AN ECONOMIC ANALYSIS OF CORAL REEF BENEFITS FROM PHI PHI ISLANDS, THAILAND

Udomsak Seenprachawong
National Institute of Development Administration, Thailand

Abstract
The focus of this study is the valuation of coral reefs and how this information can be used to improve planning for coral reef management in Thailand. Phi Phi is rich in reefs and is envisioned as an ecological tourism destination by government planners. It can generate large economic values through recreation. The annual benefit from the recreational services of Phi Phi estimated by a travel cost method was estimated at 8,216.4 million baht (USD205.41 million) (40 baht=USD1). Therefore, the value of Phi Phi is about 249,720 baht (USD6,243) per ha per year (the reef area at Phi Phi is 32,900 ha). Assuming the real value of this recreational value of 8,216.4 million baht (USD205.41 million) a year remains the same over 30 years and using a real interest rate of 5%, the present value of recreation of Phi Phi is 126,280 million baht (USD3,157 million). A contingent valuation method (CVM) was used to estimate utility values associated with coral reef biodiversity at Phi Phi. The mean willingness to pay (WTP) per visit was estimated at 287 baht (USD7.17) for domestic visitors and at 286 baht (USD7.15) for international visitors. From this the total value of Phi Phi’s coral reefs was estimated to be 5.89 million baht (USD147 million) a year for domestic visitors and 49.6 million baht (USD1.24 million) a year for international visitors. This study also used the CVM to calculate the mean willingness to pay of domestic vicarious users – 634 baht (USD15.85) – and from this the total value (use and non-use) of the reefs was estimated to be 19,895 million baht (USD497.38 million) a year, averaging 604,720 baht (USD15,118) per ha per year. It is recommended that a benefit capture instrument be implemented that targets tourists’ consumer surpluses. Determining a user fee for Phi Phi is quite straightforward as the value that people obtain from visiting Phi Phi reef site is 286-287 baht (USD7.15-7.17) per visit. Based on these numbers, this study suggests a basic entrance fee of 40 baht (USD1) per person per visit but additional user charges should be implemented when visitors received additional services from the variety of recreational sites being offered at Phi Phi.

Introduction
Powerful economic forces are driving the observed destructive patterns of coral reef uses, often rendering short-term economic profits, sometimes very large to selected individuals. Measures for coral reef protection are often presumed to conflict with economic development, and are said to sacrifice economic growth. Some of the most important values of coral reefs, such value to future generations and intrinsic values, cannot be quantified. The omission of these benefits in conventional economic analysis means that coral reefs are undervalued. This can result in unsustainable use of coral reefs. This is of particular concern for coral reefs in areas such as the Southern Seaboard Development Project (SSDP) area. Promoting the development of a new economic area is one alternative to alleviate the urban concentration around Bangkok and to create a more equitable spatial balance in the country. However this option will result in the destruction of pristine coral reefs. Because local communities in the Andaman Sea are totally dependent on the coral reefs and the rapid rate of destruction is evident throughout Thailand, sustainable coral reef management options
urgently need to be identified for the area. This research intends to value the benefits of coral reefs on the west coast (in the Andaman Sea) of the project development area. It is hoped that the results of this research will prove useful to policy makers and other relevant parties in coastal area use planning for the provinces. The SSDP areas are endowed with a variety of existing and potential tourism resources, including the beaches coexisting with a good urban amenity in Phuket. One of the nature-based with high potential for eco-tourism development is Phi Phi Islands. Phi Phi has high values, coming from both the use (e.g. recreational and tourism, educational and scientific research) and non-use values (e.g. genetic resources and known and unknown future uses of ecological functions). In fact, Phi Phi is being used as an important reference site for conducting coral reef valuation. The results from Phi Phi may be transferred to other coral reef sites such as coral reefs in the Gulf of Thailand, specifically, in the coastal town of Ban Hin Krood in Prachuabkirikun province where there is a proposed project to build the thermal power plant.

