

Does Removal Work? A One Year Comparison of Lionfish Removal Efforts at Klein Bonaire

¿Funciona el Cese? A Una Comparación Interanual de los Esfuerzos de Eliminación de Pez León en Klein Bonaire

Est-ce que les Travaux D'enlèvement? A Une Comparaison des Efforts D'élimination Lionfish à Klein Bonaire ans

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EXTENDED ABSTRACT

The Indo-Pacific lionfish (*Pterois volitans*) is an invasive marine predator now confirmed in all islands throughout the Caribbean region (Morris 2012, REEF 2012). Lionfish signify the first marine fish invader from the Western Pacific to the Atlantic and are believed to have been introduced via intentional and/or unintentional aquaria releases (Morris 2009). Lionfish are adaptable to many habitats and have colonised areas ranging from 1 to 140 m on reef walls, patch reefs, rocky areas, hard bottoms, ledges, crevices, mangrove creeks, isolated coral heads, blue holes, ship wrecks, and man-made structures (Coris 2009). Lionfish tend to live in small groups as juveniles and during reproduction but disperse and hide in reef shadows when they are adults (Fishelson, 1997). Lionfish are principally piscivorous but are known to feed on invertebrates (Morris 2009, Morris and Akins 2009). In their native range they occupy the higher levels of the food chain (Hare and Whitfield 2003, Bervoets 2009).

Their generalist diet coupled with their high growth, reproductive and feeding rates make them one of the worst marine invaders of all time. Lionfish were first confirmed in Bonaire on October 26th, 2009 (BNMP 2010, NACRI 2010, de Leon et al. 2011). Since then an extensive removal program has been established and is especially successful due to the ease of accessibility via shore diving in Bonaire. However Klein Bonaire, which is only accessible via boat, receives a significantly lower hunting pressure. Thus this project was warranted in order to determine whether lionfish were in higher densities in a less-hunted area and also if there were differences in their feeding, reproductive and general ecology.

A study was conducted in 2012 whereby the entire coastline of Klein Bonaire was surveyed via boat trips utilising a group of volunteer divers. Divers were distributed at each site at various depth profiles to ensure the entire reef was surveyed. Whilst diving, hunters would remove all lionfish where possible and keep track of lionfish depth, aggregation and behaviour on the reef. Following the dive, all lionfish were measured, weighed and dissected so that their stomach contents and reproductive condition could be analysed. Volumetric analysis was subsequently conducted in the laboratory on identifiable prey items found in stomach contents. A year later, this study was repeated to determine the effectiveness of removal efforts, and whether the removal efforts were actually making a difference to the lionfish population.

In 2012 after 150 divers spent 5136 minutes underwater, a total of 2240 lionfish were seen with 893 actually being caught (Table 1). However, in 2013, there was a 60% decline in the number of lionfish seen (854) with 542 being caught. Traditional invasive species management theory suggests that the longer an invasive species persists in an area, the more difficult it will be to control (Simberloff 2000). However efforts in Klein Bonaire suggest the contrary since there was an increase in the efficiency of hunting from a successful capture rate of 40% in 2012 to 65% in 2013 (Figure 1). This study revealed that continuous removal of lionfish is key to their control and shows that lionfish removals, even by volunteers, can make an instrumental difference.

Table 1. Comparison of removal efforts at Klein Bonaire

Year	Total # Divers	Total Bottom Time (min)	Total # Lionfish Missed	Total # Lionfish Caught	Total # Lionfish Seen
2012	150	5136	1347	893	2240
2013	154	5090	312	542	854

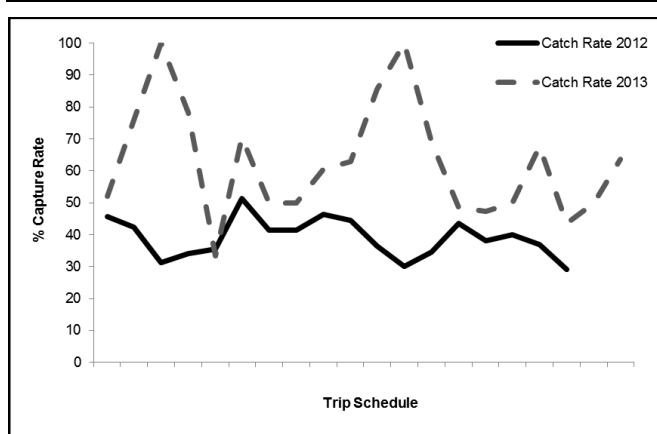


Figure 1. Comparison of the efficiency of lionfish capture in Klein Bonaire.

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