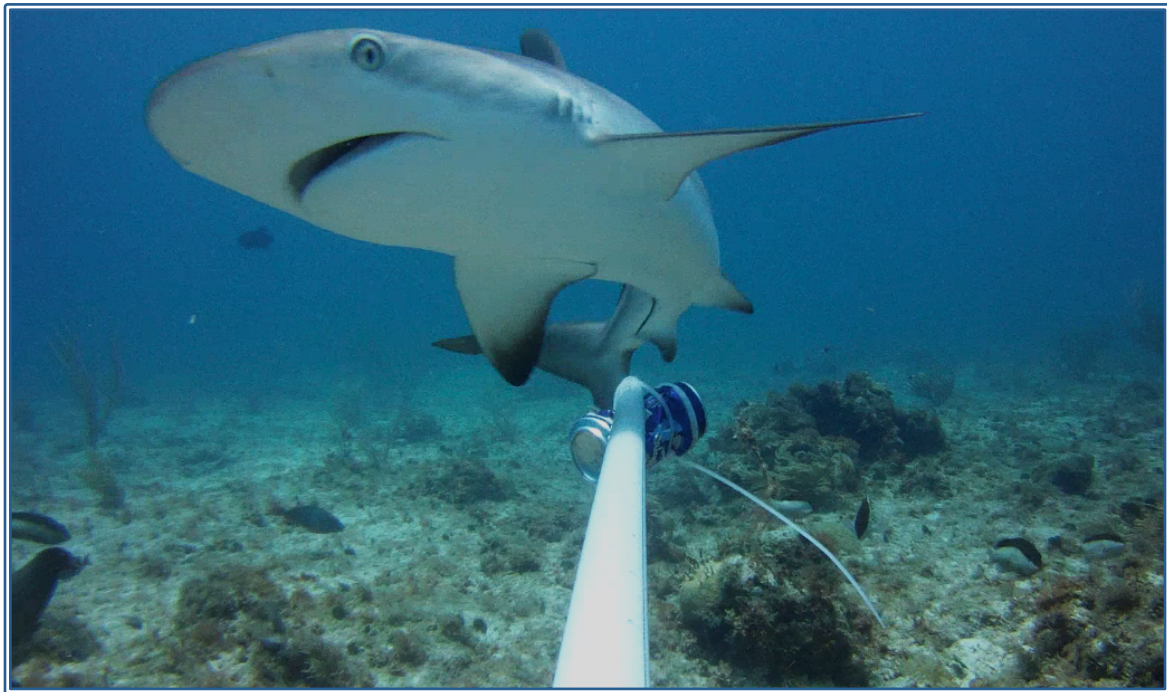


# RAPID SHARK ASSESSMENT THE SWAN ISLANDS, HONDURAS



## TECHNICAL REPORT

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## INTRODUCTION

Sharks and rays, collectively known as elasmobranchs, are unquestionably one of the most endangered assemblages of marine species known and the lack of information on sharks to establish effective management and conservation frameworks is greatly lacking in most parts of the world. Time and logistical difficulties often preclude long term sampling using techniques such as longlines for catch per unit effort, a key metric to assess patterns of relative abundance, diversity and the intraspecific demographics of sharks. Consequently, a relatively new technique that is particularly suited to rapid assessments has emerged that can further help to fill gaps in knowledge of species diversity and relative abundance. Baited remote underwater video set-ups (BRUV) have been recently used to characterize predatory fish assemblages and the role of habitat structure on their abundances and diversity in a non-invasive manner [1].

The Swan Islands, a remote outcrop on the edge of the Cayman Trench located northeast of Honduras' Bay Islands may represent one of the last pristine coral reef sites in the Western Caribbean. Remotely situated far from the Honduran coast and benefiting from protective legislation since 1991 (Government of Honduras 3056-91) and a constant terrestrial presence of the Honduran Navy, the islands are expected by scientists and conservationists to reveal positive site and species differences in fauna and flora compared to other protected and unprotected sites that are monitored throughout the Caribbean.

