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# First IOC-UNEP CEPPOL Symposium

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**UNESCO**

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## 1. OPENING

The Symposium was opened on 14 April 1994, at 9:00 a.m. by Dr. Neil Andersen, Chairman IOC-UNEP-IMO Committee for GIPME, at the Herradura Hotel and Conference Centre, in San Jose, Costa Rica. Mr. Ibe, IOC Senior Assistant Secretary, welcomed the participants and acknowledged those persons who had been involved in the co-ordination of the Symposium.

Ms. Beverly A. Miller, Deputy Co-ordinator of the Regional Co-ordinating Unit of the Caribbean Environment Programme (UNEP-CAR/RCU), in her opening remarks welcomed the participants and explained the background to the meeting.

## 2. CONTRIBUTIONS BY PARTICIPANTS

Papers on the following topics were presented:

**A MODEL FOR ABATEMENT, CONTROL AND REDUCTION OF MARINE POLLUTION IN A REGIONAL SEA**
by Chidi Ibe and Beverly A. Miller

**Abstract**

The Action Plan for the Caribbean Environment Programme was adopted by the governments of the Wider Caribbean region in 1981, and the assessment and control of marine pollution was given high priority. At the Fourth Intergovernmental and First Contracting Parties Meeting (Guadeloupe, 26-28 October 1987), the governments of the region requested a re-orientation of the Action Plan and a strategy for its development. Both the re-oriented Action Plan and the comprehensive Strategy for the Development of the Caribbean Environment Programme, took into account the high priority given to the control and abatement of marine pollution in the Wider Caribbean region.

The strategy called for the implementation in the short-term (1990-1995) of five (5) regional programmes resulting from the re-orientation of the Action Plan, one of which was the Assessment and Control of Marine Pollution (CEPPOL). These mutually reinforcing programmes respond to the objectives of the strategy. Consequently, the governments requested the implementation of these programmes during the 1990-1991 biennium.

In keeping with the thrust of the Regional Seas Programme of UNEP, as well as the recommendations emanating from the meetings and activities mentioned above, UNEP and IOC agreed to convene a regional workshop in San Jose, Costa Rica, to review the problems related to Marine Pollution in the Wider Caribbean and to discuss the priorities identified by the regional experts, as the basis for the development of the CEPPOL Regional Programme.

The Regional Programme for the Assessment and Control of Marine Pollution (CEPPOL) of the Caribbean Environment Programme, is an effective model of regional co-operation. It integrates inputs from the governmental, non-governmental, scientific, academic and the social-economic sectors of the Wider Caribbean Region into a comprehensive programme, to provide guidelines and information required for the establishment and enforcement of the necessary measures to control and reduce marine pollution.

The success of this initiative results from the application of an integrated approach to programme development and implementation. The Action Plan of the Caribbean Environment Programme can be divided into three (3) basic components: research and assessment; management; and support. The Regional Programme addressing research and assessment are the Specially Protected Areas and Wildlife (SPAW), and the Assessment and Control of Marine Pollution (CEPPOL), while the Regional Programme on Integrated Planning and Institutional Development for the Management of Marine and Coastal Resources (IPID), addresses management. Additionally, the Regional Programme on Information Systems for the Management of Marine and Coastal Resources (CEPNET), and the Regional Programme on Education, Training and Awareness for the Management of Marine and Coastal Resources (ETA), supports the programmes addressing research and assessment and management.

An example of the integrated approach mentioned above, is the relationship that exists between the SPAW Regional Programme and the CEPPOL Programme. The CEPPOL Programme provides a number of technical inputs such

as pollutant loads, which are required for the development of management decisions needed to protect and sustainably exploit coastal and marine resources.

Another example of this integrated approach is the relationship between the CEPPOL Regional Programme and the IPID Regional Programme, regarding the management of heavily contaminated bays and coastal areas. The CEPPOL Programme provides an assessment of the marine pollution problems affecting these areas, thus facilitating management decisions required for integrated planning and development.

This integrated approach in which the CEPPOL Regional Programme is a pivotal component, constitutes a successful and replicative model which should be applied in a regional context to obtain cost effective results which permit the elaboration of abatement, reduction and control strategies. It must be borne in mind that the Caribbean Environment Programme achieved this success with limited resources.

The utility of the CEPPOL model can be demonstrated through an examination of the on-going and future activities of the CEPPOL Regional Programme.

The programme consists of interlinked components of research, monitoring, baseline studies, preparation of inventories and assessments, 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

Accordingly, 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 will be prepared. Regional and site-specific pilot baseline studies will be carried out at places which are considered as most likely to be contaminated, and a region-wide and site-specific monitoring programme 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.

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

The essential elements that combined to put the CEPPOL programme on a sound footing and make it the success story it has become are:

(i) the integrated nature of the project from conception instead of after birth, as is the case with most joint projects,

(ii) it is a home brew - authentic and realistic in contrast to the recurring complaint that most UN-sponsored projects are designed in smoke-filled rooms in New York, Paris, Rome, Nairobi, etc. and imported into the regions inevitably with inconsistencies and contradictions that create a feeling of alienation on the part of the "locals",

(iii) it embodied a stepwise approach in the development of the programme - the "bite as you can chew" principle. Following an identification of the problems, the regional scientists prioritized and phased them to suit the expertise and material and financial resources available in the region. As you will hear in the succeeding presentation, these same elements have served the CEPPOL project in its development phase.

