

# Developing strategies to reduce incidental capture of sea turtles

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## I. INTRODUCTION

All species of sea turtles are listed as endangered or threatened around the world. Several sea turtle populations have declined due to pollution, human consumption, loss of nesting habitat, and interactions with fisheries (Fig. 1, Lewison et al. 2004, Spotila et al. 2000). Recent estimates suggest that approximately 200,000 loggerhead (*Caretta caretta*) and 50,000 leatherback (*Dermochelys coriacea*) sea turtles were incidentally captured in one year by pelagic longline fisheries (Lewison et al. 2004).

Experiments examining captive-reared loggerheads in a laboratory setting indicate that sea turtles are attracted to the different colored lightsticks and light emitting diodes (LEDs) used in pelagic longlines (Wang et al. 2006). Other experiments suggest that shark shapes (i.e. shark scarecrows) may trigger an escape response in sea turtles (Higgins et al. 2005).

In Baja California, we developed a technique to field test potential strategies aimed at reducing the incidental capture of sea turtles on pelagic longlines and in other fisheries. Working with local fishermen, we used tangle nets to catch sea turtles. By placing lightsticks or shark shaped silhouettes on the nets, we examined whether these affected turtle catch rates.



Fig. 1. A loggerhead sea turtle (*Caretta caretta*) hooked by a pelagic longline.

## II. OBJECTIVES:

To develop a technique useful to assess potential strategies for reducing sea turtle bycatch

- Determine whether the catch rates of sea turtles are affected by the presence of lightsticks on tangle nets.
- Determine whether shark silhouettes are useful in reducing sea turtle catch rates using tangle nets.

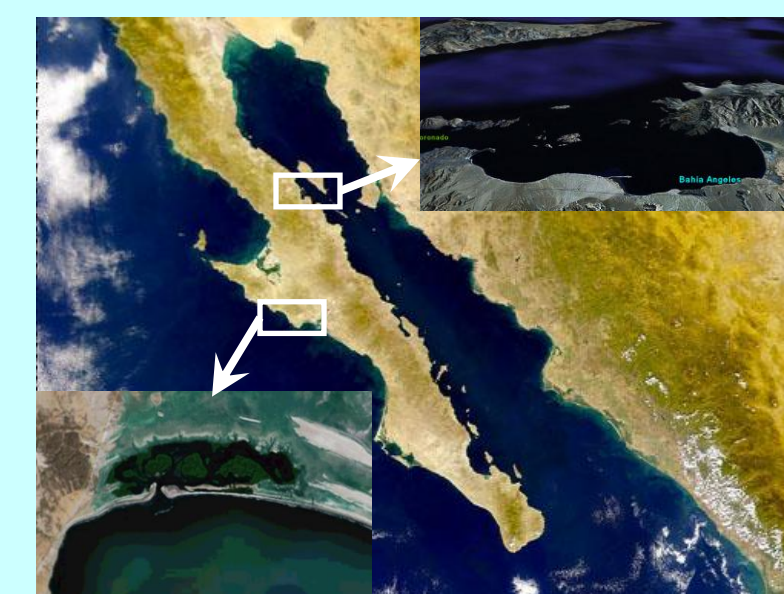


Fig. 2. A map of the Baja California Peninsula, Mexico showing the two study sites, Playa Blanca (a) in Bahía de los Angeles and Estero Coyote (b) in Punta Abreojos.

## III. MATERIAL AND METHODS

### A. LED/Lightstick experiments

- Nets were set during July 2006 near Punta Abreojos and during June 2006 around Bahía de los Angeles (Fig. 2) during the night.
- Experimental nets were set with activated, green LED lightsticks (Fig. 3) attached every 10 m.
- Control nets were set with non-activated LED lightsticks attached every 10 m.
- Nets were set for approximately five hours starting at sunset.



Fig. 3. Lightsticks and battery powered light emitting diodes (LEDs) are used on longlines to attract fishes.

### B. Shark silhouette experiments

- Experimental nets were set with a shark silhouette and bullet float (Fig. 4) every 10 m.
- Control nets were set with a bullet float (no shark silhouette) attached every 10 m.
- Shark silhouettes were constructed from plywood and painted gray.
- The bullet float kept the shark upright in the water at a depth of 2 m.
- Experiments were conducted during July, 2006 in Punta Abreojos.
- Nets were set for approximately six hours during the afternoon and early evening.

