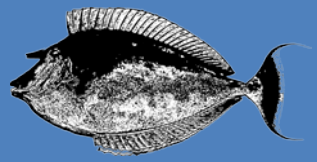
Science-to-Management Frameworks for Coral Reefs and Coastal Fisheries across Micronesia

Peter Houk[1]; Micronesia Coral Reef Monitoring Programs[2]; Javier Cuetos-Bueno[1]; Rodney Camacho[1]; Matthew McLean[1]; Jessica Deblieck[1]; Dalia Hernandez[1]; Steven Johnson[1]; Funding organizations[4]

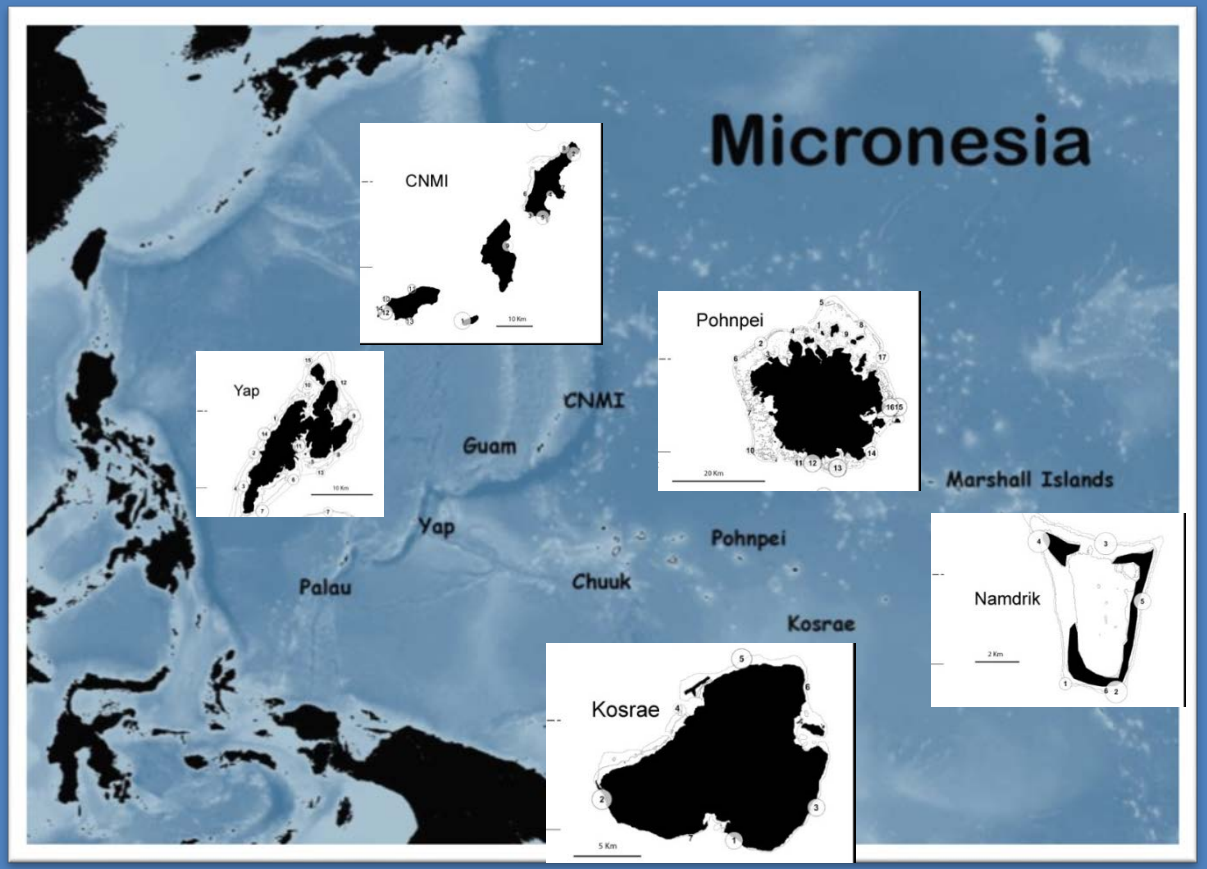
Micronesia reefs and fisheries

1. Networks facilitated by the Micronesia Challenge
2. Status and drivers of reef health in Micronesia
3. Case studies
4. The dilemma of coastal fisheries



Regional reef monitoring

- Unified effort across Micronesia
- Standardized
  - Designs
  - Protocols
  - Databases



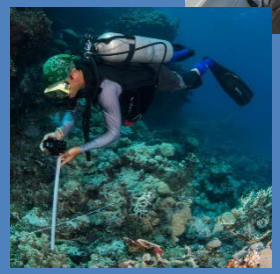
The Process

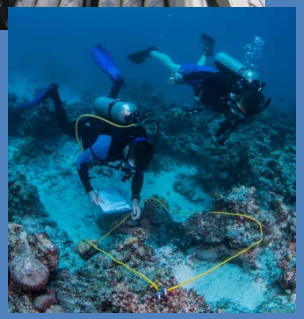
Marine Laboratory
University of Guam

Conservation Society of Pohnpei
Preserving Our Natural Heritage for a Sustainable Future

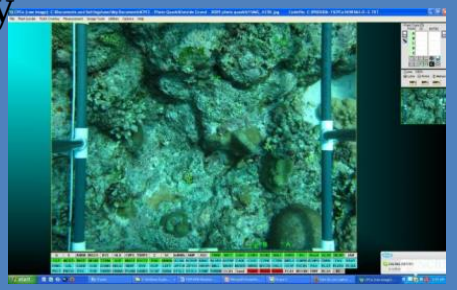
Kosrae Conservation and Safety Organization

