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Highlights of the Second Technical Workshop of the Regional Network for Marine Pollution Monitoring and Information Management

Burapha University
Bangsaen, Chonburi, Thailand
9-10 November 1998

SECOND TECHNICAL WORKSHOP OF THE REGIONAL NETWORK FOR MARINE POLLUTION MONITORING AND INFORMATION MANAGEMENT

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HIGHLIGHTS OF THE WORKSHOP

Introduction

1. The Second Technical Workshop of the Regional Network for Marine Pollution Monitoring and Information Management was held on 09-10 November 1997 at the Burapha University, Bangsaen, Chonburi ,Thailand. The workshop was attended by 23 representatives from nine East Asian countries, and the IMO Programme Development and Management Office, Manila. The List of Participants is attached as Annex A.

2. The objectives of the workshop were (1) to follow through the first workshop of the MPMIM network held on May 1996; (2) to enable participants from various countries in the region to share experiences on marine pollution monitoring as applied to ICM and related sites; (3) to discuss the strategies and mechanisms used to develop, initiate and sustain marine pollution monitoring programs at ICM sites and the problems encountered; and (4) to examine the purposes and benefits of the marine pollution monitoring and information management network, the types of and the requirements for membership and the mechanisms to operate the network. The workshop program of activities is attached as Annex B.

3. The workshop was facilitated by the Network Coordinator and staff of the IMO Programme Development and Management Office.

Opening ceremonies

4. Dr. Phasook Kullavanij, President of Burapha University, welcomed the delegates to the meeting while Dr. Chua Thia-Eng, Regional Programme Manager of the GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, provided a brief overview of the workshop and its objectives.

Experiences of marine pollution monitoring as applied to ICM

5. The presentations on pollution monitoring at the two demonstration sites, Xiamen and Batangas, provided examples of varied approaches in implementing monitoring programs. In Xiamen, an operational monitoring program is carried by five government institutions and a state university that previously went about their monitoring of Xiamen marine waters with no coordination or regard for the usefulness of the data they were generating. Under the ICM framework, however, this group has rationalized their monitoring tasks and optimized the sampling and monitoring program so that their efforts complement rather than duplicate. Results of intercomparison exercises among the participating organizations have shown that, except for a few parameters, the laboratories are able to obtain accurate and comparable results for the parameters being monitored. The data acquired are now being assessed and will be packaged to provide guidance to the local government.

6. The monitoring program being initiated in Batangas, on the other hand, seeks to bring together the resources of the local government, national line agencies and the private sector in implementing the environmental monitoring program for the bay. One factor that has helped bring about the cooperation of the private sector to this monitoring effort is the prior existence of an organization of industries operating around Batangas Bay that has expressed and shown its commitment to protect the environment. Moreover, the strategy adopted for the monitoring program, whose principal facilitator is the newly-created environment and natural resources office of the provincial government, was to focus on environmental (receiving waters) rather than compliance (end-of-pipe) monitoring.

7. Discussions ensued about the applicability of these two monitoring approaches to other sites and countries, the necessity of coupling the monitoring effort to specific sites and the ICM framework, and other ways by which data could be analyzed and processed (e.g., the utility of numerical models).

The papers presented under this session are attached as Annexes C and D.

National Profiles of Marine Pollution

8. The presentation on the national profiles on marine pollution described the continuing efforts to produce national profiles on land-based sources of pollution in the region to update the global waste survey conducted several years ago. This initiative builds upon and expands on the theme of the Global Waste Survey. At present, the profiles from the different countries are at varying stages of completion. An effort was made during the discussion to identify the institutions or individuals tasked to complete the country documents and the

required action from the program to facilitate the submission of the documents by the end of the year.

The paper is presented as Annex E.

State of Marine Environment in the East Asian Seas

9. The document on the state of the marine environment in the East Asian seas region referred to the effort in the late 1980s to assess the status of the marine environment in the region which resulted in the GESAMP report published in 1990. The major environmental issues recognized then were summarized and compared with what is perceived to be the major issues in the region today. Many of the problems have remained, albeit, increasing in severity. These include: nutrient enrichment and eutrophication; harmful algal blooms; wastes from agriculture, aquaculture and mariculture industries; wastes from industries particularly trace metals; and, oil and petroleum hydrocarbons. Plastics and environmental oestrogens in the marine environment were cited as emerging issues that should be given attention in the region. The meeting discussed the need to consider scaling down of monitoring efforts on trace elements in seawater in response to the assessment made that of the dozen or so trace metals routinely monitored, only two or three elements appear to be environmentally critical. Various regional initiatives to address marine pollution were also summarized and the need for better coordination and complementation of these efforts. Finally, the paper discussed the future and the effort to address site-specific marine pollution issues through the ICM framework.

The paper is attached as Annex F.

Lessons learned in monitoring activities

10. Discussion of the experiences and lessons learned vis-a-vis monitoring (e.g., quality assurance/quality control, the choices of parameters to be monitored, and packaging of data and information) was undertaken. The meeting agreed to continue to adopt "Category 1" parameters proposed by the HOTO/GOOS panel which are of medium or high impact but are relatively easy to measure. These parameters include: nutrients, human pathogens, dissolved O_2 (+S, T), suspended particulates, phytoplankton pigments, litter/plastics and petroleum (oil).

The country papers which were used for discussion in this session are attached as Annex G.

MPMIM Network

11. A presentation was made on the MPMIM Network - its objectives, benefits and obligations of members. The discussion amplified on the advantages in joining the network to institutions and ICM sites. Benefits derived by network members of pollution monitoring data were also highlighted. The meeting recognized the difficulties of some countries to share pollution monitoring data but agreed that processed information, instead of raw data, could be shared. Initially no fixed format would be required to be used by network members in the provision of data but rather members could choose from among the various formats that pollution information are packaged. Where available, members would be encouraged to establish their own Web pages on the Internet to allow them greater flexibility in determining the data that they are able to share. The meeting also recognized the need to include not only institutional membership but also personal membership to the network. All participants to the meeting would automatically be subscribed to the electronic mailing list of the network and, at the very least, members would derive benefits by obtaining greater access to information and advice from members. However, institutional members to the network would obtain other benefits such as a free standard reference materials for relevant matrices and parameters, subscription to marine pollution research titles, and technical assistance for monitoring, as needed.

12. The meeting considered the draft Memorandum of Agreement for institutional/site membership to the network which was later revised, taking into account the comments of the group. Institutional site/membership is assured for Xiamen (China) and Batangas (Philippines); is likely in the case of Cambodia, Malaysia, Indonesia, Republic of Korea and Vietnam; and possible in the case of Singapore. Participants promised to bring the document to their respective authorities for their consideration and possible favorable action.

The papers are presented as Annexes H and I.

Closing ceremonies

13. The meeting was closed by Dr. Chua Thia-Eng who gave special recognition to the active participation of the delegates and the support of the faculty and staff of Burapha University in making available their time and resources to enable the successful conduct of the workshop.

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Regional Workshop on Partnerships in the Application of Integrated Coastal Management
Chonburi , Thailand
12-15 November 1997

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WORKSHOP PROGRAM OF ACTIVITIES

SECOND TECHNICAL WORKSHOP OF THE REGIONAL NETWORK FOR MARINE POLLUTION MONITORING AND INFORMATION MANAGEMENT

Burapha University, Chonburi, Thailand
09-11 November 1997

PROGRAMME OF ACTIVITIES

Arrival	**09 November (Sunday)**
	Arrival of Participants
Day One	**10 November (Monday)**
0830H	Registration
0900	Opening Ceremony
	Opening Remarks • Dr. Chua Thia-Eng Regional Programme Manager GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas
	Welcome Address • Dr. Phasook Kullavanij President Burapha University
0930	Coffee Break
1000	Session I ***Experiences of Marine Pollution Monitoring as Applied to ICM***
	<u>*Xiamen, PR China .*</u> • Xu Kuncan Third Institute of Ocenography State Oceanic Administration Xiamen, PR China

Batangas Bay, Philippines

- Gil Jacinto
  Network Coordinator, MPMIM Network
- Maribel Aloira
  Environmental Monitoring Specialist
  Environment and Natural Resources Office,
  Batangas Provincial Government, Philippines

1100	Group discussion and sharing of other countries' experiences
1300	Session II: Workshop ***Presentation and Comments on Working Document: National Profiles of Marine Pollution*** • S. Adrian Ross Senior Programme Officer GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas • Leo Pura Researcher Coastal Management Center
1500	Coffee Break
1530	Session III: Workshop ***Presentation and Comments on Working Document: The State of Marine Environment in the East Asian Seas*** • Gil Jacinto Network Coordinator, MPMIM Network
1700	End of Day One
1900	Dinner

Day Two	**11 November (Tuesday)**
0830	Session IV: Workshop ***Lessons learned in monitoring activities*** Gil Jacinto • Designing and implementing a monitoring program • Sampling strategies • Quality assurance/quality control issues • Experiences at multisectoral approaches to monitoring: does it work? • Data analysis • Utilization of monitoring data • Sustainability
1000	Coffee Break
1130	Session V: Workshop **Networking** Gil Jacinto • Joining the network: benefits and obligations of participating institutions • Data formats and information exchange mechanisms that work • Data quality assurance/quality control activities to be pursued
1230	Lunch Break
1330	Session IV: Workshop **Recommendations/Action Plans**
1530	Closing ceremony
1600	Coffee Break
1630	Free time
1900	Dinner

INTEGRATED POLLUTION MONITORING IN XIAMEN

INTEGRATED OF MARINE POLLUTION MONITORING IN XIAMEN

Xu Kuncan and Yuan Dongxing

1. Introduction

Xiamen Sea, a semi-enclosed bay, is located in the Jiulong River Estuary, with an area of 320 km^2. It has many uses and supports activities related to port management, navigation, fishery, tourism, and marine chemical industry.

Since 1980, when Xiamen became one of the special economic zones in China, its population has doubled while economic development increased rapidly, particularly the expansion of marine industry. These changes posed great burdens on the marine environment. For instance, pollution accidents and red tides happened occasionally, which caused the deterioration of fisheries and marine environmental quality in some areas.

To abate these problems, the Xiamen Municipal Government has adopted management interventions which includes the integrated treatment of Yuandang Lake, control of pollution in terms of waste minimization, development and implementation of marine environmental management regulations, and other interventions aimed at maintaining the functional integrity of marine environment while attaining economic growth.

Marine environmental monitoring has played a major role in environmental management. The relationship between marine environmental monitoring and marine management is shown in Fig. 1. The main tasks of marine environmental monitoring are to set up the monitoring objectives, develop and implement the monitoring plan, and collect and analyze information which are made available for environmental managers and policy makers for decision making purposes.

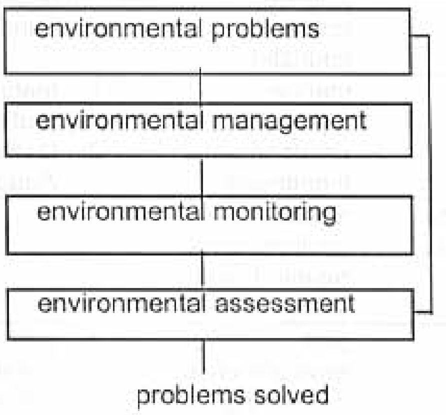

Fig. 1. Relationship between Environmental Monitoring and Management

The previous efforts of marine environmental monitoring in Xiamen, however, had some shortcomings. The most obvious one was the uncoordinated efforts among monitoring institutions. As a result, there was duplication of activities in some areas and gaps in others. The monitoring results were not consolidated. This did not allow the management to use the monitoring results in decision making and to formulateinterventions to improve the management of the marine environment.

In order to strengthen marine pollution monitoring in Xiamen to support environmental management , an integrated monitoring system has been established. It is one of the subprojects of Xiamen Demonstration Site. The integrated monitoring system includes a monitoring network among scientific, research and government institutions.

2. Marine Environmental Monitoring Network in Xiamen and Its Operational System

2.1 Institutions involved in marine pollution monitoring

1. The institutions involved in marine environmental monitoring in Xiamen are listed in Table 1. Each individual monitoring unit belongs to its own administration department and implements its own monitoring task.

Table 1. Institutions involved in Marine Pollution Monitoring in Xiamen.

Working Unit	Management Department	Working Area	Previous Monitoring Functions
Third Institute of Oceanography, SOA	State Oceanic Administration	marine science research, monitoring technical study	1. Xiamen marine investig. 2. red tide study 3. specific study 4. tasks from SOA
Environmental Monitoring Station of Xiamen	Xiamen EPB	environmental monitoring	1. marine routine monitor. 2. nearshore routine monit. 3. Xiamen seas monitoring 4. tasks from EPB
Environmental Research Center of Xiamen Univ.	State Education Committee	environmental; science research, education	1. various tasks funded by National Natural Science Fund
Monitoring Station of Fujian Aquaculture	Fujian Aquaculture Dept.	marine aquaculture environmental monitoring	1. marine aquaculture routine monitoring 2. tasks from Fujian, Xiamen Aquaculture Depts.
Fujian Oceanography Research Institute	Fujian Science and Technique Committee	marine environmental research and study	
Monitoring Station of Xiamen Port Office	Xiamen Port Office	port environmental monitoring	1. port environmental routine monitoring (was not carried out before executing this subproject)

2. *Problems in the previous marine pollution monitoring*

The previous marine pollution monitoring program had the following problems

a. The monitoring was not systematic. The efforts were done independently and overlapped with each other. There was no opportunity for data exchange;

b. There was no link between monitoring and management. Some monitoring activities were not focused on the need of the management to improve environmental monitoring as a whole.

c. Some data were not reliable. The problem was due to the poor quality assurance and quality control practices. This was also coupled to poor technical conditions in monitoring.

d. Results of monitoring were confined to individual agencies/units and were not exchanged, and sometimes duplicating. This resulted to high cost of monitoring and less benefits to management. In addition, feedback mechanisms were not instituted.

e. Monitoring data were inefficiently utilized. The data were mainly provided by the researchers in the form of scientific papers, which was not suitable for management departments or for government use.

Thus a marine monitoring network was needed to strengthen environmental management in Xiamen.

2.2 *The marine pollution monitoring network*

1. *Network organization*

As listed in Table 2, there are six member units in the established network.

2. *Responsibilities of coordinators*

a. to carry out the integrated marine monitoring plan of Xiamen, and to organize and coordinate the performance of the plan;

b. to integrate and standardize the monitoring techniques of the network;

c. to organize training and interlaboratory calibration exercises; and

d. to supervise quality control and data examination.

Table 2. The Network of Marine Pollution Monitoring in Xiamen.

Working unit and liaison person	Subproject/ Subproject number	Assigned subproject name	Linkage w/other subprojects
Third Institute of Oceanography, SOA J Weidong	No. 1 No. 2	quality monitoring of fixed places, organism poisonous residual monitoring .	No. 5 No. 6 No. 7
Environmental Monitoring Station of Xiamen GAO Chengtie	No. 3	surface seawater quality monitoring	
Environmental Research Center of Xiamen Univ. YUAN Dongxing	No. 4	sea bathing water monitoring	No. 3
Monitoring Station of Fujian Aquaculture LI Xiuzhu	No. 5	environmental monitoring of aquaculture area	No. 6 No. 7
Fujian Oceanography Research Institute YANG Huihui	No. 6	sediment monitoring	No. 1 No. 5
Monitoring Station of Xiamen Port Office HONG Lijuan	No. 7	port environment monitoring	No. 1

e. to analyze the monitoring data, and translate results into recommendations for management actions.

f. to assess the results of environmental management, and to provide recommendations as basis for management interventions.

g. to exchange the monitoring information with other network members.

h. to exchange data with members of the Regional Network of Marine Pollution Monitoring and Information Management.

3. *Network operation*

In the network, the units carry out their respective tasks as listed in Table. 2. Tasking was based on uniform standards, cooperation with each other, and sharing of information.

4. *Advantanges of the Network*

While the marine pollution monitoring network is at its early stage and it is a new mechanism in the monitoring effort of Xiamen, the network has shown some benefits as follows:

a. Reduced inputs in labor, money and time ; duplication of efforts is avoided.

b. The monitoring techniques and quality have been standardized. Data quality and comparability can be enhanced, hence and the information provided are more reliable.

c. Sharing of information has saved time and provided inputs to the management of Xiamen's marine environment and to the monitoring activities of the institutions involved.

d. The monitoring capability of each network member has improved through cooperation, training and technical assistance among the network members.

5. *Conditions of a successful network*

a. While the units joined the network voluntarily, they have obligations such as providing data to other network units.

b. The units can receive benefits, such as technical assistance and access to information from the other members of the network. Therefore, the implementation of each unit's monitoring tasks is strengthened.

c. The network members receive financial support from the government to implement monitoring activities.

e. There is a team of technicians and experts working together to carry out monitoring.

f. It is easier to get attention and support from the government.

3. The Set Up of the Technical System for Marine Pollution Monitoring

In order to successfully execute marine pollution monitoring, a monitoring plan and a technical team with relevant expertise are needed to support the system.

3.1 Formulation and implementation of the integrated monitoring plan for marine environment

1. *Integrated monitoring plan for marine environment*

An executable marine environmental monitoring plan that caters to the needs of integrated management of marine environment in Xiamen. The plan was built upon existing monitoring activities and on the lessons learned from the previous efforts in marine pollution monitoring. The plan was reviewed by experts from government departments, institutes and universities, and was adopted for implementation

The integrated monitoring plan includes seven monitoring items:

a. large area water quality monitoring
b. water quality monitoring at fixed sites
c. environmental monitoring of aquaculture area
d. sea bathing water quality monitoring
e. port water quality monitoring
f. toxic organisms monitoring
g. sediment monitoring

2. *Characteristics of the integrated monitoring plan for marine environment*

a. The monitoring plan or the network plan was built upon the monitoring plans of the network units. It is an integration of the existing monitoring plans of each monitoring unit. For instance, the network plan includes the tasks of national marine monitoring network, and adds the works of toxic organisms monitoring and sediment monitoring. The network plan also includes the port water quality monitoring which could not be carried out in Xiamen due to some technical reasons. The national monitoring plan of aquaculture area has also been combined in the network plan and was reasonably modified in terms of area and contents. Overall, the network plan coordinates all the individual plans. However, modifications were made to suit the specific needs of environmental management in Xiamen.

b. The monitoring is being coordinated according to the integrated management plan. The previous monitoring activities were done individually. As a result, there were some information, essential for marine environmental quality monitoring, which were not captured. The integrated monitoring plan is much more comprehensive and practical. For example, the monitoring of bathing beaches water quality, continuous monitoring of fixed stations, toxic organisms, and sediment are added in the plan.

c. A standard for data quality control has been developed and carried out. The monitoring activities are being supervised by the network. Therefore the data quality can be assured.

d. The plan has considered the pollution sources, pollutant characteristics, and monitoring results of the previous monitoring activities.

3.2 *Compiling of technical standards for marine pollution monitoring in Xiamen*

A set of monitoring standards for marine pollution in Xiamen has been compiled to meet the requirements of the integrated monitoring plan. The developed standards adopt the relevant international and national standards of analysis and sampling, as well as the previous experiences and research results in Xiamen Demonstration Site. The standards include the general monitoring regulations of sampling, sample reservation, transportation and management, monitoring techniques, data record, calculation and quality control. There are 12 sea water monitoring items, 11 sediment monitoring, 8 organism monitoring, and 32 analytical methods. Some items and methods are modified based on the previous experiences. Compared to National Marine Monitoring Standards, the compiled standards are more practical, and reproducible.

4. Capability Building

4.1 Interlaboratory analytical calibration among the monitoring network members

Interlaboratory analytical calibration among the monitoring network members is an effective way to assess their analytical capability. An interlaboratory analytical calibration exercise was undertaken among the network units before carrying out the monitoring plan. The exercise included standards and real samples, such as water, sediment and organisms. The monitoring parameters included nutrients, petroleum, and trace heavy metals.

The results of the calibration exercise were promising. Most of the laboratories can accurately analyze most items, except for some which need further improving the analytical technique. The interlaboratory calibration promotes the technical exchange and assistance among the laboratories, and trains the monitoring technicians. It further enhances the level of monitoring capability in Xiamen.

4.2 *Workshops of marine environmental monitoring in Xiamen Demonstration Site*

Workshops on marine environmental monitoring were undertaken to increase awareness of monitoring team. Workshops were attended by 31 people. Among the topics discussed during the workshops were:

1. the role of marine environmental monitoring in marine management
2. the design of the marine monitoring plan
3. the compiling and adoption of marine monitoring standards
4. monitoring quality assurance/quality control
5. data utilization

Marine pollution monitoring activities of the Xiamen Demonstration Site are still going-on. It is expected that more experiences will be learned in the future as the monitoring program continues in the context of ICM.

Marine Pollution Monitoring Program as Applied to ICM: The Batangas Bay Experience

A MARINE POLLUTION MONITORING PROGRAM AS APPLIED TO ICM —THE BATANGAS BAY EXPERIENCE*

Maribel A. Aloria and Gil S. Jacinto **

Introduction

Batangas Bay, Philippines was chosen as a site under the Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas (MPP-EAS) to demonstrate how marine pollution from a variety of land-based sources particularly in an industrial area can be prevented and controlled through the Integrated Coastal Management System (ICM) framework. An essential component of this system is the setting up of a monitoring program to provide information on the state of the marine environment to policy makers and managers in order that appropriate and timely strategies and action can be taken for the sustained use of the marine resources.

The monitoring program shall be designed and developed to provide a model for replication and extension to other coastal areas in the Philippines as well as in East Asia.

This paper shall focus on the major components and initial activities influencing the opportunities and successes in developing a workable marine pollution monitoring program for Batangas Bay. Shortcomings shall also be shared here as lessons learned.

Assessment of Capabilities to Obtain and Analyze Marine Environmental Samples in the Batangas Bay Area

The assessment on the capabilities of various institutions and companies to obtain and analyze marine environmental samples in the bay area was undertaken as the initial step in launching the monitoring program. The study identified appropriate laboratories that could be possibly involved in order to have a self-sustaining monitoring program.

Two survey trips were undertaken to assess the capabilities of private and government laboratories in Batangas City and in the towns of Bauan, Mabini, and San Pascual where most of the industrial establishments in Batangas Bay are located. The assessment activity involved visits to four hospitals, a water district office, two colleges and 17 industrial firms. These establishments and institutions were considered as potential collaborators of the marine pollution monitoring program. Hospital laboratories were expected to have facilities for bacteriological examination of water samples while the big colleges in the city were expected to have a chemistry or service laboratory. The

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major industrial firms in the area were presumed to have chemical laboratories for their respective operations. For the assessment of the capabilities of these laboratories, survey forms were distributed to all major institutions and companies that were thought to have technical capabilities to collect and analyze water samples. A sample survey form to identify the technical and resource capabilities of each laboratory is shown in Annex 1. Annex 2 provides a brief description of the laboratories surveyed and their capabilities to analyze water samples.

The identification of suitable parameters for the marine pollution monitoring program requires information on the major contaminants discharged into the bay. Focus was concentrated on parameters that will provide indications of the types and sources of discharges at various sampling stations.

Given the above criteria, the parameters chosen to be determined in the monitoring program include: dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), nutrients (phosphate, nitrate, ammonia, etc.), total suspended solids, oil and grease, total/fecal coliform, heavy metals, pesticides, and phenols.

Results of the study showed that the analysis of the major parameters monitored by most marine pollution programs can be performed by the existing laboratories in the bay area. Table 1 gives a list of these laboratories and the analyses the companies or institutions are willing to do for the program.

The Present Role of the Provincial Government-Environment and Natural Resources Office in Networking Collaborative Efforts on Marine Pollution Monitoring Program for Batangas Bay Area

The monitoring effort, itself, can conceivably comprise several levels of involvement by various groups around and outside the bay area. The Provincial Government-Environment and Natural Resources Office (PG-ENRO) under the Office of the Provincial Governor of Batangas will be a key player in the pollution monitoring program in Batangas Bay. PG-ENRO will have the primary responsibility of implementing the monitoring program and in coordinating with and requesting assistance from relevant companies and institutions identified in the survey.

During the initial stage of developing the marine pollution monitoring program, the newly-formed PG-ENRO had no physical resources to support the program. However, the PG-ENRO has a number of personnel that could be involved in the monitoring effort.

In order to address this capability issue, the MPP-EAS provided assistance to the PG-ENRO by acquiring some basic sampling and analytical laboratory equipment that are necessary for the monitoring program. The equipment shall be kept and housed at the PG-ENRO facility. Listed in Table 2 are the equipment provided to the PG-ENRO laboratory.

In the monitoring program, most of the sampling and field measurements shall be done by PG-ENRO staff. Samples that require more sophisticated analysis and equipment (e.g., UV-Vis spectrophotometer, Soxhlet apparatus) can be passed on to the private or government laboratories operating around the bay area that have expressed willingness to participate in the monitoring program. Where capabilities to analyze samples for more difficult parameters cannot be done in Batangas, other laboratories in Manila or Los Baños, Laguna (e.g., EMB, MSI, NSRI) may be tapped. Annex 3 provides a brief description of the laboratories identified in Manila and Los Baños. Table 3 shows the parameters that can be analyzed by these laboratories. To address quality assurance and quality control concerns, PG-ENRO will initiate inter-laboratory comparison exercises and encourage the use of standard reference materials. Moreover, academic institutions (i.e., UP MSI) shall be requested to periodically evaluate analytical results generated and protocols used by private laboratories.

PG-ENRO, therefore, will be the backbone of this monitoring program. The private sector is expected to complement the facilities of PG-ENRO and at the same time provide support for the strengthening of this continuing undertaking. We believe that given the chance to coordinate such collaborative efforts, the PG-ENRO shall effectively play its role as the environmental arm of the Provincial Government of Batangas.

Technical Training of PG-ENRO Laboratory Staff

In order to sustain the monitoring program and to extend the PG-ENRO's services with respect to water quality assessment, technical capability upgrading of PG-ENRO staff will also be provided by the Programme through an in-house training that will be conducted by the University of the Philippines-Marine Science Institute (UP-MSI).

Staff of the PG-ENRO will be trained on the basics of sample collection, quality assurance and quality control (QA/QC), good laboratory practices as well as the determination of the basic environmental parameters identified in the monitoring program. Training will be both formal and informal. A workshop on field sampling and measurements will be held after the laboratory establishment and installation of its equipment. On-the-job training for the staff will also take place in conjunction with the baseline studies to be conducted by the staff of the U.P. Marine Science Institute under the subactivity on Marine Pollution Monitoring and Assessment in Batangas Bay.

Present Status of the Marine Pollution Monitoring Program: Successes and Shortcomings Experienced; and Lessons Learned

To date, the Programme Office (MPP-EAS) had already provided some laboratory supplies and equipment that will be installed in the PG-ENRO laboratory. But up to this time, the laboratory is not yet operational due to unwanted delays in its construction. One of the major identified obstacles in the immediate construction of the building was the delay in the release of the budget appropriation from the local government. However, the construction is on-going and efforts are being exerted by

PG-ENRO to hasten the completion of the laboratory. It is also very important to note that the operationalization of the laboratory is one of the most essential components of the monitoring program and further delays would greatly affect this sub-activity.

Two of the PG-ENRO staff had undergone training on sampling and analytical techniques related to marine pollution. The training was held as early as 27 November to 18 December 1996 at the Environmental Science Research Center, Xiamen University, Xiamen, China in preparation for this monitoring program. The main objective of the training was to familiarize the staff on standard analytical methods of determining temperature, pH, salinity, total suspended solids, nutrients (nitrate, nitrite, ammonia, and total phosphorus), oil and grease, phenol, biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total coliform. The training also included familiarization with analytical procedures for each parameter, calculation of results, and data analyses. Informal training was also availed of by PG-ENRO staff during the on-site or field sampling conducted by the UP MSI group last June 1997 at the Batangas Bay Area.

Since the program's success is also contingent on the availability and continued presence of trained staff at PG-ENRO, it is very important that only permanent staff or the staff that would really be directly involved in the monitoring activities avail of the said training. Should some of the trained staff leave, like in the case of one of PG-ENRO's staff who had availed of the training in China but eventually left PG-ENRO, the continuity of the program may be compromised.

To date, since the program is only on its formative stage, the success and effectiveness of the mechanism proposed for this monitoring program cannot be adequately assessed. However, considering the program's ultimate direction, it is expected that the local government will have a credible laboratory at PG-ENRO linked to government line agencies (e.g., Philippine Coast Guard, Department of Environment and Natural Resources, Department of Health), the private sector (i.e., industries) and people's organizations. Together, these group will determine the environmental quality of Batangas Bay and the major tributaries draining into the bay, on regular basis.

We earnestly hope also that we may be able to replicate parallel activities in other bodies of water in the province as well as in other coastal areas in the country.

Table 1. Laboratories around Batangas Bay and their Willingness to Participate in the Marine Pollution Monitoring Program

Parameter	Laboratory	Likelihood of Participation in Monitoring Program*
1. Dissolved Oxygen (DO)	Sakamoto	3
	Cocochem	2
	Caltex	2
	Chemphil - LMG	1
2. Chemical Oxygen Demand (COD)	Cocochem	2
	Union Carbide	2
	Chemphil-LMG	1
	Caltex	2
3. Biochemical Oxygen Demand (BOD)	Cocochem	2
	Chemphil - LMG	1
	Caltex	2
4. Total Organic Carbon	Shell	2
5. Nutrients (phosphate, nitrate, nitrite, silicate, etc.)	Cocochem	2
6. Total Solids (total dissolved solids and total suspended solids)	PNOC Coal	1
	Cocochem	2
	Union Carbide	2
	Chemphil-LMG	1
	Shell	2
	Caltex	2
7. Phenols	Shell	2
	Caltex	2
8. Pesticides	Solid State Multi-Products	3
9. Oil and grease	Chemphil-LMG	1
	Shell	2
10 Heavy metals	PNOC Coal	1
	Sakamoto	3
11. Total Coliform Count	Batangas City Water District	1 (provided fees paid)
	Chest Center, Provincial Health Office	1 (provided fees paid)

* 1: most probable; 2: probable; 3: possible

Table 2. Laboratory Equipment that will be provided to the ENRO Laboratory

1. pH meter
2. DO meter
3. Refractometer
4. Water quality checker
5. Echo sounder
6. Hand-held GPS
7. Secchi Disc
8. Water Sampler
9. Sediment Sampler
10. Sample Bottles (Niskin)
11. BOD Bottles
12. Filtratrion Unit
13. Peristaltic Pump
14. Freezer
15. Distillation Unit
16. Reagent bottles
17. Wash bottles
18. Drying oven
19. Top-loading balance
20. Laboratory glasswares

Table 3. Parameters Analyzed by Laboratories in Manila and Los Baños

Analysis	Laboratories
Dissolved Oxygen	EMB ASL,UPLB EISAM
Chemical Oxygen Demand	ASL, UP Diliman ;PIPAC ASL,UPLB ; IESAM ASL, NSRI ;EMB
Biochemical Oxygen Demand	EMB ASL, UPLB ASL, NSRI
Total Organic Carbon	Bu. of Soils
Nutrients	Bu. of Soils
Solids	ASL, UP Diliman; ASL, NSRI EMB; PIPAC ASL, UPLB; IESAM
Phenols	EMB
Pesticides	ASL, NSRI EMB ASL,UPLB
Oil and Grease	ASL, UP Diliman EMB ; PIPAC
Surfactants	EMB PIPAC ASL,UPLB
Metals	Bu. of Soils ASL, UP Diliman ; EMB PIPAC; ASL.UPLB ; IESAM
Total Coliform Count	Culture Collection, NSRI EMB

Legend: Bu. of Soils - Bu. of Soils and Water Management
EMB - Environmental Management Bureau, DENR
ASL - Analytical Service Laboratory, UP Diliman
IESAM - Institute of Environmental Science and Management, UP Los Baños
NSRI - Natural Science Research Intitute, UP Diliman
PIPAC - Phil. Institute of Pure and Applied Chemistry
Culture Collection - Culture Collection Laboratory of NSRI, UP Diliman

Annex 1.

SURVEY FORM

Capabilities of Private and Government Laboratories in the Batangas Bay Area

1. Company/Institution Profile

   1.1 Name of Company/Hospital/Government Institution

   1.2 Address

   1.3 Telephone Number

   1.4 Fax Number

   1.5 E-mail Address

   1.6 Head of Laboratory

   1.7 Staff

   Professional _____ Person
   Technical _____ Person
   Others _____ Person

   (For information pertaining to the educational and training backgrounds of your staff, kindly complete the table provided at the end.)

   1.8 Nature of Company/Institution:

   ________ Multinational
   ________ Government
   ________ Private
   ________ Others (please specify)

   1.9 Major Functions of Laboratory

   ________ Internal Services (solely for own company's/institution's purposes)
   ________ Service Laboratory
   ________ Research
   ________ Consultancy
   ________ Others (please specify)

2. Capabilities of Chemical or Microbiological Laboratory

   2.1 Analytical and Scientific Services:

   ______ Atomic Absorption Spectrometry

______ High Performance Liquid Spectrometry
______ Gas Chromatography/Gas Chromatography-Mass Spectrometry
______ Ion Chromatography
______ Infrared Spectroscopy/Fourier Transform Infrared Spectroscopy
______ UV-Vis Spectrometry
______ Others (please specify)

2.2 Chemical and Microbiological Analysis for water;sediment and/or biota)

______ DO
______ COD
______ BOD
______ Total Organic Carbon
______ Nutrient Analysis (N.P.S.Si, etc.)
______ Solids (suspended, dissolved)
______ Heavy Metals
______ Phenols
______ Pesticides
______ Oil and Grease
______ Total Coliforms
______ Other routine analysis (please specify)

2.3 Field Sampling Equipment

______ Water Sampler (pleasespecify the type of sampling device, e.g. Nansen, Niskin, etc.)
______ Sediment Sampler (e.g.grab, core sampler, etc.)
______ Biological Sampler (e.g. microbiological sampler, benthos sampler, etc.
______ Other equipment
Secchi disk
Peristaltic pump
Filtering device
CTD
Echo sounder
GPS
Etc.

3. Kindly answer the following questions for our reference:

Is the laboratory willing to collaborate with a monitoring program designed to manage and prevent marine pollution in Batangas Bay?

Can the program request your laboratory to accommodate samples for chemical and/or microbiological analysis? If yes, please enumerate which analysis you are willing to perform.

Please provide us information on the quality assurance or quality control measures your laboratory adopt.

How often do you participate in inter-calibration exercises?

What is the limit of detection, precision and/or accuracy of the procedures/methods your laboratory use? Please supply these information below.

	Procedure	LOD	Precision	Accuracy
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Name	**Highest Degree Obtained**	**Position and Specialization**	**Gender (M/F)**

Government and Private Laboratories in the Batangas Bay Area

2.1 Government and Private Hospitals

Two privately-owned hospitals, St. Patrick's and Golden Gate Hospitals and two government hospitals, Batangas Regional Hospital and Chest Center of the Provincial Health Office, found in Batangas City were considered in the study. The laboratories of these hospitals do not have the capability to analyze marine water samples and only the laboratory of Chest Center performs potability tests on water samples like total coliform count (TCC) at $ 30.00 per sample at current rates.

2.2 Batangas City Water District

The laboratory of the Batangas City Water District routinely does chlorine and residual test and can perform TCC at $15 per sample at current rates.

2.3 Educational Institutions

Two colleges were considered in the study, Pablo Borbon Memorial Institute of Techology, a state college; and Lyceum of Batangas, a private college. Both have their chemistry laboratories solely for student's use.

2.4 Industrial Firms

2.4.1 PNOC Coal Corporation
Bolo, Bauan, Batangas

The PNOC Batangas Coal Laboratory has nine professional staff working at their laboratory, with access to the following instruments: AAS, GC, UV-Vis spectrophotometer, mercury analyzer, pH meter and an selective-ion meter. For field sampling activities, they have a Nansen water sampler, a sediment corer, a benthos sampler, and a Secchi disc.

2.4.2 Sakamoto Orient Chemicals Corporation
New Danglayan, Bauan

The laboratory of the company has two chemists and the following equipment: atomic absorption spectrophotometer (AAS), gas chromatograph (GC), UV-Vis spectrophotometer, pH meter, conductivity meter and dissolved oxygen (DO) meter. Although the laboratory is solely for the company's use, they can accommodate samples from the monitoring program for certain analyses depending on the laboratory's workload.

2.4.3 Solid State Multi-Products Corporation
San Miguel, Bauan

This company has only one chemist and the laboratory has a gas chromatograph which can be used for analysis of organic compounds such as pesticides.

2.4.4 Purefoods Flour Mill, Purefoods Corporation

The laboratory of this company has eight professional staff and primarily does, ash and moisture analyses. This laboratory does not have the facilities for analyzing marine environmental samples.

2.4.5 Farmix Fertilizer
San Miguel, Bauan

The laboratory of this company has five personnel who perform N-P-K and other routine tests for fertilizers. This laboratory is only for the company's use.

2.4.6 United Coconut Chemicals
Aplaya, Bauan

The laboratory of this company has 18 professional and technical staff. This laboratory has AA and UV-Vis spectrophotometers. They are willing to perform DO, COD, BOD, nutrients and solids analyses for the monitoring program, though this would depend on their workload.

2.4.7 Union Carbide Philippines (F.E.) Inc.

The laboratory of this company has two professional staff. They have a GC and a UV-Vis spectrophotometer. This laboratory routinely does determination of pH, DO, COD, solids and nutrients. They can perform COD and solids determination for the monitoring program depending on their workload.

2.4.8 Filsyn Corporation
San Miguel, Bauan

The laboratory of this firm is found in Sta. Rosa, Laguna. They have a GC and a UV-Vis spectrophotometer. They are willing to participate in the monitoring program but they lack the facilities and the expertise for analyzing marine samples.

2.4.9 Chemphil-LMG Chemical Plant
San Pascual, Batangas

This company is actually divided into the LMG-Chemicals Corporation, which produces the alkylbenzene product, and the Chemphil-Albright and Wilson

Corporation, which produces the surfactants. Their laboratory has ten professional staff . They have a GC and an infra-red (IR) spectrometer. They routinely perform pH, DO, COD, BOD, solids, oil and grease, and MBAS determinations. They are willing to analyze for COD, BOD, solids, and oil and grease for the monitoring program.

2.4.10 Pilipinas Shell Petroleum Corporation
Tabangao, Batangas City

The laboratory of this company has eight professional staff. They routinely perform pH, temperature, TSS, TDS, TOC, phenols, and oil and grease determinations. They will participate in the monitoring program, depending on their workload.

2.4.11 Caltex (Philippines) Inc.
San Pascual, Batangas

The laboratory of this company has 14 professional staff and is equipped with the following instruments: gas and ion chromatographs, and IR, and UV-Vis and AA spectrophotometers. They can perform determinations for DO, COD, BOD, solids, phenols, and oil and grease.

2.4.12 Others

The following establishments were also visited but found to lack the laboratory facilities that would be useful to the monitoring program:

1. Atlantic Gulf and Pacific Company
   Marine and Fabrication Yard
   San Roque, Bauan, Batangas

2. Babcock-Hitachi (Phil.) Inc.
   San Roque, Bauan

3. Keppel Philippines Shipyard Inc.
   San Miguel, Bauan, Batangas

4. Polyphosphates, Inc.
   San Miguel, Bauan, Batangas

5. Mabuhay Vinyl
   San Miguel, Bauan

6. Mabuhay Vinyl
   San Miguel, Bauan

Laboratories of Government, Academic and Research Institutions in Manila and Los Baños

3.1 Laboratories in Manila

3.1.1 Bureau of Soils and water Management
Visayas Avenue, Quezon City

The laboratory of the Bureau of Soils and Water Management mainly does chemical analysis of soil samples. If the procedure for the analysis of agricultural soils can be applied to marine sediment samples, this laboratory can do the following analysis for the monitoring program; trace metals, organic carbon/organic matter, and total nitrogen.

3.1.2 Institute of Chemistry
UP Diliman, Quezon City

The Analytical Service Laboratory of the UP Institute of Chemistry can perform determinations of COD, solids, nitrogen, phosphorus, silica, oil and grease, and metals.

3.1.3 Natural Sciences Research Institute
UP Diliman, Quezon City

This laboratory can determine COD, solids, silica, phosphorus, pesticides, and oil and grease. The Cultutre Collection Laboratory of NSRI can determine total coliform count and BOD.

