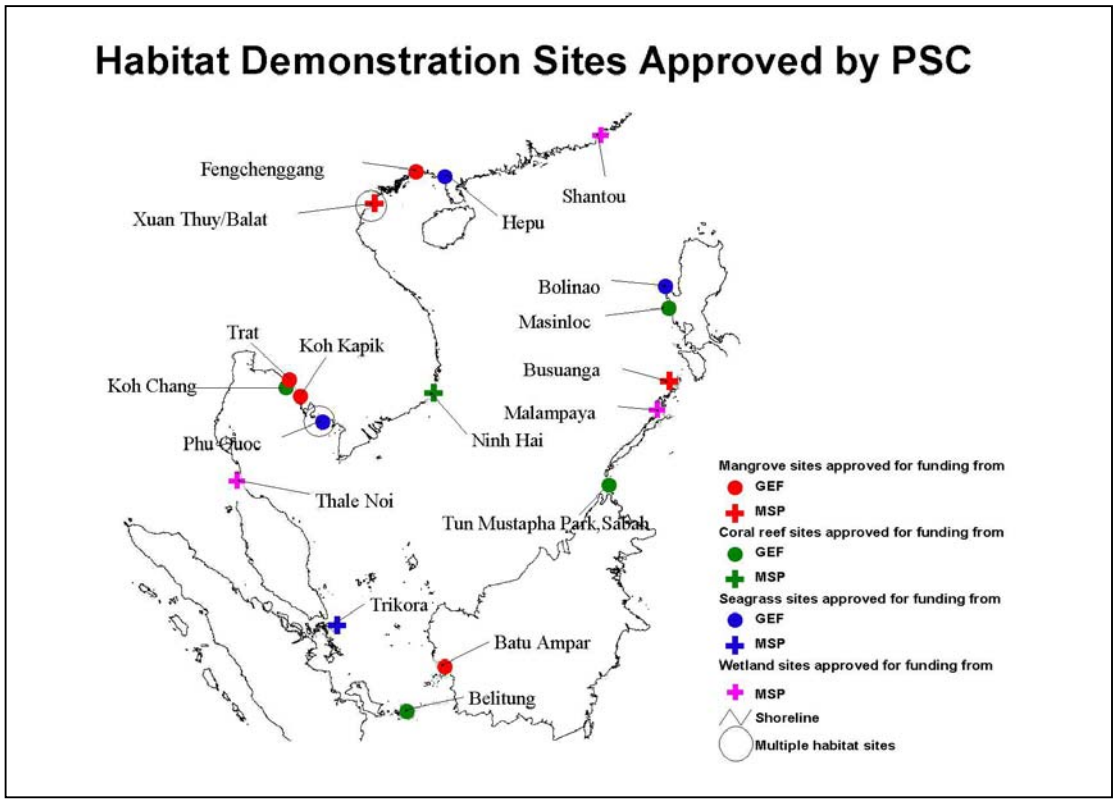
Procedure for Selection of Demonstration Sites in the context of the UNEP/GEF Project Entitled:

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



South China Sea Knowledge Document UNEP/GEF/SCS/Inf.2

First published in Thailand in 2007 by the United Nations Environment Programme.

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Cover Illustration: Habitat Demonstration Sites approved by the Project Steering Committee of the UNEP/GEF Project Entitled: "*Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand*".

For citation purposes this document may be cited as:

UNEP, 2007. Procedure for Selection of Demonstration Sites in the context of the UNEP/GEF Project Entitled: *"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand".* South China Sea Knowledge Document No. 2. UNEP/GEF/SCS/Inf.2

PROCEDURE FOR SELECTION OF DEMONSTRATION SITES IN THE CONTEXT OF THE UNEP/GEF PROJECT ENTITLED: *"REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND"*

INTRODUCTION

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

The Project is complex since it addresses three priority areas of concern identified in the Transboundary Diagnostic Analysis (TDA)[2], (Talaue-McManus, 2000) namely: the loss and degradation of coastal habitats; over-exploitation of fisheries in the Gulf of Thailand; and, land-based pollution. Of these three substantive project components, the first, relating to habitat degradation and loss, is the largest being divided into four sub-components. The fourth component of the project is concerned with regional co-ordination including facilitation of national level execution and securing inter-country agreement on project related matters. The financial appropriations approved by the GEF Council are presented in Table 1 in which it can be seen that the allocations from all sources for the priority habitats (mangroves, coral reefs, seagrass and wetlands) total just over 21 million US dollars or 65% of total project costs.

Table 1 Project Budget Summary and Component Financing in Million US$.

Project Activities	GEF	Co-financing		Grand Total
		Governments	Other Sources	
1. Habitat Degradation & Loss				
1.1 Mangroves	2.733	2.374	1.585	6.692
1.2 Non-oceanic Coral Reefs	2.587	2.326	1.560	6.473
1.3 Seagrass	2.529	2.305	1.585	6.419
1.4 Wetlands	0.975	0.400	0.082	1.457
2. Over-exploitation of fisheries in the Gulf of Thailand	1.650	0.735	0.960	3.345
3. Land-based Pollution	1.760	0.461	0.110	2.331
4. Project Co-ordination and Management	3.580	0.294	0.505	4.379
EA Overheads	0.600			0.600
Project Total	**16.414**	**8.895**	**6.622**	**31.931**
PDF-B	0.335	0.176	0.076	0.587
Grand Total	**16.749**	**9.071**	**6.698**	**32.518**

The project was designed to be implemented over a period of five years and involved the signing of Memoranda of Understanding (MoUs) between UNEP, as the GEF Implementing Agency, and seven focal Ministries, (the Ministries responsible for Environment in each country) and thirty-one Specialised Executing Agencies (SEAs) in the seven participating countries that are each responsible for one component or sub-component[3].

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

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

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

THE PROBLEM

The GEF allocation for demonstration sites was stated in the Project Brief that was approved by the Project Steering Committee during its first meeting (UNEP, 2000a, Appendix) as being 3 demonstration sites in each of the habitat sub-components of Mangroves, Coral Reefs and Seagrass. The size of each allocation for demonstration sites, by habitat sub-component, was as follows:

Mangroves:	1.2 million US$ over 3 years
Coral Reefs:	1.2 million US$ over 3 years
Seagrass:	1.1 million US$ over 3 years
Wetlands[4]:	no allocation

These funds were "blocked" in the project document and their purpose identified but the sites were not chosen at that time since the preparatory activities during the first two years of project implementation were intended *inter alia* to develop the process of site selection.

The consequences were quite clearly that:

- With seven participating countries, no one country could "expect" a demonstration site in each habitat sub-component;
- If the principal of equity were to be applied, each country could only "expect" 1.3 demonstration sites (more realistically 5 countries would get one site each and two would get two);
- "Wetlands" would have no demonstration sites unless the Project Co-ordinating Unit (PCU[5]) could raise additional funds.

Potentially, therefore, the process of site selection could have been divisive and acrimonious. It might also have resulted in the choice of sites that neither adequately represented the range of biological and environmental conditions found throughout the South China Sea nor, satisfied the achievement of the global environmental benefits anticipated from GEF interventions.

THE APPROACH

Past practice in regional programmes has generally been based on "equity" considerations such that the available resources tend to be divided equally, or nearly equally, between all participating countries. In addition, decisions on specific site-related activities in the framework of UNEP's regional seas action plans, for example, has reflected individual national priorities with little attempt being made to either determine, or take into consideration, regional priorities independently of national priorities. Regional priorities have been generally derived from a process of consensus building on the basis of the nationally-defined priorities with each party recognising that they would get "something". National, regional and global priorities are, however, rarely congruent.

