Small Shark, Big Ocean

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Spiny dogfish (*Squalus suckleyi*) are a small shark common in coastal waters of the eastern North Pacific Ocean. This species is not to be confused with the similar spiny dogfish (*S. acanthias)* found in the Atlantic Ocean, and until recently they were considered the same species. For the purposes of this article, "spiny dogfish" will refer to the North Pacific Ocean variety, *S. suckleyi.* Spiny dogfish is a small coastal shark species. They grow to about 130 cm total length. They are long lived, living up to 100 years, and quite slow growing, not reaching sexual maturity until they are about 36 years old. Spiny dogfish are spread across the temperate coastal waters of the eastern North Pacific Ocean and there is a long history of commercial fishing for the species in some areas (British Columbia, CA and Puget Sound, WA, USA).

Tagged spiny dogfish. Photo by Cindy Tribuzio

Conventional tagging studies began in the 1970s with recoveries still occurring to this day (see McFarlane and King 2003). Early tagging studies suggested two behaviors. First, spiny dogfish had the ability to undertake large-scale migrations, the maximum distance between release and recovery locations was 7000 km. Second, most of the spiny dogfish tended to stay "close to home."However, the conventional tagging methods are limited in that they only show start and end points, and time at liberty may not have spatial relevance. No studies have previously investigated the daily behavior of the spiny dogfish and the intervening movement between the tag deployment and recovery locations.

Traditional pop-off satellite archival transmitters are too large for such a small species of shark, but the advent of the smaller tag technology has allowed expanded tagging studies on spiny dogfish. We began tagging them with the Microwave Telemetry X-Tags in 2009, and have since deployed 183 tags. Most of the tags we deployed were in the Gulf of Alaska, but some were deployed in British Columbia, Canada and Puget Sound, Washington waters (Figure 1). Data have been recovered from 147 tags with some tags still at liberty. While there is a substantial volume of data analysis to be done, preliminary analyses have yielded surprising results.

As expected, many (76%) of the tagged spiny dogfish did not venture far from the Gulf of Alaska. However, a surprising number of fish (24%) not only traveled a long distance (maximum of 3509 km in 9 months) but some fish (10%) traveled far offshore in their migration, not along the continental shelf as expected (Figure 1). We have preliminarily labeled fish as either migrants or residents based on the tag deployment location and distance to the tag recovery location (Figure 1). For example, a tag that was deployed near Southeast Alaska and recovered near Kodiak Island was labeled a resident, but a tag that was deployed near Kodiak and recovered in Canadian waters was labeled a migrant. Examination of the temperature and depth data in the winter months showed that the migrants executed large daily vertical migrations (0–479 m) and experienced wide ranges of temperatures (4.4–11.4°C), compared to the residents who tended to remain in a narrow temperature (4.8–8.1°C) and depth range (23–355 m) (Figure 2). Further, the migrant fish demonstrate a strong diel pattern, significantly shallower during the day and deeper at night ($p < 0.001$), which the resident fish did not demonstrate.

These are preliminary results, as tagged fish are still at liberty and much analysis is still to be done. Future analyses of satellite tagging data from spiny dogfish have the potential to provide information directly applicable to stock assessment. For example, data on the daily depth distribution may enable examination of the species availability (and thus catch ability) to the trawl survey which is used to estimate exploitable biomass and catch quotas. In addition to understanding the temperature preferences of spiny dog fish, results of this study may help us evaluate impacts of climate change with respect to this species.

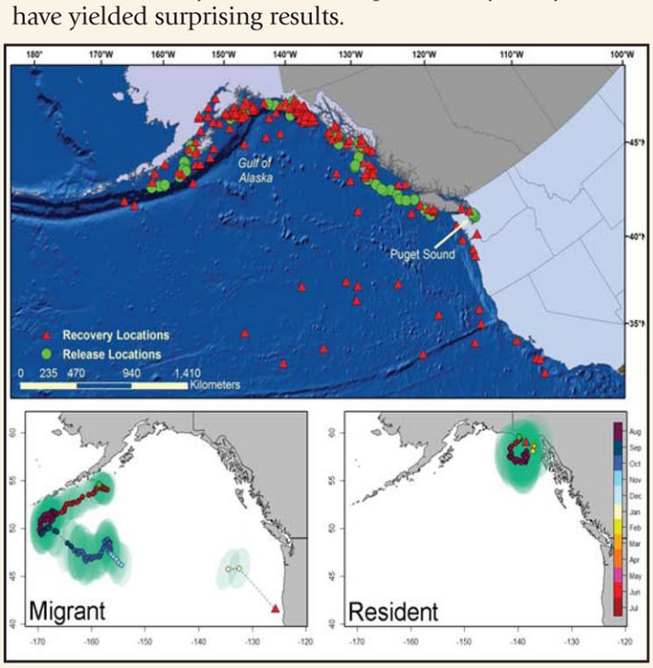

Figure 1. Map of release and recovery location for X-Tagged spiny dogfish (top). Estimated tracklines for a "migrant" (tag number 117197, bottom left) and "resident" (tag number 53691, bottom right) spiny dogfish, color coded by month.

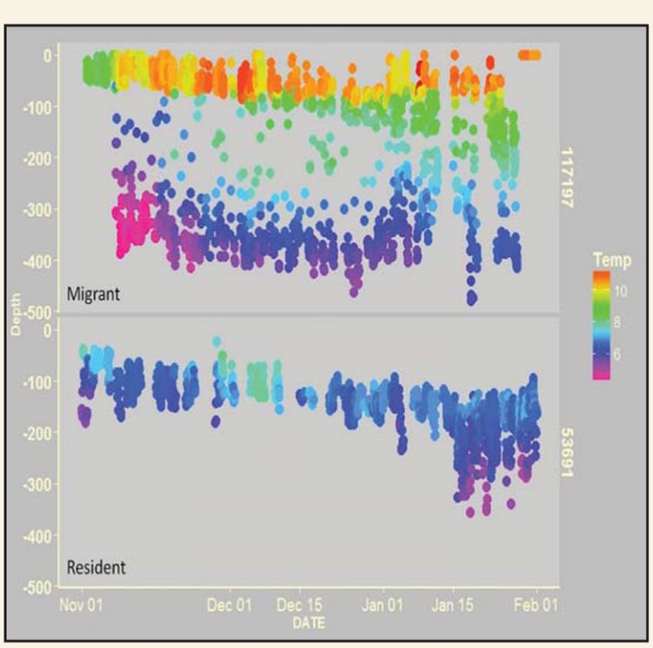

Figure 2. Graph of the depths that the migrant and resident spiny dogfish encountered from November through January. Colors represent the temperatures (°C) at those depths.