

**Consumer Demand for Lionfish :
A Multi-Disciplinary Analysis of the Potential for a Lionfish Market in the US Virgin Islands**

**Examen de la Demanda de Pez León Como Alimento: Un Análisis Multidisciplinar
de la Posibilidad de un Mercado de Pez León en las Islas Vírgenes**

**Examen de la Demande de Poisson Comme Aliment : Une Analyse Multidisciplinaire
du Potentiel d'un Marché de Poissons-papillons dans les Iles Vierges Américaines**

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EXTENDED ABSTRACT

Introduction

Seafood marketing studies are common to assess the preferences and opinions of potential consumers, especially for new products. Usually those studies focus on the characteristics of the fish, or even how and where it was harvested and handled. Such studies seek to determine if consumers will pay more or eat more if products can be guaranteed to be safe, fresh, correctly labeled, larger, or harvested in a new or more sustainable manner (e.g., aquaculture). For the invasive lionfish, one source of control would be to foster targeting of fishing effort toward lionfish. Such a strategy would, however, only be successful if there was sufficient demand for the new seafood product. This study sought to fill a gap in the analysis of potentially sustainable solutions to controlling invasive lionfish by surveying potential consumers about their preferences for adding the species to their portfolio of seafood choices. Only by fostering the demand for lionfish by consumer can a commercial fishery for lionfish be developed. This study is complemented by one that sought the preferences of fisherman in order to compare the potential supply with demand to assess the viability of a new commercial fishery in the USVI. We present an analysis of the potential demand for lionfish as food from spatial, qualitative, and quantitative perspectives. This includes analyses of both local consumers' and tourists' willingness to try and willingness to pay for lionfish, mapping of interest in lionfish, and analyzing the cultural barriers to lionfish consumption (including concerns about ciguatera toxin). Outreach efforts to address these barriers are also briefly discussed. This is the second of two proposed presentations reporting on the findings and outcomes of two-year NOAA-funded project to assess the viability of a lionfish market in St. Croix and St. Thomas, in the US Virgin Islands.

Equipment and Methods

Both qualitative and quantitative methods were used in this study. Researchers conducted a combination of interviews, intercept surveys, and in-depth surveys with restaurants, resident consumers, tourist consumers, and fishers on the U.S. Virgin Islands of Saint Croix and Saint Thomas during the summer and fall of 2016. All surveys included at least some open-ended questions which were later transcribed and coded grammatically using grounded theory (Glaser and Strauss 1967). Geo-positional data was collected from potential customers and distributors (restaurants) to allow for mapping of latent demand. All surveys also included quantitative questions that can be used with statistical estimation techniques. Many of these questions were framed in the form of a Likert type scale where the participant indicated how strongly they agree with a statement, with responses ranging from zero (does not agree at all) to three (strongly agrees). Data for willingness to pay and willingness to accept estimations were gathered using standard double bounded contingent valuation method collection techniques. To estimate potential end consumers' willingness to try lionfish while controlling for various demographic and knowledge related variables, the researchers performed a logistic regression, regressing the binary variable willing to try lionfish, on a several independent variables. Additionally, willingness to pay (WTP) and willingness to accept (WTA) estimates were derived for potential consumers and suppliers (fishers) by the Turnbull lower bound on willingness to pay estimation method. This estimation technique is a non-parametric procedure which provides a conservative estimate on mean willingness to pay/accept. While these price estimates were calculated independent of any control variables, the researchers also calculated, by way of the double contingent valuation method, how end consumers' willingness to pay is effected by their preferences and demographic characteristics.

Results and Discussion

Several barriers to a successful market for lionfish in the U.S. Virgin Islands were identified during the qualitative portion of the analysis. These include, distrust of an unknown fish and folk perceptions of danger regarding lionfish. Additionally, we identified several themes suggesting there is opportunity for a lionfish market, including a lack of awareness among would be consumers (of how lionfish is both edible and destructive to environment), that tourist consumers are often open to trying new kinds of seafood, and many are attracted by the exotic image of lionfish.