The purpose of this study was to therefore to rapidly and non-invasively assess the diversity and relative abundance of elasmobranchs at the Swan Islands, data that would contribute to their management and protection at that site.

## METHODS

Sampling took place over the course of three days following a day-long set up and calibration of the BRUVs. Four units were constructed using pre-cut PVC, wood, rope, lead weights and zinc. Cameras used were GoPro Naked cameras (GoPro, Colorado, USA) with flatport housing and red corrective filters. Bait arms consisted of two empty beer cans filled with ~300g of little tunny (*Euthynnus alleteratus*) and lionfish (*Pterois volitans*) secured to the arm using chicken wire and plastic covered wire.

The four BRUV units were deployed at 16 stations throughout the Swan Islands. Sampling took place on both the north or leeward side and south or windward side of Great and Little Swan Islands as well as near the channel bisecting the two islands. Each paired deployments represented two stations and two depth regimens. Depths roughly coincided with shallow (10m-14m) and deeper (18m-25m) bathymetric contours and represented the same mixed patch reef, and seagrass habitat throughout. Efforts were made to replicate the stations as many times as

possible during the field trip, with up to four replicates for specific stations. Each unit was lowered to the seabed off the back deck of the boat and guided into place by a snorkeler. A GPS mark was taken and sampling of the water temperature, salinity and dissolved oxygen was taken throughout the island waters using a YSI environmental parameter sampling instrument (YSI, USA).

Each deployment was run continuously for 60< minutes before the unit was lifted back on deck, the cameras removed and the data cards downloaded and batteries recharged. Video was processed with footage truncated to the first 60 minutes of the deployment. Sharks were recorded by species, sexed (where possible) and size estimates were derived when possible using the beer cans as scale. Catch per unit effort was derived as the number of sharks per hour. (shark hr<sup>-1</sup>).

