Experimental results on density dependent loss and growth in invasive red lionfish sampled at Lee Stocking Island, Bahamas in 2011

Website: https://www.bco-dmo.org/dataset/653277
Data Type: experimental
Version: 1
Version Date: 2016-08-05

Project
» Mechanisms and Consequences of Fish Biodiversity Loss on Atlantic Coral Reefs Caused by Invasive Pacific Lionfish (BiodiversityLossEffects_lionfish)

Contributors	Affiliation	Role
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Abstract
Experimental results on density dependent loss and growth in invasive red lionfish sampled at Lee Stocking Island, Bahamas in 2011

Table of Contents

Coverage

Temporal Extent: 2011-06-25 - 2011-08-21

Dataset Description

This field experiment was conducted on artificial patch reefs to test for presence of density dependence in invasive red lionfish recruitment, immigration, loss, and growth (in mass and length). The experiment used 10 reefs which were manipulated so that 4 reefs had 0 lionfish on them (controls), and 6 each had a unique density of lionfish. Each week, the number of lionfish on each reef was recorded, and new lionfish recruits and immigrants were removed. Every two weeks, lionfish growth in length was re-measured. At the end of the experiment (6 weeks), lionfish growth in mass was re-measured.

Related Manuscript: Benkwitt, C.E. (2013) and Benkwitt, C.E. (2015)

Methods & Sampling

Field experiment on artificial patch reefs to test for presence of density dependence in invasive red lionfish recruitment, immigration, loss, and growth (in mass and length). Juvenile lionfish (40 - 71 mm total length [TL]) were collected from surrounding reefs by SCUBA divers using handnets and held in 190-l flow-through aquaria prior to release onto the experimental matrix. All lionfish were tagged subcutaneously using colored elastomer (Northwest Marine Technology Inc., Shaw Island, Washington, USA) on the caudal peduncle and/or slightly anterior to the caudal peduncle just under the dorsal fins. All fish were held for at least 12 hours after tagging to allow for recovery from any tagging effects and measured (TL to nearest 1 mm) and weighed (wet weight [WW] to nearest 1 mg) just before being released onto the experimental reefs. Lionfish were transplanted to 10 artificial patch reefs (each measuring 1 cubic meter) so that 4 reefs had 0 lionfish on them (controls) and 6 each had a unique density of lionfish (2, 4, 6, 8, 10, or 12 lionfish). To account for changes in lionfish density throughout the course of the experiment, we also calculated the weighted average weekly lionfish density for each reef (1, 2, 4, 7, 10, and 12 lionfish/m^2 rounded to the nearest fish).

A pair of trained observers using SCUBA recorded the number and identity of tagged lionfish present on each reef weekly. If a lionfish was not seen on a reef, we searched the surrounding sand and seagrass for approximately 10 minutes. If the lionfish was still not found, it was marked as absent for that week. If never found again, it was marked as lost from the last day it was seen. We recorded the number of new lionfish recruits present on each reef weekly. Any new lionfish were immediately removed to preserve the treatment densities. Every two weeks, we recaptured all tagged lionfish on scuba using handnets, re-measured their TL in situ, and immediately released them back to their original locations on the reef. At the conclusion of the experiment (after 8-weeks), lionfish were re-captured and re-weighed.

All data were entered by one person, and then subsequently checked by another person to ensure accuracy.

Data Processing Description

Any equations used are described in the dataset.

DMO Notes:

-reformatted column names to comply with BCO-DMO standards
-replaced all spaces with "_"
-replaced all blank cells with "nd"

[table of contents | back to top]

Data Files

File
densityDependence_growthPersistence.csv (Comma Separated Values (.csv), 9.74 KB) MD5:a44e9b1617bf4a31e8aa8cc5814e486f Primary data file for dataset ID 653277

[table of contents | back to top]

Related Publications

Benkwitt, C. E. (2013). Density-Dependent Growth in Invasive Lionfish (Pterois volitans). PLoS ONE, 8(6), e66995. doi:10.1371/journal.pone.0066995
General

Benkwitt, C. E. (2014). Non-linear effects of invasive lionfish density on native coral-reef fish communities. Biological Invasions, 17(5), 1383–1395. doi:10.1007/s10530-014-0801-3
General

[table of contents | back to top]

Parameters

Parameter	Description	Units
lionfish_id	Unique lionfish number for each individual	unitless
reef_number	Unique reef identification code	unitless
lionfish_density_initial	Initial number of lionfish that were transplanted to each reef. Because each reef measured 1 meters squared lionfish density = number of lionfish on the reef.	count per square meter
lionfish_density_mean	Average lionfish density (rounded to the nearest fish) on each reef throughout the experiment.	count per square meter
tag	Side of body: R = right L = left; Color: B=blue O = orange Y = yellow G = green; Position on body: UC = upper caudal LC = lower caudal UM = upper middle	unitless
date	Date that lionfish were sampled; mm/dd/yy	unitless
presence	Present = present on or within several meters of reef; Absent = not found on reef or in surrounding areas	unitless
total_length	Total length of lionfish length	centimeters
mass	Mass of lionfish	grams

[table of contents | back to top]

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.

[table of contents | back to top]

Project Information

Mechanisms and Consequences of Fish Biodiversity Loss on Atlantic Coral Reefs Caused by Invasive Pacific Lionfish (BiodiversityLossEffects_lionfish)

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

Coverage: Three Bahamian sites: 24.8318, -076.3299; 23.8562, -076.2250; 23.7727, -076.1071; Caribbean Netherlands: 12.1599, -068.2820

The Pacific red lionfish (Pterois volitans), a popular aquarium fish, was introduced to the Atlantic Ocean in the vicinity of Florida in the late 20th century. Voraciously consuming small native coral-reef fishes, including the juveniles of fisheries and ecologically important species, the invader has undergone a population explosion that now ranges from the U.S. southeastern seaboard to the Gulf of Mexico and across the greater Caribbean region. The PI's past research determined that invasive lionfish (1) have escaped their natural enemies in the Pacific (lionfish are much less abundant in their native range); (2) are not yet controlled by Atlantic predators, competitors, or parasites; (3) have strong negative effects on populations of native Atlantic fishes; and (4) locally reduce the diversity (number of species) of native fishes. The lionfish invasion has been recognized as one of the major conservation threats worldwide.

The Bahamas support the highest abundances of invasive lionfish globally. This system thus provides an unprecedented opportunity to understand the direct and indirect effects of a major invader on a diverse community, as well as the underlying causative mechanisms. The PI will focus on five related questions: (1) How does long-term predation by lionfish alter the structure of native reef-fish communities? (2) How does lionfish predation destabilize native prey population dynamics, possibly causing local extinctions? (3) Is there a lionfish-herbivore-seaweed trophic cascade on invaded reefs? (4) How do lionfish modify cleaning mutualisms on invaded reefs? (5) Are lionfish reaching densities where natural population limits are evident?

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233027

[table of contents | back to top]