

# Deeper Water Fauna Caught Incidentally in the Puerto Rico Fishery

## La Fauna de Aguas Profundas Capturada Incidentalmente en la Pesquería de Puerto Rico

### Le Faune plus Profonde Capturée Accidentellement dans la Pêche de Porto Rico

MICHELLE T. SCHÄRER-UMPIERRE<sup>1\*</sup>, NOEMI PEÑA-ALVARADO<sup>2</sup>,  
STEVE G. SMITH<sup>3</sup>, RICHARD APPELDORN<sup>4</sup>, and JERALD S. AULT<sup>3</sup>

<sup>1</sup>HJR Reefscaping

P.O. Box 1442, Boquerón, Puerto Rico 00622 USA.

\*[michelle.scharer@upr.edu](mailto:michelle.scharer@upr.edu)

<sup>2</sup>Puerto Rico Department of Natural and Environmental Resources,  
P.O. Box 3665, Mayagüez, Puerto Rico 00681 USA.

<sup>3</sup>University of Miami

4600 Rickenbacker Causeway, Miami, Florida 33149 USA.

<sup>4</sup>University of Puerto Rico

P.O. Box 9000, Mayagüez, Puerto Rico 00681 USA.

#### EXTENDED ABSTRACT

Rocky reef habitats of deep (50 to 500 m) Caribbean insular slopes and offshore ridges support a diverse assemblage of fishes. In Puerto Rico these areas support a highly valuable fishery, yet information regarding the biodiversity of these habitats is scarce. The deep-water snapper and grouper fishery is considered a multi-species small scale artisanal fishery that has expanded over the past 50 years. It currently represents the largest fin fish resource in terms of catch and estimated value (US \$1,390,744 in 2008) in the US Caribbean EEZ (Tonioli and Agar 2011). Exploratory cruises, ROV, submersible and benthic mapping expeditions on large oceanographic vessels have provided valuable collections of benthic habitat information that laid the baseline for research in the region. Commercial fishers commonly catch non-target species incidentally and provide a source of information regarding the fauna of deep reef habitats. These encounters also provide researchers with specimens and tissue samples necessary to determine species identifications and potentially study connectivity of populations of fishes and prey items subject to capture at these depths. The goal of this presentation is to provide new information regarding the biodiversity and taxonomic richness of deep habitats around Puerto Rico. Documenting the fish assemblage that occurs in deep water habitats is essential to assess the biodiversity of the Caribbean region. Objectives included documenting the species composition; relative abundance and depth distribution of species subject to capture with commercial fishing gear between 50 and 500 m. Differences in the proportion of species making up the total catch were compared across regions around Puerto Rico.

Specimens caught incidentally by commercial fishers were sampled on the same day at landing sites; each fish caught was identified with taxonomic keys, and in some cases tissue samples were preserved in alcohol for species identification via DNA barcoding. Additionally, specimens were sampled during a two-year fisheries-independent research project that used standardized surveys of vertical hook and line gear of commercial fishing vessels accompanied by observers from three sampling regions around Puerto Rico. During this study trained observers quantified fishing effort and catches, identified species, measured each fish (fork length and girth) and kept specimens or tissue samples to support species identification via DNA barcoding. Discards and live fish returned to the sea were sampled in non-lethal manner prior to release.

Fishing gear rigs were composed of 12 circle hooks (# 9) on 7-inch (13 cm) long leaders extending from the main vertical line located 18 inches (46 cm) apart. Each line was soaked for a total of 60 minutes at each of 294 random stratified sites throughout three regions off Puerto Rico (Figure 1; n = 147 in Northwest; n = 72 in Northeast; n = 75 in Southeast). Each site was the center waypoint of a 500 x 500 m grid, selected randomly from strata of depth and habitat categories. Each site was sampled during one hour following a standardized protocol, and data were collected by an on-board observer. Data were summarized for relative abundance, depth of capture and size of each species and rarefaction curves were used to compare species richness between regions.

