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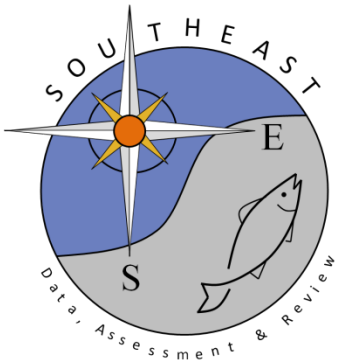

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SEDAR 65 DATA WORKSHOP DOCUMENT

Standardized catch rates of blacktip sharks (*Carcharhinus limbatus*) from the South Carolina Department of Natural Resources drumline survey

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Summary

The SCDNR drumline survey has been conducted since 2013 and is currently an ongoing program. It uses an index station protocol to sample for large coastal sharks in estuarine waters as well as sounds in SC. Sampling typically occurs from April through November. Data from this survey were used to look at trends in relative abundance for mature blacktip sharks. A binomial model was developed using the drumline data because of the use of a single hook fished on each line. Year and month were retained in the final model. Nominal and standardized CPUE results from this survey indicate a stable or slightly increasing population across the survey timeframe.

Sampling Methods

Drumlines: Mainlines are constructed of 33 m of 4.0 mm 1200 lb. test monofilament. A longline snap (model 120 4/0-3/16) and ball bearing snap swivel (130 lb., 890 lb. test) are crimped to each end using 4.2 mm bulk aluminum double sleeves. A 2 m leader is constructed using two strands of 4.0 mm 1200 lb. test monofilament, or six strands of 2.5 mm 550 lb. test monofilament. A 20/0 non-stainless Mustad circle hook (39960ST 20/0) and 12/0 1200 lb. test swivel (Rosco Crane 12/0) are attached to the leader using 4.2 mm bulk aluminum double sleeves for 1200 lb. test mono and 2.8 mm Aluminum Oval Sleeves. Surface lines are constructed of nylon trap rope (#8 ¼" diameter SNL); lengths vary based on set depth and lines are generally set depth plus 3 m extra rope. Anchors vary in weight with a minimum of 30 lbs. used, more may be used in areas of high current. A bowline is tied on each end of the surface line. The weight and buoys are clipped on using longline snaps (model 120 4/0-3/16"). Buoys are paired net balls (NB 120 and NB 50). Shark is most often used as bait, usually specimens that die in other SCDNR gears, those that are sacrificed for workup, or Atlantic sharpnose sharks. Bait species and type (i.e. head, midsection, tail or whole) is recorded on each set. Larger baits are used if targeting large coastal sharks, i.e. tigers. Sites are index stations and are either set in concert with COASTSPAN gillnet or longline sets, or as independent sets. Two to 20 sets are made per day. Soak times average two hours.

Location, depth, tide stage, salinity (ppt), DO (mg/L) and water temperature (°C) are taken with a YSI Pro 2030 for each set is recorded. Set times and pickup times are recorded and used to calculate a soak time (averages 2 hours).

Captured specimens are brought to the vessel, sexed and measured to fork length (FL, from the snout to the center of the fork in the caudal fin) and stretch-total length (STL, in which the tip of the tail is bent downward until it is straight in line with the body). When possible animals are brought on board and measured to the nearest mm, larger animals are measured in the water using a tape measure. The hook is removed after the shark is worked up in the water, and may be cut with bolt cutters if difficult to remove the hook by hand. Mating wounds, deformities and anything unusual are recorded.

Data Analysis

Survey data were filtered prior to analysis to remove sets from November as this month was not consistently sampled. Sets with non-elasmobranch bait were also removed, as teleost bait was infrequently and inconsistently used. Since the drumline employs a single hook, a binomial model was fit to the data using PROC GLIMMIX (SAS 9.4) with a logit link function. The final model was built using a backward selection procedure based on type 3 analyses with an inclusion level of significance of $\alpha = 0.05$. Factors considered for inclusion in the model were year (2013 – 2018), month (April – October), starting depth of the drumline and soak time.

Results

A total of 279 blacktip sharks were captured during 1,035 drumline sets from 2013 to 2018. The size range captured is displayed in Figure 1. More females were encountered than males (1.65 F: 1 M). Blacktip sharks were captured on 27% of sets made. The factors retained in the binomial model were year and month. A summary of the factors used in the analysis is presented in Appendix Table 1. Table 1 summarizes the final set of variables used in the submodels and their significance. The AIC for the binomial model increased during each model run, but due to the

lack of significance of the factors removed, it was deemed acceptable. Annual abundance indices are presented in Table 2 and Figure 2.

