Coral nursery research at Penn State

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Earth Talks: Exploring the Oceans
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Coral Reefs Reduce Wave Energy and Height

Coral reefs reduce wave energy by an average of 97 percent across all studies globally. The reef crest, or shallowest part of the reef where the waves break first, dissipates 86 percent of wave energy on its own. The whole reef reduces wave height by 84 percent.

Study Citation: Ferrario, F., M.W. Beck, C.D. Storlazzi, F. Micheli, C.C. Shepard, L. Airoldi. 2014. The Effectiveness of Coral Reefs for Coastal Hazard Risk Reduction and Adaptation. Nature Communications. Doi:10.1038/ncomms4794
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Economic Value of Reefs

Sum: ~$30 billion

http://coralreef.noaa.gov/aboutcorals/values/resources/cr_econ_value_cht.jpg
19% of Earth’s coral cover lost

15% projected loss in 10-20 years.

Another 20% projected loss in 20-40 years.

Nursery Benefits

• Asexual Propagation:
  – Increase biomass
  – Preserve extant diversity

• Downstream Sexual Recombination
  – Promote new diversity

Why is diversity important?
Gardner et al. (2002) Nature

Fig. 3. Number of reef provinces bleaching since 1979. (Graph modified from Goreau and Hayes (1994) with data added for 1992 onwards.) Arrows indicate strong El Niño years.

Hoegh-Guldberg et al. (1999) Marine and Freshwater Research

coralreefecosystems.org
Major question in coral biology:
Can corals adapt to climate change?
Diagram showing the process of cell division and recombination in A. palmata genets A and B. The diagram illustrates how fragments can reattach, either keeping the original symbiont or changing it, and the subsequent cell division and recombination processes.
<table>
<thead>
<tr>
<th>Species</th>
<th># MSATs</th>
<th>$P_{ID}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Host:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acropora palmata</em></td>
<td>5</td>
<td>$10^{-9}$</td>
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<tr>
<td><strong>Symbiont:</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Symbiodinium ‘fitti’</em> (A3)</td>
<td>13</td>
<td>$10^{-8}$</td>
</tr>
</tbody>
</table>

Baums *et al.* (2014) *Molecular Ecology*
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