A COST–BENEFIT ANALYSIS OF PROJECTS IMPLEMENTED TO ASSIST THE BLACK PEARL INDUSTRY IN MANIHIKI LAGOON, COOK ISLANDS

Objective

The objective of the study was to evaluate the economic net benefits of projects implemented to assist the black pearl industry in Manihiki in the Northern Cook Islands. The intention is that the findings and recommendations of the report will influence the evolution of future project activities in Manihiki and in aquaculture industries elsewhere in the Pacific. It is also intended that the study demonstrate the merits of the cost–benefit analysis approach for assisting resource allocation decisions in the Pacific.

Background

In November 2000 the black pearl industry in Manihiki Lagoon in the Northern Cook Islands was severely affected by an oyster disease, which, along with low international pearl prices, caused a steep decline in pearl export revenue, from NZD18.4 million in 2000 to NZD2.8 million in 2003.

Overstocking and poor handling of pearl oysters, combined with adverse environmental conditions, were found to be the major causes of the Manihiki disease outbreak in 2000. Scientific research and experience in other pearl farming countries suggest that more sustainable farming practices and lagoon management would have prevented the disease and subsequent decline in the quality and quantity of pearl production.

The Cook Islands Ministry of Marine Resources, with the assistance of other organisations, has implemented various projects in Manihiki that aim to achieve sustainable development of the black pearl industry and avoid future disease outbreaks. These projects involve diverse activities, including: monitoring the physical and chemical parameters in the lagoon; monitoring pearl oyster health and stocks; mapping the lagoon bathymetry and pearl farms; building local capacity in pearl farming and lagoon management skills, and drawing up a lagoon management plan and code of practice.

The Cook Islands government and supporting organisations have invested considerable resources in the projects in Manihiki. Will the projects reap economic benefits greater than their costs? Farmers can potentially use the project outputs to make their farming practices more sustainable, and thereby gain significant economic returns. The table next page gives some examples of ways in which pearl farmers may adjust their farming practices in response to information produced through four of the project areas.

Methods

The cost–benefit analysis assessed whether the projects implemented in Manihiki to achieve sustainable development of the black pearl industry are worthwhile investments for the Cook Islands. A model of pearl production was developed to estimate the economic benefits that the projects are likely to generate. The technique of cost–benefit analysis was used to compare the estimated benefits over a 15-year time period (2004–2019) with the total project costs. The net economic benefits of the projects were calculated in present value terms as an indication of whether they are good economic investments.
Table showing how pearl farmers may adapt their farming practices in response to the projects in Manihiki

<table>
<thead>
<tr>
<th>Project</th>
<th>Information produced</th>
<th>Use of information by pearl industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring buoy</td>
<td>Near real-time data on lagoon parameters e.g. dissolved oxygen, water temperature</td>
<td>If the monitoring buoy shows dangerous environmental conditions in the lagoon that stress the oysters, farmers may adjust farming practices. For example, if dissolved oxygen levels are unusually low, farmers delay cleaning and seeding, because this would further stress the oysters and could lead to high mortality rates.</td>
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<tr>
<td>Oyster health surveys</td>
<td>Statistics on the health of pearl oysters in lagoon</td>
<td>If the oyster health surveys show that oysters are diseased, farmers may adjust farming practices. For example, they may kill sick oysters to prevent the disease from spreading and reduce stock densities to prevent the disease recurring.</td>
</tr>
<tr>
<td>Mapping</td>
<td>Maps showing lagoon bathymetry and position of individual pearl farms</td>
<td>Farmers may use the maps to change the location and layout of farms to prevent overstocking of oysters, move to deeper areas of the lagoon, and avoid overlapping with neighbouring farms. For example, the maps are currently being used to plan where haruharu would be optimally located to collect juvenile oysters.</td>
</tr>
<tr>
<td>Oyster censuses</td>
<td>Estimates of oyster stocks and densities</td>
<td>If the farm censuses indicate high densities of pearl oysters in certain areas, farmers may change the location and layout of farms to avoid overstocking and disease outbreaks.</td>
</tr>
<tr>
<td>Technician training courses</td>
<td>Pearl oyster seeding skills</td>
<td>The course allows Cook Islanders to work as seeding technicians. The ecological and disease risks of high-volume seeding by foreign technicians who are only available to seed for a limited period in the year could be avoided if local technicians were available to seed all year round.</td>
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</table>

**Findings**

The model of pearl production developed in the study assumes that more sustainable oyster stocking densities and farming practices will improve oyster health, and increase the yield and quality of pearls harvested. In the first cost–benefit analysis scenario, it is assumed that the projects are supported by the implementation and enforcement of the draft pearl farming management plan, which regulates oyster stocking densities and farming practices. In this scenario, the net present value of the projects is approximately NZD 39.8 million. That is, the pearl revenue generated by the projects exceeds the total project costs by NZD 39.8 million in 2004 present value terms. The
projects also have additional indirect, secondary and non-monetary benefits.