3.1.4 Environment Management Bureau
Kamias Road, Quezon City

The laboratory of the Environmental Management Bureau (EMB) is situated inside the DENR compound in Quezon City. This lab can perform the following determinations in water and sediment samples: ammonia-N, nitrate-N, phosphate, solids, DO BOD, COD, MBAS, phenols, oil and grease, pesticides, metal and total coliform count.

3.1.5 Philippine Institute of Pure and Applied Chemistry
Loyola Heights, Quezon City

The Philippine Institute of Pure and Applied Chemistry (PIPAC) is found inside the campus of the Ateneo de Manila University. Its laboratory can perform COD, nitrate-N, ammonia-N, total phosphates, silicates, oil and grease. surfactants and metals determinators for the monitoring program.

3.2 Laboratories in Los Baños

3.2.1 Insitute of Chemistry
UP Los Baños, Laguna

The Analytical Service Laboratory of the UPLB Institute of Chemistry has an AAS, an HPLC, a GC, an IR spectrometer and an organic carbon analyzer. In 1996, they have acquired the following equipment: GC-MS (which will be exclusive used for environment samples), FTIR, FI analyzer, scanning spectroflourometer, capillary electrophoresis, voltammetric analyzer, and, thermogravimetric analyzer. This laboratory can analyze for DO, COD, BOD, nitrogen (ammonia, nitrate, nitrite), phosphate (ortho-, total, hydrolyzable), solids, silica, surfactants, pesticides and metals.

3.2.2 Institute of Environmental Science and Management
UP Los Baños, Laguna

The laboratory of the Institute of Environment Science and Management (IESAM) has an AAS, a GC, and a UV-Vis spectrophotometry. Although this laboratory is used only by the on-going projects of the Institute, the monitorng program can make arrangements with the Director for the analysis of its samples. This lab can do DO, COD, nutrients and heavy metals determinations.

3.2.3 International Rice Research Institute
UP Los Banos, Laguna

The Analytical Service Laboratory of the International Rice Research Institute has an AAS, an HPLC, and GC_MS. They routinely do analysis for TOC, nutrients, heavy metals and pesticides. This laboratory, though, is only for the use of the on-going researches and projects of the Institute.

A Summary on the Status of the Working Document: National Profiles of Marine Pollution Prevention and Management of East Asian Seas

A Summary on the Status of the Working Document: National Profiles of Marine Pollution Prevention and Management of East Asian Countries

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ABSTRACT

This paper summarizes the status of the working document on the national profiles of marine pollution prevention and management of East Asian countries, namely: Brunei Darussalam, Cambodia, China, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Singapore, Thailand, and Vietnam. Discussed were the evolvement of the national profiles, the description of the national profile fact sheet, its contents and format, and the procedure being taken to complete the profiles. The status of the data gathered as to updates and stages of completion were highlighted. The need to complete the data with the help of national profile authors was stressed to form a baseline information from which national waste management programs and a regional waste management program can be developed and against which achievements can be measured.

INTRODUCTION/BACKGROUND

The concept of a national profile was developed as part of the Global Waste Survey, a project which was initiated by IMO and the Contracting Parties to the London Convention in 1992. The profiles were seen as a means of identifying the current state of waste management and practices and their (potential) impact on the environment and human health and safety and assisting countries to recognize and respond to existing limitations and barriers.

The evolvement of the national profiles of the countries bordering East Asia was conceptualized to provide through the profiles an information system on regional waste management, forming a baseline of information from which national waste management programs and a regional waste management program can be developed and against which achievements can be measured.

DESCRIPTION

A national profile is a ten-to-fifteen page fact sheet on a country, outlining the current state of marine pollution, and the programs that are in place to prevent or control the situation, such as national waste management programs, preparedness and response initiatives, pollution monitoring and assessment, etc. The profile identifies the general characteristics of the country which may influence the type of problems being encountered, and limiting the options for environmentally sound management of marine and coastal waters. In addition to factual information on waste arisings and land, coastal and ocean disposal practices, the profile traces the *timeline of significant developments* in the evolution of the country's management infrastructure. This is particularly important in the context of transferring technologies and know-how from mature industrialized countries (i.e., those that have developed from little or no control in the 1960's to the present situation) to countries which are attempting to make the same journey.

Particular emphasis is placed in the national profile to recognizing those characteristics of each country which have an impact on how wastes are managed, especially with regard to the use of the marine environment for waste disposal, either directly or indirectly.

FORMAT

The design and format of a national profile has been made with due consideration of potential users of the final product and their information needs (e.g., national agencies; industry; NGOs; general public; international community). Such considerations as: environmental assessment and development practices; existing sources, types and quantities of waste generated; waste collection/reception, treatment and disposal capabilities and capacities; waste minimization/waste prevention initiatives; transboundary movement of waste; human health and marine environmental impacts and indicators of poor management practices and policies; waste management/marine pollution regulations and their enforcement; preparedness and response capabilities to spills and accidents; and so on, are recognised as important components of a profile covering a country's marine pollution program needs and capabilities.

The contents of a national profile are included in *Table I*.

Although the contents of a national profile is structured to allow the participating countries to supply information in a standard format, this does not preclude the provision of any other factual, textual or anecdotal information which may be important to the country. The profile is structured and the sections numbered, allowing easy cross referencing between the profiles of different countries.

A manual has been developed to assist countries in the preparation of their national profile. The manual describes a framework for identifying and comparing the state of waste management and other marine pollution prevention and response capabilities in countries at various stages of economic and industrial development and in various regions of the world. The approach is practical and consistent and is applied for the purpose of organizing and analysing information for the development and strengthening of national programmes.

PROCEDURE

The selection of the eleven countries for the development of the national profiles was primarily based on the information available on the state of the waste management system and on the basis of the availability of information. A number of additional criteria were subsequently developed for consideration to provide as many countries as possible for the region.

The final selection lists Brunei Darussalam, Cambodia, China, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Singapore, Thailand, and Vietnam. The Democratic People's Republic of Korea was excluded in the last minute due to the dearth of baseline information available on the country's waste management programs.

A summary of the steps for the preparation of the national profiles of the countries bordering East Asia is shown in Figure 1. These are described in more detail as follows:

Step 1 - Collate Information

As a starting point for production of the profiles, readily available information on the selected countries was collated. This included country papers prepared for training courses, symposia and conferences, information from the Global Waste Survey Final Report, reports from International Agencies (e.g., World Bank Country Reports) and other available information.

Step 2 - Prepare Initial Profiles

Using the collated information (*Step 3*), an initial draft of each profile was prepared for distribution to the national profile authors. The national profiles of Cambodia, Indonesia, and the Philippines have been updated.

Step 3 - Organize Briefing of National Author's

The Workshop on Regional Monitoring Network has been utilized as venue of briefing. The objectives of the briefing meetings are to:

- Introduce the National Profiles of Marine Pollution Prevention and Management Report of East Asian Countries and present the draft profiles to the prospective authors;
- Discuss the profile design and its development and use;
- Evaluate the level of technical support required during profile preparation; and
- Obtain positive feedback on the completion of the national profiles by prospective authors.

Step 4 - National Authors Prepare First Draft

The authors will prepare a first draft of their profile using an initial draft profile and the *Author's Manual* as a basis for extending the information and filling in the data gaps after the briefing meeting. Considerable *in-country* consultation will be envisaged with industry, regulatory authorities, waste management contractors and ENGOs etc., to provide a cross-section of needs, to gain an understanding of any underlying problems with waste management and to generate interest in the document: National Profiles of Marine Pollution Prevention and Management Report of East Asian Countries.

Step 5 - Finalize the Profiles

The national authors will prepare a final draft of their profiles, using the information and guidance obtained from the peer review process.

Step 6 - Development of the Regional Report on Marine Pollution Prevention and Management of East Asian Countries

The final draft of the profiles will be utilized to develop and publish a clear picture on the state of marine pollution prevention and management of the East Asian region. The document will provide through the profiles an information system on regional waste management against which achievements can be measured and legislation and programs can be made. The objectives of the regional report are the folloeing:

- Evaluate the current state of industrial and hazardous waste generation and management in the countries bordering East Asia;
- Identify the quantities of industrial and hazardous waste being generated and the capability and capacity of land-based facilities and operations within each country;
- Define industrial waste dumped at sea in the past, currently being dumped at sea or planned to be dumped at sea in the future;
- Confirm the technologies and practices that are employed or are being proposed to eliminate ocean dumping of industrial wastes;
- Establish the state of ongoing programs and activities in countries to reduce or avoid the generation of industrial and hazardous wastes; and
- Identify the priority issues and areas for technical co-operation and assistance, nationally and regionally, to support the transition to environmentally sound management of industrial and hazardous wastes.

Completion of the Regional Report and Conclusions

No collective conclusion can be formed on the status of marine pollution prevention and management of the East Asian Region. Although the draft profiles have accumulated a lot of information, most of the data need updating to complete the 11 national profiles. In this light, it is requested that the country representatives to the Workshop on Regional Pollution Monitoring Network assist in the completion of the profiles so that an information system on national waste management systems and a regional waste management system against which regional and national achievements can be measured and legislation and programs can be acted, will be established.

The following conclusions though can be stressed on the benefits of developing the national profiles of marine pollution prevention and management of East Asian countries, namely:

- o The National Profiles provide a logical way to present country information in a standardized format, that allows easy comparison. In particular:
  - Industrialized countries found the exercise of preparing the profiles useful as a means of synthesizing (the often voluminous) existing information to provide a concise "pen portrait" of the state of industrial and hazardous waste management.
  - Developing and newly industrialized countries, and countries with economies in transition, found the exercise useful in assembling partial information from many diverse sources, to provide a coherent profile which clearly identifies information gaps and focuses attention on future needs.

- o The National Profiles are useful to national governments, international agencies and bodies and lending institutions in focusing attention on priority waste management problems and on specific needs for technical co-operation.

- o The preparation of the National Profiles will facilitate the co-operation between different government agencies within countries, the process will bring these agencies together for the first time in some cases.

- o The National Profile will highlight a number of important aspects of an environmentally sound system for industrial and hazardous waste management:
  - interim recycling/treatment/disposal facilities in the short-term to facilitate identification of waste generators and to achieve early environmental improvement;
  - mechanisms to provide long-term facilities, through public-private sector partnerships; and
  - human resources with the technical, scientific, legal, and administrative skills to develop and implement waste management programmes.

Identification of Quantities of Wastes and the Capability and Capacity of Land-Based Treatment and Disposal Facilities

- o Data gaps still exist with respect to quantities of industrial and hazardous waste being generated. The National Profiles will provide an important first step towards a regional database; international agreement on categories of waste will facilitate further progress towards this goal.

- Government/private sector co-operation in the provision of recycling/treatment/disposal facilities is considered to be a key to progress. Ways and means to foster this co-operation is of critical importance.

- The National Profiles stresses that the following components of a national waste management programme to receive high priority consideration for technical co-operation and financial assistance to developing countries:

  - development of appropriate legislation, regulations and standards;
  - provision of means and capability of implementation of regulations; and
  - preparation of enforcement mechanisms.

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Draft National Profile on Marine Pollution Prevention and Management for Singapore.

Draft National Profile on Marine Pollution Prevention and Management for Republic of Korea.

Draft National Profile on Marine Pollution Prevention and Management for Thailand.

Draft National Profile on Marine Pollution Prevention and Management for Vietnam.

Global Waste Survey Final Report.

Table I *Annotated Contents List for a National Profile*

1. Country Background

- Political, geography, demography, economic indicators and industrial statistics.

2. Development of Management Programmes

2.1 *Timeline of Significant Developments*

- Chronological listing of significant events in the evolution of the present hazardous waste management system
- Division of events into legislation and administration versus facilities and infrastructure/support services
- Interim waste management solutions such as incineration or dumping at sea, export or other interim technologies

2.2 *Environmental and Health Effects*

- Problems/concerns that hazardous wastes currently pose (or in the past have posed) to public health or environment as a consequence of mismanagement regarding health hazards and water pollution problems (surface water, groundwater, disposal to sewers).
- Health related problems. Recording/reporting systems.

2.3 *Constraints on Proper Waste Management*

- Major constraints and barriers to proper waste management including the siting of land- based treatment and disposal facilities (e.g., proximity to population; high water table; use of groundwater; location of ecologically sensitive areas), etc.
- Specific problems/constraints (e.g., location and size of waste generators).

3. Waste Generation and Management

3.1 *National Definitions of Waste*

- National definitions of municipal, industrial and hazardous waste
- National/international waste classification systems

3.2 *Waste Surveys and Information Sources*

- Sources, reliability and frequency of surveys
- Quality control measures, regulated or voluntary

3.3 *Waste Generation by Selected Types of Waste*

- Sewage, dredged spoil, construction/demolition waste, etc.
- Non-industrial sources (agriculture, ships, land transport, hospitals, electricity generation, etc.)

3.4 *Waste Generation by Industrial Sector*

- Primary industry, (e.g., mining; oil/gas production; and related processing)
- Waste generation by the various sectors of economic activity, including changes over time by manufacturing industry, with data on chemicals, oil, metals, engineering and other sectors known/expected to produce hazardous wastes
- Waste generation from small and medium-sized enterprises (SMEs)

3.5 *Generation of Hazardous Waste*

- Amounts of hazardous waste generated, using national/international waste classification system

3.6 *Waste Management Services, Facilities and Practices*

- Services and Facilities for Selected Types of Non-Hazardous Waste
- Current methods and capacity for treatment and disposal of domestic and non-hazardous industrial wastes, (e.g., domestic sewage; garbage; food processing wastewaters; etc.), including recycling programmes (e.g., post-consumer products such as newpapers; packaging materials; glass; tins; plastics)

Services and Facilities for Industrial and Hazardous Waste

- Numbers and types of land-based facilities, capacities
- Standards to be met by land-based facilities

3.7 *Import/Export*

- Quantities and types of waste imported/exported; breakdown into amounts for recycling and for disposal; include countries of origin and destination

3.8 *Waste Recycling of Hazardous Wastes*

- Recycling initiatives/incentives
- Recycling facilities for hazardous waste (numbers and types)

3.9 *Waste Minimization/Pollution Prevention*

- Waste minimization initiatives
- Status/progress with waste minimization
- International (regional) links regarding recycling, waste minimization, pollution prevention e.g., UNCED, UNEP, OECD, UNIDO
- Cleaner production, integrated life cycle management initiatives of government, industry and NGO's
- Waste exchange initiatives

4. Marine Pollution Prevention, Management and Response

4.1 *Ocean Dumping*

4.2 *Prevention of Pollution from Ships*

4.3 *Oil and Chemical Pollution Preparedness and Response*

4.4 *Marine Pollution Monitoring and Assessment*

5. Legislation, Regulations, Enforcement

5.1 *International and Regional Conventions*

5.2 *Key National Legislation*

- Principal legislation controlling the management of industrial and hazardous wastes

5.3 *Waste Management Responsibilities*

- Responsibility for waste management (i.e., central government, regional or local government or part of a federal responsibility)

5.3.1 *Requirements on Waste Generators*

- Generator notification
- Storage, documentation and tracking

5.3.2 *Control of Storage*

- Licensing, emergency preparedness and safety procedures

5.3.3 *Control of Transport*

- Legislation on movement/packaging and labelling of hazardous wastes
- Manifest system and consignment procedures
- Means of providing transport for wastes, public or private sector operated

5.3.4 *Control of Treatment/Disposal*

- Licensing of facilities, monitoring programmes
- List of existing standards and codes of practice.

5.3.5 *Contaminated Sites*

- Previous waste disposal sites/decommissioned industrial sites etc. currently posing environmental/human health problems/risks
- Programmes underway to remediate such sites

5.3.6 *Control of Imports/Exports*

- National regulations/guidelines
- Status with regard to the Basel Convention

5.3.7 *Control of Marine Wastes/Disposal at Sea*

- Membership (& status) in international conventions (eg MARPOL 73/78; LC 1972, Oslo; Paris; Regional Seas)
- Status of local controls

5.3.8 *Control/Codes of Practice for Specific Waste Types*

- List of codes of practice for waste types such as asbestos, PCB, other hazardous wastes etc.

5.4 *Implementation and Enforcement*

- State of implementation/enforcement of legislation and regulations
- Capacity and capability of government for enforcement (e.g., numbers of enforcement staff; numbers of prosecutions; size of fines; percentage of

facilities licensed; nature of monitoring and surveillance programmes)

- Effectiveness of enforcement (percentage of facilities in compliance)

5.5 *Background Infrastructure/Support Services*

- Water pollution control legislation
- Air pollution control legislation
- Solid waste legislation
- Laboratories and analytical facilities
- Availability of consultants
- Training of staff and managers
- Studies and research
- Technical information
- Public awareness

6. Profile of Priority Problems and Action Plans

- Current priority problems
- Actions currently being taken
- Future action plans (short, medium and long-term)
- Requirements/support needed

7. Key Contacts

8. Sources of Information

Table 2. Checklist of Data Gathered for the Initial Draft National Profiles on Marine Pollution Prevention and Management of East Asian Countries

Section	Description	BRU	CAM	CHI	IND	JAP	MAL	PHI	ROK	SIN	THA	VIE
1.1	*Political*	■	■		■	■	■	■	■	■	■	■
1.2	*Geographic*	■	■	■	■	■	■	■	■	■	■	■
1.3	*Demographic*	■	■	■	■	■	■	■	■	■	■	■
1.4	*Economic indicators*	■	■	■	■	■	■	■	■	■	■	■
1.5	*Industrial statistics*	■	■	■	■	■	■	■	■	■	■	■
2.1	*Timeline of significant development*			■	■	■	■	■		■	■	
2.2	*Environmental and health effects*	■	■	■	■	■	■	■	■	■	■	■
2.3	*Constraints on proper waste management*	■	■	■	■	■	■	■	■	■	■	■
3.1	*National definition of waste*			■	■	■	■					
3.2	*Waste survey and information sources*			■	■	■	■	■	■	■	■	■
3.3	*Waste generation by selected types of wastes*	■	■	■	■	■	■	■	■	■	■	■
3.4	*Waste generation by industrial sector*	■		■	■	■	■	■	■	■	■	■
3.5	*Generation of hazardous waste*	■	■	■	■	■	■	■	■	■	■	■
3.6	*Waste management services, facilities and practices*	■	■	■	■	■	■	■		■	■	■
3.7	*Import/Export*	■	■	■	■	■	■	■		■	■	
3.8	*Waste Minimization/ PollutionPrevention*	■		■	■	■				■		
4.1	*Ocean dumping of waste and other matter*				■	■	■					
4.2	*Prevention of pollution from ships*		■		■	■	■			■		
4.3	*Oil and chemical pollution preparedness and response*	■	■		■	■	■					
4.4	*Marine pollution monitoring and assessment*				■	■	■					
5.1	*International and regional conventions*	■	■		■	■	■		■	■		
5.2	*Key national legislation*	■	■	■	■	■	■	■	■	■	■	■
5.3	*Management roles and responsibilities*	■	■	■	■	■	■	■	■	■	■	
5.3.1	*Requirements of waste generators*			■	■	■	■	■			■	
5.3.2	*Control of storage*			■	■	■	■	■		■	■	
5.3.3	*Control of transport*			■	■	■	■	■		■	■	
5.3.4	*Control of treatment/disposal*			■	■	■	■	■		■	■	
5.3.5	*Contaminated sites*			■	■	■	■	■		■	■	■
5.3.6	*Control of imports/exports*			■	■	■	■	■		■	■	
5.3.7	*Control/Codes of practice for specific waste types*			■	■	■	■	■		■	■	
5.4	*Implementation and enforcement*		■	■	■	■	■	■		■	■	■
5.5	*National infrastructure/support services*		■	■	■	■	■	■		■	■	■
6	*Profile of priority problems and action plans*	■	■	■	■	■	■	■	■	■	■	■
7	*Key contacts*		■	■	■	■	■	■			■	■
8	*Source of information*	■	■		■	■	■	■	■	■	■	■

Legend:

BRU *Brunei Darussalam*
CAM *Cambodia*
CHI *China*
IND *Indonesia*
JAP *Japan*
MAL *Malaysia*
PHI *Philippines*
ROK *Republic of Korea*
SIN *Singapore*
THA *Thailand*
VIE *Vietnam*
■ *Shaded areas contain information*

Table 3. Time Status of the Initial Draft National Profiles
on Marine Pollution Prevention and Management of East Asian Countries

Country	Year Updated
Brunei Darussalam	1997
Cambodia	1997
China	1995
Indonesia	1997
Japan	1995
Malaysia	1997
Philippines	1997
Republic of Korea	1997
Singapore	1997
Thailand	1995
Vietnam	1997

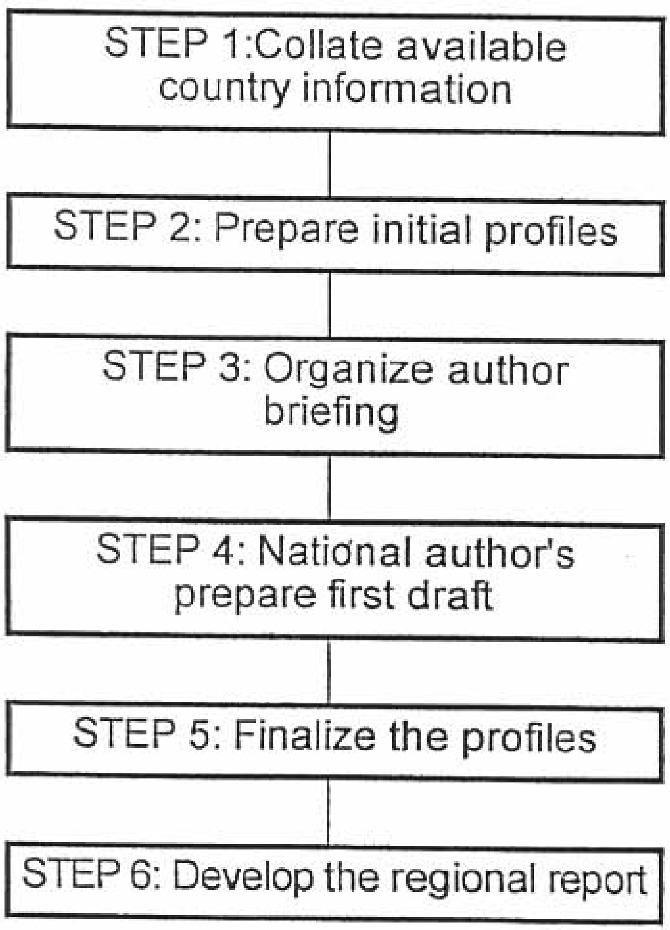
Table 4. Steps Taken on the National Profiles
on Marine Pollution Prevention and Management of East Asian

Step	Description	BRU	CAM	CHI	IND	JAP	MAL	PHI	ROK	SIN	THA	VIE
1	*Collate available information*	■	■	■	■	■	■	■	■	■	■	■
2	*Prepare initial profiles*	■	■	■	■	■	■	■	■	■	■	■
3	*Author's/ briefing*		■	■	■			■				■
4	*National author's first draft*		■		■			■				■
5	*Finalize profiles*											
6	*Develop regional report on profiles*											

Legend:

BRU	*Brunei Darussalam*	JAP	*Japan*	SIN	*Singapore*
CAM	*Cambodia*	MAL	*Malaysia*	THA	*Thailand*
CHI	*China*	PHI	*Philippines*	VIE	*Vietnam*
IND	*Indonesia*	ROK	*Republic of Korea*	■	*Shaded area means that the step has been done*

Figure 1. Steps in Preparing National Profiles



PRELIMINARY ASSESSMENT OF THE STATE OF THE MARINE ENVIRONMENT IN THE EAST ASIAN SEAS REGION

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PRELIMINARY ASSESSMENT OF THE STATE OF THE MARINE ENVIRONMENT IN THE EAST ASIAN SEAS REGION

GIL S. JACINTO

INTRODUCTION

This review is an attempt to focus on the state of the marine environment in the East Asian region, with emphasis on marine pollution problems and issues. This report is not comprehensive nor was it intended to be. Rather, it builds upon some of the earlier reviews on the region (Morgan and Valencia, 1983; Gomez et al., 1990) and is intended to elicit discussion among the participants of this workshop on the primary marine contamination problems in the region and how the conditions may have changed since the last major assessments were made. In turn, the adequacy of marine pollution monitoring efforts to determine the status and changes of the marine environment vis-à-vis the major contaminants will be examined.

As a starting point, it is useful to remind ourselves of what marine pollution means. The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) defines marine pollution as "the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality for use of seawater and reduction of amenities". The definition recognizes that the activities of human societies can significantly alter the nature of the marine environment, sometimes negatively affecting human health, the well-being of marine organisms and such resources as aesthetics and transportation (Goldberg, 1995).

Geographical coverage

For the purposes of this discussion , the East Asian Seas Region will be considered as bounded on the north by the Yellow Sea, the Andaman Sea on the west, the Indonesian Seas on the south, and the waters in between (Figure 1). These waters include the East China Sea, the South China Sea, and the Sulu-Celebes Seas. Subregional waters in the area would include the Malacca Straits, the Gulf of Thailand, the Gulf of Tonkin and Korea Bay. The Asian mainland is on the northwest sector while the Australian subcontinent is on the southeast sector. In between are the two large archipelagos of Indonesia and the Philippines.

WHAT WERE THE MARINE POLLUTION ISSUES THEN?

The assessment of the state of the marine environment by GESAMP (1990) stated that "while no areas of the ocean and none of its principal resources appear to be irrevocably damaged, while there are encouraging signs that in some areas marine contamination is decreasing, we are concerned that too little is being done to correct or anticipate situations that call for action, that not enough consideration is being given to the consequences for the oceans of coastal development and that activities on land continue with little regard to their effects in coastal waters".

A subset of the GESAMP review, the state of the marine environment in the East Asian Seas region completed at the start of the 1990s (Gomez et al., 1990), noted that in the region, marine contaminants have been analyzed only sporadically in water, sediments, and biota. Limited capability in the region was considered a factor hampering the determination of many contaminants. The need was identified to improve the quality of data and manpower capability. Sewage was considered to be the major source of organic pollution, much of which was discharged raw into coastal waters directly or through rivers and waterways. Eutrophication of some coastal waters was apparent and red tide episodes, both toxic and toxic, were recorded in virtually all the countries in the region. Elevated faecal coliform levels were found near population centers and occasionally resulted in the closure of swimming beaches. Where industries had developed, there was some evidence of industrial waste disposal at sea including mine tailings. Litter was evident, particularly near ports and harbours. A few major oil spills had occurred in the region and both port and shipping lanes were exposed to some oil contamination because of the large volume of petroleum products conveyed through these areas.

WHAT ARE THE MARINE POLLUTION ISSUES NOW?

It's been almost ten years since the review was made of the region and it is useful to consider how much has changed since. Goldberg (1995) states that "the primary factor driving coastal ocean pollution is the increase in populations that will be more affluent and hence use more energy and material resources". Despite the recent devaluation of currencies and the crash of the stock market in the region, most countries in Asia have had phenomenal growth in their economies, standard of living, and population size in the last decade. With these developments have arisen the concomitant problems in the region's coastal and open seas.

Sewage, Nutrients, and Eutrophication

Experience and perception over the past decades have changed the order of priority in the list of marine pollutants, and two that were almost disregarded in the sea in earlier times have now moved up the list - sewage and nutrients (McIntyre, 1995). The sewage problem is directly related to continually increasing human settlement along the coasts and to the indiscriminate use of the sea for waste disposal. The public health problems associated with sewage are well known and include seafood contaminated with diseases such as cholera and hepatitis while direct contact with contaminated waters subject bathers with a wide range of eye, ear, nose and throat problems.

The discharge of sewage, often untreated, into the regions waters has also often been associated with eutrophication although the increase in nutrients leading to eutrophication appears to be also due to the extensive use of fertilizers in agriculture and to the increase of intensive stock rearing. In countries in the region where aquaculture is a major activity in coastal areas (e.g., China, Indonesia, Philippines, and Thailand), effluents discharged from these aquaculture farms also contribute significantly to high nutrient loads in the receiving marine waters. The problem of eutrophication is probably most pronounced in bay areas where not only is there a very large human population discharging untreated sewage but the tributaries and watersheds that drain into such bays are also characterized by significant agriculture and aquaculture activities (e.g., Manila Bay).

Systematic programmes to assess the general problem of eutrophication have yet to appear (Goldberg, 1995) and such an activity will require measurements to be made over large areas and over a time-scale of decades. Eutrophication programmes would require chemical, biological and physical measurements; thus, such programmes would be expensive. The strategy could, therefore, be to implement such a program at sites with very high inputs of plant nutrients.

Harmful Algae

Harmful algal blooms (HABs) have been occurring in the Asia-Pacific region with increasing frequency in the last 20 years. In extreme cases, these blooms have rendered shellfish and finfish toxic or have caused massive fish and shrimp kills. The impacts of of algal blooms include paralytic shellfish poisoning, diarrhetic shellfish poisoning, ciguatera, tetrodotoxin poisoning, fish kills and tainting of fish and shellfish (Corrales and Maclean, 1995). By mid-1994, there had been 3,164 recorded cases of human poisoning and 148 reported deaths from HABs in the Asia-Pacific. The role of pollutants, particularly enhanced nutrients in eutrophic marine environments, in inducing HABs has been invoked. However, a complete understanding of the biology and ecology of the various harmful algae in the region has yet to be obtained. Countries that periodically experience HABs such as the Philippines continue to invest significantly in the routine monitoring of the organism's vegetative cells and the toxicity of the affected marine organisms.

Heavy metals

Many of heavy industries in the region produce chemicals, fertilizers, equipment/machinery, construction materials, metal and metal finishing, fuels, and electronic products. In general, these industries dump wastes, often untreated, directly into the environment. These wastes include heavy metals and toxins as typical components.

In the region, data on trace metals in coastal waters remain sparse in part due to the difficulty in accurately determining very low concentrations in seawater matrix. Reports in the 1980's or earlier of extremely high concentrations in certain coastal areas may be suspect and may have been biased due to sampling and analytical problems. Recently, greater attention to the issues of contamination and even better analytical techniques have afforded more reliable estimates of ambient trace metal concentrations even in contaminated areas. More data on trace elements in marine sediments and marine organisms are available than in seawater in the region.

There is no doubt that high concentrations of trace elements found in water and sediments in areas where mine tailings reach the sea or in the immediate vicinity of effluent outlets rich in metals cause adverse effects (McIntyre, 1995). Undoubtedly, there are many such sites among the countries in the region. However, effects at these sites tend to be localized and trace element levels measured in open ocean areas apparently are not significant. A relevant and interesting assessment of the determination of trace metals in seawater was made by Goldberg (1992). He noted that of the dozen or so metals routinely monitored in seawater, only three have actually been involved in well-established pollution episodes: tributyltin, methyl mercury and organically-bound copper. Thus, more recently, Goldberg (1995) recommended that there be less emphasis on the determination of concentrations on a full range of trace elements in seawater.

Another pertinent issue is that, while it remains difficult to accurately determine trace metals in seawater compared to marine sediments, criteria values (concentrations which if not exceeded are considered to be protective of the body of water for its designated use) are available for seawater but not for sediments. This situation prevails despite the assessment on trace elements in seawater made by Goldberg (1995) cited earlier and the generally recognized greater utility of sediments in assessing trace element contamination. Sediments generally remain at a specific locality for long periods, unlike the transient nature of seawater, and therefore the determination of trace elements in this matrix provides a time- and space-integrated picture of contamination of the marine environment. Perhaps, more attention should now be given to developing sediment quality criteria for the region.

Plastics

Goldberg (1995) warned of the "plastics problem" as evident in many well-used beaches and coastal areas of heavily populated cities. Eventually, plastics get buried in the sediments as even freshly introduced plastics would quickly accumulate organic coatings which sorb sand, shells and other debris and sink to the bottom with the increased density. The principal concern with plastics on the sediment is their ability to inhibit gas exchange between the overlying waters and the pore waters of the sediments. As a result, anoxia and hypoxia can result near the water-sediment interface. These effects can seriously interfere with the normal functioning of ecosystems and may alter the make-up of life on the sea floor (Goldberg, 1994). Fortunately, the MARPOL Convention through its Annex V has proposed a total prohibition of any discharge of plastic material to seawaters.. There is, as yet, no monitoring programme on sea-floor debris in the East Asian Seas to ascertain whether or not the coverage of the coastal sea floor is increasing so that life processes are threatened.

Impact from Aquaculture & Fish Culture

The discussion that follows on the environmental effects of intensive aquaculture is drawn primarily from the paper of Primavera (1997). The dramatic failures of shrimp farms in Taiwan, Thailand, Indonesia and China in the 1990s have raised concerns about the sustainability of shrimp aquaculture, in particular intensive farming. Intensive farms need large amounts of feeds to support high densities of shrimp, and flush correspondingly high loads of wastes into coastal waters. Estimates based on digestibility coefficients and feed conversion ratios show that only 17% by dry weight of total feeds applied to a pond is harvested as shrimp; 15% is not consumed, 20% becomes fecal material and another 48% goes to energy utilization, metabolites and molted shells. Pond wastes consist of solids (excess food, feces, plankton, bacteria) and dissolved matter (e.g. ammonia, urea, carbon dioxide and phosphorus). Levels of nitrogen, phosphorus and other water quality parameters are generally higher in effluent than inflowing water (Macintosh and Phillips, 1992).

Although the pollution potential of shrimp pond effluents is minimal compared to domestic or industrial waste water (Macintosh and Phillips, 1992), problems arise because of the large volumes of water discharged from intensive farms compounded by the high concentration of farm units in areas with limited water supplies and inadequate flushing. Intensive shrimp farming as practiced in Taiwan and parts of Southeast Asia has been unsustainable because discharge of effluents has exceeded the assimilative capacity resulting in pollution not only of receiving waters but inside the ponds as well.

A whole suite of antibiotics and other chemotherapeutants have been used to prevent or control a multitude of bacterial, fungal and viral diseases in shrimp hatcheries and farms. Other chemicals are also applied as disinfectants, water and soil conditioners, pesticides and fertilizers. The rampant use of antibiotics in shrimp hatcheries in the Philippines and Thailand has led to the development of drug-resistant bacteria (Baticados and Paclibare, 1992; Nash, 1990).

Antibiotics and other chemicals used in aquaculture may be toxic not only to the targetted pathogen or pest but also to nontarget populations such as the cultured species, wild flora and fauna, and human consumers. Oxytetracycline, furazolidone, erythromycin and kanamycin have been found to be health hazards associated with digestive disorders, allergies; the widely-used antibiotic chloramphenicol can cause anemia and stomatitis. in humans (Schnick, 1991). Even malachite green has been implicated as a carcinogen.

The environmental impact of marine fish farming is determined by the species, culture method, stocking density, feed type, hydrography of the site and husbandry practices (Wu, 1995). Wu also estimates that some 85% of phosphorus, 80-88% of carbon and 52-95% of nitrogen input into a marine fish culture system as feed may be lost into the environment through feed wastage, fish excretion, faeces production and respiration. Most of the loadings, however, accumulate in the bottom sediments and the significant impact is normally confined to within 1 km of the farm. Effects may include high sediment oxygen demand, anoxic sediments, production of toxic gases and a decrease in benthic diversity. Tributyltin (TBT) contamination and the development of antibiotic-resistant bacteria have been reported near fish farms.. It is likely that the manifestations of the environmental problems associated with marine fish farming are similar to the intensive aquaculture, varying only in the extent and intensity. For both farming practices, the detrimental effects on the environment can be substantially lessened with better (i.e., more sustainable) farming techniques coupled with a better understanding of the carrying capacity of the receiving waters.

Environmental oestrogens

Associated with the contaminants that come from aquaculture, agriculture and other land-based activities is the widespread occurrence of endocrine-disrupting chemicals (Stone, 1994). Attention has been directed to environmental oestrogens and especially the risks to humans through exposure. Many of the compounds act as anti-oestrogens by interfering with the activity of oestrogen receptors or by reducing the number of receptors in the organisms (Goldberg, 1995). Examples of these include the DDT family of chemicals that affect the reproductive success of fish-eating birds, and tributyltin (TBT) which was shown to cause sexual changes, the so-called imposex problem, in gastropods. Colborn et al. (1993) has identified a number of potential endocrine-disrupting chemicals which include herbicides, fungicides, insecticides, nematocides and other industrial chemicals (Table 1). Most are very weak but the concern is whether or not they can act in concert. There remains very little information as to which of the chemicals present in the environment might be responsible for endocrine-disrupting events. In the region, very little published data exist on the concentrations and environmental effects of environmental oestrogens. What is known is that many of the biocides continue to be used extensively in agriculture and aquaculture, and endocrine-disrupting industrial chemicals end up in the coastal and open waters.

Oil and Petroleum hydrocarbons

Asia is one of the largest offshore oils producing regions in the world, and among the South-East Asian oil producing countries, Indonesia is currently producing approximately 1.3 million barrels per day, Malaysia approximately 600,000 barrels per day, and Vietnam approximately 150,000 barrels per day.

There is very heavy oil tanker traffic in Northeast Asian Seas, mainly to Japan, Taiwan, and South Korea from the Persian Gulf through the Strait of Malacca and Singapore. About 4,000 million barrels of crude oil a day is imported by these three, representing 23 percent of the global total. New oil shipping routes running from the Bo Hai to Japan, South Korea, and southern China were opened recently. Every year, approximately 200 million tons of oil travel through Vietnam's offshore waters from the Middle East to Japan and Korea (Roop et al., 1994).

The three main types of commercial damage from oil pollution are fisheries, tainting, and decreased tourism. An oil slick drifting through the ubiquitous fish-farming cages in the region may inflict commercial damage often incommensurate with the amount of spillage. Tainting of commercial fish may cause as much damage as outright death of fish and shellfish. Tainted fish may be unmarketable or reduced in value. Entry of spilled oil onto tourist areas will always remain a cause for concern.

The actual oil concentration in the region has been measured by several national and international organizations. Oil concentrations in the open ocean are generally low--in the range of less than 10 g/l--and are high--sometimes as much as 100 g/l--in enclosed bays with concentrations of industrial and shipping activities. Bays with elevated concentrations are Tokyo and Osaka in Japan; Ulsan, Masan, and inner Kyunggi bays in South Korea; Keelung and Kaohsiung harbors in Taiwan; and major Chinese harbors in the Bo Hai.

Because oil spills are particularly striking and visual, the perception is that it is the major marine pollutant. Table 2 summarizes the major oil spills that have taken place in the region in recent years. However, long term studies are indicating that while a spill in restricted water could be a local disaster, and that in some circumstances oil residues could persist in patches for as long as 10 years, operational discharges from ships contribute a greater overall volume of oil to the world's oceans and could be a more widespread threat to birds and beaches than the annual quota of shipping accidents (McIntyre, 1995). Anecdotal reports of tar balls in the middle of the South China Sea among the islands, reefs and shoals are consistent with the heavy traffic of oil tankers that go through the area daily.

The assessment of other organic compounds associated with petroleum such as polycyclic aromatic hydrocarbons (PAH) remain sparse in the region. However, PAHs are ubiquitous in the environment and are implicated as cause of cancer in some organisms and potentially in humans (Santiago et al., in press). Work done on marine sediments (e.g., Santiago, 1997) tend to show highest concentrations near point sources of pollution such as near outfalls of petroleum refineries. However, urban run-off appears also to contribute alkylated napthalenes and phenanthrenes which are associated with petrogenic sources.

HOW ARE THESE POLLUTION ISSUES BEING ADDRESSED IN THE REGION?

Capability-building

Over the past decade, more centers with improved facilities and better-trained staff have emerged in the region. Recognition of the quality assurance and quality control concerns has also begun to pervade the conduct of pollution assessments and monitoring. Intercomparison exercises, often done through international agencies such as the Intergovernmental Oceanographic Commission (IOC) and the International Atomic Energy Commission (IAEA) have also significantly improved the reliability of analytical techniques employed and data obtained in pollution work. Individuals with advanced degrees (e.g., MSc and Ph.D.) earned within and outside the region have also returned to their countries and are now manning various academic and government institutions involved in marine scientific research. Thus, a critical mass of experts is now emerging in the region who are provided with adequate facilities to conduct marine pollution studies.

