Mississippi State University Extension

Gulf Coast Fisherman

Sea Grant Mississippi-Alabama

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Fish Tagging 101

Fish have been tagged (or marked) since anglers first started catching them. The 1653 edition of the fishing classic *The Compleat Angler* noted how anglers tied ribbons to the tails of juvenile salmon to verify that these fish return from the sea to the same rivers where they were born. While the concept of tagging

a fish to monitor its movement is intuitive, there are several aspects of a tagging program that can be customized based on the question at hand. But before you can begin a tagging study, you must first ask three important questions.

What are the objectives? In other words, what do you hope to learn from tagging fish? For example, fish tagging can be used to measure *movement*, *abundance, growth, exploitation, and/or demographics (survival, mortality, longevity).* In fact, a carefully designed tagging study can be used to measure several of the metrics above. The specific objectives of the tagging study will determine the answer to the next question.

Who will tag (and recapture) the fish? Deciding who will tag and recapture the fish will determine the types of questions that can be addressed and how the resulting data can be interpreted. Three general tagging programs are described below.

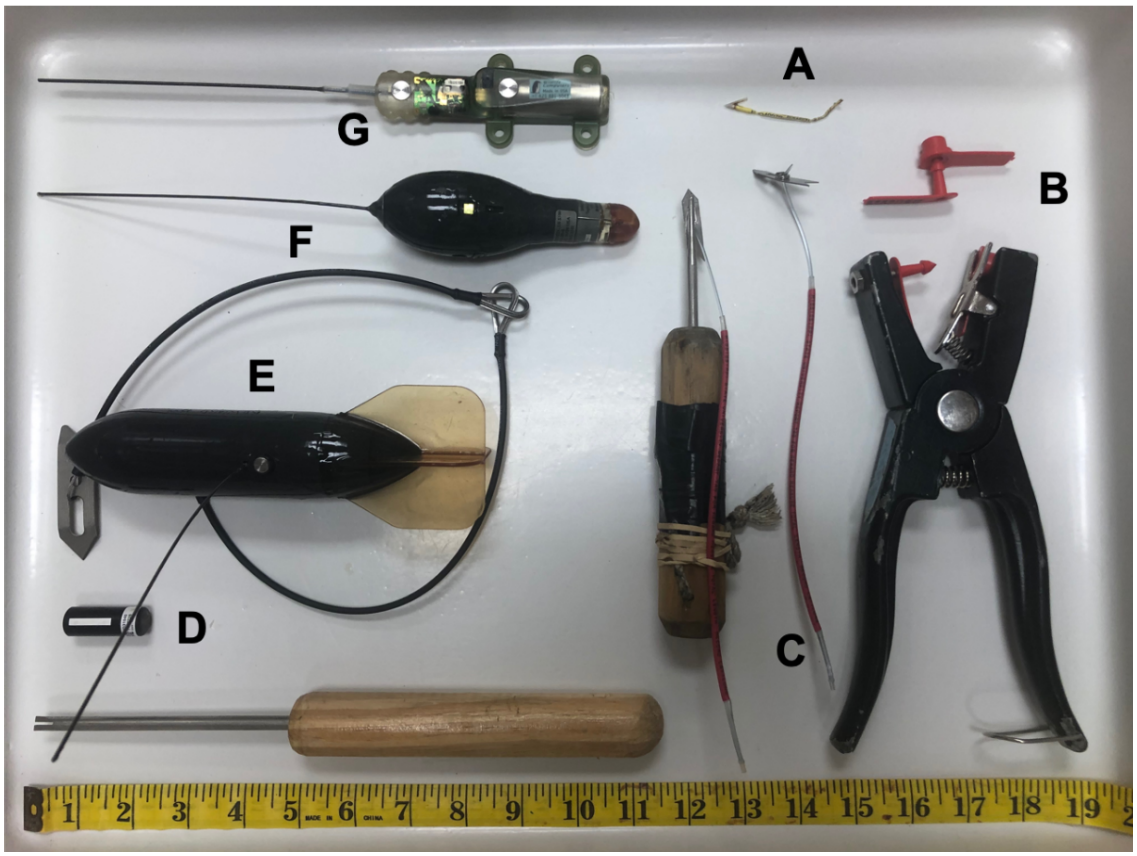
Angler-based tagging programs: Angler-based tagging programs are a cost-effective way to encourage citizen science and are best suited to provide information on fish movement. Successful angler-based tagging programs target specific species, have defined objectives, and offer training to angler-taggers (either in person or through print/digital means). An excellent example of this is the Sport Fish Tag and Release Program at the University of Southern Mississippi's Gulf Coast Research Lab (GCRL). The tagging program at GCRL began in 1989 and started with cobia. It has since expanded to include speckled trout and tripletail. Angler-based tagging programs are examples of "tag-return" programs.

