

Has the lionfish invasion of The Bahamas resulted in the predicted negative consequences to the fisheries sector?

¿La invasión del pez león a las Bahamas ha tenido las consecuencias negativas previstas para el sector pesquero?

L'invasion du poisson-lion aux Bahamas a-t-elle eu les conséquences négatives prévues pour le secteur de la pêche ?

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Located to the North of the Insular Caribbean, The Bahamas is a country of over 700 islands and cays, spread over more than 150,000 km² of water. Approximately 30 islands are inhabited, with 70% of the population residing on the island of New Providence (Bahamas Government 2010). Fishing has always been an integral part of Bahamian culture, leading to the evolution of a fishing industry that makes a sizeable contribution to the economy and employment. Several reef-associated species are of particular cultural and economic value, such as the spiny lobster, queen conch, lane snapper and Nassau grouper (Sherman et al. 2018). In 2019, the ex-vessel value of fish and fishery products accounted for USD 62.5 million, of which New Providence contributed approximately 50% (Bahamas Government 2019). Of great concern to this fishery was the introduction of the non-native Indo-Pacific lionfishes (*Pterois miles* and *Pterois volitans*), into the Wider Caribbean Region in 1985, due to the potential cultural and economic impacts on the Bahamian fisheries sector. In 2004, the first confirmed sighting of lionfish was made in Bahamian waters, and research conducted in the relatively early stages of the Bahamian invasion painted a doom-and-gloom scenario with [dismal projections for the future of the island's reef-associated fisheries](#). The primary aim of this research is to address the existing knowledge deficit regarding the status of lionfish in The Bahamas by assessing the impacts (positive or negative) that lionfish have had on Bahamian fishers to determine whether the early projections have come to pass.

The research was focused on the island of New Providence due to accessibility and its significant contribution to national fisheries landings. Secondary data were collected via a comprehensive literature review of journal articles, grey literature reports, newspapers and social media inter alia, whilst primary data were collected via a survey (questionnaire). The survey was utilised to collect quantitative and qualitative data from fishers throughout February 2021. Surveys were administered via phone and face-to-face interviews, as well as online using Google Form (catering to the COVID-19 pandemic and the high mobility of fishers). Face-to-face interviews were conducted at four landing sites around New Providence (Coral Harbour, Arawak Cay, Potter's Cay Dock and Montagu Ramp). Data collected from the questionnaires were compiled and analysed using Microsoft Excel.

A total of 49 documents were reviewed and 178 fishers were surveyed. The majority of the fishers (69%), whose roles included boat captain, first mate and diver, were experienced fishers who possessed >15 years of experience. The fishers utilised four main fishing grounds, with the Great Bahama Bank being utilised most frequently. Fishers utilised a range of gear types (most utilised: Hawaiian sling and spear/ lobster hooker) to catch a variety of target species (most targeted: snapper, lobster, grouper and conch). Fishers reported that 15+ years after the first confirmed sighting, lionfish have now established within each of the major fishing grounds of The Bahamas. However, most fishers (65%, n = 109) report lionfish densities to be low (>10 per fishing trip), based on sightings and catches. While lionfish are observed/caught at depths ranging from <10 m to >30 m, the majority of fishermen reported higher abundances in shallow water (<10 m). Regarding lionfish size, the majority of fishers (72%, n = 128) indicated observing/catching lionfish of mixed sizes (i.e. ranging from <10 cm - >20 cm).

Fishers stated that they had not been given any incentives to target lionfish, but most fishers agree that more effort is needed within the sector to harvest lionfish. The majority of fishers (80%, n = 99) indicated no recognisable changes in the abundance of high economic value species, such as lobster, grouper and snapper, within their catches. Most fishers (80%, n = 123) expressed not experiencing any additional opportunities due to the arrival of the lionfish, while 52% (n = 178) reported the lionfish as not having any impact (whether positive or negative) on their livelihoods (Figure 1A). For fishers that reported an impact, some identified those impacts as being negative (decreases in amount of target species caught, sizes of target species and earnings) and/or positive (opposite of negative impacts) (Figure 1B). Of note, is the reported observed potential spatial competition between lionfish and lobster for suitable shelter, leading to declines in lobster densities in the presence of lionfish and significant retained bycatch of lionfish in lobster traps (Henderson and Côté 2012, Gittens 2017, personal communication with fishers). Regarding catches, 67% of fishers (n = 178) reported catching lionfish, with the majority intentionally catching lionfish (Figure 1C). Caught lionfish are primarily killed and discarded or consumed, but approximately 20% of the fishers reported selling them (Figure 1D). One of the major reported challenges to the sale of lionfish is the public's perception that lionfish are poisonous and cannot be consumed. Regarding the health threats posed to fishers due to the venomous spines of the lionfish, approximately half of the fishers reported being envenomated by lionfish with the most common symptoms experienced being pain and swelling which were primarily self-treated (i.e. through the