Upon regressing residents' willingness to try lionfish on the independent variables, knowledge of lionfish, lionfish are safe to eat, interest in local seafood, concern with fish-poisoning and lionfish, income, education, age, and whether or not the last fish they ate was in a restaurant, we found significant correlated between several of these and the dependent variable. These include, knowledge of lionfish, lionfish are safe to eat, restaurant preference, and concern about fish-poisoning and lionfish. Interpretation of the coefficient for knowledge about lionfish indicates that for every additional unit of knowledge that a resident purports to have about lionfish the odds of her or him trying it increase five times. In contrast, for every unit of concern they have regarding the safety of consuming lionfish or fish-poisoning in general the odds of them trying it decrease by 73%.

A similar regression for tourists' willingness to try lionfish suggests that the independent variables, age, whether their last fish meal was caught in the U.S. Virgin Islands, knowledge of lionfish, lionfish are safe to eat, seafood is healthy, and doesn't know where to buy lionfish are all correlated with the dependent variable. Once again, individuals' reported level of knowledge about lionfish is positively correlated with the odds of being willing to try it increasing four times for every additional unit of knowledge. These findings suggest that and individual's willingness to try lionfish, whether she or he be a tourist or resident, is significantly correlated with variables related to lionfish specific and seafood specific knowledge, rather than his or her demographic characteristics.

The Turnbull lower bound on resident's willingness to pay for lionfish for home consumption is \$11.80 lb, higher than that of tourists \$10.09. While this difference may appear counterintuitive, as one expects tourists to have a larger food budget than their resident counterparts, upon considering that tourists often lack knowledge on how to prepare lionfish much less facilities where they can cook it during their stay, this discrepancy better conforms to reality. The difference between mean estimates of willingness to pay for lionfish in a restaurant by residents and tourists initially conforms better to expectations as tourists (who generally have a higher budget for eating out than residents) are willing to pay \$22.83 for an entree compared to the \$19.51 of residents.

The mean estimate of the Turnbull lower bound on willingness to pay of restaurants for lionfish is \$5.71 a pound while the mean estimate of the Turnbull upper bound for fisher's willingness to accept is \$4.37 a pound. These innately conservative estimates suggest compatibil-

ity between suppliers' WTP consumers' WTA (Haab and McConnell 1997).

Table 1. Estimated Mean of Turnbull Lower/Upper Bound on WTP/WTA for Lionfish Meat

consumer/ supplier	venue	E(LB)	V(LB)
resident	home	\$11.80/lb	8.117
resident	restaurant	\$19.51*	6.297
tourist	place of lodging	\$10.09/lb	1.658
tourist	restaurant	\$22.83*	0.692
restaurant	N/A	\$5.75/lb	1.032
fisherman	--	\$4.36 /lb	0.143

* restaurant entrée

Conclusion

This study examines the viability of a lionfish market in the U.S. Virgin Islands. Researchers used both qualitative and quantitative methods of data collection and analysis to determine potential barriers and opportunities to a market as well as estimating potential consumers' willingness to consume and willingness to pay for lionfish meat. They found that although some barriers exist to potential agents engaging in a market for lionfish: distrust of an unknown fish (potential consumers) and concerns by potential suppliers (fishers) that they are unable to cover their costs, that there is great potential for market. Estimated the prices agents in the market chain are willing to pay for lionfish meat as well as the prices potential suppliers (fishers) are willing to accept, suggest the compatibility of latent supply and demand structures in a lionfish market. Furthermore, individuals' willingness to consume and willingness to pay for lionfish are significantly correlated with lionfish specific knowledge variables providing strong evidence that stake-holders and marketers can increase both participation in the market and consumption levels by targeting potential consumers with education programs. This research suggests that a robust market for lionfish in the U.S. Virgin Islands is certainly possible although not inevitable. The growth and success of such a market in the U.S. Virgin Islands and elsewhere throughout the Gulf and Caribbean region will likely depend on further initiatives to increase consumer awareness and demand.

KEYWORDS: Lionfish, *Pterois volitans*, *P. miles*, USVI, St. Croix, St. Thomas, markets, supply, ciguatera

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