COLORADO STATE UNIVERSITY

HUMAN DIMENSIONS OF NATURAL RESOURCES

# Invasive Lionfish Market Perceptions Survey: Preliminary Findings Report

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# Study Background

**Audience:** Individuals involved in the invasive lionfish management around the world

**Objective:** Identify perceptions relating to efficiency and threats of using market based options (MBOs) to control invasive lionfish

**Methods:** Survey designed on Qualtrics; disseminated through contacts involved in marine research; distributed on social media (Twitter, Facebook)

**N** = 185

Lionfish (Pterois volitans) are an aquatic invasive species in the Western Atlantic that cause extensive negative ecological and threaten economic damage. First spotted in the Western Atlantic in the 1980's, lionfish have thrived in this region due to their high fecundity, generalist diet, and ability to occupy diverse habitats (Chapman et al., 2016). Following their arrival, lionfish have since colonized ecosystems ranging from coral reefs to mangroves (Rocha et al., 2015), and have been documented at depths ranging from 1-300m (Gress et al., 2017), complicating management efforts beyond recreational diving depths (Andradi-Brown et al., 2017).

With few examples of biotic resistance in their invaded range (Hackerott et al., 2013; Harris et al., 2020), lionfish have been mostly uninhibited in their expansion. Lionfish deplete native reef fish biomass (Green et al., 2012), and their impact upon herbivory on coral reefs threatens macroalgae induced phase shifts on shallow and mesophotic reefs (Lesser and Slattery, 2011; Kindinger and Albins, 2016). Adding to the list of concerns are the 17-18 venomous spines that can cause significant pain to humans (Haddad et al., 2015).

Managers are presented with a quagmire of considerations for managing the Western Atlantic lionfish invasion and its social, economic, and ecological impacts. While few examples exist for successful management of marine invasive species (Giakoumi et al., 2019), lionfish removal studies have shown mixed results and some have decreased lionfish density while also significantly improving prey species biomass (Frazer et al., 2012; Green et al., 2014; Harms-Tuohy et al., 2018). A critical component of any removal effort is consistency, so, a key challenge for managers and policy makers will be determining how to achieve broader success (Johnston & Purkis, 2015; Andradi-Brown et al., 2017).

Market-based options (MBOs) have been suggested as viable invasive species management tactics for several species, including Asian carp (Hypophthalmichthys nobilis) and nutria (Myocastor coypus) (Nuñez et al., 2012; Varble and Secchi, 2013). Market based options include food consumption, tradable permits to sell exotic species, bounties, and performance bonds (Knowleder & Barbier, 2005; Richards et al., 2010).

# Study Background

Market-based options to manage invasive lionfish offer the potential for both livelihood and ecological benefits, and have been explored and implemented in several circumstances (Chapman et al., 2016; Graham and Fanning, 2017). These options have included lionfish as food, as part of the curio trade (jewelry), and have taken the form of lionfish derbies (catching competitions) or opportunistic harvest (Bogdanoff et al., 2013).

The invasion requires a collaborative effort across regional and national boundaries, but exists in highly heterogeneous contexts. It is critical to assess management strategies within these heterogeneous contexts to arrive at the best strategy for the invaded range at large.

This research focuses on perceptions towards these varied market-based options. We designed and implemented a quantitative survey using Qualtrics  to individuals involved with invasive lionfish management in the Western Atlantic and Mediterranean. Survey questions saught to discern a) demographic information about those involved in invasive  lionfish management, b) the nature of respondents involvement, c) perceptions of market-based management option effectiveness, d) perceptions of threats and problems associated with management options and, e) perceptions of opportunities associated with management options.

This preliminary report illustrates the responses thus far and will inform the next round of survey distribution.

