Data generated from the manipulative experiments in Moorea, French Polynesia from February-August 2007 (CDD_in_Reef_Fish project)

Website: https://www.bco-dmo.org/dataset/726744
Data Type: experimental
Version: 1
Version Date: 2017-10-05

Project
» Cryptic density dependence: the effects of spatial, ontogenetic, and individual variation in reef fish (CDD_in_Reef_Fish)

Contributors	Affiliation	Role
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Abstract
This dataset is from a manipulative experiment investigating intracohort priority effects between two competing reef fishes (Thalassoma hardwicke and T. quinquevittatum). This particular dataset contains all data generated from the manipulative experiments within this study; Experiment 1 focuses on interspecific competition, whereas Experiment 2 focuses on intraspecific competition. For additional data please see files listed in Related Datasets.

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Coverage

Spatial Extent: **Lat**:-17.5 **Lon**:-149.8333333
Temporal Extent: 2007-03 - 2007-08

Dataset Description

This dataset is from a manipulative experiment investigating intracohort priority effects between two competing reef fishes (*Thalassoma hardwicke* and *T. quinquevittatum*). This particular dataset contains all data generated from the manipulative experiments within this study; Experiment 1 focuses on interspecific competition, whereas Experiment 2 focuses on intraspecific competition. For additional data please see files listed in Related Datasets.

Related Datasets

- Geange_and_Stier_2009 Order of Arrival: https://www.bco-dmo.org/dataset/726744 (current page)
- Geange_and_Stier_2009 Order of Arrival Size: https://www.bco-dmo.org/dataset/726781

- Geange_and_Stier_2009 Order of Arrival Background Community: https://www.bco-dmo.org/dataset/726766

Methods & Sampling

The study was conducted in the northern lagoon of Moorea, French Polynesia (17 30'S, 149 50'W) at the Gump Biological Research Station between February and August 2007, using a grid of 28 live-coral patch reefs in water 2 to 4 meters deep.

Experimental Design and Execution
To test for priority effects, we experimentally manipulated the sequence and timing of arrival of T. hardwicke and T. quinquevittatum onto reefs. We used recent settlers (13.8 mm SL; SD = 2.3; approximately two weeks post-settlement) captured from reefs roughly 4 km from the study site. All captured fish were held in tanks with running seawater for 6–12 h, then individually tagged with different colors of Visible Implant Elastomer forward of the caudal peduncle. After tagging, we returned fish to aerated aquaria for 6-12 hr before measuring them to the nearest 0.1 mm SL, and deploying them in the field. We used newly collected and tagged fish in two experiments. Experiment 1 examined interspecific priority effects between T. hardwicke and T. quinquevittatum. Experiment 2 examined intraspecific priority effects within T. hardwicke.

Experiment 1: Interspecific Priority Effects between T. hardwicke and T. quinquevittatum
We experimentally manipulated the sequence and timing of the arrival of T. hardwicke and T. quinquevittatum settlers; one portion of this experiment was designed to quantify effects of T. hardwicke (the prior resident) on T. quinquevittatum (the focal species); the other was designed to test the effects of T. quinquevittatum (as the prior resident) on T. hardwicke (as the focal species). For both cases, we simulated settlement pulses by introducing three fish of the focal species onto reefs where three tagged fish of the prior resident were either absent; had been introduced 12-days earlier than, 5-days earlier than, or simultaneously with (0-days) the focal species. All fish were collected and tagged in the 24 hours preceding their deployment in the field. We ran the experiment in two temporal blocks (11 to 30 April and 2 to 21 May), randomly assigning treatments to reefs, and fish to treatments, yielding eight replicates (four in each temporal block) for each of our seven treatments: 1) T. hardwicke without T. quinquevittatum; 2) T. hardwicke and T. quinquevittatum introduced simultaneously; 3) T. hardwicke with T. quinquevittatum introduced 5-days previously; 4) T. hardwicke with T. quinquevittatum introduced 12-days previously; 5) T. quinquevittatum without T. hardwicke; 6) T. quinquevittatum with T. hardwicke introduced 5-days previously, and 7) T. quinquevittatum with T. hardwicke introduced 12 days previously. Note that treatment 2 served as the simultaneous arrival treatment for both species. For each experimental run, we size matched focal individuals and prior residents, so that all fish were the same size at the time they were added to reefs. Size differences between prior residents and focal individuals were then a function of the length of prior residency (e.g., growth advantage conferred upon 12-day prior residents relative to 0-day prior residents was 12 days). Because recently settled fish often experience high rates of mortality, we initially introduced 6 prior residents to reefs in the 12-day and 5-day treatments. Prior to introducing focal fish to these treatments, we haphazardly removed excess residents when there were more than three residents (18 instances out of 32 reefs), and pressed residents at the same time as focal individuals were added when there were less than three residents (6 instances out of 32). We surveyed reefs twice daily (approximately 8 am and 4 pm) for seven days after we introduced focal individuals.