Regional Programmes

GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas

The Regional Programme is a Global Environment Facility (GEF) project designed to address marine pollution issues in the East Asian Seas Region. There are eleven participating countries in the project, which is being implemented by the United Nations Development Programme (UNDP) and has a duration of five years (1994-1998). The International Maritime Organization (IMO)is the executing agency.

The Xiamen Demonstration Project of the Programme aims to demonstrate the application of integrated coastal management (ICM) for effective prevention, control and mitigation of marine pollution. The project was operational in 1994 with the Xiamen Municipal Government designated as the lead implementing agency and the Marine Management Division as the operational arm. An executive committee has been established to take charge of project management, with the vice-mayor as chairperson. The Executive Committee involving over 20 government agencies on planning, finance, marine affairs, land use, environmental protection, fisheries, port operations and tourism, is the institutional mechanism for interagency consultation, coordination and review of major coastal projects. Among its achievements to date is the establishment of an operational Integrated Marine Pollution Monitoring Program under the leadership of the Third Institute of Oceanography.

ASEAN-Canada Cooperative Program on Marine Sciences - II

EVS Consultants was selected by the Canadian International Development Agency to implement a five-year project taking place in Southeast Asia. The project involves the establishment of environmental criteria for the development and managemnt of living marine resources and human health protection. The broad objective of the project is to upgrade ASEAN marine science capabilities through cooperative endeavours of participating ASEAN countries and Canada. The project includes three major activities to be completed over five years: execution of three technical studies, namely: development of tropical marine environmental criteria; pollution monitoring and baseline studies; and investigation of toxic red tides leading to toxicity of shellfish and marine fauna kills. Canadian support is in the form of technical specialists, operational and training assistance, and appropriate supporting materials such as hardware and equipment. Participation of ASEAN includes provision of personnel, facilities and equipment necessary to operate the project. The project has obtained a 2-year extension and will end in 1998.

IOC WESTPAC

a) Project on Assessment of River Inputs. Recognizing the importance of the discharged concentration relationship for the rivers as well as fluxes of materials such as suspended sediments, nutrients and pollutants to the coastal seas, the project aims to determine pollutant load reaching the coastal environment through specific river system. The initial effort has been made to assess nutrient fluxes. Intercalibration exercises for the determination of nutrients have been carried out among participating laboratories.

b) Project on Monitoring Heavy Metal and Pesticides Using Mussel Watch Approach. Considering that bivalves often constitute a major food resources in the WESTPAC region, and being filter feeders, accumulating organochlorine pesticides and heavy metals in their tissues, the use of bivalves and other sentinel organisms as indicators of persistent cumulative pollutants has received considerable attention in recent years. It has been considered one effective way to monitor pesticides and heavy metals. In co-operation with UNEP and UNU, a programme plan is being prepared and necessary training will be carried out in the region.

APEC Initiatives (http://www.apecsec.org.sg/mrcwg1.html)

The Marine Resources Conservation Working Group (MRCWG) of the Asia-Pacific Economic Cooperation (APEC) was launched in 1990. There are five shepherds in the working group, with the Lead Shepherd from Canada. The objective of the working group is to promote initiatives in the APEC region which will protect the marine environment and the resources therein, and ensure continuing socioeconomic benefits accrue through maintenance of marine environmental quality.

The work of the working group concentrates on the following projects:

a. Marine Algal Toxins (red tide/harmful algae blooms) Programme. The red tide/toxic algae project, started in 1994, reviewed the nature of red tide problems in each of the eighteen APEC economies, their capabilities and needs for effective management and existing and emerging technologies applicable to management and research, other programmes and agencies and current regulations and legislation in the APEC economies. The project was completed successfully in mid-1995 with its final report published. As the result of the findings of the project, a comprehensive and coordinated five-year programme, starting from 1996, was developed that provides the basis for trade in fisheries product free of algal toxins, through the development of effective monitoring, and analytical and research capacity among APEC economies;

b. UNCED Follow-up Project. The project is designed to facilitate a dialogue among the relevant regional and international organisations concerned with implementation of the UNCED Oceans Chapter and APEC, with a view to coordinating and enhancing efforts to implement the recommendations of the UNCED Oceans Chapter in the Region. The objectives and activities of the relevant organisations have been documented and a meeting on intra-regional cooperation participated by APEC members and the relevant regional/international organisations, was held in October 1995 to exchange information and experiences among the participating organisations and coordinate the effort in this regard; and

c. Integrated Coastal Zone Management Project. A three-pronged approach to integrated coastal zone management in the region has been adopted by the working group: i) a meeting of regional/international organisations and APEC was held in October 1995 to discuss experiences in multilateral approaches to coastal zone planning, especially dealing with problems crossing boundaries of neighboring economies; ii) information has been gathered on land-based sources of pollution in member economies, and their regulatory and institutional structures in place to manage these, and will be published; and iii) a workshop has been conducted to share ideas and insights on integrated coastal zone management approaches for semi-enclosed bays.

LOICZ (http://kellia.nioz.nl/loicz/)

The Land-Ocean Interactions in the Coastal Zone (LOICZ) Project is one of eleven programme elements of the International Geosphere-Biosphere Programme (IGBP). This Core Project focuses on the area of the earth's surface where land, ocean and atmosphere meet and interact. The overall goal of this project is to determine at regional and global scales: the nature of that dynamic interaction; how changes in various components of the Earth system are affecting coastal zones and altering their role in global cycles: to assess bow future changes in these areas will affect their use by people; and to provide a sound scientific basis for future integrated management of coastal areas on a sustainable basis.

Five Research Sites in Southeast Asia constitute the initial thrust of LOICZ integrative efforts. These sites in 1) Indonesia, 2) Malaysia, 3) the Philippines 4) Thailand and 5) Vietnam, are supported jointly by the

South East Asian Centre for START (SARCS), the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) and LOICZ. The projects all address SARCS Immediate Objective 2: to integrate natural - social science assessment of changes in coastal zones. All involve the modelling and synthesis of both biogeochemical and socio-economic data that will be useful not only in characterizing the coastal zone processes in the region, but also as test cases for the necessary conceptual and operational development for scaling up to global analysis.

Biogeochemical Modelling Core Research - This Project provides a focus for the aggregation of biogeochemical budget model outputs. The goal of this Project is to compile regional carbon/nitrogen/phosphorus data and budget models for numerous coastal areas of the world that can be used to produce global syntheses models of their flux in the coastal zone.

HOTO/GOOS (http://www.unesco.org/ioc/goos/hoto.htm).

The objectives of the Health Of The Oceans (HOTO) Module of Global Ocean Observing System are to provide a basis for the assessment of the state and trends in the marine environment regarding the effects of anthropogenic activities, including increased risk to human health, harm to marine resources, alterations of natural change and general ocean health. Central to the objectives and terms of reference of the HOTO Panel is a definition of the term "Health of the Ocean" and identification of the environmental health criteria, or biological indices, that can serve as early warning signs of change in the quality of marine environment (http://www.unesco.org/ioc/goos/hoto.htm).

THE FUTURE

Contamination will continue and will likely increase with the expected population and economic growth in the region. More efficient technologies to mitigate pollution will emerge but the receptivity of the private and government sectors to these developments will vary among countries. As beginning to be shown particularly in China and in the Philippines, the ICM strategy could be a way to increase the receptivity of coastal resource users, especially the private sector, to adopt and spend for needed interventions to protect the marine environment.

The over-fertilization of coastal surface waters, eutrophication, will remain a problem in the region and understanding the course of this phenomenon will require a long-term commitment to a monitoring program. Enhanced capability for the determination of pollutants, particularly organic compounds, will be required in the region. Much of the earlier assessments of pollutants have focused on relatively easy parameters to measure and these efforts were not necessarily linked to the sources and kinds of pollutants that affect a specific site. However, with better facilities and trained staff, it would be important to improve our understanding of compounds that are present, persist, and accumulate in the marine environment. Included among these compounds are the environmental oestrogens.

Some of the more conspicuous contaminants, such as marine litter and especially plastics, can seriously interfere with the normal functioning of ecosystems and may alter the make-up of life on the sea floor (Goldberg, 1994). Monitoring programs to determine whether or not the coverage of the coastal sea floor is increasing so that life processes are threatened should be initiated. Such programs need not be costly and trawl surveys appear to be the least expensive and could provide the statistically most acceptable results.

With the proposed downsizing of monitoring programs of metals in seawater to those elements involved in well-established pollution episodes (tributyltin, methyl mercury, and organically bound copper), monitoring programs might focus instead on sediments and sentinel organisms such as mussels. Studies might also be pursued to develop sediment quality criteria for environmental parameters that are appropriate for the region. Moreover, better packaging and utilization of pollution monitoring data will be imperative.

A network of "reference laboratories" in the region could be established that specialize in the determination of specific contaminants and that can provide training for field and laboratory training on marine pollution.

If active linkages are developed among these laboratories and other laboratories striving to improve their capabilities, it is conceivable that the network will expand and fill the growing need to conduct relevant and reliable marine pollution monitoring programs in the region. Associated with this network would be the desirability of sharing data and information among laboratories in both the formal (peer-reviewed publications) and informal (reports and internet webpages) modes. While the establishment of a common database for the region has yet to emerge, if at all feasible, a more effective mechanism will have to be found to promote the sharing of information so that the periodic assessments of the state of the marine environment can be facilitated. Mechanisms will also have to be found to enable the linkage and complementation of regional programmes that focus on marine pollution and the marine environment.

Finally, models of multi-sectoral pollution monitoring programmes need to be developed and replicated. For most countries in the region, national government institutions are unable to effectively implement pollution monitoring programs because of various constraints, not the least of which is inadequate fiscal resources. Thus, pollution monitoring activities at specific sites (e.g., bay area) linked with the local government that also involve the private sector and possibly non-governmental organizations may be the way to sustain monitoring activities.

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Table 1. Chemicals with widespread distribution in the environment reported to have reproductive and endocrine - disrupting effects. From Colborn et al. (1993).

Biocides				Industrial chemicals
Herbicides	Fungicides	Insecticides	Nematocides	
2,4-D	Benomyl	β-HCH	Aldicarb	Cadmium
2,4,5-T	Hexachlorobenzene	Carbaryl	DBCP	Dioxin (2,3,7,8-TCDD)
Alachlor	Mancozeb	Chlordane		Lead
Amitrole	Maneb	Dicofol		Mercury
Atrazine	Metiram-complex	Dieldrin		PBBs
Metribuzin	Tributyltin	DDT and metabolites		PCBs
Nitrofen	Zineb	Endosulfan		Pentachlorophenol (PCP)
Trifluralin	Ziram	Heptachlor and H-epoxide		Penta - to nonylphenols
		Lindane (γ - HCH)		Phthalates
		Methomyl		Styrenes
		Methoxychlor		
		Mirex		
		Oxychlordane		
		Parathion		
		Synthetic pyrethroids		
		Toxaphene		
		Transnonachlor		

Table 2. Chronology of the worst oil spills in the East Asian Seas in recent history.

1993

January 21 – SINGAPORE / INDONESIA / MALAYSIA - The 255,312-ton Singapore-registered tanker Maersk Navigator collided with the empty tanker Sanko Honour in the Andaman Sea en route from Oman to Japan. It was carrying a cargo of nearly 2 million barrels of oil. Its ruptured port side leaked burning oil and spread a slick up to 35 miles (56 km) long off Sumatra drifting towards India's Nicobar Islands.

1994

March 6 – THAILAND - About 105,670 gallons of diesel fuel spilled into the sea some four miles (6.4 km) off the eastern Sriracha coast after a chartered oil tanker and an unidentified cargo ship collided. The tanker, the Visahakit 5, was carrying about 1.06 million gallons of diesel and liquefied petroleum gas.

May 8 – VIETNAM - The 1,220-ton Vietnamese Chanoco I, carrying 1,012 tons of fuel oil, and a 10,000-ton Taiwanese ship Unihumanity collided in the Long Tau river near Ho Chi Minh City. About 200 tons spilled into the river from the Vietnamese ship causing a 200-ton oil slick, which killed fish and other wildlife.

October 17 – CHINA - 1,000 meters of beaches and reefs at Dongshan, a resort area at Qinhuangdao in Hebei province were polluted by an oil spill blamed on the Huahai Number Two tanker, owned by the state-run Huahai Company of Beijing.

1995

June 5 – SINGAPORE - About 100 tons of fuel oil leaked from a bunker fuel barge after it collided with the freighter Sun Pulse. The fuel oil had begun washing up on the island's east coast.

July 25 – SOUTH KOREA - Oil leaking from the 275,782 deadweight ton Sea Prince, a burning tanker off South Korea, formed a slick 20 miles (32 km) in diameter. The ship was loaded with 83,000 tons of crude oil. It was drifting toward the country's best known sea resort. 700 tons of fuel oil estimated to have been leaked.

1997

January 7 – JAPAN - Coastal fishing villages in northwestern Japan braced for economic and environmental catastrophe as oil slicks from sunken Russian tanker Nakhodka coated beaches and threatened prized shellfish beds. The spill from the ruptured tanker leaked 5,200 tons (36,400 barrels) of heavy fuel oil.

July 2 – JAPAN - A supertanker struck a shallow reef in Tokyo Bay, a famed fishing ground, leaking an estimated 1500 tons of crude oil.

October 15 – SINGAPORE - A tanker carrying 120,000 tonnes of fuel oil collides with an empty VLCC. More than 25,000 tonnes of oil leak out from the vessel, and despite huge amounts of dispersant chemicals being applied both from the air and from vessels, the beaches of several smaller islands off Singapore are covered with greasy sludge.

Sea areas of East Asian Seas (1 = Bo Hai Sea; 2 = Korea Bay; 3 = Masan Chinhae Bay; 4 = Tonkin Gulf; 5 = Bight of Bangkok; 6 = Gulf of Thailand; 7 = Malacca Strait; 8 = Jakarta Bay; 9 = Selat Madura; 10 = Makasar-Lombok Straits; 11 = Brunei Bay; 12 = Manila Bay)

COUNTRY REPORTS

Cambodia
Malaysia
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KINGDOM OF CAMBODIA
NATION RELIGION KING
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Second Technical Workshop of the Region Network for Marine Pollution Monitoring and Information Management
Burapha University, Chonburi, Thailand
09-11 November 1997

Presented by: Mr. Long Rithirak, Technical Adviser
Chief of Coordination Unit

Ministry of Environment
#48, Samdech Preah Sihanouk
Tonle Bassac, Chamkamon
Phnom Penh, Cambodia

1. Background

Cambodia is country of 181,035 sq.km situates in Southeast Asia in the Southwest part of the Indochinese Peninsula. It is bordered by Vietnam to the East and Southeast, by Laos PDR to the North, and by Thailand to the North and West. Cambodia has 21 provinces and a total population estimated 10 million in 1996.

Cambodia has a 435 km coastline on the Gulf of Thailand, three provinces occupy this coastline: Kohkong, Sihanoukville, and Kampot. The Cambodian coastal zone is located in Southwest part of the country, and coastal watershed lies outside the Mekong river basin, comprises an area of approximately 18,000 sq.km, and EEZ is estimated to be 42,000 sq.km.

2. Marine Fisheries

Fishing Effort: The number of fishing fleets along the Cambodian coast fluctuation following the natural, socio-economic, marketing conditions and pressure from others sectors especially agriculture.

Number of Coastal Fishing Vessels of Cambodia 1990-1994 (Licensed vessels)

Year	Boat<5t	Boat>5t	Motor boats 10-30 Hp	Motor boats 31-50 Hp	Motor boats <50Hp
1990	1,176	263	489	413	431
1991	1,000	809	718	230	178
1992	945	502	1,162	187	180
1993	882	350	1,377	250	186
1994	746		205	179	276

Source: Department of Fisheries, MoAFF

Production: Based on existing data, the classification of catch per unit effort has been made by the Department of Fisheries is not systematically, but for the purpose of identifying the biological evolution of the fisheries resource and its trend under pressure of intensive exploitation.

Sea food production 1990-1994 (tons)

Year	Finfish	Shrimp	Crab	Mollusk	Squid	By catch	Lobster	Total
1990	13,687	5,233	2,499	1,661	3,025	12,447	648	39,900
1991	16,540	3,796	2,421	3,133	1,297	9,054	159	36,400
1992	13,723	4,593	2,270	3,012	1,260	8,660	162	33,700
1993	12,838	3,237	3,148	983	8,484	160	160	33,100
1994	14,244	3,629	2,647	1,015	1,066	7,306	89	30,000

Source: Department of Fisheries, MoAFF

Socio-economic: Fishing operations along the coast are generally one trip per day due to poor infrastructure. At present, most fishing vessel compete to exploit inshore resource rather than off-shore. Most marine products are used to export to Thailand. Fishermen's income generated from fishing activities has gradually decreased during the last 5 years due to four vital factors: (i) market constraints; (ii) poor preservation technology; (iii) resource depletion; and (iv) security.

3. Coastal Aquaculture

Coastal aquaculture in coastal areas in Cambodia is a very recent activity compared to other countries in Asia. Shrimp culture used small-scale traditional methods before 1988 and was operated by local farmers and fishers. The Department of fisheries of the Ministry of Agriculture in Phnom Penh has issued a total of 840 ha of shrimp farm licenses to 105 owners in Kohkong . Licenses for 403 ha of shrimp farm land are under consideration. Reportedly, joint-ventures Thai-Cambodian were set-up in Kohkong along the Krangkruen river (1996). Most of the ponds were and continue to be dug in mangrove areas. All construction inputs for the financed shrimp farms came from Thailand, labor was supplied by locals and products were exported to Thailand. Uncontrolled, unregulated investment in intensive shrimp culture has led to sever destruction and pollution of the environment in Thailand and Taiwan, similar scenarios resulting in environmental damage has already begun, to affect Cambodia's coastline.

4. Industrial Statistics

The Royal Government of Cambodia encourages the development of agro-industrial enterprises and the production of fertilizers, petroleum and heavy construction and mechanical equipment. According to Provincial authorities in coastal urban centers, there have kind of factories such as: ice factory, fish souse, saw mills, brewery, plywood, oil and gas refineries and storage facilities, silica factory, cement plant, salt industry, phosphate fertilizer factory, and Voa romeat factory is reportedly a medicinal herb, and a potentially harmful waste is produced during the manufacturing of the medicine.

5. Oil and gas

All commercial energy now use in Cambodia is imported. Recent results from offshore exploratory drilling suggest that Cambodia has a high potential for natural gas and modest potential for oil. Several areas in the coastal zone have been explored in the past and continue to be explored for oil and gas supplies. At the present there are no production wells, only exploration activities. Estimated imports for 1993 were 75,000 tones of fuel oil, 126,000 tones of diesel, and 88,000 tones of gasoline. Kerosene and liquefied petroleum and gas are also being imported, but in a smaller quantity. Under the current Government policy and strategy, economic development is aimed at promoting the growth of industrial sectors in the coastal areas as the committee for Land Use and Urbanization.

The risk of oil spills in the South China Sea potentially affecting the Cambodian claimed economic exclusive zone (EEZ) water primarily stem from the three sources:

1. Accidental spills and leaks from the petroleum storage facility or during transfer of product in Sihanoukville.
2. Spill, leak and improper waste management from petroleum exploration and exploitation activities.
3. Spill and leak from vessels transporting petroleum products en route to Thailand or Japan.

6. Marine Water Quality

Generally, the water quality of coastal and marine areas appears to be good. This is because of the relatively low level of industrial activity in Cambodia's coastal areas. There have been localized instances of water quality problems in shrimp farms, likely due to poor management practices.

Water Quality in Province Koh Kong on 23/01/1996

Date	Sample No.	Depth m	Temperature C	Conductiv. mS/m 25 C	Salinity ppt	pH	D.O mg/l
23/01/96	F1-41	0.50	29.8	479	31.3	7.91	5.06
	F2-42	4.00	29.4	481	31.5	7.98	5.08
	F2-43	0.50	29.7	479	31.3	7.96	4.47
	F2-44	0.50	29.8	473	31.2	7.68	5.00
	O3-45	0.50	29.8	475	31.1	7.63	4.69
	P1-46	0.50	30.0	480	31.4	7.54	4.46

Water Quality in Sihanoukville on 25-26/01/96

Date	Sample No	Depth m	Temperature C	Conductiv mS/m 25 C	Salinity ppt	pH	D.O mg/l
25/01/96	Q1-47	0.50	27.7	482	31.5	8.15	3.58
	Q2-48	3.00	27.8	482	31.6	8.35	4.89
	Q3-49	5.00	28.6	483	31.6	8.35	6.31
	R1-50	0.50	28.7	483	31.5	8.35	5.43
	R2-51	4.50	28.4	484	31.6	8.32	6.10
	R3-52	0.50	28.6	482	31.5	8.32	6.87
	S2-53	11.00	28.2	482	31.6	8.28	6.45
	S2-54	0.05	28.4	479	31.6	8.26	6.30
	S1-55	5.00	28.3	478	31.5	8.25	6.18
26/01/96	T1-56	1.00	28.2	483	31.7	8.34	6.03
	T2-57	7.00	28.3	483	31.7	8.35	4.46
	T3-58	1.00	28.2	484	31.6	8.35	6.08
	U1-59	6.50	28.4	483	31.7	8.36	6.14
	U2-60	3.50	28.3	482	31.6	8.36	6.26
	U3-61	0.50	28.2	482	31.6	8.36	5.35
	V2-62	1.00	28.4	482	31.3	8.29	6.13
	V1-63	0.50	28.3	481	31.4	8.29	6.12

7. Environment

The primary environment issues in coastal cities are as follows:

- environmental health - need for improvements to water supply, water distribution system, sewage system, drainage, solid waste collection and disposal; need for education program on water usage, general public area cleanliness, industrial wastes and disposal of hospital wastes.
- Coastal water quality - need to set standards to control discharges of waste into watercourses and coastal sea areas
- general environment - winning of soil from coastal areas and soil erosion in the hill areas

Sewage: The combined drainage sewerage system in the central town areas is inadequate, having collapsed or blocked in sections. Discharge from the pipes to open drains and natural watercourses is uncontrolled and without treatment. The system is subject to frequent overflows. Surface water is also unable to enter the system during times of significant rainfall.

Solid Waste: Solid waste management is not being adequately addressed in any of the towns by coastal urban. For all aspects, ranging from the lack of public awareness of the need to place refuse in containers, to the unsatisfactory collection and disposal systems that are in place, improvements in solid waste management are necessary. At present, only limited areas of the towns are provided with a collection service, with the result that solid waste from the remaining areas is often being illegally dumped into vacant lots, swamps, waterways, and drainage canals creating major public health and environmental problems.

Other Wastes: Disposal of industrial liquid wastes will become a matter of greater concern as industrial development occurs. Policies should be implemented for the control of industrial wastes, which often contain chemicals which are harmful to the environment. With the extensions of the port underway and plans for the establishment of industrial zones, provision for the correct disposal (incineration or landfill disposal) must be provided.
The hospital liquid waste is discharged to the stream without treatment, this form of disposal represents a serious public health concern with the potential for transmission of infectious disease.

8. Marine Environment Issues

Due to the lack of enforcement and the absence of some important laws, and legal instruments, the marine areas are hampered by the following factors:

- Water pollution due to inadequate laws regulating sanitation and water disposal practices in urban areas including solid waste and sewage from domestic residents handicrafts factories/industries.
- Potential for mismanagements of toxic/or hazardous waste
- marine fishery habitat and population degradation from water resource management activities, sedimentation, habitat destruction to prepare for development project, over fishing and illegal fishery.
- Short and medium-term threats to the marine areas concern the instigation of inappropriate economic development. Coastal watershed and mangrove forests are currently being harvested. Overfishing in adjacent parts of the Gulf has been disastrous and threatens to be so in Cambodian water if not properly managed.
- Longer-term threats to the diversity and property of this ecosystem are the expansion of settlement and industry in the area and the development of mineral deposits in catchment areas. Erosion of coastal watersheds will pose great threat to the marine environment, particularly where mangrove areas have been degraded. As in other regions exploitation of oil resources could cause marine environment damage to both physical and biological resources in the future.

9. National Legislation

The *Law on Environmental Protection and Natural Resource Management* (EPNRM) was passed in 1996. It is intended to protected and promote environmental quality and public health through the prevention, reduction and control of pollution, assess the environmental impacts of all proposed projects prior to decision-making; ensure the rational and sustainable conservation, development, management and use of Cambodia's natural resources;
to encourage and enable public participation in environmental protection and natural resource management; and suppress acts that cause harm to the environment.

The creation and *Designation of Natural Areas sub-decree* was enacted in 1996 to enable the Environmental Law. It designated a system of national parks, wildlifesancturies, protected landscapes and Multi-use Management Areas.

The *Organization and Function of the Ministry of Environment sub-decree* quite clearly sets out the mission of the Ministry. At present it is still under consideration by the Council of Ministers, and it is expected to be passed in 1998.

The *Environmental Impact Assessment sub-decree* is still in draft form, awaiting approval by the Council of Ministers. It is expected that it will be enacted in 1998. It supports the EPNRM law, by providing implementing regulations related to environmental impact assessment, designation and amelioration.

Cambodia has no laws on water (either marine and fresh or ground), its use or its management. At the present, there are moves to encourage the Government to prepare such laws as conflicts, impacts and poor practices become more widespread in the public and private sectors.

10. Action Plan for Protection of the Marine Environment

In order to ensure sustainable management and protect marine environment from Land Based Activities require:

- preparation of management plan for the protection of marine environment.
- Integration of marine environmental policies into the socio-economic development program and decision making
- development of an integrated coastal and marine natural resources information system
- reduction and prevention the marine water pollution
- mark management boundary and establish marine zonation map
- improve the habitat for coastal and inshore fishery
- develop marine environmental regulation to protect and to control on all development activities
- increase the control of foreign fishing through various means
- establish clear definition of roles responsibility and relationships among institutions responsible for the management of marine resource
- strengthening marine environment management capacity

- to promote and support the roles and responsibilities of the private sectors, local authorities, NGOs, and International Agencies for the marine environment protection

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Management, Regulation and Enforcement Access to Conservation and Socio-Economic of the Marine Environment

Resource/Activities	Management	Regulation access	Enforcement
Mangrove forest	*	Licensing process	*
Coral reef	Ignore	abs	Ignore
Seagrass	Ignore	abs	Ignore
Marine sanctuary	Ignore	abs	Ignore
Fish habitat	Ignore	abs	Ignore
Fishing ground	*	Trawling restriction	*
Species diversity	Ignore	abs	Ignore
Genetic diversity	*	Ban for spawning period of mackerel	**
Environment	*	abs	Ignore
Fishing	**	Licensing process Ban for destructive gear: taxation	**
Coastal aquaculture	abs	Licensing process Restriction on farm location and waste disposal	*
Landing	*	abs	Ignore
Processing	**	Licensing process	abs
Preservation	*	Licensing process	abs
Marketing	Slightly inhibit (state company)	Slightly inhibit (domestic transportation licensing)	***
Scientific research	abs	**	abs
Innovation	abs	*	abs
Community-based management coastal resources	Ignore	abs	Ignore

Note: * Poor consideration

** Fair consideration

*** High consideration

abs. Absent

MALAYSIA
COUNTRY REPORT

Presented at

SECOND TECHNICAL WORKSHOP OF THE REGIONAL NETWORK FOR MARINE POLLUTION MONITORING AND INFORMATION MANAGEMENT

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November 1997.

A FRAMEWORK FOR THE PROTECTION OF MARINE ENVIRONMENT FOR MALAYSIA

1. Introduction

1.1. The needs to protect and ensure sustainable development of the coastal and marine environment have been given great emphasis both at National and State levels. The Seventh Malaysia Plan outlines the following measures relating to marine and coastal environment:-

- Formulation of a national coastal zone management policy to resolve "conflicting interests among the different types of development ...... as well as.....to ensure sustainability of coastal resources;

- Coordination and nationalisation of Federal, State and Local Authorities responsible for planning and managing resources found in the coastal zone; and

- A review of legal provisions governing the management of coastal resources and related development activities, to ensure better coordination and implementation strategy for marine and coastal protection. Chapter 17 of Agenda 21 provides the action plan for the "*protection of the oceans, all kinds of seas, and coastal areas and the protection, national use and development of their living resources*".

1.2. Malaysia's commitments towards protection and sustainable development of the marine and coastal environment in undeniable. But it is equally important for more actions to be taken to ensure the fulfillment of Malaysia's obligation towards sustainable development of marine and coastal environment.

<u>Malaysian National Conservation Strategy (MNCS)</u>

Conservation in Malaysian context is defined as continuing changes in the quantity, quality and availability of natural resources require a developing framework of strategies and action plans. These should air to assist in the move towards sustainable development.

The objectives of MNCS are:-

- Conservation of Natural Resources

- Sustainable Development

- Improved Efficiency in Resource Use and Management

To achieve these objectives, the administration of natural resources and the environment should stress:-

(i) the **PLANNING OF RESOURCE MANAGEMENT AND USE** as an integral part of the mainstream planning process;

(ii) **EDUCATION, AWARENESS AND TRAINING** to achieve the development of human resources which is crucial for sustainable development; and

(iii) **ENFORCEMENT**, as the key to ensure that the framework of law and management for resources and the environment is fully effective.

1.3. The system of protected and managed **CRITICAL AREAS** should be strengthened. Environmental performance should be measured and monitored by **NATURAL RESOURCE ACCOUNTING** and **ENVIRONMENTAL AUDITING**.

1.4. Strategies for coastal and marine resources underline in the MNCS are:-

- A Coastal Zone Management Plan is needed, and this must be consistent with the National Spatial Plan and other planning exercises and procedures;
- The Plan shoud be coordinated by a single agency;
- Follow-up studies are needed on coastal erosion, reclamation and land use; very careful and critical study is required;
- Malaysia should be involved in more marine treaties, with greater ASEAN cooperation in pollution control, conservation or marine resources, fisheries and navigation;
- Mangroves must be maintained and conserved;
- Activities on land adjacent to marine parks must be given the highest possible degree of consideration, in order to conserve marine and coastal resources;
- More research and development is needed on marine biological diversity, potential pharmaceuticals and biotechnology.

2. Management Of Marine Environment The Present Scenario

2.1 Coastal Zone Management

To be able to implement the coastal zone management is one of the best solutions in resolving the complex issue of managing coastal resources. The fragmented responsibilities of various Federal and State agencies had resulted in poor coordination and management of coastal environment. Almost all levels of Government, Federal as well as State had some forms of involvement in relation to coastal zone management policy formulation. However, the policy made by the Federal will have to be adopted, and implementation of such policy lies with the State and Local Authorities.

2.2 Marine and Coastal Biodiversity

One of Malaysia's most spectacular species i.e. the leatherback turtle, which has long been a tourist attraction is rarely seen landing on our beaches nowadays, somehow the number of turtles landing for nesting have declined. Human activities which are incompatible have threatened the marine and coastal biodiversity. Effective enforcement of existing regulations is an important consideration and the definition of protected species within the existing legislations must be made known to those who have economic as well as concerned group in order to protect the endangered species.

2.3 Marine Protected Areas

The Fisheries Act 1985 Section 4 (1) had explicitly expressed;

(i) to afford special protection to the aquatic flora and fauna of such area or part thereof and to protect, preserve and manage the national breeding grounds and habitats of aquatic life, with particular regards to species of rare or endangered flora and fauna;

(ii) allow for the natural regeneration of aquatic life in such area or part thereof where suchlike has been depleted;

(iii) promote scientific study and research in respect of such area or part thereof; and

(iv) regulate recreational and other activities in such area or part thereof to avoid irreversible damage to it's environment.

Thus, the framework to protect marine ecosystem is in existence but the inter-related issues affecting the coastal and marine ecosystem requires an integrated and coherent system in order to manage the resources we have.

2.4 Conservation of Marine Resources

Malaysia's coastal zone is rich in natural resources and has socio-economic significance. Inadequacy of conservation strategies and over-exploitation of coastal resources will cause unbalanced development and environmental degradation the country. The sustainability of this resources depends very much on how related policies, strategies and management guidelines on coastal resources are being integrated into economic activities planned along the coastal zone.

2.5 Regulatory Framework

Regulatory framework based on the Federal Constitution outlined the respective jurisdiction of Federal and State Authorities. The national and international legislations as listed in para 4.0 and the relevant agencies involved in enforcing such legislations are given in Table 1.

3. Marine Pollution Sources

3.1 Land-based Sources Of Pollution

Industrial and urban development had been identified as a major land-based sources of pollution in Malaysia. Tourism development activities along the coastal areas have increasingly contributed to marine pollution. Other land-based sources are from the agro-based industries manufacturing industries, toxic and hazardous wastes, domestic sewage and animal husbandary wastes.

3.1.1 Domestic Sewage

The increasing population density in coastal and urban areas has further worsen the quality of marine waters due to the lack of services, policies and plans for collection, treatment, disposal and overall management of domestic sewage. Around 5 percent of the population of Malaysia is served by sewers, and about 70 percent of households use either septic tanks or Imhoff tanks. Up to 40 percent of the inhabitants do not reside within a municipality and thus receive no organised sanitation services.

3.1.2 Solid Waste

Solid waste from municipalities is one of the environmental problem resulted from the increasing population densities and the lack or absence of disposal facilities. The existing methods of disposal such as landfill can resulted in leachate containing heavy metals which will end-up in the marine environment and cause destruction to the sensitive ecosystem.

3.1.3 Agricultural Waste

Agricultural waste contribute to the organic pollutant in the marine environment. Sources of agricultural waste are livestock farms, fertilizers and pesticides, and siltation from erosion. It is estimated that 10-25 % of agricultural organic waste comes from the livestock farms. Fertilizers and pesticides are heavily used in crop production and protection as well as on golf courses. While fertilizers can cause eutrophication of coastal water, pesticides on the other hand have toxic effect on fish and other marine life. Deforestation and land-clearing without proper control and protection will result in erosion and sedimentation of coastal waters, which will eventually change the characteristic of the water and cause damages to coral.

3.2 Sea-based Sources

The sources of marine pollution originated from vessels, offshore activities and coastal related activities. Discharges from vessels resulted from the normal ship operations such as deballasting, tank cleaning, bilges, bunkering and cargo loading and unloading can result in oil spill pollution. From offshore works the operational activities such as drilling effluents, domestic wastewater and also garbage generate will contribute to the pollution of seas. Other coastal related activities such as mining, aquaculture, dredging and tourism activities will contribute to the marine pollution and destruction to the marine ecosystem.

4. Legal Instrument On Marine Pollution Control

4.1 National Laws With Respect To Land -Based Pollution

Environmental Quality Act (EQA) 1974 and the Regulations made thereunder is the principal law governing land-based pollution.

Control of Agro-Based Water Pollution

- Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977.
- Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978.

Control of Municipal and Industrial Waste Water Pollution

- Environmental Quality (Sewage and Industrial Effluents) Regulations 1979.

Control of Toxic And Hazardous Waste.

- Environmental Quality (Scheduled Wastes) Regulations 1989;
- Environmental Quality (Prescribed Premises) (Schedule Wastes Treatment and Disposal Facilities) Order 1989.
- Environmental Quality (prescribed Premises) (Schedules Wastes Treatment and Disposal Facilities) Regulations 1989.

Transboundary Management of Hazardous waste.

- Environmental Quality (Scheduled Wastes) Regulations 1989.
- Under the Customs Act 1967 - The Customs (Prohibition of exports) Amendment (no. 2) Order 1993 and the Customs (Prohibition of Exports) (Amendment) (No. 3) Order 1993.

4.2 National Laws With Respect To Sea-Based Pollution

Vessel Source Pollution:

- Merchant Shipping Ordinance 1952 - Part VA.
- Merchant Shipping (Oil Pollution) Act 1994 come into force on the 6th of April 1995 (P.U.(B) 144/95).
- Environmental Quality Act 1974.
- Exclusive Economic Zone Act 1984.

Offshore Activities

- Continental Shelf Act 1966 (Revised 1972).
- Petroleum Mining Act 1966.
- Petroleum Development Act 1974.
- Petroleum (Safety Measures) Act 1984.
- Exclusive Economic Zone Act 1984.

Conservation Strategies Under The Fisheries Act 1985.

- National Policy for management of coastal resources.
- Establishment of sanctuaries.
- Creation of marine parks off Peninsular Malaysia and Labuan.
- Marine Park Councils.
- Marine Park Island Conceptual Plan.
- Protect and restore endangered marine species.

4.3 International Legislations

- **International Convention for the Prevention of Pollution from Ships 1973; Protocol 1978 (MARPOL 1973/78)**

  This is the most important convention in relation to the control of vessel-based operational pollution. It has five Annexes, and Annex I is on Oil Pollution, which is compulsory and already come into force. The relevant features of the Convention are:

  (i) It covers all forms of pollution from any ship;

  (ii) It applies to all types of ships (excluding naval and Government ships used for non-commercial purposes), including fixed or floating platforms and drilling rigs; and

  (iii) All parties to the Convention are obliged to provide appropriate reception facilities for ship wastes.

  MSO already has the enabling provisions to enact rules and regulations to implement MARPOL. Coordination with other Acts and relevant agencies is necessary to avoid conflicts and duplications.

- **International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969/73 (Intervention Convention)**

  The objective of this Convention is to ensure that a contracting state will have sufficient powers to "prevent, mitigate or eliminate grave and imminent danger to the coastline from pollution or threat of pollution by oil or other hazards from a casualty". The Convention applies to all seagoing vessels except warships and ships belonging to the Government and not used for commercial purposes.

The MSO has provisions to enable the implementation of this Convention. Regulations under the MSO should be made when Malaysia ratify the Convention to provide for the implementation of this Convention.

- **International Convention on Civil Liability of Oil Pollution Damage 1969/76/84 (CLC)**
  International Convention on the Establishment of an International Fund for Oil Pollution Damage, 1971/76/84/92 (FUND)

  Oil spills can cause wide spread damage. The risk of oil spill incidences is especially high in the Straits of Malacca. The CLC and FUND Conventions provide a compensatory regime in the event of an oil pollution incident.

  CLC Places the liability for oil pollution damage on the owner of the ship from which the oil has escaped or discharged. Ships covered by the Convention are obliged to have adequate insurance. The FUND Convention is operated on contribution from cargo owners and those handling oil at terminals in the contracting states. FUND is intended to top up inadequacy in compensation from CLC.

  Malaysia has passed the Merchant Shipping (Oil Pollution) Act 1994 in order to implement the CLC and FUND Conventions.

- 1982 United Nations Convention on the Law of the Sea (UNCLOS) (came into force November 1994)

  UNCLOS is the basic convention governing maritime activities. The Convention sets the various regimes for the proper utilization of the sea, the rights and obligations of coastal/user states, safe navigation, marine pollution control and prevention, exploitation of living and non living resources, scientific research and dispute settlement.

  Part XII of the convention provides a comprehensive basis for the protection and preservation of the marine environment. It provides an integrated framework for the development, exploitation, management and conservation of the ocean and its resources. It is important to recognise the rights and obligations of states under this Convention which include:

  (i) the right to exploit their resources but also the obligation to protect and preserve the marine environment - the concept of sustainability is introduced from the beginning;

(ii) to take individual or joint action to ensure that activities under their control do not cause damage by pollution to other states;

(iii) all sources of pollution shall be controlled and minimized including those from the use of new technologies or the introduction of new or alien species;

(iv) regional/global cooperation shall be promoted and this includes notification of imminent danger to neighbours, contingency plans, research and exchange of data and information and assistance to developing countries;

(v) monitor the risks/effects of pollution of any activity permitted and publish reports;

(vi) assess the risks of activities that may cause pollution;

(vii) adopt laws and regulations to prevent, reduce, and control pollution from land based sources and endeavour to establish global/regional rules, standards and recommended practices to prevent, reduce or control marine pollution;

(viii) adopt laws and regulations to control pollution from activities in marine areas, including dumping, vessel operation, and atmospheric pollution;

(ix) enforcement measures to enforce the law and regulations including port state control, but such enforcement shall not delay vessels; and

(x) cooperate in implementation of existing international law particularly in fulfilling their obligations and ensuring proper and prompt procedures for compensation.

Malaysia has adopted the concepts enunciated in UNCLOS such as the extended width of the Territorial Seas (to 12 nautical miles), the EEZ and the Continental Shelf. In addition to fisheries and oil and gas exploration and extraction in the EEZ, the relevant agencies should play more active role in terms of marine pollution control, marine research and navigation in the EEZ.

