Diurnal gnathiid consumption in fish sampled from shallow reef sites in Caribbean waters from May 2017 to Sep 2021

Website: https://www.bco-dmo.org/dataset/887530
Data Type: Other Field Results
Version: 1
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Project
» Beyond Cleaning and Symbiosis: Ecology of 'Ticks of the Sea' on Coral Reefs (Gnathiid isopod ecology)

Contributors	Affiliation	Role
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Abstract
Specialist species have evolved to fill narrow niches but are especially susceptible to environmental change. With sufficient functional redundancy, ecosystem services can persist without specialists. Grooming behaviors are common in both terrestrial and aquatic organisms. However, in aquatic systems there is a heavy reliance on intraspecific mutualisms where specialist species groom or "clean" parasites off of host fishes. Here, we sampled the gut contents of 709 fishes, representing 61 species and including both cleaner and non-cleaner fishes, to compare their consumption of gnathiid isopods, the most common fish ectoparasites. This dataset contains sample and collection metadata, including date, location, and method of sampling, as well as species, stage, length, and Gnathiid count for samples collected. We found that cleaner fishes eat significantly more gnathiids, and eat them more frequently, compared to non-cleaner fishes. Our results highlight the importance of both dedicated and facultative cleaners as consumers of ectoparasites and show that their role cannot be supplanted by generalist consumers. Furthermore, we suggest that different cleaner species act as complementary rather than redundant specialists.

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Coverage

Location: Caribbean waters, Virgin Islands and Puerto Rico
Spatial Extent: **N**:18.352 **E**:-64.719 **S**:17.939 **W**:-67.057
Temporal Extent: 2017-05-20 - 2021-09-01

Methods & Sampling

We sampled the gut contents of 709 fishes, representing 61 species and including both cleaner and non-cleaner fishes by opportunistic shore-based or small craft day trips to shallow reef sites in Caribbean waters by the Virgin Islands, and Puerto Rico to compare their consumption of gnathiid isopods, the most common fish ectoparasites

Sampling sites: St Thomas, usvi (18°20′25.3″ N, 64°58′36.8″ W): "baby", St. John, usvi (18°19′0.2″ N, 64°43′20.8″ W): "donkey", "jum", "lam", "tektite", La Parguera, Puerto Rico (17°57′18.1″ N, 67°03′08.1″W): "Enrique", "Mario", "Medialuna".

Fish Collection Methods
A variety of methods and net types were used to collect fish while on snorkel or SCUBA. All fish were caught between sunrise and approximately 11:00 h. This time block was selected to maximize the interface between when diurnal fishes begin to feed and when gnathiids may still be active. Details on sampling for each site can be found in supplementary material (Supplementary Table 1 in Nicholson et al., 2022). We did not account for any effect of site because all sites are similar in composition regarding biodiversity and benthic composition, and all have been confirmed to have substantial gnathiid populations (Artim et al. 2020).

Sample Processing
Gut content samples were collected via lavage (stomach pump, Artim et. al 2017), dissection, or feces collection. Fish that were large enough to have surgical tubing (either 6mm or 3mm outer diameter) safely inserted were gut lavaged. They were then returned to the location on reef where they were caught after recovering in an aerated bin of fresh seawater. Fish that were too small to be lavaged were brought back to the lab and humanely euthanized prior to dissection. However, when possible, fish were placed in aerated tanks for ~24hrs and allowed to defecate. Fecal matter was collected, and the fishes were subsequently returned to the same area reef where they were caught. Samples were screened with a dissecting scope. Since their chitinous exoskeletons are not able to be digested, remnants of gnathiids (specifically the heads, Fig. 1 in Nicholson et al., 2022), can be reliably identified by any of the sample collection methods detailed above.

BCO-DMO Curation Notes

- Imported "GCC.csv" into the BCO-DMO data system
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added columns for “Latitude” and “Longitude” based on reef site metadata
- Rounded columns: “Latitude” and “Longitude” to 3 decimal places (or to the thousandth place)
- Converted Date to YYYY-MM-DD
- Exported file as "887530_v1_diurnal_gnathiid.csv"

Problem Description

There were some issues with data transcription but these were resolved in data analysis. These include: Misspelled “Tetraodontidae”, “Eucinstmus lefroyi”, and “Nicholsina usta” in some cells.

