Names, codes, and characteristics of species observed during reef surveys in the Bahamas (Lionfish Invasion project)

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Project
» Ecological Release and Resistance at Sea: Invasion of Atlantic Coral Reefs by Pacific Lionfish (Lionfish Invasion)

Contributors	Affiliation	Role
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Abstract
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Dataset Description

Species code, species names, and other characteristics of species observed during surveys (includes length-weight conversion parameters used for biomass conversions) of coral reefs at Lee Stocking Island, Bahamas.

Part of sub-project titled "Large-scale, Long-term, Lionfish Experiment (LLLE)".

Methods & Sampling

This long-term, large-scale field experiment was designed to document the community-wide effects of invasive lionfish in the vicinity of Lee Stocking Island, Bahamas. Baseline surveys of the fish community were conducted at each of ten large (1400 to 4000 m2) reefs by counting and sizing all fishes within two permanent square plots (100 m2) and four permanent strip plots (50 m2) at each reef. Square plots were centered on the area of each reef with the greatest three-dimensional structure, whereas strip transects were placed to provide a representative sample of the entire reef (biased towards hard substrate). The reefs were paired based on habitat characteristics (depth, current, predominant substrate type, etc.), and one reef in each pair was designated as either low-lionfish-density (LLD) or high-lionfish-density (HLD). Lionfish were then removed from LLD reefs and added to HLD reefs. We attempted to remove all lionfish from LLD reefs, and to augment the density of lionfish on HLD reefs to the level observed on the highest-density reefs before the experiment. Surveys of each fish community were then repeated approximately quarterly. During each survey, any new lionfish appearing on LLD reefs were removed and distributed evenly across the HLD reefs (again, ensuring that densities at HLD reefs did not exceed natural invasive densities prior to the experiment). See details in the following related publications.

Related Publications:

Albins, M.A. (2012) Effects of the Invasive Pacific Red Lionfish Pterois volitans on Native Atlantic Coral-reef Fish Communities (Chapter 6). PhD Dissertation. Oregon State University, Corvallis, Oregon.
Albins, M.A. (in preparation) Invasive Pacific lionfish Pterois volitans reduce abundance and species richness of native Bahamian coral-reef fishes: results from a large-scale, long-term experiment. Intended for Ecological Applications.

Data Processing Description

Reference Codes (used in LW_ref column):
1 = Aiken KA,1983. The Biology Ecology and Bionomics of the Triggerfishes Balistidae. Munro JL (ed). Caribbean Coral Reef Fishery Resources Vol 7. ICLARM Manila Philippines p 191.
2 = Balart EF Gonzalez-Cabello A Romero-Ponce RC Zayas-Alvarez A Calderon-Parra M Campos-Davila L Findley LT. 2006. Length-weight relationships of cryptic reef fishes from the southwestern Gulf of California Mexico. J Appl Ichthyol 22:316-318.
3 = Bohnsack JA Harper DE. 1988. Length-weight relationships of selected marine reef fishes from the Southeastern United States and the Caribbean. NOAA Technical Memorandum NMFS-SEFC-215:31.
4= Bouchon-Navaro Y Bouchon C Kopp D Louis M. 2006. Weight-length relationships for 50 fish species collected in seagrass beds of the Lesser Antilles. J Appl Ichthyol 22:322-324.
5 = Frota LO Costa PAS Braga AC. 2004. Length-weight relationships of marine fishes from the central Brazilian coast. NAGA World Fish Center Quarterly 27:20-26.
6 = García-Arteaga JP Claro R Valle S. 1997. Length-Weight relationships of Cuban marine fishes. NAGA The ICLARM Quarterly 20:38-43.
7 = Gaut VC Munro JL. 1983. The Biology Ecology and Bionomics of the Grunts Pomadasyidae. Munro JL (ed) Caribbean Coral Reef Fishery Resources Vol 7. ICLARM Manila Philippines p 110.
8 = González-Gándara C Pérez-Díaz E Santos-Rodríguez L Arias-González JE. 2003. Length-weight relationships of coral reef fishes from the Alacran Reef Yucatan Mexico. NAGA World Fish Center Quarterly 26:14-16.
9 = Joyeux JC Giarrizzo T Macieira RM Spach HL Vaske T. 2009. Length-weight relationships for Brazilian estuarine fishes along a latitudinal gradient. J Appl Ichthyol 25:350-355.
10 = Kasim HM Hamsa KMSA Balasubramanian TS Rajapackiam S. 1996. Fishery of full beaks and half beaks with special reference to the growth mortality and stock assessment of Ablennes hians (Valenciennes) along the Tuticorin coast Gulf of Mannar. Indian J Fish 43:51-59.
11 = Kulbicki M Guillemot N Amand M .2005. A general approach to length-weight relationships for New Caledonian lagoon fishes. Cybium 29:235-252.
12 = Letourneur Y Kulbicki M Labrosse P. 1998. Length-weight relationship of fishes from coral reefs and lagoons of New Caledonia - an update. NAGA The ICLARM Quarterly 21:39-46.
13 = Manooch CS Barans CA. 1982. Distribution Abundance and Age and Growth of the Tomtate Haemulon aurolineatum Along the Southeastern United-States Coast. Fish Bull 80:1-19.
14 = Safrit GW Schwartz FJ. 1988. Length-weight relationships for gulf flounder Paralichthys albigutta from North Carolina. Fish Bull 86:832-833.
15 = Sandin SA Sampayo EM Vermeji MJA. 2008. Coral reef fish and benthic community structure of Bonaire and Curaçao Netherlands Antilles. Caribbean Journal of Science 44:137-144. (Note: This paper refers to FishBase as the source for a number of L-W conversion estimates but FishBase refers back to this paper as the original source of the estimates therefore these conversions are of questionable origin.)
16 = Author’s unpublished data. L-W curve based on 60 individuals ranging in size from 2.5 to 32.5 cm TL (R2 = 0.992).

