Against the Odds: Small scale fishers’ Climate Change Adaptation through a social ecological resilience lens

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Case Site

- Marilao-Meycauayan-Obando River System
- 52 kilometer long
- 130km²
- 1.386M people
- Drains to Manila Bay
Profile of Fisheries

Global and National Level
- 5th highest fish producing country (2010); 3.06% contribution
- 10th in aquaculture produce (2010); 1.24% share

Provincial Level
- Bulacan, one of the top milkfish and tilapia producing (2002) provinces
- 15.75% of Region 3 fishery produce (2011); 40,790+ MT
- 41.78% milkfish; 20.86% shrimp; 3.98% tilapia
- 94.04% are brackishwater fishponds out 12,419.36 has of aquaculture farms
- 13,287 municipal fisherfolk and 4 licensed commercial fisherfolks

Source: FAO & BFAR R3 (2013)
Methodology

- Key informant interviews and focus group discussions with fishers in MMORS
- 31 fishers (e.g. Barangay Fisheries and Aquatic Resources Management Council)
- Meycauayan, Marilao, Obando (Bulacan); Valenzuela (Metro Manila)
- August-September 2013
- Identified themes based on the literature
- Manual (paper-based) and Nvivo for the interviews
- VenSim for systems model
Resilience as component of adaptive capacity

- Capacity to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004)
- The key to sustainability is to enhance the resilience of social ecological system and not optimizing isolated components of a system (Walker and Salt, 2006)

For the MMORS small scale fishers: 
*Resilient fisheries = sustained and abundant fishing in MMORS*
## Climate change adaptation strategies

<table>
<thead>
<tr>
<th>Climate Change Effects</th>
<th>Impacts to Fisheries</th>
<th>Adaptation Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in water temperature</td>
<td>Decrease oxygen level</td>
<td>Early harvest (e.g. based on observation – fishes surfacing (“gataw”))</td>
</tr>
<tr>
<td></td>
<td>Increase toxicity of pollutants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Early harvest (e.g. based on observation – fishes surfacing (“gataw”))</td>
<td></td>
</tr>
<tr>
<td>Extreme weather conditions</td>
<td>Destruction of aquaculture facilities (e.g. earth dikes)</td>
<td>Repair dikes</td>
</tr>
<tr>
<td></td>
<td>Loss of fish stock</td>
<td>Increase height of earth dikes</td>
</tr>
<tr>
<td></td>
<td>Entry of invasive species</td>
<td>Use alternative barriers (e.g. nets)</td>
</tr>
<tr>
<td></td>
<td>Increase depth of fish pond</td>
<td>Sell to market; use pesticides during pond preparation</td>
</tr>
<tr>
<td></td>
<td>Water quality changes</td>
<td>Use of pumps and water exchange management</td>
</tr>
<tr>
<td>Typhoons and tropical cyclones</td>
<td>Increase salinity</td>
<td>Early harvest</td>
</tr>
<tr>
<td></td>
<td>Decrease water level</td>
<td>Increase depth of fish pond</td>
</tr>
<tr>
<td>Drought</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tracks of Tropical cyclones which crossed the Province of Bulacan from 1948 - 2011

Monthly Frequency of Tropical Cyclones

<table>
<thead>
<tr>
<th>MONTH</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td>0</td>
</tr>
<tr>
<td>FEB</td>
<td>0</td>
</tr>
<tr>
<td>MAR</td>
<td>0</td>
</tr>
<tr>
<td>APR</td>
<td>0</td>
</tr>
<tr>
<td>MAY</td>
<td>1</td>
</tr>
<tr>
<td>JUN</td>
<td>5</td>
</tr>
<tr>
<td>JUL</td>
<td>5</td>
</tr>
<tr>
<td>AUG</td>
<td>2</td>
</tr>
<tr>
<td>SEP</td>
<td>3</td>
</tr>
<tr>
<td>OCT</td>
<td>7</td>
</tr>
<tr>
<td>NOV</td>
<td>5</td>
</tr>
<tr>
<td>DEC</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>28</td>
</tr>
</tbody>
</table>

