Results of a manipulative field experiment on the effect of lionfish predation on bridled goby populations, conducted at Lee Stocking Island, Bahamas from 2009-2012 (Lionfish Invasion project)

Website: https://www.bco-dmo.org/dataset/3910
Data Type: experimental
Version: 1
Version Date: 2013-04-10

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

Contributors	Affiliation	Role
Hixon, Mark	Oregon State University (OSU)	Lead Principal Investigator
Pusack, Timothy J	Oregon State University (OSU)	Scientist
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Results of a manipulative field experiment on the effect of lionfish predation on bridled goby populations, conducted at Lee Stocking Island, Bahamas from 2009-2012.

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Coverage

Spatial Extent: **Lat**:23.75047 **Lon**:-76.14035
Temporal Extent: 2011 - 2011

Dataset Description

Results are reported from a manipulative field experiment examining the effect of lionfish predation on bridled goby population density. Experiments were conducted in 2011 at reefs near Lee Stocking Island, Bahamas.

Related Datasets from sub-project "Lionfish predation on bridled gobies": "goby consumption by lionfish"

Related Publications:
Pusack, TJ, ACD Davis, and MA Albins. In Prep. Relative effects of invasive Pacific lionfish vs. native Atlantic grouper on mortality of bridled goby. Ecology.

Acquisition Description

Investigators studied the effects of lionfish predation on bridled goby populations through a manipulative field experiment. The density of bridled goby on 24 near-shore patch reefs was manipulated. Over a 30 day experimental period bridled goby mortality was monitored among four treatments: no-predator control, lionfish only, graysby grouper (native predator) only, and lionfish + graysby grouper.

Processing Description

BCO-DMO Processing Notes:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Added lat and lon for the reef site from the metadata provided.
- Replaced blanks with 'nd' ('no data'; measurements not made due to Hurricane Irene.)
- Added 'treatment' column containing the treatment definition.
- 09-Jan-2017: removed embargo on dataset.

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Parameters

Parameter	Description	Units
site	Name of the reef site where the experiment took place.	text
lat	Latitude of the reef site.	decimal degrees
lon	Longitude of the reef site.	decimal degrees
treatment	Description of the treatment condition.	text
treatment_code	Code used to identify the predator treatment. LR = lionfish and graysby grouper. LX = lionfish only. Rx = graysby only. xx = predator free control.	text
location	ID of the specific patch reef in the reef matrix.	text
target_goby_abund	The target abundance of gobies on each reef.	integer
actual_starting_goby_abund	The actual number of gobies on the reef at the start of the experiment. This number differs from the target number, because of variable goby mortality in the 1st 24 hour acclimation period.	integer
visit	Sequential number of visit to reef.	integer
day	2-digit day-of-month of survey.	dd (01 to 31)
month	2-digit month of survey.	mm (01 to 12)
year	4-digit year of survey.	YYYY
goby_abund	The number of gobies counted during the visit.	integer
mortality	Per capita mortality; the number of gobies counted during that visit divided by the number of gobies starting on the reef.	

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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.

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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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