# Where are our respondents?

Preliminary survey results include 185 respondents across 27 nations working in 9 U.S. states and 46 countries

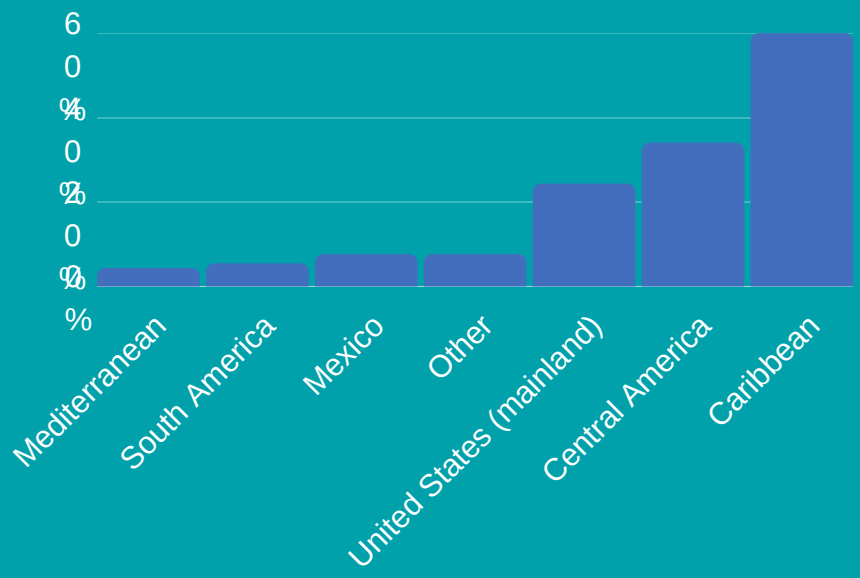


**Figure 1.** Percent of respondeds working in each region

**35%**

Of respondents engage with lionfish management exclusively in the Caribbean

## Top 5 locations of involvement

Belize (n=101)

Florida, US (n=42)

BES Islands (Bonaire, St. Eustatius, Saba) (n=25)

Bahamas (n=21)

Honduras (n=19)