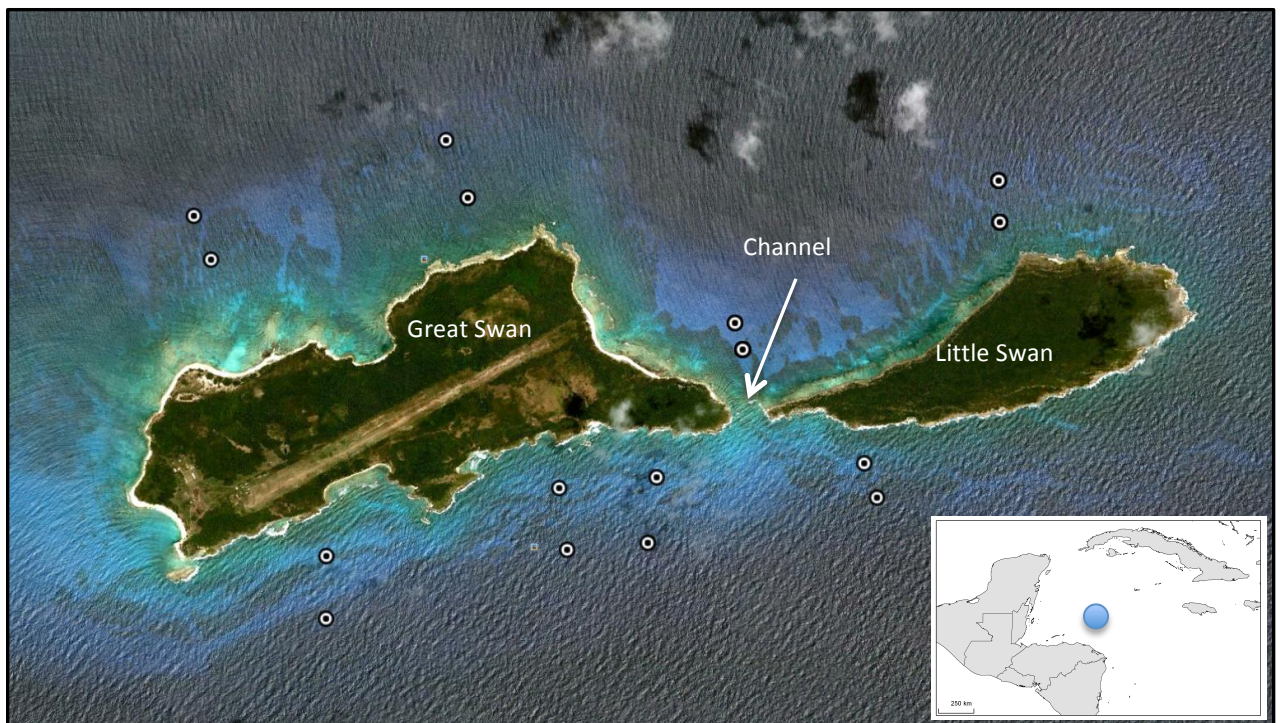


Figure 1. Location of the Swan Islands (blue dot on inset) and BRUV deployment stations (white points) parsed in two depth treatments (shallow and deep) on the leeward (north) and windward (south) sides of the islands.

Coincidentally a team of eight divers conducting AGGRA and rover diver surveys spent over 200 hours underwater at nearby sites on both the north and south sides of the islands.

## RESULTS

We conducted 28 one-hour deployments over the course of 72 hours with 1-4 replicate numbers in the four zones throughout the Swan Islands. We identified

three species of sharks, Caribbean reef (*Carcharhinus perezii*), nurse shark (*Ginglymostoma cirratum*) and great hammerhead (*Sphyrna mokarran*) in order of abundance respectively.

A full review of all deployments yielded a 68% occurrence of sharks or a total of 37 sharks (Mean  $1.32 \pm 1.24$  SD) recorded on the BRUVs. Habitats were all similar with mixed patch reef, seagrass and sand. Weather was consistent with a 0-3 Beaufort scale experienced daily with increasing strength breezes coinciding with later hours. All sites denoted as shallow registered 1-4 sharks with a total of 25 individuals. Deeper deployments recorded only 12 sharks, with nine deployments not registering any sharks (Figure 1). The leeward north side of the Swan Islands yielded 26 records of sharks and the windward southern side

