Results of manipulative field study and controlled lab experiment on growth rates of juvenile lionfish on reefs with controlled abundances of Nassau grouper; Bahamas, 2010 (Lionfish Invasion project)

Website: https://www.bco-dmo.org/dataset/3939
Data Type: Other Field Results
Version: 1
Version Date: 2013-05-06

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
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Abstract
Results of manipulative field study and controlled lab experiment on growth rates of juvenile lionfish on reefs with controlled abundances of Nassau grouper; Bahamas, 2010.

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Coverage

Spatial Extent: **N**:23.76094 **E**:-76.12997 **S**:23.75047 **W**:-76.14035
Temporal Extent: 2010-06-19 - 2010-08-30

Dataset Description

The investigators examined the interactions between invasive lionfish and native Nassau grouper using both a manipulative field study and a controlled lab experiment. This dataset, resulting from the field study, contains growth rates of juvenile lionfish (20-140 mm) on reefs with controlled abundances of native Nassau grouper.

Related Datasets from sub-project "Interactions between native Nassau grouper and invasive lionfish":
artificial and transplant reef census
grouper-lionfish refuge competition expt

Related Publications:
Pusack, TJ. Submitted. Evidence of bioltic resistance: native Nassau grouper (Epinephelus striatus) mitigate predator effects of invasive Pacific red lionfish (Pterois volitans) on Atlantic coral reefs. Ecological Applications.

Raymond WW, MA Albins, and TJ Pusack. In Review. Shelter competition between invasive Pacific red lionfish Pterois volitans) and native Nassau grouper (Epinephelus striatus). Journal of Experimental Marine Biology and

Ecology.

Methods & Sampling

During the summer of 2010, the investigators manipulated the abundance of Nassau grouper on 28 near-shore patch reefs and measured the growth and survival of juvenile (20-140 mm) lionfish. They also censused the community of small reef fishes (< 50 mm) to look for evidence of indirect effects that grouper might have mediated through lionfish.

Data Processing Description

BCO-DMO Processing Notes:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Added lat and lon from the metadata provided.
- Replaced blanks with 'nd' ('no data').
- 09-Jan-2018: removed embargo from dataset.

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Data Files

File
lionfish_growth.csv (Comma Separated Values (.csv), 41.71 KB) MD5:0cb0b90485e00ed257dab39e9ce165b1 Primary data file for dataset ID 3939

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Parameters

Parameter	Description	Units
site	Name of the site.	nd
lat	Latitude of the reef site.	decimal degrees
lon	Longitude of the reef site.	decimal degrees
grouper_abund	Number of Nassau grouper on each reef.	integer
lionfish_id	The identification number of each lionfish. See 'lionfish collections 2009-2011' dataset for information about individual.	dimensionless
location	Indicates the specfic patch reef in the matrix.	text

tag_elastomer	Indicates the side (L = left; R = right); Color (B = blue; R = red; G = green; Y = Yellow; O = orange); and location on the lionfish (C = caudal; UM = upper middle; UC = upper caudal; LC = lower caudal)	text
date	Indicates the date of each measurement in mm/dd/YYYY format.	unitless
month	2-digit month when measurement was taken.	mm (01 to 12)
day	2-digit day of month when measurement was taken.	dd (01 to 31)
year	4-digit year when measurement was taken in YYYY format.	unitless
present_or_absent	Whether or not the lionfish was present. P = lionfish was present on reef. A = lionfish was absent on reef.	P (present) or A (absent)
len_tot	Total length of lionfish in centimeters.	cm
mass	Mass of the lionfish (dry weight).	grams
num_days	Total number of days up to that measurement.	integer
growth_rate	Growth rate of lionfish since last measurement in centimeters per day.	cm/day
notes	Any information including descriptions about behavoir or interesting observations.	text

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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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