Procedure for Determination of National and Regional Economic Values for Ecotone Goods and Services and Total Economic Values of Coastal Habitats in the context of the UNEP/GEF Project Entitled:

"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"

WEIGHTED MEAN REGIONAL VALUE

$$R_V A_1^{Kg} = \frac{[(S_{Ca}*MV_{Ca})+(S_{Chi}*MV_{Chi})+(S_{In}*MV_{In})+(S_{Ma}*MV_{Ma})+(S_{Ph}*MV_{Ph})+(S_{Th}*MV_{Th})+(S_{Vi}*MV_{Vi})]}{(S_{Ca} + S_{Chi} + S_{In} + S_{Ma} + S_{Ph} + S_{Th} + S_{Vi})}$$

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Cover Illustration: Formula for determination of the weighted mean regional value (R_V) of 1 Kg of production of resource A_1 (A_1^{Kg}) based on weighted mean national values for Cambodia (Ca), China Chi), Indonesia (In), Malaysia (Ma), Philippines (Ph), Thailand (Th) and Viet Nam (Vi) and the stock (S) of each country.

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PROCEDURE FOR DETERMINATION OF NATIONAL AND REGIONAL ECONOMIC VALUES FOR ECOTONE GOODS AND SERVICES[1] AND TOTAL ECONOMIC VALUES OF COASTAL HABITATS IN THE CONTEXT OF THE UNEP/GEF PROJECT ENTITLED: *"REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND"*

INTRODUCTION

The project entitled "Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand" is funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) in partnership with seven states bordering the South China Sea[2]. A brief history of the development of the project and the Management Framework can be found in South China Sea Knowledge Document UNEP/GEF/SCS/Inf.1. Planning commenced in 1996 and the project became fully operational in February 2002.

The Project is complex as it addresses three priority areas of concern identified in the Transboundary Diagnostic Analysis (TDA)[3] (Talaue-McManus, 2000), namely: the loss and degradation of coastal habitats; over-exploitation of fisheries in the Gulf of Thailand; and, land-based pollution. Of these three substantive project components, the first, relating to habitat degradation and loss, is the largest and is sub-divided into four sub-components. The fourth component of the project is concerned with regional co-ordination, including organisation of regional exchanges of experience and information, facilitation of national level execution and securing multilateral agreement on project related matters.

The project was designed to be implemented over a period of five years and involved the initial signing of Memoranda of Understanding (MoUs) between UNEP, as the GEF Implementing Agency, and seven focal Ministries (the Ministries responsible for Environment in each country) and thirty-one Specialised Executing Agencies (SEAs) in the seven participating countries, each being responsible for one component or sub-component[4]. Subsequently, an additional 29 Memoranda of Understanding were signed to facilitate the development of the website, associated databases and models, and the work of the Regional Task Force on Economic Valuation (RTF-E) and Regional Task Force on Legal Matters (RTF-L).

THE PROBLEM

During the initial project development phase from 1996 to 1999, a framework Strategic Action Programme (SAP) was developed that not only formed the basis for the GEF approval of the project but was also somewhat innovative in including a cost benefit analysis of the benefits of action compared with non-action (UNEP, 1999). The challenge facing the SCS project in 1999 was that the only "ecosystem values" readily available were those of Costanza *et al*. (1997) that were based on global data and have subsequently been challenged on both economic and scientific grounds. The Project Steering Committee, composed solely of participating government representatives, in approving the draft SAP and the SCS GEF Project, insisted not only that the project activities include the revision of the SAP but also the determination of regionally applicable economic values for environmental goods and services.

THE APPROACH

Initially, the plan was for each national working group to review the economic data and information relating to their areas of expertise (mangroves, coral reefs, seagrass, wetlands, fisheries and land-based pollution) and to assemble data sets that would enable some form of regional analysis of values to be undertaken by the regional working groups.

It became apparent by the end of 2002, that the national working groups contained specialists in the subject matter with few or no economists amongst the members. The Project Steering Committee

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[1] *The term "services" is used in this document in an inclusive sense to encompass all non-direct use values; i.e. it includes indirect use value, option value, existence and bequest values.*

[2] *Cambodia, China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam.*

[3] *All project related documents cited in this paper can be found on the project website at www.unepscs.org.*

[4] *In the case of Cambodia the limited human capacity in the country resulted in the coral reef and seagrass sub-components being combined under responsibility of a single Specialised Executing Agency, the Department of Fisheries. The mangrove and wetlands sub-components were similarly combined resulting in the creation of only four rather than six national committees in Cambodia.*

therefore decided to establish a Regional Task Force on Economic Valuation (RTF-E) consisting of nine economists from the region charged with providing economic assistance and advice to the national and regional working groups addressing habitat, fisheries and pollution issues and determining "*regionally applicable economic values for environmental goods and services"*

During its first meeting in September 2003 (UNEP, 2003), the task force reviewed the data and information assembled by the regional working groups and provided advice regarding the further elaboration and refinement of these data sets. In addition, work commenced on the development of simple guidelines for the conduct of economic valuation studies that could be applied during the implementation of demonstration site activities, particularly in support of the activities concerned with sustainable financing of the management regime and the assessment of alternative livelihoods and sources of income.

STEPS IN THE PROCESS

Identifying the goods and services

Initially, each habitat regional working group was asked to prepare a listing of all the goods and services provided by each habitat of which they, as expert members, were aware. Such lists were prepared during 2003 and provided to the Regional Task Force on Economic Valuation who produced simple guidelines regarding what were the easiest methods to use for undertaking the economic valuation of each of the identified goods and services (Annex 4 of UNEP, 2004) and procedures for valuing the impacts of land-based pollution (UNEP, 205a) These lists subsequently provided the basis for the development of the guidelines for economic valuation studies to be undertaken at the project demonstration sites.

Empirical Data Set Relating to the Values of Goods and Services Derived from Coastal Habitats bordering the South China Sea

During the meeting in 2004 (UNEP, 2005c), the Project Steering Committee agreed to allocate funds to the Regional Task Force to assemble an empirical dataset of economic values of goods and services provided by the coastal ecotones bordering the South China Sea. During 2005, the task force assembled such data that were comprehensively reviewed during the two meetings of the Task Force convened in 2006 (UNEP, 2006a; 2006b).

Data were taken from published sources in the international literature and from the "grey" literature of government reports. The focus was on data derived from studies along the coasts of the South China Sea although, in some instances, data from elsewhere in the seven participating countries were included. Data represent "Farm Gate Prices" and this is assumed to be equivalent to the value of natural production, i.e., the value of the labour involved in harvesting is considered negligible in comparison with the "value" of the natural production. Data derived from secondary markets have not been included because the value added cannot be accurately determined in most cases.

As the data have been derived from diverse studies undertaken over the course of some twenty years, the methods used to undertake the valuations differ, as do the forms of the actual data and information contained in the publications and reports. Every attempt has been made therefore to ensure that the data contained in the final tabulations were based on primary data collection and did not represent merely the use of values derived elsewhere.

Standardisation of the Data

In order to ensure that values are comparable, all data have been expressed as production values in US dollars per hectare per annum, including the values for ecosystem services. Values have been converted to a standard year (2005) by means of the Consumer Price Index (UNEP, 2007a) and these values in local currency have been converted to US dollars using the 2005 exchange rate. Tables 1 to 8 of Annex 4 of the report of the seventh meeting of the RTF-E (UNEP, 2007b) present the empirical data and derived values for the goods and services provided by mangroves, coral reefs, seagrass and wetlands bordering the South China Sea. The largest volume of data relates to the mangrove habitat and these data are reproduced in Tables 1 and 2 of this document. Discussion of the contents of these tables provides an overview of all the issues faced in agreeing upon the final data sets for all habitats for use in determining regional values.

Table 1 Values of goods from mangrove ecosystems at various locations bordering the South China Sea. Shaded cells include values not used in the subsequent analysis to determine national and regional weighted mean values for each resource.