# Who are our respondents?

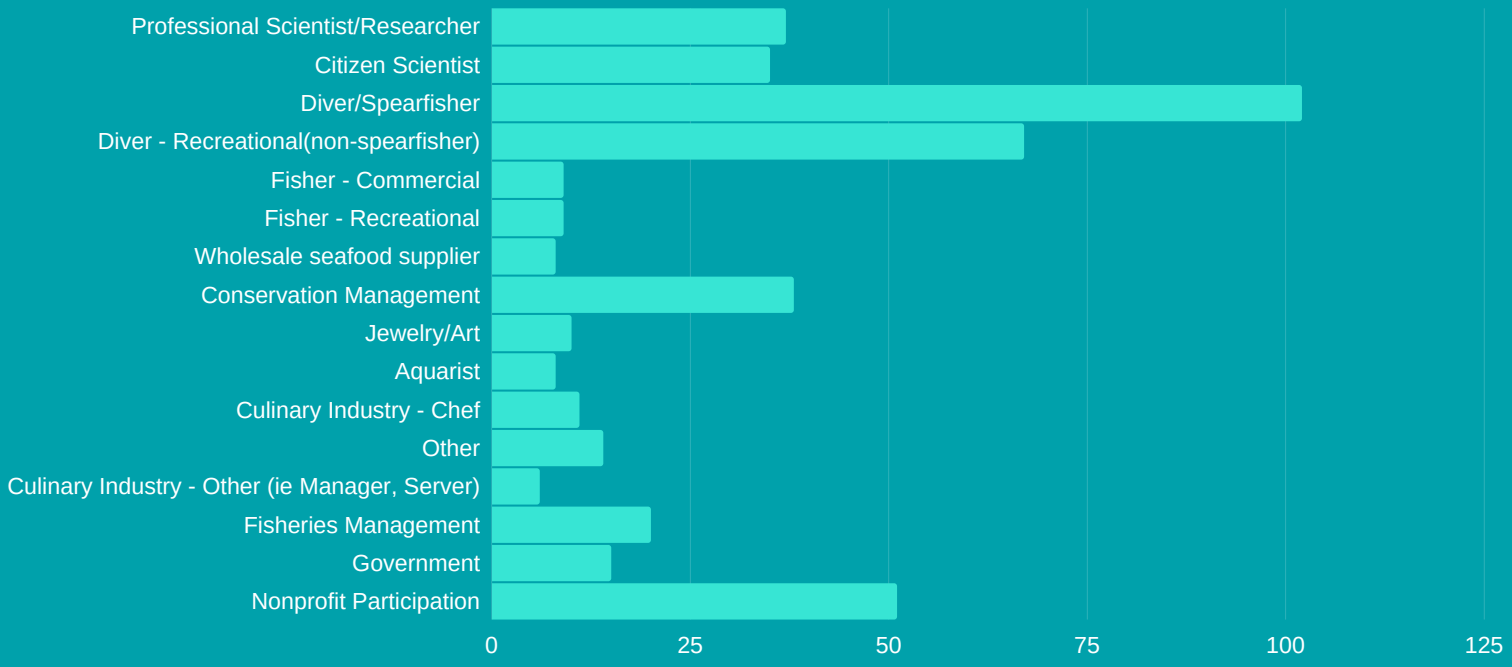


**Figure 2**. Nature of participant involvement with lionfish (respondents could choose as many as apply)

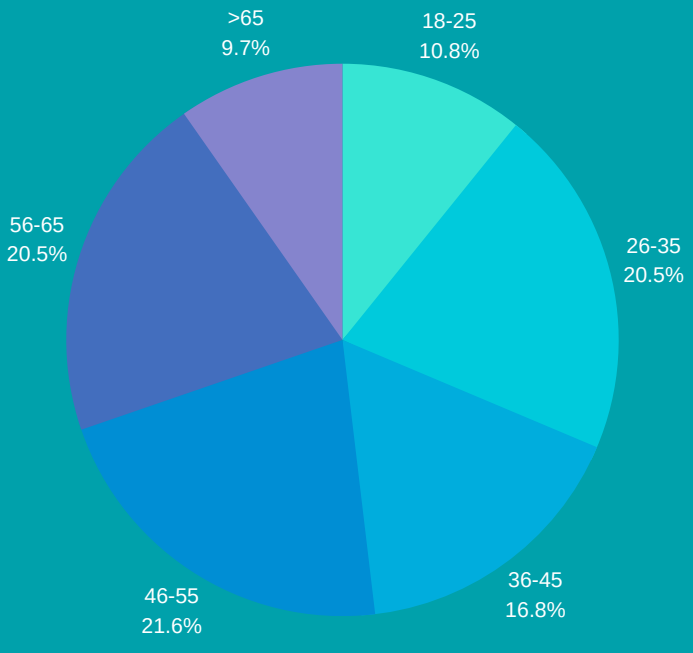


**Figure 3**. Age distribution of survey respondents

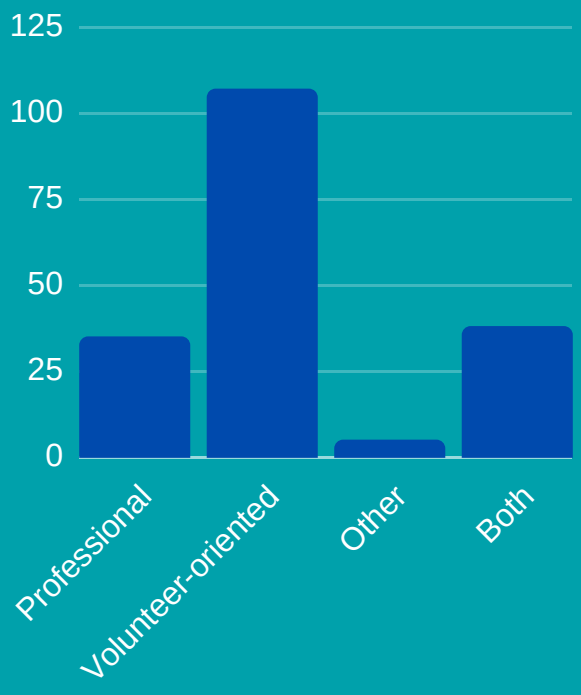


**Figure 4.** Respondent involvment type

# What do respondents think?

*Results below are based on answers to the following survey questions.*

In general, **what is your level of experience** (facilitation, participation, research, etc.) with the following **market based options?**

