GIWA Sub-region 53, Bay of Bengal
Final Workshop 28-29 June 2003, Colombo, Sri Lanka

Draft Workshop Report

1.0 Background

The GIWA Sub-region 53, Bay of Bengal Assessment was initiated in October 2001. Dr. J. I. Samarakoon, Focal Point, GIWA Sub-region Task Team (SRTT) participated at the General Assembly Meeting in October 2001, Kalmar, Sweden. The SRTT assembled by Dr. Samarakoon participated at the Scaling and Scoping Workshop convened by the South East Asian Regional START Programme in Bangkok in November 2001. This was done for the purpose of familiarization with the GIWA process. The budget for the GIWA Sub-region 53, Bay of Bengal assessment was approved in December 2001 and the contract signed later in the same month.

The cost of travel and daily subsistence allowance (DSA) for participation of the Sub-region 53 SRTT at the Scaling and Scoping Workshop, Bangkok, 5-8 November 2001 was provided from a source other than the budget in the contract for the Sub-region 53 Assessment. The cost of air travel of Dr. Samarakoon to Kalmar and the honoraria paid to the SRTT members for participation at the workshop in Bangkok were deducted from the Sub-region 53 Assessment budget.

2.0 GIWA Sub-region 53: 1st Assessment Workshop and Consultations

The Report of the 1st Assessment Workshop and subsequent consultations held in New Delhi, India; Phuket and Bangkok, Thailand; Dhaka, Bangladesh and in Yangon, Myanmar were previously submitted to the GIWA Office in Kalmar. These costs have already been reimbursed.

3.0 GIWA Sub-region 53, Bay of Bengal: Scaling and Scoping Report

The draft Scaling and Scoping Report was submitted to the GIWA Office, Kalmar in May 2003. It was reviewed and permission granted for the Final Workshop for Causal Chain Analysis and Policy Option Analysis scheduled for 28-30 June 2003.

4.0 The GIWA Final Workshop

4.1 Organization

The South Asia Co-operative Environment Programme (SACEP) collaborated with Dr. Samarakoon in the organization of the workshop in response to an invitation from Dr. Dag Daler, Scientific Director. In parallel, invitations were also dispatched by Dr. Daler to policy level invitees from Bangladesh, India and Myanmar.

The contribution of SACEP was significant for facilitating the issuance of visas, and organization of the venue, field excursion and the reception attended by Hon. Rukman Senanayake, Minister for Environment and Natural Resources. The support of Mr. Mahboob Elahi, Director General and Mr.

Prasantha Dias Abeyegunawardene, Interim Coordinator, South Asian Seas Programme is acknowledged with gratitude. The address of the Minister is in *Annex 1*.

4.2 Workshop Participants

GIWA Office Kalmar: Dr. Juan Carlos Belausteguigoitia, GIWA Coordinator, Southern Hemisphere.

Bangladesh: Mr. Mohamed Sayef Uddin, Secretary, Ministry of Water Resources; Dr. Q. K. Ahmad, Chairman, Bangladesh Unnayan Parishad; Dr. M. A. Quassem, Consultant in Water Resources Management (former Director General, Water Resources Planning Organization); Dr. Atiq Rahman, Executive Director, Bangladesh Center for Advanced Studies.

India: Prof. Paul Appasamy, Director, Madras School of Economics; Dr. Dilip Biswas, Chairman, Central Pollution Control Board; Prof. Ramachandra Ramesh, Institute for Ocean Management, Anna University.

Indonesia: Dr. S.K.Agus, Chief of Statistics and Information, Directorate General of Water Resources.

Malaysia: Prof. Ong Jin Eong, Mangrove Ecosystem Specialist, Universiti Sains Malaysia.

Myanmar: Ms. Daw Yin Yin Lay, Joint Secretary, National Commission for Environmental Affairs; Mr. U. Ye Myint, Director, Department of Meteorology and Hydrology.

Nepal: Mr. Dipak Gyawali (former Minister of Water Resources), Academician, *Pragya*, Royal Nepal Academy of Science and Technology.

