Invasive lionfish: What do we really know?

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http://www.ccfhr.noaa.gov/stressors/lionfish.aspx

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USGS science for a changing world

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Photo by Rich Carey


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Lionfish invasion history

- Two visually identical species of lionfish were introduced into the Atlantic via the US aquarium trade beginning in the 1980's.
- First documented as established off the coast of North Carolina in 2000.
- Widespread in the Southeast U.S., Caribbean, and invading the Gulf of Mexico.
- Expected to invade South America as far south as the northern coast of Argentina.

Morris and Whitfield 2009

Lionfish biology

- Live decades and reach sizes up to 47cm (19 inches).
- Inhabit all marine habitat types and depths (shoreline to over 1000').
- Venomous spines capable of deterring predators
- Temperature tolerance is approximately ~10 – 35C.
- Sexually mature in less than one year and spawn in pairs.
- A single female lionfish spawns over ~2 million eggs/year.
- Eggs are held together in a gelatinous mass and are dispersed by currents.
- Larval duration is ~25 days.

Lionfish ecology

- Can reach densities higher than 200 adults per acre.
- Generalist carnivores that consume >60 species of fish; many crustaceans.
- Feed during day and night; higher rate during the crepuscular periods.
- High affinity for structure but inhabit most marine habitat types.
- Prey are commercially, recreationally, and ecologically important.
- Native predators have been observed to exhibit avoidance for lionfish.
- Few parasites compared to native species.
- Exhibit site fidelity.

Lionfish Impacts -- Not just another stressor!

- Other stressors have occurred over long time scales – lionfish can cause high impacts in less than four years
- Scale of lionfish impacts is very large – extreme impacts to biodiversity
- Potential interactions with other stressors…
  - Climate change
  - Ocean acidification
  - Overfishing
  - Coral bleaching
  - Anthropogenic pollution

Lionfish ecological impacts

- Biodiversity and resilience of coral, hardbottom, and artificial reefs.
- Potential reduction of ecologically important species such as cleaners, herbivores, and forage fishes.
- Cascading impacts across food webs is possible (e.g., predation on herbivores, increased macroalgae, decreased coral biomass).
- Potential impacts to species of concern (Nassau grouper, Warsaw grouper, speckled hind, striped croaker, key silverside).
- The scale of ecological impacts is high in magnitude and geographically broad (North Carolina to the Caribbean and the Gulf of Mexico).
- Potential impacts on nursery areas (mangroves).

Socio-economic impacts

- Potential impacts to stock rebuilding efforts for commercially important species.
- Potential reduction of native species catch rates (e.g., lobster trap fisheries).
- Economic losses for commercial fishermen include loss of fishing days when envenomation occurs.
- Potential impact to tourism due to lack of diversity, reef health, and diving safety concerns.

Human health impacts

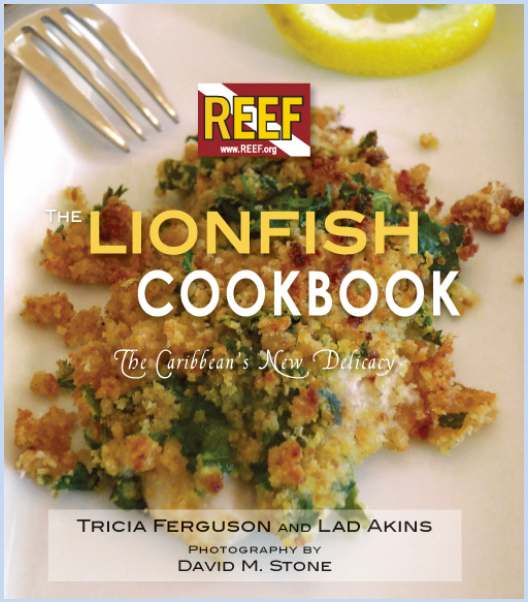
- Lionfish sting symptoms include tachycardia, hypertension, hypotension, seizures, chest pain, abdominal pain, swelling, pain, and subdermal necrosis at the sting site, and temporary paralysis to all extremities.
- Long term health impacts of repeated envenomations are unknown.
- High densities = high encounter rates.
- Envenomation risk to bathers/swimmers increases at locations with structure such as piers, breakwaters, and confined tidal swimming pools.

Control and management strategies

- Control plans that support sustained removals can significantly reduce local lionfish densities.
- Programs for local lionfish control include commercial harvesting as a food fish, sport tournaments, and adopt-a-reef and other citizen-based removal efforts.
- Based on current technology, lionfish eradication at the regional scale is likely not feasible given the expansive depths and geography of lionfish habitat.
- Proven capture methods include spearfishing, netting, and bycatch from traps and hook and line.

Eat Lionfish Campaigns

- Objectives: To encourage fishing pressure on lionfish in local areas and stimulate market development.
- Benefits – control in protected areas, locations with accessible reefs (i.e., some Caribbean islands), economic, and ecological.
- We do not believe that fishing pressure can reduce the entire lionfish population but can control in local areas.



