

The Great Red Snapper Count



Red snapper (*Lutjanus campechanus*) is one of the most economically valuable and culturally relevant fisheries in the Gulf of Mexico (Figure 1). The earliest fishery for red snapper began in the eastern Gulf of Mexico in the 1840s. The fishery was originally centered close to shore, but, as technology improved, the fleet expanded offshore and into the western Gulf. Over the next century, the fishery experienced periodic pulses of growth. Following World War II, advances in technology expanded the capabilities of the commercial fishery, and recreational anglers sought increased fishing opportunities.

Ultimately, the trends in fishing activity over the past 150 years led to a depleted stock, which is now under a rebuilding plan. As the stock continues to show signs of recovery, anglers are seeing more (and larger) red

snapper in the population; however, even though anglers perceive the population to be recovered, the stock is not yet considered rebuilt because it does not contain enough reproductively active females. This discrepancy has caused widespread frustration among anglers. Hearing the frustration from their constituents, lawmakers took action.

In 2016, Congress made funding available to independently estimate the red snapper population size in the Gulf of Mexico. Mississippi-Alabama Sea Grant awarded a total of \$10 million for a 2-year project (2017–19) known as the Great Red Snapper Count. The goal of this project is to estimate the absolute abundance of red snapper in the Gulf of Mexico. This evaluation will be conducted separately from the assessment process used by federal managers (National Oceanic and Atmospheric



Figure 1. Red snapper (*Lutjanus campechanus*). Photo by Brian Jones.

Administration Fisheries). The project will be led by a well-integrated, multidisciplinary team of 21 investigators, who are leading fisheries experts from the Gulf region and beyond. Several research methods, including habitat classification, direct visual counts, depletion surveys, and a high-reward tagging study, will be used across the U.S. Gulf of Mexico (Figure 2).

The first phase of the Great Red Snapper Count involves habitat classification. Before scientists begin to collect fish abundance data, they must fully understand the distribution and extent of the habitat types in the U.S. Gulf of Mexico. This region consists primarily of unconsolidated (sand/mud) sediment. Natural reefs are present but are relatively scarce. However, there are many artificial structures in the northern Gulf of Mexico that serve as habitat for several species of fish, including the red snapper. These artificial structures range in size and shape from large oil and gas platforms common in the western Gulf to chicken transport cages, pyramids, and other smaller structures that are deliberately placed on the seafloor to attract reef fish. The coverage of the three general types of habitat (unconsolidated, natural, and artificial) varies dramatically within and among regions in the northern Gulf. By classifying habitat before

sampling, scientists learn how much sampling effort will be needed at each of these habitat types to ensure that the study is rigorous.

Classifying habitat is a multi-step process. To begin, the shelf waters of the northern Gulf will be separated into four regions: Texas, Louisiana, Mississippi/Alabama (between the Mississippi River and the Alabama/Florida state line), and Florida. Then, each region will be divided into three depth zones, creating 12 unique sections. Next, the habitats present in each section will be classified. Specifically, the amount of unknown/unconsolidated bottom habitat, the amount of natural reef habitat, and the number of existing artificial reef structures will be determined.

Once the habitat has been classified, scientists will start collecting fish abundance data. One component of the multi-faceted sampling approach involves direct visual counts of red snapper across the northern Gulf. These counts will be accomplished using two types of camera equipment. The first is a remotely operated vehicle (ROV), which is deployed from a vessel and driven by an operator in a specific pattern, much like the operation of a remote-controlled car. The second is a towed camera array, which is towed from a research vessel at a constant speed and altitude above the seafloor along a predetermined path.



Figure 2. Gulf of Mexico scientists conducting a red snapper survey. Photo by David Hay Jones.

Before this study, scientists tested both types of equipment. Specifically, they investigated sampling efficiency (the area sampled by the equipment), behavioral responses (changes in red snapper behavior because of the equipment), and detection probabilities (the chance that the equipment will detect red snapper). Based on the results of this pilot work, scientists decided that ROVs are best suited to sample artificial and natural habitats, while towed cameras are ideal for sampling large expanses of low-relief and unconsolidated bottom habitat.

After the ROV and towed camera data is collected in the field, it will be analyzed in the lab. The first step will involve counting the number of red snapper in each ROV and towed camera video. Then, these counts will be converted to red snapper density estimates. For locations sampled with an ROV, the density calculations will be based on reef area; for locations sampled with towed cameras, the density calculations will be based on the total area of seafloor viewed during each video.

Another general approach for estimating the size of the Gulf of Mexico red snapper population involves depletion of the species by consecutive removals. At natural and artificial reef sites, this involves successive cycles of counting the population using ROV video footage, depleting the population (using hook-and-line gear), and counting again. One cycle of this sampling procedure can be thought of as “count, remove, count.” After at least one cycle is completed, scientists will compare the first count to the second count; the latter should be a reduction of the former, according to the amount of removals. Since the number of red snapper removed from the population is a known quantity (determined during the removal component), scientists can convert the difference between the first and second counts to an abundance estimate, which, in turn, will be used to estimate the population size. These techniques have been used with great success for terrestrial species like deer but are trickier to implement in marine environments.

Involving stakeholders in the research process increases buy-in of the resulting science and helps relieve tension between anglers and resource managers. One particular component of the Great Red Snapper Count will provide

an ideal opportunity for stakeholder engagement in the scientific process. This component is based on an ongoing high-reward tagging study by Auburn University and the University of South Alabama in the north-central Gulf of Mexico. The tagging study used during the Great Red Snapper Count will follow a similar approach. Participants will earn rewards for recovering tags (Figure 3).



Figure 3. A high-reward tag to be used during the red snapper tagging study.

During spring 2019, regional science teams will tag red snapper across the U.S. Gulf of Mexico, ensuring consistency of the tagging procedures throughout the study. Tags will be placed in the back of the fish, just below the dorsal fin, and will carry a value of \$250 apiece. Some fish will be double-tagged to estimate tag loss, and these fish will carry a value of \$500 apiece. Throughout the 2019 federal red snapper season, scientists will rely on anglers to report the capture of tagged fish. Tag returns and estimates of catch and harvest from participating anglers will be used in models to estimate red snapper abundance, exploitation, and movement patterns.

The Great Red Snapper Count will provide an independent estimate (separate from the NOAA Fisheries estimate) of red snapper abundance in the Gulf of Mexico. Once analyses are complete, this project's estimate will be compared to the NOAA stock assessment results for Gulf of Mexico red snapper. In this way, the Great Red Snapper Count will provide new insight into the Gulf of Mexico red snapper population, while also helping to calibrate the current stock assessment. Ultimately, this will lead to reduced stock assessment uncertainty, increased revenue to coastal communities, and maximum fishery access for stakeholders.

The Great Red Snapper Count team includes scientists from Texas A&M University, Corpus Christi; Texas A&M University, Galveston; Southern Methodist University; Louisiana State University; Louisiana Department of Wildlife and Fisheries; Mississippi State University; University of Southern Mississippi; Auburn University; University of South Alabama; University of Florida; University of South Florida; Florida International University; and Virginia Institute of Marine Science.

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