Additionally, the implementation of the CEPPOL Programme will continue to be based on the broad range of regionally developed measures and policies to assess and control marine pollution and coastal degradation.

CEPPOL will co-ordinate the activities required for addressing the following issues: the transboundry movement of hazardous wastes, the contingency planning for marine pollution emergencies, the research and development of appropriate technologies for pollution control and abatement, the reception and disposal of wastes generated by tourism and maritime transport activities and last but by no means least, the continued implementation of a number of the objectives of Agenda 21.

San Jose proved a fertile ground for the conception of the CEPPOL programme. We hope it will prove to be an equally effective springboard for consolidating and expanding the achievements of the programme.

**Discussion**

In addition to Mr. Ibe's recognition of the persons involved in the CARIPOL and CEPPOL Programmes, Mr. Corredor recognized the inputs into the programme from Mr. Atwood, Mr. Vazquez Botello and Mr. Costanares.

Mr. Vazquez Botello enquired about the availability of the IOC-UNEP publication on Climate Change in the Interamerican Seas. Ms. Miller informed that the book would be distributed to all the States and Territories of the Wider Caribbean Region.

## LAND-BASED SOURCES OF MARINE POLLUTION, REGIONAL OVERVIEW

by Raul Mederos

**Abstract**

The CEPPOL Programme, which was initiated in August 1990, had several components relevant to the assessment and control of the quality of the marine and coastal environments of the Wider Caribbean Region (WCR). Among the above-mentioned components, the control of domestic, industrial and agricultural land-based sources of pollution (LBSP) became one of the most important activities of the programme.

The present report summarizes the results of the above-mentioned CEPPOL activity and provides information on the LBSP inventories undertaken in 25 countries of the WCR. This comprehensive information has been compiled from national LBSP inventories, mainly from point sources, together with the assessment of the types and amounts of major pollutants reaching the coastal and marine environment from the above sources as well as information on legislative and administrative measures relevant for their control. The detailed results of the inventories are presented in tables and maps. Additionally, a regional overview is provided taking into account sub-regional differences and total pollution loads affecting the entire WCR. This report includes a review of current management practices to control pollution as well as the following recommendations and conclusions:

(i) It has been possible over a short period (2 years), to achieve a comprehensive overview of land-based point sources of marine pollution in the Wider Caribbean Region, (in which information from 25 countries has been included).

(ii) Results obtained through indirect methods of evaluation, can be used to compare the discharges from industries and domestic effluents for national, sub-regional and regional levels.

(iii) The coastal and marine environment of the north of South America and Gulf of Mexico sub-regions receive the largest amounts of pollutant loads.

(iv) Oil refineries constitute the most significant source ofindustrialmarine pollution in the Wider Caribbean, contribution approximately 70% of the total BOD load and over 80% of the total oil and grease discharged from industrial point sources in the region.

(v) There are six industrial categories mentioned in Table 12 that represent 85% of both organic matter BOD and oil discharges from industrial sources in the Wider Caribbean Region.

(vi) Of the six (6) pollutant categories examined in the inventory, BOD and Total Suspended Solids (TSS) represent two of the greatest pollutant loads entering the marine environment of the Wider Caribbean from point sources. BOD and TSS loads for the WCR are the same order of magnitude as the Mediterranean basin, although the distribution of these discharges is concentrated in a few countries for the Wider Caribbean Region while in the Mediterranean Basin it is more widespread.

(vii The negative impact of organic matter (BOD) and bacteriological pollution on coastal ecosystems and the risk to public health are increasing as a result of the lack of adequate systems for the treatment and control of domestic wastewaters.

(viii)The BOD discharges from domestic effluents are around 105 t/y. This figure is similar to the total load reported by the Mediterranean Programme (MEDPOL).

(ix) Although the information on rivers is sparse, the preliminary data indicate that TSS loads from rivers are one order of magnitude higher than loads from industrial and domestic sources discharging directly to coastal waters.

**Discussion**

Mr. Bewers congratulated Mr. Mederos on his very thorough presentation and suggested that in future surveys, care should be taken to include the non-point sources of marine pollution and the pollutant loads from agricultural and non-urban run off.

## LAND-BASED SOURCES OF POLLUTION CONTROL STRATEGIES TO BE CONSIDERED FOR APPLICATION AND USE IN THE WIDER CARIBBEAN REGION

by Tim Kasten

**Abstract**

Technology-based controls and criteria to protect environmental quality both play important and complementary roles in the prevention, reduction, and control of marine pollution to achieve and maintain established environmental quality goals. This paper will demonstrate the significance of identifying, developing, and implementing technology-based controls (including cleaner production) as an immediate need and first priority in a pollution control strategy for the Wider Caribbean Region.

Technology-based controls provide an effective uniform level of control that should be the foundation for a marine pollution control strategy. However, various levels of technology-based controls exist. Depending on existing technical and scientific infrastructure, a particular level of technological control may be chosen.

Ultimately, a technology-based control programme should be supplemented by water quality criteria. Criteria is important as a measurement of environmental quality and in this way supplements technology-based controls. Criteria can determine the effectiveness of controls for marine pollution and the attainment of environmental quality objectives.

