



The status and management of the lionfish, *Pterois* sp. in Trinidad and Tobago



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ABSTRACT

Trinidad and Tobago was the last Caribbean island to be invaded by the lionfish and since its invasion in 2012 they have spread to most coral reef and hard bottom environments. Standard reef fish surveys were used to assess lionfish population densities and size distributions from 2013–2015. Total lengths ranged between 6.2–40.4 cm and 2.2–950 g in weight. The length-weight relationship was described by $W = 0.0002 L^{2.5654}$. Fish densities were highest in the northeast Tobago at 326 lionfish/ha and the lowest in the southwest Tobago at 10.5 lionfish/ha. In order to curtail the spread of this invasive species, a culling programme was initiated at selected reefs to regularly remove lionfish at monthly intervals. On the selected reefs 26–30% reduction in mean lionfish biomass and 25–27% reduction in abundance was noted compared to control sites ($p < 0.05$).

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1. Introduction

The rapid proliferation of the Indo-Pacific Lionfish (*Pterois* spp.) throughout the northern Atlantic Ocean and Caribbean Sea has made this invasive species one of the newest emergent threats to already stressed Caribbean coral reefs (Green et al., 2013). The lionfish was first observed off the southeastern coast of Florida in 1985 (Morris and Akins, 2009; Betancur-R et al., 2011). Since then the lionfish population has steadily increased; and over the last 15 years they have been firmly established throughout much of the US east coast, Gulf of Mexico and the entire Greater Caribbean (Gonzalez et al., 2009; Aguilar-Perera and Tuz-Sulub, 2010; Schofield, 2010; Côté et al., 2013). By 2010 lionfish were reported as far south as Venezuela (Lasso-Alcalá and Posada, 2010), and in 2012 Trinidad and Tobago was the last of the Caribbean nations to be invaded by the lionfish (USGS, 2014). Most recently in 2015, the first lionfish sighting was recorded in south Brazil, an occurrence previously thought to be unlikely due to the substantial barrier that the discharge of the Amazon and Orinoco Rivers represents to dispersal between the Caribbean and the coast of Brazil (Luiz et al., 2013). However, this recent invasion has been genetically linked to the invasive Caribbean population (Ferreira et al., 2015), likely due to natural larval dispersal from the Caribbean.

The rapid success of the lionfish invasion has been attributed to a number of factors including the fish's voracious appetite, its high fecundity (Morris, 2009), rapid life cycle (Denney et al., 2002) and tolerance of a wide range of environmental conditions such as temperate hard bottoms (Whitfield et al., 2002, 2007); shallow and mesophotic coral reefs (Albins and Hixon, 2011; Biggs and Olden, 2011; Lesser and Slattery,

2011); seagrass beds (Claydon et al., 2012); mangroves (Barbour et al., 2010); and estuarine rivers (Jud et al., 2011). Moreover, a scarcity of natural biological controls such as predators, parasites or disease; coupled with the resilience displayed by the lionfish as an invasive species has generated legitimate ecological and economic concerns (Morris, 2012).

