The Great Red Snapper Count

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Red snapper (*Lutjanus campechanus*) is one of the most economically valuable and culturally relevant fisheries in the Gulf of Mexico. 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 have 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, the spawning potential of the population (the number of reproductively active females) is still lower than the target required to rebuild the stock. The divergence between a population that is clearly rebuilding, and a stock that has not met its rebuilding target (the biomass needed for long-term sustainable yield), has led to widespread frustration among anglers. Hearing the frustration from their constituents, lawmakers took action.

In 2016 Congress made funding available to independently estimate the population size of Gulf of Mexico red snapper. Mississippi-Alabama Sea Grant awarded $10 million for a two-year project, which will run from 2017 – 2019. The project is known as the Great Red Snapper Count, and its goal 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 Administration (NOAA)). The project will be led by a well-integrated, multidisciplinary team of 21 investigators, which comprises leading fisheries experts from the Gulf region and beyond.[1] A suite of methods, including habitat classification, direct visual counts, depletion surveys, and a high-reward tagging study, will be used across the entire U.S. Gulf of Mexico.

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 of the various habitat types present 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 artificial structures in the northern Gulf of Mexico that serve as artificial habitat for several species of fish, such as 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 prior to sampling, scientists will learn how much sampling effort is needed at each of these habitat types to ensure that the study is rigorous.

Classifying habitat will be 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 quantified.

Once the habitat has been classified, scientists will begin the sampling and data collection process. One component of the multi-faceted sampling approach involves direct visual counts of red snapper across the northern Gulf. This will be accomplished using two types of camera equipment. The first is a remotely operated vehicle (ROV), which is deployed from a stationary 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 consistent altitude above the seafloor along a predetermined path. Prior to this study, scientists tested both types of equipment. Specifically, they investigated sampling efficiency (i.e. the area sampled by the equipment), behavioral responses (i.e. changes in red snapper behavior because of the equipment), and detection probabilities (i.e. 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 are 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 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 indexing (or counting) the population using ROV video footage, depleting the population (using hook-and-line gear), and indexing again. One cycle of this sampling procedure can be thought of as "index, removal, index." After at least one cycle is completed, scientists will compare the first "index" to the second "index"; 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 "index" values to an absolute 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. In 2016 Auburn University and the University of South Alabama initiated a high-reward tagging study of red snapper in the north-central Gulf of Mexico. The tagging study used during the Great Red Snapper Count will follow a similar approach, encouraging participation by rewarding recovery of high-reward tags on the fish.

During the spring of 2019, regional science teams will tag red snapper across the U.S. Gulf of Mexico. Scientific tagging of the fish is necessary to maintain 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, anglers who catch and report the tagged fish get the reward. Scientists will rely on those tag returns as well as estimates of catch and harvest from participating anglers to create models to estimate Red Snapper abundance, exploitation, and movement patterns.

These methods implemented by fisheries experts across the U.S. Gulf of Mexico in the Great Red Snapper Count will provide an independent estimate (separate from the NOAA estimate) of red snapper abundance in the Gulf. 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 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.

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Endnotes

1. 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 & 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.