Intergovernmental Oceanographic Commission

Workshop Report No. 59

IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring, Research, Control and Abatement in the Wider Caribbean

San Jose, Costa Rica, 24-30 August 1989

Part 1 Report

Part 2 Marine Pollution Assessment and Control Programme for the Wider Caribbean Region - CEPPOL

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No.	Title	Publishing Body	Languages
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia (Report of the IDOE Workshop on); Bangkok, Thailand 24-29 September 1973 UNDP (CCOP), 138 pp.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974 (Unesco Technical Paper in Marine Sciences, No. 20).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish (out of stock)
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock)
4	Report of the Workshop on the Phenomenon known as "El Niño", Guayaquil, Ecuador, 4-12 December 1974.	FAO Via delle Terme di Caracalla 00100 Rome, Italy	English (out of stock) Spanish (out of stock)
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
7	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/Unesco/EAC, Nairobi, Kenya, 25 March-2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock) Russian
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish (out of stock)
11 Suppl.	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
12	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, Fort-de-France, Martinique 28 November-2 December 1977.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, Port of Spain, Trinidad, 16-18 January 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific, Santiago de Chile, 6-10 November 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Russian
17	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
17 Suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
18	IOC/Unesco Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (Unesco reports in marine sciences, No. 4)	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) French Spanish (out of stock) Russian
19	IOC Workshop on Marine Science Syllabus for Secondary Schools, Llantwit Major, Wales, U.K., 5-9 June 1978 (Unesco reports in marine sciences, No. 5).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian Arabic
20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
21	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
22	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Russian
24	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
25	Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (superseded by IOC Technical Series No. 22)
26	IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September-5 October 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
27	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Nouméa, New Caledonia, 9-15 October 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes Lima, 20 April-5 May 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
29	WESTPAC Workshop on Marine biological methodology Tokyo, 9-14 February 1981.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
30	International Workshop on Marine Pollution in the South-West Atlantic Montevideo, 10-14 November 1980.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English (out of stock) Spanish
31	Third International Workshop on Marine Geoscience Heidelberg, 19-24 July 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
32	UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime Paris, 27 September - 1 October 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish

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FOREWORD

In keeping with the decisions taken by the Fourth Intergovernmental Meeting on the Action Plan and First Meeting of the Contracting Parties to the Convention of the Caribbean Environment Programme (Guadeloupe, French Antilles, 26-28 October 1987), as well as by the Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (Havana, Cuba, 8-13 December 1986) and within the framework of the Joint IOC-UNEP Project on the "Assessment and Control of Marine Pollution in the Wider Caribbean", IOC and UNEP convened this Regional Workshop to Review Priorities for Marine Pollution Monitoring, Research, Control and Abatement in the Wider Caribbean.

The main purpose of the Workshop was to formulate a draft of a regionally co-ordinated comprehensive programme for the assessment and control of marine pollution for the Wider Caribbean, to be presented for approval by the Contracting Parties of the Caribbean Environment Programme and by IOC/IOCARIBE, taking into account the present knowledge of the state of pollution in the Wider Caribbean Region and the needs and requirements of the States participating in the Caribbean Environment Programme, as well as in the IOC-IOCARIBE Programmes.

The regionally co-ordinated comprehensive programme is intended:

(i) To be based on marine pollution research and monitoring activities sponsored in the past and at present by IOC and UNEP in the Wider Caribbean Region, as well as by other organizations and governments;

(ii) to include research and monitoring of the sources, distribution, levels, effects and transformation of marine pollutants carried out according to commonly agreed methods;

(iii) to provide a mechanism for the assessment of the magnitude of the environmental problems caused by marine pollution;

(iv) to contribute to the strengthening of the capabilities of national institutions to carry out marine pollution monitoring and research and to formulate and apply pollution control measures;

(v) to develop proposals for pollution control and abatement measures which may be adopted by the States participating in the Caribbean Environment Programme and in the IOC-IOCARIBE Programmes as applicable in the region; and

(vi) to develop preventive measures for pollution control such as environmental education and public awareness programmes.

The marine pollution monitoring and research component of the programme also contributes to the Global Environment Monitoring System (GEMS) of UNEP and to the Global Investigation of Pollution in the Marine Environment (GIPME) of IOC and its Marine Pollution Monitoring System (MARPOLMON).

The participants to the workshop were selected by the Secretariats of UNEP and IOC and were invited to attend in their personal expert capacity. In selecting participants, IOC and UNEP were guided by proposals received from UNEP's National Focal Points for the Caribbean Environment Programme and from IOC's Action Addresses, as well as by the relevance of the prospective participants to the subject matter of the meeting. The List of Participants is appended as Annex II to this report.

CONTENTS

PART 1

PART 2

MARINE POLLUTION ASSESSMENT AND CONTROL PROGRAMME FOR THE WIDER CARIBBEAN REGION - CEPPOL

ANNEXES

PART 1

REPORT OF THE WORKSHOP

1. OPENING OF THE MEETING

The meeting was opened on 24 August 1989 at 10:30 a.m. at the Chemistry School of the University of Costa Rica with inaugural addresses by the Secretary of IOC, Mr. Gunnar Kullenberg; the Co-ordinator of the Caribbean Environment Programme of UNEP, Mr. S lvano Briceño; the President of the University of Costa Rica, Mr. Luis Garita, and the Minister for Natural Resources, Energy and Mines of Costa Rica, Mr. Alvaro Umaña. They all highlighted various aspects of the subjects to be covered by the meeting, emphasizing inter alia the need for international co-operation in, and co-ordination of monitoring, research, control and abatement activities, so as to ensure that results are properly used in a socio-economic context. The need to obtain a holistic view of the problem was emphasized and they concluded that the meeting was very timely and that the co-operation between UNEP and IOC should be supported and should involve the respective regional bodies of these organizations.

2. ADMINISTRATIVE ARRANGEMENTS

2.1. ADOPTION OF THE AGENDA

The meeting adopted the agenda (Document IOC/UNEP-RRW-I/1) as amended and it is attached as Annex I to this report. The List of Documents (IOC/UNEP-RRW-I/4) is appended as Annex III to this report.

2.2. ELECTION OF OFFICERS

The meeting unanimously elected the following officers:

Chairman:	Mr. Gunnar Kullenberg, Secretary IOC
First Vice-Chairman:	Mr. Manuel Murillo, University of Costa Rica
Second Vice-Chairman:	Mr. Barry Wade, Jamaica
Rapporteurs:	Mr. Manuel Alepuz, Cuba Mr. Wayne Hunte, Barbados

3. MARINE POLLUTION MONITORING AND RESEARCH PROGRAMMES RELEVANT TO CONTROL AND ABATEMENT : PAST, ON-GOING AND PRIORITIES

Mr. A. V. Botello introduced the draft paper (IOC/UNEP-RRW-I/6 prov.), highlighting the development of relevant programmes since the International Workshop on Marine Pollution in the Caribbean and Adjacent Regions (Trinidad and Tobago, December 1976). All participants were urged to provide comments in writing to the Secretariat, which would be taken into account in the preparation of the final version of the document.

Comments of general interest made in the subsequent discussions included: (i) the need to include in the document implementation costs of the programmes executed in the past; (ii) the importance of formulating proposals during the present meeting which are realistic and demonstrate a positive possibility of implementation, focusing on activities which can be implemented; (iii) the need to include training and the associated exchange and dialogue between laboratories participating in the monitoring and research networks; (iv) the need to seek financial support from all possible

sources (the Organization of American States, the World Bank, regional development banks, etc.); and (v) the need to use results from past and future activities in the formulation of measures for control and abatement. On this last point, reference was made to the CARIPOL results indicating that these should be used to formulate control measures based on a regional assessment of the data. It was recommended that marine debris, plastics and other persistent materials must be included in the proposed programme and that technical information relevant to the region should be published regularly in the form of a newsletter. In this context, it was suggested that the existing CEPNEWS publication from CAR/RCU could be used. It was mentioned that, in addition to strengthening the capabilities of existing institutions, more laboratories needed to be established to fill in gaps in coverage. It was also noted that a review of the existing technical capabilities of some laboratories of the region had been initiated recently and that this information should be used as the basis for the establishment of the regional network of laboratories. However, to date, this review has only included a limited number of laboratories, mostly CARIPOL participants, who responded when contacted. Thus, there exists the need to complete and finalize this evaluation exercise of laboratories in order to cover all available facilities in the region. All participants agreed to provide the Secretariat with written comments on this document during the meeting, which they did and these have been duly taken into account to the extent possible for its finalization.

The final version of this document appears as Annex VI to this report.

4. PRESENT STATE OF MARINE POLLUTION AND ITS CONTROL AND ABATEMENT

Mr. E. Mandelli (IOC-UNEP Consultant) presented the draft paper "State of Marine Pollution, Priorities and Strategies for its Control and Abatement in the Wider Caribbean Region" (IOC-UNEP/RRW-I/7 prov). He emphasized that the draft had been prepared in order to stimulate further contributions from participants in the meeting and provide all possible additional information. Several participants, and in particular, the participants from US/NOAA and US/EPA, confirmed that they would provide the Secretariat with a considerable amount of additional information, which they did and it has been taken into account to the extent possible for the finalization of this document.

Comments made in the subsequent discussions included: (i) several other organizations besides IOC and UNEP could make important contributions to the programme, for example, the IAEA through the Monaco Laboratory, in particular, with respect to intercalibration exercises. Reference was made in this context to the on-going joint UNEP-IAEA-IOC project on the establishment of a global framework to provide technical support to marine pollution research and monitoring, with emphasis on methodological developments, quality control of data, the preparation of reference methods, standards and reference materials.

Several participants suggested that more emphasis should be placed on the subject of control and abatement of marine pollution in order to ensure a closer relationship of research and monitoring in this area. It was also noted that there was a need to give consideration to the transboundary movement of hazardous wastes and its control, as this constitutes a serious problem in some parts of the region. In this context, reference was made to the Basel Convention.

The point was made that there was a need to have an integrated view of regional problems influencing the marine environment including: (i) land-use changes; (ii) soil degradation; (iii) deforestation; (iv) coastal water; (v) watersheds; (vi)

lagoons and estuaries; (vii) siltation; (viii) sedimentation changes; and (ix) to define the boundary of the coastal areas. Several participants emphasized the need for improved environmental education and the creation of public awareness as basic elements of preventive measures and to take cultural attitudes and socio-economic aspects into account when formulating and implementing the programme. The problems arising from increased erosion of the coastal land areas were considered very important and it was pointed out that this was also being included in several other programmes, e.g., the Ocean Science in Relation to Non-living Resources Programme (OSNLR) of IOC-UN(OALOS). Additionally, reference was made to the need to include marine debris as a major marine pollution problem and the existing review of the present situation in the Gulf of Mexico. The importance of establishing a mechanism for regular communication between laboratories and institutions participating in the envisaged networks was also stressed. Reference was made to the existence of a large amount of grey literature, as well as to the need to take this information into account and to establish a central depository for such literature. It was emphasized that the information presented should be up-dated and all participants agreed to provide additional inputs to the draft document during the meeting. Most participants did provide information which has been taken into account to finalize the document. It was stressed by several participants that the control strategy to be developed should also include preventive measures. It was also suggested at the meeting that, in addition to the development of a regional protocol for transboundary movements of hazardous wastes as a supportive element to the Basel Convention, the countries of the region should establish appropriate national legislation to prohibit the importation of hazardous wastes into their territories.

The completed version of the document appears as Annex VII to this report.

5. IDENTIFICATION OF IMMEDIATE AND LONG-TERM PRIORITIES FOR MARINE POLLUTION ASSESSMENT, CONTROL AND ABATEMENT

The draft "Framework for a Regionally Co-ordinated Comprehensive Programme for Marine Pollution Assessment and Control for the Wider Caribbean" (document IOC-UNEP/RRW-1/8 prov.) was introduced by the Secretariat as the joint IOC-UNEP framework for the programme, to be completed during the meeting by the participants. The need for an integrated and regional approach was emphasized, with co-ordination of the different activities among organizations, so as to avoid duplication and dispersion of efforts. Hence, the need for a joint programme which should also involve other organizations (such as FAO, IAEA, WHO, IMO) in subject areas of their competence, and to ensure a co-ordination between these activities. It was pointed out that the financial estimate included in the draft for the different components was meant as an indication of the expected magnitude of the support. It was explained that the 4 annexes in the draft were expected to be completed during the meeting by the participants.

Considerable discussions followed the presentation and points made included: (i) the need to refer to the development achieved so far in the region (this is considered in the previous documents); (ii) the need to pursue a global integrated approach including the interactions between the different parts of the environment (land, freshwater, sea); (iii) the importance of the coastal zone was emphasized by the need for land and sea-use planning; (iv) the increasing population pressure at the coast together with the increasing but often conflicting uses, makes coastal zone management an urgent task and experiences from various parts of the region can guide the development of pilot projects. Once more, public awareness and environmental education were considered essential elements; (v) the need to co-ordinate existing monitoring programmes was emphasized as part of the present comprehensive programme;

and (vi) the need to use national plans and projects as building blocks was stressed, as well as the importance of involving other organizations, other than IOC and UNEP in the comprehensive programme (e.g., IAEA, FAO, IMO, WHO). Additionally, it was noted that the strategy should include restoration, preservation, prevention and protection as elements or approaches for planning and management. It was also noted that there is a strong need to increase the exchange of relevant pollution data and establishing appropriate mechanisms for its dissemination and to elaborate inventories of land-based sources of pollution taking into account the conflicting uses of the parts of the marine environment and the resources under consideration. This is the case particularly for the coastal zone, where quality parameters and criteria need to be defined and applied for the different uses or activities and again, the integrated approach was stressed in this context. Regarding land-based sources of pollution, the need to develop a protocol relating to this subject was emphasized, and in this context, reference was made to on-going activities for this purpose (see agenda item 7). In general, the participants largely indicated satisfaction with the draft document.

6. REGIONALLY CO-ORDINATED COMPREHENSIVE PROGRAMME FOR MARINE POLLUTION ASSESSMENT AND CONTROL

The Secretariat proposed that in order to facilitate the completion of the comprehensive programme document and its Annexes (IOC-UNEP/RRW-1/8 prov.), the meeting should divide itself in 4 working groups, and that each group would address a priority subject area. It was emphasized that the formulation of the comprehensive programme should be completed on the basis of identified immediate and long-term priorities. The 4 subject areas of the working groups were:

(i) Industrial pollution, including mining activities;

(ii) pollution from agriculture and land-use activities, including pesticides;

(iii) domestic sources of pollutants and physical modification of the coastal zone; and

(iv) marine based sources of pollution, including oil, marine debris and dumping.

Each group was to consider all the annexes and all the elements of implementation referred to in the draft document (Section 4), as well as the related implementation mechanisms and the resources required (human, infrastructure, equipment and financial). It was specifically explained that this procedure would help bridge the gap between the research/monitoring and control/abatement elements, which has been identified as being a problem in previous programmes. The meeting agreed to this approach.

During the discussion of the subject areas reflected in this report, it was pointed out that an approach along these lines had worked in the formulation of other regional programmes. The necessity for specific recommendations on control and abatement to be urgently initiated on a regional scale was also emphasized. Agreement was reached that the integration and co-ordination between the 4 elements was a necessity. Additionally, it was proposed and agreed that a fifth annex on control and abatement should be added to the comprehensive programme document.

Four working groups were subsequently established composed of a Chairman and Rapporteurs.

The working groups were requested to include consideration of several specific items as appropriate, besides the completion of the annexes and other relevant parts of the draft document. In addition to the elements mentioned in the draft document (namely monitoring, baseline studies, research, formulation of proposals for pollution control measures and assistance to the States in the implementation of pollution control measures) other items for discussion included: (i) information exchange; (ii) inputs and sources of contaminants; (iii) assessments; (iv) public awareness and environmental education; and (v) institution strengthening, regulatory action and legal frameworks.

Following this, Mr. L. Mee made a brief presentation of the joint UNEP-IAEA-IOC global programme for technical support and of the activities of the joint Marine Environment Studies Laboratory (MESL)

The meeting thereafter split into the 4 working groups. Progress made by the groups was reported in plenary sessions once a day. This also allowed for exchange between the groups.

Systematic summaries of the discussions and proposals of each of the working groups are presented in Annex IV of this report. The summaries define a statement of each problem, the status of prior activities, requirements for new actions, the existing regional capacity to address the problem and proposed actions and priorities. Estimates of the level of support required were submitted to the Secretariat for subsequent analysis and integration (see Annex V).

The main activities identified by the working groups as priorities to be undertaken in the 1990-1991 biennium are the following:

(i) The preparation of 2 inventories on: (a) the major sources of contaminants (sources, types, levels, treatment available, etc.); and (b) land-use changes and agro-chemical use in the region. These will provide the required information to develop appropriate control measures, as well as suitable monitoring and research activities;

(ii) the preparation of baseline studies for pesticides and organo-tin compounds by conducting pilot surveys in selected areas where this type of contamination is likely to be present, with the aim of formulating a regional monitoring programme for these contaminants, if appropriate;

(iii) the development of 4 research programmes to include:

a) Common and appropriate methodology and standards for bacterial pathogens in bathing and shellfish-growing waters.

b) The transfer, fate and effects in the marine environment of pesticides, mainly organo-phosphates and carbonates.

c) The effects of suspended material and nutrients on critical marine ecosystems.

d) The recuperation rates of marine ecosystems or organisms following their mechanical damage or exposure to specific pollutants.

(iv) based on existing information, 3 regional monitoring programmes were proposed for hydrocarbons and tar; marine debris; and faecal pathogens in bathing and shellfish growing waters; and

(v) three regional control and abatement activities were also proposed: (i) the establishment of tropical coastal water quality standards appropriate for the region; (ii) the development of control measures for industrial and domestic wastes (including effluent standards, education on public awareness, etc.); and (iii) assistance to the countries for the implementation of existing legal instruments (the London Dumping Convention (LDC), MARPOL 73/78, the Cartagena Oil Spill Protocol, etc.) to control oil pollution.

A full description of these projects is outlined in Annexes I to V of the completed comprehensive programme document which has been prepared as a separate report (IOC-UNEP/RRW-I/8) by the IOC and UNEP Secretariats using the results from the Workshop and the inputs provided by the participants.

7. OTHER MATTERS

Various participants were encouraged to make short presentations of other regional, sub-regional or national on-going programmes or activities of relevance to CEP POL.

On behalf of US/NOAA, Mr. John Calder, presented a national programme being carried out in the United States of America. The US National Oceanic and Atmospheric Administration (NOAA) has developed and presently maintains and updates a computer-based database, the National Coastal Pollutant Discharge Inventory (NCPDI), concerning the input of pollutants from a number of categories of point and non-point sources to the coastal waters of the United States. Information is maintained in this database on inputs on a number of toxic trace metals and nutrients, as well as several categories of organic substances. The information in the database is obtained by using data already available gathered by other agencies, where possible and by using estimating techniques where actual measurements are not available. This database is used to provide assessment reports on various aspects of contaminant inputs. It contains information from all US continental coasts, including the Gulf of Mexico and is available for providing reports on inputs from this region to support pollution input assessments for the Wider Caribbean area. Mr. Andrew Robertson was referred as a contact for further information on the NCPDI database and the reports arising from its use.

Mr. James M. Coe of NOAA provided the Workshop with a briefing on the US Marine Debris Programme which is summarized as follows:

In response to widespread reports of entanglement of marine mammals, seabirds, sea turtles and other marine species, the US Congress established and funded the Marine Entanglement Research Program (MERP) within the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration. In evaluating the scale of the entanglement problem, the MERP quickly realized that marine debris and its impacts extended far beyond damage to marine life and that the strategies for its solution involved both ship-source and land-source solid waste disposal issues. To address this range of issues related to pollution by persistent debris in the marine and coastal environment, MERP is conducting research and monitoring, mitigation, and education projects throughout the United States. Research emphasis is on the evaluation of debris impacts on threatened, endangered or protected species.

Monitoring activities involve development of survey methodologies for beach and sea-borne debris, support for national beach clean-up programmes and the systematic monitoring of beach debris in national seashores on all US coasts. Mitigation activities are focussed on the identification and evaluation of promising technologies for debris reduction and control and on the prompt and efficient implementation of MARPOL 73/78 Annex V world-wide. Finally, education programmes have been established for specific industries known to be sources of marine debris (oil and gas shipping, plastics, tourism, fishing, etc.). Currently, MERP is supporting Marine Debris Information Offices in Washington, DC and San Francisco, California, to serve the general public. Mr. Coe assured the Workshop that the full range of products, experiences and contacts were freely available to the participants, as CEPPOL involves itself in the marine debris issue in the Wider Caribbean Region.

Mr. Eric Schneider, NOAA, presented a short report from the International Mussel Watch (IMW) Programme. The IMW is a proposed coastal ocean monitoring programme supported by the United Nations Environment Programme and the Intergovernmental Oceanographic Commission. The initial project will monitor chlorinated hydrocarbons, pesticides and poly-chlorinated biphenyls in bivalves collected from coastal marine waters throughout the world. The IMW intends to initiate this monitoring programme in the Wider Caribbean region and will work closely with qualified co-operating laboratories in the region. Mr. Schneider promised to send copies of the IMW Programme Plan to all the participants of the Workshop.

Mr. Douglas Lipka from the USA Environmental Protection Agency's (EPA) Gulf of Mexico Programme briefly informed the meeting of this programme and his presentation has been summarized as follows:

The USA Environmental Protection Agency's Gulf of Mexico Programme (formerly Gulf Initiative) is a Joint Regional Programme initiated by Region 4 in Atlanta and Region 6 in Dallas in response to emerging issues that threaten the environmental integrity of the Gulf. Emphasis will be given to pollution prevention oriented activities in an effort to keep ahead of the emerging environmental issues in the Gulf rather than waiting until major damage occurs to a vital natural resource. Its main objectives are to provide a forum to define and address environmental problems that face the Gulf of Mexico and to develop and implement a comprehensive strategy for managing and protecting the resources of the Gulf. The problems to be addressed in the comprehensive strategy will be selected using the following set of criteria:

(i) The nature and extent of the problem is cross-jurisdictional and pervasive in nature;

(ii) the problem results in a threat to beneficial uses of the Gulf's resources; and

(iii) a reasonable prospect for solution to the problem exists.

The Gulf of Mexico Programme is working on a 5-year time frame to develop the comprehensive plan and has just completed the first year of the Programme. EPA's approach is to co-ordinate the activities of the 5 Gulf coast states before initiating international aspects of the Programme.

The Report of a Workshop held in Puerto Rico on Land-based Sources of Marine Pollution (7-10 August 1989) was briefly presented and copies made available to the meeting. The report recommended inter alia:

(i) The development by UNEP/CEP of a Protocol for the control of marine pollution by land-based sources;

(ii) immediate steps be taken towards the abatement and control of marine pollution by the adoption of technology-based effluent standards;

(iii) the development of inventories of land-based sources of marine pollution; and

(iv) the development and implementation of a strategy for the control of marine pollution and resulting impacts utilizing the appropriate recommendations of the Montreal Guidelines.

