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Environmental Economics of Coral Reef Destruction in Sri Lanka

Coral reefs are a resource of immense importance for a large number of people, especially the coastal populations of the developing world. Available information on coral reefs in Sri Lanka and Southeast Asia has been used to evaluate the ecological services provided by coral reefs and to assess the long-term economic benefits derived from some of the ecosystem functions. The minimum economic value of coral reefs in Sri Lanka is estimated at USD 140 000–7 500 000 km⁻² reef over a 20-yr period. The economic consequences of coral mining were investigated and economic costs (USD 110 000–7 360 000) were found to exceed net benefits (USD 750 000–1 670 000) by as much as USD 6 610 000 km⁻² reef when analyzed over 20 years in tourism areas. The highest costs were associated with decreased tourism (USD 2–3 million) and increased erosion (USD 1–4 million). However, in rural areas there is still a strong incentive for coral mining, because coral mining in the short-term perspective provides a more profitable business compared to fishing and agriculture. The results have implications for management and show that Sri Lankan legislation banning coral mining in the coastal zone is beneficial to the country's economic development.

INTRODUCTION

Tropical coastal zones contain a variety of ecosystems such as coral reefs, mangroves, and seagrass beds, which are all utilized as resources. The coral reef is the most diversified and complex marine ecosystem. It provides humans with many benefits including food from reef fish, recreation for tourists, coastal protection and lime for the building industry. Hence, many people depend on coral reefs for their livelihood in monetary terms as a source of income as well as for subsistence. With most coral reefs situated in the developing world their importance as a resource is tremendous. However, poor management has resulted in resource depletion and most of the world's coral reefs, especially those situated in the vicinity of human settlements, are under great pressure from human activities.

Being the source of important resources it is remarkable that there are so few studies on the ecological economics of coral reefs. In a recent economic analysis of Indonesia's coral reefs, Cesar et al. (1) concluded that the cost over 25 years of destructive coral reef uses, such as coral-mining, was between USD 176 000 and USD 903 000 km⁻² reef. Hodgson and Dixon (2) compared the benefits provided by logging and sustainable use of coral reefs in Bantay Bay, the Philippines, and found that

comprehensive picture necessary for a general applicable model. Such a case study is provided by Sri Lanka. It has an easily defined coastline of some 1550 km, which supports highly productive ecosystems including coral reefs (5–7). Almost half of the 17 mill. human population lives in coastal areas and a majority of the country's economic centers are situated near the coast (8). The large population in combination with modern methods of resource utilization have resulted in considerable pressure on coastal resources (8–11). Subsequently, coral reefs have been degraded and their areal extent is continuously decreasing due to various human disturbances including destructive fishing methods, coral mining, boating (anchor damage), ornamental-fish collection, pollution, etc. (8, 10, 11).

There is reason to believe that more information about the environmental economics of Sri Lanka's reefs, and other reef areas, could generate incentives for new management strategies. The apparent resource depletion, which is probably caused by financial goals that are guided by short-term benefits such as coral mining, may be shown to result in long-term costs. This paper aims to determine a minimum estimate of the economic value of coral reefs in Sri Lanka, and to evaluate the economic loss from coral-reef destruction. We do so by looking at the coral reef as a resource and investigating the various benefits it may offer in terms of reef fishery, tourist attraction, coastal protection and coral mining.

QUANTIFIABLE ECONOMIC VALUE OF CORAL REEF FUNCTIONS

The first step in an integrated ecological-economic analysis is to define the ecosystem functions in relation to the economy (12). Ecosystem goods and services are commonly used to define the benefits derived from ecosystem functions. In this paper, we estimate some of the goods and services provided by coral reefs in economic terms. Total quantifiable economic value (TQEV) is estimated by adding the value of different compatible functions of the coral reef ecosystem. However, not all ecosystem functions can be valued in monetary terms. Therefore, the economic benefits, which are accredited to the coral reef ecosystem in this study, are a minimum estimate of the true value.

An indirect economic benefit of the coral reef is that of the physical-structure function which protects against coastal erosion. Direct economic benefits are provided through resource use, for example the fish-habitat function (through fishing or ornamental fish collection) and the tourist attraction function (through tourism). Coral mining is an example of a resource use which will provide economic benefits through the production of

uses of coral reefs in Bacuit Bay, the Philippines and found that a logging-ban would result in 70% higher gross revenues from use of ecosystem functions than would continued logging. In addition, the carrying capacity of coral reefs, with regard to tourism use, was determined by Dixon et al. (3) for a coral reef marine sanctuary in the Caribbean. Costanza et al. (4) reviewed the available information on valuations of world ecosystem services and concluded that the quantifiable benefits of coral reefs add up to USD 607 500 km⁻² reef yr⁻¹.

Case studies may prove useful in developing techniques for studying the ecological economics of coral reefs; if many such studies are conducted the compiled information will provide the

will provide economic benefits through the production of time. Costs of coral mining will include labor costs (direct cost of resource use), reduction of indirect economic benefits, as a result of a reduction in the physical-structure function of the reef, and reduction of economic benefits derived from resource uses of the affected coral reef functions such as fisheries (derived from the fish-habitat function) and tourism (derived from the tourist attraction function).

Fish-Habitat Function

The economic benefits of the coral reef fish-habitat function are derived from fishing which is a resource use of considerable eco-

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Abstract:

Coral reefs are a resource of immense importance for a large number of people, especially the coastal populations of the developing world. Available information on coral reefs in Sri Lanka and Southeast Asia has been used to evaluate the ecological services provided by coral reefs and to assess the long-term economic benefits derived from some of the ecosystem functions. The minimum economic value of coral reefs in Sri Lanka is estimated at USD 140 000-7 500 000 km⁻² reef over a 20-yr period. The economic consequences of coral mining were investigated and economic costs (USD 110 000-7 360 000) were found to exceed net benefits (USD 750 000-1 670 000) by as much as USD 6 610 000 km⁻² reef when analyzed over 20 years in tourism areas. The highest costs were associated with decreased tourism (USD 2-3 million) and increased erosion (USD 1-4 million). However, in rural areas there is still a strong incentive for coral mining, because coral mining in the short-term perspective provides a more profitable business compared to fishing and agriculture. The results have implications for management and show that Sri Lankan legislation banning coral mining in the coastal zone is beneficial to the country's economic development.



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