Past experience has shown that, where a limited pool of resources is to be divided amongst a large number of possible recipients, there is a general trend for those with the best command of written English to prepare proposals that are superficially more attractive; if the decision, is taken by "consensus" during an open meeting with few or no guidelines, the individuals with the greatest facility in spoken English (or who shout the loudest) have a higher probability of winning their argument. Selection of demonstration sites in other contexts is therefore frequently based upon "perceptions" of what are good sites; thus, individuals in the Southeast Asian region will quote Apo Island in the Philippines as a good example of community-based coral reef management, even though the site is small and the current operation is no longer as successful as it was initially.

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[4] *It should be noted that the definition of wetlands in the context of the project excluded the three itemised habitat types and restricted consideration to coastal wetlands, such as estuaries, mudflats, and lagoons.*

[5] *It should be noted that although the consequences of the original allocations were accepted by the representatives of the participating countries, they resulted in significant lowering of morale amongst the expert focal points who saw their colleagues having the prospect of substantial activities during the operational phase of the project whilst they, on the other hand, could potentially have nothing to show in concrete terms from the preparatory phase activities.*

Recognising these problems, it was decided to attempt to construct a more "objective" approach to selecting demonstration sites in the framework of the South China Sea Project. This required that, at the very least:

- All parties accept that the funds were limited and that equitable (equal) division of the resources among all countries would compromise the integrity and success of the demonstration sites[6];
- The process of site selection be fully transparent and comprehensible to all parties, both technical and political, and that it be based as far as possible on "objective" quantifiable criteria and indicators; and,
- The criteria used for assessing the comparative importance of the sites should reflect their importance from the perspectives of biological diversity, transboundary relevance and the regional and global significance of the site.

STEPS IN THE PROCESS:

Defining the data and information needs

The first action required securing agreement at the regional level regarding the data and information needed to characterise individual sites. Such characterisation, for example, would include: indicators of environmental state, such as percentage seagrass cover; indicators of biological diversity, such as presence or absence of individual mangrove genera; and/or the numbers of hard coral species.

This process was initiated during the first meeting of the Regional Scientific and Technical Committee (RSTC) (UNEP, 2002a) during which specific guidance was developed for each regional working group regarding the "types" of data that should be considered and selected within each habitat sub-component.

The first meeting of each Regional Working Group (RWG) (UNEP, 2002b; UNEP, 2002c; UNEP, 2002d; UNEP, 2002e) defined the data and information required to characterise specific sites. Tables 1 and 2 provide, as examples, the lists of properties and variables initially identified by the mangrove and coral reef regional working groups. In all instances, these lists were comprehensive and overly ambitious, listing properties and variables that were difficult to obtain from published information and existing databases. Subsequent to this, a regional GIS meeting was convened (UNEP, SEA START, 2002) and SEA START RC[7] prepared GIS data formats based on the lists of properties and variables prepared by each regional working group. During the inter-sessional, six month, period between the first and second regional working group meetings, national focal points in each SEA commenced the process of assembling site-specific data sets from existing published and unpublished sources[8].

The second meeting of each regional working group (UNEP, 2002f; UNEP, 2002g; UNEP, 2003a; UNEP, 2003b) reviewed the initial data sets that had been compiled and, in most instances, agreed to drop from consideration properties and variables that were either generally unavailable throughout the region or which were too difficult to standardise across countries. In addition, clarification of the exact interpretation of defined properties and variables was required. For example, mangrove data relating to the density of trees were clearly not comparable between and among countries with some data sets reflecting the occurrence of all classes of "tree" including seedlings, saplings and mature trees. This property was re-defined as the density of mangrove trees exceeding 1.5 metres in height, thereby excluding seedlings but not excluding species with low maximum mature height. During its second meeting, the RSTC (UNEP, 2003c) reviewed the properties and variables selected by each working group and provided some comments and guidance to the RWGs.

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[6] *In this context the GEF Project brief was explicit in stipulating 3 demonstration sites in the three habitat sub-components. The approval of the project budget by the Project Steering Committee at its first meeting resulted in implicit acceptance of this limitation by the participating countries.*

[7] *South East Asian Regional Centre for START (SysTem for Analysis, Research and Training).*

[8] *In the case of China, the absence of any national data sets regarding the distribution and/or diversity of seagrass habitats was addressed through substantial co-financing made available through the central government to enable the SEA to prepare distribution maps based on remotely sensed images and assemble basic data through field surveys. The outcome was the first internationally-available data sets regarding seagrass in China.*

Table 1 Details of properties and variables, Data and Information requirements for Mangrove Site Characterisation.

	Properties and Variables	Data & Information needed
Geographic information	Co-ordinates	Latitude & Longitude central position of areas <50 Ha; GPS Boundary or number (min 4) of paired co-ordinates for larger areas; end points for linear strips.
	Area	(Units Km^2 or Ha)
Physical Environment	Substrate (soil)	Proportion of sand, silt, clay
		Bulk Density
	Freshwater regime	Mean monthly rainfall (mm)
		Mean monthly River discharge (m^3sec^{-1})
	Tidal regime	Range (m)
		Diurnal, semi-diurnal, mixed
	Slope	Degrees (tangent)
	Temperature	Mean, max, min, monthly (^oC)
	Soil Salinity	Range (psu)
	Water quality	Total suspended solids
		Contaminant concentration/flux
		Other parameters as available
	Geomorphic class	Description, lagoon, tidal flats, estuaries, islands etc.
Environmental state information	Present status	Vegetation Canopy Cover (% area)
	Pressure (threats) – present	% loss of species or area or canopy cover in last five years
	Pressure (threats) – future	Estimated future losses from known development plans
Social & use information	Ownership	Description: Federal, State, Community, private
	Management regime	Description: Land-use planning, Institutional framework, stakeholder co-ordination, forestry practices, restoration replanting, stakeholder investment, fishery practices.
	Current use	Description: Commercial, subsistence
	Potential use	Alternative livelihoods
	Significance/national importance	Use designation in national/state master plans
Biological data	Natural/Managed	Proportions of total area natural and replanted
	Species diversity	(True) Mangrove[9] tree species Density (no ha^{-1})
		Crustacea – Crab genera, density
		Molluscs – Bivalve genera, density
		Molluscs – gastropods genera, density
		Fish – Residents, species abundance
		Fish – Transient for breeding, species abundance
		Mammals, resident
		Birds, resident species
		Birds, migratory species
		Reptiles, resident species
		List others as available (e.g. mud lobster)
	Genetic diversity	
	Heterogeneity	Formations – number of canopy layers (strata)
		Average and range Height (m), by species
		Average and range Girth, (cm) by species
		Zonation – number of zones by dominant species
		Ecotones – average width (m), major species
	SCS Endemic species	List species and abundance
	Endangered or threatened species (IUCN criteria)	List species and abundance if data available
Stress-pressure Information	Intrinsic/internal sources of change	Resident human population
		Natural e.g. frequency of typhoon throw, change in allochthonous sediment inputs, marine based flooding
	Extrinsic/external sources of change	Changes in catchment basin e.g. dam construction water diversion etc.
	Rates of change, historical review	Rates of loss of cover and/or species over the period 1990-2000
	Social and economic drivers of change in environmental state	Description, quantitative if possible e.g. pop'n growth, immigration, income/livelihood, demand/ consumption, management regime)
Economic valuation[10]	Values of direct use	Timber, charcoal, living marine resource extraction Yr 2000 local currency total
	Values of indirect use	Carbon sequestration, ecotourism, nursery areas for shrimps Yr 2000 local currency total
	Values from environmental services	Coastal protection, sediment stabilisation, water quality enhancement, contaminant sink, reduction of wave energy & erosion
	Value of investment	Restoration, replanting
	Values of potential (commercial) sustainable use	
	Total Economic Value	Yr 2000 local currency total

[9]

[10] *Barbier, E.B. 1997. Economic Valuation of wetland: A guide for policy makers and planners. RAMSAR Convention Bureau, IUCN.*

Table 2 Details of properties and variables, Data and Information requirements for Coral Reef Site characterisation.

