Hook Selectivity in gray triggerfish observed in the for-hire fishery off the Atlantic coast of Florida

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SEDAR41-DW43

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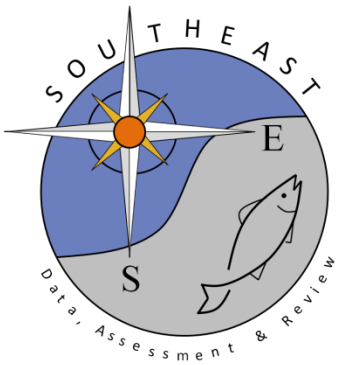

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Hook selectivity in gray triggerfish observed in the for-hire fishery off the Atlantic coast of Florida.

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I. Introduction

Harvest control measures have been long employed to manage fish stocks, including gray triggerfish, *Balistes capriscus* (Gmelin, 1789). Harvest control measures include size limits, bag limits, and seasonal closures. Additional measures, including regulating hook type, have been adopted to reduce hook related injuries to individuals that are released. Since 2011, circle hooks have been required when fishing for snapper or grouper species in federal waters north of 28º latitude (Brevard county line) in the south Atlantic. Species such as gray triggerfish, however, can be caught both north and south of the 28º latitude line. As a result, differences can be seen in fishing practices above and below that line. To simplify discussion, north of the 28º latitude line will be referred to as the northern region (NE), where circle hook use is required, while south of the 28º latitude line will be referred to as the southern (SE) region, where circle hook use is not required.

The implementation of this regulation led to a shift to circle hook use in the NE region, while hook use in the SE region continued to be dominated by J hooks. This analysis seeks to better understand how hook size and hook type might influence the size of fish caught despite regional differences in fishing techniques. Data for this analysis were collected after the circle hook requirement was implemented; however, there were enough observations of gray triggerfish caught on both hook types in all regions to offer some insight into potential changes in selectivity since circle hooks were required.

II. Methods

Data were collected as part of a cooperative research project with operators of for-hire fishing vessels that offer recreational fishing trips off the Atlantic coast of Florida. Biologists were assigned to randomly selected vessels to observe recreational anglers during hook and line fishing. Further details of the study are described inSEDAR41-DW34. Variables collected for individual gray triggerfish include region, depth of capture, fork length, hook size, hook type, whether the hook was offset, and anatomical location where the hook embedded. Hook size was

determined in the field by laying each hook onto a standardized sizing chart (Figure 1). Hook sizes were binned into three categories; small (3 and smaller), medium (4-8) and large (9 and larger). The sample area was divided into two regions, the NE region, where circle hook use is required, and the SE region, where circle hook use is not required.

Generalized linear models (GLM) were used to test the significance of hook type and hook size on the fork length of gray triggerfish caught by recreational anglers (PROC GLM in SAS software). Variables offset, year, hook size, hook type and zone were included as categorical variables, while depth was included as a continuous variable. One-way ANOVA models were performed using the GLM procedure to initially determine which variables had the greatest significant effect on gray triggerfish fork length. The results of those models were then used to perform ANCOVA analyses.

Results

Of the 1,323 gray triggerfish observed, 42% were caught with a circle hook, while 58% were caught with a J hook (Table 1). In the NE region, there was a 4:1 ratio of circle hook to J hook use, while in the SE region, there was a 1:6 ratio of circle hook to J hook use. Hook size ranged from 2 – 11 in the NE region while hook size ranged from 2-8 in the SE region. Gray triggerfish caught in the NE region of Florida were larger in size (Figure 2), with the most frequent size being in the 40 cm length bin (between 35 and 45cm), while gray triggerfish caught in the SE region were most frequently in the 30 cm length bin (between 25 and 35cm).

Using ANOVA and ANCOVA tests, hook size, hook type, region, and depth of capture were determined to be the effects that help explain gray triggerfish fork length variability the best. Depth of capture was kept in the model as a co-variate since it was found to have a significant effect on fork length in each region (p-value <0.05), and helped to reduce variability. Separate models were performed for each region since region was found to be significant ($F=292.05$, $p = <0.0001$), indicating regional differences in the sizes of gray triggerfish caught in the fishery. In the NE region, neither hook size, nor hook type, were found to significantly affect fork length ($p = 0.6515$, $p = 0.7849$, respectively). This was also true in the SE ($p = 0.9212$, $p = 0.439$, respectively). No interaction was found between hook type and hook size. These results are shown in Figure 3.