- **International Convention on Oil Pollution Preparedness, Responses and Cooperation, London 1990 (OPRC) (Not yet in force)**

OPRC sets the framework within which parties to the Convention can cooperate, provide assistance and work towards the speedy and effective combat of any major oil spill, with the coordination of the IMO. Under this Convention, coastal states bordering high risk areas are required to have adequate number of response centres which should have the minimum stockpile of oil spill combat equipment. Control of pollution from sludge, oil refuse and refuse products are covered under this Convention.

Malaysia already has its own National Oil Spill Contingency Plan which is currently under reviewed. Certain inadequacies of the existing plan were noted in combating the 'Nagasaki Spirit' incident. The National Plan is supported by a number of other private or public sector initiatives which include:

(i) Private sector programme - Petroleum Association of Malaysia Mutual Aid Group (PIMMAG);

(ii) ASEAN Oil Spill Regional Action Plan (OSRAP) project; bilateral MoUs on Standard Operating Procedure (SOP) for joint oil spill combat with Philippines, Indonesia abd Brunei;

(iii) Oil Spill Prevention and Response (OSPAR) project for ASEAN - funding has been provided by the Japanese Government through Petroleum Association of Japan for stockpiling of oil spill response equipment in ASEAN countries; and

(iv) East Asian Response Limited (EARL).

- International Maritime Organisations' Conventions

Malaysia has ratified the following Conventions under the IMO, primarily concerning safety of navigation at sea for all cargo ships, including oil tankers:

(i) Safety of Life at Sea (SOLAS) 1974;

(ii) Convention on the International Regulations for Preventing Collisions at Sea (COLREG) 1972;

(iii) International Convention on Load Lines (LOADLINE) 1966;

(iv) International Convention of Tonnage Measurement of Ships; and

(v) International Convention on Standards of Training, Certification and Watchkeeping (STCW) 1978.

Provisions are available in Malaysian legislation (MSO) for the enforcement of these Conventions.

Relevant to the implementation of these Conventions is the **Tokyo MoU on Port State Control for Asia-Pacific** which has been accepted by Australis, Canada, China, Hong Kong, Japan, Republic of Korea, Malaysia, New Zealand, Papua New Guinea, Singapore and Vanater (Indonesia, Philippines, Solomon Island, Thailand and Vietnam have not accepted). This MoU has the same provision as IMO Convention 147 giving the rights to the Port State to inspect foreign flag ships under specific conditions. It has been suggested in a recent study that Malaysia should develop regional PSC understanding which will carry out investigation on ships that call at their respective ports in response to a request by the littoral states.

- **International Convention on Salvage 1989** (Not in force internationally - Malaysia not a party)

  This Convention set the provisions on salvage in the event of a casualty in the sea which may be undertaken by professional salvors or voluntary services from passing vessels in the vicinity. Effective salvage operations are important in mitigating the effects and impact of a casualty.

6. Proposed Strategies and Action Plan for the Protection and Management of Marine Environment

6.1 National Policies on Coastal Zone Management

The national policies should encompass integration of resources management, and relevant government agencies in decision making. An appropriate framework must be identified for the enforcement of the legislation. Regulatory and economic instruments must be introduced to improve the efficiency of implementing the policies.

6.2 Pollution Reduction

Strategies to reduce pollution can be achieved through proper planning and avoid conflicting interest. Integration of all the relevant agencies on effective enforcement of laws and the regulation to minimise environmental impacts from all major development activities, must be initiated.

6.3 Marine Conservation

The marine protected areas in Malaysia must be establish and management through proper planning, gazettment and research activities. And the other fragile environment must be identify and protected for the sustainability of the marine eco-system.

6.4 Activities and Agencies Identified

Each of the agencies identified in Table 1 have their own role to play in managing the marine environment but there is no formal mechanism to coordinate the activities of these agencies resulting in conflict of management. As such there is a need to have coordination in managing the marine environment. Some of the laws which have jurisdiction over the coastal and marine areas are out-dated and do not have environmental criteria in their provisions. There is a need to amend these laws taking into account for the sustainable management and development of the coastal and marine resources.

7. List of References

7.1. Anon. Chapter 17, Protection of the oceans, all Kinds of Seas, Including Enclosed and Semi- Enclosed Seas, and Coastal Areas And The Protection, Rational use and Development of Living Resources, Agenda 21.

7.2. A.R. Abdullah & C.W. Wong, Oil and Grease Pollution in The Malaysian Marine Environment, Department of Environment, 1996.

7.3. Economic Planning Unit, Malaysian National conservation strategy, volume 1, Executive Summary and The Strategy, 1993.

7.4. GEF/UNDP/IMO, Regional network on the legal aspects of Marine Pollution, Manila 1996.

TABLE 1

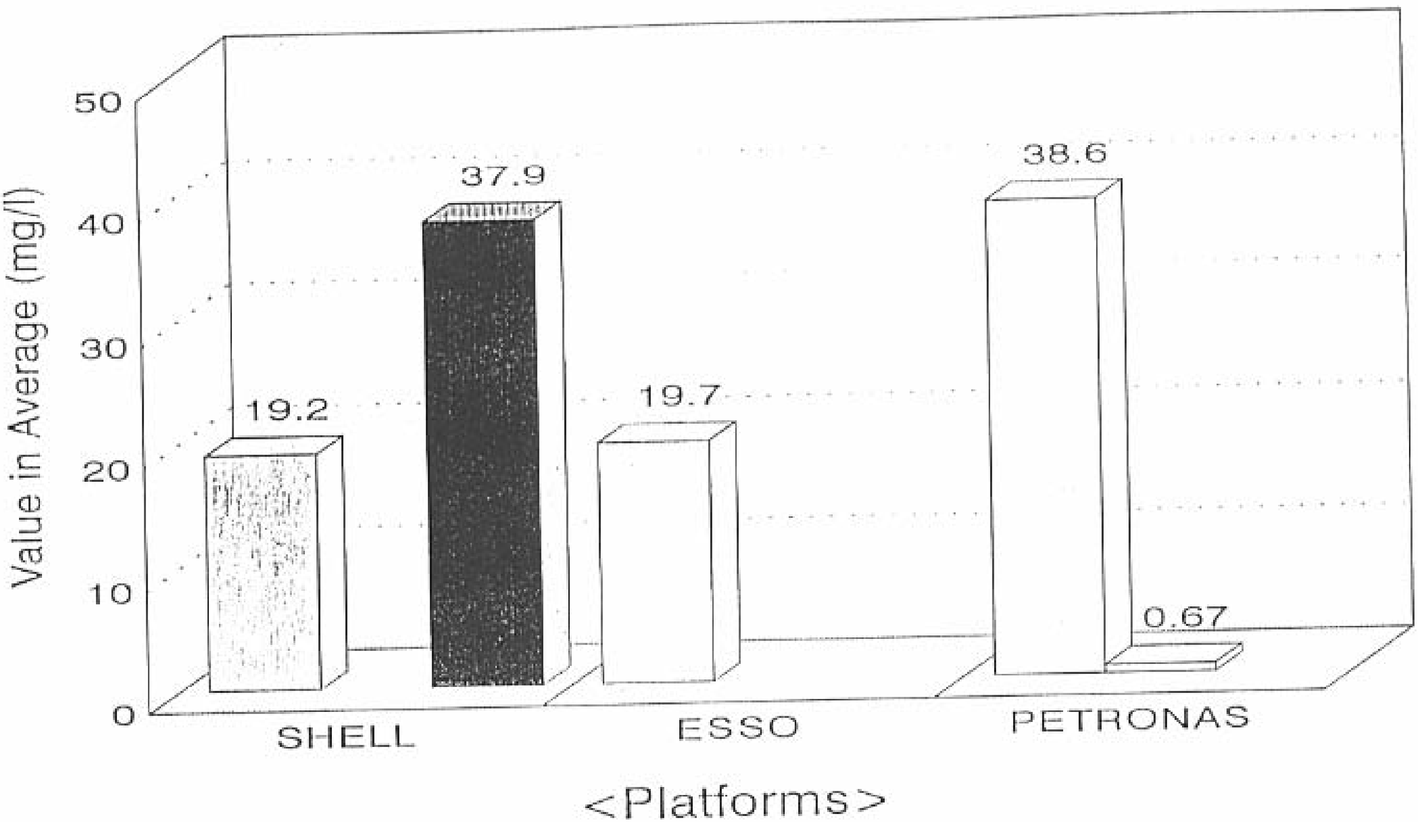
MARINE PROTECTION AND CONSERVATION ACTIVITIES
AND THE RESPONSIBLE AUTHORITY
COORDINATING AGENCY : ECONOMIC PLANNING UNIT
OF PRIME MINISTER DEPARTMENT

ACTIVITIES (As stipulated in Agenda 21)	AGENCIES	RELATED-LAW	TARGET DATE
a) **Management Related Activity**			
• Coastal profiles identifying critical areas user conflicts and specific activities for management.	Drainage and Irrigation Department Local Universities Research Agencies	Water Act 1920	
• EIA, Systematic Observation and follow-up of major projects, including the systematic incorporation of result in decision making.	Department of Environment Planning Authorities.	EQA 1974 Town And Country Planning Act.	
• Contingency plans for human induced and natural disasters.	Marine Department Department of Environment Fire Department	MSO 52/MSA 1994 EQA 1974	
• Improvement of treatment and disposal of sewage, solid waste and industrial effluent esp. in coastal human settlement.	Department of Sewerage Services Department of Environment Department of Marine	MSO 52/MSA 1994 EQA 1974	

ACTIVITIES	AGENCIES	RELATED-LAW	TARGET DATE
• Conservation and restoration of Marine and coastal ecosystem for example mangroves, turtle, fishes, coral reefs and other inshore and offshore communities.	Department of Forestry Department of Fisheris Local Universities Research Agencies	National Forestry Act 1984 Fisheries Act 1985.	
• Integration of Sectoral programmes on sustainable development such as the coastal zone management.	Multi-Agencies Task Local Universities		
• Better infrastructure and alternative employment for example the coastal erosion abatement and remediation projects or prevention programmes such as mangroves planting.	Ministry of Housing and Local Authority, DID, Planning Authorities	Uniform building systems 1988, Housing Developers (Control and Licensing) Act 1966 (Amendment) 1988	
• Human Resource Development and Training in management for conservation, reduce destructive fishing.	Multi-Agencies Task Such as DOE, DOF Fishermen Association etc.		

ACTIVITIES	AGENCIES	RELATED-LAW	TARGET DATE
• Public Awareness programmes and campaign.	Multi-Agencies Task, NGO's		
• Promoting environmentally sound technology and sustainable practices.	Department of Environment Local Universities Research Agencies		
• Development and implementation of marine quality criteria.	Department of Environment Department of Fisheries Research Agencies	EQA 1974, Fisheries Act 1974	
• Enforcement of Marine Pollution.	Department of Environment and all other Maritime Agencies	Continental shelf Act 1972 Petroleum Mining Act 1966 Petroleum Development Act 1974 Exclusive Economic Zone Act 1984	
b) **Data and Information**			
• Develop and maintain data bases of all areas, seas and their resources.	Department of Environment Department of Marine Department of Fisheries Department of Forestries Department of Sewerage Department of Drainage and Irrigation Planning Authorities Local Universities		

ACTIVITIES	AGENCIES	RELATED-LAW	TARGET DATE
		• Memorandum of Understanding on Port State Control in the Asia-Pacific Region 1993, (Tokyo MoU 1993)	



Produced Water Quality for Offshore Platforms in Malaysia, 1996.

min(94)/minyak/zmd/aba/240197

Malaysia : Interim Standards for Marine Water Quality

INTERIM STANDARDS FOR MARINE WATER QUALITY

PARAMETERS		UNIT	INTERIM STANDARDS	REMARKS
Escherichia coli	E_Coli	MPN/100ml	100	*
Oil & Grease	O & G	mg/l	0	**
Total Suspended Solids	TSS	mg/l	50	* TYPE 1
Arsenic	As	mg/l	0.1	* TYPE 2
Cadmium	Cd	mg/l	0.1	* TYPE 2
Chromium (total)	Cr	mg/l	0.5	* TYPE 2
Copper	Cu	mg/l	0.1	* TYPE 2
Lead	Pb	mg/l	0.1	* TYPE 2
Mercury	Hg	mg/l	0.001	* TYPE 2
Nickel	Ni	mg/l	-	* TYPE 1

LEGEND

* : Based upon The People's Republic of China Standard
** : Based upon Japan's Standard

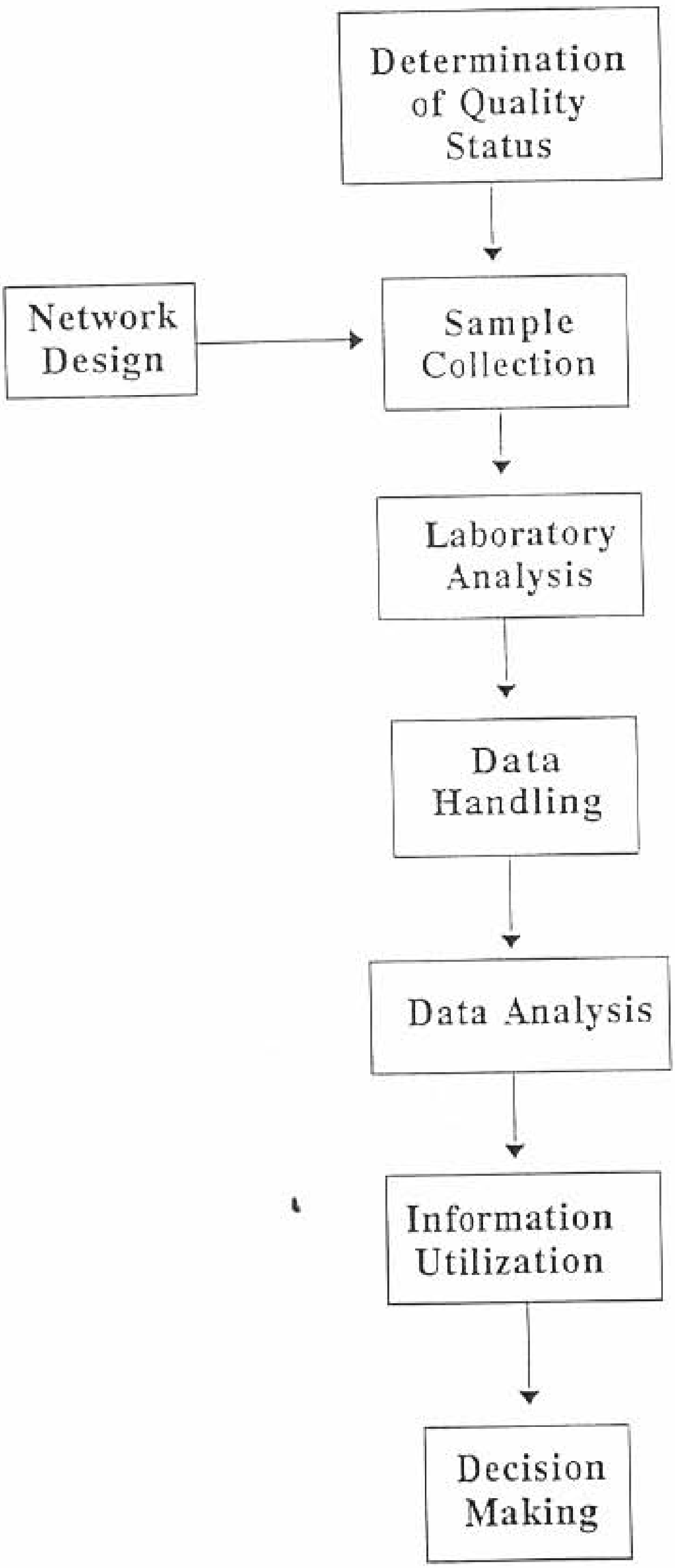
Types of quality are in accordance to use :

TYPE 1 : For the conservation of marine equatic resources and safe utilization by humans (includes salt field, food processing, desalination, fisheries, aquaculture and marine park (conservation area).

TYPE 2 : For recreation

TYPE 3 : For industrial processing, harbour, port and oceanic exploitation and development.

MONITORING ACTIVITIES



Experiences of marine pollution monitoring in Chinhae-Masan Bay, Korea

including the linkages undertaken between marine pollution monitoring and management strategies and intervention

1997. 11. 10-11

Jang-Won CHAE, Hong-Yeon CHO
KORDI, Coastal & Harbor Engineering Research Center

I. Introduction

a. Description of the issues and problems in Korea that are expected to be addressed through site specific marine pollution monitoring

- Marine WQ management and environmental protection around Korean penninsula by Governmental agency (see Figure 1)
- Red tide, hypoxia, and eutrophication problems in semi-enclosed bay and coastal zone
- Integrated coastal management for pollution control and sustainable development

Cf. Chinhae Bay : Designation of the Special Management Seas in 1982

b. Description of the marine pollution monitoring system in Korea, including institutional arrangements to implement such systems

- Continuous and consistent monitoring on the chemical WQ parameters by MOE
- Extensive and intensive monitoring for the red tide, including understanding of the seasonal WQ variation (on the physical, chemical and biological parameters) by Institutes
- History of the monitoring in Chinhae & Masan Bay (see Figures 2, 3)

II. Linkages/mechanisms established between marine pollution monitoring and management strategies and interventions

a. Description of management strategies and interventions resulting from marine pollution monitoring preferably at Chinhae-Masan Bay in Korea

- Polluted sediment dredging during 1990-1994 (2 Million Tons)
- WTP construction (1993.11, Primary treatment, 250,000 Ton/day, Governmental Fund)
- Plan : WTP extension (2001, Secondary treatment, 500,000 Ton/Day)

- Continulous monitoring in Masan Bay by the Kyungnam Univ. (1990-1994)

b. Institutional structures/requirements that enable these linkages to take place
- Requirement of the NGO, citizen involvement for the WQ improvement

c. Pollution problems/issues addressed or expected to be adressed through the linkages of monitoring and management interventions
- Red tide → toxic algal bloom → human health problem due to PSP, DSP
- Heavy metal and toxicants pollution (e.g., TBT, Cd, Hg, etc.) → risk in human health

III. Lessons learned in marine pollution monitoring

a. Design of pollution monitoring system including most relevant biological, chemical or physical parameters

National marine pollution monitoring system (MOE, MOMAF)

- Coastal zones are divided into 6 zones, as shown in Figure 1.
- Monitoring frequency : 6 times/year (2, 5, 6, 8, 9, 11), surface layer, only chemical parameters are measured (biological parameter & sediment excluded)

Site specific monitoring for problem issued area(Research Institutes & Universities)

- In general, the physical, chemical and biological WQ parameters are intensively monitored in the specific bay and/or coastal regions during 1-4 years
- Continuous and consistent monitoring cannot be conducted by the fund and the object of the projects
- Monitoring frequency : 6-12 times/year, 3 or multi layers for the water column (sediment quality analysis and pollutants loads are sometimes included)

b. Sampling strategies
- Sampling frequency and points are determined by the object of the research project.
- In WQ management modeling, land-based pollutants loads, WQ parameters and pollutants release rate from the sediment in the coastal region are periodically monitored, and the pollutants mass balances are simulated.
- In the red tide study, the dominant species, succession and cell numbers of the phytoplankton and zooplankton are intensively measured and lab. test are carried out for the understanding of the plankton-growth characteristics.

c. Quality assurance/quality control
- Standard methods issued by MOE(Environmental pollution standard method) (e.g., DO - Winkler's method, COD - $KMnO_4$ Method, SS - Filtration using GF/C, TN and TP - UV Spectrophotometer, etc)

d. Data analysis
- Graphical and statistical analysis are carried out. Statistical analysis includes trend and regression analysis.

e. Packaging and utilization of monitoring data by coastal managers
- Data report and electric data loading to KORDI Ocean Data Center
- Monitoring data is used to set up the WQ management modeling(see Figure 4).

f. Multisectoral monitoring programs - do these works?
- MOE, MOMAF, research institutes and universities do their own monitoring program and exchange data.

g. Role of private sector in marine pollution monitoring
- E.g. KORDI (Integrated coastal management, 1995-1996) : Extensive monitoring strategies are systematically planned and conducted, e.g., physical, chemical, biological and geological WQ parameters are monitored by the KORDI engineering division, Kyungnam University, KORDI biological division, and geological division. For the integrated WQ management, the legistration and political sectors are also joined.

h. Sustainability of the monitoring program : fund-dependent
- MOE and MOMAF have sustainable monitoring program

IV. Recommendations for future action (see Fegure 5)

- Integrated coastal environmental monitoring including physical, chemical, and biological parameters. Weather and pollutants load data also must be included.
- Marine pollution monitorings are conducted continuously and consistently

Attached : EMECS'97 Presentation Paper (1997. Sweden)

Third Grade Coastal Region and Oil Spill & Red Tide Damage Region

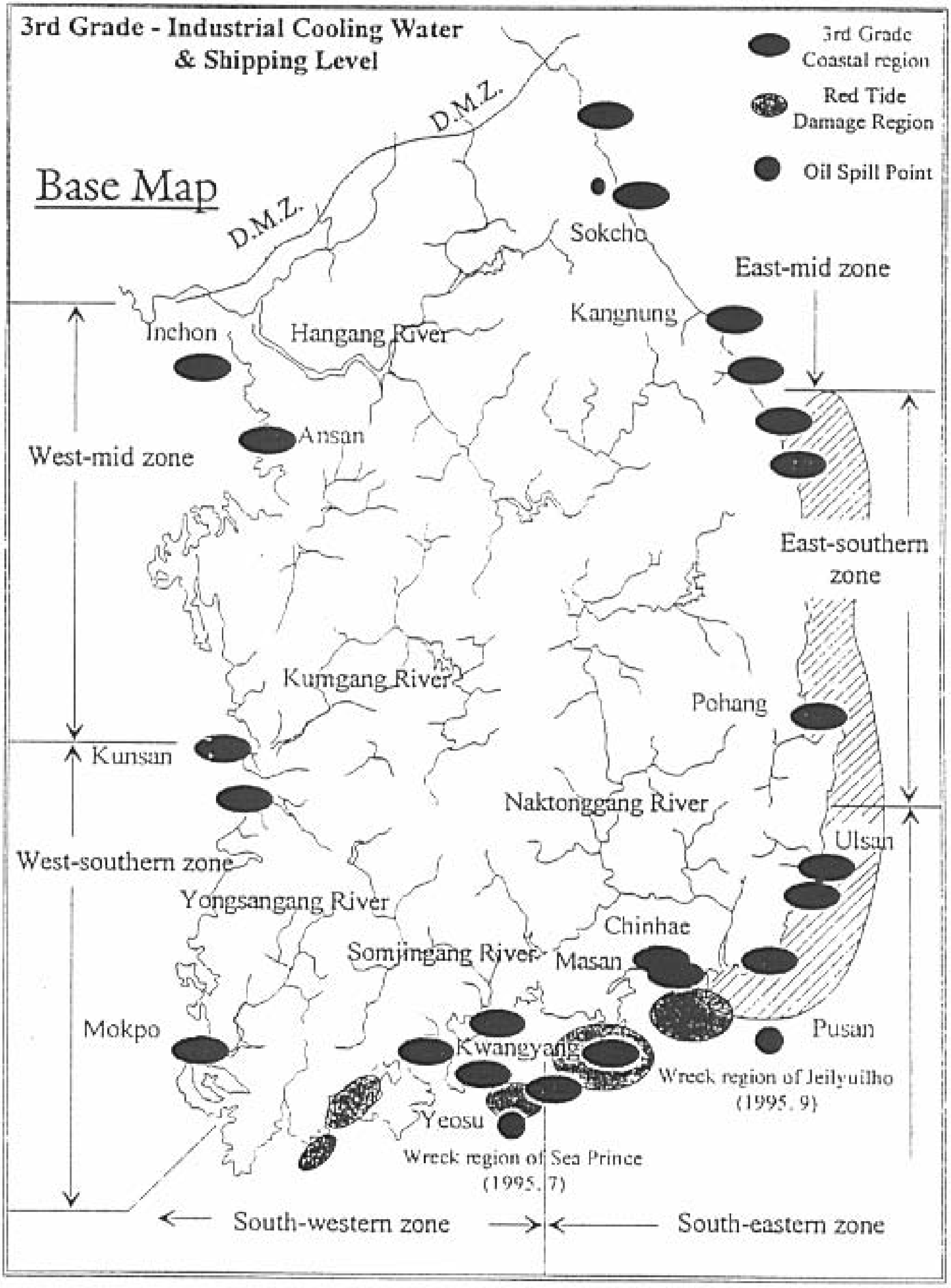


Figure 1. Marine pollution monitoring zones in KOREA

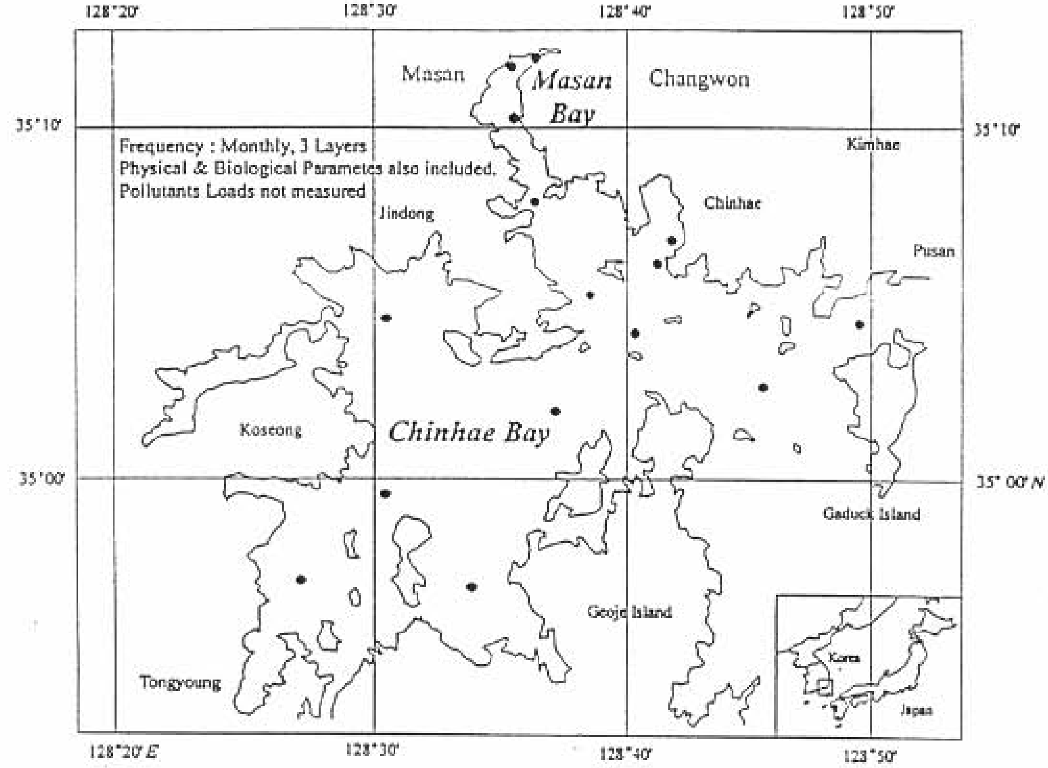


Figure 2.a. Monitoring Stations in Chinhae & Masan Bay(KORDI, 1979-1984)

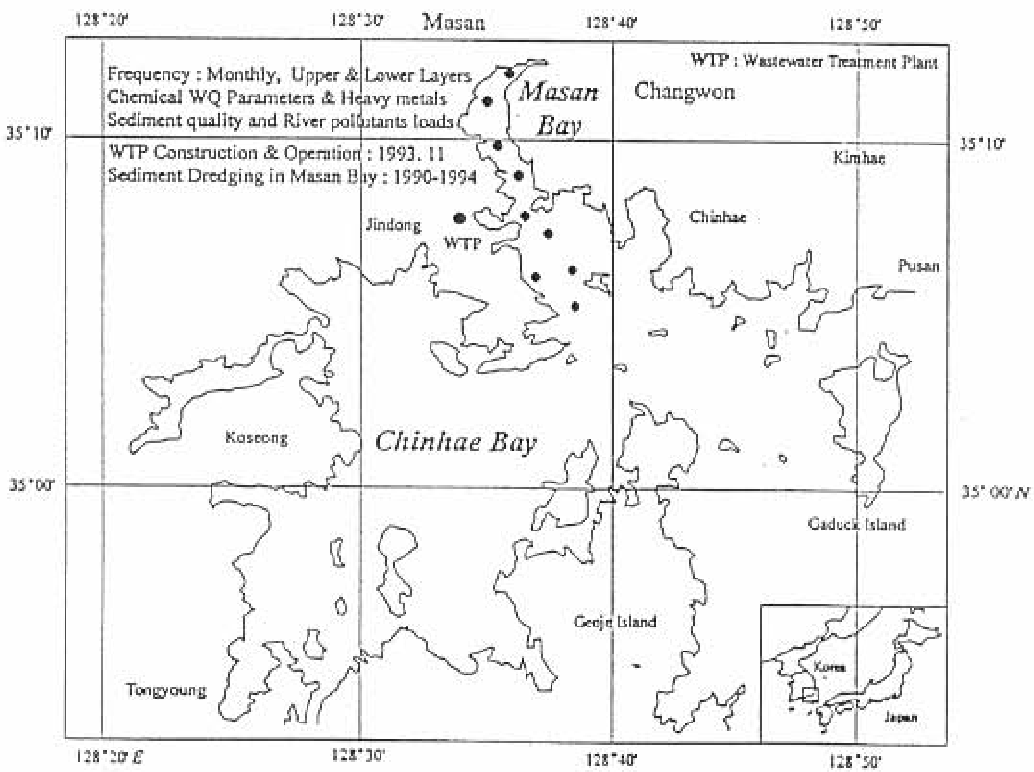


Figure 2.b. Monitoring Stations in Chinhae & Masan Bay
(Kyungnam University, 1990-1994)

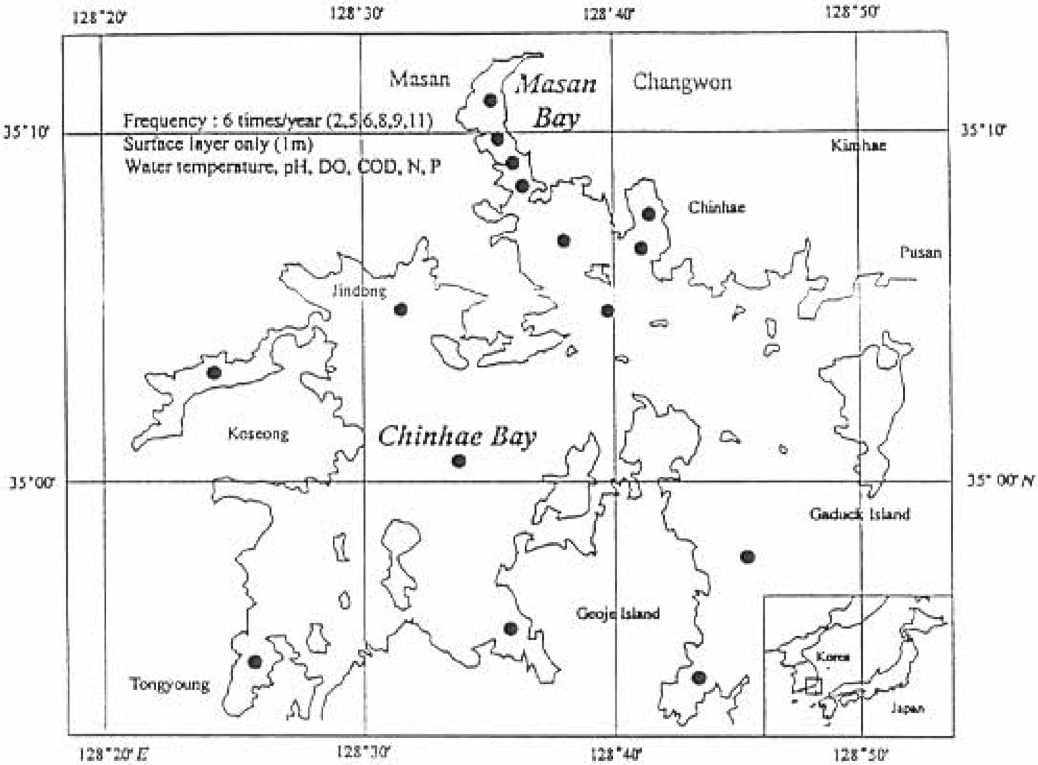


Figure 2.c. Monitoring Stations in Chinhae & Masan Bay
(Ministry of Environment, National Maritime Policy, etc.)

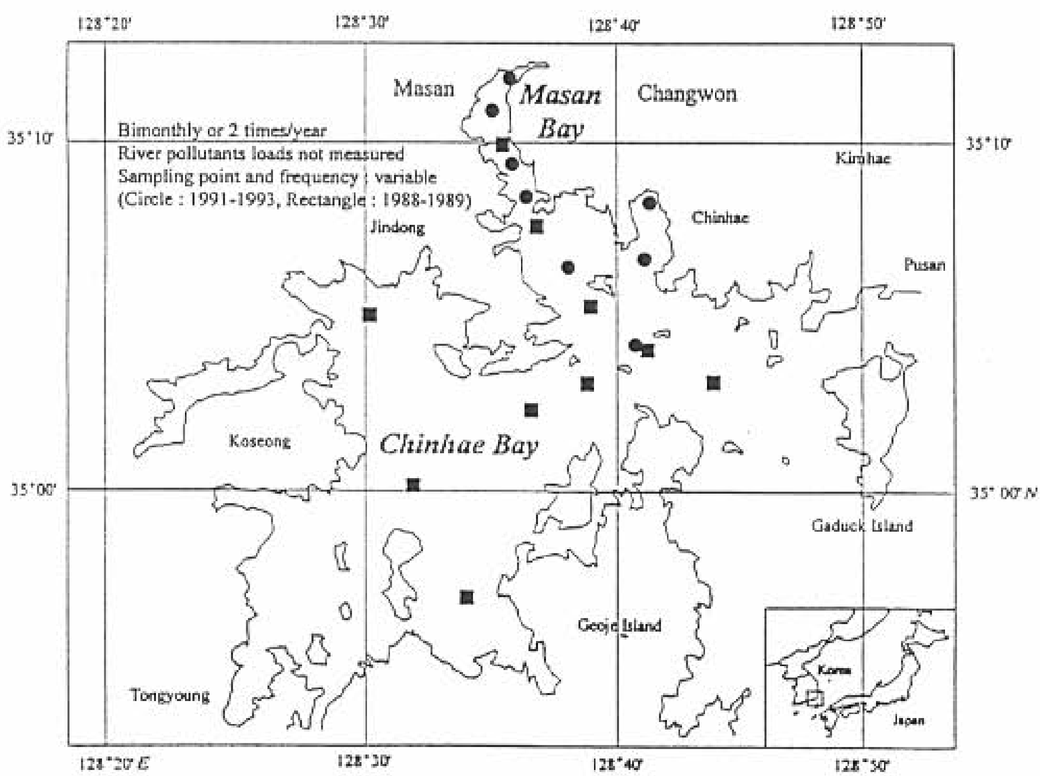


Figure 2.d. Monitoring Stations in Chinhae & Masan Bay
(KORDI; 1986, 1988-1989,1991-1993; Reaction Mechanism)

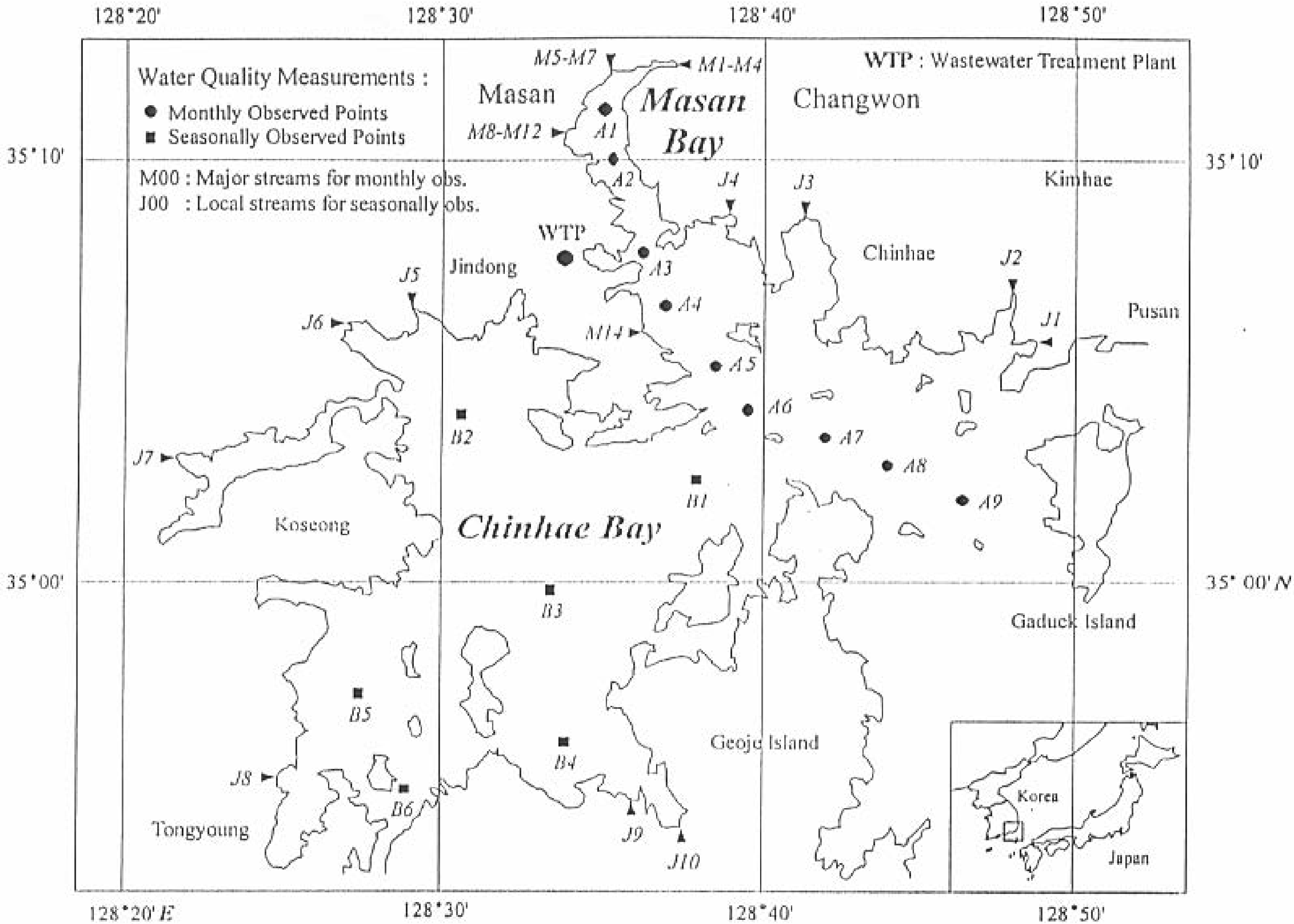


Figure 3. Monitoring Stations in Chinhae & Masan Bay
(KORDI, 1995 -1996; Integrated Coastal Management Study)