Sri Lanka: Dr. Ranjith Galappatti, Managing Director, Lanka Hydraulics Institute; Dr. Jayampathy Samarakoon, Coordinator, GIWA Sub-region 53 Task Team.

Thailand: Dr. Hansa Chansang, Coral Reef Ecologist; Dr. Vudichai Janakern, Chief, Marine Fisheries; Dr. Somkiat Khokiattiwong, Oceanographer, Phuket Marine Biological Station.

Regional Institutions
Bay of Bengal Inter-governmental Organization: Dr. Yugraj Yadava, Interim Coordinator;

Bay of Bengal Large Marine Ecosystem Programme: Dr. Philomene Verlaan, Regional Coordinator.

Network of Aquaculture Centers in Asia-Pacific: Dr. Michael Phillips, Environmental Specialist.

South Asia Co-operative Environment Programme: Mr. Prasantha Dias Abeygunawardene, Interim Coordinator, South Asian Regional Seas Programme.

Third World Center for Water Management, Mexico City: Prof. Asit K. Biswas, President and Academician (Chaired the Panel Discussion on 29th June and participated in the morning session on Policy Option Analysis).

4.3 Workshop Agenda

The workshop programme *(Annex 2)* provided for explanation of the background to the Final Workshop, the procedure for Causal Chain Analysis (CCA) and Policy Option Analysis (POA) and a Panel Discussion which addressed policy issues. The detailed analysis was carried out by two working groups which focused on:

Working Group 1: Freshwater Shortage
Working Group 2: Habitat and ecosystem modification.

Dr. Samarakoon presented the findings from the Scaling and Scoping exercise at the beginning of the workshop programme to provide the necessary background and to set the stage for the Final Workshop. The Working Group sessions of each day were preceded by a presentation by Dr. Belausteguigoitia on the respective tasks for the day, CCA and POA. Professor Appasamy explained examples of case studies to illustrate the manner in which CCA and POA could proceed.

The panel discussion on 29th June was chaired by Prof. Biswas, Advisor, GIWA Sub-region 53, Bay of Bengal Assessment. Subsequently he participated in the working session of Group 1 during the forenoon.

4.4 Workshop Outputs

Two main workshop outputs resulted:

Working Group 1:

The initial draft document prepared by Prof. Appasamy for finalization by way of discussion with the SRTT is given below:

Group Members:
Dr. Agus (28th June only)
Dr. Ahmad
Professor Appasamy (discussion leader)
Dr. Dilip Biswas
Prof. Biswas (29th morning only)
Dr. Galappatti
Mr. Gyawali
Mr. Myint

Prof. Ramesh
Dr. Quassem
Mr. Sayef Uddin

FRESH WATER SHORTAGE IN THE GANGES-BRAHMAPUTRA-MEGHNA RIVER SYSTEMS

Diversion of Stream Flow – Causal Chain Analysis

The Ganga-Brahmaputra-Meghna (GBM) river system is one of the largest in the world and delivers an enormous quantity of fresh water into the Bay of Bengal. The GBM is a transboundary system in the sense that at least three countries – Nepal, India and Bangladesh – are involved in sharing the water resources. Fresh water shortage in Bangladesh has occurred due to diversion of stream flow in India.

Immediate Causes

The major portion of the Ganga estuary is in Bangladesh. There are many diversions and impoundments of the river. Within India the utilizable water resources of the Ganga amount to 250,000 MCM. The live storage capacity is 54,196 MCM and the projects under consideration of 29,614 MCM or a total of 33.3% of the utilizable water resources.

The construction of the Farraka barrage in 1975, 18 kilometres upstream of the border with Bangladesh, diverted water into the Hooghly River. The ostensible purpose of the diversion was to make the Hooghly navigable and reduce the siltation of Kolkata (Calcutta) harbour. However, the diversion has reduced the dry weather flows of the Ganga in Bangladesh. This has resulted in reduction in irrigated area, reduced food production, and affected important coastal mangrove areas due to saltwater intrusion. (Rosegrant, 1997).