Hook size use across depths is shown in Figure 4. Larger hook sizes were used at deeper depths in the NE region ($p <0.0001$). In the SE, there was no significant difference in the depths that small hooks were used compared to medium hooks ($p = 0.6915$). Figures 5 and 6 illustrate how fork length varies with increased hook size for both circle hooks and J hooks in each region. Small hooks, regardless of hook type or region, capture a wide size range of fish; however, smaller fish disappear with increasing hook size.

Table 1. Gray triggerfish observations by hook type in the NE and SE regions.

Region	Circle hook	J hook	Total
NE	457	91	548
SE	105	687	792

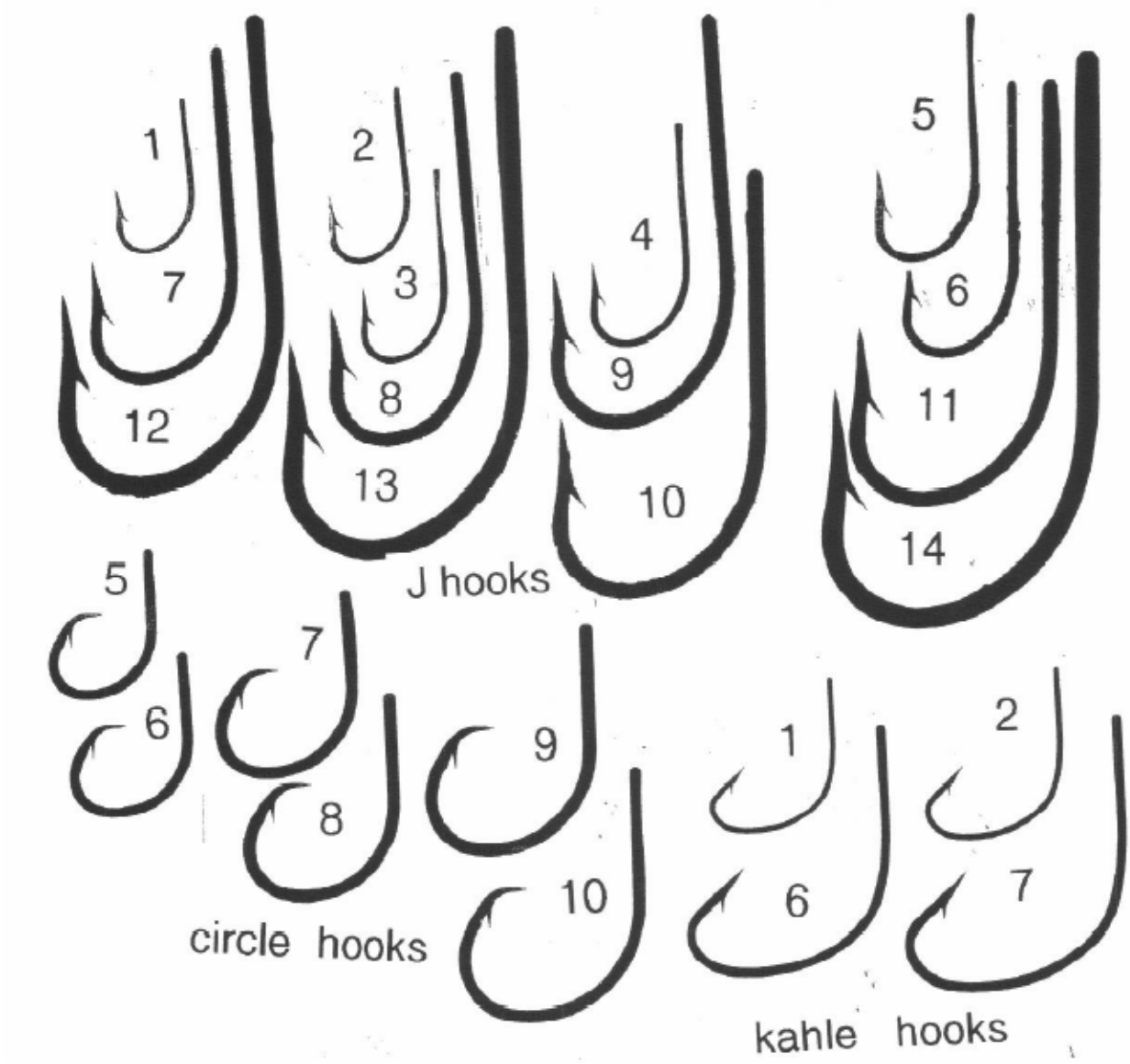

Figure 1. Hook sizing chart used in the field.

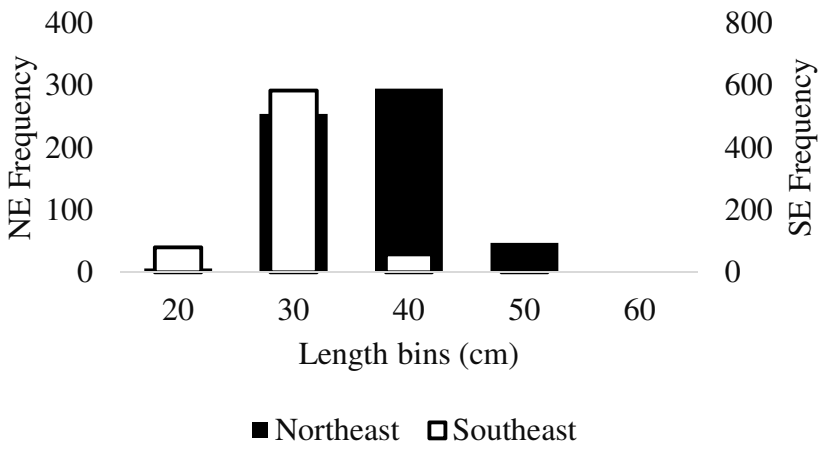

Figure 2. Size frequency of gray triggerfish in the NE and SE regions of Florida. Fish are binned into 10 cm fork length bins. NE (n=601) is shown in black and SE (n=722) is shown in white.

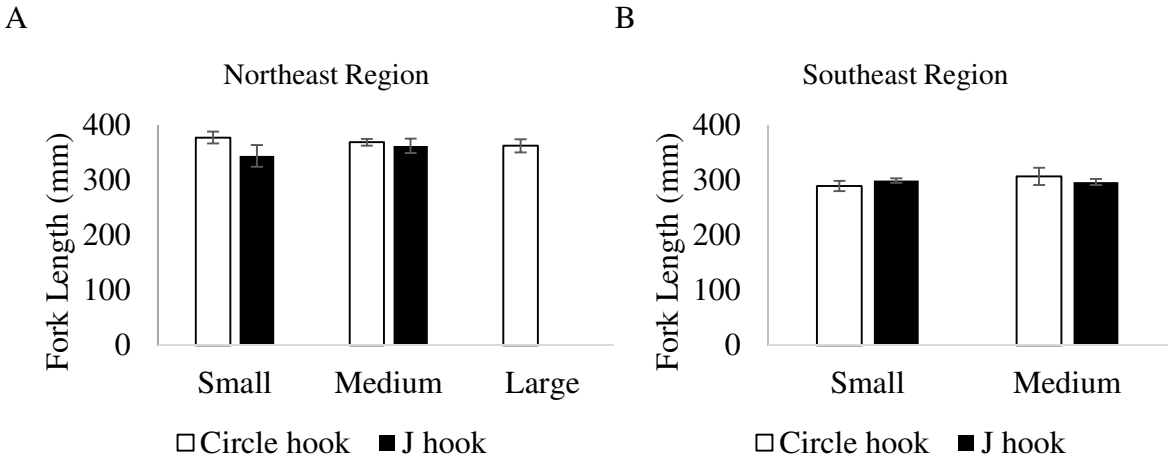

Figure 3. Least square mean fork length of gray triggerfish (adjusted for capture depth) caught on small, medium and large hooks for both circle and J hooks by region.