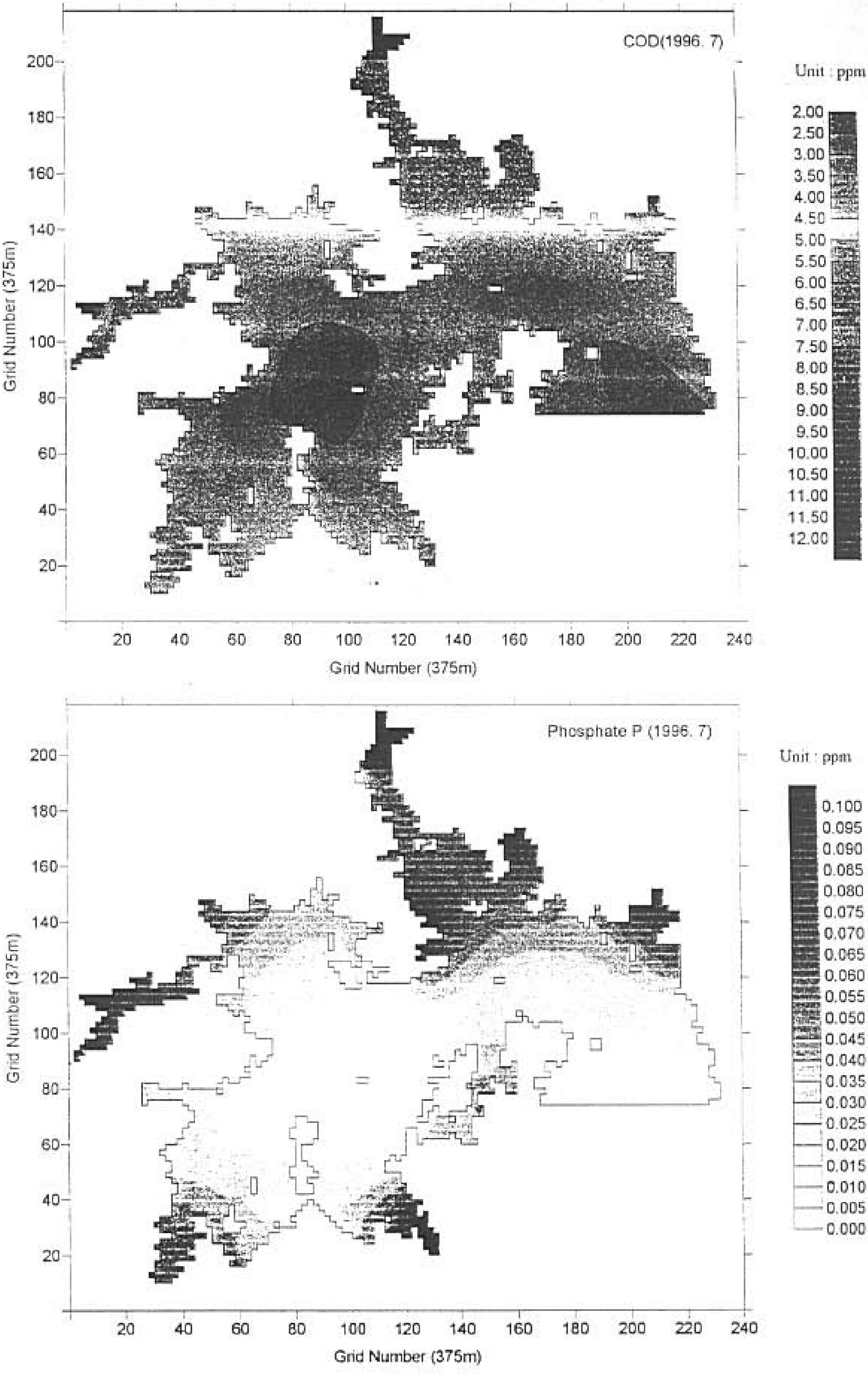


Figure 4. WQ Management Model Simulation Results (COD, Phosphate-P)

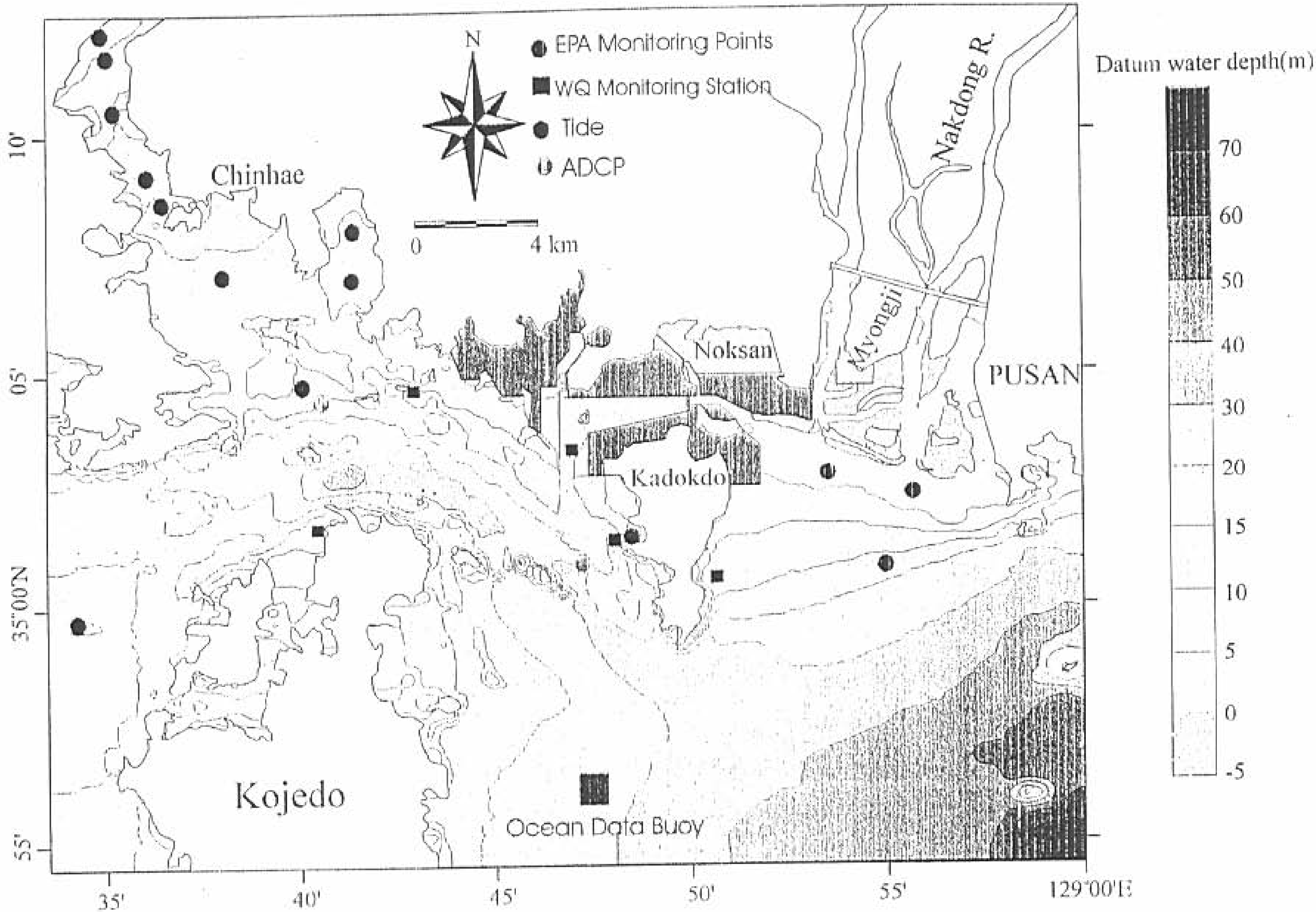
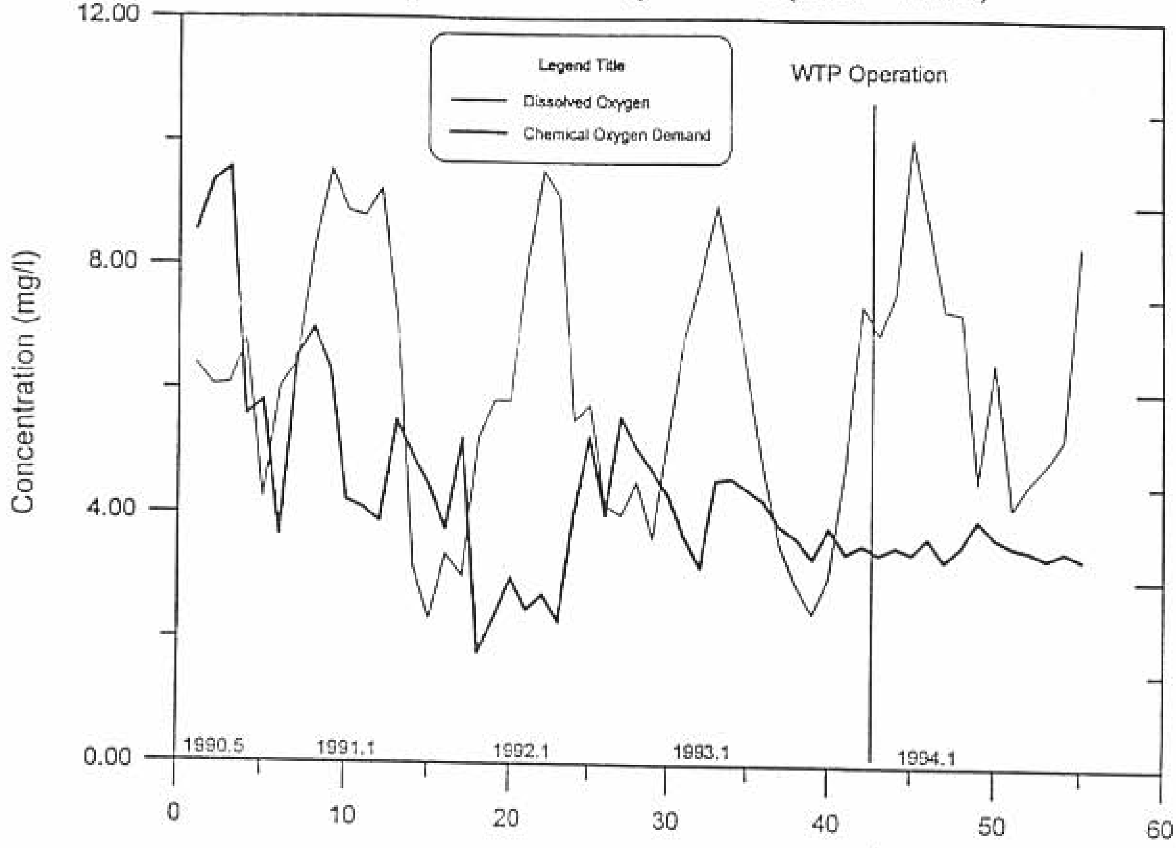
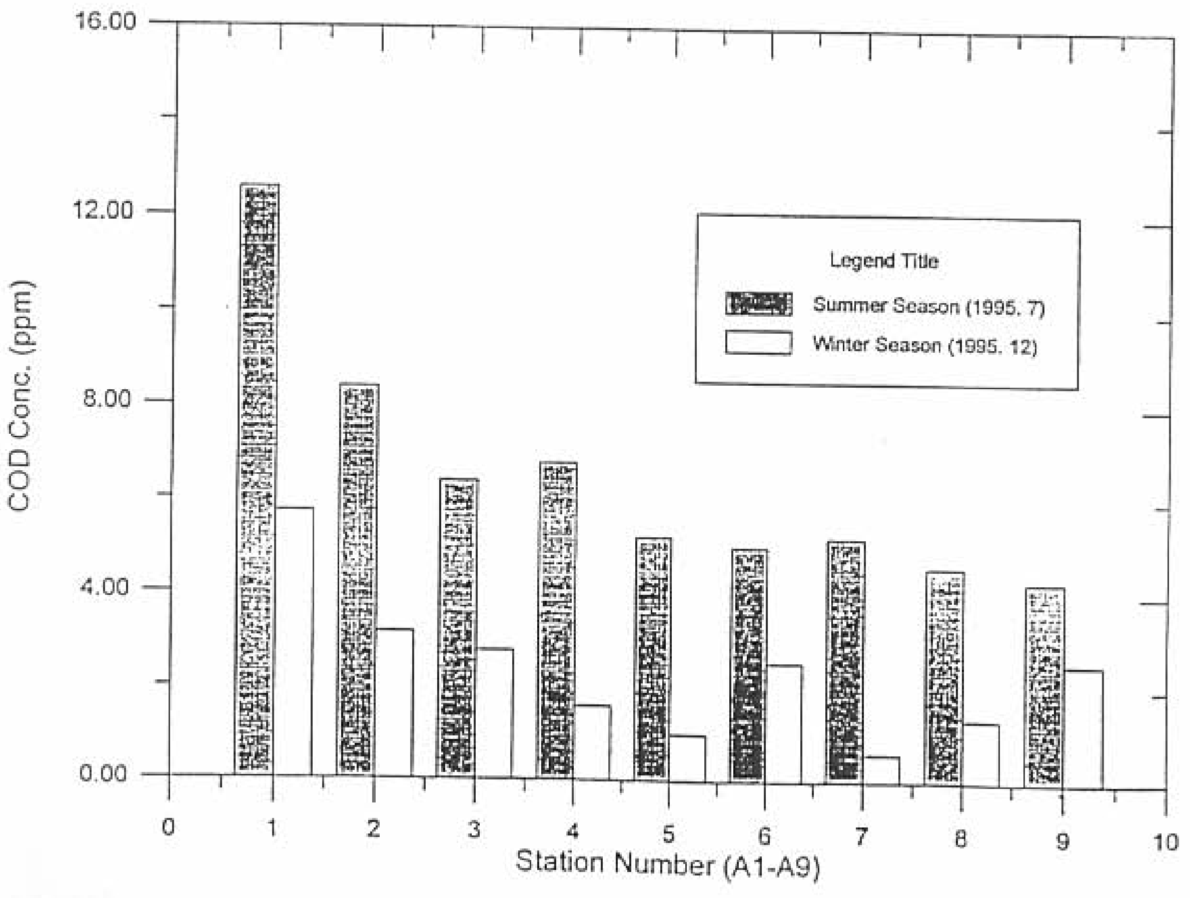


Figure 5. Monitoring Network of Coastal Environment

Monthly Variation of the WQ Constituents (1990.5 - 1994.12)





With rivers to the sea, 1997. Joint Conferences : 7th Stockholm Water Symposium 3rd Int'l Conf. on the Environmental Management of Encolsed Coastal Seas, Sweden

WATER QUALITY MODELING FOR THE ENVIRONMENTAL MANAGEMENT IN CHINHAE-MASAN BAY

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Introduction

Chinhae-Masan Bay is a representative semi-enclosed coastal sea of 502 km^2 in South Korea. This Bay has been reserved for its beauty and mariculture, but the water and sediment qualities are heavily deteriorated due to rapid industrialization, urban development, and also overintensive mariculture. The eutrophication, anoxic watermass formation due to thermal and salinity stratification in summer, heavy metals and toxic algal blooms seriously affect the bay ecosystem and further quality of human life in this catchment area.

In 1982, the Ministry of Environment designated the Bay as a 'Special Management Seas'. Pollution control programs were established to clean the water and restore the coastal ecosystem through the construction of a wastewater treatment plant (hereinafter WTP) and dredging of contaminated sediments in the Masan Inner Bay, which is a drainage basin of major streams running from urban and Masan/Changwon industrial complexes. The WTP has been operated since Nov. 1993, and primarily treats daily average of 200,000 ton of sewage and industrial wastewater. About 1,850 thousand tons of contaminated bottom sediments were also dredged during the period of 1990-1994. After those measures the heavy metal contents were successfully removed but nutrients were not.

Extensive/Integrated Field Measurement for Water Quality Modeling

Scientific surveys for the Bay started in 1976 and so far a great number of field measurements and analyses have been carried out, which were mostly focused on the analysis of the special scientific issues and mechanisms of the phenomena related with the water pollution. But, the cooperative research and information exchange between the related fields participated in those study were not actively made. Recently, a joint-research program, 'Study on Coastal Zone Utilization and Integrated Management,' has been launched by Korea Ocean Research and Development Institute. It has been conducted through integration of related studies such as oceanographic sciences, coastal engineering, and socio-economics.

Numerical Modeling and Calibration

First of all, the complex pollutant's interaction system is to be fully understood and modeled by the scientific review, monitoring, and the multi-disciplinary study. The main item of the environmental modeling is the seasonal and yearly water quality (hereinafter WQ) variation, i.e. long-term prediction of WQ changes. All the major factors affecting the simulated constituents are COD, DO, nutrients, phytoplankton, zooplankton, and other arbitrary first-order decaying constituents.

With the use of the joint-studies' results an efficient numerical water quality model has been set up as a tool for the environmental management in the Bay. That is horizontal 2-D WQ model which is based on the WASP-5 and modified as grid-type to improve the accuracy with respect to site-specific model structures and model parameters.

Flow, salinity, and temperature fields computed by the separate numerical models, which were extensively calibrated with those field data, were used as the hydraulic input data for the WQ model through the averaging process. The phytoplankton-zooplankton interaction studies and sediment quality analysis were made by oceanographical biology and geology divisions, respectively. About 10 WQ constituents were measured at 15 points monthly or seasonally in 1995-1996. Pollutant loads were measured at 20 major streams running into this Bay and at the outlet of the WTP. Bottom sediments were sampled at 4 sites, and SOD (sediment oxygen demand) and nutrients (ammonia, phosphate) release rates were also measured (as shown in Fig. 1).

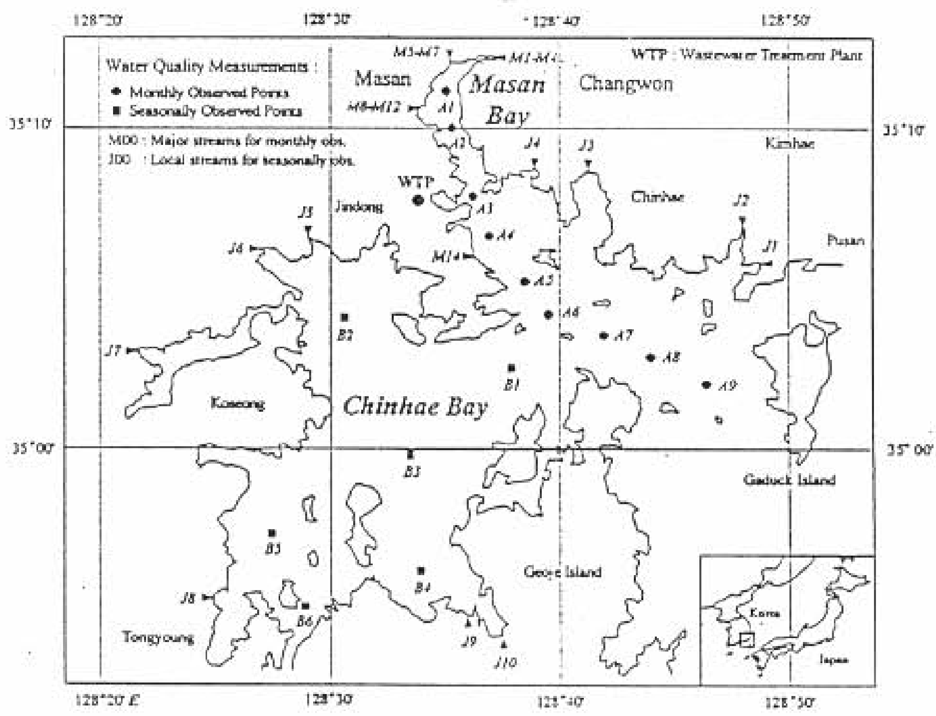

Fig. 1 Monitoring Stations in Chinhae-Masan Bay

With the data obtained through interactive studies was the model calibrated, and verified by the measured WQ data in 1995-96 (as shown in Fig. 2). This model predicts relatively well the distribution pattern of the WQ concentration in almost area even though the complex phenomena in this Bay are simplified. However, there is some limitation of model, e.g. uncompatible DO simulation because of 2-D model structure, and overestimation of WQ concentration in Masan Bay.

Model Application Results

From the model application results, it is shown that the WQ concentrations in most of the regions adjacent to land and river inflow are considerably high, but rapidly decrease along the seaward direction except Masan Bay. Because the particulate inflow-pollutants were deposited and gradually contaminated the bottom sediment on account of the regional stagnancy. Deposition rates of those particulates were assumed high in the model application. Eutrophication in the effluent discharge region was also being slowly progressed by the unefficiently treated wastewater containing amount of N and P constituents.

Seasonal concentrations of DO, COD, SS, nutrients, and phytoplankton as carbon units were simulated and compared with field measured data. From the distribution of COD concentration which is the main WQ parameter for coastal zone management in KOREA, the stagnant regions in far inside of small bays (shown in Fig. 2) appear to be seriously polluted by the pollutant releases of the sediment, low seawater-exchange rate and excessive pollutants loads beyond environmental capacity.

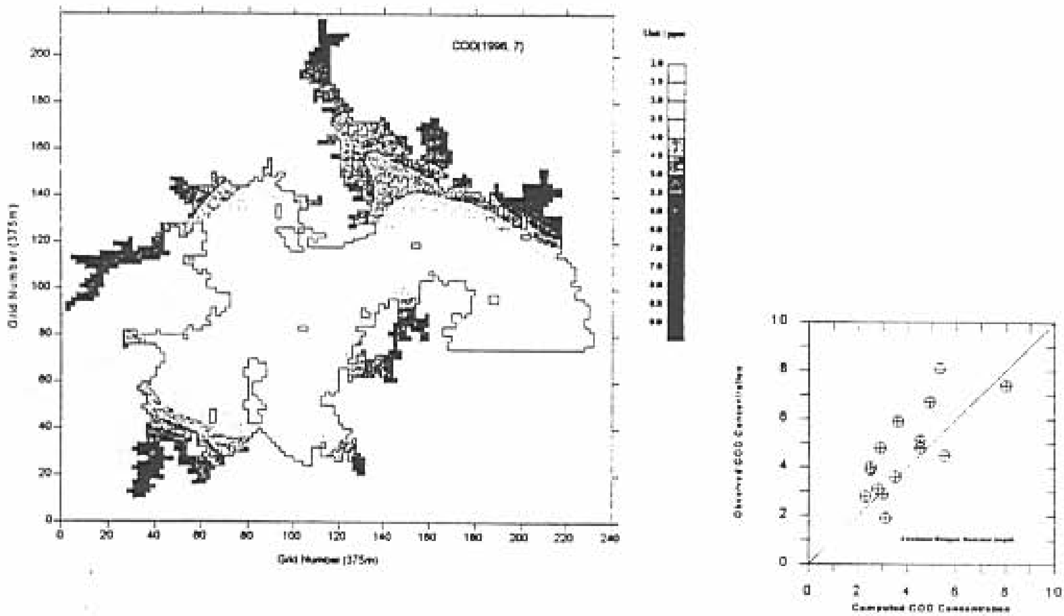

Fig. 2 COD Contour Plot and Model Calibration Results

Now, the model has gained considerable precision and confidency for the potential user of WQ management for this Bay. This model will be combined with GIS and related submodels, i.e. models of non-point source, vertical diffusion, ecosystem, water-sediment interaction and economy and be used for the simulation of various scenarios of the regional development plans.

MARINE POLLUTION MONITORING IN SINGAPORE

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INTRODUCTION

Coastal ecosystems play a major role in the life cycle of economically important marine species. Unpolluted coastal areas and watercourses also play an important economic role in promoting tourism as well as providing recreational areas for the locals. However, with increasing human activities, coastal areas are gradually being affected by pollution generated from inland sources. Unlike oceans where pollution is more easily dispersed and diluted, pollution of coastal areas tends to remain for a longer time because of its water circulation characteristics.

Land-based sources of marine pollution are one of the most serious environmental problems faced by many countries in the world. There are two types of land-based marine pollution, viz. direct pollution to the sea from land and indirect pollution to the sea through rivers. The two types of pollution are similarly varied and complex, ranging from domestic waste, agricultural and industrial waste to toxic and hazardous waste. Compared with direct pollution source, the indirect source contains much larger quantities of pollutants which reflect the activities and natural conditions of its whole catchment.

The Ministry of the Environment, ENV is responsible for pollution control for all land-based activities while the Port of Singapore Authority (PSA) in tandem with ENV is responsible for pollution control for marine activities, including the combating of oil spills from ships.

The key elements in our strategy for water pollution control are prevention, enforcement, monitoring and education. Prevention of water pollution requires provision of sewerage infrastructure, development control and building plan control. Once the preventive measures are established, legislation is strictly enforced to ensure that all wastewater is discharged into the sewerage system and industrial effluent is pre-treated before discharge into the sewerage system or watercourses. The quality of coastal water is monitored regularly to ensure that these pollution control measures are adequate.

WATER QUALITY MONITORING

Water quality monitoring is an integral part of Singapore's water pollution control programme. ENV regularly monitors the water quality of various water bodies in rivers, streams and coastal waters in and around Singapore to assess the adequacy and effectiveness of the control programmes in maintaining a clean and healthy environment.

COASTAL WATER QUALITY MONITORING PROGRAMME

Water samples are collected from 9 sampling points in the Straits of Johor and 10 points in the Straits of Singapore. Figure 1 shows the locations of the sampling points. The sampling frequencies and parameters analysed are as shown in Table 1.

Under the Malaysia-Singapore Joint Committee on the Environment (MSJCE) seawater monitoring programme, which started in 1991, 18 sampling stations along the Straits of Johor are monitored on a bi-monthly basis by both countries. Figure 2 shows the locations of the sampling points. The parameters analysed are as shown in Table 1.

The monitoring shows that the coastal water quality is good and suitable for recreation and aquaculture.

WATER QUALITY MONITORING FOR IDENTIFIED MARINE CORAL AREAS

Singapore Reef Survey and Conservation Project

The objective of this project is to preserve coral reefs around selected islands for posterity. An extended water quality monitoring programme was put in place in 1994 to monitor the water quality around the selected coral reef areas.

The monitoring is carried out twice a year. Physical, chemical and bacteriological examinations are carried out on the samples collected.

BIOLOGICAL MONITORING OF COASTAL AND RIVER WATERS

Study of Biodiversity and Environmental Monitoring of the Coastal and Riverine Waters

The Ministry initiated a 5-year joint research project with the National University of Singapore to monitor the abundance and diversity of aquatic species in our coastal and riverine waters in 1992. This scientific study involves the gathering of baseline data on physico-chemical parameters and aquatic life at selected sites including sites which had been previously polluted by various activities such as pig-farming. The study will provide the scientific basis for the development of a comprehensive biological monitoring programme.

Grab and trammel net samples are taken at the sites and the benthic and pelagic species in the samples are identified and counted. The results of the study obtained so far show a significant increase in the number of aquatic species over the years and their abundance in the rivers indicates improving water quality.

TABLE 1

Location	Sampling Frequency	Parameters Tested
Straits of Johor	Monthly	DO, pH, salinity, depth, conductivity, clarity, turbidity, TOC, colour, oil & grease, DDPH, total & faecal coliform
	Bi-monthly	cadmium, chromium, copper, lead, nickel, mercury, selenium, zinc, BTX, PAHs
	Quarterly	ammonia, nitrate, nitrite, phosphate, chlorophyll-a, plankton
	Yearly	arsenic, total kjeldahl nitrogen, detergent
Straits of Singapore	Monthly	DO, clarity, pH, faecal coliform
	Bi-monthly	tin, zinc, DDPH
	Quarterly	ammonia, phosphate, nitrate, nitrite, chlorophyll-a, plankton
	Yearly	salinity, conductivity, TOC, colour, turbidity, detergent, total kjeldahl nitrogen, total coliform, oil & grease, arsenic, cadmium, chromium, copper, mercury, nickel, lead
Straits of Johor (MSJCE)	Bi-monthly	DO, salinity, conductivity, pH, colour, turbidity, TSS, TOC, DDPH, oil & grease, plankton, ammonia, nitrate, nitrite, phosphate, total & faecal coliform, arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc

FIGURE 1
LOCATIONS OF WATER MONITORING POINTS

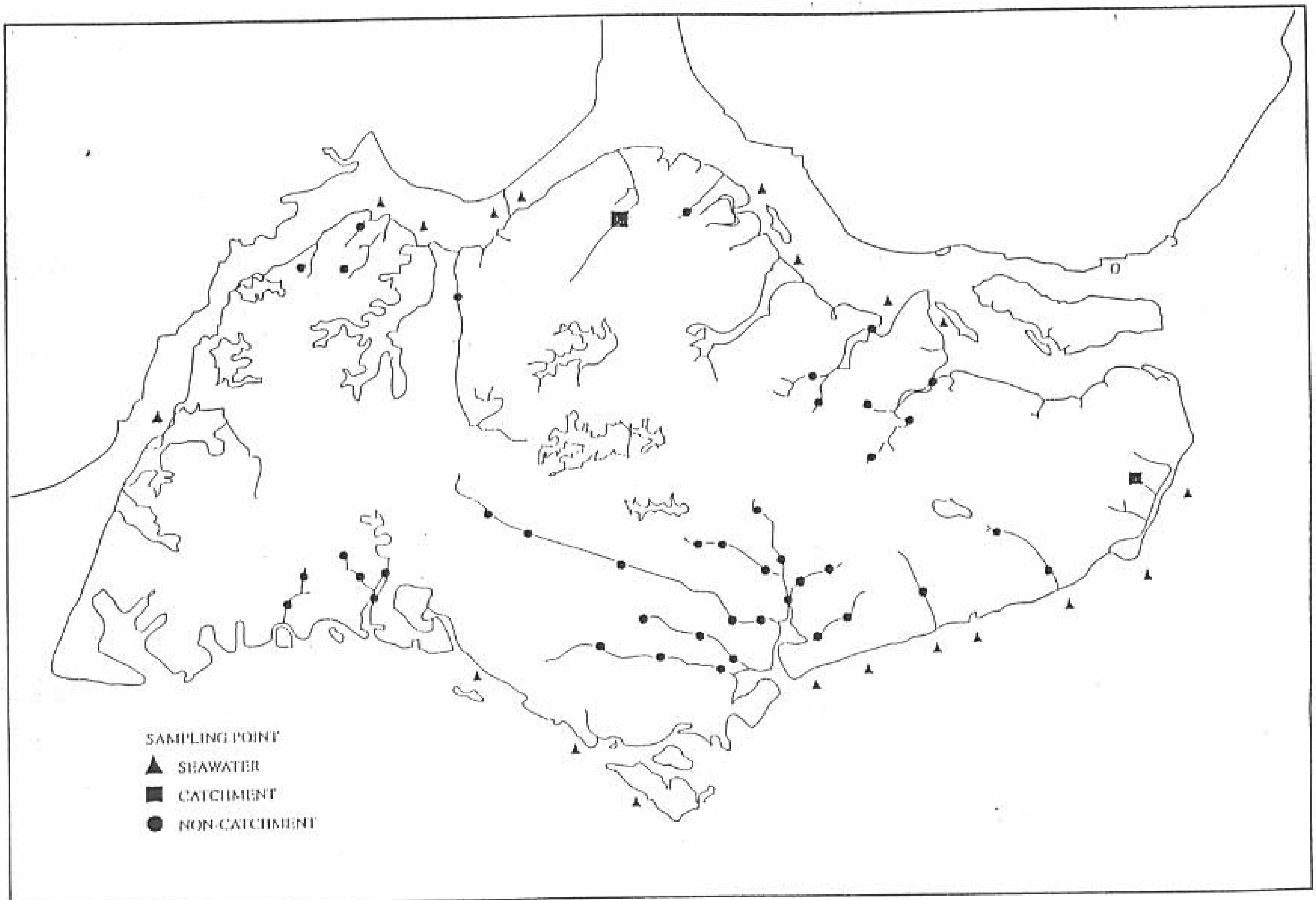
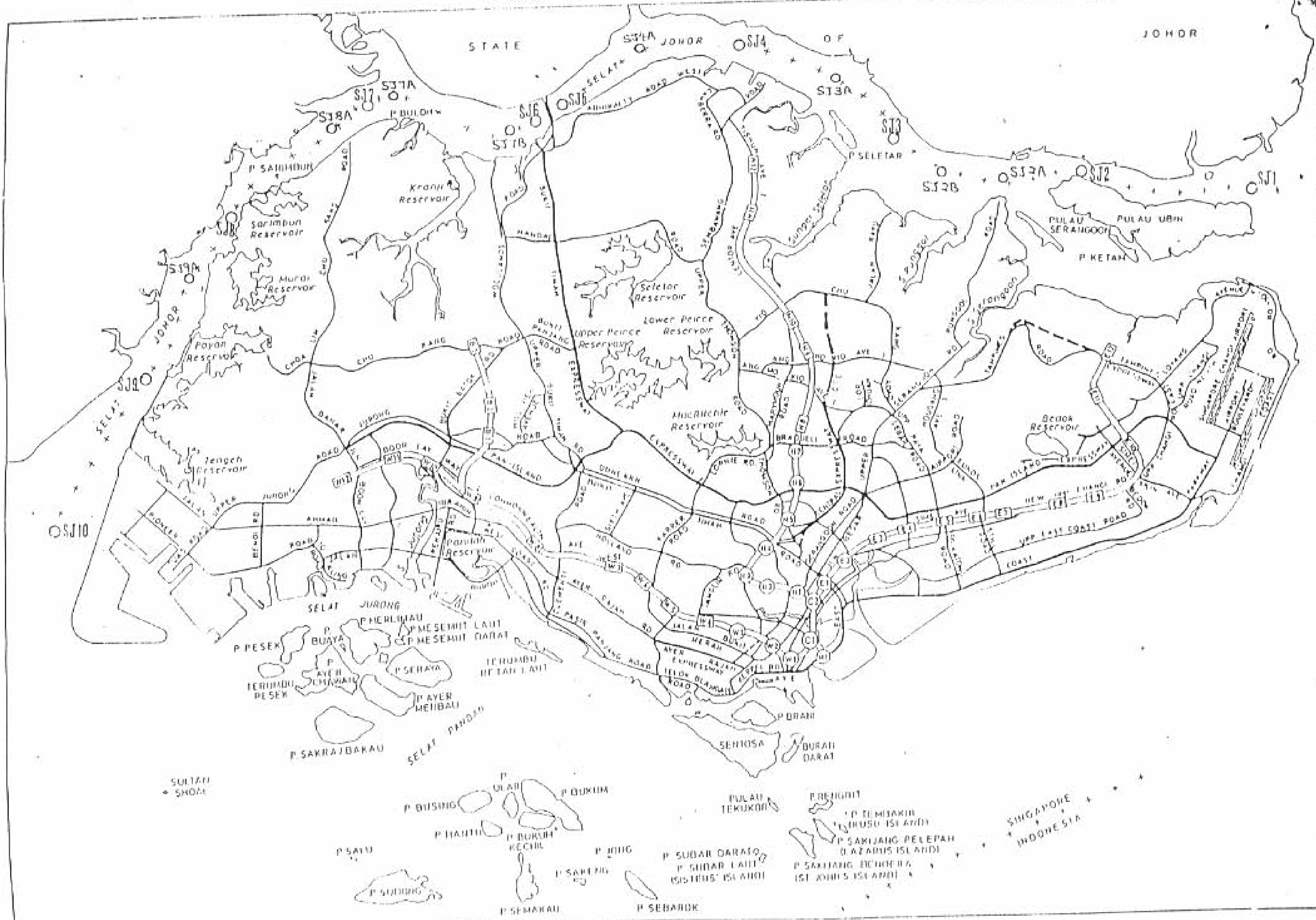


FIGURE 2



STATE
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SJ7A
SJ7B
SJ8
SJ8A
SJ9
SJ9A
SJ10
P. BULOH
P. SARIMBUN
P. SELETAR
PULAU SERANGOON
PULAU UBIN
P. KETAM
Kranji Reservoir
Sarimbun Reservoir
Murai Reservoir
Poyan Reservoir
Tengeh Reservoir
Seletar Reservoir
Upper Peirce Reservoir
Lower Peirce Reservoir
MacRitchie Reservoir
Bedok Reservoir
Pandan Reservoir
PAN-ISLAND EXPRESSWAY
SELAT JURONG
P. MERLIMAU
P. MESEMUT LAUT
P. MESEMUT DARAT
P. PESEK
P. BUAYA
P. AYER CHAWAN
P. SERAYA
TERUMBU PESEK
TERUMBU RETAN LAUT
P. AYER MERBAU
P. SAKRA/BAKAU
SELAT PANDAN
SENTOSA
P. BRANI
BURAN DARAT
SULTAN SHOAL
P. BUSING
P. ULAR
P. BUKUM
P. HANTU
P. BUKOM KECHIL
P. SALU
P. SUDONG
P. SAKENG
P. SEMAKAU
P. JONG
P. SEBAROK
PULAU TEKUKOR
P. SUBAR DARAT
P. SUBAR LAUT (SISTERS' ISLAND)
P. SENGKIT
P. TEMBAKUL (KUSU ISLAND)
P. SAKIJANG PELEPAH (LAZARUS ISLAND)
P. SAKIJANG BENDERA (ST. JOHN'S ISLAND)
SINGAPORE
INDONESIA

UNDP/ IMO
Regional Programme for the Prevention
and Management of Marine Pollution
in the East Asian Seas

Second Technical Worshop on the Regional Network of Marine Pollution Monitoring and Information Management

Chonburi, Thailand, 10 -11 November, 1997

Country Report

Coastal Pollution Monitoring in Vietnam

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Vietnam, 1997

Abstract

Vietnam is a coastal country in ASEAN region with some 3260km of coastline. The coastal development is more and more influenced on coastal resources and environment in Vietnam. So, since 1995 coastal pollution monitoring system is established by GOV. to assess the state of coastal environment, it's change... The monitoring activities are conducted at 19 sites located along the coast, near coastal tourism resorts, in estuaries or near the coastal industrial zones. Total 22 parameters have been monitored by this system, among them there were contaminants such as: oil content, pesticides, heavy metal, coal dust. They are analyzed in environmental components in the coastal zone: seawater, bottom sediment and biota (*bivalvia*). At all sites, the monitoring activities is implemented 4 times per year such as : in March, June, September and December.

The results collected from the monitoring system have contributed in the annual report on the state of environmental in Vietnam for submission to National Assembly, as well as timely informed the National Environment Agency about some oil spills...

This paper will present the main issues as following:

- National system on coastal/marine environment monitoring
- Sampling strategy
- Monitored parameters/indicators
- Field survey, measurement and analyzing methods
- Initiative results and lessons learned from practical activities.
- The needs to upgrade this system and regional cooperation plan
- Case study in Ha Long Bay - a World Natural Heritage adopted by UNESCO in 1994

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1. Introduction

1.1. Coastal Pollution Issues in the Country

Vietnam is coastal country in ASEAN region with some of 3260km of coastline and over 3000 islands. Its coastal zone contains a number of unique ecosystems with valuable tropical resources such as: mangrove (252000 ha), lagoon and semi-closed bays (100000ha), tidal marshes and mudflats (290000ha), some 100 large estuaries, two big delta (Mekong and Red River system), 9 centres of upwelling, coral reefs and seagrass distributed along the coast and throughout the sea of Vietnam. About 80% of all marine fisheries production comes from shallow coastal waters. Sea fish supply some 30% of the animal protein consumed in Vietnam. The coastal zone of Vietnam is also a ecologically sensitive, dynamically interface and a dumped location of land-based/sea-based sources. Recently, the environmental pollution in its coastal waters is increased due to the coastal economic development in relation to GOV's regulated-market economic reform.

The sources of coastal pollution in Vietnam may be grouped into several main classes: coastal agriculture sewage, urbanization and industrial discharges, shipping activities, aquaculture, and coastal mining. According to roughly estimated results, total area of watersheds is of 230000 sq.km, about 70% of total area of terrestial region of Vietnam. About 900 billions m^3 of water load and 200-250 millions tones of sediment load are yearly discharged into the coastal waters. Total of the solid fluxes (tones) input from rivers to the Vietnam seas is presented as below:

(Source P.V. Ninh, 1997)

Cu	Pb	Cd	Zn	Co	Ni	As	Hg	PO_4^-	NO_3^-
18084	2063	1082	21739	504	523	2407	134	54220	230710

The oil/gas exploitation in the continental shelf and oil spills are also a major sea-based pollution which are affected on coastal waters. To date, there have been about over 20 documented oil spills in the coastal waters and estuaries of Vietnam, which leaked between 100 tones to 2,000 tones during 1989 - 1996 (H. C. Thang, 1996). Pesticide are applied to 90 percent of agricultural land in Vietnam in general and in the coastal plains of two large delta (Red River and Mekong delta) in particular. Pesticide use has increased dramatically in just a few decades.

Apart from these, there are also some 200,000 ha of brackishwater ponds, 37 main ports/harbors with 8,000 ships and 54,000 fishing boats in the coastal waters. Approximately 50 percent of the country's cities and large industrial zones with about 16.5 million people are lived in the coastal areas.

Coastal environmental pollution and degradation lie at the heart of the conflict between developmental needs and environmental protection. Many coastal ecosystems in the country are suffering from severe habitat and species losses associated with coastal pollution (MOSTE/NEA report, 1995).

