

A Preliminary Comparison of Red Snapper Utilization of Artificial and Natural Reef Habitats Between the Gulf of Mexico and the U.S. South Atlantic.



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Introduction

- Several Gulf of Mexico (GOM) and U.S. South Atlantic (SA) reef fishes, including Red Snapper, are *overfished and/or undergoing overfishing*
- Stock Assessments historically relied on Fisheries-Dependent (FDM) data:
 - Limited to catch and effort data from the fishery
 - Utility of FDM data to assess population changes through time has been reduced due to industry changes (regulations, technology, fishing gears, economy, etc.) and does not necessarily reflect changes in the fish stocks
 - Management measures, including harvest restrictions and closures, most impactful
- Need for **Fisheries-Independent Monitoring (FIM)** data which are:
 - Collected following consistent, scientifically-valid methods
 - More representative of the population, not limited to the fishery catch
- FWC has been conducting FIM surveys to assess Red Snapper and other reef fishes (e.g., Black Sea Bass, Vermilion Snapper, Gag) in the GOM and SA since 2008
- Historically, fishery independent surveys for Red Snapper and other reef fishes excluded artificial reef habitats, so important questions remain as to the effects of habitat type on reef fish abundance and life history.
- Accordingly, we examined data from FWC FIM hooked-gear surveys conducted in the GOM and SA to determine whether (1) abundance or size/age composition varies between artificial and natural reef habitats, and (2) whether observed differences are consistent between the GOM and SA

Sampling Regions

- Northern Gulf Of Mexico
 - Zones 7, 8, 9, 10
- South Atlantic Ocean
 - Zones 722, 728, 732

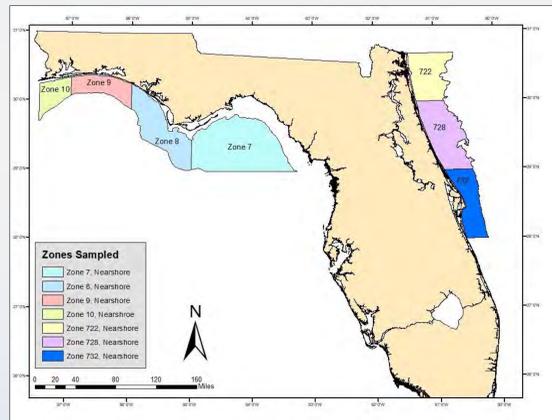


Figure 1. Map of regions and zones sampled.

Habitat

- Water Depth
 - ≤ 37m GOM
 - > 30m SA
- Habitat Type
 - Artificial Reef
 - Natural Reef

Sampling Gear

Standardized hooked-gear sampling conducted using 12-V powered Elec-Tra-Mate® fishing rig (Figure 2) outfitted with a Penn 9/0 reel on an 8' fishing pole

- Standardized two-hook "chicken rig" (Figure 3)
- Three fishing rigs
 - Hook sizes (Mustad Ref. 39960D):
 - 8/0
 - 11/0
 - 15/0
 } 2 hooks of same size per rig
 - Bait - Atlantic Mackerel (*Scomber scombrus*) cut proportional to hook size

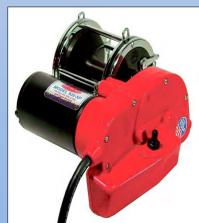


Figure 2. Elec-Tra-Mate® reel.

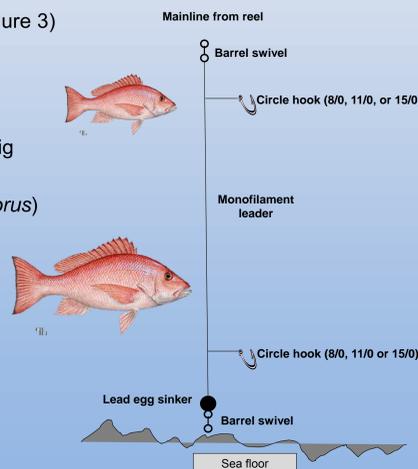


Figure 3. Diagram of two-hook "chicken rig".



Sampling Methods

- Sampling conducted from April – August of 2017 and 2018
- Sampling sites randomly selected from an FWC universe of known natural and artificial reef locations
- At each site, three anglers were randomly-assigned to a particular fishing rig, each with a different hook size (8/0, 11/0, or 15/0)
- Standardized system of active fishing that used a series of ten team drops with a set bottom soak time (2 minutes) for each angler at each site [referred to as **repetitive timed-drop (RTD)**] aimed to reduce individual angler bias

Data Analysis

- Relative frequency of Red Snapper was plotted against length (mm FL) and age (years) for each region by habitat
- Catch-per-unit-effort (CPUE) for Red Snapper was calculated for each sample site as the number of Red Snapper collected per total number of hooks dropped. Mean CPUE (±SE) values were plotted by region for each habitat type. The Kruskal-Wallis One-Way Analysis of Variance on Ranks ($P < 0.001$) was used to test for differences between regions and habitat types and the Dunn's method ($P < 0.050$) was used for pairwise comparison
- The length-frequency distributions of Red Snapper were compared using kernel density estimates (KDE) by region and habitat type

Results

A total of 151 sites in the GOM and 195 sites in the SA were sampled during 2017 and 2018 FWC RTD sampling seasons (Table 1). A total of 438 Red Snapper were collected in the GOM and 1,091 in the SA.

