Initial hunting preferences by predator species in the Bahamas in 2013

Website: https://www.bco-dmo.org/dataset/700263
Data Type: experimental
Version: 1
Version Date: 2017-05-16

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
Initial hunting preferences by predator species in the Bahamas in 2013

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Dataset Description

Behavioral response of invasive lionfish versus native grouper when presented with two congeneric prey fishes (fairy and blackcap basslets) in aquaria.

For related datasets, please visit the project link listed at the top of the page.

Methods & Sampling

To determine whether the preference of predators for basslets was driven by basslet species (fairy and blackcap) or basslet size (small and large: 1.7–2.5 and 3.5–5.2 cm TL, respectively) we presented pairs of basslets in cross-factored combinations of the 2 variables, resulting in the following treatments: (1) small fairy and large fairy, (2) small blackcap and large blackcap, (3) small fairy and small blackcap, (4) large fairy and large blackcap, (5) small fairy and large blackcap, and (6) large fairy and small blackcap. In addition to randomizing the order of basslet treatments presented to each predator, we also randomized the corner of the tank basslets were placed in every time a treatment was presented.

Once the predator and basslets were in their respective sides of the tank, we allowed them to acclimate for 20 min, after which we removed the central barrier and observed the predator’s behavior for 10 min. Observations were performed either in person (74 lionfish trials; 73 graysby trials) or filmed with a digital video camera (16 lionfish trials; 17 graysby trials) positioned outside of the tank. During each 10 min trial, we recorded (1) which basslet the predator hunted first (initial hunting preference); (2) the number of times the predator's mouth made physical contact with each glass container (number of strikes); and (3) the amount of time the predator hunted each basslet (hunting time). We defined the hunting behavior of lionfish as occurring when an individual directly faced a basslet with flared pectoral fins and/or blew pulsed jets of water towards a basslet (Cure et al. 2012). We characterized graysby hunting behavior as occurring when an individual positioned itself near a basslet (<10 cm in this experiment) while directly facing the basslet (Webster 2004).

At the conclusion of the 10 min trial, we separated the predator from the basslets and placed the central barrier back in the tank. A new combination of basslets were placed in the glass containers, and all fish were allowed to acclimate for 20 min before removing the barrier and observing predator response for another 10 min. This procedure was repeated until all 6 basslet treatments had been presented to each predator in random order.

Data Processing Description

To test whether initial hunting preferences be - tween basslet species (fairy and blackcap) and bass - let sizes (small and large) significantly differed be - tween predators (lionfish and graysby) and/or among predator sizes (continuous variables), we fitted generalized estimation equations (GEEs) with binomial distributions and exchangeable correlation structures. GEEs are an extension to the generalized linear model approach that allow for correlations between observations from the same subject, thus allowing us to account for repeated measures. We fitted a full model with an interaction between predators and predator size, and then compared the model fit to that of the reduced additive model by calculating quasilikelihood values under the independence model criterion (QIC; Pan 2001). If the initial hunting preference significantly varied between predators, we then performed a post-hoc McNemar test with a continuity correction for lionfish and graysby (separately) to test whether each predator had a significant initial preference.

BCO-DMO Processing Notes:

- reformatted column names to comply with BCO-DMO standards
- reformatted dates
- nd used to fill blank cells

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Data Files

File
predInitial.csv (Comma Separated Values (.csv), 7.73 KB) MD5:740fb2c5e99b861708d0ab75684b9124 Primary data file for dataset ID 700263

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Related Publications

Cure, K., Benkwitt, C., Kindinger, T., Pickering, E., Pusack, T., McIlwain, J., & Hixon, M. (2012). Comparative behavior of red lionfish Pterois volitans on native Pacific versus invaded Atlantic coral reefs. Marine Ecology Progress Series, 467, 181–192. doi:10.3354/meps09942
Methods

Kindinger, T., & Anderson, E. (2016). Preferences of invasive lionfish and native grouper between congeneric prey fishes. Marine Ecology Progress Series, 558, 247–253. doi:10.3354/meps11833
Methods

Pan, W. (2001). Akaike's Information Criterion in Generalized Estimating Equations. Biometrics, 57(1), 120–125. doi:10.1111/j.0006-341x.2001.00120.x https://doi.org/10.1111/j.0006-341X.2001.00120.x
Methods

Webster, M. S. (2004). DENSITY DEPENDENCE VIA INTERCOHORT COMPETITION IN A CORAL-REEF FISH. Ecology, 85(4), 986–994. doi:10.1890/02-0576

Methods

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Parameters

Parameter	Description	Units
predator_ID	Identification number for each predator observed	unitless
predator_species	Species of predator; CECR = Cephalopholis cruentatus; PTVO = Pterois volitan	unitless
predator_size	Total body length of predator	centimeters
bass_treatment	Combination of basslets (fairy vs. blackcap basslets) presented to predator in aquarium tank: (1) GRLO.sm_GRLO.lg = small fairy vs. large fairy; (2) GRME.sm_GRME.lg = small blackcap vs. large blackcap; (3) GRLO.sm_GRME.lg = small fairy vs. large blackcap; (4) GRME.sm_GRLO.lg = small blackcap vs. large fairy	unitless
first_size	Size of basslet that predator initially hunted (small or large)	unitless
first_species	Species of basslet that predator initially hunted (GRLO = fairy basslet; GRME = blackcap basslet)	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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