



Gaining a Clutch on Sand Tiger “Sea Dogs” Using Spot-a-Shark USA

Anna Cecil¹, Dr. Carol Price²

University of North Carolina at Chapel Hill¹; North Carolina State University Center for Marine Sciences and Technology²



Research Objectives

- I. Determine the number of total uploaded images, pattern matches, and unmatched first encounters.
- II. Identify the sex, physical injuries, and spot pattern of each shark, as well as the orientation of the photograph.
- III. With respect to pattern matches, establish the locations and dates of recurrent observation.



Figure 1. Sand tiger shark global locations.

Background

Sand tiger sharks are a coastal species with distinguishable features including a flattened, cone-shaped snout, protruding teeth, small eyes, brown/sand-colored spotted skin, and a typical length of 2-3.2 m. Spot-a-Shark (SAS) engages recreational divers who submit their sand tiger shark photos to study this species habitat use and site fidelity to shipwreck sites off NC (Paxton et al., 2019). This database currently has over 2500 unique sharks in the photo library and over 130 sharks that have been photographed on more than one date.



Figure 2. Locations of shipwrecks where divers photographed sand tiger sharks spot mapped in this study.

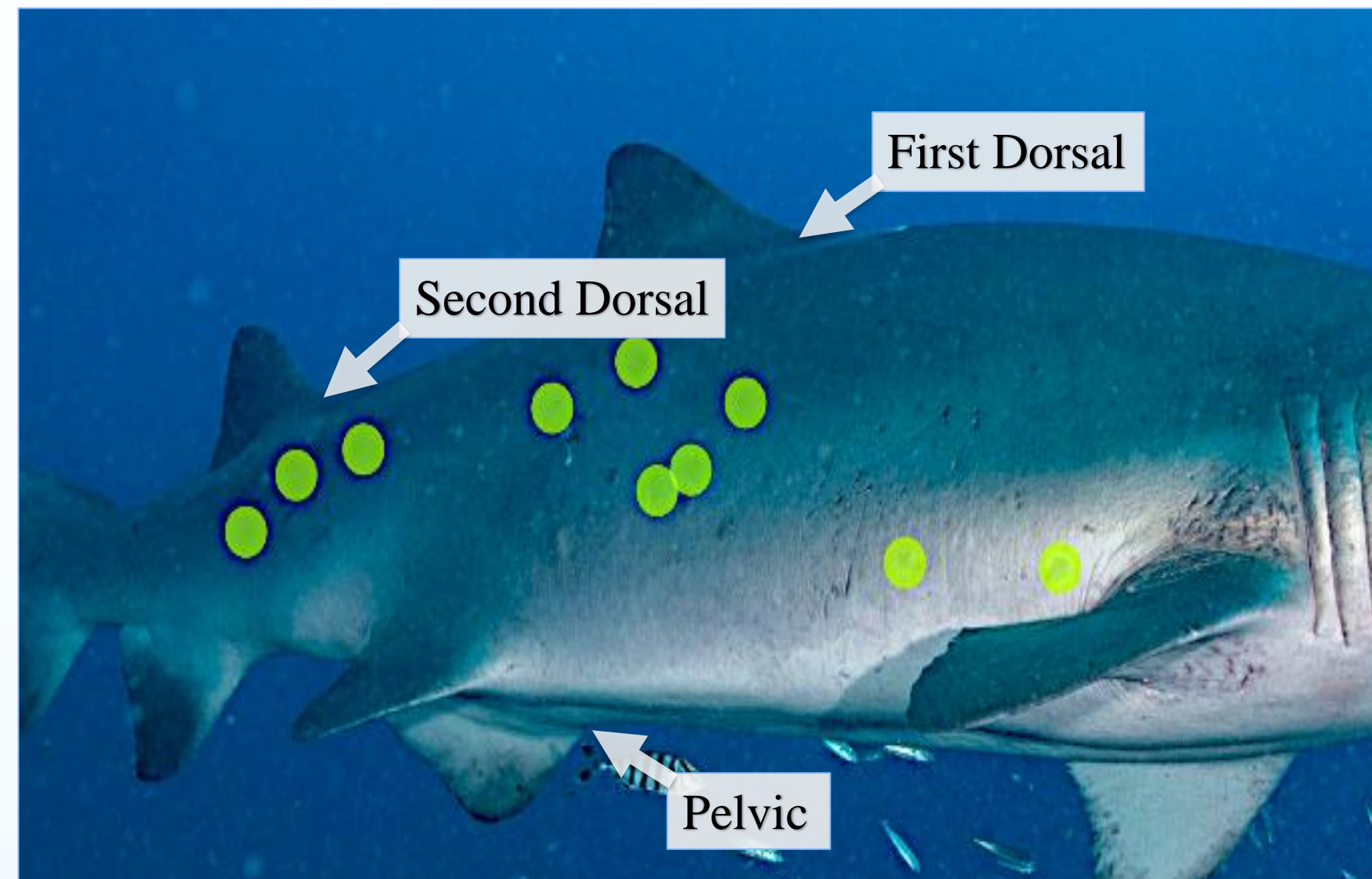


Figure 3. Spot Mapping of USA-R0981. Images without caudal fins and the head of the shark are applicable for spot mapping.

Methodology

- I. Upload Encounter to the SAS website – include date, location, and diver responsible for the photograph.
- II. Examine the photo for other objects/organism's present – fish, divers, remora, mating scars, tags, etc.
- III. Spot-Map the shark using Wildbook© by identifying 10-16 spots, as well as the first dorsal, second dorsal, and pelvic fin.
- IV. Scantask – The system utilizes 2 variations to match previously identified sharks – Modified Growth and I3S. A 2D algorithm will provide the researcher with proposed matches, which will then be approved or denied. Modified Growth has shown to be the preferred method of the two, due to accuracy; however, both sets of results are examined.