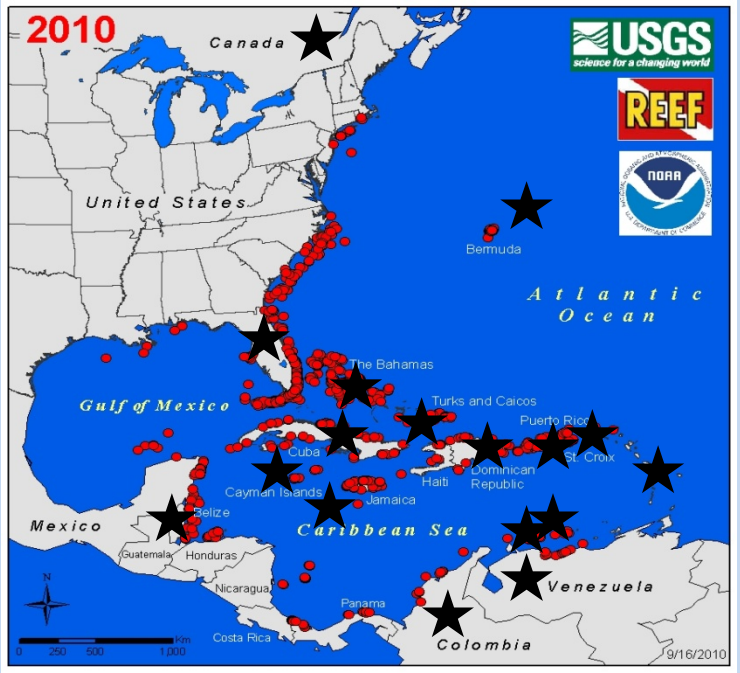
Credit Fred Lentz

What's happening domestically?

- H. Res. 132 Invasive lionfish
- NOAAs Lionfish Action Plan
- Puerto Rico - Fishing Regulation #7949, of 24 Nov. 2010. Article 22 - Special Dispositions for Lionfish
- US Virgin Islands – Lionfish Management Initiative bill underway in Senate
- NOAA National Marine Sanctuaries Response Plans

What's happening internationally?

- ICRI Regional Lionfish Workshop (Aug 2010, Cancun, Mx)
  - Broad attendance (16 countries)
  - Best practices discussion and scoping of a manual



International Coral Reef Initiative (ICRI)

Created an *Ad hoc* committee to "facilitate a coordinated response to the lionfish invasion in the Caribbean" (Nov 2010):

- Committee representation: ICRI, CAR-SPAW, Mexico, U.S., REEF, CABI
  - Build active participation
  - Disseminate best practices manual
  - Develop a regional lionfish strategy
  - Give lessons learned to other regions for ED-RR

Specially Protected Areas and Wildlife – Regional Activity Centre (SPAW-RAC)

•Passed a motion to promote "Participation in the development of a Caribbean regional response to the lionfish invasion." (Oct 2010)

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Mitigating the threats of invasive alien species in the insular Caribbean

Overview | Results | The team | Related information

So what's the problem?

Invasive species are plants, animals or microorganisms not native to an ecosystem, whose introduction is threatening biodiversity, food security, health or economic development. Islands, with their diverse but delicate ecosystems are particularly at risk from invasive alien species which can do great damage to the native biodiversity. In the Caribbean invasive alien species are a major threat to the vulnerable marine, freshwater and terrestrial biodiversity of the many islands, and to the people depending on this biodiversity for their livelihoods and wellbeing.

Due to the nature of many of the invasive species and their ability to spread and colonise new areas, any attempt to tackle this threat will require a regional effort. Caribbean states have recognised this need for a regional strategy, in line with the Convention on Biological Diversity's declaration that efforts must be made to prevent, control or eradicate invasive species that threaten ecosystems.

What is this project doing?

CABI is coordinating the project and is working with a multitude of partners from island nations across the insular Caribbean.

This project aims to broaden the approach to deal with invasive alien species both by strengthening existing national capacity and measures and by fostering regional cooperation frameworks through which Caribbean-wide strategies can be developed.

So far, the Bahamas is the only partner country which already has a national invasive species strategy. Through this project, and under the guidance of a national steering committee, the other four countries involved will develop their own national strategies which will inform coherent policies, legislation, regulation and management of invasive species.

In order to establish Caribbean wide cooperation and strategy, regional consultations will be held on marine, terrestrial and freshwater aquatic invasives. These will form the basis for a draft region-wide invasive species strategy. The Caribbean Invasive Species Working Group (CISWG) has developed a Caribbean Regional Invasive Species Intervention Strategy (CRISIS) but so far this has agricultural pests as its main focus. Under the proposed project, the mechanisms proposed by CRISIS will be adapted and expanded to include invasive species which threaten biodiversity. The project will also develop regional strategies for marine, terrestrial and aquatic species, broadening the scope of the work done to date.

