Standardized Abundance Index for Great Hammerhead from the Rosenstiel School of Marine and Atmospheric Science Drumline Survey

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Introduction

The data reported here are from standardized drumline surveys conducted from Miami through the middle Florida Keys to examine spatial, seasonal and environmental patterns in shark occurrence, catch per unit effort, composition, and demographic structure (reported in Tinari and Hammerschlag 2021). Data from great hammerhead sharks *Sphyrna mokarran* (n=207) captured in the survey between 2009 and 2019 were extracted to evaluate trends in relative abundance over the course of the survey.

Methods

As outlined in Tinari and Hammerschlag (2021), shark surveys were conducted year-round, encompassing Florida's wet season (May-October) and dry season (November – April). Shark surveys in the Keys region predominately occurred between January 2009 and December 2013, whereas surveys in the Miami region primarily occurred between April 2014 and February 2021. Daily sampling locations were selected randomly within inshore or offshore habitats (Figure 1). The choice of inshore versus offshore sampling on a given day was based on prevailing wind conditions (i.e. strong winds prevented offshore excursions). Within offshore habitats, sampling gear was deployed on sand or mud to avoid contact with the reef. Within inshore habitats, sampling gear was generally placed in or at the mouth of submerged channels (shallow flats were avoided to prevent boat grounding).

Sharks were surveyed using a standardized and minimally invasive drumline fishing method as described in Gallagher et al. (2014). The fishing gear consisted of a submerged 20-kg weight tied to a line running to the surface by means of an attached inflatable buoy. A 23-m monofilament ganglion line (~400 kg test) was attached to the submerged weight by a swivel, which terminated at a baited 16/0 5°-offset circle hook. This method permitted sharks to swim in a 23-m radius circle around the base when captured.

Two sets of five baited drumlines were deployed and hooks were baited with a standardized type of cut fish, primarily great barracuda (*Sphyrna barracuda*) and false albacore (*Euthynnus alletteratus*), and to a lesser degree ladyfish (*Elops saurus*), greater amberjack (*Seriola dumerili*) and jack crevalle (*Caranx hippos*). Each drumline within a set was separated by ~100 m. Crates (20 x 15 x 12 cm) filled with bait of the same fish species used for the hooks were also placed on the float line of every other drumline (odd numbers) as a standardized attractant. After an hour from when the first drumline was deployed, each drumline was sequentially checked for shark presence. However, the time was recorded when the first drumline was deployed and the last drumline was retrieved in each set of five to determine the soak time for each set.

If a shark was present, it was immediately brought to the boat for processing. A saltwater pump was placed in the sharks' mouth to permit oxygenation of the gills. All sharks were then sexed and measured (in cm) for pre-caudal length (PCL), fork length (FL) and total length (TL). Sharks were also marked with conventional identification tags, the majority of which were provided by the U.S. National Marine Fisheries Service (NMFS) Cooperative Shark Tagging Program

(Kohler and Turner 2019), the remainder which were custom ordered from tag manufacturers (hallprint www.hallprint.com and floy tags www.floytag.com). Sharks were then released in the general location of capture.

Catch per unit effort were calculated by dividing the number of hammerheads captured by the total soak time of the 10 drumlines deployed at a specific site on a given day. Data were analyzed using the gamlss R package with a negative binomial distribution. Model covariates including month, region (Keys vs Miami), Habitat (Bay vs Ocean), Season (Wet vs Dry) and Latitude and Longitude. Soak Time was included as an offset in the model.

Results and Discussion

Captured great hammerheads ranged in size from 130 – 350 cm total length (TL), but averaged 270.9 cm ± 51.9 S.D. Due to the high zero inflation of the data, the data was modeled using a type-2 negative binomial distribution using the gamlss package in R which assumes the variance is modeled as a linear function of the mean.

The overall index values can be found in Table 1. The best fit model included catch ~ year + habitat + offset(soak). The standardized abundance indexes generated for the overall model and habitat specific models are shown in Figure 2.

Table 1. Standardized index of abundance for great hammerhead from the RSMAS drumline survey.