	Parameter	Data & Information needed
Geographic information	Co-ordinates	Latitude & Longitude central position of areas, GPS Boundary or number (min 4) of paired co-ordinates for larger areas; end points for linear strips.
	Area	(Units Km^2 or Ha)
Physical Environment	Reef type	Fringing (mainland & island), barrier, atoll, patch, other
		Slope Degrees (tangent)
	Bathymetry	Depth contour
	Climate	Prevailing wind; sea surface temperature, (seasonal mean, max & min); rainfall mean monthly rainfall (mm)
	Current pattern	Seasonal current pattern
	River discharge	Sediment load, quantity of freshwater discharge salinity
	Tidal regime	Range (m)
		Diurnal, semi-diurnal, mixed
	Water quality	Nutrients, total P, N, nitrite, total suspended solids
		Turbidity
		Other parameters as available
Environmental state information	Present status	Live coral cover, dead coral cover, algae, abiotic
		Level of exploitation (indicator species, catch per unit)
	Present threats	Sedimentation
		Destructive fishing (no. of cases, both bombing & poisoning, reported per year
		Pollution (no. pop'n & distance to the sources of pollutants)
		Crown of Thorns (COT) infestation (density of COT, no. of cases, and infested areas)
		Bleaching (% bleaching of live coral, % of covered)
		Others
	Trends	Increase or decrease of live coral cover
	Pressure (threats) – future	Development plan & distance to the coral reef area
Social & use information	Ownership	Description: Federal, State, Community, private, common property
	Management regime	Description: Land-use planning and coastal zoning, Institutional framework, stakeholder co-ordination, restoration, stakeholder investment, fishery practices
	Current use	Description: Commercial, subsistence, fishing ground, tourism and/or MPA
	Traditional use	Description of
	Potential use	Tourism and MPA (sustainable use)
	Significance/national importance	Use designation in national/state master plans
Biological data	Species diversity	No. of species and coverage of hard coral
		No. of species and coverage of soft coral
		Molluscs – species and density (no. per m^2)
		Crustacean- species and density (no. per m^2)
		Fish – coral reef fish, species abundance
		Fish – Transient for breeding, species abundance
		Mammals
		Reptiles
		Echinoderm
		No. species of algae
		Other species
		Diversity index
	Genetic diversity	
	SCS Endemic species	List species and abundance
	Endangered or threatened species (IUCN criteria)	List species and abundance
	Source & sink of larvae	Location & types (breeding ground), density of larvae
	Migratory species	List species and abundance
	Ecosystem diversity	Description of complexity of habitats
	Interaction with other ecosystems	Description of associated ecosystems
Economic valuation[11]	Extractive	Reef related fish landing (mt/$$)
		Subsistence fishery (no. of fishers dependent on reef – mt/$)
		Commercially (live fish and fish landing – mt/$)
	Non extractive (tourism)	No. of visitors. ($ generated)
		No. of people involved in industry (income generated) – no. of chalets/hotels operators - no. ferry/boats operator - no. guide/agents
		Environment services
		Education
		Others

[11] *Barbier, E.B. 1997*. Economic Valuation of Wetlands: A guide for policy makers and planners. *RAMSAR Convention Bureau, IUCN, Gland, Switzerland.*

Defining the process:

Also, at its second meeting, the RSTC (UNEP, 2003c) considered the process of site selection and ranking. It agreed to recommend to the PSC a three-step process involving: characterisation of the sites; a cluster analysis to identify major groupings of similar sites; and ranking of sites within each cluster, using both environmental and socio-economic criteria. It is important to note that only at the end of the first year was a discussion initiated as to how sites would be selected; the reason being that by assembling preliminary data sets without specifying that these might ultimately be used in site selection and ranking, some objectivity could be ensured in the process, thereby preventing individuals from presuming the purpose and outcome.

The recommendation of the PCU to the RSTC to use cluster analysis was based on the fact that each RWG had prepared site characterisation sheets for in excess of forty sites and the selection of three sites without some form of preliminary screening would have been a difficult, if not an impossible, task. The argument presented was that clustering resulted in sites being grouped on the basis of their similarity and that identifying at least three major clusters and then selecting one priority site from each cluster, would ensure maximum coverage of the range of biological diversity exemplified by sites bordering the South China Sea[12]. The rationale, in simple terms, was that three contrasting sites would be preferable as demonstration sites, rather than three similar ones if global and regional biological diversity objectives were to be addressed. This approach maximises the range of different environmental and biological conditions encompassed by the three sites selected as demonstration sites within each habitat type.

This recommendation was adopted by the Project Steering Committee (UNEP, 2003d) during its second meeting and involved the PCU essentially providing, to both RSTC and PSC members, a "short course" in the statistics of cluster analysis as well as presenting the arguments as to why a preliminary screening was required.

Evaluating the data:

During the third meetings of the RWGs (UNEP, 2003e; UNEP, 2003f; UNEP, 2003g; UNEP, 2003h)., the data and information were reviewed, anomalies identified and discussed, and a series of preliminary cluster analyses conducted using different data sets and transformations. At the same time, criteria to be used in the ranking process were discussed and agreed upon and preliminary rankings using the environmental criteria were prepared. The outcomes of these activities were presented to the third meeting of the RSTC (UNEP, 2003i) that reviewed them in some detail. The RSTC made specific comments and criticisms and recommended modifications or changes prior to their finalisation. It also agreed that supporting data for certain parameters must be provided in order to verify the data quality.

During the inter-sessional period, data were reviewed, anomalies corrected and the data sets finalised for the conduct of a final clustering in advance of the fourth meeting of the RWGs. Agreed principles used in the final analysis were that any site for which less than fifty percent of the agreed data set was available would be dropped from further consideration and any parameter for which fewer than 50% of the sites had data would also be excluded from further consideration.

During the fourth meetings of the RWGs (UNEP, 2004a; UNEP 2004b; UNEP, 2004c; UNEP, 2004d), the data sets were subjected to final review prior to their acceptance and the system for determining ranking scores was also reviewed in the light of the empirical data collected for the sites on the list. The final data sets used in the cluster analysis are presented in Tables 3, 4, 5, 6 and 7.

Where data could not be verified via species lists and/or published surveys, the sites were discussed and reviewed individually and the majority excluded from further consideration. In the case of the Regional Working Group on Mangroves, for example, data were initially assembled for forty-four mangrove sites, of which twenty-six data sets were judged by the Regional Working Group[13] to be sufficiently well documented to merit inclusion in a regional comparison.

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[12] *It is well recognised in the field of ecology that ecosystems at the margins of the overall global distribution differ quite significantly in terms of their species composition, productivity and ecosystem processes from those located at the "centre" of the distribution. Were mangrove sites to be selected, for example, solely on the basis of their species diversity, then the three most diverse sites would quite likely to be found in Indonesia and the particular associations characteristic of Northern Viet Nam and southern China, with their very different species composition, would have been unlikely to have been selected.*

[13] *At the time of this decision the ten person working group had combined experience of research and mangrove management totalling 191 person years.*

One consequence of these decisions was that sites of potential regional or global significance for which data were not available could not be included in the ranking procedure. This risk was not considered significant because most sites of global and/or regional significance are also considered of national significance[14]; hence data sets are generally available for such sites. An exception to this occurs in the case of Cambodia where basic data relating to coastal habitats are generally lacking; accordingly some funds were allocated to Cambodian focal points during the preliminary phase to conduct basic habitat surveys.

Whilst each regional working group considered and critically reviewed the data and information available for each site, the value of a higher-level body reviewing the outcome is demonstrated in the insights and comments provided by the RSTC on the outcome of the wetlands analysis. In the case of the wetlands sites, the excessively large size of some potential sites was questioned in terms of the uniformity of the habitats contained therein and the RSTC was of the opinion that integrated management of these areas was unlikely to be achieved due to the multiple administrative jurisdictions associated with the sites concerned. Furthermore, the RSTC noted that the wetlands component of this project focused on only five wetland types (inter-tidal, unvegetated mudflats; coastal brackish water lagoons; estuaries; coastal freshwater peat swamp forest; and coastal swamp forest). Hence, if each site was designated according to its major habitat type, the maximum number of additional (associated) ecosystems/or habitats that would be included would be four. These and other queries resulted in a second review and reconsideration of the data by the working group resulting in the final cluster analysis being completed only during the sixth meeting of the working group.

