Potential Effects of the Indo-Pacific Lionfish Invasion on the Bahamian Lobster Fishery

Los Posibles Efectos de la Invasión del Pez León del Indo-Pacífico en la Pesquería de Langosta de Bahamas

Les Effets Potentiels de L'invasion des Rascasses Volantes de l'Indo-Pacifique sur la Pêche au Homards aux Bahamas

EVAN B. HENDERSON* and ISABELLE M. CÔTÉ
Department of Biological Sciences, Simon Fraser University,
*8888 University Drive ,Burnaby, BC V5A1S6 Canada. *evanh@sfu.ca. imcote@sfu.ca.*

EXTENDED ABSTRACT

Human-mediated introductions of species outside of their native range are becoming increasingly common and pose a significant threat to marine biodiversity (Ruiz et al. 1997, Molnar et al. 2008). When introduced species become invasive, they interfere with the ecological functioning of native communities (Grosholz 2002) and can cause ecological and economic impacts ranging from species extinction to altered industry and societal structure (Bax et al. 2003).

Introduced by way of the southeastern United States, Indo-Pacific lionfishes (*Pterois volitans* and *P. miles*) have rapidly swept through the Caribbean region with the first recorded sighting in the Bahamas in 2004 (Whitfield et al. 2002, Schofield 2009). They are now observed in densities far exceeding those of their native range (Green and Côté 2009) and can reduce recruitment of native fish species by up to 79% (Albins and Hixon 2008). The ecological impacts of the lionfish invasion have been the focus of most research to date, as these predatory fish consume a wide array of native fish and crustacean species (Morris and Akins 2009). Although many of these prey species are of economic importance, as of yet there has been virtually no investigation of the economic implications of the lionfish invasion.

Lionfish could impact fisheries in at least three ways:

i) By preying on larval and juvenile stages of species important to reef fisheries, lionfish could cause declines in recruitment to larger size classes, leading to a gradual reduction in landings. This is likely to be difficult to detect in the short term due to the relatively recent nature of the invasion.
ii) Lionfish may compete with native reef predators for prey but may also compete spatially with a variety of native species for suitable shelter, and
iii) Lastly, fishers anecdotally report slowing their pace when working around lionfish because of concerns over their venomous spines (E.B.H., unpublished data). Depending on the fishery and the type of gear used, lionfish in and around traps could lead to increased handling time, reducing fishing efficiency with concomitant drops in catch per unit effort and income. The main goal of this study is to examine the potential economic repercussions of this invasion by measuring its effect on the economically important spiny lobster (*Panulirus argus*) fishery of the Bahamas.

Field surveys of lobster and lionfish habitats on a natural reef system off the southwest coast of New Providence Island, Bahamas, suggest some overlap in the characteristics of habitat used by both species. But, since suitable space on natural reefs is relatively abundant, there were few occurrences of shelter sharing between lionfish and lobsters.

However, an inverse relationship existed between lobster and lionfish numbers in lobster shelter traps (condos) placed in sand and seagrass areas by local fishers, implying potential conflict for habitat use in non-enclosed fishing gear set in locations with little natural structure. Of the 83 condos visited, 11 contained a total of 18 lionfish. In the absence of lionfish, lobster densities were high, whereas when they were present in condos, lobster densities were significantly lower (Wilcoxon test, $p = 0.004$; Figure 1). However, it is not clear from this preliminary analysis which species is driving this relationship.

Data collected from formal interviews with fishers will allow us to estimate the monetary cost to the fishery with each lionfish found in and around traps. Economic modeling is currently in progress to estimate the opportunity cost to fishers when they encounter and choose to kill a lionfish. Given the observed frequency of lionfish in lobster condos, even a small opportunity cost per individual fish could translate into a sizeable amount if lionfish densities remain high or increase. As an island nation, the Bahamas relies both economically and culturally on its marine resources. Quantifying how ecological shifts manifest themselves in the local economy will be invaluable to planners and policy makers attempting to adapt to, and mitigate, the effects of this marine invasion.

LITERATURE CITED

Albins, M.A. and M.A. Hixon. 2008. Invasive Indo-Pacific lionfish *Pterois volitans* reduce recruitment of Atlantic coral-reef fishes. *Marine Ecology Progress Series* **367**:233-238.