Note: BCO-DMO modified original parameter names to conform with BCO-DMO naming conventions.

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Data Files

File
specieslist.csv (Comma Separated Values (.csv), 21.06 KB) MD5:5b8514e59bbb78232036abd1ef32bd48 Primary data file for dataset ID 3896

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Parameters

Parameter	Description	Units
species_code	4-letter genus species code (typically first two letters are the first two of the genus and last two letters are the first two of the species - corresponds with "Species" column in "LLLE Surveys clean" dataset). Originally named 'SpeciesID'.	dimensionless
species	Scientific name of species (Genus species) at the beginning of the project.	text
name_change	Indicates whether or not there has been a name change for the species since the inception of the project (0 = no change, 1 = change).	0 or 1
species_new	Currently recognized scientific name of species (should match "SpeciesName" if "NameChange" = 0, and should contain the more recent version of the name if "NameChange" = 1). Column originally named 'NewName'.	text
common_name	Common name of the species.	text
family	Family of species.	text
transient	Takes value of 1 if species is primarily transient at the experimental reef scale and 0 otherwise.	0 or 1
piscivore	Takes value of 1 if species is primarily a piscivore and 0 otherwise.	0 or 1
herbivore	Takes value of 1 if species is primarily an herbivore and 0 otherwise.	0 or 1
mature_lt_5cm	Takes value of 1 if species reaches reproductive maturity at a TL of less than or equal to 5 cm and 0 otherwise. Originally named 'MatLess5'.	0 or 1
obligate_cleaner	Takes value of 1 if species is documented as an obligate cleaner and 0 otherwise.	0 or 1
faculative_cleaner	Takes value of 1 if species is documented as a faculative cleaner and 0 otherwise.	0 or 1
invertebrate	Takes value of 1 if species is an invertebrate and 0 if species is a fish.	0 or 1
LW_a	Parameter "a" in corrected length-weight conversion equation used for biomass calculations.	numeric
LW_b	Parameter "b" in corrected length-weight conversion equation used for biomass calculations.	numeric
LW_c	Standard length to total length conversion parameter (LWc = 1 if "a" and "b" were fit on total length and LWc equals ratio of SL to TL if "a" and "b" were fit on standard length.	numeric
LW_ref	Reference code identifying source of LW conversion parameters.	code
species_substitute	Name of substitute species used for LW conversion parameters (if parameters could not be found for a given species those for a similarly shaped species were used - SubSp is equal to "na" if parameters for the actual species were used).	text

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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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