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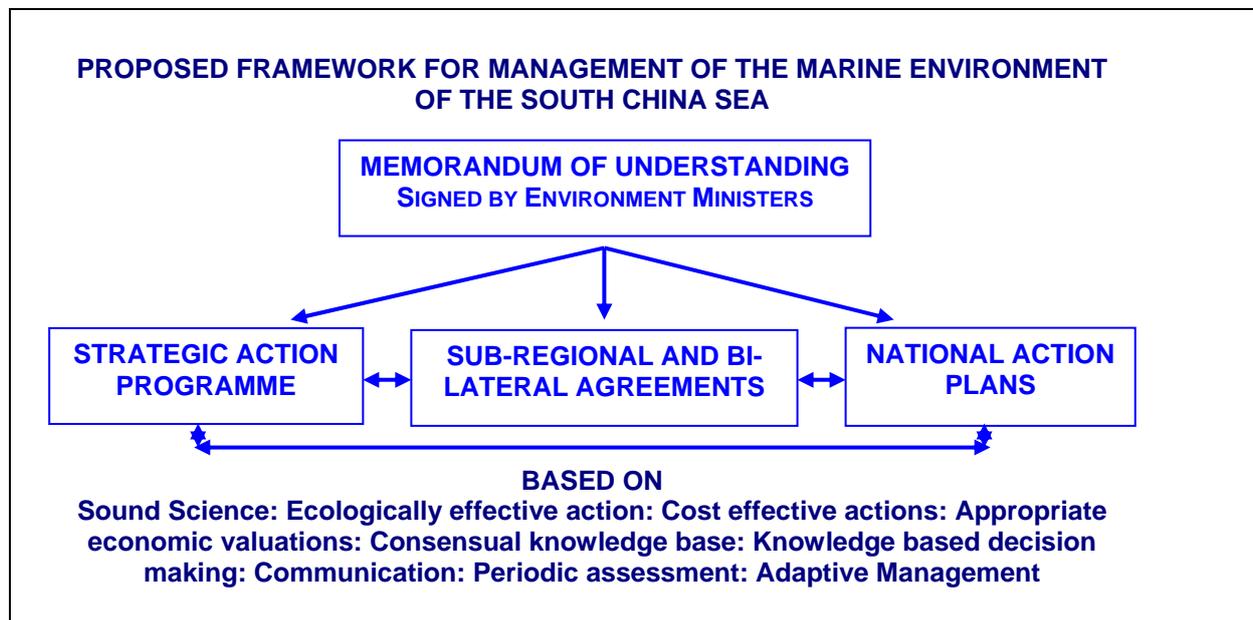


UNEP/GEF South China Sea
Project



Global Environment
Facility

STRATEGIC ACTION PROGRAMME FOR THE SOUTH CHINA SEA



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THE DEVELOPMENT OF THE STRATEGIC ACTION PROGRAMME¹ FOR THE SOUTH CHINA SEA²

One of the anticipated outputs from the UNEP/GEF Project entitled “*Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand*” is an up-dated Strategic Action Programme, and the present document contains the final text as approved by all countries³ during the 8th meeting of the Project Steering Committee in Hanoi, Viet Nam, – 26th August 2008. It is anticipated that the countries will commence implementation of the envisaged actions in 2008/2009.

The South China Sea is a semi-enclosed sea, which supports a number of unique habitats and ecosystems that are amongst the most biologically diverse shallow water marine ecosystems globally. The countries surrounding the South China Sea have undergone very rapid economic development and rapid population increase in coastal areas over the past two decades resulting in degradation and loss of coastal habitats and resources.

Recognising that actions were urgently needed to halt degradation of the environment of this marine basin, the countries of the region sought the assistance of UNEP and the Global Environment Facility (GEF) in preparing a Transboundary Diagnostic Analysis of the issues and problems and their societal root causes as the basis for development of a Strategic Action Programme. A proposal was endorsed by the twelfth intergovernmental meeting of the Coordinating Body for the Seas of East Asia (COBSEA) in December 1996 and the GEF financially supported this initiative.

During the Project Development Phase from 1996 to 2001 and in accordance with the GEF Operational Strategy activities were undertaken at the national and regional level to prepare national reports of water-related environmental issues and problems; a Transboundary Diagnostic Analysis (TDA) (UNEP SCS/TDA ver. 3); and a Strategic Action Programme (SAP). These documents were submitted to the Thirteenth Intergovernmental Meeting of COBSEA (UNEP/(WATER)/EAS IG9/3), which endorsed the draft SAP. This Strategic Action Programme was prepared in collaboration and cooperation with other regional institutions, organisations and bodies including: Food and Agricultural Organisation of the UN; South East Asia (START) Regional Centre; The South China Sea Informal Working Group at the University of British Columbia; the IOC Sub-Commission for the Western Pacific (WESTPAC); and the GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas.

The TDA identified the priorities among water-related problems and concerns, their socio-economic root causes, the sectorial implications of actions needed to mitigate them and the extent to which the problems were transboundary in either origin or effect. The draft Strategic Action Programme based on the findings of the regional Transboundary Diagnostic Analysis (TDA) was used as the basis for preparing the full GEF Project document, which entered the work programme of the GEF in December 2000. Due to the geopolitical sensitivity of the South China Sea marine basin the countries expressed the wish that no international or regional entities, other than UNEP be involved in the management of the project.

The actions proposed in the framework of the draft Strategic Action Programme were wide ranging in both context and proposed areas for action and the key elements of the project included actions that would lead to the further elaboration and development of the draft Strategic Action Programme. Experiences over the period 2002 to 2006 in managing appropriate activities at both the national and regional levels have been utilised in the drafting of the present revised SAP that has been developed through an iterative process with activities at the national level feeding into the regional review process which in turn provided advice and guidance to the national entities in finalising their draft inputs to the regional SAP.

¹ No activities shall be undertaken under this Strategic Action Programme in disputed areas of the South China Sea, nor shall issues of sovereignty be addressed directly or indirectly through project activities.

² The term "South China Sea" is used in its geographic sense and does not imply recognition of any territorial claims within the area.

³ Cambodia, People's Republic of China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam.

A key element in this process has been the development of detailed National Action Plans by each country that address the specific concerns and issues relevant to the components of the draft Strategic Action Programme. These National Action Plans are at various stages of government approval but it is anticipated that all will be approved for implementation by the end of 2007.

During the development of the NAPs the regional working groups have analysed their contents and developed the regional elements for inclusion in the SAP on the basis of the identified national actions and priorities. These have been aggregated into the present revised draft which therefore presents a shared vision regarding the actions that need to be undertaken at the regional level in support of national actions. Regional level actions include *inter alia* networking, capacity building, public awareness and education and applied research into management techniques and approaches that maximise the level of sustainable use without adverse environmental impact.

One significant and perhaps unique element of this Strategic Action Programme is the inclusion of detailed economic values for coastal habitat goods and services and their use in the determination of regionally applicable Total Economic Values. These have been subsequently applied in an analysis of the costs and benefits of the regional actions proposed in this Strategic Action Programme. In some instances the SAP is clearly cost effective since a modest investment of 3 million US dollars at a regional level is associated with a net benefit of 1.5 billion US dollars per annum if the mangrove targets are met over the next five years. It is anticipated that total investment at the national level to achieve this benefit will be of the order of 300 million US dollars.

The final section examines the need for regional co-operation and suggests that the SAP serve as the primary instrument for regional co-operation in the management of the marine and coastal environment, amongst the countries bordering the South China Sea and that this co-operation be formally established via a Memorandum of Understanding signed by the Ministers⁴ responsible for the Environment.

⁴ *In the event that the Memorandum is signed in a meeting and a Minister is unable to be present, his/her representative in the meeting may sign the Memorandum if authorised to do so by the Minister.*

STRATEGIC, PRIORITY ACTIONS FOR MANGROVES IN THE SOUTH CHINA SEA⁵

Around 30% of the world's remaining mangrove is found in the countries participating in this project and 8% of the World's total is found along the margins of the South China Sea marine basin. Rates of loss are generally higher along the South China Sea coastlines than elsewhere in the seven countries participating in the UNEP GEF project. For example around 80% of the mangrove bordering the Gulf of Thailand has been lost compared with only around 20% on the Andaman coast of Thailand. The annual rates of loss in the seven countries, between 1990 and 2000, were greater than the world average (Table 1). Such losses represent a loss of global biological diversity that must be a matter of global concern (UNEP, 2004). The total area of mangrove lost in the participating countries over different time spans (70 years for the Philippines) was estimated in 1998 at 4.2 million ha suggesting that over half of the original mangrove bordering the South China Sea had been lost during the last century.

Table 1 Estimates of Area (Ha) and Rates of Loss of Mangrove Habitat in Seven Countries Bordering the South China Sea, Compared with the World Totals. [Most recent data from FAO, 2003] (Based on UNEP, 2004. *Mangroves in the South China Sea*. UNEP/GEF/SCS Tech. Publ. No. 1.)

	Most recent estimate FAO	Date of FAO estimate	National Estimates of total mangrove area			Current South China Sea area	% Rates of loss per year	
			1980	1990	2000		1980 - 1990	1990-2000
Cambodia	72,835	1997	83,000	74,600	63,700	72,350	-1.01	-1.46
China	36,882	1994	65,900	44,800	23,700	23,446	-3.20	-4.71
Indonesia	3,493,110	1988	4,254,000	3,530,700	2,930,000	934,000	-1.70	-1.70
Malaysia	587,269	1995	669,000	620,500	572,100	532,100	-0.72	-0.78
Philippines	127,610	1990	206,500	123,400	109,700	28,014	-4.02	-1.11
Thailand	244,085	2000	285,500	262,000	244,000	62,618	-0.82	-0.69
Viet Nam	252,500	1983	227,000	165,000	156,608	156,608	-2.73	-0.51
Total	4,814,291		5,790,900	4,821,000	4,099,808	1,799,136	-1.67	-1.61
World	15,763,000	1992	19,809,000	16,361,000	14,653,000	15,763,000	-1.74	-1.04
% world total	30.54		29.23	29.47	27.62	11.41		

THREATS TO MANGROVES BORDERING THE SOUTH CHINA SEA

The causes of mangrove destruction identified in the TDA (UNEP, 1998) along the coastlines bordering the South China Sea, included conversion to pond aquaculture, particularly for shrimp, clear felling of timber for woodchip production, land clearance for urban and port development and human settlements; and harvest of timber products for domestic use (UNEP, 2004). Present causes of loss of mangrove habitat are no longer dominated by shrimp culture although this remains one cause of conversion in China, Indonesia and Viet Nam. Conversion of mangrove to land for industrial purposes (including harbour construction) has grown over the last ten years, and is now significant in China, but of low importance in Indonesia, the Philippines and Viet Nam, and not important in Thailand and Cambodia. Degradation of mangrove habitats as a consequence of chronic pollution from shrimp farming operations is now more prevalent in China, Indonesia and Thailand, whilst charcoal production continues to degrade mangrove in Cambodia, Indonesia and the Philippines despite legislation banning all harvesting of mangroves in Cambodia and the Philippines. At a regional level the following are seen as the current threats to mangrove systems bordering the South China Sea:

ANTHROPOGENIC THREATS

1. Reclamation and infrastructure development.
2. Pollution from Shrimp farming (China, Indonesia, Thailand).
3. Industrial conversion (China, small in Philippines, Indonesia and Viet Nam, negligible in Cambodia, and Thailand).
4. Charcoal production (Indonesia, Philippines and Cambodia).
5. Conversion-to shrimp culture potential long-term threat in Viet Nam.

NATURAL THREATS

1. Sea level rise.
2. Episodic events –tsunami, typhoon.

⁵ Initially Malaysia did not participate in this sub-component of the UNEP/GEF Project.

Transboundary influences are seen through the operation of the world markets and global trade for example, in shrimp. The high global level of demand for shrimp is itself driven by demand in Japan, North America and Europe which sets the world price such that, economic incentives for the conversion of “non-productive” mangrove habitats operate at both the individual and national levels in producing countries. Hard currency income and economic development fuel the motives at the national level whilst individual producers, at least in the short-term, derive considerable cash income from cutting mangrove and converting to shrimp ponds.

On a smaller scale, trade in charcoal derived from mangrove in Cambodia to Thailand was a major cause of mangrove loss in the areas of Cambodia close to the Thai border, in the recent past. This market appears to have declined somewhat over the last five years under the influence of more widespread use of cheap and convenient, liquid gas in Thailand.

When mangrove forests are destroyed and replaced by alternative forms of land use, not only are the species of plants and animals lost but also many services provided by mangrove systems are lost as well. This is well known in Viet Nam where the function of coastal vegetation, particularly mangroves is considered a vital service with measurable economic benefits as a protection against hurricane damage and marine based flooding. Mangrove degradation causes losses in direct and indirect economic values that support socio-economic development at both local and national scales.

CURRENT MANAGEMENT OF MANGROVES AND PROPOSED TARGETS⁶

Table 2 presents information relating to the management of mangrove areas in six of the seven countries bordering the South China Sea. Five categories of mangrove forest are recognised in the region: production forest, used on a sustainable basis for timber and wood chip production; conversion forest, a category in Indonesia representing areas of mangrove land designated for alternative land use under current plans; Parks and Protected Areas; and areas in which timber extraction is not permitted but extractive use of other resources is permitted. In the case of Thailand, another category is recognised namely “Private land, unregulated use”, which accounts for 10,000 hectares.

Table 2 Areas of Mangrove Currently under Different Forms of Land-use Designation and Management.

	Cambodia	China	Indonesia	Philippines	Thailand	Viet Nam	Total	%
Total area (ha)	72,350	23,446	934,000	28,014	62,616	156,608	1,277,034	100
Production forest	0	0	610,800	0	1,600	18,000	630,400	49.36
Conversion	0	0	165,000	0	0	0	165,000	12.92
Parks & Protected Areas (Conservation) non-extractive use	13,558	15,772	158,200	27,072	11,520	20,000	246,122	19.27
Non-use of mangrove but extractive resource use (fish, crabs etc.)	58,792	7,674	0	942	39,496	118,608	225,512	17.66
Private land, unregulated use	0	0	0	0	10,000	0	10,000	0.78
Area currently under management Regulated in laws/regulations	13,558	15,772	768,800	27,072	11,520	155,000	987,793	77.40
Areas estimated as currently under sustainable management ⁷	13,558 8,820	15,772 1,000 ⁸	158,200 100,000	26,010	11,520 1,600	20,000 18,000 46,608	432,078	32.60

This table illustrates the complexity of management regimes in six of the seven countries concerned but does not provide a mechanism for objectively determining the effectiveness of that management regime. For example in Cambodia 13,558 hectares of mangrove are contained within Parks and Protected areas for which there is no legal extractive use of either the mangrove trees or other resources, this area is also listed as being under a management regime regulated in law, and again within the areas listed as being sustainably managed at the present time. The assumption is that since

⁶ These targets were accepted by the sixth meeting of the Regional Scientific and Technical Committee.

⁷ Areas considered as being sustainably managed at the present time include all lands designated as production forest since it is a legal requirement that these be replanted; all mangrove lands contained within National Parks and Protected Areas; and a proportion of the mangrove area subject to extractive use of non-timber resources.

⁸ Area outside the protected area for which some form of management plans exist – estimated.

access to and use of this area is restricted the management is sustainable. In contrast, 58,792 hectares in Cambodia are currently not regulated under the law, and are subject to extractive resource use other than the mangroves themselves and of this area only 8,820 are considered as being exploited in a sustainable manner. The target for Cambodia is therefore to ensure that all 49,972 hectares of mangrove outside the legally protected Parks and protected areas are used in a sustainable manner by 2012. Targets for the six countries are presented in Table 3 below.

Table 3 Targets [Proposed areas in hectares to be subject to changes in designation and/or management regime] for Future Mangrove Management.

	Cambodia	China	Indonesia	Philippines	Thailand	Viet Nam	Total	% of total area of mangrove
Area to be transferred to National Parks and Protected Area status	0	5,330	20,000	631	1,400	30,000	57,361	4.49
Non-conversion of mangrove but sustainable use	0	0	165,000	0	1,600	0	166,600	13.05
Improved management relating to sustainable use	49,972	0	490,800	2,000	10,000	50,000	602,772	47.20
Replanting of deforested mangrove land	2,500	500	0	2,000	8,000	8,000	21,000	1.64
Enrichment planting to increase mangrove biodiversity	0	5,000	0	1,000	3,200	2,000	11,200	0.88

Recognising that the existence of a management regime and legal protection do not necessarily reflect the effectiveness of management the RWG-M developed a set of indicators of the sustainability of current management. Table 4 presents the indicators of sustainability discussed and agreed during the seventh meeting of the Regional Working Group. The indicators are grouped into three classes, which in the case of the management indicators are divided into three sub-groups. In the case of both "management capacity" and "management tools" if all the indicators are met there is a higher likelihood that management is more sustainable than if only a few, or none are present.

Table 4 Sustainable Management Indicator Matrix. [A baseline, mid-term and end of first phase of SAP implementation assessment of these indicators is required to indicate whether or not the targets have been met.]

Management Indicators	Ecological/Environmental Indicators	Socio-Economic Indicators
MANAGEMENT CAPACITY <ul style="list-style-type: none"> Formal Management framework Trained Man-power (No./levels) Facilities and equipment Sustainable Financing 	<ul style="list-style-type: none"> Forest Cover Tree density (trees over 1.5 metres high) Number of True Mangrove species <i>Scylla spp</i> (size and abundance) <i>Sesarma spp</i> (size and abundance) 	FISHERIES <ul style="list-style-type: none"> Catch per unit effort Total landing from mangrove area Income Nos. people directly involved
MANAGEMENT APPROACH <ul style="list-style-type: none"> Sectorial Integrated Community-based Multiple-use 		TOURISM <ul style="list-style-type: none"> Number of visitors Number of tourism operators Income Nos. people directly involved
MANAGEMENT TOOLS <ul style="list-style-type: none"> Licensing and permits Seasonal closure Zoning 		FORESTRY <ul style="list-style-type: none"> Volume of timber Weight of charcoal product Income Nos. people directly involved

CHALLENGES FOR MANGROVE MANAGEMENT

The National Action Plans provide information regarding the challenges for mangrove management at the national level which centre on:

1. Lack of sustainable financing, Cambodia, Philippines, and Indonesia less so in China, Thailand and Viet Nam;
2. Poverty of coastal communities in all countries⁹;
3. Weak or non-existent law enforcement, in all countries;
4. Ineffective management systems and land-use planning (Viet Nam and Indonesia);
5. Lack of experience and techniques for multi-species replanting (in all countries);
6. Lack of long-term regional and international co-ordination and co-operation;
7. Inadequacies and weaknesses in the management systems in Viet Nam and Indonesia;
8. Lack of understanding on the part of the general public and decision makers regarding the functions and values of mangrove ecosystems.

REGIONAL ACTIONS AND COST ESTIMATES

The proposed regional activities to promote sustainable management of Mangroves were elaborated during the seventh meeting of the Regional Working Group on Mangroves and are presented in Annex 4 of the report of that meeting. Table 5 of this document presents the actions and also includes preliminary cost estimates prepared by the regional working group during the seventh meeting. A total of 35 actions are proposed grouped into three components.

1. BUILDING CAPACITY TO ENSURE LONG-TERM SUSTAINABLE USE OF MANGROVE HABITATS AND RESOURCES

The objective of this component is to increase the knowledge of government officials, managers and stakeholders regarding the functions, value and approaches to sustainable management of mangrove ecosystems. The component is divided into two subcomponents the first of which outlines the required regional mechanisms for information exchange via the World Wide Web, study tours and visits, periodic meetings and targeted training activities. The second subcomponent focuses on the development and dissemination of the necessary materials for use at all levels in promoting knowledge and awareness of sustainable management practices.

2. ENHANCING MANGROVE MANAGEMENT SKILLS THROUGH DEVELOPMENT AND DISSEMINATION OF REGIONALLY APPLICABLE TOOLS

This component aims to provide a sound scientific and technical basis for sustainable management of mangrove ecosystems at the regional levels. The two sub-components focus on the development of guidelines and other tools as information resources, and facilitate their regional dissemination and adoption by mangrove managers and the second addresses applied research needs, knowledge management, and monitoring of mangroves for sustainable management.

3. INSTITUTIONAL ARRANGEMENTS AND REGIONAL CO-ORDINATION

The objective of this component is to assist countries in effectively and sustainably managing their mangrove resources through: the development of mechanisms including policy, where appropriate on ecological security; the integration of sound science into policy making and management decision making; and fostering cost effective strategic actions that enhance regional co-operation.

⁹ Originally listed as Coastal Poverty.

Table 5 Proposed Regional Actions for the Mangrove Component of the Regional Strategic Action Programme.

Component	Sub-Component	Activity	2008	2009	2010	2011	2012	Total
1. Building Capacity to ensure long-term sustainable use of mangrove habitats and resources	1.1 Mechanisms for information exchange	1.1.1 Maintain and expand the existing regional website as a mechanism for programmed exchange of information and experience between managers, government officials, teachers, research students, and community leaders	20,000	20,000	20,000	20,000	20,000	100,000
		1.1.2 Organise programme of study visits for government officials, community leaders, and mangrove managers to demonstration sites to study on-going practices in rehabilitation, management and conservation in the region.	40,000	40,000	40,000	40,000	40,000	200,000
		1.1.3 Organize regional forum every two years to share knowledge and experiences on how to improve government services in managing mangroves in Marine Parks and MPAs		30,000		30,000		60,000
		1.1.4 Meeting to secure Regional exchange of experience on how to enforce the laws in practice	18,000	18,000	18,000	18,000	18,000	90,000
		1.1.5 Regional training programme for country trainers on effective monitoring the state of mangrove ecosystems.	35,000					35,000
		1.1.6 Regional workshop every two years for exchange of experiences of developing livelihood and other income generation activities		30,000		30,000		60,000
		1.1.7 To Establish a network of environmental journalists and educators, and provide them materials of awareness on mangroves.						0
	1.2 Materials for use at all levels in promoting knowledge and awareness of sustainable management practices	1.2.1 Develop regional guidelines on establishment of community based micro-credit schemes	24,000					24,000
		1.2.2 To establish a regional bibliography			148,000			148,000
		1.2.3 Produce guide books for mangrove rehabilitation, management and conservation in the region	144,000					144,000
		1.2.4 To translate relevant national publications to English for regional use	140,000	140,000	140,000	140,000		560,000
		1.2.5 Development of curricular and materials for use in training programmes relating to sustainable use and management of mangroves, offered by educational institutions in the region.		97,000				97,000

Table 5 cont. Proposed Regional Actions for the Mangrove Sub-component of the Regional Strategic Action Programme.