Bax, N., A. Williamson, M. Aguero, E. Gonzalez, and W. Greaves. 2003. Marine invasive alien species: a threat to global biodiversity. *Marine Policy* **27**(4):313-323.

Green, S.J. and I.M. Côté. 2009. Record densities of Indo-Pacific lionfish on Bahamian coral reefs. *Coral Reefs* **28**(1):107.

Grosholz, E. 2002. Ecological and evolutionary consequences of coastal invasions. *Trends in Ecology and Evolution* **17**(1):22-27.

Molnar, J.L., R.L. Gamboa, C. Revenga, and M.D. Spalding. 2008. Assessing the global threat of invasive species to marine biodiversity. *Frontiers in Ecology and the Environment* **6**(9):485-492.

Morris, J.A. and J.L. Akins 2009. Feeding ecology of invasive lionfish (*Pterois volitans*) in the Bahamian archipelago. *Environmental Biology of Fishes* **86**:389-398.

Ruiz, G.M., J.T. Carlton, E.D. Grosholz, and A.H. Hines. 1997. Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent, and consequences. *American Zoology* **37**(6):621-632.

Schofield, P.J. 2009. Geographic extent and chronology of the invasion of non-native lionfish (*Pterois volitans* [Linnaeus 1758] and *P. miles* [Bennett 1828]) in the Western North Atlantic and Caribbean Sea. *Aquatic Invasions* **4**(3):473-479.

Whitfield, P.E., T. Gardner, S.P. Vives, M.R. Gilligan, W.R. Courtenay Jr., G.C. Ray, and J.A. Hare. 2002. Biological invasion of the Indo-Pacific lionfish *Pterois volitans* along the Atlantic coast of North America. *Marine Ecology Progress Series* **235**:289-297.

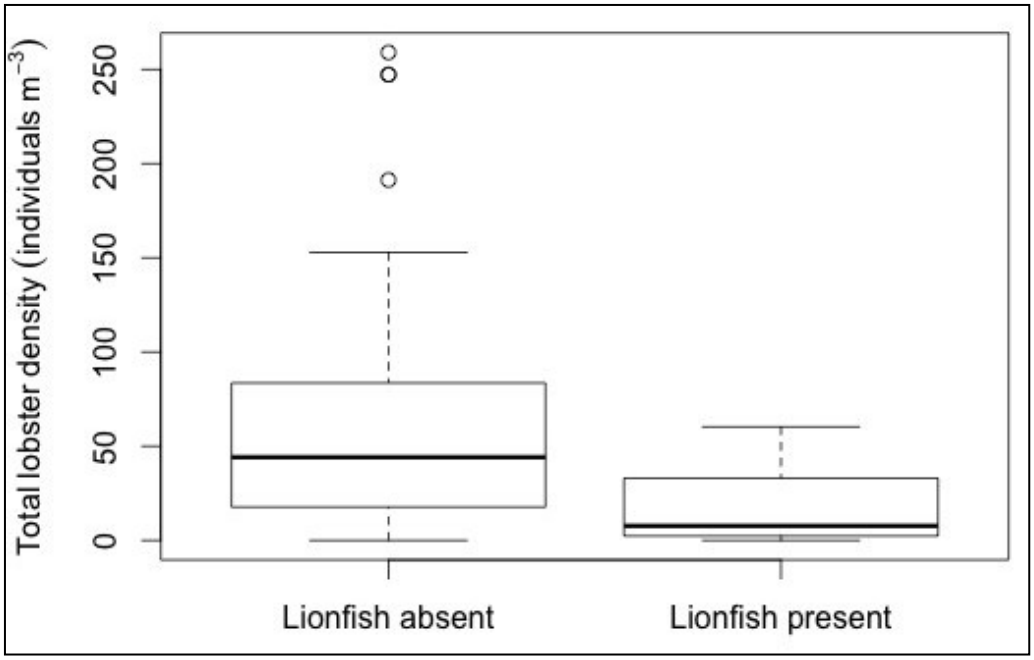

Figure 1. Boxplot showing lobster density in the presence and absence of lionfish in lobster condos. The solid line in each box represents the median value while the upper and lower bounds of the box represent the 75th and 25th percentiles, respectively. The ends of each whisker show the data points within an interquartile range of 1.5 of the lower and upper quartiles.