This paper will assert that a well designed strategy to control marine pollution and meet environmental goals contains three successive steps: 1) identification of the resources in need of protection, 2) the identification, design and implementation of technology-based controls, and 3) the development and implementation of water quality criteria. Although this process describes a scientific and technologically evolutionary process, it does not preclude the use of existing criteria or the development of a limited number of new qualitative criteria for immediate use.

**Discussion**

Mr. Henry Salas raised his concern over the costs involved in the transfer of technology either for best technology circulation or best management practice in order to have uniformity in the Region.

Mr. Kasten explained that each polluted area and source of pollution would receive attention in keeping with its severity and cost.

## MARINE DEBRIS IN THE WIDER CARIBBEAN REGION

by Jim Coe

**Abstract**

A discussion paper was presented on design considerations for a marine debris monitoring programme as follows:

It is critical to decide on the questions you want the monitoring programme to address because these questions will influence the design. These questions must be written in specific measurable terms. For example, it is not enough to say the programme needs to detect whether or not marine debris is decreasing on the beaches. It must be specified as to what debris (all debris or some subset), what specific decrease (absolute numbers or a percentage), and the level of decrease (20%, 50%). Specifications of geographic-scale and time-frame of interest are critical. Is the programme to cover the entire basin or some specific sub-basins? Designing the survey to answer simple questions (e.g. is there a trend basi-wide?), will preclude answering more complicated questions (e.g. are there sub-basin trends?). Measuring "success" (after success is defined in a quantitative manner) over a 2-year time-frame will yield a different design than a 10-year time-frame. A planning process to specify the questions of interest is critical to the success of the intercalibration exercise.

For beach surveys, the variable that is measured must be decided on in advance. There are three variables that may be of interest: (i) standing stock, (ii) loading rate, and (iii) net accumulation rate.

There have been many different types of survey units for marine debris surveys. The most natural unit for beach surveys would be an entire beach. However, in some areas of the Caribbean basin, the entire coastline is a beach. Therefore, the survey unit will have to be more arbitrarily defined, based on the types of debris in the survey.

After the survey unit is defined, a list of all potential survey units for the basin or each sub-basin area should be made. Since the survey unit is an indicator of oceanic conditions, the potential survey units should be those units that collect or could potentially collect debris (as indicated by collection of natural items such as seaweed or kelp). Once the lists are made, a random sample scheme should be followed to choose the survey units to use.

A typical sampling scheme for beach studies may use a stratified-geographic random sampling approach. The sampling scheme should ensure adequate geographic coverage and include random selection of the sampling units.

We believe that carrying out a power study before a monitoring programme is implemented is important if the managers are to have any indication that the goals of the monitoring programme are achievable. Because of the complicated nature of marine debris surveys, particularly for beach surveys, we suggest a simulation approach with a finite number of scenarios be made (e.g. specified change, number of time periods, number of survey units per subregion).

Given the complicated nature of the design, particularly an inter-calibration exercise, there is no standard procedure for doing a power analysis. Data from the area of interest are needed to provide estimates of the means and variances needed for the power calculations. We encourage the use of workshops to involve the appropriate parties in making decisions about the sampling design and power analysis.

**Discussion**

Following Mr. James Coe's presentation the following comments were recorded. A proposal is in the making for Mr. Coe to provide recommendations to GIPME. Concern was expressed regarding the sampling statistics in explaining variance and control variance to be clearly understood for marine debris. The question arose as to whether it would be possible to organize an intercalibration exercise to include additional partners from the Wider Caribbean Region.

Mr. Bewers enquired about exercises which might have been carried out to determine what percentage of debris collected on the beaches came from the sea.

Ms. Ribic responded that no exercises had been carried out and stated that a bottle exercise had been done in the United Kingdom. Further discussion was recommended.

## OIL POLLUTION IN THE WIDER CARIBBEAN REGION

by Jorge Corredor

**Abstract**

Co-ordinated region-wide monitoring of petroleum pollution in the Wider Caribbean was carried out during the decade of the 1980's, under the auspices of the Intergovernmental Commission of UNESCO with the assistance of FAO and UNEP. These efforts yielded an unprecedented data base describing both temporal and regional variations of the various parameters measured. Records of the incidence of tar balls on beaches, for example, show preferential accumulation of these aggregates on windward beaches throughout the region. Temporal records of floating tar aggregates south of Puerto Rico and off the coast of Florida, are correlated at the 0% level with patterns of tanker traffic. Local submerged seeps and/or inflow from the open Atlantic are thought to account for the remaining half. Seawater content of dissolved or dispersed petroleum hydrocarbons was shown to be higher in enclosed basins such as bays and coastal lagoons, and especially in major ports such as Havana, Cartagena and Kingston harbors and sites of intensive crude petroleum extraction, such as the Rio Coatzacoalcos system in Mexico.

Data derived from the analysis of petroleum hydrocarbon accumulation in marine sediments and bioaccumulation in the mangrove oyster, chosen as an appropriate sentinel organism, have proven more difficult to consolidate. Nevertheless, significant efforts have been undertaken at several sites in the region. These studies likewise point out that, with the exception of major spills from either extraction facilities such as the IXTOC blowout or tanker accidents, severe anthropogenic influence is restricted to enclosed basins.