Cluster Analysis

Recognising that there exist sub-regional differences in the biological diversity contained in the seagrass, coral reef and mangrove habitats bordering the South China Sea, it was agreed that a statistical comparison of all sites be undertaken in order to determine the relative similarity (and differences) among the sites. These data are presented in Tables 3, 4, 5, 6 and 7. It can be seen that: in the case of mangroves, 12 properties and variables for a total of 26 sites were used in the analysis; for seagrass and coral reefs, 11, and 8 properties and variables and 26, and 44 sites respectively were included. In the case of mangroves 17 cells (5.4%) in Table 3 lack entries while for seagrass and coral reefs missing data represented 5.2%, and 15.6% of the comprehensive data sets. In the case of the wetlands sites, it was finally agreed to analyse the sites on the basis of wetland types, namely estuaries, inter-tidal mudflats, coastal lagoons and peat and non-peat swamp. The data for the first three habitats are presented in Table 6 including six properties and variables for 15 estuaries, 12 for inter-tidal mudflats and 7 for coastal lagoons. The data for seven properties and variables for 4 peat swamp and 2 non-peat swamp forest locations are presented in Table 7.

All of the data sets used in the cluster analysis, represent a compromise between a fully comprehensive and descriptive set of data and that available for the largest number of sites.

A cluster analysis was performed using the Clustan Graphic 6 software that enables estimation of missing values. All values were transformed to z scores, thus giving equal weight in the analysis to each variable. The resulting dendrograms are presented in Figures 1 to 6.

It can be seen that the mangrove sites fall into three clusters, two of which are comparatively small (four sites each). These two small clusters encompass sites in China, Thailand and Viet Nam representing the northern and northwestern margins of the South China Sea. The larger central cluster of 18 sites is more heterogenous, encompassing both insular and mainland sites generally lying in the southern and eastern portions of the region.

[14] *In contrast, the reverse is not necessarily true; sites of national importance may be insignificant from a regional or global perspective. See below.*

Table 3 Selected physical and biological properties and variables for mangrove potential demonstration sites bordering the South China Sea. (M = data unavailable)

Site	Present Area	Zones spp. assoc	% change in area	True mangrove spp.	Density >1.5m high /Ha	% cover	No. Crustacean. spp.	No Bivalve	No. Gastropod spp.	No Fish spp.	No Bird spp.	No migratory bird spp.
China												
Shangkou	812	4	11	9	11,980	90	65	40	33	95	28	76
Quinglangang	1,189	6	-56	25	10,183	80	60	50	62	90	39	32
DongXhaiGang	1,513	5	-14	16	8,433	80	32	24	27	84	43	35
Futien	82	3	-26	7	10,233	80	29	16	21	11	58	99
Fangchenggang	1,415	4	-10	10	12,300	90	67	62	40	71	42	145
Indonesia												
Belitung Island	22,457	5	0	8	467	100	5	26	43	71	**M**	**M**
Angke Kaput	328	9	-2	12	569	70	29	21	4	22	40	4
Batu Ampar	65,585	5	0	21	2,391	100	11	15	17	51	19	27
Ngurah Rai	1,374	6	27	25	660	100	38	10	32	34	38	42
Bengkalis	42,459	7	-15	18	490	99	12	8	9	3	16	15
Philippines												
Busuanga	1,298	5	-5	24	7,550	90	6	15	36	9	45	27
Coron	1,296	5	-50	26	7,080	**M**	7	15	37	13	42	34
San Vicente	133	5	-15	14	3,780	80	6	15	36	13	36	40
Ulugan	790	4	-10	16	5,100	85	8	15	36	13	42	39
San Jose	483	4	-80	25	3,180	60	7	13	34	7	48	37
Subic	148	3	-20	23	1,420	90	8	14	35	16	44	57
Quezon	1,939	5	-40	32	4,000	80	5	14	37	11	44	37
Thailand												
Trad Province	7,031	5	2	33	1,100	90	32	**M**	**M**	55	98	24
Thung Kha Bay - Savi Bay	3,543	4	34	23	1,628	90	58	**M**	**M**	36	13	8
Pak Phanang Bay	8,832	3	2	25	1,282	56	36	**M**	**M**	85	72	45
Kung Kraben Bay	640	2	0	27	6,100	80	19	**M**	**M**	35	75	16
Welu River Estuary	5,478	3	31	33	1,400	60	25	**M**	**M**	52	69	15
Viet Nam												
Tien Yen	2,537	2	-25	13	7,000	60	51	**M**	**M**	79	**M**	**M**
Xuan Thuy	1,775	3	98	11	9,500	75	61	25	30	90	31	62
Can Gio	8,958	3	100	32	6,000	80	28	17	32	103	96	34
Ca Mau	5,239	3	60	30	7,500	85	12	6	15	36	18	53

Table 4 Biodiversity and other environmental properties and variables for selected seagrass sites in the South China Sea. (M = data unavailable)

Site Name	Area (ha)	% cover	Depth range	Seagrass spp.	Penaeid spp.	Gastropod spp.	Siganid spp.	Urchin spp	Threatened spp.	Associated ecosystems	Migratory species
Cambodia											
Kampot	25,240	45	2	6	**M**	**M**	**M**	**M**	2	2	2
China											
Hepu	540	85	4	4	5	12	1	3	3	1	2
Liusha	900	90	3	2	5	11	1	1	2	2	2
LiAn	320	82	3.2	5	4	17	1	1	3	2	2
Xincun	200	87	2	4	4	6	1	1	2	2	1
Indonesia											
Trikora Beach	280	95	2	9	3	16	3	4	6	2	3
Mapur	275	85	3	9	3	11	3	4	5	2	3
Malaysia											
Tanjung Adang Laut Shoal	40	80	1.2	9	2	2	1	1	2	2	2
Tanjung Adang Darat Shoal	42	80	0.7	9	2	2	1	1	2	1	2
Merambong Shoal	30	80	0.7	10	2	2	2	**M**	2	1	2
Sungal Paka Shoal	43	**M**	4	2	**M**	2	**M**	2	1	1	1
Pulau Tinggi Mersing	3	70	3	6	**M**	**M**	2	2	2	1	2
Setiu Terengganu	3	70	6	3	**M**	3	2	M	1	1	1
Pulau Besar Mersing	3	70	4	5	**M**	1	2	**M**	2	1	2
Philippines											
Cape Bolinao	2,500	75	1.7	9	7	23	6	4	3	2	1
Puerto Galera	114	95	4.5	9	3	11	2	3	3	2	1
Ulugan Bay	11	90	2.5	8	3	10	2	5	4	2	0
Puerto Princesa/Honda Bay	670	90	4	8	4	18	4	5	3	2	1
Thailand											
Kung Krabane Bay	700	80	4	5	4	5	2	**M**	2	1	1
Surat Thani	500	65	3	6	2	73	3	1	2	1	2
Pattani Bay	273	80	3	4	8	35	5	**M**	2	1	2
Viet Nam											
Bai Bon, Phu Quoc Is	2,000	70	6	7	3	46	1	3	5	2	2
Rach Vem, Phu Quoc Is	900	65	6	6	3	30	1	3	3	2	2
Con Dao Island	200	25	9.6	10	8	45	1	3	4	2	4
Phu Qui Island	300	50	2.5	6	2	35	3	3	3	2	2
Thuy Trieu (Khan Hoa)	800	60	1	7	4	10	3	2	4	2	0

Table 5 Properties and variables for potential coral reef demonstration sites used in determining similarities and differences among sites. (M = data unavailable)

