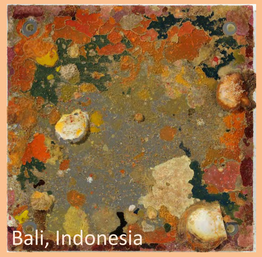

Getting ARMS up on coral reef analysis

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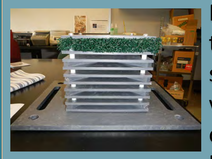
Introduction

ARMS: **A**utonomous **R**eef **M**onitoring **S**tructures



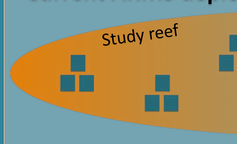
Man-made structures designed to facilitate the study of coral reefs in a non-invasive, standardized way. The ARMS structure mimics a variety of benthic habitats found on reef communities, and they can be used to study both sessile and motile invertebrates.

What settles on an ARMS?

There same four major groups of sessile marine invertebrates found on coral reefs are found on ARMS deployed on reefs:

Although all four of these groups are consistently found on reefs, the composition and relative abundance of each group vary dramatically in time and space.

Current ARMS deployment



- ARMS are deployed in a 3x3 nested design.
- Over 500 ARMS have been deployed on coral reefs in the Pacific, Indian, and Atlantic oceans.

Although hundreds of ARMS have been deployed, no one has tested the variance and subsequent sensitivity of these structures to assess reef biodiversity.

Research questions

1. Are ARMS replicates collecting a consistent sample of sessile reef organisms?
2. What is the intra- and inter-site variance between ARMS on the same reef?
3. Do ARMS capture biodiversity differences between reefs?
4. Are re-deployed ARMS different from newly-deployed ARMS?

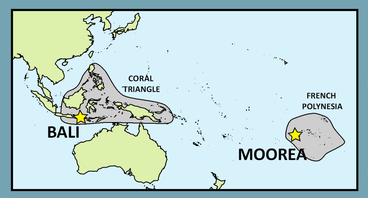
Methods

Summary: We compared the percent cover of each of the four major groups of sessile invertebrates (sponges, tunicates, bryozoans, cnidarians) using landscape analysis of photo-records of each ARMS plate collected from Bali, Indonesia and Moorea, French Polynesia. We then analyzed the intra- and inter-site variance between ARMS in both locations.

Study regions

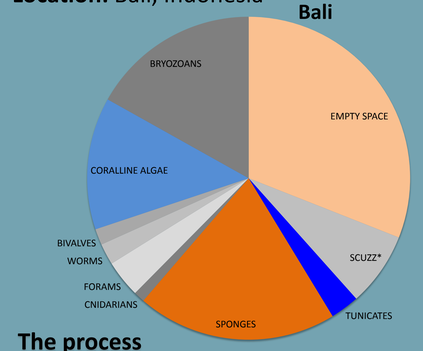
The Coral Triangle is the indisputable peak of marine diversity on the planet, decreasing both latitudinally and longitudinally from this hotspot.

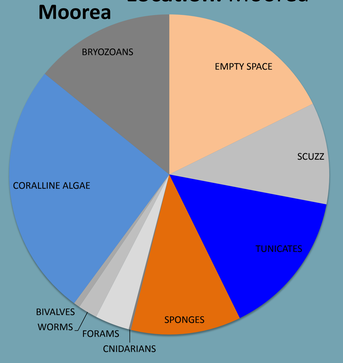
Location: Bali, Indonesia



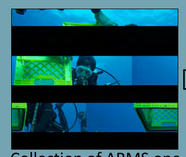
French Polynesia is located on the eastern margin of the Indo-West Pacific region and contains 10-30% of the diversity found to the West.

Location: Moorea





The process



Collection of ARMS one year after deployment

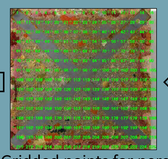
ARMS in sea water and bubbler prior to dismantling

A single ARMS plate in Bali, Indonesia

Photography of all plates

MAJOR CATEGORY (% of transect)	MEAN
EMPTY SPACE (E)	30.95
OTHER (ZZ)	7.48
TUNICATES (T)	2.88
SPONGES (S)	19.92
CORAL (CORAL)	1.09
FORAMS (F)	3.76
WORMS (W)	2.15
BIVALVES (V)	1.61
CORALLINE ALGAE (A)	13.33
BRYOZOANS (B)	16.82

Coral Point Counts with excel outputs (CPCe)

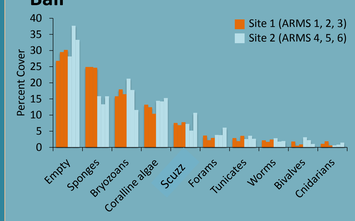


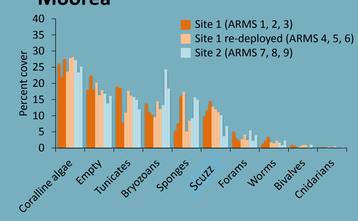
Gridded points for percent cover analysis using CPCe.

Top and bottom images of each of the 10 ARMS plates

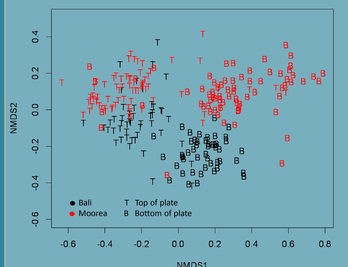
Results

Intra- and inter-site comparison: similar community composition in ARMS within and between sites, and in re-deployed ARMS



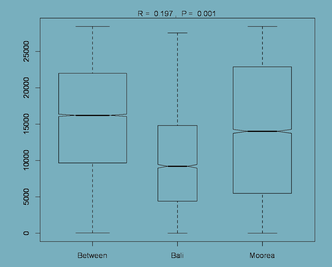


Ordinance shows clear disparity between Bali and Moorea and plate tops and bottoms



Each point represents a single side of an ARMS plate plotted based on similarities in percent cover. The two clusters of top and bottom sides represent settlement biases in several major sessile groups.

Analysis of similarities shows significant differences between Bali and Moorea



Differences between community composition in Bali and Moorea is significantly greater than differences within each locale (R=0.197, P=0.001).

Conclusions and applications

Conclusions

- ARMS replicates are collecting a consistent sample of sessile reef organisms. This validates the use of ARMS as standardized monitoring devices at a functional group level.
- The low variance seen within a site and between sites confirms that the ARMS are behaving as replicates. This finding also suggests that a 3x3 nested design may be redundant, depending on the intended purpose of ARMS.
- ARMS captured low variation within a geographic location and high variation between locations, showing that ARMS are sensitive to differences between geographic regions, and are a valid tool for global comparisons.

Applications

- Data can validate molecular analyses of ARMS communities.
- Supports ARMS as effective monitoring devices.
- Establishes that re-deployed ARMS do not bias community composition.

References and acknowledgements

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NOAA Pacific Islands Fisheries Science Center. www.pifsc.noaa.gov/cred/arms.php.

*Scuzz = mucus bound or otherwise consolidated sediment