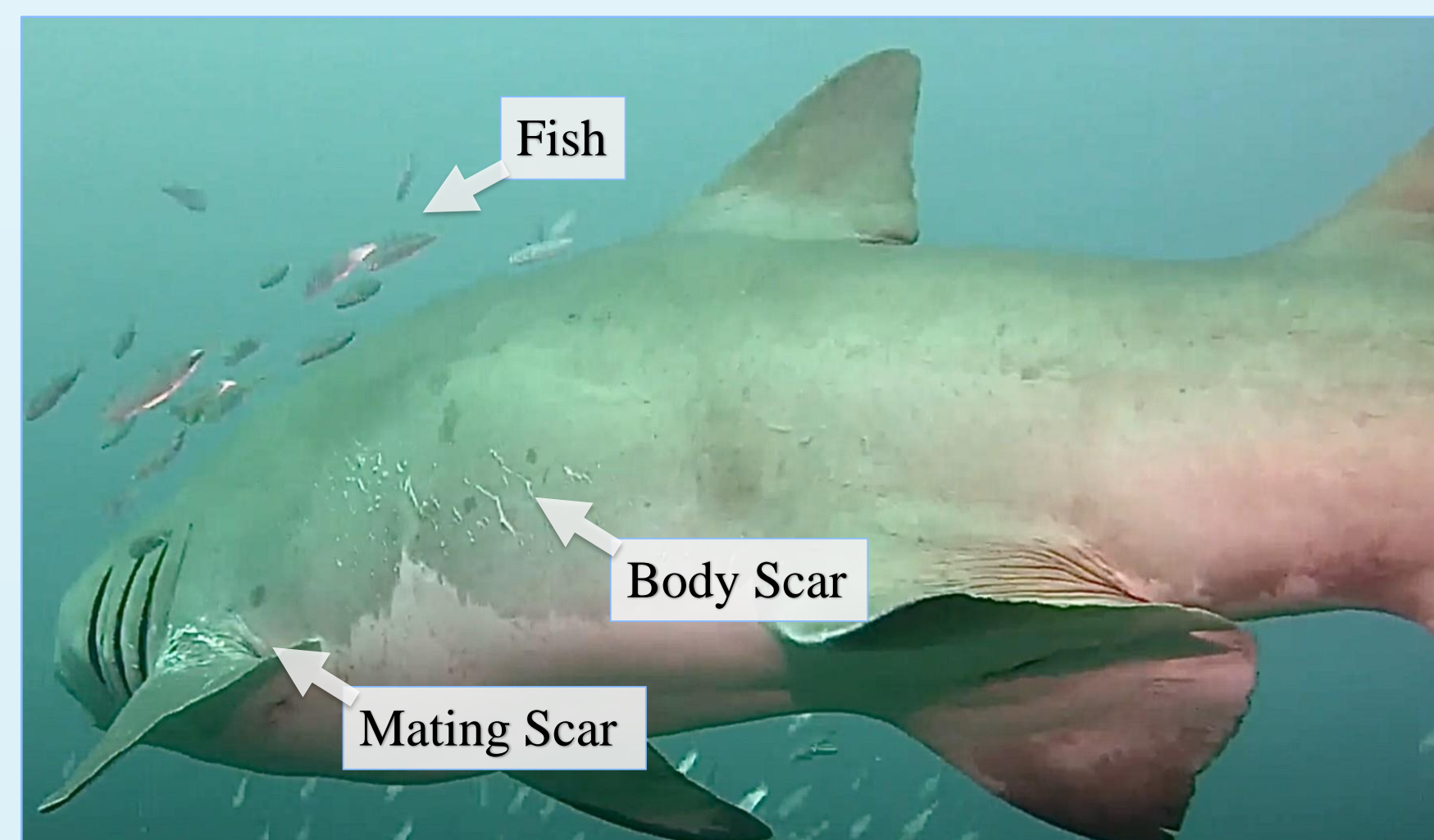


Figure 4. A few example keywords commonly identified.

Results

Table 1.

Major Data Findings of Uploaded Encounters

Photo Orientation	Male	Female	Unknown	Body Scar	Mating Scar	Fin Damage
Right-Side	1	12	8	8	3	4
