

## APPENDIX 2. ECONOMIC VALUATION METHODOLOGY

**Table 4. Potential Sustainable Annual Economic Net Benefits per km<sup>2</sup> of Healthy Coral Reef in Southeast Asia**

Coastal protection and tourism data are based on annualized figures of medium and high values from Cesar (1996). Table 4 presents annual net benefits, while White, Vogt, and Arin (2000, p. 599) focused on annual revenues. Hence estimates have been adjusted to reflect costs. This recalculation for sustainable fisheries (local consumption) assumes an average market price of US \$1.5 per kg of reef fish and that fishing costs are 20 percent of revenue. Sustainable fisheries (live fish export) assumes a market price to fishers of US\$10 per kg of live reef fish and costs of 50 percent of revenues. Tourism and recreation revenue estimates assume a wide range of tourism types, from huts and cottages to five-star resorts, and uses cost and revenue data from Cesar (1996, p. 21). Aesthetic / biodiversity value (willingness to pay) assumes an average expenditure of US\$4 per day for entrance to a marine sanctuary for the support of conservation. Coastal protection estimates, given in Cesar (1996, p. 23), quantify loss of agricultural land in rural areas and loss of buildings, etc. in areas with considerable infrastructure and tourism presence.

**Table 5. Total Net Benefits and Losses on Southeast Asian Coral Reefs by Activity (Net Present Value in US\$ 000 per km<sup>2</sup> over a 20-Year Period)**

The Net Present Value (NPV) presented in Table 5 is calculated over a 20-year period rather than a 25-year period, as in Cesar et al. (1997) in order to be consistent with other tables in this report.

**Table 6. Potential Sustainable Annual Economic Net Benefits for Indonesia and the Philippines (US\$ million)**

Table 6 is based on value per unit area estimates (*See Table 4*) and reef area estimates from RRSEA.

a. Sustainable fisheries production was assumed to yield 15 mt per km<sup>2</sup> per year (McAllister 1988), annual net benefits of US\$24,000 per km<sup>2</sup>, and reef area estimates of 50,875 km<sup>2</sup> and 25,819 km<sup>2</sup> for Indonesia and the Philippines, respectively (*See Table 3*).

- b. Tourism and recreation were assumed to have annual net benefits of US\$330 for coral reefs with low tourism potential (beyond 10 km from current identified tourism development) and US\$56,000 for areas with good tourism potential (within 10 km of current tourism development). Only 3 percent of Indonesia's reefs and 7 percent of Philippine reefs were identified as having high tourism potential.
- c. Aesthetic / biodiversity value was evaluated only for reefs with high tourism potential and was assumed to have annual net benefits of US\$5,700 per km<sup>2</sup>.
- d. Coastal protection assumed annual net benefits of US\$110,000 for reefs near high development areas, US\$5,600 near medium development areas, and US\$90 for reefs in low development areas or more than 4 km from the coastline.
- e. Total net annual benefits is the sum of annual benefits from the goods and services associated with sustainable fisheries, tourism, coastal protection, and aesthetics/biodiversity. The Net Present Value (NPV) reflects these annual benefits over a 20-year period and uses a 10 percent discount rate.

**Table 7. Net Losses to Society over a 20-Year Period from Overfishing, Blast Fishing, and Upland Activities in Indonesia and the Philippines (Net Present Value in US\$ million)**

Estimates of Net Present Value (NPV) of losses to society are based on cross-tabulations of Reefs at Risk results (area estimates) by threat category and benefit or loss estimates presented in Table 5 and Cesar (1996, 2000).

- a. For blast fishing, losses of tourism, coastal protection, and sustainable fisheries were evaluated. The following per km<sup>2</sup> losses were combined with the reef area estimates for Indonesia and the Philippines.