**Methods**

The analysis of economic values of coral reefs can be done based on their many functions. Each of these functions has an economic value. Following the environmental economics literature (Dixon 1995) we can distinguish extractive direct use values, non-extractive direct use values, indirect use values, and non-use values. In this study, no attempt is made to calculate the total economic value of the coral reefs. Instead, values are calculated for some specific functions. The function that was analyzed in some detail is recreational and tourism values. There are two major issues regarding to recreation and tourism valuation (Cartier and Ruitenbeek 1999). Firstly, the recreation and tourism direct use value attributable to a coral reef is usually estimated by accounting for tourism revenue generated by a particular coral reef holiday destination. From a utility perspective, these values ignore the consumer surplus generated by the recreational experience and hence underestimate the values. Secondly, problems with using tourism revenue relate to the bundling of a vacation destination’s attributes. When a coral reef is just one attribute of the bundle, tourism revenue cannot solely attributable to the reef. Most studies focusing on coral reef recreation/tourism estimate consumer surplus using a travel cost method (TCM) or a contingent valuation method (CVM) (see for example, Driml 1999, and Hundloe et al. 1987). This study employed both the TCM and the CVM to generate estimates of reef values at Phi Phi. It first used the TCM to estimate the consumer surplus for domestic and international visitors to Phi Phi. However, the estimated value from the TCM may include all the attributes of Phi Phi, valued by those who have come to view coral as part of their vacation package. To isolate the consumer surplus associated with visits to the coral sites, the CVM study was conducted that focuses only on tourists visiting the reef sites.

**Travel cost method**

TCM is based on the idea that, although the actual value of the recreational experience does not have a price tag, the costs incurred by individuals in travelling to the site are an indication of their willingness to pay for the experience be used as surrogate prices. From this and other data, it is possible to estimate the area’s consumer surplus - a measure of its value to users as a recreational resource. The survey approach collected information about visitors’ trips, as well as their age, income, sex and other socio-economic factors. 850 questionnaires were distributed; 630 domestic visitors and 128 international visitors returned completed forms.
Contingent valuation method

CVM was used to see how much people would be willing to pay for the conservation of Phi Phi’s coral reefs. 400 domestic visitors and 128 international visitors were interviewed. The people questioned were given information about the current conservation situation in Phi Phi. They were told that the reef at Phi Phi Islands is about one quarter degraded and that if nothing is done, scientists estimate that it will become 40% degraded in about 20 years. Respondents were asked whether they would be willing to pay a pre-determined amount to a trust fund to totally restore the coral reefs at Phi Phi. This ranged from 50 to 2,000 baht a year for domestic tourists and from USD1 to USD50 a year for international visitors. The amount suggested was varied randomly among respondents to reduce the possibility of people’s answers being biased by the question itself.

Table 1 Coral reef benefits based on the travel cost method

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>3,403.55 baht (USD85)</td>
<td>20,540</td>
<td>69.9 million baht (USD1.75 million)</td>
</tr>
<tr>
<td>(n=630)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>59,760 baht (USD1,494)</td>
<td>136,277</td>
<td>8,146.4 million baht (USD203.66 million)</td>
</tr>
<tr>
<td>(n=128)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results

The survey found that the total benefits of the recreational services offered by Phi Phi were about 69.9 million baht (USD1.75 million) a year for domestic visitors and 8,146.4 million baht (USD203.66 million) a year for international visitors. Adding these two numbers up gives a figure of 8,216.4 million baht (USD205.41 million) a year for the total recreational benefit Phi Phi provides. Therefore, the value of Phi Phi is about 249,720 baht (USD6,243) per ha per year (the reef area at Phi Phi is about 32,900 ha). Loss of the site usually means loss of all future recreational opportunities, not just the current annual value. The entire future stream of annual recreational values must therefore be included. Economic theory suggests this stream of benefits, because they happen in the future, should be discounted to make them comparable with the present. Assuming that the annual value of recreation is constant over time, the present value of the stream of future benefits can be calculated simply by the following formula:

$$ PV = \sum_{t=1}^{T} \frac{TB}{(1+r)^t} $$

Assuming the real value of this recreational value of 8,216.4 million baht (USD205.41 million) a year remains the same over 30 years and using a real interest rate of 5%, the present value of recreation of Phi Phi is 126,280 million baht (USD3,157 million). It was found that the mean maximum willingness to pay for domestic visitors was 287 baht (USD7.17) per year. For international visitors the figure was 286 baht (USD7.15) per year. From this it was calculated that the total value of Phi Phi’s coral reefs were 5.89 million baht (USD .147 million) a year for domestic visitors and 49.6 million baht (USD1.24 million) a year for international visitors. This study also used the CVM to calculate the mean willingness to pay of domestic vicarious users – 634 baht (USD15.85) – and from this the total value (use
and non-use) of the reefs. This was estimated to be 19,895 million baht (USD497.38 million) a year, averaging 604,720 baht (USD15,118) per ha per year.

