Body stoichiometry of coral reef fishes collected from the Indo-Pacific in 2016-2017

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Data Type: Other Field Results
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Project
» CAREER: Fish-derived nutrients in a coral reef ecosystem - impacts on benthic communities and importance for coral restoration (Fish Derived Coral Nutrients)

Contributors	Affiliation	Role
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Abstract
This dataset includes body stoichiometry of coral reef fishes collected from the Indo-Pacific (Palmyra and Moorea) in 2016-2017.

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Coverage

Spatial Extent: **N**:5.8885 **E**:-149.8295 **S**:-17.5388 **W**:-162.0787
Temporal Extent: 2016-07-06 - 2017-09-25

Acquisition Description

All fish capturing was sanctioned via IACUC permit #915 from the University of California Santa Barbara. For catching live individual fishes, we employed a variety of gear types to target and capture individuals across the available size range. Gear included hook and line, fish traps, barrier nets, and hand nets with sampling from coral reefs, sand flats, and rubble areas. We also harvested fishes via spearguns, pole spears, hook and line, and barrier nets. Fishes that were not immediately killed by our capture method were euthanized by transferring them to polyethylene bags containing a solution of seawater and MS 222. This solution was buffered with sodium bicarbonate to pH ~8.0 as monitored with pH strip test kits. Fishes were incubated in this solution until death is confirmed by the lack of respiration. Once euthanized, fishes were dissected to remove the gut contents with the digestive tract placed back in the fish once emptied. The fishes were then processed for body stoichiometric measurements (body composition of carbon, nitrogen, and phosphorus). Fishes were dried for 5-7 days at 60 degrees C until the body was devoid of moisture. The dried fishes were then ground separately in a large ball mill to a talcum power-like consistency. This dried powered was then subjected to analytical procedures to measure body C, N, and P. Ground samples were analyzed for %C and N content with a CHN Carlo-Erba elemental analyzer (NA1500)

CN Analyzer, and for %P using dry oxidation-acid hydrolysis extraction followed by a colorometric analysis (Aplkem RF300). Elemental content was calculated on a dry weight basis.

Processing Description

BCO-DMO Processing:
- replaced "NA" with "nd" (no data value);
- renamed fields (changed "%" to "pcnt");
- corrected 2026 to 2016 in date field;
- changed date format to YYYY-MM-DD.

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Parameters

Parameter	Description	Units
date_collected	Date the sample was collected; format: YYYY-MM-DD	unitless
Location_collected	Location sample was collected: eitehr Palmyra or Moorea, French Polynesia	unitless
Habitat_collected	Habitat sample was collected	unitless
Fish_total_length_mm	Total length of fish in millimeters	millimeters (mm)
Fish_wet_mass_g	Wet mass of fish in grams	grams (g)
Fish_dry_mass_g	Dry mass of fish in grams	grams (g)
family	Family of fish	unitless
genus	Genus of fish	unitless
species	Species of fish	unitless
total_n_pcnt	Percentage of nitrogen per unit dry mass of fish tissue	unitless (percent)
total_c_pcnt	Percentage of carbon per unit dry mass of fish tissue	unitless (percent)
total_p_pcnt	Percentage of phosphorus per unit dry mass of fish tissue	unitless (percent)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Manual Biota Sampler
Dataset-specific Description	For catching live individual fishes, we employed a variety of gear types to target and capture individuals across the available size range. Gear included hook and line, fish traps, barrier nets, and hand nets with sampling from coral reefs, sand flats, and rubble areas. We also harvested fishes via spearguns, pole spears, hook and line, and barrier nets.
Generic Instrument Description	Manual Biota Sampler indicates that a sample was collected in situ by a person, possibly using a hand-held collection device such as a jar, a net or their hands.

