Effect of lionfish presence on native fish abundance on satellite coral heads in seagrass habitats on Eleuthera, Bahamas during 2013 (Biodiversity Loss Effects Lionfish project)

Website: https://www.bco-dmo.org/dataset/655380
Data Type: experimental
Version: 1
Version Date: 2016-08-23

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

Contributors	Affiliation	Role
Hixon, Mark	University of Hawaii (UH)	Principal Investigator
Benkwitt, Cassandra E.	Oregon State University (OSU)	Contact
Ake, Hannah	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Effect of lionfish presence on native fish abundance on satellite coral heads in seagrass habitats on Eleuthera, Bahamas during 2013 (Biodiversity Loss Effects Lionfish project)

Table of Contents

Coverage

Temporal Extent: 2013-06-22 - 2013-08-29

Dataset Description

This field experiment was conducted on coral patch reefs to test for the effect of lionfish presence on native fish abundance both on main reefs where lionfish resided and in habitats surrounding the main reefs (satellite coral heads, open areas, and standardized habitat units [SHUs]). The experiment used 16 main reefs which were manipulated so that 8 reefs had few lionfish present (low lionfish treatment) and 8 had lionfish present at naturally-observed densities (high lionfish treatment). Complete censuses of the native prey fish populations on each reef and in the surrounding habitats were conducted weekly for 7 weeks during the summer recruitment season.

Related datasets:

- Effect of lionfish density on native reef fishes - DOI: 10.1575/1912/bco-dmo.655301.1
- Effect of lionfish in main seagrass habitats - DOI: 10.1575/1912/bco-dmo.655342.1
- Effect of lionfish in seagrass open area habitats - DOI: 10.1575/1912/bco-dmo.655420.1
- Effect of lionfish in standardized habitat units in seagrass - DOI: 10.1575/1912/bco-dmo.655455.1

Species key for all individuals identified in this dataset - DOI: 10.1575/1912/bco-dmo.655195.2

Methods & Sampling

This was a manipulative field experiment conducted during June – August 2013 to determine whether lionfish affect native fishes in the areas surrounding coral patch reefs. Sixteen patch reefs were paired based on similarity in location, size, benthic composition, initial fish community, and surrounding habitat, then one reef in each pair was randomly assigned to either low-lionfish or high-lionfish treatments. A pair of divers removed all lionfish from the eight low-lionfish reefs during weekly visits (resulting mean lionfish density on low-lionfish reefs was 0.01 to 0.03 lionfish/square meter). The eight remaining reefs were maintained as high-lionfish treatment reefs, with divers adding lionfish to the reefs to keep densities within the naturally occurring range observed in Rock Sound (resulting mean lionfish density on high-lionfish reefs was 0.12 to 0.29 lionfish/square meter.

A pair of divers returned to each reef weekly for 7 weeks to census the native fish communities on the main reefs and in three different habitat types in the surrounding areas. During all surveys, divers counted all fish less than 15 cm TL and all piscivores of any size. Around each main reef, selected between one and four satellite coral heads were haphazardly selected to survey. Satellite coral heads were small structures comprised of one to several coral colonies, ranging in size from 0.31 to 4.7 meters squared and located between 3.8 and 25.1 m from the main reefs. In addition to being smaller than the main reefs, satellite heads also supported neither resident lionfish nor native piscivores. To document native fish communities in open sand and seagrass areas without any coral heads or other hard structures, two 35 m transects were run outward from each main reef in randomly selected directions. Divers surveyed fish at 5-m intervals within 2 square meter plots around the transect tapes. To obtain a standardized measure of fish communities at set distances from each reef that accounted for habitat type, patch size, and initial fish community, I set-up small (0.5 meters squared) identical standardized habitat units (SHUs) consisting of 9 empty queen conch (*Strombus gigas*) shells with their apertures facing upward. All reefs had one row of 4 SHUs located at 7-m intervals extending away from the reef. Half of the reefs (4 high-lionfish and 4 low-lionfish reefs) also had a second row of 2 SHUs located at 15 m and 31 m from the reef and extending outward in the opposite direction from the first row. During the final week of the experiment, in addition to visually surveying the fish communities on the SHUs, a pair of divers placed all conch shells in dry bags and brought them up to a boat. Each shell was shaken in a bucket of seawater to remove and count any individuals hiding in the shells.

Note that five of the 16 main coral patch reefs had high abundances of small, juvenile grunts (*Haemulon* spp.), which formed large schools of approximately 100 - 300 individuals above the reefs. Counts of these juvenile grunts are not considered to be precise or accurate.

Data Processing Description

All data were entered by one person, and then subsequently checked to ensure accuracy. Any equations used are described in the parameter metadata.

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
seagrass_satelliteCoralHeads.csv (Comma Separated Values (.csv), 156.19 KB) MD5:867062d47b52745fb95b584d979c5734 Primary data file for dataset ID 655380

[table of contents | back to top]

Related Publications

Benkwitt, C. E. (2016). Central-place foraging and ecological effects of an invasive predator across multiple habitats. Ecology, 97(10), 2729–2739. doi:10.1002/ecy.1477
General

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	Year of survey; YYYY	unitless
month	Month of survey; mm	unitless
day	Day of survey; dd	unitless
start	Time that census began; HH:MM	unitless
end	Time that census ended; HH:MM	unitless
visit_number	Visit number; one visit per reef per week	unitless
treatment	Low = low lionfish treatment (lionfish removed from main reefs); High = high lionfish treatment (lionfish maintained on main reefs)	unitless
reef	Name of main reef	unitless
satellite_number	Each satellite coral head around each main reef was assigned a unique number (1-4)	unitless
satellite_distance	Distance of satellite coral head to main reef	meters
satellite_size	Size of satellite coral head	meters squared
species	First 2 letters of genus and first 2 letters of species; see species key dataset for full species names.	unitless
length_max_1	Number of individuals that were between 0-1 cm total length	count
length_max_2	Number of individuals that were between 1.1-2 cm total length	count
length_max_3	Number of individuals that were between 2.1-3 cm total length	count
length_max_4	Number of individuals that were between 3.1-4 cm total length	count
length_max_5	Number of individuals that were between 4.1-5 cm total length	count
length_max_6	Number of individuals that were between 5.1-6 cm total length	count
length_max_7	Number of individuals that were between 6.1-7 cm total length	count
length_max_8	Number of individuals that were between 7.1-8 cm total length	count
length_max_9	Number of individuals that were between 8.1-9 cm total length	count
length_max_10	Number of individuals that were between 9.1-10 cm total length	count
length_max_15	Number of individuals that were between 10.1-15 cm total length	count
length_max_20	Number of individuals that were between 15.1-20 cm total length	count
length_max_25	Number of individuals that were between 20.1-25 cm total length	count
length_max_30	Number of individuals that were between 25.1-30 cm total length	count
length_max_35	Number of individuals that were between 30.1-35 cm total length	count
length_max_40	Number of individuals that were between 35.1-40 cm total length	count
length_max_45	Number of individuals that were between 40.1-45 cm total length	count
eel_shark_count	Abundance of large eels and sharks (GYMO - green moray, GICI - nurse shark); sizes were not estimated. See species key dataset for full species names.	count
notes	Notes on site observations	unitless

[table of contents | back to top]

Deployments

Eleuthera_Reef_Surveys_2012

Website	https://www.bco-dmo.org/deployment/59028
Platform	Cape_Eleuthera_Reefs
Start Date	2012-07-03
End Date	2012-08-28
Description	Reefs were surveyed near the Cape Eleuthera Institute, Eleuthera Bahamas during the summer of 2012 as part of the project "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).

[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]