Therefore, measuring coastal pollution degree is one of urgent tasks for wise management of coatal resources in Vietnam. Especially, the Law of Environment

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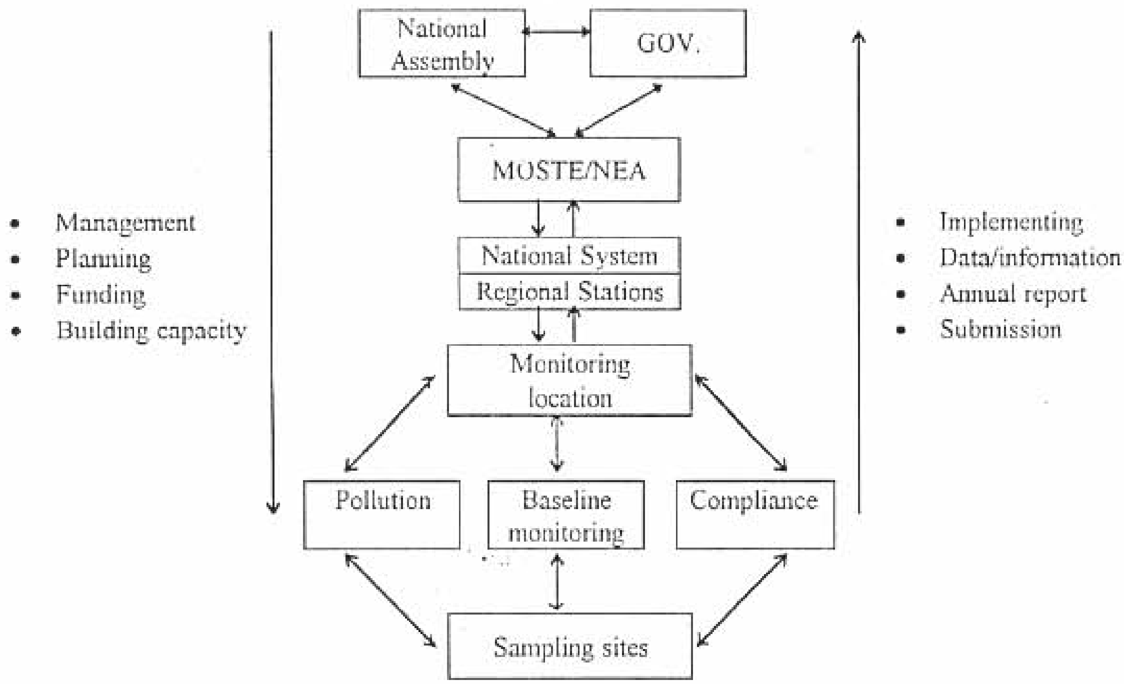
Protection enacted by Vietnam's GOV. in 1994 has determined MOSTE's responsibility to establish a national system on coastal/marine environment monitoring.

I. 2. Coastal pollution monitoring system

- The coastal/marine environment monitoring system started to carry out its task since 1995 in the northern part of Vietnam and was continuously expanded its scope throughout the coast and offshore waters in 1996. This monitoring system is a result of a cooperation between Ministry of Science, Technology and Environment/National Environment Agency (MOSTE/NEA) and other sectors/institute: Natural Centre for National Science and Technology (Institute of Oceanology, Institute of Mechanism), Ministry of Fishery (Institute of Sea-product Research) and NAVY (Department of Chemistry). The coordinated mechanism of the system is able to present as follows:



The monitoring system may be categorized into some types, mainly: hypothesis testing/impact assessment and trends analysis.

- The purpose of the coastal/marine environment monitoring system is to collect up-to-date information about coastal/marine environement quality, including three components such as : sea water, surface sediment and biological component. This partly meets the needs for data on some oceanographical and hydrochemical conditions, as well as on contaminants in coastal waters. These data are also accorded for coastal management and historical purpose
- The coastal marine environment monitoring system consists of 13 monitoring locations in and near the main estuarine areas or socio-economic centres, as well as 6 locations in and around the oil/gas platform area or some inshore islands (fig. 1)

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Fig.1: NATIONAL SYSTEM ON MARINE ENVIRONMENT MONITORING
(Vietnam, 1997)

The marine environment monitoring stations (MEMS) like MEMS at Do Son and Nha Trang periodically gather informations of monitoring results. From the central MEMS, coastal/marine environmental quality information is made available to the users. The results contribute to the assessment of the annual state of Vietnam's marine environment. These are submitted to the GOV./MOSTE in conformity with the 1993 Environment Protection Law. The monitoring data are presented in the form of data report (quartely) and annual report

2. Lessons learned in marine pollution monitoring

2.1. Sampling Strategy and Analyses

At each monitoring location, the measuring sites or transects line are arranged crossing the river-brackish-saline water masses or parallel with current directions. Sampling frequency : 4 times/year in March, June, September and December. These samples are collected during the highest and lowest tides for every site and at two layers of water column (surface and bottom). The field sampling is carried out by a motorboat/ship with GPS equipment.

The collected samples are preserved by different survey manuals for coastal/marine resources, for example:

- DO sample is collected into oxygen bottles and fixed by *manganese chloride* ($MnCl_2$) and *potassium iodide* in *sodium hydroxide* solutions
- Oil sample: in Teflon bottles with *sulfuric acid* added as preservative
- Heavy metal sample: in Teflon bottles with *hydrochloric acid* (HCl) 6N added.
- Nutrient sample: *mercurie chloride* solution
- Plankton: with 5% *formalin*/70 percent *alcohol*
- Coliform sample is put in clean bottles and kept at 4°C in thermally - insulated box (ice box)

These samples are also analyzed by different methods such as:

- The water temperature is measured by the thermometer with accuracy of ± 0.5°C
- A water sampler such as a Nikin Bottle is used
- pH is measured by Palicse standard colorimetry with cresol red indicator or by using digital pH meter
- Salinity is determined by the Mork-Knudxen method or by refractometer/digital salinity meter
- DO and BOD are determined by Winkler method or by using a water quality checker/digital BOD and DO meter
- A Secchi disc to measure turbidity
- Nutrient contents (NO_3^-,PO_4^{3-}, SiO_3^{2-}) and total phosphorus were determined by chlorimeter and UV-Vis spectrophotometer
- Oil content with partition-gravimetric method or by Infrared spectrophotometer IR-470 Shimadzu
- Coliform is determined by the Vincent culture method
- Pesticide residues are determined by gas-chromatograph 9A-Shimadzu
- Heavy metals with AA-Shimadzu

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2.2. The Monitoring Parameters

The coastal/marine environment information provided by the national system includes data on:

- Sea water levels and current
- Nutrients
- Contaminants in water, sediment and biota
- Plankton

The overview of the parameters at each monitoring location is presented in the table 1.

2.3. Contaminants in Vietnam's coastal waters

Data on the concentration of main contaminants in coastal waters have been documented by MEMSs in 1996 at coastal monitoring locations.

- Oil content

The oil content in coastal water of Vietnam has been recorded in average 0.62mg/l. In Northern coast, it is of 0.1-0.72mg/l and average 0.36mg/l. In central coast, the value is lower (0.07-0.67 mg/l), average 0.21mg/l and coastal water in Southern coast where oil/gas mines are exploited, the oil content is highest 0.54-2.05 and average 1.29mg/l. It show that coastal water near large ports, oil storages and oil/gas platforms are has been polluted by oil. Its content exceeds the allowable concentration level 2 - 4 times in conformity with Vietnam standard (TCVN 5943-1995) and over 3 times in comparison with 1995 monitoring results. Some oil spills have been also documented by MEMS in 1996, where the oil content is 20 times higher than allowable standard of Vietnam.

- Organochloride pesticides

The organochlorined pesticides residue in coastal waters of Vietnam are in the range of 0.09 - 1.17μg/l, the average value 0.32 μg/l which is lower than the allowable standards. The pesticide residues are concentrated in South coast 8 times higher than other regions in relation with situation of pesticide expenditure per hectare in the South 2 times more than Northern:

Pesticide residue value (μg/l) in different coast in Vietnam (1996 data)

Region	Range	Average
Northern coast	0.09-0.24	0.11
Central	0.09-1.17	0.53
Southern	0.82-0.85	0.84

The common compounds of organochlorined pesticide residues are also appeared at various levels:

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Table 1: Overview of the parameters at each monitoring location

Locations	Main monitoring parameters										
	Current	T°C	pH	Turbidity	BOD/ COD	Nutrients	Plankton	Coliform	Oil content	Pesticide	Heavy metal
Ha Long	x	x	x	x	x	x	x	x	x	x	x
Do Son	x	x	x	x	x	x	x	x	x	x	x
Ba Lat	x	x	x		x	x	x	x	x	x	x
Sam Son	x	x	x	x	x	x	x	x	x	x	x
Cua Lo	x	x	x	x	x	x	x	x	x	x	x
Deo Ngang	x	x	x	x	x	x				x	x
Da Nang	x	x	x	x	x	x		x	x	x	x
Dung Quat	x			x		x			x		x
Qui Nhon	x			x	x	x		x	x		x
Nha Trang	x	x	x	x	x	x	x	x	x	x	x
Vung Tau	x	x	x	x	x	x	x	x	x	x	x
Dinh An	x	x	x		x	x			x	x	x
Rach Gia	x	x	x		x	x	x		x	x	
Bach Ho	x	x	x	x			x		x		
Dai Hung	x	x	x	x			x		x		
Bach Long Vy	x	x	x	x		x	x		x	x	x
Con Co	x	x	x	x		x	x		x	x	x
Phu Quy	x	x	x	x		x	x		x	x	x
Con Dao	x	x	x	x		x	x		x		x

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	Range (mg/l)
Lindane	trace - 0.178
HCB	trace - 0.015
DDE	0.001 - 0.538
DDD	trace - 0.989
DDT	0.133 - 5.478
Others	only in trace

According to 1995 evaluated data, the pesticide residue in coastal water of Mekong and Red River delta are usualy 4 times higher than other locations. This is related to the agricultural lands in which pesticide are applied 90%, mostly in the from of the insecticides. Especially, the DDT is highly concentrated in coastal water (5.5 μg/l) Ba Lat mouth in comparison with other compounds of pesticides, as well as concentrated in marsh sediment and littoral benthos (*bivalvia*)

- Heavy metals

The heavy metals which have been monitored in coastal waters in 1996 as follows: Lead (Pb), Cadmium (Cd), Arsenic (As), Coper (Cu), Zince (Zn) and Iron (Fe). Their content in different regions is introduced in table 2.

Table 2: The values (μg/l) of heavy metals in coatal waters of Vietnam (1996 data)

Region	Heavy metals (range/average)					
	Pb	*Cd*	*As*	*Cu*	*Zn*	*Fe*
Northern	9.2-30.4 /16.4	0.2-0.3 /0.3		4.4-11.5 /7.4	1.3-104 /22	
Central	0.2-80 /42	0.1-0.2 /0.2	2.3-5.0 /4.3	3.3-7.8 /5.8	23-324 /168	4.2-625 /544
Southern	0.7-1.0 /0.9	<0.5 /0.3	7.2-16.2 /12.9	5.4-25 /14	19-35 /26	147-2404 /600
Total	0.2-30.4 /7.2	0.1-0.5 /0.3	2.3-16.2 /8.6	3.3-25 /9	1.3-324 /72	4.2-2404 /572

The table 2 show that the concentration value of heavy metals at some locations is exceed the allowable standards of Vietnam, among Pb and Cd is usualy lower allowable standards. Apart from this, Zince (Zn) in coatal waters of Vietnam is exceed the allowable standards for aquaculture: 2 times (North), over 10 times

(Central) and 6 times (South). Iron (Fe) in Central and Southern coastal waters is usaly exceed 5 times, coper (Cu) and Arsenic (As) in Southern coastal waters is 1.3 times higher than allowable for aquaculture

- Coliform

The samples of coliform were collected at some locations in coastal waters where near coastal/beach tourism resorts. The mean total of coliform is in wide range (0-6116 MPN/100ml), its annual average value 1976MPN/100ml

Region	Range (MPN/100ml)	Average
Northern	564-1987	928
Central	0-5640	1205
Southern	85-6116	3796
Total	0-6116	1976

The monitoring results is also show that in summer season (tourism activity), the coliform value is usualy higher than other one. This issue relates to directly discharging the wastewater/domestic waste non-treated into the coastal waters.

3. Linkages beween marine pollution monotoring and management strategies

The coastal/marine pollution in Vietnam is one of key coastal environmental issues in priority order of the coastal management plan in first phase (1996 - 2000). In this period, Ha Long Bay is selected as a case study on coastal pollution monitoring in the framework of integrated coastal area management (ICAM) which have been established as a national project since 1996. The Haiphong Institute of Oceanology is leading implementation of the project. The participating agencies in ICAM are as folows:

- Ministry of Planning and Investment (MPI): Department of Education, Cutural and Environment and Institute of Strategy and Development Planning.
- Ministry of Science, Technology and Environment (MOSTE)/ National Anvironment Agency.
- Ministry of Fishery (MF): Agency of Aquatic Resources Protection.
- Ministry of Agriculture and Rural Development (MARD): Agency of Forestry Management.
- Coastal provinces: Local Department of Science, Technology and Environment and Department of Planning and Investment.

3.1. Ha Long Bay Case study: a initiative results

- **General Description**

Ha Long Bay (HLB) is located in Quang Ninh province, Northern Vietnam (fig. 1). It is a large and shallow coastal waterbody system, including Cua Luc embayment and Ha Long Bay encompassing an area of approximately 1,500km^2. The bay is to become a natural system rich in ecosystem and recreation-tourism potentials. Therefore, Ha Long Bay is adopted by UNESCO in 1994 as a Natural World Heritage with spectacular limstone island and underwater landscapes. Ha Long bay is also culturally,

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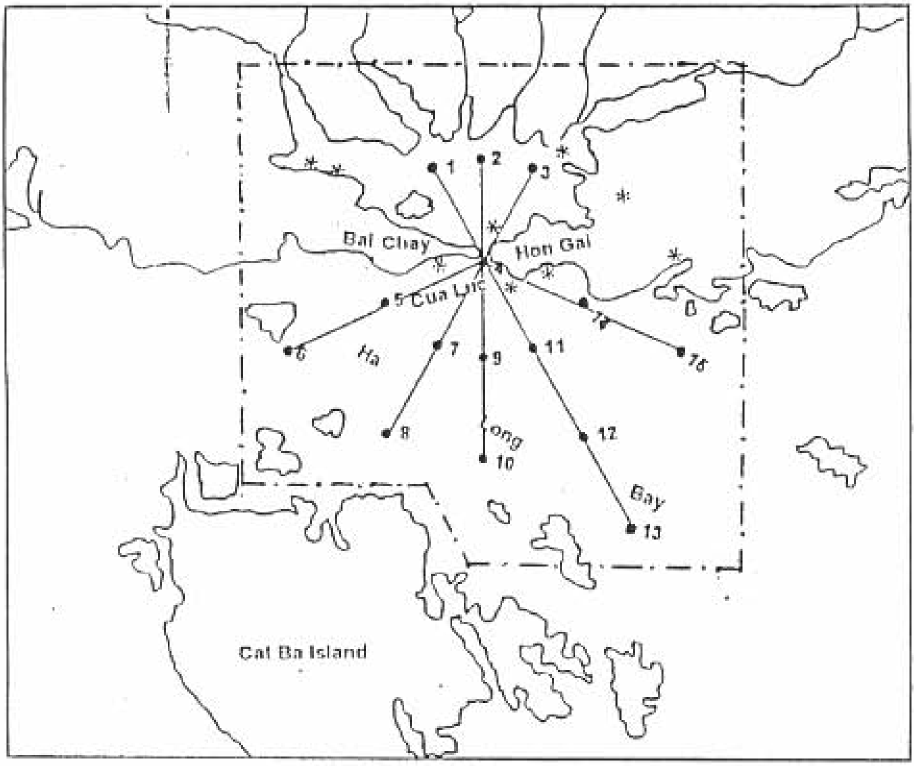

Figure 2: Proposed Field Sampling Strategy. Utilises a modified Triangular Grid with sites set at 4.5km intervals along grid lines

Legend

- · - · - · -	Study Area Boundary
——•——	Sampling sites
*	Priority Pollution Sources
1:300,000	Scale

historically and ecologically important to Vietnam. It contains numerous archeological sites of national significance and the high marine biodiversity.

The Quang Ninh province with Ha Long Bay is well-known as Vietnam's industrial centre, highlighted by a series of very large anthracite coal mines many of which exist very near the coast in watershed that drain into Ha Long Bay and coastal waters to the east. Ha Long Bay waters also contains the most bathemetrically favourable deep water port in the Northern part of the country. The transportation route in and out of the port runs directly through Ha Long Bay and is used presently for small scale oil imports and exports of coal.

The industrial development, urbarnization and tourism are all contributed to increasing pollution problem in Ha long Bay. Currently, the principal sources of pollution are land-based, and include discharges from coal mining operations, soil erosion, and discharge of sewage, solid waters from urbans such as Ha Long city and Hon Gai. The resultant increase in the bay's pollution has become a major concern of the Government.

The GOV. has addressed the problem by conducting the HLB monitoring plan. It seeks to determine the degree and extent of pollution in the HLB and determine trends in the bay's water quality within the period of the monitoring plan and if possible, predict its future quality

The bay is relatively shallow, 4-5m on average with some narrow deeper depressions (up to 20m) suitable for vesel transport. Tides are diurnal and average 4.0m in height with velocity of tidal current is 0.2-0.5m/s. Ha Long bay is strongly influenced by rivers, including the Troi, Mip, Man, Vu Oai, and Dien Vong rivers. The main coastal ecosystems in Ha Long bay are coral reef, mangrove, seagrass and other tidal wetlands with about 810 species. The study area is prone to periodic typhoons (0.85 typhoon per year) and annual rainfall is about 1,800-2,000 mm. The rainy season is from April to October, and most of the rainfall occurs in July and August. Monthly humidity is 82-86% on average, and highest in February, March and lowest in November. The average water temperature ranges 13-27°C. The coal materials are covered over bottom sediment of Ha Long Bay with grain-size 0.05-0.2mm dark-gray colour and the content level reducing step by step from coal mining sites. Water turbidity is high and transparency is ofen less than 0.5m. High levels of nutrients (nitrogen and phosphorus) in the bay waters, and low levels of dissolved oxygen have been recorded adjacent to urban and industrial areas.

- **Monitoring strategy**

Sampling Network is carried out from modified Triangular Grid (fig. 2). Almost the transect lines were passed across Cua Luc inlet. The sampling network has reflected the possible sources of pollution which are predicted from dianogtic review results conducted by rapid appraisal. Total 15 sampling sites were designed on these transects, among them there are 3 sites (number 4, 6, 12) with 24 hours operation, and remain 12 sites are the spatial sites.

Sampling Strategy. At the sites with 24 hours operation (4, 6, 12) the parameters sush as: $S^0/_{00}$, pH, COD, BOD_5, DO, NO_3^-, NO_2^-, NH_3^-, PO_4^{3-}, SiO_3^{2-}, total phosphoruss, turbidity, and temperature were collected or measured in both surfacial and bottom

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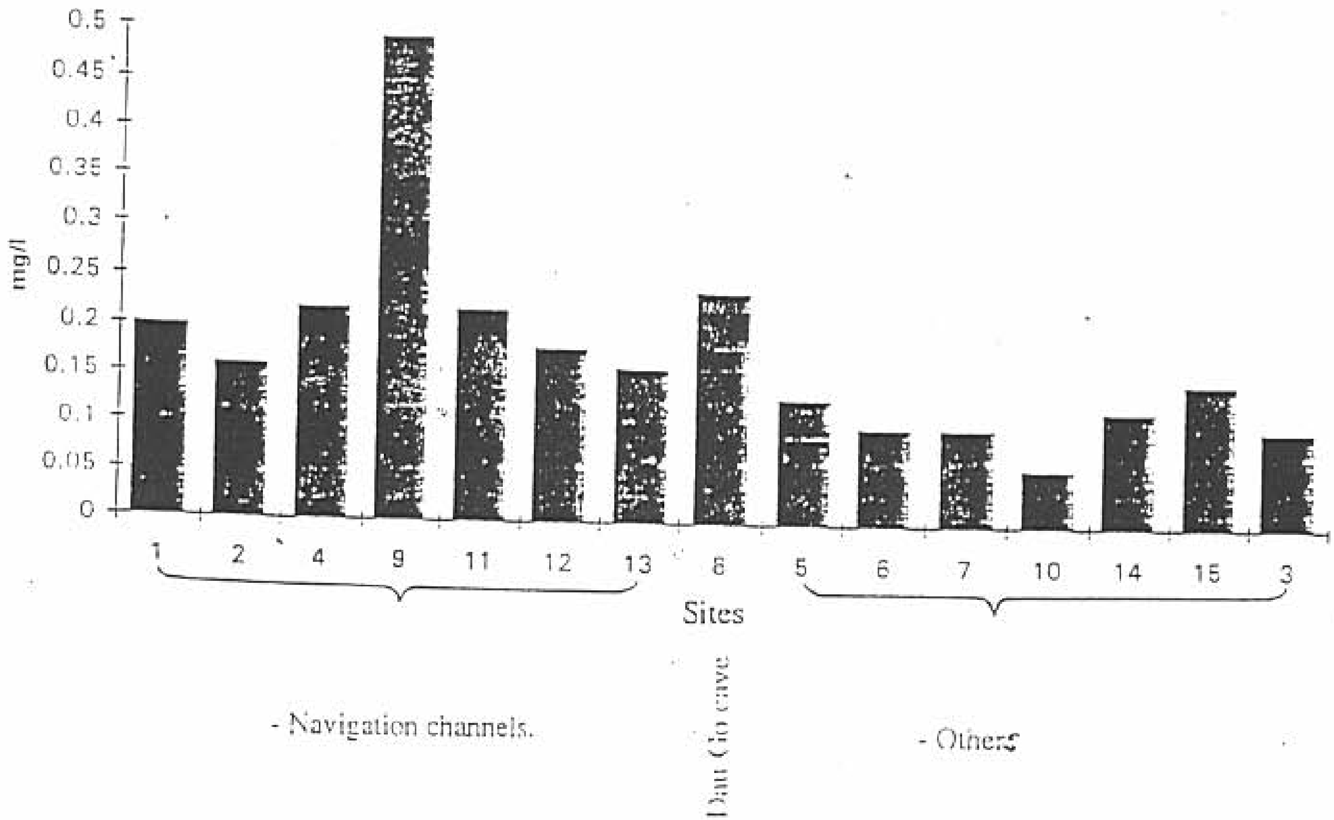

Fig. 3: Average oil content in various sites of Ha Long Bay

layers. Especially, oil and heavy metals were collected at low and high tides; pesticide and colifrorm like oil, but only in surfacial layer. Plankton sampling is conducted in two layers and every 4 hours. The sediment and benthos samples were collected by petersen grab. Else, at the spatial sites these parameters were collected only in the two layers, and one time.

It is notice that the coliform samples were collected at the sampling sites where near the coast and in Cua Luc embayment. The bedform of the bay was controled on 5 transects by Echo-sounder (Furuno-400). The current was also measured at 3 sites with 24 hours.

Monitoring site documentation: Documentation for each station included:

- Identification of site number
- Latitude and longitude coordinates
- General description of the site conditions
- Depth of water
- Distance from nearest mainland
- Local pollution sources, if any
- Any observable pollution
- Making sample number

The sample types include seawater, bottom sediment, some organisms, and suspended matter

Sampling time: Seasonal sampling (in January/February and July/August). The sampling equipments analyzed and preserved methods are above mentioned in conformity with *the Manual on Sampling and Analysis of Monitoring the Marine Environment* and *the Environment Monitoring Workbook*.

The double sampling and repeatly analysis were also applied to check analyzed methods

- **Main results**

Organic pollution

In Cua Luc embayment, DO value is on average 4.39ml/l in the surface layer, and 4.06ml/l in the bottom layer. The content of DO in the sites far from coastline is higher than in Cua Luc embayment. The average value of DO in surface layer is 5.24ml/l and in bottom one is 4.83ml/l.

In water of Cua Luc embayment, the COD value is highest of Ha Long Bay, on average 4.18mg/l. At raiman sites, COD value is rather low, in range 2.0-3.6mg/l.

The average BOD value for both water layers is low (0.1-2.2mg/l)

Oil pollution

The oil content in Ha Long waters is in range of 0.02-0.70 mg/l. Some 80% of total analyzed samples have contained oil with the content 0.05mg/l. In Cua Luc embayment and in the scope of navigation channels, the oil content is high (0.16-0.49 mg/l). The high oil content is related to shipping, tourism activities and near big ports (fig. 3). The bay waters is polluted by oil in comparison with Vietnam permissible standard

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Pesticide residue

The 11 water samples of surface layer in Ha Long Bay were analyzed in term of pesticide. The main substances of pesticide are recorded: Lindane and DDT.

Lindane content in surface layer of the bay is rather low, on average 0.0003mg/l. The value is lower in comparison with Vietnam permissible standards.

DDT content is very low (average 0.0003mg/l). At the sites in Cua Luc embayment near agricultural/forestry activities, its content is considerable high, about 0.003 mg/l, but still many times lower than permissible standard

Heavy metals

Copper content in Ha Long Bay waters is in range of 4.7-57.0 μg/l, on average 11.4 μg/l and higest of the whole heavy metals. Its content in the bottom water layer is 16.3 μg/l average, about 2-3 times higher than in the surface layer (6.4 μg/l average)

Lead content is relatively low, about 2.15 μg/l average. Its average value in the botton layer (2.9 μg/l) is also 2 times higher than in the surface layer (1.4 μg/l)

Cadmium content is very low, in range of 0.1-0.4 μg/l and 0.2 μg/l average. Similar Cu^{2+}, Pb^{2+}, cadmium is also concentrated in the bottom layer higher than the surface one.

Among 4 studied heavy metals, the mercury (Hg^{2+}) is relatively low, often under 0.1 μg/l

4. Recommendation for future action

- The national system on marine environment monitoring is established and its initiative results have contributed in understanding the state of coastal/marine environment in Vietnam in general, as well as coastal/marine pollution parcularily
- Since 1995, the monitoring data were/are being one of inputs for annual report subnmitted the National Assembly
- Some national laboratories on marine environment monitoring are being developed with new added equipments, but the staff of these LAB. are still not very much skill
- QA/QC procedures are still not often applied in the steps of the monitoring programme
- The linkage between marine pollution monitoring and management strategy is still not highlighted. In the near future, a institutional framework for ICAM including marine polution management will be set up in Vietnam as a national focal point. The HIO is playing the role of Technical Coordinating Unit (TCU).
- The experience in monitoring programme design is weak, so the regional/international technical asisstances are necessary and urgent.

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Environnemental Quality of Nha Trang bay .

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1. Materials and Methods

For implementing monitoring program on the environmental quality of Nha Trang Bay and adjacent waters 3 surveys had been carried out during Dec. 1996 - April 1997.

In the first survey (18^{th} - 27^{th} December 1996) 20 water samples characterizing rainy season were collected at 12 stations among them 5 stations are located in the northern part of the bay, 4 in the southern part, 2 in Nha Phu Bay and 1 in Cai River. In the second survey (22^{th} February 1997) water samples were taken only at limited number of stations. The third survey was performed in dry season (12^{th} to 17^{th} April 1997; the station framework is similar the first survey but some stations (13,14,15 16 were added and continous sampling with 4 h intervals was carried out at the stations 1,2 and 9. Sediment samples were taken at the stations located at the channel along the coast. The locations of the stations of 3 surveys are showed in Figure 1.

Water samples were taken by 51 plastic water samplers and pH was measured aboard using pHmeter. Other samples were treated immediately and analyzed as soon as possible at Institute of Oceanography. Analyzed parameters were: salinity, suspended matter (SM), dissolved oxygen (DO), BOD, COD, ammonia, nitrite, nitrate, phosphate, silicate, dissolved organic nitrogen (DON), particulate organic nitrogen (PON), dissolved organic phosphorous (DOP), particulate organic phosphorous (POP) using methods described in APHA, 1992; heavy metals (iron, manganese, zinc, copper, lead, arsenic) using colorimetric methods (APHA, 1992); hydrocarbon (UV spectrometry, Levy, 1971).

Sediment samples were collected by divers using plastic tubes (5cm in diameter). The uppermost 3cm part of each core was splited into 5 aliquots. 3 of them were analyzed for organic carbon, organic nitrogen and total phosphorous; 1 for water content and the last one was treated with 10% v/v nitric acid and warmed 2 h at 100°C, cooled and filtered; the filtrate was analyzed for heavy metals using colorimetric methods.

Analytical results are presented in Annexes 1-4.

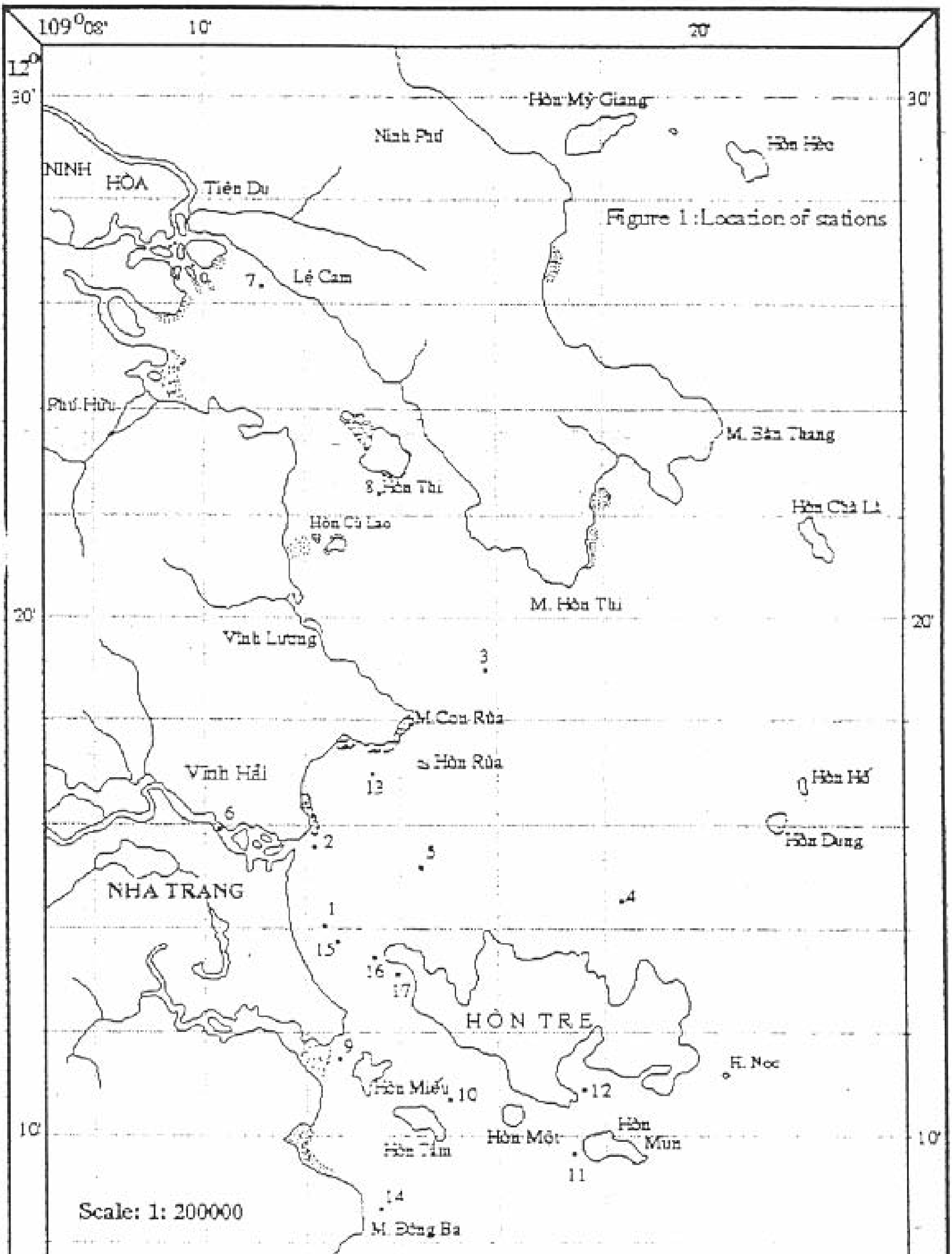


Figure 1 :Location of stations

2. Results

Distribution of surveyed parameters in water:

Rainy season:

Influence of heavy rains before the survey was expressed obviously in the salinity values. In the whole of Nha Trang bay, salinity varied from 16.74‰ đến 32.81‰ in surface layer and from 30.28‰ to 34.05‰ in bottom layer; value greater than 34‰ was recorded only at bottom layer of station 4 (located in the center of northern part). In Nha Phu lagoon values 30.93‰ and 31.20‰ of salinity were recorded. Variation ranges and average values of surveyed parameters in the northern (stations 1,2,3,4,5) and southern parts (stations 9,10,11,12) of the bay and in Nha Phu lagoon (stations 7, 8) are presented in Table 1.

Spatial distribution trend of surveyed parameters can be summarized as below:

Salinity and COD values in surface layer were usually lower than ones in bottom layer. Contrarily, DO, BOD, nitrate, silicate and iron usually concentrated in surface layer.

Transversal variations of surveyed elements in surface layer along selected transects are illustrated in Figures 2, 3 and 4. These figures show that:

- Variations of DO and BOD along the transects were not noticeable.

- In Nha Trang bay there were some irregularly variations of salinity and silicate concentrations (transect 1).

- In the river mouths (stations 2 and 9) COD values were lower than other stations.

- Suspended matter decreased offshoreward. The same trend was found for nutritive salts and organic nitrogen in the northern part of Nha Trang Bay; distribution of these elements in the southern part were irregularly.

- Distribution of most of heavy metals and hydrocarbon were also irregularly. However bleached materials from islands in the bay might influence the distribution of some metals such as iron an manganese.

- Influence of the rain was greater in Nha Trang Bay in comparison with the Nha Phu lagoon (in the time of the survey).

COD were always greater than BOD for many times (see Table 1).

Dry season:

Analyzing results of the limited number of samples collected in February survey (including the stations near river mouths) indicate relatively high values of salinity (31.87‰-33.37‰). Consequently silicate concentrations were lower than values found in December 1996 survey (138-440, average 256µg/l). DO varied from 6.05 to 6.75mg/l, average 6.43mg/L. Suspended matter and COD values were also lower (5.40-12.80, average 8.48mg/l; 1.2-5.3, average 3.1mg/l respectively). COD was much greater than BOD (variation range of the second was 1.08-2.94mg/l with the average 1.78mg/l). pH values were somewhat lower than ones of normal sea water (7.88-8.06, average 7.96). Ammonia and nitrite existed in trace level. There were no abnormal distribution of nit. .te (180-280µg/l, average 230µg/l).

Variation ranges and average values of other elements were as below:

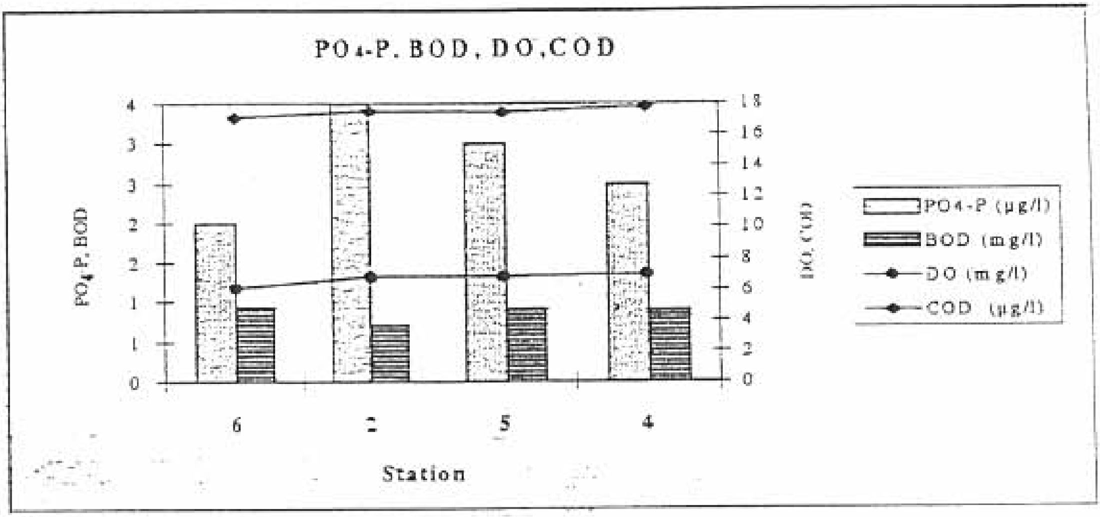
- Phosphate: 0.5-5.0µg/l; 1.8µg/l
- Organic P: 12.0-43.0µg/l; 24.5µg/l
- Organic N: 340-577µg/l; 487µg/l
- Iron: 105-300µg/l; 168µg/l
- Maganese: 0.3-4.5µg/l; 1.2µg/l
- Zinc: 6.7-25.6µg/l; 13.9µg/l
- Copper: 2.7-6.1µg/l; 4.6µg/l
- Lead: 0.7-1.9µg/l; 1.4µg/l
- Asenic: 14.3-22.1µg/l; 18.0µg/l

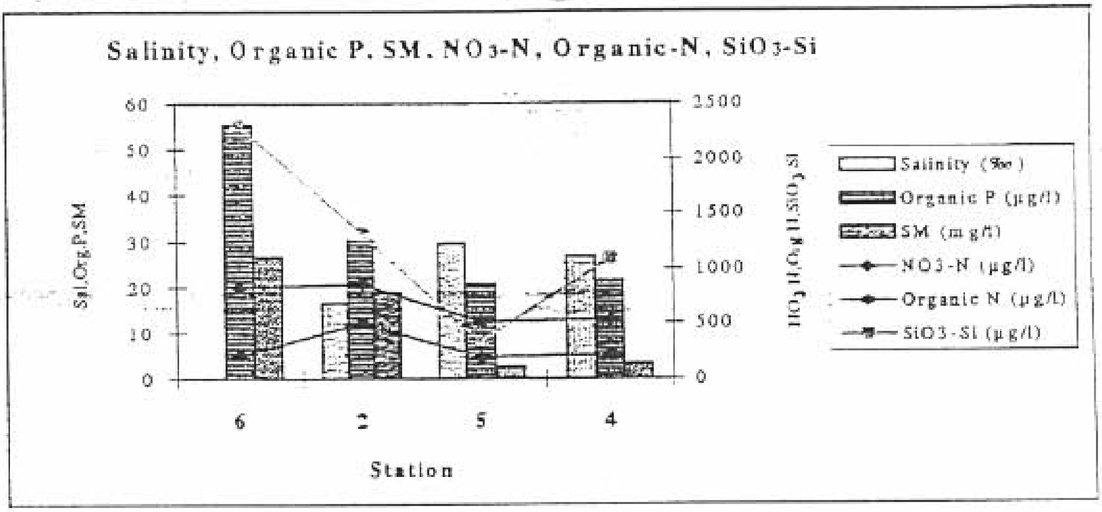
The April 1997 survey droped in the characterizing dry period of the region. Therefore salinity recorded in Nha Trang Bay is highest among 3 surveys (19.63-33.87‰ in surface layer and 33.69-34.13‰ in bottom layer). In Nha Phu lagoon salinity was somewhat lower than value found in December 1996 although the survey had been carried out in dry season. This phenomenon suggests the influence of the local rain in Dinh river basin. It is necessary to remember that the heavy rain during December 1996 survey concentrated in the Cai river basin and effected mainly the hydrography of Nha Trang bay. Variation ranges and average values of surveyed parameters in the northern (stations 1,2,3,4,5,13,15,16) and southern parts (stations 9,11,12, 14) of the Nha Trang bay and in Nha Phu Lagoon (stations 7, 8) are indicated in Table 2.

