

Abundance and assemblage assessment of native fish along with the invasive lionfish *Pterois volitans* in the Colombian Caribbean

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Background

The lionfish *Pterois volitans* is a predatory fish native to the Indo-Pacific that has invaded the Western Atlantic Ocean. The lionfish was reported in Colombia for the first time in Providencia in 2008 (Schofield, 2009). The success in such expansion is largely due to the fact that it has few natural predators, its extensive diet, and its life history traits (Acero P. *et al.* 2019). Its colonization has been of great concern due to the evidence of its negative effects favoring the change in the composition of coral reefs fishes (Albins y Hixon, 2008; Muñoz *et al.*, 2011; Acero P. *et al.*, 2019).

Objectives

The objective was to carry out an evaluation of the abundance of Lionfish (*Pterois volitans*) in the Colombian Caribbean and the effects that this may have on the abundance and richness of the native reef fish community, as well as the evaluation of the spatial and temporal differences of the assemblage.

Methodology

The composition and abundance of the native fish assemblage, and the abundance of the invasive Lionfish were evaluated through visual censuses carried out in two climatic periods (dry and rainy) and two regions of the Colombian Caribbean (Bolívar and Magdalena) from 2016 to 2020. Permanent transects of 25 × 10 m were delimited at depths between 10 and 24 m.

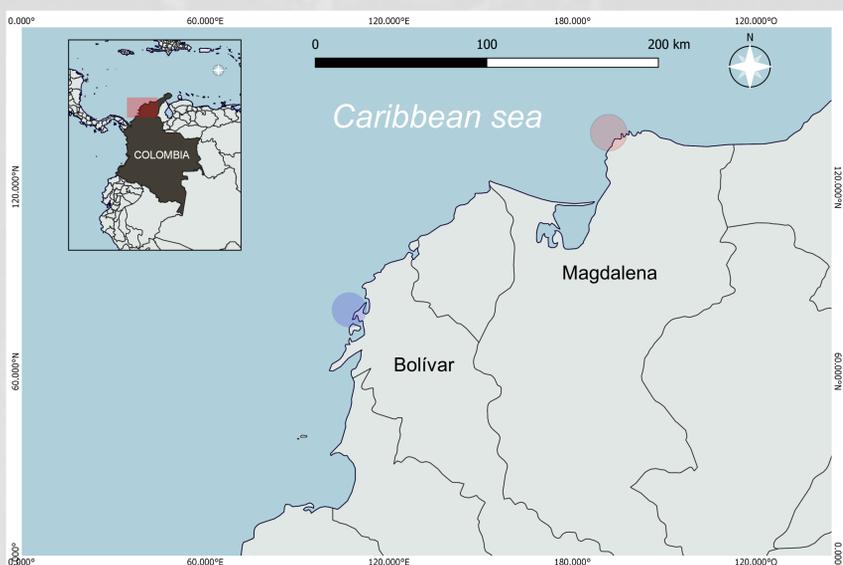


Fig 1. Study area. The circles show sites sampling.

Results

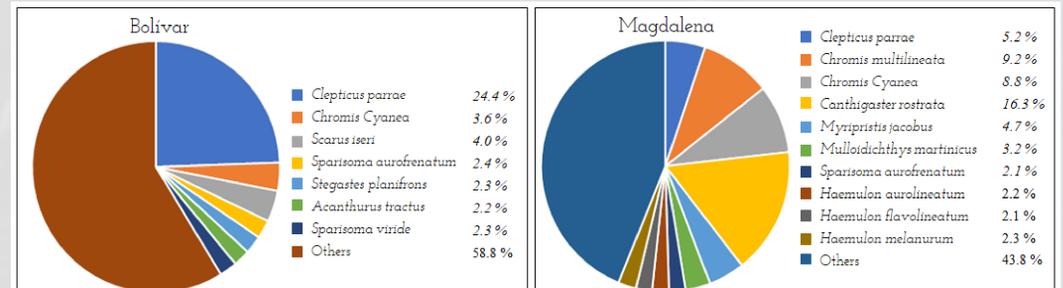


Fig 2. Relative abundances of the fish assemblages in Bolívar and Magdalena.