Data collection
Training
Taxonomy

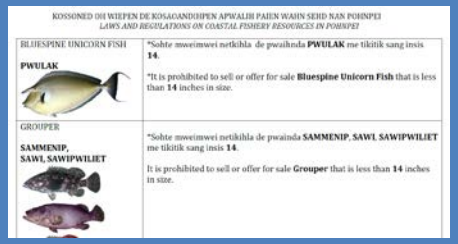




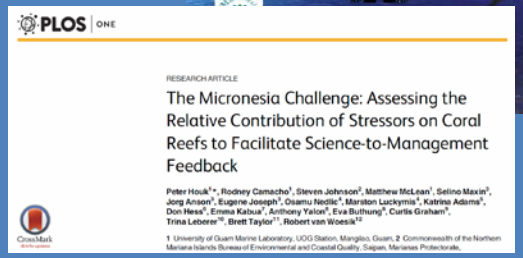
Data entry



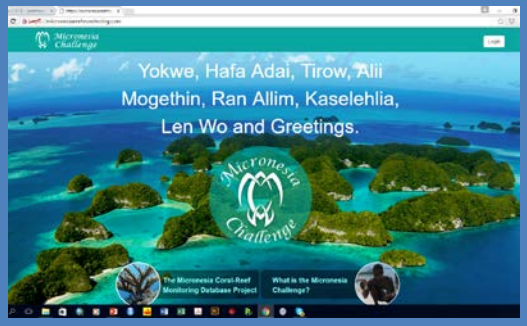
Data transfe
Data storage
QA/QC



Managemen
t guidance –
recommend
and evaluate

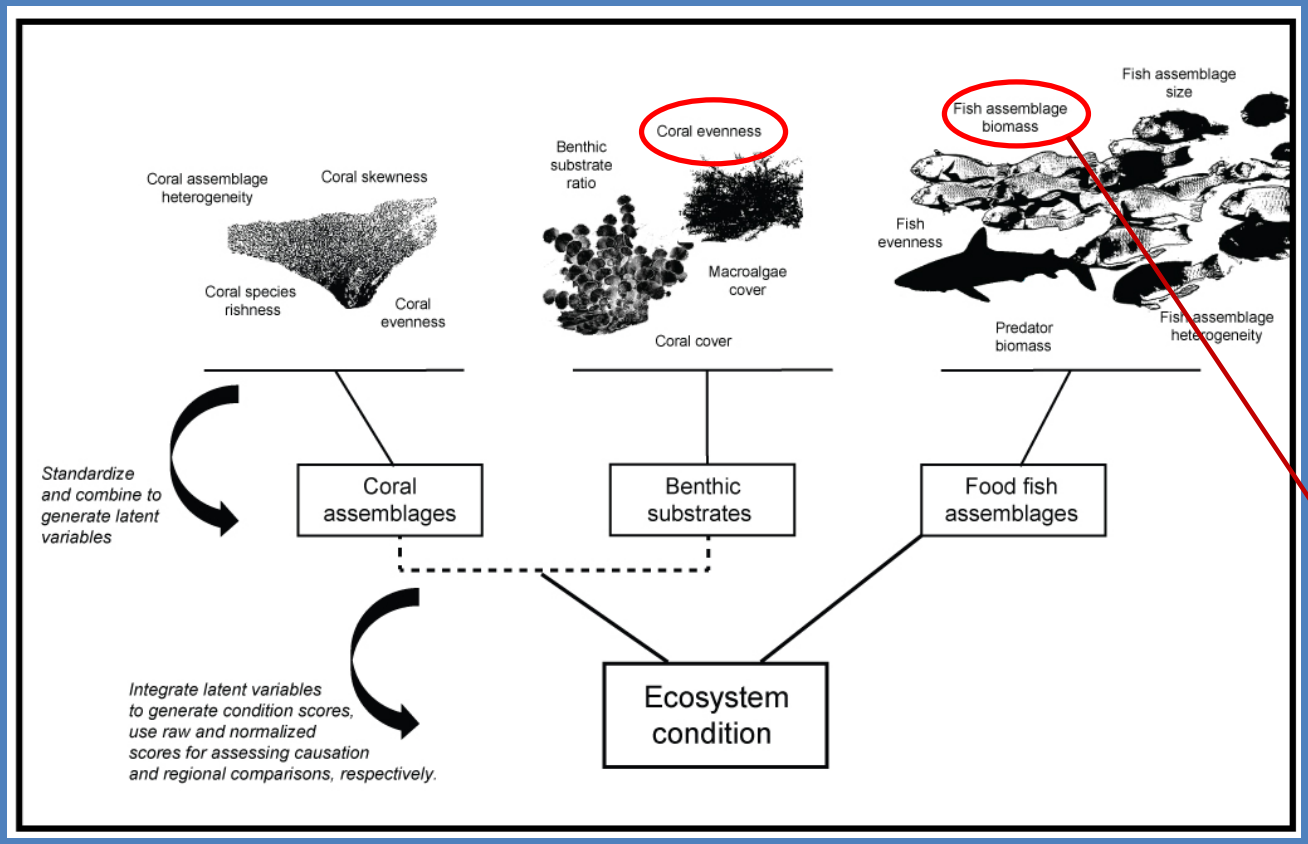


Data
analysis for
local needs
and peer-
reviewed
science

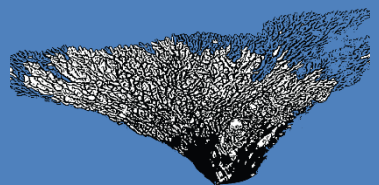


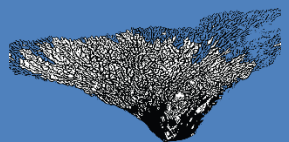
Status and drivers of reef health across Micronesia

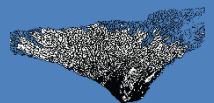
Reef “health”



Components of reef health similar to human health, blood pressure, cholesterol,

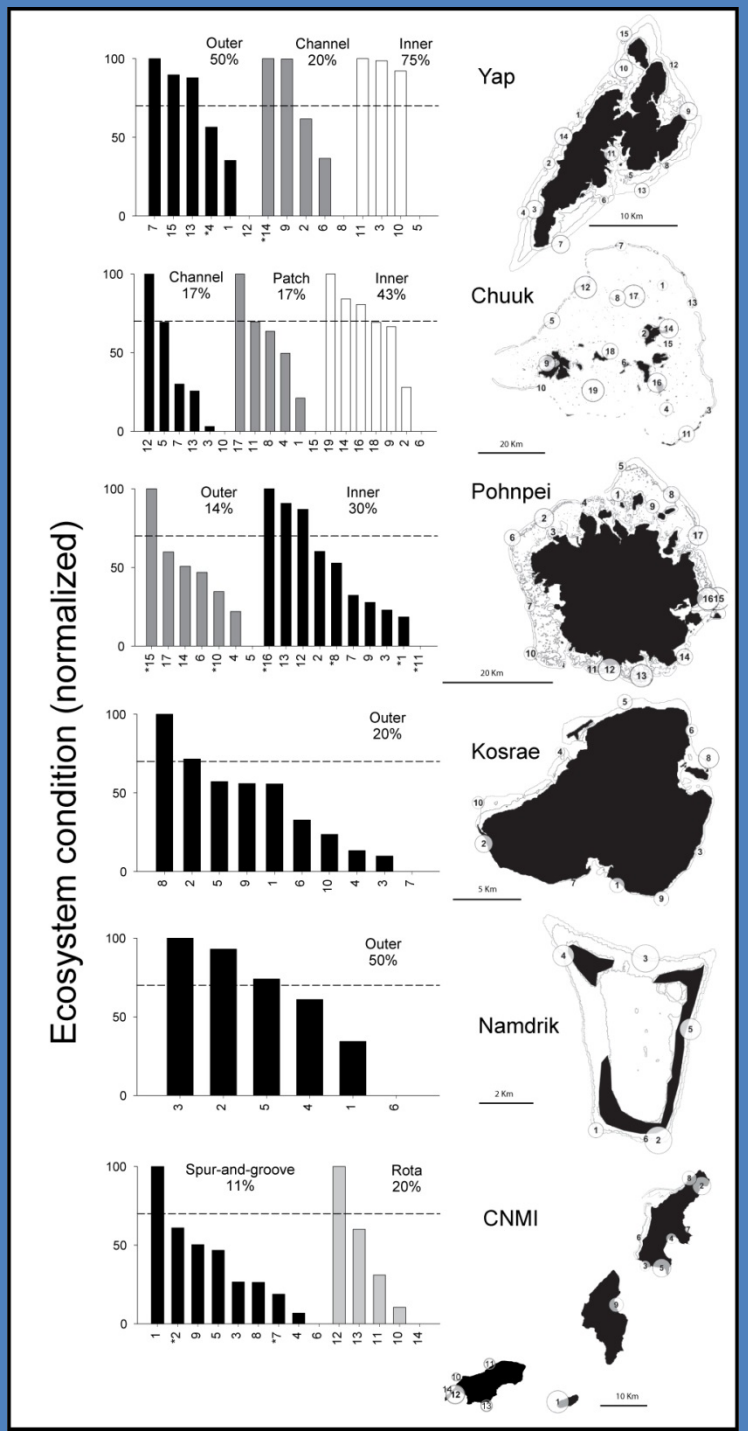






MC Scorecard

- Released with MC 10-year report (February)
- Eventually, scorecard based on temporal data



PLOS ONE

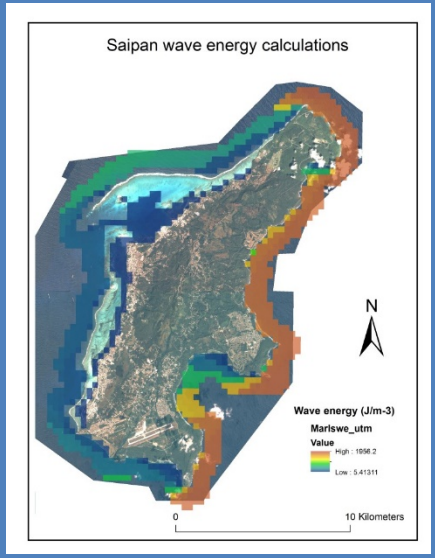
RESEARCH ARTICLE

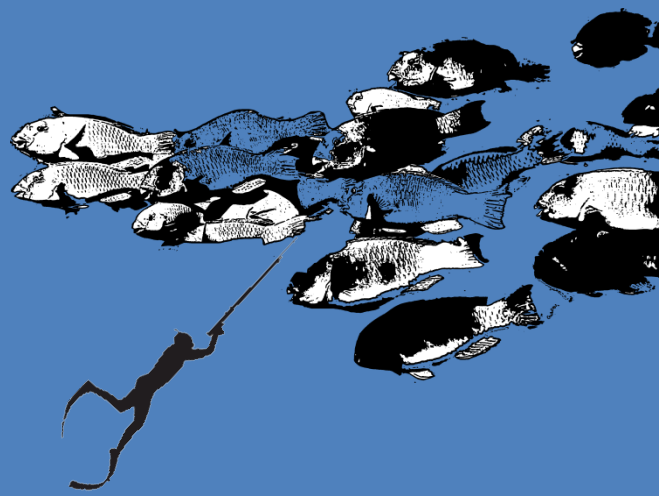
The Micronesia Challenge: Assessing the Relative Contribution of Stressors on Coral Reefs to Facilitate Science-to-Management Feedback

P. Houk *et al.*,. *PloS one* **10**, e0130823 (2015)

Scorecard is useful for MC, but what drives healthy reefs?