Component	Sub-Component	Activity	2008	2009	2010	2011	2012	Total
2. Enhancing mangrove management skills through development and dissemination of regionally applicable tools	2.1 Develop guidelines and other tools as information resources, and facilitate their regional dissemination and adoption for mangrove managers	2.1.1 To develop regionally applicable standards and criteria for defining sustainability of mangrove management system.	41,000	30,000				71,000
		2.1.2 Document models for sustainable use of mangrove ecosystem	30,000	18,000				48,000
		2.1.3 Identify and encourage the use of environmental friendly technologies for timber harvesting, fishing and shrimp farming	30,000	36,000				66,000
		2.1.4 Promote multiple-use of mangrove resources and alternative livelihood	23,000	46,000				69,000
		2.1.5 Establish criteria and guidelines for zoning of mangrove ecosystem	29,000	27,000	15,000			71,000
		2.1.6 Develop and design standardized methodology and guideline for inventory and assessment, using skilled managers and community volunteers	27,000	18,000				45,000
	2.2 Applied research, knowledge management, and monitoring of mangroves for sustainable management	2.2.1 Establish a regional system to Periodically Monitor the state of Mangrove Ecosystem in the region	27,000	27,000	15,000			69,000
		2.2.2 Study the potential impacts of sea level rise, climate change, and episode events on mangrove ecosystems bordering the South China Sea	27,000	66,600	15,000			108,600
		2.2.3 Quantification of mangrove as a carbon sink	27,000	114,200	15,000			156,200
		2.2.4 Develop algorithms for interpretation of remotely sense images of mangrove associations and zonation.	27,000	36,800	15,000			78,800
		2.2.5 Build on the work of the RTF-E of economic value of mangrove goods and services in order to determine total economic value of mangrove ecosystems						
		2.2.6 To establish a mechanism for collection and exchange of regional mangrove data and information	29,000	15,000	15,000			59,000
		2.2.7 Establish a web-based regional mangrove information centre				27,000	15,000	42,000
		2.2.8 Test and elaborate the criteria and indicators of sustainable mangrove management				63,500	63,500	127,000
2.2.9 Develop and test guidelines to strengthen community participation in mangrove management				63,500	63,500		127,000	
2.2.10 Establish guidelines to promote participation of local communities in management of mangrove habitats		27,000	18,000				45,000	
2.2.11 Develop and test specific guidelines for the conduct of environmental impact assessment in mangrove areas			63,500	63,500		127,000		
3. Institutional Arrangement and Regional Co-ordination	3.1 Integration of Research Programme with Management and Policy Making	3.1.1 To maintain the network of communication between policy makers managers, and scientists as established under the UNEP/GEF/SCS Project, to ensure the inclusion of new research findings in management and policy making				72,500	72,500	145,000
		3.1.2 Establish an expert group to assist participating countries in meeting their obligations under international conventions relating to biological diversity and RAMSAR conventions				25,000	25,000	50,000
	3.2 International and Regional Co-operation	3.2.1 To maintain the network of mangrove specialists established under the UNEP/GEF/SCS Project, to advice the governments on sustainable management of mangroves				72,500	72,500	145,000
		3.2.2 Organise periodic regional conference to facilitate cross-sectorial discussion of issues and problems relating to mangrove management.			25,000	25,000	25,000	75,000
		3.2.3 Establishment of formal mechanism for cooperation in managing the mangroves of the South China Sea.			20,000	20,000		40,000
		3.2.4 Establish an appropriate mechanism to monitor and evaluate the implementation of SAP and achievement of the mangrove targets			27,000		18,000	45,000
GRAND TOTAL			765,000	827,600	655,000	710,500	369,500	3,327,600

STRATEGIC, PRIORITY ACTIONS FOR CORAL REEFS IN THE SOUTH CHINA SEA¹⁰

Southeast Asia is recognised as the global centre of coral reefs, both in terms of extent and species diversity. An estimated 1/3 of the earth's coral reefs (91,700 per 284,300sq. km) are located in the seas of Southeast Asia (Burke *et al.*, in UNEP, 2004). Fringing reefs are well developed away from the major river estuaries, particularly in the Philippines and the central - southern areas of the South China Sea. All major reef types fringing, patch or platform reefs, and atolls occur in the South China Sea, with a total estimated reef area of the order of 10,000km² (based on aggregation of national statistics - Spalding *et al.* 2001). Offshore, a series of large platform reefs and atolls are found; the most well-known being the Spratly Islands, the Tung-Sha Reefs and the Paracel Islands. These oceanic reefs are highly diverse and are thought to play a key role in the maintenance and replenishment of regional biodiversity, and may be particularly important in the replenishment of populations of some harvested species, such as the giant groupers.

If coral reefs are the most diverse tropical marine ecosystem on earth, then the Indo-Pacific in general and the South China Sea in particular are home to the most diverse coral reef ecosystems. The South China Sea is considered as the area with the highest diversity of hermatypic corals in the world (Veron, 1995). More than 70 hermatypic coral genera are recorded from the reefs of the South China Sea and hotspots of coral species diversity occur at Nha Trang (Viet Nam) with 351 species and El Nido (Palawan, Philippines) with 305 species. Records of more than 200 species occur in a number of sites in Viet Nam, Indonesia, and the Philippines (UNEP, 2004).

Coral reefs are an important marine ecosystem and habitat that provide nurseries and breeding grounds for coral reef associated species and some pelagic and migratory species. Like an oasis in the ocean, coral reefs serve as aggregation points for schools of migratory pelagic fish and as much as a quarter of the diet of pelagic and migratory species such as the yellow fin tuna (*Thunnus albacares*) is from reef-associated organism (Grandperin, 1978). The high species richness of corals and reef-associated fauna and flora in the South China Sea makes this area a valuable source of genetic and biochemical materials.

THREATS TO CORAL REEFS BORDERING THE SOUTH CHINA SEA

Not only are the coral reefs in South East Asia the most biologically diverse and productive reef ecosystems in the world but, they are also the most threatened and damaged reefs, with unprecedented rates of coral reef destruction from anthropogenic pressures that have accelerated over recent decades (Tun *et al.*, 2004). The Regional Working Group on Coral Reefs, identified regionally significant threats to coral reefs in the South China Sea, as being over-fishing, use of destructive fishing techniques, pollution (mainly eutrophication) and sedimentation (Table 6). Indirect causes of these threats are unsustainable practices in the fisheries sector, coastal development, deforestation and unsustainable tourism. Coral bleaching is considered as a serious threat to coral reefs in the region.

Table 6 Prioritisation of the Threats to Coral Reefs Bordering the South China Sea (excluding China).

	Cambodia		Indonesia		Malaysia		Philippines		Thailand		Viet Nam		Region
	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	
Direct threats													
Over-fishing	1	0.4	1	5.2	5	29.0	1	61.9	7	84.07	1	14.69	195.2
Destructive fishing	2	0.7	2	10.5	2	11.6	2	123.8	5	60.05	2	29.38	236.1
Sedimentation	5	1.9	4	21.0	1	5.8	3	185.7	4	48.04	3	44.04	306.4
Pollution (Eutrophication)	4	1.5	5	26.2	4	23.2	5	309.6	6	72.06	4	58.72	491.2
Coral bleaching	8	3.0	3	15.7	7	40.5	9	557.2	1	12.01	5	73.4	701.8
Indirect threats													
Unsustainable fisheries and aquaculture	3	1.1	8	41.9	9	52.1	4	247.6	8	96.08	8	117.4	556.3
Coastal development	6	2.2	7	36.7	6	34.7	6	371.5	3	36.03	6	88.08	569.2
Unsustainable tourism	9	3.3	9	47.2	3	17.4	8	495.3	2	24.02	9	132.1	719.3
Deforestation on upland areas	7	2.6	6	31.4	8	46.3	7	433.4	9	108.09	7	102.8	724.6
Total area of coral reefs	2,807		39,287		43,411		464,000		90,000		110,000		749,505
Proportion of total coral reef area	0.37		5.24		5.79		61.91		12.01		14.68		

¹⁰ China did not participate in the Coral Reef Sub-component consequently did not provide and did not review data and information of this section.

Table 6 presents the threats ranked for each country from 1 to 9, with 1 the most, and 9 the least serious. The ratio of the coral reef area in each country compared to the total area for the South China Sea (excluding China) was used to weight the individual country ranks resulting in a regional weighted score. The weighted scores suggest that on a regional scale the most serious threat is over-fishing; followed by destructive fishing; sedimentation; pollution; unsustainable fisheries practices; coastal development; coral bleaching; unsustainable tourism; and finally deforestation on upland areas.

THE MANAGEMENT STATUS OF CORAL REEFS BORDERING THE SOUTH CHINA SEA

Based on the provision of data by the Focal Points of the participating countries a total area of 749,505ha of coral reefs were identified in six countries as follows: Cambodia, 2,807ha; Indonesia, 39,287ha; Malaysia, 43,394ha; Philippines, 464,000ha; Thailand, 90,000ha; and Viet Nam, 110,000ha.

Table 7 provides details of the management status of coral reef target sites bordering the South China Sea, including *inter alia* their legal status and effectiveness of management. In the case of Cambodia, Indonesia, Malaysia and Thailand, the total coral reef area is estimated as being the same as these areas of targeted sites. The area of coral reefs in the 82 target coral reef sites is 217,390ha (29% of the total area in the South China Sea, excluding China), of which 99,673ha (13% of the total area) at 61 sites, is under management at the present time. In terms of management effectiveness only around 16% of this area at thirteen sites is considered as being under successful management. Thirty seven percent of sites are considered to be moderately well managed (medium effectiveness) while for 24% of the sites management effectiveness is considered low, and 23% have plans but no effective management.

Table 7 Management Status of Coral Reef Sites in the South China Sea.

Country & Site Name	Area (ha)	Live Coral Cover (%)	Management legal status	Area under Management (ha)	Management Effectiveness ¹¹
Cambodia	2,808			293	
Koh Kong	73	47	Fisheries Management Area (FMA)		
Koh Sdach	529	29	Proposed MPA		
Koh Rong	468	23	Proposed MPA		
Koh Takiev	293	58	National Park	293	Medium
Koh Tang	439	38	FMA		
Prek Ampil	953	53	FMA		
Koh Pouh	53	41	FMA		
Indonesia	39,286			12,511	
Anambas	6,255	52	Marine Management Area (MMA)	6,255	Low
Bangka	2,934	37	MMA	2,934	Medium
Belitung	2,271	52	MMA	2,271	Low
Karimata	1,041	53	Marine Reserve	1,041	Medium
Senayang Lingga	4,735	37			
Barelang dan Bintan	6,145	44			
Natuna	15,905	31			
Malaysia	43,394			28,209	
Pulau Redang	2,550		Marine Park	1,658	High
Pulau Lima	878		Marine Park	571	High
Pulau Ekor Tebu	812		Marine Park	528	High
Pulau Pinang	978		Marine Park	636	High
Pulau Perhentian Kecil	1,621		Marine Park	1,054	High
Pulau Perhentian Besar	1,824		Marine Park	1,186	High
Pulau Lang Tengah	1,230		Marine Park	800	Medium
Pulau Susu Dara	286		Marine Park	186	Medium
Palau Tenggol	480		Marine Park	312	Low
Palau Nyireh	288		Marine Park	187	Low
Pulau Kapas	427		Marine Park	277	Low
Pulau Tioman	5,023		Marine Park	3,265	High
Pulau Labas	896		Marine Park	582	Medium
Pulau Sepoi	891		Marine Park	579	Medium
Pulau Gut	904		Marine Park	588	Medium
Pulau Tokong Bahara	903		Marine Park	587	Low

¹¹ **Categories of Management Effectiveness: Low:** Area declared or proposed to be declared for management; Management Plan developed and approved. **Medium:** Existing Management Framework is implemented with inadequacy of manpower, finance and/or equipment. **High:** Existing Management Framework is implemented with enough trained manpower, equipment, facilities and sustainable finance.

Table 7 *cont.* Management Status of Coral Reef Sites in the South China Sea.

Country & Site Name	Area (ha)	Live Coral Cover (%)	Management type	Area under Management (ha)	Management Effectiveness
Malaysia continued					
Pulau Chebeh	898		Marine Park	584	High
Pulau Tulai	1,272		Marine Park	827	High
Pulau Sembilang	1,212		Marine Park	788	Low
Pulau Seri Buat	1,544		Marine Park	1,004	Low
Pulau Rawa	1,016		Marine Park	660	Medium
Pulau Hujung	1,047		Marine Park	681	Medium
Pulau Tengah	1,030		Marine Park	669	Medium
Pulau Besar	1,683		Marine Park	1,094	Medium
Pulau Tinggi	2,036		Marine Park	1,323	High
Pulau Aur	1,949		Marine Park	1,267	Low
Pulau Pemanggil	1,758		Marine Park	1,143	Low
Pulau Harimau	980		Marine Park	637	Medium
Pulau Gual	914		Marine Park	594	Medium
Pulau Mensirip	932		Marine Park	606	Medium
Pulau Sibul	852		Marine Park	554	High
Pulau Sibul Hujung	237		Marine Park	154	High
Pulau Mentinggi	880		Marine Park	572	High
Pulau Kuraman	1,339		Marine Park	870	Low
Pulau Rusukan Besar	894		Marine Park	581	Low
Pulau Rusukan Kecil	930		Marine Park	605	Low
Philippines	464,000			2,390	
Batanes	2,050	55	Protected Land/Seascape	40	Medium
Bolinao/Lingayen Gulf	9,560	40	Municipal Coastal Development Plans & National Park	750	Medium
Masinloc, Zambales	2,000	31	Protected Land/Seascape & Fish Sanctuary	120	Medium
Batangas Bay, Maricaban Strait	100	52	Marine Tourism Reserve	80	Medium
Puerto Galera, Mindoro	48	22	Man & Biosphere Reserve	20	Medium
Calamianes Group of Islands	18,200	29		300	Low
El Nido, Palawan	4,250	21	Marine Park	1,000	Medium
Port Barton	454	38.2		80	Low
Balabac	2500		Environmental Critical Protection Zone		
Thailand	90,000			54,000	
Mu Koh Chumporn	7,790	55	National Park	7,360	Medium
Mu Koh Chang	18,670	40	Marine National Park	11,780	Medium
Mu Koh Ang Thong	5,110	55	Marine National Park	5,110	Medium
Mu Koh Samui	38,990	40	Marine National Park	22,770	Low
Mu Koh Samet	4,200	35	Marine National Park	3,240	Medium
Sichang Group	760	20	None	0	
Sattaheep Group	1,670	33	Navy Control Area	1,320	Low
Lan and Phai Group	3,910	18	Navy Control Area	1,200	Low
Chao Lao	860	30	None	0	
Prachuab	2,450	40	Marine National Park	270	Low
Koh Tao Group	2,300	45	None	0	
Song Khla	1,200	20	None	0	
Koh Kra	670	40	None	0	
Losin	950	40	Navy Control Area	950	Low
Viet Nam	110,000			2,270	
Cu Lao Cham	200	34	MPA	100	Medium
Nha Trang bay	570	26	MPA	100	Medium
Con Dao	1,000	23	National Park	1,000	Medium
Phu Quoc	600	42	Proposed MPA	0	
Ninh Hai	1,070	37	Proposed MPA & Community - based Management	1,070	Medium
Ca Na bay	2,270	41	Proposed MPA	0	
Ha Long - Cat Ba	N/A	43	World Heritage & National Park	No Available	Medium
Hai Van - Son Tra	N/A	51	Proposed MPA	0	
Bach Long Vi	N/A	22	Proposed MPA	0	

TARGETS

Table 8 presents general status of coral reef management in the South China Sea geographic region of the six countries based on information assembled for 82 individual coral reef areas. The area to be added to the total area managed sustainably by the year 2015 is 54,130ha, thereby increasing the total area under sustainable management to 153,803ha which represents 20% of the total reef area of the South China Sea or 71% of the area of the target sites.

Table 8 Status of Coral Reef Management in the South China Sea Biographic Region of the Participating Countries.

	Cambodia	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Total
Total coral reef area in the South China Sea (ha)	2,808	39,286	43,394	464,000	90,000	110,000	749,488
Total coral reef area of the 82 target sites	2,808	39,286	43,394	36,662	89,530	5,710	217,390
Coral reef area under existing management at the 83 sites	293	12,511	28,209	2,390	54,000	2,270	99,673
Number of target sites with management information	7	7	36	9	14	9	82
No effective management, plans only	6	3	0	1	5	4	19
No. of sites with low management effectiveness	0	2	11	2	5	0	20
No. of sites with medium management effectiveness	1	2	12	6	4	5	30
No. of sites with high management effectiveness	0	0	13	0	0	0	13
Existing management types ¹² [1]	FMA, MPA, NP	MMA, MR	MP	PLS, MCDP, MTS, MBR, ECPZ	NP, MNP, NCA,	MPA, NP, CBM, WH	
Target area to be added for management by 2015 (ha)	1,965	5,580	15,185	10,100	18,000	3,300	53,130
Total area to be under management by 2015 (ha)	2,258	18,091	43,394	12,490	72,000	5,570	153,803

Coral reef monitoring has expanded over more than last ten years in most countries bordering the South China Sea and provided technical baselines for long-term coral reef management (Tun *et al.*, 2004). The data obtained in the framework of the Global Coral Reef Monitoring Network (GCRMN) indicated that the percentage of reefs in Southeast Asia countries had declined in state from one quartile category to a lower one, equivalent around 16%, during the period of 1994 – 2004.

It was noted that setting a target for the total area under management did not represent a target for the state of the reef although it could be assumed that those under management would, depending on the management regime, be more likely to sustain their biological diversity than those that were not under management. Therefore, the Regional Working Group on Coral Reefs considered an additional target related to the reduction of degradation rate. The focal points of participating countries agreed that improvement of coral reef management in next ten year could support to reduce decadal degradation rate of coral reefs in their countries, resulting in a regional estimation as around 5%. The regional assessment of coral reef status for the next period to 2014 following the GCRMN plan will enable to follow up this expectation and evaluate management effectiveness during implementing the revised SAP.

The specific targets for Coral Reef management are:

- **By 2015, at least 70% of the existing area of coral reefs in the 82 target coral reef sites (153,000ha) to be put under an appropriate form of sustainable management;**
- **By 2015, reduce the regional decadal rate of degradation in live coral cover from the present rate of 16% to 5%.**

¹² Cambodia - FMA: Fisheries Management Area, MPA: Marine Protected Area, NP: National Park; Indonesia - MMA: Marine Management Area, MR: Marine Reserve; Malaysia - MP: Marine Park; Philippines - PLS: Protected Land/Seascape, MCDP: Municipal Coastal Development Plan, MTS: Marine Tourism Reserve, MBR: Man & Biosphere Reserve, ECPZ: Environmental Critical Protection Zone; Thailand - NP: National Park, MNP: Marine National Park, NCA: Navy Control Area; Viet Nam - MPA: Marine Protected Area, NP: National Park, CBM: Community-based Management, WH: World Heritage).

Many of the coral reefs in the region are under existing management with low effectiveness and criteria for effective management have not been identified or applied. The working group developed a sustainable management indicator matrix on the assumption that sustainable management of coral reefs means management of the ecosystem in such a way that the resource(s) can be used continuously in a cost effective and ecologically friendly manner.

Such a management regime would normally have a formal management framework, clearly understood at every level by all stakeholders. One approach to assessing management sustainability is to use indicator(s) and three categories are proposed; namely: management, ecological-environmental, and socio-economic indicator(s) (Table 9).

The purpose of the defining these indicators is to provide a means of assessing whether an area is or, is not, under sustainable management in the context of the targets of the SAP, which states that by the year 2015, 70% of the coral reef area in 82 target sites of the South China Sea shall be under sustainable management. Depending on the objective(s), management input(s) (column 1) are expected to produce measurable output(s) which should be reflected through ecological indicator(s) (column 2) and/or socio-economic indicator(s) (column 3).

Table 9 Sustainable Management Indicator Matrix. [A baseline, mid-term and end of first phase of SAP implementation assessment of these indicators is required to indicate whether or not the targets have been met.]

Management Indicators	Ecological/Environmental Indicators	Socio-Economic Indicators
MANAGEMENT CAPACITY <ul style="list-style-type: none"> • Formal Management framework • Trained Man-power (numbers/levels) • Facilities and equipment • Sustainable Financing 	<ul style="list-style-type: none"> • Live Coral Cover • Butterflyfish (density) • Grouper (number of fish larger than 30cm) • Sea Urchin <i>Diadema</i> • Giant clam <i>Tridacna squamosa</i> 	FISHERIES <ul style="list-style-type: none"> • Catch per unit effort • Total landing • Income • Number of people involved
MANAGEMENT APPROACH <ul style="list-style-type: none"> • Sectorial • Integrated • Community-based • Multiple-use 		TOURISM <ul style="list-style-type: none"> • Number of visitors • Number of tourism operators • Income • Number of people involved
MANAGEMENT TOOLS <ul style="list-style-type: none"> • Licensing and permits • Seasonal closure • Zoning 		

REGIONAL ACTIONS AND COST ESTIMATES¹³

During the sixth meeting of the Regional Working Group on Coral Reefs (RWG-CR), a comparative analysis of the content of the National Action Plans was undertaken to identify common threats to the habitats and actions needed at the regional level. The seventh meeting of the RWG-CR reviewed and expanded the text, which is presented in Annex 6 of the meeting report (UNEP/GEF/SCS/RWG-CR.7/3). The RSTC reviewed the proposed regional actions and suggested a re-arrangement of the order of components and actions, to ensure that the regional actions address the identified threats to coral reefs and improve the effectiveness of management. The eight meeting of the RWG-CR in Phu Quoc, Viet Nam, 4th – 7th June 2007 considered and revised the proposed regional actions and estimated costs required for these actions as presented in Table 10.