Over the course of the fisheries independent study 176 individuals of at least 26 species were captured during sampling conducted between 2017 and 2018. Coupled with the fisheries dependent sampling at the landing sites at least 48 species belonging to 26 families and 10 orders were recorded (Table 1), although species confirmation is still pending from DNA barcoding. Many species provide new reports for the region, one new species of grunt is currently being described, and samples collected from specimens pending species confirmation with genetic methods could increase these discoveries. Of the 48 species documented, 9 had been reported previously as hand line by-catch in Puerto Rico (Matos-Caraballo et al. 2007). Of all the individuals documented during this project, Serranidae was the family with the highest number of species (8), followed by Lutjanidae (7) and then Carangidae (5). The most commonly captured non-target species were two of sharks, *Squalus cubensis* and *Mustelus canis* with a cumulative frequency of 64% of all non-target species during the fisheries independent study. The fork length of *S. cubensis* ranged from 23 to 50 cm (n = 99), while for *M. canis* it ranged from 45 to 83 cm (n = 14), spatially the former species was caught most frequently in the northwest region and the latter in

the southeast. The depth of capture ranged from 195 to 391 m for *M. canis* and 352 to 529 m for *S. cubensis*.

This is the first comprehensive description of the diversity of fish species that occur in deep water habitats throughout the island of Puerto Rico. Rarefaction curves revealed different patterns of biodiversity between the three regions (Figure 2), with the northwest supports greater biodiversity than the other two. Approximately 15 - 20 days of sampling are considered necessary to fully characterize most of the species in the northwest, while 10 - 15 days were not sufficient to fully account for the species diversity. These results suggest additional sampling is necessary in the eastern regions, although it is also possible that the northwest region has a greater total amount of deep-water habitat with greater habitat heterogeneity composed of seamounts, multiple shelf slopes or ridges, while the northeast and southeast areas are composed of linear features of deep-water habitat. These variations in structural habitat could help explain the differences between regions.

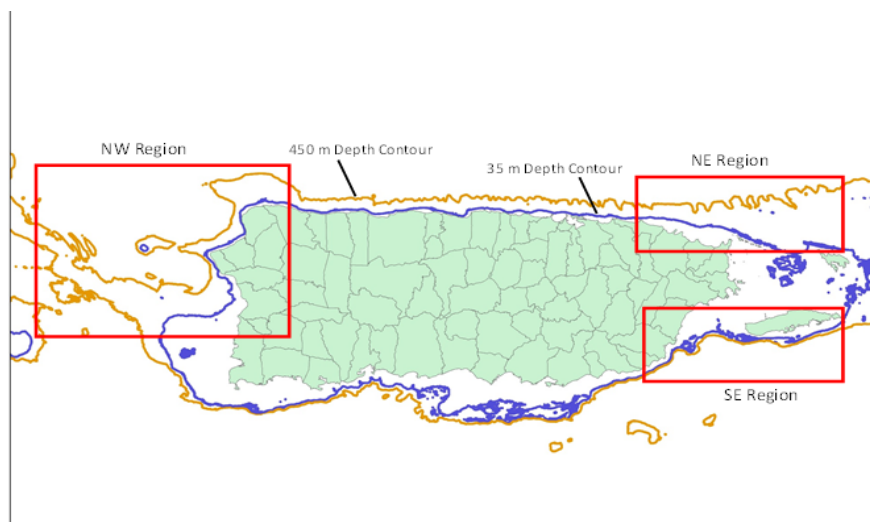
**KEYWORDS:** Biodiversity, deep-water habitat, incidental catch, Puerto Rico, sharks

