The Use of Acoustic Sampling to Estimate the Red Snapper, *Lutjanus campechanus*, Populations in the Northern Gulf of Mexico

El Uso del Muestreo Acústico para Estimar el Pargo Rojo, *Lutjanus campechanus*, Poblaciones en el Norte del Golfo de México

L'utilisation de L'échantillonnage Acoustique pour Estimer le Vivaneau Rouge, *Lutjanus campechanus*, les Populations du Nord du Golfe du Mexique

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KEY WORDS: Red snapper, hydroacoustic, side-scan sonar, artificial reef

EXTENDED ABSTRACT

One of the largest artificial reef programs in the world exists in the northern Gulf of Mexico. Red snapper, *Lutjanus campechanus*, are one of the dominant species from this system, and are important to both commercial and sport fisheries (Gallaway et al. 2009). The red snapper fishery has been subject to strict regulations in recent years (SEDAR 2013), and an empirical population estimate will help validate population models that are used in management. The present study examined mid-shelf waters between the 18 m and 40 m depth contours off coastal Alabama, USA. This area is 4,530 km^2 and is characterized by sand and mud substrates with little natural reef habitat. Within this area there were 850 artificial reefs deployed by the state (public reefs), but also artificial reefs deployed by private individuals with unpublished locations (private reefs; Minton and Heath 1998).

We used a side-scan sonar (Edgetech 4125, 400/900 khz) to survey for reef structures over the Alabama continental shelf, and covered an area of 244 km^2 (transects = 42) (Figure 1). Side-scan sonar contacts were ranked on a scale of 1 to 5 based on the quality of the reef image. Any side-scan sonar contact with an area < 3 m^2 was eliminated from our artificial reef count, because they were too small to support adult red snapper. We validated 144 of these reef sites by SCUBA diver visual surveys that identified the reef structure and confirmed the presence of adult red snapper.

We also applied hydroacoustic methods (Simrad split beam EK-60 echosounder) to estimate red snapper abundance on individual reefs (n = 58; Kracker 2007). Hydroacoustic samples were collected on four reef types: 15 public concrete pyramids (5 m^3), 15 small private reefs (concrete pyramids, 7-m^3 steel cages, concrete bridge rubble, and one natural

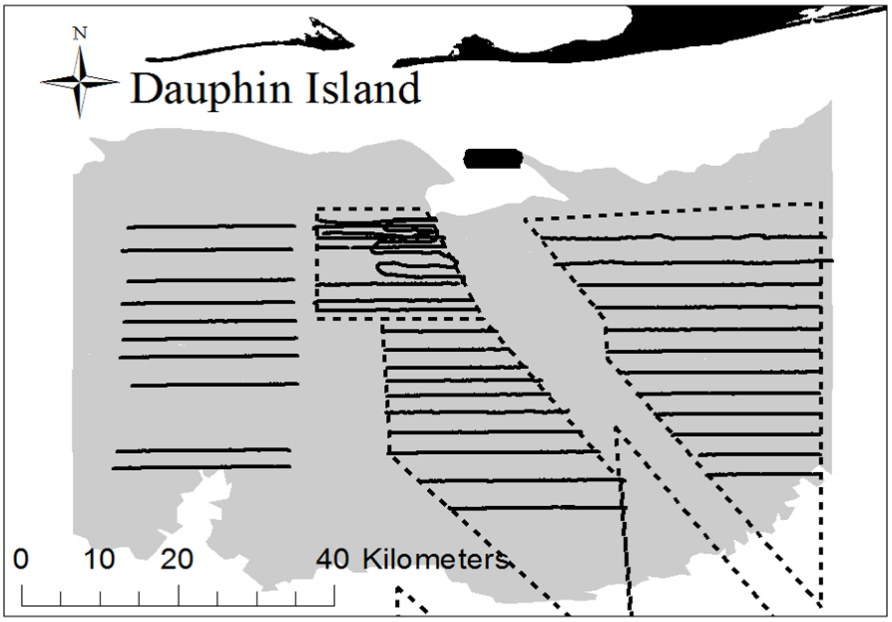

Figure 1. A map depicting side-scan sonar coverage within the study area off coastal Alabama, USA. The gray region represents the area between the 18 m and 40 m depth contours, dashed lines represent the Alabama artificial reef zones, and the solid lines represent the side-scan sonar transects (n = 42).

limestone reef), 14 army tanks (decommissioned M60 military tanks), and 14 large reefs (ships, barges, bridge spans, natural gas platforms, submerged pipeline, and natural limestone reef). Hydroacoustic surveys included four transect scans across each reef from different directions, while species compositions were based on SCUBA diver visual surveys. We estimated fish densities from the hydroacoustic surveys using the area backscattering coefficient and the mean target strength.

In addition to the private reefs counted with the side-scan sonar, there were 712 public pyramids and 94 public army tanks within the study area. Side-scan sonar surveys estimated a total of (Total ± SD) 6,176 ± 2,279 small private artificial reefs within the study area. In addition, there were 56 large artificial reefs with published locations, and side-scan sonar estimates yielded another (Total ± SD) 56 ± 148 unpublished large reefs. The hydroacoustic surveys showed a mean ± SD of 93 ± 65 red snapper per public pyramid, 366 ± 363 red snapper per army tank, and 212 ± 155 red snapper per small private reef. These densities combined with the reef count estimates, provides a quantitative total population estimate of 1,409,932 red snapper within the study area (excluding the red snapper counts on large reefs).

LITERATURE CITED

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