Are We Connected? The Link Between White Shark Groups in the Northeastern Pacific

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1- California State University, Monterey Bay; 2- Monterey Bay Aquarium; 3 – Montana State University; 4 – Stanford University; 5 – Point Reyes National Seashore; 6 – White Shark Adventures

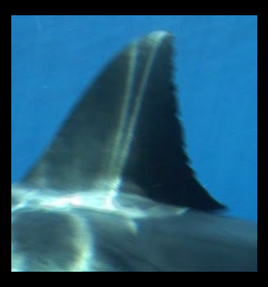
(a)

Capture tapes

(b)

Analyze video clips & identify shark

(c)

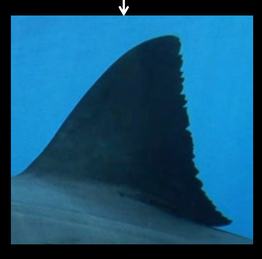


Deinterlace

(d)

Superresoluton

(e)



Capture dorsal fin image

(f)

Match dorsal fin ID (Figures 1 - 4)

Introduction

There are two groups of white sharks within the Northeastern Pacific (NEP) population and it is widely believed that there is limited connectivity between these groups (Jorgensen, 2010). Past studies have supported two separate groups of white sharks located off Central California (CCA) and at Guadalupe Islands (GI), each with long-term site fidelity, who intermingle at the White Shark Café (Figure 5). We believe there is a higher rate of movement between these two groups than previously documented. We hope to confirm this by identifying individual sharks that have moved between both sites using dorsal fin identification technigues that have been validated to be reliable for 26 years (Anderson, 2011). Determining the connectivity of these two groups may have a major influence on how white sharks are managed in the NEP.

Work Flow

Long-term identification through visual comparison of dorsal fin morphology offers a large window into the sharks' life that a battery powered tag does not have the durability to match. We developed a stepwise methodology to work with these data sets (a-f). These data sets are derived from historic cage diving video footage from Guadalupe Island, Mexico ranging from 2000 – 2011 (a). The video was transefered from cassettes to external hard drives and analyzed to identify individual sharks (b). When necessary, the video element interlacing was removed through post-processing (c). If needed, a post-processing superresolution program was used to combine images for increased resolution (d). Images of the dorsal fin were captured (e) and compared to other fin images from both CCA and GI (f).

