

# Reef Predator Movements at the Molokini Marine Life Conservation District (MLCD) and the greater Maui Nui Complex

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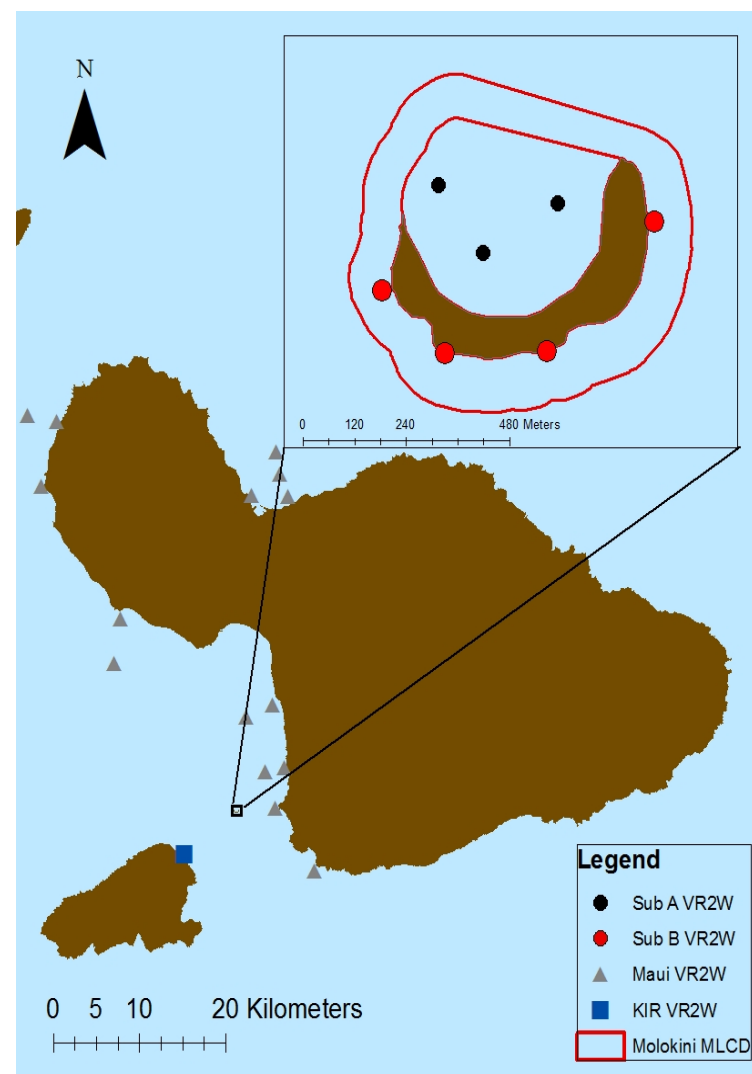
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## Introduction

From November 2013 to August 2015, the movement patterns of five species of predators including, White Tip Reef Shark (*Triaenodon obesus*), Grey Reef Shark (*Carcharhinus amblyrhynchos*), Ulua (*Caranx ignobilis*), Omilu (*Caranx melampygus*) and Uku (*Aprion virscens*) were studied with passive acoustic telemetry. The objective of this study was to describe the movement and residency of these species within the Molokini Marine Life Conservation District (MLCD).

## Acoustic array design

An array of acoustic monitors was used to track the movements of predators in the Molokini MLCD. Seven receivers were deployed around the Molokini MLCD and 18 receivers were in place around Maui and Kahoolawe. The array allowed us to document predator movements within the Molokini MLCD and also look at large-scale movements among the islands of Maui Nui (Figure 1).



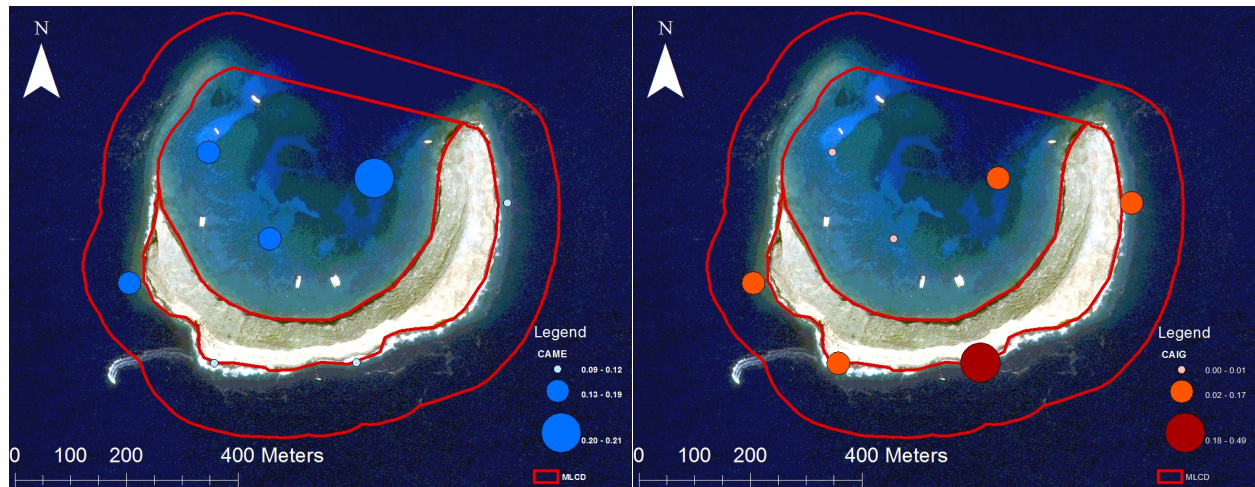
## Fish capture and transmitter deployment

Predators in the MLCD were captured with hook and line and tagged with Vemco V-13 coded transmitters surgically implanted into the body cavity of each animal through a 2 cm incision in the abdominal wall and tagged with a conventional dart tag.