Table 1: *Variation ranges and average values of surveyed parameters in different areas (December 1996)*

Parameters (unit)	Northern Part	Southern Part	Whole of Nha Trang Bay	Nha Phu Lagoon
Salinity (‰)	28.39 *(16.74-34.05)*	31.40 *(25.72-32.90)*	29.73 *(16.74-34.05)*	31.07 *(30.93-31.20)*
pH		8.12 *(8.08-8.17)*		
SM (mg/l)	5.7 *(1.7-18.6)*	2.4 *(0.3-6.0)*	4.2 *(0.3-18.6)*	38.3 *(9.1-67.5)*
DO (mg/l)	6.51 *(6.13-6.90)*	6.58 *(6.33-7.35)*	6.54 *(6.13-7.35)*	6.37 *(6.33-6.41)*
BOD (mg/l)	0.70 *(0.25-0.92)*	0.62 *(0.22-1.30)*	0.66 *(0.22-1.30)*	1.55 *(0.97-2.14)*
COD (mg/l)	18.77 *(10.1-26.1)*	18.76 *(11.5-33.1)*	18.77 *(11.5-33.1)*	14.97 *(13.28-16.66)*
Ammonia-N (µg/l)	trace	trace	trace	trace
Nitrite-N (µg/l)	12.6 *(6-20)*	7.2 *(4-10)*	10.2 *(4-20)*	7.3 *(5-9)*
Nitrate-N (µg/l)	251.5 *(165-500)*	140.6 *(80-250)*	202.2 *(80-500)*	108 *(70-145)*
Phosphate-P (µg/l)	3.0 *(1.0-4.0)*	2.0 *(0.5-4.5)*	2.6 *(0.5-4.5)*	2.3 *(1.0-3.5)*
Silicate-Si (µg/l)	538 *(117-1312)*	276 *(152-535)*	422 *(117-1312)*	198 *(158-238)*
Organic N (µg/l)	668 *(522-862)*	584 *(456-694)*	631 *(456-862)*	649 *(634-665)*
Organic P (µg/l)	34.3 *(20.7-49.7)*	29.9 *(14.7-49.7)*	32.4 *(14.7-49.7)*	24.1 *(21.5-26.8)*
Iron (µg/l)	336 *(137-615)*	274 *(137-597)*	308 *(137-615)*	406 *(165-648)*
Manganese (µg/l)	4.6 *(0.7-18.0)*	2.5 *(1.0-6.3)*	3.7 *(0.7-18.0)*	30.6 *(4.5-56.7)*
Zinc (µg/l)	12.7 *(4.3-20.7)*	10.9 *(2.0-21.0)*	11.9 *(2.0-21.0)*	2.8 *(2.7-3.0)*
Copper (µg/l)	6.3 *(3.1-13.2)*	4.9 *(2.8-7.6)*	5.7 *(2.8-13.2)*	5.8 *(4.7-7.0)*
Lead (µg/l)	0.6 *(0.2-1.4)*	0.8 *(0.4-1.2)*	0.7 *(0.2-1.4)*	0.7 *(0.2-1.3)*
Arsenic (µg/l)	6.1 *(1.7-13.6)*	6.2 *(2.6-9.2)*	6.1 *(1.7-13.6)*	10.0 *(7.9-12.0)*
Hydrocarbon (µg/l)	217 *(90-461)*	212 *(134-417)*	214 *(90-461)*	148 *(91-205)*

Figure 2: *Variation of surveyed parameters in surface layer (Transect 1: stations 6,2,5,4)*





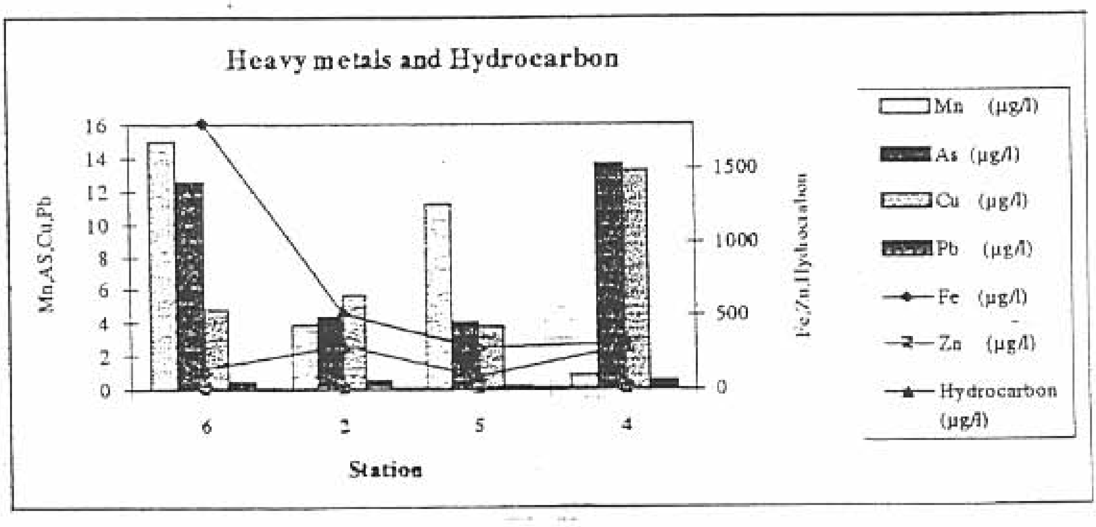
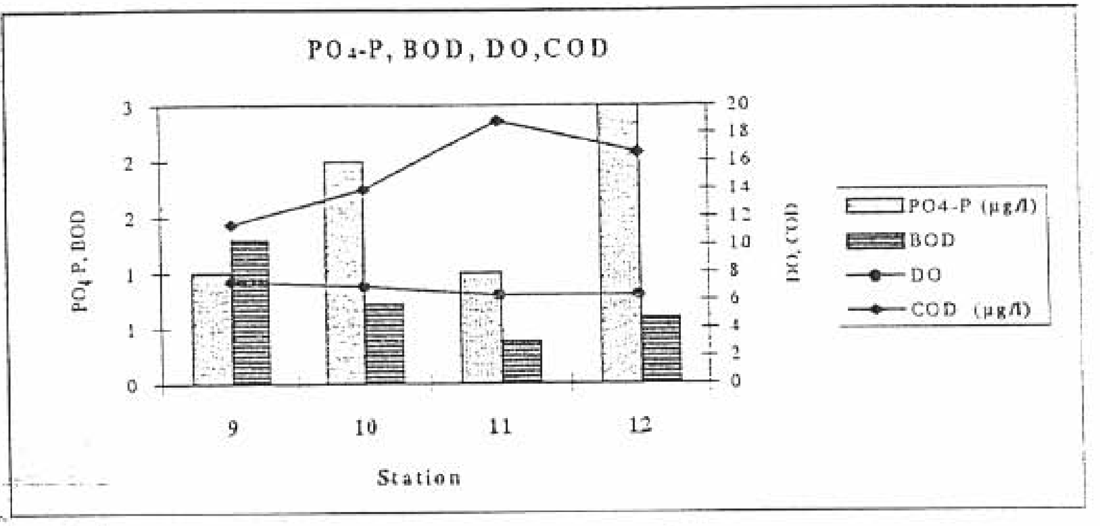
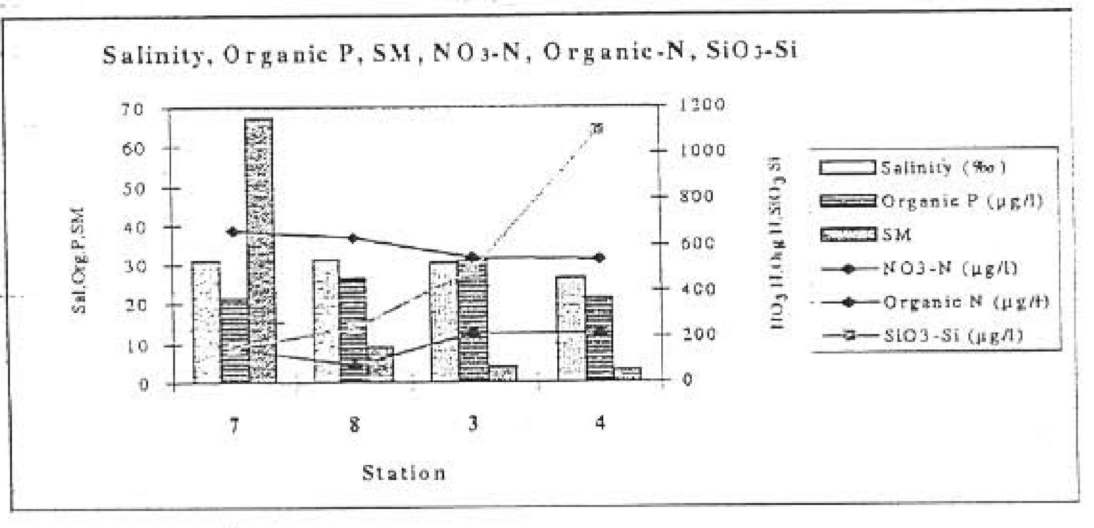


Figure 3: *Variation of surveyed parameters in surface layer (Transect 2: stations 9,10,11,12)*





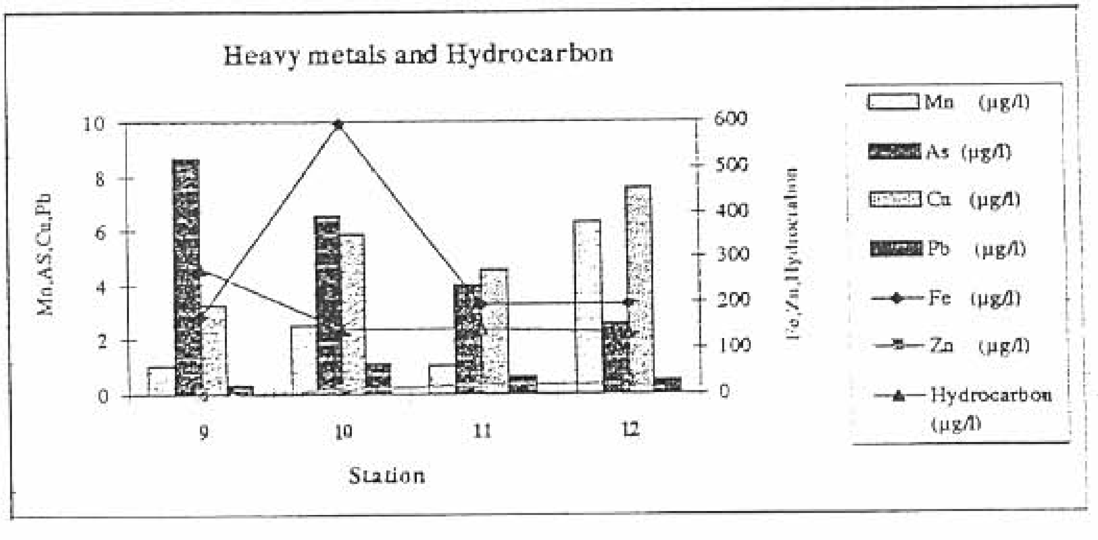
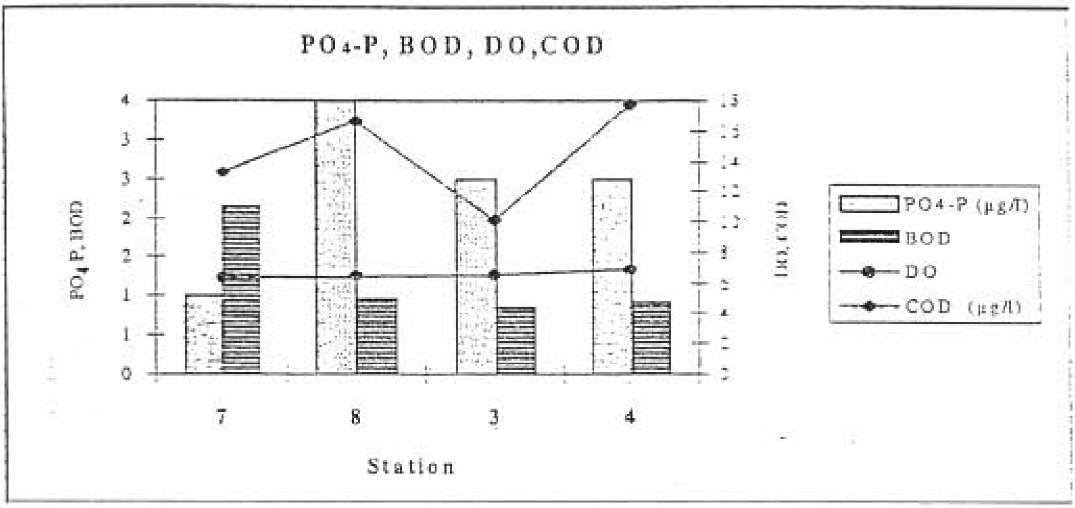
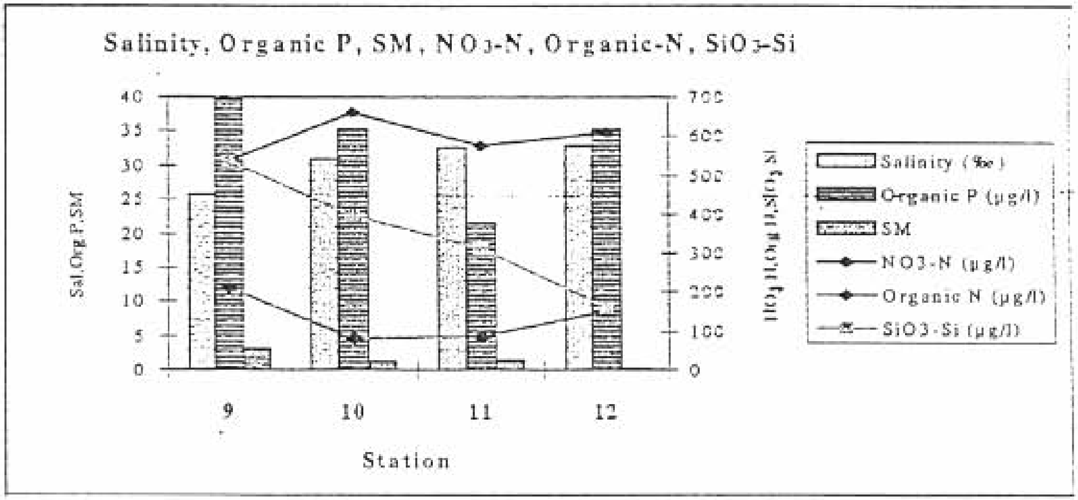
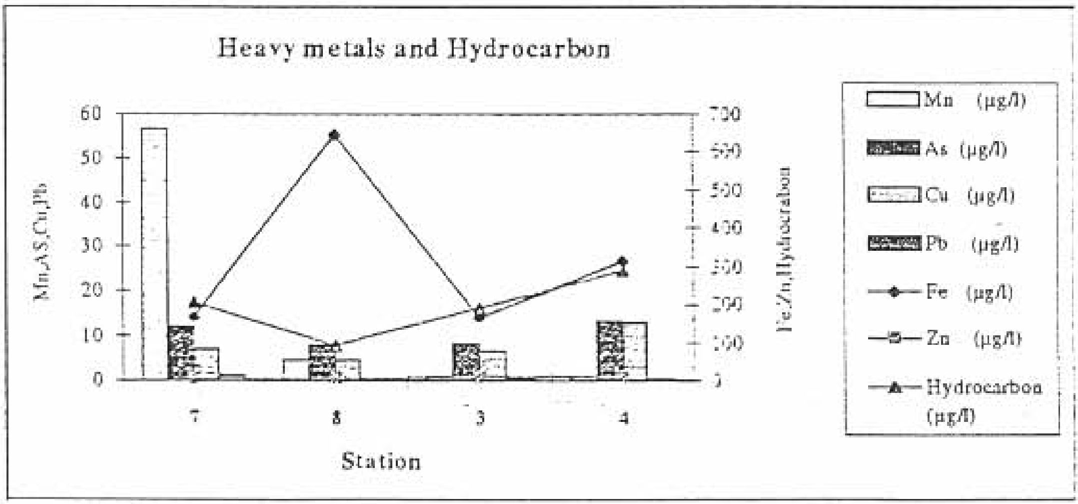


Figure 4: *Variation of surveyed parameters in surface layer (Transect 3: stations 7,8,3,4)*







Data on concentrations of the surveyed elements in surface and bottom layers indicate that salinity, DO and BOD values usually concentrate in bottom layer. Contrarily, concentrations of silicate and copper in surface layer are usually higher than ones in bottom layer. There is no clearly vertical distribution trend for other elements.

Figures 5, 6 and 7 illustrating the variations the elements in surface layer along selected transects indicate that:

- Variation of DO and nitrate along the transects were not noticeable except for the case of nitrate concentration at station 8 (in Nha Phu lagoon).

- BOD declined from the mouth of Cai and Dinh rivers toward the Nha Trang bay. Concentrations of silicate at the stations near river mouths and in Nha Phu lagoon were much greater than other areas. Similar trend was found for manganese except for station 2 (at Cai river mouth).

- In the stations near the river mouths (stations 2 and 9) COD values were lower than other stations.

- Suspended matter and organic N concentrations decreased from Nha Phu lagoon to Nha Trang bay. In the Nha Trang bay distribution of these parameters were irregularly.

- Concentration of As was highest near Cai river mouth (stations 1 and 2). It decresed in Nha Trang Bay and Nha Phu lagoon.

- Distribution of phosphate, organic P, Pb hydrocarbon were irregularly.

- COD are always greater than BOD for many times (see Table 2).

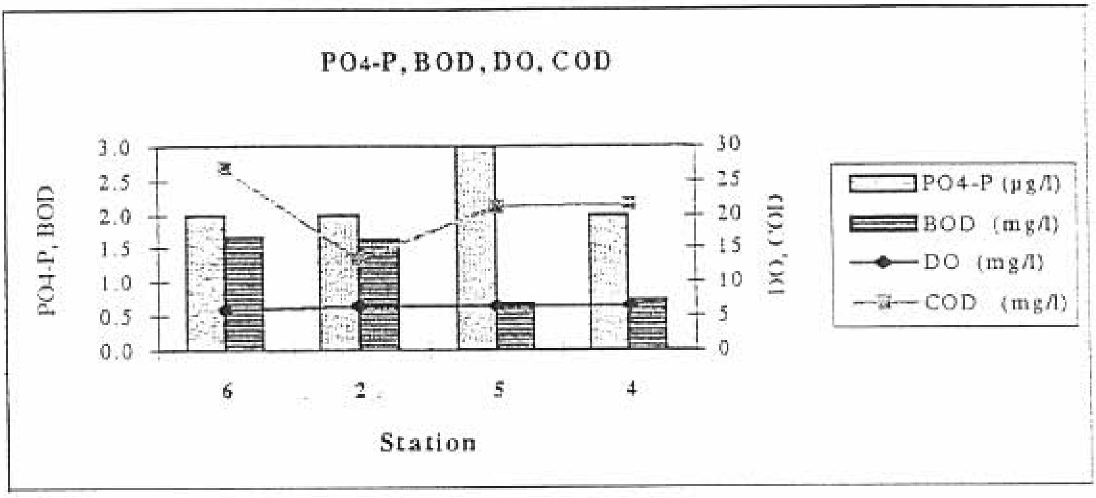
Temporal variations of the elements at stations 1, 2 and 9 (7 observations in 24 h) are illustrated in Figures 8-11. Variations of salinity and silicate in figures 8 and 9 indicate that station 1 is not influenced by the river discharge. There was no important change of these parameters and DO in tidal cycle. COD varied similarly in surface and bottom layers and its variation might be depended on water level. Phosphate reached maximum concentration in surface layer when water level is lowest, its variation in bottom layer was irregularly. Variation of nitrate, organic N and organic P concentrations were irregularly, their variation ranges were moderately.

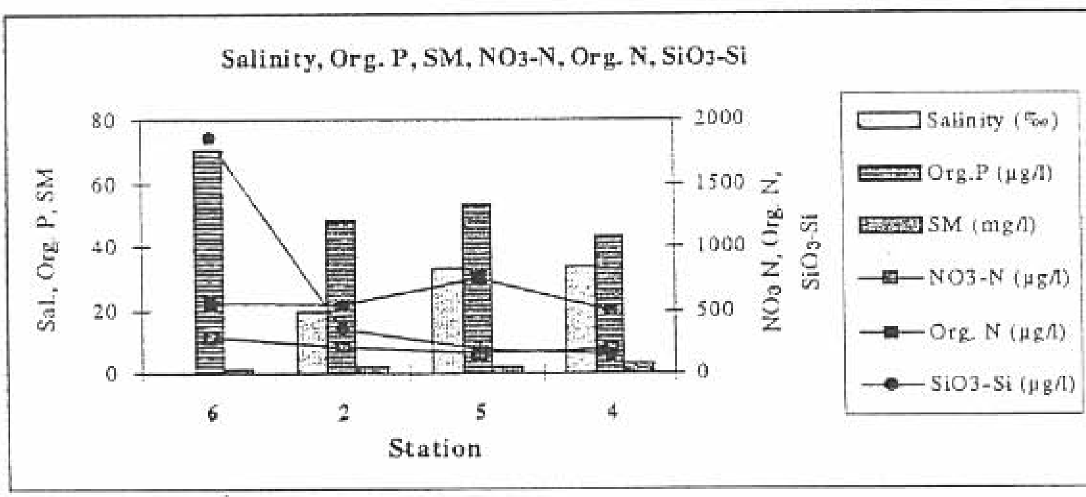
At station 2 DO varied insignificantly as found at station 1. Variations of salinity was related with the change of water level while silicate concentration was continously

Table 2: *Variation ranges and average values of surveyed parameters in different areas (April 1997)*

Parameters (unit)	Northern Part	Southern Part	Whole of Nha Trang Bay	Nha Phu Lagoon
Salinity (‰)	32.63 *(19.63-33.98)*	33.88 *(33.69-34.13)*	33.05 *(19.63-34.13)*	30.86 *(27.94-33.77)*
pH	8.24 *(8.20-8.30)*	8.23 *(8.18-8.30)*	8.24 *(8.18-8.30)*	8.25 *(8.22-8.28)*
SM (mg/l)	2.1 *(0.4-7.4)*	1.3 *(0.5-2.7)*	1.8 *0.4-7.4)*	9.1 *(5.7-12.6)*
DO (mg/l)	6.51 *(6.17-6.82)*	6.41 *(6.26-6.55)*	6.47 *(6.17-6.82)*	5.80 *(5.77-5.81)*
BOD (mg/l)	0.95 *(0.63-1.62)*	0.74 *(0.52-0.90)*	0.88 *(0.52-1.62)*	1.58 *(1.13-2.02)*
COD (mg/l)	17.04 *(9.70-24.70)*	18.60 *(9.50-31.80)*	17.56 *(8.50-31.80)*	10.70 *(10.50-10.90)*
Ammonia-N (µg/l)	trace	trace	trace	trace
Nitrite-N (µg/l)	3 *(0-15)*	trace	2 *(0.15)*	23 *(0-45)*
Nitrate-N (µg/l)	204 *(165-260)*	189 *(150-205)*	199 *(150-260)*	303 *(205-400)*
Phosphate-P (µg/l)	2.9 *(1.0-6.5)*	3.4 *(2.5-4.5)*	3.0 *(1.0-6.5)*	3.0 *(2.0-4.0)*
Silicate-Si (µg/l)	138 *(60-350)*	134 *(98-220)*	137 *(60-350)*	685 *(250-1120)*
Organic N (µg/l)	578 *(308-826)*	587 *(350-770)*	581 *(308-826)*	648 *(490-805)*
Organic P (µg/l)	43.6 *(27.5-58.5)*	54.5 *(37.8-70.5)*	47.2 *(27.5-70.5)*	48.0 *(45.3-50.8)*
Fe (µg/l)	136 *(90-195)*	143 *(88-205)*	138 *(88-205)*	204 *(190-218)*
Mn (µg/l)	0.6 *(0.1-3.9)*	0.6 *(0.2-2.3)*	0.6 *(0.1-3.9)*	2.7 *1.0-4.5)*
Zn (µg/l)	17.0 *(7.4-36.1)*	20.6 *(6.4-35.1)*	18.2 *(6.4-36.1)*	6.4 *(3.0-9.9)*
Cu (µg/l)	6.6 *(2.9-8.3)*	6.1 *(4.2-10.1)*	6.4 *(2.9-10.1)*	6.6 *(6.2-6.9)*
Pb (µg/l)	0.4 *(0.1-0.8)*	0.3 *(0.1-0.6)*	0.4 *(0.1-0.8)*	0.1 *(0.1-0.1)*
As (µg/l)	10.4 *(3.4-28.5)*	8.5 *(4.0-11.5)*	9.8 *(3.4-28.5)*	8.5 *(8.0-9.0)*
Hydrocarbon (µg/l)	99 *(71-158)*	125 *(51-223)*	108 *(51-223)*	87 *(64-110)*

Figure 5: *Variation of surveyed parameters in surface layer (Transect 1: stations 6,2,5,4)*





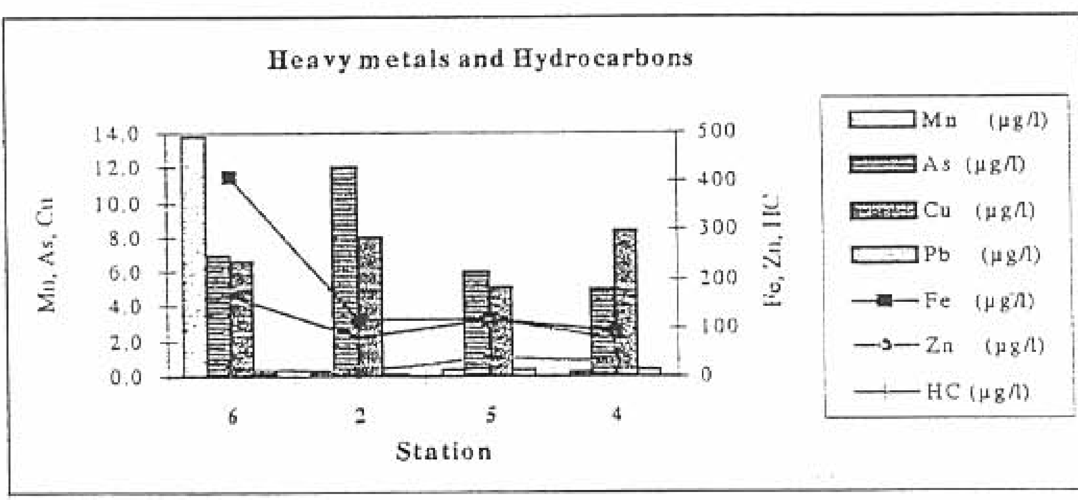
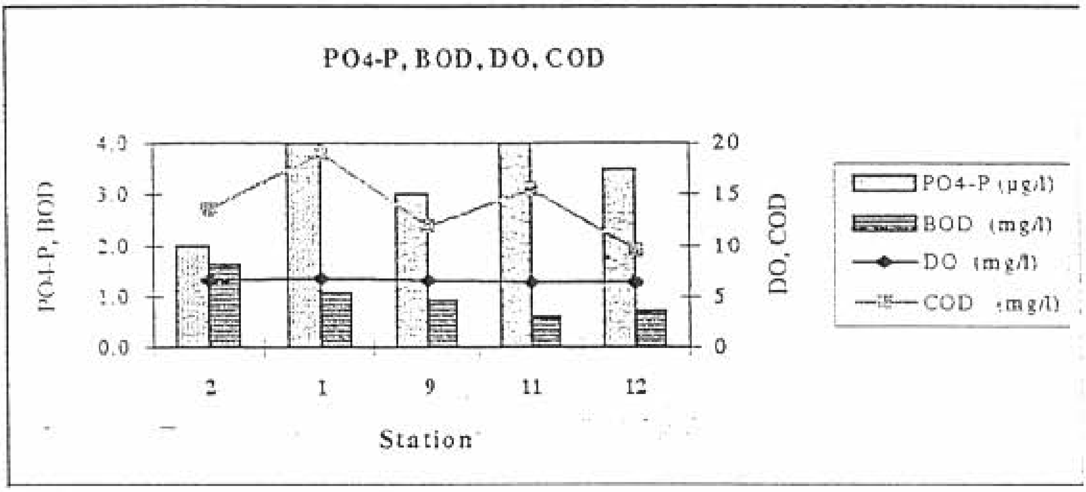
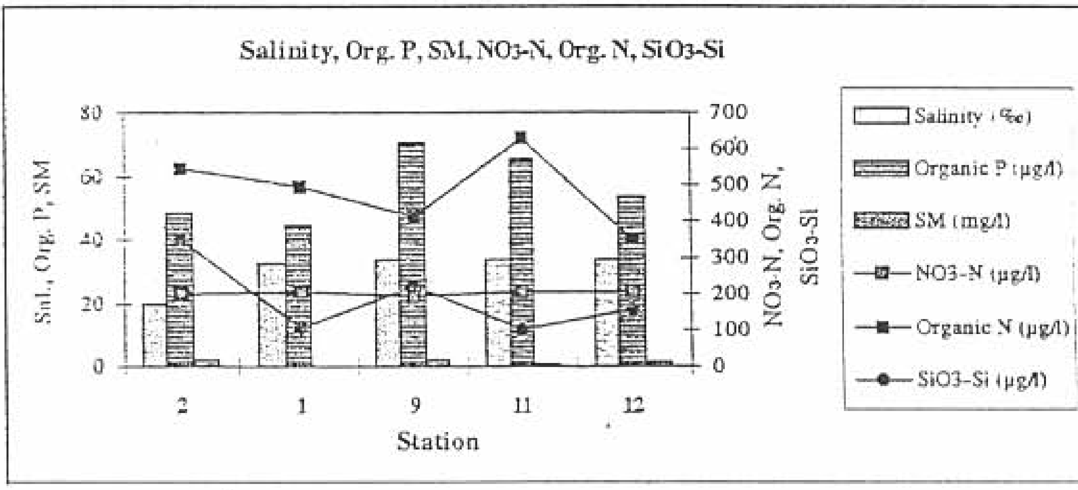


Figure 6: *Variation of surveyed parameters in surface layer (Transect 2: stations 2,1,9,11,12)*





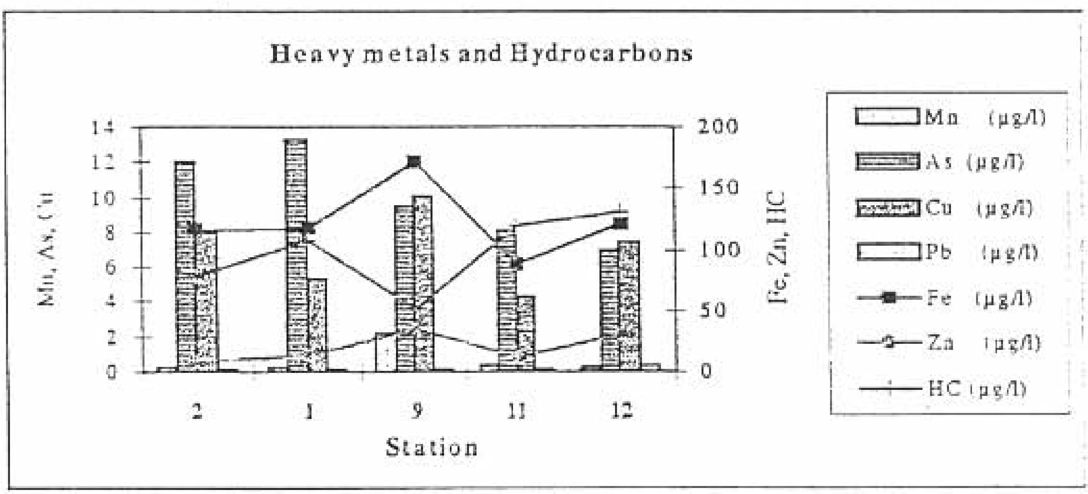
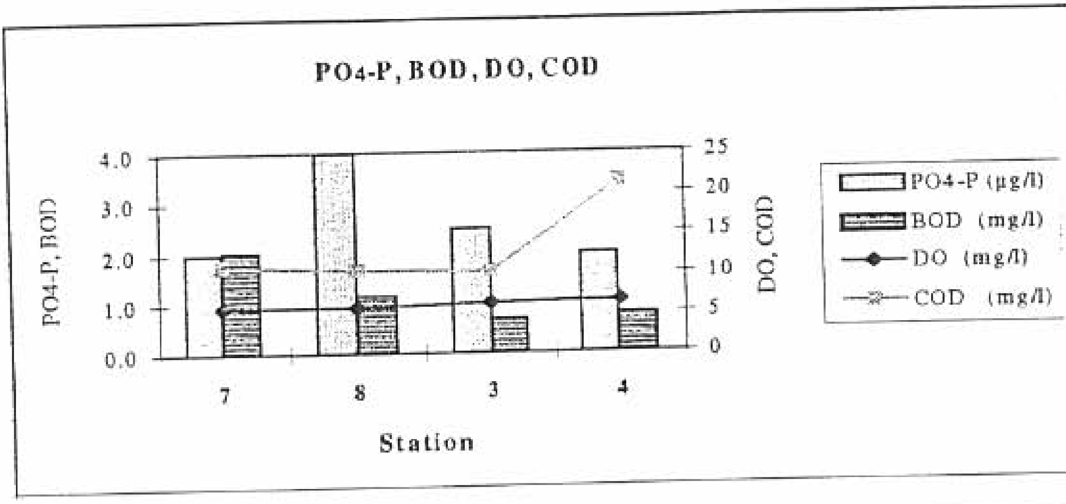
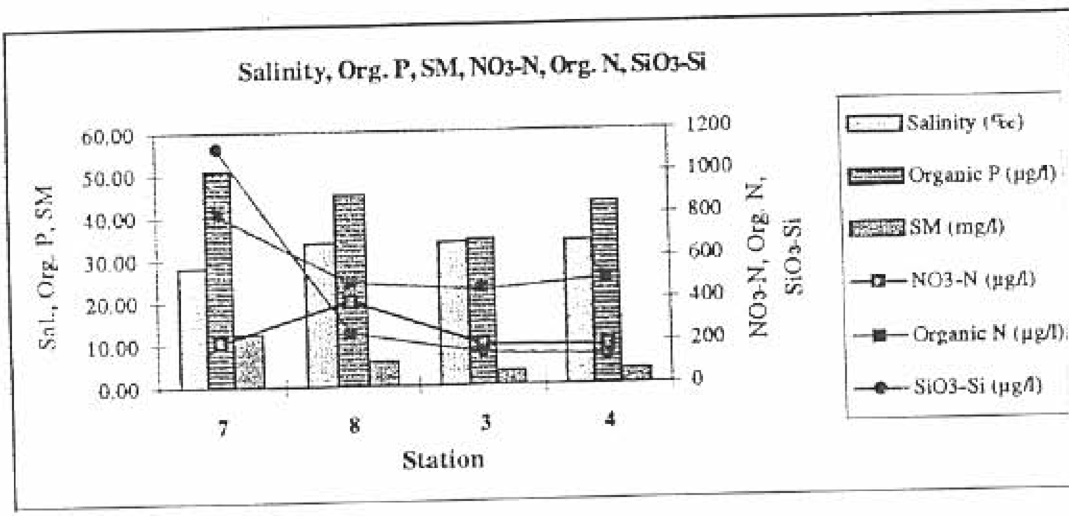
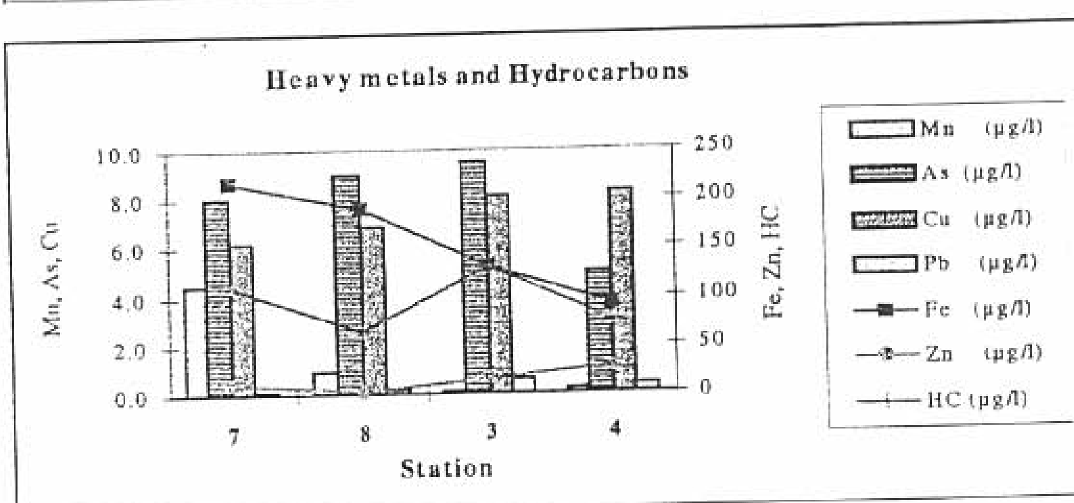


Figure 7: *Variation of surveyed parameters in surface layer*
(Transect 3: stations 7,8,3,4)







decreased when sea level rised, COD value was highest when sea level was lowest but its temporal variation was not closely related with the tide. Phosphate concentration and sea level varied similarly but their variation had a difference in time. Variation of silicate concentration was also related to sea level, its maximum concentration found in low tide. Organic N varied insignificantly in tidal cycle; a more significantly (but irregularly) variation was found for organic P (Figure 10).

At station 9 apparent decrease of salinity and abnormal increase of silicate concentration were recorded in the same observation (during low tide). DO also varied insignificantly. Variations of phosphate, nitrate concentration and COD value were irregularly. Variations of organic N and organic P were not important but might be related with sea level. However, their variation trends were contrarily (Figure 11).

Variation ranges and average values of surveyed parameters at the 3 station in 24 h continous obsevation were presented in Table 3. They can be considered as presentative data for nearshore area in dry season. Data on the table suggests the influence of fresh water is important only at Cai river mouth (station 2). However, there are only the obviously difference in salinity and nitrate and silicate concentrations at the station in comparision with the others (stations 1 and 9).