Left-Side	4	13	8	9	6	5

Note. The total number of encounters is 46 (n=46). Pattern match (n=5) and first encounter (n=41) are both included.

Figure 5.

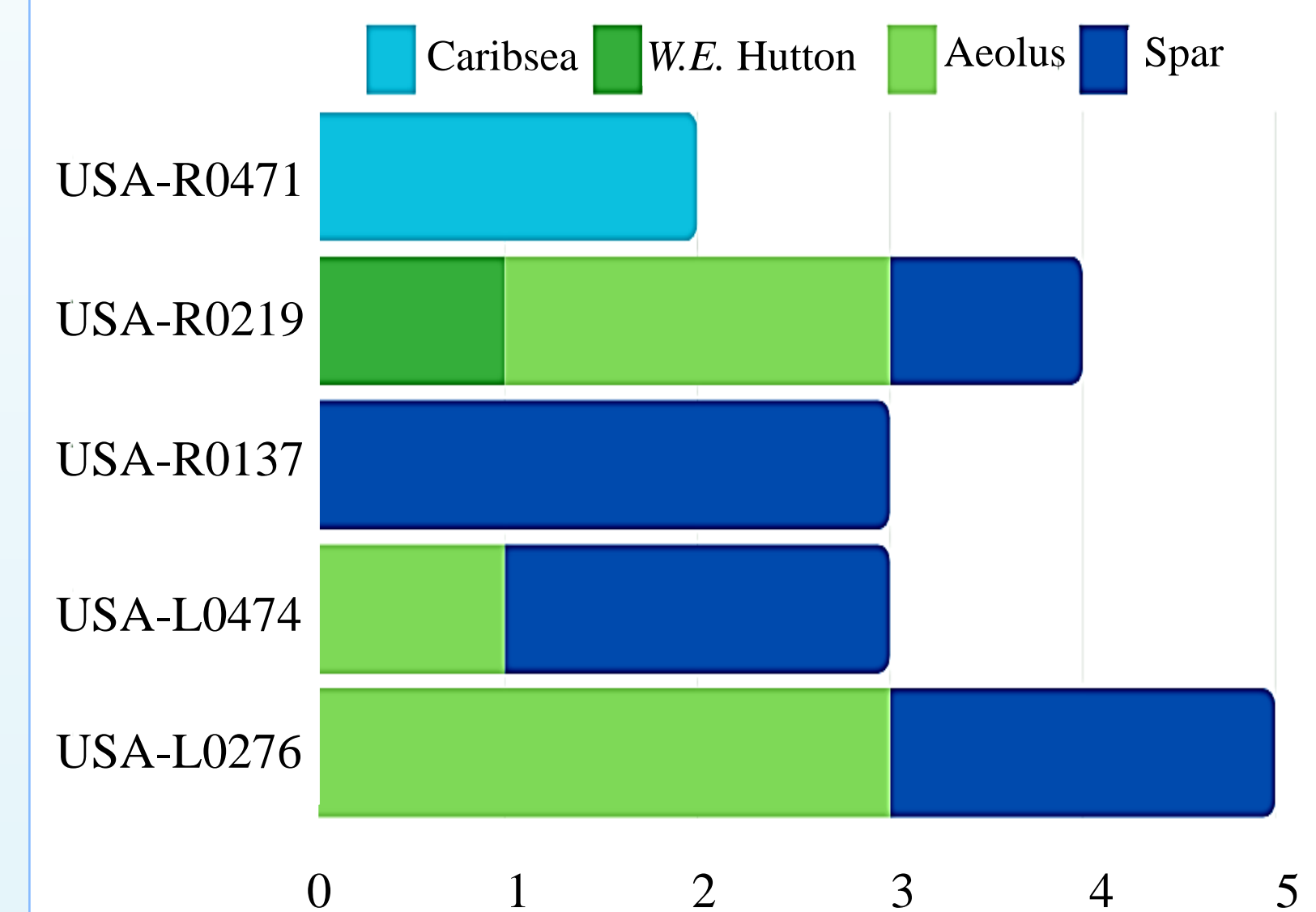
Pattern Matches (a) USA-R0219, (b) USA-R0137, and (c) USA-L0474.