While the lethal effects of massive oil spills are readily apparent, little information has been forthcoming regarding sublethal effects of petroleum pollution in the region. Of special interest in this sense are recent results from our laboratory in Puerto Rico, obtained through collaboration with the University of Massachusetts at Amherst, pertaining to the mutagenicity of petroleum hydrocarbons released to the marine environment. We have demonstrated that the rate of mutation in the red mangrove, specifically that of genes involved in the biosynthesis of photosynthetic pigments, is correlated at a level of greater than 90% with the incidence of petrogenic polynuclear aromatic hydrocarbons in the sediments. Although this research was not directly supported by the UN agencies, the expertise garnered with the aid of these agencies over the years, proved vital to its development.

**Discussion**

Mr. Corredor's presentation included the impact of oil pollution on mangrove forests, acute and chronic effects, particularly the red mangle. Questions were raised concerning the chronic impact on the mutagenic conclusions of the work, particularly the validity of the correlations regarding cause and effect. Consideration was also given to whether these effects can be detected in other types of mangrove forests. Mr. Corredor indicated that the observations are only valid in red mangrove because they are viviparous.

## P.A.H'S IN MEXICAN COASTAL AREAS OF THE GULF OF MEXICO

by Alfonso Vazquez Botello
Guadalupe Ponce and
G. Diaz-Gonzalez

### Abstract

Information collected over a 15 year period, on the presence and distribution of petroleum hydrocarbons and PAH's along the Mexican coastline of the Gulf of Mexico was presented.

The highest total concentrations of hydrocarbons correspond to the Tonala and Coatzacoalcos rivers in Veracruz State, (1148 y 680ppm). This is a clear indication of the intensive oil activities carried out in that area.

On the other hand, the continental shelves of the Caribbean and Campeche Bank also registered high levels (70 and 94ppm). Of paramount importance is the presence of PAH's in coastal lagoons, because of their ecological importance, especially those compounds conformed by 3, 4 and 5 benzene rings because their carcinogenic properties as Benzo(a)pyrene and Crysene.

The composition of the PAH's identified is related to their main sources as pirolisis, burn of vegetation, oil spills, diagenesis of organic matter, seeps and atmospheric transport.

### Discussion

It was emphasized that most of the investigations carried out by Mexico were financed in their entirety through local funding.

## IMPACT OF POLLUTION ON COASTAL AND MARINE ECOSYSTEMS GENERATED BY THE UTILIZATION OF PESTICIDES ON RICE CROPS IN CARTAGENA, (COLOMBIA)

by Jesus Garay Tinoco

### Abstract

In Colombia actually, more than 600 different pesticides are used which represent near 33,000 tons per year. Mainly organoclorated, fosphorated and carbamates, these substances are used in banana, cotton, rice, fruit and other crops that are along the Magdalena River basin, the most extensive in the country. On the other hand, most of these compounds are manufactured and distributed from Cartagena from where significant runoffs over the coastal zone originate.

The "Cienega de la Virgen" is a coastal lagoon, on the Colombian Caribbean northeast of the city of Cartagena, particularly important for its fisheries which support a coastal population near 30,000. The lagoon is influenced by short course rivers particularly in the rainy season. Close to the Cienaga there are fields on which different formulations of pesticides are used, estimations yield 50 tons per year.

This document corresponds to the final report of the Colombian pilot project carried out by CIOH with the cooperation of INDERENA (Cartagena) and the support of UNESCO/IOC/UNEP. An inventory, complete and actualized with qualification and quantification of the pesticides used in the Colombian Caribbean rivers is given, with special emphasis on the cienaga de la Virgen and its surrounding zone. Also, organoclorated compound levels in water, sediments, and important commercial species of the cienaga were analyzed. Measures for the rational use of these compounds and recommendations to increase the quality of the waters of the cienaga are also presented.

### Discussion

The question was asked whether organochlorine pesticides were still being used in Colombia, any evidence of this, it was stated, would have been from old applications. The frequency of sampling was also considered. No bioaccumulation has been determined in fish. Proparil compounds used to protect rice crops were not determined because of the lack of standards.

## RESIDUES OF INSECTICIDES IN JAMAICAN RIVERS, COASTAL WATERS AND AQUATIC FAUNA

by A. Mansingh

**Abstract**

Monthly monitoring of residues in the Hope River (South Central Jamaica) at 7 sampling stations, during 1990 and 1991, revealed the presence of insecticides in 12 to 65% of samples. The mean levels in water (ng-L) and sediments (ng-g: data in parentheses) for various insecticides in 1990 and 1991, respectively, were: a-endosulfan, 2.07 (95.5) and 0.87 (2.22); p-endosulfan, 5.2 (2.21) and 0.15 (4.02): endosulfan sulphate, 0.21 (35.2) and 0.48 (4.02); diazinon, 0 (0) and 43.6 (2211.3); and dieldrin, 0 (0) and 0.0002 (0.73 ng-g). The low levels are atypical of the expected situation since little spraying activity was carried out in the region due to almost complete destruction of plantations by the 1988 hurricane.