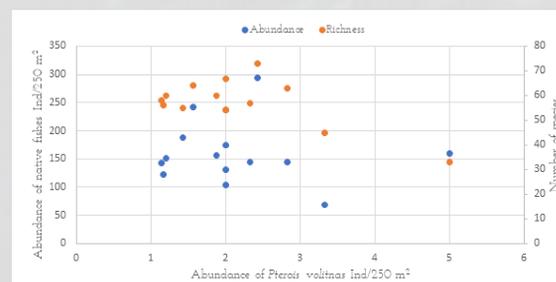


Fig 3. Relationships between abundance of lionfish with abundance of native fish ($r_{13} = -0.10$; $P = 0.720$) and species richness ($r_{13} = -0.62$; $P = 0.017$) in Bolívar.

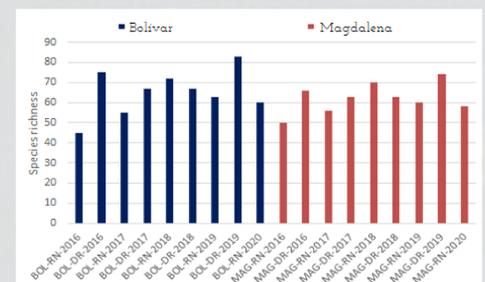


Fig 4. Species richness in every region every climatic period, and every year evaluated. BOL: Bolívar, MAG: Magdalena, RN: rainy and DR: dry.

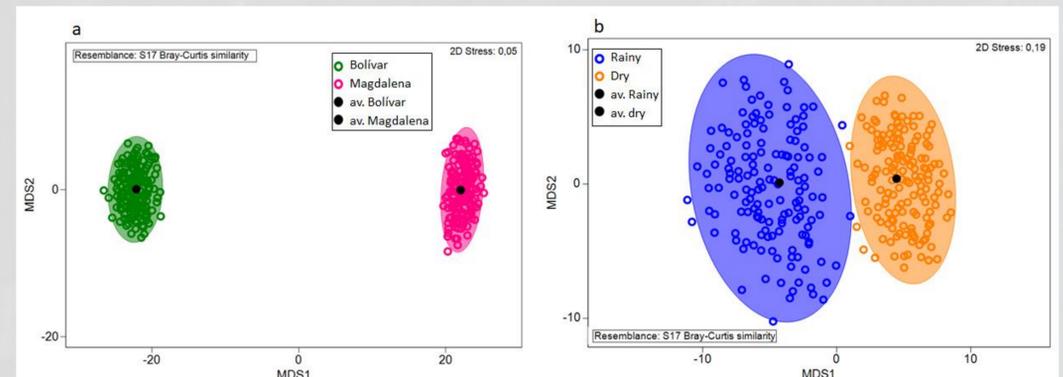


Fig 5. MDS of bootstrap averages for fish assemblage of (a) regions (Bolívar in green and Magdalena in pink) and (b) climatic periods (rainy in blue and dry in orange). The symbols' position represent the position of centroids per bootstrap, with dark symbols being averages and shaded areas the 95% confidence intervals.

Concluding remarks

The structure of the fish assemblage varies significantly spatially between regions (PERMANOVA, Pseudo- $F_{1,211} = 38.39$; $P = 0.001$) and temporally between periods (PERMANOVA, Pseudo- $F_{1,211} = 3.01$; $P = 0.001$) and years (PERMANOVA, Pseudo- $F_{4,211} = 4.44$; $P = 0.001$), except between 2017 and 2018, and 2019 and 2020. In Bolívar the species richness ($r_{13} = -0.62$; $P = 0.017$) was significantly negatively influenced by lionfish presence, whereas the abundance was not significant ($r_{13} = -0.10$; $P = 0.720$). In Magdalena, the relationships between lionfish presence and species richness and lionfish presence and abundance were positive but not significant ($r_{12} = 0.47$; $P = 0.101$ and $r_{12} = 0.48$; $P = 0.09$ respectively).

References

- Acero P., A., D. Bustos-Montes, P. Pabón Quintero, C.J. Polo-Silva y A. Sanjuan-Muñoz. 2019. Feeding habits of *Pterois volitans*. A real threat to Caribbean coral reef biodiversity. Coastal Research Library. 269-314.
- Albins, M. y M. Hixon. 2008. Invasive Indo-Pacific lionfish *Pterois volitans* reduce recruitment of Atlantic coral-reef fishes. Marine Ecology Progress Series, 367 : 233-238.
- Muñoz, R.C., C.A. Currin y P.E. Whitfield. 2011. Diet of invasive lionfish on hard bottom reefs of the Southeast USA: Insights from stomach contents and stable isotopes. Marine Ecology Progress Series, 432 : 181-193.
- 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): 443-449.