Coordinating Lionfish Removal Efforts Using a Publicly Accessible Web Map

Coordinación de los Esfuerzos de Remoción de Pez León Utilizando un Mapa Web Accesible Públicamente

Coordonner les Efforts de Déménagement du Lion en Utilisant une Carte Web Accessible au Public

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EXTENDED ABSTRACT

Indo-Pacific lionfish have established themselves in the western Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, and have the potential to severely damage regional marine ecosystems. Since the first year of the invasion, local scientists, dive operators, and volunteers have conducted weekly lionfish culls on the reefs around Little Cayman, Cayman Islands. Data recorded from these culls since 2012 include dive site(s) culled, number of lionfish caught, number of lionfish missed, number of divers culling, and the maximum depth and dive time of all divers. Total length, weight, and sex of each lionfish captured are also recorded. Overall, the efforts on Little Cayman have been productive, with over 200 community culls scheduled over the past six years and over 18,000 lionfish removed from the reefs. Analysis of the data taken from this community culling effort shows that these targeted removals can decrease lionfish density as well as their size distribution. It has also been observed that there are differences in lionfish densities as well as lionfish replenishment rates around the island. Targeted removals have been shown to be effective on a local scale, and therefore focus should be shifted to determining how to coordinate the limited resources available to provide the greatest positive impact.

To this end, we have created a publicly accessible, interactive web map of the community culling efforts using ArcGIS software. The web map is open and accessible to stakeholders through the Central Caribbean Marine Institute's (CCMI) lionfish management webpage (https://reefresearch.org/what-we-do/conservation/lionfish-management/). A total of 64 dive sites are included in the map, and each site is grouped into one of 31 culling zones based on physical proximity and reef topography. Cull zones are shaded on a green-yellow-red color scale that reflects average lionfish catch per team, which can be used to infer relative lionfish densities (Figure 1). Cull zones and individual dive sites are also assigned pop-up labels that provide the latest culling information. For cull zones this information includes average catch per team, total number of fish caught in the last year, and recommended number of culls per year (Figure 2). For individual dive sites the date of last cull, the number of fish caught on the most recent cull, average catch per team, recommended culling frequency, and any other pertinent site details are provided (Figure 3).
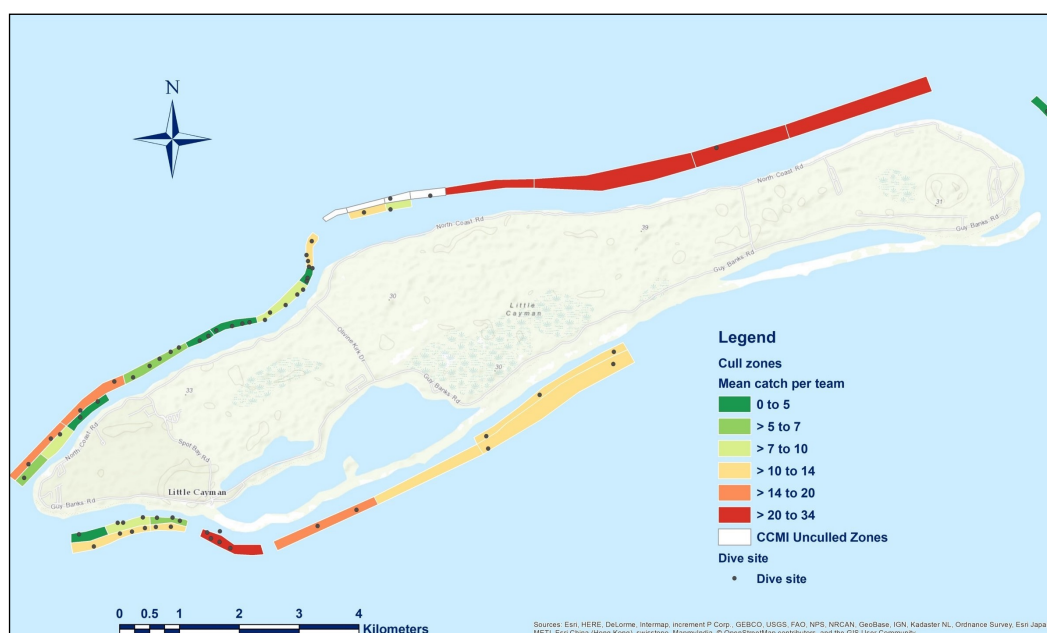
Figure 1. Little Cayman lionfish culling map with dive sites and shaded culling zones.