Region	Natural	Artificial	Total sites sampled
GOM	93 (62%)	58 (38%)	151
SA	159 (82%)	36 (18%)	195

Region	Natural	Artificial	Total Red Snapper
GOM	316	122	438
SA	939	152	1,091

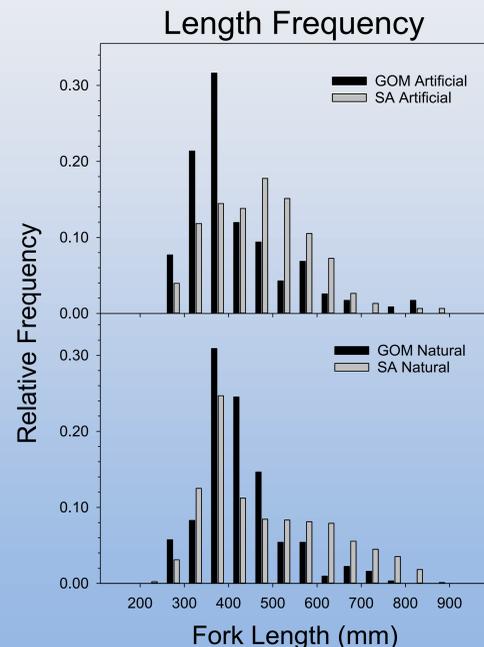


Figure 4. Length frequency of Red Snapper collected by FWC RTD in artificial and natural reef habitats in the GOM and SA, 2017 - 2018.

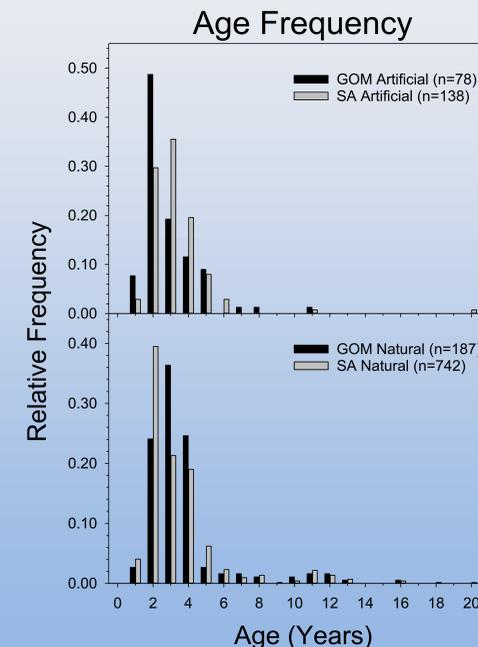


Figure 5. Age frequency of Red Snapper collected by FWC RTD in artificial and natural reef habitats in the GOM and SA, 2017 - 2018.

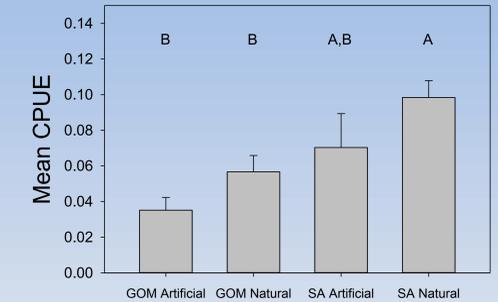


Figure 6. Mean CPUE (±SE) for Red Snapper collected during FWC RTD hooked-gear surveys by region and habitat, 2017 - 2018. Values with the same letter are not significantly different at $P < 0.050$.

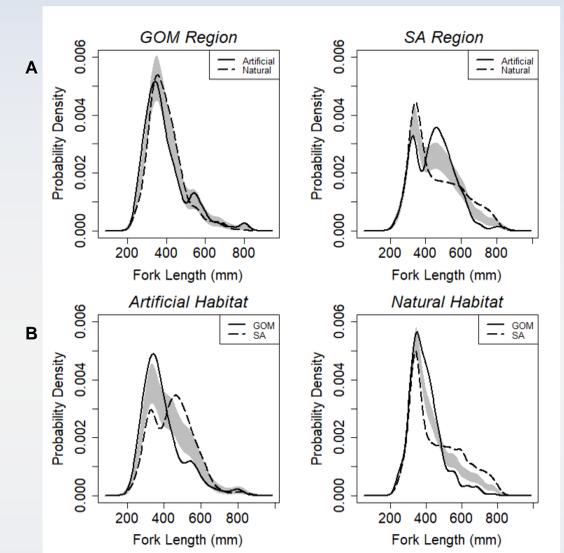


Figure 7. KDE of length frequency distributions of Red Snapper collected during FWC RTD hooked-gear surveys in: A. Artificial (solid line) and Natural (dashed line) habitats by regions, and B. the GOM (solid line) and SA (dashed line) regions by habitat type.

Conclusions/Future Direction

- Differences were detected with respect to abundance and size/age composition between artificial and natural reef habitats for Red Snapper
 - May be similar for other species
- KDE analysis indicated there were significant differences in length frequency distributions between habitats within each region and between regions within each habitat:
 - Red Snapper on SA artificial habitats were generally larger than SA natural and GOM artificial habitats
 - Red Snapper on GOM natural habitats were slightly larger than GOM artificial habitats
- A large body of evidence exists supporting differences in habitat utilization within the GOM
 - Habitat utilization within the SA is relatively understudied
- Critical to incorporate artificial reefs into ongoing surveys
 - Already included in the GOM surveys
 - Potential considerations for the greater SA region (the *Great Red Snapper Count*)
 - FWC has included artificial reefs in regional surveys since 2017
- Need for refined information on the percentage of total available habitat that artificial reefs represent - major or minor component?
- Studies designed to directly compare natural vs. artificial reef habitats are needed to determine if there are temporal or spatial differences of Red Snapper habitat usage within the different regions