Three rivers and sea coast (SC) in the North East were monitored 9-10 times between October 1991 and December 1992. Endosulfan (a-end)., p-end and end. sulphate) residues were present in 70-80% of water or sediment samples from Spanish (SR) and Swift (SWR) rivers, 25% of SC, and only 20% of Rio Grande samples. Other residues were detected only once or twice. The mean levels of residues in water (pg-L) and sediments (ng-g: data in parentheses) of SR, SWR and SC respectively were: a-end, 2.59 (3.95), 1.25 (24.6) and 2.63 (1.8); p-end, 1.7 (0), 2.1 (0) and 0.65 (1.8); end. sulphate, 1.3 (4.9), 4.52 (4.59) and 3.15 (3.3); dieldrin, 0 (0) 0.85 (0) and 10.1 (0); DDE, 0 (0), 0 (3.1) and 1.1 (0); arochlor, 0 (0), 0 (0) and 0.25 (0). Ninety percent of river shrimps and 66% of coastal fishes were contaminated, the mean residue levels (ng-g wet wt.) for SR, SWR and SC fauna being: a-end, 16.12, 7.1 and 86.33; p-end, 8.6, 11.25 and 39.2; and end.sulphate, 10.2, 8.21, respectively. The fluctuations in the residues were directly related mainly to the spraying of coffee and rainfall patterns.

Rio Cobre, which drains the South Central Jamaica has contaminated Kingston Harbour. Weekly sampling of the coast for a month in July, 1992, revealed the following mean residue level in water (pg-L) and sediments (ng/g in parentheses): a-end, 2.18 (0.52); p-end, 7.86 (0.38); end. sulphate, 0.0003 (0); DDT, 7.02 (0.035); dieldrin, 1.88 (0.001); aldrin 0 (9.2); endrin, 0.26 (0.006); lindane, 0 (0.5); HCB, 0 (1.0); and diazinon, 0.05 (0.0045). One of the six fish samples had diazinon (0.31 ng/g), while two of the three oyster samples were contaminated, one with diazinon (0.04 ng/g) and a-end (3.25 ng/g) and the other with 2.24 ng/g of aldrin.

**Discussion**

The management plan in place in Jamaica was discussed in detail. High levels of contamination were found in the rivers under study, but no effects were shown in the fish. Bioassays were used LC50 LC90 static were performed for mixtures of endosulfon. The question was asked concerning the impact of non persistent pesticides and a satisfactory response was received.

## ORGANOTIN CONTAMINATION IN THE USA AND BRITISH VIRGIN ISLANDS

by Peter Desrosiers

**Abstract**

The measurements described above are clear evidence that tributyltin contamination is widespread in the Virgin Islands. Sea water concentrations of tributyltin exceeding 500 ng/L have been found at sites in both the United States and British Virgin Islands. These concentrations are surprisingly high given the small populations on these islands (50,000 on St. Thomas and 10, 000 on Tortola) and are comparable to the concentrations measured at more heavily populated areas such as San Diego, California (900 ng/L) San Remo, Italy (600 ng/L), Nice, France (800 ng/L). More important, these concentrations are over fifty times greater than the concentrations known to be toxic to non-target organisms. This is of particular concern since these islands are surroundedby extraordinarily fragile coral reef ecosystems, and the islands depend on the tourism these reefs generate. An equally important observation is that the highest concentrations of tributyltin are found at sites which service primarily small (less than 25 meters) recreational vessels. This last result

suggests that tributyltin contamination may be a problem even on smaller islands with little or no commercial boat traffic and indicates the need for further studies to determine the range and magnitude of tributyltin contamination throughout the Caribbean.

The completed longitudinal study of St. Thomas Harbour and results from sampling other sites in St. Thomas and St. John are to be presented in a final report to be written in September 1994. Other suggested studies which are to be the subject of a proposal to be submitted to UNEP for funding include:

(i) A longitudinal study of tributyltin concentrations at the cruise ship dock in Tortola. Of particular concern is how rapidly the tributyltin concentrations build up after the dock starts servicing cruise ships and what will be the ultimate levels of trubutyltin.

(ii) A longitudinal study of Christiansted Harbour on St. Croix, the largest of the Untied States Virgin Islands. Because the geography of St. Croix is substantially different from that of either St. Thomas or Tortola (the ocean floor drops to several thousand meters within a few kilometers of shore) the levels of tributyltin may be considerably different from St. Thomas.

(iii) A study to sample sea water from other Caribbean islands (e.g. Anegada, St. Martin, St. Barth, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, Barbados, Grenada, Trinidad, Bonaire, and Aruba) to determine extent and magnitude of tributyltin contamination in the Caribbean.

**Discussion**

Mr. Bewers commented that in the future, greater attention should be paid to TBT and its derivates in sediments. When the use of TBT is discontinued, sediments will become the predominant source and will determine the magnitude and period of residual contamination. Mr. Neil Andersen asked about the lack of correlation with the number of cruise ships. Mr. Tim Kasten asked if TBT was regulated in other islands and it was suggested that a survey should be done.

Mr. Enrique Mandelli informed that a new type of antifilming paint is being developed. However, in order to monitor TBT pollution, an indicator organism should be chosen.