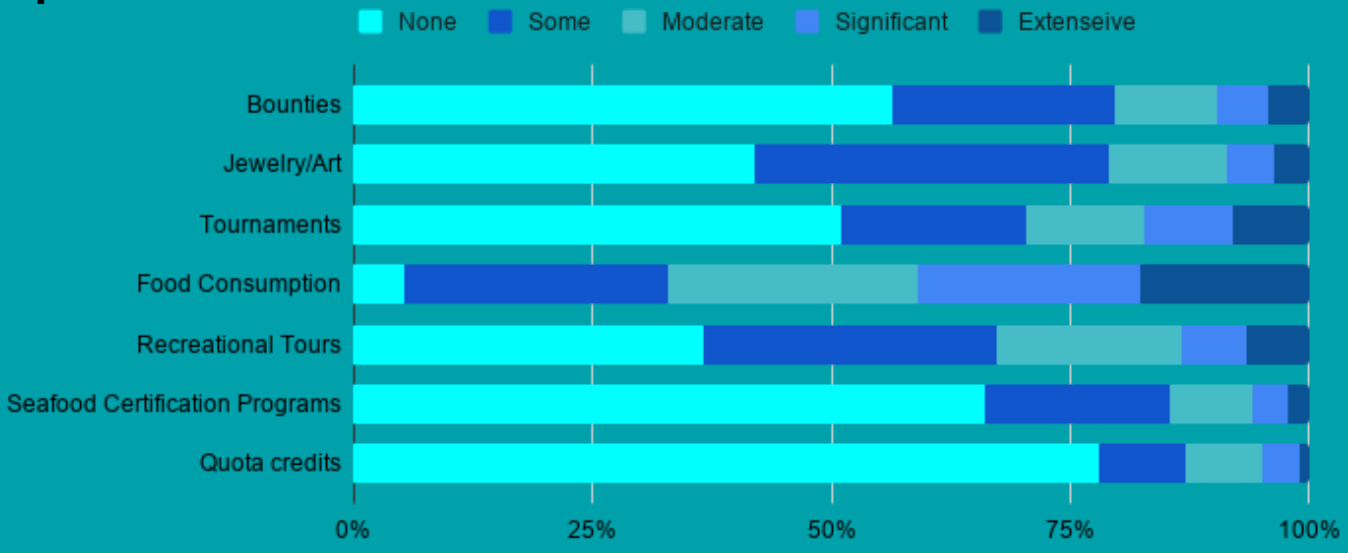


**Figure 5.** Experience level for different MBOs

How **effective** do you feel the following **market based options** would be at **reducing the negative impacts** of invasive lionfish in your primary region of engagement?

