Community-based giant clam restocking - hopes for biodiversity conservation

H. P. Calumpong, A. B. Apao, J. R. Lucañas and J. S. Estacion

ABSTRACT

Efforts at restocking coral reefs with giant clam juveniles have been done by the Silliman University Marine Laboratory since 1997 using community-based approach. Only reefs protected by local communities were restocked. So far, six sites have been restocked with 2056 individuals of five species: Tridacna gigas, T. squamosa, T. derasa, T. crocea and Hippopus hippopus. Survival and growth in three reefs were monitored during this period. Survival for T. gigas is 24.24% and H. hippopus is 2.5%. Growth rate for T. gigas is 0.75 ± 0.16 cm mo⁻¹ and for H. hippopus is 0.21 ± 0.07 cm mo⁻¹. Tridacna squamosa, T. derasa and T. crocea did not survive in these sites.

Keywords Biodiversity, Community-based, Giant clam, Conservation, Restocking

Introduction

Since 1985, Silliman University Marine Laboratory (SUML) has embarked on restocking shallow nearshore areas with cultured giant clams as a means of restoring its already extirpated populations. Of the nine species of giant clams in the world, seven are present in the Philippines: Tridacna gigas, T. derasa, T. squamosa, T. crocea, T. maxima, Hippopus hippopus and H. porcellanus. The first two biggest species and H. porcellanus are either extirpated, or rare and are in the vulnerable status (Philippine Red Data Book 1997).

During the period 1985-1993, 26 sites in the Philippines were restocked with more than 20,000 clam juveniles ranging from 2 cm to 10 cm shell length (Calumpong and Solis-Duran 1993). Among the lessons learned from this restocking program were 1) natural phenomena such as typhoons and monsoons were the major causes of clam mortality (up to 35.2%); 2) biotic factors such as predation was also a major cause of clam deaths (28.6%); 3) poaching constituted 5.2% and was high only in unprotected areas, i.e., open-access areas; and 4) Hippopus hippopus did well in most habitats while Tridacna derasa did well in shallow, sandy areas with clear water.

The restocking program was continued in 1997 (this study) using the community-based approach to reduce poaching and establish breeding populations. This means that the community was involved in the whole program. Their involvement started with a consultation meeting wherein their opinions were sought with regard to the restocking program, to the restocking activity itself, and most importantly during the monitoring stage. Results of the monitoring were fed back to the community during barangay (smallest political unit) meetings.

Site Selection

Only marine sanctuaries (no touch zones) or areas with protection, i.e, seaweed farm, were restocked. Six sites were selected, five of which were marine sanctuaries and one a seaweed farm. These sites were Apo Island, Bolisong, Cangmating and Sagay, all located on Negros Island and Panganan and Danahon Bank, all in Bohol. The physical and chemical characteristics of these sites are given in Table 1. Apo is a barangay of Dauin in Negros Oriental (9° 04' N lat, 123° 16' E long) which declared 11 ha of nearshore area as a fish sanctuary on 3 Nov 1986 through a municipal resolution (Calumpong and Cadiz 1993). This has been protected by the community through a Marine Management Committee (MMC) until 1994 when Apo was integrated into the National Protected Areas System. Community protection has strengthened especially after the declaration of the whole Island as Protected Landscape and Seascape on 9 Aug 1994, and its management transferred to a Protected Area Management Board (PAMB) where half of the membership comes from the community. Apo I is fringed with coral reef with 82.92% total live coral cover in 1995 (Reboton 1997b).

Bolisong is a barangay of Manjuyod in Negros Oriental (9° 44' N lat, 123° 12' E long). The 10-ha marine reserve was established in 1988 where the community kept watch over it. It was supported by a municipal ordinance in 1995 and "Bantay Dagat" (Sea Watch) are deputized as Reserve guards. The area is a fringing reef with good to excellent coral cover (Montebon 1996).

Cangmating is a barangay of Sibulan, Negros Oriental (9° 21' 15.5"-22.2" N lat, 123° 17' 43.3"-54.3" E long). The 6-ha marine reserve was established on 28 April 1997 by municipal resolution No. 97-86, Ordinance No. 14 and managed by a Marine Reserve Council. It is a sandy, seagrass bed with patch reefs. Total live coral cover in 1998 was 34.31%.

Sagay Marine Reserve (11° 08' N lat, 123° 28' E long) is part of Sagay, Negros Occidental. It was established as a municipal marine reserve in 1983 under Municipal Ordinance No. 59, series 1983 and as Sagay Marine Reserve under Presidential Proclamation No. 592. The restocking site was Carbin Reef, which has good coral cover of 53% (Reboton 1998).

Panganan is a barangay of Calape, Bohol (9° 52' N lat, 123° 43' E long). It is a coral reef with 15.94% total live coral cover in 1996 (Reboton 1997a).
Table 1. Physico-chemical characteristics of the study sites (values are means ± SD).

