

Residency and Diel Activity Patterns of Lionfish in the Florida Keys Identified Using Acoustic Telemetry

Residencia y Patrones de Actividad Diaria del Pez León en los Cayos de Florida Identificado Utilizando Telemetría Acústica

Résidence et Activités Diurnes du Poisson-lion dans les Florida Keys Identifiées par Télémétrie Acoustique

MICHAEL P. MCCALLISTER^{1,2*}, BENJAMIN BINDER³, JEFFREY RENCHEN¹, and ALEJANDRO ACOSTA¹

¹Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, South Florida Regional Lab, 2796 Overseas Highway, Suite 119, Marathon, Florida 33050 USA.

²Florida Atlantic University, Harbor Branch Oceanographic Institute, Fort Pierce, Florida 34946 USA.
[*mmccallister@fau.edu](mailto:mmccallister@fau.edu)

³Florida International University – Biscayne Bay Campus, 3000 N.E. 151st Street, North Miami, Florida 33181 USA.

EXTENDED ABSTRACT

The invasive red lionfish (*Pterois volitans*), hereafter referred to as lionfish, was first detected in Florida in 1985. Since then, lionfish have spread rapidly throughout the Caribbean, southeastern U.S. Atlantic coast, and Gulf of Mexico; establishing large populations in a wide variety of habitats in these regions. As a result, the lionfish invasion is now considered a global conservation issue (Sutherland et al. 2011).

Since becoming established, there have been numerous studies that have examined the ecology and biology of lionfish. Yet, despite the breadth of research on lionfish ecology, there have been only a few studies that have examined the movement patterns of lionfish within their invaded range, and represents a large knowledge gap in the lionfish literature. Previous studies have characterized lionfish site fidelity and general movement patterns, however, the daily activity patterns and diel movements of lionfish are not well known. Describing such spatio-temporal movement patterns is critical to understanding and managing the spread of invasive marine species like the lionfish (Molnar et al. 2008).

In this study, we used passive acoustic telemetry to examine the movement patterns of invasive lionfish on a subtropical coral reef ecosystem in the Florida Keys. Specifically, the objectives of this study were:

- i) To quantify daily activity patterns of lionfish over a 24 hour cycle, and
- ii) Describe spatial and temporal movement patterns of lionfish. Results from this study provided further insight into lionfish behavior in a coral reef ecosystem.

Such information is essential to further understanding the ecological effects of lionfish within its invaded range, and improving existing management plans used to help control the lionfish population.

From April – October 2014, the movements of 11 lionfish were tracked multiple coral reef sites in the Florida Keys, USA using passive acoustic telemetry. Lionfish were tracked from 5 – 141 days and exhibited high levels of site fidelity (mean residency index = 0.83 ± 0.07). Plots of both the mean number of detections per hour and the mean number of unique stations at which a fish was detected revealed distinct daily activity patterns, with peaks in activity occurring at dawn and dusk (Figure 1), suggesting a strong diel component of lionfish activity. Further analysis of detection data showed a significant effect of time of day on lionfish activity. Specifically, mean detections per hour were greater during twilight than during day or night (Figure 2).

This study is the first that provides a detailed description of lionfish daily activity patterns using acoustic telemetry in a coral reef ecosystem. In particular, acoustic data collected in this study provide valuable insight into the diel activity patterns of lionfish that had previously only been described through observations made during foraging or conventional tagging studies. Increased activity during twilight periods is a typical pattern for the lionfish in both its native and nonnative ranges (Cure et al. 2012), and most likely corresponds with more frequent foraging at those times. The results of this study have increased our understanding of lionfish behavior in a coral reef system, and provide valuable information that can be used to improve invasive lionfish control and management efforts.

KEY WORDS: Invasive species, tracking, daily activity, coral reefs

LITERATURE CITED

- Cure, K., C.E. Benkwitt, T.L. Kindinger, E.A. Pickering, T.J. Pusack, J.L. McIlwain, and M.A. Hixon. 2012. Comparative behavior of red lionfish *Pterois volitans* on native Pacific and invaded Atlantic coral reefs. *Marine Ecology Progress Series* **467**:181–192. <http://doi.org/10.3354/meps09942>.
- 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**:485–492. <http://doi.org/10.1890/070064>.
- Sutherland, W.J., S. Bardsley, L. Bennun, M. Clout, I.M. Côté, M.H. Depledge, L.V. Dicks, A.P. Dobson, L. Fellman, E. Fleishman, and D.W. Gibbons. 2011. Horizon scan of global conservation issues for 2011. *Trends in Ecology and Evolution* **26**:10–16. <http://doi.org/10.1016/j.tree.2010.11.002>.