Knowledge generation, management and dissemination will be a key part of this project, allowing the impact of the work to continue long after the end of the life of the project. This involves developing and disseminating best practice guidelines based on a critical situation analysis for each country and making the research findings from this and other projects available.

Access to data will also be key, as is the need to build capacity at each level in order to eradicate, and improve control and management of invasive species and to prevent new invasions.

In parallel with participation in the development of national and regional strategies, each country will also address its own most pressing problems. This will be achieved through12 pilot projects relating to prevention,

Project manager: Naitram (Bob) Ramnanan

Start date: 23 September 2009

End date: 23 August 2013

Lead CABI centre: CABI Caribbean & Latin America

Location: Bahamas, Dominican Republic, Jamaica, Saint Lucia, Trinidad and Tobago

Reports:
Project flyer

Sponsors:
United Nations Environment Programme - Global Environment Facility

Partners:
Rural Agriculture Development Authority (RADA), Jamaica
Environmental Management Agency (EMA), Trinidad and Tobago
Institute of Marine Affairs, Council of Presidents of the Environment (COPE), Trinidad and Tobago
Ministry of Agriculture, Land and Marine Resources, Trinidad and Tobago
Ministry of Agriculture, Lands, Forestry & Fisheries, Saint Lucia
Ministry of Land and Environment, Jamaica
National Environment Planning Agency

MTIASIC project

- Bahamas lionfish pilot
- Jamaica lionfish pilot
- Marine invasives strategy

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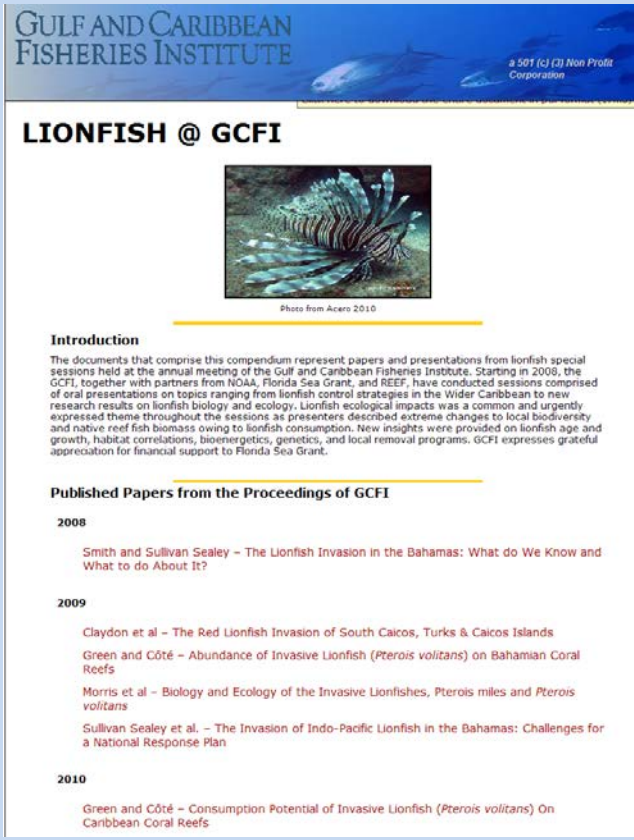
- Lionfish special sessions during annual meeting
  - -2008 Guadeloupe, FWI
  - -2009 Venezuela
  - -2010 San Juan, Puerto Rico
  - -Fall 2011 Mexico



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LIONFISH @ GCFI

Photo from Acero 2010

Introduction

The documents that comprise this compendium represent papers and presentations from lionfish special sessions held at the annual meeting of the Gulf and Caribbean Fisheries Institute. Starting in 2008, the GCFI, together with partners from NOAA, Florida Sea Grant, and REEF, have conducted sessions comprised of oral presentations on topics ranging from lionfish control strategies in the Wider Caribbean to new research results on lionfish biology and ecology. Lionfish ecological impacts was a common and urgently expressed theme throughout the sessions as presenters described extreme changes to local biodiversity and native reef fish biomass owing to lionfish consumption. New insights were provided on lionfish age and growth, habitat correlations, bioenergetics, genetics, and local removal programs. GCFI expresses grateful appreciation for financial support to Florida Sea Grant.

Published Papers from the Proceedings of GCFI

2008

Smith and Sullivan Sealey – The Lionfish Invasion in the Bahamas: What do We Know and What to do About It?

2009

Claydon et al – The Red Lionfish Invasion of South Caicos, Turks & Caicos Islands

Green and Côté – Abundance of Invasive Lionfish (*Pterois volitans*) on Bahamian Coral Reefs

Morris et al – Biology and Ecology of the Invasive Lionfishes, Pterois miles and *Pterois volitans*

Sullivan Sealey et al. – The Invasion of Indo-Pacific Lionfish in the Bahamas: Challenges for a National Response Plan

2010

Green and Côté – Consumption Potential of Invasive Lionfish (*Pterois volitans*) On Caribbean Coral Reefs


Questions?
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