- Natural environments?
- Fishing access?
- Pollution proxy?

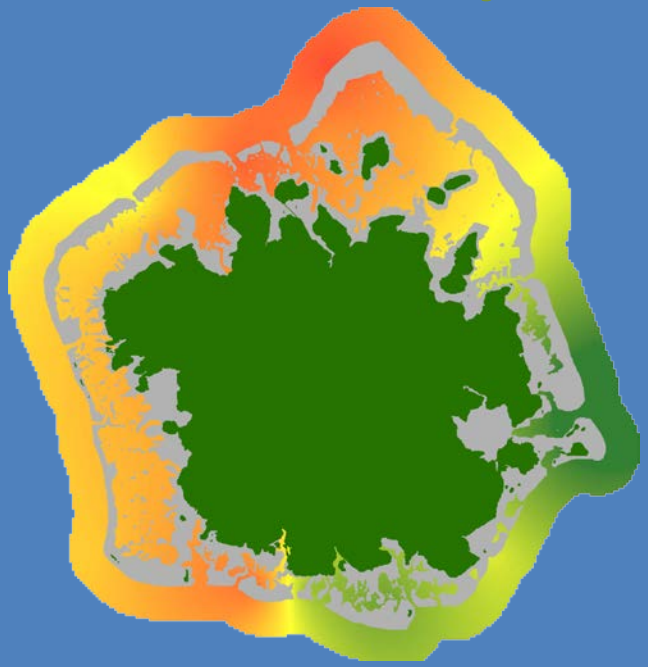




Pohnpei example

Red – less healthy

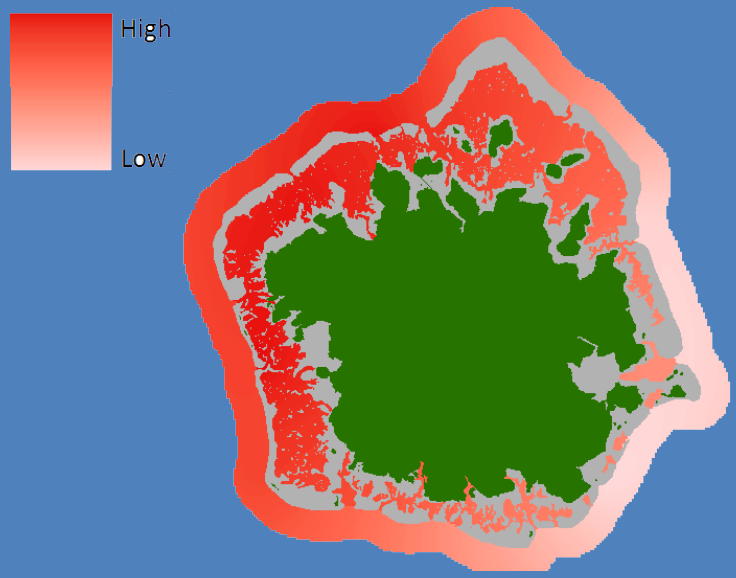
Green – more healthy



Ecosystem condition scores integrated across the island

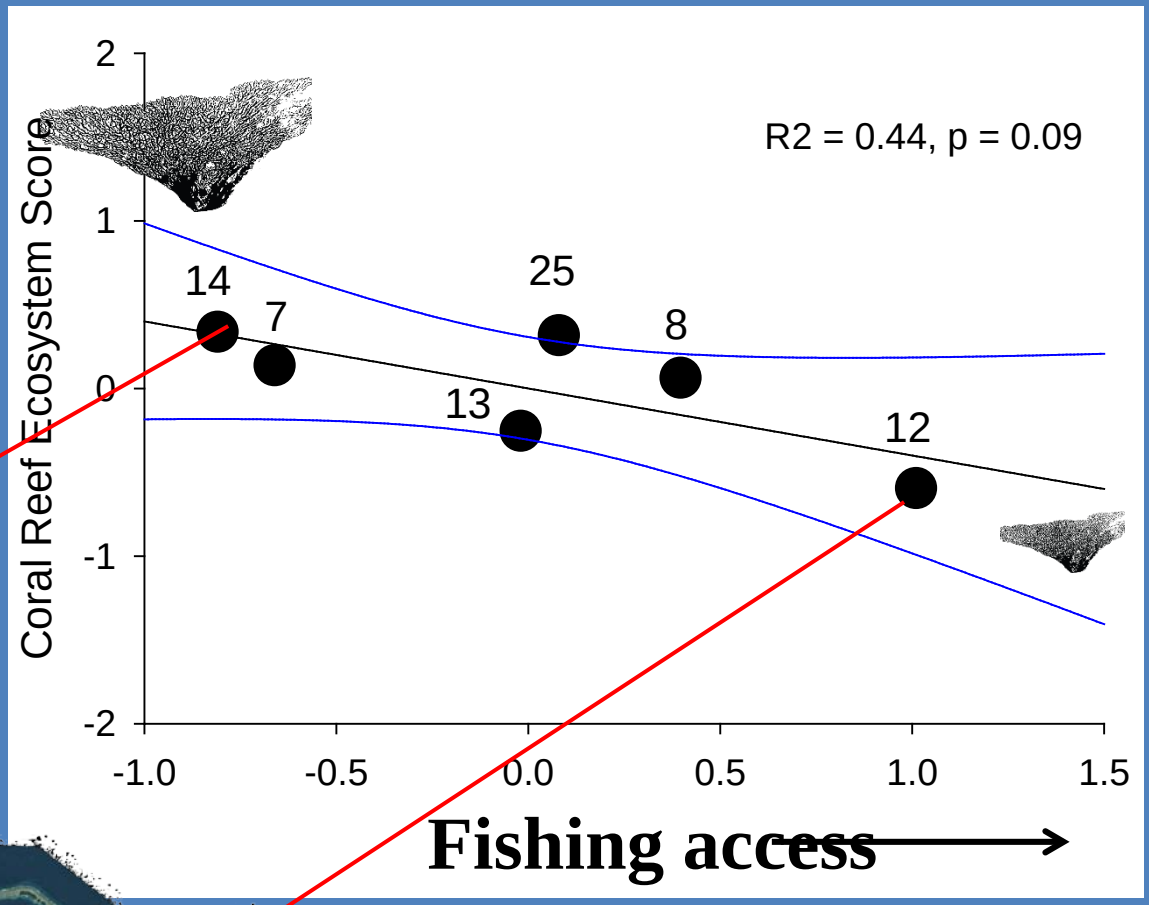
Red – more fishing access

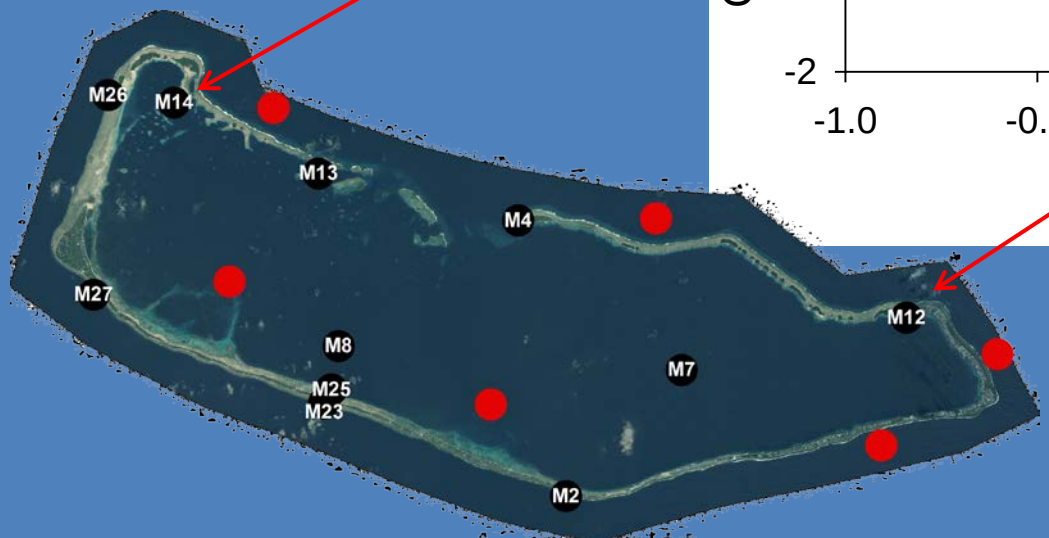
White – less fishing access



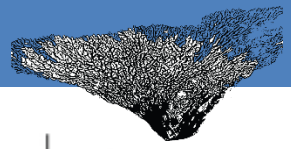
Fishing access – distance to market/fishers and wave

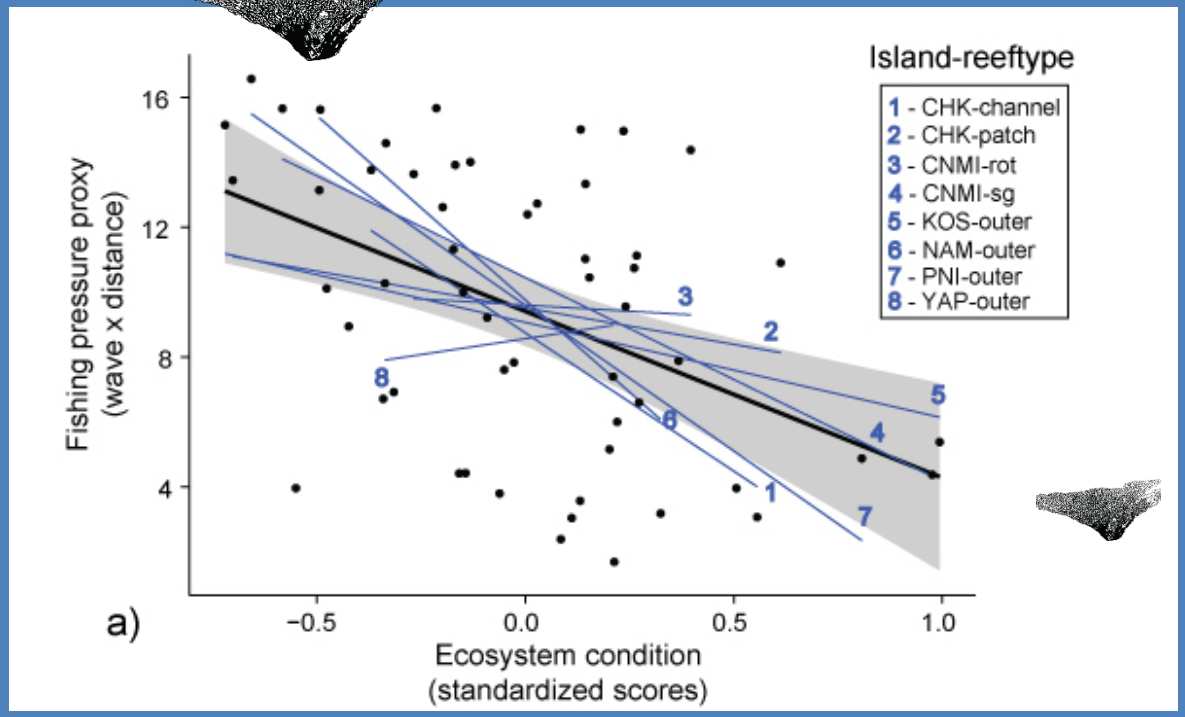
Majuro

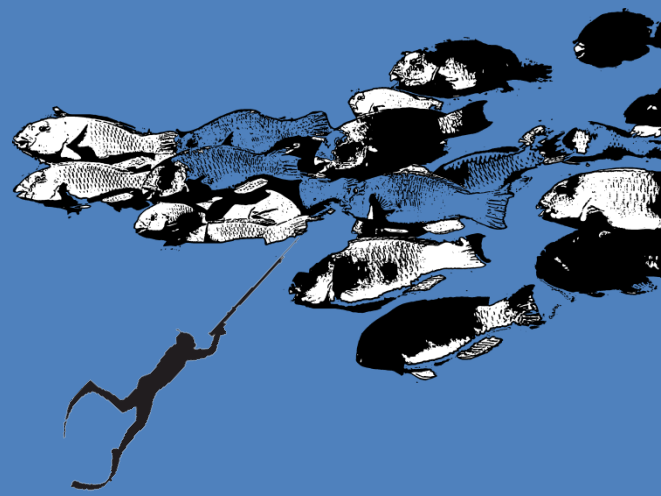

R2 = 0.44, p = 0.09
Coral Reef Ecosystem Score
2
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
14
7
25
8
13
12
Fishing access