Finally, information was presented which had been received from the regional office of IUCN in San José, Costa Rica, regarding this non-governmental organization's work in Central America. As its major regional priority, IUCN is engaged in a programme of integral management of forest resources in all of the countries of the region. The regional office currently has a specialist staff of 8 persons and promotes projects related with environmental education, the rehabilitation of eroded land, the rational exploitation of forest resources, among others.

It was clear from the information made available, that the activities of IUCN bear great relevance to the problems expressed by the participants with regard to monitoring land-use changes and promoting integral coastal land management. Close co-operation between IUCN and CEPPOL should be encouraged on these matters.

8. ADOPTION OF THE REPORT

The draft report of the meeting's deliberations was presented by the Chairman and it was adopted with additions and modifications as reflected in this document.

9. CLOSURE OF THE WORKSHOP

The Chairman of the meeting, Mr. Gunnar Kullenberg, closed the meeting at 6:30 p.m. on 30 August 1989. The participants expressed their satisfaction with the results of the Workshop and recognized the efforts of the Secretariats and the support staff, as well as of the local support group which provided not only well organized working conditions for the meeting, but also an environment of warm Costa Rican friendship and hospitality. Additionally, Mr. Laurence Mee, on behalf of UNEP, briefly outlined the objectives and goals of CEPPOL and stressed UNEP's interest and commitment to support the programme, provided that the Governments of the region will work within an integrated and concerted approach. He exhorted the participants to convey the recommendations and conclusions of the Workshop to their Governments, so that these proposals can be translated into concrete actions in the very near future. Finally, the representative from the Instituto de Oceanología of Cuba, on behalf of her Government, extended an invitation from her Government to host the next workshop of CEPPOL in their country. Both the Chairman and the representative from the University of Costa Rica, Mr. Manuel Murillo, also thanked the participants for the high quality of their inputs and the constructive spirit in which the meeting was conducted. The meeting also thanked the Government of Costa Rica for the support provided to the Workshop.

ANNEX 1

AGENDA

1. **OPENING OF THE MEETING**

2. **ADMINISTRATIVE ARRANGEMENTS**

   2.1 ADOPTION OF THE AGENDA
   2.2 ELECTION OF OFFICERS

3. **MARINE POLLUTION MONITORING AND RESEARCH PROGRAMMES RELEVANT TO CONTROL AND ABATEMENT: PAST, ON-GOING AND PRIORITIES.**

4. **PRESENT STATE OF MARINE POLLUTION AND ITS CONTROL AND ABATEMENT.**

5. **IDENTIFICATION OF IMMEDIATE AND LONG-TERM PRIORITIES FOR MARINE POLLUTION ASSESSMENT, CONTROL AND ABATEMENT.**

6. **REGIONALLY CO-ORDINATED COMPREHENSIVE PROGRAMME FOR MARINE POLLUTION ASSESSMENT AND CONTROL**

7. **OTHER MATTERS**

8. **ADOPTION OF THE REPORT**

9. **CLOSURE OF THE WORKSHOP**

ANNEX II

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ANNEX III

LIST OF DOCUMENTS

WORKING DOCUMENTS

IOC-UNEP/RRW-I/1	Agenda and timetable
IOC-UNEP/RRW-I/2	Annotated agenda
IOC-UNEP/RRW-I/3	Summary report (as IOC Workshop Report No.59)
IOC-UNEP/RRW-I/4	List of documents
IOC-UNEP/RRW-I/5	List of participants
IOC-UNEP/RRW-I/6	Past and On-going Marine Pollution Monitoring and Research Programmes Relevant to Pollution Control and Abatement in the Wider Caribbean
IOC-UNEP/RRW-I/7	State of Marine Pollution, Priorities and Strategies for its Control and Abatement in the Wider Caribbean
IOC-UNEP/RRW-I/8	Framework for a Regionally Co-ordinated Comprehensive Programme for Marine Pollution Assessment and Control for the Wider Caribbean

REFERENCE DOCUMENTS

1. IOC Workshop Report No.11 and Supplement	Report of the IOC-FAO-UNEP International Workshop on Marine Pollution in the the Caribbean and Adjacent Regions, Port of Spain, Trinidad and Tobago, 13-17 December 1976
2. UNEP, 1983	Action Plan for the Caribbean Environment Programme. UNEP Regional Seas Reports and Studies No. 26
3. UNEP, 1983	Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (including Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region). UNEP Regional Seas Conventions and Protocols

4.	UNEP(OCA)/CAR IG.2/4	Fourth Intergovernmental Meeting on the Action Plan for the Caribbean Environment Programme and First Meeting of Contracting Parties to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, Guadeloupe, French Antilles, 26-28 October 1987
5.	UNEP(OCA)/CAR WG 1/6	Report of the Meeting of Experts on the Caribbean Environment Programme, Mexico City, Mexico, 7-9 September 1988
6.	UNEP(OCA)/CAR IG.3/5	Report of the Seventh Meeting of the Monitoring Committee on the Action Plan and Special Meeting of the Bureau of Contracting Parties to the Convention for the Caribbean Environment Programme, Mexico City, Mexico, 12-14 September 1988
7.	UNEP(OCA)/CAR WG.1/3	Regional Overview of Environmental Problems and Priorities Affecting the Coastal and Marine Resources of the Wider Caribbean (Draft)
8.	UNEP(OCA)/CAR WG. 1/INF.3	Implications of Climatic Changes in the Wider Caribbean Region (Draft) (English only)
9.	IOC/UNEP/FAO, 1988	State of the Marine Environment in the Wider Caribbean Region (Draft) (English only)
10.	IMO, 1988	Strategy for the Protection of the Marine Environment (English only)
11.	UNEP, 1985	Marine Pollution from Land-based Sources (Environmental Law Guidelines and Principles No. 7)
12.	CARISEM/4	International and National Legal Instruments on the Prevention and Control of Marine Pollution with particular reference to waste disposal (IMO-UNEP-IOC, Government of Mexico Seminar on the Control of Waste Disposal at Sea, Mexico City, Mexico, 28 September - 1 October 1987) (English and Spanish only)
13.	SC-IOCARIBE-II/3	IOC Sub-Commission for the Caribbean and Adjacent Regions, Second Session, Havana, Cuba, 8-14 December 1986.
14.	Marine Pollution Bulletin (Vol.18, No.20, 2987)	Results and Experiences to date of the CARIPOL Monitoring Programme, pp. 540-548 (English only)
15.	IOCARIBE, 1989	Pollution Problems of Regional Concern - Pesticides/PCB

16.	IOCARIBE, 1989	Pollution Problems of Regional Concern - Heavy Metals (English only)
17.	IOCARIBE, 1989	Pollution Problems of Regional Concern - Organic Loading and Eutrophication (Spanish only)
18.	IOCARIBE, 1989	Pollution Problems of Regional Concern - Sewage and Bacterial Contamination (English only)
19.	IOCARIBE, 1989	Pollution Problems of Regional Concern - Marine Debris (English only)
20.	Caribbean Journal of Science (Vol.23, No.1)	Proceedings of the CARIPOL Symposium on Research and Monitoring of Petroleum in the Caribbean and Adjacent Regions, La Parguera, Puerto Rico, 2-6 December 1985
21.	IOC Training Course Report No. 9	IOC-UNEP-UNAM Workshop on Determination of Petroleum Hydrocarbons in Sediments and the Caribbean and Adjacent Areas, Puerto Morelos, Mexico, 10-23 November 1986.
22.	UNEP, 1988	UNEP-IAEA-IOC: Reference Methods and Materials: A programme of comprehensive support for regional and global marine pollution assessments. (English only)
23.	Greenpeace, 1988	Environmental Assessment of the Wider Caribbean Region
24.	Caribbean Islands Directorate/US MAB 1989	Workshop on Land-based Sources of Marine Pollution in the Wider Caribbean Region, San Juan, Puerto Rico, 7-9 August 1989 (Final Draft)

ANNEX IV

REPORT OF THE WORKING GROUPS

GROUP I: INDUSTRIAL POLLUTION

1. STATEMENT OF THE PROBLEM

In order to control or mitigate the nature and level of marine pollution, it is essential that the pollutants be identified. This determination involves a knowledge of the types and sources of wastes, their volume, concentration of the potential pollutants, localization of discharges, etc. The extent of the transfer of hazardous wastes to developing countries of the region by industrially developed countries must also be assessed.

The discharge of industrial effluents without proper treatment will eventually result in the impairment of marine ecosystems. Consequently, it is imperative to develop the necessary strategies to minimize the impact of the wastes discharged. These actions are generally based on both legal instruments and technical actions aimed at preventive and/or corrective measures.

2. STATUS OF PRIOR ACTIONS

Concerning the actions conducive to the evaluation of sources of industrial pollution within the region and the application of legal instruments to curb these sources of pollution, very little information is available. With the exception of the work being carried out in the U.S Gulf of Mexico, some information has been gathered mainly in Cuba, Venezuela, Colombia and Mexico through national efforts and with the assistance of international programmes, but no attempt has been made to harmonize these efforts at the regional level.

3. REQUIREMENTS FOR ACTIONS

The lack of inventories on the amounts of industrial wastes being discharged into the coastal waters of the region, as well as the development of appropriate water quality and effluent standards needs to be addressed. This lack of information will deprive governments of a cost-effective mechanism to control industrial discharges and to monitor the compliance, with the standards. Thus, the governments of the region should be able to develop control instruments such as permits, guidelines, codes of practice or other specific measures. Monitoring would be a necessary step in assessing the impact of the discharges. This means considering the present water quality in relation to the desired quality with particular reference to physical, biological and chemical parameters.

4. EXISTING REGIONAL CAPACITY TO ADDRESS THE PROBLEM

In view of the diverse nature of the countries comprising the Wider Caribbean and their capabilities, the existing regional capacity to address the problems created by the disposal of industrial waste varies from the very sophisticated to the non-existent.

At the head of this arbitrary classification is the Environmental Protection Agency (EPA) of the United States of America, probably the most important source of information with regard to disposition of industrial wastes. However, most of the information accumulated by EPA has been gathered along the Gulf Coast of the U.S.A., Puerto Rico and the U.S. Virgin Islands.

Among the other countries of the region that have established national infrastructures to deal with the control and abatement aspect of marine pollution, the following can be mentioned:

Country	Enforcement Agency	Monitoring and Research
Barbados	Environmental Health Engineering	Environmental Health Engineering
Colombia	INDERENA, DIMAR	INDERENA, CIOH
Costa Rica	Ministerio de Recursos Naturales, Energía y Minas Ministerio de Salud	CICA, CIMAR
Cuba	COMARNA	IIT (MITRANS), IDO (ACC)
France	Secretariat d'Etat à l'environnement et autorités régionales et locales	Université Antilles-Guyane: Laboratories of Animal and plant biology
Jamaica	Natural Resources Conservation Division Environmental Control Division	Natural Resources Conservation Environmental Control Division University of the West Indies
Mexico	SEDUE	Universities and other Research Centres Private Consultants
Nicaragua	DIRENA	DIRENA
Panama	CONAMA DIGERENA	CONAMA University of Panama

Trinidad & Tobago	Ministry of the Environment and National Service Ministry of Health Ministry of Energy	Institute of Marine Affairs (IMA)
Venezuela	MARNR	MARNR Universidad Simón Bolívar Universidad de Oriente Petróleos de Venezuela, S.A.

In numerous countries of the region, despite the lack or weaknesses of institutional arrangements in the public or academic sector, there exists enormous potential for monitoring and research of marine pollution with appropriate strengthening of existing capabilities.

5. PROPOSED ACTIONS AND PRIORITIES

5.1 INVENTORY OF WASTES DISCHARGED

It is important at an early stage to establish an inventory of the wastes generated by industrial activities which are likely to reach the coastal marine environment via point/non-point sources.

As a first priority, consideration should be given to the development of an inventory of the following industries:

(i) Petroleum storing,, transporting, refining and extraction of oil and gas.

(ii) Sugar processing and distilleries.

(iii) Tanneries.

(iv) Pulp and paper.

(v) Inorganic chemical manufacturing.

(vi) Petrochemicals.

(vii) Breweries, soft drink plants and canneries.

(viii)Mining operations.

(ix) Thermal effluents (cooling towers and power plants).

5.2 DEVELOPMENT OF CONTROL STRATEGIES, LAWS, RULES AND REGULATIONS

Recommendations for regulatory action by each country:

(i) An inventory and assessment of existing laws, rules and regulations to control industrial discharges.

(ii) Adoption of the necessary laws, rules and regulations to allow the issuance of enforceable permits.

(iii) Adoption of the necessary laws, rules and regulations to control the transboundary movement of hazardous wastes.

(iv) Adoption of technology based effluent standards for permitting.

(v) Water quality standards should be developed for marine waters.

As in the case of the inventory of sources of industrial wastes and recognizing the financial and technical capabilities of the different countries of the region, the following actions related to training and assistance are recommended:

(i) Inventory of industrial sources of wastes should be developed by each country.

(ii) Workshop on development of treatment technology and effluent standards.

(iii) Workshop on development of marine water quality standards.

(iv) Assistance be made available from IOC/UNEP to develop an industrial inventory.

(v) Assistance be made available from IOC/UNEP to develop effluent standards.

(vi) Assistance be made available from IOC/UNEP to develop marine water quality standards.

GROUP II: POLLUTION FROM AGRICULTURE AND LAND-USE ACTIVITIES, INCLUDING PESTICIDES

1. STATEMENT OF THE PROBLEM

Continued economic growth and development in the Wider Caribbean region require changes in historical land use patterns. However, adverse effects in the marine environment, caused by changes in land-use are occurring in the region. Soil erosion and the heavy use of pesticides are the major immediate causal factors. In some areas of the region, fertilizer run-off may also constitute an additional problem. Little reliable data exists defining the distribution of sediments, turbidity and the concentration of pesticides in order to assess the magnitude of the adverse effects. Such data is required in order to educate the public and encourage land-use changes that will promote long-term benefits and cause the least damage to interrelated ecosystems.

2. STATUS OF PRIOR ACTIONS

The negative implications of land-use changes on the coastal and marine environments have not been directly addressed by previous projects of a regional nature. Similarly, the consequences of pesticide residue discharges (sources, levels, fates and effects) have not been assessed on a regional basis. Detrimental effects of land-use changes have been the subject of limited attention by individual institutions in the region, such as U.S./NOAA and by non-governmental agencies, notably IUCN. Information bases (remote sensing images, coral reef surveys, among others) already exist but have not been interpreted in order to study the pattern, timescale and consequences of land-use changes in the drainage basin of the Wider Caribbean. Very little information exists on the levels of pesticides in the Caribbean marine environment, though on the landward side of the shoreline, programmes such as the WHO sponsored mother's milk surveys have provided conclusive evidence of

the serious nature of the problem of environmental contamination by these substances in the region. Additionally, preliminary results of work carried out by the Caribbean Environmental Health Institute (CEHI) in the Lesser Antilles suggest that the levels of organochlorine pesticides in marine waters are within acceptable limits, but levels in biota and sediments warrant further investigation. Many of the substances applied have not been studied in the tropical marine environment as insufficient information is available on their degradation times and environmental fate. Regionally accepted protocols for their analysis have not yet been developed.

3. REQUIREMENTS FOR ACTION

Regional capabilities must be developed to observe and quantify the marine environmental consequences of the changes in land-use patterns and agriculture development. These capabilities must be based on a knowledge of the sources of contaminants (primarily eroded soil and pesticides), ambient level (over the appropriate time and space scale) and ecosystem-level effects. Efforts are required to ensure that data and information obtained by various institutions throughout the region are useful and comparable and that mechanisms exist for retrieving and evaluating the diverse types of data required for comprehensive environmental assessment.

4. EXISTING REGIONAL CAPACITY TO ADDRESS THE PROBLEM

As yet, there is no regional network of centres to evaluate the effects of land-use changes or of laboratories to monitor pesticide residues. However, there are a number of national institutions engaged in this type of work to evaluate land-use changes. Remote sensing data is available through NOAA and the European Space Agency (ESA) and several countries are in the process of consolidating national capabilities for data interpretation (centres created, training courses programmed, etc.). Most countries have centres capable of monitoring the basic effects of introducing eroded soil to the marine environment and groups capable of obtaining data on the pattern of pesticide application (these tasks do not require major items of equipment).

Regarding analytical laboratories, the situation is somewhat more complex. Table 1 presents a preliminary list of laboratories engaged in monitoring pesticides in the coastal marine environment of the Caribbean or having expressed an interest in doing so. It must be stressed that this list should be corroborated, as soon as possible, (personnel figures are indicated but do not include graduate trainees). From this list it may be concluded that, excluding the United States of America and Puerto Rico, about 8 laboratories have modern capillary column chromatographs suitable for producing reliable, high-quality pesticide data, or they appear to have participated in quality assurance exercises. The capacity to perform assays of organophosphorus pesticides is particularly limited (about 4 laboratories). The number of personnel actively engaged in pesticide analyses is quite small (about 16-20) and in many laboratories only a small fraction of the total time can be dedicated to these tasks. The availability of reagent supplies, technical support facilities and equipment maintenance problems appear to be important general constraints in the development of this type of laboratory.

Table 1: Preliminary List of Laboratories with capabilitites to measure pesticides in the Caribbean Marine Environment

Country	Institution	Equipment	Personnel
Colombia	CIOH (Cartagena)	1 pc GC ECD/FID	1
	INDERENA (Cartagena)	1 cap.GC ECD/FID	1
	INVEMAR (Santa Marta)	1 pc GC ECD	1
Costa Rica	UCR-CICA (San José)	2 cap GC ECD/FID/NPD	3
Cuba	IIT (La Habana),	1 cap. GC ECD/FID	1
	Instituto Higiene y Epidemiología (La Habana)	1 pc GC ECD/FID	2
Guatemala	INCAP (Guatemala City) *	2 pc GC	1
Honduras	(1 lab. recently installed information to be requested) *		
Jamaica	UWI *	1 Cap GC/1 pc GC	3
Mexico	UNAM (Mexico City)	3 Cap GC ECD/FID	3 (+5)
	CINVESTAV (Merida)	1 Cap GC, pc GC ECD/FID	1
Nicaragua	CIRA (Managua) *	1 pc GC	1
Panama	Universidad de Panama (LEA)	1 pc GC ECD/FID 1 cap GC ECD	1
Puerto Rico	Several	Several (ECD/FID/FPD,NPD)	2
St. Lucia (regional)	CEHI	1 cap GC ECD/FID/NPD	1
USA	Several (NOAA co-ordination)	Several	Several
Venezuela	MARNR	1 cap GC ECD/FID	1*

* Not actively engaged in the analysis of marine samples cap GC = capillary column gas chromatograph

pc GC = packed column gas chromatograph
ECD = Electron capture detector
FID = Flame Ionization detector
FPD = Flame photometric detector
NPD = Nitrogen/Phosphorus detector

5. PROPOSED ACTIONS AND PRIORITIES

The ultimate goal is the attainment of a regional capability for the assessment of coastal marine environmental quality that is coupled with regional and national planning for land-use and economic development (integrated coastal zone management). An initial priority is the creation of a database describing current land-use patterns and quantifying pesticide manufacture and uses throughout the region. Immediately following this, an assessment of the data should be conducted by CEPPOL. The assessment should include recommendations for control measures, where this is considered appropriate, or for the establishment of additional monitoring/research activities. The existing regional capability for the analysis of pesticides in marine matrices must be strengthened and new capabilities developed. Likewise, the regional capability for analysis of remote sensing images must be broadened and mechanisms for the widest dissemination of the images themselves must be developed.

Following these activities, pilot studies addressing specific coastal marine environmental quality issues should be initiated in areas known to be suffering from adverse impacts. The pilot studies should be focussed on valuable and fragile marine ecosystems. Of particular concern are mangrove swamps, sea grass beds and coral reefs that are now threatened by increases in turbidity and siltation and by higher levels of pesticides coming from intensive agricultural activities. Additionally, the special case of the total small islands systems should be addressed as a pilot study. Once the pilot studies have been completed, a regional assessment of the pesticide problem should be prepared. This will draw upon information obtained in the inventory, the pilot studies, the Mussel Watch Programme and from references to the open literature. The assessment will include a study of sources, pathways to the marine environment, levels and the risk which the substances pose to the human population and critical ecosystems. On the basis of this assessment, the feasibility of implementing a pesticide monitoring network will be considered. If a network is considered necessary, laboratories chosen for the pilot study will act as the nucleus for the development of other centres in the region (a sister laboratory approach).

Applied research projects that will improve the ability to evaluate specific issues should also be part of the initial stage of the programme. Results from these early efforts will guide the development of the future regional programme and of public education and policy related efforts which are to be undertaken by the Caribbean Environment Programme. Throughout the programme, adequate attention must be given to the infrastructure required for management and co-ordination, data management and exchange, data and information analysis and synthesis and dissemination of results and recommendations.

GROUP III: DOMESTIC SOURCES OF POLLUTANTS AND PHYSICAL MODIFICATIONS OF THE COASTAL ZONES

1. STATEMENT OF THE PROBLEM

Three major categories of contaminants are derived from domestic sources and urban activities:

(i) Waste (sewage, garbage, solid wastes);
(ii) urban run-off; and
(iii) physical modification of the coastal zones (dredging/filling, mining, exploitation of resources, etc.).

With the exception of the U.S. coast of the Gulf of Mexico, in the Wider Caribbean Region there is, to a large degree, a general lack of control and abatement measures pertaining to the three categories mentioned above. This situation reflects the widespread lack of knowledge of pollution problems in general and of their deleterious impact on social well-being, a situation which is found in both the public and private sectors. It must also be recognized that this lack of awareness exacerbated by budgetary constraints, leads to the low priority in local planning decisions.

2. STATUS OF PRIOR ACTIONS

Some countries of the region have conducted studies to assess the effects of domestic wastes on their environment. Unfortunately, most of these studies have not produced any concrete remedial actions to mitigate the problems. The UNDP-UNESCO-UNEP Havana Bay Project is probably the only comprehensive study so far conducted in the region (excluding the U.S Coast of the Gulf of Mexico) which not only designed but also implemented abatement measures.

In Jamaica, the Kingston Harbour Project and in Trinidad and Tobago, coastal quality assessment work have been conducted, but these have yet to result in comprehensive actions to protect the environment.

To control sewage contamination, a very limited number of sewage treatment plants have been established (excluding the U. S. coast of the Gulf of Mexico). Most of the countries of the region, however, and in particular, the island states, use pipelines outfalls to discharge poorly treated domestic sewage. Direct discharge into the coastal areas of sewage collected from septic tanks is also a common practice in the region.

Regarding solid wastes, land filling is one of the most common methods used in the region. A limited number of countries carry out solid waste separation for disposal or reuse. In general, there is a lack of accurate information on the quantity, quality and the fate of solid wastes from the Wider Caribbean. Very little has been done to assess this problem with a regional integrated approach.

Contamination caused by coastal development activities has gained a lot of attention in recent years. Many countries of the region require Environmental Impact Assessment (EIA) studies prior to the implementation of development projects, as well as adequate land-use planning mechanisms. Nonetheless, sedimentation and erosion still pose a major threat to the coastal marine environment of the region.