A total of 37 regional actions are proposed under the coral reef sub-component of the revised SAP. The actions are allocated in four components as below.

¹³ The activities proposed in the coral reef sub-component focus on non-oceanic reef systems outside disputed areas in the coastal waters of the countries bordering the South China Sea.

1. ENHANCEMENT OF RESOURCE AND HABITAT MANAGEMENT

This component is divided into two sub-components. The first aims to promote good environmental governance and sustainable management of coral reef ecosystems. Regional actions focus on the review, synthesis, assessment and dissemination of good experiences and lesson learnt in the management of coral reefs. The second sub-component is to maintain a regional management framework to ensure the use of sound science in the sustainable management of coral reefs in the South China Sea. Regional actions include: maintenance of the regional expert group and coordinating mechanism, involvement and empowerment of stakeholders and communities and sharing experiences between countries on coral reef research and management.

2. PUBLIC AWARENESS, COMMUNICATION AND EDUCATION

The objective is to increase awareness of stakeholders regarding the ecological roles, economic values, and need for sustainable management of coral reefs. This component will facilitate the mainstreaming of information into educational programmes, develop information campaigns and sharing of training materials through the regional website.

3. RESEARCH AND MONITORING

The component aims to provide relevant scientific data and information for sustainable management of coral reefs. A number regional actions are proposed to support the scientific community in: assessing status of coral reefs; monitoring biological and socio-economic factors; maintaining, updating GIS and meta-databases and disseminating information for management purpose; and developing mechanism in environment impact assessment in transboundary areas.

4. SUSTAINABILITY AND CAPACITY BUILDING

The component is developed with the aim to improve regional capacity in management of transboundary issues regarding coral reefs. Some proposed actions are related to human resource development by exchanging experts, training trainers, sharing experiences in enforcement and developing capacity in fund raising and financial sustainability. Other actions focus on maintenance and improvement of the networks of demonstration sites, research centres and reef management agencies; and provision guideline for sustainable use of coral reefs and information on value added benefit derived from transboundary management of reefs.

Table 10 Proposed Regional Actions for the Coral Reef Component of the Strategic Action Programme.

Component	Sub-Component	Activity	Description	2008	2009	2010	2011	2012	2013	2014	2015	Total	
1. Enhancement of Resource and Habitat Management	1.1 To promote good environmental governance and sustainable management of coral reef ecosystem	1.1.1 Review, synthesis and formulation of good practices in coral reef sustainable management	2 workshops, 5 days, 2 times; consultancy, printing and distribution				44,500			44,500		89,000	
		1.1.2 Assessment and advice of technique on enhancement and rehabilitation of coral reefs.	Workshops, 3 days, 2 times; consultancy, printing and distribution					37,600				37,600	
		1.1.3 Review and formulation of good practices in community - based management activities at the region	Workshops, 3 days, 2 times; consultancy, printing and distribution					37,600				37,600	
		1.1.4 Introduction of cost effective waste management and environment friendly systems	Workshops, 3 days, 2 times; consultancy				34,600					34,600	
		1.1.5 Synthesis of successes on alternative livelihood programme, including funding mobilisation & technical support	Workshops, 3 days, 2 times; consultancy, printing and distribution				18,800			18,800		37,600	
		1.1.6 Review of existing transboundary management practices and identification of priorities in transboundary management zones	Workshops, 3 days, 2 times; consultancy, printing and distribution					37,600				37,600	
	1.2 To maintain of regional management framework to ensure the use of sound science in the sustainable management of coral reefs in the South China Sea	1.2.1 Regional coral reef expert group maintained to integrate research programmes and data and information used for coral reef management.	6 workshops, 3 days, consultancy		13,950	13,950	13,950	13,950	13,950	13,950			83,700
		1.2.2 Monitor achievement of SAP targets and NAP objectives every 5 year period.	Consultancy					18,000				18,000	36,000
		1.2.3 Synthesis of laws that contribute effectively to sustainable coral reef management, emphasizing on rule and regulation for good management practices	Workshop, 3 days & consultancy							37,950			37,950
		1.2.4 Regional coordinating mechanism to facilitate convergence of national and regional action plans.	2 workshop, 3 days & consultancy			37,950				37,950			75,900
		1.2.5 Information exchange for promotion of stakeholder involvement in sustaining management.	Printing, distribution & consultancy							14,000			14,000
		1.2.6 Review of traditional value and knowledge, and application in coral reef management in the region	Printing, distribution & consultancy						27,000				27,000
		1.2.7 Establishment of recognition and award system for good management of coral reefs.	Workshop & Award		45,300								45,300
		1.2.8 Review of level of compliance to various int'l obligations and conventions pertaining coral reefs	Consultancy				8,000						8,000
		1.2.9 Exchange and sharing experience between nations on coral reef research and management.	2 workshop			13,950				13,950			27,900

Table 10 *cont.* Proposed Regional Actions for the Coral Reef Component of the Strategic Action Programme.

Component	Sub-Component	Activity	Description	2008	2009	2010	2011	2012	2013	2014	2015	Total	
2. Public Awareness, Communication and Education	2.1 Increase awareness of stakeholders on the ecological roles, economic values of coral reefs, and need for sustainable management	2.1.1 Facilitation of mainstreaming of regional coral reef information and education programme	Development, printing, distribution & national workshop		14,000	25,000			25,000			64,000	
		2.1.2 Development and launching of regional information campaigns for sustainable use of coral reefs.	Consultancy, printing & 2 seminars				24,160				24,160	48,320	
		2.1.3 Sharing training materials among the countries by dissemination through regional website.	No cost										
3. Research and Monitoring	3.1 To provide relevant scientific data and information for sustainable management of coral reefs	3.1.1 Facilitation of and support to assess baseline information and status of coral reefs	Data collection, 6 countries, 2 time, 3 workshop, printing and distribution		55,300			55,300			55,300	165,900	
		3.1.2 Facilitation of and support to regular biological and socio-economic monitoring	3 workshops & support to target sites		33,950			33,950			33,950	101,850	
		3.1.3 Analysis of regional socio-economic status and culture significance of coral reefs, to provide vital information for sustainable management and use of coral reefs	2 workshops, 3 days				13,950				13,950	27,900	
		3.1.4 Management and update of coral reef GIS and other databases by SEA START RC.	Technical staff one month/year * 8 years	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	8,000	
		3.1.5 Prepare a base map of coral reefs in SCS and overlays to reflect indicators of sustainable management	Consultancy				14,000					14,000	28,000
		3.1.6 Regular analysis, synthesis and update of databases, and dissemination of information to general public, decision makers, governments, potential partners	2 workshops & printing, distribution				16,950					16,950	33,900
		3.1.7 Develop mechanism for analysis of impacts of different development scenarios on coral reef environment.	Consultancy			16,000					16,000		32,000
		3.1.8 Develop a research project regarding economic valuation of coral reefs in the South China Sea, focusing on indirect values	2 workshops, in-country surveys, 30 sites		38,680					38,680			77,360

Table 10 cont. Proposed Regional Actions for the Coral Reef Component of the Strategic Action Programme.

Component	Sub-Component	Activity	Description	2008	2009	2010	2011	2012	2013	2014	2015	Total	
4. Sustainability and Capacity Building	4.1 To improve regional capacity in management of transboundary issues regarding coral reefs	4.1.1. Exchange of experts for human resource development in coral reef management.	Experts, training course, administrative cost	12,835	12,835	12,835	12,835	12,835	12,835			77,010	
		4.1.2. Conduct of training of trainers for coral reef management at regional level	2 training courses, payments for trainers, administrative cost	64,614			64,614						129,228
		4.1.3. Exchange of experiences regarding skill of law enforcement and exchange of information, compliance and effectiveness of enforcement	Workshop					18,600					18,600
		4.1.4. Review and formulation of mechanism for financial sustainability for application in the region.	Workshop and consultancy						34,600				34,600
		4.1.5. Development of capacity in fund raising and implementation of financial scheme for coordination of coral reef management	Workshop, payment for trainers	29,100									29,100
		4.1.6. Maintenance of demonstration site network through forum of local government officials, project management personnel from demonstration sites	2 fora	27,900			27,900						55,800
		4.1.7. Forum of research centres and reef management agencies	2 fora		27,900			27,900					55,800
		4.1.8. Development of guideline for sustainable use of coral reefs	Consultancy, printing & distribution			20,500							20,500
		4.1.9. Provision of information on value added benefit of enhancement of sustainable use derived from transboundary management of reefs	Workshop & consultancy			34,600							34,600
Total				135,449	242,915	175,785	295,259	321,335	229,915	94,250	177,310	1,672,218	

STRATEGIC, PRIORITY ACTIONS FOR SEAGRASS IN THE SOUTH CHINA SEA

The recently published World Atlas of Seagrass (Green and Short, 2003) provides information on the world's seagrass habitats globally, incorporating their status in the face of environmental change. This is part of an ongoing initiative of the UNEP-WCMC to develop a comprehensive global GIS dataset with data derived from multiple sources. There are however, still substantial information gaps and for the South China Sea the UNEP/GEF project has already provided the first comprehensive seagrass data set from China. These data, however, was based on field survey at known sites in SCS countries and one should be aware that it does not reflect the total distribution of seagrass or seagrass beds in these countries. Some algorithms for mapping seagrass using remote sensing has been developed but this has yet to be applied to the entire South China Sea coastline.

Of the approximately 60 seagrass species described worldwide 18 species are found in, the coastal waters of the South China Sea. The numbers of seagrass species known to occur in each country are: Cambodia, 9; China, 8; Indonesia, 12; Malaysia, 14; Thailand, 12; Philippines, 15; and Viet Nam, 14. *Halophila* is the most diverse and widespread genus in coastal waters throughout the region. Further taxonomic work is essential to verify the 4 new *Halophila* species found in Malaysia (Japar *et al.* 2004).

The coastlines of the northern sub-region, in China and northern Viet Nam, have characteristics of subtropical areas, and the species include *Zostera japonica* together with *Halophila beccarii*, *Halophila ovalis*, *Halophila decipiens*, *Enhalus acoroides*, *Thalassia hemprichii*, *Halodule pinifolia*, *Halodule uninervis*, *Cymodocea rotundata* and *Ruppia maritima*. All but the first are widespread throughout the South China Sea region. Additional seagrass species recorded in the tropical zone include *Halophila spinulosa*, *Halophila minor*, *Cymodocea serrulata*, *Halodule pinifolia*, *Syringodium isoetifolium* and *Thalassodendron ciliatum*.

The sub-tropical species *Zostera japonica* often forms mono-specific seagrass beds, and has been recorded in Tieshan Bay and Pearl Bay, Guangxi Province, and Hong Kong in China. Its distribution also extends down to northern and central Viet Nam, and its' occurrence in Binh Dinh Province represents the southernmost limit of this temperate species in the Indo-west Pacific.

Of the tropical species, *Thalassodendron ciliatum* is generally found in seagrass beds from the intertidal to the low sub-tidal zone (2 – 17m) in the eastern part of Indonesia, and the southern and western shores of the Philippines. This species also occurs in the seagrass beds in Con Dao, southern Viet Nam. In the Philippines, it has been reported in Cuyo Island, the northernmost limit of its distribution in the Indo-west Pacific.

CURRENT MANAGEMENT STATUS OF SEAGRASS BEDS BORDERING THE SOUTH CHINA SEA

In the South China Sea region there has been a rapid rate of seagrass loss and decline in recent years. Indonesia has lost about 30-40% of its seagrass beds, with as much as 60% being destroyed around Java. In Singapore, the patchy seagrass habitats have suffered severe damage largely through burial under landfill operations. In Thailand, losses of the beds amount to about 20-30% and in the Philippines, it is about 30-50%. Very little information on seagrass loss is available from Cambodia, China, Malaysia, and Viet Nam (UNEP, 2004).

On the basis of data provided by the participating countries in the eighth meeting of the RWG-SG, the total of 43 target seagrass sites are recorded in the coastal areas bordering the South China Sea with the details as follows: Cambodia 33,814ha in 4 sites; China 1,960ha from 4 sites; Indonesia 3,035ha from 7 sites; Malaysia 222ha from 13 sites; Philippines 23,245ha from 5 sites; Thailand 2,553ha from 4 sites; and Viet Nam 13,503ha from 6 sites. Table 11 provides information regarding current management status indicating that 12,928ha (16.5%) of the total area is currently under some form of management. The total estimated area of seagrass amounts to 78,332ha of which 25,876ha (33%) is targeted to be under sustainable management by 2012.

Table 11 Status of Some Seagrass Sites in the South China Sea and Gulf of Thailand. Numbers summed for each country only reflect the sites shown in this table and do not represent the country totals.

Country and Site Name	Area (ha)	Legal Status	Area under Management	Management Effectiveness ¹⁴	Target for Management by 2012
Cambodia	33,814		2,000		11,446
Kampong Sam Bay	164	None	No	N/A	0
Chroy Pros	3,910	Provincial designated MPA	2,000	Medium	0
Kampot	25,240	Proposed fish Sanctuary	No	N/A	10,096
Kep Beach & Koh Tonsay	4,500	None	No	N/A	1,350
China	1,960		150		700
Hepu seagrass bed	540	National Dugong Reserve	150	Medium	150
Liusha seagrass bed	900	None ¹⁵	No	N/A	200
LiAn seagrass bed	320	Proposed Marine Park	No	N/A	200
Xincun seagrass bed	200	Proposed Marine Park	No	N/A	150
Indonesia	3,035		0		2,420
Medang-Mesanak	5	None	No	N/A	5
Temiang	5	None	No	N/A	5
East Bintan	2,000	Proposed Marine Management Area	No	N/A	1,500
Mapor	275	Proposed Marine Management Area	No	N/A	275
Anambas	150	Proposed Marine Management Area	No	N/A	35
Bangka-Belitung	350	Proposed Marine Management Area	No	N/A	350
Senayang	250	Proposed MPA	No	N/A	250
Malaysia	222		17		40
Tanjung Adang Laut Shoal	40	None	No	N/A	40
Tanjung Adang Darat Shoal	42	None	No	N/A	0
Merambong Shoal	30	None	No	N/A	0
Sungai Kemaman	17	None	No	N/A	0
Telaga Simpul	28	None	No	N/A	0
Sungai Paka Shoal	43	None	No	N/A	0
Pulau Tinggi Mersing	3	Marine Park	3	Medium	0
Pulau Perhentiar	3	Marine Park	3	Medium	0
Pulau Redang	2	Marine Park	2	Medium	0
Setiu Terengannu	3	None	No	N/A	0
Pulau Besar Mersing	3	Marine Park	3	Medium	0
Merchang	2	None	No	N/A	0
Tunku Abdul Rahman Park	6	State Park	6	Medium	0
Philippines	23,245		6,641		6,920
Cape Bolinao	22,400	Environmentally Critical Area - MPA	6,000	Medium	6,720
Puerto Galera	114	Fish sanctuary part of the Man and Biosphere reserve/	60	Low/Medium	50
Ulugan Bay	11	Fish sanctuary part of the Man and Biosphere reserve/	11	Medium	0
Honda Bay	470	Fish Sanctuary part of the Man and Biosphere reserve/	320	Medium	150
Puerto Princesa	250	Protected Area part of the Man and Biosphere reserve/	250	Medium	0
Thailand	2,553		1,780		0
Kung Krabane Bay	700	None ¹⁶	700	High	0
Tungka Bay	1,080	National Park	1,080	Low	0
Sarat Thani	500	None	No	N/A	0
Pattani Bay	273	None	No	N/A	0
Viet Nam	13,503		2,340		5,050
Phu Quoc archipelago	4,600	Phu Quoc Marine Protected ¹⁷ Area	2,050	Low	3,000
Con Dao Islands	200	National Park	200	Medium	200
Phu Qui Island	400	Proposed MPA	No	N/A	0
Thuy Trieu	800	Proposed MPA	50	N/A	350
Tam Giang	2,000	Proposed Ramsar	No	N/A	1,000
Cu Lao Cham	40	MPA	40	Medium	0

¹⁴ **Categories of Management Effectiveness: Low:** Area declared or proposed to be declared for management; Management Plan developed and approved. **Medium:** Existing Management Framework is implemented with inadequacy of manpower, finance and/or equipment: **High:** Existing Management Framework is implemented with enough trained manpower, equipment, facilities and sustainable finance.

¹⁵ Local Reserve.

¹⁶ Under King's project.

¹⁷ Phu Quoc National Park is an area of designated terrestrial Forest whilst the Marine Protected Area has recently been declared by the Provincial Government adjacent to the National Park.

THREATS TO SEAGRASS

The Regional Working Group identified six threats to seagrass including: destructive fishing such as push net, trawler; sedimentation from coastal development; waste water, effluents; nutrients; coastal construction; and over-fishing. Focal points from each country were asked to rank the relative importance of these six threats. To determine the regional significance of each threat the rank for each threat was weighted using the proportion of the area of seagrass in the country concerned compared with the regional total. The resultant values were summed to produce the regional weighted total, which is inversely related to the regional significance (small values are more significant than larger values). The relative importance of the threats from a regional perspective is summarised in Table 12.

Table 12 Regional ranking of threats to seagrass, by the members of RWG-SG, 1=most serious and 6=least serious. (scoring regionally the threats based on country score provided by the focal points and rate between seagrass areas of each country and region)

Country	Cambodia		China		Indonesia		Malaysia		Philippines		Thailand		Viet Nam		Total	
Area (ha)	33,814		1,960		3,035		222		23,245		2,553		13,503		78,332	
Proportion of regional total	0.458		0.027		0.041		0.003		0.315		0.035		0.121		1.00	
	Rank	weight score	Rank	weight score	Rank	weight score	Rank	weight score	Rank	weight score	Rank	weight score	Rank	weight score	Total Weight score	Regional ranking
Destructive fishing such as push net, trawler	1	0.432	1	0.025	1	0.039	3	0.009	2	0.593	1	0.033	1	0.172	1.303	1
Sedimentation from coastal development	4	1.727	3	0.075	3	0.116	4	0.012	3	0.890	2	0.065	2	0.345	3.230	2
Waste water effluent	3	1.295	4	0.100	5	0.194	5	0.015	4	1.187	4	0.130	5	0.862	3.783	3
Nutrients	6	2.590	5	0.125	4	0.155	6	0.018	1	0.297	3	0.098	6	1.034	4.317	5
Coastal construction	5	2.158	2	0.050	2	0.077	2	0.006	5	1.484	6	0.196	3	0.517	4.488	6
Over-fishing	2	0.863	6	0.150	6	0.232	1	0.003	6	1.780	5	0.163	4	0.690	3.882	4

CHALLENGES FOR SEAGRASS MANAGEMENT

Challenges for sustainable seagrass management (not in order of priority) in the countries bordering the South China Sea are:

1. Lack of sustainable financing.
2. Lack of awareness among people who are causing damages to seagrass on their consequences.
3. Coastal development plans, if any, usually do not take seagrass into consideration.
4. Poverty of coastal communities.
5. Lack of effective seagrass management systems.
6. Weak law enforcement.
7. Lack of long-term regional and international cooperation/coordination.

GOAL AND TARGETS

During the 6th meeting of the RWG-SG, there was agreement regarding the goal of the SAP with respect to seagrass which was defined as:

“To conserve, manage and sustainably utilise seagrass habitats and resources.”

The specific targets for management and conservation of seagrass ecosystems in the SCS are as follows:

- *Twenty-one managed areas totalling 26,576 hectares (approximately 33% of the 78,332 hectares identified as seagrass sites) in the South China Sea, to be brought under sustainable management by the year 2012.*
- *Government recognition of the ecological importance of seagrass through amendment of the management plans for seven existing MPAs with significant areas of seagrass habitat, to include specific seagrass-related management actions by the year 2012.*
- *Adoption of 7 new Marine Protected Areas specifically focussing on seagrass habitats identified in the prioritised listings of the SCS Project, by the year 2012.*

Table 13 Sustainable Management Indicator Matrix. [A baseline, mid-term and end of first phase of SAP implementation assessment of these indicators is required to indicate whether or not the targets have been met.]

Management Indicators	Ecological/Environmental Indicators	Socio-Economic Indicators
MANAGEMENT CAPACITY <ul style="list-style-type: none"> • Formal Management framework • Trained Man-power (No./levels) • Facilities and equipment • Sustainable Financing 	<ul style="list-style-type: none"> • Percent seagrass cover • Shoot density per sq m • Abundance of sea urchin, <i>Tripneustes gratilla</i> • Abundance of sea cucumber, <i>Stichopus chloronotus</i> 	FISHERIES <ul style="list-style-type: none"> • Catch per unit effort • Total landing from the seagrass area • Proportion of rabbitfish (siganids) in total landing • Income No. people involved
MANAGEMENT APPROACH <ul style="list-style-type: none"> • Sectorial • Integrated • Community-based • Multiple-use 		TOURISM <ul style="list-style-type: none"> • Number of visitors • Number of tourism operators • Income No. people involved
MANAGEMENT TOOLS <ul style="list-style-type: none"> • Zoning 		AWARENESS Proportion of local people that are aware of seagrass ecosystems functions and values

REGIONAL ACTIONS AND COST ESTIMATES

The overall goal of the proposed regional activities is to enhance the sustainable use and management of seagrass resources and ecosystems in the region. The activities were elaborated during the seventh meeting of the Regional Working Group on Seagrass and are presented in Annex 6 of that meeting report. Table 14 of this document itemises the actions and includes preliminary cost estimates prepared by the regional working group during the seventh meeting. There are 15 actions proposed, which are grouped into three components.

1. BUILDING CAPACITY AND AWARENESS AT ALL LEVELS TO ENSURE LONG-TERM SUSTAINABLE USES OF SEAGRASS HABITATS AND RESOURCES

The aim of this component is to increase the knowledge of government officials, managers, and stakeholders concerning the importance and value, of seagrass resources and ecosystems in the region. This component is divided into two sub-components; the first of which provides details of the actions required to maintain and elaborate regional mechanisms for knowledge and information exchange through training, site visits, meetings, regional symposia, a South China Sea website, and publications. The second focuses on the production of materials for use in promoting knowledge and awareness of sustainable practices.