## BIOGEOCHEMICAL NITROGEN CYCLE AND ITS RELATIONSHIP TO THE EUTROPHICATION PROCESS IN THE COASTAL WATERS OF THE WIDER CARIBBEAN REGION

by Jorge Corredor

**Abstract**

Nitrogen, phosphorus, silicon and more recently, iron, have been identified as limiting nutrients for phytoplankton growth in marine waters. Preferential uptake of nitrate of overt phosphate in the Guajira upwelling along the southern margin of the Caribbean points towards nitrogen limitation in Caribbean waters. In pelagic environments, nitrogen limitation is, to some extent, overcome through the fixation of molecular nitrogen by cyanophytes; notably *Trichodesmium thieuhatii.* The colonial filamentous cyanophyte *Microcoleus lyngbyaceus,* together with the closely related *Trichodesmium,* constitute the two most abundant cyanophyte species worldwide. In contrast to *Trichodesmium,* however, *Microcoleus* inhabits nearshore marine environments. Massive proliferation of this species, able to exploit fixed nitrogen as well as molecular nitrogen, commonly occurs in eutrophic nearshore tropical marine environments. Such algal proliferation and eventual decay may lead to severe environmental degradation.

Benthic remineralization and the consequent rapid return of inorganic nitrogenous compounds to the euphotic zone,assures the maintenance of substantially higher biological productivity in nearshore waters, when compared to pelagic marine environments where detrital material is lost to the abyssal depths. In temperate coastal marine environments, benthic microbialdenitrification, whereby nitrate and nitrite are transformed to molecular nitrogen, constitutes a "safety valve" which buffers the deleterious effects of excessive inputs of fixed nitrogen. Tight coupling of

nitrification and denitrification is however a requisite for this effect. In oligotrophic non-depositional tropical marine environments, notably coral reefs, nitrification proceeds at substantial rates through the action of sponge symbionts and sedimentary microbial communities. In depositional environments, characterized by low circulation rates, nitrification may be severely restricted by oxygen availability causing uncoupling of the processes. This in turn can allow for harmful accumulation of nitrogenous products. Anthropogenic nutrient inputs, either in the form of inorganic or of organic species of limiting nutrients, may exacerbate such problems leading to the further accumulation of organic matter in the sediments, to enhanced release of reduced nitrogenous products, principally ammonium, and thus to continued environmental degradation.

As benthic nitrification is dependent upon oxygen availability, documentation of the depth and magnitude of the redoxocline may serve as a simple operational diagnostic for eutrophication of inshore marine environments. In coral reef sands, this discontinuity may be found at depths of up to 30 cm within the sediment. In depositional environments, subject to incipient eutrophication, the discontinuity migrates upward to within millimeters of the sediment-water interface. Under severe eutrophication, the redoxocline may break free of the sediment surface and invade the water column leading to anoxic waters.

**Discussion**

Mr. Neil Andersen congratulated Mr. Corredor on his presentation and comments.

"Trichod" is excluded from upwelling regions and from coastal waters in general. It appears that its ability to utilize fixed nitrogen (ammonium and nitrate) is much lower than that of the Microcaleus. This might explain the observed mutually exclusive distribution of these two closely related species.

The blooms generally occur during exceptionally calm periods. Nitrogen fixed or transported by this organism is severely affected by mechanical stress such as wave action.

Mr. Bewers: Is nitrogen or phosphorous the limiting nutrient in the Caribbean?

Mr. Jorge Corredor responded that the question was still open but in their view, it was nitrogen.

Mr. Henry Salas: Should control measures be taken on Nitrogen or Phosphorous?

Mr. Jorge Corredor: Anthropagenic loading is mostly sewage. The answer is not to control Nitrogen or Phosphorous; it is to control sewage.

## SANITARY QUALITY OF THE COSTARICAN CARIBBEAN BEACHES

by Darner Mora Alvarado

**Resumen**

Con el objetivo de contribuir a la creacion de criterios de calidad en aguas marinas utilizadas para recreacion, se determinaron los tiempos de declinacion del 90% (T90) de los microorganismos indicadores de calidad, en las aguas del mar Caribe costarricense. Los bioensayos se hicieron durante el ano a992, con una frecuencia mensual y el ambiente natural de la ciudad de Limon. En la determinacion de las T90 diurnas se utilizaron envases de 20 litros cristalinos o transparentes y en las T90 nocturnas envases opacos. Los microorganismos a los cuales les determinaron las T90 fueron: Escherichia cali (EC), Enterococcus (ET), Pseudomonas aeruginosa (PA), Staphylococcus aureus (SA) y Candida albicans (CA). Los promedios de las T90 nocturnas en minutos, indican: 140, 94, 82, 122 minutos para EC, ET, PA, SA, respectivamente. El hongo CA no presenta una declinacion del 90% en las condiciones nocturnas. Las T90 en las horas diurnas fueron: 60, 66, 45, 104,118 minutos para EC, ET, PA, SA y CA respectivamente.

**Discurso**

Mr. Neil Andersen: Does your monitoring programme include any radioisotope measurements? Mr. Andersen continued to state that hospitals sometimes discharge radioisotopes (resulting from diagnostic procedures) into the marine environment.

Mr. Mora: This is so. It will be necessary to implement a monitoring programme to ascertain the impact on the marine environment from the use of radioisotopes.

Mr. Douglas Lipka: Have any measures been taken subsequent to the monitoring programme? The response was positive and Mr. Darner Mora continued to state that diverse programmes and studies are being implemented to control marine pollution from land-based sources.

Mr. Vazquez Botello asked if there were any studies on marine organisms for human consumption to which Mr. Mora responded that such studies had recently been initiated.

Ms. Angela Wagner stated that with regard to submarine outfall, oceanographic and environmental impact studies should be conducted prior to the construction of the outfall.