Effluent standards for domestic sewage have not been established at a regional level. The level of information on the effects of sewage pollutants and sediments on the fragile coastal ecosystem of the Wider Caribbean (e.g. coral reefs and mangroves), as well as on human health is still very limited or almost non-existent. This information is needed for setting effluent standards.

3. REQUIREMENT FOR ACTION

The general lack of scientific information is just one of the problems that needs to be addressed, but perhaps of greater importance at this time, is the need for enforceable criteria and standards. Destruction of the coastal environment from domestic and demographic sources is occurring at such a rapid pace that it would be unwise to wait for all the scientific information to be

collected before standards are set. In light of this statement, there is a need for the immediate setting of standards based on available local and international information. At the same time, research and monitoring programmes must be carried out, especially where information is lacking, and the results of these should be used, when appropriate, to modify standards which would have to be reviewed periodically.

Research activities will need properly equipped and staffed laboratories and support should be provided where needs have been clearly identified. In some cases, laboratory facilities might even have to be built from scratch.

Every effort must be made to conduct relevant training courses, as well as to include participants from the region, in global training courses pertinent to the needs of the region. This will ensure the harmonization of methodology for comparable and meaningful data generation. Once standards are recommended, and research information becomes available, there is the need to communicate this information to the policy and decision-makers and to the general public. For any environmental programme to be successful, especially where the pollution sources are generated from urban centres, full public co-operation is essential. Public education must, therefore, be included as an important strategy for the control of domestic sources of pollution.

4. EXISTING REGIONAL CAPACITY TO ADDRESS THE PROBLEMS

This section must follow the three previously identified pollution sources, domestic, urban run-off and physical modification, since capacities to address the problems are rather diverse, ranging from research and monitoring of effluents, to expertise in coastal dynamics and ecology, and of course, an informed and effective management structure within the public sector. The following sub-sections identify the principal pollutants and the regional capabilities available at present to address problems associated with them in the marine environment..

Pollutants from domestic sources, principally sewage, garbage and solid wastes, include inter alia: organic loading, pathogens, associated toxic substances (metals, pesticides, volatile compounds, toxic organic), and solid wastes. With the partial exception of solid wastes, the identification and assessment of the remaining pollutants require capabilities basically in analytical chemistry with attendant laboratory sophistication and qualified research personnel. Such research capacities/capabilities are relatively rare in the region and have a highly "patchy distribution"; some countries have multiple capabilities while in other countries, there are none. This statement of general capability argues for the necessity of a regional co-operative network of laboratories.

Laboratories in the region which could identify and assess the above-mentioned chemical pollutants are listed in Table 2.

Table 2: Regional Laboratories capable of research/monitoring of domestic pollutants

Country	Laboratory/Institution
Anguilla	Caribbean Environmental Health Institute (CEHI)
Barbados	Bellairs Research Institute
Cayman Islands	Mosquito Research and Control Unit and Natural Resources Laboratory
Colombia	Instituto Nacional de los Recursos Naturales (INDERENA), Universidad de Bogota "Jorge T. Lozano", Centro de Investigaciones Oceanograficas e Hidrograficas (CIOH), Ministerio de Salud Pública
Costa Rica	Centro de Investigacion Marina (CIMAR), Centro Investigacion Contaminacion Ambiental (CICA)
Cuba	Instituto de Oceanologia, IIT (MITRANS)
Dominica	Caribbean Environmental Health Institute (CEHI)
Grenada	Caribbean Environmental Health Institute (CEHI)
Guadeloupe	Institut Pasteur de la Guadeloupe, Université Antilles-Guyane - le Laboratoire de biologie animale et vegetale
Guyana	National Research Council, University of Guyana
Jamaica	University of the West Indies, Natural Resources Conservation Division, National Scientific Research Council
Martinique	Institut Pasteur de la Martinique, Université des Antilles-Guyane
Mexico	CINVESTAV-IPN (Unidad Mérida), ICMyL (UNAM, Engineering Institute (UNAM), University of Tabasco, Metropolitan Autonomous University, Oceanographic Institute of Navy, Mexican Institute of Petroleum
Montserrat	Caribbean Environmental Health Institute (CEHI)
Netherlands Antilles	Department of Public Health, Caribbean Marine Biological Institute (CARMABI)
Panama	CONAMA, Universidad de Panama
Puerto Rico	University of Puerto Rico (several departments), Department of Public Health, Department of Natural Resources, Environmental Quality Control Board.
St. Kitts-Nevis	Caribbean Environmental Health Institute (CEHI)

St. Lucia	Caribbean Environmental Health Institute (CEHI)
Trinidad & Tobago	Institute of Marine Affairs (IMA), Water and Sewage Authority, CARIRI, Chemistry Department of the University of the West Indies, Caribbean Epidemiological Centre (CAREC)
USA (mainland)	EPA (Texas, Mississippi, Florida), NOAA, University of Texas, Florida Institute of Oceanography, University of Miami
US Virgin Islands	University of the Virgin Islands, Fairleigh Dickinson University, West Indies Laboratory
Venezuela	Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR), Universidad Central de Venezuela, Universidad Simón Bolívar, Universidad de Oriente, Universidad Francisco Miranda, Universidad del Zulia, Instituto Venezolano de Investigaciones Científicas (IVIC), Instituto Venezolano del Petróleo (INTEVEP)

Pollutants from urban run-off, via storm sewers and surface draining, including nutrients, organic loading, associated toxic substances (such as metals, hydrocarbons, pesticides, toxic organic), solid wastes and suspended solids (typically inorganic sediments as well as others). With the exception of solid wastes and suspended solids, the remaining pollutants require approximately the same analytical chemistry capacities for identification and assessment as described in Section 4.1.

Solid waste and suspended solids discharges, often through storm sewers, but also through surface drainage, require completely different capacities to handle problems and accumulations.

These capacities are basically in the hands of municipalities and local governments and require entrapment and removal capabilities, as well as terrestrial sites for disposal. Disposal capabilities typically range from burning to solid filling. Re-use or receding capabilities, although not widespread, are expanding in the region as developing technologies improve the potential economic returns.

The capacity to deal with the various problems deriving from physical modifications of the coastal zone such as dredging and canalization, infilling and dumping of spoil, constructions which impact both the local ecosystems and the dynamic equilibria of the coastal zone have quite different scientific requirements than those for waste and urban run-off.

Specifically, two broad scientific disciplines must be brought to bear. One pertains to environment impact and usually requires the input of biologists and ecologists. The second, pertaining to interrupted coastal equilibrium systems is normally handled by a combination of coastal engineers, oceanographers and geologists. Additionally, for both categories, environmental planners and legislators should also be considered.

In the Wider Caribbean, the preponderance of existing scientists are in the biological sciences, with tendencies toward marine biology. This is to say that the biological science manpower situation is favourable. Well trained marine/coastal ecologists, however, appear to be in short supply. Much more critical is the coastal engineer/coastal geological and oceanographer manpower situation, as well as the general public education and awareness. It is

estimated that in the Wider Caribbean region, an area the size of Europe, there are less than a total of 10-12 individuals (except in the U.S.A.) capable of identifying, assessing or predicting cause-effect relationships in the field of coastal dynamics. These people are presently located in Puerto Rico, Barbados, Trinidad, Venezuela, Cuba and Mexico. This lack of qualified manpower is a critical hindrance to developing control and abatement measures in physical modification of the coastal zone.

5. PROPOSED ACTIONS AND PRIORITIES

(i) A regional comprehensive survey of sewage disposal methods in the Wider Caribbean has to be conducted in order to provide the necessary information for the development of the appropriate control measures. The terms of reference of the survey should include:

a) quantity and quality of sewage wastes being introduced into the coastal marine environment of major selected sites, as well as projected or envisaged sewage wastes to be produced;

b) location, types, capacity and status of existing sewage treatment facilities; and

c) documented and/or potential effects to the marine and coastal environment caused by these sewage wastes.

In order to provide comparable information, a questionnaire should be prepared with the assistance of WHO/PAHO, U.S./NOAA and U.S/EPA and be distributed to the countries of the region. As a follow-up action, the consultant in charge of the survey preparation will visit the countries to gather additional information and clarify any items of the questionnaire.

(ii) As an economically feasible alternative for sewage disposal, guidelines need to be developed for the establishment of ocean outfalls at specific sites. The guidelines should include an assessment of the relevant oceanographic studies and site conditions required for the establishment of ocean outfalls.

(iii) Effluent and water quality standards need to be assessed, adopted and implemented by the countries of the region. These standards will be subject to periodic evaluations following the research and monitoring components of the programme. Existing standards developed by EPA, PAHO/WHO and others should be used as much as possible during this exercise.

(iv) In parallel and in order to evaluate existing standards and formulate, if necessary, new standards appropriate for the region, it is necessary to conduct research on the effects of pollutants from domestic sewage on human health and on the main fragile ecosystems of the region. As domestic sewage is the source of a wide range of pollutants, the research should be conducted addressing a set of parameters considered as of basic importance, such as nutrients, suspended matter and faecal bacteria (pathogens).

(v) Compilation and, if necessary, development of standardized

(v) Compilation and, if necessary, development of standardized methodology and guidelines appropriate for the Wider Caribbean and required for assessing the impacts of domestic sewage and sedimentation on fragile coastal ecosystems.

(vi) Regarding the accelerated regional loss of sensitive coastal habitats, it is strongly recommended to the countries of the region, and under the framework of the Cartagena Convention, to take every possible measure to prevent further planned development that would affect such biologically-fragile and productive habitats; namely coral reefs, seagrass beds, lagoons, mangroves and other wetlands.

(vii) The formulation of management plans of the coastal/marine areas and of the resources contained in them.

GROUP IV: MARINE-BASED SOURCES OF POLLUTION

1. STATEMENT OF THE PROBLEM

Important ocean or ship source pollutants in the Wider Caribbean are: oil and petroleum products, marine debris, sewage from ships, Tributyl-tin (TBT's) and pollutants originating from ocean dumping.

The extraction and transport of oil in coastal and offshore regions introduces petroleum hydrocarbons to the environment. Increased oil tanker traffic and presence of large refineries combined with the insufficiency of adequate reception facilities create concern for oil spills and coastal and marine contamination, with the resulting toxic effects and impacts on amenities.

Significant quantities of persistent debris end up in coastal and marine waters, endangering wild life, littering beaches, disabling vessels and diminishing tourism values. Sewage from ships impacts on coastal water quality, especially in anchorage areas, ports and harbours, with attendant public health and ecosystem concerns. Tributyl-tin (TBT), an organo-metal compound widely used in anti-fouling paints for boats, has been found to have adverse biological effects. The nature of the problem in tropical waters is not well understood yet.

Limited information is available regarding ocean dumping sites and illegal ocean dumping activities, but there is concern about types and quantities of wastes entering the marine and coastal environment in this manner and resultant effects to man, marine organisms and the marine environment.

2. STATUS OF PRIOR ACTIONS

The IOCARIBE component of the GIPME/MARPOLMON-CARIPOL programme has, since 1979, collected more than 10,000 data points on petroleum pollution in the Caribbean. An evaluation of the database indicated that about half of the petroleum pollution originates within the region mainly through tanker ballast operations, and the other half enters from the Atlantic. The second phase of the CARIPOL programme involves monitoring of petroleum pollution in marine sediments and organisms.

Ten Caribbean nations have acceded to MARPOL 73/78 and are automatically bound to implement Annex I relevant to oil pollution.

Several interagency studies have been conducted in the U.S. on persistent marine debris. The interagency Gulf of Mexico Programme has highlighted the problem and has addressed methods to quantify debris and identify sources. An Adopt-a-Beach Programme, in which local volunteers pledge to maintain the cleanliness of stretches of beach, as well as an annual Beach Awareness Day, are underway in Texas, Costa Rica and Honduras until now. Private organizations have also organized clean-up activities and have accentuated public education and environmental awareness.

Nine Caribbean countries have ratified MARPOL 73/78 Optional Annex V entitled "Regulations for the Prevention of Pollution by Garbage from Ships". The problem of sewage from ships in the region has not yet been quantified or evaluated.

Concerns regarding the effects of TBT's have been raised by some States of the Caribbean. However, none or limited information is available regarding their use or environmental impact in the region.

With regard to ocean disposal, several Caribbean countries adhere to the International Maritime Organization's (IMO), London Dumping Convention. Assessments of ocean dumping practices in the Wider Caribbean Region have not been carried out.

3. REQUIREMENTS FOR ACTIONS

Regarding petroleum pollution, the existing database could be used to propose relevant control and abatement actions by improving the information exchange between scientists involved in pollution monitoring programmes, industries, such as national oil corporations and high-level government decision-makers.

Preparation of a continuous up-dated inventory on port reception facilities for both waste oils and garbage from ships is also a necessary step. The use and functional state of these facilities should be monitored by IMO and UNEP's CAR/RCU and the information should be disseminated, preferably through CEPNEWS and the RCU's CEPNET Programme.

Countries should be encouraged to ratify the IMO Protocols for Oil Spill Liability and Compensation, and accede to MARPOL 73/78, under which there exists an automatic requirement to implement Annex I relevant to oil pollution. There is a region-wide concern that only a few countries have until now acceded to MARPOL 73/78 or ratified Optional Annex V. With respect to the control of marine debris and garbage from ships, protection from pollution by garbage is afforded only the waters of nations ratifying Optional Annex V. Thus, vessels may discharge garbage into waters of those non-participating nations. All are encouraged to ratify Annex V.

Marine debris is a pollution problem of regional concern for the Wider Caribbean. Monitoring of types and amounts of debris should be carried out under the umbrella of the CARIPOL I Programme and this monitoring should be closely co-ordinated with beach clean-up activities.

Organotin compounds have found widespread use as marine anti-fowling hull coatings in recent years. Although their use in small boats has been banned in the U.S., it is still widely used elsewhere. A first estimation of the

pollution situations should be carried out by a pilot monitoring project of organotin compounds in the Caribbean marine environment.

With regard to ocean dumping, the Secretariat of the London Dumping Convention (LDC) and the RCU should disseminate on a continuous basis information concerning Caribbean nations' membership to the LDC and the status of ratifications of the MARPOL 73/78 Convention and its Annexes.

4. EXISTING REGIONAL CAPABILITY TO ADDRESS THE PROBLEMS

The required monitoring and research activities could be implemented within the existing networks of environmental institutions and international programmes, such as IOC's CARIPOL and CARICOM's CEHI. As far as control and abatement is concerned, assistance should be sought from PAHO/WHO, IMO, U.S./EPA, U.S./NOAA, among others, to gather information on their experiences, as well as obtaining guidance in order to facilitate the development of relevant control and abatement measures in the region. In the Caribbean and Latin American region, some countries, have relevant national legislation while others have limited or no existing legal instruments for the control and abatement of marine pollution.

Even when the legal instruments do exist, it may be difficult to enforce and put into force necessary control and abatement actions.

5. PROPOSED ACTIONS AND PRIORITIES

5.1 INFORMATION EXCHANGE

Information exchange on several levels must be strengthened. The Workshop called upon UNEP's CAR/RCU in Kingston to establish a marine pollution information office to promote public, industry and government awareness of marine pollution issues. In this capacity, CAR/RCU is called upon to use its existing CEPNEWS bulletin as a regional vehicle for the dissemination of marine pollution information. Participating individuals are called upon to submit information on results of their monitoring efforts, on instances of oil spills, ocean dumping and related pollution events.

The IOCARIBE Secretariat should re-instate its Newsletter and use this publication as a vehicle for regional information on technical and scientific aspects of marine pollution.

Given the gap observed between the production of technical data on pollution and the use of this information for control and abatement measures, it was recommended that UNEP CAR/RCU implements a series of seminars for high-level government officials on the different aspects of marine pollution. Such seminars could be incorporated into the regular Intergovernmental Meetings of CEP.

5.2 MONITORING, INPUTS AND SOURCES

Given the success of the CARIPOL Monitoring Programme it was suggested that monitoring of marine debris on beaches and at sea should be fully incorporated into the on-going CARIPOL effort. The Workshop called upon the IOCARIBE Group of Experts on Marine Pollution Research and Monitoring to consider the mechanisms for incorporating these variables into the Regional Programme.

The Secretariat is requested to ensure prompt publication and dissemination of the CARIPOL II Manual for the monitoring of oil and marine debris pollution. The group requests that IMO disseminates on a continuous basis information on the ratification of the London Dumping Convention (LDC), as well as of Annexes I and V of MARPOL 73/78, and encourages non-participating countries to become signatories to these international legal instruments. Note was also taken of the planned monitoring of marine pollution in U.S.A. waters and in the Wider Caribbean by the U.S.A. National Status and Trends Programme.

With regard to heavy metal pollution from marine sources, it was agreed that the main problem may be that of organo-tin compounds in anti-fouling coatings.

5.3 CONTROL AND ABATEMENT

The following actions were viewed as priorities under this heading:

(i) The preparation and continued up-date of an inventory of port reception facilities for both waste oils and garbage from ships. Monitoring of the levels of use of these facilities should be carried out by IMO and this information should be submitted to RCU for dissemination through CEPNEWS.

(ii) Beach clean-up activities closely co-ordinated with the monitoring of amounts and types of marine debris within the existing CARIPOL project.

(iii) CAR/RCU to establish a Marine Pollution Information Office to serve the public, industry and governments throughout the region.

(iv) A strategy for effective communication between government decision-makers and the scientific community is suggested in order to bridge the gap between the on-going activities in the sphere of research and monitoring of petroleum pollution, and the use of this information for control and abatement measures.

Finally, the Secretariats are requested to encourage the countries participating in the Caribbean Environment Programme to promptly ratify the Cartagena Convention and its Protocols, as well as pertinent Annexes of the MARPOL 73/78 Convention.

It was also suggested to conduct a joint CEP meeting with CARIPOL participants and people working directly on control and abatement (IMO, national governments, etc.) issues in order to use the existing information for the formulation of effective control measures for marine pollution.

5.4 INSTITUTIONAL STRENGTHENING

With regard to research and monitoring, the group strongly endorsed the networking of regional laboratories as embodied in the concept of regional analytical support centres.

In addition to information exchange, training on technical laboratory practices and research to elucidate the nature of pollution problems, it was recognized that training in environmental auditing and risk assessment and the incorporation of environmental assessment into proposed development planning are very important in achieving the goals and objectives of CEPPOL.

Training, education and mutual assistance activities which focus on preventative, mitigative and control measures for the range of key issues identified by all working groups at this meeting should also be strongly encouraged.

Most of the groups also stressed the need to obtain additional technical support (methodology, intercalibration, equipment maintenance, etc.) from international agencies in order to obtain high quality and intercomparable data in pilot and full-scale monitoring exercises. This could be achieved by the extension of the current on-going (UNEP-IAEA-IOC) programme described in Agenda Item 5.

6. SUPPORT REQUIRED

The subgroups made an estimate of the total cash requirements for the proposed priority actions which resulted in an amount of about US $4.0 million dollars over a three year period. However, following a detailed analysis by the IOC and UNEP Secretariats of the proposed activities and considering the expected available funds for CEPPOL for the 1990-1991 biennium, a more realistic estimate of the cash requirements for the programme was prepared by the Secretariats and it is outlined in Annex V of this report.

ANNEX V

SUMMARY OF FINANCIAL SUPPORT REQUIRED FOR CEPPOL (1990-1991)[1]

PROJECT CO-ORDINATION[2] (from RCU)			
PROJECT PERSONNEL:			
- Project Co-ordinator (P-4/5) (including travel)	18 m/m	US$	90,000
- Bi-lingual Secretary (G4/5)	12 m/m		20,000
MEETINGS			
- Meetings of UNEP/IOC Expert Group			40,000
EQUIPMENT			
- Non-expendable equipment (computer /word-processor, printer, etc.)			6,000
TOTAL			US$ 156,000

1 This budget breakdown was prepared on the basis of the proposals presented during the Workshop which are outlined in Document IOC Workshop Report No. 59 Part 2 (formerly IOC-UNEP/RRW-I/8).

2 The above cost projection does not include the cost of additional support to project co-ordination and implementation provided through UNEP (OCA/PAC) with funds of UNEP Environment Fund, through UNEP (CAR/RCU) with funds of UNEP and CTF, through IOC with funds of IOC, and through the UNEP-IAEA-IOC comprehensive technical support programme with funds of UNEP, IAEA and IOC.

PROJECT ACTIVITIES AND IMPLEMENTATION[3]

Project Component		Projected Cost (in thousands of US $)		
		UNEP/IOC/CTF in cash	Counterpart contribution in kind and services	Total
1.	Control of domestic, industrial and agricultural land-based sources of pollution	88	150	238
II.	Baseline studies on pesticide contamination and formulation of control measures	115	150	265
III.	Monitoring and control of the sanitary quality of bathing and shellfish growing waters	80	110	190
IV.	Monitoring and control of pollution by oil and marine debris	86	135	221
V.	Site-specific studies of damaged ecosystems and development of proposals for remedial action	62	150	212
VI.	Development of environmental quality criteria	118	120	238
VII.	Research on the significance of organotin as pollutant of the Wider Caribbean region	15	50	65
VIII.	Co-ordination of CEPPOL	156	-	156
	TOTAL:	720	865	1,585

3 See IOC Workshop Report No. 59 Part 2 (formerly IOC-UNEP/RRW-I/8) for detailed description of project activities

ANNEX VI

PAST AND ON-GOING MARINE POLLUTION MONITORING AND RESEARCH PROGRAMMES RELEVANT TO POLLUTION CONTROL AND ABATEMENT IN THE WIDER CARIBBEAN

CONTENTS

1. INTRODUCTION

The International Co-ordination Group (ICG) for the Co-operative Investigations of the Caribbean and Adjacent Regions (CICAR) at its Sixth Session in Cartagena, Colombia, in 1973 noted the increasing concern about marine pollution matters in the CICAR area. The meeting, therefore, recommended that FAO and IOC immediately take the necessary steps to obtain from countries in the CICAR area the basic information needed to hold a workshop on marine pollution.

A questionnaire on marine pollution in the Caribbean region was distributed by IOC in April 1974 to member countries of CICAR and by FAO to member countries of FAO not members of CICAR, and the Operative Co-ordinator of CICAR visited the CICAR member countries to obtain additional information on marine pollution in the region.

At the Seventh Session of the ICG for CICAR (Mexico City, April 1975), it was recognized that the response to the questionnaires, so far, was unsatisfactory. Nevertheless, the CICAR National Co-ordinators were of the opinion that there existed a distinct urgency regarding marine pollution problems in the CICAR area, and therefore recommended that a Workshop on Marine Pollution be convened in 1976. A Steering Committee was established to organize the "International Workshop on Marine Pollution in the Caribbean and Adjacent Regions"; the Committee first met in Trinidad in October 1975.

The Western Central Atlantic Fishery Commission (WECAFC) of FAO recognized at its First Session in Trinidad and Tobago (October 1975) the importance of this Workshop, and agreed that it should be a joint WECAFC/CICAR effort. The United Nations Environment Programme (UNEP) agreed to co-sponsor and financially support the Workshop, as a contribution to the evolving Caribbean Environment Programme and the Government of Trinidad and Tobago generously offered to host it.