Apart from the immediate cause of reduction in stream flow due to the Farraka Barrage, there are also other abstractions for irrigation, urban and industrial uses that are limiting the flow in the Ganga. Embankments and other structures may be causing riverbed changes and siltation. There is concern that the proposal for interlinking rivers in India may have serious consequences for Bangladesh. Finally, climate change may also be causing modifications to stream flow.

Intermediate Causes

The underlying causes include the following:

a) Navigation in the Hooghly River has been reduced due to siltation, resulting in disruption of harbour activities. Flows into the Hooghly have reduced due to abstractions.
b) In the basin both in India and Bangladesh there is increased use of water for irrigation due to changes in cropping pattern favouring water intensive crops.

c) The other major reason for abstractions is changes in land use to urban and industrial uses. The water requirement for urban and industrial uses would be much higher on a per-capita basis compared to rural areas. There is also pollution caused by the wastewater from urban areas which may limit the availability of fresh water.

Root Causes

a) Inadequate Pricing Policies*:* In the irrigation sector in both India and Bangalore investment costs are rarely recovered. The low level of irrigation charges may be responsible for the overuse of water by farmers, and for the shift to water intensive crops. Hence proper pricing policies are necessary. There is some attempt now to recover atleast a part of the operation and maintenance costs. One way to do this is to turnover a part of the irrigation system to the farmers for joint management. Farmers will not only put in their labour but recover some of the costs of the part of the system for which they are responsible. In setting water charges for surface water or the power tariff for ground water extraction, it should be ensured that these are not detrimental to small and marginal farmers. Difference in prices has also led to cross border trade between India and Nepal and between India and Bangladesh. Uniformity in pricing policies among countries in the basin would be important.

b) Neglect of Environmental Value of Water*:* In allocating the water in the basin for various uses such as agriculture, industry, domestic, navigation, etc. the ecosystem function of water has been neglected. It is important to keep the river alive to support aquatic ecosystems. In this particular basin, the coastal mangroves are very much dependent on the balance between fresh water and salt water. When this balance is disturbed, the wetland ecosystems such as the Sunderbans are affected.

c) Lack of Good governance:

(i) National Level – In all the three countries of the basin, India, Nepal and Bangladesh, domestic policy on water resources needs attention. Water resources management is fragmented among many agencies and needs to be integrated, since water is a unitary resource. Water Resources Councils have been established in all three countries, but only in Bangladesh does the Council meet on a regular basis. Environmental laws have delayed water projects considerably resulting in increase in costs. There is need to involve and share information among stakeholders. Focus can shift to small storages like ponds and tanks so that the major impacts of large diversions can be avoided.

(ii) International Level – There is currently no mechanism for monitoring the hydrological data and ensuring accurate data is used by all the countries in the region. The Indo-Nepal Treaty (1995) has not progressed much because of differences in perspective about the respective water rights and also about the area to be submerged if a dam is built. The Indo-Bangladesh Treaty of 1996 has taken the process forward. Under the agreement, Bangladesh will receive about one half of the average flow at Farraka (as computed between 1949 and 1988). The treaty not only attempts to apportion the water resources at Farraka in an equitable manner but also refers to best utilization of the resource. Since the GBM region encompasses many rivers, the treaty provides for considering the sharing of the other rivers. Thus, the lack of a good international treaty

between India and Bangladesh for nearly two decades was overcome in 1996, and has been relatively successful in dealing with the issue.

Policy Option Analysis

The root causes for the modification of stream flow in the GBM system were identified to be

a) Lack of Pricing Policies for water in the three countries of the Ganga basin
b) Neglect of the environmental value of water in decision-making
c) Lack of good governance both at the national level and at the international level in the three countries.

Policy options to address these causes could be broadly classified as Conservation and Augmentation.

I. CONSERVATION OPTIONS

1. Pricing Policies for Water

In all the three countries, the irrigation charge is modest and is often not sufficient to cover even the operation and maintenance costs. With regard to groundwater extraction, the power tariff for agriculture has been introduced in Nepal and some Indian states but not in Bangladesh. In all the countries, piped water for urban and industrial users is generally metered and priced. However, domestic consumers may not be charged the full resource price. It was generally felt that the price should cover the cost of supply to ensure the financial viability of the provider. In the case of irrigation, joint management or participatory approaches can be tried to recover at least the operation and maintenance costs.