Country	Year	Location	Total Area (ha)	Volume (per ha)	Unit Net Price	Currency	Value (per ha)	CPI (base 2005)	Exchange rate 2005	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Stock Value by Locality (Area *x*Value/ha in US$)
Timber M^3/Ha												
Cambodia	2006	Peam Krasop	12,638.00	9.20	90.00	US$	828.00	106.16	4,187.17	779.95	779.95	9,857,068.58
China	2002	Fangchenggang	1,414.50	1.13	933.45	RMB	1,050.13	93.38	8.20	1,124.58	137.09	193,911.96
Indonesia	2004	Youtefa Bay	188.00	130.00	12,057.69	Rupiah	1,567,499.70	90.54	9,721.65	1,731,278.66	178.08	33,479.95
	2004	Bali	9.00	50.00	27,160.00	Rupiah	1,358,000.00	90.54	9,721.65	1,499,889.55	154.28	1,388.55
	2004	Karawang, West Java	1,692.40	40.00	52,500.00	Rupiah	2,100,000.00	90.54	9,721.65	2,319,416.83	238.58	403,777.17
	2004	Marisa District, Gorontalo	5,332.00	7.95	200,000.00	Rupiah	1,590,000.00	90.54	9,721.65	1,756,129.89	180.64	963,178.35
	2003	Kangean Island	5,716.00	30.76	72,480.00	Rupiah	2,229,484.80	85.22	9,721.65	2,616,152.08	269.11	1,538,208.28
	2003	Sikka district NTT	220.00	28.12	88,880.00	Rupiah	2,499,305.60	85.22	9,721.65	2,932,768.83	301.67	66,368.26
	2001	Kalimantan	14,941.00	91.92	27,440.00	Rupiah	2,522,284.80	71.46	9,721.65	3,529,645.68	363.07	5,424,637.40
	2001	Buton, Southeast Sulawesi	144.00	17.25	60,000.00	Rupiah	1,035,000.00	71.46	9,721.65	1,448,362.72	148.98	21,453.58
	2000	West Seram District : Area I	175.00	50.00	181,000.00	Rupiah	9,050,000.00	64.09	9,721.65	14,120,767.67	1,452.51	254,188.73
	2000	West Seram District : Area II	706.00	40.00	181,000.00	Rupiah	7,240,000.00	64.09	9,721.65	11,296,614.14	1,162.01	820,375.97
	2000	West Seram District : Area III	110.00	64.30	181,000.00	Rupiah	11,638,300.00	64.09	9,721.65	18,159,307.22	1,867.92	205,471.65
	2000	Batu Ampar, Pontianak	10,277.00	91.92	47,498.71	Rupiah	4,366,081.42	64.09	9,721.65	6,812,422.25	700.75	7,201,581.06
	1999	Segara Anakan	8,975.00	17.00	10,000.00	Rupiah	170,000.00	61.79	9,721.65	275,125.42	28.30	253,994.97
	1999	Segara Anakan	12,090.00	19.40	50,000.00	Rupiah	970,000.00	61.79	9,721.65	1,569,833.31	161.48	1,952,269.54
	1999	Gelumbang District, South Sulawesi	9,538.00	20.00	60,000.00	Rupiah	1,200,000.00	61.79	9,721.65	1,942,061.82	199.77	1,905,374.32
	1998	Tulung Selapan, South Sumatra	8,232.00	64.40	100,000.00	Rupiah	6,440,000.00	51.28	9,721.65	12,558,502.34	1,291.81	10,634,159.02
	1997	Batam Rempang and Galang Island	16,520.00	49.74	7,840.00	Rupiah	389,961.60	32.38	9,721.65	1,204,328.60	123.88	2,046,515.22
	1996	Subang District	5,327.00	38.00	160,000.00	Rupiah	6,080,000.00	30.48	9,721.65	19,947,506.56	2,051.86	10,930,279.09
	1991	Bintuni Bay Papua	300,000.00	80.00	128,000.00	Rupiah	10,240,000.00	20.16	9,721.65	50,793,650.79	5,224.80	1,567,438,901.94
	1988	Sumatra	386,100.00	66.00	7,520.00	Rupiah	496,320.00	16.06	9,721.65	3,090,410.96	317.89	122,737,133.01
Philippines	1996	Pagbilao, Philippines	1,440.00	4.00	1,664.00	PHP	6,656.00	59.56	55.14	11,175.29	202.67	291,846.46
Malaysia	1998	Kuala Selangor	379.00	61.80	4.12	RM	254.81	87.87	3.79	289.99	76.54	29,009.24
	1997	Coast of Malacca	78,395.00	N/A	N/A	RM	913.36	83.47	3.79	1,094.24	288.82	22,642,333.56
Viet Nam	2005	Balat estuary	3,000.00	8.05	200,000.00	VND	1,610,000.00	100.00	15,967.54	1,610,000.00	100.83	302,488.76
	2004	CanGio	75,740.00	12.25	400,000.00	VND	4,900,000.00	92.38	15,967.54	5,304,178.39	332.19	25,159,704.55
	2005	CaMau	5,800.00	17.00	370,000.00	VND	6,290,000.00	100.00	15,967.54	6,290,000.00	393.92	2,284,760.87
	2005	SocTrang	1,686.60	11.52	390,000.00	VND	4,492,800.00	100.00	15,967.54	4,492,800.00	281.37	474,560.18
Firewood M^3												
Cambodia	2006	Peam Krasop	12,638.00	1.84	10.00	US$	18.42	106.16	4,187.17	17.35	17.35	219,284.06
Indonesia	2005	Makassar	27.00	25.00	183,851.85	Rupiah	4,596,296.30	100.00	9,721.65	4,596,296.30	472.79	12,765.32
	2005	Mamuju	976.00	70.00	21,183.04	Rupiah	1,482,813.00	100.00	9,721.65	1,482,813.00	152.53	148,866.21
	2005	Donggala	18,300.00	70.00	18,195.43	Rupiah	1,273,679.92	100.00	9,721.65	1,273,679.92	131.01	2,397,570.19
	2004	Karawang, West Java	1,692.40	50.00	5,600.00	Rupiah	280,000.00	90.54	9,721.65	309,255.58	31.81	53,836.96
	2004	Bali	9.00	20.00	79,541.65	Rupiah	1,590,833.00	90.54	9,721.65	1,757,049.92	180.74	1,626.62

Table 1 *cont.* Values of goods from mangrove ecosystems at various locations bordering the South China Sea. Shaded cells include values not used in the subsequent analysis to determine national and regional weighted mean values for each resource.

Country	Year	Location	Total Area (ha)	Volume (per ha)	Unit Net Price	Currency	Value (per ha)	CPI (base 2005)	Exchange rate 2005	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Stock Value by Locality (Area *x*Value/ha in US$)
	2002	Tinanggea District, SE Sulawesi	6,596.00	25.92	9,000.00	Rupiah	233,280.00	79.95	9,721.65	291,782.36	30.01	197,970.11
	2002	Talise, Minahasa	62.00	68.16	7,500.00	Rupiah	511,200.00	79.95	9,721.65	639,399.62	65.77	4,077.78
	2000	Batu Ampar, Pontianak	7,460.00	40.00	4,300.00	Rupiah	172,000.00	64.09	9,721.65	268,372.60	27.61	205,938.21
	1999	Gelumbang District, South Sulawesi	9,538.00	50.00	10,000.00	Rupiah	500,000.00	61.79	9,721.65	809,192.43	83.24	793,905.96
	1999	Segara Anakan	7,904.00	42.40	1,013.97	Rupiah	42,992.44	61.79	9,721.65	69,578.31	7.16	56,569.30
	1998	Tulung Selapan, South Sumatera	8,232.00	40.00	1,250.00	Rupiah	50,000.00	51.28	9,721.65	97,503.90	10.03	82,563.35
Philippines	2004	Busuanga	1,298.50	4.12	800.00	PHP	3,296.00	87.67	55.14	3,759.55	68.18	88,534.28
	1996	Pagbilao, Philippines	1,440.00	4.00	810.00	PHP	3,240.00	59.56	55.14	5,439.89	98.66	142,064.68
Thailand	1995	Trang not included	35,665.28	15.62	1,616.25	Baht	25,245.83	72.65	40.31	34,749.93	862.15	30,748,845.10
	1993	Ranong	19,236.64	2.11	1,616.25	Baht	3,410.29	65.37	40.31	5,216.90	129.43	2,489,839.00
	1993	Krabi	28,273.48	1.49	1,616.25	Baht	2,408.20	65.37	40.31	3,683.95	91.40	2,584,178.78
Viet Nam	2005	Balat estuary	3,000.00	4.64	195,000.00	VND	904,500.00	100.00	15,967.54	904,500.00	56.65	169,938.56
	2004	CanGio	75,740.00	8.18	325,000.00	VND	2,658,500.00	92.38	15,967.54	2,877,787.40	180.23	13,650,423.38
	2005	CaMau	97,187.00	16.00	299,000.00	VND	4,784,000.00	100.00	15,967.54	4,784,000.00	299.61	29,117,994.61
	2005	SocTrang	1,686.60	7.97	184,615.38	VND	1,471,384.60	100.00	15,967.54	1,471,384.60	92.15	155,417.68
Poles value per pole												
Philippines	2004	Busuanga Philippines	1,298.50	0.60	200.00	PHP	120.00	92.91	55.14	129.16	2.34	3,041.54
Charcoal Kg												
Cambodia	2006	Peam Krasop	12,638.00	1,010.00	0.08	US$	75.75	106.16	4,187.17	71.35	71.39	902,226.82
Indonesia	2004	Bali	4.00	797.00	1,229.22	Rupiah	979,688.34	90.54	9,721.65	1,082,050.30	111.30	445.21
	2000	Batu Ampar, Pontianak	7,460.00	246.00	400.03	Rupiah	98,407.38	64.09	9,721.65	153,545.61	15.79	117,824.65
Philippines	2004	Busuanga Philippines	1,298.50	911.25	0.04	PHP	36.45	87.67	55.14	41.58	0.75	979.09
	1996	Pagbilao, Philippines	1,440.00	1,012.50	0.04	PHP	35.44	59.56	55.14	59.50	1.08	1,553.94
Thailand	1980	Chathaburi	24,064.00	12.16	1.67	Baht	20.31	37.38	40.31	54.33	1.35	32,434.54
	1980	Ranong	22,592.00	29.19	4.20	Baht	122.60	37.38	40.31	327.98	8.14	183,834.91
	1980	Krabi	31,760.00	18.72	1.20	Baht	22.46	37.38	40.31	60.10	1.49	47,354.09
	1980	Phang Nga	48,716.00	12.30	1.10	Baht	13.53	37.38	40.31	36.20	0.90	43,748.11
Leaves/palm fronds (Thatch, fodder) per frond												
Cambodia	2006	Peam Krasop	12,638.00	14.50	1.00	US$	14.50	106.16	4,187.17	13.66	0.00	41.23
Philippines	2004	Busuanga Philippines	1,298.50	6.37	5.00	PHP	31.85	87.67	55.14	36.33	0.66	855.53
	1996	Pagbilao, Philippines	1,440.00	22.50	4.50	PHP	101.25	59.56	55.14	170.00	3.08	4,439.52
Fruit - propagules Kg												
China	2002	Fangchenggang	1,414.50	321.69	2.40	CNY	772.00	93.38	8.20	826.73	100.78	142,553.64