2. THE 1976 WORKSHOP AND ASSOCIATED DEVELOPMENTS

The International Workshop on Marine Pollution in the Caribbean and Adjacent Regions was held in Port of Spain, Trinidad from 13-17 December 1976, under the auspices of the Intergovernmental Oceanographic Commission (IOC), the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP).

The Workshop was attended by 38 participants including regional experts representing national institutions, invited lecturers and observers from the Intergovernmental Maritime Consultative Organization (IMCO, now IMO), UNESCO, UNEP, Gulf and Caribbean Fisheries Institute, Western Central Atlantic Fisheries Commission (WECAFC), the International Atomic Energy Agency (IAEA), the Economic Commission for Latin America (ECLA), the Caribbean Conservation Association (CCA), the World Health Organization (WHO) and the IOC Regional Association for the Caribbean and Adjacent Regions (IOCARIBE).

Eight invited lectures were presented at the Workshop in order to provide a common framework for discussion among the participants, who were mainly, but not entirely, scientists actively involved in the study of marine pollution problems in the region. The main results of the Workshop have been published in the IOC Workshop Report No. 11 and the scientific contributions are contained in the same report as a supplement (IOC/FAO/UNEP, 1977).

2.1. RECOMMENDATIONS AND PRIORITIES ESTABLISHED

The Workshop was an important milestone in identifying major marine pollution problems in the region and recommended a set of priorities which would lead to a better understanding of these problems covering petroleum hydrocarbons, heavy metals, halogenated hydrocarbons, sewage, suspended artificial particulates (asbestos, plastics), freshwater intrusion, effluents from food processing, and changes in water regimes caused by coastal installations.

The Workshop considered that pollution by petroleum and petroleum products were of the highest priority in the region.

In total, seven project proposals were presented at the Workshop, namely:

(i) "Sources, effects and fates of petroleum and petroleum products in the Caribbean, Gulf of Mexico and adjacent regions".

(ii) "Health aspects of the disposal of human wastes into the marine environment".

(iii) "Investigation of the hydrological regime as it affects the transport and fate of pollutants in coastal lagoons and estuaries".

(iv) "The effects of medium-scale eddies on the transfer and mixing of pollutants".

(v) "Effects of pollutants, especially those from domestic and industrial sewage, on tropical ecosystems of economic importance".

(vi) "Baseline and monitoring studies of persistent chemicals in the Caribbean, Gulf of Mexico and adjacent regions".

(vii) "Controlled experiments on the effects of pollutants on tropical marine organisms and ecological communities".

In addition to the above-mentioned projects, the Workshop recognized that training, education and mutual assistance were the most important elements together with the development of appropriate and standardized sampling and analytical methods for the region.

2.2. IMPLEMENTATION : PETROLEUM HYDROCARBONS

The report of this Workshop was reviewed by the IOC Working Committee for Global Investigation of Pollution in the Marine Environment (GIPME) Group of Experts on Methods, Standards and Intercalibration (GEMSI) at its meeting in Bergen, Norway in May 1978, which recommended that a petroleum pollution monitoring project modelled after the successful IOC-WMO (World Meteorological Organization) Marine Pollution Monitoring Project (Petroleum - MAPMOPP) should be implemented in the region.

At its meeting in San José, Costa Rica in 1979, the IOC Regional Association for the Caribbean and Adjacent Regions accepted the GEMSI recommendation and established a marine pollution research and monitoring programme called CARIPOL and defined its first project as monitoring of

petroleum pollution in the region. IOC initiated this activity by working through a Steering Committee of regional scientists to design a programme to provide necessary information, and to allow laboratories from the region to participate in the monitoring without the need for expensive sophisticated equipment.

The project was initiated in 1979 with a pilot study conducted by the Atlantic Oceanographic and Meteorological Laboratory/National Atmospheric and Oceanographic Administration (AOML/NOAA), Miami, followed by a regional training course in Costa Rica in 1980, during which personnel from governments throughout the region received training in CARIPOL methodology (IOC Manuals and Guides No. 7, 11 and 13) (IOC-WMO, 1976; IOC, 1977; IOC, 1982; IOC, 1984).

The programme has developed gradually in close co-operation with and financial support from IOC and UNEP.

The CARIPOL Monitoring Programme has concentrated on four parameters related to oil pollution in the marine environment:

(i) tar on beaches;
(ii) floating tar;
(iii) dissolved/dispersed petroleum hydrocarbons; and
(iv) petroleum hydrocarbons in sediments and marine organisms.

The field programme has been supplemented by extensive training and intercalibration exercises. In December 1985, a Symposium on Monitoring and Research of Petroleum Pollution was held at the University of Puerto Rico, in La Parguera. Thirty-nine participants from eighteen countries attended the Symposium. The results have been published in the Caribbean Journal of Science, Vol. 23(1), 1987.

An interregional Workshop on the Analysis of Petroleum Hydrocarbons in Sediments and Marine Organisms was held in November 1986 in Puerto Morelos, Quintana Roo, Mexico, with the co-sponsorship of the National Autonomous University of Mexico. Twenty-one participants from the Caribbean and South East Pacific regions attended the Workshop. This initiated the second phase of the CARIPOL project and was followed by the elaboration of a manual for the assessment of petroleum hydrocarbons and an intercalibration exercise.

Besides the region-wide seminars and workshops, analytical and technical training has been provided through the project for individual experts and groups of trainees at selected host laboratories. Further analytical equipment has been provided through donations to participating laboratories.

The project has yielded respectable scientific data for a serious assessment of petroleum pollution in the Wider Caribbean and the results have been recently published in Marine Pollution Bulletin and Oceanus (Atwood et. al., 1987).

Within the programme, and with the assistance of AOML/NOAA and the US National Oceanographic Data Centre (NODC), an effective data handling system has been developed. The Data Bank today includes about 10,000 data points on marine petroleum pollution and provides participating scientists with a continuous feedback of computerized data printouts and information about petroleum pollution throughout the Caribbean region. Through standardized methodology, specialized manuals and intercalibration exercises, high quality scientific data is produced.

Based on these experiences, it can be stated that the successful implementation of the project resulted from an initial strategy which included the following elements:

(i) Monitoring of a pollution problem of truly regional concern;

(ii) recognition of existing capabilities in the region and the initiation of projects which could function within these capabilities;

(iii) standardized methodology, development of detailed manuals and continuous training opportunities for new and potential participants;

(iv) careful archival of data and continuous feedback of data and information to participants and governments; and

(v) strong support from the governmental institutions in the region, as well as the support of the IOC and UNEP.

Considering the original objectives of the petroleum pollution project proposed at the Trinidad Workshop, the GIPME/MARPOLMON-CARIPOL Programme has been most successful. Thanks to strong support from the individual experts and governmental institutions in the region, as well as the support of the Intergovernmental Oceanographic Commission (IOC) and the United Nations Environment Programme (UNEP), the programme has set an example both at the regional and global level.

2.3. FOLLOW-UP OF OTHER RECOMMENDATIONS

With the exception of the petroleum component which has had a co-ordinated regional follow-up, the other recommendations of the Workshop have either never been initiated or were partially implemented by individual experts or research institutions but without a concerted regional approach.

2.4. OTHER IMPLEMENTED PROJECTS

Parallel to the development of the CARIPOL Project, other preparatory activities related to marine pollution were initiated in the region as part of UNEP's Regional Seas Programme, and later integrated into the Caribbean Environment Programme. These are:

(i) "Investigation and Control of Marine Pollution in Havana Bay, Cuba" implemented by UNESCO and the Government of Cuba.

(ii) "Protection of the Marine and Coastal Environment of the Caribbean Islands" implemented by CARICOM.

(iii) "Formulation of a Caribbean Oil Spill Plan" implemented by the Organization of American States (OAS).

(iv) "IMO/UNEP Workshop on Oil Spills and Shoreline Clean-up in the Islands of the Caribbean" implemented by IMO.

(v) "Development of Sub-regional Contingency Plans for the Islands of the Wider Caribbean and Survey of the Status of Oil Pollution and Control in the South American Sub-region of the Wider Caribbean" implemented by IMO.

(vi) "Directories of Marine Institutions and Bibliographies of Marine Pollution" implemented by the Food and Agriculture Organization (FAO).

2.5 OUTPUTS

The following are the main outputs of the projects mentioned above that are oriented towards the control and abatement of marine pollution in the Wider Caribbean:

(i) A Regional Assessment of Marine Pollution by Petroleum Hydrocarbons (see Caribbean Journal of Science 23 (1) 1987; Oceanus 30 (40), Winter 1987/88; Marine Poll. Bulletin 18 (10): 540-548, 1987).

(ii) Four Manuals and Guides for monitoring oil pollution: IOC-WHO Manuals and Guides No. 7, IOC-WHO-UNEP Manuals and Guides No. 7 (Supplement), IOC Manuals and Guides No. 11 and IOC Manuals and Guides No. 13.

(iii) A Master Plan and Long-term Strategy for the Control and Abatement of Pollution in Havana Bay and Adjacent Areas (Instituto de Investigaciones del Transporte de Cuba - Final Report of the UNEP-UNESCO-Government of Cuba Pilot Project on Research and Control of Pollution in Havana Bay).

(iv) Four volumes containing a detailed manual of methodologies for monitoring pollution in Havana Bay, a complete inventory and characterization of pollutants discharged into the Bay, and specific management recommendations to abate the pollution problems of the Bay and decontaminate its water (under same project mentioned above).

(v) Baseline information for the Protection of Marine and Coastal Areas in the Eastern Caribbean (CEHI Technical Reports of the UNEP-CARICOM/PAHO Project on "Protection of the Marine and Coastal Environment of the Caribbean Islands").

(vi) Report entitled "Land-based Sources of Pollution in the Coastal, Marine and Land Areas in CARICOM States" published by PAHO, 1985 (under same project mentioned above).

(vii) IMO-UNEP Survey on the Status of Oil Pollution and Oil Pollution Control in the South American Sub-region of the Wider Caribbean (available in English and Spanish).

(viii) UNEP-FAO Directory of Marine Environmental Centres in the Caribbean. UNEP Regional Seas Directories and Bibliographies (1985).

(ix) The outstanding number of scientific and technical personnel trained during the implementation of these projects.

(x) The networks of co-operating and communicating associated laboratories.

3. PRESENT REGIONAL AND INTERREGIONAL ACTIVITIES ON MARINE POLLUTION RESEARCH AND MONITORING IN THE WIDER CARIBBEAN

3.1 IOC/IOCARIBE

Considerable progress has been made in the region, particularly through the efforts of the IOC-IOCARIBE/CARIPOL Programme guided by its Steering Committee.

Following recommendation SC-IOCARIBE-II/2, adopted by the Sub-Commission at its Second Session (Havana, Cuba, 8-13 December 1986, document SC-IOCARIBE-II/3), the second phase of the programme was initiated and the IOCARIBE Group of Experts for Marine Pollution Research and Monitoring in the Caribbean and Adjacent Regions to be formed, substituting the CARIPOL Steering Committee. The second phase of the programme includes the determination of petroleum hydrocarbons and pesticides in sediments and selected marine organisms.

Thus, it is clear that the CARIPOL Programme, constituting the IOCARIBE component of the GIPME/MARPOLMON has achieved significant success in its efforts to define and implement a regional scientific project in marine pollution research and monitoring in the Wider Caribbean.

Further successful implementation of the marine pollution, research and monitoring programme, including the implementation of data quality assurance procedures, possible identification of Regional Analytical Support Centres (RASC's) and intra- and interregional intercalibration exercises, will depend on long-term strategies and strong support of the governments in the region.

However, the success has been, and will continue to be limited, unless long-term strategies which complement definition and implementation of the scientific strategies, are developed and followed up within the region. Areas in which these strategies need to be addressed include the following:

(i) Training, education and mutual assistance;
(ii) institution building;
(iii) networking of institutions;
(iv) data archival and exchange; and
(v) information exchange.
(vi) the dissemination and use of scientific background information through an established mechanism in order to formulate the appropriate control and abatement measures.

The scientific contributions of the Marine Pollution Research and Monitoring Programme in the region will not be fully exploited unless strategies are implemented in other areas which include:

(i) Development of public awareness.
(ii) Development and/or enforcement of regional and interregional conventions and related protocols.
(iii) Develop institutional mechanisms to use the generated information.

The second phase of the IOC-IOCARIBE (CARIPOL) Programme was initiated through the Workshop in Puerto Morelos, November 1986, with participants from the Caribbean and South-East Pacific regions.

The Groups of Experts of IOC (GIPME-MARPOLMON) on Methods, Standards and Intercalibration (GEMSI), jointly sponsored by IOC and UNEP, on Biological Effects of Pollutants (GEEP), jointly sponsored by IOC, IMO and UNEP, and on Standards and Reference Materials (GESREM), jointly sponsored by IOC, IAEA and UNEP, are developing methods for the determination of pollutants and their effects and associated data quality control procedures, as well as guiding the production and distribution of standards and reference materials for the Caribbean region.

An ad hoc consultation of experts on marine pollution research and monitoring was held at the CAR/RCU, Jamaica, 11-13 May 1988, to review activities and plan immediate actions.

In fact, UNEP and IOC have a very fruitful co-operation in pollution research and monitoring programmes at both a global and regional level, including co-sponsoring the Group of Experts.

The experiences of the global jointly sponsored Group of Experts have revealed several advantages, including increased financial support, improved co-ordination between programmes and the use of outputs by the broader scientific community at both the national and international levels.

The experience of the regional marine pollution programme of IOCARIBE demonstrates the effectiveness of that mechanism.

3.2. UNEP/CARIBBEAN ENVIRONMENT PROGRAMME

In 1974, UNEP initiated the Regional Seas Programme, an action-oriented programme for the control of marine pollution and the protection and management of the marine and coastal environment. The Regional Seas Programme has since expanded to cover twelve regions of the world including the Wider Caribbean.

In spite of political and financial obstacles, the Regional Seas Programme has met its objectives with great success in those regions of the world where governments are determined to jointly confront pressing environmental and development issues of common concern. In the last few years, the Caribbean Environment Programme has matured to become an effective instrument for regional co-operation able to address a wide range of environmental problems.

Among the major accomplishments of the Caribbean Environment Programme in the area of marine pollution is the adoption of the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region and its associated Protocol concerning Co-operation in Combating Oil Spills. Both legal instruments entered into force in 1986, and, so far, have been ratified by 16 countries of the region.

Since its inception, the Caribbean Action Plan has sponsored forty projects mainly financed by the United Nations Environment Programme's Environment Fund (EF), the Caribbean Trust Fund (CTF), as well as funds from FAO, CARICOM, CCA, ECLAC, IMO, IOC, PAHO, OAS, UNESCO, UNDP, USAID, WIDECAST and with contributions from governments, universities and research institutions from the countries of the region.

Approximately 450 scientific and technical personnel have been trained or have participated in 20 workshops, seminars or courses dealing with various aspects of marine pollution assessment and monitoring as part of the Caribbean Environment Programme.

At present, the following projects related to marine pollution are being implemented within the framework of the Caribbean Environment Programme and co-ordinated by its Regional Co-ordinating Unit:

(i) "Environmental Training Network for the Wider Caribbean Region" being implemented by UNEP's Regional Office for Latin America and the Caribbean for the establishment of a network of co-operating institutions for training activities in the areas of marine pollution and environmental health;

(ii) "Development of Scientific Methodologies for the Preparation of Environmental Impact Assessments" implemented by the Government of Mexico;

(iii) "Sub-regional Oil Spill Contingency Planning in the Wider Caribbean - (Phase II)" implemented by the International Maritime Organization (IMO);

(iv) "Environmental Management of Bays and Coastal Zones of the Wider Caribbean" implemented by UNESCO and the Government of Cuba in which the experiences gained through the project implemented for Havana Bay are being utilized and expanded to address other case study areas in the region;

(v) "Assessment of Contamination by Hydrocarbons and other Pollutants in the South-eastern Waters of the Caribbean Sea" implemented by the Government of Venezuela;

(vi) "Development of a Regional Project for the Assessment and Control of Marine Pollution in the Wider Caribbean" implemented by the Intergovernmental Oceanographic Commission (IOC) of UNESCO; and

(vii) "Development of a Basis for Coastal Water Quality Criteria for the Wider Caribbean Region" implemented by the Government of Colombia in co-operation with FAO and IOC.

3.3 CARICOM

A sub-regional training course on petroleum pollution monitoring sponsored by CARICOM, UNEP and IOC was carried out at the Caribbean Environmental Health Institute (CEHI) in St. Lucia from 6-9 October 1988.

Eight participants from Grenada, St. Lucia, Dominica, St. Kitts, St. Vincent, British Virgin Islands, Montserrat and Turks and Caicos were trained in beach tar monitoring and sampling of dissolved/dispersed petroleum hydrocarbons. Through this training course, the activities of the CARICOM project have been linked with the CARIPOL programme, and it is anticipated that petroleum monitoring activities will be intensified in the Eastern Caribbean.

In accordance with the new regional approach of environmental issues, the continuation of activities, especially those related with marine pollution in the Eastern Caribbean, are now under the overall co-ordination and supervision of IOC.

Additionally, CEHI currently undertakes activities related to the assessment and monitoring of marine pollution, including bacterial pollutants, pesticides and heavy metals, and waste management in the Eastern Caribbean islands.

3.4. CPPS (PERMANENT COMMISSION OF THE SOUTH PACIFIC)

Interregional co-operation between UNEP, CPPS and IOC/IOCARIBE and between UNEP/CPPS' South East Pacific Action Plan and the Regional Co-ordinating Unit of the Caribbean Environment Programme has been very successful especially with regard to marine pollution aspects related to training and the exchange of information.

Five scientists from the South East Pacific region attended the IOC-UNEP-UNAM Puerto Morelos Training Course, November 1986, and, in addition,

five scientists from the Caribbean region participated in the CPPS-UNEP-IOC-FAO-IAEA Training Course on Pesticides and Heavy Metals, Cartagena, Colombia, in August 1987.

3.5 OUTPUTS

The main obtained and envisaged outputs of the above-mentioned projects are:

(i) Results of the CARIPOL programme (Phase II), including the adoption of a regionally agreed methodology for the analysis of petroleum and other pollutants in sediments and organisms and continued generation and storage of data;

(ii) Establishment of regional and sub-regional mechanisms for co-operation and mutual assistance on oil spill contingency plans, clean-up procedures and management and safety procedures for the transportation of toxic chemicals;

(iii) Characterization and assessment of the major pollutants entering the south-eastern waters of the Wider Caribbean;

(iv) Publication of guidelines and methodologies for environmental management of coastal areas in the region;

(v) Updated information on the number, technical levels and human resources of existing environmental laboratories dealing with marine pollution issues in the region;

(vi) Establishment of a Regional Network of Institutions for training and mutual assistance in marine pollution assessment, monitoring and control;

(vii) Development of a regional criterion for water quality discharges in the Caribbean region; and

(viii) This IOC-UNEP Regional Workshop aiming at developing a long-term strategy on control and abatement of marine pollution in the Wider Caribbean and its associated research and monitoring component.

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ANNEX VII

STATE OF MARINE POLLUTION AND PRIORITIES AND STRATEGIES FOR ITS CONTROL AND ABATEMENT IN THE WIDER CARIBBEAN REGION

CONTENTS

1. INTRODUCTION

Awareness of the steadily growing rate of contamination of the Wider Caribbean region has become more and more apparent. In response to this awareness, national authorities and research institutions of the region, as well as international organizations have expressed their concern by fostering the development of plans, including conventions and protocols to safeguard the coastal and marine resources of the region.

While the solution to some of the environmental problems of the Caribbean region should be sought through action at the global level, the solution to most of these problems is through national and regional pollution control measures.

The present document summarizes the present state of marine pollution in the region and reviews the national and regional priorities and strategies for its control and abatement. The document was prepared by the Secretariats of UNEP and IOC as a background information document to be used in developing a comprehensive programme for marine pollution assessment and control for the Wider Caribbean region.

2. STATE OF MARINE POLLUTION IN THE WIDER CARIBBEAN

The Wider Caribbean region is, in general, a developing area where the levels of urbanization and industrialization are still relatively modest. Nevertheless, economic development has placed heavy demands on some areas along the coastlines of the States and territories of the Wider Caribbean and there are localized areas which are severely polluted, particularly in coastal waters adjacent to urban and industrial sites. Several major urban areas and industrial complexes in the region are located on the coasts of bays, near coastal lagoons and river estuaries in response to the need for the siteing of port facilities.

With regard to the volume and type of wastes being disposed of at sea in the Wider Caribbean, most of the available information corresponds to the dumping activities of the U.S. Gulf coastline. According to Burrough (1988), the trends in ocean dumping of the U.S.A. indicate a decrease in the volumes of certain authorized materials, such as dredged spoils and industrial wastes. We are not aware if other countries from the region practice the disposal of materials at sea.

A large number of publications including several general and detailed overviews have been prepared on the environmental problems of the Wider Caribbean Region, some of which have been used to prepare this document (IOC-FAO-UNEP, 1977; Rodriguez, 1981; UNEP-ECLAC, 1984; UNEP-IOC-FAO, 1987).

The main problems identified by these publications are summarized in the present document. Since the environmental problems differ considerably in various parts of the Caribbean region, the summaries are given by an arbitrary separation of the region.

2.1 GULF OF MEXICO

Development is particularly intense along the United States Gulf coast where industrial zones, urban development and recreational areas are interspersed. This coastline, with its extremely productive habitats and wealth of sea life, is one of the most important marine environments in the United States. It also receives large amounts of many pollutants. Large volumes of pollutants are carried to the Gulf by the Mississippi River which drains 75% of the United States and contains 50% of the nations' wasteload, mostly, in particulate form. This particulate load is a potential source of heavy metals, petroleum hydrocarbons, PCBs and other contaminants. In 1982, the greatest volume of dredged material dumped into the Gulf, approximately 4 million cubic meters, came from the Mississippi River (Texas General Land Office, 1987). Additionally, coastal wetlands are being lost due to development, agricultural uses and coastal erosion. Louisiana is losing 50-60 square miles of coastal marsh land per year. Large areas of seagrass beds are also being threatened or lost. Marine debris along Gulf coast beaches has averaged more than 1 ton per mile (2 tons on Texas beaches alone), with 500 tons collected over the Gulf each year, causing harm to wildlife and littering once pristine beaches.

Although small, relative to the quantities of riverborne materials, considerable amounts of waste are also discharged into the coastal areas from municipal and industrial sources, particularly oil refineries and petrochemical industries. The petrochemical plants discharge more than 68% of the waste waters that reach this area, in addition to the waste waters coming from the oil refineries, metal and paper industries, as well as from the mining and exploration activities (NOAA, 1985). On the U.S. Gulf coast alone, there are fifty-seven refineries with an aggregate production of approximately 350 million tons a year. The biggest concentration of basic and secondary petrochemical plants in Mexico today, are located on the Mexican Gulf Coast (Coatzacoalcos region). There are more than sixty-five giant plants with a productive capacity in excess of 15 million tons a year in petrochemical products (Centro de Ecodesarrollo and Universidad Veracruzana, 1988).