2. Reuse of Wastewater

South Asian societies have traditionally reused wastewater. However, there has to be official recognition that large quantities of wastewater are available for reuse. If the wastewater is not treated, it can become a pollution problem. Given the problems of fresh water shortage in the region, reuse of wastewater for agriculture, pisciculture, etc. must be given serious consideration. This would be another way of conserving fresh water.

3. Water Harvesting

Instead of constructing more large storages in the Ganga basin, one option would be to construct or rehabilitate tanks/ponds which have been a traditional source of water management. These could be maintained by decentralized institution at the local level. These small storages also keep to recharge wells and springs and are a good insurance against drought.

In terms of the performance criteria of the policy options for conservation the following observations can be made:

a) Effectiveness: Pricing could reduce the usage especially in the irrigation sector, which is the largest user of water. Participatory management may help to make the policy more acceptable to the farmers. In the case of the urban and the industrial sector, proper pricing may reduce the subsidies which are now being enjoyed by those who can afford to pay.

b) Efficiency: The primary purpose of pricing is to ensure the efficient use of resources. The revenue generated will also be helpful to the respective agencies to ensure financial viability. Reuse of wastewater will be an efficient use of the resource.

c) Equity: There is some concern that small and marginal farmers should not be adversely affected. It may be possible to give them a direct cash subsidy to enable them to pay. The problem has been that the non-poor have received subsidized water both in rural and urban areas. Water harvesting may be of benefit to the poor.

d) Political Feasibility: Proper pricing of water and power (for groundwater extraction) has not taken place largely for political reasons. However, given the difficult financial position of many governments and the need for reform, there has been some movement towards proper pricing. It may be necessary to prepare the ground by public awareness programmes and by involving the stakeholders to the extent possible.

e) Implementation: Legal changes other than legislation may not be needed. The political parties in power may have to develop a consensus on the need for reform of the water sector. Resources may not be a constraint for implementation. Reuse of wastewater and water harvesting may require improving public awareness and involvement.

II AUGUMENTATION OPTIONS

The other major policy option to deal with the problem of fresh water shortage in the dry season is augmentation. This can be done by building a medium sized storage in Nepal and releasing the water during the dry season. This option requires a regional treaty between Nepal, India and Bangladesh. Of crucial importance is that the project should take into account the environmental value of water downstream i.e. the objective would be to keep the river alive. Possibly, navigability of the Ganga could also be considered. A regional project such as the above would require participation by all the governments. Bangladesh may have to invest in the project if it is to receive dry weather flows. However, there would be problems with submergence in Nepal and displacement of about 100,000 persons.

The institutional arrangement could be a joint company with participation by the private sector. Financing modalities would have to be worked out. 400 MW of electricity could be produced in an environment-friendly manner. There would be need to exchange real time data among the three countries. A regional commission like the Mekong Commission would have to be set up to manage the process.

In terms of the performance criteria for this option, the following aspects need to be mentioned:

a) Effectiveness – There are some negative impacts like submergence and displacement that must be considered. Nepal would be bearing these costs. There are also major political

obstacles to regional cooperation, since three governments need to cooperate – given the history of the region, the probability of success is not high!

b) Efficiency – The benefits of the project include minimum stream flow downstream to maintain ecosystems, hydroelectric power, and possibly other benefits like irrigation and fisheries. Apart from the financial costs of the project, there would also be environmental costs of submergence of forest areas and social costs of displacement. A detailed project report would have to be prepared to estimate the benefits and costs.

c) Equity – There are clearly costs of displacement and an affected population in Nepal. However, there may be benefits to irrigation and small farmers / fisheries downstream in Bangladesh. Bangladesh would pay for some of the investment costs of the project.

d) Political Feasibility – The biggest stumbling block is the intergovernmental agreements that would have to be worked out. Nepal may gain from the hydroelectric power and associated development but lose in terms of submergence and displacement of population. Bangladesh would be the primary beneficiary from augmentation of stream flow in the dry season. The Indo-Nepal Treaty and India – Bangladesh Treaty have been bilateral treaties. So far, India has not supported regional treaties. Such regional approach should be attempted through the aegis of SAARC or some other means of regional cooperation. There seems to be little hope of such a regional agreement being signed in the present political climate.

