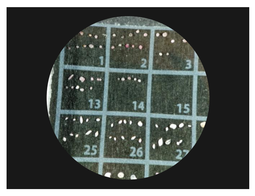
Foraminiferal symbiont diversity and role in the benthic ecosystem functioning in Okinawan mudflats

Dewi Langlet and Filip Husnik

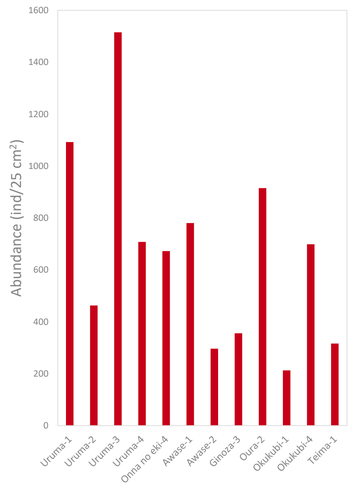
Preliminary study: Foraminiferal diversity in intertidal mudflats

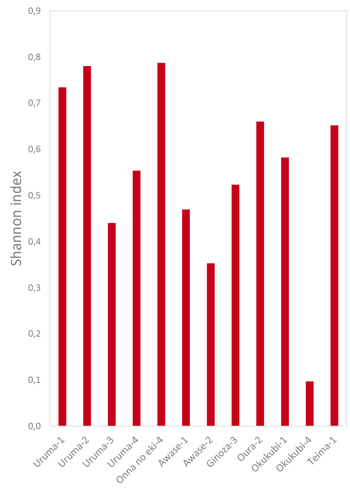
Sampling
Surface sediment (0-1cm; 6 cm diameter core) was collected at low tide in seven Okinawan intertidal mudflats.



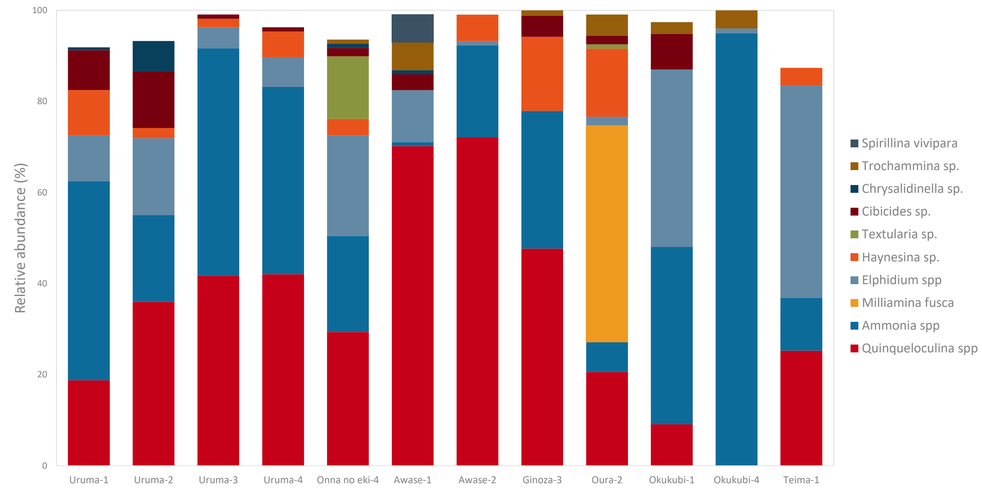
Microscopy
Sediment was sieved (>125µm) and examined to count and identify living (Rose-Bengal stained) foraminifera.

Taxonomy
Benthic foraminifera are unicellular marine protists creating a calcite shell.





