

NATIONAL LIONFISH RESPONSE PLAN



Department of Marine Resources
The Commonwealth of The Bahamas



The Bahamas
2009

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Abaco

Moore's Island
Grand Bahama
Exuma
Mayaguana
South Andros
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Ministry of Tourism
(Grand Bahama)

Department of Public Health

Royal Bahamas Defence Force

Port Department

The Bahamas National Trust

The Nature Conservancy

Bahamas Reef Environment Educational Foundation

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MISSION

The mission of The National Lionfish Response Plan is to maintain the distinctiveness and diversity of Bahamian marine communities, protect commercially important fisheries, safeguard public health, and reduce the growth and spread of lionfish populations.

BACKGROUND

The Bahamas has been faced with the challenge of combating the Indo-Pacific lionfish for some five (5) years since its first documented sighting in 2004. It is estimated that their populations doubled within the years 2004 to 2006. Scientists have been working to determine the source from which the lionfish was introduced to the Western Atlantic. The most commonly held belief is that the invasion is the result of intentional and unintentional aquarium releases. Lionfish are highly favored as an aquarium item, with some 80,000 specimens imported to the US in 2007 for this purpose. Transport via ballast water is a possible route of entry but is not considered the main vector of introduction.

Lionfish are now located on every island group in The Bahamas, in a range of habitats and depths, as great as 472ft, with higher concentrations on or near artificial structures. The invasion should not solely be a concern for The Bahamas, as the eastern coast of the United States (Florida to Rhode Island) have been seeing the spread of this species from the 1990's. Currently, lionfish have been sighted in other parts of the region including Bermuda, The Turks and Caicos Islands, Cuba, Jamaica, The Cayman Islands, Belize, Mexico (Cancun), The Dominican Republic, Puerto Rico, St. Croix and Columbia.

The lionfish invasion is a major cause of concern to The Bahamas for several reasons. These include:

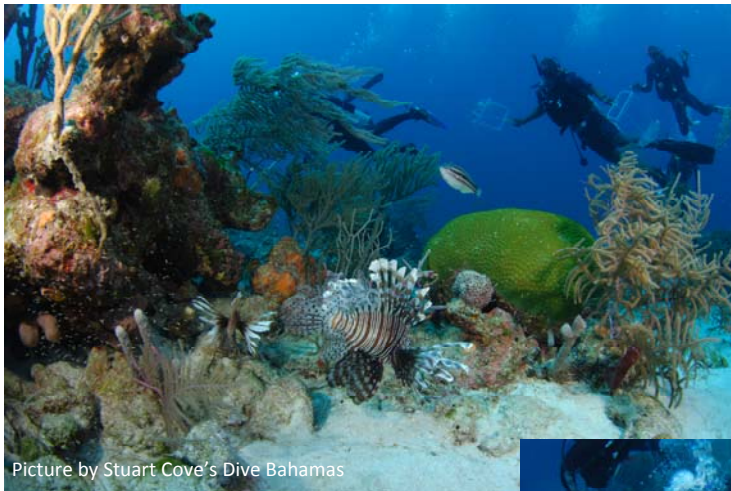
- 1) The threat to human health from the venomous spines as they can cause extremely painful injuries, additionally it is unclear what effects envenomation (being stuck by a venomous spine) has on persons with pre-existing health conditions, as well as from multiple envenomations;
- 2) Their ambush style of predation allows them to compete very successfully with, or in some cases out-compete native species;
- 3) Lionfish now prey on a number of species that are direct targets in the commercial fishing industry. This sector of the economy contributes some 4% to the Gross Domestic Product (GDP);
- 4) There are few true known predators, as only isolated documented cases of predation on lionfish in this region exist.

The College of The Bahamas Marine and Environmental Studies Institute (COB-MESI), in collaboration with the Department of Marine Resources initiated a long-term National Lionfish Response Plan that involves local and regional partners including; 1) Building research and information management, 2) Building Outreach and Education Initiatives, 3) Financing and

identifying resources and 4) Developing Invasion Policies and Regulations. All components work in accord to implement an efficient management plan.

An online survey, managed by COB-MESI, was implemented in 2007 to offer the general public the opportunity to report lionfish sightings allowing information to be collected that contributes towards the understanding of past, current and future distribution of lionfish. This information has assisted the Department of Marine Resources in reviewing the current Fisheries Regulations to accommodate ways in which lionfish can be removed, particularly from areas where they are most concentrated, in an effort to control their population.