e) Implementation Capacity – The three countries will have to work out all the technical, financial, and institutional details of the project. Resources have to be mobilized from the three countries and from financing institutions like the Asian Development Bank. Nepal, in particular would have to do detailed impact studies to see if it would be worthwhile. India would have to ensure that the water passes through without diversion. These obstacles may have to be overcome if the project is to see the light of day. The augmentation option would need detailed planning after an agreement is reached by the three countries to have such a project. In comparison to augmentation, the conservation options are more easily achievable because intergovernmental agreements are not needed.

Working Group 2: The first draft prepared by Dr. Chansang is given below:

Group Members

Mr. Abeygunawardena
Dr. Agus (29th only)
Dr. Chansang, (discussion leader)
Prof. Eong
Dr. Janakern
Dr. Khokiattiwong
Mrs. Lin Lay
Dr. Phillips
Dr. Rahman
Dr. Samarakoon (GIWA SRTT Coordinator)

Dr. Verlaan (facilitator)
Dr. Yadava

Habitat and Ecosystem Modification: Merbok, Malaysia and the Sunderbans, Bangladesh & India

Causal Chain Analysis

Site identification:

The main criterion to be used was transboundary implications. Mangroves were decided as the priority habitat to be considered although coral reefs and peat swamps and their regional and global implications were discussed.

Transboundary was defined not only in terms of bio-physical aspects but also in relation to trade in products (both through direct extraction and by way of production activities, mainly shrimp culture).

Dr. Verlaan, based upon her familiarity with the Global Environment Facility funding policy pointed out that mangroves and aquaculture would be 'geffable' because of shared interest of several countries. Mangroves and aquaculture also have implications for overfishing, and for maintaining balance between trade and livelihood (relations between government and local population). This also brings out the question of what are the microeconomic consequences of macroeconomic policy.

Two sites were identified to represent the Andaman Sea coast and the South Asian coast as well as different socio-economic aspects of uses:

Andaman Sea coast:

Merbok Mangroves in Peninsular Malaysia situated in the Malacca Straits. This mangrove system has the highest species diversity in the world. It has transboundary significance since:

- Its ramking as having the highest mangrove biodiversity in the world gives it a uniqueness which requires both global and regional attention,
- the waters of Malacca Straits is shared by Indonesia (Sumatra) and Malaysia,
- the changes occurring in Merbok can be repeated at many locations on the western coast of Malaysia and Thailand and the area of Sumatra bordering the Malacca Straits. The growing affluence, particularly of Malaysia and Thailand are driving land use changes that ignore the real economic value of mangroves.

South Asian coast:

Sunderbans shared by India and Bangladesh. The Sunderbans Mangroves are significant in itself since they constitute the largest mangrove ecosystem in the world. The part in Bangladesh is a World Heritage Site. Apart from the transboundary implications shared by Bangladesh and India, its structure and functioning also have consequences for coastal waters of the northern Bay of Bengal.

The immediate causes of habitat modification at both sites were identified as:

- Aquaculture,
- Land use change
- Unsustainable harvesting

The driving forces (root causes) of change in the two systems were considered in historical perspective.

Merbok Mangroves

Prof. Eong provided the substantive information based upon his research in the area spanning two decades. In terms of historical land use changes during the past 50 years, the reduction in extent attributable to the most significant uses is *(Table 1)*:

