Coral Reef Ecosystem Monitoring in Guam

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Coral Reef Biocriteria Workshop
Pacific Islands Environmental Conference
June 21, 2005
Tumon, Guam
Monitoring and Assessment Activities in Guam

- Guam Coral Reef Monitoring Group
- Coordinated Monitoring
- Monitoring for Management
  - Marine Preserve
  - Coastal EMAP
  - War in the Pacific National Historical Park
  - University of Guam Marine Laboratory
Guam Coral Reef Monitoring Group

- Division of Aquatic and Wildlife Resources
- Guam Environmental Protection Agency
- University of Guam Marine Laboratory
- Water and Environmental Research Institute
- National Park Service
- Guam Coastal Management Program
Monitoring For Management

- Monitoring provides data necessary to make informed management decisions
  - Marine Preserves Effectiveness (DAWR)
  - Coastal Environmental Monitoring and Assessment Program (GEPA)
  - Effects of Wildland Fires and Badland Mitigation on Nearshore Environments (NPS)

- Complemented by targeted research to address specific issues
  - University of Guam Marine Laboratory
  - Water and Environmental Research Institute
Coordinated Monitoring

War in the Pacific
DAWR – Fish, Benthic
NPS – Sedimentation, Coral

Piti Bomb Holes Preserve
DAWR – Fish, Benthic
GEPA – Water Quality
UOGML – Algal abundance, Seagrass, Nutrients

Fouha Bay
UOGML – Coral, algae, sediment

GEPA – EMAP
5 Permanent Sites
45 Random Comprehensive Assessment

Bay
DAWR – Fish, Benthic
Water Quality
UOGML – Algal abundance, coral, diseases and bleaching

Achang Reef Flat Preserve
Fish, Benthic
Water Quality
UOGML - Seagrass
Marine Preserves

- Monitoring began prior to full enforcement in 2001
  - Achang Reef Flat Marine Preserve
  - Piti Bomb Holes Marine Preserve
- Designed to assess the effectiveness of the marine preserves
  - Monitoring to be expanded in 2005 to include Tumon Bay Marine Preserve and Water Quality Parameters
Marine Preserve

- **Fish Surveys (DAWR)**
  - Permanent Strip Transects, 50 x 5 m
  - Timed Swim Counts 30 minutes
    - Reef Flat - 8 transects
      - Seagrass Beds, Coral/Rubble, Channel
    - Fore Reef Slope – 4 transects at 2 sites
      - 20, 30, 40, & 50 foot contour

- **Benthic Surveys (DAWR)**
  - Video Transects
    - % cover

- **Water Quality (GEPA)**
  - Grab Samples
    - Bacteria, Conductivity, Nitrate-nitrogen, Chlorophyll-a, Pheophytina, Ammonium, Total Nitrogen, Ortho-Phosphate, Total Phosphorous, pH, Total Dissolved Solids, Total Suspended Solids, Dissolved Oxygen
  - In Situ Samples
    - Conductivity/Salinity, Depth, Dissolved Oxygen, pH, Temperature, Turbidity (NTU), and Transparency/Clarity
COASTAL EMAP

- Uses a probabilistic, stratified-random sampling design for Islandwide coverage
- Integrates data from multiple indicators
  - Biological
  - Water Column
  - Sediment Chemistry
- Goals:
  - To assess the physical, biological, and chemical condition of Guam’s Marine waters
  - To rank relative importance of various stressors on the affected resource types
### 1. Physical/Chemical

#### Water Column Parameters

<table>
<thead>
<tr>
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<th>Parameter</th>
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<tbody>
<tr>
<td>1</td>
<td>Temperature</td>
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<tr>
<td>2a</td>
<td>Transparency/Clarity (Secchi Visibility)</td>
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<tr>
<td>2b</td>
<td>Transparency/Clarity (PAR)</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
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<tr>
<td>4</td>
<td>Salinity</td>
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<tr>
<td>5</td>
<td>Conductivity</td>
</tr>
<tr>
<td>6</td>
<td>Dissolved Oxygen</td>
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<tr>
<td>7</td>
<td>Depth</td>
</tr>
<tr>
<td>8</td>
<td>Turbidity (NTU)</td>
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#### Water Column Characteristics

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<thead>
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<tbody>
<tr>
<td>9</td>
<td>Bacteria (enterococci)</td>
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<tr>
<td>10</td>
<td>Nitrite Nitrogen</td>
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<tr>
<td>11</td>
<td>Nitrate+nitrite Nitrogen</td>
</tr>
<tr>
<td>12</td>
<td>Ammonia-nitrogen</td>
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<tr>
<td>13</td>
<td>Orthophosphorus</td>
</tr>
<tr>
<td>14</td>
<td>Chlorophyll a</td>
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<tr>
<td>15</td>
<td>Total Suspended Solids</td>
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#### Sediment Physical Characteristics

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<tr>
<td>16</td>
<td>Total Organic Carbon</td>
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<tr>
<td>17</td>
<td>Granulometry</td>
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</table>
War in the Pacific National Historical Park

- Monitoring to assess the impact of wildland fires and badland mitigation techniques
- Chemical/Physical Parameters
  - Total Sediments
  - % Organic Content
  - % Carbonate Content
  - Sediment Size
  - Water Temperature
  - Light Penetration
- Biological Parameters
  - Benthic Cover
  - Coral Recruitment
  - Fish Abundance and Diversity
NOAA-MARAMP

- Fish, Turtle, & Marine Mammal Surveys
  - Belt Transects
  - Stationary Point Counts
  - Towed-diver surveys
  - Roving Diver Surveys
  - Hydroacoustic Surveys

- Benthic Surveys
  - Belt Transects
  - Towed Diver Surveys
  - Roving Diver Surveys
  - TOAD Towed Camera Surveys

- Oceanography
  - Closely-spaced CTDs
  - Drifters
  - Subsurface Temperature
  - ADCP Transects
  - CREWS/SST Buoys
  - Current/Wave Moorings
University of Guam
Marine Laboratory

- Long-term Monitoring
  - Coral Cover
  - Coral Recruitment
  - Water Quality
- Coral Disease
- Molecular Biomarkers
- Soft-Coral Bioindicators
- Fouha Bay
  - Monitoring sediment input and coral cover
Thank You!