Legend:

- Line symbol
- Tropical Depression
- Tropical Storm
- Typhoon
- Super Typhoon
- Areas
  - Bulacan Province

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Dynamics of MMORS’ small scale fishers’ resilience using a systems dynamics template

Cultural Adaptation Template
Newell & Dyball, 2014
MMORS Fisheries’ System of Interest
Sustained Fishing in MMORS

Level of income and livelihood

Number of fishers in MMORS

Belief in open access resource

Belief in optimal sustainable yield

Level of MMORS water quality

Level of command and control approaches

Frequency and intensity of climate change effects

Level of intertidal river flow
Indicators of Social Resilience of MMORS’ Fishers

<table>
<thead>
<tr>
<th>Indicators of Social Resilience (Johnson et al., 2014)</th>
<th>Adaptation Strategies of MMORS Fishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>Fishing as a means of survival; no access to alternative livelihood or capital</td>
</tr>
<tr>
<td>Diversification</td>
<td>Some fishers have other sources of livelihood; switch from milkfish to tilapia</td>
</tr>
<tr>
<td>Getting by</td>
<td>Sell lesser value fishes; gleaning</td>
</tr>
<tr>
<td>Social identity</td>
<td>Fishing as a “way of life” passed on by earlier generation</td>
</tr>
<tr>
<td>Optimism</td>
<td>Fishing is a “gamble”; still hopeful of fisheries in the area</td>
</tr>
</tbody>
</table>
## Indicators of Social Resilience of MMORS’ Fishers

<table>
<thead>
<tr>
<th>Indicators of Social Resilience (Marshall and Marshall, 2007)</th>
<th>Adaptation Strategies of MMORS Fishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of risk associated with change</td>
<td>Used to fishing and passed on from generations</td>
</tr>
<tr>
<td>perception of ability to plan, learn and organize</td>
<td>Want to learn technologies to help improve fish yield and access to financial resources</td>
</tr>
<tr>
<td>Perception of the ability to cope</td>
<td>Those with capital, technology, and know-how continue on; they invest on equipment, improve their fishponds</td>
</tr>
<tr>
<td>Level of interest to change</td>
<td>Social identity plays a part; Availability of other opportunities in the area</td>
</tr>
</tbody>
</table>
Categories of adaptation strategies of fishers in MMORS

- Technological
- Cultural and social learning
- Economic
- Institutional
Distinct mental models

Need to integrate...

- level of income and livelihood
- number of fishers in MMORS
- level of MMORS water quality
- MMORS fishers’ mental model

- level of profit
- number of industries along MMORS
- access to raw materials
- MMORS industries’ mental model

The diagram illustrates the relationships between different aspects, showing how factors like the number of fishers in MMORS and MMORS fishers’ mental model influence the level of income and livelihood. Similarly, the number of industries along MMORS and access to raw materials are connected to the level of profit. The relationships are represented with arrows indicating positive (+) or negative (-) influences.
MMORS fishers’ mental model

MMORS industries’ mental model

level of income and livelihood
- +

number of fishers in MMORS
- +

belief in open access resource

level of MMORS water quality

MMORS fishers’ mental model

level of profit

number of industries along MMORS
- +

belief in industry development

access to raw materials

level of profit

Belief in equity

regional well-being

level of implementation of IWRM

level of water quality in MMORS

MMO Water Quality Management Area = area for integration
Conclusion

• Social ecological resilience as component of adaptive capacity.
• Climate change affects other system factors which could serve as barriers or drivers to resilience.
• Cultural adaptation templates based on systems dynamics approach could be used to frame and understand the dynamics of climate change adaptation.
• The integrated resource water management council (e.g. WQMA) could be a venue for shared learning and integrated planning and management.
References

- Photos courtesy of Blacksmith Institute and HSBC volunteers
- BFAR R3, Bulacan Fisheries Profile (2013) (powerpoint presentation)