- Agriculture: 20%
- Aquaculture: 25%
- Real estate: 10%

Immediate Causes	% Change in 50 years	Driving Force	Current Situation	Remarks
Agriculture	20%	Implementation of the stated government policy for self-sufficiency in rice production started in 1980.	Market forces have made rice cultivation unprofitable. Much of the rice growing areas were situated on acid-sulphate soil where productivity was low. Now many cultivation areas lie fallow. No longer a threat. A supportive policy does not exist.	Could the driving force also be the political need to maintain control by the land owning class over tenant cultivators? Has technology made a difference? Originally the land was state owned, now it is private property.
Aquaculture, mainly shrimp farming	25%	Investment capacity of the affluent from outside the local area. Emphasis on foreign exchange earnings as a high priority in the national development plan.	Operation and existence justified on the basis of 'foreign exchange' contribution to the national economy. Recent problems of disease have affected export earnings. Investor interest is retarded.	Rate of expansion is slowing down because of competition in the land market between shrimp aquaculture and real estate development. Real estate development is more profitable under state patronage where land transfers are subsidized. Political implications in the

				market are evident.
Real estate	Less than 10%	Local housing for middle and upper income groups. Development under local government patronage. Rapid economic growth, despite the recent South east Asian economic downturn.	An increasing threat since the economic profitability is high. The market demand from the higher income groups continues to grow. Malaysian economic policy is directed at achieving developed country status based upon the existing economic growth performance.	Conflicts with the national policy on mangroves. The Federal government stands for protection of mangroves. However, the decentralized legal provisions at the state level are stronger than the federal powers.
Ineffectiveness of political clout of civil society	The adversely affected group has decreased in 'size' of head counts and therefore in voting power.	The financial interest of decision makers who also have entrenched market interests in real interest development. This is a force that neutralizes efforts by the remaining population dependent on natural resources to protect the functioning of the mangrove ecosystem.	Continues as a driving force	A situation that requires transparent government commitment and equitable law enforcement to introduce balance. An unlikely perspective.

Institutions

Mangroves are under state control (local government). The state can overrule the requirements under the environmental policy of the central government. The Central Government is responsive to

the worldwide consciousness of the value (both environmental and economic) of mangroves. However, the state government is insensitive. The trend in real estate development will continue unabated since economic growth in Malaysia is continuing at a high rate. Politicians in the state government do not recognize the real economic value of mangroves. Civil society has lost its voluntary organizational power to exert any meaningful political influence. Many government, civil society and market distortions contribute to the aggravation of isolation of civil society. Government and markets have moved away from the accountability that can be imposed by civil society.

The mangroves belong to the state government. Therefore the state government is in a position to allocate land for real estate development at concessionary rates mainly because of direct and indirect interest of politicians. The virtually abandoned paddy lands which should be the proper sites for real estate development are more expensive since they are privately owned.

The changes in the Mebok mangroves are driven by market forces facilitated by political (government intervention). Greed dominates land use change. The opportunity for compromise brought about by the need of communities that depend upon the productivity of the mangroves and associated fishery productivity is ignored since mangroves are grossly undervalued. Preference of the political leadership is likely to perpetuate under valuation of mangroves.

Transboundary value

The transboundary ecological and economic value of the Merbok mangroves was shown to be high because of its biodiversity uniqueness. On the basis of research findings, the species diversity of this mangrove ecosystem is recognized as the highest in the world. Hence its transboundary significance.

The Sunderbans

Sunderbans is the largest continuous mangrove tract in the world. The scale and nature of the problems of habitat change in these mangroves are fundamentally different from the Merbok area. The substantive information with regard to the Sunderbans was provided by Dr. Atiq Rahman and by Dr. Yugraj Yadava who had both research and management experience in the field. The significant driving forces are both natural and anthropogenic:

Immediate causes	% of existing mangroves relative to 50 years ago	Driving forces	Current situation	Remarks on trends
Natural: the freshwater and sediment discharges from the Ganges-Brahmaputra-Meghna river systems in interaction with the coastal dynamics of the	Natural expansion in some areas and reduction in others. Not measurable since adequate research has not been undertaken. Some mangrove areas as in Cox's Bazaar have been	Both natural (large scale) and socio-economic. The government forces (the management authority) are involved in various market activities that contribute to	Continues but aggravated by anthropogenic interventions.	The dynamic equilibrium of Sunderbans shall continue since the existing state was created by stabilization of eustatic sea level changes about 7,000 years ago. However the natural direction of change can be