Dataset-specific Instrument Name	CHN Carlo-Erba elemental analyzer (NA1500)
Generic Instrument Name	Carlo-Erba NA-1500 Elemental Analyzer
Dataset-specific Description	Ground samples were analyzed for %C and N content with a CHN Carlo-Erba elemental analyzer (NA1500) CN Analyzer.
Generic Instrument Description	A laboratory instrument that simultaneously determines total nitrogen and total carbon from a wide range of organic and inorganic sediment samples. The sample is completely and instantaneously oxidised by flash combustion, which converts all organic and inorganic substances into combustion products. The resulting combustion gases pass through a reduction furnace and are swept into the chromatographic column by the carrier gas which is helium. The gases are separated in the column and detected by the thermal conductivity detector which gives an output signal proportional to the concentration of the individual components of the mixture. The instrument was originally manufactured by Carlo-Erba, which has since been replaced by Thermo Scientific (part of Thermo Fisher Scientific). This model is no longer in production.

Dataset-specific Instrument Name	Aplkem RF300
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Ground samples were analyzed for %P using dry oxidation-acid hydrolysis extraction followed by a colorometric analysis (Aplkem RF300).
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Project Information

CAREER: Fish-derived nutrients in a coral reef ecosystem - impacts on benthic communities and importance for coral restoration (Fish Derived Coral Nutrients)

Coverage: Moorea, French Polynesia

NSF abstract:
Coral reefs are currently imperiled from a variety of human-induced threats from climate change, coral diseases, overexploitation of important fish species, and enrichment with excessive amounts of nutrients. These threats can result in the decline in corals and fishes and the rise in seaweeds, turning coral reefs into seaweed reefs. One important aspect of understanding how human-mediated changes impact the ecology of reefs is to understand how fishes impact important nutrient cycles on reefs. The investigators prior research suggests that fishes may be one of the most important sources of nitrogen and phosphorus on reefs via their daily excretions. These fish-derived nutrients may help corals grow faster but could also help seaweeds grow faster if corals are killed by other processes such as climate change or disease. However, nutrients from human-derived sources such as runoff from agriculture or sewage discharge can be harmful to corals as these nutrients are often of different types than those in fish excretions. The investigator seeks to understand how the different effects of fish-derived vs. human-derived nutrients impact coral growth, seaweed growth, and, ultimately, the health of coral reef ecosystems. This research will also facilitate a number of training and outreach opportunities including: (1) training graduate and undergraduate students, (2) creating a partnership between FIU and MAST@FIU, a new science and technology magnet high school, to educate underrepresented minorities in marine biology, (3) taking marine science to the masses with widely distributed videos, and (4) creating a citizen science initiative that will get interested marine biology students involved with helping to monitor some of the field experiments. Further, this work will generate much needed information on the science of coral reef restoration. Restoration of reefs is a growing field but many restoration efforts have little solid grounding in understanding the ecological processes that keep reefs healthy. Thus, this work will be able to make significant contribution to educating managers and restoration practitioners as to the processes that can help facilitate successful restoration efforts.

This research will address fundamental and untested questions of how nutrient excretion by fishes impacts coral reef communities. Prior data suggest that the ecology of reefs is critically linked to the role of fishes as providers of limiting nutrients since fishes are one of, if not the most important, sources of N on reefs. This research is not only unique in its scope but also timely due to the global threats to reefs. As overfishing removes important fishes (and their role as nutrient providers) and anthropogenic nutrient loading increases the abundance of potentially harmful nutrients, the nutrient regimes on reefs may be changing for the worse. The goal of this project is to quantify how nutrients from fish excretion impact coral reef community structure and how this effect varies across environmental context. Specifically, the investigator outlines research to focus on three general sets of objectives that will be approached on reefs in the Florida Keys, USA: (1) Assess how fish-derived nutrients influence benthic community structure and coral growth and health both across and within reefs and how this influence varies with abiotic context, (2) Test how the physiology and growth of individual corals and algae respond to the different nutrient sources in fish excretion vs. anthropogenic nutrient loading, and (3) Examine how fish-derived nutrients impact coral restoration and how to design restoration programs to take advantage of important of fish-derived nutrients for coral growth. These questions will be addressed with: (1) a field monitoring program (Objective 1), (2) mechanistic nutrient enrichment experiments (Objective 2), and (3) coral restoration experiments (Objective 3).

Please note that the project geolocation changed from the Florida Keys to Moorea, French Polynesia.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1547952