## Movement patterns of each species in the MLCD

Omilu are primarily active in subzone A of the MLCD during day light hours and on average were present during 77% of the days they were monitored. In contrast, Ulua were present in deep water in subzone B (Figure 2) and spend more time away from the MLCD. This species was present on an average of 52% of days monitored and movements ranging from 5 to 11 km between Maui or Kahoolawe were documented in half of the Ulua tagged at the MLCD. White Tip Reef sharks were active in subzone A at night and subzone B throughout the day. The residency times for Grey Reef Sharks were only 36% and long distance movements of 7 km to the receiver stationed at Kahoolawe were documented for four out of the five Grey Reef Sharks tagged. The majority of the Uku exhibited transient behavior with 4 out of 10 fish spending less than 10 days at the MLCD or leaving for extended periods of time. Residency among species at the MLCD varied greatly and Omilu spent the greatest amount of time within the MLCD compared with other species (Figure 3).

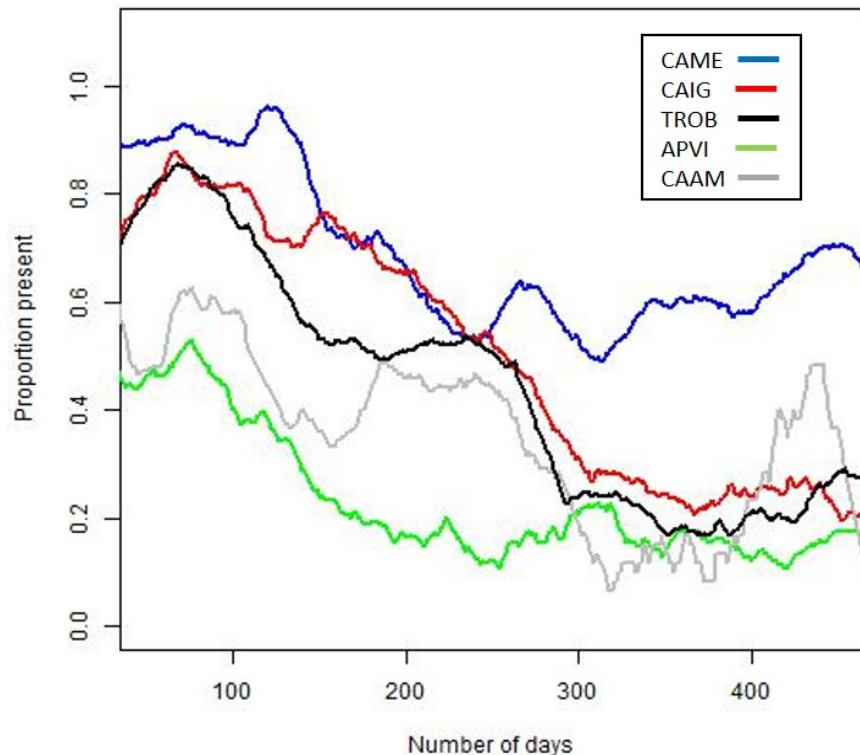
**Figure 1:** The Molokini acoustic array, and receiver locations at Maui and Kahoolawe. Red lines indicate subzone demarcation; black dots indicate subzone A receivers, red dots represent subzone B receivers, grey triangles indicate the location of receivers on Maui and the blue square indicates the Kahoolawe receiver.



**Figure 2:** Scaled bubbles representing the number of detections for Omilu (blue) and Ulua (red) at the seven receivers located in the Molokini MLCD.

### Summary

Our results indicate that the composition of reef predators at the Molokini MLCD, is dominated by boney fishes (primarily Omilu and Ulua) during the day, and by sharks at night. Residency time was variable across species, with Omilu exhibiting the highest residency time within the MLCD, and Uku the lowest. Long distance movements between the Molokini MLCD and other islands within the Maui Nui Complex were common in Grey Reef Sharks and Ulua. In contrast to Uku, which were transient, Ulua and Grey Reef Sharks exhibited a tendency to return to the MLCD after forays to other Islands in the Maui Nui Complex. Despite the small size of the Molokini MLCD, it serves as an important habitat for predators around the islands of Maui Nui, and as a result, may help provide some limited level of protection from harvest for these important species of fish.



**Figure 3:** A 30 day moving average of the proportion of individuals from each species present at the MLCD, plotted against days elapsed since initial tagging. Colored lines correspond to individual species (CAME = Omilu, CAIG = Ulua, TROB = whitetip reef sharks, APVI = Uku, and CAAM = grey reef sharks).