To formalize a response plan, The Department of Marine Resources, in collaboration with the College of The Bahamas Marine and Environmental Studies Institute, spearheaded a 2-day National Lionfish Response Planning Workshop from November 6th – 7th, 2008 consisting of 41 participants from 16 stakeholder organizations. The workshop entailed presentations on several aspects of lionfish, (lionfish ecology & regional initiatives, first aid procedures, sighting survey, proposed fisheries legislation amendments and collection handling & shipping procedures), breakout discussions to prioritize management goals and strategies, and hands-on training for 16 participants to safely collect, handle, dissect and clean lionfish for consumption.



Picture by Stuart Cove's Dive Bahamas

Lionfish on coral reefs with workshop participants with nets in background.

Workshop participants transferring lionfish from nets to collection bags.



Picture by Stuart Cove's Dive Bahamas

MANAGEMENT GOALS

Stakeholders assessed and ranked all management goal options. Each goal may have different consequences and associated costs for each stakeholder group, and each goal would also have a time-frame, with short-term and long-term strategies. From each goal, strategies and action responsibilities could be developed for each stakeholder group.

TABLE 1: Invasive Species Management Goals in NATIONAL LIONFISH RESPONSE PLANNING WORKSHOP, 6-7 November 2009.

<u>Government and Regulatory Management Goals</u>	<u>Workshop assessment of Probability, Possibilities and Risks</u>	<u>STAKEHOLDERS' RANKING</u>
M1: No Action	<i>Easy and low cost to implement, but likely will lead to many uncoordinated stakeholder actions. Stakeholder group with the greatest concern would de facto become the planner and implementer.</i>	VERY LOW PRIORITY, with some groups not considering this as an option
M2: Actively remove or eradicate Lionfish from selected areas of interest, such as popular beaches and marine parks.	<i>With public health and human safety a key issue, this goal would seek to minimize the contact between lionfish and vulnerable populations (e.g. beachgoers, tourists). There may be an assumption that lionfish could be most easily removed from protected (un-impacted) park areas. Management of lionfish within parks may lead to new technologies to apply to wider scale eradication in the future. The selective eradication in areas could lead to an overall reduction in lionfish populations.</i>	HIGH PRIORITY FOR IMMEDIATE IMPLEMENTATION
M3: Eradication and Complete removal of Lionfish from all Bahamian waters	<i>Full eradication of invasive species is costly, long-term and strategic. It involves eliminating any new sources of lionfish, then strategies to remove fish at high densities, followed by strategies to remove fish once they become rare or scarce. There is a high risk that resources can be spent with no results. This options requires regional partnerships and cooperation. Some stakeholder groups do not think this goal is realistic; but new research or technology developments may change the options for total eradication in the future.</i>	HIGH PRIORITY FOR MEDIUM TO LONG TERM IMPLEMENTATION
M4: Develop and Manage an Indo-Pacific Lionfish Fishery	<i>Some stakeholders believe that lionfish could be a high-income fishery; however there is debate on the role of government in developing the markets and fishing capacity to exploit this resource. This goal is different from but partially compatible with the total eradication, and this goal may receive more resources if total eradication fails.</i>	MEDIUM TO LOW PRIORITY FOR IMMEDIATE IMPLEMENTATION

STAKEHOLDER GROUP CONTRIBUTIONS

Each stakeholder group would take a lead role in one of four components: 1) Financing and identifying resources; 2) Building Research and information management; 3) Outreach and Education Initiatives; and 4) Developing of Policies and Regulations. Potential to contribute to each component is ranked HIGH, MEDIUM, LOW or NONE based on stakeholder discussions.

TABLE 2: Invasive Species STAKEHOLDER RESPONSIBILITIES from NATIONAL LIONFISH RESPONSE PLANNING WORKSHOP, 6-7 November 2009.

