Establishment and management of communal sandfish (*Holothuria scabra*) sea ranching in the Philippines

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• High species richness (40 species) and diversity (H=2.67)
• Low population densities (0.3 to 9 ind.ha\(^{-1}\))
  - Holothuria scabra (5.2 ind.ha\(^{-1}\))
• Majority immature

( Olavides et al., in press )
Holothuria scabra
“sandfish”

Sandfish (*Holothuria scabra*):
- Among the most valued tropical sea cucumber species.
- Year round spawners
- Short larval period
- Sedentary, inhabiting inshore areas (e.g. seagrass beds)

<table>
<thead>
<tr>
<th>SPECIES NAME</th>
<th>TOTAL FOR ALL HABITATS (17,250 m²)</th>
<th>COUNT</th>
<th>REL. ABUN.</th>
<th>DENSITY (ind has⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Actinopyga echinites</em></td>
<td></td>
<td>3</td>
<td>2%</td>
<td>1.74</td>
</tr>
<tr>
<td><em>Bohadicha similis</em></td>
<td></td>
<td>2</td>
<td>1%</td>
<td>1.16</td>
</tr>
<tr>
<td><em>Holothuria atra</em></td>
<td></td>
<td>1</td>
<td>1%</td>
<td>0.58</td>
</tr>
<tr>
<td><em>Holothuria fuscocinerea</em></td>
<td></td>
<td>11</td>
<td>7%</td>
<td>6.38</td>
</tr>
<tr>
<td><em>Holothuria laeucospilota</em></td>
<td></td>
<td>49</td>
<td>31%</td>
<td>28.41</td>
</tr>
<tr>
<td><em>Holothuria pervicax</em></td>
<td></td>
<td>2</td>
<td>1%</td>
<td>1.16</td>
</tr>
<tr>
<td><strong>Holothuria scabra</strong></td>
<td></td>
<td>9</td>
<td>6%</td>
<td>5.22</td>
</tr>
<tr>
<td><em>Pearsonothuria graeffei</em></td>
<td></td>
<td>5</td>
<td>3%</td>
<td>2.90</td>
</tr>
<tr>
<td><em>Stichopus horrens</em></td>
<td></td>
<td>7</td>
<td>4%</td>
<td>4.06</td>
</tr>
</tbody>
</table>

*(Olavides et al., in press)*

Reported average catch in Bolinao

<table>
<thead>
<tr>
<th>Year</th>
<th>Ave. catch per day per person (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970’s</td>
<td>90</td>
</tr>
<tr>
<td>1980’s</td>
<td>80</td>
</tr>
<tr>
<td>1990’s</td>
<td>60</td>
</tr>
<tr>
<td>2000’s</td>
<td>30</td>
</tr>
<tr>
<td>Present</td>
<td>10</td>
</tr>
</tbody>
</table>

Cited reasons for the decline in catch:
- Dynamite fishing
- Hookah diving
- Fish pens
- Overfishing

Source: 16 respondents trepang fishers for >30 years
Establishment of pilot sea ranching site

1. Bio-physical suitability assessment
2. Community orientation & public consultation (IEC)
3. Presentation to LGU & securing legal permits (use rights)
4. Planning workshop & partnership agreement (capability building)
5. Site delineation & development
Rights holders: exclusive harvest rights for sea cucumber in 5-hectare area and exclusive access - Zone A and Zone B

Other local community members: access - Zone C
C. Monitoring Scheme

**Zones**

<table>
<thead>
<tr>
<th>Zones</th>
<th>Area (m²)</th>
<th>Surveyed area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring pens</td>
<td>300 (3 x 100m²)</td>
<td>300 (100%)</td>
</tr>
<tr>
<td>A – Core release</td>
<td>2,200 (50m x 50m)</td>
<td>360 (16.4%)</td>
</tr>
<tr>
<td>B – Nursery</td>
<td>7,500 (100m x 100m)</td>
<td>1,600 (21.3%)</td>
</tr>
<tr>
<td>C – Buffer</td>
<td>40,000 (250m x 250m)</td>
<td>1,600 (4%)</td>
</tr>
<tr>
<td>D – Outside</td>
<td>---</td>
<td>1,600 (n/a)</td>
</tr>
</tbody>
</table>

**Population Parameters:**

- **Growth**
  - In pens (single batch)
  - Entire sea ranch (multiple batches)
    - average weight over time
    - modal progression of length converted to weight frequency distributions (FISATII 2000)

- **Survival rate (%Sur)**
  \[
  \%\text{Sur} = \frac{Ab_{\text{tot}}}{RH_{\text{tot}}} \]
  where
  - \(Ab_{\text{tot}}\) = total Ab in sea ranch
  - \(RH_{\text{tot}}\) = total # released juveniles