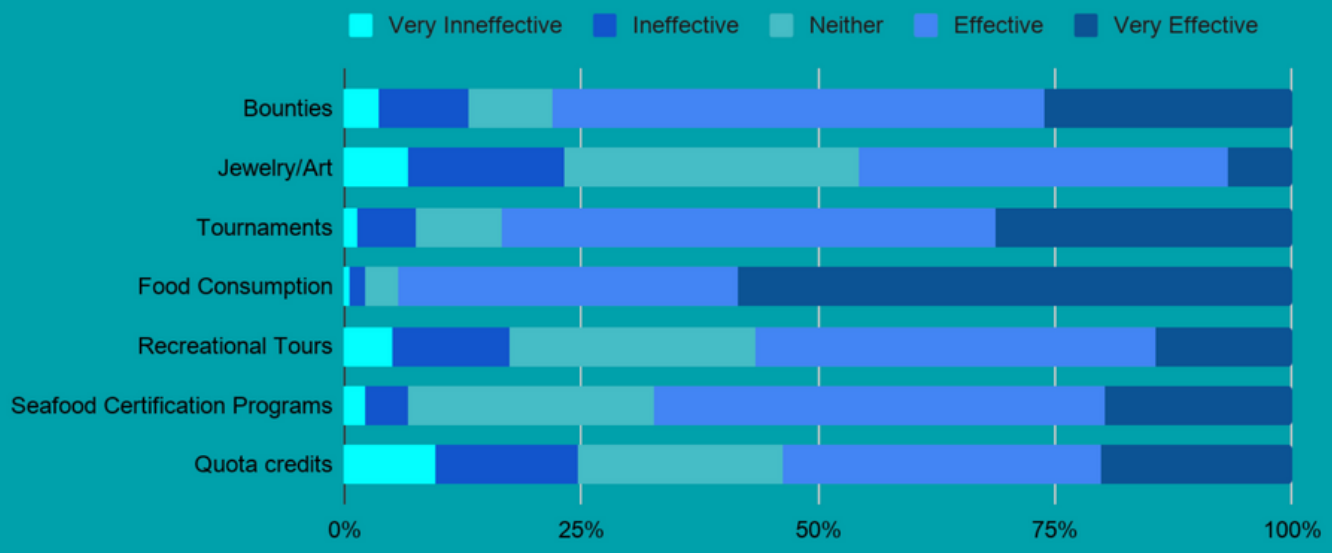


**Figure 6.** Perceived effectiveness of different MBOs

# What do respondents think?

From your personal perspective, please rate the following **potential problems** associated with using market-based options to manage lionfish from **"not a concern" to "of serious concern."**