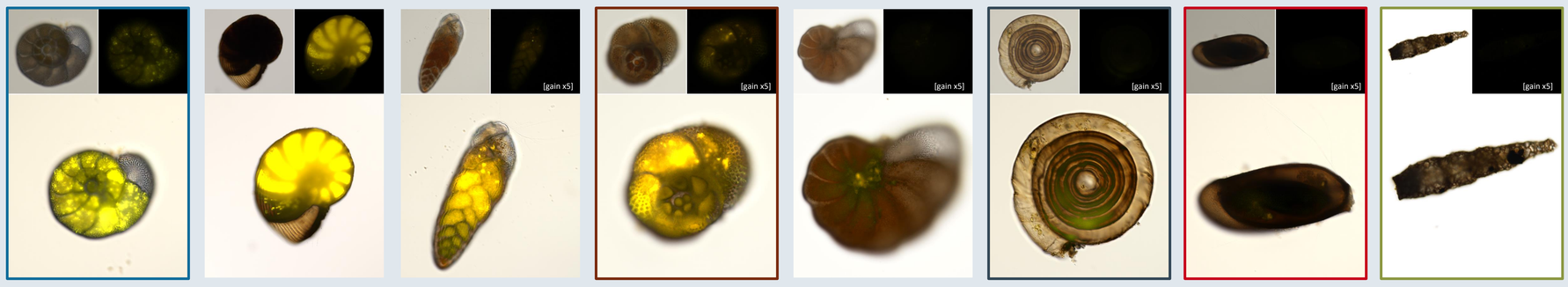
Foraminiferal abundance and diversity are high in the organic-matter rich silty sediment of Uruma 1, Uruma 3 and Oura 2 and low in the sandy samples in Awase 2, Ginoza 3, Okukubi and Teima river.



Foraminiferal communities are dominated by *Quinqueloculina* spp., *Ammonia* spp., *Elphidium* and *Haynesina* spp.. Few species composition changes were observed except in Oura and Okukubi mangroves flats.

Project 1: Photosymbiont occurrence in benthic foraminifera

Ammonia sp. | *Perenoplis* sp. | *Bolivina* sp. | *Cibicides* sp. | *Nonion sp.* | *Spirillina sp.* | *Quinqueloculina sp.* | *Textularia sp.*

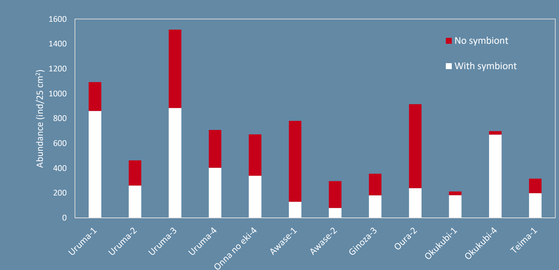


Ammonia spp. and *Perenoplis* spp. show intense autofluorescence in all chambers.

Bolivina spp. and *Cibicides* spp. show lower intensity autofluorescence but still host potentially-photosynthetic symbionts

Other species such as *Nonion* sp., *Spirillina* sp., *Quinqueloculina* sp. or *Textularia* sp. do not show any autofluorescence (ex 535/40, em 590/40) suggesting that they likely do not host any algal (e.g., diatoms, dinflagellates, red algae, etc.) or cyanobacterial symbionts.

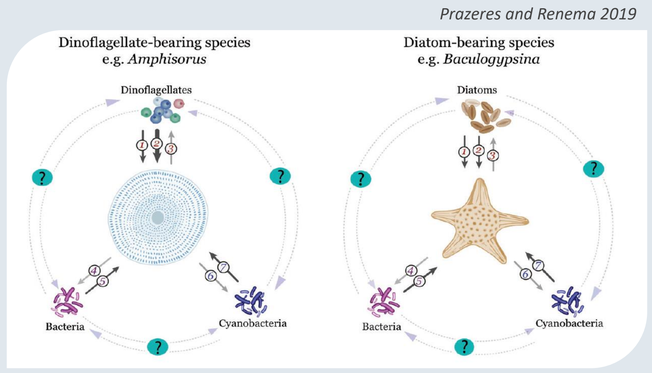
Overall, more than 55% of Okinawa mangroves foraminifera seem to host symbionts



What is the origin of these symbionts and what are their functions?

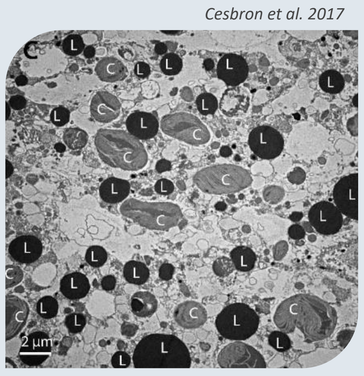
Project 2: Diversity and origin of symbionts in foraminifera

Prazeres and Renema 2019

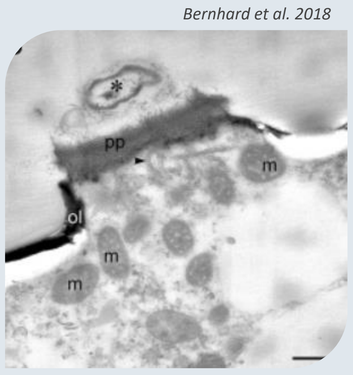


In coral reefs, large benthic foraminifera host bacterial, diatom, dinoflagellate, red and green algae, and cyanobacterial symbionts involved in photosynthesis, calcification, and nutritional supplementation.