STAKEHOLDER GROUP	CATEGORY	DESCRIPTION	Ability to contribute			
			FINANCIAL SUPPORT	RESEARCH AND INFORMATION ANALYSES	EDUCATION AND PUBLIC OUTREACH	MANAGEMENT REGULATION
Grand Bahama Port Authority	Pseudo-government Authority	<i>Local responsibility for Freeport environs and Freeport Harbour, needs to be part of national initiatives</i>	MED	LOW	MED	LOW
Local Government	Government - elected councilors	<i>Local government responsible for the management of Family Island settlements, some with oversight of harbours and ports</i>	LOW	LOW	MED	LOW
Bahamas Environment, Science and Technology (BEST) Commission	Government agency	<i>Commission charged with enforcement of international treaty obligations and advisement on environmental issues, now part of the Ministry of the Environment. BEST can access regional or international funds to facilitate</i>	MED	MED	LOW	HIGH
Department of Agriculture	Government agency	<i>Department charged with the permitting and regulation of imported pets and animals</i>	LOW	MED	LOW	HIGH
Department of Marine Resources	Government agency	<i>Department charged with the management and protection of marine resources, especially fisheries.</i>	MED	HIGH	MED	HIGH
Ministry of Education	Government agency	<i>Ministry responsible for curriculum and educational initiatives, can play a key role in long-term public awareness of invasive species and relating environmental protection to public</i>	MED	LOW	HIGH	MED
Royal Bahamas Defense Force	Government agency	<i>Responsible for national security, and intercepts foreign fishing vessels in the country; can assist with diving, coastal clean up and outreach programmes.</i>	MED	LOW	MED	LOW
Department of Ports	Government agency	<i>Department charged with management of the major national ports and enforcement of IMO policy and treaty obligations.</i>	HIGH	LOW	LOW	MED
Ministry of Tourism	Government agency	<i>Ministry responsible for the promotion and support of the tourism industry of The Bahamas.</i>	HIGH	LOW	HIGH	MED
Public Hospital Authority	Government agency	<i>Responsible for emergent health care and treating medical conditions in public health network.</i>	MED	MED	HIGH	MED
Department of Public Health	Government agency	<i>Responsible for preventative health care and public health issues.</i>	LOW	MED	HIGH	MED

Bahamas National Trust	Non-Government Organization	<i>Non-government organization with legal mandate to manage national parks and protected area.</i>	HIGH	HIGH	HIGH	MED
Bahamas Reef Environmental Education Foundation (with NOAA-NMFS partnership)	Non-Government Organization	<i>Non-government organization with mission to support marine environmental education and citizen action to protected coastal wetlands and reefs.</i>	MED	MED	HIGH	MED
The Nature Conservancy (North Caribbean Programme)	Non-Government Organization	<i>Non-government organization with international partners, can help with development of policy options and regional collaborations.</i>	HIGH	HIGH	HIGH	MED
Bahamas Dive Association	Private Commercial	<i>Trade organization of Diver Operators in the Bahamas; can benefit from intrinsic dive attractions (lionfish hunts or viewing lionfish). Concerns with economic and safety impacts.</i>	HIGH	MED	MED	MED
Fish Sellers and Processors	Private Commercial	<i>Diverse group that may be motivated by both economic benefits of harvesting lionfish and by safety issues. May need specialized training or information on handling lionfish.</i>	LOW	LOW	LOW	MED
Hotel Owners, Resort Operators	Private Commercial	<i>Includes resort attractions including Dolphin encounters, eco-tours, etc that bring clients in contact with marine resources, or have interest in status/ safety of marine resources.</i>	HIGH	LOW	MED	LOW
Bahamian Public	Private Individuals	<i>Mostly urbanized population on New Providence, large proportion used beaches, especially during the summer.</i>	LOW	NONE	LOW	NONE
Tourists and Foreign visitors	Private individuals	<i>Diverse group; People with limited local knowledge or experience in the country short-term. Beachgoers, Divers and fishers.</i>	MED	NONE	NONE	NONE
Fishermen - Commercial & recreational	Private; Organized by island or settlement	<i>Broad diverse group of fishers across the archipelago, includes commercial, occasional and recreational fishermen.</i>	MED	NONE	LOW	NONE
College of The Bahamas - Culinary and Hospitality Management Institute	Tourism education and Training	<i>Train young chefs in lionfish preparation and support cooking competitions to use the invasive fish.</i>	LOW	LOW	MED	LOW
College of The Bahamas - Marine and Environmental Studies Institute	Research Unit	<i>Institute within the National Tertiary Institution with responsibility for research related to marine resource management and training undergraduates; can propose policy options and survey stakeholder opinions.</i>	LOW	HIGH	HIGH	MED
Foreign Research Permit Holders	Research Unit	<i>International Universities and Research Institutes with interest and funding to work on systems in The Bahamas.</i>	HIGH	HIGH	LOW	NONE

MANAGEMENT STRATEGIES BASED ON GOALS

HIGH PRIORITY: (Immediate implementation 1-2 years)

- 1) Recommended **amendments to existing fisheries regulations** to:
 - i. Allow spear fishing for lionfish only within the 1 mile (New Providence) and 200 yards (Family Islands) limits.
 - ii. Allow unlimited bag of lionfish limits for persons fishing with a sportsfishing permit per vessel.
 - iii. Allow fishing tournaments for lionfish and organized dive groups to remove lionfish by use of SCUBA, spears and nets.
- 2) **Encourage commercial fisheries** based on lionfish. This includes supporting efforts to educate fishers on techniques to clean and prepare lionfish, in addition to educating the general public and visitors on lionfish as a fishery source to create a demand.
- 3) **Expand and improve protection of National Parks and Marine Reserves.** A well established network of parks and reserves can represent marine environments with no fishing, and active coastal management which includes active removal of lionfish and monitoring within marine protected areas.

