Bottom-up conservation: Using translational ecology to inform conservation priorities for a recreational fishery

Conservación de abajo hacia arriba: uso de la ecología traslacional para informar las prioridades de conservación para una pesquería recreativa

Conservation ascendante : utiliser l'écologie translationnelle pour éclairer les priorités de conservation d'une pêche récréative

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EXTENDED ABSTRACT

Marine fisheries are a source of food, recreation, and jobs to human populations across the globe, and they are a vital component of the economy in many coastal communities (Sumaila et al., 2016). However, when these fisheries are not managed sustainably, it jeopardizes future fishing opportunities, which can have devastating effects (Pauly et al., 2005). Despite their importance, the status of many global fisheries remains unknown or poorly estimated due to a lack of sufficient data necessary to conduct stock assessments. Fisheries lacking formal assessment comprise over 80% of global catch, and studies have estimated that these unassessed fisheries may be in significantly worse condition than assessed fisheries (Costello et al., 2012). However, due to increasing fishing pressure and constraints on fisheries management programs, developing monitoring and assessment plans for all harvested fish species is an unattainable goal (Harford and Carruthers, 2017; Sagarese et al., 2019). There is a need for methods that can identify the unregulated fisheries that are in greatest need of attention and develop rapid yet robust assessments that guide initial management action and help determine priorities for future research.

Translational ecology (TE) is a developing field that aims to address urgent ecological issues via a collaborative approach (Enquist et al., 2017; Schlesinger, 2010). This approach can be applied in a fisheries management context when information needed to inform regulations is unavailable, such as for many unregulated fisheries, yet conservation concerns exist. Our research applies a framework for incorporating TE into fisheries management that involves accessing fishing guide local ecological knowledge (LEK) via in-depth interviews and using that knowledge to rapidly develop testable hypotheses that can be used to inform management recommendations and prioritize future research (Figure 1). Recreational fishing guides in developed countries such as the United States rely on healthy fish stocks for their livelihoods and have an intimate knowledge of the aquatic environments where they fish. These stakeholders can therefore help fisheries scientists and managers keep a finger on the pulse of the environment, and quicky identify changes and potential issues (Gervasi et al., 2021; Kroloff et al., 2019; Santos et al., 2019). Our method was applied to the Crevalle Jack (Caranx hippos) fishery in Florida, U.S.A. The Crevalle Jack was identified by recreational fishing guides as a species of concern, as a marked decline in catch rates has been observed in the Florida Keys. However, the species is currently unregulated in the state despite its importance to both commercial and recreational fisheries.

The first component of our framework was to develop and test angler-derived hypotheses about the Crevalle Jack fishery in Florida. From 2019 to 2020, 19 recreational fishing guides from the Florida Keys with expert knowledge of the coastal environment were interviewed using semi-structured survey methods. Guide observations were used to develop six hypotheses about the stock status of Crevalle Jack in the Florida Keys and changes in stock abundance over time (Gervasi et al., 2021). In summary, guides have observed a gradual decline in adult Crevalle Jack catch rates, beginning as early as 1990, with very low catches observed over the past 5-10 years. A decline in large size classes is often indicative of overfishing. Guides also observed that Crevalle Jack appeared to be migratory, suggesting that the stock may encompass a broader range than the Florida Keys region and that the decline in catch rates may be more widespread. Two hypotheses received minimal support from long-term data, highlighting critical research needs. The second component of our framework involved conducting additional research that filled in knowledge gaps based on fishing guide observations. One main unknown concerning the Crevalle Jack is what the spatial distribution of the population is. Knowledge of daily, seasonal, and lifetime migration patterns of fishes is vital, since it is important that spatial management match the spatial distribution of a species (Crossin et al., 2017). For example, if a species exhibits high residency throughout its life (perhaps mostly

staying on one reef track), local management of that specific area may be sufficient to restore and sustain the population. However, if the species is highly migratory and exhibits long-range movements throughout its life, statewide management actions may be necessary. To assess the movement patterns of juvenile and adult Crevalle Jack in South Florida, we conducted a twofold study involving the use of two complimentary techniques, otolith microchemistry and acoustic telemetry, to determine daily, seasonal, and lifetime movement patterns. The results of this research revealed substantial movements and migrations throughout the state of Florida but suggested no population connectivity with Crevalle Jack in other areas of the Gulf of Mexico. Our findings that Florida Crevalle Jack may represent a single, self-recruiting stock will help guide management action. The final component of our TE framework was to use fishing guide LEK to help select a data-limited stock assessment method to apply to the Crevalle Jack fishery in Florida.

