

Examination of commercial bottom longline data for the construction of indices of abundance of dusky shark in the Gulf of Mexico and US South Atlantic

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Handline, electric reel (bandit rig), and longline landings and fishing effort of commercial vessels operating in the Gulf of Mexico (GOM) and U.S. South Atlantic are reported to the National Marine Fisheries Service (NMFS) through the Coastal Fisheries Logbook Program (CFLP, conducted by the NMFS Southeast Fisheries Science Center). The program collects landings and effort data by fishing trip from vessels that are federally permitted to fish in a number of fisheries managed by the Gulf of Mexico and South Atlantic Fishery Management Councils. The coastal logbook program began in 1990 (Gulf of Mexico; 1992 South Atlantic) with the objective of a complete census of coastal fisheries permitted vessel activity, with the exception of Florida, where a 20% sample of vessels was selected to report. Beginning in 1993, reporting in Florida was increased to include all vessels permitted for federally managed coastal fisheries.

The CFLP available catch per unit effort (CPUE) data were examined to determine their usefulness in constructing a standardized abundance index for dusky shark. Data for all gears other than bottom longline were insufficient for index construction, however, bottom longline data initially appeared adequate to explore index construction. Dusky shark landings were reported from bottom longline trips during the years 1992-2005 and in 2007. The availability of such a long time series of commercial landings and effort data was surprising given the moratorium on the harvest of dusky sharks beginning in 2000.

Data in the coastal logbook database included, for each fishing trip, a unique trip identifier, the landing date, fishing gear(s) deployed, areas fished, number of days at sea, number of crew, gear specific fishing effort, species caught, and weight of landings. Fishing effort data available for longline gear included number of sets and number of hooks fished per set. Due to reporting inconsistencies with number of hours recorded on the logbook forms, the number of hooks fished was used in this analysis as the measure of fishing effort. Multiple areas and multiple gears fished may be reported for a single fishing trip. In such cases, assigning catch and effort to specific locations or gears was not possible; therefore, only trips which reported one area and one gear fished were included in these analyses.

Data were further restricted to include only those trips with landings and effort data reported within 45 days of the completion of the trip. Reporting delays beyond 45 days (some reporting delays were greater than one year) may not affect reliability of landings data which may be retrieved from trip ticket reports, but are likely to result in decreased reliability of reported fishing effort.

Clear outliers in the longline dataset, e.g. values falling outside the 99.5 percentile of the data, were excluded from the analyses. These included data from trips reporting more than 24 sets per day, fewer than 25 hooks per set, more than 3,000 hooks per set, longline lengths less than 1 mile, and longline lengths more than 20 miles. Data from trips that reported crews of more than 6 or trips of more than 20 days at sea were also excluded.

Positive dusky shark trips were rarely reported in the Gulf of Mexico west of Florida or north of 36°N in the South Atlantic. Data from those areas with few or no dusky shark landings were excluded from the analysis.

Fishing trips targeting dusky shark were identified using a data subsetting technique (modified from Stephens and MacCall, 2004) intended to restrict the data set to trips with fishing effort in dusky shark habitat. Such an approach was necessary because fishing location is not reported to the CFLP at a spatial scale adequate to

identify targeting based upon the habitat where the fishing occurred. The modified Stephens and MacCall method was an objective approach in which a logistic regression was applied to estimate the probability that dusky shark could have been encountered given the presence or absence of other species reported from the trip. As a function of the species reported from a trip, a score was assigned to the trip and that score was converted into the probability of observing dusky sharks. Trips with scores above a critical value were included in the CPUE analysis. That critical value was set at the score that minimized the number of predictions of dusky shark occurring when the species was actually absent (false positives) while also minimizing incorrect predictions of dusky shark absence when the species was actually present (false negatives).

Following data filtering and the Stephens and MacCall analysis, no trips landing dusky shark were identified after during the years 1994-1995 or after 2000. Of the seven years with positive dusky shark trips, four years had 10 or fewer positive trips for the entire region examined (Florida Panhandle to North Carolina). With such limited data, neither a useful nor reliable index of dusky shark abundance could be produced using the commercial coastal logbook data.