Table 1. Summary of backward selection procedure for building a binomial model for blacktip shark abundance from the South Carolina Dept. of Natural Resources Drumline Survey from 2013 to 2018.

Model Run #1	*Binomial Submodel Type 3 Tests (AIC 1137.2)*					
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	5	987	5.18	1.04	0.3943	0.3949
Depth	1	987	2.85	2.85	0.0916	0.0919
Duration	1	987	1.32	1.32	0.2509	0.2512
Month	6	987	40.46	6.74	<.0001	<.0001
Model Run #2	*Binomial Submodel Type 3 Tests (AIC 1150.8)*					
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	5	1003	5.29	1.06	0.3815	0.3822
Depth	1	1003	2.05	2.05	0.1522	0.1525
Duration				Dropped		
Month	6	1003	40.06	6.68	<.0001	<.0001
Model Run #3	*Binomial Submodel Type 3 Tests (AIC 1150.8)*					
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	5	1004	5.71	1.14	0.3354	0.3362
Depth				Dropped		
Duration				Dropped		
Month	6	1004	40.71	6.79	<.0001	<.0001

Table 2. Indices of blacktip shark abundance developed using a binomial model (BN) for South Carolina Dept. of Natural Resources Drumline Survey from 2013-2018. The nominal frequency of occurrence, the number of samples (*N*), the BN Index (number per trawl-hour), the BN indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	*N*	BN Index	Scaled Index	CV	LCL	UCL
2013	0.22857	105	0.16551	0.92522	0.22534	0.58444	1.40878
2014	0.30851	188	0.20579	1.15038	0.16117	0.82851	1.55643
2015	0.25287	174	0.17407	0.97308	0.17990	0.67553	1.36529
2016	0.20833	216	0.13586	0.75947	0.18026	0.52847	1.07009
2017	0.30348	201	0.18541	1.03647	0.16536	0.74105	1.41527
2018	0.34091	132	0.20668	1.15538	0.18596	0.78955	1.63306

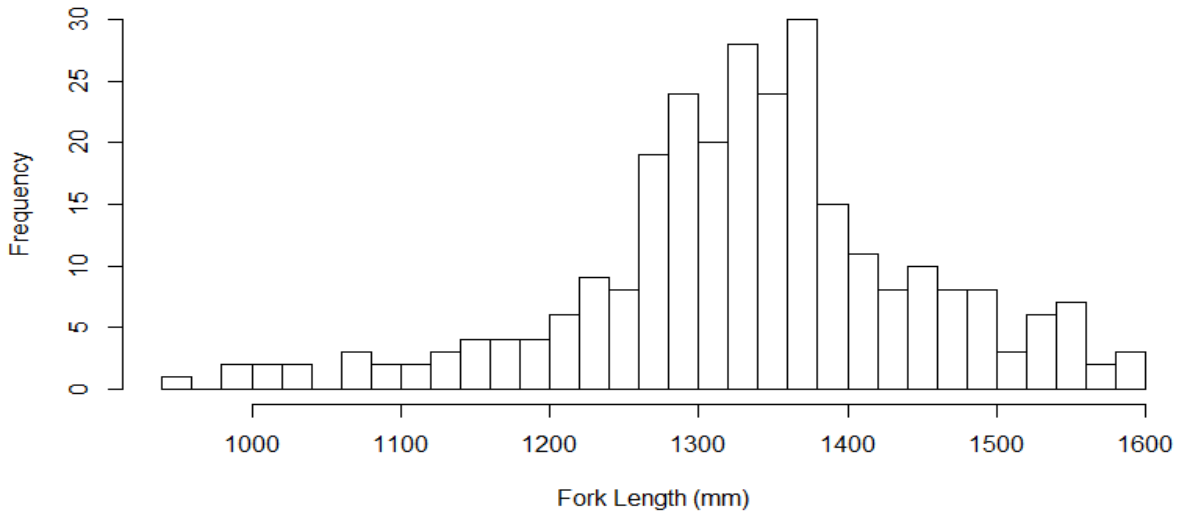

Figure 1. Length frequency (fork length in mm) of blacktips captured in the South Carolina Dept. of Natural Resources Drumline Survey (n=279).