Another major problem is the contamination of the coastal zone with domestic wastes. Marine renewable resources have been adversely affected by sewage discharges. Many of the shell-fish beds are contaminated with human fecal coliforms and in approximately 10% of the total area used for their cultivation collection of shell-fish has been banned (Broutman and Leonard, 1986). Extensive hypoxia (low dissolved oxygen levels harmful to marine life) now occurs in the summer months over approximately 3,000 sq. miles of the Louisiana and Texas gulf coast. The specific causes of this phenomenon are not fully understood; however, agricultural runoff and municipal discharges are the probable causes. However, since the late 1960's and early 1970's, some locations along the U.S. Gulf coast have significantly reduced the release of nutrients and oxygen demanding substances from municipal and industrial discharges. Likewise, point source discharges of faecal coliforms and other pollutants have been reduced in some areas (Edwards, 1986).

The described sources of pollutants, nevertheless, still pose severe and sometimes worsening problems in parts of the sub-region, largely because of rapid population growth.

The Mexican Gulf coast, unlike the U.S. Gulf coast, is an area which is sparsely populated, and consequently, severe cases of chronic coastal pollution are restricted to very localized zones.

With regard to the localized areas with severe coastal pollution problems, the most important example on the Mexican Gulf coast is the estuary of the Coatzacoalcos River, the site of the petrochemical complex Minatitlan-Coatzacoalcos. A comprehensive study on the impact of this industrial complex on the adjacent ecosystems was sponsored by the Centre for Ecodevelopment of Mexico. In addition to the petrochemical industries, this area constitutes the most important complex in Mexico for oil-related activities, including docking and transport. The heavy industrialization of the area has resulted in a twenty-fold increase in the number of inhabitants in the last two decades. This situation has led to an abrupt decline in fishing activities due to the discharge of untreated industrial wastes and the frequent accidental spills (Centro de Ecodesarrollo and Universidad Veracruzana, 1988). The extensive use of pesticides for agricultural purposes and to control diseases such as malaria is another potential source of pollution in the coastal waters of the Gulf, particularly, in the Veracruz area. Additionally, this area is also subject to high sediment loads as a result of bad land-use practices.

Other areas of localized coastal pollution, such as Tampico, Veracruz and the coastal areas of the state of Tabasco, are mainly affected by point and diffused sources of pollutants generated by shipping, urban and industrial activities. Vazquez and Villanueva (1987) prepared a comprehensive review on the above subject. For example, they point out that the levels of micro-organisms and heavy metals found in sediments and biological samples were higher than the recommended permissible concentrations probably as a result of the disposal of untreated domestic and industrial wastes into the coastal waters.

Finally, it is important to note the establishment of the nuclear power plant at Laguna Verde, north of Veracruz. This plant is the second nuclear power plant operating in the Wider Caribbean, the first one being located at Turkey Point, Florida, U.S.A.

Studies in the Wider Caribbean have demonstrated that a wide-spread source of contamination in this part of the region is related to the exploration, exploitation, processing and transport of petroleum and petroleum products. Chronically high levels of dissolved/dispersed hydrocarbons in the waters of the Gulf of Mexico, where average values exceed 10 micrograms per litre, are an indication that there is a constant, new input of petroleum into these waters. These studies indicate that most of this new input is from petroleum tanker ballast washings (Atwood et. al., 1987).

2.2 THE MEXICAN CARIBBEAN AND CENTRAL AMERICA

The extensive coastline of the Mexican Caribbean and Central America is an area which is under-populated, and consequently, information on coastal pollution is very sparse with the exception of the oil terminal of the Panama Canal at Limón Bay, Panama and the contamination by toxic chemicals from electroplating operations near the City of Belize. In addition to petroleum hydrocarbons coming from oil spills, Limón Bay receives domestic wastes from 95% of the population on the Caribbean coast of Panama, of which only 10% receives primary treatment (CONAMA, 1988b).

The reason for the paucity of information is that Central America's major urban centres are inland or along the Pacific coast, and for this reason, the Caribbean coastline of Central America is virtually undisturbed. Over two-thirds of the population in Central America live within approximately forty miles of the Pacific Ocean where richer volcanic soils predominate. On the other hand, over two-thirds of the area's surface water runs down the

Caribbean slope, away from major population concentrations, and at least 80% of the remaining densely forested areas of Central America also lie on the Caribbean side of the continental divide (Leonard, 1987). However, deforestation, an attendant problem, is taking place at a rapid pace and eventually will lead to environmental stress on the coastal ecosystems. For example, most countries in Central America are losing between 500 km^2 and 1,000 km^2 of their remaining tropical rainforests every year. Although this forest clearing occurs mostly on the Pacific side, lately, because of extensive road construction, major pressure is now being put on the forests along the Caribbean slope (Leonard, 1987).

In some areas of this part of the Wider Caribbean, the increasing use of agrochemicals, particularly pesticides, are also of concern to the marine and coastal environments. The majority of the people in this area depend on agriculture for their livelihood and these numbers are swollen by the area's rapid population growth (2-9% per year). Indiscriminate use of pesticides, many of which are no longer used or are heavily restricted in the United States, is one of the most pervasive causes of environmental contamination and human health problems in Central America. For example, it is estimated that a total of 80 kg. of insecticides is used on each hectare of cotton annually, one of the highest use levels in the world (Leonard, 1987). In Costa Rica, an average of 553 cases of pesticide poisoning is reported each year, with the numbers doubling in recent years (Leonard, 1987). Although this phenomenon mainly affects the Pacific basin, it could become one of the main environmental problems of the Caribbean coast of Central America.

Over the past few years, a new problem has developed in the Caribbean region caused by the international transport of toxic wastes. Several Central American countries have been pressured to accept shipments of industrial and urban wastes from industrialized developed countries. A case in point is the example provided by Panama, CONAMA (1988a).

2.3 THE NORTHERN AREAS OF SOUTH AMERICA

In South America, the northern coasts of Colombia and Venezuela are heavily industrialized compared to the adjacent Caribbean states. The two dominant industrial centres within the region are Cartagena Bay, Colombia, and the basin of Lake Maracaibo in Venezuela. In Colombia, for example, a significant percentage (approximately 90%) of the industrial and domestic wastes discharged along the Colombian Caribbean coastline are generated in Cartagena (Escobar et al 1985).

The main source of these wastes is the city of Cartagena and the adjacent industrial area of Mamonal, the site of 47 industries and one oil refinery. The bay also receives contaminated fresh water inputs via the Canal del Dique which connects Cartagena Bay with the Magdalena River. Through this canal, the oil refinery receives crude oil from the production area of Barrancabermeja located upstream the Magdalena River. Other areas of concern along the Colombian Caribbean coastline are Santa Marta and Barranquilla. Studies aimed at the control and abatement of the pollution problem of Cartagena Bay were prepared by Consultores Generales Asociados Ltda., Cartagena, Colombia (1983).

In Venezuela, the basin of Lake Maracaibo is an important industrial centre and the largest oil producing area of the country. This area is heavily polluted. However, very little information is available (Batelle, 1979, Parra Pardi, 1986). Additionally, considerable amounts of contaminants reach the Caribbean coasts of South America through the Orinoco River, which drains large agricultural areas of Colombia and Venezuela, as well as the main mining area of Venezuela.

2.4 THE INSULAR CARIBBEAN

In the Caribbean island States and territories, progressive economic development, improper planning, waste disposal, increased demands for the development of coastal lands, shipping traffic, population growth, and various other factors have resulted in adverse effects on coastal zones and their resources.

The pollution of coastal waters is due to several kinds of activities. Two of the major problems have been the contamination by petroleum hydrocarbons originated by ship tank washings, ballast discharges, operation of oil refineries, harbour activities and oil spills, and the problem of marine debris. In particular, the problem of beach contamination by tar is serious in many of the islands, with numerous beaches having average concentrations in excess of 100 grams per meter of shore-front. The high concentrations of tar on beaches in the Cayman Islands and on the windward side of islands such as Barbados, Grenada and Trinidad and Tobago are of special concern. In fact, beach contamination is particularly serious in Grand Cayman, where there is no domestic petroleum activity, but the island is located in an area adjacent to heavy tanker traffic (Atwood et. al., 1987).

In the bays and estuaries of the Caribbean islands, the indiscriminate siteing of cities and harbours has developed over time into localized areas with severe marine pollution problems. The best examples of this problem being illustrated by the deterioration of the waters of Kingston Harbour, Jamaica and Havana Bay, Cuba. For example, it has been documented that approximately 8 to 10 million gallons of inadequately treated sewage is discharged into Kingston Harbour daily, in addition to the industrial wastes coming mainly from food preparation plants and oil refineries (Government of Jamaica and R. M. Field Associates, 1987). In the case of Havana Bay, although the hydrocarbon inputs have been reduced since 1985 by more than 50%, approximately 100 tons of organic material is being dumped daily into the bay from different sources. Three rivers discharge about 100,000 cubic meters per day of contaminated waters and the industries contribute with more than 150,000 cubic meters per day of contaminated effluents (MITRANS-UNDP-UNEP-UNESCO, 1985; Instituto de Investigaciones del Transporte, 1989).

Industries located on the coast have traditionally used coastal waters for waste dilution, and in addition, solid and liquid wastes generated inland may also find their way to these waters. Coastal erosion, normally resulting from natural processes has been enhanced by the removal of sand from beaches for construction purposes and sedimentation and turbidity problems arising mainly from development on shorelines (mangrove reclamation by dredge/fill operations) are causing stress to fragile ecosystems such as coral reefs. The increasing use of pesticides in some of the islands with intense agriculture also poses a major threat to the marine resources.

The disposal of untreated sewage, a common practice in the region, has severely impacted on the quality of coastal waters. In fact, a report from a 1979 survey indicated that 10% of the sewage generated in the Wider Caribbean was treated (Mood, 1978) and (Reid, 1981). Furthermore, the presence of pathogenic micro-organisms and noxious compounds in many coastal areas of the region are above the acceptable levels stipulated by WHO (World Health Organization) (Ward and Singh, 1987).

On the basis of existing data from the Wider Caribbean region, it is not possible to establish trends or changes in contamination levels, except possibly regarding petroleum hydrocarbons.

3. PRIORITIES AND STRATEGIES FOR CONTROL AND ABATEMENT OF MARINE POLLUTION

Recognizing the growing threat of pollutants to the quality of the marine environment, to its resources and to human health, a number of pollution control measures were taken individually and collectively by the States of the Wider Caribbean region.

The most notable collective pollution control measure taken by the States of the Wider Caribbean region was the adoption in 1981 of the Action Plan for the Caribbean Environment Programme (UNEP, 1983a). The adoption of the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean by the same States in 1983 (UNEP, 1983b), and its entering in force in 1986, signifies the highest level of political commitment of these States to the goals of the Action Plan. The main provisions relevant to marine pollution control and abatement contained in the Action Plan and in the Convention, as well as in some other international conventions signed by some of the Caribbean States are reviewed.

Despite the relatively large amount of research and monitoring related to marine pollution problems of the Wider Caribbean region already carried out, large gaps remain in our knowledge about the present state of pollution within the region. Nevertheless, it seems that, with the exception of pollution caused by petroleum hydrocarbons, pollution problems of the Wider Caribbean are localized to "hot spots" in the vicinity of urban and industrial developments and vary considerably from country to country. Furthermore, it seems that the major environmental problems of the region as a whole are caused by the following factors, listed in order of their significance:

- Pollution by petroleum hydrocarbons, including oil dispersants;
- pollution by domestic waste, sewage in particular;
- pollution by industrial waste products;
- pollution by agrochemicals (fertilizers and pesticides);
- coastal erosion;
- siltation and sedimentation; and
- deforestation and changes in land management.

The widespread pollution caused by petroleum hydrocarbons (Atwood et. al., 1987) remains unabated, despite considerable studies conducted during the implementation of the programme CARIPOL of IOC/IOCARIBE and the efforts to regulate all the operations relating to exploration, exploitation, processing and transport of petroleum and petroleum products.

A major problem common to all countries is the increasing disposal in coastal areas of domestic and other wastes from land-based sources and ships. This results mainly from the dumping of industrial wastes coupled with unknown dumping practices within the territorial waters of the countries.

Some problems which are becoming more apparent are bad-land management practices associated with development, which result mainly in deforestation and erosion, and the increased utilization of agrochemical products, particularly among the Central American countries and Mexico.

The land-based sources of pollution, undoubtedly, provide the major threat to the quality of the marine environment and to human health in the Wider Caribbean region, and therefore, the control of pollution from these sources should receive the highest priority attention of the States of the region. To this end, the adoption of measures such as the Montreal Guidelines is recommended (UNEP, 1985). The adoption of a protocol concerning the control of pollutants from land-based sources within the framework of the Cartagena Convention and the enforcement of its provisions is an obvious ultimate answer to the problem. However, in view of the present inadequate information on the actual sources, amounts and effects of pollutants from land-based sources in the Wider Caribbean region, it would be advisable to obtain by a way of thorough baseline study such information prior to the negotiation of the protocol, in order to avoid the imposition of costly preventive measures which may prove to be unnecessary.

The following specific principles and strategies may be considered in designing a regionally significant and meaningful programme for pollution assessment and abatement:

(i) Oil pollution from land-based sources may be addressed by the construction of reception facilities for waste oil and its collection should be established. Serious consideration must be given on what to do with the waste oil, particularly from oil refineries and automobiles and how to handle residual toxic wastes. As regards oil pollution from ships, fishing boats and small craft, this can be minimized by strict compliance with safety measures and by imposing heavier penalties on intentional oil discharges. Finally, oil spill contingency plans should be finalized at the national and regional levels. Ratification of oil pollution control-related international conventions, as well as the Cartagena Convention's Protocol related to oil spills, and the enactment of national legislation in support of the same should be seriously considered by the participating countries. The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean should be extended to include all hazardous materials and efforts should also be made to harmonize the approach to control, management and legislation in the region;

(ii) sewage treatment facilities are required for controlling sewage pollution. In critical sites, sewage treatment plants should be established, operated and maintained. In some areas, the proper construction of sewage outfalls will minimize impacts. With these in place, enforcement of regulations on waste disposal must follow in order to eliminate or minimize the risks of pollution of rivers, ground water and near-shore zones. An analysis of population growth on the coastal cities would be necessary in order to establish preventive measures for potential pollution caused by domestic sewage;

(iii) industrial pollution is fast becoming an overwhelming problem, as many countries in the region are rapidly industrializing their economies. Both preventive and curative measures have to be instituted. Countries should be more selective in approving industrial projects and preferably use those with clean technologies. The project planning instruments such as environmental impact assessment studies should be introduced and effectively implemented. In order to promote industrial development, the relevant national authorities should ensure that the necessary provisions of common toxic and hazardous waste treatment facilities are established. Industries should also be encouraged, perhaps be given incentives, to exchange their waste products as raw materials with other interested parties. Curative measures, comprehensive legislation, as well as

effluent standards and strict law enforcement, including planning, follow-up and monitoring are necessary to address the problem of industrial pollution. Proper waste treatment facilities are needed to eliminate or recycle contaminants at their source. Manufacturers and other relevant industrial concerns should assume a greater social responsibility towards communities. The establishment of necessary national and regional infrastructures in order to ensure the proper management and disposal of all hazardous materials, as well as for research and monitoring needs is required. Where necessary, suitable legislation should be enacted without further delay in order to facilitate the putting into place of the national and regional institutional arrangements. Finally, mechanisms for regional co-operation with regard to national contingency plans must be developed to cope with incidents involving hazardous materials;

(iv) pollution from agricultural activities may be tackled by the regulation of farm inputs. This basically involves restrictions on the use of persistent pesticides and inorganic fertilizers and the application of appropriate fertilizer levels. In addition, the adoption of integrated pest management and organic farming must be encouraged;

(v) the erosion of soils induced by man's activities and its impact on the marine environment (as a result of siltation/sedimentation and the consequent destruction of critical ecosystems) can be prevented by proper control measures such as the strict implementation and enforcement of appropriate management schemes. These would include the use of buffer zones, proper land-use practices, including the rational use of lowland and upland resources such as forests, the proper disposal of mine tailings and soil conservation practices. Environmental impact assessments should be conducted for projects before they are undertaken in the coastal zone. Similarly, EIA studies should also be carried out where coastal engineering schemes are likely to result in erosion of the coastline;

(vi) although the multi-media approach for the disposal of wastes from land-based sources, in principle, makes ocean dumping of selected wastes possible, i.e., dredged spoils, sewage sludge and industrial wastes, among others, the transport, disposal and dumping of hazardous wastes must be strictly controlled. Industries producing these wastes must prepare and establish waste disposal and management systems duly approved by the governments before they are allowed to operate. There must be monitoring of the quantity and mode of disposal of these wastes to prevent their entry into the natural environment;

(vii) until recently, it was very unlikely that countries from other regions considered the disposal of wastes within the Wider Caribbean area. However, the transfer of toxic wastes to developing countries from the region by industrially developed countries has become an additional pollution problem in the Wider Caribbean and the countries of the region should consider joining the recently signed Basel Convention and to develop within the framework of the Cartagena Convention a regional protocol to control the transboundary movement of hazardous wastes. Additionally, the countries of the region should establish the necessary national legislation to ban the importation of hazardous wastes into their territories as soon as possible;

(viii) the technical aspects to be considered in the control and abatement of wastes affecting the coastal environment should be generally based on the following criteria (UNEP-WHO, 1982):

a) characteristics and composition of the wastes;
b) characteristics of waste constituents with respect to their harmfulness;
c) characteristics of a discharge site and the receiving marine environment;
d) availability of waste treatment technology; and
e) potential impairment of marine ecosystems.

(ix) the concept of environmental capacity, defined by GESAMP (1986), as the ability of a particular environment to accommodate a particular activity or rate of activity (e.g. volume of waste discharged per unit of time, quantity of dredgings dumped per unit of time, etc.) should be incorporated into the process of defining pollution control measures. The environmental capacity of the marine environment will vary with the characteristics of each site and the type and number of discharges or activities affecting the site; and

(x) the concept of environmental education at all levels, and public awareness should be incorporated into the formulation of strategies for control, abatement and prevention of marine pollution.

A large number of pollution control and abatement measures were taken by many States of the Wider Caribbean region. A sample of these measures is presented in the ensuing paragraphs.

Concerning the abatement of the levels of pollution in the Gulf of Mexico, SEDUE (Secretariat of Urban Development and Ecology of Mexico, 1988), responsible for the national programmes for urban development and ecology of Mexico, requested that the industrial sector of Minatitlan-Coatzacoalcos prepares proposals to achieve the reduction of pollution. More than 80% of the industries complied with SEDUE's request by submitting preliminary proposals.

A major source of mercury pollution on the northeast coast of Colombia, located in the Mamonal area, was closed in 1978 thanks to the available regulations being enforced in Colombia, after it was estimated that more than 10 tons of mercury was present in a contaminated area of 6 km^2 around the plant (FAO, 1979). Additionally, an important step in the control of marine pollution in Colombia has been the establishment in recent years of various laws and regulations which have resulted in the establishment of mandatory environmental education programmes in schools, mandatory EIA studies prior to the implementation of any development project and the establishment of water quality criteria, among others.

In 1986, an agreement between ICLAM (Institute for the Preservation of the Basin of Lake Maracaibo) and PDVSA (Petroleum of Venezuela, S.A.) was established to develop a master plan to control and manage the water quality of Lake Maracaibo and adjacent areas (Parra Pardi, 1986). This document, based on all the available information, will assist MARNR (Ministry of the Environment and Renewable Natural Resources of Venezuela) to co-ordinate the environmental management programme aimed at the restoration of the water quality of the lake (MARNR, 1988).

In the French Departments of the Wider Caribbean, namely Martinique and Guadeloupe, in recreational coastal waters, quality controls are carried out on a regular basis and the results are made available to the general public through leaflets or are posted in town halls.

An important programme for the rehabilitation of heavily polluted coastal areas was the UNDP-UNEP-UNESCO Project "Research and Control of Marine Pollution in Havana Bay, Cuba" and under this project, a comprehensive study of the pollution of Havana Bay was carried out from 1978 until 1986. The results of this project were utilized to formulate a master plan for the environmental management of the city of Havana. Moreover, the institutional strengthening created during the implementation of the project is at present engaged in performing baseline studies on contaminants in other coastal areas of Cuba.

A regional programme, "Environmental Management of Bays and Coastal Zones in the Wider Caribbean", based on the Cuban experience, is being financed by UNEP and implemented in co-operation with UNESCO, with the participation of Colombia, Cuba, Mexico, Nicaragua, Panama and Venezuela.

It is clear that the magnitude of environmental threats to the Caribbean coastal and marine ecosystems is increasing daily due to marine pollution problems. Thus, the need to protect the marine environment and to implement all possible measures to minimize these threats should be undertaken with urgency.

It should be stressed that, in spite of a good understanding of the causes and magnitude of some of the problems listed in the preceding paragraphs, and in spite of existing international, regional and national control measures (including legislative acts) adopted by a number of Caribbean States, problems remain largely unsolved due to laxity in the implementation of these measures. Therefore, the solution to the problems should not be sought primarily through more studies, research and monitoring alone, but through the enforcement of existing and new pollution control measures, most of which could be easily formulated without any delay on the basis of the present understanding of the problems.

4. CONCLUSIONS AND RECOMMENDATIONS

Priorities for the assessment and control of marine pollution in the Caribbean region were defined by the IOC-FAO-UNEP Workshop in 1976 (IOC-FAO-UNEP, 1977), by the Intergovernmental Meeting adopting the Action Plan for the Caribbean Environment Programme in 1981 (UNEP, 1983a), and by the Conference of Plenipotentiaries adopting the Cartagena Convention and its Protocol in 1983 (UNEP, 1983b). Since these meetings and conferences, major changes have occurred in real and perceived threats caused by various marine pollutants. Changes have also occurred in the scientific understanding of the environmental problems of the region and in the Governments' policies and strategies towards control and abatement of marine pollution, as well as in the social, economic and technical development of the Caribbean States. Therefore, the earlier defined priorities may or may not continue to be pertinent today. Recognizing this state of affairs and taking into account the present state of marine pollution and the priorities for its control and abatement, as reviewed in the preceding sections of this document, the following recommendations were submitted to the present Workshop in order to facilitate the development of a comprehensive regional pollution assessment and control programme and were taken into account for completing document IOC-UNEP/RRW-I/8.