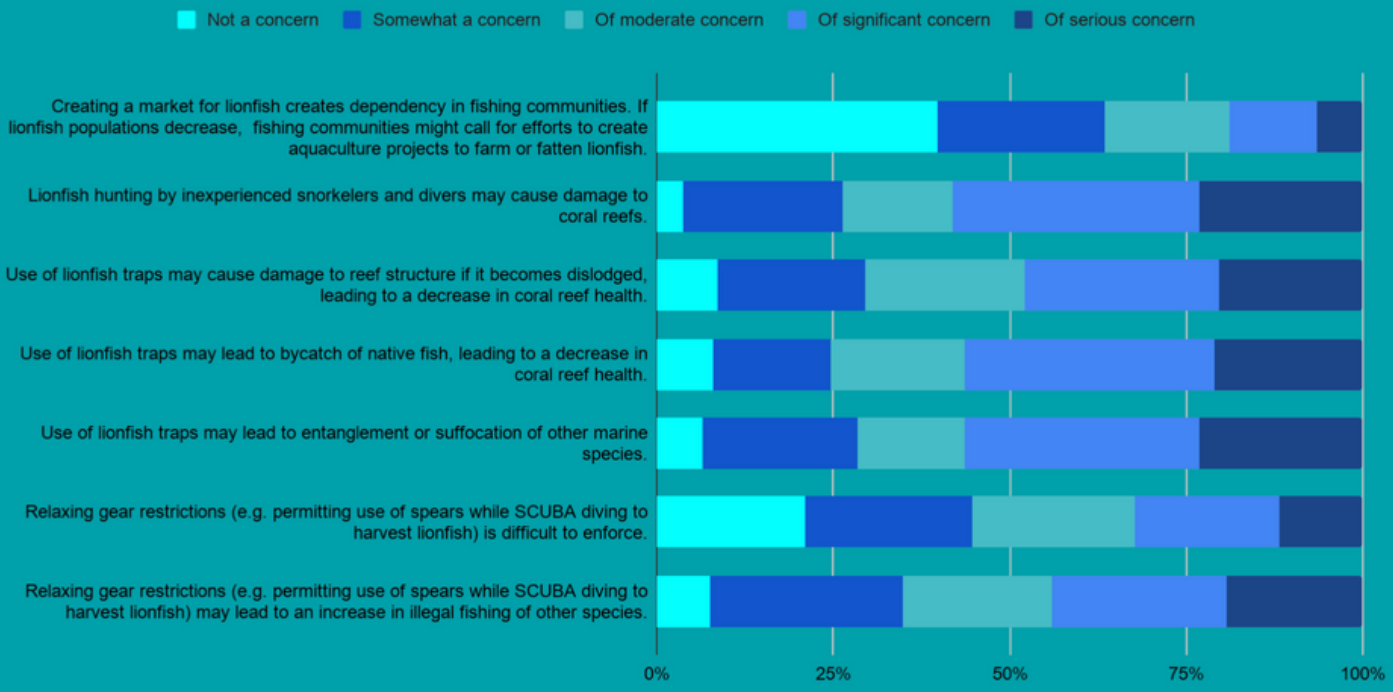


**Figure 6.** Concerns regarding lionfish hunting, trapping, and fishing

From your personal perspective, please rate the following potential problems associated with using market-based options to manage lionfish from **"not a threat" to "extreme threat."**

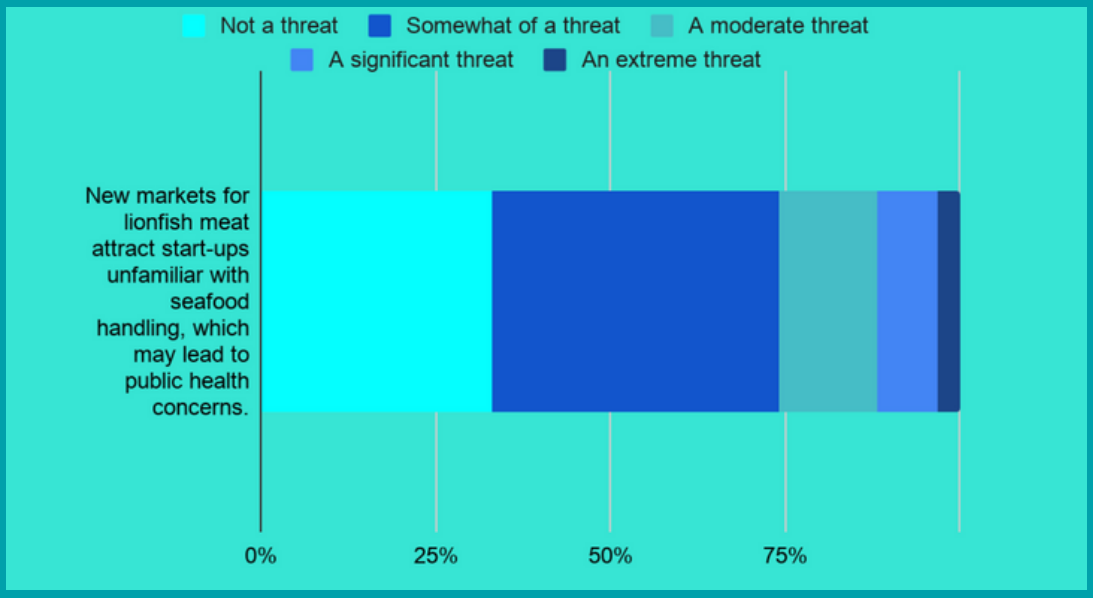


**Figure 7.** Public health concerns

# What do respondents think?

How effective do you feel **Food Consumption as an MBO** would be at reducing the negative impacts of invasive lionfish? *[ Crosstab results **based on level of involvement** and **primary region of engagement** ]*