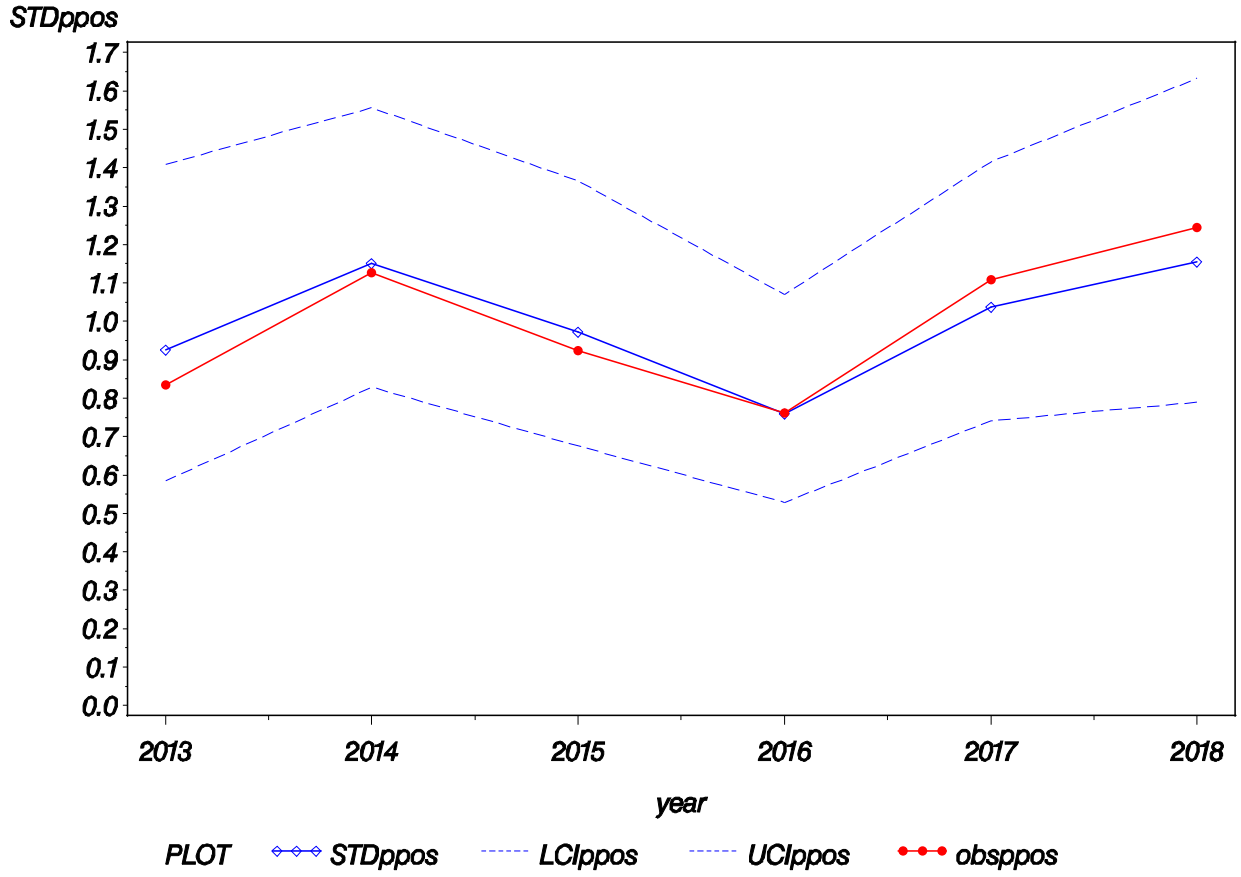

Figure 2. Annual index of abundance for blacktip shark from the South Carolina Dept. of Natural Resources Drumline Survey from 2013 – 2018.

Appendix

Appendix Table 1. Summary of the factors used in constructing the vermilion snapper abundance index from the South Carolina Dept. of Natural Resources Drumline Survey (2013-2018) data.

Factor	Level	Number of Observations	Number of Positive Observations	Proportion Positive	Mean CPUE
Month	4	43	6	0.13953	0.13953
Month	5	323	121	0.37461	0.37461
Month	6	267	85	0.31835	0.31835
Month	7	139	33	0.23741	0.23741
Month	8	118	20	0.16949	0.16949
Month	9	81	10	0.12346	0.12346
Month	10	45	2	0.04444	0.04444
Year	2013	105	24	0.22857	0.22857
Year	2014	188	58	0.30851	0.30851
Year	2015	174	44	0.25287	0.25287
Year	2016	216	45	0.20833	0.20833
Year	2017	201	61	0.30348	0.30348
Year	2018	132	45	0.34091	0.34091