A closely co-ordinated programme for the monitoring of sources, levels, pathways and effects of pollutants, combined with concrete proposals for abatement and control measures should be developed on the basis of past and

on-going projects supported within the framework of IOC's GIPME/MARPOLMON (CARIPOL) and UNEP's Caribbean Environment Programme. The co-ordinated programme should include:

(i) Establishment and consolidation of an operational network of environmental laboratories in the region in order to assess on a continuous basis the causes and extent of marine pollution;

(ii) formulation of proposals for pollution control measures deemed appropriate and necessary on the basis of the best scientific analysis of the causes and extent of marine pollution;

(iii) assistance to the States of the Caribbean region in the application of pollution control measures already adopted and in the formulation and application of new measures as necessary;

(iv) establishment of a continuous training programme for experts and technicians in the region on the application and updating of methods and analytical procedures used in the assessment of marine pollution;

(v) introduction of commonly agreed methods and guidelines for reliable marine pollution research and monitoring, taking into account regional specific needs, leading to the assessment of sources, levels and effects of marine contaminants and to the formulation of the appropriate control and abatement measures;

(vi) provision of reference materials for standardization, intercomparison and intercalibration to ensure high-quality control results and region-wide comparability;

(vii) regular monitoring programmes for water quality of coastal waters and for chemical residues in effluent discharges should be undertaken when the problems are clearly identified, coupled with required research to facilitate the interpretation of the results; and

(viii) full use should be made of regional resources and technical experience in the solution of common pollution problems, as well as environmental and scientific institutions dealing with marine pollution aspects.

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APPENDIX

MARINE POLLUTION CONTROL AND ABATEMENT PROVISIONS OF SELECTED REGIONAL AND GLOBAL INTERNATIONAL AGREEMENTS RELEVANT TO THE STATES OF THE WIDER CARIBBEAN REGION

1. THE ACTION PLAN FOR THE CARIBBEAN ENVIRONMENT PROGRAMME

The Action Plan for the Caribbean emerged as a result of many years of work by governmental and non-governmental representatives of the Caribbean community, assisted by the United Nations Environment Programme (UNEP) and the Economic Commission for Latin America and the Caribbean (ECLAC).

This was a grass-root, regionally initiated process set in motion by a deep concern about the future of social/economic development and resource management in the region. Its evolution was an exhaustive process involving extensive discussion and consultation.

Eventually, differences in viewpoints and political perspectives were overcome in the interest of regional co-operation. At Montego Bay, Jamaica in April 1981, twenty-two States and territories adopted the Action Plan for the protection and development of the marine and coastal resources of the Wider Caribbean region.

Its development was requested, as it was recognized that a regional co-operative approach was most suitable to address the growing concern for the conservation, protection and development of the marine and coastal resources of the region.

The geographic coverage of the Caribbean Environment Programme comprises all of the insular and coastal States and territories of the Caribbean Sea and the Gulf of Mexico and their adjacent waters, from the U.S. Gulf coast states and the islands of the Bahamian chain, south to the French Department of Guiana.

With the adoption of the Action Plan for the Wider Caribbean in 1981, the participating governments also approved supporting resolutions dealing with programme implementation, financing and institutional arrangements. Two major legal instruments were subsequently adopted in 1983:

(i) The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean; and

(ii) the Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region.

These two major instruments entered into force in 1986, and to date, have been ratified by 16 countries from the region (see Section 2 below).

Gradually, all thirty four States and territories of the Wider Caribbean region, including the European Economic Community are becoming involved in the Programme and joining together in pursuit of a common goal - the protection of the marine and coastal environment through the promotion of balanced and sustainable economic development. To this end, various past and on-going projects have been implemented within the framework of the Caribbean Environment Programme comprising four wide subject areas:

(i) Co-ordination, information and institutional development;
(ii) environmental management of coastal and terrestrial ecosystems;
(iii) assessment and control of marine pollution; and
(iv) environmental training, education and public awareness.

The development of the Programme has been further enhanced with the establishment of the Regional Co-ordinating Unit in Kingston, Jamaica, which commenced operations in September 1986.

The principal function of the Regional Co-ordinating Unit is to provide policy consistency, administrative oversight, technical guidance and co-ordination to national and international institutions participating in the Action Plan. Another important function of the RCU is to organize the government-expert and Intergovernmental Meetings that monitor the Action Plan and make recommendations on its future implementation.

The RCU does not itself conduct research, but serves as a focus for the collection, review and dissemination of information on the results of work performed under the aegis of the Action Plan.

The Action Plan and its Regional Co-ordinating Unit will never become a substitute for existing institutions now successfully operating in the region. Its purpose is to support, not supplant the region's scientific research, educational and related institutions.

The overall authority to determine the content of the Action Plan, review its progress and direct its course is to be found in the Intergovernmental Meetings (at the ministerial/plenipotentiary level) of the participating States and territories. These governments have assigned responsibility for overall co-ordination and implementation of the Action Plan to UNEP, which answers to the member governments.

A Monitoring Committee, formed by representatives from nine member countries, meets at least once a year and oversees financial arrangements. The Committee is responsible for supervising the progress of specific projects and for ensuring that continuous contacts of a technical nature are maintained among the involved experts and institutions during the period between Intergovernmental Meetings.

The Monitoring Committee also prepares the agenda for the Intergovernmental Meetings, reviews project requests and is responsible for follow-up and evaluation of the Plan, as well as for providing the Regional Co-ordinating Unit with operational and policy guidance for implementing the Action Plan.

2. THE CARTAGENA CONVENTION

The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean was signed in Cartagena, 24 March 1983 by thirteen countries of the region: Colombia, France, Grenada, Honduras, Jamaica, Mexico, Netherlands, Nicaragua, Panama, St. Lucia, United Kingdom, United States of America, Venezuela and the European Economic Community. Barbados and Guatemala signed soon after in the period open for signature. The Convention was adopted with a Protocol on Co-operation for Combating Oil Spills. The Convention and its Protocol entered into force on 11 October 1986 having been ratified by nine countries. At present, the following countries have become Contracting Parties to the Convention: Antigua and Barbuda, Barbados, Colombia, Cuba, France, Grenada, Guatemala, Jamaica, Mexico, Netherlands (on behalf of Aruba and the Netherlands Antilles Federation),

Panama, St. Lucia, Trinidad and Tobago, United Kingdom (on behalf of the British Virgin Islands, the Cayman Islands and the Turks and Caicos Islands), United States of America and Venezuela.

The provisions of the Convention include that appropriate measures be taken to prevent, reduce and control pollution caused by discharges from ships, by dumping, from land-based sources, from sea-bed activities and by discharges into the atmosphere. Additionally, there are provisions for scientific and technical co-operation, for co-operation in cases of emergency, for the development of environmental impact assessment guidelines and for the establishment of specially protected areas.

At present, an additional Protocol to the Convention concerning Specially Protected Areas and Wildlife has been developed and it will be presented for adoption by the Contracting Parties in December 1989. Additionally, the necessary steps have been taken in co-operation with the International Maritime Organization (IMO) for the extension of the Protocol Concerning Co-operation in Combating oil Spills to Include Spills of Other Hazardous Substances.

3. THE LONDON DUMPING CONVENTION (LDC)

With reference to the rules and standards, the London Dumping Convention (LDC), being global in scope, is best seen as an umbrella Convention, which, in the absence of controls specific to an area, can provide some measure of protection to that area from possible adverse effects caused by ocean dumping. The London Dumping Convention, to which thirteen countries from the Wider Caribbean are Contracting Parties (Cuba, Dominican Republic, France, Guatemala, Haiti, Honduras, Mexico, Netherlands, Panama, Saint Lucia, Suriname, United Kingdom and the United States of America), places a mandatory ban on the disposal at sea of a variety of noxious substances and demands that special care be taken in the disposal of others (Annexes I and II of the LDC, respectively), and then calls for all other dumping to be controlled by licence or permit.

Concerning the disposal at sea of authorized materials the application of the LDC's Convention rules involves, as described by Parker (1987), the following stages:

(i) Assessment of the characteristics of the wastes;

(ii) choice of a satisfactory disposal site in relation to ecology and alternative uses;

(iii) establishment of licence conditions to avoid exceeding the environmental capacity of the site; and

(iv) monitoring the disposal operations and its inputs, to confirm the adequacy of the permit conditions to protect the environment.

4. THE MARPOL CONVENTION

The International Convention for the Prevention of Pollution from Ships (London 1973), which was modified by its Protocol of 1978 (MARPOL 73/78), concerns the release of hazardous substances caused by shipping activities, with the exception of land-generated wastes released at sea by dumping and the discharge of substances directly arising out of the exploration and exploitation of sea-bed mineral resources. The Convention consists of articles

and protocols dealing with reports of incidents involving harmful substances and arbitration procedures. It also contains five annexes with regulations for the prevention and control of marine pollution caused by shipping activities. Ten countries from the Wider Caribbean region are signatories to one or more annexes (Antigua and Barbuda, Bahamas, Colombia, France, Netherlands, Panama, St. Vincent and the Grenadines, Suriname, the United Kingdom and the United States of America).

The MARPOL 73/78 annexes are:

Annex I - Regulations for the Prevention of Pollution by Oil.

Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.

Annex III - Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Forms, or in Freight Containers, Portable Tanks or Rail Tank Wagons.

Annex IV - Regulations for the Prevention of Pollution by Sewage from Ships.

Annex V - Regulations for the Prevention of Pollution by Garbage from Ships.

The inter-agency scientific advisory body on matters concerning the evaluation of hazards from substances carried by ships is GESAMP, which also provides advice, as appropriate, on the scientific basis for the implementation of the international Convention (MARPOL 73/78). The hazard profiles for toxic substances developed by GESAMP as described in GESAMP XVIII/3/1 are currently in use by the International Maritime Organization (IMO) to establish the following criteria and requirements for:

(i) The discharge at sea of residue and tank washings from chemical tankers (MARPOL 73/78, Annex II);

(ii) the allocation of ship (chemical tanker) type requirements for the transportation of chemicals (MARPOL 73/78, Annex II); and

(iii) the identification of goods carried in packed forms as "marine pollutants" (MARPOL 73/78, Annex III).

Detailed requirements concerning amounts, concentrations and circumstances under which residues of these compounds may be discharged into the sea are described in accordance with the type of compounds involved, based on the guidelines for the categorization of noxious substances (MARPOL 73/78, Annex II, Appendix 1).

5. THE BASEL CONVENTION

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted unanimously on 22 March 1989 by the 116 States participating in the Conference of Plenipotentiaries to the Global Convention on the Control of Transboundary Movement and Disposal of Hazardous Wastes, which was convened by the United Nations Environment Programme (UNEP) and held in Basel at the invitation of the Government of Switzerland. The Final Act of the Basel Conference was signed by 105 States and the European Economic Community (EEC).

The Basel Convention is the result of six sessions of the ad hoc Working Group in which experts from 96 States and representatives of over 50 organizations participated. Informal negotiations conducted by UNEP with Governments, organizations and industries also played an important part in the success of the preparatory process.

Thirty-five States and the EEC have signed the Basel Convention. It will enter into force upon ratification by 20 States. The following countries from the region have signed the Basel Convention: Colombia, France, Guatemala, Haiti, Mexico, Panama, Netherlands and Venezuela.

The provisions of the Convention include the following:

(i) The generation of hazardous wastes, as well as their transboundary movements shall be reduced to a minimum. The wastes should be disposed of as close as possible to their source of generation;

(ii) every State has the sovereign right to ban the import of hazardous wastes. The Parties to the Convention shall not allow any transboundary movement of hazardous wastes to a State that has prohibited their import. Transboundary movements shall also be prohibited if the exporting State has reason to believe that the wastes in question shall not be managed in an environmentally sound manner;

(iii) a Party shall not permit hazardous wastes to be exported to a non-Party or to be imported from a non-Party, unless it is in accordance with a bilateral, multilateral or regional agreement, the provisions of which are no less environmentally sound than those of the Basel Convention;

(iv) the State of export shall not allow a transboundary movement of hazardous wastes to commence until it has received the written consent, based on prior detailed information of the State of import, as well as of any State of transit that has not informed the Convention's Secretariat of its decision to require no prior written consent for transboundary movements of hazardous wastes;

(v) when a transboundary movement of hazardous wastes which is carried out in accordance with the Convention cannot be completed in an environmentally sound manner, the State of export has the duty to ensure the re-importation of the wastes; and

(vi) transboundary movements of hazardous wastes which do not conform to the provisions of the Convention are deemed to be illegal traffic. The Convention states that "illegal traffic in hazardous wastes is criminal". The State responsible for an illegal movement of hazardous wastes has the obligation to ensure their environmentally sound disposal, by re-importing the wastes or otherwise.

The wastes covered by the Convention are defined in its annexes. Hazardous wastes subject to transboundary movement must be packaged, labelled and transported in conformity with generally recognized international rules and standards. Since the authorities of many countries, especially developing ones, frequently do not have the trained specialists and technical know-how to assess information concerning hazardous wastes and handle it efficiently, the Convention calls for international co-operation involving, among other things, the training of technicians, the exchange of information and the transfer of technology. Guidance materials to assist countries in using the technical annexes are to be prepared.

The Convention provides for the establishment of a Secretariat, the main functions of which shall be to process and disseminate information provided to it by the Parties, to ensure co-operation between Parties and to provide assistance to them in implementing the Convention.

The Convention provides that UNEP will carry out the Secretariat functions on an interim basis, pending the first meeting of the Parties to the Convention after its entry into force. These functions will include undertaking activities in accordance with the resolutions adopted by the Basel Conference. One of these resolutions called upon all States to become Parties to the Convention and to take actions in accordance with its provisions even before its entry into force. In another, the Conference requested the Executive Director of UNEP to take the necessary steps for the interim Secretariat to commence its activities as soon as possible, and called upon Governments to contribute financially towards its costs. In this connection, the Executive Director of UNEP has presented preliminary budget estimates and stated UNEP's willingness to contribute towards the costs of the interim Secretariat during its initial two years of operation.

6. UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

This is the major international Convention which deals comprehensively with the sea, both its resource potential and its environmental vulnerability. Its objective is the establishment of a comprehensive new legal system for dealing with the oceans and the seas. The Convention is ultimately long and detailed, including environmental related provisions. It is divided in 17 parts and 9 Annexes. It encompasses the principles of all preceding maritime legislation and sets the framework for future maritime arrangements between countries.

Through this Convention the sea-bed and its sub-soil are declared to be common heritage of mankind. Rules concerning navigation of and access to the oceans are given. Environmental issues such as pollution and the conservation of living resources are treated extensively. It addresses as well the conservation and management of living resources of the high seas for optimum utilization and sustainable yields, while ensuring ecological integrity.

The following are some of the issues dealt with in this Convention: Protection and Preservation of the Marine Environment; subsections include global and regional co-operation, technical co-operation, monitoring and environmental assessment, international rules and national legislation to prevent, reduce and control pollution of the marine environment, etc.

This Convention was adopted in 1982 and it will enter into force one year after it has received sixty ratifications. It has been ratified by 42 nations, of which 8 belong to the Wider Caribbean region (Antigua and Barbuda, Bahamas, Belize, Cuba, Jamaica, Mexico, St. Lucia and Trinidad and Tobago).

PART 2

MARINE POLLUTION ASSESSMENT AND CONTROL PROGRAMME FOR THE WIDER CARIBBEAN REGION - CEPPOL

1. BACKGROUND AND LEGISLATIVE AUTHORITY

The Fourth Intergovernmental Meeting on the Action Plan for the Caribbean Environment Programme and the First Meeting of the Contracting Parties to the Cartagena Convention (Guadeloupe, 26-28 October 1987), having examined the status of the programme's implementation, adopted the "assessment and control of marine pollution" as one of the four major programme elements of the Caribbean Environment Programme (UNEP(OCA)/CAR IG.2/4, Annex VI).

Recognizing:

(i) The status and results of the past and on-going marine pollution monitoring and research programmes relevant to pollution control and abatement in the Wider Caribbean (Annex VI of IOC Workshop Report No.59);

(ii) the state of marine pollution and priorities for its control and abatement in the Wider Caribbean (Annex VII of IOC Workshop Report No.59);

(iii) the complementary nature of the decision of the Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (Havana, 8-13 December 1986), which assigned high priority to marine pollution research and monitoring activities and to co-operation with UNEP in their implementation (SC-IOCARIBE-II/3); and

(iv) the advantages offered by the joint IOC/UNEP project on the "Assessment and Control of Marine Pollution in the Wider Caribbean Region";

the IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring, Research, Control and Abatement in the Wider Caribbean Region (San Jose, 24-30 August 1989) examined a possible general framework for a regionally co-ordinated comprehensive joint IOC/UNEP programme for marine pollution assessment and control in the Wider Caribbean region (CEPPOL), on the basis of a proposal jointly prepared by the secretariats of IOC and UNEP (IOC-UNEP/PRW-I/8 prov).

Taking into account the comments, suggestions and amendments offered by the workshop, the secretariats of IOC and UNEP prepared the present document which is intended to be submitted for endorsement to the Third Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions - IOCARIBE (Caracas, 4-8 December 1989) and to the Fifth Intergovernmental Meeting on the Action Plan for the Caribbean Environment Programme and Second Meeting of the Contracting Parties to the Cartagena Convention (Kingston, 17-18 January 1990).

2. OBJECTIVES

The overall objective of CEPPOL is to establish a regionally co-ordinated comprehensive joint IOC/UNEP Marine Pollution Assessment and Control Programme catering to the immediate and long-term requirements of the Cartagena Convention and its Protocols (including those that are in the process of development), as well as the requirements of the member States of IOCARIBE.

The specific objectives of the programme are:

(i) To organize and carry out a regionally co-ordinated marine pollution monitoring and research programme concentrating on contaminants and pollutants affecting the quality of the marine and coastal environment, as well as the human health in the Wider Caribbean and to interpret/assess the results of the programme as part of the scientific basis for the region;

(ii) to generate information on the sources, levels, amounts, trends and effects of marine pollution within the Wider Caribbean region as an additional component of the scientific basis upon which the formulation of proposals for preventive and remedial actions can be based;

(iii) to formulate proposals for technical, administrative and legal pollution control, abatement, and preventive measures and to assist the Governments in the region in implementing and evaluating their effectiveness; and

(iv) to strengthen and, when necessary, to develop/establish the capabilities of national institutions to carry out marine pollution monitoring and research, as well as to formulate and apply pollution control and abatement measures.

3. PRINCIPLES

The monitoring of pollutants will focus on pollutants and sites identified as requiring urgent attention. An assessment of the state of pollution will be prepared for each of the monitored sites together with a concrete proposal for remedial action which may eliminate or mitigate the negative impact of pollution for that site.

Research will focus on topics deemed necessary for a better understanding of problems identified as requiring urgent attention or clarification. Concrete proposals for pollution control or abatement measures should be the desirable end product of such research.

National, sub-regional and regional baseline studies on the sources, amounts, levels and effects of contaminants and pollutants will be focussed on compounds justifiably suspected as being significant for the quality of the marine environment and human health. Such baseline studies will be carried out within a defined time frame, and after the evaluation of the results obtained, will be either terminated or will lead to the establishment of monitoring programmes in the appropriate areas.

Representative reference sites considered as being outside the direct influence of identifiable sources of pollution will be monitored for selected contaminants in order to establish the variations and long-term trends, if any, in the levels of these contaminants;

The pollution monitoring and research envisaged to be carried out as part of the programme will be built, as much as feasible, on the relevant past and on-going activities sponsored by IOC, UNEP and other organizations in the Wider Caribbean region and elsewhere. Moreover, these activities will be

considered as elements of the Caribbean regional components of IOC's GIPME-MARPOLMON (i.e. of CARIPOL) and of UNEP's Global Environment Monitoring System (GEMS).

The use of common sampling strategies and methods, analytical methods, data quality control programmes and data processing will be mandatory for all participants in the programme in order to ensure the adequate quality and comparability of data generated through the programme.

A mechanism will be established to facilitate the free flow and exchange of information and results after their careful and critical scientific evaluation.

The implementation of the programme will be achieved through activities carried out by national, sub-regional and regional institutions of the Wider Caribbean region under formal contracts with the body taking care of the day-to-day co-ordination of the programme.

Development plans in the Wider Caribbean region will be taken into account in the design and implementation of CEPPOL in order to ensure an integrated approach necessary for control and prevention of marine pollution.

4. ELEMENTS OF THE PROGRAMME

The programme shall consist of inter-linked components of research, monitoring, baseline studies, preparation of inventories and assessments, identification of priorities, dissemination of information, formulation of proposals for pollution control, abatement and preventive measures and assistance to Governments in the implementation of these measures and in the evaluation of their effectiveness. Concrete activities envisaged for the initial two-year period of CEPPOL are described in the annexes of this report.

4.1 INVENTORIES

As an essential activity, it is necessary to prepare a comprehensive inventory of the major land-based sources of contaminants and of land-use changes which are likely to have deleterious effects on the environment.

While the preparation of the inventory of land-based sources of pollution is envisaged as part of CEPPOL, the analysis of changing land-use practices is, for methodological reasons, not envisaged to be carried out in the framework of CEPPOL but as part of the "Environmental management of coastal areas and terrestrial ecosystems", one of the components of the Caribbean Environment Programme. However, it is recognized that environmentally sound coastal zone management strategies are the key to the reduction of the potentially detrimental impact of land-use practices on the coastal and marine environment. Significant changes from historical land-use patterns are occurring in the region due to economic growth and development. Many of these changes are leading to increased soil erosion and eventually produce undesirable effects on coastal marine environments, including the destruction of sensitive ecosystems (mangroves, coral reefs, seagrass beds, coastal lagoons, etc.). There is considerable evidence to suggest that widespread damage is already occurring, particularly to coral reefs along the Caribbean coast of Central America and to mangrove fringes throughout the

Caribbean coast of Central America and to mangrove fringes throughout the region. The lack of a comprehensive data base on patterns of land-use changes makes it difficult to quantify, predict and prevent this form of environmental degradation. Such a data base is an essential element of an integrated coastal zone management strategy and is needed for meaningful interpretation and utilization of the results expected to be obtained through CEPPOL.

4.2 BASELINE STUDIES

Given the limited technical capabilities of the region and the need to gather information on substances likely to cause contamination of the marine environment and to determine the feasibility of establishing region-wide monitoring programmes, regional and site-specific pilot baseline studies will be carried out at places which are considered as most likely to be contaminated.

The results of each pilot baseline study will be used to make preliminary assessments and, if appropriate, to design region-wide or site-specific monitoring programmes for selected contaminants.

4.3 RESEARCH

Only research directly relevant to the achievement of the objectives of the programme are envisaged.

The results of the research should provide clear advice on the need for monitoring activities and on the effectiveness of proposed control measures. Furthermore, the research is expected to contribute to the quantification of the biological and ecological effects of contamination, as well as to the improvement of the quality of life of the inhabitants of the area.

4.4 MONITORING

Region-wide and site-specific monitoring programmes will be carried out based on the results of the inventories, baseline studies and research activities, on the needs and priorities of the region, on the principles adopted for the programme and on the need to gather additional information for the formulation of concrete proposals for the most suitable measures which may eliminate or mitigate the problems caused by marine pollution.

Monitoring of "reference sites" will be undertaken to provide information on the "background level" of contaminants in unpolluted areas of the Wider Caribbean.