Site Name	Hard coral species	live coral cover (%)	No. of algae spp.	No. of crustacean species	No. of echinoderm species	No. of coral reef fish species	Other ecosystem	No. of endangered and threatened species
Viet Nam								
Cu Lao Cham	131	33.9	122	84	4	178	1	4
Nha Trang bay	351	26.4	55	69	27	222	2	3
Con Dao	250	23.3	84	110	44	202	2	4
Phu Quoc	89	42.2	98	9	32	135	2	3
Ninh Hai	197	36.9	190	24	13	147	1	4
Ca Na bay	134	40.5	163	46	26	211	1	3
Ha Long - Cat Ba	170	43	94	25	7	34	2	4
Hai Van – Son Tra	129	50.5	103	60	12	132	1	4
Bach Long Vi	99	21.7	46	16	8	46	**M**	2
Philippines								
Batanes, Basco	**M**	55.00	41	**M**	**M**	86	1	3
Bolinao/Lingayen Gulf	199	40.00	224	**M**	**M**	328	2	4
Masinloc, Zambales	**M**	33.00	57	**M**	**M**	249	2	4
Batangas bay/Maricaban	290	48.00	141	**M**	**M**	155	2	4
Puerto Galera, Mindoro	267	33.00	75	**M**	**M**	333	2	5
El Nido, Palawan	305	40.00	129	**M**	**M**	480	2	5
Thailand								
Mu Koh Chumporn	120	55	**M**	304	21	106	4	5
Mu Koh Chang	130	40	43	250	20	113	4	6
Mu Koh Ang Thong	110	55	7	136	21	106	4	1
Mu Koh Samui	140	40	7	136	21	106	4	5
Mu Koh Samet	41	35	38	134	11	74	4	5
Sichang Group	90	20	40	304	11	86	4	2
Sattaheep Group	90	33	40	304	15	75	4	2
Lan and Phai Group	72	18	40	304	15	75	2	2
Chao Lao	80	30	33	123	12	105	2	3
Prachuab	74	40	18	106	16	162	2	4
Koh Tao Group	79	45	7	136	21	106	2	4
Song Khla	12	20	2	**M**	**M**	30	2	2
Koh Kra	80	40	**M**	**M**	**M**	80	1	2
Losin	90	40	**M**	**M**	**M**	90	1	2
Indonesia								
Anambas	206	**M**	26	24	25	128	3	2
Bangka	126	**M**	**M**	25	23	169	3	2
Belitung	164	38.46	**M**	10	35	170	3	2
Karimata	192	**M**	**M**	15	15	200	3	2
Malaysia								
Batu Malang, Pulau Tioman	96	62.6	3.8	**M**	**M**	123	1	4
Pulau Lang Tengah	86	41.3	3.1	**M**	**M**	117	2	4
Pulau Lima, Pulau Redang	96	46.3	10	**M**	**M**	113	1	4
Teluk Jawa, Palau Dayang	80	38.4	11.9	**M**	**M**	156	1	4
Tun Mustapha, Sabah	252	**M**	69	**M**	45	375	4	4
Cambodia								
KKCR2	67	29.3	**M**	**M**	1	51	2	**M**
SHVCR1	34	23.1	**M**	**M**	14	6	3	**M**
SHVCR2	23	58.1	3	**M**	**M**	51	3	**M**
SHVCR3	70	**M**	**M**	**M**	14	42	3	**M**
KEPCR1	67	41	**M**	**M**	14	51	3	**M**

Table 6 Final agreed properties and variables used for the cluster analysis of wetland potential demonstration sites. (M = data unavailable)

Site	Area (ha)	Total no. fish spp.	Total no. birds spp.	No. wetland types	No. migratory spp.	Site specific endemic spp.
Data set for estuaries						
Welu River Estuary	10,400	52	74	2	21	M
Ban Don Bay Estuary	49,459	35	46	2	12	M
Thung Kha Bay-Savi Bay Estuary	5,204	86	115	2	33	M
Pattani Bay Estuary	6,149	215	93	2	43	M
Pak Phanang Bay Estuary	13,597	140	226	2	84	M
Pansipit River Estuary	15	75	24	1	10	1
Balat Estuary	26,397	130	181	2	136	6
Tien River Estuary	100,691	155	41	3	20	2
Dong Nai River Estuary	49,711	155	130	2	22	5
Van Uc Estuary	6,990	123	118	2	90	2
Bach Dang Estuary	80,358	117	153	2	25	5
Tien Yen Estuary	24,738	82	57	2	31	5
Beilun Estuary	1,083	145	133	2	93	13
Pearl River Estuary	12,783	302	227	2	141	37
Koh Kapik Estuary	12,000	25	30	2	6	4
Data set for Inter-tidal Mudflats						
Mu Koh Chang National Park Tidal Flat	65,000	11	72	1	16	M
Don Hoi Lord Tidal Flat	2,490	3	18	2	12	M
Mu Koh Ang Thong Marine National Park Tidal Flat	10,200	75	53	1	13	M
Balayan Bay Tidal flats	75,000	M	25	2	20	15
Manila Bay Tidal Flat	30,000	M	25	3	20	10
El Nido, Palawan mudflats	54,303	M	26	2	10	1
Ca Mau Southwest Tidal Flat	60,711	147	171	2	27	3
Kim Son Tidal Flat	12,620	132	140	**3**	54	5
Dan zhou lingao Intertidal Flat	806	149	157	**3**	101	21
Hepu Intertidal	3,951	227	193	**3**	137	27
Shantou Inter-tidal	1,435	213	179	**3**	100	15
Russey Srok-Tourl Sragnam Tidal flat	4,890	10	9	**2**	3	2
Data set for Coastal Lagoons						
Tam Giang-Cau Lagoon	21,600	171	73	3	35	5
Tra O Lagoon	2,000	67	55	3	25	3
Malampaya Sound	24,500	156	26	**3**	10	**0**
Degi Lagoon (Binh Dinh Province)	1,600	105	40	2	25	2
Thi Nai lagoon (Binh Dinh Province)	5,000	119	37	3	25	2
Wenchang Lagoon	218	227	193	3	137	20
Beung Kachhang Lagoon	4,503	17	12	**2**	4	1

Table 7 Final agreed data set used for the cluster analysis of peat and non-peat swamp wetlands potential demonstration sites. (M = data unavailable)

Site	Area (ha)	Total no. fish	Total no. birds	No. vascular plant spp.	No. resident mammal spp.	No. wetland types	No. migratory spp.
Data set for Non-peat swamp							
Khao Sam Roi Yot National Park freshwater marsh	9,808	34	150	**M**	14	3	**M**
Taal Lake freshwater	65,720	242	24	26	0	1	76
Peat swamp							
Thale Noi Wildlife Non-hunting Area Peat swamp	45,700	30	202	260	7	2	60
Thale Sap Song Khla Non- hunting Area Peat swamp	36,467	106	143	25	M	2	63
Phru To Daeng Wildlife Sanctuary Peat Swamp	20,120	42	194	14	61	2	21
Phru Kan Tulee Peat swamp	140	29	47	35	16	1	6

Figure 1 Cluster diagram of twenty-six mangrove sites bordering the South China Sea based on Euclidean distance and mean proximity.

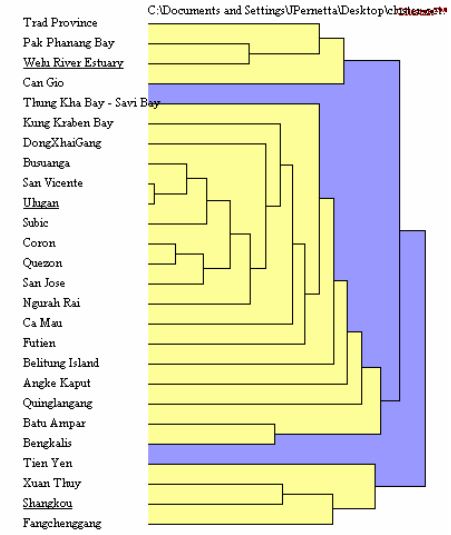


Figure 2 Cluster analysis of twenty-six potential seagrass demonstration sites bordering the South China Sea based on Euclidean distance and mean proximity.