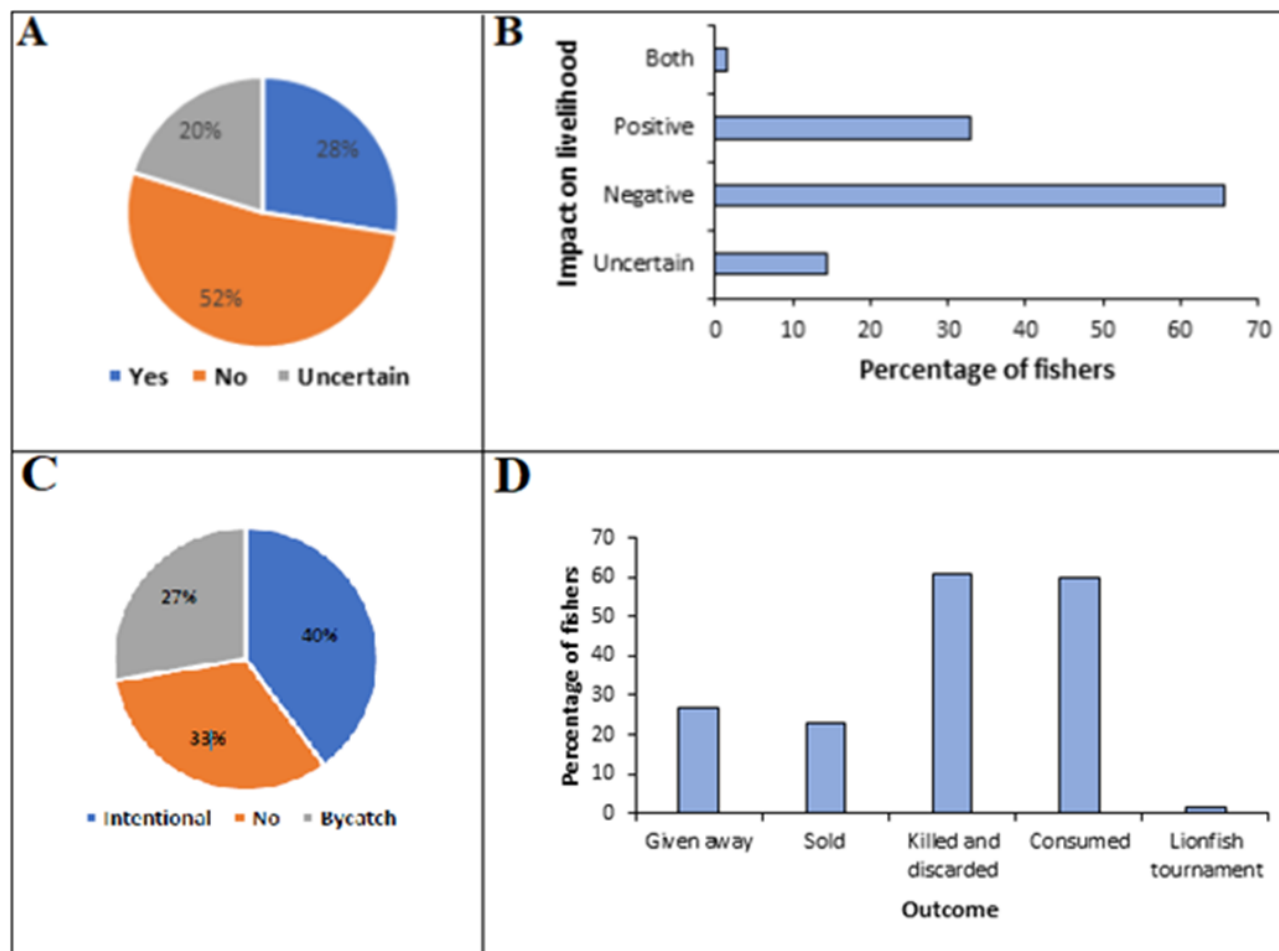


Figure 1. A - Fishers' perceptions regarding impacts of lionfish on livelihood (n=178), B – Quantification of impact type for those fishers identifying an impact (n = 178), C – fishers' indication of catching lionfish (n = 178) and D – fate of caught lionfish (n = 130)

use of home remedies). Most fishers (88%) indicated a willingness to participate in a lionfish fishery, primarily if demand increased and adequate training was provided pertaining to handling techniques.

The fishing industry is essential to the Bahamian economy as a source of earnings, nutrition and employment (Sherman et al. 2018). The importance of the Great Bahama Bank was identified, where typical gear like nets and fish pots are used to capture snappers, groupers or other demersal fish, and lobster traps and the Hawaiian sling and spear used to catch lobsters. Overall, it appears that the doom-and-gloom scenario painted by researchers during the early stages of the invasion has not been realised. The predominant lack of reported negative impacts, especially to fisher livelihoods and commercial species, refutes the dismal projections made regarding the future of the island's reef-associated fisheries. It must however be noted that subtle changes in fish sizes (decreases), distance travelled for fish (increasing) and catch per unit effort (decreases), inter alia, may not be readily noticeable by fishers and thus underscores the need for regular long-term monitoring to accurately assess the

impacts of the lionfish.

The relatively low reported densities as well as declines in initial densities (Benkwitt et al. 2017) suggest that the current measures in place (intentional capture by fishers and through organised derbies as well as unintentional capture) are helping to prevent the realisation of the early predictions. Interestingly, greater abundances were reported at shallower depths, however, this may be a consequence of where surveyed fishers fish and not necessarily an indication of lionfish concentrations. Nevertheless, accessibility along with a seeming lack of deterrent by fishers after envenomation, a willingness to participate in a lionfish fishery (providing safe handling techniques are taught) and the current lack of incentives provided suggests a potential opportunity for fishers if demand increases and a fishery is developed. To this end, there is a significant need for further research and monitoring, as well as focused public awareness and education programmes for the citizens and fishers of The Bahamas.

KEYWORDS: invasive species, lionfish, The Bahamas

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