Counts of fairy basslet and predator species at reefs near Eleuthera, Bahamas following the establishment of experiment treatments in 2012 (Lionfish Invasion project)

Website: https://www.bco-dmo.org/dataset/3926
Data Type: Other Field Results
Version: 25 April 2013
Version Date: 2013-04-25

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
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Coverage

Spatial Extent: **N**:24.81645 **E**:-76.28745 **S**:24.75715 **W**:-76.3506
Temporal Extent: 2012-07-03 - 2012-08-14

Dataset Description

This dataset contains counts of fairy basslet and predator species at reefs near Eleuthera, Bahamas following the establishment of experiment treatments.

To rigorously test whether and how lionfish have altered prey density-dependent dynamics, a manipulation was conducted of both basslet and lionfish densities in a cross-factored design, such that differences in patterns of mortality between treatments could be attributable to lionfish predation alone. Because density-dependent basslet mortality was attributed to predators aggregating preferentially near high prey concentrations, predatory behavior of both native and invasive predators was also examined in order to determine whether differences in any aggregative response could explain different patterns of prey mortality.

Related Datasets from sub-project "Lionfish alter density dependence in fairy basslet":
fairy basslet baseline density
predator surveys Eleuthera

Methods & Sampling

During the summer of 2012, a field experiment was conducted on 14 isolated patch reefs near the Cape

Eleuthera Institute, Eleuthera, Bahamas. Reefs were paired into blocks by location, size, depth, and vertical relief so that reefs in each block demonstrated similar environmental characteristics. Reefs were then randomly assigned to one of two lionfish treatments: low lionfish reefs (where divers regularly removed lionfish), and high lionfish reefs (where lionfish were added to maintain differential lionfish densities. At each reef, the investigator selected two isolated populations of fairy basslet on small ledges sufficiently separated from each other and from other suitable basslet habitat to inhibit emigration or immigration. Populations were then randomly assigned to either receive artificially increased recruitment or remain unmanipulated. Following the establishment of treatments, the investigator returned to census each population after two days, four days and weekly thereafter, with a final census after four weeks. During each census, the investigator recorded the size of each basslet (adult and juvenile), the total population size, any predators within 2-m of the target basslet ledge, and whether those predators where actively hunting among the experimental basslet populations.

Data Processing Description

BCO-DMO Processing Notes:
- Added lat and lon for each site from the metadata provided.
- Converted lat and lon from degrees and decimal minutes to decimal degrees.
- Modified parameter names to conform with BCO-DMO naming conventions.
- 28-Dec-2017: removed embargo from dataset.

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Data Files

File
fairy_basslet_census_Eleuthera.csv (Comma Separated Values (.csv), 96.67 KB) MD5:f672db9b03375157636fc2bbe42f83de Primary data file for dataset ID 3926

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Parameters

Parameter	Description	Units
site	Name of reef site.	text
lat	Latitude of the reef site.	decimal degrees
lon	Latitude of the reef site.	decimal degrees
date	Date of survey.	mm/dd/YYYY
survey	Survey number.	text
ledge_tag	Two-digit numeral corresponding to ear tag ledge marker.	dimensionless

count_tot	Total number of fairy basslet of all sizes.	dimensionless
len_PTVO	Size (in cm) of Pterois volitans (PTVO) observed within 2-m of experimental ledge during survey.	cm
len_CECR	Size (in cm) of Cephalopholis cruentatus (CECR) observed within 2-m of experimental ledge during survey.	cm
len_EPST	Size (in cm) of Epinephelus striatus (EPST) observed within 2-m of experimental ledge during survey.	cm
len_EPGU	Size (in cm) of Epinephelus guttatus (EPGU) observed within 2-m of experimental ledge during survey.	cm
len_EPAD	Size (in cm) of Epinephelus adscensionis (EPAD) observed within 2-m of experimental ledge during survey.	cm
len_MYBO	Size (in cm) of Mycteroperca bonaci (MYBO) observed within 2-m of experimental ledge during survey.	cm
len_CEFU	Size (in cm) of Cephalopholis fulva (CEFU) observed within 2-m of experimental ledge during survey.	cm
len_GYMO	Size (in cm) of Gymnothorax moringa (GYMO) observed within 2-m of experimental ledge during survey.	cm
len_LUAP	Size (in cm) of Lutjanus apodus (LUAP) observed within 2-m of experimental ledge during survey.	cm
len_LIRU	Size (in cm) of Liopropoma rubre (LIRU) observed within 2-m of experimental ledge during survey.	cm
len_SETI	Size (in cm) of Serranus tigrinus (SETI) observed within 2-m of experimental ledge during survey.	cm
len_basslet	Fairy basslet length in cm.	cm
count	Number of fairy basslet of given size.	dimensionless

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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).

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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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