Table 1 *cont.* Values of goods from mangrove ecosystems at various locations bordering the South China Sea. Shaded cells include values not used in the subsequent analysis to determine national and regional weighted mean values for each resource.

Country	Year	Location	Total Area (ha)	Volume (per ha)	Unit Net Price	Currency	Value (per ha)	CPI (base 2005)	Exchange rate 2005	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Stock Value by Locality (Area *x*Value/ha in US$)
Wildlife Values per hectare												
Indonesia	2004	Youtefa Bay	188.00	N/A	N/A	Rupiah	21,660.00	90.54	9,721.65	23,923.13	2.46	462.63
	2004	Karawang, W. Java, Perhutani's property	1,292.40	N/A	N/A	Rupiah	364,000.00	90.54	9,721.65	402,032.25	41.35	53,446.32
	2004	Karawang, W. Java, Private property	400.00	N/A	N/A	Rupiah	351,000.00	90.54	9,721.65	387,673.96	39.88	15,950.95
	2004	Marisa District, Gorontalo	5,332.00	N/A	N/A	Rupiah	604,538.73	90.54	9,721.65	667,703.48	68.68	366,212.97
	1999	Segara Anakan	12,090.00	N/A	N/A	Rupiah	24,311.00	61.79	9,721.65	39,344.55	4.05	48,929.51
Extraction for Medicine Values per hectare												
Indonesia	2004	Marisa District, Gorontalo	5,332.00	20.00	155,125.00	Rupiah	3,102,500.00	90.54	9,721.65	3,426,662.25	352.48	1,879,409.33
	2002	TNL Bunaken	2,689.00	10.00	92,611.70	Rupiah	92,611.70	79.95	9,721.65	115,837.02	11.92	32,040.41
Fish capture Kg												
China	2002	Fangchenggang - wild fish	1,414.50	500.00	2.85	CNY	1,427.00	93.38	8.20	1,528.16	186.29	263,502.65
Indonesia	2005	Mamuju	976.00	890.93	2,442.40	Rupiah	2,176,000.00	100.00	9,721.65	2,176,000.00	223.83	218,458.35
	2005	Donggala	18,300.00	1,246.95	1,346.49	Rupiah	1,679,000.00	100.00	9,721.65	1,679,000.00	172.71	3,160,543.15
	2004	Youtefa Bay	188.00	?	?	Rupiah	25,425,040.00	90.54	9,721.65	28,081,555.11	2,888.56	543,048.90
	2004	Karawang, W. Java, Perhutani's property	1,292.40	1,262.17	780.40	Rupiah	985,000.00	90.54	9,721.65	1,087,916.94	111.91	144,628.08
	2004	Karawang, W. Java, Private property	400.00	410.54	2,252.67	Rupiah	924,800.00	90.54	9,721.65	1,021,426.99	105.07	42,026.89
	2005	Pondok Bali, Subang	225.45	225.33	5,000.00	Rupiah	1,126,650.00	100.00	9,721.65	1,126,650.00	115.89	26,127.58
	2004	Bali	9.00	5,152.00	8,285.49	Rupiah	42,686,857.00	90.54	9,721.65	47,146,959.35	4,849.69	43,647.17
	2004	Marisa District, Gorontalo	5,332.00	819.15	18,428.87	Rupiah	15,096,008.86	90.54	9,721.65	16,673,303.36	1,715.07	9,144,747.75
	2001	Buton, Southeast Sulawesi	144.00	728.00	3,000.00	Rupiah	2,184,000.00	71.46	9,721.65	3,056,255.25	314.38	45,270.16
	2000	West Seram District	991.00	?	?	Rupiah	1,440,968.72	64.09	9,721.65	2,248,351.88	231.27	229,191.17
	2000	Batu Ampar, Pontianak	8,800.00	8.00	13,797.75	Rupiah	110,382.00	64.09	9,721.65	172,229.68	17.72	155,901.61
	1999	Segara Anakan - Cilacap	12,090.00	63.74	4,080.01	Rupiah	260,060.00	61.79	9,721.65	420,877.16	43.29	523,409.50
	1999	Gelumbang District, South Sulawesi	9,538.00	1,095.00	3,000.00	Rupiah	3,285,000.00	61.79	9,721.65	5,316,394.24	546.86	5,215,962.19
Philippines	2004	Philippines	1,298.50	4.12	41.25	PHP	169.95	92.91	55.14	182.92	3.32	4,307.59
	1996	Pagbilao, Philippines	1,440.00	409.80	24.28	PHP	9,949.94	59.56	55.14	16,705.75	302.97	436,276.44
Thailand	1995	Trang	35,665.28	18.98	30.00	Baht	569.42	72.65	3.79	783.79	206.88	7,378,430.34
Malaysia	1998	Kuala Selangor District all fisheries resources	379.00	3,750.00	3.33	RM	12,477.50	87.87	3.79	14,199.95	3,748.07	1,420,520.18
	1997	Straits of Malacca all fisheries resources	78,395.00	6.61	1,737.04	RM	11,486.88	83.47	3.79	13,761.69	3,632.39	284,761,505.39
Viet Nam	2005	Ba Lat estuary	2,889.00	200.00	16,000.00	VND	3,200,000.00	100.00	15,967.54	3,200,000.00	200.41	578,974.76
	2004	Can Gio	7,990.00	12,000.00	10,000.00	VND	120,000,000.00	92.38	15,967.54	129,898,246.37	8,135.15	64,999,824.11
	2005	Soc Trang	10,702.00	5,000.00	10,000.00	VND	50,000,000.00	100.00	15,967.54	50,000,000.00	3,131.35	33,511,746.72

Table 1 *cont.* Values of goods from mangrove ecosystems at various locations bordering the South China Sea. Shaded cells include values not used in the subsequent analysis to determine national and regional weighted mean values for each resource.