## SEWAGE DISPOSAL ALTERNATIVES FOR COASTAL CITIES

by Henry Salas

**Resumen**

Se presenta un enfoque sabre la actual disposicion de aguas negras en America Latina y El Caribe asi coma una breve descripci6n sabre las alternativas principales disponibles para disposicion de aquas negras en ciudades costeras. Despues del reuso, la alternativa del emisario submarino largo con pretratamiento (militamices) o tratamiento primario es el metodo mas atractivo relativo al tratamiento secundario con disposicion cerca al litoral en terminos de confiabilidad, costa, eficiencia que requiere poca operacion y mantenimiento. Sin embargo, se deben evitar las descargas de aquas negras cerca a comunidades naturales biologicas sensibles coma son los corales. Se presentan curvas de costa para emisarios submarinos. Tambien la existencia de plasticos y metodos de construccion modernos hacen que los emisarios submarinos largos sea factible para comunidades pequenas y complejos turisticos.

Actualmente existen 84 emisarios submarinos en America Latina y El Caribe que se distribuyen coma sigue: Venezuela (39), Puerto Rico (14), Brazil (12), Mexico (9), Chile (8), and Uruguay (1). Fuera de Puerto Rico hay solo un emisario submarino en la subregion caribena, lo que demuestra que este tipo de sistemas tiene muy poco usa en El Caribe.

En el contexto del reuso, se presentan experiencias en America Latina con tratamiento de aguas negras mediante lagunas de estabilizacion para la remocion de patogenos. Tambien se hace una comparacion entre los sistemas de tratamiento alternativos y eficiencias en la remocion de bacterias, helmintos, virus, quistes y se indica las ventajas y desventajas de los reactores anaerobios de flujo ascendente (RAFA).

**Discussion**

Mr. Corredor indicated that discharge depths of greater than 30 meters should be considered in light of oceanographic phenomena.
All these factors would be considerd in the decision for an outfall disposal system. However, several engineering rules of thumb state that diffuser depth be in the region of 20 meters or more, to achieve appropriate dilutions. The 60m maximum depth is applied for inspection and maintenance considerations since this is the maximum depth to which a diver can safely go with standard equipment.

Equalization tanks are usually used in submarine outfalls disposal systems where sedimentation is minimal. CEPIS recommends that submarineoutfall systems include pre-treatment (millu screens) or primary treatment.

Tim Kasten stated that submarine outfalls appear to be a viable alternative in some cases for the treatment of domestic sewage, and should be considered for the protocol on Land-Based Sources of Marine Polluton. Two other control measures mentioned by Mr. Henry Salas should also be considered: (i) Stabilization lagoons and (ii) Anaerebic(?) reactors of ascending flow.

Question: Must some kind of collection tank or primary treatment be utilized with long submarine outfalls?

Angela Wagner: Previous to designing and planning a submarine outfall, it is absolutely necessary to implement a long-term survey of the oceanographic and meteorological condition of the target region. The topographic condition of the sea bottom (bed/floor?) must also be taken into consideration. In the case of the Rio de Janeiro outfall, there is a group of islands in front of Ipanema beach avoid the fast dispersion of the sewage material. In addition, in the winter time there is no stratification of the water column, the sewage plume rises to the surface, and depending on the wind direction, can reach the beach. During the summer, cold upwelling water causes the establishment of a thermocline, the sewage mass is retained at a certain depth, spreading over a large area. It can be compressed towards the beach by rising waste masses.

A change in sediment composition has been observed. Nowadays sediments are a potential source of phosphorous and heavy metals which have been deposited over the 18 years of operation of the outfall. Besides bacterial concentration, one has to take into consideration the impact of such an installation on the marine environment: the outfall is also a source of organic pollutants and trace elements in the marine ecosystem.

Response: Data presented shows that the Ipanema submarine outfall system has reduced total coliform levels on the beaches of Ipanema and Leblon from average levels greater than 100,000 MPN/100 ml to less than 1000 MPN/100 ml. It was noted that high land costs in Rio de Janeiro did not permit the construction of planned treatment facilities which may be the reason for the contamination of heavy metals and other pollutants in the vicinity of the outfall. Also, discharges further than the present three kms from beach areas would have been more desirable. Nevertheless, from a sanitary human health (public health?) point of view, substantial improvement has been achieved and present faecal contamination on the bathing beaches is due to other sources and not the outfall, as demonstrated by the data.

## SOLID WASTE MANAGEMENT

by Homero Silva

### Abstract

The pollution caused by solid wastes in developing countries is largely disregarded. Most of the attention is given to pollution caused by wastewater discharges, both sanitary and industrial. Solid wastes are usually regarded as a problem primarily because of the negative impact on the aesthetics of the environment when it is inappropriately disposed of. The real problem, however, lies in the fact that because of poor disposal practices, the potential exists for adverse effects upon the individual and community health and the environment in general (including marine). Add to the foregoing the results of dumping on wetlands with their delicately balanced ecosystems, and the potential for ground and surface water contamination from indiscriminate dumping in gullies, sinkholes, mined out limestone pits and similar environments.

The pollution caused by solid wastes surpasses largely (10 to 20 times) the one caused by domestic sewage, because while it is estimated that 52 grams of sanitary waste (in terms of BOD) are produced and discharged by an individual, compared with 500 grams to 1,000 grams of solid waste which are produced by the same individual.