### LOSSES PER KM<sup>2</sup> PER YEAR BY LEVEL OF BLAST FISHING (US\$)

LEVEL OF THREAT FROM BLAST FISHING	LOSSES IN SUSTAINABLE FISHERIES			LOSSES OF COASTAL PROTECTION			LOSSES IN TOURISM REVENUE	
	ESTIMATED LEVEL OF OVERFISHING			ESTIMATED LEVEL OF COASTAL DEVELOPMENT			ESTIMATED TOURISM POTENTIAL	
	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	HIGH
Low	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Medium	\$17,000	\$34,000	\$51,100	\$200	\$11,300	\$226,400	\$650	\$1,300
High	\$34,100	\$68,100	\$102,200	\$400	\$22,600	\$452,900	\$276,500	\$453,000

b. For overfishing, losses from sustainable fisheries are evaluated. Potential tourism losses are not calculated owing to lack of data. The analysis of losses to sustainable fisheries takes into account short-term benefits of overfishing and loss of sustainable fisheries. These per km<sup>2</sup> estimates are combined with reef area estimates for Indonesia and the Philippines.

### LOSSES PER KM<sup>2</sup> PER YEAR BY LEVEL OF OVERFISHING (US\$)

LEVEL OF THREAT FROM OVERFISHING	BENEFIT TO INDIVIDUAL	LOSSES IN SUSTAINABLE FISHERIES
Low	\$13,000	\$34,000
Medium	\$26,000	\$68,000
High	\$39,000	\$102,000

c. For sedimentation from upland activities, private benefits from logging and losses to society from sustainable fisheries and tourism are evaluated.

### LOSSES PER KM<sup>2</sup> PER YEAR BY LEVEL OF THREAT FROM UPLAND ACTIVITIES (US\$)

LEVEL OF THREAT FROM SEDIMENTATION FROM UPLANDS	PRIVATE BENEFITS FROM LOGGING	LOSSES IN SUSTAINABLE FISHERIES	LOSSES IN TOURISM REVENUE
Low	No logging	\$0	\$0
Medium	\$49,000	\$40,500	\$96,000
High	\$98,000	\$81,000	\$192,000

The reef area statistics by cross-tabulated threat categories are available from the Reefs at Risk web site at [www.wri.org/wri/reefsatrisk](http://www.wri.org/wri/reefsatrisk).

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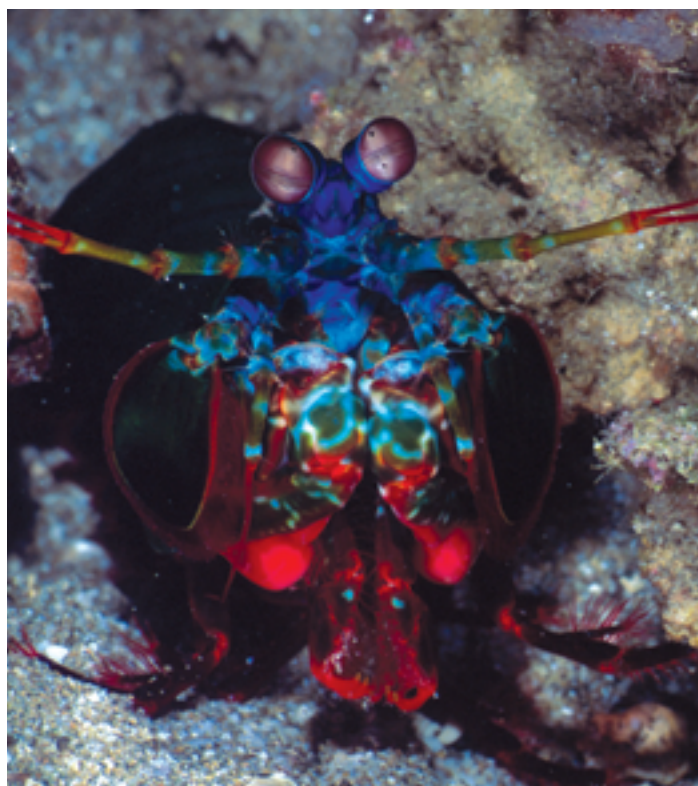


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