Hyperspectral Response Library:
Key for Mapping the Coral covered with algae and Rubble

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## Research Topics

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<th>Hyperspectral</th>
<th>Multispectral</th>
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<tr>
<td>Laboratory measurements</td>
<td>2008 Capability test of ALOS AVNIR-2 with Landsat-7 ETM</td>
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<tr>
<td>- Soft coral</td>
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<td>- Hard coral</td>
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<td>In situ measurements</td>
<td>2009 Classification Coral Reef benthic communities with ALOS AVNIR-2</td>
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<td>- Living corals</td>
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<td>- Dead corals</td>
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<tr>
<td>In situ measurements</td>
<td>2010 - 2011 Integrating in situ reflectance with ALOS AVNIR to detection</td>
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<tr>
<td>- Living corals</td>
<td>coral health</td>
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<td>- Dead corals</td>
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<td>- Sea grass</td>
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<td>- Other reef substrate</td>
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Knowledge on the spectral separability of benthic objects is useful for designing and optimizing coral reef remote-sensing applications.

- improve the accuracy of coral reefs maps when applied in remote sensing image classification

- in selection of optimal band location and bandwidth characteristics
(1) Document the spectral features of healthy corals and dead corals covered with algae and coral rubble as distributed within four study site in the Spermonde archipelago;

(2) Develop spectral library to determine whether living and dead corals and coral rubble are spectrally discriminable and how to achieve discrimination.
Spermonde archipelago, South Sulawesi, Indonesia
- Samatellu Lompo island
- Samatellu Borong
- Samatellu Caddi

Field study

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Fishing with explosives
Blast fishing & Chemical Fishing

- Coral rubble is covered with epiphytic algae after bleaching by blast fishing activities.

- Coral rubber bleached less than 3 months, began covered with turf algae and calcareus skeleton is visible clearly.

- Coral rubber bleached more than 3 months are mainly covered with turf algae that growing rapidly
Object

- *Acropora formosa*,
- *Seriotopora stelata*,
- *Acropora macrostomata*,
- *Acropora sarmentosa*,
- *Porites columnaris*,
- *Porites meyeri*,
- dead *Porites*.
- dead *Acropora*,
- coral rubber (<3 months
- coral rubber (>3 months).

- 90 representative samples of living coral
- 26 of dead coral
- 106 of coral rubber

were selected randomly.
Spectral Measurement

- Using spectroradiometer instrument
- Working at wavelengths of 400-800nm

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• Corelation Analysis: compare intensity of relationship among reflectance. Pearson correlation given a proximity matrix.

• Cluster Analysis: investigate the variability within population. Distance scale determined spectral similarity and dissimilarity in which object with shorter distance would be more similar each other compared to object with longer distance.

• ANOVA was used to compare means of samples. Two estimates are made of the population variance to compare the group to discover if this apparent difference is statistically significant.
Figure 1. Curve of spectral reflectance

Acropora formosa

Seriatopora stelata

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Figure 1. Curve of spectral reflectance
Porites meyeri

Porites columnaris

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Reflectance (%) vs. Wavelength (nm) for Coral Rubber (<3 months) and Coral Rubber (>3 months).

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Reflectance (%) vs. Wavelength (nm) for various coral species and conditions.

- **Coral Rubber (<3 months)**
- **Coral Rubber (>3 months)**
- **Dead Acropora**
- **Dead Porites**

Species included:
- **Acropora formosa**
- **Seriatopora stelata**
- **Porites meyeri**
- **Porites columnalis**
- **Acropora macrostomata**
- **Acropora sarmentosa**

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Table 1. Correlation coefficients for 10 categories of live corals, dead corals covered with algae, coral rubber covered with algae

<table>
<thead>
<tr>
<th></th>
<th>Acropora</th>
<th>Acropora macrostomata</th>
<th>Acropora sarmentosa</th>
<th>Seriotopora stelata</th>
<th>Porites meyeri</th>
<th>Porites columnalis</th>
<th>Coral Rubber (&lt;3 months)</th>
<th>Coral Rubber (&gt;3 months)</th>
<th>Dead Acropora</th>
<th>Dead Porites</th>
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<tbody>
<tr>
<td>Acropora</td>
<td>1</td>
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<tr>
<td>Acropora</td>
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<td>0.97</td>
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<td>Seriotopora</td>
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<td>0.93</td>
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<td>stelata</td>
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<td>Porites meyeri</td>
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<td>Porites</td>
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<td>columnalis</td>
<td></td>
<td>0.96</td>
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<td>0.99</td>
<td>0.95</td>
<td>0.98</td>
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<tr>
<td>Coral Rubber</td>
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<td>(&lt;3 months)</td>
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<td>0.86</td>
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<td>0.84</td>
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<tr>
<td>Coral Rubber</td>
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<tr>
<td>(&gt;3 months)</td>
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<td>0.77</td>
<td>0.88</td>
<td>0.86</td>
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<td>0.96</td>
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<td>0.96</td>
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<tr>
<td>Dead Acropora</td>
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<td>0.85</td>
<td>0.92</td>
<td>0.90</td>
<td>0.85</td>
<td>0.98</td>
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<td>0.99</td>
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<td>Dead Porites</td>
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<td>0.81</td>
<td>0.89</td>
<td>0.87</td>
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<td>0.91</td>
<td>0.99</td>
<td>0.98</td>
<td>0.99</td>
</tr>
</tbody>
</table>

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Figure 2. Graph of dendogram

Similarity

Acropora formosa
Seriatopora stolata
Acropora macrostomata
Acropora saraentosa
Porites columnalis
Porites meyeri
Coral rubber (>3 months)
Dead Acropora
Dead Porites
Coral rubber (<3 months)

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• There is a strong correlation between and within the living corals, dead coral covered with algae and coral rubber covered with algae

• *Porites meyeri* couldn`t be easily separated from dead corals and old coral rubber.

• spectral reflectance values at peak and minima were significantly different among them

• The overall results suggest good separability based on measured reflectance.
Thank you

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Ectodermis

Mesoglea

Zooxanthellae

endodermis
### Data Analysis

#### Table 1. Interval of Wavelengths Used in this Research

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>Colour</th>
<th>Wavelength (nm)</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>380-450</td>
<td>Violet</td>
<td>550-575</td>
<td>Green-Yellow</td>
</tr>
<tr>
<td>450-480</td>
<td>Sky Blue</td>
<td>575-585</td>
<td>Yellow</td>
</tr>
<tr>
<td>480-510</td>
<td>Blue</td>
<td>585-620</td>
<td>Orange</td>
</tr>
<tr>
<td>510-550</td>
<td>Green</td>
<td>620-700</td>
<td>Red</td>
</tr>
</tbody>
</table>

![Wavelength Scale](image)