Hook Selectivity in red snapper observed in the for-hire fishery off the Atlantic coast of Florida

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Hook selectivity in red snapper 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 Red Snapper (*Lutjanus campechanus*). Harvest control measures include size limits, bag limits and seasonal closures. 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. Red snapper observations were almost exclusively above the 28º north latitude line due to the natural range of the species; therefore, nearly all red snapper were caught in the region where circle use is required.

This analysis seeks to better understand how hook size and hook type might influence the size of fish caught. Data for this analysis were collected after the circle hook requirement was implemented; however, there were enough observations of red snapper caught with 'J' hooks 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 in SEDAR41-DW33. Variables collected for individual red snapper include latitudinal region and 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 (4 and smaller), medium (5-6) and large (7 and larger).

Generalized linear models (GLM) were used to test the significance of hook type and hook size on the fork length of Red Snapper 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 fork length. The results of those models were then used to perform ANCOVA analyses.

III. Results

Of the 2,281 red snapper observed, 65% were caught with a circle hook, while 35% were caught with a 'J' hook. The most frequent red snapper size was in the 40 cm length bin (between 35cm and 45cm), as seen in Figure 2. The average fork length of fish caught on circle hooks (regardless of hook size) was 4 mm larger than fish caught on 'J' hooks and was not statistically significant.

Using ANOVA and ANCOVA tests, hook size, hook type and depth of capture were determined to be the effects that help explain red snapper 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 ($F=45.04$, p-value <0.0001), and helped to reduce variability. Hook size was a significant influence on fork length ($F=14.13$, $p = <0.0001$), while hook type was not ($p=0.6205$). A significant interaction was found between hook type and hook size. These results are shown in Figure 3.

Hook size use across depths is shown in Figures 4. Larger hook sizes were used at the deepest depths ($p = <0.0001$), however small and medium hooks seem to be used interchangeably in shallower depths (less than 30 meters). 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.

Figures 3 and 4 illustrate how fork length varies with increased size of circle hooks and J hooks. All hook sizes were found to capture a wide size range of fish, regardless of hook type.

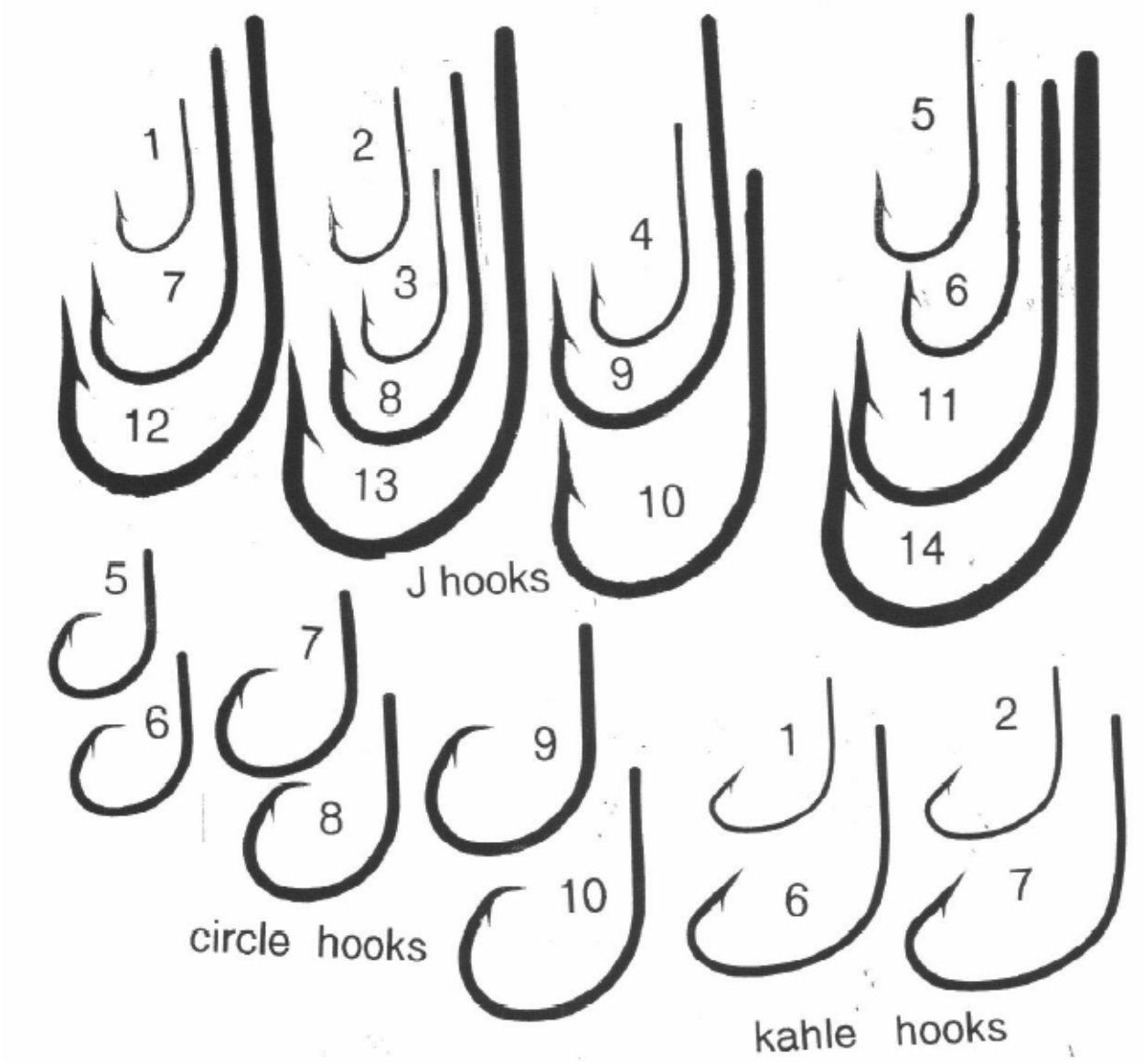

Figure 1. Hook sizing chart used in the field.

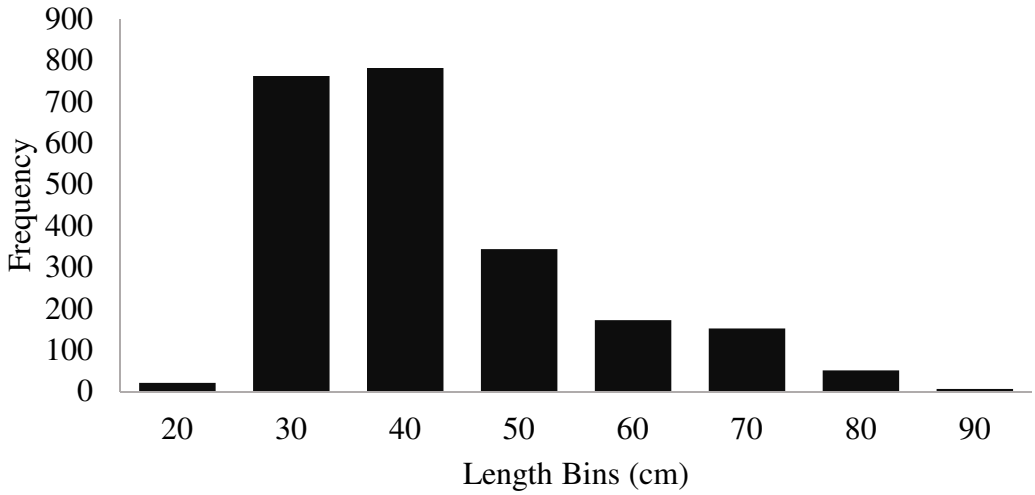

Figure 2. Size frequency of red snapper observed. Fish are binned into 10 cm fork length bins (n=2290).

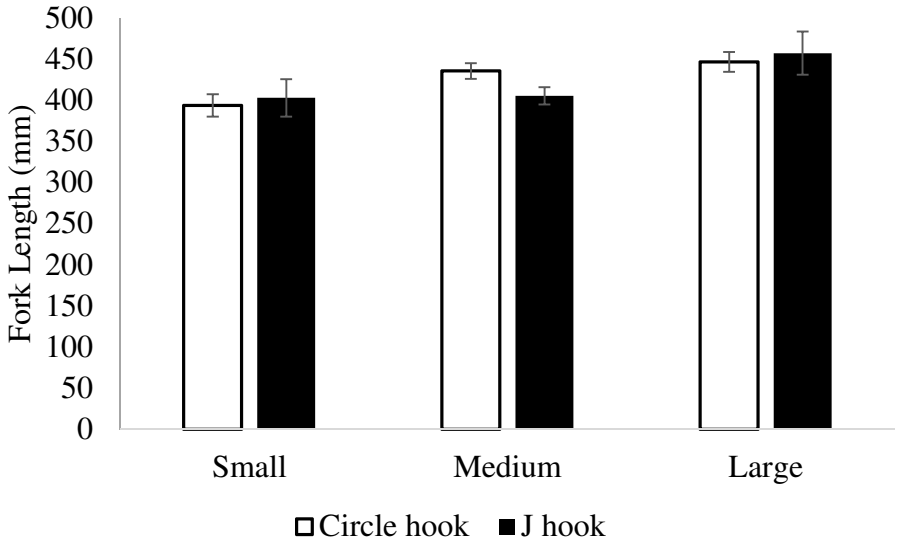

Figure 3. Least square mean fork length of red snapper caught on small, medium and large hooks for both circle and J hooks adjusted for depth of capture.

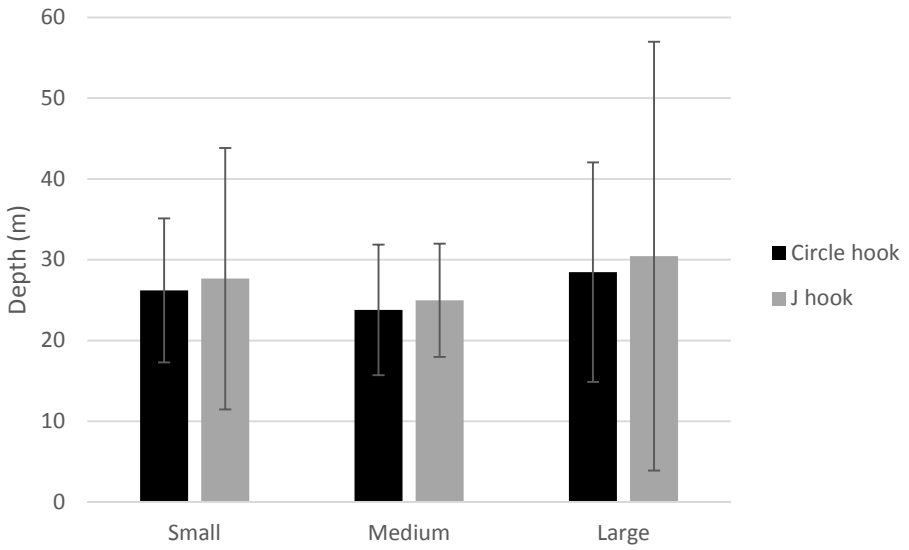

Figure 4. Average depth fished for small (size <5), medium (sizes 5-6) and large (size 7+) hooks that caught red snapper, with 95% confidence intervals.

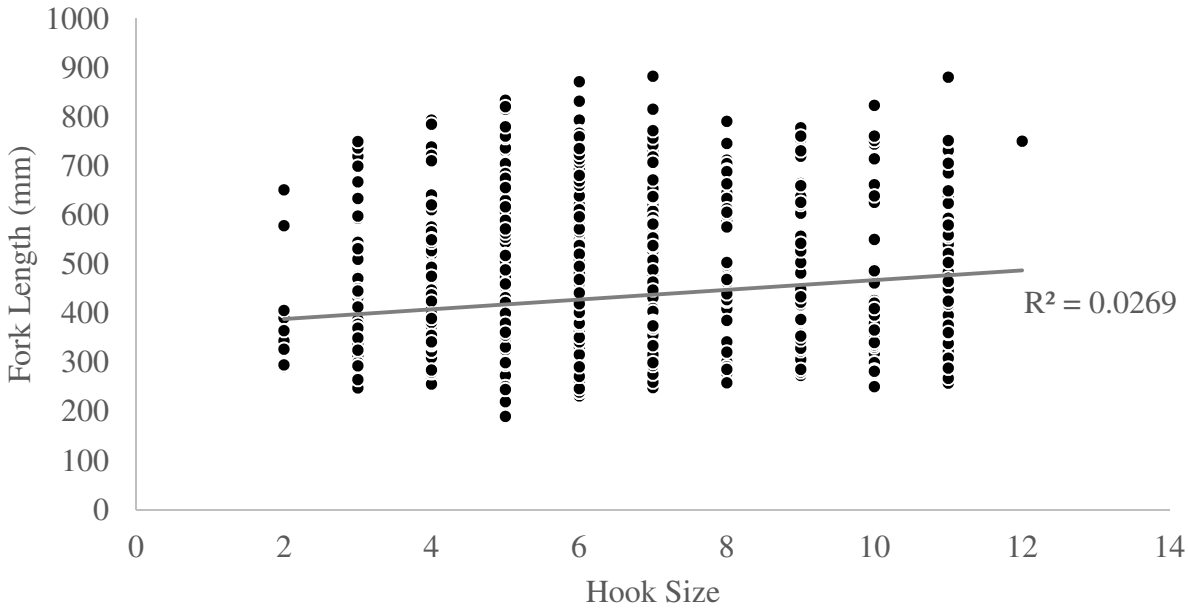

Figure 5. Fork length of red snapper caught on circle hooks by hook size and region (n=1494). All small hooks below size 3 were combined into the size 2 category.

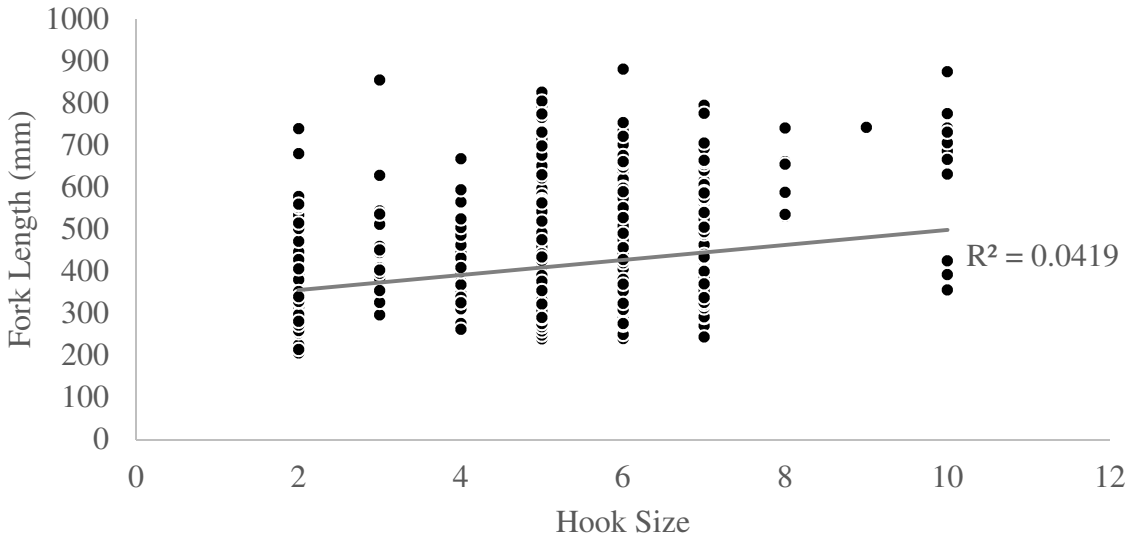

Figure 6. Fork length of red snapper caught on 'J' hooks by hook size and region (n=787). All small hooks below size 3 were combined into the size 2 category.

IV. 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.

The null hypothesis that hook type has no effect on red snapper is accepted. Very little differences were seen in red snapper fork length between red snapper caught on circle hooks and red snapper caught on J hooks, as is illustrated in figure 3. Regulation changes that require circle hooks to be used while fishing for snapper and grouper species are likely to not affect the size of red snapper caught, which could have been mistakenly interpreted as increased size and overall improved stock health following the regulation change. The null hypothesis that hook size has no effect on red snapper fork length, on the other hand, is rejected; however, as illustrated in figures 5 and 6, fork length increased only slightly with hook size for both circle hooks and J hooks.

References

SEDAR41-DW33. Sauls, B., A. Gray, C. Wilson, K. Fitzpatrick. 2015. Size distribution, release condition, and estimated discard mortality of red snapper observed in for-hire recreational fisheries in the south Atlantic.