Observations of damselfish (Stegastes planifrons) behavior in the presence of lionfish and other native fishes at Lee Stocking Island, Bahamas and Little Cayman Island in 2011 (Lionfish Invasion project)

Website: https://www.bco-dmo.org/dataset/3992
Data Type: Other Field Results
Version: 1
Version Date: 2013-07-09

Project
» Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish (Lionfish Invasion)

Contributors	Affiliation	Role
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Abstract
A field study was conducted to determine whether territorial aggression from three-spot damselfish (Stegastes planifrons) could limit local populations of invasive lionfish. The investigators observed damselfish behavior in the presence of lionfish relative to when other native fishes were present.

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Coverage

Spatial Extent: **N**:23.8313 **E**:-76.10603 **S**:19.6989 **W**:-80.06049
Temporal Extent: 2011-07-06 - 2011-08-18

Dataset Description

A field study was conducted to determine whether territorial aggression from three-spot damselfish (*Stegastes planifrons*) could limit local populations of invasive lionfish. The investigators observed damselfish behavior in the presence of lionfish relative to when other native fishes were present.

Acquisition Description

Field observations were conducted in 2011 at 3 sites in the Bahamas and 3 sites in the Cayman Islands using a model-bottle study design. Twenty damselfish in the Bahamas and 20 damselfish in the Cayman Islands were observed. Various coral-reef fishes were placed in clear plastic 1-gallon bottles and were presented in random order at decreasing distances from damselfish territories: predatory coney grouper (*Cephalopholis fulva*), non-herbivorous white grunt (*Haemulon plumierii*), herbivorous ocean surgeonfish (*Acanthurus bahianus*), invasive lionfish, and an empty bottle control. At each set distance (1m, 0.5m, and 0m from center of territory), the number of times the resident damselfish made physical contact with the bottle (strikes) during a 2-minute observation period was counted. Then, the bottle was placed outside of the damselfish territory and gradually moved closer to the center of the territory until the damselfish made physical contact with the bottle. This latter measure determined how far from their territories damselfish would strike at each fish species. This procedure was repeated until all 4 fish species had been presented to each individual damselfish.

Processing Description

BCO-DMO Processing Notes:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Added lat and lon values for each site included in the original metadata.
- Created 'treatment' column and transposed data for each treatment from columns into rows.
- 08-Jan-2018: removed embargo from dataset.

Parameters

Parameter	Description	Units
treatment	Treatment; type of fish placed in the treatment bottle (empty bottle is the control).	text
site	Name of the reef site.	text
lat	Latitude of the reef site.	decimal degrees
lon	Longitude of the reef site.	decimal degrees
location	Study location: Bahamas = sites off of Lee Stocking Island, Bahamas; Caymans = sites off of Little Cayman Island, Cayman Islands.	text
damselfish_tot_len	Total body length (in centimeters) of each damselfish observed.	cm
num_attacks_1m	Number of damselfish attacks per bottle treatment at 1-meter distance from the center of damselfish territory.	integer
num_attacks_half_m	Number of damselfish attacks per bottle treatment at 0.5-meter distance from the center of damselfish territory.	integer
num_attacks_0m	Number of damselfish attacks per bottle treatment at 0-meter distance from the center of damselfish territory.	integer
max_attack_dist	Greatest distance away from damselfish territory where each damselfish would attack each bottle treatment.	meters
depth_ft	Depth at observed damselfish territory.	feet
habitat	Code for damselfish habitat: Dead Acrop = low relief, dead Acropora sp.; Bommies = coral bommies (high relief); Low Contin = low relief, continuous reef; High Contin = high relief, continuous reef.	text
date	Date when data were collected.	mm/dd/YYYY

Deployments

LSI_Reef_Surveys_09-12

Website	https://www.bco-dmo.org/deployment/59019
Platform	Tropical Marine Lab at Lee Stocking Island
Start Date	2009-05-30
End Date	2012-08-18
Description	Locations of coral reef survey dives and sightings, or collections of the invasive red lionfish, Pterois volitans, near Lee Stocking Island, Bahamas for the projects "Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish" and "Mechanisms and Consequences of Fish Biodiversity Loss on Atlantic Coral Reefs Caused by Invasive Pacific Lionfish" (NSF OCE-0851162 & OCE-1233027). All dives were made from various small vessels (17' to 24' l.o.a., 40 to 275 HP outboard motors, 1 to 7 GRT). Vessel names include, Sampson, Orca, Potcake, Lusca, Lucaya, Zardoz, Parker, and Nuwanda.