Biologist-based tagging programs: Given the amount of data that must be collected (precise lengths, weights, and locations) and the strict assumptions that must be met (100% tag reporting), most tagging studies designed to estimate abundance, mortality, or growth are conducted completely by biologists who capture, tag, release, and later recapture the fish of interest. An example of this is the tagging program conducted by the International Pacific Halibut Commission, which used a biologist-based program to estimate fishing mortality, natural mortality, and migration rates for Pacific Halibut. These types of programs are often known as "capture-recapture" programs.

Fishery-dependent tag-return programs can be a mixture of the two types mentioned above. In this case, biologists tag the species of interest, but they

rely on recreational and commercial fishers to return the tags. An example of this is a "high-reward tagging program," where anglers receive a monetary reward for reporting recaptured fish.

What type of tag will be used? Now that you've defined the tagging study objectives, and decided who will capture, tag, release, and recapture the fish, it's time to select a tag type. There are several tag types, ranging from inexpensive conventional tags to complicated electronic tags. Below are three broad categories of tags commonly used in fisheries settings.



Tag types (clockwise from top): *Conventional tag types, such as plastic dart (A), rototag (B), and metal dart (C) are simple and inexpensive but require the tagged fish to be recaptured. Acoustic tags (D), towed SPOT tags (E), PAT tags (F), and fin-mounted SPOT tags (G) are telemetry tags (see below). These tags are expensive but allow data to be collected without recapturing the fish.*

Conventional tags: These tags are simple, inexpensive, and intuitive. The most basic tag type is a "mark," which can be as simple as a hole punch through the fin or a distinctive notch removed from a fin. These are best applied to designate between groups of fish rather than among individuals. Other conventional tags include disc tags, rototags (also used for livestock), t-bar tags (also used by retailers to attach price tags to clothing), dart tags (plastic or metal), opercule tags and cinch tags. Examples of some conventional tags we

use are shown in the photo above.

Telemetry tags: Advances in technology have made tracking fish via telemetry (defined as "measuring something remotely") more accessible. Telemetry tags are more expensive, but they typically provide more information (per tag) than conventional tags. The two most common types of fish telemetry tags are *acoustic* and *satellite*. Acoustic telemetry requires two components: a transmitter and a receiver. The acoustic transmitter (i.e. acoustic tag) emits an acoustic signal that's unique to an individual fish. That signal is recorded by an acoustic receiver (i.e. listening station) when the transmitter is within range (typically 1,500 feet or so). Fish detections can then be retrieved by downloading data from the acoustic receiver. Satellite tags offer a different approach for tracking fish. Once a satellite transmitter (i.e. tag) is attached to a fish, movement information from that fish is then relayed to a satellite. Those data are then shared with the researcher through the Internet. Two types of satellite tags commonly used are SPOT (Smart Position or Temperature) tags and PAT (Pop-off Archival Transmitting) tags.

Natural tags: Fisheries scientists are increasingly using natural tags to address some of the objectives discussed above. For example, the unique DNA from an individual fish serves as a natural "tag." In gene-tagging programs, muscle biopsy samples are taken from captured fish, which are then released back into the population. DNA from those fish are used to create a library that can be compared to fish that are caught in the future to examine the number of "recaptures." Fish movement can also be assessed along with different chemical tags using techniques like stable isotope analysis and otolith microchemistry.

Summary: While the concept of fish tagging is simple, the details of a well-designed fish-tagging program are complicated. Ultimately, the success of fish tagging programs will depend on 1) identifying appropriate objectives, 2) choosing the right tagging/recovery approach, and 3) selecting the right tag(s). Tight lines!

Recapture Red Snapper, Receive a Reward

1. What are the objectives? To estimate red snapper abundance

2. Who will tag (& recapture) the fish? Biologists tag, anglers recapture

3. What type of tag will be used? High-reward, conventional dart tag

The Great Red Snapper Count – a collaborative, multi-state effort to estimate the number of red snapper in the U.S. Gulf of Mexico – is in full swing. This spring, the project team is initiating the final component of the project – a tagging study, which will rely immensely on participation from stakeholders, such as commercial and recreational fishers. Scientists will tag and release 4,000 legal-sized red snapper across the U.S. Gulf of Mexico immediately prior to the Gulf states' recreational red snapper fishing season. To ensure consistency, all of the red snapper will be tagged by scientists working on the Great Red Snapper Count, in collaboration with recreational and commercial fishers.

Yellow tags with text beginning with “RS” followed by a unique 5-digit ID number will be placed beneath each fish’s dorsal fin. Most fish will have one tag, but some fish will have two tags so that tag shedding rates can be estimated. Tags from recaptured fish will be worth $250 per fish, and some double-tagged fish may be worth up to $500.

