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

Website: https://www.bco-dmo.org/dataset/653309
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 recruitment and immigration in invasive red lionfish sampled at Lee Stocking Island, Bahamas in 2011

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Coverage

Temporal Extent: 2011-07-03 - 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 effects of invasive red lionfish density on native coral-reef fishes. Four reefs were used as 0-lionfish control reefs and there was one reef per remaining lionfish treatment

(2, 4, 6, 8, 10, and 12 lionfish/m^2). Using SCUBA and handnets, we collected lionfish ranging in initial size from 40 to 71mm total length [TL] from nearby reefs. Each lionfish was given a unique elastomer tag (Northwest Marine Technology Inc., Shaw Island, WA, USA) to differentiate between lionfish at the start of the experiment and any new immigrants over the course of the study and to monitor demographic rates as part of another study (see related files and references). Treatments were started on all reefs within a 2-week period. To maintain treatments, we monitored lionfish density during weekly visits and removed any new lionfish recruits (total of 15 throughout experiment) and immigrants (total of 5 throughout experiment). In addition, we removed resident native piscivores and standardized the number of Nassau grouper (*Epinephelus striatus*) and territorial damselfishes (*Stegastes* spp.) weekly to mitigate any confounding effects of these strong interactors on fish recruitment. Of the lionfish initially placed on the reefs, only 6 out of 40 disappeared. To account for the small changes in lionfish density throughout the experiment, we averaged the weekly lionfish densities on each reef over the course of the experiment (1, 2, 4, 7, 10, and 12 lionfish/m^2).

Following the establishment of lionfish density treatments, a pair of divers using SCUBA censused the entire fish community on each reef weekly for 7 weeks, recording the species, abundance, and body size (TL estimated to the nearest centimeter) of all fish present both on the reefs and within a 1-m radius around the reefs. Divers slowly approached the reefs and first counted all planktivorous and active species hovering above the reefs from a distance of approximately 3 m. From a distance of 1 m, the divers slowly circled the reefs and counted all other species, using dive lights to count cryptic species in holes.

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

Data Processing Description

No processing was done.

DMO Notes:

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

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Data Files

File	
densityDependence_recruitmentImmigration.csv	(Comma Separated Values (.csv), 508 bytes) MD5:66484e300ed8f424c8d8e6bc9313032e
Primary data file for dataset ID 653309	

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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

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Parameters

Parameter	Description	Units
date	Date that lionfish were sampled; mm/dd/yy	unitless
reef	Unique reef identification code	unitless
lionfish_density_mean	Average lionfish density (rounded to the nearest fish) on each reef throughout the experiment.	count per square meter
lionfish_size	Total length of new lionfish found on the reef (i.e. an untagged lionfish)	centimeters
notes	Notes on findings	unitless

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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

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?

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Funding

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

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