Cesbron et al. 2017

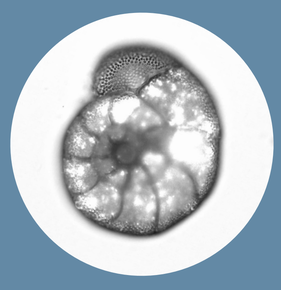


Bernhard et al. 2018



In temperate mudflats some species can sequester photosynthetically active chloroplasts from diatoms and hosts prokaryotic symbionts. To date, the role of these bacterial symbionts remain unknown.

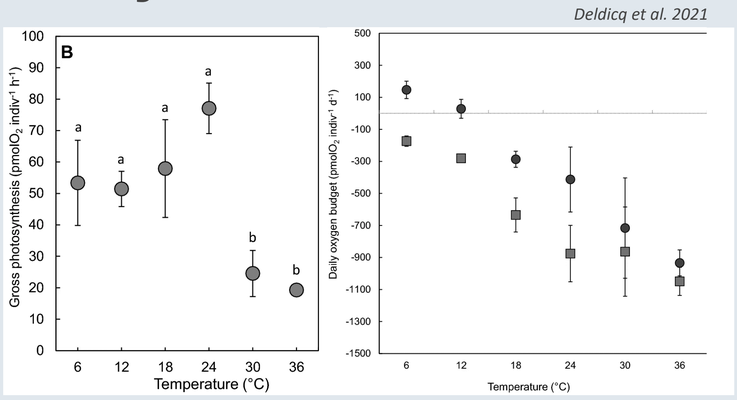
What are the origins of the symbionts in subtropical-mangroves foraminifera?



We will examine this question using microscopy (TEM, etc.) and single-cell genomics techniques

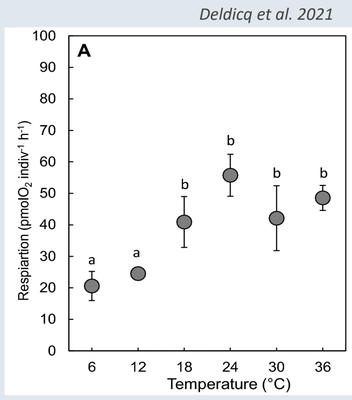
Project 3: Role of foraminifera in mangrove ecosystem functioning

Deldicq et al. 2021

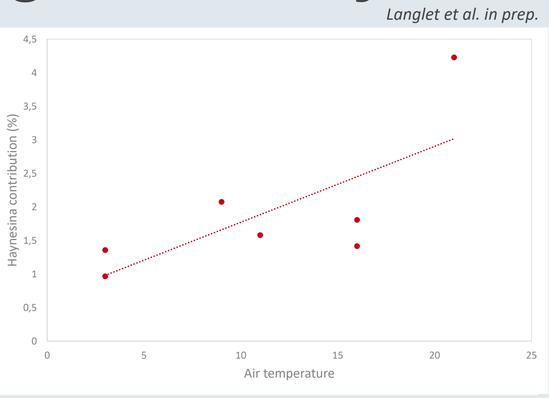


In temperate mudflats, sequestered chloroplasts are photosynthetically active. Yet, their contribution to benthic photosynthesis appears to be minimal.

Deldicq et al. 2021



Langlet et al. in prep.



However, foraminifera greatly impact carbon mineralization since they contribute up to 4% to total benthic respiration.

In temperate mudflats, foraminifera deeply affect carbon cycle via respiration and photosynthesis.

What is foraminifera contribution to blue carbon storage in Okinawa mangroves?

EVOLUTION, CELL BIOLOGY, & SYMBIOSIS UNIT

OIST OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY GRADUATE UNIVERSITY 沖縄科学技術大学院大学

Dewi Langlet
Staff scientist
dewi.langlet@oist.jp