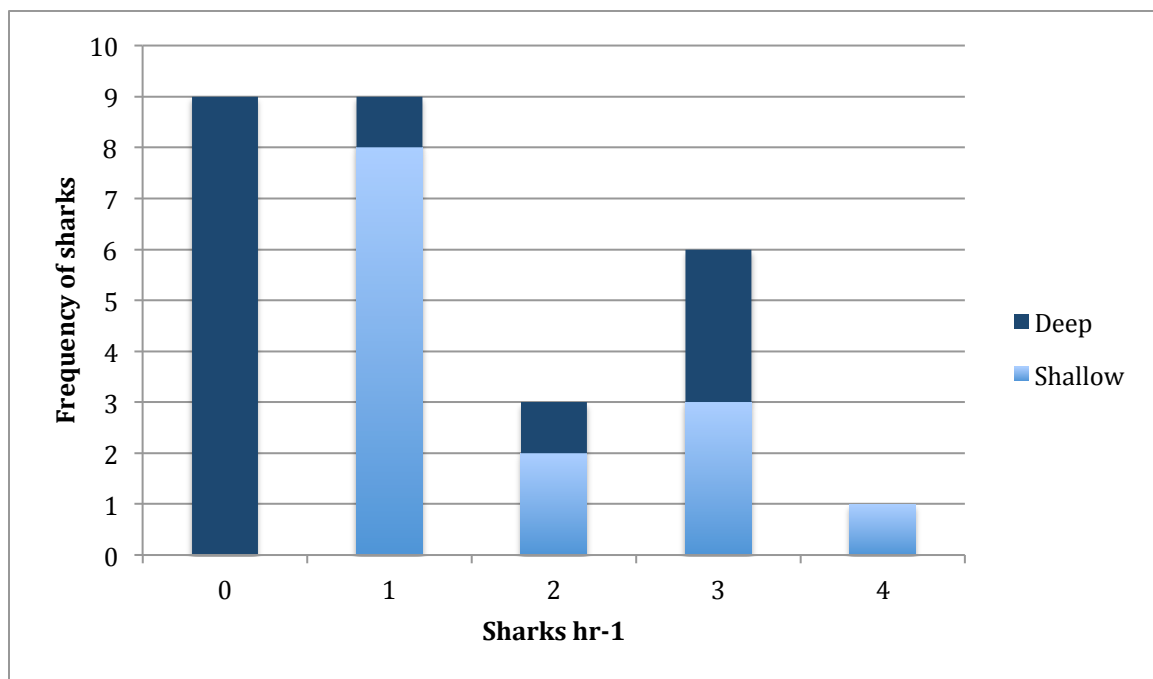


Figure 2. Catch per unit of sharks as sharks h<sup>-1</sup> recorded on the BRUVs in the two depth treatments.

20 casts of the YSI revealed a mean water temperature during the 3 day period of  $29.2^{\circ}\text{C} \pm 0.29$  SD (range 28.6-29.5), salinity ( $35.01 \pm 0.31$  SD range 34.6-35.5) and dissolved oxygen ( $4.35 \text{ ml/L} \pm 0.25$  SD range 3.82-4.80).

Over 200 hours of diver surveys conducted by the team of divers yielded sightings of two Caribbean reef sharks, one nurse shark and two records of southern stingray (*Dasyatis americana*), a species that was not recorded on the BRUVs.

BRUVs consistently recorded other species of note that were rarely captured in the diver surveys including two hawksbill and one green turtle and a range of large predatory fish including yellowfin grouper (*Mycteroperca venenosa*), barracuda



(*Sphyraena barracuda*), horse eye jack (*Caranx latus*), barjack (*Caranx ruber*) and two pairs of courting yellow jacks (*Carangoides bartholomaei*).

## DISCUSSION

The low abundance of large fish and piscivorous teleosts in particular as recorded in both the BRUVs and rover diver surveys as compared to other sites in the Caribbean suggests that the Swan Islands have been heavily fished recently. This site may be under continued fishing pressure despite the site's declaration as a protected area in 1991 as the Honduran Navy remains underfunded and terrestrially-constrained.

Surprisingly though, sharks were recorded on 68% of all BRUV deployments with the majority of sharks occurring on the shallow waters on the leeward, calmer side of the islands. The overwhelming majority of sharks recorded were Caribbean reef sharks, which are the most abundant demersal species in the Caribbean. Surprisingly, all animals recorded could be classified between 1.0-1.5 m, denoting them as juveniles based on known length at maturity and lack of calcification of claspers in those animals that were sexed as males. Nurse sharks and the single hammerhead recorded also appeared to be juveniles suggesting that the shallow calmer waters on the north side of the islands serves as a nursery ground in particular for the Caribbean reef sharks. Sharks often segregate by sex and size [2] and it is possible that deployment of BRUVs in 40 m+ areas could have yielded records of adult animals but deeper casts were not feasible due to safety concerns as the island shelf is broad requiring moving the Aggressor far from the divers. It is also plausible that few adult sharks were recorded due to anecdotal indications of heavy fishing for sharks in the Caribbean, which would leave only juveniles in the shallows because this area benefits from greater oversight by the Honduran Navy.