M26
M14
M13
M4
M27
M12
M8
M7
M25
M23
M2

Micronesia

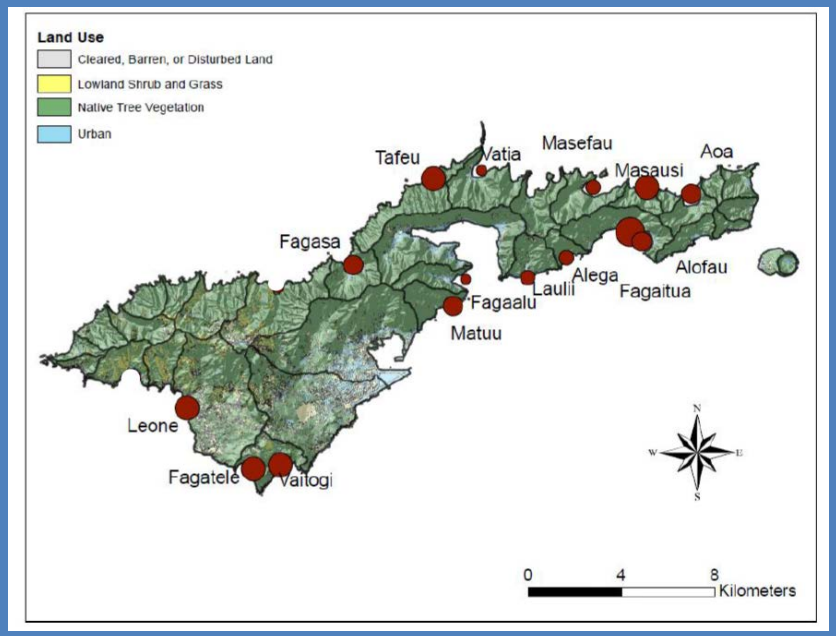


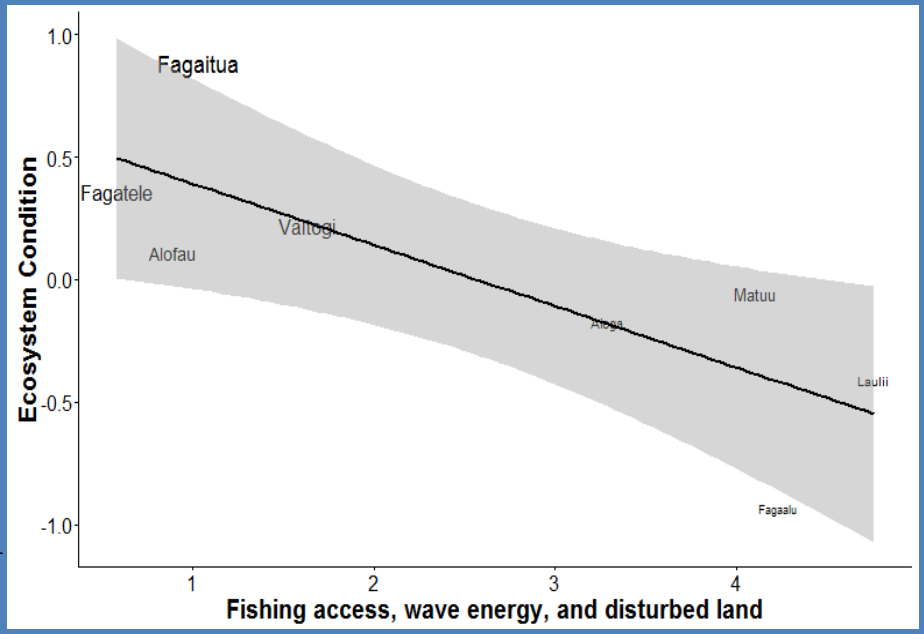

Island-reeftype
1 - CHK-channel
2 - CHK-patch
3 - CNMI-rot
4 - CNMI-sg
5 - KOS-outer
6 - NAM-outer
7 - PNI-outer
8 - YAP-outer
Fishing pressure proxy
(wave x distance)
16
12
8
4
−0.5
0.0
0.5
1.0
Ecosystem condition
(standardized scores)
a)