Country	Year	Location	Total Area (Ha)	Volume (per ha)	Unit Net Price	Currency	Value (per Ha)	CPI (base 2005)	Exchange rate 2005	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Stock Value by Locality (Area *x*Value/Ha in US)
Young Milkfish kgs												
Indonesia	2001	Buton, Southeast Sulawesi	144.00	21,600.00	30.00	Rupiah	648,000.00	71.46	9,721.65	906,801.01	93.28	13,431.81
	2000	West Seram District : Area III	706.00	?	?	Rupiah	234,560.91	64.09	9,721.65	365,986.75	37.65	26,578.47
Thailand	1997	Samut Sakorn fish larvae	1,696.00	N/A	N/A	Baht	751.78	81.21	40.31	925.72	22.97	38,952.59
	1997	Ranong fish larvae	19,237.00	N/A	N/A	Baht	414.23	81.21	40.31	510.07	12.65	243,443.74
	1997	Trang prawn larvae	24,696.00	N/A	N/A	Baht	89.03	81.21	40.31	109.63	2.72	67,171.14
	1997	Samut Sakorn crab larvae	1,696.00	N/A	N/A	Baht	1,673.04	81.21	40.31	2,060.14	51.11	86,686.58
	1997	Ranong crab larvae	19,237.00	N/A	N/A	Baht	984.82	81.21	40.31	1,212.68	30.09	578,780.53
	1997	Trang crab larvae	24,696.00	N/A	N/A	Baht	207.11	81.21	40.31	255.03	6.33	156,259.85
Crabs Kg												
China	2002	Fangchenggang	1,414.50	165.00	9.30	CNY	1,535.00	93.38	8.20	1,643.82	200.39	283,445.39
Indonesia	2005	Makassar	27.00	?	17,292.90	Rupiah	4,779,761.90	100.00	9,721.65	4,779,761.90	491.66	13,274.86
	2005	Mamuju	976.00	233.13	24,424.00	Rupiah	5,694,000.00	100.00	9,721.65	5,694,000.00	585.70	571,646.06
	2005	Donggala	18,300.00	242.24	23,424.90	Rupiah	5,674,513.90	100.00	9,721.65	5,674,513.90	583.70	10,681,683.15
	2004	Karawang, W. Java, Perhutani's property	1,292.40	21.57	22,256.70	Rupiah	480,000.00	90.54	9,721.65	530,152.42	54.53	70,478.66
	2004	Karawang, W. Java, Private property	400.00	20.49	22,256.70	Rupiah	456,000.00	90.54	9,721.65	503,644.80	51.81	20,722.60
	2004	Bali	9.00	1,248.00	19,006.41	Rupiah	23,719,999.68	90.54	9,721.65	26,198,365.01	2,694.85	24,253.62
	2004	Marisa District, Gorontalo	5,332.00	202.29	34,444.44	Rupiah	6,967,765.77	90.54	9,721.65	7,695,787.24	791.61	4,220,881.22
	2002	Tinanggea Distric, SE Sulawesi	6,596.00	784.75	21,500.00	Rupiah	16,872,125.00	79.95	9,721.65	21,103,345.84	2,170.76	14,318,314.61
	2001	Buton, Southeast Sulawesi	144.00	720.00	10,000.00	Rupiah	7,200,000.00	71.46	9,721.65	10,075,566.75	1,036.40	149,242.29
	2000	West Seram District : Area I	175.00	16.43	10,000.00	Rupiah	164,300.00	64.09	9,721.65	256,358.25	26.37	4,614.72
	2000	West Seram District : Area II	706.00	3.38	10,000.00	Rupiah	33,800.00	64.09	9,721.65	52,738.34	5.42	3,829.93
	2000	West Seram District : Area III	110.00	86.73	10,000.00	Rupiah	867,300.00	64.09	9,721.65	1,353,253.24	139.20	15,311.99
	2000	Batu Ampar, Pontianak	10,277.00	25.00	8,405.48	Rupiah	210,137.00	64.09	9,721.65	327,877.98	33.73	346,607.97
	1999	Segara Anakan	7,904.00	9.40	14,339.57	Rupiah	134,791.96	61.79	9,721.65	218,145.27	22.44	177,358.77
	1998	Tulung Selapan, South Sumatera	8,232.00	0.20	6,000.00	Rupiah	1,200.00	51.28	9,721.65	2,340.09	0.24	1,981.52
Philippines	2004	Philippines	1,298.50	5.24	126.00	PHP	660.24	95.66	55.14	690.19	12.52	16,253.49
	1996	Pagbilao, Philippines	1,440.00	694.60	7.60	PHP	5,278.96	59.56	55.14	8,863.26	160.74	231,467.22
Thailand	1995	Trang	35,665.28	7.71	85.00	Baht	655.35	72.65	40.31	902.06	22.38	798,201.51
Viet Nam	2005	Balat estuary	2,889.00	260.00	80,000.00	VND	20,800,000.00	100.00	15,967.54	20,800,000.00	1,302.64	3,763,335.96
Prawn Kg												
China	2002	Fangchenggang	1,414.50	34.50	30.00	CNY	1,035.00	93.38	8.20	1,108.37	135.11	191,117.90
Indonesia	2005	Makassar	27.00	162.00	17,292.90	Rupiah	2,801,375.00	100.00	9,721.65	2,801,375.00	288.16	7,780.28
	2005	Mamuju	976.00	132.84	24,424.00	Rupiah	3,244,444.44	100.00	9,721.65	3,244,444.44	333.73	325,724.25
	2005	Donggala	18,300.00	182.53	23,424.90	Rupiah	4,275,714.29	100.00	9,721.65	4,275,714.29	439.81	8,048,588.14
	2004	Karawang, W. Java, Perhutani's property	1,292.40	102.50	22,256.70	Rupiah	2,281,250.00	90.54	9,721.65	2,519,604.59	259.17	334,957.17

Table 1 *cont.* Values of goods from mangrove ecosystems at various locations bordering the South China Sea. Shaded cells include values not used in the subsequent analysis to determine national and regional weighted mean values for each resource.

Country	Year	Location	Total Area (Ha)	Volume (per ha)	Unit Net Price	Currency	Value (per Ha)	CPI (base 2005)	Exchange rate 2005	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Stock Value by Locality (Area *x*Value/Ha in US)
	2004	Karawang, W. Java, Private property	400.00	83.68	22,256.70	Rupiah	1,862,500.00	90.54	9,721.65	2,057,101.83	211.60	84,640.01
	2005	Pondok Bali, Subang	225.00	288.85	15,000.00	Rupiah	4,332,750.00	100.00	9,721.65	4,332,750.00	445.68	100,278.10
	2004	Bali	9.00	1,248.00	11,995.73	Rupiah	14,970,667.00	90.54	9,721.65	16,534,865.25	1,700.83	15,307.46
	2004	Marisa District, Gorontalo - Windu	5,332.00	44.12	85,000.00	Rupiah	3,750,200.00	90.54	9,721.65	4,142,036.67	426.06	2,271,768.21
	2004	Marisa District, Gorontalo - Putih	5,332.00	14.71	20,000.00	Rupiah	294,200.00	90.54	9,721.65	324,939.25	33.42	178,218.28
	2002	Tinanggea Distric, Southeast Sulawesi	6,596.00	9,187.00	12,500.00	Rupiah	114,837,500.00	71.46	9,721.65	160,701,791.21	16,530.30	109,033,838.65
	2001	Buton, SE Sulawesi - Udang Windu	144.00	640.00	35,000.00	Rupiah	22,400,000.00	71.46	9,721.65	31,346,207.67	3,224.37	464,309.36
	2001	Buton, SEt Sulawesi - Udang Putih	144.00	60.00	15,000.00	Rupiah	900,000.00	71.46	9,721.65	1,259,445.84	129.55	18,655.29
	2000	Batu Ampar, Pontianak	9,800.00	17.60	34,688.18	Rupiah	610,511.97	64.09	9,721.65	952,585.38	97.99	960,262.40
	1999	Segara Anakan	7,904.00	122.20	17,222.72	Rupiah	2,104,616.00	61.79	9,721.65	3,406,078.65	350.36	2,769,246.03
	1999	Segara Anakan	12,090.00	92.57	19,254.81	Rupiah	1,782,417.76	61.79	9,721.65	2,884,637.90	296.72	3,587,381.33
	1998	Tulung Selapan, South Sumatera	8,232.00	9.08	25,000.00	Rupiah	227,000.00	51.28	9,721.65	442,667.71	45.53	374,837.59
Philippines	2004	Busuanga, Philippines	1,298.50	1.88	300.00	PHP	564.00	92.91	55.14	607.04	11.01	14,295.26
	1996	Pagbilao, Philippines	1,440.00	1,226.90	200.00	PHP	245,380.00	59.56	55.14	411,987.91	7,471.67	10,759,207.47
Thailand	2003	Chanthaburi	192.00	43.17	130.00	Baht	5,611.45	93.08	40.31	6,028.63	149.57	28,717.67
Viet Nam	2005	Balat estuary	2,889.00	1,500.00	70,000.00	VND	105,000,000.00	100.00	15,967.54	105,000,000.00	6,575.84	18,997,609.43
	2004	Can Gio	7,990.00	4,000.00	65,000.00	VND	260,000,000.00	92.38	15,967.54	281,446,200.48	17,626.15	140,832,952.23
	2005	Ca Mau	247,510.00	4,000.00	60,000.00	VND	240,000,000.00	100.00	15,967.54	240,000,000.00	15,030.50	3,720,198,436.09
	2005	Soc Trang	43,311.00	3,200.00	70,000.00	VND	224,000,000.00	100.00	15,967.54	224,000,000.00	14,028.46	607,586,818.72
Eels kg												
Indonesia	2004	Karawang, W. Java, Perhutani's property	1,292.40	75.60	5,000.00	Rupiah	378,000.00	90.54	9,721.65	417,495.03	42.94	55,501.94
	2004	Karawang, W. Java, Private property	400.00	64.00	5,000.00	Rupiah	320,000.00	90.54	9,721.65	353,434.95	36.36	14,542.18
Shellfish kg												
Indonesia	2004	Bali	9.00	302.50	6,869.01	Rupiah	2,077,875.53	90.54	9,721.65	2,294,980.70	236.07	2,124.62
	2004	Marisa District, Gorontalo	5,332.00	32.50	5,000.00	Rupiah	162,500.00	90.54	9,721.65	179,478.68	18.46	98,438.04
Thailand	2003	Bang Khun Thien	192.00	352.69	41.11	Baht	14,499.09	93.08	40.31	15,577.02	386.47	74,201.87
Philippines	2004	Philippines (MUSSELS)	1,298.50	2.62	30.00	PHP	78.60	92.91	55.14	84.60	1.53	1,992.21
	2004	Philippines (Shellfish- "KIBAW"	1,298.50	6.75	20.00	PHP	135.00	92.91	55.14	145.30	2.64	3,421.74
China	2002	Fangchenggang	1,414.50	260.00	33.61	CNY	8,738.00	93.38	8.11	9,357.46	1,153.82	1,632,075.59
Viet Nam	2005	Ba Lat estuary	2,889.00	12,000.00	5,200.00	VND	62,400,000.00	100.00	15,967.54	62,400,000.00	3,907.93	11,290,007.89
	2004	Can Gio oysters	7,990.00	5,000.00	2,500.00	VND	12,500,000.00	92.38	15,967.54	13,531,067.33	847.41	6,770,815.01
Worms Kg												
China	2002	Fangchenggang	1,414.50	1,190.00	16.62	CNY	19,781.00	93.38	8.20	21,183.34	2,582.30	3,652,660.10
Philippines	2004	Philippines	1,298.50	1.13	20.00	PHP	22.60	92.91	55.14	24.32	0.44	572.82