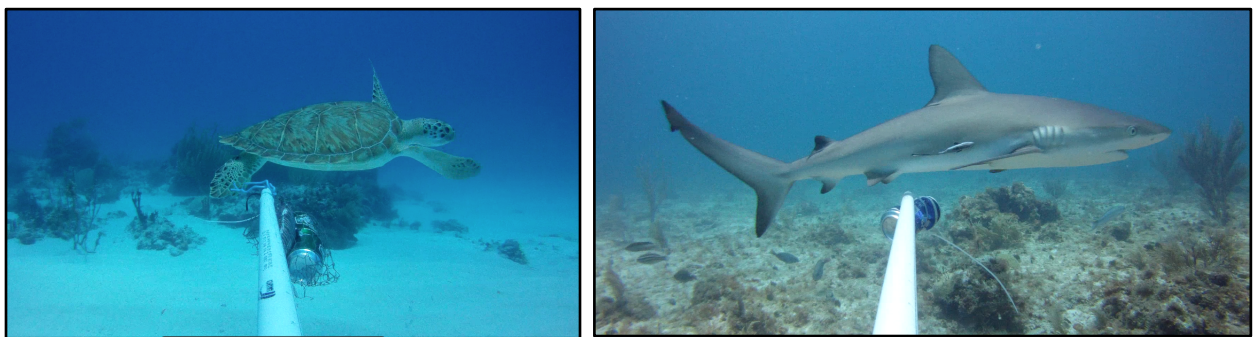


Figure 3. A green turtle (*Chelonia mydas*) and a Caribbean reef shark (*C. perezii*) captured on BRUVs deployed at deep and shallow sites respectively.

Methodologically, the BRUVs proved to be a very cost effective with low construction costs and ease of deployment. They represent an excellent complement of the site's traditional rapid faunal assessment undertaken by divers as their hour-long deployment can occur concurrently with diver surveys and cover identical habitats.

The BRUVs not only recorded sharks but also a range of piscivorous finfish (jacks, barracuda, groupers) and turtles (green and hawksbill – all juveniles), species rarely observed by divers. Video recorded a high catch per unit effort of sharks with 1.5 orders of magnitude greater than recorded by divers with 1.3 sharks per hour versus 0.03 sharks/rays per hour. This suggests that diver surveys alone can grossly underestimate elasmofauna. The video units further provided insights into the impact of divers and boat noise on sharks, where rapid evasive behavior was recorded in sharks during at least two pick-ups as the boat was positioned over the BRUVs.

The units provided insights into fish behavior: BRUVs recorded courting yellow jacks, as evidenced by the dark coloration in the following animal previously recorded in the same species prior to spawning in Belize, which suggests that this species is spawning at the Swan Islands. Large aggregations of black durgons (*Melichthys niger*), coneys (*Cephalopholis fulva*) with rapid coloration changes and unusually high abundances of ocean triggerfish (*Canthidermis sufflamen*) also suggest that these species are reproducing nearby.

The discovery of two goliath grouper (*Epinephelus itajara*) measuring an estimated 90 cm and 120 cm in total length respectively suggest that juveniles (up to 110 cm for males) and adults (over 110cm for males and 120cm for females)[3,4] of this species inhabit caves near the channel bisecting the two islands. Based on known growth rates and those measured in Belize, the individuals encountered were approximately 4 and 6 years old respectively. Whether they travelled from the coast to the Swan Islands or their presence represents recruitment from a nearby spawning ground is unknown. It is worth noting that semi-structured general fisher questionnaires administered to local fishers in Utila in 2008 recorded that two fishers identified the Swan Islands and its nearby banks as a formerly productive site, yielding high numbers of very large goliath grouper in the summer months. This further suggests that this site had once been, and may still function as a spawning ground for this species.

The presence of goliath grouper provides hope as this species is listed as critically endangered by the IUCN due to broad extirpation of populations throughout its range, with only three sites globally recording frequent encounters (USA, Brazil and Southern Belize). Although the presence of juveniles in Honduras and Belize indicates that spawning is taking place, there are currently no spawning sites for goliath grouper documented outside of the United States and Brazil.

This suggests that if fishing pressure were decreased dramatically through the enforcement of established protected area laws, goliath grouper could make a strong comeback and the Swan islands could eventually become a sanctuary for a spawning population (and renamed the Spawn Islands. Moreover, if the 2010 presidential decree banning shark fishing throughout Honduras were enforced, sharks could repopulate the Caribbean coast with the Swan Islands becoming a

hotspot for these slow-growing apex predators, particularly if their prey species are allowed to rebuild.

Similar surveys to this study should be undertaken at least every two to three years preferably with an increase in sites and time to better assess diversity and relative abundance as well a recruitment of sharks in relation to depth and habitat types.

## **ACKNOWLEDGEMENTS**

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