Year	Standardized Index	CV	Nominal
2009	0.027	0.707	0.036
2010	0.055	0.297	0.070
2011	0.053	0.265	0.056
2012	0.036	0.317	0.037
2013	0.039	0.268	0.039
2014	0.053	0.241	0.058
2015	0.048	0.255	0.052
2016	0.074	0.194	0.081
2017	0.055	0.180	0.058
2018	0.053	0.197	0.054
2019	0.053	0.184	0.051

Figure 1. Distribution of sampling effort in the RSMAS Drumline Survey, including the Miami (white circles) and Keys (black circles) regions. Management zones are distinguished by hashed lines and identified by the figure legend. Figure from Tinari and Hammerschlag (2021).

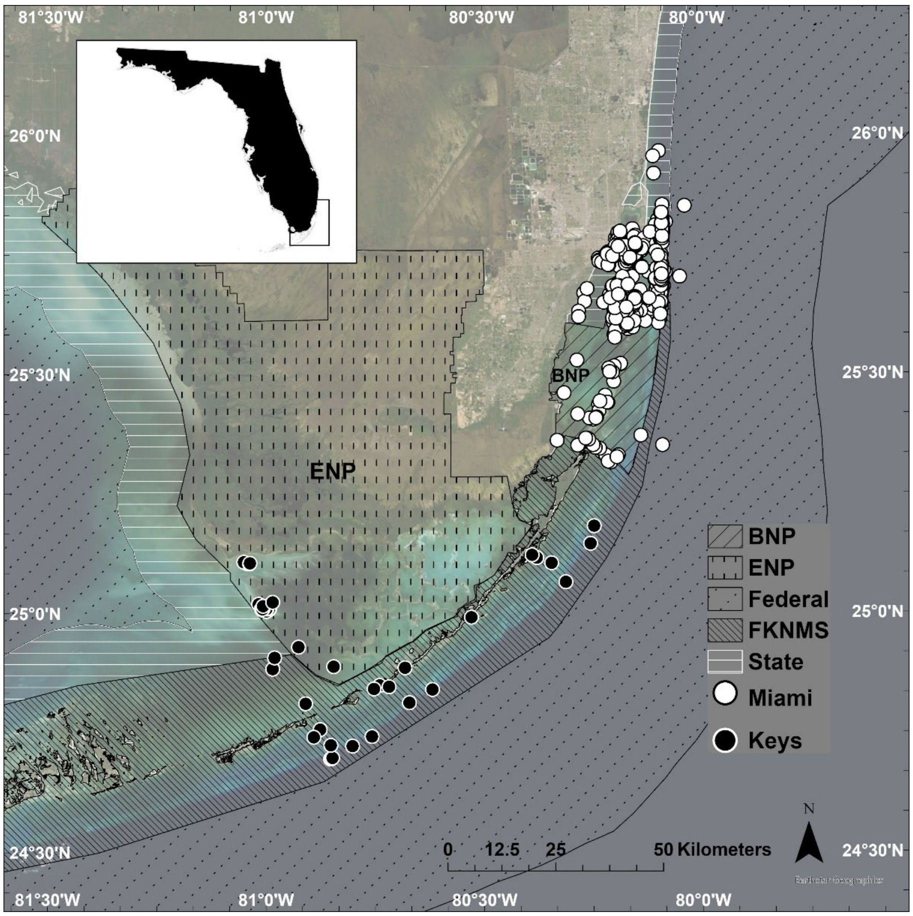
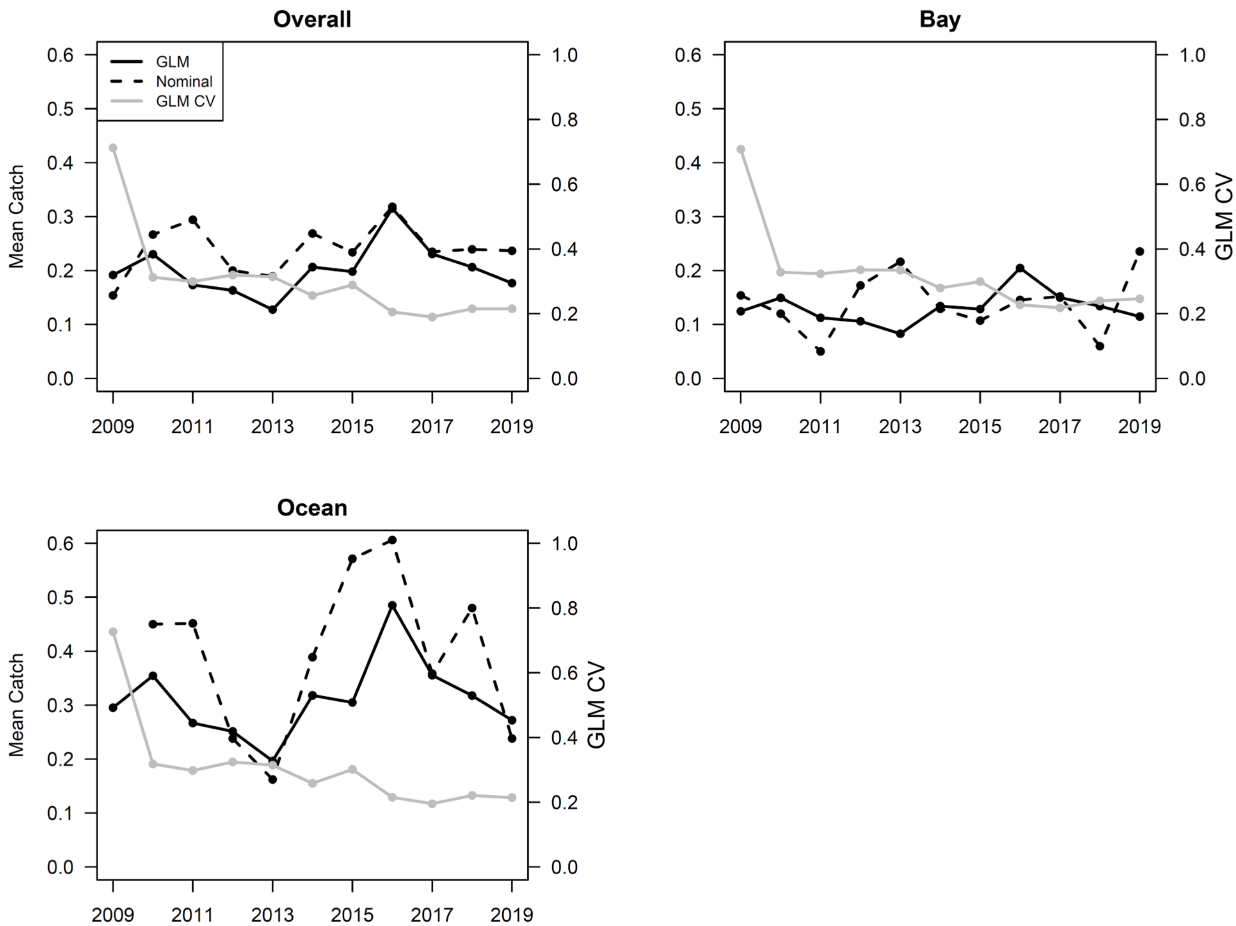


Figure 2. Standardized indices of abundance for great hammerhead.



Cited

Gallagher, AJ, Serafy, JE, Cooke, SJ, Hammerschlag, N (2014) Physiological stress response, reflex impairment, and survival of five sympatric shark species following experimental capture and release. Marine Ecology Progress Series; 494: 207-218

Kohler, N.E., and Turner, P.A., 2019. Distributions and Movements of Atlantic Shark Species: A 52-Year Retrospective Atlas of Mark and Recapture Data. Marine Fisheries Review. 81(2): 1-93. doi:10.7755/MFR.81.2.1.

Tinari AM, Hammerschlag N. (2021) An ecological assessment of large coastal shark communities in South Florida. Ocean & Coastal Management, 211(1):105772. https://doi.org/10.1016/j.ocecoaman.2021.105772.