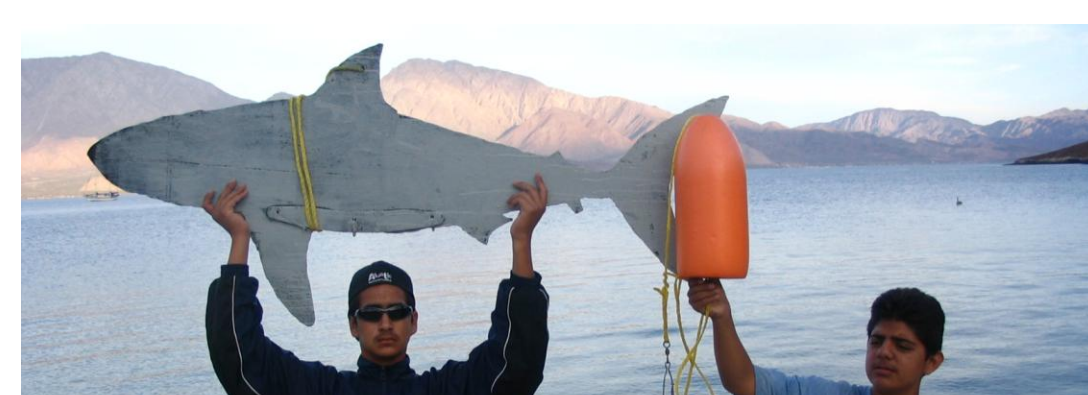


Fig. 4. A shark silhouette and bullet float.

## III. MATERIALS AND METHODS continued

### C. All net sets

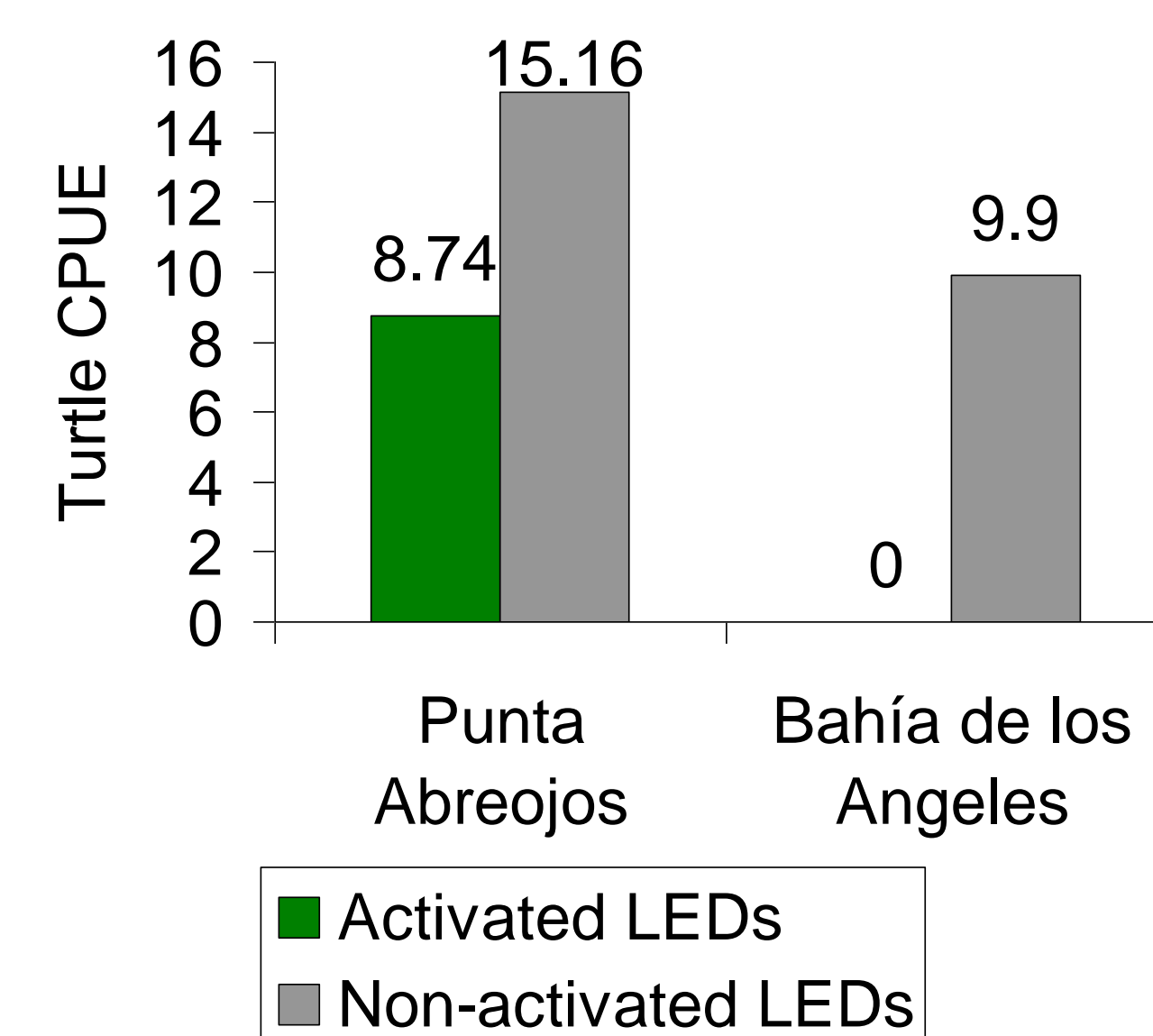
- Net size ranged from 60-130 m long.
- Nets were checked for turtles at approximately 1.5 hour intervals.
- Captured turtles were transported by boat to a beach or floating dock for collection of morphometric data (Fig. 5).
- Total catch of sea turtles in each net was converted to catch per unit effort (CPUE), which was calculated as the number of turtles captured per 100 m of net in 24 hours.



