Coral Reefs and Climate Change in Micronesia Fact Sheet

Sea Surface Temperature

- Coral bleaching can occur when temperatures rise just 1°C above the average warmest temperature to which a reef is accustomed.
- Global Temperatures have risen approximately 0.8°C since the late 19th century[1].
- At current green house gas emissions, global temperature rise of 2.4-6.4°C is possible, with concurrent sea surface temperature (SST) increase from 1.0-3.0°C[1].
- As SST increases we will likely see more frequent mass bleaching events which will result in less time for reef recovery between events and other impacts like less calcification and growth, less reproductive output, and less resistance to disease and competitors.

Ocean Acidification

- Ocean acidification reduces the availability of carbonate ions, including aragonite, which corals and other calcifying organisms require to form their calcium carbonate skeletons and shells.
- Ocean pH has already decreased by 0.1 pH units[1].
- Projected decreases of 0.3-0.4 pH units[1] are possible which translates roughly to a 150% increase in hydrogen ions and a 50% decrease in carbonate ions[2].
- Based on the "Business as Usual" scenario, by 2100 aragonite saturation levels will be marginal to low in the tropics compared for coral reef calcification to occur. This may result in a 30% decrease in calcification rates over the next century.
- Ocean acidification may result in slower coral growth rates, low density skeletons that are more fragile and corals diverting energy from other processes (reproduction, healing damage, etc) in order to continue calcifying. This could lead to a shift in the balance between reef construction and erosion.

Other Climate Change Impacts to Reefs

- Changing patterns of storms, extreme tides, and ocean circulation could also have impacts on coral reefs that are not completely understood at this time.
- Droughts and higher sea levels and increased precipitation patterns associated with ENSO could also have impacts to reefs as these patterns potentially change.
- Adding to our concern is the cumulative impacts of climate change and other human related threats to reefs such as coastal development, shoreline modification, harvesting of reef species, sedimentation, nutrient run-off, over exploitation of fish, damaging fishing practices, invasive species, poor management and governance and recreational overuse.

Coral Reefs and Adaptation Strategies

- Adaptation is doing what you are already doing but doing it more effectively and considering the climate context or "climate lens".
- To increase the resilience of coral reefs to climate change impacts we must manage local stressors.
- Adaptation Strategies Include;
  - Reduction of overfishing and harmful fishing practices (educate, protect herbivores and other key species, locally managed marine areas)
  - Reduction in pollution (location of piggeries, better trash disposal, addressing human waste)
  - Reduction of sedimentation (land use practices, restore/protect natural shoreline protection such as mangroves, seagrass beds, and beaches, best practices for roads and infrastructure)
  - Reduction of recreational damage (buoys to prevent anchor damage, fees to help finance MPAs)
  - Protect associated habitats to ensure a healthy ecosystem (mangroves, seagrass beds)
  - Create LMMAs, MPAs, MPA Networks, etc (habitat protection plus fisheries management, reduce fishing pressure, protect key species, support connectivity gradients, protect resilience areas, involve the community in decisions and enforcement)
  - Early warning, proactive planning, and strategic monitoring for bleaching events (bleaching response plans, NOAA Coral Reef Watch satellite bleaching alerts)
  - Think outside the box (new partnerships, new funding sources, different approaches)

[1] Actual and projected temperature and ocean pH numbers come from IPCC-AR4 http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm

[2] Orr, J.C. et al. 2005. Anthropogenic ocean acidification over the twenty-first century and its impacts on calcifying organisms. Nature 437(29):681-686.