Table 2 Values of services from mangrove ecosystems at various locations bordering the South China Sea. Values in the shaded cells were not used in the subsequent analysis to determine national and regional weighted mean values for each service.

Country	Year	Location	Total Area (Ha)	Currency	Value per Ha Local currency	CPI (base 2005)	2005 Exchange Rate	Valuation Method	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Value by Locality
Ecotourism											
Indonesia	2004	Youtefa Bay (**not included**)	4.00	Rupiah	203,400,011.25	90.54	9,721.65	Travel cost	224,652,099.90	23,108.43	92,433.72
	1999	Segara Anakan	12,089.99	Rupiah	18,508.40	61.79	9,721.65	Travel cost	29,953.71	3.08	37,250.88
	1999	Gelumbang District, South Sulawesi	9,538.00	Rupiah	790,889.08	61.79	9,721.65	Travel cost	1,279,962.91	131.66	1,255,783.12
Nursery ground											
China	2002	Fangchenggang, Guangxi	1,414.50	RMB	9,762.00	93.38	8.20	market price	10,454.06	1,274.37	1,802,601.88
Indonesia	2005	Makassar	27.00	Rupiah	120,707.76	100.00	9,721.65	CVM	120,707.76	12.42	335.24
	2005	Mamuju	975.50	Rupiah	3,922.57	100.00	9,721.65	CVM	3,922.57	0.40	393.60
	2005	Donggala	18,300.00	Rupiah	196.38	100.00	9,721.65	CVM	196.38	0.02	369.66
	2005	Pondok Bali	225.45	Rupiah	2,540.70	100.00	9,721.65	CVM	2,540.70	0.26	58.92
	2004	Bali	9.00	Rupiah	67,013.00	90.54	9,721.65	CVM	74,014.80	7.61	68.52
	2004	Karawang, W. Java Perhutani's property	1,292.40	Rupiah	7,269,454.28	90.54	9,721.65	Shadow Project	8,028,997.44	825.89	1,067,377.90
	2004	Karawang, W. Java Private property	400.00	Rupiah	7,269,454.28	90.67	9,721.65	Shadow Project	8,017,485.70	824.70	329,881.62
	2003	Kangean Island	1,887.00	Rupiah	7,112,000.00	85.22	9,721.65	Shadow Project	8,345,458.81	858.44	1,619,877.06
	2003	Sikka district NTT	74.00	Rupiah	7,112,000.00	85.22	9,721.65	Shadow Project	8,345,458.81	858.44	63,524.59
	2003	Belanakan, Subang	287.75	Rupiah	65,550.00	85.22	9,721.65	CVM	76,918.56	7.91	2,276.70
	2001	Buton, Southeast Sulawesi	144.00	Rupiah	9,739,596.57	71.46	9,721.65	Shadow Project	13,629,438.25	1,401.97	201,883.30
	2001	Kalimantan	14,941.00	Rupiah	720,000.00	71.46	9,721.65	CVM	1,007,556.68	103.64	1,548,492.43
	2000	West Seram District : Area I	175.00	Rupiah	2,719,214.00	64.09	9,721.65	Shadow Project	4,242,805.43	436.43	76,374.98
	2000	West Seram District : Area II	706.00	Rupiah	2,550,141.64	64.09	9,721.65	Shadow Project	3,979,000.84	409.29	288,960.63
	2000	West Seram District : Area III	110.00	Rupiah	2,550,909.09	64.09	9,721.65	Shadow Project	3,980,198.30	409.42	45,035.74
	2000	Batu Ampar, Pontianak	13,900.00	Rupiah	1,078,305.67	64.09	9,721.65	market price	1,682,486.61	173.07	2,405,616.29
	1999	Segara Anakan	12,089.99	Rupiah	74,769.00	61.79	9,721.65	market price	121,005.02	12.45	150,483.63
	1998	Tulung Selapan, South Sumatera	8,232.00	Rupiah	3,432,000.00	51.28	9,721.65	Shadow Project	6,692,667.71	688.43	5,667,148.10
	1996	Subang district	5,327.00	Rupiah	2,850,000.00	30.48	9,721.65	Shadow Project	9,350,393.70	961.81	5,123,568.32
Nutrient - Sediment Retention											
China	2002	Fangchenggang	1,414.50	RMB	86,902.00	93.38	8.20	market price	93,062.75	11,344.56	16,046,886.80
Coastal protection (replacement values divided by 25 years to provide annual benefit)											
China	2002	Fangchenggang	1,414.50	RMB	8,000.00	93.38	8.20	replacement Cost	8,567.14	1,044.35	1,477,239.81
Indonesia	2005	Makassar	27.00	Rupiah	83,532,059.26	100.00	9,721.65	replacement Cost	83,532,059.26	8,592.37	231,994.07
	2005	Mamuju	976.00	Rupiah	4,485,291.92	100.00	9,721.65	replacement cost	4,485,291.92	461.37	450,298.47
	2005	Donggala	18,300.00	Rupiah	110,919.62	100.00	9,721.65	replacement cost	110,919.62	11.41	208,794.67
	2004	Karawang, W. Java Perhutani's property	16,000.00	Rupiah	415,380.00	90.54	9,721.65	replacement cost	458,780.65	47.19	755,066.17
	2004	Karawang, W.t Java Private property	7,200.00	Rupiah	403,849.44	90.54	9,721.65	replacement cost	446,045.33	45.88	330,347.81

Table 2 *cont.* Values of services from mangrove ecosystems at various locations bordering the South China Sea. Values in the shaded cells were not used in the subsequent analysis to determine national and regional weighted mean values for each service.