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Data Files

File	
887530_v1_diurnal_gnathiid.csv	(Comma Separated Values (.csv), 88.80 KB) MD5:57092b1315e2d00c6f6d564e1eeab7c2
Primary data file for dataset ID 887530, version 1	

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Related Publications

Artim, J. M., Hook, A., Grippo, R. S., & Sikkel, P. C. (2017). Predation on parasitic gnathiid isopods on coral reefs: a comparison of Caribbean cleaning gobies with non-cleaning microcarnivores. Coral Reefs, 36(4), 1213–1223. https://doi.org/10.1007/s00338-017-1613-6
Methods

Artim, J. M., Nicholson, M. D., Hendrick, G. C., Brandt, M., Smith, T. B., & Sikkel, P. C. (2020). Abundance of a cryptic generalist parasite reflects degradation of an ecosystem. Ecosphere, 11(10). Portico. https://doi.org/10.1002/ecs2.3268
Methods

Nicholson, M., Pagan, J., Hendrick, G., & Sikkel, P. (2022). Are cleaner fishes replaceable on coral reefs as consumers of fish ectoparasites? https://doi.org/10.22541/au.166004853.31851926/v1
Results

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Parameters

Parameter	Description	Units
Number	Overall sample number	unitless
ID	unique sample ID from when sample was collected	unitless
Location	Site where sample was collected	unitless
Latitude	Latitude of sample site	decimal degrees
Longitude	Longitude of sample site (West is negative)	decimal degrees
Method	Method used to collect sample (lavage, dissection, or poop)	unitless
Date	Date sample was collected	unitless
Common_Name	Species common name	unitless
Species	Scientific name of fish species	unitless
Family	Family fo fish collected	unitless
Stage	Life history stage of collected fish, if able to be determined	unitless
Length	Fish length, Total Length (TL), or Standard Length (SL)/Fork Length (FL)/ Total Length (TL)	centimeters (cm)
Gnathiids	Gnathiids present or absent	unitless
Notes	Count of gnathiids from sample	unitless
Gnathiid_count	Any special notes about sample	unitless

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Instruments

Dataset-specific Instrument Name	An assortment of nets (e.g. hand nets, cast nets, barrier nets)
Generic Instrument Name	Hand Net
Dataset-specific Description	An assortment of nets (e.g. hand nets, cast nets, barrier nets) was used for fish catching.
Generic Instrument Description	A hand net (also called a scoop net or dip net) is a net or mesh basket held open by a hoop. They are used for scooping fish near the surface of the water.

Dataset-specific Instrument Name	Dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Dissecting microscope for sample sorting
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

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Project Information

Beyond Cleaning and Symbiosis: Ecology of 'Ticks of the Sea' on Coral Reefs (Gnathiid isopod ecology)

Coverage: Eastern Caribbean, Philippines, Australia

NSF Award Abstract:
Most research on the complex biological interactions that inhabit coral reefs has focused on larger organisms that are easily observed by divers. However, marine scientists are increasingly aware of the importance of the tiny organisms that make up the "smaller majority." This includes parasites, organisms that feed on other organisms without killing them, which may make up as many as 80% of the species on coral reefs. Among the most important parasitic organisms on coral reefs are gnathiid isopods, so-called 'ticks of the sea', that share many similarities with blood-feeding ticks and other arthropods on land. Like ticks and mosquitoes, gnathiids transmit malaria-like blood parasites. In high numbers, they can remove enough blood to kill adult fish, but even a single gnathiid can kill a juvenile fish. Thus, gnathiids may have a significant effect on coral reef communities through their effects on coral reef fishes. This project will use an integrative interdisciplinary approach involving field and laboratory observations and experiments, and molecular tools. In addition to contributing to our understanding of life in our oceans, this research will provide continued support for U.S. Doctoral and Masters students and will create valuable research opportunities for undergraduates from multiple institutions. The project will further build on the investigators existing relationships with resource managers, local divers, fishers, and boat operators, as well as K-12 schools and environmental education programs, and will contribute to local economies. A major goal of our outreach efforts will include an exhibit featuring our research at Coral World Ocean Park on St. Thomas, participation in Virgin Islands radio programs, and hosting high school students from South Carolina Governor's School.

The overall goal this investigation is to understand the ecology of fish-parasite interactions on coral reef and associated ecosystems. This project focuses on fish-parasitic gnathiid isopods, the most common ectoparasites of coral reef fishes that are best known for their role in cleaning symbiosis, as the major food item of cleaner fishes. However, their abundance, host range, role as micropredator, disease vector, and

potential prey item for other species, as well as their strong association with the benthos suggests the potential for much stronger community impacts. The goals for this project are to: 1) characterize the factors influencing local gnathiid isopod density by examining the role of fish-hosts, benthic cover, gnathiid predators including cleaners, and gnathiid conspecific attraction; 2) determine and quantify variation in host exploitation and the effects of gnathiid density on larval fish-host recruitment. To accomplish the first objective, the investigators will trap gnathiids from the substrate at sites in the Caribbean, Australia, and the Philippines. Variables associated with benthic habitat as well as local fish communities will be quantified and compared with local gnathiid abundance. Laboratory experiments will be conducted to determine the effects of different host species on gnathiid growth and reproduction and to determine the role of conspecific attraction in the formation of aggregations. Predators of gnathiids will be identified through examination of gut contents and through laboratory feeding studies. To accomplish the second objective, patterns of host-exploitation will be determined by DNA barcoding of blood meals from wild-caught gnathiids and results compared with the availability of different host species. To determine the effects of gnathiids on early life history stages of coral reef fishes, gnathiid abundance will be manipulated on small artificial patch reefs onto which newly-settled reef fishes will be transplanted.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536794

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