2. ENHANCING MANAGEMENT SKILLS THROUGH DEVELOPMENT AND DISSEMINATION OF REGIONALLY APPLICABLE TOOLS

This component aims to enhance the management skills and experience of all stakeholders by providing a sound scientific and technical basis for management of seagrass resources and ecosystems. The first sub-component involves compiling, developing and enhancing guidelines and other tools for disseminating and facilitating experiences and good practices at the regional level. The second sub-component focuses on the application of research and knowledge for monitoring and sustainable management of seagrass habitats.

3. INSTITUTIONAL ARRANGEMENTS AND REGIONAL CO-ORDINATION

This component aims at assisting the countries in effectively managing their seagrass resources and ecosystems in a sustainable manner, via the development of mechanisms including policy, where appropriate for co-ordination of actions. The first sub-component addresses the integration and promotion of research programmes with policy and decision-making and the second focuses on international and regional co-operation and co-ordination. This includes the maintenance and enhancement of the existing regional seagrass network, development and collection of data/information on seagrass at regional scales, promotion of transboundary management, zoning, and promotion of regional/sub-regional bodies for joint management of seagrass resources and ecosystems, where appropriate.

Table 14 Proposed Regional Actions for the Seagrass Sub-component of the Regional Strategic Action Programme.

Components	Sub-components	Activities	Description	Total Costs	Costs by Year				
					2008	2009	2010	2011	2012
1. Building capacity and awareness at all levels to ensure long-term sustainable uses of seagrass habitats and resources	1.1 Mechanisms for knowledge and information exchange	1.1.1 Exchange of personnel among seagrass sites.	3 pers/country, 7 countries, 2 times, 30 days. Costs: air fare: US\$500, Stipend: US\$15/per/day	39,900		19,950		19,950	
		1.1.2 Regional Training on seagrass management models and National Echo-seminars.	Biennial Trainings: (4 pers/country, 7 countries/course) + (National echo-seminars: 7 countries, US\$5,000 x 2 seminars)	210,000	70,000	35,000	70,000	35,000	
		1.1.3 Maintain the SCS Website and input new data and information.	In-kind contribution from the network						
		1.1.4 Bi-annual seagrass "YALAMUN" publication. For example the outputs from 2.1.4.	Translation into 7 languages from in-kind contribution. English text to be prepared by a coordinating entity						
		1.1.5 Biennial Regional Conference on seagrass management.	2 conferences, 100 pers./conference, 3 days/conference	186,000	93,000				93,000
	1.2 Materials for use at all levels in promoting knowledge and awareness of sustainable management practices	1.2.1 National echo-seminars to incorporate seagrass into primary and secondly school curricula.	1 seminar, US\$5,000/country, 7 countries	35,000	35,000				
		1.2.2 Compilation, selection, production and dissemination of general awareness materials of seagrass through national media.	In-kind contribution from the national government						
2. Enhancing management skills through development and dissemination of regionally applicable tools	2.1 Develop and enhance guidelines and other tools as information resources and facilitate their regional dissemination and adoption for seagrass management	2.1.1 Further enhance the regional seagrass GIS database (e.g. finer resolutions, using standardized methods, technology).	Updating the GIS database to the regional database by SEAs as in-kind contribution. Maintaining the regional GIS database by a coordinating entity: 20% of staff of SEA START RC (US\$200/month, 12 months, 5 years)	12,000	2,400	2,400	2,400	2,400	2,400
		2.1.2 More assessment of baseline information on seagrass from unstudied areas to find the seagrass distribution.	National activities as in-kind contribution from the national governments						
		2.1.3 Expand and up-date the regional seagrass meta-database.	Updating the meta database to the regional database by SEAs as in-kind contribution. Maintaining the regional meta database by a coordinating entity: 20% of staff of SEA START RC (US\$200/month, 12 months, 5 years)	12,000	2,400	2,400	2,400	2,400	2,400
		2.1.4 Regional synthesis of experiences and lessons learnt at UNEP/GEF/SCS demonstration and other sites; and replicate models useful in other areas.	A 3-day workshop for participants from national echo-seminar and demo-site, 2 per/country, 7 countries	13,020			13,020		
		2.1.5 Development of criteria and award system for successful seagrass management.	It will be discussed during regular meetings of the RWG-SG. Award after 5 years: Total three prizes: US\$10,000	10,000					10,000

Table 14 cont. Proposed Regional Actions for the Seagrass Sub-component of the Regional Strategic Action Programme.

Components	Sub-components	Activities	Description	Total Costs	Costs by Year				
					2008	2009	2010	2011	2012
3. institutional arrangement and regional coordination	3.1 Integration of research results into Management and policy making	3.1.1 Develop guidelines to integrate research results into management and policy making	These guidelines will be discussed during the regular the RWG-SG meetings. A workshop with participation of the RWG-SG, policy makers, invited scientists and legal experts: 3 days, 7 countries, 3 pers/country, 3 invited speakers	22,320		22,320			
	3.2 International and regional cooperation, and co-ordination	3.2.1 Annual Meetings of the Regional Working Group on Seagrass (RWG-SG)	1 meeting/year, 5 years, 1 per/country, 7 countries, 5 days	54,250	10,850	10,850	10,850	10,850	10,850
		3.2.2 Promote transboundary management of seagrass for sustainable fisheries and the protection of endangered species (dugongs and turtles)	Five 3-day workshops for the development of management plans. 1 Cambodia-Viet Nam (US\$6,000*5=30,000), 2.Philippine-Malaysia-Indonesia (US\$10,000*5=50,000), 3.Viet Nam-China (10,000*5=50,000). 10 pers/workshop	130,000	26,000	26,000	26,000	26,000	26,000
	3.3 Improvement of the management plans of current seven prioritised MPAs	3.3.1 Review of existing data and information, legislations and regulations related to the establishment of MPA	In-kind co-financing from the government						
		3.3.2 Amend the existing management plans to include specific seagrass related management actions based on results of the legal review.	In-kind co-financing from the government						
	4. Strengthening managed seagrass areas and establishment of new MPAs with focussing on seagrass habitat.	4.1 Put 23 managed areas into sustainable management	4.1.1 Review and update existing data and information on the 23 seagrass areas	In-kind co-financing from the government					
4.1.2 Develop sustainable management plans based existing data and information			In-kind co-financing from the government						
4.1.3 Implement the management plans			Beyond the target time (after 2012)						
4.2 Establishment of 7 new MPAs focussing on seagrass habitat		4.2.1 Development criteria for selecting the MPAs focussing on seagrass	Regional Working Group Meetings.						
		4.2.2 From the prioritised listings of seagrass areas, select 7 sites for the establishment of 7 new MPAs (in regional working meetings)	Regional Working Group Meetings						
		4.2.3 Development and adoption of management plans for the 7 MPAs	In-kind co-financing from the government						
		4.2.4 Implement the 7 MPAs	Beyond the target (after 2012)						
Total					724,490	239,650	118,920	124,670	96,600

STRATEGIC PRIORITY ACTIONS FOR COASTAL WETLANDS BORDERING THE SOUTH CHINA SEA

MANAGEMENT STATUS OF COASTAL WETLANDS BORDERING THE SOUTH CHINA SEA

Under the UNEP/GEF South China Sea Project, activities in the wetland sub-component focus on five specific types of wetlands, namely intertidal mudflats, estuaries, lagoons, peat swamps and non-peat swamp, excluding mangroves, coral reefs and seagrass beds which are the subjects of separate sub-components. Table 15 summarises the legal and management status of major lagoons, estuaries, inter-tidal mudflats, peat swamps and non-peat swamps bordering the South China Sea. A total area of 4,201,145ha of the five specific types of wetland sites has been identified, specifically lagoons (34,921ha), estuaries (1,203,871ha), inter-tidal flats (691,859ha), non-peat swamps (1,623,567ha), peat swamps (646,927 ha).

Table 15 Legal and Management Status of some Inter-tidal Mudflats, Estuaries, Coastal Lagoons and Coastal Peat Swamps bordering the South China Sea.

Name of site	Area (ha)	Legal and Management Status		
		Protected – Non-use (Subsistence/commercial)	Sustainable use	Non-sustainable use
Estuaries				
Cambodia				
Koh Kapik Ramsar in Koh Kong Province	12,000	National Park and RAMSAR site	N.A.	N.A.
China				
Pearl river	12,783	Wetland Park (200ha)	N.A.	N.A.
Beilun river	1,083	National level nature reserve	N.A.	N.A.
Indonesia				
Bakau Selat Dumai	60,000	Yes		
Pulau Padang dan Tanjung Pandan	111,500	-		√
Muara Sungai Guntung	26,000	Small part		√
Delta Banyuasin	200,000	Yes		
Sembilang	387,500	Yes	-	-
Philippines				
Malampaya Sound	24,500	Protected seascape	N.A.	N.A.
Pansipit River Estuary	15	N.A.	N.A.	√
Thailand				
Pattani Bay	6,149	N.A.	N.A.	√
Ban Don Bay	49,459	N.A.	N.A.	√
Welu River Estuary	10,400	N.A.	N.A.	√
Thung Kha Bay-Savi Bay	5,204	National Park	N.A.	N.A.
Pak Phanang Bay	13,597	N.A.	√	N.A.
Viet Nam				
Balat Estuary	26,397	National Park and National Nature Reserve	N.A.	N.A.
Tien River Estuary	100,691	Than Phu Nature Reserve – small part of the estuary	N.A.	√
Dong Nai River Estuary	49,711	Can Gio Biosphere Reserve	N.A.	√
Van Uc Estuary	6,990	N.A.	N.A.	√
Bach Dang Estuary	80,358	N.A.	N.A.	√
Tien Yen Estuary	24,738	N.A.	N.A.	√
SUBTOTAL	1,203,871	692,184	38,097	328,511 [+137,500]
Peat Swamps				
Cambodia				
Prek Kampong bay in Kampot Province	16,250	National Park	N.A.	N.A.
Prek Kampong Som Shanoukeville	10,800	National Park	N.A.	N.A.
Indonesia				
Berbak NP	162,700	yes		
SM Terusan Dalam	74,750	yes		
Way Kambas NP	130,000	yes		
Sungai Merang	150,000	yes		
Thailand				
Wetlands in Thale Noi Wildlife Non-hunting Area	45,700	Includes RAMSAR Site	N.A.	N.A.
Phru To Daeng Wildlife Sanctuary	20,120	Wildlife Sanctuary; RAMSAR site	N.A.	N.A.
Wetlands in Thale Sap Wildlife Non-hunting Area	36,467	Non-hunting Area		N.A.
Phru Kan Tulee	140	N.A.	√	N.A.
SUBTOTAL	646,927	564,620	82,307	0

Table 15 cont. Legal and Management Status of some Inter-tidal Mudflats, Estuaries, Coastal Lagoons and Coastal Peat Swamps bordering the South China Sea.

Name of site	Area (ha)	Legal and Management Status		
		Protected – Non-use (Subsistence/commercial)	Sustainable use	Non-sustainable use
Non-peat Swamps				
Cambodia				
Kampong Trach in Krong Kep	7,500	National Park	N.A.	N.A.
Prek Toek Sap	21,259	National Park	N.A.	N.A.
Indonesia				
Tulang Bawang	86,000	Partly		
Rawa-rawa Kubu Padang Tikar	1,499,000	-		
Thailand				
Khao Sam Roi Yot National Park	9,808	National Park	N.A.	N.A.
SUBTOTAL	1,623,567	38,567 [86,000]	0	[1,499,000]
Lagoons				
Cambodia				
Beoung Ka Chang	4,503	National Park & RAMSAR site	N.A.	N.A.
China				
Wenchang	218	Provincial level nature reserve	N.A.	N.A.
Viet Nam				
Tam Giang-Cau Lagoon	21,600	N.A.	N.A.	√
Tra O Lagoon	2,000	N.A.	N.A.	√
Degi Lagoon (Binh Dinh Province)	1,600	N.A.	N.A.	√
Thi Nai lagoon (Binh Dinh Province)	5,000	N.A.	N.A.	√
SUBTOTAL	34,921	4,721	0	30,200
Inter-tidal flats				
Cambodia				
Ruer Sey Srock Toul Srav Gnamim Krong Kep	4,890	National Park	N.A.	N.A.
China				
Shantou	1,435	Municipal level nature reserve	N.A.	N.A.
Hepu	3,951	Municipal level nature reserve	N.A.	N.A.
Danzhou	806	Provincial level nature reverse	N.A.	N.A.
Indonesia				
CA Pulau Burung	200	yes		
Tanjung Datuk	25,000	-		
Tanjung Jabung	3,000	yes		
Paloh	176,548	yes		
Muara Kendawangan	150,000	yes		
CA Pulau Dua	30	yes		
Pualu Rambut	46	yes		
Muara Angke	25	yes		
CA Muara Gembong	10,481	yes		
Philippines				
Balayan Bay Tidal flats	75,000	N.A.	√	N.A.
Manila Bay Tidal Flat	30,000	N.A.	√	N.A.
El Nido, Palawan mudflats	54,303	Protected Seascape	N.A.	N.A.
Thailand				
Don Hoi Lot	2,409	RAMSAR Site	N.A.	N.A.
Wetlands in Mu Koh Chang National Park	65,000	National Park	N.A.	N.A.
Wetlands in Mu Koh Ang Thong National Park	10,200	National Park and RAMSAR Site	N.A.	N.A.
Thung Kha Bay – Savi Bay	5,204	National Park	N.A.	N.A.
Viet Nam				
Ca Mau Southwest Tidal Flat	60,711	National Park	N.A.	N.A.
Kim Son Tidal Flat	12,620	N.A.	N.A.	√
SUBTOTAL	691,859	487,323	161,712	37620
TOTAL	4,201,145	1,787,415	282,116	[2,032,831]

THREATS TO COASTAL WETLANDS

Population growth, and urbanisation of the coastal fringe, combined with rapid economic growth in this region places tremendous pressure on coastal wetland ecosystems. Major threats to the coastal wetlands bordering the South China Sea can be grouped as follows:

1. LOSS OF WETLAND AREAS THROUGH CONVERSION FOR:

- Agriculture
- Aquaculture
- Port and harbour development
- Human settlement
- Tourist development
- Urbanization
- Industrialization

2. DEGRADATION OF WETLAND ECOSYSTEMS AS A RESULT OF:

- Over-exploitation of living resources
- Use of inappropriate fishing techniques and gear
- Pollution
- Deforestation in upland area
- Invasive species
- Global trends and natural episodic events such as sea level rise, typhoons and tsunamis

Overall it has been estimated that around 30% of coastal wetlands are lost in Southeast Asia each decade giving an approximate annual loss in value of 3% per annum.

GOAL AND TARGETS

The ultimate goal of the SAP for wetland management and use is to:

Promote the sustainable use of coastal wetland resources by developing integrated management plans and enhancing conservation and restoration of coastal wetlands bordering the South China Sea and the Gulf of Thailand, specifically lagoons, estuaries, mudflats, peat swamps, and non-peat swamps.

The specific targets for wetland management are:

- *By the year 2012, to set up or update management plans for at least three lagoons, nine estuaries, five tidal flats, one peat swamp and one non-peat swamp in the South China Sea (See Table 16).*
- *By the year 2012, to increase by at least 7 wetland areas, the number of sites or specified wetland areas with protection status (i.e. non-hunting area, nature reserves, protected areas, Ramsar Sites, etc).*
- *By the year 2017, to have a regional estuary monitoring scheme implemented in the participating countries .¹⁸*

Table 16 list of sites specified in the targets. N = no existing management plan; u = existing but out-dated plans requiring amendment and up-dating.

	Lagoons	Estuaries	Tidal mudflats	Peat swamp	Non-peat swamp
Cambodia		Koh Kapik-N			
China	Wenchang -N	Pearl river-N; Beilun river-U	Shantou-N; Hepu-N; Zhanzhou-N		
Indonesia		Sembilang NP-U			
Philippines		Malampaya sound-U; Pansipit-N	Manila Bay-N		
Thailand				Thale Noi non hunting area – U	Khao Sam Roi Yot National Park-U
Viet Nam¹⁹	Tamgiang-Cauhai-N; Thi Nai-N	Tien River Estuary; Dong Nai-U; Balat-U	Southwest Ca Mau-U		
Total	3	9	5	1	1

¹⁸ UNEP, 2005. *Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand. Report of the Fifth Meeting of the Regional Working Group on Wetlands. UNEP/GEF/SCS/ RWG-W.5/3.*

¹⁹ Amendments provided by the Viet Nam Focal Point on 29th May following the 8th meeting of the RWG-W.

Table 17 Sustainable Management Indicator Matrix. [A baseline, mid-term and end of first phase of SAP implementation assessment of these indicators is required to indicate whether or not the targets have been met.]

Management Indicators	Ecological/Environmental Indicators	Socio-Economic Indicators
MANAGEMENT CAPACITY <ul style="list-style-type: none"> Formal Management framework Trained Man-power (No./levels) Facilities and equipment Sustainable Financing 	<u>Estuaries:</u> <ul style="list-style-type: none"> Turbidity Water colour Absence or presence of oil contamination <u>Intertidal Mudflat:</u> <ul style="list-style-type: none"> Mudflat area (ha) Abundance of cockle or clam Abundance of shore bird Amount of litters Erosion/deposit (progression/regression) <u>Coastal Lagoon:</u> <ul style="list-style-type: none"> Water area (ha) Plants reflect salinity change such as <i>Nipa</i> sp. and <i>Metroxylon sagu</i> Area of associated habitats (seagrass, mangroves) <u>Peat Swamp:</u> <ul style="list-style-type: none"> Abundance of primary trees Freshwater supply (inundation mark) Amount of litters Abundance of water birds <u>Non-peat Swamp:</u> <ul style="list-style-type: none"> Land and water area (ha) Turbidity Abundance of water birds 	FISHERIES (Estuaries, Intertidal mudflats, lagoons,) <ul style="list-style-type: none"> Catch per unit effort Total landing Catch composition Income No people directly involved
MANAGEMENT APPROACH <ul style="list-style-type: none"> Sectorial Integrated Community-based Multiple-use 		TOURISM <ul style="list-style-type: none"> Number of visitors Number of tourism operators Income No people directly involved
MANAGEMENT TOOLS <ul style="list-style-type: none"> Zoning Regulations and agreements (e.g. seasonal closures, licensing, and permits) 		FORESTRY (Peat Swamp & Non Peat Swamp) <ul style="list-style-type: none"> Volume of timber Income No. people directly involved

REGIONAL ACTIONS AND COSTING

The proposed regional activities are designed to promote sustainable management and use of the wetland ecosystems are categorised into five main components; namely:

Component 1 – Capacity development to enhance sustainable wetland management.

Component 2 – Institutional arrangements and international collaboration.

Component 3 – Participatory wetlands management and monitoring mechanism.

There are in total 22 actions proposed and these are grouped into three components each of which contains specific objectives, and activities, while the approximate costs are presented in Table 18.

COMPONENT 1. CAPACITY DEVELOPMENT TO ENHANCE SUSTAINABLE WETLAND MANAGEMENT

The main objective of this component is to enhance and sustain the capacity of wetland management agencies and strengthen knowledge and public awareness on the wise use of wetlands in the region. This component is divided into two sub-components; the first of which focuses on the required regional mechanisms for human resource development through a training programme including study tours and field visits for wetland managers, community representatives, students, and NGO members. The second sub-component encompasses the production and dissemination of materials for public awareness, the development of an educational centre, the development of curricula, and the production of national newsletters.

COMPONENT 2. INSTITUTIONAL ARRANGEMENTS AND INTERNATIONAL COLLABORATION

This component aims to improve the effectiveness of national policy, legal and institutional arrangements and co-ordination. It is divided into two sub-components, the first of which involves the maintenance and strengthening the Regional Working Group on Wetlands, as the regional scientific and technical advisory body on coastal wetland management. The second sub-component focuses on establishment of linkages among wetland management institutes or agencies in the region and on the maintenance of linkages between and within the academic and professional communities.

COMPONENT 3. PARTICIPATORY WETLANDS MANAGEMENT AND MONITORING MECHANISM

The objective of this component is to maintain and update the regional Wetlands GIS database and meta-database including scientific baseline data for wetland conservation and sustainable use. Activities are grouped into two sub-components; the first of which involves developing regional handbooks/manuals, and guidelines; maintaining regional GIS- and meta-databases, developing and implementing the regional estuary monitoring scheme. The second sub-component involves the convening of regional meetings among countries to review the status of wetland management plans, develop manuals/handbooks for sustainable use including restoration of estuaries, coastal lagoons, etc.

Table 18 Proposed Actions for Coastal Wetland Management and Conservation.

Components Objectives	Sub-components	Regional Activities	ESTIMATED COST (US\$)						Total
			Basis for estimation	Years					
				2008	2009	2010	2011	2012	
<p>1. Capacity development to enhance sustainable wetland management.</p> <p><i>To enhance and sustain the capacity of wetland management agencies and strengthen knowledge and public awareness on wise use of wetland management in the region</i></p>	1.1 <i>Human Resource Development</i>	1.1.1 Training needs assessment (forms of training, target audiences, places of training, timeframe, existing course programme)	2 times in 10 years x 50,000 first time of assessment 20,000 for the updating of the assessment	50,000	0	0	0	20,000	70,000
		1.1.2 Biennial Training Course; may include elements on basic ecology, law enforcement, monitoring, valuation, management and community participation.	15/days per course; 3 people per course from 7 countries. 75,000 US\$ per course Total 150,000	0	75,000	0	75,000	0	150,000
		1.1.3 Regional inter-country training. The programme may include study tours, and field visit for wetland managers, communities, students, and NGOs	1 study tour per year, 1 week duration 15 participants: S25,000US per year	25,000	25,000	25,000	25,000	25,000	125,000
		1.1.4 Personnel exchange programme	1 person/country/year, up to 2 months, 5 years (\$5000 x 7 X 5= 175,000	35,000	35,000	35,000	35,000	35,000	175,000
	1.2 <i>Communication, education & public awareness</i>	1.2.1 Develop regional education and public awareness plan, based on national needs assessment	National Focal Points and National Committees x 7 countries 25 days In-Kind contribution (7x2 mtgs x 10,000) = 140,000: 1 regional meeting 16 people 8 days to finalise plan	0	35,000	0	0	0	35,000
		1.2.2 Edit, Translate, Publish and disseminate the regional education and public awareness plan to stakeholders in participating countries by CD and hardcopy	Editorial (15,000) and translation costs (5 x 15,000 US\$), Publication 7 X 3,000 US\$ Total 110,000 US\$	0	0	110,000	0	0	110,000
		1.2.3 Develop curricula guidelines (context, format, directed to different educational levels, and covering different type of wetlands)	(1 consultant x 3 months x 10,000) (translation in 7 local languages x4,000) (made publicly available via the web)	0	58,000	0	0	0	58,000
		1.2.4 Produce national newsletters to disseminate within countries in this region.	National Focal Points and National Committees x 7 countries	0	0	0	0	0	0

Table 18 cont. Proposed Actions for Coastal Wetland Management and Conservation.