Country	Year	Location	Total Area (Ha)	Currency	Value per Ha Local currency	CPI (base 2005)	2005 Exchange Rate	Valuation Method	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Value by Locality
	2004	Marisa District, Gorontalo	5,332.00	Rupiah	1,815,650.00	90.54	9,721.65	replacement cost	2,005,356.75	206.28	1,099,870.93
	2003	Kangean island	1,708.00	Rupiah	14,000,000.00	85.22	9,721.65	replacement cost	16,428,068.53	1,689.84	2,886,252.42
	2002	TNL Bunaken	160,700.00	Rupiah	3,432,000.00	79.95	9,721.65	replacement cost	4,292,682.93	441.56	70,958,532.54
	2001	Kalimantan	14,941.00	Rupiah	3,816,000.00	71.46	9,721.65	replacement cost	5,340,050.38	549.29	8,207,009.90
	2000	Ameth Village, Malluku	8,500.00	Rupiah	255,000.00	64.09	9,721.65	replacement cost	397,877.98	40.93	347,879.45
	2000	Batu Ampar, Pontianak	127,600.00	Rupiah	4,163,880.00	64.09	9,721.65	replacement cost	6,496,926.20	668.29	85,274,375.08
	1999	Segara Anakan	12,090.00	Rupiah	3,195,105.47	61.79	9,721.65	replacement cost	5,170,910.29	531.90	6,430,625.85
	1999	Gelumbang District, South Sulawesi	9,538.00	Rupiah	1,641,000.00	61.79	9,721.65	replacement cost	2,655,769.54	273.18	2,605,599.38
	1996	Subang district	5,327.00	Rupiah	3,500,000.00	30.48	9,721.65	replacement cost	11,482,939.63	1,181.17	6,292,101.45
	1988	Sumatra	386,100.00	Rupiah	1,815,000.00	51.28	9,721.65	replacement cost	3,539,391.58	364.07	140,568,610.57
Thailand	1998	Surathanee	400.00	Baht	77,775.00	87.77	40.31	replacement cost	88,612.28	2,198.48	879,393.26
Windbreak (40%of coastal defence costs)											
China	2002	Fangchenggang	1,414.50	RMB	9,194.73	93.38	8.20	market price	9,846.57	1,200.32	1,697,852.66
Carbon sequestration (carbon fixed per hectare per annum)											
China	2002	Fangchenggang	1,414.50	RMB	2,500.56	93.38	8.20	market price	2,677.83	326.43	461,740.85
Indonesia	2001	Kalimantan	14,941.00	Rupiah	222,008.00	71.46	9,721.65	market price	310,674.50	31.96	477,469.04
	1999	Segara Anakan	8,975.00	Rupiah	282,900.00	61.79	9,721.65	market price	457,841.07	47.09	422,677.52
	1996	Subang district	5,327.00	Rupiah	222,200.00	30.48	9,721.65	market price	729,002.62	74.99	399,458.55
	1991	Bintuni BaY	300,000.00	Rupiah	289,825.00	20.16	9,721.65	market price	1,437,624.01	147.88	44,363,572.24
	1989	Sumatra	386,100.00	Rupiah	159,400.00	17.09	9,721.65	market price	932,709.19	95.94	37,042,986.52
Thailand	1998	Surathanee	400.00	Baht	2,136.81	87.77	40.31	market price	2,434.56	60.40	24,160.67
Oxygen release											
China	2002	Fangchenggang	1,414.50	RMB	3,331.00	93.38	8.20	market price	3,567.14	434.84	615,085.73
Option value – biodiversity											
Indonesia	2005	Makassar	27.00	Rupiah	156,855.00	100.00	9,721.65	benefit transfer	156,855.00	16.13	435.63
	2005	Mamuju	976.00	Rupiah	500,558.80	100.00	9,721.65	benefit transfer	500,558.80	51.49	50,253.33
	2005	Donggala	18,300.00	Rupiah	154,365.00	100.00	9,721.65	benefit transfer	154,365.00	15.88	290,576.08
	2004	Youtefa Bay	188.00	Rupiah	142,500.00	90.54	9,721.65	benefit transfer	157,389.00	16.19	3,043.63
	2004	Karawang, W. Java Perhutani's property	1,292.40	Rupiah	135,262.50	90.54	9,721.65	benefit transfer	149,395.29	15.37	19,860.67
	2004	Karawang, W.t Java Private property	400.00	Rupiah	135,262.50	90.54	9,721.65	benefit transfer	149,395.29	15.37	6,146.91
	2004	Marisa District, Gorontalo	5,332.00	Rupiah	375,000.00	90.54	9,721.65	benefit transfer	414,181.58	42.60	227,164.71
	2003	Derawan Island	44.60	Rupiah	2,867,680.00	85.22	9,721.65	benefit transfer	3,365,031.68	346.14	15,437.75
	2003	Pulau Derawan	44.60	Rupiah	2,867,680.00	85.22	9,721.65	benefit transfer	3,365,031.68	346.14	15,437.75

Table 2 *cont.* Values of services from mangrove ecosystems at various locations bordering the South China Sea. Values in the shaded cells were not used in the subsequent analysis to determine national and regional weighted mean values for each service.

Country	Year	Location	Total Area (Ha)	Currency	Value per Ha Local currency	CPI (base 2005)	2005 Exchange Rate	Valuation Method	Standard National Value, 2005, per hectare in local Currency	Regionally comparable Value per hectare US$	Total Value by Locality
Indonesia	2002	TNL Bunaken	2,689.00	Rupiah	12,000,000.00	79.95	9,721.65	benefit transfer	15,009,380.86	1,543.91	4,151,581.02
	2002	Tinanggea, Southeast Sulawesi	6,596.00	Rupiah	147,606.69	79.95	9,721.65	benefit transfer	184,623.75	18.99	125,264.54
	2001	Kalimantan	14,941.00	Rupiah	123,760.00	71.46	9,721.65	benefit transfer	173,187.80	17.81	266,168.64
	2000	West Seram District	991.00	Rupiah	1,019,500.00	64.09	9,721.65	benefit transfer	1,590,731.78	163.63	162,155.08
	2000	Batu Ampar, Pontianak	13,900.00	Rupiah	123,750.00	64.09	9,721.65	benefit transfer	193,087.85	19.86	276,076.65
	1999	Gelumbang District, South Sulawesi	9,538.00	Rupiah	243,751.31	61.79	9,721.65	benefit transfer	394,483.43	40.58	387,031.24
	1999	Segara Anakan	12,090.00	Rupiah	146,700.00	61.79	9,721.65	benefit transfer	237,417.06	24.42	295,255.61
	1996	Subang district	5,327.00	Rupiah	115,200.00	30.48	9,721.65	benefit transfer	377,952.76	38.88	207,100.02
	1991	Bintuni BaY	44.60	Rupiah	37,500.00	20.16	9,721.65	benefit transfer	186,011.90	19.13	853.37
	1989	Sumatra	44.60	Rupiah	37,500.00	17.09	9,721.65	benefit transfer	219,426.57	22.57	1,006.66
Aesthetic (5% of land prices)											
China	2002	Fangchenggang	1,414.50	RMB	14,300.00	93.38	8.20	Hedonic Price	15,313.77	1,866.78	2,640,566.17

Surprisingly few data were available for either coral reefs or wetlands and this may be an artefact as scientific data and information tend to be highly compartmentalised in the participating countries and it is often not easy to access data from sources outside an individual's own institution or organisation. The lack of data for seagrass habitats is less surprising because the actual extent of this habitat in the region cannot be accurately determined at this time and the numbers of scientists currently involved in the study of seagrass ecosystems is quite limited resulting in a comparatively small body of published literature.

These data sets have been extensively discussed and reviewed by the regional task force and, where anomalies or questions remain unresolved or unanswered, the data have been excluded from further consideration. Such cells are shaded in these tables and it can be seen that a number of values for wild capture of fish, crab and prawns and for natural production of molluscs have been excluded from further analysis as the values were considered by the task force to be too high to represent natural production and more likely represent production from some form of mariculture.

In the case of services, data have been excluded from further consideration that were deemed by the task force to represent unrealistically high, or unrealistically low, values. The extremely high value for ecotourism for Youstefa Bay in Indonesia was excluded, for example, because this almost certainly represents the total annual value for all tourism at this location and not merely the value of tourism associated with the mangrove habitat in this Bay.

The valuation of the nursery function of mangroves is of some interest as apparently, in no case, has any attempt been made to value the natural production resulting from the use of mangroves by off-shore demersal fish and crustaceans as nursery areas. This is somewhat surprising in that McNae, for example, was able to demonstrate as early as 1974 a strong correlation between the off-shore catch of penaeid shrimp and the area of mangrove on the adjacent coastline (McNae, 1974) and such relationships could have been used to value this function. In contrast, valuations have been done either in terms of the market value of larval fish and crustaceans caught in the mangrove area for sale to mariculture farmers or through a shadow pricing method using the costs of producing such larvae through other means. Neither of these methods can be considered ideal, nor do they actually represent a "true" evaluation of the "nursery function"; nevertheless, they were used in the absence of other data.

Examination of any one portion of this dataset reveals wide variation in farm gate prices. Mangrove timber from Indonesia, for example, apparently varies from US$ 76 to in excess of US$ 5,000 per cubic metre. In this instance, a weak but significant negative correlation exists between the value per cubic metre and the stock or more precisely the area of mangrove. This issue of widely differing prices within each country is addressed through the calculation of weighted mean national values.

Determination of Weighted Mean National Values

As is well known, farm gate prices for environmental goods vary within countries reflecting both the local supply and the demand. Where blood cockle beds (*Anadara granosa*), for example, are located in close proximity to a centre of population, the unit farm gate price is higher than when an equivalent sized resource is located farther away.

In order to address this problem of the wide variation in prices within one country, the RTF-E decided to weight the data from each location and determine a **"Weighted Mean National Value"** that reflected ***both*** the prices for the same resource at each location and the "stock" of that resource at the same locations. Hence, the price at location A was multiplied by the stock (or area where the stock could not be estimated) in area A and this value was added to other values determined for locations B, C, etc. The summation was then divided by the total stock for which prices were available, thus providing the ***Weighted Mean National Value***. This results in a national value that reflects the totality of the national stock rather than being a simple arithmetic average of all values. Full details of this method are contained in the various reports of the regional task force.

Tables 3 to 6 present the weighted mean national and weighted mean regional values for mangroves, coral reefs, seagrass and wetlands respectively.

Table 3 Weighted mean national and regional values for the per hectare annual production of goods and services by mangroves bordering the South China Sea.

