

A Comparison of Red Snapper, *Lutjanus campechanus*, Age, Growth, Distribution, and Abundance Between an Earlier (1999 - 2004) and a Recent (2011 - 2015) Fishery Independent Survey

Una Comparación de Pargo Rojo, *Lutjanus campechanus*, la Edad, el Crecimiento, la Distribución y la Abundancia Entre una Encuesta de Pesca Independiente Anterior (1999 - 2004) y una Encuesta Reciente (2011 - 2015)

Une Comparaison de Vivaneau Rouge, *Lutjanus campechanus*, L'âge, La Croissance, la Distribution et L'abondance Entre une Enquête Précédente de la Pêche Indépendante (1999 - 2004) et une Autre Récente (2011 - 2015)

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EXTENDED ABSTRACT

Red Snapper, *Lutjanus campechanus*, is a dominant reef fish in the northern Gulf of Mexico, but is still considered overfished. This study focused on Red Snapper populations from the continental shelf east of the Mississippi River. This area has little natural reef habitat, but extensive artificial reefs. These artificial reef areas were first surveyed for Red Snapper from 1999 to 2004. Approximately ten years later (2011 - 2015) a second survey was carried out that used similar sample methods as the first survey. The first survey was prior to the implementation of strict limitations on the Red Snapper fishery in 2007 and prior to the Deep Water Horizon oil spill in 2010.

All reef sites were sampled once within the first and second surveys. Red Snapper were collected using multiple methods that included hook and line, fish traps, and SCUBA surveys. In the second survey, hydroacoustic surveys were added with a Simrad EK60. Also, in the second survey the numbers and locations of reef structures were estimated using an Edgetech 4125, side-scan sonar. Reef sites sampled included areas of the continental shelf off the coast of Mississippi and Alabama, USA, from 15 to 50 m depths or to the edge of the continental shelf.

In both surveys we used standardized hook-and-line fishing (30 min with 2 fishers) and a fish trap (15-min trap sets) for all fish collections. Fishing gear included double 7/0 J hooks, 27-kg test monofilament line, 45-kg test monofilament leader, and whole Gulf Menhaden, *Brevoortia patronus*, as bait. Hook-and-line fishing gear was selected to target Red Snapper above the minimum retention size limit (33 cm TL). Traps were fished after completion of hook-and-line sampling with gulf menhaden as bait. In the first survey a single baited fish trap (1.2 x 1.5 x 0.6 m, Collins 1990) was deployed near each reef site with an attached line and buoy to the surface. Based on the first survey the trap showed the highest Red Snapper CPUE compared to other methods (Szedlmayer 2007) and was repeated in the second survey, but increased to four trap sets per reef site (Jaxion-Harm and Szedlmayer 2015). A maximum of 50 fish were retained for otolith age analyses from each reef site, with all others released alive. All fish designated for live release were released from the trap at the surface, while the trap was still in the water. This surface trap release reduced injury and increased survival of released Red Snapper. All captured Red Snapper retained for age analyses were immediately packed on ice in large coolers, and transported back to the lab as quickly as possible for further processing (sample work up within 24 h of capture).

In the laboratory all retained Red Snapper were measured (nearest mm) and weighed (nearest 0.1 g) on an Ohaus balance (DS4 20 kg max). Sagittal otoliths were removed, cleaned, and stored dry in labeled plastic vials. Otoliths from young Red Snapper (< 5 years) were read whole, while all older otoliths were sectioned and counted. Otolith images were captured with an Infinity-1 camera mounted on a Leica NZ6 dissecting microscope. The otolith images were measured and annuli counted using the Image-pro software package.