American Samoa

Circle size = reef health/condition

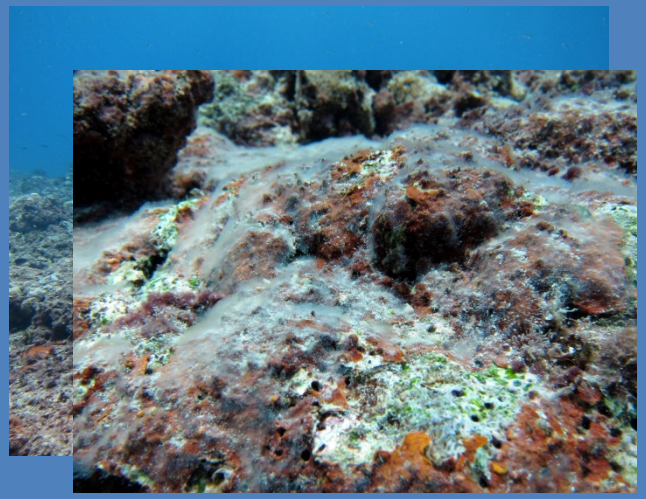


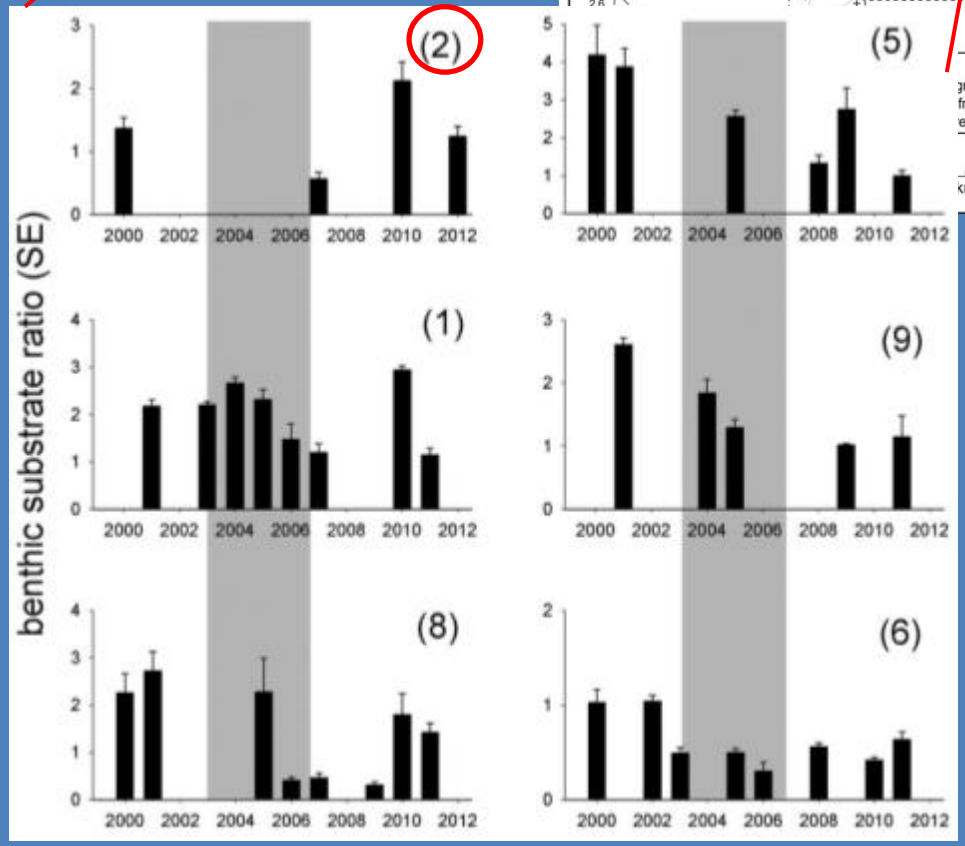


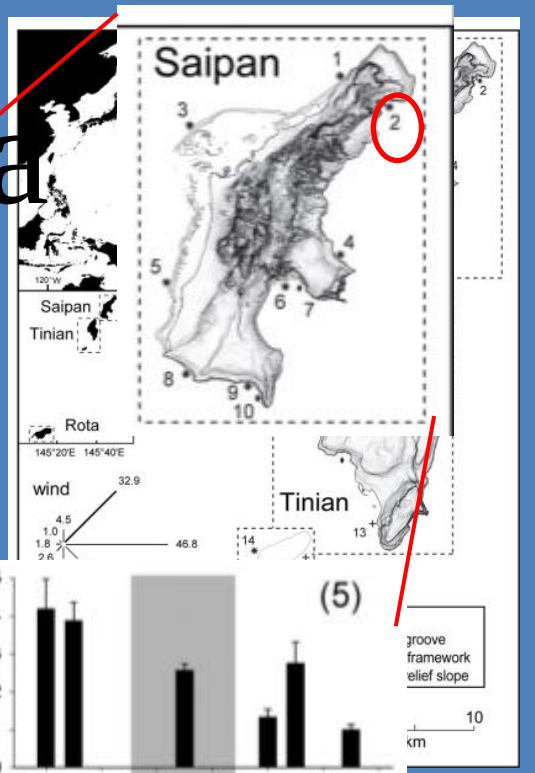
*Ongoing work with AS DMWR, CRAG, EPA

Time series data

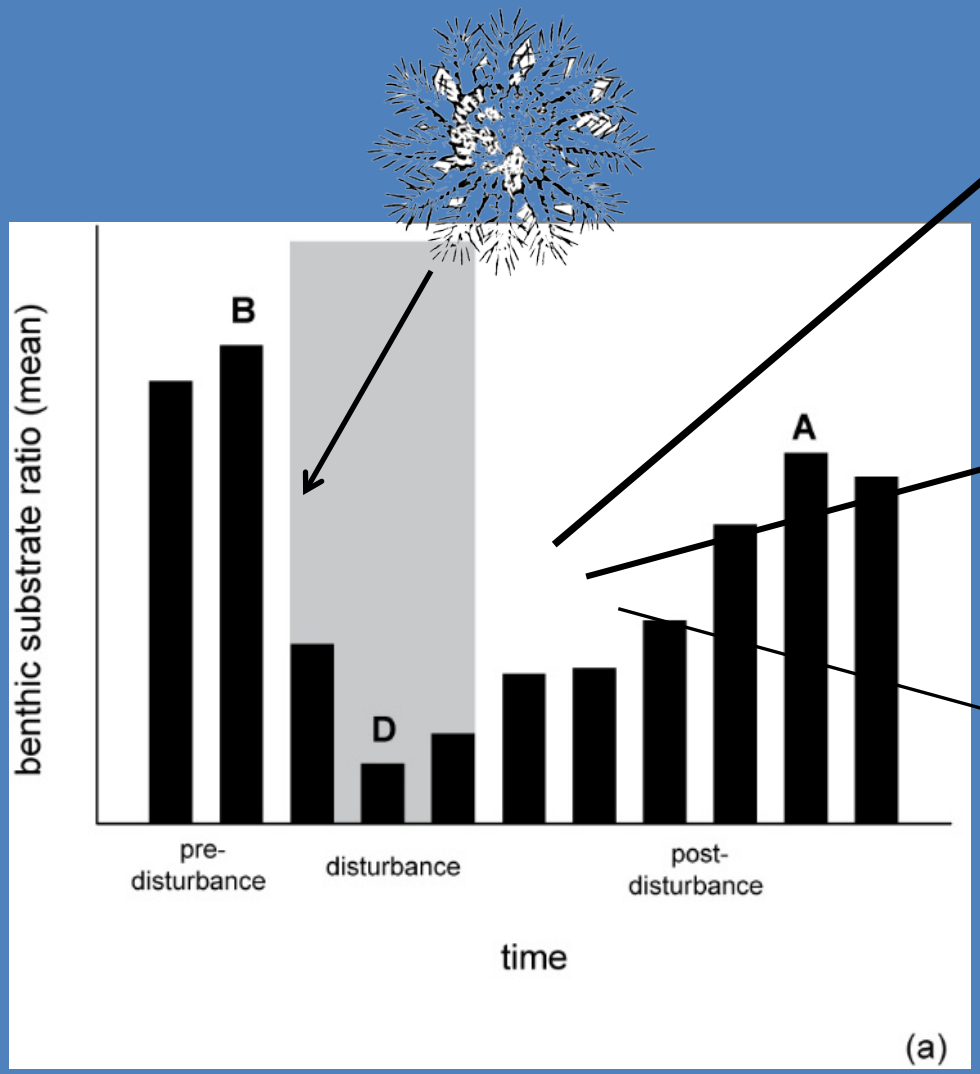
CNMI time series data



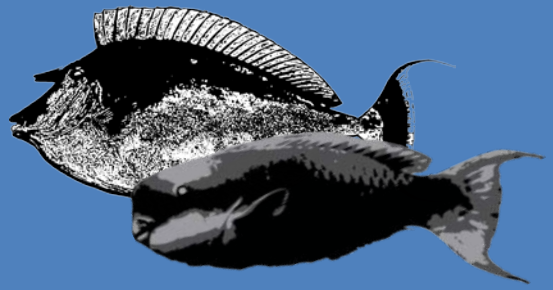




Drivers?



wave exposure (20 to 50%)



herbivore size (5 to 30%)

pollution proxy (5 to 10% - few isolated v

P. Houk *et al.*,. *PloS one* **9,** e105731 (2014)

Sustainable societies, reefs, and economies depend on fisheries

Science to Management

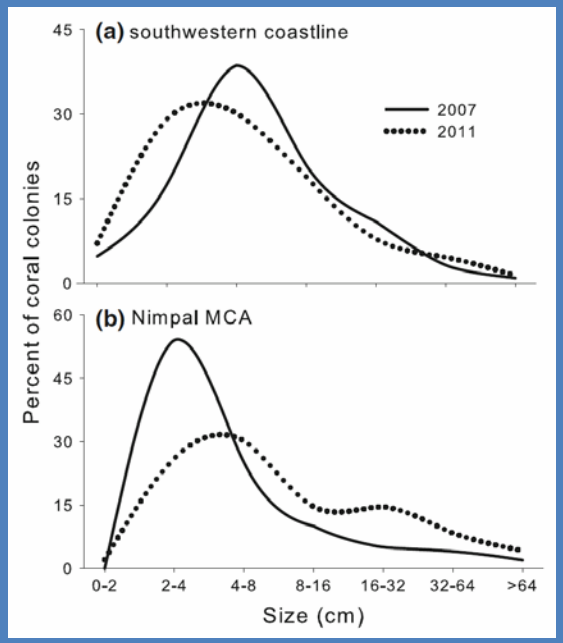
Coral-reef fisheries in Chuuk, Federated States of Micronesia

