Impacts of sedimentation on coral settlement, Pelekane Bay, Hawai‘i

Yuko Stender¹, Paul Jokiel², Ku‘ulei Rodgers²

¹University of Hawai‘i at Mānoa Geography Dept.  
²University of Hawai‘i, Hawai‘i Institute of Marine Biology  
Coral Reef Assessment and Monitoring Program (CRAMP)
Project objective 2014

- To understand the potential of reef recovery
- To evaluate habitat quality in relation to reef recovery
- Understand the potential threat that existing mud deposits pose to adjacent, relatively pristine coral reef ecosystems
Reef study projects, Pelekane and Kawaihae

- 1976    Chaney et al. (1977)
- 1994-95  Jokiel et al. (1999)
- 2000-12 HIMB-CRAMP (Kawaihae)
- 2002    HIMB-CRAMP (Pelekane)
- 2004    USGS (2007), habitat mapping
- 2005    Beets et al. (2010), fish
- 2006    Hoover and Gold (2006)
- 2010-2011 Collaborative USGS, NOAA, HIMB-CRAMP, TNC
- 2011    HIMB-CRAMP, coral settlement and water quality
- 2012    Stender et al. (2014) long-term comparison
- 2014    HIMB-CRAMP, coral settlement in progress
Corals, habitat quality, and fisheries

Recruit Fish Use vs Availability of Rugose Corals

Pelekane Bay: use vs availability of rugose (finger and cauliflower) corals by station. Sample sizes above bars indicate number of recruit reef fish encountered near or in rugose corals on July 2010 survey. Habitat availability based on percentage cover estimated from 300 line-point-counts per station.

DeMartini et al. (2013) Journal of Coastal Conservation
Growth and reproductive health of adult
Coral Growth Studies
Finger Coral *Porites compressa*
June 2010-Nov 2010
Larval settlement and recruitment

Glossary:
- **LARVAL AVAILABILITY**: Broadcast spawners 1-2 cycles per year many gametes.
- **SETTLEMENT ECOLOGY**: Settlement hours-days in plankton.
- **POSTSETTLEMENT ECOLOGY**: Postsettlement ecology decades 3-7 years.
2010 coral settlement

Montipora = 4

Porites = 1
2011 coral settlement

Expanded spatial scale

40 sites
Depth 1.5 – 15 m
Methodological approach

- Unglazed clay tiles
- Light, temperature, salinity, pH, turbidity, rugosity, depth
- Number of recruits, genus, size, surface
2010-2011 findings: are there different environmental regimes?

There are two major environmental regimes: characterized by available light, temperature, salinity, and depth.

Inshore: shallow, less light, warmer temperature, lower salinity

Offshore: deep, more light, cooler temperature, higher salinity

Spearman's rank correlation $P = 0.023$

PCA
2011 overall settlement

Settlement rate by genus

<table>
<thead>
<tr>
<th>Genus</th>
<th>Mean settlement rate (m²/90 days⁻¹)</th>
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<tbody>
<tr>
<td>Montipora</td>
<td>*</td>
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<tr>
<td>Pocillopora</td>
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<td>Porites</td>
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2. Do settlement patterns differ between the environmental regimes?

**Bootstrap percentile 95% CI**
- **Inside**: 1.244, 2.433

**Offshore**: higher settlement \((43.7 \pm 9.6 \text{ s.e.m. m}^2 \text{90days}^{-1})\)

**Inshore**: lower settlement \((7.9 \pm 2.2 \text{ s.e.m. m}^2 \text{90days}^{-1})\)
Edge and lower bottom surface: more settlement
Upper top and lower top: less settlement

Light and smothering were major limiting factors.
2011 summary and conclusion

- Two major types of environment: inshore and offshore, characterized by light, temperature, salinity, and depth

- Significantly less settlement was found in inshore reef than offshore reef

- Settlement limited by available light:
  - Inshore: suspended solids/sediments, smothering
  - Offshore: depth
2014 accomplishment

- Environmental conditions at Pelekane Bay following a recent heavy rain event have been assessed through aerial photo documentation and shoreline surveys through helicopter surveys by PI.

- Settlement tiles have been deployed at 34 sites in Pelelame and Kawaihae, 3 sites at Puakō.

- Total suspended solids and photosynthetically active radiation (PAR) were measured at each site.