Like any informational product, the efficacy of the web map is dependent on the quality of data put in. Community engagement is critical to ensuring that the most information possible is included in the web map. In order to streamline the collection of community culling data, an online data submission form has also been created on CCMI's website (https://reefresearch.org/what-we-do/conservation/lionfish-management/lionfish-culling-information/). This allows community cull members to share their data as conveniently as possible, hopefully removing any previous barriers to data sharing. In total, when updated regularly with accurate culling information, CCMI's lionfish culling web map will provide a novel guide for stakeholders seeking to increase the sustainability and efficiency of Little Cayman's community lionfish culling program.

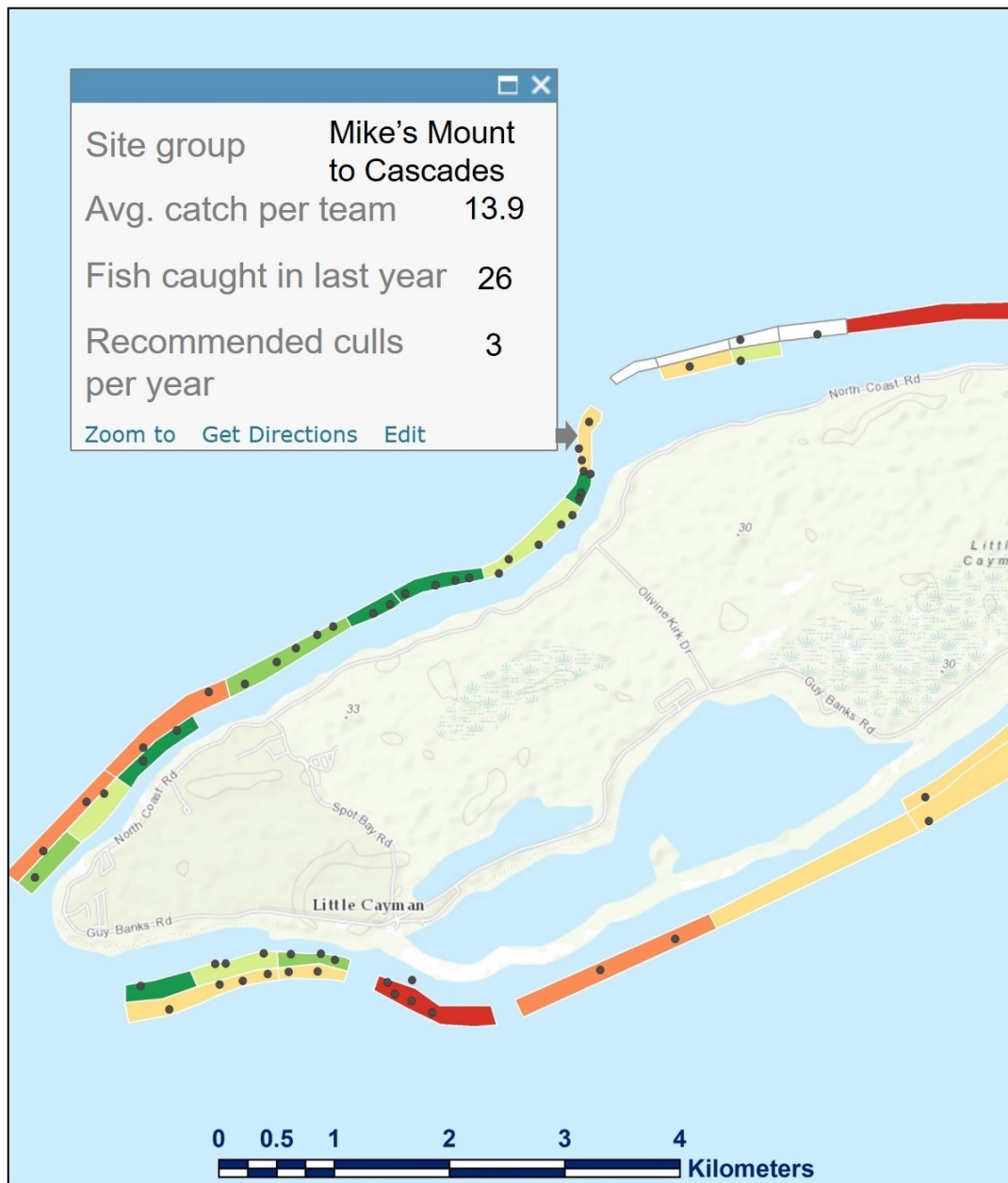KEYWORDS: Lionfish, culling, Little Cayman, ArcGIS, CPUE

