Peer Community In Ecology

# Constraining the importance of heterotrophic vs autotrophic feeding in photosymbiotic cnidarians

**Ulisse Cardini** *based on peer reviews by 2 anonymous reviewers*

Nils Radecker, Anders Meibom (2023) Symbiotic nutrient cycling enables the long-term survival of Aiptasia in the absence of heterotrophic food sources. bioRxiv, ver. 3, peer-reviewed and recommended by Peer Community in Ecology.
https://doi.org/10.1101/2022.12.07.519152

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The symbiosis with autotrophic dinoflagellate algae has enabled heterotrophic Cnidaria to thrive in nutrient-poor tropical waters (Muscatine and Porter 1977; Stanley 2006). In particular, mixotrophy, i.e. the ability to acquire nutrients through both autotrophy and heterotrophy, confers a competitive edge in oligotrophic waters, allowing photosymbiotic Cnidaria to outcompete benthic organisms limited to a single diet (e.g., McCook 2001). However, the relative importance of autotrophy vs heterotrophy in sustaining symbiotic cnidarian's nutrition is still the subject of intense research. In fact, figuring out the cellular mechanisms by which symbiotic Cnidaria acquire a balanced diet for their metabolism and growth is relevant to our understanding of their physiology under varying environmental conditions and in response to anthropogenic perturbations.

In this study's long-term starvation experiment, Radecker & Meibom (2023) investigated the survival of the photosymbiotic sea anemone Aiptasia in the absence of heterotrophic feeding. After one year of heterotrophic starvation, Apitasia anemones remained fully viable but showed an 85 % reduction in biomass. Using 13C-bicarbonate and 15N-ammonium labeling, electron microscopy and NanoSIMS imaging, the authors could clearly show that the contribution of algal-derived nutrients to the host metabolism remained unaffected as a result of increased algal photosynthesis and more efficient carbon translocation. At the same time, the absence of heterotrophic feeding caused severe nitrogen limitation in the starved Apitasia anemones.

Overall, this study provides valuable insights into nutrient exchange within the symbiosis between Cnidaria and dinoflagellate algae at the cellular level and sheds new light on the importance of heterotrophic feeding as a nitrogen acquisition strategy for holobiont growth in oligotrophic waters.

***References:***

McCook L (2001) Competition between corals and algal turfs along a gradient of terrestrial influence in the nearshore central Great Barrier Reef. Coral Reefs 19:419–425. https://doi.org/10.1007/s003380000119

Muscatine L, Porter JW (1977) Reef corals: mutualistic symbioses adapted to nutrient-poor environments. Bioscience 27:454–460. https://doi.org/10.2307/1297526

Radecker N, Meibom A (2023) Symbiotic nutrient cycling enables the long-term survival of Aiptasia in the absence of heterotrophic food sources. bioRxiv, ver. 3 peer-reviewed and recommended by Peer Community in Ecology. https://doi.org/10.1101/2022.12.07.519152

Stanley GD Jr (2006) Photosymbiosis and the evolution of modern coral reefs. Science 312:857–858. https://doi.org/10.1126/science.1123701

# Reviews

## Evaluation round #2

DOI or URL of the preprint: https://doi.org/10.1101/2022.12.07.519152
Version of the preprint: 2

### Authors' reply, 05 May 2023

Dear Ulisse,
we were delighted to hear that our manuscript is ready for recommendation.
We have revised the remaining minor edits according to the suggestions of reviewer 1.
We would like to thank you and the reviewers for the constructive feedback and the interest expressed in our work.
Sincerely,
Anders & Nils

PS: Apologies for the poor figure quality in the track changes document. But file size limits required PDF compression resulting in quality loss. For the high-quality figures, please refer to the biorxivs submission.
**Download tracked changes file**

### Decision by Ulisse Cardini, posted 02 May 2023, validated 02 May 2023

**Decision on your preprint article**

Dear Nils,
Thank you for submitting your preprint article "Symbiotic nutrient cycling enables the long-term survival of Aiptasia in the absence of heterotrophic food sources" to PCI Ecology. Following careful assessment of your submission, two expert reviewers feel that it is ready for recommendation, pending two minor comments.
Congratulations on your interesting contribution to the field! I am ready to write a recommendation text of your article as soon as these remaining minor comments are addressed.
Please feel free to contact me with any questions.
Sincerely,
Ulisse Cardini

### Reviewed by anonymous reviewer 1, 18 April 2023

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### Reviewed by anonymous reviewer 2, 02 May 2023

The authors correctly addressed all comments. I would like to congratulate the authors on the SEM-NanoSIMS correlation.

As far as I am concerned, the paper is ready for publication.

Kind regards,

## Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2022.12.07.519152

Version of the preprint: 1

### Authors' reply, 28 March 2023

**Download author's reply**

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### Decision by Ulisse Cardini, posted 23 January 2023, validated 23 January 2023

**Decision on your preprint article**

Dear Nils,

Thank you for submitting your preprint article "Symbiotic nutrient cycling enables the long-term survival of Aiptasia in the absence of heterotrophic food sources" to PCI Ecology. Following careful assessment of your submission, two expert reviewers feel that it has potential for recommendation, so we would like to invite you to revise the paper following their comments.

Please see the attached reviewer comments for further details about necessary revisions.

We ask that you submit the revised version of your manuscript by February 27, but please let me know if you need more time. Your revised manuscript should be accompanied by a summary of how you responded to the reviewers' comments.

Please feel free to contact me with any questions.

Sincerely,

Ulisse Cardini

### Reviewed by anonymous reviewer 1, 04 January 2023

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### Reviewed by anonymous reviewer 2, 04 January 2023

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