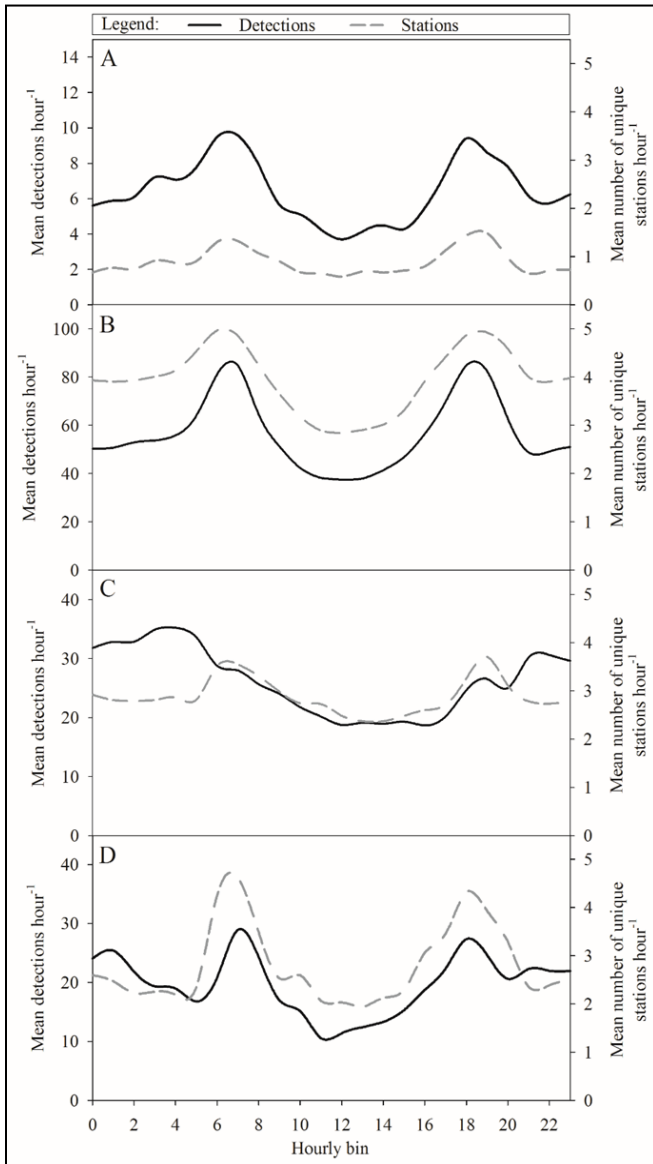


Figure 1. Lionfish daily activity patterns at four coral reef sites in the Florida Keys. Site 1 (A), site 2 (B), site 3 (C), and site 4 (D).

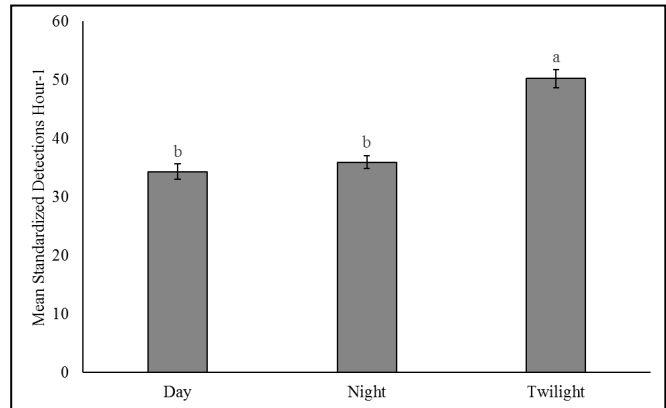


Figure 2. Overall mean standardized detections per hour for time-of-day periods. Letters denote significant differences from post-hoc tests. Error bars represent standard error.