SANDBAR AND BLACKNOSE SHARK OCCURRENCE IN STANDARDIZED LONGLINE, DRUMLINE AND GILL NET SURVEYS IN SOUTHWEST FLORIDA COASTAL WATERS OF THE GULF OF MEXICO

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Introduction

Mote Marine Laboratory's Center for Shark Research (CSR) has conducted relative abundance studies of coastal sharks along the Florida Gulf coast since 1991. In 2001, the CSR launched a new series of studies on larger sharks inhabiting southwest Florida offshore waters utilizing standardized, stratified drumline and longline surveys. This offshore sampling was conducted as regular quarterly surveys and continued through 2009. The primary objectives of these surveys were to: a) assess the relative abundance of large and small coastal shark species; b) determine the migratory patterns of shark species in the eastern Gulf of Mexico; c) investigate depth and temperature preferences of these species and how these change among seasons; and d) examine post-release mortality of large and small coastal sharks. Although large coastal sharks were the primary target of these fishing efforts, small coastal species also were a regular component of the catch. The dataset from these surveys includes sandbar (*Carcharhinus plumbeus*) and blacknose (*C. acronotus*) sharks. No dusky sharks (*C. obscurus*) were found in these surveys; in fact, no dusky sharks have been observed in Mote Marine Laboratory's area of coverage in the eastern Gulf of Mexico since 1992, including all sampling efforts by the CSR and other Mote research centers and all fishing and collecting activities of the Mote Aquarium.

In addition to offshore sampling by longline and drumline, the CSR has conducted relative abundance studies on inshore populations of coastal sharks in Florida Gulf of Mexico waters since 1991. Most of these studies have concentrated on the juveniles to study nursery area dynamics and examine trends in juvenile shark production. In 1995-97, the CSR conducted a NMFS/MARFIN-funded project to assess Florida's Gulf coastal areas as nurseries specifically for the blacktip shark (*C. limbatus*). The study areas encompassed three major estuaries along the Florida Gulf coast. Building upon the CSR's MARFIN study, research funded primarily through NMFS Highly Migratory Species (HMS) Division continued the CSR shark nursery studies in the Gulf of Mexico through 2004, which allowed a relatively continuous sampling of small shark species in these nurseries in all years between 1995 and 2004, except 1998. The dataset from these gill net surveys includes catches of blacknose sharks; only three sandbar sharks, all neonates, were observed in these surveys.

Materials and Methods

Coastal Drumline/Longline Surveys

Large shark surveys were conducted 2001-2009 off the southwest Florida coast north and south of Sarasota four times each year, once per season (typically March, June, September and December), with five days of surveys in each season. Transects were standardized and aligned with five primary passes along the Florida Gulf coast (mouth of Tampa Bay, Longboat Key Pass, New Pass, Big Sarasota Pass, and Midnight Pass, moving north to south) and extending WSW from 1 to 15 miles from the shoreline. One additional transect was sampled in 2001, aligned off Boca Grande Pass, 35 miles south of Midnight Pass. The Boca Grande Pass transect was eliminated in 2002 due to accessibility and distance from home port and replaced by the Big Sarasota Pass station. Each day of sampling normally consisted of two sets of 10-20 drumlines set in a WSW direction and a single longline set 1 mile south and perpendicular to the drumline set. Sharks captured were identified, measured, sexed, tagged and released.

A total of 2,447 single-hook drumlines were set during these large shark surveys. The gear type consisted of a concrete cone-shaped anchor with a ½" galvanized eyebolt embedded into the top, attached to 20-40 m of line (depending on water depth) that connected with a surface float, and a 30 m heavy monofilament gangion (800 lb test) secured to the bottom anchor by a swivel and terminating with a baited circle hook (16/0 or 18/0). Bait used in these surveys consisted of equal proportions of shark (*C. limbatus, C. acronotus, Rhizoprionodon terraenovae* or *Sphyrna tiburo*), ray (*Rhinoptera bonasus* or *Dasyatis* spp.) and teleost fish (*Euthynnus alletteratus*, *Sphyraena barracuda* or *Scomberomorus maculatus*). Individual drumlines (10-20 per sample day) were set approximately 1 km apart and allowed to soak for 2 to 4 hours before being checked for sharks and/or re-baited. Drumlines facilitate high survivorship as they permit the hooked shark to swim in circles around the anchor. Although this gear selects for relatively large sharks, it also catches some small coastal species, such as blacknose sharks.

Bottom longlines were similarly used to target adult and large juvenile sharks, primarily off Tampa Bay and Sarasota, since 2002. The gear comprised 57-121 hooks (9/0 J or 18/0 circle), 3 m gangions with a 1 m leader (stainless steel or monofilament) and a 1.6 km mainline. The primary bait for these surveys was mullet (*Mugil* sp.) and little tunny (*E. alletteratus*) and the typical soak time was 4 hours. Sets made during 2002 and 2003 used stainless steel leader material; this was changed to monofilament in early 2004. A total of 96 longline sets of this type were conducted in 2002-2009.

Inshore Gill Net Surveys

Monthly, random stratified, fishery-independent sampling by gill net was conducted in the three Florida Gulf shark nurseries from March through October (with sampling in summer months only during 1999-2004) in all years except 1998. In each area, two geographically fixed 10 km^2 grids were regularly sampled based upon previous exploratory surveys that revealed subareas with relatively high catch rates. For quantitative assessment of relative abundance, standardized sets were conducted each month in five of the ten 1 x 1 km blocks for each grid. Sets were made using 0.52 mm monofilament, 11.8 cm stretch mesh, 366 x 3 m weighted gill nets, used because of their relatively high selectivity for small sharks and relatively low bycatch of other species.

The net was allowed to soak for one hour before being retrieved. All shark catch was identified, sexed, categorized by stage of maturity (neonate, YOY, older juvenile, or mature), measured and weighed, and live sharks were tagged and released. Physical data including depth, tide, salinity, temperature, dissolved oxygen, bottom type, and weather were collected for each set to characterize shark habitat in the three study areas.

General Results:

In the gill net surveys from 1995 to 2004, a total of 8,295 sharks were documented. These comprised: sandbar (3); blacknose (28); blacktip (3,865); bonnethead *S. tiburo* (3,551); Atlantic sharpnose *R. terraenovae* (742); great hammerhead *S. mokarran* (58); scalloped hammerhead *S. lewini* (20); bull *C. leucas* (14); spinner *C. brevipinna* (7); nurse *Ginglymostoma cirratum* (3); lemon *Negaprion brevirostris* (2); Florida smoothhound *Mustelus norrisi* (1); and finetooth *C. isodon* (1). In the nine years of drumline/longline surveys from 2001-2009, a total of 1,059 sharks were documented comprising: sandbar (120); blacknose (117); blacktip (224); nurse (223); spinner (154); bull (110); lemon (55); great hammerhead (28); Atlantic sharpnose (18); tiger *Galeocerdo cuvier* (7); and scalloped hammerhead (3).