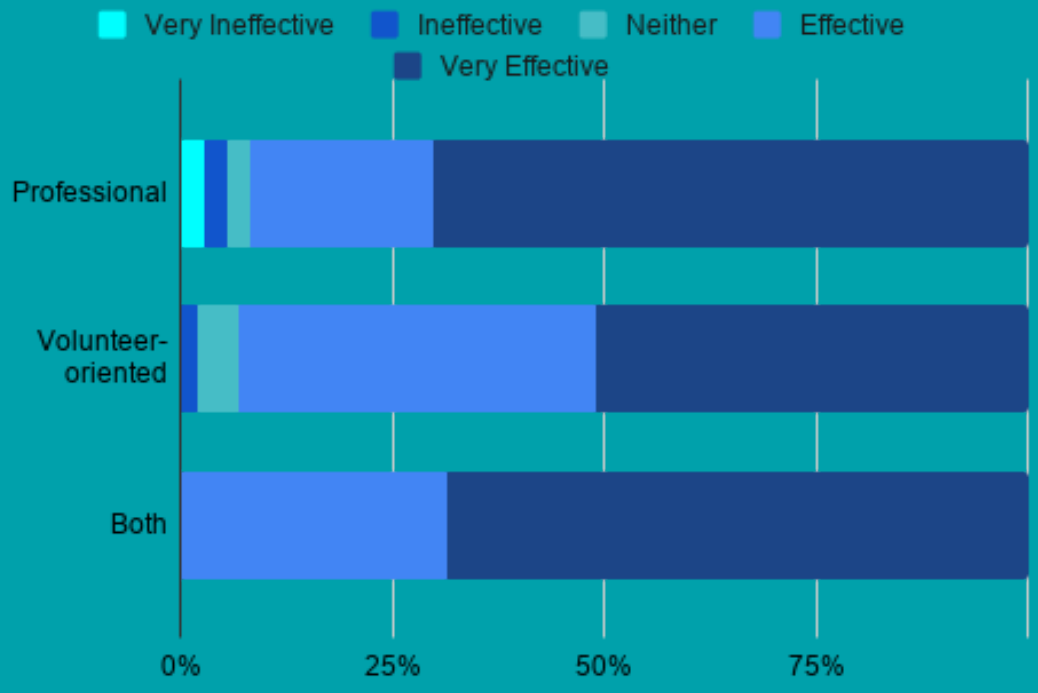


**Figure 8.** Effectiveness of Food Consumption based on level of involvement (crosstab)

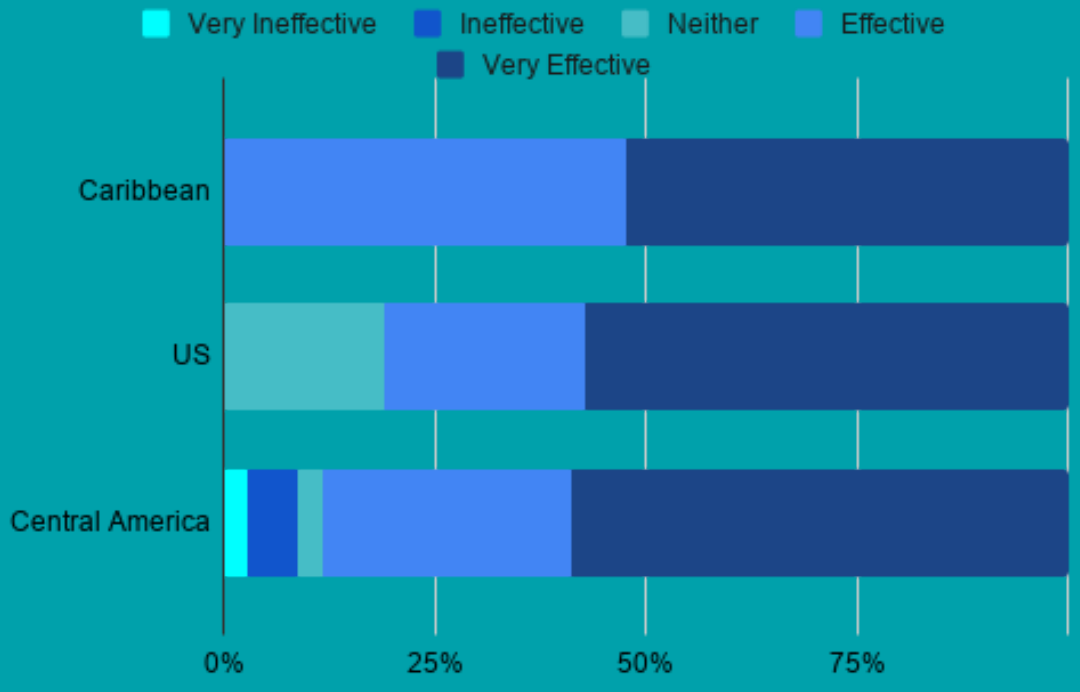


**Figure 9.** Effectiveness of Food Consumption based on primary region of engagement (crosstab)

# Soundbites from the field

"We have worked on cozumel island in many different ways, in order to control lion fish. Many innefective. The most effective was promoting the consumption among community, working hard on merchandise strategies, so the lion fish can be sold on prices similar to the most expensive fish on the local market (in our case it was grouper) so the fishermen will be well payed. It is important to get the strong involvement of