MEDIUM PRIORITY: (3-5 years of implementation)

- 4) Require the **removal of marine debris or artificial substrates** around docks, piers, harbours and beaches. These provide habitats for lionfish.
- 5) **Improve coastal zone management**, particularly land based sources of pollution, and coastal alteration that degrade natural coastal environments.

LOW PRIORITY: (6 – 10 years of implementation)

- 6) **Ban lionfish as aquarium pests** and restrict possession or transport of live lionfish. Since the most likely vector of introduction of lionfish to the Western Atlantic Ocean is by aquarium releases, this option tends to minimize re-introductions of lionfish.

Bounty for fish killed and turned in was discussed, but the consensus was that the disadvantages outweighed the advantages, with major issues being the amount of funding required, possible impacts to other fishery resources.

Advantages:

- 1) Could result in rapid removal of lionfish especially from targeted areas.
- 2) Popular with some stakeholder groups (i.e. fishers and commercial diver operators).

Disadvantages:

- 1) The administration and management of a bounty program would be too problematic overall.
- 2) Would require significant human and financial resources to implement.
- 3) May impact ability to gather scientific and research information on the lionfish.
- 4) Removal efforts would cease once the monetary incentives were exhausted.
- 5) It would be difficult to administer such a program in all parts of The Bahamas.

Building Research & Information Management:

Based on the high priority goals, research needs could be identified and marketed to research partners. Example of the types of research information needed to inform management decisions, and the likelihood of generating the information on a national level are ranked.

TABLE 4: Invasive Species INFORMATION NEEDS AND RESEARCH GAPS from NATIONAL LIONFISH RESPONSE PLANNING WORKSHOP, 6-7 November 2009.

<u>Research and Information Management Goals</u>	Requirements in term of time and resources	Extent of Bahamian lead or participation
S1: DISPERSAL OCEANOGRAPHY: Understand the mechanisms and rates for dispersal and recruitments	<i>Requires long term progression datasets and regional collaboration; requires sophisticated modeling, based on locally collected information from many countries.</i>	Regional participant
S2: ECOSYSTEM IMPACTS Understand impact of lionfish on the reef or shallow-water marine system from what they eat to predators to impacts on other species' abundance and occurrence	<i>Requires focused research on marine ecosystem, with hypo-thesis drive field work within the country to understand the specific ecological response on southern, northern islands, before or after major storms, developed or undeveloped areas.</i>	Nationally directed studies possible
S3: DEMOGRAPHICS: Understanding where lionfish are and how many are there? Spatial and temporal trends critical to assessment of management strategy successes	<i>Requires collecting, and managing information from many stakeholders, with some expertise in spatial statistics, and familiarity with local information sources.</i>	Nationally directed studies
S4: GROWTH AND REPRODUCTION: Understanding variability in the rates of growth and reproduction	<i>Requires large data sets of samples collected from fish.</i>	Nationally directed studies possible, also regional participant
S5: BIOCONTROLS: Understanding parasites, diseases or other control mechanisms that can impact the population dynamics of the invasive species	<i>Requires diverse scientific expertise, perhaps working in many different areas on mechanisms for biological control and their consequences.</i>	Regional participant

Lionfish research in The Bahamas:

- 1) Dr. Kathleen Sullivan-Sealey – COB-MESI; *Research support for National Response Plan to the Lionfish Invasion in Bahamian Waters.*
- 2) Nicola Smith, University of British Columbia; *"Do humans indirectly facilitate invasions? The role of artificial structures in the establishment of Indo-Pacific lionfish in Bahamian near-shore waters."*
- 3) James Morris – NOAA, Lad Akins – REEF, Andy Dehart, National Aquarium Institute and Bruce Purdy; *Reproductive Biology and Life History of the Lionfish.*
- 4) Stephanie Green – Simon Fraser University; *Predicting the Impact of Introduced Lionfish on Bahamian Reef Communities.*
- 5) Dr. Mark Albins and Mark Hixon – Oregon State University; *The Ecological Impacts of The Invasive Indo-Pacific Lionfish on Bahamian Coral Reef Communities.*
- 6) Krista Sherman – University of Southampton; *Stable Carbon and Nitrogen Isotope Analysis of the Red Lionfish (P. volitans) from Bahamian Waters.*