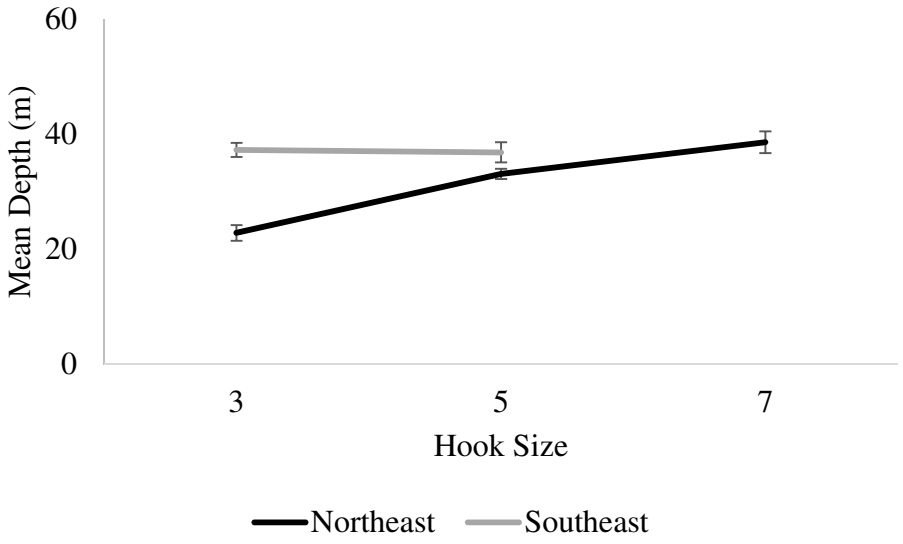

Figure 4. Least square mean depth fished for small (1-3), medium (5-8) and large (9+) hook sizes.

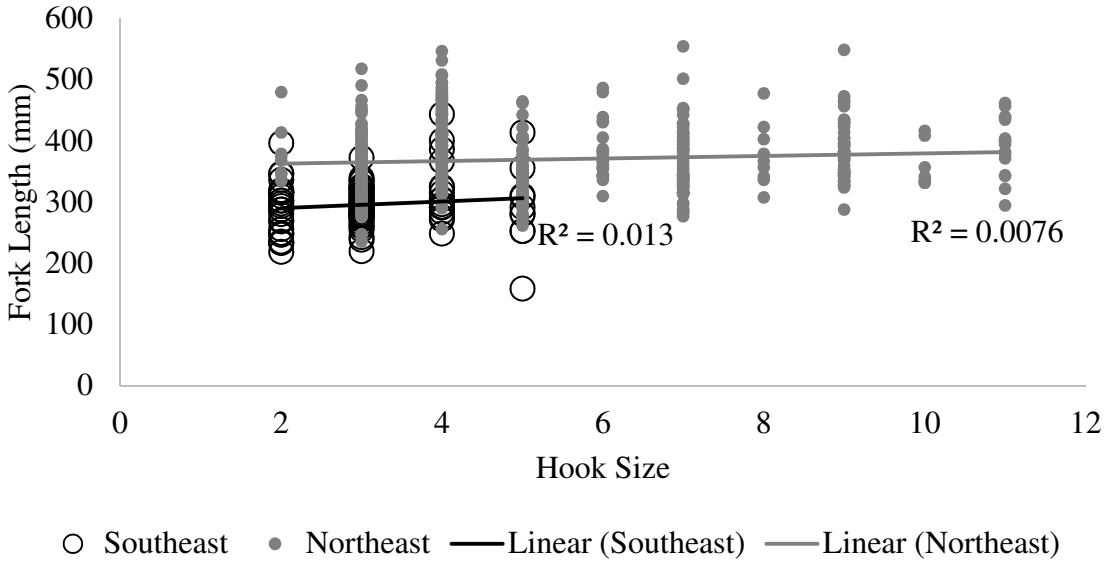

Figure 5. Fork length of gray triggerfish caught on circle hooks by hook size and region. All small hooks sized 2 and below were combined into the size 2 category. NE (n=458) is shown as solid gray dots and SE (n=100) is shown in black hollow circles.