Mangrove Goods	Cambodia	China	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Regional
Timber	779.95	137.07	73.55	9.59	202.67	0.00	10.91	**73.45**
Firewood	17.35	0.00	65.06	0.00	84.21	106.80	242.63	**2.08**
Poles	0.00	0.00	0.00	0.00	2.34	0.00	0.00	**0.06**
Charcoal	71.39	0.00	15.85	0.00	0.92	2.42	0.00	**0.43**
Leaves/palm fronds (Thatch, fodder)	13.66	0.00	0.00	0.00	1.93	0.00	0.00	**0.27**
Fruit/propagules	0.00	100.78	0.00	0.00	0.00	0.00	0.00	**0.59**
Bark (tanning & dyes)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Medicine	0.00	0.00	238.31	0.00	0.00	0.00	0.00	**172.52**
Sap (sugar, alcohol, Acetic acid)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Wood tar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Fish capture	0.00	186.29	281.88	0.00	160.89	206.88	200.41	**230.64**
Fish fry	0.00	0.00	47.07	0.00	0.00	51.11	0.00	**37.43**
Eels	0.00	0.00	41.39	0.00	0.00	0.00	0.00	**30.21**
Crab capture	0.00	200.39	266.67	0.00	12.52	22.38	0.00	**199.46**
Prawn capture	0.00	135.11	272.33	0.00	11.01	149.57	0.00	**210.19**
Shellfish collection	0.00	1,153.82	18.83	0.00	2.08	386.47	0.00	**55.26**
All Fisheries resources	0.00	0.00	0.00	3,632.95	0.00	0.00	0.00	**513.54**
Insect and larvae collection	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Worms	0.00	2,582.30	0.00	0.00	0.44	0.00	0.00	**40.66**
Wildlife	0.00	0.00	25.13	0.00	0.00	0.00	0.00	**18.19**
Zooplankton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Jellyfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Honey & wax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Algae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Total value of goods US$ per Ha	**882.35**	**4,495.76**	**1,346.06**	**3,642.54**	**479.02**	**925.63**	**453.95**	**1,584.97**
Mangrove Services								
Ecotourism	0.00	0.00	59.79	0.00	0.00	0.00	0.00	**43.28**
Nursery Function	0.00	1,274.37	781.50	0.00	0.00	0.00	0.00	**573.23**
Sediment retention	0.00	11,344.56	0.00	0.00	0.00	0.00	0.00	**66.43**
Coastal Protection	0.00	1,044.35	421.56	0.00	0.00	2,198.48	0.00	**443.85**
Windbreak	0.00	1,200.32	0.00	0.00	0.00	0.00	0.00	**7.03**
Carbon Sequestration	0.00	326.43	115.62	0.00	0.00	60.40	0.00	**89.26**
Oxygen Production	0.00	434.84	0.00	0.00	0.00	0.00	0.00	**2.55**
Option Value	0.00	0.00	70.07	0.00	0.00	0.00	0.00	**50.73**
Aesthetic Value	0.00	1,866.78	0.00	0.00	0.00	0.00	0.00	**10.93**
Total value of services US$ per Ha	**0.00**	**17,491.67**	**1,448.53**	**0.00**	**0.00**	**2,258.88**	**0.00**	**1,287.28**
Grand Total Goods and Services	**882.35**	**21,987.43**	**2,794.59**	**3,642.54**	**479.02**	**3,184.51**	**453.95**	**2,872.25**
Total Area of Mangrove Ha	**72,350**	**23,446**	**934,000**	**532,100**	**28,014**	**62,618**	**156,608**	**1,809,136.00**
Value of Total Annual Production US$	**63,838,022**	**515,517,394**	**2,610,142,421**	**1,938,197,499**	**13,419,183**	**199,407,799**	**71,091,633**	**5,196,296,711**

Table 4 Weighted mean national and regional values for the per hectare annual production of goods and services by coral reefs bordering the South China Sea.

	Cambodia	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Regional
Coral Reef Goods							
Capture Fisheries (food and aquarium fish)	0.00	285.49	0.00	150.98	0.00	0.00	**108.31**
Shrimp	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Shellfish collection	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Molluscs	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Sea Cucumbers	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Echinoderms-Sea urchins	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Coral - Building materials m3	0.00	482.81	0.00	0.00	0.00	0.00	**25.28**
Coral (curio trade)	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Seaweed	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Total Value Goods US$ per Ha	**0.00**	**768.30**	**0.00**	**150.98**	**0.00**	**0.00**	**133.59**
Coral Reef Services							
Coral Reef Tourism	0.00	0.00	0.00	270.19	7,149.70	964.17	**1,024.62**
Research	0.00	0.00	0.00	0.00	0.00	0.00	
Beach Protection	0.00	7,330.56	0.00	0.00	0.00	0.00	**383.80**
Biodiversity Option Value	0.00	10.57	0.00	0.00	0.00	0.00	**0.55**
Total Value Services US$ per Ha	**0.00**	**7,341.13**	**0.00**	**270.19**	**7,149.70**	**964.17**	**1,408.97**
Total Value Goods and Services US$	**0.00**	**8,109.43**	**0.00**	**421.17**	**7,149.70**	**964.17**	**1,542.56**
Total coral reef area in the South China Sea (ha)	**2,807**	**39,287**	**44,276**	**464,000**	**90,000**	**110,000**	**750,307**
Value of Total Annual Production US$	**0**	**318,595,042**	**0**	**195,422,880**	**643,473,000**	**106,058,248**	**1,157,393,756**

Table 5 Weighted mean national and regional values for the per hectare annual production of goods and services of seagrass meadows bordering the South China Sea.

	Cambodia	China	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Regional
Seagrass Goods								
Capture Fisheries (food and aquarium fish)	452.15	176.33	0.00	0.00	34.84	0.00	0.00	**222.92**
Shrimp	96.14	158.82	0.00	0.00	0.00	0.00	0.00	**48.29**
Crabs	117.00	0.00	0.00	0.00	0.00	0.00	0.00	**53.63**
Crustaceans	0.00	0.00	0.00	0.00	0.00	0.00	117.54	**14.24**
Shellfish/Molluscs collection	12.04	0.00	0.00	0.00	0.00	0.00	399.30	**53.91**
Acorn worms	0.00	794.10	0.00	0.00	0.00	0.00	0.00	**21.10**
Seaweed-algae	508.67	584.69	0.00	0.00	0.00	0.00	36.40	**253.11**
Seagrass fertiliser	0.00	0.00	0.00	0.00	0.00	0.00	29.12	**3.53**
Handicrafts	0.00	559.84	0.00	0.00	0.00	0.00	0.00	**14.87**
Cosmetics	0.00	1,007.76	0.00	0.00	0.00	0.00	0.00	**26.78**
Total Value of Goods US$ per Ha	**1,186.00**	**3,281.53**	**0.00**	**0.00**	**34.84**	**0.00**	**582.36**	**712.38**
Seagrass Services								
Seagrass Tourism	0.00	0.00	0.00	0.00	0.00	0.00	1,264.13	**153.20**
Research	0.00	57.83	0.00	0.00	0.00	0.00	0.00	**1.54**
Beach Protection	0.00	1,190.80	0.00	0.00	0.00	0.00	0.00	**58.41**
Nursery Function	0.00	1,966.79	0.00	0.00	0.00	0.00	414.64	**102.51**
Biodiversity Option Value	0.00	439.02	0.00	0.00	0.00	0.00	0.00	**11.66**
Turtle Nesting beaches	0.00	0.00	0.00	0.00	0.00	4,097.93	0.00	**141.82**
Carbon sequestration	0.00	2.26	0.00	0.00	0.00	0.00	0.00	**0.06**
water quality-nutrient removal	0.00	38.54	0.00	0.00	0.00	0.00	0.00	**1.02**
Oxygen release	0.00	3.71	0.00	0.00	0.00	0.00	0.00	**0.10**
Total Value of Services US$ per Ha	**0.00**	**3,656.70**	**0.00**	**0.00**	**0.00**	**4,097.93**	**1,678.77**	**469.21**
Grand Total Goods and Services Value US$	**1,186.00**	**6,938.23**	**0.00**	**0.00**	**34.84**	**4,097.93**	**2,261.13**	**1,181.59**
Total known areas of seagrass	**33,814**	**1,960**	**3,035**	**222**	**23,245**	**2,553**	**8,940**	**73,769**
Value of total Annual production in US$	**40,103,435**	**13,598,940**	**0**	**0**	**809,766**	**10,462,004**	**20,214,500**	**87,164,402**

Table 6 Weighted mean national and regional values for the per hectare annual production of goods and services of wetlands[5] bordering the South China Sea.