Experiment 2: Intraspecific Priority Effects between T. hardwicke Individuals
We used a similar experimental design to examine intraspecific priority effects for T. hardwicke (i.e., T. hardwicke recruits served as both the focal and resident individuals). Because the intraspecific design had four instead of seven treatments, all seven replicates of the four treatments were conducted together once (6 July to 25 July).

Behavioural Observations
To help elucidate the mechanisms driving priority effects we conducted five-minute behavioral observations at the time we added focal individuals to reefs. After allowing fish to acclimate to the observer's presence for approximately three minutes, behavioral observations were conducted at a distance of approximately two meters from the reef. We recorded three response variables: 1) The number of chases between focal individuals and both prior residents and the background community; 2) The number of fin bites inflicted during chases; and 3) Time spent inside Pocillopora by focal individuals.

Data Processing Description

This is raw data.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions

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Data Files

File	
GeangeandStier_2009_Orderofarrival.csv	(Comma Separated Values (.csv), 10.71 KB) MD5:0a3c89b4e13739bb464c9a1295e8954e
Primary data file for dataset ID 726744	

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Related Publications

Geange, S. W., & Stier, A. C. (2009). Order of arrival affects competition in two reef fishes. Ecology, 90(10), 2868–2878. doi:10.1890/08-0630.1
General

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Related Datasets

IsRelatedTo

Geange, S., Stier, A. (2021) **Description of the background community of reefs used in an experiment at Moorea, French Polynesia from February-August 2007 (CDD_in_Reef_Fish project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2017-10-05 doi:10.26008/1912/bco-dmo.726766.1 [view at BCO-DMO]

Geange, S., Stier, A. (2021) **Size of individuals used within each experiment at Moorea, French Poynesia from February-August 2007 (CDD_in_Reef_Fish project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2017-10-05 doi:10.26008/1912/bco-dmo.726781.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
run	experimental run identifier	unitless
reef	unique identifier for each reef in experimental array	unitless
priority	Treatment level for priority effect (Absent; 0-days; 5-days; 12-days; Sim (i.e. “Simultaneously))	unitless
focal	Genus and species of the focal species (T.(Thalassoma) hardwicke or T. (Thallasoma) quinquevittatum)	unitless
competitor	Genus and species of the competitor species (T.(Thalassoma) hardwicke or T. (Thallasoma) quinquevittatum)	unitless
substrate	the number of substrate bites by focal individuals	unitless
chase	the number of chases between other fishes and the focal individual	unitless
finbite	the number of fin bites inflicted upon the focal individual	unitless
poc	percent of time spent inside Pocillopora by the focal individuals	unitless (percent)
social	percent of time (in five minutes) spent swimming with- or near a conspecific individual	unitless (percent)
survival	proportional survival of focal individuals at end of experiment	unitless

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Instruments

Dataset-specific Instrument Name	tanks
Generic Instrument Name	Aquarium
Dataset-specific Description	All captured fish were held in tanks with running seawater for 6–12 h, then individually tagged with different colors of Visible Implant Elastomer forward of the caudal peduncle.
Generic Instrument Description	Aquarium - a vivarium consisting of at least one transparent side in which water-dwelling plants or animals are kept

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Deployments

Osenberg_et_al_Moorea

Website	https://www.bco-dmo.org/deployment/644752
Platform	Osenberg et al Moorea
Start Date	2003-05-19
End Date	2015-07-12

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Project Information

Cryptic density dependence: the effects of spatial, ontogenetic, and individual variation in reef fish (CDD_in_Reef_Fish)

Coverage: Moorea, French Polynesia (-17.48, -149.82)

Description from NSF award abstract:
Ecologists have long been interested in the factors that drive spatial and temporal variability in population density and structure. In marine reef systems, attention has focused on the role of settlement-the transition of pelagic larvae to a benthic stage-and on density-dependent processes affecting recently settled juveniles. Recent data suggest that co-variance in settlement and subsequent density-dependent survival can obscure the patterns of density dependence at larger scales, a phenomenon called cryptic density dependence. This research will explore the mechanisms that underlie the spatial covariance of settlement and site quality - a process that has received little attention in the standard paradigm. These mechanistic studies of cryptic density dependence will facilitate the development of new frameworks for fish population dynamics that incorporate larval ecology, habitat quality, density dependence, life history, and the patterns and implications of spatial covariance among these factors. More generally, the work provides a specific empirical context, and a general theoretical treatment, of cryptic heterogeneity (hidden individual variation in demographic rates).

Note: Drs. Craig W. Osenberg and Ben Bolker were at the University of Florida at the time the NSF award was granted. Dr. Osenberg moved to the University of Georgia during the summer of 2014 (current contact information). Dr. Bolker moved to McMaster University in 2010 (current contact information).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0242312

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