Evaluating Management Strategies for Ecosystem Services in a Hawaiian Islands Coral Reef IEA

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PICES, October 2019
Through IEA Framework

1. Understand the dynamics of the natural and human-related drivers including climate change
2. Develop an ecosystem model to simulate these dynamics
3. Quantify socio-ecological tradeoffs for different marine resource users
Ecosystem Services
## Ecosystem Services

<table>
<thead>
<tr>
<th>ECOSYSTEM STRUCTURE &amp; RESILIENCE</th>
<th>DIVE TOURISM</th>
<th>FISHERIES</th>
</tr>
</thead>
</table>

Ecosystem services including dive tourism and fisheries are being studied for their trade-offs. The study was presented at the PICES conference in Victoria, Canada, in October 2019.
Equally exposed

Less sensitive
More adaptive

More sensitive
Less adaptive
Evaluating Alternative Management

Evaluated the performance of six management scenarios over the next 15 years.

1. Current Management (i.e. no change)
2. Reduce fishing effort to 90% of estimated MSY
3. Reduce land-based sources of pollution by 50%
4. No take of herbivorous fishes
5. Limit fishing gear to line only
6. Create a fully protected MPA

PICES, Victoria Canada. October 2019
Ecopath with Ecosim (EwE) modeling framework

Used for:

- Ecological descriptions
- Evaluating tradeoffs in (fisheries) management options
- Environmental impact assessments
- Predict impact of climate change
Estimating Future Ecosystem Changes
Evaluating Alternative Management Scenarios

Decision support matrix for assessing the efficacy of each management scenario

<table>
<thead>
<tr>
<th></th>
<th>Current Management</th>
<th>90% MSY</th>
<th>50% LBSP</th>
<th>No Herbivore Fishing</th>
<th>Only Line Fishing</th>
<th>No Take MPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem Structure and Function</td>
<td>-13.3%</td>
<td>6.5%</td>
<td>3.6%</td>
<td>34.2%</td>
<td>32.9%</td>
<td>35.4%</td>
</tr>
<tr>
<td>Dive Tourism</td>
<td>3.8%</td>
<td>10.1%</td>
<td>-0.9%</td>
<td>4.8%</td>
<td>22.4%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Fishery</td>
<td>-5.8%</td>
<td>2.9%</td>
<td>0.1%</td>
<td>-15.8%</td>
<td>-13.6%</td>
<td>-27.8%</td>
</tr>
</tbody>
</table>

Relative Change

- > 15%
- 5% – 15%
- ±5 %
- -5% – -15%
- < -15%
Summary

Ecosystem models in IEAs make it possible to:

1. Integrate natural and social science;
2. Take climate change impacts to the ecosystem into consideration;
3. Evaluate socio-ecological tradeoffs of alternative management scenarios.