Bay of Bengal. Low-level seismic activity contributes to stabilization of sediment deposition.	entirely lost to shrimp farming.	large scale change. The impact of low-income groups is marginal in comparison.		influenced by anthropogenic change which places population centers at risk.
Polderization as a development intervention about 3 decades ago reduced the options available for livelihood. Now the embankments have become an opportunity for inefficient shrimp culture	Need maps, quantification	Demand for wild shrimp seed	Continues although shrimp hatcheries are expanding production	Shrimp farmers are now becoming increasingly interested in long-term management for sustainability
Water management in the watershed	- considered by the water group -	--- Water Group ---	-----Water Group -----	--- Based on water group findings---
Extraction of timber	Not known, but substantial. Do the FAO/UNDP/DIFID studies give quantities?	Collusion between the responsible government agency and political forces (personal enrichment)	Continues since the responsible government agency exercises authority	This is a problem stemming from the absence of interactive terrain for discussion of issues among the leading stakeholders (government, civil society and the markets). This issue is discussed separately.
Conversion: Agriculture, initially for rice cultivation. Pure rice cultivation is no longer profitable. Now rice cultivation is done in combination with fish culture. Marginally profitable.	Quantitative information is not available	Poverty combined with political exploitation of poor constituencies. Exploitation of opportunities to appease low income constituencies regardless of consequences	Continues unabated.	Proposed development programmes include further conversion of mangroves into settlement areas irrespective of the adverse environmental consequences and long-term socio-economic consequences.

Livelihood: the population pressure is driving encroachment into state owned land.	Reliable information is not available	Demographic push factor: the high density of population and the general poverty of coastal populations. Poverty and the tendency of the poor people to vote in general elections that give legitimacy to the political leaders to make decisions	Continues	To what extent are political priorities driven by the donor and multilateral financial agencies?
External Causes: Reduction of water flow because of excessive upstream water abstraction, and possible sea level rise due to climate change. These are long term changes that require further research.		Inadequate flows for nature in spite of the Indo-Bangladesh agreement		May aggravate unless water demand in Indian Ganges basin is not adequately managed.
Historical impacts: in view of several serious flood episodes Bangladesh implemented a polderization programme which involved the transformation of the hydraulics of substantial areas. These interventions	To e ascertained since the data is available.	The driving forces are based upon government policy as well as the recognition that community groups need to be given an opprtunity for effective participation.		

are now beging revised. The needs of the time of polderization appears to have changed. The emergent priorities are now becoming the driving forces.				

Comparison of Merbok and Sunderbans

Immediate Causes	Merbok	Sunderbans
Agriculture	Yes	Yes
Aquaculture	Yes	Yes
Real estate	Yes	No
Livelihood	Marginal	Yes
Infrastructure	Yes	No
Unsustainable harvestation	Not applicable	Yes

The causal chain analysis resulted in the identification of the following issues for policy option analysis. These were Viz:

- Merbok Mangroves:
  - Containment of real estate development in mangrove areas, it should more properly be done in uncultivated paddy areas,
  - absence of harmony between national policy and local government, persistent (of the state government) disregard for the value of mangroves,
  - feasibility of mangrove restoration.
- Sunderbans Mangroves:
  - empowerment of local communities to a level where they can hold government (Forest Department) accountable for commercial destruction of mangroves,
  - improvement of survival strategies of poor people,
  - link investment activities, including aquaculture and other infrastructure development, to income enhancement for the poor.

Policy Option Analysis

Merbok

The problem: Loss of mangrove due to habitat conversion.

The level of the problem was analysed. The well studied situation in Merbok reflects a situation of global significance. The research substantiates the global significance of the highest diversity situation of Merbok. Its sub-regional significant areas in the Bay of Bengal and Andaman Sea areas was uncontested.

Local level: survival of fisher folk, loss of aesthetic value and nursery area for coastal fishery.

Substantiation is to be provided by Prof. Eong who has been involved in research in the Merbok area for the last 20 years.

The Stakeholders:

- The state: jurisdiction over land rights
- National Government, formulating overall policy,
- Investors in land development,
- Shrimp farmers,
- Rice farmers,
- Fishers,
- Civil society, NGOs and the silent majority,
- Global community (in terms of carbon sink, biodiversity).

Policy Options

Merbok

Do nothing:

The situation in Merbok and in the Sunderbans suggested that 'do nothing' is not an option because of the international significance of both Merbok and the Sunderbans.