Components Objectives	Sub-components	Regional Activities	ESTIMATED COST (US\$)						Total
			Basis for estimation	Years					
				2008	2009	2010	2011	2012	
2. Institutional arrangements and international collaboration <i>To improve the effectiveness of national policy, legal and institutional arrangement and coordination</i>	2.1 <i>Enhancing the policy, legal and institutional framework</i>	2.1.1 Review the implementation of the NAPs at regional level and review and update the existing framework of wetland policy and regulation in the region.	2 meetings of National Focal Points site managers, practitioners and potential donors; 1 in year 1 the second in year 5, 45 people 6 days 60,000 per time.	60,000	0	0	0	60,000	120,000
		2.1.2 Maintain and strengthen the Regional Working Group on Wetlands to provide policy, scientific and technical advice on coastal wetland management to the participating countries.	Regional biennial meetings, 20,000/meeting	20,000	0	20,000	0	0	40,000
		2.1.3 Undertake a regional review of current stakeholders' roles in wetland management and conservation and Identify good practices on community empowerment.	National Focal Points and National Committees x 7 countries 25 days In-Kind contribution 1consultant x 2 months x 10,000) = 20,000 Output to be reviewed in the regional biennial meeting	20,000	0	0	0	0	20,000
		2.1.4 Promote the replication of good practices in community empowerment regionally through pilot activities.	(\$40,000 per activity x 7 countries) = 280,000	0	280,000	0	0	0	280,000
		2.1.5 Compile and analyse traditional knowledge and practices and to evaluate their utility in the modern context.	(2 consultants x 3 months x 10,000) = 60,000	0	60,000	0	0	0	60,000
	2.2 <i>Promotion of international cooperation</i>	2.2.1 Organize international conference on wetland management among countries in region and international agency.	(2 conferences x 100,000) = 200,000	0	0	100,000	0	10,000	110,000

Table 18 cont. Proposed Actions for Coastal Wetland Management and Conservation.

Components Objectives	Sub-components	Regional Activities	Basis for estimation	ESTIMATED COST (US\$)					Total
				Years					
				2008	2009	2010	2011	2012	
3. Participatory wetlands management and monitoring mechanism <i>To maintain and update Regional Wetlands GIS database and meta-database including scientific baseline for wetland conservation and sustainable use</i>	3.1 <i>Develop , maintain information system and disseminate products</i>	3.1.1 Develop a regional handbook/manual for standardization of techniques for wetland resource assessment and the conduct of socio-economic surveys economic valuation studies and cultural assessments.	(1 consultant X 4 months X 10,000) + (1 Mtg/country 4 days, 10,000 X 7) 110,000 I regional meeting 35,000 and publication costs (3,000 copies at 10\$/copy)	0	0	110,000	30,000	0	140,000
		3.1.2 Develop guidelines on wetland classification and mapping for estuaries and mudflats area and develop a regional map of peat-swamps, non-peat swamp and coastal lagoons.	(1 consultants X 3 months X 10,000) + (2 Mtgs. X 25,000) = 80,000	35,000	45,000	0	0	0	80,000
		3.1.3 Regional Wetland data and information compilation	(1consultant x 2 weeks per year) = 15,000	3,000	3,000	3,000	3,000	3,000	15,000
		3.1.4 Develop guidelines for and implement a regional estuarine monitoring scheme.	(1 consultant x 6months x 8,000) (1 regional expert meeting 25 participants 5 days coordination 35,000)	0	0	48,000	35,000	0	83,000
	3.2 <i>Wetland conservation and restoration</i>	3.2.1 Develop or update wetland management plans for the important priority coastal wetland sites in the region.	National Focal Points and National Committees x 7 countries 25 days In-Kind contribution Plans to be reviewed regionally during meetings under 2.1.2	0	0	0	0	0	0
		3.2.2 Establish criteria and guidelines for zoning of wetland ecosystem use for management and conservation.	1 consultant x 2 months x 10,000 I regional meeting 35,000	0	0	55,000	0	0	55,000
		3.2.3 Conduct, pilot tests to elaborate the criteria and indicators of sustainable wetlands use.	National Focal Points and National Committees x 7 countries 25 days In-Kind contribution 1 research assistant per country 1 year (7 x 10,000) (1 regional mgt x 25,000) = 120,000	70,000	25,000	0		0	95,000
		3.2.4 Disseminate environmental friendly methods and good practices in the region.	Via regional website, loaded by National Committee members	0	0	0	0	0	0
TOTAL COSTS				248,000	616,000	506,000	298,000	153,000	1,821,000

MANAGING FISH HABITAT AND FISH STOCKS IN THE SOUTH CHINA SEA²⁰²¹

The South China Sea and Gulf of Thailand is a global centre of shallow water marine biological diversity, supporting a significant world fishery of importance to the food security of, and as a source of export income for, Southeast Asian countries. The fisheries sector is significant since unrefined estimates of the value of capture production indicate that capture fisheries contribute more than 2.0 percent to total GDP in the majority of countries in the area. Since the majority of fisheries are small-scale in nature, and land fish in a large number of decentralised landing places for distribution through complex marketing networks at the community level, estimates of the value of capture fisheries production are largely underestimates and do not adequately value the artisanal or subsistence part of the sector.

Landings from the Gulf of Thailand and the South China Sea contribute to approximately 10 percent of reported global fisheries production per annum. It is considered likely that increased inter-annual variations in landings will be observed in the future as the fisheries of both areas become increasingly dependent on small pelagic species. This results from “fishing down the food chain” that has occurred in both areas. Demersal fisheries in the Gulf of Thailand and South China Sea are fully exploited with evidence showing that the landings of many species are declining. Declining fish availability, coupled with over-capacity and the dependence of coastal communities on small scale coastal fisheries for income generation has led to the adoption of destructive fishing practices such as blast fishing to maintain short-term incomes and food production. These trends suggest that production from capture fisheries will wane in coming years unless fishing effort and related over-capacity, are reduced.

FISHERIES MANAGEMENT ISSUES

Fisheries management in the Gulf of Thailand and South China Sea must balance the interests of multiple jurisdictions, coastal community dependence on fisheries for food security, in the face of problems resulting from over-fishing, destructive fishing practices, incidental capture of endangered species, and the inherently complex nature of the tropical multi-species fisheries. Most marine fisheries in Southeast Asia are characterised by excess competition among fishers, and as such suffer from the problems of over-capitalisation and over-exploitation. Despite this trend, the management of the majority of fisheries conducted in the region continues to rely heavily on input control based approaches.

This situation has provided the impetus for the development of innovative approaches to moderate the tendency to over-exploit Southeast Asian fish resources. Significant efforts are being made throughout the region to decentralise the responsibility for fisheries management with the aim of establishing co-management approaches to fisheries. The notion of rights-based approaches to the management of the region’s small coastal fisheries is also gaining ascendancy. It is also well recognised that coral reef, seagrass, mangrove, and wetland habitats contribute significantly to the productivity of coastal fisheries, and act as refuges for the majority of fished species during critical phases of their lifecycles. Fisheries management involving decentralisation and rights-based systems will need to incorporate strategies that aim to foster the critical links between the life-cycles of important fish species and coastal and marine habitats.

IMPROVING THE INTEGRATION OF FISHERIES AND HABITAT MANAGEMENT – THE REGIONAL FISHERIES REFUGIA INITIATIVE

Based on the recognition that coral reef, seagrass, mangrove, and wetland habitats help to sustain coastal fisheries, and act as refuges for important species during many phases of their life-cycles, new approaches to fisheries management will need to be supported by initiatives that aim to foster improved management of critical fish life-cycle and habitat linkages. Such approaches should ensure adequate cross sectorial consultation between fisheries and environment departments in the countries bordering the South China Sea and Gulf of Thailand. This is particularly important in relation to the designation of Marine Protected Areas and Fisheries Management Areas in order to ensure that areas designated for protection by environment ministries are, whenever possible congruent with critically important areas for fish stocks.

²⁰ China did not participate in the activities of this component consequently did not provide or review data in this section.

²¹ Malaysia did not participate initially in the activities of this component but was involved in the review of species of transboundary importance and future proposed actions in developing the regional refugia system.

In order to develop a mechanism to facilitate this, the Regional Working Group on Fisheries (RWG-F) has been and is collaborating with the Southeast Asian Fisheries Development Center (SEAFDEC) to:

- Establish a system of **fisheries refugia** in the South China Sea and Gulf of Thailand that focuses on the critical links between fish stocks and their habitats.

INFORMATION BOX 1

The RWG-F Definition of Fisheries *Refugia*

Fisheries *refugia* in the context of the UNEP/GEF South China Sea Project are defined as:

“Spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use.”

Fisheries *refugia* should:

NOT be “no take zones”,
Have the objective of sustainable use for the benefit of present and future generations,
Provide for some areas within *refugia* to be permanently closed due to their critical importance [essential contribution] to the life cycle of a species or group of species,
Focus on areas of critical importance in the life cycle of fished species, including spawning, and nursery grounds, or areas of habitat required for the maintenance of broodstock,
Have different characteristics according to their purposes and the species or species groups for which they are established and within which different management measures will apply,
Have management plans.

Management measures that may be applied within fisheries *refugia* may be drawn from the following [non-exhaustive] list:

Exclusion of a fishing method (e.g. light luring, purse seine fishing),
Restricted gears (e.g. mesh size),
Prohibited gears (e.g. push nets, demersal trawls),
Vessel size/engine capacity,
Seasonal closures during critical periods,
Seasonal restrictions (e.g. use of specific gear that may trap larvae),
Limited access and use of rights-based approaches in small-scale fisheries.

The regional fisheries *refugia* initiative addresses the present problems by drawing on fisheries management concepts that are easily understood at the fishing community level, and emphasising sustainable use rather than prohibition. It focuses on building fishing community support for spatial planning approaches to coastal and marine resource management. This activity has been recognised by regional and International fisheries organisations as a unique regional fisheries initiative in that it represents one of the first attempts to develop integrated fisheries and environmental management for regional benefit.

FISHERIES REFUGIA – A UNIQUE RESPONSE TO THE OVER-EXPLOITATION OF FISHERIES

The effective management of fisheries and their habitats in the South China Sea and Gulf of Thailand requires an institutional setting in which collaboration and partnership is fostered and encouraged. For the fisheries sector this requires the establishment of workable mechanisms to effect the integration of fisheries issues into broader initiatives for marine resource and environmental management. Such mechanisms should be aimed at:

- Improving the understanding amongst stakeholders, including *inter alia* fisher folk, scientists, policy-makers, and fisheries managers, of ecosystem and fishery linkages, as a basis for integrated fisheries and habitat management; and
- Building the capacity of fisheries ministries and departments to engage in meaningful dialogue with the environment sector regarding how multiple marine use planning (in whatever form) can best contribute to improving the state of fisheries in areas of the South China Sea and the Gulf of Thailand.

In order to provide regional policy support to this activity, regional guidelines on the use of fisheries *refugia* for capture fisheries management in Southeast Asia were prepared by the RWG-F, and subsequently published as part of the ASEAN-SEAFDEC Regional Guidelines for Responsible Fisheries in Southeast Asia²². Specific resource and institutional objectives for a regional system of fisheries *refugia* have been elaborated by the RWG-F (Tables 19 and 20).

Table 19 A Preliminary Set of Performance Assessment Criteria and Means of Verification for the Resource-related Objectives of a Regional Fisheries *Refugia* Plans.

Resource-Related Objectives	Performance Assessment Criteria	Means of Verification
Longer-Term Objectives		
1. Biomass of commercially important fish (pelagic and demersal) and invertebrate species in the Gulf of Thailand and South China Sea maintained	Biomass trend (multi-year average annual percentage rate of change)	Results of abundance surveys employing relative abundance (CPUE), swept area, acoustic, or egg production methods
2. Average size of commercially important fish (pelagic and demersal) and invertebrate species caught in the Gulf of Thailand and South China Sea maintained or increasing	Average fish size relative to historical average	Results of size-frequency analyses of fish landed at key landing places and in markets
3. Egg production of commercially important fish and invertebrate species in the Gulf of Thailand and South China Sea maintained or increasing	Abundance of eggs and larvae of commercially important species in key spawning areas relative to historical average	Results of surveys of egg and larval fish density in key spawning areas
4. Recruitment of commercially important fish and invertebrate species to fisheries the Gulf of Thailand and South China Sea maintained or increasing	Year class strength relative to historical average	Results of abundance surveys employing relative abundance (CPUE) or swept area methods
Shorter-Term Objectives		
1. Reduced capture of juveniles and pre-recruits of commercially important fish (pelagic and demersal) and invertebrate species, as well as endangered species, in critical fisheries habitats of the Gulf of Thailand and South China Sea	Abundance of juveniles in fishery <i>refugia</i> areas a) Fishing effort dynamics in fishery <i>refugia</i> areas b) Selectivity of fishing operations conducted within juvenile <i>refugia</i> c) Frequency of inappropriate fishing operations in fishery <i>refugia</i> areas d) Volume and size composition of commercially important fish (pelagic and demersal) and invertebrate species landed and traded in main markets	a) Results of fishery dependent and independent surveys b) Interviews of fishers, fishing communities, and traders c) Results of studies of species and size composition conducted within <i>refugia</i> d) Observations/reports of illegal or destructive fishing in fishery <i>refugia</i> areas e) Results of studies of the volume and size of fish landed at main landing places and traded in main market
2. Reduced targeting and capture of commercially important fish (pelagic and demersal) and invertebrate species in spawning condition, and when forming spawning aggregations, in the Gulf of Thailand and South China Sea	a) Fishing effort dynamics in fishery <i>refugia</i> areas b) Selectivity of fishing operations conducted within spawning <i>refugia</i> c) Gonosomatic index (GSI) of commercially important fish (pelagic and demersal) and invertebrate species landed and traded in main markets d) Abundance of eggs and larvae of commercially important species in key spawning areas	a) Interviews of fishers, fishing communities, and traders b) Results of studies of species and size composition of landings during known spawning seasons c) Results of studies of the gonosomatic condition of commercially important species landed and traded in main markets d) Results of surveys of egg and larval fish density in key spawning areas
3. System of fisheries <i>refugia</i> , including both juvenile and spawning <i>refugia</i> , which provides for: a) networks of fisheries <i>refugia</i> across the geographical ranges of individual species, b) networks of fisheries <i>refugia</i> that include both juvenile and spawning <i>refugia</i> , c) fisheries management consistent with the RGRFSEA	Total number/size of juvenile <i>refugia</i> and spawning <i>refugia</i> : a) Number of species for which a network of fisheries <i>refugia</i> has been developed across its geographical range b) Number of fisheries <i>refugia</i> networks that include multiple <i>refugia</i> types c) Number of fisheries <i>refugia</i> for which management systems have been developed	The number and size of fisheries <i>refugia</i> as defined in <i>refugia</i> management plans adopted by national governments a) Description of the species – specific linkages between <i>refugia</i> in management plans for each <i>refugia</i> in a geographical range based network b) Description of the life-cycle – specific linkages between <i>refugia</i> in management plans for each <i>refugia</i> in a life-cycle based network c) Adoption of <i>refugia</i> management plans

²² SEAFDEC, 2006. *Supplementary Guidelines on Co-management using Group User Rights, Fisheries Statistics, Indicators and Fisheries Refugia*. Southeast Asian Fisheries Development Center, Bangkok, Thailand. 84pp.

Table 20 A Preliminary Set of Performance Assessment Criteria and Means of Verification for the Institutional-related Objectives of a Regional System of Fisheries *Refugia*.

Institutional-Related Objectives	Performance Assessment Criteria	Means of Verification
1. Integration of fish life-cycle considerations in fisheries and habitat management in the Gulf of Thailand and South China Sea	Preparation and publication of a management plan for a regional system of fisheries <i>refugia</i> .	Adoption by appropriate regional fora of a management plan for a regional system of fisheries <i>refugia</i> . Management plan to include: a) goals, objectives, target reference points, indicators, and performance measures for each <i>refugia</i> (and <i>refugia</i> network in the system) b) system for reporting on results of analysis of data collected in support of the regional <i>refugia</i> system c) criteria for the identification of new <i>refugia</i> d) research priorities and national commitments of support to the conduct of fisheries research
2. National level commitments to integrate the fisheries <i>refugia</i> concept into fisheries and habitat management	Preparation and publication of National Plans of Action for the Development of the Regional System of Fisheries <i>Refugia</i>	Adoption of plans of action by appropriate Government Ministries.
3. Regionally agreed fisheries <i>refugia</i> science programme, which details: a) Objectives b) Decision-support inputs c) Strategic research partnerships/resourcing d) Research activities	Preparation and publication of a fisheries <i>refugia</i> science programme	Adoption of the programme at a regional expert consultation and then representatives of five SEAFDEC member countries
4. Regionally agreed framework of criteria, target reference points, indicators, and performance measures for identifying and evaluating the performance of <i>refugia</i> that, aim to: a) reduce the capture of juveniles and pre-recruits of commercially important fish, and endangered species, in critical fisheries habitats b) reduce the targeting and capture of commercially important fish in spawning condition, and when forming spawning aggregations c) contribute to the development of species-specific networks of <i>refugia</i> across (i) the geographical range, and (ii) the life-cycle, of individual species.	Preparation of a framework of criteria, target reference points, indicators, and performance measures for identifying and evaluating the performance of fisheries <i>refugia</i>	Adoption of the framework at a regional expert consultation
5. Regional agreement on standardised methodology for the identification and evaluation of important: a) juvenile <i>refugia</i> b) spawning <i>refugia</i> , and c) <i>refugia</i> that can assist in building geographical range and life-cycle based networks of <i>refugia</i>	Preparation and publication of standards for <i>refugia</i> identification and evaluation methods relating to data collection and storage, and analysis	Adoption by appropriate intergovernmental fora of regional standards
6. Regionally agreed guidelines on the use of the fisheries <i>refugia</i> concept in fisheries management.	Regional agreement on guidelines for the use of the fisheries <i>refugia</i> concept	Adoption by appropriate intergovernmental fora of regional guidelines

This initiative is considered important regionally because of the potential fisheries benefits associated with effective fisheries and habitat management at the local level. It is likely that the role of such approaches to fisheries management will become more important in the region, especially in the light of the continuing importance of fisheries to food security, nutritional security, and maintenance of livelihoods. Such approaches may also assist in curbing the effects of trends in regional fisheries relating to over-capacity and over-exploitation, the use of destructive fishing gear and practices, habitat destruction and pollution, and illegal fishing.

OBJECTIVES, TARGETS, REGIONAL ACTIONS AND COST ESTIMATES

The general longer-term objectives of this component of the SAP are to:

- Build the resilience of Southeast Asian fisheries to the effects of high and increasing levels of fishing effort,
- Improve the understanding amongst stakeholders, including fisher folk, scientists, policy-makers, and fisheries managers, of ecosystem and fishery linkages, as a basis for integrated fisheries and ecosystem/habitat management,
- Build the capacity of fisheries departments/ministries to engage in meaningful dialogue with the environment sector regarding the improvement of fisheries and management of interactions between fisheries and critical marine habitats.

The specific targets identified for the fisheries component of the Strategic Action Programme are:

- By 2012 to have established a regional system of a minimum of twenty *refugia* for the management of priority, transboundary, fish stocks and endangered species;
- By 2012 to have prepared and implemented fisheries management systems in the identified *refugia* based on, and consistent with, the ASEAN SEAFDEC Regional Guidelines for Responsible Fisheries in Southeast Asia.

More specifically the planned activities are expected to achieve the following outcomes in addition to the targets specified above:

- Improved integration of habitat and biodiversity conservation considerations in the management of fisheries in the South China Sea and Gulf of Thailand;
- Improved national management of the effects of fishing on critical habitats within fisheries *refugia*; and,
- Enhanced uptake of good practices in integrating fisheries management and biodiversity conservation in the design and implementation of regional and national fisheries management systems, and marine protected areas.

To date 46 known critical spawning and nursery areas for important fisheries species have been identified in the Gulf of Thailand and the South China Sea. Fourteen of these areas have been selected for inclusion in an initial regional system of fisheries *refugia*, and an additional nine sites have been identified as tentative fisheries *refugia* sites. Developing a regional and national level system of *refugia* requires actions at both national and regional level.

The planned regional activities are outlined in Table 21 however it must be recognised that without supporting national investments the regional activities will not be sufficient to meet the targets specified. National level activities will include, but not be limited to the following:

- Evaluate the effectiveness of fisheries management systems.
- Evaluate the status and trends of fisheries resources in relation to catch efforts and availability of resources in defined areas.
- Reduce the use of fishing gear and practices that damage ecologically sensitive areas with the long term aim of removing and replacing them with more environmentally acceptable fishing gear and practices.
- Review compliance with international and regional fisheries agreements and guidelines.
- Promote the application of the Regional Guidelines for Responsible Fisheries in Southeast Asia through workshops, awareness building, translation into national languages and education of people.
- Develop educational and public awareness materials on sustainable fishery practices.
- Implement programmes to provide information on sustainable fishery practices among small and artisanal fishing communities, and commercial fisheries operators as appropriate.
- Train technical fisheries staff in the identification of fish eggs and larvae.
- Design and establish a programme for identifying important spawning and nursery areas.
- Establish *refugia* in areas identified as critical habitats for the life cycle of fisheries resources.
- Establish in selected *refugia* sound management systems, which can be tested to determine if they are leading to sustainable exploitation of resources and reduction of conflicts between groups of fishermen.

