Analyzing Parameters for a Low Power Circuit in a Net Buoy

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***Abstract*—The low power LED net buoy is an effective way to deter turtles from fishing nets in order to greatly decrease turtle bycatch. More specifically, the circuit portion of the LED buoy has to be small, low power, inexpensive, and be lit for 24, and up to 48, hour fishing periods. The parameters within the low power circuit will be varied and tested for future research with turtles.**

I. Introduction

The overall problem is that turtles are being caught in fisherman's fishing nets and drowning. As a result, the amount of turtles is greatly decreasing. If this behavior of turtle bycatch continues, sea turtles can go extinct. Research has shown that attaching green LED scuba lights on a fishing net decreases the turtle bycatch by 50% and increases the desired catch by 20% [4].

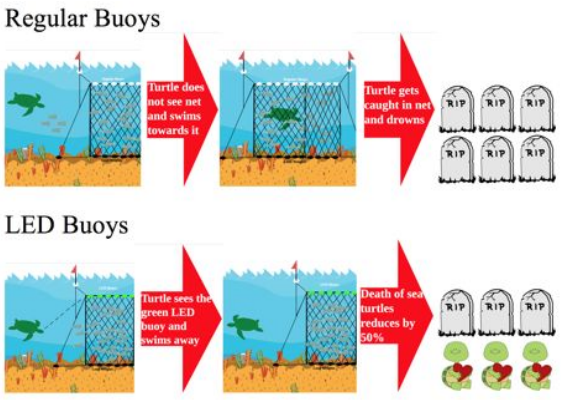

Figure 1. Turtle response with and without LED buoys

In the REU program, we were tasked with designing a low powered, light up, net buoy. Previous problems with the attachable scuba light were it getting tangled in the net, and the waste created with the non-renewable batteries. As the batteries ran out of power, the fisherman threw them over the boat and into the ocean. Design requirements for the net buoy are easy to use, does not tangle in the net, can withstand 6 atm of pressure, minimal power consumption, deters turtle from net, and use of renewable energy source. For the first prototype, design decisions were made to fulfil the requirements. The first prototype is shaped like a buoy and can be attached to the net in the same fashion as a regular buoy, to avoid getting tangled in the net. The prototype is made out of polyethylene terephthalate glycol(PETG), which is then designed to withstand up to 6 atm of pressure and be transparent so that sunlight may enter the system. The circuit inside the buoy will be using green LEDs and solar panels for as the renewable energy source. The circuit is run on an NE555 timer and uses low power parts, in order to have low power consumption.

The previous system for green LEDs on fishing nets, the LEDs were lit for the entire duration of fishing [4]. Keeping the LEDs lit the entire time will consume a lot of power. One way to reduce the power consumption is to blink the LEDs rather than have them lit the entire time. Research has shown that turtles can see light when flashed between 4Hz and 12 Hz [1]. The frequency of the circuit can then be adjusted to fit the range for the turtles, and simultaneously reduce the power consumption of the circuit With this, different parameters of the circuit can also be varied to further reduce power consumption. They can later be tested against turtle response to see if there is a similar reduction in turtle bycatch. The different parameters for the circuit are light intensity, frequency, pulse width, and switching power. Light intensity measures how bright a light is, frequency is how fast the light blinks, pulse width is how long the light stays on while blinking, and switching power is a measure of how much power it takes to switch the light on. These will all be varied and tested to see the best turtle bycatch reduction with minimal power consumption.

[1]K. Lohnmann, J. Wang and L. Boles, "Development of turtle-safe light sticks for use in longline fisheries", *NOAA Technical Memorandum NMFS-PIFSC-7*, pp. 65-75, 2006.
[2]Wang, J.H., Fisler, S., Swimmer, Y. (2010) Developing visual deterrents to reduce marine turtle bycatch in gill net fisheries. Marine Ecology Progress Series 408: 241-250.
[3]Wang JH, Barkan J, Fisler S, Godinez-Reyes C, Swimmer Y (2013) Developing ultraviolet illumination of gillnets as a method to reduce sea turtle bycatch. Biol Lett 9: 20130383.
[4]Senko J, Wang J, Lucero-Romero J, Maldonado D, Aguilar D, Figueroa A, Peckham SH (2013) Effects of LED illuminated gillnets on bycatch of loggerhead turtles in coastal mesh net fisheries at Baja California Sur,

Mexico. Talk presented at the 33rd International Symposium on Sea Turtle Biology and Conservation, Baltimore, MD, USA.