Table 2 Coral reef benefits based on the contingent valuation method

<table>
<thead>
<tr>
<th></th>
<th>Users</th>
<th>Non-users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic (n=400)</td>
<td>International (n=128)</td>
</tr>
<tr>
<td>WTP per visit</td>
<td>287 baht (USD7.17)</td>
<td>286 baht (USD7.15)</td>
</tr>
<tr>
<td>Numbers of visitors (1998)</td>
<td>20,540</td>
<td>136,277</td>
</tr>
<tr>
<td>Total benefits</td>
<td>5.89 million baht (USD .147 million)</td>
<td>49.6 million baht (USD1.24 million)</td>
</tr>
</tbody>
</table>

Discussion
The focus of this study is the valuation of coral reefs and how this information can be used to improve planning for coral reef management in Thailand. The site analyzed, Phi Phi, is rich in reef and is envisioned as an ecological tourism destination by government planners. Phi Phi is representative of many coastal areas in Thailand with potentially rich coral reefs in need of improved management so that economic and other benefits can be restored and enhanced. Phi Phi can generate large economic values through recreation. The consumer surplus associated with visits to Phi Phi represents an annual value of 8,216.4 million baht (USD205.41 million). It is apparent from this analysis that local and national government in Thailand can justify larger allocations for their annual budgets in managing coastal resource. One of the economic instrument options to capture net benefit values of Phi Phi is to directly target the consumers. Tourists could be charged through the activities that physically use the environment, such as water sports (specifically including snorkeling boats, and dive operations), swimming and beach activities. The results of contingent valuation study provide information regarding the extent of consumer surpluses. These values represent the extent of the marine derived production contributions at risk of being lost if conservation efforts prove inadequate. This study used CVM to estimate utility values associated with coral reef biodiversity at Phi Phi. At the sample means, willingness to pay was estimated at 286-287 baht (USD7.15-7.17) per visit. It is recommended that a benefit capture instrument be implemented that targets tourists’ consumer surpluses. Based on this number, this study suggests a basic entrance fee of 40 baht (USD1) per person per visit for Phi Phi. Having found that Phi Phi provides numerous recreational experiences to the visitors it is then possible that the park imposes additional user charges for some special and fragile recreational sites. A user charge should be collected when visitors make special visits to other exotic sites (e.g. Maya Bay). For instance, after having paid the basic entrance fee of 40 baht (USD1), the park can impose an extra fee of 150 baht (USD3.75) per person per visit if the visitor chose to visit the coral reef at Maya Bay. This user charge would help raise additional revenue for the park by transferring surpluses from high-end consumers leaving the low-income visitors unaffected. At the same time, charging additional fee at the reef site would help reduce the number of visitors and hence negative pressure on the fragile marine environment. This additional fee could be more expensive during
times when marine environment is more sensitive to disturbance, hence providing an incentive for tourists to visit at other times. Critical issues remain to be explored further before the recommended policy for benefit value capture can be realized. These include policy procedures and process for implementation, including information sharing and consultation, and the administrative organization for implementation and enforcement. This is the best conducted in a subsequent process through the responsible management authority, the Phi Phi Management Committee.

Acknowledgements The author wishes to acknowledge the research grant extended by Economy and Environment Program for Southeast Asia (EEPSEA) and valuable comments provided by H. Jack Ruitenbeek.

References

Contact Information:
Udomsak Seenprachawong
School of Development Economics
National Institute of Development Administration
Serithai Road, Bangkapi, Bangkok, Thailand 10240
Email: Udomsak.s@nida.nida.ac.th
Fax: 662-375-8842 Phone: 662-377-7400 Ext. 2320