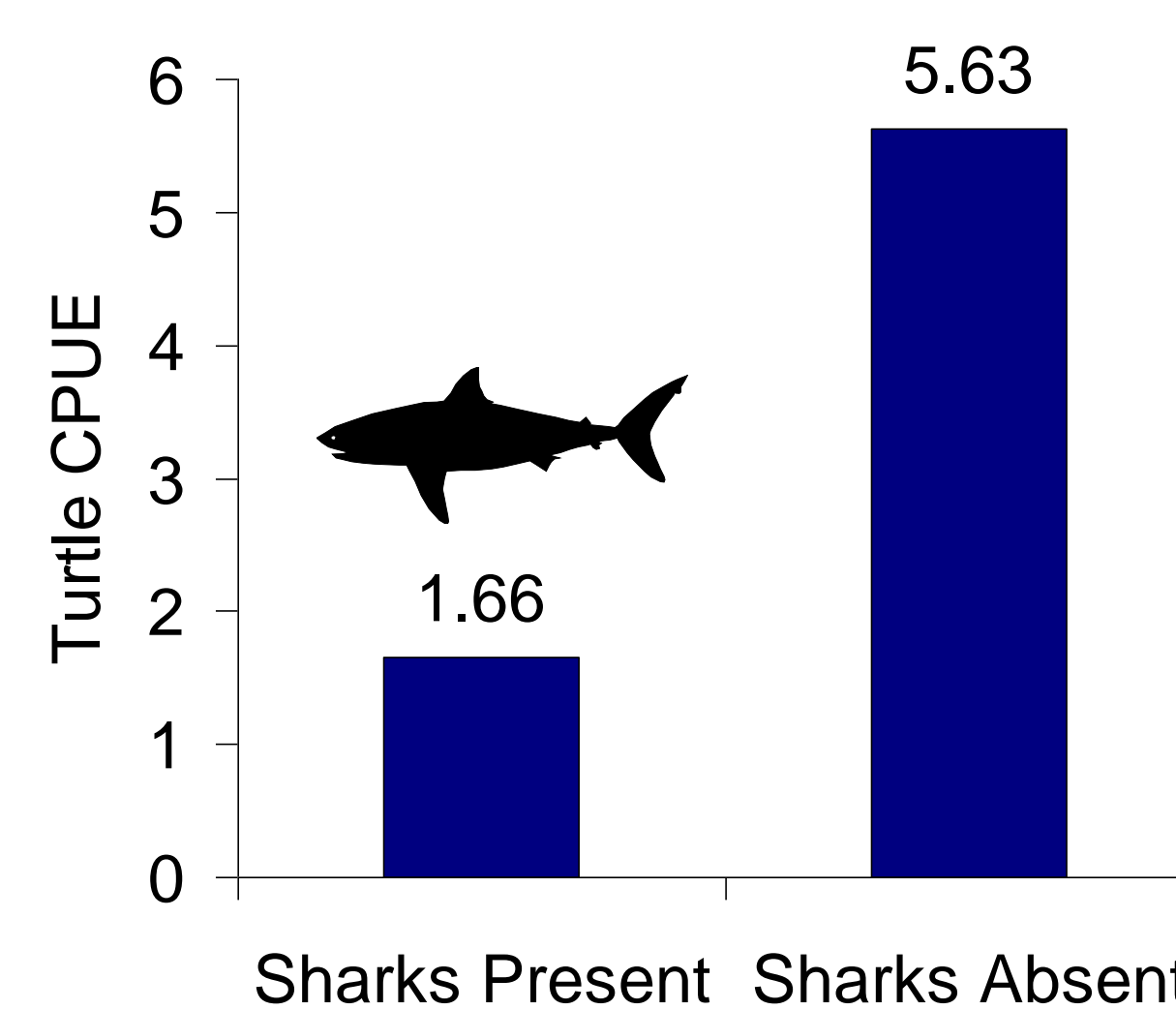
Fig. 5. Collecting morphometric measurements.