In light of pressing global anthropogenic and climatic changes, new methods of environmental planning and management are necessary to ensure sustainable use and conservation of natural resources (Lipsman, 2019). Combining multiple data sources and including stakeholders in science co-production under a translational ecology framework provides opportunities for rapid, proactive, and adaptive management (Chapin, 2017; Zipkin and Saunders, 2018). The results of our study outline an effective translational ecology approach for recreational fisheries management designed to rapidly recognize potential management needs as identified by fishing guides, which allows for actionable science and proactive management. Furthermore, our framework (Figure 1) can be easily applied to other species and areas, as fishing guides typically encounter a wide variety of fishes as they tailor their charter trips to diverse clients. The translational ecology approach outlined herein provides an additional tool for the fishery scientist's toolbox that can help better develop conservation priorities and effective management.

KEYWORDS: translational ecology, local ecological knowledge, recreational angling, fisheries management, unregulated species

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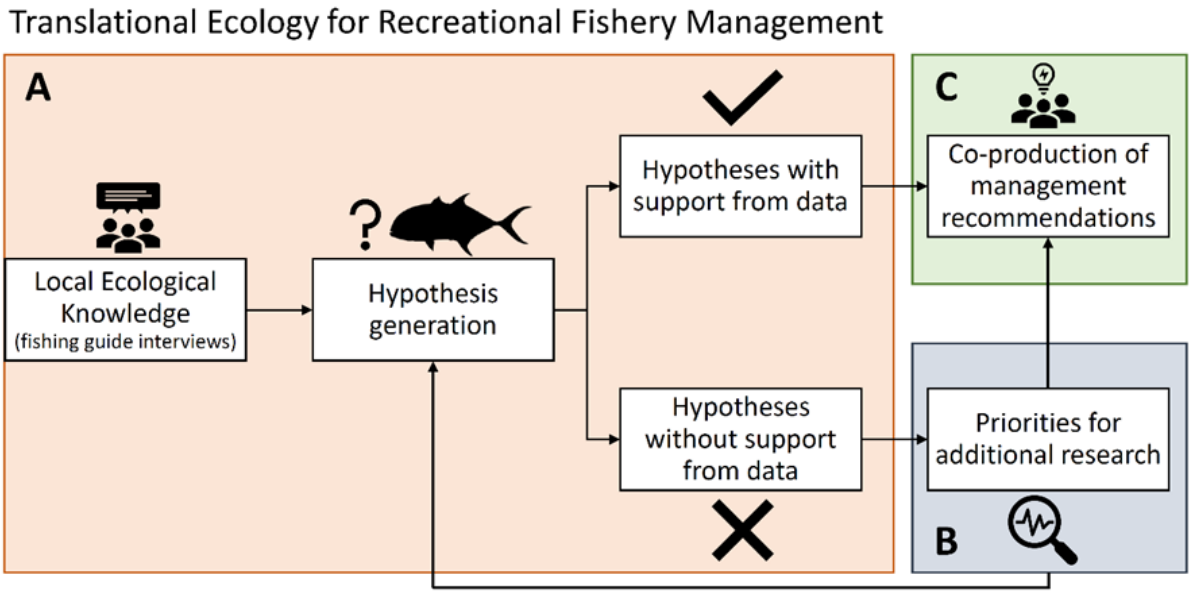

Figure 1. Conceptual diagram of the translational ecology framework applied in this study to a recreational fishery: Crevalle Jack in the Florida Keys (Gervasi et al., 2021). Panel A outlines a rapid approach to developing hypotheses concerning fishery resources via fishing guide local ecological knowledge and using existing data to test the hypotheses. Hypotheses without clear support from existing data serve as priorities for additional research (Panel B), which can provide missing support for existing hypotheses or lead to additional hypotheses. Finally, information from Panels A and B are used to produce management recommendations supported by both fishery scientists and stakeholders (Panel C).
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