Identifying Features

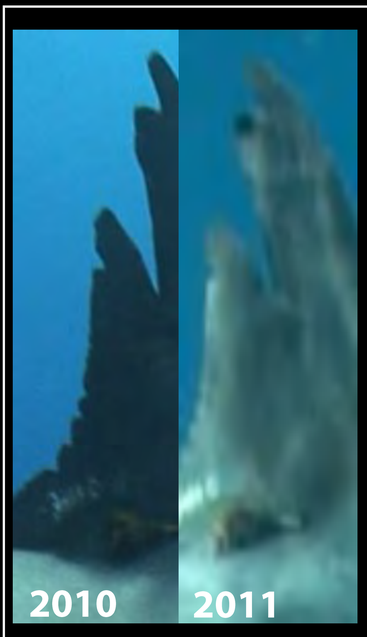


Figure 1: "Gouged fin" at Guadalupe Island

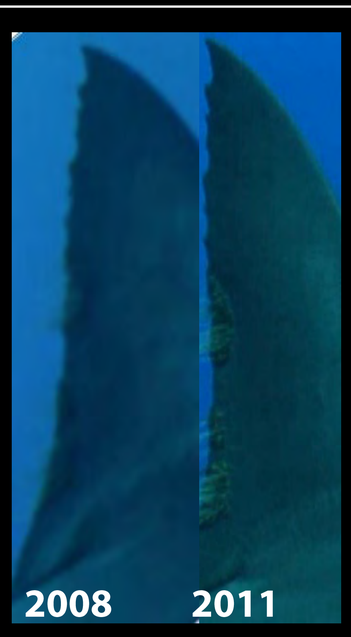


Figure 2: "Nocked tip" at Guadalupe Island

Figure 3: "Saw Blade" at Guadalupe Island

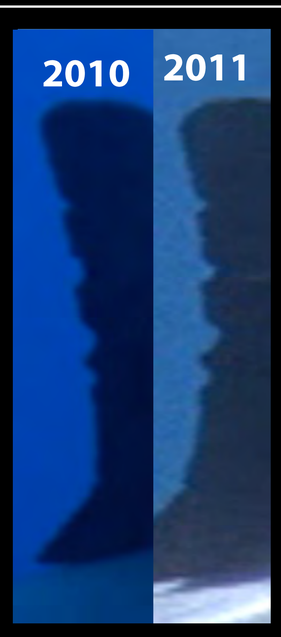


Figure 4: "Triple Dip" at Guadalupe Island

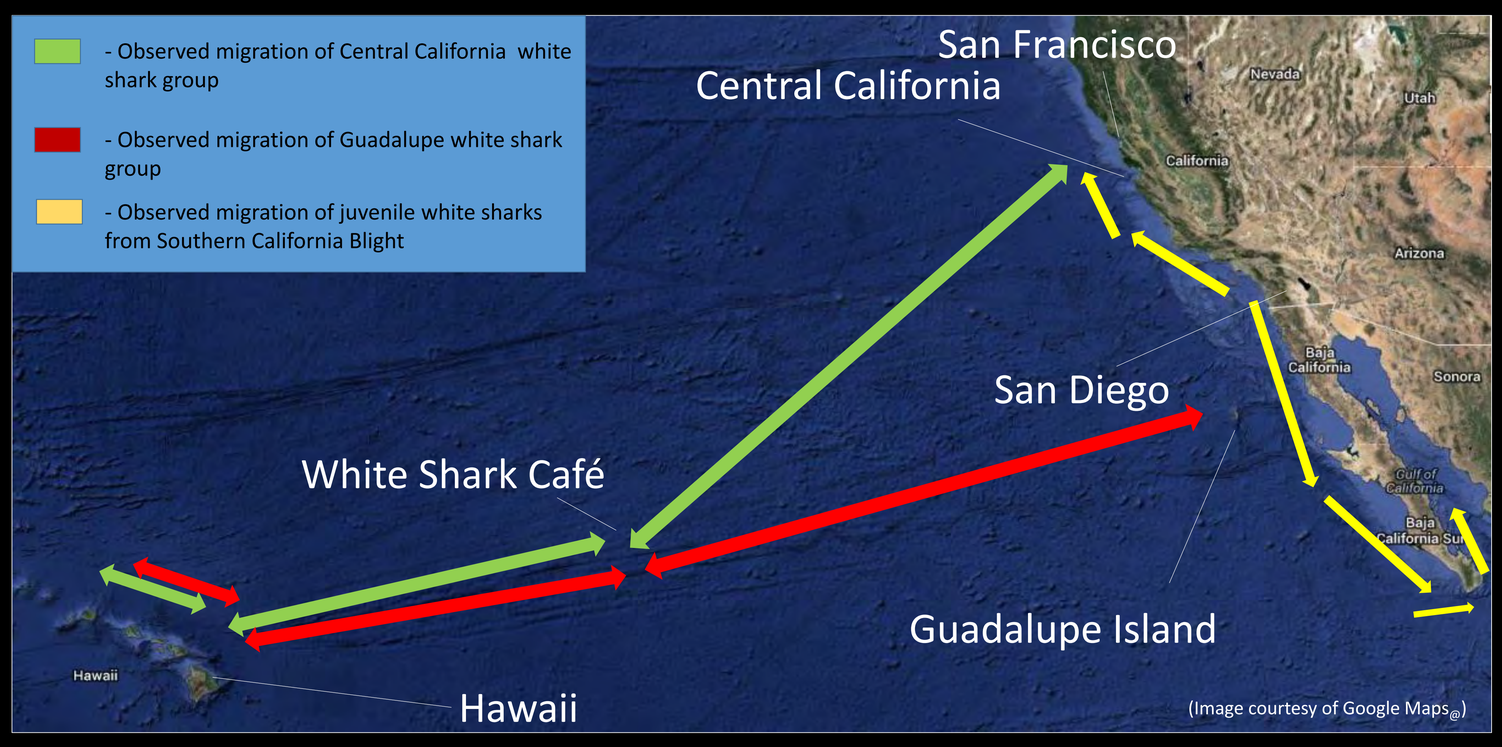


Figure 5: Known movement of the two white shark groups in the NEP

Discussion

We will continue to analyze the historic footage from Guadalupe Island to identify every shark captured on footage. The hope of this work will be to create a comprehensive database to include as many NEP individual IDs as possible across their entire range.

I am expecting to identify at least one shark which has migrated from the Farallon Islands to Guadalupe Island. This individual, an adult female, tagged off CCA and recorded at GI was the only one out of 140 individuals who migrated during the working duration of the tag (Jorgensen, 2010). Our hypothesis will be supported if there are additional sharks we can identify and resight as having made a migration between the two sites.

These migrations would show that there is a long-term movement pattern connecting these two groups. The implications of a single, more-connected population would require greater coordination between the United States and Mexico to manage white sharks across their range. A comprehensive database of identified individual white sharks is also a valuable resource that can be used to track changes in the population and monitor the effectiveness of the management plans.

Acknowledgements

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Citations

Anderson, S. D., Chapple, T. K., Jorgensen, S. J., Klimley, A. P., Block, B. A. (2011). Long-term individual identification and site fidelity of white sharks, *Carcharodon carcharias*, off California using dorsal fins. *Marine Biology*, *158*(6), 1233–1237. DOI:10.1007/s00227-011-1643-5

Jorgensen, S. J., Chapple T. K., Anderson, S., Hoyos, M., Reeb C., Block, B.A.: Connectivity among white shark coastal aggregation areas in the northeastern Pacific. In *Global Perspectives on the Biology and Life History of the White Shark*. Edited by Domeier, M.L. Boca Raton: CRC Press; 2012:159–168