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>STUDY SITES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apo Island</td>
</tr>
<tr>
<td>Water Transparency (m)</td>
<td>19.8 ± 1.7</td>
</tr>
<tr>
<td>Total Live Coral Cover (%)</td>
<td>82.96</td>
</tr>
<tr>
<td>Salinity (ppt)</td>
<td>34.8 ± 0.6</td>
</tr>
<tr>
<td>Water Temperature (°C)</td>
<td>28.1 ± 0.8</td>
</tr>
<tr>
<td>Total Suspended Solids (g l⁻¹)</td>
<td>4.4 ± 1.2</td>
</tr>
<tr>
<td>Sedimentation Rate (mg cm⁻² day⁻¹)</td>
<td>1.4 ± 1.9</td>
</tr>
</tbody>
</table>

Danahon Bank (10° 20' N lat, 124° 24' E long) is located in northern Bohol. It is a seaweed farm leased to several families and corporations. Except for Cangmating where the area is a patch reef with seagrass patches, and Danahon Bank which is sandy, all the sites are coral reefs (Fig. 1).

Materials and Methods

Clams used in the restocking program were spawned and reared at the SUML Hatchery, except for T. gigas which was obtained from the University of the Philippines-Marine Science Institute. Except for T. squamosa measuring 4-7 cm, most clams were tagged using Dymo® tape and glued with epoxy. Burrowing and semi-burrowing clams were allowed to grow on various substrates: cement, limestone and rubble, except for clams in Danahon which were placed directly on sand or coral rubble. Size at deployment varied from 2 cm to 30 cm.

Before deployment, a consultation meeting was held with the community, especially the members of the marine sanctuary management committee and "Bantay Dagat" (Seawatch) and local government officials such as the mayor, barangay captain and council members. They were the ones who gave the go signal to go ahead with the program. At this point, they would indicate their support by committing to assist during deployment and do the overall monitoring against poaching. Deployment was done in coordination with the assigned community members. Monitoring of the three nearby sites by the SUML team was done every month. The following parameters were monitored: number of survivors, shell length (SL) using a caliper, total suspended solids and sedimentation rate using a modification of the method described by Rogers et al. (1994), water transparency using a Secchi disk, temperature using a quick reading mercury thermometer and salinity using a temperature-compensated refractometer. Clams were marked lost when no shell or remains were seen. Every time monitoring was done, the community was always informed through a letter or courtesy call.

Results

A total of 2,046 giant clams, consisting of five species, were restocked in six sites in Central Philippines (Fig. 2). Only 6.68% have survived to this date (Fig. 3). Survival was highest for Hippopus hippopus (28.85%) one year after deployment. Tridacna gigas had a survivorship of 23.53 % while T. squamosa only had 2.68%. Survival was dependent on size at restocking (R² = 0.800355; p=8.69E-12; n = 48). Clams restocked at SL >15 cm had 48% survival while those restocked at SL >20 cm has 76% survival. All the T. derasa and T. crocea died or were lost.
Fig. 2. Restocked clams in Apo Island.

Fig. 3. Total number of clams restocked per species per site. Numbers represent % survivors.

No obvious recruits were seen. Wild populations of *T. crocea* and *T. squamosa* were seen in Bolisong (Fig. 4) and *T. squamosa* and *T. maxima* were observed in Apo. The *T. crocea* in Bolisong ranged in size from 3.9 cm - 10 cm SL and occupied standing dead corals at depths of no more than 6 m while *T. squamosa* ranged in size from 7 cm -33 cm SL and occupied the deeper areas to 10 m. In Apo, *T. squamosa* was seen just outside of the sanctuary at a depth of 10 m while *T. maxima* was seen inside the sanctuary.

Causes of mortality were investigated. In all of these sites, except, Apo I., all clams died or were lost due to storms. In Apo I., however, more than 60% of the restocked clams were lost (no shells seen) due to unknown causes. These were mostly the smaller clams. Our guess is that these were either carried by strong currents, preyed upon by predators or poached by tourists and dive guides. We have received reports from members of the community attesting to the latter, especially before the implementation of the PAMB (Protected Area Management Board) rules in December 2000 wherein boat operators could just anchor in the marine sanctuary without having to register. A small percentage (17%) died (shell remains seen) of natural causes.

**Discussion**

Except in Apo, all clam mortalities or losses were due to storms or strong winds. This is consistent with the findings of Calumpong et al. (1993). Restocking only areas managed by communities not only assures protection to the clams but eliminates poaching by local fishermen who help guard the marine reserve themselves. In our restocking sites, no poaching by local fishermen was observed, except in Apo where poaching by tourists and dive guides was suspected. The persistence of "wild" populations in restocking sites indicated effectiveness of protection. Whether these populations were from the wild or were part of the restocked clams in the past (period 1986) can only be ascertained through genetic studies as suggested by Calumpong et al. (1993).

An involved community contributes invaluable insights to the restocking program. For example, in Apo, the barangay captain and a dive guide showed us the usual tourist dive route and advised us not to put the clams along this route. In Cangmating, they informed us of an octopus which was a resident of the reef. In Bolisong, they kept us informed of recent divers or visitors to the Marine reserve. In all these places, they informed us when a storm hit the area, or when clams were overturned or carried by strong currents.

**Conclusions**

1. Community involvement eliminates poaching by local fisherfolks.
2. Survival is positively correlated with size at deployment.
3. Majority of the mortality was caused by storms.
4. No obvious recruits were seen but wild populations of *T. squamosa* and *T. crocea* were observed in Bolisong and Cangmating, indicating the effectiveness of community protection.

**Acknowledgement** We gratefully acknowledge the financial support of the Commission on Higher Education of the Philippines through its Center for Development in Marine Science grant to Silliman University Marine Laboratory and Biodiversity Project under the Mindanao Advanced Educational Program. We also thank the...
communities involved in the restocking program for their cooperation.

References


