly difficult to monitor the populations of the adult leatherback sea turtles, as only the females return to land when they come to nest. More research needs to be done on monitoring the populations out at sea, to determine whether or not it's necessary to move some eggs to incubate as males. I can't recall whether or not the temperature of the sand at the Pacuare hatcheries is recorded and monitored to ensure equal levels of male and female turtles. If not, it seems important to include the internal temperature of the sand as a part of the nightly census.

I also learned that the educational outreach slows the researchers down, and that when no students are around, they don't stick around to watch the turtle return to the sea. Although my peers and I greatly benefited from going on the night patrols, it seems like it would make sense to have at least one shift per week/night with only researchers. This way, the educational outreach could still occur but there would be some nights with more efficient data collection. It also seems like it would be beneficial to train more researchers so some of them could lead censuses with students, and some could go on their own.

One last recommendation I would make to the BIOMA program at Pacuare would be to spend more time learning about the different plant life around. We learned a bit about the plants, but were mostly focused on the animals. I enjoyed the focus on animals, but I and I'm sure others would be interested in a plant diversity section.

5. Part V: Reflective Experience:

The BIOMA program was life changing. It was truly inspiring to spend two weeks in a biodiversity hotspot, with little electricity and living amongst nature. As an environmental studies major, I already had an interest in protecting the environment, but BIOMA further inspired me to pursue restoration and conservation efforts. After conducting my research for ES 192, I have evidence to suggest that the Pacuare nature reserve is operating ethically as well.

I really appreciated the amount of hands-on experience that was offered at Pacuare. I never thought that I would be in a position to hold a baby leatherback sea turtle in my life. My patrol group had the luckiest nights at the hatchery, and so by the end of my time at BIOMA I held countless baby leatherbacks. I learned how to measure

their carapaces, weigh them, and properly help them with their journey to the sea. My expedition occurred towards the end of nesting season, so we encountered far more babies than mothers. However, we did see one mother leatherback, and one hawksbill. I found the night patrols from south station to north station to be very meditative.

I also appreciated that we learned about more than just leatherbacks while at Pacuare. We had researchers lecture us about the different birds, mammals and reptiles nearby. I especially enjoyed our monitoring activity involving the howler monkeys.

I could go on and on about what BIOMA taught me and meant to me, but the last thing I will note that I really enjoyed was the cultural focus and the talks led by locals. I was really inspired by the story of the woman who used to be a poacher that is now dedicated to leatherback conservation. I loved that she was willing to share her story with us and open up her home. Her story truly inspired me about the potential for positive environmental change. She also taught us how to make a delicious coconut dessert. Costa Rica was the first country I visited outside of the US, and I didn't know much about the culture going into this expedition. I am very grateful that the local people and the program took the time to share pieces of Costa Rica with me.

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