by: Javier Cuetos-Bueno

Yap

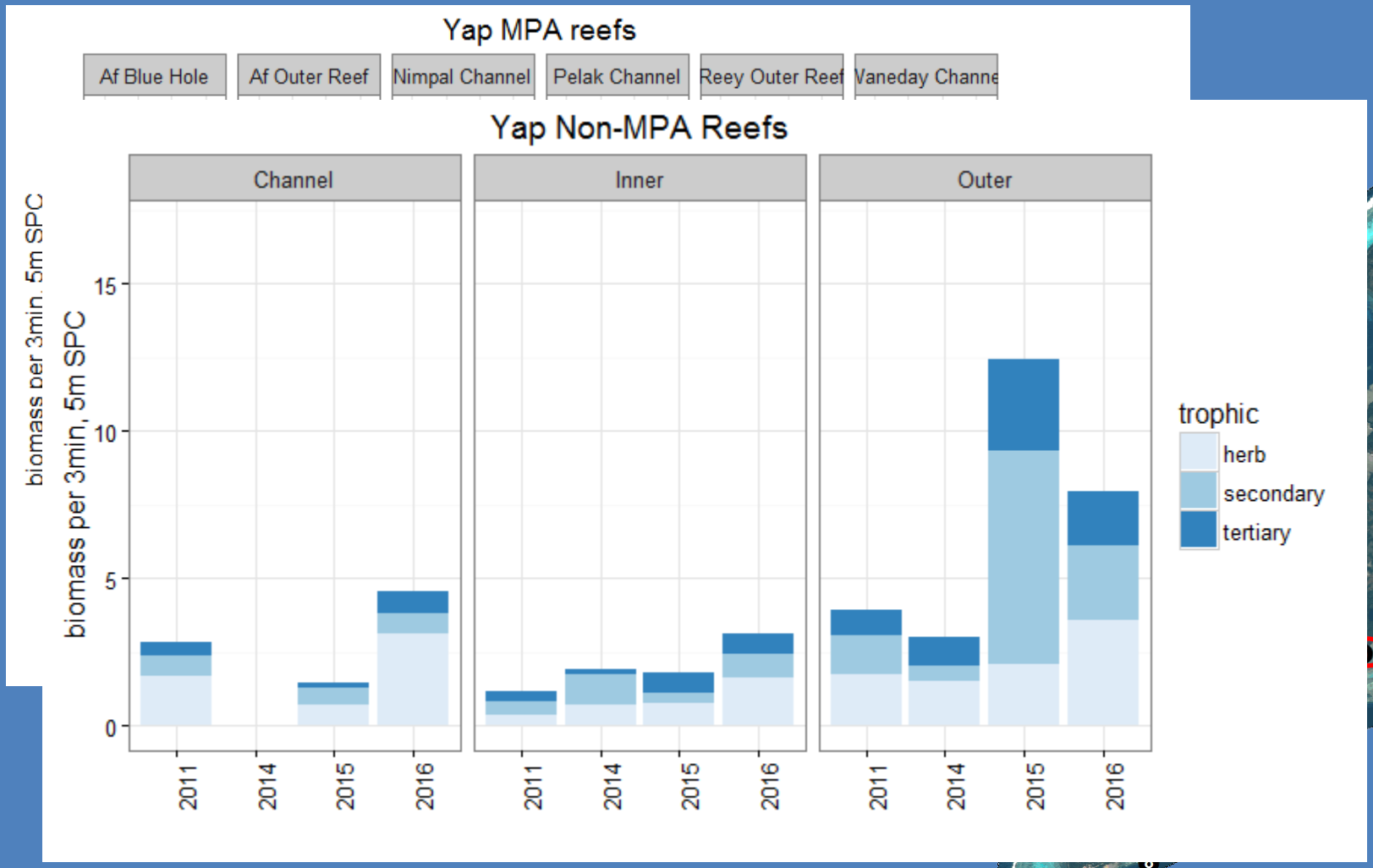
Local MPA Network

- 2006 –Nimpal MCA



Houk et al. *Biod. Conserv.*, 2012

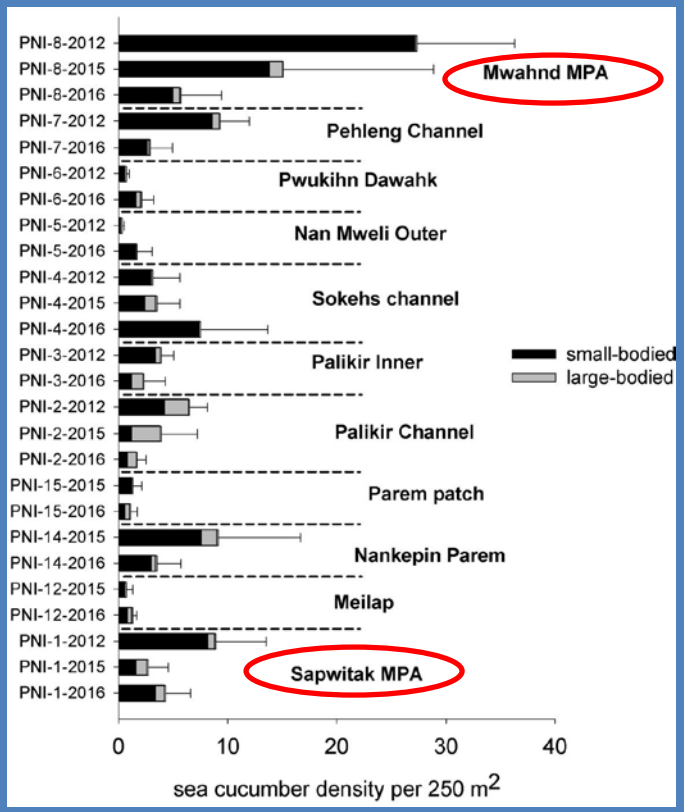
Community-based learning networks



Photographic trends

Pohnpei