## IV. PRELIMINARY RESULTS

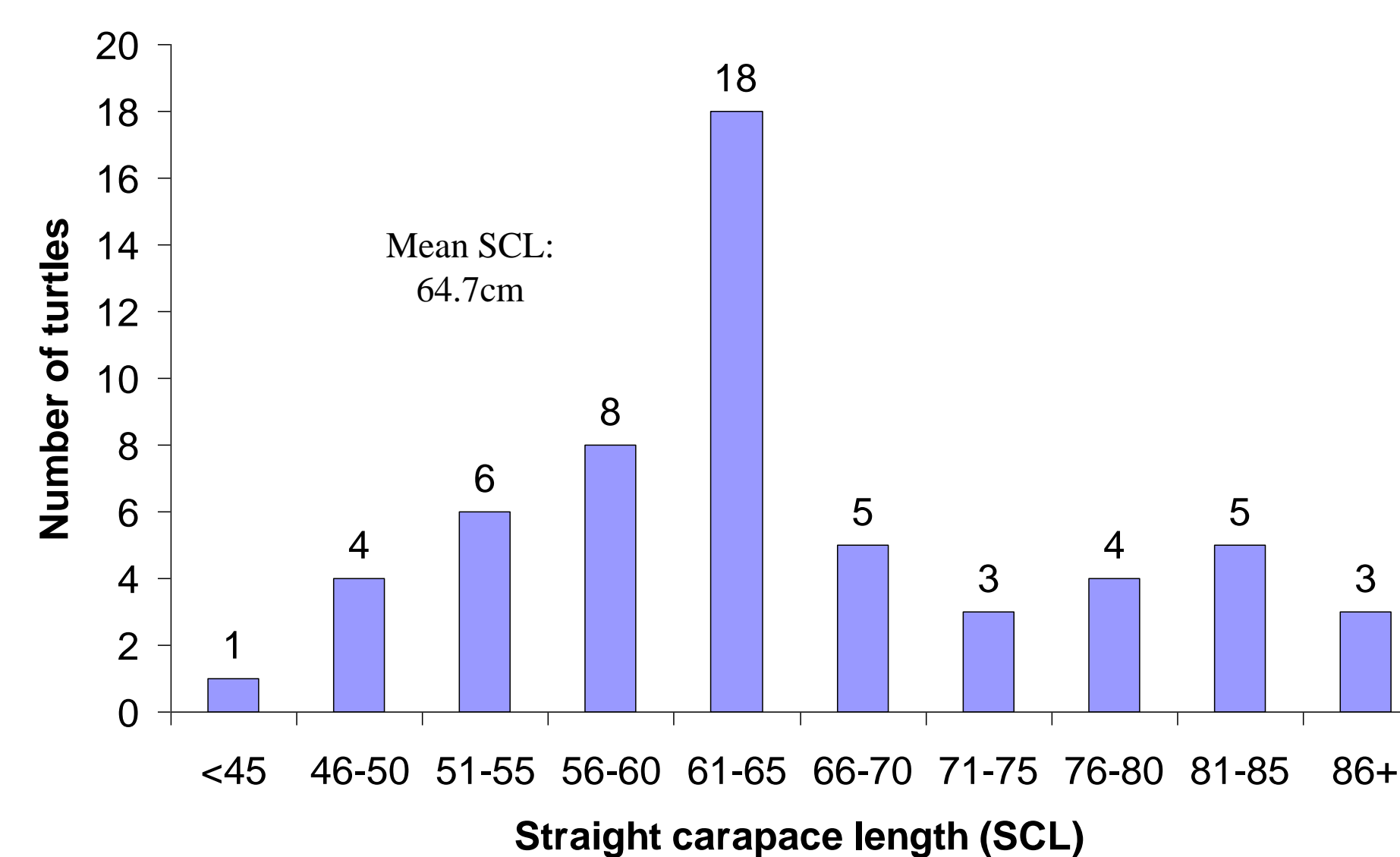
### A. LED/Lightstick experiments



### B. Shark silhouette experiments



### C. Size distribution of green turtles caught in Punta Abreojos



- A total of 41 green turtles (*C.mydas*) were captured during the LED experiments.
- The CPUE of nets with activated LEDs was less than the CPUE of nets with non-activated LEDs at both Punta Abreojos and Bahía de los Angeles (A).
- A total of 17 green turtles were captured during the shark silhouette experiment.
- The CPUE of nets with shark silhouettes present was less than the CPUE of nets with shark silhouettes absent at Punta Abreojos (B).
- The average SCL for turtles captured at Punta Abreojos was 64.7 cm and ranged from 49.2 to 90.4 cm (C).