	Cambodia	China	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Regional
Wetland Goods								
Timber	0.00	92.58	0.00	0.00	0.00	0.00	147.53	**14.23**
Firewood	0.00	0.00	0.00	0.00	0.00	0.00	135.04	**12.61**
Charcoal	0.00	0.00	0.00	0.00	0.00	0.00	5.87	**0.55**
Leaves/palm fronds (Thatch, fodder)	0.00	0.00	0.00	0.00	0.00	21.84	0.00	**1.43**
Medicine	0.00	0.00	0.00	0.00	0.00	0.00	**22.51**	**2.10**
Fish capture	0.00	109.66	0.00	0.00	0.00	438.67	966.93	**119.53**
Crab capture	0.00	192.55	0.00	0.00	0.00	0.00	0.00	**0.93**
Wildlife	0.00	0.00	0.00	0.00	0.00	4.38	0.00	**0.29**
Honey & wax	0.00	0.00	0.00	0.00	0.00	0.00	164.18	**15.34**
Total Goods US$ per Ha	**0.00**	**394.79**	**0.00**	**0.00**	**0.00**	**464.89**	**1,442.05**	**167.00**
Wetland Services								
Ecotourism	0.00	294.46	0.00	0.00	0.00	75.45	26.62	**8.84**
Research & Education	0.00	954.54	0.00	0.00	0.00	0.00	0.00	**4.61**
Migratory species	0.00	373.62	0.00	0.00	0.00	0.00	0.00	1.80
Sediment retention	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Nutrient retention	0.00	0.52	0.00	0.00	0.00	0.00	0.00	**0.00252**
Coastal Protection	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Windbreak	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Carbon Sequestration	0.00	140.61	0.00	0.00	0.00	0.00	0.00	**0.68**
Oxygen Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Option Value	0.00	0.00	0.00	0.00	0.00	0.13	0.00	**0.01**
Aesthetic Value	0.00	0.00	0.00	0.00	0.00	0.00	1,201.32	**112.21**
Total Services US$ per Ha	**0.00**	**1,763.75**	**0.00**	**0.00**	**0.00**	**75.58**	**1,227.94**	**128.15**
Grand Total Goods and Services Value US$	**0.00**	**2,158.54**	**0.00**	**0.00**	**0.00**	**540.47**	**2,670.00**	**295.15**
Total known areas of wetlands	**77,202**	**20,276**	**3,252,780**	**0**	**183,818**	**274,653**	**392,416**	**4,201,145**
Value of total annual production in US$	**0.00**	**43,766,563**	**0.00**	**0.00**	**0.00**	**148,440,949**	**1,047,749,247**	**1,239,956,427**

[5] *It should be remembered that, in the context of the UNEP/GEF project, the only habitats included in the coastal wetlands group are: coastal lagoons, estuaries, inter-tidal mudflats, and peat and non-peat swamp forest.*

Determination of Weighted Mean Regional Values

The determination of weighted mean regional values was undertaken in a similar manner to the computation of weighted mean national values but using data and information concerning the total stock (or area) in each country and the weighted mean national values. Thus, the weighted mean national value for each resource was multiplied by the stock for each country and the resultant values summed, then divided by the total stock (or area) of the habitat bordering the South China Sea.

The absence of values in a particular table may reflect one of two circumstances:

- First, and most commonly, no data for farm gate prices and hence no value could be found for that resource in the country concerned; and,
- Secondly, that a particular resource is not used in the country concerned.

An example of the latter is the case of sipunculid worms that are highly prized in China and also eaten to a lesser extent in the Philippines but which are not consumed in the other countries of the region. Consequently, there are no market values from Cambodia, Indonesia, Malaysia, Thailand and Viet Nam reflecting the fact that these worms are not eaten and do not enter the market in these countries. Sipunculid worms are, however, found in all mangrove areas in all countries. The contribution of the weighted mean regional value for sipunculid worms to the total economic value of mangrove production in the region is therefore much smaller than if a benefits transfer method of determining value were used to value the entire South China Sea stock of sipunculid worms.

In the case of mangrove “fruit” or propagules, the value from China represents the price of *Avicennia marina* propagules that are used in soup and other dishes in southern China and are apparently not eaten elsewhere in the region. Propagules of other species are processed as sweets and eaten in Thailand but no farm gate price is available from that country. What is interesting is the apparent absence of a market for mangrove propagules in countries where propagules are purchased from local villagers for use in re-forestation and re-planting schemes. During the sixth meeting of the regional Working Group on Mangroves (UNEP, 2006), there was a discussion regarding the value and sale of propagules during which it was noted that propagules from the Batu Ampur demonstration site were being sold for replanting elsewhere in West Kalimantan at a price for *Rhizophora* of 1$ for 200 propagules. In Thailand and Viet Nam the price was cited at around 1$ for 100 propagules, whilst in the Philippines the price was higher at 1$ for 50 propagules. Markets thus do exist for these products but values are apparently not formally recorded in the literature.

Determination of Total Economic Value (TEV)

The task force agreed that the Total Economic Value of the habitats bordering the South China Sea should be estimated as the summation of the values of all goods and services produced by each habitat on an annual basis. The summation of the regionally weighted values therefore represents the Total Economic Value of the annual production per hectare, whilst the Total Economic Value for the entire area of each habitat is derived from the product of this value multiplied by the total area of the habitat bordering the South China Sea.

In the case of mangroves, the annual values of production per hectare for both goods and services varies from 450 US dollars in Viet Nam and the Philippines to in excess of 21,000 US dollars in the case of China. The latter value reflects the high value for the service of sediment retention by mangroves determined by the difference in annual cost of dredging of the Fangchenggang Port before and after removal of mangroves. As the total area of mangrove in China is only 23 thousand hectares compared with nearly 2 million hectares along the Indonesian coast of the South China Sea, this very high value does not distort the regional value for this service which computes at a modest 66 US dollars per hectare annually.

The most comprehensive dataset is that for mangroves, whilst the least comprehensive are those for coral reefs and wetlands. Only three national datasets were found for coral reef goods and, in the case of wetlands, the bulk of the data are from Viet Nam. This results in a regional value of coral reef production of a modest 1,500 US dollars per hectare per annum and for wetlands of around 300 US dollars per hectare per annum. These should be compared with the regional value for mangrove of nearly three thousand dollars per hectare and the value of 1,118 US dollars per hectare for seagrass meadows.

Discussion

On first principles, one might expect the value of mangrove goods to exceed those for coral reefs and seagrass because the former will include values for mangrove timber and other direct derivatives that have few, if any, equivalents in coral reef and seagrass habitats. In contrast, one would expect that the service values for coral reefs would be greater than those for the other three habitats given the extensive coral reef tourism in the region.

Examination of the value of total annual production of goods and services by the four habitats from areas bordering the South China Sea demonstrates unequivocally the importance of mangroves in this region. The total annual value of mangrove production exceeds 5.1 billion[6] US dollars annually compared with around 1.2 billion for wetlands and coral reefs and a mere 86 million US dollars for seagrass habitats.

It is important to recognise that the values for goods and services, both individually and collectively, are extremely conservative as a consequence of the manner in which they have been calculated using weighted means. Where data are lacking for a good or service from one country, the consequence will be a lowering of the weighted mean regional value. Given the absence of values for many goods and services in each habitat, the values are likely to be as low as 50% or less of the real value. For comparison, the values derived by Costanza *et al*. are presented along side those from the present study in the following table.

Table 7 Comparison of the Total Economic Value of coastal habitats as determined by Costanza *et al.* 1997 and during the present study.

	Area ha	US$ per hectare per annum		Total Economic Values	
		Costanza *et al*	Present study	*Costanza et al*	Present study
Mangroves	1,799,136	9,990	2,872.25	17,973,368,640	5,167,568,376
Coral reefs	750,307	6,076	1,542.56	4,558,865,332	1,157,393,566
Seagrass	73,769	22,400	1,181.59	1,652,425,600	87,164,713
"Wetlands"	4,201,145	14,785	295.15	62,113,928,825	1,239,967,947

In all four cases, the values cited by Costanza *et al.* 1997 are greater than those determined in the present study and consequently would result in Total Economic Values ranging from 3 to 22 times greater than those determined in the present instance. It is important to recognise, however, that the two sets of values are not directly comparable since those of Costanza *et al*. relate to capital values whilst those of the present study reflect annual production values.

FINAL OUTCOMES:

The original outcome of the project was simply anticipated as being "*regionally applicable values for habitat goods and services*"

Additional Outcomes not envisaged during project design:

What has resulted from this work is a standardised method for computing national and regional weighted mean values of resources and services that can be applied more widely in handling and manipulating economic valuation data from multiple locations across any time span. The techniques can be applied in any region where multiple currencies, varying exchange rates and widespread inter-locational variation in farm gate prices are found.

The specific targets of the revised SAP have been valued or, more specifically, the incremental benefit derived from achieving the target has been valued. The values saved by achieving the targets have been compared with the costs of implementing the actions defined in the regional SAP through a cost benefit analysis (see Annex 6 of document UNEP/GEF/SCS/RTF-E.7/3).

John C. Pernetta
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[6] *The American billion is used in this document, i.e. 10^9*

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