1. fishermen, to catch it and sale it
2. local restaurants to sale it
3. A well informed community to buy it
4. A leader, that can be government to put all the efforts together."

"Humans are generally selfish creatures, so I feel the best way to make them want to help the lionfish invasion efforts is to make it a competition or for some personal gain like a prize or food."

"The reproductive rate of the lion fish is such that initiatives such as jewelry/art will only be impactful as a way of raising public awareness, not as a mechanism for control. The only people that could have a significant influence over their numbers are local fishermen who know the waters and make a living there. Any scheme has to embed the harvesting of lionfish into the local culture, unlike a bounty scheme which will be transient in its effect. Thus, there needs to be a market for them and an incentive for local boats to go out and target their capture."

"Market based options are already in place. As long as policymakers are willing to honestly define the threat of the lionfish to the fish populations of our home reefs and continue the policy of open season everywhere they are found, the market will develop on its own. The question is, how fast will the market develop? Creating demand, by finding ways to make lionfish filets affordable and available to the average consumer, is a challenging problem."

# DISCUSSION

Although these results are preliminary, they provide important insights that can direct efforts for future survey deployments and can begin to illustrate attitudes, beliefs, and perceptions regarding market based options for invasive lionfish control. Parametric statistical analysis has not yet been performed on this data.

**Demographic Discussion Points**

Language Limitations

- This survey excludes many stakeholders whose primary language is not English
  - We plan to translate to survey into Spanish and re-distribute in early 2021.
  - Additional plans for translating into languages appropriate for the Mediterranean is under discussion.

Involvement Considerations

- Respondents were overwhelmingly divers, conservation managers, academics, and non-profit affiliates.
  - This demonstrates the need for more jeweler/art, culinary, wholesale, government and fisher perspectives.

Geographic Considerations

- The majority of respondents work in **only one** region (n=55) or in **one nation** (n=130).
  - Among the least represented are: the Mediterranean, South America, and Mexico.
  - This could indicate a lesser focus on lionfish management, or that future survey deployments must emphasize circulation for these areas.

**Public Health Discussion Points**

- Despite the increase in studies and news reports linking animal markets to pandemics in the wake of COVID-19, most respondents (87.6%) did not consider ciguatera a significant or extreme concern.

- Climate change may expand the range for the dinoflagellates that produce ciguatoxins, so particular future attention should be given to additional responses about human health as it relates to lionfish consumption (Chinain et al., 2020).

**MBO Effectiveness Discussion Points**

Effectiveness Takeaways

- Markets for Consumption was considered the most effective - 94.4% of respondents considered this option to be either "Effective" or "Very Effective".
  - This could be due to the disproportionate amount of respondent experience, literature and marketing materials that highlight lionfish as a food product.
- 62.4% of respondents expressed moderate to serious concern that a human consumption market may not adequately remove small lionfish from damaging coral reefs.
  - This suggests a trend building towards a concern for ecological impacts, but also an embrace for a human consumption market.
  - Further analysis to discern any significant findings regarding the acceptance of a human consumptive market amongst the various respondent groups will be critical.
  - For example, analysis to determine attitudes across variables such as geographic location and profession may illustrate differing levels of support.

**Future Directions**

- This survey both fills and opens gaps in lionfish management research.
- From this research, we think the following would be worth additional study:
  - More perception research in the Mediterranean, where lionfish are an emerging issue
  - Research on the use of the term "invasive" as it relates to consumptive desirability and socio-political contexts
  - Research on levels of lionfish ecological knowledge among stakeholders

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