Protect Existing Area by increasing its extent through restoration:

Arrest expansion of housing into existing mangroves. This would require land use zoning and strict enforcement with adequate legal backing by the state government. Incentives would have to be provided to set up housing development in abandoned agricultural areas. This can only be done by market forces that make mangroves more expensive that the abandoned paddy areas.

A well conceived education and awareness intervention targeting paddy land owners will be required to convince them of the economic benefits in the short-term and in the long-term. The paddy land owners may be enabled to obtain substantial returns from real estate development by becoming equity partners. The unused paddy land could be their equity contribution. This would require elimination of distortion in the land market induced by state politicians becoming market players.

The evaluation of the available policy options is presented in the *Table 2.*

Table 2: Evaluative criteria for policy options relating to the Merbok mangroves

Policy Option	Effectiveness	Efficiency	Equity	Political feasibility	Implementation capacity	Outcome
Do nothing	-	-	-	+	Not relevant	No mangroves in 2020
Protect	+	+	+	+	-	Existing mangroves continue. Paddy land owners share benefits from real estate development
Restore	+	+	+	+	+/-	Loss compensated by extra mangrove areas

Each category has to be properly defined. Otherwise divergent interpretations will confuse policy determination.

Sunderbans

1. The problem: Loss of mangroves in the largest unitary mangrove ecosystem in the world. Habitat degradation is occurring because of unsustainable use. The impacts are visible at all levels from the poor and vulnerable to the rich elites. The impact is global, regional and local.

2. The substantiation shall be provided by Dr. Rahman and by Dr. Quassem.

3. The stakeholders are:
    - National government,
    - Local government,
    - Fishers'
    - Farmers'
    - Resource extractors (mainly timber for household use, construction, fuel wood)
    - Shrimp farmers,
    - Commercial timber extractors
    - Politicians who use bureaucrats for market opportunity,
    - Civil society (NGOs and community members),
    - Local money lenders,
    - Donor agencies,
    - Supporting systems
    - Traders
    - Boat/fishing gear builders
    - Tourists

4. Existing situation:
    - National policy exists to protect the area and provide for sustainable use of the resources,

- A land use Zoning Framework for the World Heritage Site exists with appropriate protected areas (buffer zone), subsistence living area, and commercial zone for sustainable harvesting.

The Real Issue:

Ineffective implementation to achieve the policy objective.
Needs: Better management practices:

- shrimp and other aquaculture by means of land zonation, production practices, and enforcement Etc,
- timber and non-timber extraction on sustainable basis,
- participation of all stakeholders,
- appropriate knowledge available for all levels of stakeholders.

Remarks:

- Due to restricted time frame and complexity of issues many important subjects were left out: i.e. shrimp production and trade, subsistence fisheries, possible long-term degradation of mangroves due to reduction of flow from upstream, and sea level rise.

4.5 The Next Steps

The following tabulation shows the next steps to be taken for completion of the GIWA Sub-region 53, Bay of Bengal Assessment with the target dates:

Activity	Target Date
Finalization of CCA and POA	31 July 2003
Carrying out a CCA and POA for overexploitation of fisheries*	31 July 2003
Acquisition of maps and illustrations	31 July 2003 (specific requests to be made)
Comments on first draft of the paper for the January 2004, Ambio issue	15 August 2003
Acquisition of maps and illustrations	15 August 2003
Draft Final Report	31 August 2003
Comments from SRTT members	15 September 2003
Finalization	30 September 2003

* Dr. Yadava has undertaken to carry out a CCA and POA for Unsustainable Exploitation of Fisheries and Other Living Resources based upon his experience in the Bay of Bengal Programme. This has become necessary since, this GIWA Priority has generally acquired very high scores in all the other

GIWA Sub-regional Assessments. It is seen as very interesting to analyse why this priority ranks lower in the Bay of Bengal Sub-region. The linkages of this priority to fresh water shortage and habitat modification also has serious implications for food security (for a large segment of the populations in India and Bangladesh) which depend upon fresh water fisheries as well as artisanal coastal fisheries.