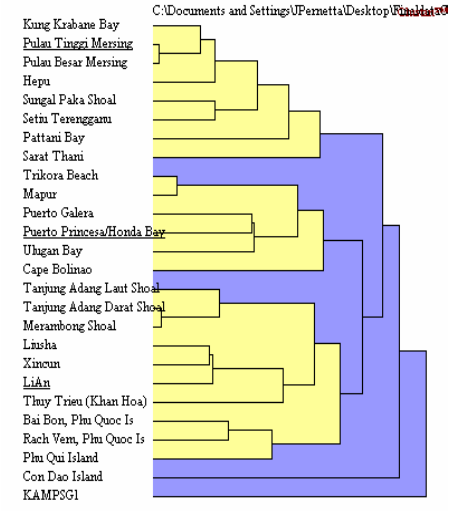


Figure 3 Cluster diagram of 44 coral reef sites bordering the South China Sea based on Euclidean distance and mean proximity.

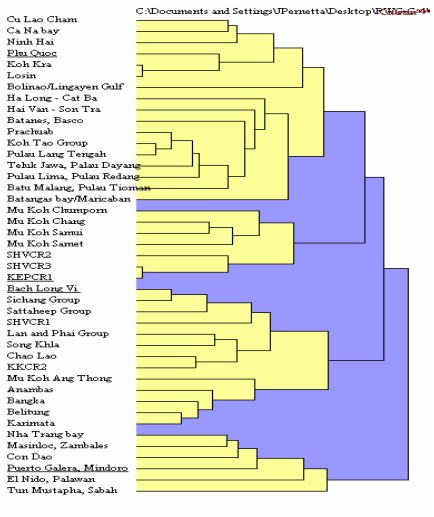


Figure 4 Results of Cluster Analysis of 15 estuarine sites bordering the South China Sea based on Euclidean distance and mean proximity.

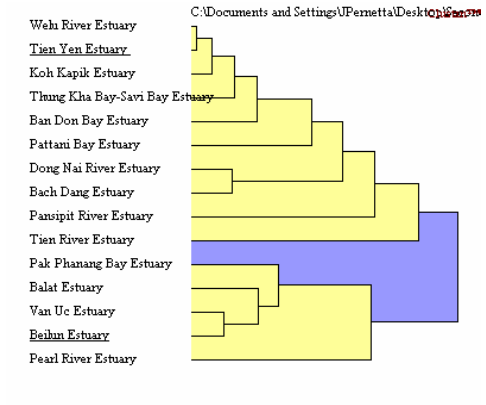


Figure 5 Results of Cluster Analysis of 12 inter-tidal mudflats bordering the South China Sea based on Euclidean distance and mean proximity.

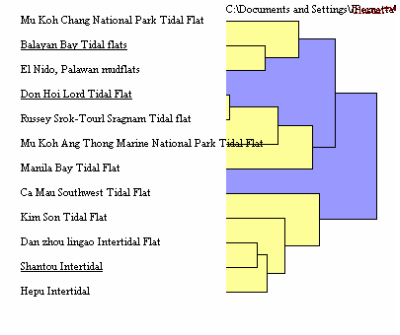
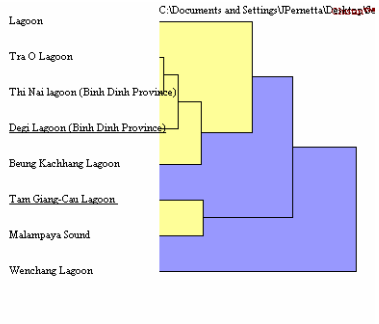


Figure 6 Results of Cluster Analysis of 7 coastal, brackish water lagoons on the margins to the South China Sea based on Euclidean distance and mean proximity.



In the case of the seagrass sites, the resulting dendrogram presented in Figure 2 shows that sites fall into three major clusters with two outlying sites. The clusters in this case do not appear to reflect recognisable geographic sub-divisions of the South China Sea with, for example, the Chinese Hepu site falling into the uppermost cluster comprising principally of sites bordering the Gulf of Thailand.

Figure 3 presents the dendrogram resulting from a cluster analysis of the data for coral reef sites presented in Table 5. Four clusters of sites are apparent, the lower cluster consisting of a grouping of outlying sites that, for various reasons, are somewhat distinct from the remainder of the set.

Figures 4, 5 and 6 present the dendrograms resulting from three separate cluster analyses conducted on the data presented in Table 6. It can be seen that the data for estuaries suggests the existence of two clusters, whilst the data for intertidal mudflats fall into three clusters and those for coastal lagoons into two with a single outlier. The sample size for peat swamp and non-peat swamp forest is too small to permit a meaningful analysis.

The purpose of performing such analyses was to identify groups of similar sites and ultimately to spread the interventions across different groups thus maximising the between site variation covered by the selected demonstration sites.

DETERMINING REGIONAL PRIORITY OF POTENTIAL DEMONSTRATION SITES

National and Regional Priority. Whilst most countries have determined national priorities for intervention including conservation and sustaining coastal biodiversity, such priorities have generally been determined and agreed independently of neighbouring countries. The determination of national priorities may not necessarily include consideration of the regional and or global significance of a particular site or of the species found there. Hence, the top priority mangrove site in one country may fall far below the lower priority sites from a second country when both sets are compared from the perspective of regional or global significance. One major challenge faced by the South China Sea Project was the determination of the comparative significance of different national areas of each habitat that included consideration of transboundary, regional and global factors.

To initiate the process of determining the comparative regional importance of national sites, it was agreed by the Regional Working Groups to develop a set of environmental criteria and indicators reflecting biological diversity and the transboundary and regional significance of each site. A similar system of criteria and indicators was also developed for the social and economic characteristics of the sites. Both sets of criteria and indicators are presented in Appendix 1 of this document and were reviewed by the Regional Scientific and Technical Committee (UNEP, 2003c; 2003i) prior to being applied to data from each site to produce a score representing a regional perspective on priorities.

Environmental Indicators

Table 8 presents a summary of the major classes of indicator, the number of individual indicators and the weight assigned to them by each working group. It can be seen that all four groups adopted the same four basic classes of indicator but that the number of indicators within each class varied somewhat between the groups.

Within each class of indicator, a series of one or more specific indicators were identified on the basis of the outcome of the initial site characterisations; hence indicators were not included by most groups when it was apparent that the information and/or data were difficult to assemble as evidenced by the frequency of missing data in the preliminary set.

Following a careful analysis of the range of values demonstrated by the site data available to the meetings, the regional working groups considered the number of divisions and weighting that would be appropriate to assign to any individual site value. Hence, for example, the number of migratory bird species recorded from each mangrove site ranged from 13 at Trad Province in Thailand to 145 species at Fangchenggang in China. For this indicator, it was decided to distinguish five categories based on an increment of 30 species and weights were assigned accordingly.

Table 8 Comparison of the number of indicators in each class of environmental indicator and the weight assigned to different classes by the Regional Working Groups on habitats.

Class	Mangrove		Coral Reef		Seagrass		Wetland	
	No. Indicators	Weight	No. Indicators	Weight	No. Indicators	Weight	No. Indicators	Weight
Area	1	35	1	10	2	25	1	10
Biological Diversity[15]	*7*	*50*	*8*	*60*	*8*	*60*	*5*	*60*
Sub-set 1 - Species	5	30	-	-	7	52	-	-
Sub-set 2 - Community	2	20	-	-	1	8	-	-
Transboundary significance	1	10	3	20	1	5	1	15
Regional/Global Significance.	2	5	1	10	1	10	2	15

Socio-Economic Indicators

Table 9 lists the indicators selected by the regional working groups as being indicative of socio-economic conditions, including indicators of national priority, stakeholder involvement and threats. As in the case of the environmental indicators, each regional working group discussed and agreed the comparative weight that should be assigned to each class of indicator and then to individual indicators within each class, finally deciding on the divisions and weights that should be assigned to the observed values at any one site.