Table 21 Proposed Regional Actions for the Fisheries Component of the Regional Strategic Action Programme.

Components	Sub-Components	Regional Activities	ESTIMATED COST (US\$)								
			Basis for estimated Costs	2008	2009	2010	2011	2012	TOTAL		
1. Development of a Regional Network of Fisheries Refugia Sites	1.1 Identification of Fisheries and Critical Habitat Linkages in the South China Sea and Gulf of Thailand	1.1.1 Develop criteria for identifying and delineating the boundaries of critical habitat areas that act as fisheries <i>refugia</i> for regionally important fish stocks, particularly those of transboundary importance	(1 person month x 9,000) + (2 regional meetings x 15,000) = 39,000	39,000						39,000	
		1.1.2 Compile National information on the boundaries of the 14 sites selected for inclusion in the regional system of fisheries <i>refugia</i> , and additional 9 sites identified as tentative <i>refugia</i>	(2 person months x 9,000) + (25 x information collection x 3,000) + (6 NFP co-ordinating x 3,000) = 96,000	96,000							96,000
		1.1.3 Compile a regional GIS database of national information on known fishing grounds, spawning and nursery areas for fishery species of transboundary importance	(3 person months x 9,000) + (1 st regional meeting x 10,000) + (2 nd regional meeting x 15,000) + (1 person month x 3 years (2010-2012) x 9,000 = 79,000	37,000	15,000	9,000	9,000	9,000			79,000
		1.1.4 Establish a database for the regional compilation of National fish egg and larvae data generated from samples collected during SEAFDEC research cruises	(6 person months x 9,000) + (2 * regional meetings x 15,000) = 54,000	24,000	18,000	33,000	9,000				84,000
		1.1.5 Compile maps of fish egg and larvae distribution/abundance using data generated from samples collected during SEAFDEC research cruises	(6 person months x 9,000) = 54,000		9,000	18,000	18,000	9,000			54,000
		1.1.6 Compile regional GIS maps from National level information on the distribution of coastal habitats, and locations of marine protected areas and fisheries management zones	(6 person months x 9,000 (2008)) + (1 regional mtg. x 15,000 (2008)) + (3 person months x 9,000 (2010)) + (1 regional mtg. x 15,000 (2010)) + (1 person month x 9,000 (2012)) + (1 regional mtg. * 15,000 (2011)) = 135,000	69,000			42,000		24,000		135,000
		1.1.7 Develop a modelling system that links known sources and sinks of fish larvae to ocean circulation patterns and nutrient/chlorophyll concentrations in the South China Sea and Gulf of Thailand	(3 person months x 9,000) = 27,000					27,000			27,000
		1.1.8 Convene annual technical meetings to (a) review regional findings and national designations of <i>refugia</i> , and to (b) make recommendations regarding the adoption of national <i>refugia</i> as components of the regional system of fisheries <i>refugia</i>	(5 meetings x 20,000) = 100,000	20,000	20,000	20,000	20,000	20,000	20,000		100,000

Table 21 cont. Proposed Regional Actions for the Fisheries Component of the Regional Strategic Action Programme.

Components	Sub-Components	Regional Activities	ESTIMATED COST (US\$)							
			Basis for estimated Costs	2008	2009	2010	2011	2012	TOTAL	
1. Cont. Development of a Regional Network of Fisheries Refugia Sites	1.2 Improving the Management of Critical Habitats for Fish Stocks of Transboundary Significance	1.2.1 Identify in conjunction with SEAFDEC fisheries <i>refugia</i> that require bilateral, multilateral, and regional management collaboration	(2 person months x 9,000 (2009)) + (1 regional meeting x 15,000 (2009)) + (1 person month x 9,000 (2010) + (1 regional meeting x 15,000 (2010)) = 57,000		33,000	24,000				57,000
		1.2.2 Support and guide National Fisheries Departments in establishing coastal fisheries management systems in priority fisheries <i>refugia</i>	(3 person months x 9,000 x 3 years (2008-2011)) + (6 NFP co-ordinating x 5,000/yr (2009-2010)) + (3 regional meetings x 15,000 (2009-11)) + (National Co-ordination costs) = 213,000 + NC	27,000	72,000	72,000	42,000			213,000
		1.2.3 Select 2 <i>refugia</i> in each country to trial the use of rights-based and co-management approaches to fisheries <i>refugia</i> management	(2 pilot activities x 6 countries x 60,000/activity) = 720,000		180,000	180,000	180,000	180,000		720,000
		1.2.4 Select 1 <i>refugia</i> in each country in which to identify and trial the use of fishing gear and practices that reduce the capture of (a) juveniles and pre-recruits, and (b) fish in spawning condition	(1 pilot activities x 6 countries x 60,000/activity) = 360,000			120,000	120,000	120,000		360,000
		1.2.5 Select 1 site in each country in which to identify and trial approaches to reducing the effects of trawl/push net fishing on seagrass communities	(1 pilot activities x 6 countries x 60,000/activity) = 360,000			120,000	120,000	120,000		360,000
		1.2.6 Develop national plans for improved management of the effects of fishing on critical habitats within fisheries <i>refugia</i>	(1 plan per country x 30,000/plan (including publication and national consultations) = 180,000			60,000	60,000	60,000		180,000
Sub-Total				312,000	347,000	698,000	605,000	542,000	2,504,000	

Table 21 *cont.* Proposed Regional Actions for the Fisheries Component of the Regional Strategic Action Programme.

Components	Sub-Components	Regional Activities	ESTIMATED COST (US\$)						
			Basis for estimated Costs	2008	2009	2010	2011	2012	TOTAL
2. Establishing Training and Public Awareness Programmes for a Regional System of Fisheries Refugia	2.1 Developing Human Resource Capacity for the Identification and Management of Fisheries Refugia	2.1.1 Organise annual regional training workshops on fisheries <i>refugia</i> management	(5 x regional training workshops (21 participants) on the management of fisheries <i>refugia</i> x 45,000) = 225,000	45,000	45,000	45,000	45,000	45,000	225,000
		2.1.2 Organise annual regional training workshops on larval fish identification and fish early life history science	(5 x regional training workshops (21 participants) on fish egg and larvae identification x 50,000) = 250,000	50,000	50,000	50,000	50,000	50,000	250,000
	2.2 Improving Information Management and Dissemination	2.2.1 Establish in conjunction with SEAFDEC an Information and Education Campaign (IEC) for small-scale fishing communities on the critical links between fish stocks and their habitats	(2 person months x 2 yrs (2010&2011) x 9,000) + (2 x regional meetings (2010&2011) x 15,000) + (preparation and publication of local language IEC material * 6 countries * 6000 (2011)) = 102,000			33,000	69,000		102,000
		2.2.2 Generate English language guidelines for translation into local languages on how to empower communities to enforce agreed management rules in fisheries <i>refugia</i>	(2 person months (2010&2011) x 9,000) + (2 x regional meetings (2010&2011) x 15,000) + edition/publication of English language guidelines * 6,000 = 102,000			33,000	39,000		72,000
		2.2.3 Develop indicators to monitor the effectiveness of coastal fisheries management systems established in priority fisheries <i>refugia</i>	(4 person months x 9,000) + (2 x regional meetings (2009&2010) x 15,000) + (1 case study x 6 countries x 6000) = 102,000			33,000	69,000		102,000
		2.2.4 Establish in conjunction with SEAFDEC a regional programme for the compilation of standardized fisheries statistics in support of the identification and management of fisheries <i>refugia</i>	(4 person months x 9,000) + (2 x regional meetings (2009&2010) x 15,000) = 66,000			33,000	33,000		66,000
		2.2.5 Develop the online Fisheries <i>Refugia</i> Information Portal < http://refugia.unepscs.org > as (a) a tool for enhancing regional communication and the sharing of information regarding the development of the regional <i>refugia</i> system, and (b) a regional online education and public awareness centre for the compilation and dissemination of information regarding the effects of fishing on coastal habitats and biodiversity	(2 person months x 9,000 x 5 years) + (website hosting and back-up x 1,000/yr) = 90,000	19,000	19,000	19,000	19,000	19,000	90,000
	Sub-Total			114,000	114,000	246,000	324,000	114,000	907,000

Table 21 *cont.* Proposed Regional Actions for the Fisheries Component of the Regional Strategic Action Programme.

Components	Sub-Components	Regional Activities	ESTIMATED COST (US\$)						
			Basis for estimated Costs	2008	2009	2010	2011	2012	TOTAL
3. Development of Regional Activities to Assist in the Management of Fisheries <i>Refugia</i> at the National Level	3.1 Promotion of Regional Fisheries Management Arrangements	3.1.1 Promote in appropriate regional fora and media the role of the regional system of fisheries <i>refugia</i> in harmonizing fisheries and environmental management in order to achieve sustainable fisheries in the South China Sea and Gulf of Thailand	(Representation in 5 regional meetings/year x 2000/meeting x 5 years) + (Preparation of 4 popular articles/year x 1000 x 5 years) = 90,000	14,000	14,000	14,000	14,000	14,000	90,000
		3.1.2 Establish in conjunction with SEAFDEC a regional collaborative network of experts to guide the scientific, policy, and legal arrangements for the management of fisheries <i>refugia</i> in National waters	(2 person months x 9,000 (2008)) + (1 regional meeting x 30,000 (2008)) + (2 person months x 9,000 (2009) + (3 regional meeting x 15,000 (2009-2012)) = 141,000	48,000	48,000	15,000	15,000	15,000	141,000
		3.1.3 Plan and establish in conjunction with SEAFDEC joint fisheries management frameworks between and among countries which share the use of critical habitat areas for fish stocks of transboundary importance and rare and endangered species	(4 person months x 9,000) + (3 x regional meetings (2009-2011) x 30,000) + (6 case studies x 10,000) = 186,000			48,000	78,000	60,000	186,000
	3.2 Generation and Uptake of Good Coastal Fisheries Management Practices at the National Level	3.2.1 Generate English language guidelines on managing the effects of fishing on coastal habitats and biodiversity for translation into local languages	(2 person months (2010&2011) x 9,000) + (2 x regional meetings (2010&1011) x 15,000) + edition/publication of English language guidelines * 6,000 102,000			33,000	39,000		72,000
		3.2.2 Develop in conjunction with SEAFDEC cost estimates for a programme of action for future improvements to the management of the effects of fishing on critical habitats within fisheries <i>refugia</i> and on biodiversity (2013-2017)	(6 person months x 9,000) + (3 x regional meetings (2009-2011) x 20,000) = 122,000			38,000	38,000	38,000	122,000
Sub-Total			62,000	62,000	148,000	184,000	127,000	611,000	
TOTAL			488,000	523,000	1,092,000	1,113,000	783,000	4,022,000	

REGIONAL ACTIONS TO SUPPORT MANAGEMENT OF LAND-BASED POLLUTION LOADINGS IN THE SOUTH CHINA SEA MARINE BASIN

The ultimate causes of land-based pollution in the South China Sea include increases in coastal population density, increased food production in the agricultural sector, and increasing industrialisation. The proximate causes include inadequate waste-water treatment whilst intermediate causes include inadequate standards and lack of capacity to monitor, regulate and control pollution discharge. A major contributing factor is the lack of financial resources to invest in actions addressing the causes at all levels. In analysing national information it was apparent that sources of waste ranked as follows: domestic, agricultural, industrial, poor land-use practices, and urban solid waste.

Excessive nutrient loads and suspended solids are among the most common problems in coastal waters of countries bordering the South China Sea. High concentrations of suspended solids largely result from poor land-use practices, including logging activities and conversion of forests in upland areas. On the other hand, high nutrient loads mainly result from untreated domestic wastes that are directly discharged into the receiving water bodies. Both contaminants impact the ecological functioning of coastal ecosystems. In addition, heavy metals such mercury (Hg), Arsenic (As) and lead (Pb) have tended to increase in both biota and sediments in coastal waters of the South China Sea during the last decade. These heavy metals have potential negative impact on the health of marine living resources and human who consume seafood products.

A total of 17 pollution hot spots were characterised using the ranking system agreed at the 2nd Meeting of the Regional Working Group (Figure 1). Present pollutant and contaminant discharges may have transboundary consequences in some of the identified “hot spots” and sensitive areas in terms of increasing the rate of habitat degradation in those coastal ecosystems.

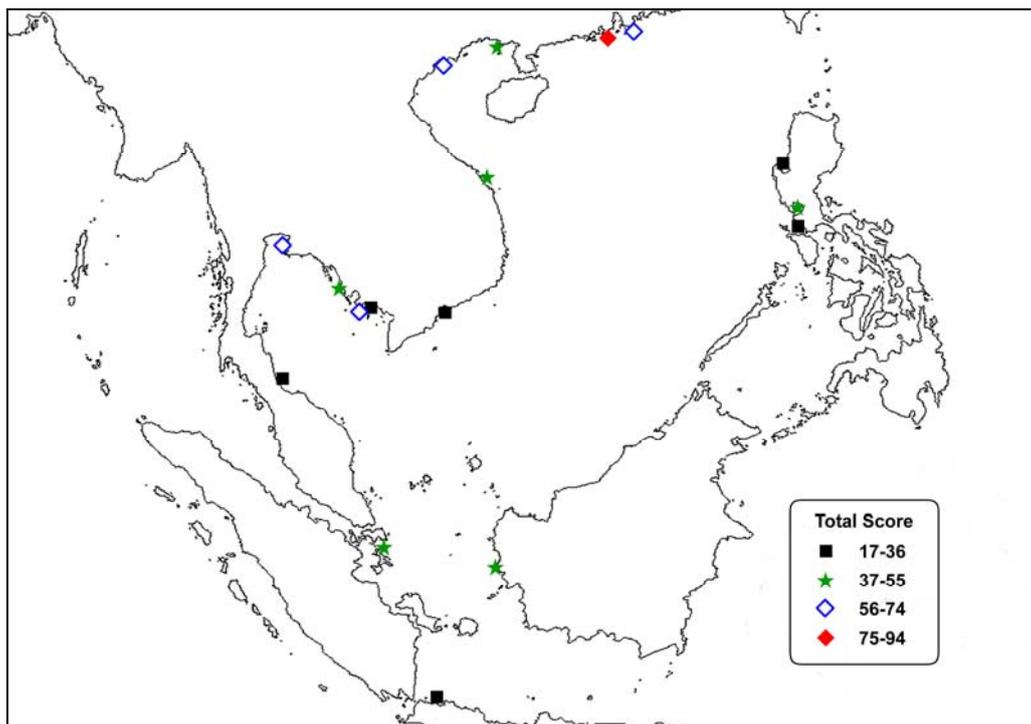


Figure 1 Pollution hotspots in the South China Sea characterised and ranked on the basis of a combination of ASEAN and China contaminant criteria adopted for the purpose in the project.

The contents of the National Action Plans indicate that the main contaminants include nutrients, suspended solids, and heavy metals in sediments and biota, derived from sewage, agricultural runoff, shrimp farming and industrial sources resulting in impacts such as eutrophication, sedimentation, living resource and ecosystem degradation and potential impacts on human health and food quality of export products.

CURRENT MANAGEMENT OF LAND-BASED POLLUTION AND CHALLENGES TO FUTURE MANAGEMENT

Most countries have environmental laws or acts under which environmental standards are in place with mechanisms for approved enforcement procedures to ensure compliance. In order to meet with standards and regulations stipulated under the law, structural facilities like waste water treatment plants are one way to treat waste water before discharging it to the environment. In addition to enforcement of existing laws and regulations only and building treatment facilities, environment planning, a part of the development process may prevent and mitigate potential impacts. In line with this, most countries in the region have Environmental Impact Assessment (EIA) prior to development. Countries are also working on environmental awareness, communication and education to enhance public understanding of pollution problem and practices at the individual level that may reduce contaminant loads to the environment. In addition, monitoring of pollution sites and water quality is currently undertaken by all countries while some countries include monitoring programmes for sediment quality and bio-parameters as well.

Although these management practices are in place in most countries, there are many problems in their implementation. Some countries lack the capacity to enforce the Environmental Acts due to limited budgets and lack of collaboration with waste producers. The waste producers, are not equipped with the necessary treatment facilities or have limited facilities resulting in low levels of compliance with regard to the standards stipulated under the law. Although environment assessment is incorporated into development planning in most countries, the effectiveness of the plans is questionable. Monitoring programmes for some countries although extensive as regards the number of sites, and the data collected, are not used effectively in pollution management. The data is often only used for the publication and dissemination of annual and environment quality reports. In some countries, the data obtained from the monitoring programmes are not reliable for decision making.

The following regional challenges were identified from the available National Action Plans and discussions of the Regional Working Group:

- High population pressure and industrialization causing increased contaminant load;
- Lack of treatment facilities;
- Lack of cooperation and coordination among related sectors at the national level and weak linkage between central and lower levels of the governments;
- Lack of appropriate legislation and weak law enforcement;
- Low public awareness and lack of (responsible) committed of citizens;
- Lack of government commitment in balancing economic growth and environmental protection and low priority given to environment protection;
- Lack of research and monitoring resources (man power, facilities);
- Lack of regionally comparable monitoring and analytical methodology; and
- Lack of criteria for sediment quality.

GOAL AND TARGETS

The main goal of the land-based pollution component is to foster regional co-operation in the identification of sensitive ecosystems, land-based contamination problems, evaluation of their significance and development of standards for national level adoption within a regional context in order to develop an appropriate precautionary approach to discharges to the South China Sea marine basin. The targets for the land-based pollution component are to set and periodically review region-wide water quality standards and water quality objectives which will assist in maintaining health of the coastal ecosystems. The specific targets for Land-based Pollution management are:

1. By the year 2012, estimate total contaminant loading to the South China Sea.
2. By the year 2012, agree and adopt regional criteria for contaminants in sediment and biota.
3. By the year 2012, characterise and prioritise all hot spots surrounding the South China Sea.
4. By the year 2012, review and prepare recommendations for application in amending national/provincial, legislation/regulations in support of all Land-based Pollution targets of the SAP.
5. By the year 2017, to meet ASEAN seawater quality (14 parameters) criteria (except pollutants from scientifically identified natural sources, if any) for:
 - 90% of monitoring stations in the 17 hot spots characterised by the RWG-LbP between 2002 – 2004;

- 80% of other monitoring stations (more than 400 at present) in coastal waters of the South China Sea.

The present monitoring stations and pollution hot spots in the participating countries, and potential targets to be included in the SAP are presented in Table 22.

Table 22 Monitoring Stations and Pollution Hot Spots in the Participating Countries, and Potential Targets to be Included in the SAP.

	Cambodia	China	Indonesia	Malaysia	Philippines	Thailand	Viet Nam
Monitoring stations	PRESENT						
Water	8	102	100	128	9 (Manila Bay)	170	22
Sediment	3	>9	n/a	n/a	15 (Manila Bay)	50	22
Biota	3	No routine monitoring	n/a	n/a	3	15 (fish/shellfish)	22
Hot Spots	3	3	3	n/a	3	2	3
TARGETS 2012							
Total contaminant loads to SCS be estimated	All countries						
Criteria for contaminants in sediment and biota be adopted in the region	All countries						
All hot spots in SCS Sea be characterised and prioritised	All countries						
National legislation in support of targets be reviewed and amended	All countries						
TARGETS 2017							
90% of hot spots meet water quality criteria	3	3	3	n/a	3	2	3
80% of water monitoring stns meet water quality criteria	6	80	80	104	7	136	17

n/a = not available.

REGIONAL ACTIONS AND COST ESTIMATES

The proposed regional activities to promote sustainable management of Land-based Pollution are categorised into three main components and together with the cost estimates are presented in Table 23.

COMPONENT 1. BUILDING CAPACITY TO ENSURE SUSTAINABLE USE OF COASTAL WATERS

Activities under the component are arranged in two sub-components and are designed to improve mechanisms for information exchange and support the development, improvement and dissemination of regional public awareness and educational materials.

COMPONENT 2. ENHANCE POLLUTION CONTROL AND MANAGEMENT

This component focuses on preparation of marine environment quality guidelines and tools for dissemination and adoption in the region; and the development of common methodologies that will generate comparable data among participating countries.

COMPONENT 3. INSTITUTIONAL ARRANGEMENTS AND COORDINATION

The purpose of activities under this component is to support integration of regional science with policy making in the management of Land-based Pollution and to enhance international and regional cooperation.

Table 23 Proposed Regional Actions and cost estimates in support of the management of Land-based Pollution.