4.5 FORMULATION OF PROPOSALS FOR POLLUTION CONTROL AND PREVENTIVE MEASURES

Environmental impact assessments should be carried out for all major pollutants, taking into account the state of knowledge of the sources, levels and effects of these pollutants. Pollution control and prevention measures expected to be formulated as parts of these assessments may include proposals for environmental quality criteria, emission/effluent standards, administrative and legislative measures, as well as measures for their enforcement. The following general guidelines for the formulation of

proposals aimed at pollution control and abatement are recommended to the States and Territories of the Wider Caribbean for specific types of pollutants:

(i) To control oil pollution, waste reception facilities and disposal procedures should be established, oil spill contingency plans should be finalized and related international, regional and national legislation enacted.

(ii) Sewage treatment combined with appropriate disposal facilities and sites are required for controlling sewage pollution and solid waste disposal. If appropriate and when necessary ocean outfalls at specific sites may be established.

(iii) Industrial pollution should be controlled at the source by appropriate treatment or recycling of wastes and by use of the best available and applicable non-polluting technology. The most appropriate waste disposal alternatives, including land disposal, need to be examined and applied as well.

(iv) To control pollution from agricultural activities, legal and administrative measures restricting the use of persistent pesticides and inorganic fertilizers needs to be enacted and enforced.

(v) Integral coastal zone management should be encouraged to help control the increased discharge of eroded coastal and upland soils to the sea largely due to deforestation. This concept includes the rational use of forest and agricultural resources, the implementation of impact assessments and planning for new urban, industrial and touristic developments, the proper disposal of mine tailings, etc. Guidelines, plans and alternatives for adequate land and resource management need to be established.

(vi) Appropriate oceanographic and coastal engineering studies and practices (coastal defense structures, impact assessments) are required to mitigate the undesirable effects of changes in sediment transport patterns (siltation, coastal erosion). This need may increase if significant future sea-level rises and more frequent storm events take place as a result of global climatic changes.

Strict measures of control must be enacted and enforced at the national and regional levels to control the disposal (including dumping and incineration at sea) and transboundary movement of hazardous wastes.

Public awareness campaigns (including environmental education at all levels) should be fostered as one of the most effective tools in achieving full support to enforcement of pollution control and preventive measures.

More specific proposals for pollution control and prevention measures are expected to result from activities described in previous paragraphs.

4.6 ASSISTANCE TO THE STATES AND TERRITORIES IN THE IMPLEMENTATION OF POLLUTION CONTROL MEASURES

The technical, administrative and legal measures which may be adopted as a result of recommendations emanating from the programme will need two types of follow-up which are expected to be provided through the programme. These include:

(i) Monitoring of the changes in the levels and effects of pollutants, as an indication of the effectiveness and adequacy of the adopted measures; and

(ii) reassessment of the situation created by the application of the adopted measures and, if necessary, the formulation of proposals for new or supplementary measures which may be needed for further improvement of the situation.

5. ORGANIZATION OF THE PROGRAMME

A complex programme, such as CEPPOL, obviously requires clear and well-defined management and organizational structures and mechanisms as the basic prerequisite for the achievement of its objectives. In defining these structures and mechanisms, the following were specifically kept in mind:

(i) CEPPOL is part of: (a) the Caribbean Environment Programme, as implemented under the authority of the Contracting Parties to the Cartagena Convention; and (b) the programme of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), as implemented under the authority of member States of IOCARIBE;

(ii) CEPPOL activities relevant to the assessment of the quality of the marine environment are the Caribbean components of IOC'S GIPME/MARPOLMON and of UNEP's Global Environment Monitoring System (GEMS);

(iii) the on-going CEPPOL related activities and programmes supported by UNEP, IOC and other organizations globally and in the Caribbean region in particular, will be associated with, and as far as appropriate, incorporated in CEPPOL; and

(iv) the existing structures established by UNEP, IOC and other organizations will be used to the maximum benefit of CEPPOL.

5.1 PARTICIPANTS

The programme will be implemented by networks of national and regional institutions of the States and Territories from the Wider Caribbean region, selected by the co-ordinating structures of the programme (see 5.2), in consultation with the relevant national focal points.

The modalities of co-operation, and of the concomitant financial arrangements, will be negotiated between the national and regional institutions and the IOC represented by its staff member outposted to and associated with the Co-ordinating Unit for the Caribbean Action Plan (CAR/RCU) in Kingston. The contractual obligations resulting from these negotiations

will be formalized in a Memorandum of Agreement (contract) signed between the participating institutions and UNEP (CAR/RCU) on behalf of IOC and UNEP.

5.2 CO-ORDINATION

The periodic meetings of the Contracting Parties to the Cartagena Convention and of the member States of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) are the highest authority deciding about the content, direction, workplan, timetable and budget of the programme.

Recommendations which may facilitate making these decisions will be prepared by a joint group of experts for the Caribbean Environment Programme jointly sponsored by IOC and UNEP on the basis of proposals formulated by:

(i) National focal points of the Programme;
(ii) co-ordinating structures of CEPPOL;
(iii) IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE);
(iv) the Caribbean Environment Programme of UNEP; and
(v) other international or regional organizations involved in the implementation of the programme.

The general supervision and guidance for the development and implementation of the programme will be jointly provided by: (a) UNEP as the Secretariat of the Caribbean Environment Programme (through its Regional Co-ordinating Unit for the Caribbean Environment Programme (CAR/RCU) in Kingston, Jamaica); and (b) IOC as the parent body of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE).

The day-to-day implementation and co-ordination of agreed programme activities will be entrusted to IOC in close co-operation with CAR/RCU in Kingston. These functions will be carried out by IOC, through an IOC staff member outposted to and associated with CAR/RCU:

(i) On the basis of a UNEP-IOC project document specifying the modalities of co-operation between UNEP and IOC on the implementation of the programme; and

(ii) through direct contacts with relevant national focal points, institutions agreed as participants in the programme, as well as with international, intergovernmental and regional organizations identified as participants or supporters of CEPPOL, IOCARIBE in particular.

Other international organizations will be expected to provide support to CEPPOL in their respective field of competence, through co-operation with the co-ordinating mechanisms of the programme. For instance, co-operation with IMO is expected on matters related to control of pollution through development and application of contingency plans for maritime emergencies; with IAEA on provision of data quality assurance programme, data management procedures, application of reference methods, etc.; with FAO on pollution problems affecting marine living resources and involving agricultural activities; with WHO on human health related subjects, such as quality of bathing waters and of food of marine origin; with WMO on atmospheric input of pollutants; etc.

In order to ensure efficient communication links with the States and Territories supporting and participating in the programme, they will be requested by CAR/RCU to designate a specific national focal point for CEPPOL. Until such designations are received by CAR/RCU, the national focal points for the Caribbean Environment Programme and the IOC (including IOCARIBE) Action Addresses will be considered as the national focal points for CEPPOL.

A joint UNEP-IOC Expert Group will be established in order to ensure the appropriate scientific and technical evaluation of the development of the programme and its results, as well as to advise on its orientation. The members of the Group will be selected in their personal capacity by the Secretariats of UNEP and IOC on the basis of proposals received from the CEPPOL national focal points (see previous paragraph). The Group will consist of experts familiar with the main aspects of the programme, i.e. pollution research, monitoring, control and abatement, including environmental planning and policy making and enforcement.

5.3 PROGRAMME SUPPORT

5.3.1 **Training**

Individual and collective training will be provided when necessary for scientists and technicians in techniques required for their effective participation in studies, research and monitoring envisaged in the framework of CEPPOL. This assistance will be in the form of fellowships, experts' workshops, seminars, study tours, grants for attendance at meetings, etc., and will cover training in subjects such as use of analytical techniques, data processing, interpretation of results and various research topics.

Training for administrators, technicians and scientists will be organized in order to facilitate the formulation and application of pollution control and abatement measures. The forms of training will be similar to those mentioned in the preceding paragraph.

In addition to training organized and provided through CEPPOL, participants in the programme will be included in the inter-regional and global training activities relevant to marine pollution assessment and control organized or sponsored by UNEP and IOC, as well as other organizations supporting CEPPOL (see 5.2).

5.3.2 **Equipment**

In order to enable the full participation in CEPPOL of institutions which do not have adequate equipment required for the analysis of contaminants or sufficient supplies (chemicals, spare parts, etc.) needed to operate their equipment, limited amounts of such equipment and supplies will be made available to certain participants in the programme.

5.3.3 **Common methodology, intercalibration, data quality control and data management**

Sampling and analytical techniques used in monitoring of standard parameters will be based on mandatory guidelines and reference methods provided through the co-ordinating mechanisms of CEPPOL. Other methods could also be used, including remote sensing, subject to a satisfactory

intercomparison with reference methods. Additional reference methods will be developed and tested, as required, during the implementation of the programme. This will also include updating of existing methodology.

Reference materials for intercomparison and intercalibration will be provided to the participants in the programme in order to ensure data quality control and comparable results. Weaknesses detected through the quality assurance programme will be corrected through additional training and technical assistance, whenever necessary.

The participants in the programme will be included in the planning of intercomparison and intercalibration exercises organized or sponsored by UNEP, IOC, IAEA and other organizations, on a region-wide and inter-regional basis.

A quality control programme will be part of CEPPOL to ensure the highest degree of quality and of comparability of data.

The controlled and analyzed data will be reported by the participating institutions through a mechanism to be established, in an agreed format and according to an agreed schedule, to IOC at CAR/RCU, as the organization entrusted with the direct co-ordination of the programme. On this level, with the use of computer facilities existing in the region, the second analysis of data will be carried out, including the control of their quality (data validation). The co-ordinating body of CEPPOL will develop a mechanism to ensure availability and proper dissemination of the gathered and evaluated data.

Data will be subjected to preliminary quality control and analysis by the institutions participating in the programme.

The specialized IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials (GESREM), IOC-UNEP-IMO Group of Experts on the Effects of Pollutants (GEEP), IOC-UNEP Group of Experts on Methods, Standards and Intercalibration (GEMSI) and the UNEP-IAEA-IOC comprehensive technical support programme will play an active role in providing methodological support to CEPPOL.

5.4 EVALUATION AND FOLLOW-UP OF RESULTS

The scientific and technical evaluation of the programme will be carried out within two years of the initiation of the programme during a meeting of the CEPPOL Expert Group. The meeting will evaluate the progress made, the results and outputs obtained and the future direction of the programme, including the reassessment of marine pollution priorities, if necessary.

The evaluation of the programme relevant to the mandate of the IOC Sub-Commission for the Caribbean and Adjacent Regions (pollution assessment) will be carried out by the Sub-Commission.

The overall general evaluation of CEPPOL will be carried out by UNEP in association with IOC. The evaluation will be presented to the meetings of the Contracting Parties to the Cartagena Convention, together with the Secretariat's recommendations for the future development of CEPPOL.

6. BUDGETARY CONSIDERATIONS

The financial resources needed for the work envisaged in the framework of CEPPOL are expected from:

(i) Contracting Parties to the Cartagena Convention (cash contributions through the Caribbean Trust Fund);

(ii) UNEP (cash contributions from the Environment Fund, on a project funding basis and contributions in kind through certain services);

(iii) IOC and IOCARIBE (cash contributions through Trust Funds and the regular programme budget as well as contributions in kind through certain services);

(iv) National institutions participating in the programme (contributions in kind through services, staff time, etc.);

(v) International organizations participating in and supporting the programme (contributions in kind through services, staff time and activities related to CEPPOL); and

(vi) Voluntary contributions from various sources.

For the first two years of the operational phase of CEPPOL and taking into account the proposed programme of work during this phase (see annexes 1 - VIII), the following financial allocations are envisaged as support to CEPOL (expressed in thousands of US $):

(i)	IN CASH	
	from the Caribbean Trust Fund	300
	from UNEP Environment Fund	320
	from IOC/IOCARIBE	100
	Sub-total:	720
(ii)	IN-KIND AND SERVICES	
	from national institutions	820
	from other international organizations	45
	Sub-total:	865
	TOTAL:	1,585

In addition to the cost indicated in the preceding paragraph, the cost of additional support to CEPPOL, as described in paragraph 7(ii) - (v) of Annex VIII, is estimated as about US $160.000.

The projected cost of individual project components is indicated in the annexes. The summary of these costs is as follows:

	Project Component	Projected Cost (in thousands of US $)		
		UNEP-IOC-CTF	**Counterpart Contribution**	**Total**
I.	Control of domestic, industrial and agricultural land-based sources of pollution	88	150	238
II.	Baseline studies on pesticide contamination and formulation of control measures	115	150	265
III.	Monitoring and control of the sanitary quality of bathing and shellfish growing waters	80	110	190
IV.	Monitoring and control of pollution by oil and marine debris	86	135	221
V.	Site-specific studies of damaged ecosystems and development of proposals for remedial action	62	150	212
VI.	Development of environmental quality criteria	118	120	238
VII.	Research on the significance of organo-tin as pollutant of the Wider Caribbean region	15	50	65
VIII.	Co-ordination of CEPPOL	156	-	156
	TOTAL:	720	865	1,585

The scope of the projects presented is constrained by the budget available and it is unrealistic to address all of the items outlined in Section 4 satisfactorily within the first biennium of operation, unless additional support becomes available. The seven substantive components selected are a response to the priorities indicated in the Costa Rica workshop. Additional components will be introduced and the existing ones expanded as the programme develops, on the basis of programme evaluation and availability of funds.

ANNEX I

CONTROL OF DOMESTIC, INDUSTRIAL & AGRICULTURAL LANDBASED SOURCES OF POLLUTION

1. OBJECTIVE

To reduce the pollution load reaching the marine environment from land-based sources.

2. RATIONALE

Pollutants from domestic, industrial and agricultural activities seem to be the most important source of pollution affecting the marine environment of the Wider Caribbean region and therefore their control through adequate technical, administrative and legal measures should be considered as high priority. Meaningful control measures must be based on reliable information on the land-based sources of these pollutants, on the type and amounts of pollutants generated by these sources, on waste treatment and disposal facilities and practices, on the used amounts of certain products which may end up as marine pollutants (e.g. pesticides), etc. At present such information is generally inadequate in spite of widely reported but poorly documented cases of regional, sub-regional and site-specific significance.

3. METHODOLOGY

Specific guidelines to be used for the preparation of

(i) inventory of land-based sources of pollution;

(ii) assessment of types and amounts of pollutants reaching the marine environment from land-based sources; and

(iii) information on legal and administrative measures regulating the control of pollution from land-based sources;

will be prepared by the Secretariat, taking into account the experience gained with similar inventories and assessments elsewhere, as well as the specific characteristics of the Wider Caribbean region.

The guidelines will be distributed to CEPPOL national focal points who will be responsible for organizing the preparation, in a common format, of country inventories of the sources, assessments of the types and amounts of major pollutants reaching the marine environment from these sources, and information on national legal and administrative measures relevant to control of pollution from land-based sources and their implementation. Assistance (financial and technical) for the completion of this task will be available from the Secretariat to the focal points, if requested.

The information contained in the national reports, together with information available from other sources, will be used by the Secretariat to prepare the draft of a consolidated regional overview, including:

(i) Inventory of land-based sources of marine pollution in the region;

(ii) assessment of types and amounts of pollutants reaching the marine environment of the Wider Caribbean from these sources;

(iii) analysis of national, regional and global legal and administrative measures relevant to control of marine pollution from land-based sources;

(iv) recommendations for concrete regional, site-specific and pollutant-specific technical and administrative/legal measures which may reduce the pollution load on the marine and coastal environment, taking into consideration the needs and capabilities of the countries of the region;

(v) recommendations for technical annexes of a protocol on control of land-based sources of pollution; and

(vi) recommendations for research and monitoring programmes which may be needed for better understanding of the pathways, levels and impact of pollutants from land-based sources on the coastal and marine ecosystems, as well as on human health.

A joint meeting of the UNEP-IOC group of experts and of experts designated by CEPPOL national focal points will be organized by the Secretariat to examine the draft of the regional overview and the recommendations contained therein, and to amend it, as deemed necessary.

The amended version of the regional overview will be presented to the meeting of Contracting Parties for their consideration and action, as appropriate.

4. **OUTPUTS**

(i) National reports prepared according to guidelines referred to in the methodology.

(ii) Regional overview as described in the methodology.

5. WORKPLAN

Activity	Timetable from initiation of the project
Preparation and distribution of the guidelines	0 - 2 months
Preparation of country reports	3 - 9 months
Preparation of regional reports	10 - 12 months
Meeting of experts	13 months
Finalization of the regional report	14 - 16 months

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) National institutions under supervision of CEPPOL focal points

7. BUDGET (IN US $)

(i) cash from UNEP, IOC and CTF

-	consultant, including travel (3 m/m)	18,000
-	assistance to countries for preparation of national reports	30,000
-	meeting of experts	40,000
	Sub-total	88,000

(ii) in-kind from national institutions

-	preparation of national reports	150,000
	Sub-total	150,000
	TOTAL:	238,000

ANNEX II

BASELINE STUDIES ON PESTICIDE CONTAMINATION & FORMULATION OF CONTROL MEASURES

1. OBJECTIVE

To assess the environmental problems associated with the use of pesticides and to develop proposals for measures which may reduce these problems.

2. RATIONALE

The extensive use of pesticides in the region is well known and its deleterious consequences on the marine environment are reasonably suspected. Through run-off, erosion and misapplication, significant quantities of persistent organochlorine pesticides are probably reaching the coastal marine environment where they may affect the marine organisms, and through consumption of contaminated seafood, may pose public health problems. These suppositions must be verified in order to provide a basis for the formulation of proposals for measures which may reduce the risk to ecosystems and humans from pesticide contamination.

Pesticide usage patterns in tropical regions have changed considerably in the last decade with a strong tendency to replace organochlorine compounds with less stable organophosphorus or carbamate compounds. The frequently observed fish-kills may be caused by such compounds. Very little information is available on the behaviour of these substances in the tropical marine environment and research is urgently needed on topics including degradation rates, partition and biological uptake and transfer through food chains to humans.

3. METHODOLOGY

Five types of areas where persistent organochlorine pesticide use is known to be extensive are initially recommended for a pilot study. They are:

(i) Banana growing areas (Panama, Costa Rica and Honduras);

(ii) Cotton growing regions (Colombia and Venezuela);

(iii) Sugar cane growing areas (Cuba and Mexico);

(iv) Coffee growing areas (Jamaica and Cuba); and

(v) Certain islands as unique environments (based in areas covered by activities of CEHI).

The final selection of sites to be included in the pilot study would be made by the secretariat on the basis of concrete proposals expected to be received from national and regional research centres through the respective CEPPOL focal points.

In each of the areas selected for the pilot study the levels of pesticides would be determined in representative samples of sediments and biota, specifically in edible marine organisms. The selection of matrices and pesticides to be studied, the sampling strategy and the analytical methods to be used, as well as the data quality assurance programme and the data management procedures would be jointly agreed by the research centres participating in the pilot study, taking into account the need for comparability of obtained data on a global scale. In order to reach such an agreement a meeting of the representatives of the research centres would be organized by the Secretariat before initiating the work.

In order to facilitate the participation of the research centres in the pilot study, training and technical assistance (equipment, material, experts) would be available to the research centres from the secretariat, and through the UNEP-IAEA-IOC comprehensive technical support programme.

The pilot study would be a contribution and a part of the global "Mussel Watch Programme", whose aim is to determine the global pattern of the marine environment's contamination with persistent pesticides.

The capabilities of one research centre would be strengthened in order to enable it to function as the regional centre for studying the effects of non-organochlorine pesticides. The centre would be expected to assist the region to determine the importance of those types of pesticides under the environmental conditions prevailing in the Wider Caribbean region.

The participants in the pilot study involving organochlorines and in the study of non-organochlorines would be expected to submit to the Secretariat a report containing:

(i) The factual results of their studies;

(ii) an analysis of the significance of the obtained results in the context of the sites from which they were obtained; and

(iii) recommendations for follow-up activities (i.e. eventual further studies) and for concrete measures which may be required to control pollution in the areas covered by the pilot study, if such measures are identified as necessary.

A meeting of the representatives of the institutions participating in the pilot study and in the research on non-organochlorines would be convened by the Secretariat to review the obtained results and to formulate recommendations for further action.

4. OUTPUTS

(i) Assessments of the levels, pathways and likely effects (on human health and marine ecosystems) of organochlorine pesticides for each area included in the pilot study, including concrete recommendations for measures needed to mitigate or avoid the negative impact of these pesticides.

(ii) Assessment of the environmental impact of non-organochlorine pesticides in the Wider Caribbean region, including concrete recommendations for control measures which may diminish that impact.

(iii) Proposals for further studies or monitoring programmes needed for better understanding of the problems associated with the release of pesticides in the marine environment of the Wider Caribbean region.

5. WORKPLAN

Activity	Timetable from initiation of the project
Proposals for areas to be included in the pilot study solicited by the secretariat from research centres and national CEPPOL focal points	0 - 1 months
Selection of areas to be included into the pilot study and of the research centre to be involved in the study of non-organochlorine pesticides	2 - 3 months
Meeting of representatives of the research centres participating in the pilot study to agree on methodological problems	4 months
Pilot study and research on non-organochlorine pesticides	5 - 18 months
Site-specific assessments submitted to the secretariat by research centres participating in the pilot study	19 months
Assessment of the impact of non-organochlorine pesticides submitted to the secretariat	19 months
Meeting of representatives of the research centres participating in the pilot study and in the research of non-organochlorine pesticides to review the obtained results and to formulate recommendations for further action	20 months

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) National institutions selected as participants in the pilot study and in the organochlorine research. The following institutions have been identified as potential participants to initiate this activity:

- Instituto de Ciencias del Mar y Limnologia, UNAM, Mexico City, Mexico
- Escuela de Quimica, Universidad de Costa Rica (EQ-UCR), San Jose, Costa Rica
- University of the West Indies, Kingston, Jamaica

- Caribbean Environment Health Institute (CEHI), St. Lucia
- Centro de Investigaciones Oceanograficas e Hidrograficas (CIOH), Cartagena, Colombia
- National Oceanic and Atmospheric Administration, NOAA, Washington, USA (for data from USA national "Status and Trends Programme")

7. BUDGET (IN US $)

(i) cash from UNEP, IOC and CTF

- assistance to participating institutions	80,000
- meeting to determine methodological approach	10,000
- review meeting	25,000
Sub-total:	115,000

(ii) in kind from participating institutions

- staff time, facilities, etc.	150,000
Sub-total:	150,000
TOTAL:	265,000

ANNEX III

MONITORING & CONTROL OF THE SANITARY QUALITY OF BATHING & SHELLFISH GROWING WATERS

1. OBJECTIVE

To safeguard the public health by surveillance of the sanitary quality of bathing and shellfish growing waters and by development of measures ensuring maintenance of adequate sanitary quality of these waters.

2. RATIONALE

Most of the sewage is released into the coastal waters of the Wider Caribbean region without adequate treatment. Carriers of pathogenic organisms which may reach the coastal waters through inadequately treated sewage are common throughout the region and therefore sewage contamination of these waters is widely recognized as a major public health problem for the bathers and consumers of marine food.