**ACKNOWLEDGEMENTS**

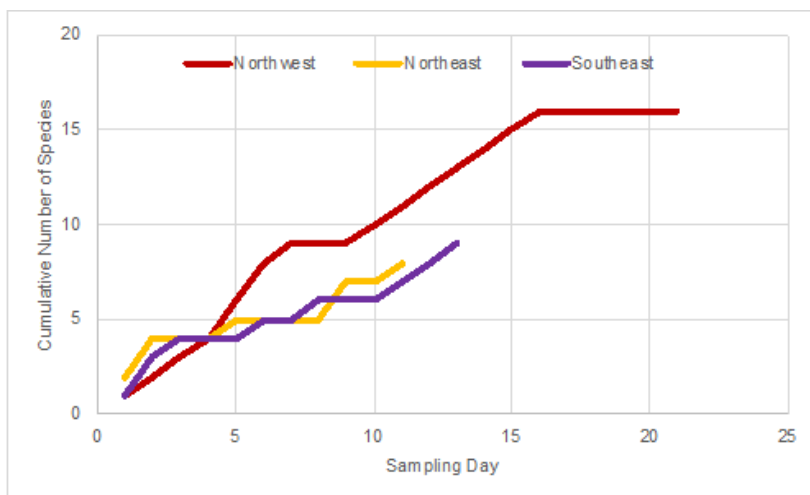
The participation of R. Silva, J. López, E. Font, O. Velez, E. Agosto and C. Zayas was crucial for completing the project’s goals, and M. Prada assisted in the planning phase. The fisheries-independent sampling was funded by the NOAA Saltonstall-Kennedy Program, collections were made under DNER permits 2017-IC-031 and 2018-IC-039.

**LITERATURE CITED**

- Matos-Caraballo, D., M. Cartagena-Haddock, and N. Peña-Alvarado. 2007. By-catch study of the Puerto Rico’s marine commercial fisheries. *Proceedings of the Gulf and Caribbean Fisheries Institute* 58:136 - 146.
- Tonioli, F.C. and J. J. Agar. 2011. *Synopsis of Puerto Rican Commercial Fisheries*. NOAA Technical Memorandum NMFS-SEFSC-622. 69 pp.



**Figure 1.** Study area showing three sampling regions around Puerto Rico.



**Figure 2.** Rarefaction curves for each one of the three sampling regions.

**Table 1.** List of confirmed species caught in deep water habitats.

<b>Family</b>	<b>Species</b>
Aulopidae	<i>Aulopus filamentosus</i>
Holocentridae	<i>Ostichthys trachypoma</i>
Carcharhinidae	<i>Carcharhinus perezii</i>
Scyliorhinidae	<i>Scyliorhinus sp.</i>
Triakidae	<i>Mustelus canis</i>
Hexanchidae	<i>Heptanchias perlo</i>
Hexanchidae	<i>Hexanchus nakamurai</i>
Ginglymostomatidae	<i>Ginglymostoma cirratum</i>
Bramidae	<i>Taractichthys longipinnis</i>
Caproidae	<i>Antigonia capros</i>
Carangidae	<i>Caranx crysos</i>
	<i>Caranx lugubris</i>
	<i>Decapterus tabl</i>
	<i>Seriola dumerili</i>
	<i>Seriola rivoliana</i>
Echeneidae	<i>Echeneis naucrates</i>
Emmelichthyidae	<i>Erythrocles monodi</i>
Gempylidae	<i>Neopinnula americana</i>
	<i>Ruvettus pretiosus</i>
Haemulidae	<i>Pomadasy sp.</i>
Labridae	<i>Decodon puellaris</i>
Lutjanidae	<i>Apsilus dentatus</i>
	<i>Etelis oculatus</i>
	<i>Lutjanus buccanella</i>
	<i>Lutjanus vivanus</i>
	<i>Pristipomoides aquilonaris</i>
	<i>Pristipomoides macrophthalmus</i>
	<i>Rhomboplites aurorubens</i>
Malacanthidae	<i>Caulolatilus dooleyi</i>
	<i>Caulolatilus cyanops</i>
Priacanthidae	<i>Cookeolus japonicus</i>
Scombroptidae	<i>Scombrops oculatus</i>
Serranidae	<i>Cephalopholis fulva</i>
	<i>Epinephelus guttatus</i>
	<i>Gonioplectrus hispanus</i>
	<i>Hyporthodus flavolimbatus</i>
	<i>Hyporthodus mystacinus</i>
	<i>Hyporthodus nigrilus</i>
	<i>Hyporthodus niveatus</i>
	<i>Serranus notospilus/phoebe</i>
Polymixiidae	<i>Polymixia lowei</i>
	<i>Polymixia nobilis</i>
Scorpaenidae	<i>Pontinus castor</i>
	<i>Pterois volitans</i>
Dalatiidae	<i>Dalatis licha</i>
Etmopteridae	<i>Etmopterus hillianus</i>
Squalidae	<i>Squalus cubensis</i>
Fistulariidae	<i>Fistularia petimba</i>