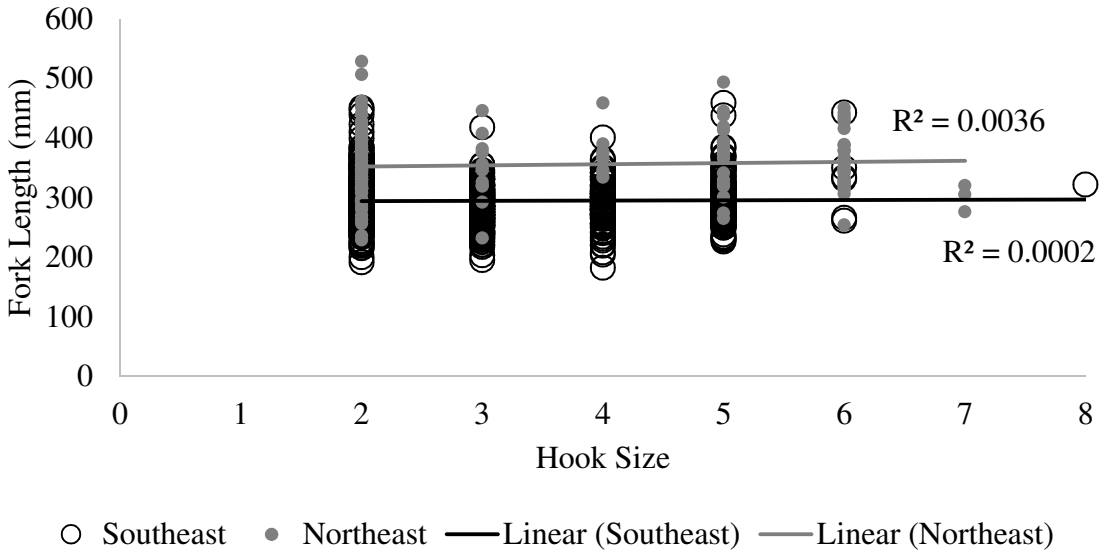

Figure 6. Fork length of gray triggerfish caught on J hooks by hook size and region. All small hooks size 2 and below were combined into the size 2 category. NE (n=143) is shown as solid gray dots SE (n=622) is shown as black hollow circles.

III. Conclusions

In fishery dependent observations, a high degree of variability is expected. Terminal tackle used on for-hire fishing vessels have a wide variety of configurations, vessel operators may choose from a variety of hook brands and fish with a variety of baits, and skill levels vary among anglers. However, observational studies that measure conditions within a fishery are important for understanding the true degree of impact, given all of the inherent variability.

This analysis reveals regional differences in the recreational hook-and-line fishery.

Anglers in the NE region fish predominantly with circle hooks, while anglers in the SE region fish predominantly with J hooks. Anglers in the NE region also fish with larger hook sizes than their SE counterparts, indicating that NE anglers are targeting larger species in the snapper-grouper complex when they catch gray triggerfish; whereas, anglers in the SE region may target gray triggerfish. Regional differences in the types of hooks use is likely the result of the federal regulation that requires the use of circle hooks above the Brevard county line (28º north latitude). Gray triggerfish were caught in shallower depths and were significantly larger in the NE region compared to the SE (LSM = 370mm in NE and 301mm in SE, $p<0.0001$). The Florida shelf is narrower in the SE region, and vessels in this region fish and capture gray triggerfish at deeper depths. In the NE region, where the shelf is much wider, a longer distance must be travelled to reach deeper depths.

The null hypothesis that hook size and hook type have no significant effect on the size of gray triggerfish is accepted in both the NE and SE regions. Figures 5 and 6 demonstrate that there is little to no increase in fork length as hook size increases. Figure 3 shows that there is also no difference in fork length between circle hook and J hooks. The overall conclusion from this analysis is that larger hook sizes and circle hooks do not select for substantially larger or older gray triggerfish within each region. The limited selectivity that was accounted for in the model was primarily attributed to differences across regions.

References

SEDAR41-34. Sauls, B., A. Gray, C. Wilson, K. Fitzpatrick. 2015. Size distribution, release condition, and estimated discard mortality of gray triggerfish observed in for-hire recreational fisheries in the south Atlantic.