The monitoring of the sanitary quality of the bathing and shellfish growing waters and the enforcement of adequate environmental quality criteria for these waters is a basic prerequisite for protection of public health. The monitoring is usually based on indicators of faecal contamination which in most cases are not pathogens per se. However, it seems that research would be needed to determine whether or not under tropical conditions monitoring based only on "classical" indicators of faecal contamination may be misleading.

3. METHODOLOGY

A seminar/workshop of regional experts would be organized by the Secretariat, in close co-operation with WHO(PAHO):

(i) To review the present state of pollution of the Wider Caribbean coastal waters by sewage;

(ii) to examine the present practices in monitoring the sanitary quality of bathing and shellfish growing areas, as well as the adequacy of these practices;

(iii) to analyze the environmental quality criteria used in the region, the experience gained in their application and their adequacy in safeguarding the public health;

(iv) to recommend measures needed to improve the control of contamination of coastal waters by sewage and to diminish the public health risk from such contamination; and

(v) to formulate a monitoring and research programme leading to the development of environmental quality criteria suitable for the region and on which a rational public health protection strategy could be based.

The participants in the seminar/workshop would be requested to prepare, on the basis of their experience and as an input into the seminar/workshop, a report covering subjects mentioned in (i) - (iv) of the preceding paragraph.

The monitoring and research programme formulated by the seminar/workshop would be followed up by national and regional institutions interested to participate in the programme. Support to the participating institutions would be provided by the Secretariat, in co-operation with WHO/PAHO, specifically on subjects related to research relevant to development of methodologies and environmental quality criteria.

A review meeting would be organized by the Secretariat, in co-operation with WHO/PAHO, to examine the progress of work on the programme agreed at the seminar/workshop and to recommend further activities which may contribute to the control of the sanitary quality of bathing and shellfish growing waters of the Wider Caribbean region.

4. OUTPUTS

(i) Report of the seminar/workshop, covering subjects identified in (i) - (v) of the methodology.

(ii) Report of the review meeting.

5. WORKPLAN

Activity	Timetable from initiation of the project
Organization of the seminar/workshop	0 - 3 months
Seminar/workshop	4 months
Implementation of activities recommended by the seminar/workshop to be carried out	5 - 18 months
Review meeting	19 months

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) WHO/PAHO

(iii) National institutions participating in the agreed programme

7. BUDGET (IN US $)

(i) cash from UNEP, IOC and CTF

-	seminar/workshop	15,000
-	assistance to participating institutions	50,000
-	review meeting	15,000
	Sub-total:	80,000

(ii) in kind from WHO/PAHO		
- staff time		10,000
	Sub-total:	10,000
(iii) in kind from participating institutions		
- staff time, facilities, etc.		100,000
	Sub-total:	100,000
	TOTAL:	190,000

ANNEX IV

MONITORING AND CONTROL OF POLLUTION BY OIL AND MARINE DEBRIS

1. OBJECTIVE

To assess the extent and impact of oil pollution and marine debris, and to develop proposals for their control.

2. RATIONALE

A significant amount of information has been generated on the state of marine pollution caused by petroleum hydrocarbons in the Wider Caribbean, mainly through the IOC-CARIPOL programme. A number of national and sub-regional contingency plans for control of oil pollution in cases of emergency were or are being developed with assistance of IMO, as response to the Protocol concerning co-operation in combating oil spills in the Wider Caribbean region. Additional monitoring of the extent of pollution caused by oil would be required to provide the scientific basis for contingency plans being developed and an indication of the effectiveness of the adopted contingency plans.

Although the presence of marine debris, particularly plastic wastes on beaches and in coastal waters, is a major concern in the region, the existing information on the nature, severity and extent of the problem in the Wider Caribbean region is inadequate for the formulation of proposals for measures which may contribute to the control of this type of pollution.

3. METHODOLOGY

On the basis of information available from various sources the draft of an overview will be prepared by the Secretariat, in co-operation with relevant regional and international organizations, containing the

(i) assessment of the present state of pollution by oil and marine debris in the Wider Caribbean region; and

(ii) review of existing national, sub-regional and regional technical, administrative and legal measures designed to control pollution from oil and marine debris, including an analysis of the effectiveness of these measures.

A workshop of national experts (scientists, administrators and managers) will be convened by the Secretariat, in co-operation with IMO and the Association of the State Oil Corporations of Latin America and the Caribbean (ARPEL) to

(i) Examine the draft of the overview and to suggest corrections and amendments as deemed necessary for the finalization of the overview; and

(ii) formulate a programme of monitoring and research needed for development of new technical, administrative and legal measures to control pollution by oil and marine debris and as an indication of the effectiveness of existing measures.

The proposed programme would be carried out by national institutions expressing interest to participate in the programme. Assistance from the Secretariat would be available to the participating institutions.

A review meeting will be convened by the Secretariat, in co-operation with IMO and ARPEL, to

(i) Review and evaluate the results obtained through the implementation of the monitoring and research programme formulated at the workshop;

(ii) recommend administrative and legal measures (regional, sub-regional and national) which may contribute to the control of pollution by oil and marine debris; and

(iii) propose further monitoring and research needed as the scientific basis for development of additional measures to control pollution by oil and marine debris and as indication of the effectiveness of existing measures.

4. OUTPUTS

(i) An overview as described in the methodology.

(ii) A programme of monitoring and research as described in the methodology.

(iii) A set of recommendations for measures which may contribute to the control of pollution by oil and marine debris.

5. WORKPLAN

Activity	Timetable from initiation of the project
Preparation of the draft overview	0 - 3 months
Workshop of experts	4 months
Implementation of the monitoring and research programme	5 - 18 months
Review meeting	19 months

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) IMO and ARPEL

(iii) National institutions participating in the monitoring and research programme

7. BUDGET (IN US $)

(i)	cash from UNEP, IOC and CTF		
	- consultant (1 m/m)		6,000
	- assistance to national institutions participating in the programme		40,000
	- workshop		20,000
	- review meeting		20,000
		Sub-total:	86,000
(ii)	in kind from IMO and ARPEL		
	- staff time		15,000
		Sub-total:	15,000
(iii)	in kind from participating institutions		
	- staff time, facilities, etc.		120,000
		Sub-total:	120,000
		TOTAL:	221,000

ANNEX V

SITE-SPECIFIC STUDIES OF DAMAGED ECOSYSTEMS AND DEVELOPMENT OF PROPOSALS FOR REMEDIAL ACTION

1. OBJECTIVE

Restoration of coastal and marine ecosystems damaged by pollution and prevention of damage to undisturbed ecosystems.

2. RATIONALE

Eutrophication and the increase in coastal water turbidity, as a result of domestic waste discharges, or riverine transport of eroded soils to the sea, has serious negative consequences on sensitive coastal ecosystems, such as mangroves (loss following siltation), seagrass beds and coral reefs, as well as on shellfish growing waters, all of which are important coastal resources in the Wider Caribbean.

In order to take effective and appropriate remedial or preventive actions following or prior to the destruction or damage of critical ecosystems, it is important to understand the effects and to determine the mechanisms and rates of recovery of damaged organisms or areas.

The results of these studies will provide information on the resilience and capacity for recovery of the ecosystems which is essential for the formulation of appropriate remedial measures. Additionally, these results will also contribute to the establishment of appropriate water quality criteria, specifically those for shellfish growing areas.

3. METHODOLOGY

Proposals for specific case studies will be solicited, through CEPPOL national co-ordinators, from marine research centres in the following study fields:

(i) Impact of domestic pollution (mainly sewage) on coral reefs, mangroves and seagrass beds. For each of the three ecosystems, the community structure of nearby polluted and pristine sites will be compared and the suspended particulate material, turbidity and nutrient load measured in the adjacent seawater.

(ii) Study of cores taken from coral reefs in order to determine the past history of coral growth and annual and interannual changes in the turbidity of the overlying waters. The experience with such studies carried out on the Great Barrier Reef of Australia will be used in carrying out such studies.

(iii) Studies of the depuration, re-lay and rates of purification of shellfish subjected to faecal contamination in order to determine recovery of bivalves. The ability of many organisms to cleanse themselves of pathogens has been well recorded, but poorly quantified under tropical conditions. Organisms, such as bivalves, can either be relayed (in clean sites) or be transferred to depuration tanks containing clean seawater.

Studies are needed to determine the efficiency of these two processes in eliminating microbial pathogens.

(iv) Study of recovery rates of damaged ecosystems after major pollution events, such as:

a) Destruction of mangrove stands by coastal engineering projects or hurricanes;

b) damage of mangroves, coral reefs or seagrass beds following an oil spill; and

c) destruction of corals by dredging or offshore mining.

The analysis of damaged ecosystems should contain proposals on how to minimize or compensate the consequences of the damage once it has occurred and on measures which may enhance recovery of damaged systems.

The result of the studies and the resulting proposals will be reviewed by the meeting of the UNEP/IOC Expert Group.

4. OUTPUTS

(i) Technical/scientific reports on studies carried out in the fields identified in (i)-(iv) of the methodology.

(ii) Proposals on how to minimize the consequences of the damage to ecosystems by pollution events and on measures which may enhance recovery of damaged systems.

5. WORKPLAN

Activity	Timetable from initiation of the project
Proposals for studies solicited by the Secretariat from research centres and national CEPPOL focal points	0 - 1 months
Selection and negotiation of studies to be included in the programme	2 - 6 months
Implementation of studies by research centres (first phase)	3 - 18 months
Interim or final reports submitted by research centres to the Secretariat	19 months
Continuation of certain studies by research centres	18 months and onwards

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) National institutions selected as participants in the studies.

7. BUDGET (IN US $)

(i) cash from UNEP, IOC and CTF

- consultant (2 m/m) for study identified in 3(b)		12,000
- assistance to participating institutions		50,000
	Sub-total:	62,000

(ii) in kind from participating institutions

- staff time, facilities, etc.		150,000
	Sub-total:	150,000
	TOTAL:	212,000

ANNEX VI

DEVELOPMENT OF ENVIRONMENTAL QUALITY CRITERIA

1. OBJECTIVE

To establish a set of scientifically based environmental quality criteria for the coastal environment of the Wider Caribbean region.

2. RATIONALE

Environmental quality criteria are among the most effective administrative tools providing for a rational approach to the protection of human populations and of critical ecosystems from deleterious effects of pollution. They are used, in conjunction with consideration of social and economic factors, for the formulation of primary national environmental quality standards determining the acceptable level of contaminants or damage to the ecosystems, as well as for the formulation of secondary standards, such as the effluent/emission standards.

A large variety of environmental quality criteria and standards exist at present in the Wider Caribbean region. Most of them are not based on sound scientific rationale and are not suitable for the tropical conditions of the region because they were taken over, without adequate adaptation, from developed countries of temperate climate zone.

In order to remedy the situation, a programme for development of regionally applicable environmental quality criteria is urgently needed, specifically for the requirements of the planned negotiation of a regional protocol for control of pollutants from land-based sources and for the implementation of the regional protocol on the specially protected areas.

3. METHODOLOGY

A compilation of existing environmental quality criteria, as well as of primary and derived environmental quality standards relevant to the marine and coastal environment of the Wider Caribbean region will be prepared by the Secretariat. The compilation will also include critical evaluation of these criteria and standards from the standpoint of their suitability for and applicability in the region.

A workshop of regional experts will be convened by the Secretariat, in co-operation with relevant international and regional organizations (WHO/PAHO, FAO, CEHI, and others) to consider the compilation prepared by the Secretariat. The workshop will be expected to

(i) Amend the compilation with corrections and additions deemed appropriate;

(ii) propose a programme for development of environmental quality criteria, including guidelines for their application, which may be necessary for the application of the protocol on specially protected areas and for the negotiation of the protocol on control of pollution from land-based sources.

The programme proposed by the workshop would be implemented by national institutions of the region, with assistance of the Secretariat and of the relevant international and regional organizations.

The results of the programme would be presented to the meeting of the UNEP-IOC Expert Group, and the recommendations of that Group will be brought to the attention of the Contracting Parties and to the relevant meetings organized in the framework of CEP.

4. OUTPUTS

(i) A compilation and critical evaluation of existing environmental quality criteria and standards as described in paragraph the methodology.

(ii) A programme for development of environmental quality criteria and guidelines for their application, as described in the methodology.

(iii) A set of environmental quality criteria and guidelines for their application formulated through the agreed programme.

5. WORKPLAN

Activity	Timetable from initiation of the project
Compilation and analysis of existing environmental quality criteria and standards	0 - 3 months
Workshop of regional experts to amend the compilation and the analysis, and to agree on a programme for development of environmental quality criteria	4 months
Selection of national institutions as participants in the programme	5 - 8 months
Implementation of the programme for development of environmental quality criteria	6 - 18 months
Review of the results of the programme and formulation of recommendations by the UNEP-IOC Expert Group	20 months

6. PARTICIPATING INSTITUTIONS

(i) Secretariat

(ii) International organizations (WHO/PAHO, FAO, etc.)

(iii) National and regional organizations participating in the programme.

7. **BUDGET (IN US $)**

(i) cash from UNEP, IOC and CTF

-	consultant (3 m/m)	18,000
-	assistance to participating institutions	70,000
-	workshop	30,000
	Sub-total:	118,000

(ii) in kind from international organizations

-	staff time	20,000
	Sub-total:	20,000

(iii) in kind from participating institutions

-	staff time, facilities, etc.	100,000
	Sub-total:	100,000
	TOTAL:	238,000

ANNEX VII

RESEARCH ON THE SIGNIFICANCE OF ORGANOTIN AS POLLUTANT OF THE WIDER CARIBBEAN REGION

1. OBJECTIVE

To determine whether organotin contamination represents a serious threat to Caribbean marine ecosystems and to recommend the appropriate control measures.

2. RATIONALE

Tributyl-tin (TBT) is one of the most toxic substances that has been intentionally introduced by man into the marine environment. Negative biological effects have been observed at seawater concentrations as low as 10 ng/l, particularly on some bivalves and fish larvae. The use of this compound in anti-fouling boat paints has been banned, or partially banned in France, United Kingdom and some States of the USA. However, there appears to be no legislation on this matter in the Wider Caribbean and the use of TBT seems to be widespread, particularly in places where large recreational fleets operate.

3. METHODOLOGY

A research centre with capability to measure TBT levels in the marine environment would be selected.

The research centre selected for the study would:

(i) Prepare a survey on the sources, extent and mode of TBT use in the Wider Caribbean region;

(ii) determine the levels and impacts of TBT in selected sites suspected as contaminated by TBT; and

(iii) prepare concrete proposals for measures which may mitigate or avoid the negative consequences of TBT contamination of the Wider Caribbean region.

The report on the study, containing the elements identified in would be considered by the meeting of the UNEP/IOC Expert Group, and the relevant recommendations of the Group would be brought to the attention of the Contracting Parties and to the meetings organized in the framework of negotiation of the protocol concerning control of pollution from land-based sources.

4. OUTPUTS

(i) Report as specified in the methodology (i)-(iii).

(ii) Recommendations for measures which may mitigate or avoid the negative impact of TBT contamination, as indicated in the methodology

5. WORKPLAN

Activity	Timetable from initiation of the project
Submission of detailed research proposals to the Secretariat	0 months
Acceptance of proposals and award of contracts	2 months
Research activities	3 - 15 months
Submission of the report on the research activity to the Secretariat	18 months

6. PARTICIPATING INSTITUTIONS

At present very few institutes in the Caribbean region have technical capabilities for monitoring organo-tin in the marine environment. Other than laboratories in the USA, only the University of Puerto Rico (Marine Science Department) and CEHI may have these capabilities.

7. BUDGET (in US $)

(i)	cash from UNEP, IOC and CTF assistance to the research centre		15,000
		Sub-total:	15,000
(ii)	in kind from participating institutions		
	- staff time, facilities, etc.		50,000
		Sub-total:	50,000
		TOTAL:	65,000

ANNEX VIII

CO-ORDINATION OF CEPPOL

1. OBJECTIVE

To ensure the implementation of agreed CEPPOL activities and their harmonious development with other sub-programmes of the Caribbean Environment Programme (CEP).

2. RATIONALE

The results expected from CEPPOL are not an end in themselves but are contributing to and are part of a wider effort of the States and Territories of the Wider Caribbean region to protect and develop their region. In order to ensure that the results of CEPPOL feed into these efforts and interact with other sub-programmes of CEP, a close technical co-ordination of agreed CEPPOL aactivities is essential.

3. METHODOLOGY

The approach which will be used in co-ordination of CEPPOL is described in Section 5 of this document.

4. OUTPUTS

As identified in the section on outputs in Annexes I - VII.

5. WORKPLAN

In addition to the workplans identified in annexes I - VII, a meeting of the UNEP/IOC Expert Group will be organized by the Secretariat to evaluate the results of CEPPOL and to recommend.its future orientation. The meeting of the Group is planned to be convened 20 months after the initiation of the programme described in this document.

6. PARTICIPATING INSTITUTIONS

The secretariat of the project is a joint IOC/UNEP secretariat, operating as described in Section 5 of this document.

7. BUDGET (in US $)

(i)	cash from UNEP, IOC and CTF		
-	CEPPOL Co-ordinator (P-4/5) including his/her travel (18 m/m)		90,000
-	Bi-lingual Secretary (G-4/5) 12 m/m)		20,000
-	Word processor with printer		6,000
-	Meeting of UNEP-IOC Expert Group		40,000
		Sub-total	156,000

The above cost projection does not include the cost of additional support to project co-ordination and implementation provided through UNEP (OCA/PAC) with funds of UNEP Environment Fund, through UNEP (CAR/RCU) with funds of UNEP and CTF, through IOC with funds of IOC, and through the UNEP-IAEA-IOC comprehensive technical support programme with funds of UNEP, IAEA and IOC. They include:

(ii) support through UNEP (OCA/PAC)

- staff time

(iii) support through IOC/IOCARIBE

- staff time

(iv) support through CAR/RCU

- marine scientist (P-3/4) 24 m/m
- secretarial assistance 24 m/m
- office space, facilities and services (telecommunication, mail, reproduction of documents, etc.)

(v) support from the UNEP-IAEA-IOC support programme

- expert advice 6 m/m
- reference methods and materials

ANNEX IX

REQUIRED AND AVAILABLE BUDGET FOR CEPPOL
(in thousands of US$)

		Required funds estimated for the Regional Workshop, San Jose, C.R., 24-30 August 1989	Expected funds available for 1990-1991
I.	Control of domestic, industrial and agricultural land-based sources of pollution	80	88
II.	Baseline studies on pesticide contamination and formulation of control measures	460	115
III.	Monitoring and control of the sanitary quality of bathing and shellfish growing waters	Not available	80
IV.	Monitoring and control of pollution by oil and marine debris	113	86
V.	Site-specific studies of damaged ecosystems and development of proposals for remedial action	425	62
VI.	Development of environmental quality criteria	280	118
VII.	Research on the significance of organotin as a pollutant of the Wider Caribbean region	75	15
	TOTAL	1,433	564

This budget breakdown does not include three projects proposed during the Costa Rica Workshop for a total of $546,000 to (i) study land use changes; (ii) establish a marine pollution information office; and (iii) establish intercommunications between decision makers and scientists. Proposals (i) and (ii) have been included in other programmes of the Caribbean Environment Programme and proposal (iii) has been incorporated into the general co-ordination of CEPPOL.

No.	Title	Publishing Body	Languages
32 Suppl.	Papers submitted to the UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime Paris, 27 September-1 October 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
33	*Workshop on the IREP Component* of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR) Halifax, 26-30 September 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
34	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa) Tenerife 12-17 December 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
35	CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific Suva, Fiji, 3-7 October 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36	IOC/FAO Workshop on the Improved Uses of Research Vessels Lisbon, 28 May - 2 June 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36 Suppl.	Papers submitted to the IOC-FAO Workshop on Inproved Uses of Research Vessels Lisbon, 28 May-2 June 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
37	*IOC/Unesco Workshop on Regional* Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs Colombo, 8-13 July 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
37 Suppl.	Papers submitted to the IOC-Unesco Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs Colombo, 8-13 July 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
38	IOC/ROPME/UNEP Symposium on Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region Basrah, Iraq, 8-12 January 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
39	CCOP (SOPAC)-IOC-IFREMER-ORSTOM Workshop on the Uses of Submersibles and Remotely Operated Vehicles in the South Pacific Suva, Fiji, 24-29 September 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
40	IOC Workshop on the Technical Aspects of Tsunami Analyses, Prediction and Communications Sidney, B.C., Canada, 29-31 July 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
40 Suppl.	IOC Workshop on the Technical Aspects of Tsunami Analyses, Prediction and Communications *Submitted Papers* Sidney, B.C., Canada, 29-31 July 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
41	First Workshop of Participants in the Joint FAO/IOC/WHO/IAEA/UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region (WACAF/2) Dakar, Senegal, 28 October - 1 November 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
42	IOC/UNEP Intercalibration Workshop on Dissolved/Dispersed Hydrocarbons in Seawater Bermuda, USA, 3-14 December 1984 (in press)	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
43	IOC Workshop on the Results of MEDALPEX and Future Oceanographic Programmes in the Western Mediterranean Venice, Italy, 23-25 October 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
44	IOC/FAO Workshop on Recruitment in Tropical Coastal Demersal Communities Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish
44 Suppl.	IOC/FAO Workshop on Recruitment in Tropical Coastal Demersal Communities - *Submitted Papers* Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
45	IOCARIBE Workshop on Physical Oceanography and Climate Cartagena, Colombia, 19-22 August 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
46	Reunión de Trabajo para Desarrollo del Programa «Ciencia Oceanica en Relación a los Recursos No vivos en la Región del Atlantico Sudoccidental Porto Alegre, Brazil 7-11 de Abril de 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	Spanish
47	IOC Symposium on Marine Science in the Western Pacific: The Indo-Pacific Convergence Townsville, 1-6 December 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
48	IOCARIBE Mini-Symposium for the Regional Development of the IOC-UN (OETB) Programme on "Ocean Science in Relation to Non-Living Resources (OSNLR)"	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
49	AGU-IOC-WMO-CPPS Chapman Conference: An International Symposium on "El Niño" Guyaquil, Ecuador, 27-31 October 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
50	CCAMLR-IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, particularly Krill (organized in collaboration with SCAR and SCOR) Paris, France, 2-6 June 1987	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
51	CCOP/SOPAC-IOC Workshop on Coastal Processes in the South Pacific Island Nations, Lae, Papua-New Guinea, 1-8 October 1987	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
52	SCOR-IOC-Unesco Symposium on Vertical Motion in the Equatorial Upper Ocean and its Effects upon Living Resources and the Atmosphere Paris, 6-10 May 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
53	IOC Workshop on the Biological Effects of Pollutants Oslo, 11-29 August 1986	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
54	Workshop on Sea-level Measurements in Hostile Conditions Bidston, UK, 28-31 March 1988	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
55	IBCCA Workshop on Data Sources and Compilation Boulder, Colorado, 18-19 July 1988	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
56	IOC/FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP) Cleveland, Australia, 24-30 July 1988	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
57	IOC Workshop on International Co-operation in the Study of Red Tides and Ocean Blooms Takamatsu, Japan, 16-17 November 1987	IOC, Unesco Place de Fontenoy 75700 Paris, France	English