Table 3: *Variation ranges and average values of surveyed parameters in 24 h at stations 1, 2 and 9*

Station		Salinity (‰)	DO (mg/l)	COD (mg/l)	NO_3-N (µg/l)	PO_4-P (µg/l)	SiO_3-Si (µg/l)	Org. P (µg/l)	Org. N (µg/l)
1	Avg.	33.63	6.41	18.22	222	2.9	133	33.7	629
	Min.	*32.66*	*6.12*	*8.30*	*185*	*1.0*	*107*	*21.5*	*420*
	Max.	*33.89*	*6.71*	*45.60*	*265*	*5.5*	*215*	*45.2*	*798*
2	Avg.	26.26	6.31	21.36	346	3.2	1378	46.1	697
	Min.	*14.70*	*6.10*	*9.70*	*205*	*1.5*	*133*	*35.3*	*591*
	Max.	*33.68*	*6.55*	*37.20*	*540*	*4.5*	*2550*	*62.0*	*797*
9	Avg.	32.93	6.44	17.44	273	3.1	250	37.0	745
	Min.	*29.42*	*6.27*	*7.60*	*170*	*1.0*	*102*	*32.0*	*672*
	Max.	*33.66*	*6.65*	*29.50*	*330*	*5.0*	*962*	*40.2*	*854*

Figure 8: *Temporal variation of surveyed parameters in surface layer (Station 1)*

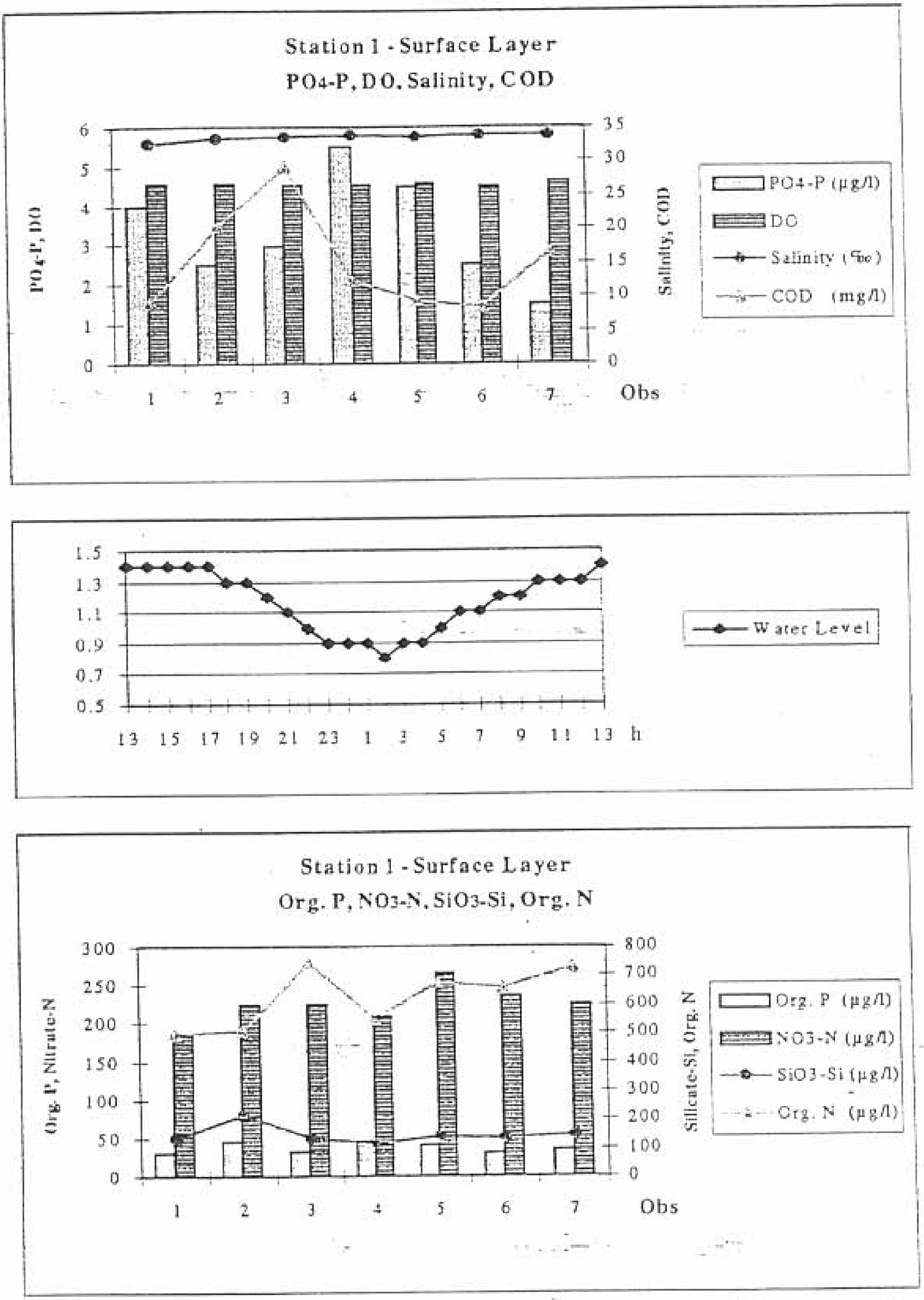
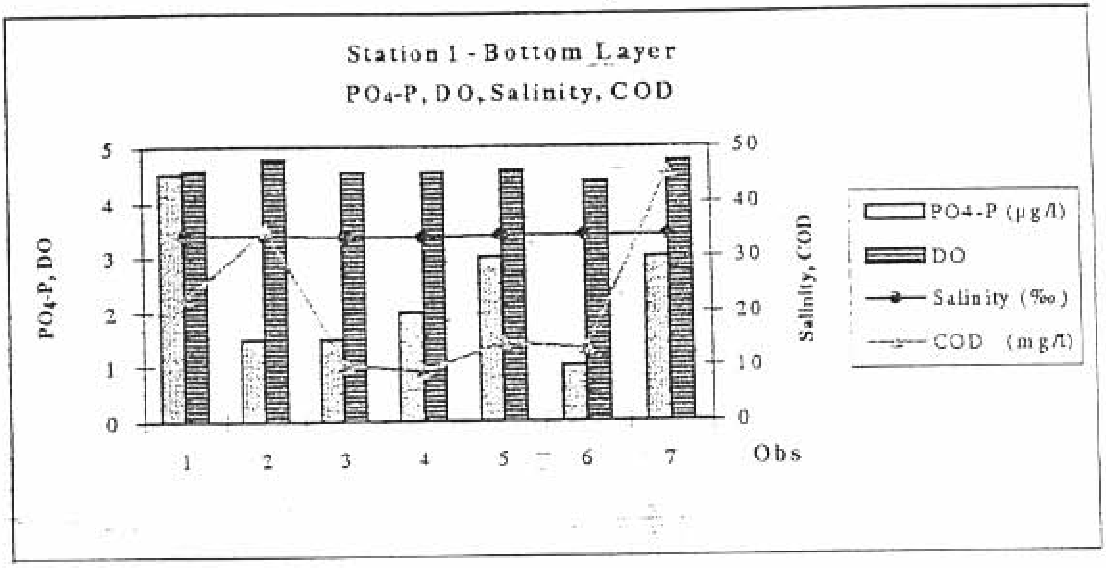
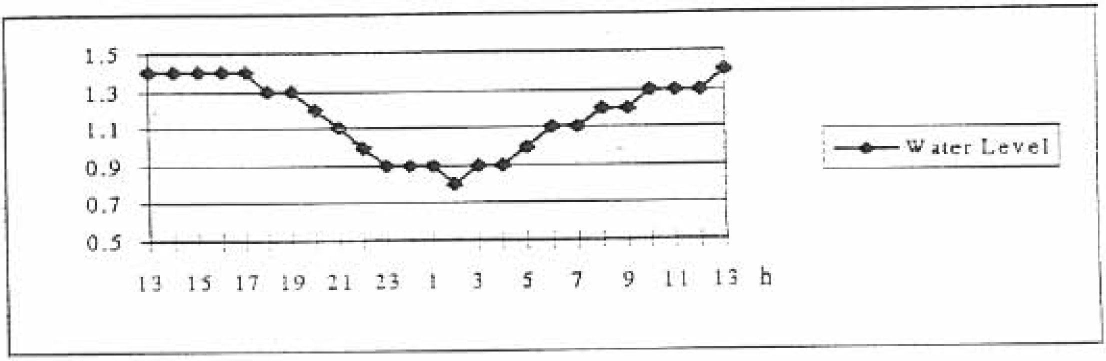


Figure 9: *Temporal variation of surveyed parameters in bottom layer (Station 1)*





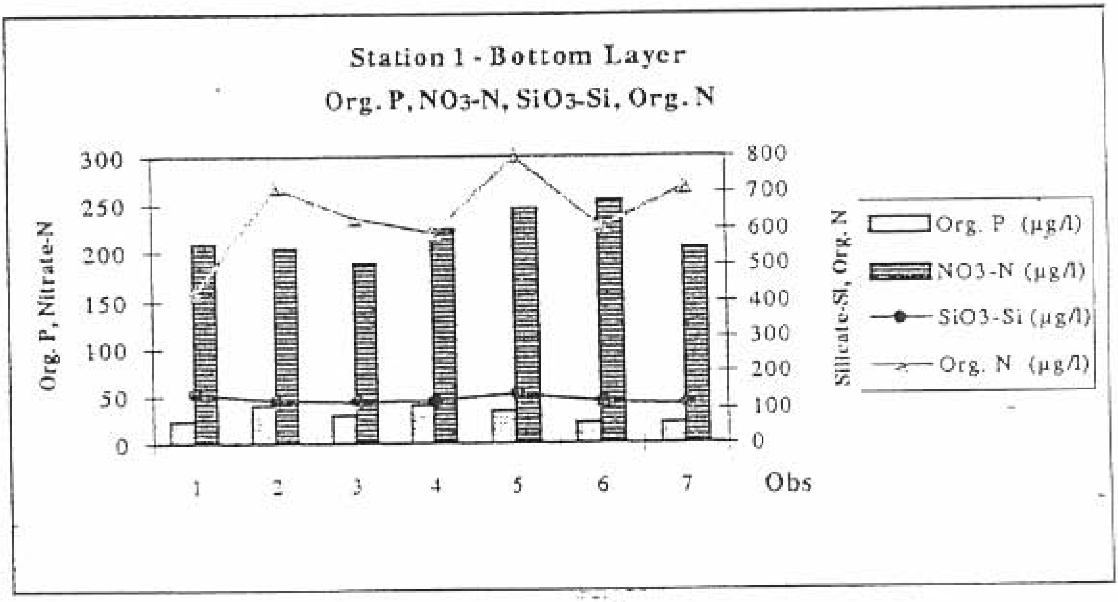
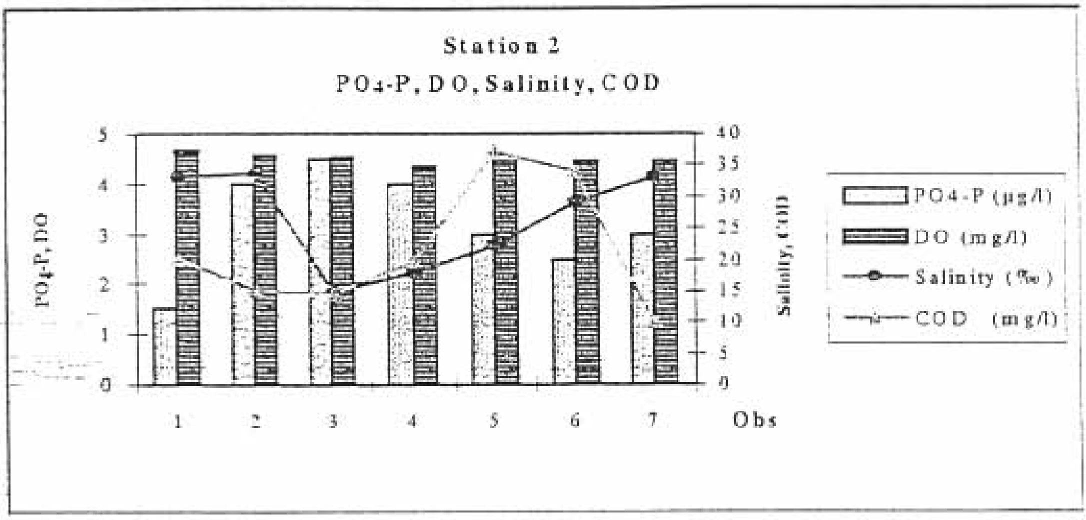
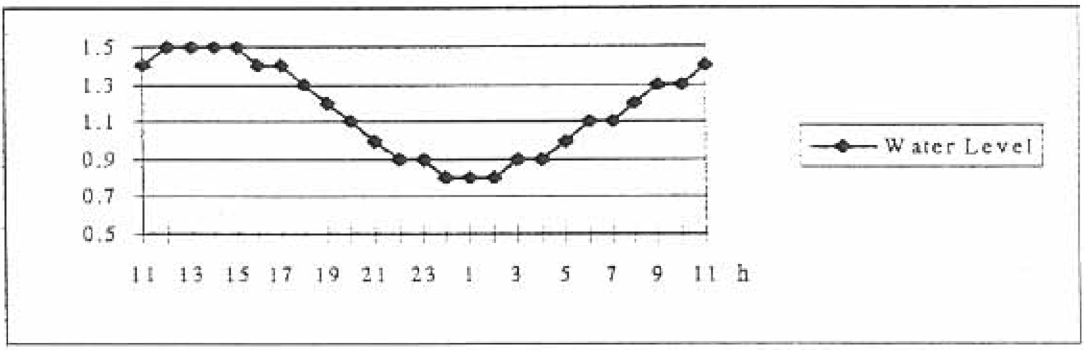


Figure 10: *Temporal variation of surveyed parameters in surface layer (Station 2)*





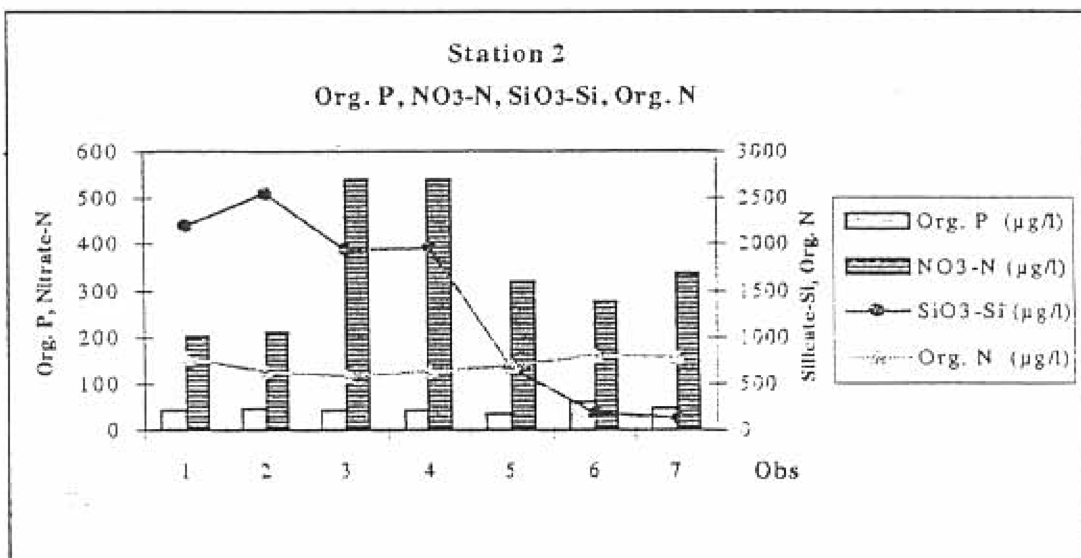
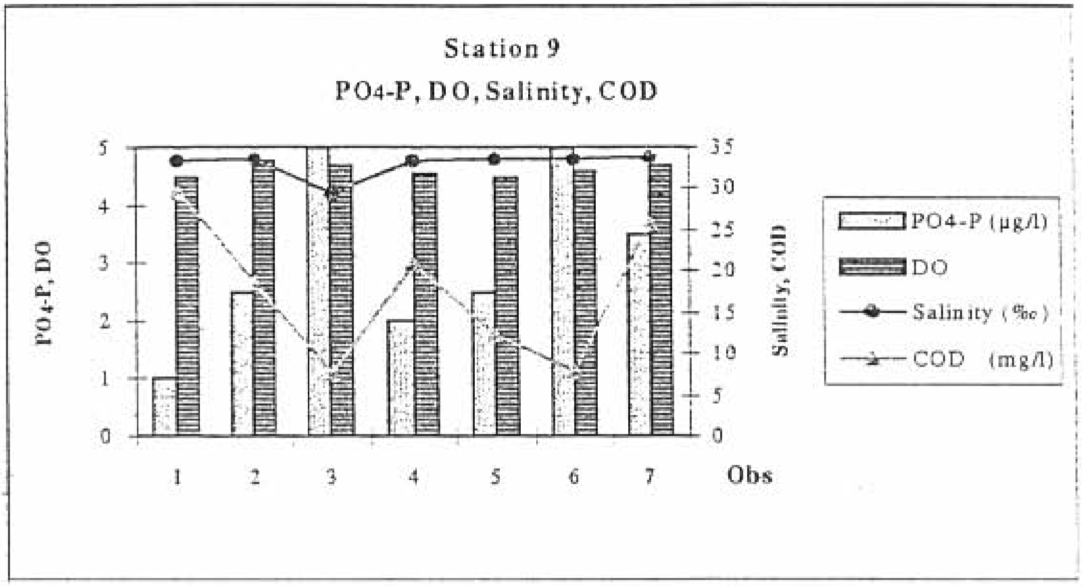
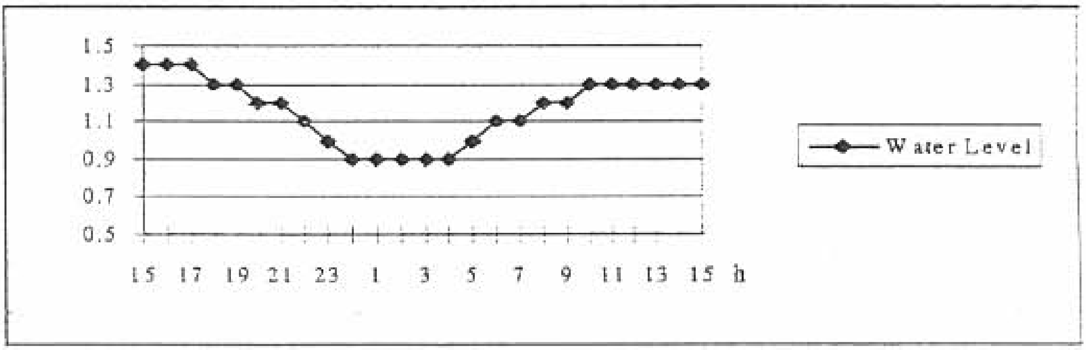
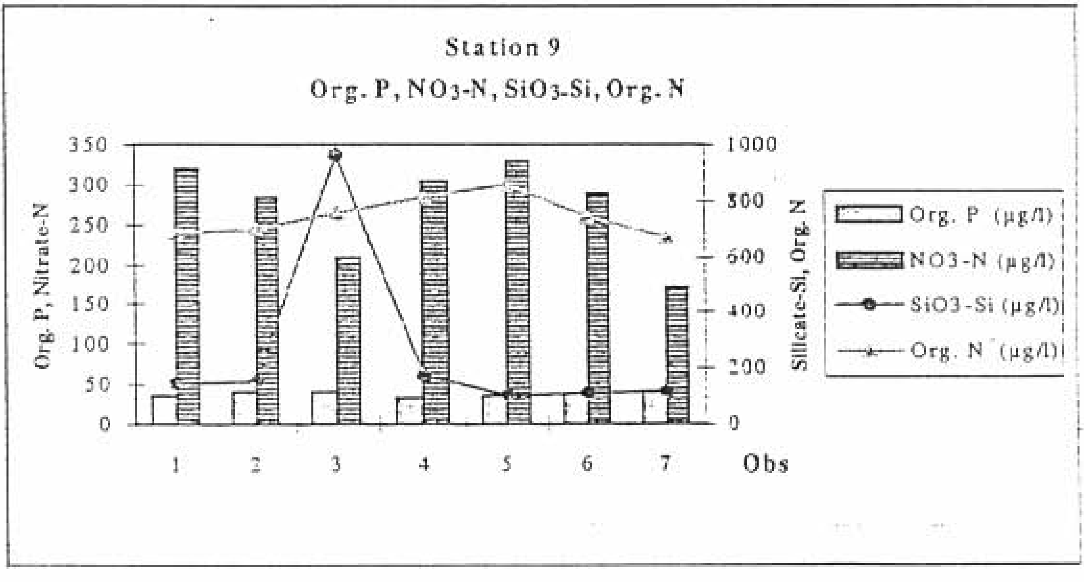


Figure 11: *Temporal variation of surveyed parameters in surface layer (Station 9)*







Chemical composition of bottom sediments:

Originally there are 2 sediment types in Nha Trang: (1) relict sediments, mainly sandy in grain size, distributing in offshore area in northern part of the bay; (2) modern sediments distribute along the channel which is paralel with the Nha Trang beach; they are principally sandy mud and mud (Pham Van Thom, 1990). The second type of sediment were collected for studying quality of bottom sediment. Chemical composition of them is summarized in Table 3.

Table 3: *Chemical composition of modern sediment in Nha Trang bay*

Station (Sample)	Org.C (µg/g)	Org. N (µg/g)	Total P (µg/g)	Fe (µg/g)	Mn (µg/g)	Zn (µg/g)	Cu (µg/g)	Pb (µg/g)	As (µg/g)
1	5400	385	116.3	15000	176.7	1.7	5.8	0.3	7.1
2	25000	344	107.5	26000	185.6	12.1	4.6	0.6	7.6
3	10900	543	167.5	13500	129.5	5.0	10.3	0.1	2.3
17	6200	459	140.6	26000	320.0	5.3	13.5	1.3	7.2
9	12000	549	167.5	13000	80.5	2.3	7.3	0.1	3.7
12	7000	848	248.4	15000	104.4	4.3	7.8	0.1	2.9

Data in the table indicate the moderate variation ranges of determinants. Among analyzed heavy metals iron and manganese were most abundant and Pb existed in negligible amount.

3. Discussion:

Water quality:

Water quality in Nha Trang bay is evaluated using criteria described in Vietnamese Fishery Standard (MOSTE, 1995) for DO, BOD, SM, heavy metals hydrocarbon and Chinese Fishery Standard (Guao Shenquan et al., 1991) for nitrate, phosphate and COD (because of the lack of these criteria in Vietnamese Fishery Standard).

Statistic data presented in Table 4 show that:

- In period of the 3 surveys had been performed by the program Nha Trang bay is not polluted by suspended matter, BOD, phosphate, maganese, copper, lead and hydrocarbon; concentration of dissolved oxygen is higher than minimum permitable limit described in the standard.

- Average values of COD, nitrate, iron and zinc are always higher than critical values. The pollution coefficients of these pollutants vary from 2.83-6.26, 1.99-2.30,1.38-3.08, and 1.19-1.82 respectively. Pollution coefficient of COD is lowest in February 1997 survey and one of iron is highest in December 1996 survey. Appearance frequency of values greater than permitable limit of water quality parameters in different surveys (calculated from the data in the Anexes 1-3) as below:

December 1996 survey: COD 100%, nitrate 76.19%, Fe 100% and Zn 57.14%.
February 1997 survey: COD 100%, nitrate 100%, Fe 100%, Zn 60% and As 100%.
April 1997 survey: COD 100%, nitrate 100%, Fe 91.66% and Zn 75%.

- Arsenic pollution exited only in Feb. 1997 survey (pollution coefficient is 1.80).

Table 4: *Pollution coefficients of some parameters in 3 surveys (Nha Trang bay)*

Parameter	Unit	Average Value			Criteria	Pollution Coefficient		
		Dec. 1996	Feb. 1997	April 1997		Dec. 1996	Feb. 1997	April 1997
DO	mg/l	6.54	6.43	6.47	≥5	0.76	0.78	0.78
SM	mg/l	4.2	3.1	1.8	50	0.08	0.06	0.04
BOD_5	mg/l	0.66	1.78	0.88	10	0.07	0.18	0.09
COD	mg/l	18.77	8.48	17.56	3⁺	6.26	2.83	5.85
NO_3-N	μg/l	202	230	199	100⁺	2.02	2.30	1.99
PO_4-P	μg/l	2.6	1.8	3.0	15⁺	0.17	0.12	0.20
Iron	μg/l	308	168	138	100*	3.08	1.68	1.38
Manganese	μg/l	3.7	1.2	0.6	100*	0.04	0.01	0.01
Zinc	μg/l	11.9	13.9	18.2	10*	1.19	1.39	1.82
Copper	μg/l	5.7	4.6	6.4	10*	0.57	0.46	0.64
Lead	μg/l	0.7	1.4	0.4	50*	0.01	0.03	0.01
Asenic	μg/l	6.1	18.0	9.8	10*	0.61	1.80	0.98
Hydrocarbon	μg/l	214	-	108	300⁺	0.71	-	0.36

* Vietnamese fishery standard (MOSTE, 1995)
⁺ Chinese fishery standard (Guao Shenquan et al., 1991)

Another problem is the apparent abundance of nitrate concentration in comparison with phosphate concentration. In rainy season survey the nitrate/phosphate molar ratios varied from 88.56-464.94 with average value 199.62. In organic matters N was also dominant but the difference between their concentrations was decreased: organic N/ organic P molar ratios varied 24.57 đến 84.25, average value was 47.22.

In dry season survey somewhat lower values were found for both N/P ratios (76.65-398.57, average 163.98 for nitrate/phosphate and 12.88-45.09, average 28.33 for organic N/ organic P.

The above ratios prove the limiting role of phosphorous in trophic regime of Nha Trang bay in both dry and rainy seasons.

In the other hand. the COD are always very high in comparison with BOD and permanganate indice while values of the two later is often similar. This phenomenon suggests the abundance of organic carbon derived from terrigenous organic matters in surveyed waters.

Sediment quality:

Organic matter contents in bottom sediment in Nha Trang bay is not very high. Concentrations of heavy metals are also acceptable except for the case of iron. In rainy season when water temperature of bottom layer increase and DO decrease iron can be redissolved and concentration of the metal in water can exceed the critical value.

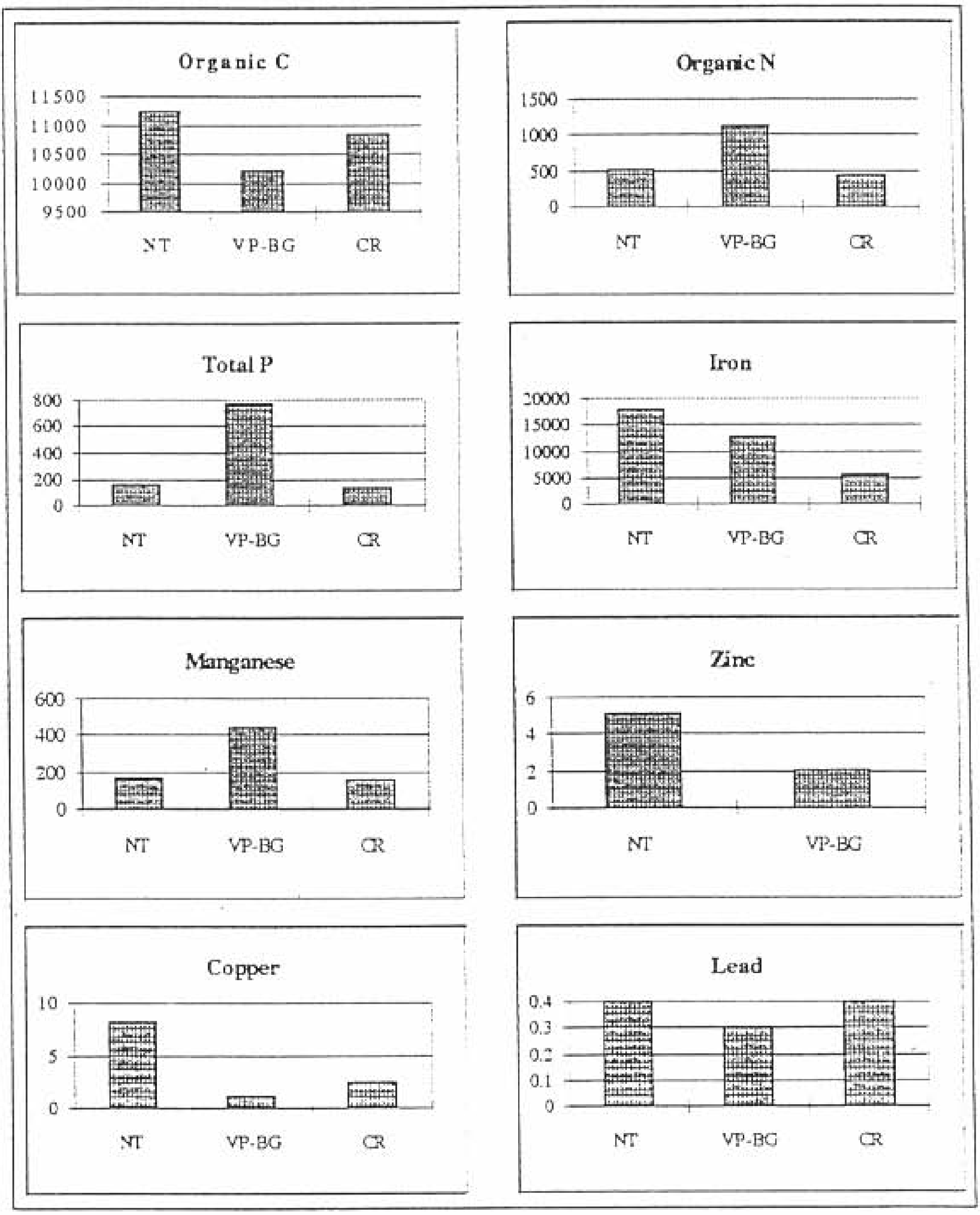
For comparison purpose, quality of bottom sediment in Nha Trang bay (NT) are presented in Figure 12 together with ones of Van Phong-Ben Goi (VP-BG) and Cam Ranh (CR) bays where the influence of aquacultural activities is more important. The figure indicates that sediments in Nha Trang bay are rich in organic carbon, iron, zinc and copper in comparison with sediments in other bays. The first two elements are from natural source and the last two are mainly derived from agriculture (in Cai river and Dinh river basins). The influence of aquaculture is not important yet.

4. Conclusion

For conclusion it is possible to state that the environmental quality of Nha Trang in present time is relatively good. There is the light pollution of nitrate, iron, zinc and moderate pollution of organic contamminants. Even the concentration of nitrate alsway exceed the permitable limit but the phytoplankton bloom rarely occurs because of the low concentration of phosphate, the limiting nutrient in the surveyed waters. However, the hight concentration of nitrate in the bay, especially in the northern part promoting the growth of marine plant may be the factor prohibit the recovery of coral reefs in this part of the bay, as reported by Pham Van Thom and Vo Si Tuan (in press).

The characteristic of trophic regime suggests that the control of phosphorous containing compounds in the waste discharging into the bay is necessary. An advisor in the use of fertilizers, pesticides and herbicides (containing P and zinc, copper...) is also a meaningful action in the prevention of marine pollution in the bay.

Figure 12: *Comparison of concentrations of contamminants (ppm) in sediments in the bays of Khanh Hoa Province*



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Pham Van Thom and Vo Si Tuan, in press: The characteristics of environmental chemistry and the possible relation between them and the degradation of coral reefs in Nha Trang bay.

Annex H

CONCEPT PAPER ON THE FRAMEWORK FOR MARINE POLLUTION MONITORING AND INFORMATION MANAGEMENT NETWORKING

CONCEPT PAPER ON THE FRAMEWORK FOR MARINE POLLUTION MONITORING AND INFORMATION MANAGEMENT NETWORKING

Introduction

As discussed during the Inception Workshop of the Regional Network on Marine Pollution Monitoring and Information Management held in the Philippines on 8-10 April 1997, the exchange and access of information, data and technical advice by the participating countries relevant to marine pollution monitoring is necessary to harmonize efforts in the region.

The exchange and access of information, data and technical advice will involve scientific organizations, academic institutions, marine research centers and government organizations in the eleven member countries in East Asia. Networking, therefore, is an essential mechanism to facilitate such exchange and access of information.

Networking would facilitate the transfer of information among network members; hence, updated data would be available for decision makers. Networking would also promote the harmonization of pollution monitoring and analytical measurements techniques. This would also address some issues on quality assurance/quality control in the generation of marine environmental data.

Member countries would be able to get information on the state of marine and coastal environment in the East Asian countries and other information generated by demonstration sites, standardize parameters and exchange monitoring protocols.

Objectives of the network

The objectives of the network are:

1. To collate published and unpublished information on marine pollution at specific sites among the countries.
2. To document the information into a database network system
3. To facilitate information exchange and communication to various users (e.g. scientists, resource managers, NGO's, etc.) in the region.
4. To propose a protocol on data access and use of network data and information
5. To establish a functional and mutually-advantageous network of marine pollution researchers and institutions in the region
6. To provide technical assistance to members to address specific needs in marine pollution monitoring and facilitate access to protocols and information relevant to the implementation of marine pollution programs.

Advantages in joining the network

Among the benefits in joining the network are:

1. Easy access to information on the state of the marine environment at specific sites (i.e., parallel sites) including information on pollutants and pollution monitoring protocols used.

2. Depending on need, training of staff on field and laboratory techniques for marine pollution monitoring that can be conducted within participating countries or in one of the countries in the region.

3. Standard reference materials for key contaminants in water, sediments and biota to two member laboratories per country.

4. Subscription to the Internet for those members that have no ready access to the facility to two member institutions per country.

5. One-year subscription to the publication, "Marine Pollution Research Titles" to two member institutions per country.

6. Access to a mechanism to answer specific questions/issues related to marine pollution through an email-based "mailing list" whose subscribers shall be network members.

7. Regular updates via the network web-page on the latest articles, technologies, and information relevant to marine pollution monitoring.
   Members of the MPMIM network can join the networking.

On the other hand, the obligations of the network members are:

1. To provide staff to regularly liaise with the network via e-mail or through the Internet

2. To provide every three months data/information generated from marine pollution monitoring efforts in the network member's country and at specific sites;

3. To abide by the agreements stipulated in the use of the network data and information

Data formats and information exchange mechanisms

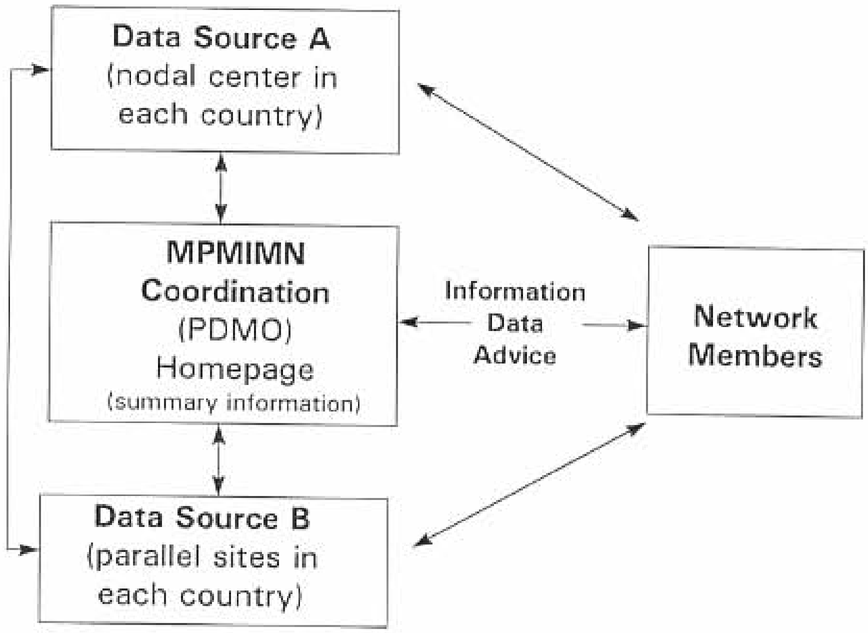
Data shall be in tabular and graphical formats depending on the type of information required. Each network node shall maintain databases which shall form the metadatabase for the network.

Exchange of information shall be through Internet or e-mail. Each network member country shall maintain and catalogue information on marine pollution monitoring. The catalogue shall include information on the data set, date acquired, sources of information, accessibility of information and other related data. The exchange of information shall be governed by the statement of agreement to be formulated by the MPMIM network in consultation with its members.

The proposed structure of the network is illustrated in Fig. 1.

Data quality assurance/data control activities to be pursued

Activities shall be undertaken to strengthen QA/QC practices in the region. These will include interlaboratory calibration exercises and training on field and laboratory techniques in marine pollution monitoring.



Data source A: Summary/raw data be deposited at each nodal center (i.e., member country) in the region.

Data source B: Summary/raw data are kept by the owners of the data (i.e., parallel sites). A description of types of information held at each 'site' would be included in the metadirectory.

Exchange and access of information/data and advice will be through web-page, e-mail, letter or fax.

Figure 1. MPMIM Network Structure

TECHNICAL ASSISTANCE PROGRAM TO SUPPORT ICM SITES DEVELOP AND IMPLEMENT A MARINE POLLUTION MONITORING AND INFORMATION SHARING NETWORK

TECHNICAL ASSISTANCE PROGRAM TO SUPPORT ICM SITES DEVELOP AND IMPLEMENT A MARINE POLLUTION MONITORING AND INFORMATION SHARING NETWORK

Introduction

ICM parallel sites have been developed and established in several countries as a result the demonstration efforts of the MPP-EAS. A major thrust of this component is to develop a networking system that would enable the participating countries/network members to exchange and share information on monitoring parameters, results, protocols, and other information related to marine pollution monitoring in East Asia.

As envisioned by the Programme, one to two ICM parallel sites in each country shall be invited to join the MPMIM Network to share and exchange results of marine pollution monitoring efforts with the other ICM sites. With this, the MPMIM Network shall assist the parallel sites develop and implement a monitoring and information management system that would be linked with the metadatabase of MPMIM Network.

Areas to be covered by the TA program

The technical assistance program shall cover the following:

1. development of marine pollution monitoring information database using the Internet as a platform that would form part of the MPMIM network;

2. depending on need, training of staff on field and laboratory techniques for marine pollution monitoring that can be conducted within participating countries or in one of the countries in the region.

3. standard reference materials for key contaminants in water, sediments and biota to two member laboratories per country.

4. subscription to the Internet for those members that have no ready access to the facility to two member institutions per country.

5. subscription to the publication, "marine pollution research titles" to two member institutions per country.

6. access to a mechanism to answer specific questions/issues related to marine pollution through an email-based "mailing list" whose subscribers shall be network members.

7. regular updates via the network web-page on the latest articles, technologies, and information relevant to marine pollution monitoring.

Availing the TA program

Parallel sites, one to two from each country can avail of the various technical assistance programs by submitting a proposal to the MPMIM Network outlining the issues to be addressed and the proposed system to be developed. Parallel sites shall put up local costs such as personnel, purchase of necessary equipment and other facilities needed in the establishment of the system.

A Memorandum of Understanding shall be drawn between the parallel site and the MPMIM through the MPP-EAS, related to the technical assistance.

MEMORANDUM OF AGREEMENT

KNOW ALL MEN BY THESE PRESENTS:

This Memorandum of Understanding is entered into by and among:

The **International Maritime Organization** (IMO) with office address at 4 Albert Embankment, London SE1 7SR, United Kingdom, herein represented by the Programme Manager of GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, **Dr. Chua Thia-Eng** with ofice address at DENR Compound, Visayas Avenue, Quezon City 1100, Philippines;

and

____, with office address at ____________ ____, herein represented by its ________________, ______________________.

WITNESSETH

WHEREAS, IMO which has the experience and expertise to control, manage and prevent marine pollution arising from land- and sea-based sources is the executing agency of the GEF/UNDP Regional Programme for the Prevention of Marine Pollution in the East Asian Seas, herein referred to as the Programme;

WHEREAS, one of the major thrusts of the Programme is the establishment of regional networks of research/academic institutions interested in integrated coastal management, marine pollution monitoring and information exchange closely linked with the Programme Demonstration Sites through the concept and spirit of south-south cooperation (SSC) and technical cooperation among developing countries (TCDC);

WHEREAS, one of the components of the Programme is the Marine Pollution Monitoring and Information Management which aims to establish a network in the region among research and academic institutions, marine research centers and government agencies involved in marine pollution monitoring;

WHEREAS, the network shall include exchange and access of information among and between the network members to enhance the use of marine pollution monitoring data in management and decision making purposes;

WHEREAS, the Programme shall assist the start up of ICM parallel sites, through technical assistance in developing and implementing a marine pollution monitoring and information sharing network;

WHEREAS, ________________(country/network member) has expertise on, and been involved in marine pollution monitoring in (country); and a member of the MPMIM Network;

WHEREAS, (country) has selected ____ site/s namely: (Site 1 and Site 2) as recipient of the technical assistance.

NOW, THEREFORE, in recognition of the above, the parties hereby agree as follows:

1. That parties shall cooperate with each other in implementing the mutually agreed activities related to marine pollution monitoring, information management and integrated coastal management in the East Asian Seas;

2. That (Sites 1 and 2) shall serve as parallel sites in developing and implementing marine pollution monitoring and information networking;

3. That the Programme shall assist country/network member in the following::

   a. Development of a marine pollution monitoring information database using the Internet as a platform that would form part of the MPMIM Network;

   b. Capacity building through:

      i) Training of staff on field and laboratory techniques for marine pollution monitoring;

      ii) Provision of standard reference materials for key contaminants in water, sediments and biota to two member laboratories in the country;

      iii) Connection subscription to the Internet for those members that have no ready access to the facility.

   c. Subscription to the publication, "Marine Pollution Research Titles" to two member institutions in the country.

   d. Development of a network helpline to answer specific questions/issues related to marine pollution

   e. Regular updates on the latest articles, technologies, and information relevant to marine pollution monitoring.

4. That (the country/institution) shall:

   a. provide staff to regularly liaise with the network via e-mail or through the Internet

   b. Submit data/information generated from marine pollution monitoring efforts in the network member's country and at specific sites;

   c. abide by the agreements stipulated in the use of the network data and information management system.

IN WITNESS WHEREOF, the parties have here unto affixed their signature on this _________ day of __________, 1995 in _________.

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CHUA THIA-ENG
Programme Manager
GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas