

Predation Effects on Juvenile Red Snapper, *Lutjanus campechanus*, in the Northern Gulf of Mexico

PETER A. MUDRAK and STEPHEN T. SZEDLMAYER*

Marine Fish Laboratory, Department of Fisheries and Allied Aquaculture, Auburn University, 8300 State Hwy 104, Fairhope, Alabama 36532 USA. *szedlst@auburn.edu.

ABSTRACT

Artificial reefs (1.1 x 1.0 x 1.2 m) were built in July 2008 (n = 20) and 2009 (n = 20), 28 km south of Dauphin Island, Alabama, USA, in the northern Gulf of Mexico. Each reef consisted of a polyethylene pallet, with 10 concrete blocks (10 x 20 x 41 cm) and a plastic crate (65 x 35 x 28 cm). We also built 20 larger artificial reefs (8 m³; steel cages 2.5 x 2.6 x 1.2 m). Each year, 10 small reefs were placed at 15 m and 10 were placed at 500 m from the larger cage reefs. Each set of reefs (2 small and 1 large) were placed 1 km apart. All reef fishes were visually counted, videotaped, photographed, and sizes estimated in August 2008, and August and September 2009, by two SCUBA divers. In the lab, all fish in the photographs were identified to species and counted with Image-pro software. There were significantly ($p < 0.05$) higher abundances of age-0 red snapper, *Lutjanus campechanus*, on the small reefs placed 500 m ($46.1/m^2 \pm 8.3$) from the larger reefs compared to small reefs placed 15 m away ($3.4/m^2 \pm 1.8$) on all three surveys. We suggest that the typically larger fish (> 300 mm TL) of several species (red snapper, gag *Mycteroperca microlepis*, gray triggerfish *Balistes caprisiscus*, greater amberjack *Seriola dumerili*) that had colonized the larger reefs resulted in a predator avoidance response by the age-0 red snapper.

KEY WORDS: Age-0 fish, *Lutjanus campechanus*, competition, habitat, nursery, recruitment

Depredación Efecta sobre Menores Pargo, *Lutjanus campechanus*, en el Norte del Golfo de México

PALABRAS CLAVE: Menores pargo, *Lutjanus campechanus*, depredación, Golfo de Mexico

Prédation Effecte sur Juvénile, *Lutjanus campechanus*, dans le Nord du Golfe du Mexique

MOTS CLÉS: Juvénile, *Lutjanus campechanus*, prédation, Golfo de Mexico

The objective of this study was to compare the presence/absence of “larger” fishes on the recruitment of newly settled age-0 red snapper *Lutjanus campechanus*. To address this question we compared juvenile reef fish recruitment between small “nursery” reefs that were located near larger “adult” reefs, to those that were placed at much greater distances from any known larger reefs. The study site was 28 km south of Dauphin Island, Alabama, at 20 m depths, in the northern Gulf of Mexico. Substrate in the area was characterized by sand or mud sediment with few natural reefs. Small artificial “nursery” reefs (0.3 x 1.0 x 1.2 m) were built on 24 - 28 July 2008 (n = 20) and 9 - 10 July 2009 (n = 20), 28 km south of Dauphin Island, Alabama, in the northern Gulf of Mexico. Each reef consisted of a polyethylene double pallet (1.22 x 1.02 x 0.14 m), to which 10 concrete half-blocks (each 10 x 20 x 41 cm) and a plastic crate (65 x 35 x 28 cm) were attached with 175 lb cable ties. A small float (5.1 x 12.7 cm) was tied on each corner of the reef so that they floated at a height of 1 m above the plastic pallet. One larger float (15.2 cm diameter) was also tied in the center of the reef, also at a height of one meter (Figure 1). We also built larger artificial “adult” reefs on 2 Apr 2008 (n = 10) and

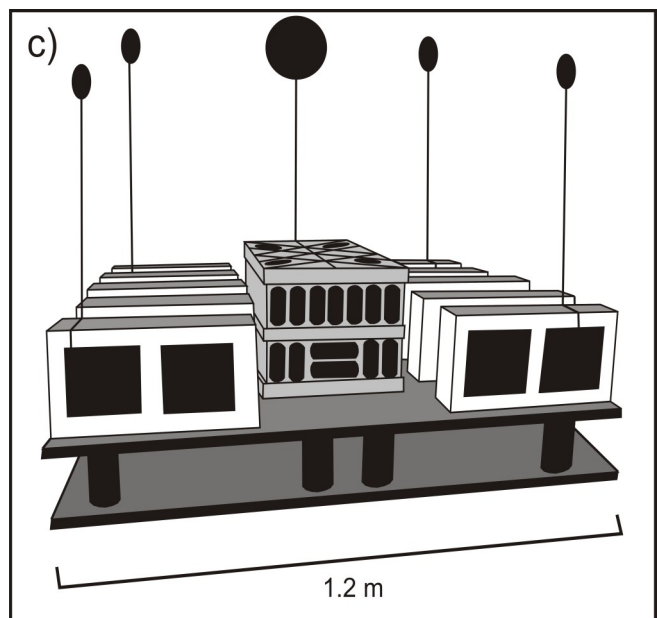


Figure 1. Reef design for small recruitment reefs.

on 14 Apr 2009 (n = 10; 8 m³; steel cages 2.5 x 2.6 x 1.2 m). All reefs were secured to the substrate with a 1.5 m ground anchor.

Each year 10 small reefs were placed 15 m away from the larger cage reefs and 10 were placed 500 m away from the larger cage reefs. The 15 m distance was considered within the range of larger competitors/predator fishes on the adult reef, while the 500 m distance was considered outside the usual foraging distance of these larger fish communities. Each set of reefs (2 small and 1 large) were placed 1.7 km apart.

All reefs were visually surveyed by two SCUBA divers. During each survey all fish were identified, counted and placed in estimated 25 mm length categories. Surveys were completed on all 2008 reefs (n = 20) from 6 - 15 Aug 2008, 11 - 16 days after reefs were built. Subsequently all 2008 reefs were moved or destroyed by hurricane Gustav the first week in Sep 2008. We completed two surveys on all 2009 reefs (n = 20 small reefs; n = 10 large reefs) on 4 - 6 Aug 2009 (25 - 26 days after deployment) and 9 - 10 Sep 2009 (61 - 62 days after deployment). We compared the periods of highest age-0 red snapper densities between 15 and 500 m small reefs for each survey. We detected significantly lower numbers of new age-0 red snapper recruits on small reefs that were near (15 m) the large reefs compared to those that were far (500 m) from the large reefs. In 2008, the mean ± SD density of

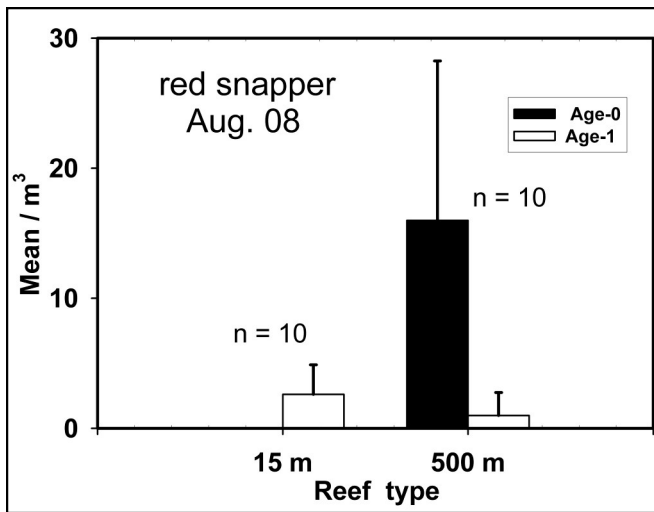


Figure 2. Mean densities of red snapper *Lutjanus campechanus*, in the 2008 survey. Age-0 fish were significantly different in comparison between 15 and 500-m reefs ($p < 0.05$).

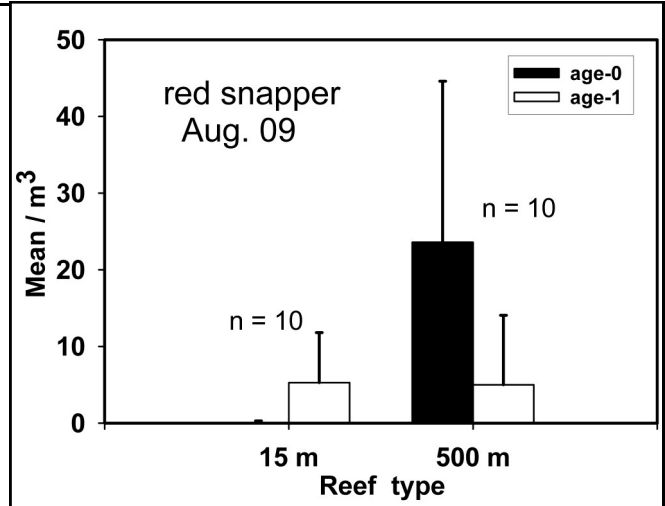


Figure 3. Mean densities of red snapper *Lutjanus campechanus*, in the August 2009 survey. Age-0 fish were significantly different in comparison between 15 and 500-m reefs ($p < 0.05$).

age-0 red snapper on the 500 m reef = $15.9 \pm 12.3/m^3$, compared to $0.0 \pm 0.0/m^3$ on the 15-m small reefs (ANOVA, $p < 0.05$) (Figure 2). We also detected significant differences in 2009 with more age-0 red snapper on the 500 m reefs (mean ± SD = $23.6 \pm 21.0/m^3$) compared to the 15 m reefs (mean ± SD = $0.1 \pm 0.2/m^3$; ANOVA, $p < 0.05$; Figure 3).

In summary, we suggest that the typically larger fish (> 400 mm TL) of several species that had colonized the larger reefs resulted in a predator/competitor avoidance response by the age-0 red snapper (for example: > 400 mm SL, red snapper, gag *Mycteroperca microlepis*, gray triggerfish *Balistes capriscus*, and greater amberjack *Seriola dumerili*, were all observed on the larger cage reefs).