Table 9 Comparison of the number of indicators in each class of socio-economic indicator and the weight assigned to different classes by the Regional Working Groups on habitats.

Class	Mangrove		Coral Reef		Seagrass		Wetland	
	No Indicators	Weight	No Indicators	Weight	No Indicators	Weight	No Indicators	Weight
Threats [16]	2	-30	5	+15	2	-10	2	+20
National Significance	1	20	3	25	1	16	3	40
Financial	2	20	1	20	2	22	1	20
Stakeholder involvement	4	30	1	20	4	22	1	20
Transboundary Management	-	-	1	20	-	-	-	-
Management Potential	-	-	-	-	3	30	-	-

It was noted by all groups that a number of the indicators listed in Table 2 were highly subjective. A major issue for discussion at the RSTC concerned the way in which the “threats” category should be scored. Two regional working groups scored it positively with high threats getting high scores whilst two groups scored in the reverse manner with low threats getting high scores. The rationale for the latter being that, if the threat is large or strong enough then there is no possibility of mitigating it with the resources available. The RSTC discussed this matter and agreed that what should be considered is not the threat itself but rather the reversibility of the threat. Hence the “reversibility of threat”, should be scored such that high probability of reversing a threat received a higher score and low probability of reversing the threat received a low score. This procedure was adopted in the final ranking.

Priority sites for intervention and Agreeing the outcome:

Having agreed the criteria, indicators and scoring system and conducted an independent cluster analysis to group similar sites, the rank order within each cluster was determined and a set of demonstration site proposals prepared for consideration by the Regional Scientific and Technical Committee and the Project Steering Committee (UNEP, 2004e; UNEP, 2004f).

[15] *Biological diversity was sub-divided into two levels species and community diversity by two groups.*

[16] *“Reversibility of threat” should be scored; with high probability of reversing a threat receiving a higher score and low probability of reversing the threat receiving a low score.*

By the end of the fourth round of RWG meetings, each group had produced an agreed data set, an agreed final cluster analysis, an agreed set of criteria and indicators for ranking sites and an agreed ranking of individual sites within each cluster. These agreements were presented to the fourth meeting of the Regional Scientific and Technical Committee together with the recommendations from each group regarding the demonstration sites that should be financed from the GEF Project budget. The RSTC reviewed these recommendations and outcomes making some comments and criticisms regarding some aspects of the application of the process but essentially approved the recommendations for consideration by the Project Steering Committee.

The third meeting of the Project Steering Committee considered the recommendations of the RSTC and the RWGs and accepted the recommendations with some minor additions/alterations based primarily on political considerations of "equity".

FINAL OUTCOMES:

The procedure was developed in an open and transparent manner, and was based on an agreed objective set of indicators and criteria. The process involved consensus building with all focal points participating such that all parties understood and accepted the final outcome.

The original outcome of the project was anticipated as being nine regional priority demonstration sites, three each focussing on mangroves, seagrass and coral reefs.

Additional Outcomes not envisaged during project design:

1. Regionally prioritised listings of sites as follows:
   - 26 mangrove sites;
   - 43 coral reef sites;
   - 26 seagrass sites; and
   - 40 wetlands sites (15 estuaries; 12 inter-tidal mudflats; 7 coastal lagoons; and 6 swamp forest sites)
2. Draft proposals for intervention in 23 sites across all habitats types;
3. An inter-governmentally agreed procedure for determining regional priority[17] which can be used to rank sites either nationally or regionally in the future;
4. A regional GIS database having an extensive number of sites characterised in geographical and environmental, including biological, terms;
5. Application of the approach at the national level in two countries to determine national priorities for intervention;
6. Decisions taken in an amicable manner through consensus among all participating countries;
7. A procedure and process that serves as a potential model for replication elsewhere when choices between alternative sites for intervention must be made based on financial limitations.

John C. Pernetta
July 18th 2007.

[17] *The Regional Priority is not based solely on national priorities but includes national priority as one indicator of significance.*

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Appendix 1

Table 1 Indicators and weight for criteria used in ranking mangrove systems in terms of biological diversity, transboundary, regional and global significance.

Class of Indicator	Indicator scale Score				
1. Area maximum 35 points					
1.1 Total existing natural mangrove area (ha)	< 500	500-1,000	1,001-5,000	5,001-15,000	>15,000
Score	7	14	21	28	35
2. Biological diversity 50 points					
2.1 Species diversity Score maximum 30 points					
2.1.1 True mangrove species	< 10	10-20	21-30	30-40	>40
Score Maximum 14 points	1	3	6	10	14
2.1.2 Associate mangrove species	<10	11-20	>20		
Score Maximum 4 points	1	2	4		
2.1.3 Total fish species4	<50	51-150	>150		
Score Maximum 4 points	1	2	4		
2.1.4 Crustacean	40	41-90	>90		
Score Maximum 4 points	1	2	4		
2.1.5 Resident bird species	< 15	16-50	>50		
Score Maximum 4 points	1	2	4		
2.2 Community diversity 20 points					
2.2.1 Number of zones or associations	1-2	3-4	>4		
Score Maximum 11 points	3	6	11		
2.2.2 Number of trophic levels below the top carnivore in the terrestrial food chain	1-2	3-4	>4		
Score Maximum 9 points	3	6	9		
3. Transboundary significance 10 points					
3.2 No migratory bird species include seasonal migratory spp. and long distance migrators	<30	30-59	60-89	90-120	>120
Score Maximum 10 points	2	4	6	8	10
4. Regional/Global significance 5 points					
4.1 Number of associate and true mangrove species found only in the South China Sea	0.5 points for each endemic to a maximum of 2.5				
Score Maximum 2.5 points					
4.2 Number of endangered & threatened species	0.5 points for each endangered species to a maximum of 2.5				
Score Maximum 2.5 points					

Table 2 Indicators for socio-economic considerations used in the ranking of mangrove sites bordering the South China Sea.

Class of Indicator	Indicator scale Score			
1. Reversibility of Threats				
1. Change of area (% Lost over ten years)	<5	6-10	11-25	>25
Score – max 20	20	15	10	5
2. Human population stress (population density, people/Km^2) in the site	<40	40-199	200-400	>400
Score – max 10	10	6	4	2
2. National significance/priority-Government support				
1. National priority	Low	Medium	High	
Score – max 20	2	10	20	
3. Financial considerations /co-financing				
1. Project cost ($US)	<150,000	150,000	>150,000	
Score – max 10	10	5	0	
2. Co-financing commitment	<1/1	1/1	>1/1	
Score – max 10	0	5	10	
4. Stakeholders involvement 30				
Local government (in cash/in-kind)	Low	Medium	High	
Score – max 8	2	5	8	
Central government (in cash/in-kind)	Low	Medium	High	
Score – max 8	2	5	8	
NGOs/Civil Society (in cash/in-kind)	Low	Medium	High	
Score – max 8	2	5	8	
Private Sector (in cash/in-kind)	Low	Medium	High	
Score – max 6	1	3	6	

Table 3 Indicators and weight for environmental characteristics used in ranking of potential coral reef demonstration sites.