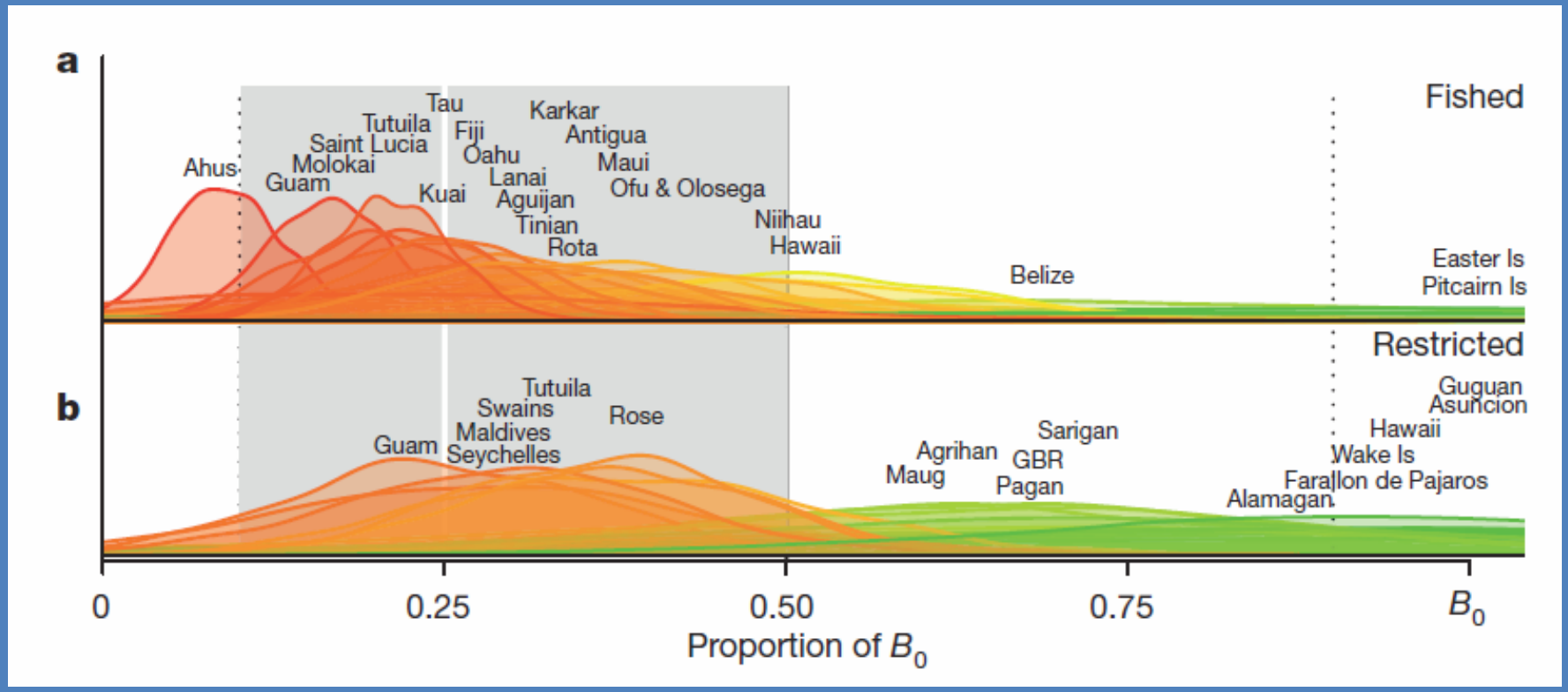
Sea cucumbers in Pohnpei



Two ongoing court cas
opposing the harvestin

Success stories are growing, but fisheries are challenging across the region

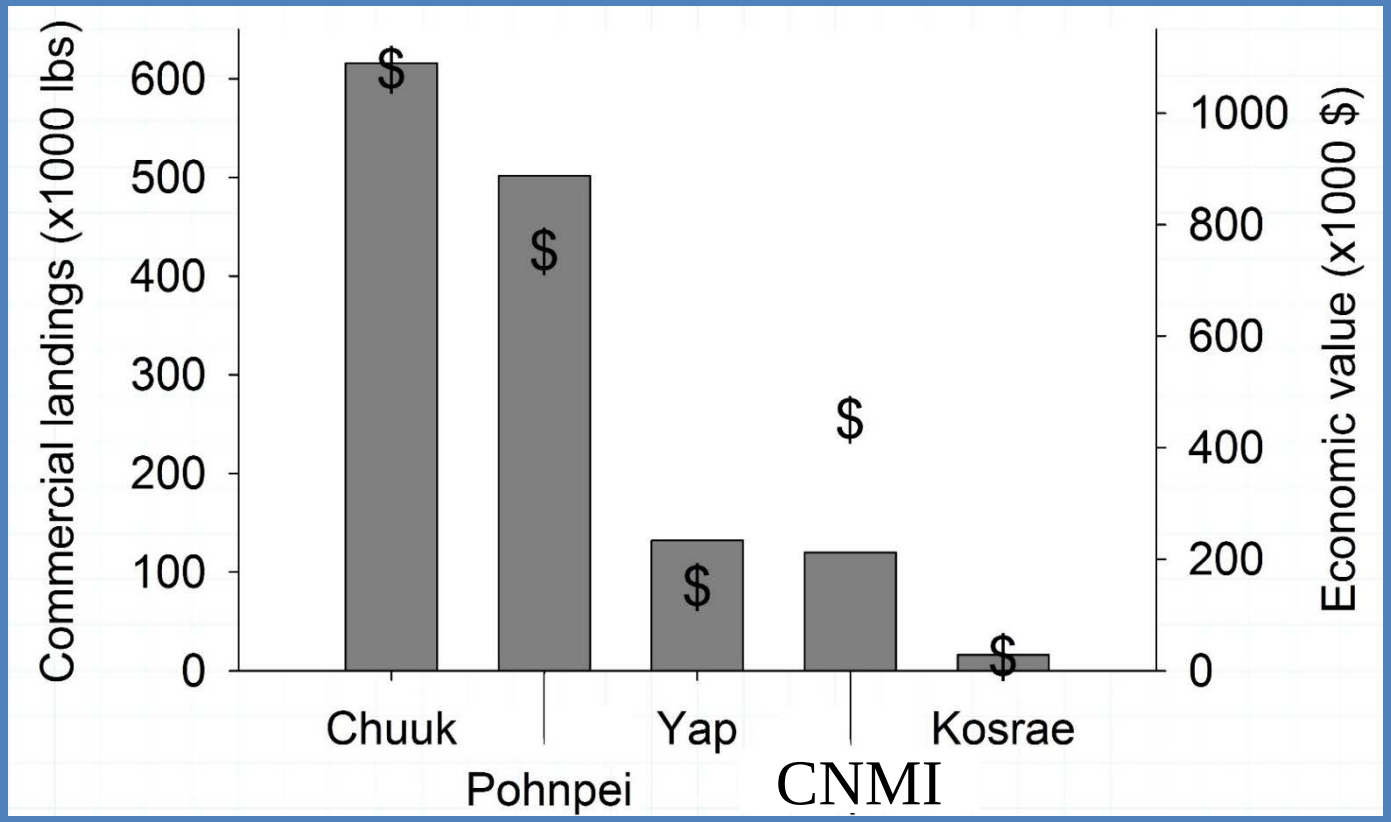
Populated US territories among lowest in biomass



