Predator effects on reef fish settlement in Bonaire, Dutch Caribbean in July and August of 2014 (BiodiversityLossEffects_lionfish project)

Website: https://www.bco-dmo.org/dataset/728796
Data Type: Other Field Results
Version: 1
Version Date: 2018-03-01

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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Coverage

Spatial Extent: **Lat**:12.153614 **Lon**:-68.278553
Temporal Extent: 2014-07 - 2014-08

Dataset Description

This dataset contains results from a field experiment to test for the effect of lionfish and native fish presence on settlement of coral-reef fishes. Native and invasive predators were placed in cages next to small artificial reefs and new recruits settling to reefs were counted and removed daily. Treatments were also rotated daily. Two rounds of the experiment were run, bracketing the new moon (when settlement rates are highest) in July and August 2014. Sampling took place off the leeward coast of Bonaire, Dutch Caribbean (12°09'13.0"N 68°16'42.8"W) at a 5-meter depth.

These data were utilized in the following publication (Benkwitt 2017)

Methods & Sampling

Two manipulative field experiments were conducted July-August 2014, both using the same basic experimental design. Standardized reefs (80 × 60 × 15 cm) were constructed using dead coral rubble placed inside of stainless steel wire baskets. Predators were housed next to reefs in individual hardware-cloth cages (150 mm diameter × 300 mm length, 10 mm mesh) such that recruiting coral-reef fish were exposed to chemical and some visual cues from the predator, but the predator could not consume recruits. To measure settlement, a

pair of divers counted and removed all fish from each reef every morning beginning within an hour of sunrise. In the first experiment, each reef within each of block was randomly assigned one of the following treatments: invasive piscivore (red lionfish), native piscivore (graysby grouper), native invertivore (French grunt), empty cage (no predator), and empty control (no cage and no predator). To determine whether the diet of native or invasive predators affects settlement, the experiment described above was repeated using different treatments. Each reef within each block was randomly assigned one of the following treatments: native piscivore (graysby grouper) fed bicolor damselfish recruits, native piscivore (graysby grouper) fed mahogany snapper recruits, invasive piscivore (red lionfish) fed bicolor damselfish recruits, invasive piscivore (red lionfish) fed mahogany snapper recruits, and empty cage control. Recruits of these two reef fishes were chosen as feed for the predators because they were the most abundant recruits to the reefs during the first experiment. For full methods, see Benkwitt (2017).

Reef configuration:
The reefs referred to in this dataset are 80 × 60 × 15 cm patches of coral rubble inside of stainless steel baskets. These were arranged in groups/blocks (letter codes B-E) that were separated from the next block by~17 m. Each block contained five reefs (numbered 1-5), which were separated from each other by ~3 m. The latitude and longitude (12.15361,-68.27855) corresponds to the approximate the center of the array.

Species Key:
The species names for the species codes used in the "SPECIES", "TREATMENT", and comment columns of this dataset, please refer to the following dataset: https://www.bco-dmo.org/dataset/655195

Data Processing Description

There were a few days on which fish recruits were counted and removed before predator diet treatments were established. They are still included in the dataset, but there is a note next to those dates in the data.

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* changed column names 1,2,3..10 to len_1,len_2..len_10. Data parameters in our system can't start with a number.
* changed column name 2_OBS to SECOND_OBS. Data parameters in our system can't start with a number.
* commas and leading asterisks removed from comments to support .csv download of data.

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Data Files

File
settlement.csv (Comma Separated Values (.csv), 145.38 KB) MD5:5d982ac3f754e3ece0e2275f91cefbe5 Primary data file for dataset ID 728796

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Related Publications

Benkwitt, C. E. (2017). Predator effects on reef fish settlement depend on predator origin and recruit density. Ecology, 98(4), 896–902. doi:10.1002/ecy.1732
Results
,
Methods

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Parameters

Parameter	Description	Units
YEAR	Sampling year in format yyyy	unitless
MONTH	Sampling month in format mm	unitless
DAY	Sampling day in format dd	unitless
EXPT	Experiment was run during 2 separate rounds, labelled either 1 (Jul 16 - Aug 1) or 2 (Aug 17 - Aug 28)	unitless
EXPT_DAY	Number of days since start of experiment	unitless
MOON_DAY	Days before/after new moon (when recruitment typically peaks). New moon is set at day 0.	unitless
OBSERVER	Initials of primary observer conducting census and collecting fishes	unitless
SECOND_OBS	Intitials of secondary observer conducting census and collecting fishes	unitless
TIME	Time that census began in format HH:MM	unitless
BLOCK	Letter corresponding to block/group of reef (4 blocks, 17 m apart, each with 5 reefs)	unitless
REEF_NUMBER	Number of reef in block (each block had 5 reefs, 3 m apart, numbered 1-5)	unitless
TREATMENT	BLANK = no cages or treatments on entire block (control), EC = Empty cage (control), NOTHING = no cage (control), CECR = Cephalopholis cruentata (native piscivore), HAFL = Haemulon flavolineatum (native invertivore), PTVO = Pterois volitans (invasive piscivore)	unitless
DIET	Diet of caged predators - N/A = Not applicable, STPA = Stegastes partitus, LUMA = Lutjanus mahogoni, BW/SHRIMP = freeze-dried bloodworms and mysiid shrimp	unitless
SPECIES	First 2 letters of genus, first 2 letters of species of fish recruit (see species key dataset https://www.bco-dmo.org/dataset/655195)	unitless
len_1	Number of individuals that were between 0-1 cm total length	per individual
len_2	Number of individuals that were between 1.1-2 cm total length	per individual

len_3	Number of individuals that were between 2.1-3 cm total length	per individual
len_4	Number of individuals that were between 3.1-4 cm total length	per individual
len_5	Number of individuals that were between 4.1-5 cm total length	per individual
len_6	Number of individuals that were between 5.1-6 cm total length	per individual
len_7	Number of individuals that were between 6.1-7 cm total length	per individual
len_8	Number of individuals that were between 7.1-8 cm total length	per individual
len_9	Number of individuals that were between 8.1-9 cm total length	per individual
len_10	Number of individuals that were between 9.1-10 cm total length	per individual
TOTAL	Total number of individuals of that species (sum of previous 10 columns)	per individual
Comment	Comment	unitless

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Deployments

Hixon_Bonaire_lionfish

Website	https://www.bco-dmo.org/deployment/728806
Platform	shoreside Bonaire

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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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