Components, Sub-component and Actions	Description	Cost Estimation (USD)						
		2008	2009	2010	2011	2012	Total	
Component 1 - Building Capacity to Ensure Sustainable Use of Coastal Waters								
Sub-component 1.1 Mechanisms for information exchange								
1.1.1	Conduct workshop/conferences to review and to transfer clean technologies for cost-effective waste management in the region	2 workshops, 3 days * 21pers.; Consultancy, 1 pers. * 1 month * 2times; Printing and distribution, 210 copies, 2 times		31,680		31,680		63,360
1.1.2	Conduct workshops for exchange and adoption of existing successful management models developed by the countries bordering the South China Sea	2 workshops, 3 days*21pers.; Consultancy, 1 pers. * 1 month * 2times, Printing and distribution, 210 copies, 2 times		31,680		31,680		63,360
1.1.3	Conduct regional workshops to share experiences and technologies in establishing integrated waste treatment facilities	1 workshop, 3 days * 35 pers.; Consultancy, 1 pers. * 1 month			41,550			41,550
1.1.4	Organise seminar/workshops for sharing experiences in law enforcement and cross-cutting issues related to land-based pollution control.	1 workshop, 3days * 35pers.; Consultancy, 1 per. * 1 month		41,550				41,550
1.1.5	Organise seminar/workshops for sharing and dissemination of experiences and lessons learned on community participation/empowerment in managing Land-based Pollution	2 seminars, 3days * 35 pers.; Consultancy, 1 per. * 1 month * 2 times			41,550		41,550	83,100
Sub-component 1.2 Development, Improvement, and Dissemination of Awareness Materials								
1.2.1	Identify and engage non-government organisations to encourage community participation on marine pollution awareness/advocacy	1 seminar, 3days* 21pers. * 310; Consultancy, 1 per. * 1 month		28,530				28,530
1.2.2	Develop public awareness materials for different target groups (3 video sets, 3 flyers, 3 types brochures & 1 type of poster for use at the national level)	Consultancy for designation & material preparation, 3pers.* 1 month; Support for participating countries in printing and distribution of materials		21,000	55,515			76,515
1.2.3	Develop programmes on Land-based Pollution for journalists and broadcasters for dissemination	Consultancy for review & preparation of materials, 2 pers. 1 month; Seminar, 2days * 35pers.		37,700				37,700
Component 2 - Enhance Pollution Control and Management								
Sub-component 2.1 Develop marine environmental quality guidelines and tools for dissemination and adoption in the region								
2.1.1	Develop guidelines or criteria for sediment and biological quality for the region (7 parameters: Hg, Cd, Pb, Cu, Cr, As, Zn)	Consultancy, 2 * 8month; 1st regional workshop/training, 5days, 6pers*7countries; National workshops, 3 days*7 countries, 8000USD/countries;Sediment toxicity testing, 7 parameters * 41,000USD/3 species; 2nd regional workshop/training, 5days, 6pers*7countries; Printing and distribution, 210 copies		300,600	179,500	104,250	36,000	620,350
2.1.2	Develop guidelines for spatial planning of coastal land-use and marine zoning	Consultancy, 1 per. * 4 months; Workshop, 3days, 21pers.; Printing and distribution, 210 copies			58,680			58,680
2.1.3	Harmonize Standard Operating Procedures (SOPs) for pollution control and management	Consultancy, 1 per. * 3 months; Workshop, 3days, 21pers.		46,530				46,530
2.1.4	Review and synthesise EIA practices from the countries bordering the South China Sea	Consultancy, 1 per. * 2 months; Workshop, 3days, 21pers.		37,530				37,530
2.1.5	Transfer knowledge on simple waste treatment techniques (man-made wetlands and communal septic tanks) for small scale management of pollution.	Study tour for local officials from 6 countries to Batam (2 sites, 2days, 2pers.)		14,880				14,880

Table 23 cont. Proposed Regional Actions and cost estimates in support of the management of Land-based Pollution.

Components, Sub-component and Actions	Description	Cost Estimation (USD)					Total	
		2008	2009	2010	2011	2012		
Sub-component 2.2 Develop common methodologies that will generate comparable data among participating countries								
2.2.1	Select and adopt key water quality parameters (among the 14 - DO, NO ₃ , NO ₂ , PO ₄ , NH ₃ , FCB, Hg, Cd, Pb, Cu, Cr, As, Zn, Phenol) to optimise monitoring programmes in the region	Consultancy, 1 per. * 1 month	9,000					9,000
2.2.2	Estimate total contaminant loading and carrying capacity of the South China Sea basin using quantitative modelling and GIS (7heavy metals)	Consultancy, 1 per. * 12 months; 2 workshop, 3days, 21pers.	73,530	73,530				147,060
Component 3 - Policy, and Institutional Arrangements and Coordination								
Sub-component 3.1 Integration of Research Programme with Management and Policy Making								
3.1.1	Review of marine sediment and biota quality guideline/criteria for possible adoption in the region	Meeting of stakeholders, 2 days * 21pers.				8,680		8,680
3.1.2	Review, synthesis and dissemination of community based practices in management of wastes from aquaculture and settlement	Meeting of stakeholders, 2 days * 21pers.; Workshop, 3days, 21pers.; Printing and distribution, 210 copies		35,700				35,700
3.1.3	Creation of award programme for local governments for best practices in pollution management every two years	7 awards* 2 times* 2000USD; 2 ceremonies, 1day, 21pers.		20,510		20,510		41,020
3.1.4	Update and maintain roster of experts that can review and improve legislation as required	Free of charge						
3.1.5	Periodic (each five year) evaluation of SAP and NAPs implementation to be conducted by independent experts	Consultancy, 2 * 1 month				18,000		18,000
Sub-component 3.2 International and Regional Cooperation								
3.2.1	Establishment of Regional Land-based Pollution Funding mechanism	2 days' workshop of Int'l organisations, donors, government, NGOs (7 countries * 2pers.)	8,680	8,680				
3.2.2	Establishment of institutional network for exchange of information and technical support.	Free of charge			x			
3.2.3	Maintenance of coordinating framework developed by the SCS Project to ensure SAP implementation	Annual meetings, 3 days, 10pers., 4 years	9,300	9,300	9,300	9,300		37,200
3.2.4	Organisation of a forum for cooperation between and among national and international agencies/ institutions such as GPA LBA, IMO, IOC, ASEAN, COBSEA	Cost for participants from developing countries, 7 countries* 3 pers.*2 days; Administrative cost		17,670				17,670
Total:			8,680	683,510	533,505	176,910	134,040	1,536,645

REGIONAL ECONOMIC VALUES AND COST/BENEFIT ANALYSIS OF SAP ACTIONS

ECONOMIC VALUATION

Today's society uses and is heavily dependent on the environment as a source of a range of services and resources, that is, natural capital. At the same time, society uses (or abuses) and depends heavily upon the environment as a "sink" or repository for its pollution and waste. The source and sink services are in scarce supply and are continually being degraded and limited by economic activities. This requires the adoption of more conservative patterns of use that will increase the base of environmental assets over time, which is related to sustainability of the environments capacity to provide continued goods and services.

Economic valuation is defined as the attempt to assign quantitative or monetary values to the goods and services provided by environmental resources, whether or not market prices are available to assist in the process (Barbier²³ and Aylward, 1996; Bateman²⁴ *et al.*, 2002). The National Research Council²⁵ (1995) defines economic valuation as an attempt to provide an empirical account of the value of the services and amenities or of the benefits and costs of proposed action (project or policies) that would modify the flow of services and amenities. Both definitions are in agreement regarding the quantification of goods and services that provide information about the environmental resources.

Valuation forms a key exercise in economic analysis and provides important information for the sustainable use of any habitat. The basic aim of valuation is to determine people's preferences – how much they are willing to pay for, and how much better or worse off they would consider themselves to be as a result of changes in the supply of different goods and services. Valuation provides a means of quantifying the benefits that people receive from habitats, the costs associated with their loss, and the relative profitability of land and resource uses which are compatible with habitat conservation *vis-à-vis* those economic activities that contribute to habitat degradation. Valuation helps to predict and understand the consequences of economic decisions and economic activities which impact on the integrity and status of habitats.

Valuation in the context of habitat management is generally used to indicate the overall economic efficiency of the various competing uses of habitats and resources. That is, the underlying assumption is that habitat resources should be allocated to those uses that yield an overall net gain to society, as measured through valuation in terms of the economic benefits of each use, less its' costs. However, the valuation should be based on reasonably well-founded methodology and speculative assumptions will not contribute to decision-making (Munasinghe, 1995²⁶).

"Valuing" an ecosystem is essentially valuing the characteristics of a system. Costanza²⁷ *et al.* (1997) have made a comprehensive list of ecosystem functions and services and defined ecosystem services as "flows of materials, energy and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare".

The concept of Total Economic Value (TEV) provides a framework for valuing natural systems and is used to identify and estimate the monetary value of all economic benefits that a society derives from a particular ecosystem. In some countries this method has been used to improve forest policy, planning, and management decisions by accounting for all short- and long-term benefits to society from forests, including alternative options. TEV accounts for a wide variety of market and non-market functions and services provided by the habitat.

²³ Barbier, E.B. and Aylward, B. (1996). *Capturing the pharmaceutical value of biodiversity in a developing country. Environmental and Resource Economics.* (8), pp.157-181.

²⁴ Bateman, I.J., Carson, R.T., Day, B., Haneman, M., Hanley, N., Hett, T., Lee, M.J., Loomes, G., Mourato, S., Ozdemiroghu, E., Pearce, D.W., Sugden, R., and Swanson, J. (2002). *Economic valuation with stated preferences techniques - A manual.* Cheltenham, UK: Edward Elgar.

²⁵ National Research Council. (1995). *Wetlands characteristics and boundaries.* National Academy Press, Washington D.C.

²⁶ Munasinghe, M. (1995). *Applicability of techniques of cost-benefit analysis to climate change.* In *global climate change, economic and policy issues.* Edited by Mohan Munasinghe. World Bank Environment Paper Number 12. The World Bank, Washington D.C.

²⁷ Costanza, R., d'Arge, R. de Groot, R., Farber, S., Grasso, M., Hannon, B. Limburg, K., Naeem, S., O'Neill, R.B., Paruelo, J., Raskin, R.G., Sutton, P. and van den Belt, M. (1997). *The Value of the world's ecosystem services and natural capital Nature* 387 (6630) 253-260.

The Regional Task Force on Economic Valuation (RTF-E) developed a procedure and related methods to derive regional values of the goods and services from coastal habitats bordering the South China Sea. Values derived at sites in any particular year are standardised using 2005 as the base year. The Consumer Price Index (CPI) for 2005 in each country is used as the basis for conversion of the data for other years and all nominal values have been converted to real values using the CPI. This conversion is effected using the following equation:

In local currency

$$\text{STANDARD VALUE 2005 (SV}_{2005}) = \frac{(\text{RAW VALUE DATA} * \text{CPI OF 2005})}{\text{CPI YEAR OF VALUATION}}$$

For comparability all standard values are converted into US dollars as follows:

In US dollars

$$\text{STANDARD US\$ VALUE 2005 (}^{\text{US\$}}\text{SV}_{2005}) = (\text{SV}_{2005}) * (\text{US DOLLAR EXCHANGE RATE FOR 2005})$$

At the national level, where several differing values for the same resource or service are available from one country, a weighted mean national value has been derived based on the economic values related to the stock at each location, using the following equation:

$$\text{WEIGHTED MEAN NATIONAL VALUE (}^{\text{US\$}}\text{MV}_{2005}) = \frac{\sum (^{\text{US\$}}\text{SV}_{i,2005} * \text{S}_i)}{\sum (\text{S}_i)}$$

where $^{\text{US\$}}\text{SV}_{i,2005}$ = Standard US\$ Value of 2005 at Location i
 S_i = Stock at location i
 i = 1..... N
 N = Number of values (locations) from the country concerned.

The total economic value in one country is thus the product of the stocks and the weighted mean national value, i.e.,

$$\text{TEV} = \sum (\text{S}_i) * ^{\text{US\$}}\text{MV}_{2005}$$

The regional total economic value is derived in a similar manner to the weighted mean national value²⁸ and in instances where the volume (or weight) of the total stock is not available for all countries then a surrogate, namely the area of the habitat in each country, has been used to weight the mean national values in the following equation:

Weighted Mean Regional Value of Resource or Service A_1 is:

$$\text{R}_V\text{A}_1^{-\text{Kg}} = \frac{[(\text{S}_{\text{Ca}} * \text{MV}_{\text{Ca}}) + (\text{S}_{\text{Chi}} * \text{MV}_{\text{Chi}}) + (\text{S}_{\text{In}} * \text{MV}_{\text{In}}) + (\text{S}_{\text{Ma}} * \text{MV}_{\text{Ma}}) + (\text{S}_{\text{Ph}} * \text{MV}_{\text{Ph}}) + (\text{S}_{\text{Th}} * \text{MV}_{\text{Th}}) + (\text{S}_{\text{Vi}} * \text{MV}_{\text{Vi}})]}{(\text{S}_{\text{Ca}} + \text{S}_{\text{Chi}} + \text{S}_{\text{In}} + \text{S}_{\text{Ma}} + \text{S}_{\text{Ph}} + \text{S}_{\text{Th}} + \text{S}_{\text{Vi}})}$$

Where **S** = The Stock
MV = Weighted Mean National Value for countries (in US\$):
 Ca = Cambodia; Chi = China; In = Indonesia; Ma = Malaysia; Ph = Philippines;
 Th = Thailand; Vi = Viet Nam.

Thus, the regional total economic value of the stock of the resource is measured by the product of the total stock with the weighted mean regional value i.e.,

$$(\text{S}_{\text{Ca}} + \text{S}_{\text{Chi}} + \text{S}_{\text{In}} + \text{S}_{\text{Ma}} + \text{S}_{\text{Ph}} + \text{S}_{\text{Th}} + \text{S}_{\text{Vi}}) * \text{R}_V\text{A}_1^{-\text{Kg}}$$

²⁸ UNEP/GEF/SCS/RTF-E.5/6 "Derivation of Regional Values of the Goods and Services from Coastal Habitats".

In deriving the regional total economic values the following items should be included in the guidelines for valuation by resource categories for each ecosystem:

1. Value of Resource i per hectare, $i = 1 \dots n$ at site j [\$/ha]
2. Total Value of Resource i for the country: $\sum [1 \times \text{acreage at site } j]$ over all sites [\\$]
3. Calculate the Weighted Value of the Resource i for the country per hectare: $[2 \div \text{total country acreage}]$ [\$/ha]
4. Total Value of Resource i for the region: $\sum [2]$ over all countries [\\$]
5. Calculate the Weighted Regional Value of the Resource i per hectare: $[4 \div \text{total regional acreage}]$ [\$/ha]
6. Calculate the Regional Total Value of all resources: $\sum [4]$ over all resources [\\$]
7. Calculate the Weighted Regional Total Value per hectare: $[6 \div \text{total acreage for the region}]$ [\$/ha]

The regional total economic values are used in the cost benefit analysis of actions versus non-action as contained in the revised SAP.

COST AND BENEFIT ANALYSIS

Financial analysis is usually the first step in assessing the monetary costs and benefits of projects or management options. A financial analysis is taken from the perspective of private investors who are typically interested in the actual money costs and returns on their projects. It therefore measures private profits accruing to households or firms based on market prices. While financial analysis can be invaluable in illustrating the motivations of the private sector, it does not ask whether market price is the "proper" price and reflects true economic value.

An economic analysis goes beyond a financial analysis to perceive a project's economic costs and benefits on the welfare of society. It examines all of a project's impacts, including its environmental consequences. An economic analysis usually requires various adjustments to financial prices to correct for market imperfections, policy distortions and distributional inequities.

The economic cost-benefit analysis is said to provide a better framework for assessing the holistic profitability of project alternatives by incorporating the environmental costs and benefits of use and non-use activities. This economic analysis approach departs from the financial analysis because the latter only accounts for direct transacted cost and benefit elements. The financial values are inadequate to capture all environmental effects and are inadequate representations of the welfare of society. Environmental effects increase or decrease welfare even though they may not be traded in the market with monetary prices. In financial analysis, environmental effects are considered only when they directly affect revenue streams or cost outlays of the project concerned.

Cost-Benefit Analysis of Action Versus Non-action in the Strategic Action Programme

The benefits derived from action as outlined in the SAP reflect in reality the anticipated change (decline) in the rate of loss or degradation of the habitat. Each regional working group provided up-to-date estimates of the rates of loss and degradation of important coastal habitats in order that the costs of non-action could be estimated. These are then compared with the costs of the actions proposed in the SAP and a measure of the cost effectiveness of acting derived. The data and information used include:

- 1) Time series data of the rates of habitat loss and degradation;
- 2) Estimated rates of loss and degradation in high-pressure (non-action scenario) and low-pressured scenarios (action scenario); and
- 3) Investments and costs needed to undertake the actions and achieve the targets included in the SAP.

Tables in the preceding chapters of the SAP present a summary of the costs of regional actions proposed by the regional working groups for inclusion in the SAP. It should be noted that in the case of the wetlands some attempt was made to cost national level actions and these have been discounted from the present analysis.

In broad terms the total costs over five years are quite modest when compared with the value of annual production from each habitat:

- Mangroves 2.99 million US dollars compared with 5.1 billion US dollars of annual production;
- Coral reefs 1.67 million US dollars compared with 1.1 billion US dollars of annual production;
- Seagrass 1.58 million US dollars compared with 87.2 million US dollars of annual production;
- Wetlands 1.82 million US dollars compared with 1.2 billion dollars of annual production.

Costs and Benefits of Mangrove Interventions

The value of the annual production of goods and services by mangrove habitats bordering the South China Sea has been established as US\$2,872.25 per hectare, giving a total value of US\$5,196,296,711 per annum.

The targets in the SAP are of four types:

1. Areas to be transferred from various categories of use to protected area status.
2. Areas to be transferred from status defined as "conversion" to sustainable use.
3. Areas in which management is to be improved.
4. Areas of deforested mangrove land to be replanted.
5. Areas of degraded mangrove to be subject to enrichment planting to increase the species diversity.

1. In the first case the rate of mangrove loss in the region over the preceding decade of 1.61% per annum is used to ascertain the proportion of the mangrove currently not accorded protection status that will be saved by achieving this target. It is further assumed that the proportion accorded protection status is equally spread across the first five years of the SAP implementation. The cumulative benefit is therefore the value of the annual production saved through such a change in designated status.

2. In the second case it is assumed that mangrove forest designated for conversion to alternate uses will have a change in designation to sustainable use (including sustainable timber extraction) and that such change in designation will impact areas in equal proportion over the first five years of the SAP implementation. The cumulative benefit is therefore the value of the annual production saved.

3. In the third case a modest 5% per annum improvement in annual production is projected over the first five years of the SAP implementation.

4. In the case of areas of degraded mangrove forest that are replanted, no cumulative benefits are anticipated over the first four years and the first year in which a return is likely to be seen is in year five. In this year the annual production of the area planted in the first year is assumed to reach one sixth of the Total Economic Value. This proportion was decided upon based on the harvest cycle of mangroves under sustainable forestry management, namely a thirty year rotation in the only known example of sustainable forest management of mangroves at Matang, Malaysia.

5. As in the case of the fourth target it is assumed that no benefit accrues until the final year of the first phase of SAP implementation. Benefit is calculated in a similar manner to that calculated for the fourth target.

The costs of the actions contained in the SAP were determined by the Regional Working Group for mangroves on the basis of experience in implementing the first phase of the UNEP/GEF project entitled "*Reversing Environmental Degradation trends in the South china Sea and Gulf of Thailand*" and are expressed as 2006 costs.

It is important to recognise that the actions costed in the Strategic Action Programme are only those actions undertaken at a regional level to ensure co-ordination of national actions and the sharing of experience and expertise across national boundaries. The Regional Task Force on Economic Valuation is of the opinion that national level management costs might be expected to reach between 15 and 20% and that correspondingly regional management and administrative costs might be

expected to reach a maximum of 1% of the total value of the interventions. Using these figures it is possible to extrapolate that the costs of national level actions might reach as much 300 million US\$ if the targets of the regional SAP are to be met.

Table 24 presents the costs and benefits with respect to mangroves, over the first five years of SAP implementation, whilst Table 25 presents a summary of the costs and benefits. From Table 25 it can be seen that the costs represent 0.2% of the estimated net benefits amortised over the five years.

Table 24 Summary of the Regional Costs and Benefits of Achieving the Mangrove Targets Defined in the Strategic Action Programme.

YEARS	Values in US\$ ha ⁻¹	2008	2009	2010	2011	2012	TOTAL
Target 1 Area of mangrove saved Benefit increased i.e. rate of loss avoided – 1.61 % per annum		185	369	554	739	924	
i. Value of Mangrove Goods	1,585	292,748	585,496	878,243	1,170,991	1,463,739	
ii. Value of Mangrove Services	1,287	237,764	475,527	713,291	951,055	1,188,819	
iii. Total	2,872	530,512	1,061,023	1,591,535	2,122,046	2,652,558	
Target 2 Non-conversion of mangrove, sustainable use		33,320	66,640	99,960	133,280	166,600	
i. Mangrove goods	1,585	52,811,200	105,622,401	158,433,601	211,244,802	264,056,002	
ii. Mangrove services	1,287	42,892,170	85,784,339	128,676,509	171,568,678	214,460,848	
iii. Total	2,872	95,703,370	191,406,740	287,110,110	382,813,480	478,516,850	
Target 3. Improved management relating to sustainable use	0	120,554	241,109	361,663	482,218	602,772	
i. Mangrove goods	1,585	9,553,755	19,107,511	28,661,266	38,215,021	47,768,777	
ii. Mangrove services	1,287	7,759,363	15,518,727	23,278,090	31,037,454	38,796,817	
iii. Total	2,872	17,313,119	34,626,238	51,939,356	69,252,475	86,565,594	
Target 4. Replanting of deforested mangrove land		4,200	8,400	12,600	16,800	21,000	
i. Mangrove goods	1,585	0	0	0	0	1,109,479	
ii. Mangrove services	1,287	0	0	0	0	901,096	
iii. Total	2,872	0	0	0	0	2,010,575	
Target 5. Enrichment planting to increase mangrove biodiversity		2,240	4,480	6,720	8,960	11,200	
i. Mangrove goods	1,585	0	0	0	0	591,722	
ii. Mangrove services	1,287	0	0	0	0	480,585	
iii. Total	2,872	0	0	0	0	1,072,307	
Total for goods	1,585	62,657,704	125,315,407	187,973,111	250,630,814	314,989,719	
total for services	1,287	50,889,297	101,778,593	152,667,890	203,557,187	255,828,164	
Grand total	2,872	113,547,000	227,094,001	340,641,001	454,188,001	570,817,883	1,706,287,886
SUMMARY							
COSTS at 2006 prices		765,000	827,600	655,000	710,500	369,500	
Discount factor NPV for 2006 i=4%		0.9246	0.8890	0.8548	0.8219	0.7903	
Costs 2006 value		707,286	735,733	559,897	583,979	292,021	2,878,916
Compound factor NPV for 2007 i=4%		1.0400	1.0400	1.0400	1.0400	1.0400	
Costs 2007 values		735,577	765,163	582,293	607,338	303,702	2,994,073
BENEFITS at 2005 prices		113,547,000	227,094,001	340,641,001	454,188,001	570,817,883	
Discount factor for NPV 2005 i=4%		0.8890	0.8548	0.8219	0.7903	0.7599	
Benefits 2005 values		100,942,870	194,120,903	279,982,072	358,951,375	433,774,677	
Compound factor for NPV 2007 i=4%		1.0816	1.0816	1.0816	1.0816	1.0816	
Benefits 2007 values		109,179,808	209,961,169	302,828,609	388,241,807	469,170,691	1,479,382,085
Net Benefits		108,444,231	209,196,006	302,246,317	387,634,469	468,866,989	1,476,388,012

Table 25 Summary of Benefits in Terms of Cumulative National Production over the First Five Years of SAP Implementation and Costs of Executing the Mangrove Component of the Strategic Action Programme.