## V. DISCUSSION

### LED/Lightstick Experiments

The preliminary LED experiments suggest that turtles are captured less in tangle nets with activated LEDs than in nets with non-activated LEDs. Several possibilities may have contributed to these results. Wild turtles may not be attracted to green LEDs, or it is possible that the LEDs illuminated the net, making it visible to the turtles which allowed them to avoid it. This idea is supported by anecdotal evidence from the local fishermen. In the past, fishermen targeting sea turtles did not set nets during the full moon because they believed that the turtles were able to see and avoid their nets.

### Shark Silhouette Experiments

Our preliminary results indicate that shark silhouettes on nets may reduce the number of turtles captured. This data suggests that turtles avoid shark silhouettes. Of the 17 turtles caught during the 4 days of our trials, 10 turtles were caught on the first day. The subsequent decrease in catch may be the result of strong tidal currents in the lagoon causing sea grasses to become tangled in the nets. Also, it is possible that the turtles may have left the lagoon after their release, reducing the number of turtles in the study area. This idea is supported by the lack of recaptures we observed during the study.

## VI. FUTURE DIRECTIONS

Studies comparing sea turtle and fish vision indicate that turtles can see into the ultraviolet (UV) range of the light spectrum, but some longline targeted fish such as mahi mahi and marlin, can not (Friches, pers. comm.). It may be possible to create shark silhouettes out of transparent UV absorbent plastics that would be visible to turtles but not visible to fish species targeted by longlines (Fig. 6).

In addition, shark silhouettes may have other applications in marine conservation. Shark "scarecrows" may be useful in reducing the interactions of sea turtles with power plant intake pipes and could be used to deter marine mammals, such as sea lions and porpoises, from fishing gear or particular areas. Our preliminary data supports further testing of using shark shaped silhouettes on tangle nets and potentially on pelagic longlines.

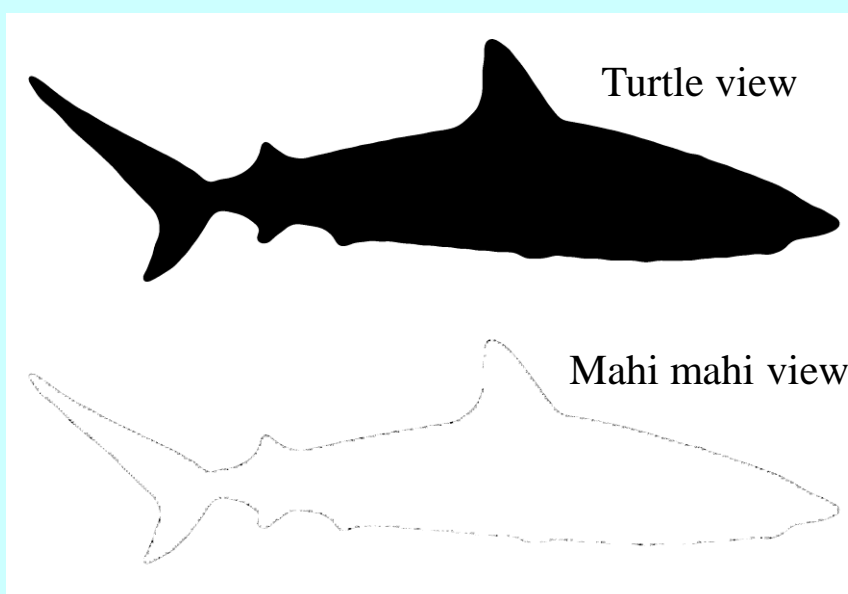


Fig. 6. View of UV absorbent plastic shark silhouettes by a turtle and a mahi mahi.

### Broader Impacts

The students, educators, and scientists who conducted this research are part of Aquatic Adventures' "BAHÍA" program. This program engages students from one of San Diego's most underserved high schools by supporting them as they make tangible contributions to ongoing research. Students are afforded extensive instruction and guidance throughout their research project. With this experience, students work toward a future in the sciences with a better understanding of what is expected of themselves and what potential opportunities exist in their paths. For more information contact: sharafisler@aquaticadventures.org. or www.aquaticadventures.org

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