

Comparing Fish Survivorship between *In Situ* and Boat Tagging Methods Using Internal Acoustic Tags

Comparación de la supervivencia de peces entre los métodos de marcado in situ y en barco utilizando etiquetas acústicas internas

Comparaison de la survie des poissons entre les méthodes de marquage in situ et de bateau à l'aide d'étiquettes acoustiques internes

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EXTENDED ABSTRACT

Acoustic monitoring of fish with acoustic receiver arrays enables monitoring the movements of hundreds of fish on the scale of minutes to multiple years at a relatively low cost. Scientists have successfully used this technology to identify new spawning areas, track broad scale migrations, estimate home ranges, and calculate site fidelity for a wide variety of fishes throughout the world (Crossin et al. 2017). Although acoustic telemetry is widely used there are far fewer studies that examine the influence of tagging methodology on acoustic telemetry results (Dance et al. 2016). Effects of the tagging process, including physical impacts on animal health and performance, and their impact on the validity of study results, have been of scientific interest since tagging became a common practice among fisheries scientists (Jepsen et al. 2015; Vollset et al 2020). This information is needed because the physical act of tagging a fish can affect the outcome of the tagging event, potentially change the behavior of that fish, and even influence the interpretation of results. Internally tagging fish on a boat, in extreme cases, can result in mortality due to barotrauma injuries, increased stress from prolonged handling times, or predation after a fish has been released back into the water. Conducting *in situ* internal acoustic tagging at depth of capture removes barotrauma stresses and allows for fish to be released immediately into sheltering habitat, which may improve fish survival



Figure 1. Map of the study area.

A total of a 105 fishes (35 boat tagged and 70 underwater tagged) representing fourteen species of groupers (Serranidae) and snappers (Lutjanidae) were internally tagged with acoustic transmitters (tag life: 417-1825 days) from 2008–2016 by Florida Fish and Wildlife Conservation Commission’s Fish and Wildlife Research Institute staff in the Florida Keys and Dry Tortugas, Florida (Fig. 1). Fish were captured by hook & line when tagged on the boat and by fish traps when tagged underwater and implanted with V13 or V16 Vemco acoustic tags. Fish tagged on the

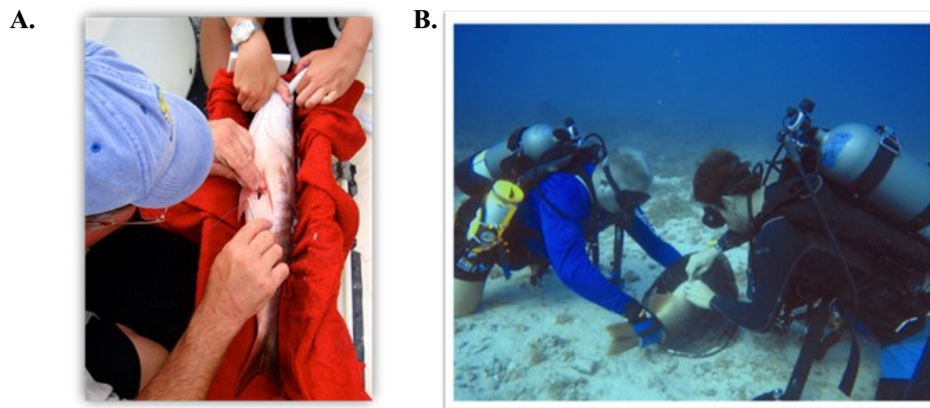


Figure 2. Acoustic tagging **A:** on the boat and **B:** *in situ*

boat were anesthetized while fish tagged *in situ* were held ventral side up where they displayed behavior similar to that of fish that had been anesthetized. We used eight years of acoustic tagging data to determine if the tagging method (*in situ* versus on the boat (Fig. 2)), influenced fish survivorship and evaluated the role of other tagging variables (e.g. handling time, surgeon experience, etc). Cox proportional hazard models indicated that the tagging method was the only variable to significantly affect survival probability, with fish tagged *in situ* ~75% less likely to have an ‘event’ (mortality, tag loss, or emigration) compared to fish tagged on the boat at both 4 and 6-days after tagging. Examining tagging methods separately, handling time only marginally influenced survival probability of boat tagged fish and no variables had a significant effect on survival of *in situ* tagged fish.

In situ acoustic tagging has many advantages over traditional surface tagging operations. The *in situ* process is conducted without removing the fish from the water, eliminates barotrauma, and reduces handling times as no anesthesia or recovery time was found to be needed. However, this approach is not a practical method for every species and for every environment, but given the increased fish survivorship demonstrated here, we suggest it be considered where applicable. More research is needed to determine how other tagging procedure variables impact fish survival. These results are important for biologists and fisheries managers for maximizing both fish health and the data produced from acoustic telemetry studies. *See the recording of the presentation for more additional information.*

KEYWORDS: Underwater tagging, Reef fishes, Acoustic telemetry

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