DEVELOPING INVASION POLICIES AND REGULATIONS

The establishment of an online sighting and distribution database, managed by COB-MESI, initiated the establishment of permanent monitoring sites for lionfish recruitment studies around New Providence as lionfish are mostly found on or near artificial structures both in offshore and near-shore waters throughout The Bahamas. Artificial structures includes anything from marine debris (car tires, pvc pipes, sunken boats, boat engines etc.) to dock, pilings and jetties.

The sighting survey is accessible for persons with internet access through the main page of The Bahamas Government's website (www.bahamas.gov.bs), and also through The Bahamas Reef Environment Educational Foundation (BREEF) website, (www.breef.org).

The information needed to complete the online sighting survey is as follows;

1) Name, 2) contact information, 3) date lionfish sighted, 4) island and location description where lionfish sighted, 5) approximate distance from shore, 6) approximate water depth, 7) habitat type, 8) approximate size of lionfish, 9) total lionfish observed in a single area 10) total number of lionfish caught/killed and 11) behavioural observations.

Stakeholder groups who receive sighting information can submit them directly to the online database, and should forward hardcopies to COB-MESI or DMR. Both entities are collecting lionfish from persons interested in bringing in specimens for the National Lionfish Specimen library. The library is housed at the Department of Marine Resources Food, Safety and Technology Laboratory. For shipping specimens from the Family Islands, refer to the Capture & Shipping Protocol.

BUILDING EDUCATION & OUTREACH INITIATIVES:

Many stakeholder groups should be capable of contributing to education and public outreach efforts for lionfish. There is a wide range of audiences (fishers, schools, hotels, tourist, restaurants/chefs, general public/Bahamians etc.) that should be targeted in many different ways to achieve this goal. Ideally, such approaches should be measured to determine if persons are aware of the presence, danger (venomous not poisonous) and first aid procedures in addition to the management goals to control the spread of lionfish.

Several stakeholders have already assisted in outreach and educational efforts via: Town meetings, Public Service Announcements, newspaper articles, talk shows (radio & TV), flyers and posters, demonstrations, school/group talks etc. It is important that these efforts be continued to reach all Bahamians and visitors.

All stakeholder groups involved in The National Lionfish Response Plan (NLRP) should develop a program based on the prioritized goals and strategies according to their organizational capabilities for the projects 4 components of 1) Building research and information management, 2) Building Outreach and Education Initiatives, 3) Financing and identifying resources, and 4) Developing Invasion Policies and Regulations.

A special thanks to the local organizations who have been assisting the Department of Marine Resources and The College of The Bahamas Marine & Environmental Studies Institute, by implemented programs that contributes to the mission and goals of the NLRP:

- 1) The Maillis Family—Education/Outreach on cleaning & preparing lionfish for consumption.
- 2) The Bahamas National Trust—series of town meetings throughout the Family Islands.
- 3) Friends of The Environment—co-sponsored town meetings in Abaco
- 4) Dolphin Encounters—educational talks, poster competition on invasive species in schools.
- 5) BREEF—school talks, flyers during the Nassau grouper closed season, and infomercials.
- 6) Stuart Cove’s Dive Bahamas— lionfish research and educational efforts.
- 7) Lionfish response team from various organizations who have assisting in collecting specimens for outreach initiatives with the DMR & COB-MESI (The Nature Conservancy, BREEF, Dolphin Encounters, Atlantis, The Maillis Family)
- 8) NISP partners (TNC, BEST, BNT & DMR) - Lionfish Pilot Program (All 4 project components).
- 9) Department of Public Health— Education (first aid treatment for lionfish)

Please forward all organizational activities and programs to the Department of Marine Resources to be included under the umbrella of the NLRP.

CD contains the following:

- ◆ National Lionfish Response Plan Full document
- ◆ National Lionfish Response Plan PowerPoint Presentation
- ◆ Lionfish collection & Shipping Protocol
- ◆ Lionfish 5 x 7 informational flyer
- ◆ Capture, Handling & Cleaning Brochure
- ◆ Bahamas Lionfish Sighting Survey Form

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