Note. Left most photo represents the first encounter in the database, while the right most is the most recent encounter. Figure is not representative of all pattern matches obtained in this study.

Figure 6.

Encounter Locations of Each Pattern Match Shark



Note. The number of re-encounters is not equal among pattern matches.

Conclusion

- I. The presence of pattern matches supports the idea of sand tiger sharks revisiting shipwrecks; however, this study does not yield any conclusions on the movement between photos.
- II. New unmatched encounters are essential to identify additional sand tiger sharks – specifically as a motive for habitat conservation.
- III. Sand tiger sharks are listed of concern by NOAA Fisheries and globally vulnerable on the IUCN Red List, highlighting the importance of SAS continuation.

Acknowledgements

This research was possible due to the amazing mentorship of Dr. Carol Price of NC State's CMAST. Additional thanks to Dr. Rachel Noble, Dr. Vicky Thayer, and the faculty of UNC's Institute of Marine Sciences for their continuous support.

References

Blount D, Gero S, Van Oast J, Parham J, Kingen C, Scheiner B, Stere T, Fisher M, Minton G, Khan C, and others (2022) Flukebook: An open-source AI platform for cetacean photo identification. *Mammalian Biology : Zeitschrift Für Säugetierkunde*

Carlson JK, Mccandless CT, Cortés E, Dean Grubbs R, Andrews KI, Macneil MA, Musick JA (2009) NOAA technical memorandum NMFS-SEFSC-585 AN UPDATE ON THE STATUS OF THE SAND TIGER SHARK, *CARCHARIAS TAURUS* IN THE NORTHWEST ATLANT

Castro J, Woodley CM, Brudeck R (1999) A preliminary evaluation of the status of shark species. *FAO fisheries technical paper no. 380*, FAO, Rome, p 72

Paxton, A. B., Blair, E., Blawas, C., Fatzinger, M. H., Marens, M., Holmberg, J., ... & Penfold, L. M. (2019). Citizen science reveals female sand tiger sharks (*Carcharias taurus*) exhibit signs of site fidelity on shipwrecks. *Ecology*, 100(8), 1-4.