

Shark diversity across three regions of the Chandeleur Island chain based on historic longline survey data

Diversidad de tiburones en tres regiones de la cadena de islas Chandeleur según datos históricos de estudios de palangre

Diversité des requins dans trois régions de la chaîne de l'île Chandeleur d'après les données historiques des relevés à la palangre

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EXTENDED ABSTRACT

The Chandeleur Island chain is a natural barrier island formation off the east coast of Louisiana. Due to the north-south orientation of the Chandeleur Island chain, an estuary is formed between the eastern coast of Louisiana and the western boundary of the islands. Though the Chandeleur Island chain is known to support shark populations, there is considerable environmental variability associated with the area, thereby obscuring the specific usage by various species and life stages. The western, estuarine area, the Chandeleur Sound, is relatively shallow, and more subject to freshwater runoff from terrestrial sources creating an environment with generally lower salinity and higher nutrients. This is evidenced by the rich seagrass beds present on the west side of the islands. In contrast, the east side of the island chain does not support seagrass beds, generally has a higher salinity, and drops off to depths greater than 20 feet within a couple of nautical miles. The southern end of the island chain (south of Curlew Island) supports smaller seagrass beds on the western side of the islands, receives terrestrial runoff, but is not as insulated, as the islands become smaller and less contiguous, thus more exposed to the open Gulf. Understanding the specific utilization of the island chain by multiple species and life stages of sharks, especially in regards to the area serving as a potential nursery ground, is imperative. The island chain regularly experiences hurricanes, freshwater runoff, and land mass loss, all of which are expected to increase in coming years and contribute to a vastly fluctuating environment.

The University of Southern Mississippi's Center for Fisheries Research and Development (CFRD) sampled the northern Chandeleur Sound by means of a standardized Southeast Area Monitoring and Assessment bottom longline survey from 2009-2011. In 2015, this effort expanded to include the waters east and south of the Chandeleur Island chain. Sampling occurs seasonally in the spring (April, May), summer (June, July) and fall (August, September). A range of five to nine randomly generated stations sampled per season. Each station is comprised of a one mile longline, fitted with 100 baited hooks, that fishes for one hour. Water quality parameters are measured at the midpoint of each station. Elasmobranch catch is enumerated, measured, weighed, identified to species and sex, tagged and released.

Stations were sorted into one of three designated zones around the Chandeleur Island chain. The North Sound zone encompassed stations west of the chain, and north of Curlew Island. The North Gulf zone encompassed stations east of the chain, and north of Curlew Island. The third zone, the South zone included stations both east and west of the chain and south of Curlew Island. Environmental parameters including temperature, salinity, dissolved oxygen, and depth were compared among the three zones. Shark species composition of each zone was summarized and total shark catch per unit effort (CPUE) was compared among the three zones seasonally. Four commonly occurring large-coastal shark species were chosen for further analysis. Seasonal CPUE, as well as length frequency and sex ratio of *Carcharhinus limbatus*, *Carcharhinus leucas*, *Carcharhinus brevipinna*, and *Negaprion brevirostris* were also compared among the three zones.

From 2015 to 2022, a total of 53, 63, and 65 stations were sampled in the spring, summer and fall seasons, respectively. The North Sound zone contained 92 stations, the North Gulf zone contained 48 stations, and the South zone contained 42. Temperature in the spring was lowest in the North Gulf zone at 21.8°C, highest in the North Sound zone at 24.1°C, and intermediate in the South zone at 22.7°C. Temperature ranged from 26.2°C to 27.5°C in the summer and 28.0°C to 28.9°C in the fall; there was no statistical difference in temperature among the zones in the summer or fall. Salinity was lowest in the North Sound zone for all three seasons; the North Gulf and South zones did not differ in salinity in any season. Dissolved oxygen did not differ among the zones in spring, summer, or fall. Average depth differed among all three zones and was lowest in the North Sound zone and greatest in the North Gulf zone.

Species composition was similar among the three zones; however, *Galeocerdo cuvier* was only encountered in the North Sound zone, and *Carcharhinus plumbeus* and *Sphyrna tiburo* were not encountered in the North Gulf zone. In both the spring and summer, total shark CPUE was lowest in the North Sound zone and highest in the South zone, with the North

Gulf zone CPUE not differing from the other two. CPUE was not different among the zones in the fall. *C. limbatus* CPUE only differed in the spring; the North Sound zone CPUE was lower than the other two zones. *Carcharhinus leucas* CPUE in the North Gulf zone was lower than the other two zones in the spring only. *Carcharhinus brevipinna* or *N. brevirostris* CPUE did not differ regardless of season.

Length frequency data of *C. limbatus* showed that both immature and mature individuals were present in all three zones, but that most mature individuals were encountered in the South zone. Only one mature *C. leucas* was encountered in the study period. Most of the smaller *C. leucas* were encountered in the North Sound zone. No mature females were encountered during the study period. For both males and females, larger individuals were mostly encountered in the South zone. For *N. brevirostris*, no mature males or females were encountered; females were only encountered in the North Gulf zone and males were only encountered in the North Sound and South zones.

Sex Ratio analyses for *C. limbatus* and *C. brevipinna* revealed that all three regions were female dominated for both immature and mature individuals; however, the ratio was not statistically different from the expected 1:1 ratio. *C. leucas* in the North Sound zone were female dominated, while the individuals in the other two zones were males dominated, but the ratio was also not significant. There were not enough *N. brevirostris* encountered in the study period to perform a sex ratio analysis.

KEYWORDS: Chandeleur Islands, Sharks, Distribution, Abundance