Indicators	Scale of Indicators				
	1	2	3	4	5
Biological diversity, 60 points					
No. Hard coral Genera	< 30	31-40	41-50	51-60	> 60
Maximum score, 10	1	4	6	8	10
No. Hard coral species	< 100	101-150	151-200	201-300	> 300
Maximum score, 10	2	4	6	8	10
Percentage live coral cover	0-10	11-25	26-50	51-75	>75
Maximum score, 8	1	2	4	6	8
Percentage algal cover	>40	10-40	<10		
Maximum score, 3	1	2	3		
Number of coral reef fish genera	< 20	21-30	31-50	51-60	>60
Maximum score, 9	1	3	5	7	9
Number of coral reef fish species	<100	101-250	251-400	401-600	>600
Maximum score, 10	2	4	6	8	10
Number of other ecosystems	<1	1-2	> 3		
Maximum score, 10	0	6	10		
Transboundary Significance, 20 points					
No. of Migratory Species	<5	5-10	> 10		
Maximum score, 8	3	6	10		
Tourism (yes or no)	no	yes			
Maximum score, 5	0	5			
Cross-boundary Fishing (yes or no)	no	yes			
Maximum score, 5	0	5			
Regional/Global Significance, 10 points					
Number of endangered and threatened species	<5	5-10	>10		
Maximum score, 10	3	6	10		
Area, 10 points					
Area of coral reefs (ha)	< 100	101- 500	> 500		
Maximum score, 10	3	6	10		

Table 4 Indicators for socio-economic considerations of coral reef systems used in the ranking of coral reef sites bordering the South China Sea.

Indicators	Scale of Indicators			
	1	2	3	
Threats, 15 points				
Reversibility of fishing impact	Low	Medium	High	
Maximum score, 3	1	2	3	
Reversibility of development impact	Low	Medium	High	
Maximum score, 3	1	2	3	
Reversibility of coral mining	Low	Medium	High	
Maximum score, 3	1	2	3	
Reversibility of land-based pollution	Low	Medium	High	
Maximum score, 3	1	2	3	
Natural impact(typhoon, bleaching and COT star fish)	Low	Medium	High	
Maximum score, 3	1	2	3	
National significance, 25 points				
Identified as a national priority	Rest	3	2	1
Maximum score, 10	0	3	6	10
Level of direct stakeholder involvement in management	Low	Medium	High	
Maximum score, 5	1	3	5	
socio-economic value	Low	Medium	High	
Maximum score, 10	3	6	10	
Finance consideration - co financing, 20 points				
Potential for co financing	< 1:1	1:1	> 1:1	
Maximum score, 20	10	15	20	
Local stakeholder/ community involvement, 20 points				
Local stakeholder/ community involvement	Low	Medium	High	
Maximum score, 20	10	15	20	
Transboundary management, 20 points				
Potential transboundary management	no	yes		
Maximum score, 20	0	20		

Table 5 Indicators and weight for seagrass systems of biological diversity, transboundary, regional and global significance.

Class of Indicator	Indicator scale				
	Score				
1. Area maximum 25 points					
1.1 Total area (ha) maximum 15 points	<20	21-100	101-300	301-500	>500
Score	3	6	9	12	15
1.2 Percent coverage maximum 10 points	<20	21-40	41-60	61-80	>80
Score	2	4	6	8	10
2. Biological diversity 60 points					
2.1 Species diversity Score maximum 52 points					
2.1.1 Seagrass species	<2	3-4	5-6	7-8	>8
Score Maximum 15 points	3	6	9	12	15
2.1.2 Gastropods	<20	21-40	41-70	71-100	>100
Score Maximum 5 points	1	2	3	4	5
2.1.3 Penaeid shrimps	0	1-3	4-5	6-7	>7
Score Maximum 8 points	0	2	4	6	8
2.1.4 Sea Urchins	0	1-2	>2		
Score Maximum 4 points	0	2	4		
2.1.5 Siganids	0	1-2	3-4	>4	
Score Maximum 8 points	0	2	5	8	
2.1.6 Holothurians	0	1-5	>5		
Score Maximum 8 points	0	4	8		
2.1.7 Starfish	0	1-3	>3		
Score Maximum 4 points	0	2	4		
2.2 Community diversity Score maximum 8 points					
2.2.1 Number of other aquatic ecosystems	1	2	>2		
Score Maximum 8 points	3	5	8		
3. Transboundary significance 5 points					
3.1 Number of migratory aquatic species					
Score Maximum 5 points	score 1 point per species				
4. Regional/Global significance 10 points					
4.1 Number of endangered & critically endangered aquatic species					
Score Maximum 10 points	score 1 point per species				

Table 6 Indicators for socio-economic considerations of seagrass systems to be used in the ranking of seagrass sites bordering the South China Sea.

Class of Indicator	Indicator scale			
	Score			
1. Reversibility of Threats maximum 10 points				
1.1 From destructive fishing	Low	Medium	High	
Score – max 5	1	3	5	
1.2 From pollution	Low	Medium	High	
Score – max 5	1	3	5	
2. National significance/priority-Government support maximum 16 points				
2.1 National priority	Low	Medium	High	
Score – max 16	5	10	16	
3. Financial considerations /co-financing maximum 22 points				
3.1 Project cost ($US)	>150,000	150,000	<150,000	
Score – max 10	3	6	10	
3.2 Co-financing commitment	<1/1	1/1	>1/1	
Score – max 12	4	8	12	
4. Stakeholders involvement maximum 22 points				
4.1 Local government (in cash/in-kind)	Low	Medium	High	
Score – max 6	2	4	6	
4.2 Central government (in cash/in-kind)	Low	Medium	High	
Score – max 4	1	2	4	
4.3 NGOs/Civil Society (in cash/in-kind)	Low	Medium	High	
Score – max 6	2	4	6	
4.4 Private Sector (in cash/in-kind)	Low	Medium	High	
Score – max 6	2	4	6	
5. Management potential maximum 30 points				
5.1 Accessibility	Low	Medium	High	
Score – max 10	3	6	10	
5.2 Existing institutional framework	Low	Medium	High	
Score – max 10	3	6	10	
5.3 Existing information	Low	Medium	High	
Score – max 10	3	6	10	

Table 7 Environmental Indicators and Scores for Criteria used in the Ranking of potential Peat and Non-Peat Swamp Wetlands demonstration sites. In the case of inter-tidal mudflats, estuaries and coastal lagoons, the indicator "No. of mammal species" was omitted.

Environmental Indicators					
1. Area (ha) 10%					
Area 10%	100 - 10,000	10,000-50,000	50,000-100,000	100,000-150,000	> 150,000
	2%	4%	6%	8%	10%
2. Biological diversity 60%					
2.1 No. of Fish species 18%	1 - 50	51 - 100	101 - 150	151-200	> 200
	4%	7%	11%	15%	18%
2.2 No. of bird species 18%	1 - 50	51 - 100	101 - 150	151-200	> 200
	4%	7%	11%	15%	18%
2.3 No. of plant species 6%	1- 100	101-200	201-250	251-300	> 300
	1%	2%	3%	5%	6%
2.4 No. of mammal species 6%	1-10	11- 20	21 - 30	31-50	> 50
	1%	2%	3%	5%	6%
2.5 Wetland types 12%	1	2	3	4	> 5
	2%	4%	6%	10%	12%
3. Transboundary Significance 15%					
3.1 No. of migratory. Species 15%	1 - 10	11- 20	21 - 30	31-40	> 40
	3%	6%	9%	12%	15%
4. Regional/Global Significance 15%					
4.1 No. of endemic species 7%	1	2	> 3		
	2%	4%	7%		
4.2 No. of endangered. species 8%	1 - 6	7 -10	> 10		
	3%	5%	8%		

Table 8 Socio-economic Indicators and Scores for wetlands bordering the South China Sea.

Socio-Economic indicators			
1. Threats 20%			
1.1 Reversibility of External sources of change, 10%	Low	Medium	High
	2%	6%	10%
1.2 1 Reversibility of Internal source of change, 10%	Low	Medium	High
	2%	6%	10%
2. National significance 40%			
2.1 Identified as a national priority, 25%	1	2	3
	25%	15%	10%
2.2 Level of direct stakeholder involvement in management, 10%	Low	Medium	High
	2%	6%	10%
2.3 Commitments to RAMSAR, 5%	no	planned	yes
	0	3%	5%
3. Financial considerations 20%			
3.1 Potential for co financing (% of potential project budget), 20%	25	50	100
	5%	10%	20%
4. Local stakeholder involvement 20%			
4.1 Local stakeholder/community involvement	Low	Medium	High
	2%	12%	20%