- **Population density (D_z)**
  in individuals per square meter
  \[
  D_z = \frac{n_z}{a_z} \]
  where
  - \(n_z\) = number of samples in a zone
  - \(a_z\) = total area (m²) surveyed in a zone

- **Estimated Abundance (Ab_{tot})**
  in number of individuals
  \[
  Ab_z = D_z \times A_z \]
  where
  - \(D_z\) = population density
  - \(A_z\) = total area (m²) of zone
  \[
  Ab_{\text{tot}} = \text{sum of } Ab_z \]

- **Biomass (kg ha⁻¹)**
  \[
  B_{\text{tot}} = \frac{(\text{sum of } Ab_c \times W_c / 5)/1000}{\text{sum of } Ab_c} \]
  where
  - \(Ab_c\) - number of individuals per size class
  - \(W_c\) - mid weight of size class (g)
First Sea Ranching Site: Brgy. Victory, Bolinao, Pangasinan

Signing of partnership agreement: December 6, 2007

Total juvenile released: 24,175
Year 1 = 5,011 (Dec 2007-June 2008)
Year 2 = 11,106 (Sept 2008 – Apr 2009)
Year 3 = 9,313 (Jan-Jul, 2010)
Year 4 = 600 (Nov, 2010)

No. of monitoring surveys conducted: 11

(e.g. MPA; mangrove reforestation; culture of sea urchins, seaweeds and grouper)
Second Sea Ranching Site: Brgy. Sablig, Anda, Pangasinan

Excellent track record in Mangrove rehabilitation, seaweed culture, grouper culture, & Marine Protected Area

Signing of partnership agreement: February 5, 2009

Total juvenile released: 20,548
Year 1 = 5,613 (Dec 2008 – Apr 2009)
Year 2 = 14,935 (July 2009-Apr 2010)
Year 3 = 4,723 (Nov-Dec, 2010)
No. of monitoring surveys conducted: 7
Third Sea Ranching Site: Sitio Panglit, Masinloc, Zambales

Signing of partnership agreement: May 13, 2009

Total juvenile released: 22,472
Year 1 = 3,275 (May 2009)
Year 2 = 19,197 (Jun 2009-Apr 2010)

No. of monitoring surveys conducted: 6

Actively participating in community-based resource management (Marine Protected Area Managers)
Typhoon Emong

After Emong

1st Harvest
(n=127; 40 kg)

2nd Harvest
(n=33)
No. of individuals

Size class (grams)

M7
M6
M9
M8
M10
M11
M11

Mass spawning

Typhoon Ondoy & Pepeng

Estimated density for the sea ranching site = 1,800 ind ha\(^{-2}\)

Mass Harvest (n=1,563; 224kg)

Results

RELEASERS (n)

600
1958
1150
4350
1255

Releases
Monitoring

No. of individuals

Size class (grams)
19.7% (38 out of 181) adults observed

(Olavides et al., 2011)
Survival

Estimated survival of release per quarterly monitoring

- Total released animals
- Estimated Abundance

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Total Released</th>
<th>Estimated Abundance</th>
<th>Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2008</td>
<td>2,300</td>
<td>329</td>
<td>14%</td>
</tr>
<tr>
<td>July 2008</td>
<td>3,846</td>
<td>1,696</td>
<td>44%</td>
</tr>
<tr>
<td>Oct 2008</td>
<td>6,856</td>
<td>2,953</td>
<td>43%</td>
</tr>
<tr>
<td>Jan 2009</td>
<td>8,713</td>
<td>3,042</td>
<td>35%</td>
</tr>
<tr>
<td>Apr 2009</td>
<td>16,447</td>
<td>3,089</td>
<td>19%</td>
</tr>
<tr>
<td>July 2009</td>
<td></td>
<td>5,748</td>
<td>35%</td>
</tr>
</tbody>
</table>
Visitors from all over the country

**LUZON:**
- Ilocos Norte
- Tuguegarao City
- Aparri, Cagayan
- San Fernando, La Union
- Pangasinan
- Zambales
- Marinduque
- Ilocos Sur
- Camarines Norte

**VISAYAS:**
- Tigbauan, Iloilo
- Bantayan Island
- Tacloban
- Bohol
- Antique
- Eastern Samar

**MINDANAO:**
- Davao City
- Davao Oriental
- Tawi-Tawi
- Cagayan de Oro City
Maraming Salamat!

Australian Center for International Agriculture Research

Department of Science and Technology

Adopted from Battaglene, 1999