Developing Form Factors for Rechargeable Sea Turtle Deterring Buoys

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***Abstract*—With increasing population, the need for large scale fishing has increased exponentially. This has produced fish in numbers magnitudes larger than previously seen. However, this also brings new challenges. One of the biggest problems with large scale fishing operations is the bycatch of megafauna. One animal that has a significantly high bycatch rate is sea turtles. Three out of five species of sea turtles that live in the Pacific Ocean are threatened with the other two being endangered. In Baha, Mexico, some fishermen are catching up to 48 turtles per day. Research has shown that one way to minimize these turtle casualties is through the use of specific wavelengths of light. By emitting these specific wavelengths of light, fisherman have been able to deter sea turtle bycatch by up to 50%. However, current methods involve using either disposable lights or disposable batteries. Both of these options are far too expensive and create far too many environmental pollutants to be implemented long turn. With this in mind, we plan to design and build rechargeable buoys that emit specific wavelengths of LED light in order to deter sea turtles and other large megafauna.**

I. Introduction

Determining a good form factor is important in creating a successful design. The most important design characteristic is being able to withstand up to 6 atmospheres of pressure. Many different form factors have been theorized to allow for this. A spherical shape works the best at equally distributing the pressure, however, there are other criteria being taken into account. A successful design will also allow for a strong connection to the net while avoiding tangling within the net. There are two options for the buoys connection to the net. The first is to add a clip to the buoy that allows easy attachment and detachment of the buoy from the net. This option offers convenience however lacks in durability. A clip would need to be excessively bulky in order to provide adequate resistance to the various forces acting on it within the ocean. The second option is to create a cavity within the buoy for the rope to be threaded through. This option offers less convenience in removing the buoy however takes advantage of the buoys structural integrity. By integrating the attachment of the rope with the center of the buoy, nothing short of destroying the entire buoy will be able to remove it from the rope.

A **B** **C**

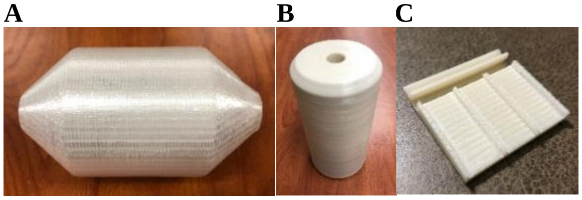

Figure 1: 3D printed models (A) A single piece print that will allow for accurate pressure testing (B) A two piece print with a cavity through the middle for rope (C) A device to hold three solar panels in place that can be placed within different buoy designs

It is also important to consider how the form factor may affect feasibility of charging. Solar energy, the current forerunner of renewable energy prospects requires that solar panels be oriented towards the sun when removed from water. Although this may seem like a simple task, fishermen are likely to lay out nets so that the buoys are left in random orientations. Several approaches have been theorized to mitigate this problem. The first of which is to place solar panels in multiple orientations within the buoy. This is an effective solution however it is likely that it will increase cost as well as lower power production from any one specific orientation. Other solutions involve internal mechanisms that allow solar cells to orient themselves such as a gyroscope. These solutions offer increased power production but decrease the overall all durability of the design. Other power sources such as hydro electrics and piezo electrics have also been theorized however they require much more specialized form factors

Figure 22: Initial prototype printed from ABS with solar panels, lithium polymer batteries, and LED lights

References

[1] Swimmer, Yonat, and Richard Walter Brill, eds. *Sea turtle and pelagic fish sensory biology: developing techniques to reduce sea turtle bycatch in longline fisheries*. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Fisheries Science Center, 2006.B. Pardo and W. Birmingham, "Encoding Timing Information for Musical Query Matching," ISMIR, 2002.

[2] Reidenberg, Joy S. "Anatomical adaptations of aquatic mammals." *The Anatomical Record* 290.6 (2007): 507-513.