Sensitivity analysis showed that the projects have a large multi-million dollar net present value under a range of different assumptions about future pearl prices, project costs, discount rates and employment levels.

The exception is the sensitivity analysis scenario in which the management plan is not implemented and enforced, so that incentives remain for resource users to stock the lagoon at unsustainable oyster densities and employ poor farming practices. In this scenario, pearl revenue declines and the projects fail to reap their large potential economic benefits. Under these assumptions, the projects have a negative net present value of approximately (NZD 2.4 million). That is, the project costs exceed the pearl revenue generated by the projects by NZD 2.4 million in 2004 present value terms. Many of the indirect, secondary and non-monetary benefits are also lost.

Recommendations

The following recommendations provide a road map for gaining the large positive net present value of NZD 39.8 million that the original cost–benefit analysis shows the projects could potentially be worth.

1) Projects must be supported by good management structures

The management plan is fundamentally important for the continuation of pearl farming in Manihiki. Without an enforced system of rules and regulations, incentives for individual farmers to overexploit the lagoon will lead to reduced profits for all, repeated disease outbreaks, and could eventually cause the demise of the Manihiki pearl industry. It is strongly recommended that the draft Manihiki pearl farming management plan be implemented as soon as possible, to guarantee that the projects effectively reap their substantial potential economic rewards for the Cook Islands. To be effective, the management plan must include the right to remove the permits of repeat offenders in order to create real incentives for farmers to eliminate unsustainable farming practices.

2) Data from monitoring buoy must arrive promptly and regularly

The information from the monitoring buoy must arrive promptly and regularly to be of direct use to farmers, and make a difference to production decisions. In early 2004 several farmers handled their oysters, either for cleaning or seeding, and subsequently experienced very high mortality levels among the oysters. A monthly report summarising the monitoring buoy data later indicated that dissolved oxygen levels were unusually low around the time that the oysters were handled. If farmers had received the monitoring buoy information earlier they might have delayed handling the oysters, and the mortalities and subsequent revenue losses could have been avoided.

3) Capacity building needed for interpretation of scientific data

An educational workshop that teaches farmers how to interpret the scientific information from projects such as the monitoring buoy and from maps, oyster censuses and health surveys would help them to apply the information to their farming practices. Such a workshop was suggested by several of the farmers interviewed for the study.

Conclusions

In conclusion, the information and skills generated by the projects in Manihiki have the potential to generate multi-million dollar net benefits in terms of pearl revenue for the Cook Islands, and numerous other indirect, secondary and non-monetary benefits. But these benefits will only materialise if...
there is an effective resource management regime to ensure sustainable farming practices, such as the Manihiki pearl farming management plan that is currently in draft form.

Others involved in aquaculture elsewhere in the Pacific region can learn lessons from the Manihiki example. Scientific research and capacity building projects that aim to achieve sustainable management of natural resources need to be supported by effective resource management regimes, to ensure that the information and skills generated by the projects are channelled into good management decisions. With the support of good management structures, the economic benefits of capacity building and scientific research projects will be vast; without that support, the benefits will be limited.

Acknowledgements

This study was funded by the Secretariat of the Pacific Community (SPC) and the South Pacific Applied Geoscience Commission (SOPAC). Meitaki maata to all the pearl farmers, pearl retailers and Island Council members who provided valuable information and assistance in the Cook Islands. In particular, thank you to Ian Bertram, Jo Anderson, Tangi Napara and Teina Tuatai at the Cook Islands Ministry of Marine Resources and Terai McFadzien at the Bank of the Cook Islands for their help and support. Thanks also to Berni Aquilina, Roger Fouquet, Paula Holland, Padma Lal, Elisabeth Paul, Bernard Poirine and Neil Sims who provided constructive advice and comments.