Recreational and commercial fishers can get involved in the tagging study by recapturing tagged fish and reporting those recaptures by calling the

phone number printed on the tags. Upon catching a tagged red snapper, fishers should record the fishing port from which they departed, the date, the fish's length and weight, and the latitude and longitude where the fish was caught. Because the physical tag must be mailed in to claim the reward, fishers should always clip off and save the tag, even if they plan to release the fish. Fishers who report their recapture AND return the physical tag to the research team will receive the reward. If a fish has two tags, both tags should be reported and returned. Rewards will be distributed through the end of 2019. Tag returns and estimates of catch and effort from participating fishers will be used in models to estimate red snapper abundance.

For more information, please visit us at www.SnapperCount.org.

Tarpon Telemetry

1. What are the objectives? To identify critical mating areas

2. Who will tag (& recapture) the fish? Biologists tag angler-caught fish, no recaptures necessary (tags transmit positions via satellite).

3. What type of tag will be used? Towed SPOT tag

Tarpon, aka silver kings, are prized game fish capable of growing over 8 feet long and well over 250 pounds. These fish winter in southern Florida and

Mexico before migrating large distances in the late spring to the northern Gulf of Mexico. However, we know very little about their movements once they reach the northern Gulf of Mexico, particularly eastern Louisiana and Mississippi. To address this knowledge gap, we used a type of satellite tag called a SPOT (Smart Position or Temperature) tag to monitor daily horizontal movements of tarpon. In July 2018, with the help of local tarpon fishermen, we intercepted schools of tarpon migrating west along the Alabama coast and attached SPOT tags to 10 individuals.

These SPOT tags allowed us to track their daily locations whenever the tag breached the surface for an extended period of time (such as when the tarpon “rolled”, i.e. surfaced to take a gulp of air to supplement their oxygen intake). After tagging, all tarpon continued to travel westward at a rate of about 20-30 miles a day, with some tarpon making stops in Mobile Bay and Lake Pontchartrain. These tarpon eventually finished their migrations somewhere between Chandeleur Sound and the southeastern tip of Louisiana, generally spending large periods of time within a 10-mile radius of one central location.

The exact reasons why tarpon make these long seasonal migrations is believed to be tied to water temperatures, feeding, and potentially reproduction. While spawning has not been observed in the northern Gulf of Mexico, juvenile tarpon are found in Mississippi and Alabama estuaries, leading some to believe that spawning is also occurring in the northern Gulf. This movement information is critical for helping us understand why these giant fish make long seasonal migrations and where they go once they reach the northern Gulf. Our tarpon tagging effort will continue in 2019, with a focus on better describing long-term movements of individual fish.

A Tale of Two Tags

1. What are the objectives? Identify habitat areas of particular concern (HAPC) for scalloped hammerheads and measure post-release mortality for great hammerheads

2. Who will tag (& recapture) the fish? Biologists tag sharks, no recaptures necessary (tags transmit positions via satellite).

3. What type of tag will be used? Fin-mounted SPOT tags and PAT tags

Understanding the movement patterns of large sharks is vital to successful conservation of these species. In a collaborative effort, our team deployed satellite tags on two different iconic shark species in the north central Gulf of Mexico: the scalloped hammerhead and the great hammerhead. Both of these species are listed as Endangered by the International Union for the Conservation of Nature (a network of scientists known as the IUCN) and are extremely susceptible to high post-release mortality following stressful events, such as capture by hook and line.

The scalloped hammerhead was the first shark species to be protected under the U.S. Endangered Species Act. To investigate its habitat preferences and movement patterns, we were part of a study that tagged 33 scalloped hammerheads with fin-mounted SPOT tags that tracked the movement patterns of these sharks for an average of five months. These sharks showed a strong preference for areas near the continental shelf. The tags provided evidence that these sharks have a large range, but limited long-distance movements.

Another species of hammerhead shark common in the Gulf of Mexico is the great hammerhead. Just as we did for scalloped hammerheads, we attached fin-mounted SPOT tags to three individuals off the coast of Mississippi and Alabama. In addition to the SPOT tags, we attached pop-off archival tags (PATs) to provide information on their post-release condition (i.e. did the shark survive after we released it?). All three tags indicated post-release survival of these sharks, as well as a preference for shallow waters (less than 20 feet deep).

Sea of Acronyms

Being an informed angler begins with understanding the terminology used in fisheries management. This series helps demystify the concepts hidden beneath a sea of acronyms.

HAPC

Habitat Areas of Particular Concern

Habitat Areas of Particular Concern are defined as subsets of Essential Fish Habitat that exhibit one or more of the following traits: rare, stressed by development, provide important ecological functions for federally managed species, or are especially vulnerable to anthropogenic (or human impact) disturbances. They can cover a specific location (a bank or ledge, spawning location) or cover habitat that is found at many locations (e.g., coral, nearshore nursery areas, or pupping grounds).

Marine Fisheries Ecology Lab

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