MacNeil et al. 2015, *Nature*

B_0 – predicted ‘pristine’ fish bio

Economics of fisheries



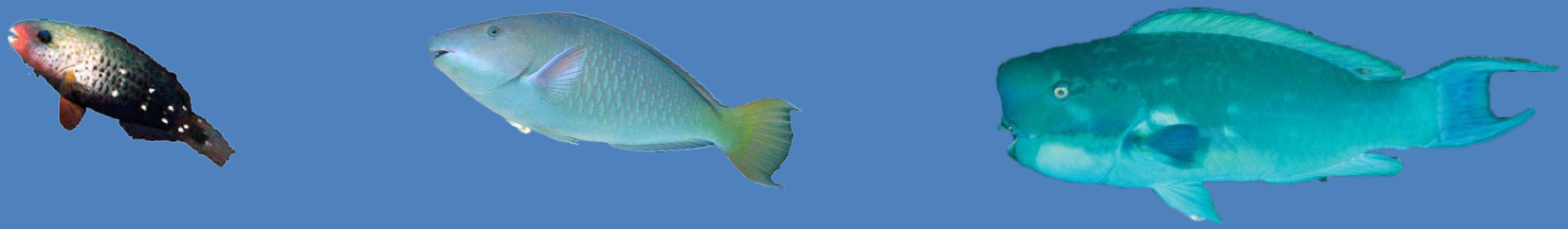
Estimated $2.4 million USD per annum for these jurisdi

Subsistence fisheries estimates at 5:1 (c

CNMI and Yap - Houk et al. 2012
Chuuk – Cuetos Bueno, 2014
Kosrae – Houk, McLean, Tilfas, et al. 2014
Pohnpti – Rhodes and Hernandez-Ortiz 2015

Management units dictate fisheries “parrotfishes”

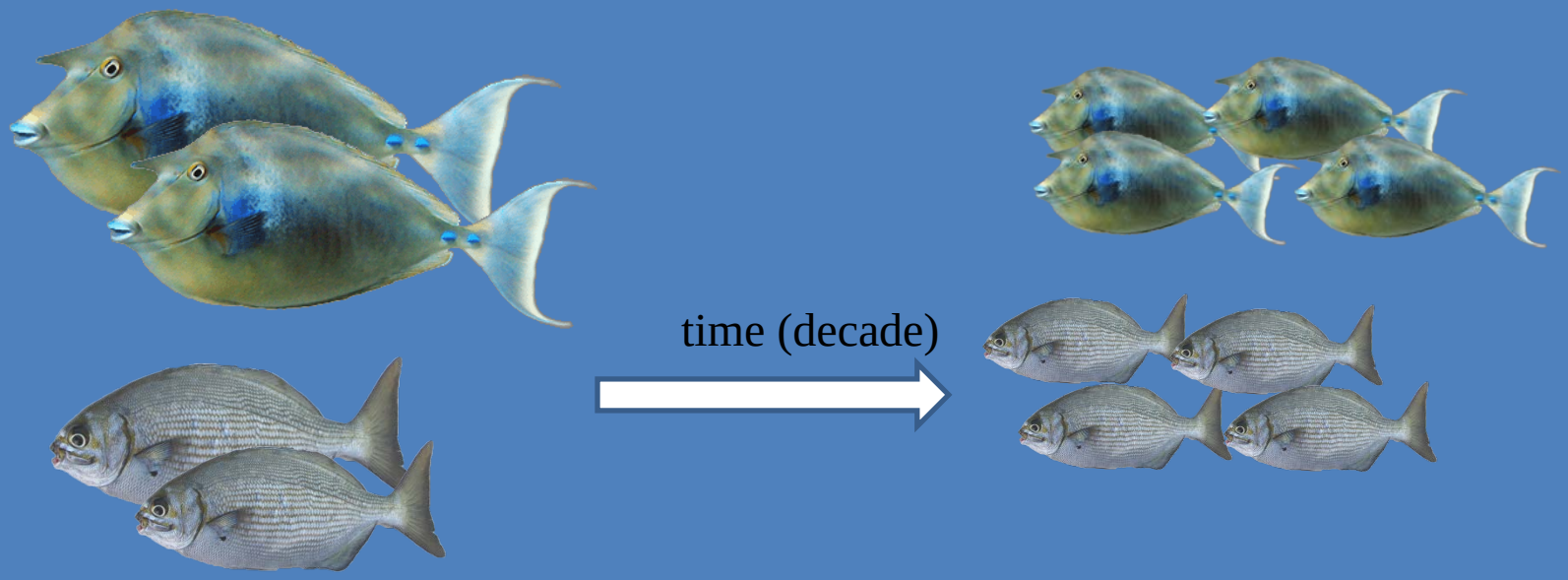
2.8x 2.2x 1x

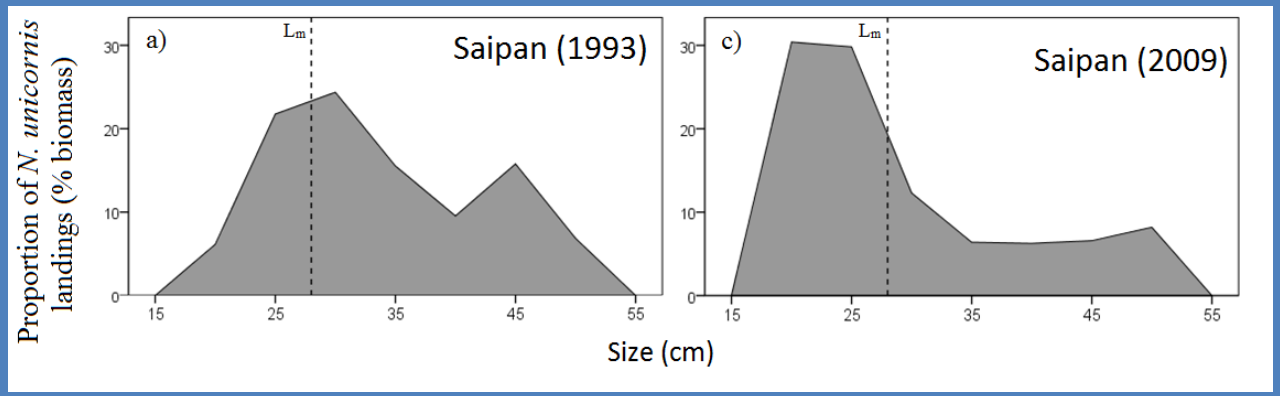


Taylor and Choat, 2014 – J Fish Biol

Selective catch favoring bigger fish for commercial sales

Managing for biomass and not size structure





Social, ecological, and economic problem that can't be solved without scientific diversity

overfishing ---------- managed fisheries ---------- new fishing grounds

Kammagar, Sulang, Kulo, Kalahngan, Kommol tata,

Kinisou, Si yu'us ma'ase, and Olomwaay

peterhouk@gmail.com