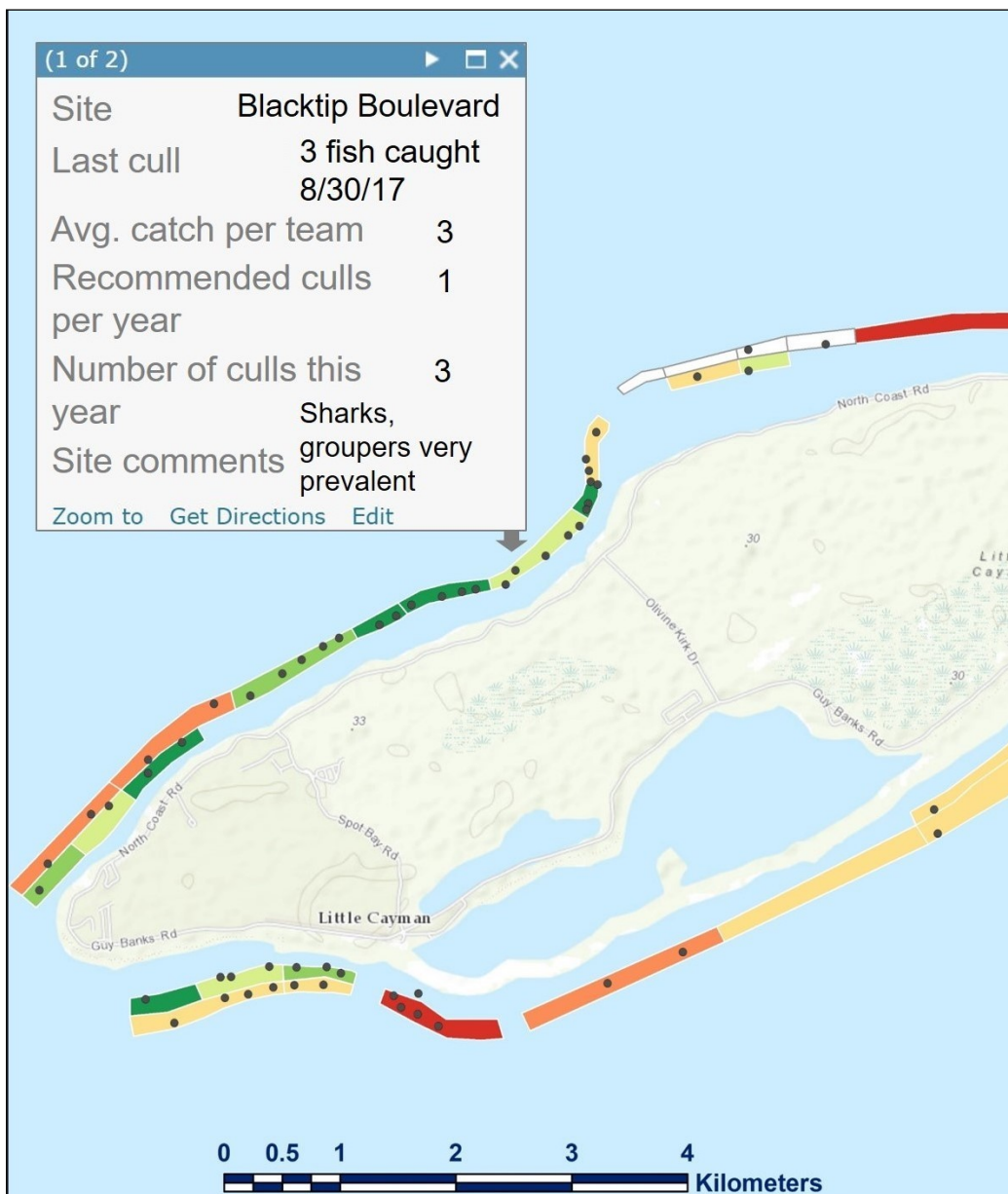**Figure 2.** An example culling zone pop-up label.

Figure 3. An example dive site pop-up label.