Cayman_Reef_Surveys_10-11

Website	https://www.bco-dmo.org/deployment/59048
Platform	Cayman_Islands
Start Date	2010-06-14
End Date	2011-08-29
Description	Coral reefs were surveyed/studied near the Cayman Islands during the summers of 2010 and 2011 as part of the projects "Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish" and "Mechanisms and Consequences of Fish Biodiversity Loss on Atlantic Coral Reefs Caused by Invasive Pacific Lionfish" (NSF OCE-0851162 & OCE-1233027).

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Project Information

Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish (Lionfish Invasion)

Website: http://hixon.science.oregonstate.edu/content/highlight-lionfish-invasion

Coverage: Bahamas; Cayman Islands; Mariana Islands; Philippines

Invasive species are increasingly introduced by human activities to new regions of the world where those species have never existed previously. In the absence of natural enemies (predators, competitors, and diseases) from their homeland, invasives may have strong negative effects on invaded ecosystems, especially systems with fewer species ("ecological release"), and may even drive native species extinct. However, if native natural enemies can somehow control the invaders ("ecological resistance"), then ecological disruption can be prevented or at least moderated. Most of the many invasive species in the sea have been seaweeds and invertebrates, and the few documented invasive marine fishes have not caused major problems. However, this situation has recently changed in a stunning and ominous way. In the early 1990s, lionfish (Pterois volitans) from the Pacific Ocean were accidentally or intentionally released from aquaria to the ocean in the vicinity of Florida. Camouflaged by shape and color, protected by venomous spines, consuming native coral-reef fishes voraciously, and reproducing rapidly, lionfish have subsequently undergone a population explosion. They now range from the mid-Atlantic coast of the US to the Caribbean, including the Bahamas. Native Atlantic fishes have never before encountered this spiny, stealthy, efficient predator and seldom take evasive action. In fact, the investigator has documented that a single lionfish is capable of reducing the abundance of small fish on a small coral patch reef by nearly 80% in just 5 weeks. There is great concern that invasive lionfish may severely reduce the abundance of native coral-reef fishes important as food for humans (e.g., grouper and snapper in their juvenile stages) as well as species that normally maintain the integrity of coral reefs (e.g., grazing parrotfishes that can prevent seaweeds from smothering corals). There are far more species of coral-reef fish in the Pacific than the Atlantic, so this invasion may represent a case of extreme ecological release with minor ecological resistance. Dr. Hixon and colleagues will study the mechanisms of ecological release in lionfish, as well as examine potential sources of ecological resistance in the heavily invaded Bahamas. Because very little is known about the ecology and behavior of lionfish in their native Pacific range, he will also conduct comparative studies in both oceans, which may provide clues regarding the extreme success of this invasion. In the Bahamas, the investigator will document the direct and indirect effects on native species of the ecological release of lionfish, both as a predator and as a competitor. These studies will be conducted at various scales of time and space, from short-term experiments on small patch reefs, to long-term experiments and observations on large reefs. Whereas direct effects involve mostly changes in the abundance of native species,

indirect effects can be highly variable. For example, lionfish may actually indirectly benefit some native species by either consuming or outcompeting the competitors of those natives. The project will explore possible ecological resistance to the invasion by determining whether any native Bahamian species are effective natural enemies of lionfish, including predators, parasites, and competitors of both juvenile and adult lionfish. Comparative studies of natural enemies, as well as lionfish ecology and behavior, in both the Atlantic and the Pacific may provide clues regarding the explosive spread of lionfish in the Atlantic. Regarding broader impacts, this basic research will provide information valuable to coral-reef and fisheries managers fighting the lionfish invasion in the US, the Bahamas, and the greater Caribbean, especially if sources of native ecological resistance are identified. The study will fund the PhD research of U.S. graduate students, as well as involve assistance and participation by a broad variety of undergraduates and reef/fisheries managers, including women, minorities, native Bahamians, and native Pacific islanders. Participation in this project will promote education in marine ecology and conservation biology directly via Dr. Hixon's and graduate students' teaching and outreach activities, and indirectly via the experiences of undergraduate field assistants and various associates.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0851162

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