Total benefit	1,479,382,085
Total cost	2,994,073
Total Net benefit	1,476,388,012
Benefit-Cost ratio	494
Costs as percentage of benefits	0.2 %

Costs and Benefits of Coral Reef Interventions

The total area of coral reefs bordering the South China Sea is estimated at 750,307 hectares of which the present area under management at 82 identified locations is around 102,105 hectares. The total value of annual production is estimated at 1,157,393,566 US dollars.

The targets for the coral reef component of the Strategic Action Programme are of two types:

- 1 Placing additional identified areas under sustainable management regimes bringing the total management area to 152,057 hectares.
- 2 At a regional scale reducing the decadal rate of loss of live coral cover from 16 to 5%.

In the case of the first target it is assumed that the areas are brought progressively under sustainable management of the first five years and consequently the cumulative benefit is represented by a reduction in the present decadal rate of coral cover from 16 to 0 percent as the areas are brought under sustainable management.

For the second target the area under consideration is the total coral reef of the region (750,307) of which 647,195 hectares are currently unmanaged and the cumulative benefits are derived from reducing the decadal rate of decline from 16% of live coral cover to 5% by 2015. This equals a reduction in the rate of decline to 1.375% per annum

Table 26 provides details of the costs and benefits to be derived from implementing the coral reef actions outlined in the SAP as in the case of mangroves it should be noted that the costs do not include national level costs. Table 27 presents a summary with the benefits for management, i.e. the first target separated from those for the second target and for the two targets combined (all benefits). It can be seen that placing a further 50,000 hectares of coral reefs under sustainable management is not as cost effective as successful achievement of the target to reduce the regional rate of degradation. The costs expressed as a percentage of benefits are somewhat high which is likely explained by the low valuation for coral reef goods and services determined during the present study.

Table 26 Summary of the Costs and Benefits of successful implementation of the Coral Reef Activities in the SAP to meet the Coral Reef Targets

	2008	2009	2010	2011	2012	2013	2014	2015	Total
Total accumulated new area under management (ha)	6,244	12,488	18,732	24,976	31,220	37,464	43,708	49,952	
Coral reef value 1,542.56 US\$ per hectare 2005 prices adjusted 4% per annum	1,735	1,805	1,877	1,952	2,030	2,111	2,196	2,283	
Benefit expected from coral reef management if value increased by 16% under management	173,333	360,653	562,559	780,050	1,014,026	1,265,384	1,535,724	1,824,647	
Costs (at 2006 prices) costs for the last three years estimated at 5% increase per annum on 2012 costs.	135,449	242,916	175,785	295,259	321,335	229,915	94,250	177,310	
Discount factor (NPV for 2006) i=4%	0.9246	0.889	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	
Costs 2006 value	125,236	215,952	150,261	242,673	253,951	174,712	68,868	124,578	1,356,233
Compound factor (NPV for 2007) i=4%	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
Costs 2007 values	130,246	224,590	156,271	252,380	264,109	181,701	71,623	129,561	1,410,482
Benefits at 2005 prices 16% of total value saved	173,333	360,653	562,559	780,050	1,014,026	1,265,384	1,535,724	1,824,647	
Discount factor for NPV 2005 (i=4%)	0.889	0.8548	0.82193	0.79031	0.75992	0.73069	0.70259	0.67556	
Benefits 2005 values	154,093	308,287	462,384	616,482	770,578	924,603	1,078,985	1,232,658	5,548,071
Compound factor for NPV 2007 (i=4%)	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	
Benefits 2007 values	166,667	333,443	500,115	666,787	833,458	1,000,051	1,167,030	1,333,243	6,000,793
Cumulative benefits at 2005 prices of reducing the decadal rate of decline from 16% of live coral cover to 5% by 2015. Equals decline in loss of 1.375% per annum	15,314,711	15,777,627	16,245,834	16,727,386	17,221,510	17,727,434	18,252,696	18,779,815	
Discount factor for NPV 2005 (i=4%)	0.889	0.8548	0.82193	0.79031	0.75992	0.73069	0.70259	0.67556	
Benefits 2005 values	13,614,778	13,486,715	13,352,938	13,219,820	13,086,970	12,953,259	12,824,162	12,686,892	
Compound factor for NPV 2007 (i=4%)	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	1.0816	
Benefits 2007 values	14,725,744	14,587,231	14,442,538	14,298,558	14,154,867	14,010,245	13,870,614	13,722,142	113,811,938
Total Benefits	14,892,411	14,920,674	14,942,653	14,965,344	14,988,324	15,010,296	15,037,643	15,055,386	119,812,731
Net Benefits	14,762,165	14,696,084	14,786,382	14,712,964	14,724,215	14,828,595	14,966,020	14,925,825	118,402,249

Table 27 Summary of Costs and Benefits of Coral reef Interventions

	Management	All Benefits
Present Value of Benefits	6,000,793	119,812,731
Present Value of Costs	1,410,482	1,410,482
NPV	4,590,311	118,402,249
Benefit-Cost Ratio	4.254	84.94
Cost as percentage of Benefit	23.5	1.18

Costs and Benefits of Seagrass Interventions

Addressing problems regarding the loss and degradation of seagrass habitats in the South China Sea poses problems unlike those faced in the case of the other coastal habitat types. These include the absence of good data regarding the actual distribution and abundance of seagrass meadows in the region; a lack of data regarding the rates of loss and degradation and inadequate understanding of the economic significance of these habitats as nursery areas for fish and crustaceans of subsistence and commercial importance. Only 73,769 hectares of seagrass are sufficiently well documented to be included in the estimations and the value of annual production is estimated at US\$1,181.59 per hectare giving a total value for the region of only US\$87,164,402 per annum. This is significantly smaller than the estimates for coral reef and mangroves which reach 1.1 and 11.6 billion US dollars respectively.

Costs of action have been estimated by the Regional Working Group on Seagrass in 2006 at 2006 prices, and encompass actions over the first five years of implementation of the Strategic Action Programme. These costs represent the costs of regional actions and not the cost of the national actions required to achieve the national targets established within the National Action Plans and reflected in the SAP. The values used are based on the Total Economic Value of seagrass habitats derived from the values for goods and services as calculated by the Regional Task Force on Economic Valuation and are standardised to 2005 prices.

In calculating the benefits of the Strategic Action Programme an average annual loss of seagrass habitat of 3.5 percent of total area per annum has been assumed. Hence the avoided loss represents 3.5% of the habitat area placed under sustainable management over the five year period. Net benefits and the cost benefit ratio have been calculated using net present (2007) values

Table 28 presents an analysis of the costs and benefits of the regional actions to address seagrass degradation in the South China Sea, whilst Table 29 presents a summary of these costs and benefits which suggests that the costs represent greater than 50% of the benefits over the five years of SAP Implementation. This almost certainly reflects the gross undervaluation of the seagrass habitat, particularly with respect to its nursery function for commercial and subsistence fisheries.

Table 28 Costs and Benefits of the Regional Actions to Address Seagrass Loss.

YEARS	2008	2009	2010	2011	2012	Total
Cumulative Target Areas to be Managed (ha) 2008 onwards	18,151	23,374	28,598	33,821	39,044	142,988
Cumulate benefit in terms of area saved	183	366	548	731	914	
Value of Benefits at 2005 prices	216,009	432,018	648,026	864,035	1,080,044	3,240,132
Discount factor for NPV 2005 (i=4%)	0.89	0.85	0.82	0.79	0.76	
Benefits 2005 values	192,031	369,291	532,631	682,860	820,745	2,597,557
Compound factor for NPV 2007 (i=4%)	1.08	1.08	1.08	1.08	1.08	
Benefits 2007 values	207,701	398,834	575,241	737,488	886,404	2,805,668
Costs at 2006 prices	239,650	118,920	124,670	96,600	144,650	724,490
Discount factor (NPV for 2006) i=4%	0.92	0.89	0.85	0.82	0.79	
Costs 2006 value	221,570	105,719	106,568	79,398	114,319	627,575
Compound factor (NPV for 2007) i=4%	1.04	1.04	1.04	1.04	1.04	
Costs 2007 values	230,433	109,948	110,831	82,574	118,892	652,678
Net Benefits	-22,732	288,886	464,410	654,914	767,513	2,152,990

Table 29 Summary of Costs and Benefits of Seagrass Interventions.

Total Benefit	2,805,668
Total Cost	652,678
Total Net Benefit	2,152,990
Benefit-Cost ratio	4.30
Cost as percentage of benefit	23%

Costs and Benefits of Wetland Interventions

As in the case of seagrass some difficulties arise in the case of the information assembled by the Regional Working Group on Wetlands. Initially this group was to have focussed on coastal lagoons, estuaries and inter-tidal mudflats. Subsequently coastal freshwater, peat and non-peat swamp forests were added to the range of habitats under consideration. Unfortunately the range of data available for the economic values of goods and services from these habitats was far less extensive than for the other habitats resulting in a regional value for annual production of US\$295.15 per hectare, which is absurdly low. This results in a total value of US\$1.2 billion for the estimated 4,201,145 hectares of these habitats bordering the South China Sea. Further work is needed to refine and improve the estimates of value.

Table 30 provides an analysis of the costs and benefits of the actions proposed in the wetlands component of the SAP whilst Table 31 provides a summary of the costs and benefits. These tables suggest that less economic benefit is derived from investing in coastal wetlands than in coral reefs and mangroves and approximately the same benefit as in the case of seagrass.

Table 30 Costs and Benefits of the Wetlands interventions in the SAP.

Years	2008	2009	2010	2011	2012	Total
Total costs of proposed actions (USD\$)	248,000	616,000	506,000	298,000	153,000	1,821,000
Discount factor (NPV for 2006) i=4%	0.92	0.89	0.85	0.82	0.79	1
Costs 2006 value	229,290	547,622	432,531	244,934	120,918	1,575,295
Compound factor (NPV for 2007) i=4%	1.04	1.04	1.04	1.04	1.04	
Costs 2007 values	238,462	569,527	449,832	254,732	125,755	1,638,307
Total value per hectare of annual production of wetland goods and services 2005 values	295 US dollars					
Total area to be brought under sustainable management within five years	938,261 hectares					
Total benefits derived from avoiding the annual losses(USD\$) 2005 values	830,783	534,694	802,041	1,069,393	1,336,740	4,573,651
Discount Factor	0.889	0.855	0.822	0.790	0.760	
Benefits 2005 values discounted	738,563	457,059	659,219	845,157	1,015,813	3,715,810
Compound factor (NPV for 2007) i=4%	1.082	1.082	1.082	1.082	1.082	
Benefits 2007 values (Compound factor i=4%)	798,830	494,355	713,012	914,122	1,098,703	4,019,020
Benefit-Cost (USD\$)	560,368	-75,172	263,179	659,390	972,948	2,380,714
Rate of loss assumed as 30% per century = 0.3% per annum or 0.003 per annum	2,815	5,630	8,444	11,259	14,074	42,222
Costs as percentage of benefits	41%					

Table 31 Summary of Costs and Benefits of Wetland Interventions.

Total Benefits	4,019,020
Total Costs	1,638,307
Total Net Benefits	2,380,714
Benefit-Cost Ratio	2.45
Costs as percentage of Benefits	40.76

REGIONAL CO-OPERATION

RATIONALE

The environment of the South China Sea continues to degrade despite actions taken at the national, sub-regional and regional levels. Part of the problem stems from the transboundary marine problems in the region and their impact on the ecosystems and resources of the South China Sea. This provides the ecological impetus for co-operation that is also based on the fact that the region is a large marine ecosystem with intrinsic integrity and inter-connections between all trophic levels. Fish and other migratory species do not recognise national boundaries, and the loss of endangered species in one area has not only regional but global significance. Due to the inherent conflict between the boundaries of the ecological system and man-made, national boundaries, countries must co-operate to meet the challenges to managing and sustainably using the shared ecological system.

These ecological issues are compounded by gaps in regional co-operation, which existed despite the ratification of many international conventions, which contain the legal basis for regional collaboration. Moreover, the present instruments and mechanisms for regional co-operation in the management of the marine and coastal environment of the South China Sea area are neither extensive nor well developed. While a number of sub-regional agreements or soft laws have been developed and numerous bi-lateral agreements have been entered into by, all governments individually and severally, there exists no overarching regional agreement governing the management of the marine environmental in the South China Sea.

The necessity for co-operation is reinforced by the need to prevent wastage of scarce financial resources that result from duplication of actions by countries in the region and the need to ensure that regional efforts are co-ordinated and effective. This in turn depends on the efficacy of related national actions which form the foundations of regional action and co-operation.

OBSTACLES TO REGIONAL CO-OPERATION AND PROPOSED SOLUTIONS

Despite the widespread recognition of the necessity to promote formal inter-governmental regional co-operation, there exist some common obstacles to strengthening existing mechanisms or forging new ones for regional co-operation. These identified obstacles include:

- Financial constraints; continued long-term financing;
- Lack of understanding of the root causes of regional marine environmental problems;
- Lack of consideration of long-term impacts;
- Inability to predict the impacts of future threats;
- Lack of a regional and global perspective;
- Lack of respect and recognition of regional expertise among some high-level decision-makers;
- Lack of a regional political consensus;
- Lack of a regional network and mechanism for action; and,
- Lack of understanding of the benefits of regional co-operation.

In identifying ways to overcome the obstacles the Regional Task Force on Legal Matters (RTF-L) conducted a number of reviews including: a review of states obligations to co-operate regionally under existing multi-lateral environmental agreements; a comparative review of national legislation relating to coastal habitats and pollution; a review of existing regional and sub-regional legal agreements in the field of marine environmental management.

In addition the RTF-L commissioned a study by a regional consultant, of instruments and mechanisms used elsewhere for strengthening and enhancing regional co-operation in the management of the marine environment. As part of this study a questionnaire was administered to various regional entities around the world regarding the effectiveness or otherwise of their existing instruments and mechanisms, the responses suggest that:

- Regional legal agreements are the most influential instruments, in strengthening regional co-operation and fostering regional stability and confidence building among the countries;
- The ecological effectiveness and economic efficiency of regional co-operation are necessary to avoid the waste of scarce financial resources;

- A process-oriented focus to improving the effectiveness of actions and implementation is appropriate for regional cooperation;
- A strong, proactive institutional mechanism empowered to act effectively, results in the most effective regional co-operation: and lastly;
- That regional co-operation may take many forms, but it must be appropriate to the regional ethos and culture.

The RTF-L also conducted a survey and carried out consultations at national level to gauge views among government and non-government organisations on the level and effectiveness of co-operation in the South China Sea and whether an alternative mechanism is needed to enhance co-operation in marine environment management in the region. The results of the surveys and a comparative analysis of national views is given in Annex 5 “Comparative Analysis of Countries Perspectives from Informal National Consultations” of the Report of the Fifth Meeting of the RTF-L.

Based on the results of the review and national consultation, and notwithstanding the outcomes of the commissioned study the RTF-L was of the opinion that the optimum way forward in this region at the present time was the preparation of a non-legally binding framework.

A PROPOSED FRAMEWORK FOR CO-OPERATION IN THE MANAGEMENT OF THE MARINE ENVIRONMENT OF THE SOUTH CHINA SEA AND GULF OF THAILAND

GOALS AND OBJECTIVES

The overall goals of this framework are: to create an environment at the regional level, in which collaboration and partnership in addressing environmental problems of the South China Sea, between all stakeholders, and at all levels is fostered and encouraged; and to enhance the capacity of the participating governments to integrate environmental considerations into national development planning.

The medium term objective of the framework is to implement and execute the actions defined in the Strategic Action Programme (SAP, this document) that encompass specific, targeted and costed actions for the longer-term, to address the priority issues and concerns. More specifically the proposed activities are designed to assist countries in executing the existing national action plans and meeting the environmental targets specified in the SAP.

The recommended framework must be functional and effective in resolving environmental problems and fostering strong regional cooperation and coordination of appropriate cost-effective actions. The framework must include, *inter alia*:

- Sound science. The use of sound science must be incorporated into policy-making processes and underpin decisions to foster ecological and economic soundness.
- Ecologically effective actions. It is increasingly recognised that many laws, policies and actions are ineffective in terms of ecological improvements. Ecological ineffectiveness also results in waste of scarce financial resources. Ecologically effective actions must be based on sound science and not on perceptions.
- Cost effective actions.
- Economic valuation. Economic valuation of environmental goods and services as a tool for sound development planning.
- Knowledge-based decision-making. This entails gathering all relevant information for the purpose of making effective decisions. Studies indicate that working toward a consensual knowledge-base for decision-making purposes improves the effectiveness of decisions and it also improves cooperation.
- Consensual knowledge-base. Promoting and building a consensual knowledge base (a base of information that the parties agree is applicable) facilitates cooperation and decision-making processes. This is particularly true where progress on regional cooperation is stalled or slowed due to complexities or uncertainty surrounding the issue.
- Communication. The lack of effective vertical and horizontal communication has been identified as a serious impediment to effective cooperation.

- Periodic assessment and review and revision of instruments or actions as required. Significant amounts of money and valuable resources are wasted due to the failure to assess or review laws, policies, mechanisms and measures to ensure they are effective or even implemented. Where assessments indicate problems, it is imperative that revisions are undertaken.
- Adaptive management. This provides a flexible approach that allows for the inclusion of new information.

AREAS FOR CO-OPERATION

The areas for co-operation to be covered by the framework include:

1. Establishment and management of regional database

2. To identify and collect data & information in the areas of:

- Marine and coastal legislation, regulation and institutional arrangement and coordination related to the analyse of the contents of the Draft National Action Plan from the Perspective of the Regional Strategic Action Programme.
- Ratified international and regional conventions and agreements on marine and coastal issues to find out the similarities and differences of all countries involved for Regional Cooperation perspectives.
- Scientific and technical data and information, including monitoring data, economic data related to marine and coastal environment.
- Experts and institutions in the region.
- Experience of each country, including pilot projects that can serve as models.

3. Exchange of data, information and experience

4. Regional prioritisation of environmental issues

The coastal States should cooperate on a sub-regional or regional basis to identify and prioritize regional and transboundary environmental issues. States should co-operate with each other in addressing the prioritized marine environmental issues in the South China Sea.

Each Party should mobilize necessary resources, capacities and services, as well as develop legal, financial and economic arrangements, including the adoption of a strategic plan for the management and conservation of coastal and marine resource to reach the targets stated in the South China Sea SAP.

5. Public Awareness and Education

Public awareness should be raised through countries' education systems, campaigns and other activities at the regional, national, and local community levels, especially those living along the coastlines, on the following issues:

- Ecological unity of the South China Sea and Gulf of Thailand;
- Social, economic and environmental benefits arising from the proper exploitation, management and conservation of marine resources of the South China Sea and Gulf of Thailand;
- Social, economic and environmental adverse impacts possibly arising from the degradation of the ecosystems of the South China Sea and Gulf of Thailand; and
- Necessity of regional cooperation on the exploitation, management and conservation of the marine resources of the South China Sea and Gulf of Thailand.

MECHANISMS

A management framework that:

- Restricts the membership of the policy/decision making body to government representatives only;
- The policy/decision making body may invite a limited number of observers from regional and international agencies and institutions as deemed appropriate;
- Includes a high level scientific and technical body that serves: a) as a forum for reconciling both sectorial and national interests and priorities; and, b) as the source of independent scientific and technical advice to the policy making body;
- Ensures and maintains a separation between discussions of scientific and technical matters from discussions dealing with policy and principles at both the national and regional levels;
- Facilitates and ensures the incorporation of sound scientific and technical advice and information into politically based decision-making;
- Emphasises the use of experts and consultants from the participating countries, having regional knowledge and perspectives;
- Fosters the establishment of epistemic communities within the region and utilises effectively their advice and experience;
- Permits and encourages networking and interactions among and between specialist epistemic communities;
- Emphasises and fosters networking at all levels and amongst all stakeholders;
- Fosters and strengthens both “horizontal” (inter-country) and “vertical” (intra-country) interactions and networking between individuals at all levels of SAP implementation and execution;
- Encourages adaptive management, which is subject to periodic review in line with the reviews of the SAP;
- Is developed through a process of detailed planning and consultation that ensures consensus regarding the final, agreed management framework; and,
- Is managed and operated by committed, experienced, independent, and full-time professionals, guided by and responsible to the policy/decision making body.

COMPONENTS

The proposed framework should contain the following components:

Memorandum of Understanding adopted at the ministerial level

The MoU serves as the political instrument for the implementation of the entire Strategic Action Programme.

Regional Strategic Action Programme

The regional Strategic Action Programme will be the operational arm of the Memorandum of Understanding and outlines the actions that need to be taken to address environmental degradation in the South China Sea and Gulf of Thailand. The first draft of the regional SAP was adopted in 1999 and has been revised and replaced by the present document which will form the basis for action over the next five years.

Sub-regional and bi-lateral Agreements

Countries are encouraged to enter into sub-regional and bi-lateral agreements to address issues relating to the implementation of the SAP. The Memorandum of Understanding will form the umbrella under which these sub-regional and bilateral agreements are negotiated and implemented.

Existing National Action Plans

During the course of the UNEP/GEF project entitled “Reversing Environmental Degradation in the South China Sea and the Gulf of Thailand”, participating countries have prepared National Action Plans (NAPs) for habitats, fisheries and land-based pollution. The existing NAPs will form the national basis for action in implementation of the SAP.