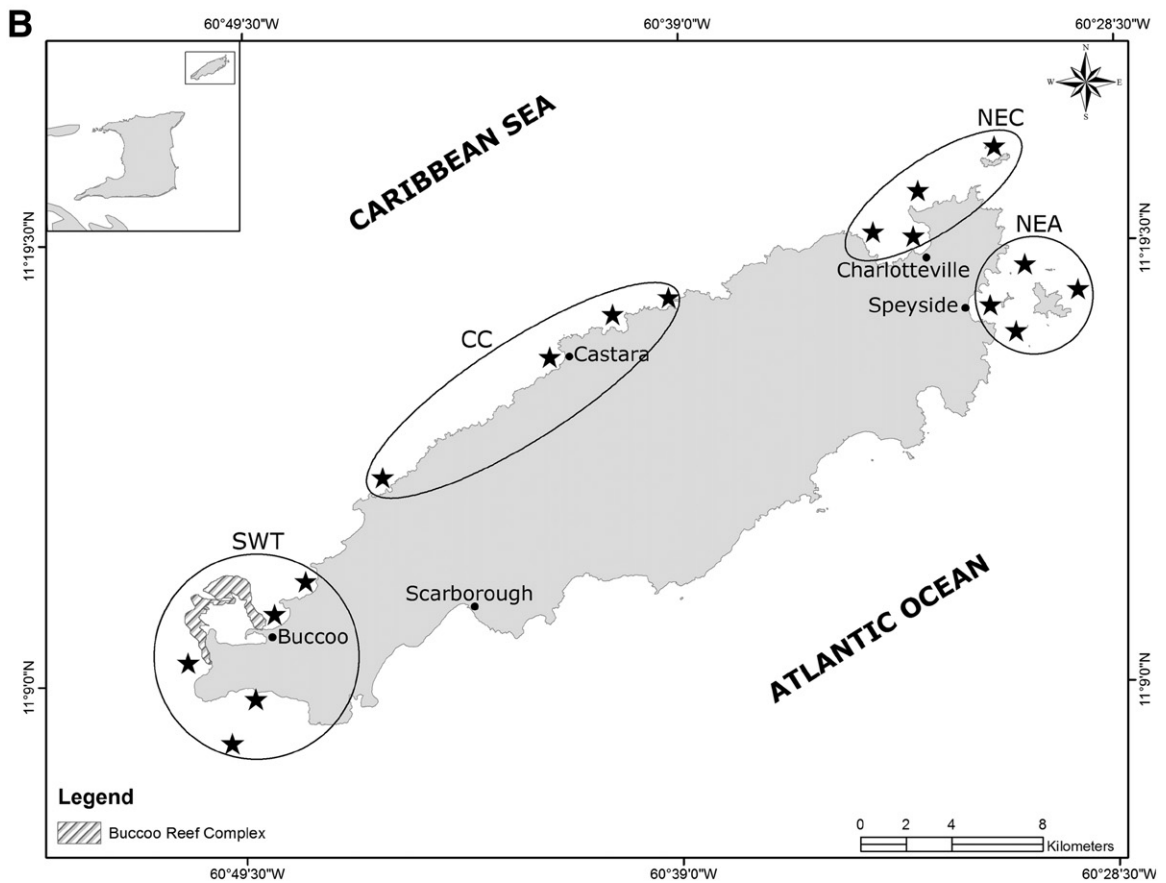
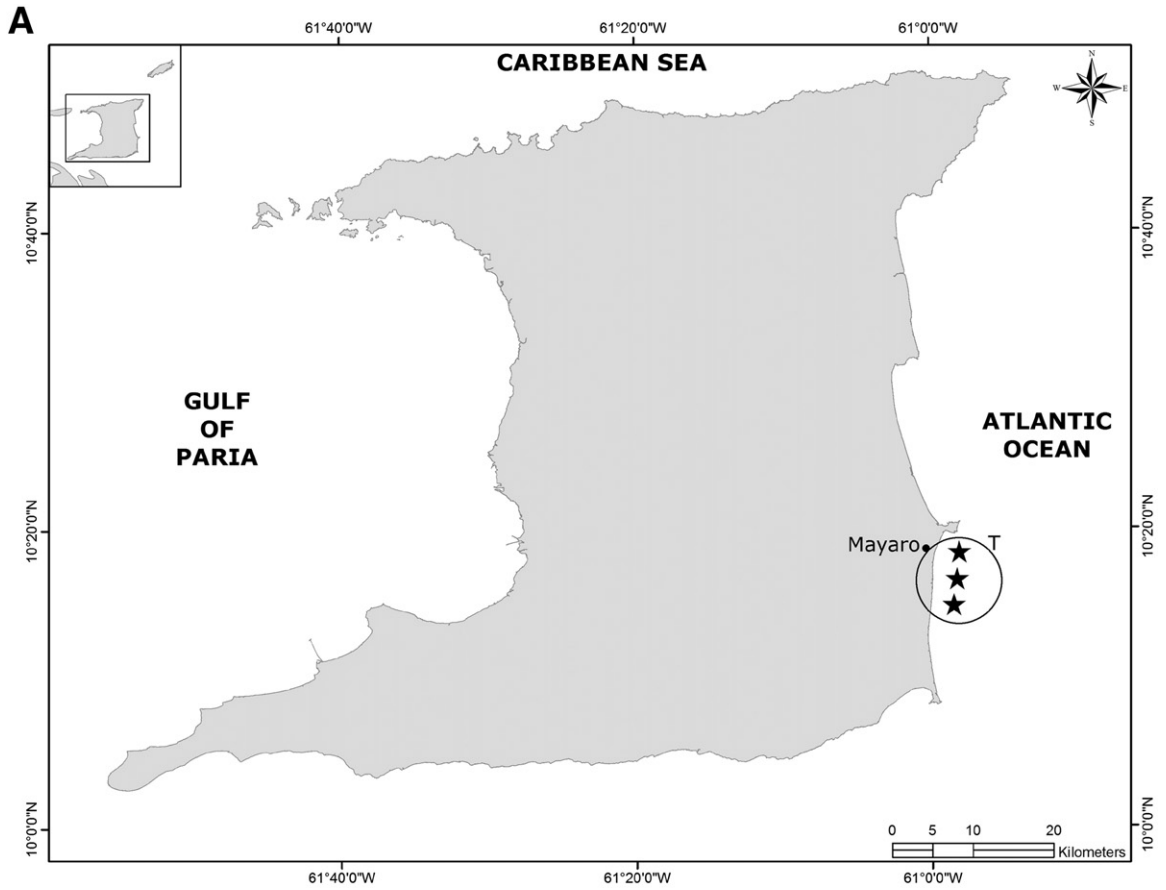
In lieu of natural controls and in response to increasing concerns about the potential environmental and socio-economic impacts of the lionfish on Trinidad and Tobago, local managers have employed a number of control measures. This included fishing derbies, monthly culling, food expos and tournaments. Guided by successes and lessons learned from other Caribbean nations, an ad hoc management plan for Trinidad and Tobago was developed and implemented, and has achieved varying degrees of success. This study presents the first assessment of the status of the lionfish population in Trinidad and Tobago and the evaluation of these control measures to slow the impact of this invasive species.

2. Materials and methods

2.1. Site Description

Lionfish were collected from hard bottom environments around Trinidad and Tobago at depths ranging between 10 and 40 m over the period July 2013 to July 2015. Sampling sites were grouped into five sub-regions for analysis: T = Trinidad, SWT = Southwest Tobago, CC = Central Caribbean Tobago, NEC = Northeast Caribbean Tobago and NEA = Northeast Atlantic Tobago (Fig. 1). The Trinidad sub-region is located on the Atlantic coast of the island Trinidad and was characterised by a relic reef forming a hard bottom with rocky outcrops. The underwater topography of Tobago is characterised by two extremes with a gradient of topography between the southwest and northeast of

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