In the first survey 92 reef sites were sampled and 3,415 Red Snapper collected, and in the second survey 102 reefs were sampled and 3,529 Red Snapper collected. There was little difference in growth rates between surveys: first survey $TL = 923 * (1 - e^{-0.17(\text{age}+0.79)})$, second survey $TL = 994 * (1 - e^{-0.13(\text{age}+0.97)})$, Figure 1). In the second survey, side-scan sonar reef estimates (number of reefs) and hydroacoustic fish counts (number of Red Snapper per reef) were combined to provide a quantitative estimate Red Snapper total population \pm SD = 2.2 ± 1.5 million/5973 km², with a CV = 0.7 - 1.2 from this area in the northern Gulf of Mexico. Comparison of Red Snapper age distributions between the first survey and the second survey showed substantial increases in older age Red Snapper in the later survey. For example, ages 6, 7, and 8 more than doubled in relative abundance (Figure 2). This shift provides fishery independent quantitative evidence that management efforts have positively affected Red Snapper populations in the northern Gulf of Mexico.

KEYWORDS: Age frequency distribution, von Bertalanffy growth curves

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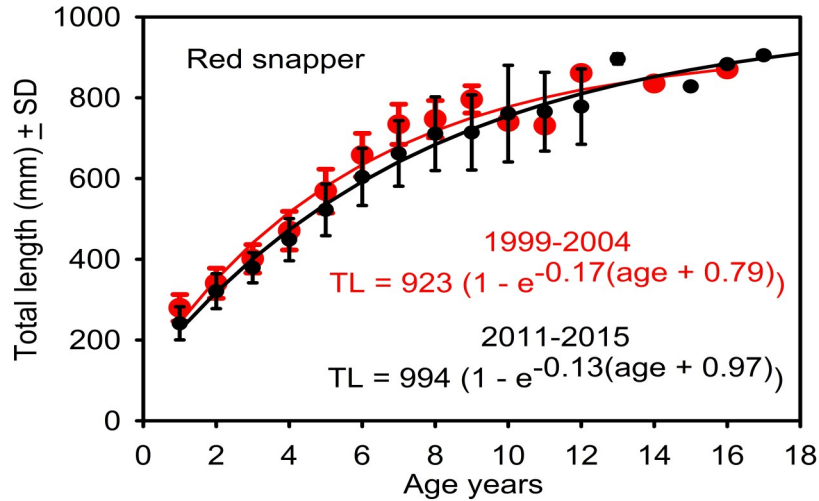


Figure 1. Comparison of Red Snapper, *Lutjanus campechanus*, von Bertalanffy growth curves from an earlier 1999 - 2004, to a later 2011 - 2015 fishery independent survey.

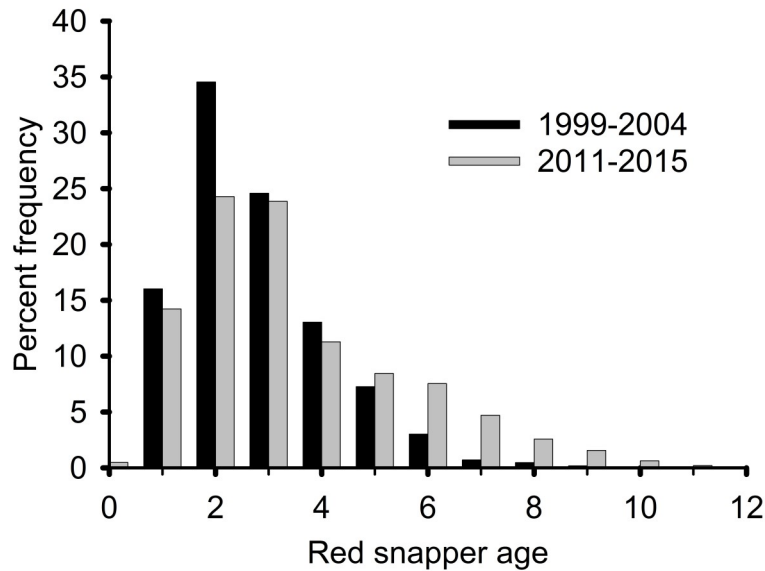


Figure 2. Comparison of Red Snapper, *Lutjanus campechanus*, age frequency distributions from an earlier 1999 - 2004, to a later 2011 - 2015 fishery independent survey.