# Lionfish and grouper density from surveys conducted at Lee Stocking Island, Bahamas from 2009-2015 (BiodiversityLossEffects_lionfish project)

**Website**: https://www.bco-dmo.org/dataset/728810
**Data Type**: Other Field Results
**Version**: 1
**Version Date**: 2018-04-04

**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**:23.7667 **Lon**:-76.099167
**Temporal Extent**: 2009 - 2015

## Dataset Description

Survey data for invasive lionfish and a comparison native predator (Nassau Grouper) on reefs around Lee Stocking Island, The Bahamas (23°46'0.12"N 76° 5'57.00"W). These data are compiled across multiple spatial scales and were collected from the time lionfish first arrived in the study area (2009) through 2015.

Species names and common names for the species codes used in this dataset can be found in the "Species Key" dataset https://www.bco-dmo.org/dataset/655195.

These data were utilized in the following publication (Benkwitt et al., 2017)

### Methods & Sampling

To determine patterns of lionfish (*Pterois volitans*) and Nassau Grouper (*Epinephalus striatus*) abundance and body size over the first decade of the lionfish invasion, we examined fish survey data collected in the Exuma Cays, The Bahamas, from when lionfish first arrived in the study area in 2005 through 2015. We surveyed reef-resident fishes at three spatial scales: (1) small patch reefs; (2) medium-sized patch reefs; and (3) large reefs.  Small reefs included 32 coral patch reefs (ca. 6 m2) as well as 16 artificial reefs (ca. 1 m2) constructed

of concrete blocks. Surveys were conducted annually on these reefs from June to August during 2005–2015, with the exception of 2006 and 2012–2014. A pair of trained observers recorded the abundance and visually estimated body size (to nearest cm total length, TL) of all resident fishes on each reef. Censuses consisted of divers slowly circling the reefs at distances of ~3, ~1, and 0 m and then using flashlights to thoroughly search all holes and crevices. Medium-sized reefs comprised six natural coral patches (ca. 6 to 23 m2). Fish populations on these reefs were censused in 2006–2012 and 2015 following the same protocol as for the small reefs. At the largest scale, ten reefs (ca. 1400 to 4000 m2) were surveyed as part of a long-term lionfish manipulation experiment. All resident fishes in 400 m2 survey areas (two 10 x 10 m plots and four 2 x 25 m transects) were censused on each reef. We examined fish surveys that were conducted in June 2009, before any lionfish manipulations, to surveys conducted in July/August 2015, 3 years after the experiment of Albins (2015) was completed. Lionfish were never manipulated on one of these large reefs, which was isolated from other reefs. We examined a complete time series of surveys on this particular reef, including censuses conducted in both winter (November–February) and summer (June–August) of 2009, 2010, 2011, and in summer of 2012 and 2015.

Additional methods for surveys of large reefs included in: Albins, MA. 2015.

#### Data Processing Description

Several years are missing data, due to logistical constraints that prevented surveys.  In 2015, only 3 out of 6 subsamples of large reefs were surveyed due to time constraints.

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 5,10,15,..65 to len_5,len_10..len_15 etc.  Data parameters in our system can't start with a number.
* column "NOTES" removed as it has nothing in it.

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## Data Files

| File | |
|---|---|
| **Lionfish_and_grouper_density.csv** | (Comma Separated Values (.csv), 56.39 KB) MD5:1687e492617792bc351e9891b072ad62 |
| Primary data file for dataset ID 728810 | |

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## Related Publications

Albins, M. (2015). Invasive Pacific lionfish Pterois volitans reduce abundance and species richness of native Bahamian coral-reef fishes. Marine Ecology Progress Series, 522, 231–243. doi:10.3354/meps11159
*Methods*

Benkwitt, C. E., Albins, M. A., Buch, K. L., Ingeman, K. E., Kindinger, T. L., Pusack, T. J., … Hixon, M. A. (2017). Is the lionfish invasion waning? Evidence from The Bahamas. Coral Reefs, 36(4), 1255–1261. doi:10.1007/s00338-017-1620-7
*Results*

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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 |
| OBSERVER | Initials of primary observer conducting census | unitless |
| REEF | Name of reef surveyed | unitless |
| SUBSAMPLE | For large reefs, number or letter denoting permanent subsample (1-2 = 10 x 10 m plot, A-D = 2 x 25 m transect). For all other reefs, the entire reef was surveyed so subsample is not applicable (n/a) | unitless |
| TYPE | Type of reef, either ART = artificial (cinderblocks), NAT = natural, or TRANS = transplanted coral heads | unitless |
| SCALE | Size of reef, either small (< 6 m^2), medium (6 - 23 m^2), or large (1400-4000 m^2) | unitless |
| SPECIES | Either EPST = Epiniphalus striatus (Nassau Grouper) or PTVO = Pterois volitans (Red lionfish) | unitless |
| len_5 | Number of individuals that were between 0-5 cm total length (visually estimated) | unitless |
| len_10 | Number of individuals that were between 5.1-10 cm total length (visually estimated) | unitless |
| len_15 | Number of individuals that were between 10.1-15 cm total length (visually estimated) | unitless |
| len_20 | Number of individuals that were between 15.1-20 cm total length (visually estimated) | unitless |
| len_25 | Number of individuals that were between 20.1-25 cm total length (visually estimated) | unitless |
| len_30 | Number of individuals that were between 25.1-30 cm total length (visually estimated) | unitless |
| len_35 | Number of individuals that were between 30.1-35 cm total length (visually estimated) | unitless |
| len_40 | Number of individuals that were between 35.1-40 cm total length (visually estimated) | unitless |
| len_45 | Number of individuals that were between 40.1-45 cm total length (visually estimated) | unitless |
| len_50 | Number of individuals that were between 45.1-50 cm total length (visually estimated) | unitless |
| len_55 | Number of individuals that were between 50.1-55 cm total length (visually estimated) | unitless |
| len_60 | Number of individuals that were between55.1-60 cm total length (visually estimated) | unitless |
| len_65 | Number of individuals that were greater than 65 cm total length (visually estimated) | unitless |
| TOTAL | Total number of individuals (summed across all size classes) | unitless |

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## Deployments

**PIMS_Hixon**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/59038 |
| **Platform** | Tropical Marine Lab at Lee Stocking Island |
| **Start Date** | 2009-05-30 |
| **End Date** | 2012-08-18 |
| **Description** | Various lab experiments were conducted between 2009 and 2012 at the facilities at the Perry Institute for Marine Science Tropical Marine Lab (at Lee Stocking Island, Bahamas) for the project "Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish". |

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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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