Moreover, the adverse impacts caused by solid wastes spread over a wider spectrum than those caused by sanitary ones, because while the adverse impacts of sanitary wastes are more related to infectious diseases and organic matter(impacts that are important, however), the ones caused by solid waste include not only those but those adverse impacts caused by high organic

concentrates (leachates), toxic wastes, hazardous wastes, infectious wastes, radiological wastes etc.

Adding to the foregoing is the fact that only between 40 to 60% of the solid waste produced is collected, the remainder is disposed of in empty lots, river banks, etc. polluting the environment. Moreover, the waste collected is usually disposed of in open dumps as properly managed landfills are very rare. For example in the case of Costa Rica, of fifty-five (55) municipal landfills, only one (1) may be considered as a "regular" sanitary landfill.

In a study conducted in Jamaica in 1989, similar results were found. In this study twenty-six (26) officially recognized dump sites were identified. Thirteen (13) of them were located near water bodies (swamp land, sea shores, rivers and gullies), six (6) in abandoned mined out pits, six (6) in land formerly used for agriculture and one (1) near an institution. Only three (3) were considered adequately located, two (2) have cover material available (the others were merely open dumps), one (1) site had what can be considered a work front, none of them had a filling schedule worked out for regulating the rate of site utilization. Other problems found were: no runoff diversion, lack of proper equipment, burning to reduce volume, unskilled operators, no security, no tipping fee, poor accessibility, rampant scaengin, fly-breeding and foul odour.

Among the factors which contribute to the problem of solid waste management are: public lack of awareness, weak solid waste management companies (low budget, lack of collection equipment, inadequate equipment in landfills, unskilled personnel, inadequate tariffs, lack of professionals, low wages, lack of interest from industries, low regulatory capacity, insufficient promotion on waste management (reuse, recycling, waste reduction and rejection).

**RECOMMENDATIONS**

The problem of solid waste is a multiple variable equation, where each variable should be transferred to produce an efficient and effective waste management programme at the lowest cost and with the highest beneficial impact on the environment. The frame of a solid waste management programme should include the producers, the waste management agencies and the regulatory agencies as well as the financing institutions.

The producers (community, industries, commerce, agricultural sector, etc.) should look for ways to produce less waste, to increase the utilization of clean technologies, to have a greater involvement in the solutions (through NGO's or community-based organizations), and to demand corrective measures from the politicians and decision-makers. They should be willing to pay the right tariffs. The regulating agencies (Ministry of Health, Ministry of Natural Resources, etc.) should establish suitable regulations, strengthen surveillance, acquire suitable equipment and hire trained people or train the present staff. They should support environmental education programmes, formal and non-formal and informal. They should allow for the participation of NGO's and community-based organizations in the solution of solid waste management problems.

The public education programme should include waste management programmes such as rejection of products, reduction, reuse and recycling.

Discussion

Mr. Fred Berry made the following comments: The information especially from Costa Rica will be very useful.

Banana plastics

(i) in a few Costa Rican plantations examined, plastics and banana often are not in land-fill, but onto surface as land-build.

(ii) Banana stalk plastic bags are probably more deleterious than (for example) tourist-deposited plastics. Also, banana plastics should be measured differently (perhaps by surface area) and relative % to other debris should somehow be ameliorated.

Response: Time does not permit further discussion of additional details concerning banana plantations. I agree with your comments although we should consider optimum ways of disposal of the plastic bags and how these could be used in the production of energy.

## INTEGRATED MANAGMENT AND SUSTAINABLE DEVELOPMENT OF THE MARINE AND COASTAL ZONES IN VENEZUELA

by Hernan Perez Nieto

**Abstract**

La ordenacion integrada y el desarrollo sostenible de las zonas marinas y costaras constituyen una estupenda herramienta para que los Estados riberenos logren el adecuado aprovechamiento de los espacios y recursos naturales de tales areas, par cuanto ofrecen pautas para mejorar la calidad de vida de la poblacion actual sin poner en pelibro el provenir de las generaciones del futuro. Asi quedo evidenciado en la Conferencia de las Naciones Unidas sabre el Medio Ambiente y el Desarrollo o CNUMAD o "Cumbre de la Tierra" (Rio de Janeiro, Brasil, 3-14 de junio de 1992).

Los principios basicos del desarrollo sostenible estan claramente definidos entre otros documentos, en "Nuestro Futuro Comun" o "Informe Brundtland" de la Comision Mundial del Medio Ambiente y del Desarrollo (1988). Lo relativo a la planificacion y gestion de las areas marinas y costeras esta muy bien expuesto en el capitulo 17 de la Agenda 21 de la CNUMAD, titulado "Proteccion de los oceanos y de todos los tipos de mares, incluidos los mares cerrados y semi-cerrados, y de las zonas costeras, y proteccion, utilizacionb racional y desarrollo de sus recursos vivos", cuya seccion o area de programa "A" se titula precisamente "Ordenacion integrada y desarrollo sostenible de las zonas costeras y de las zonas economicas exclusivas".

A nivel regional, se han llevado a cabo o se continuan efectuando actividades al respecto en el seno de organismos internacionales, tales coma la Comision Economica para America Latina y el Caribe (CEPAL) y, sabre todo, la Subcomision de la Comision Oceanografica Intergubernamental (COI) de la UNESCO para el Caribe y Regiones Adyacentes (IOCARIBE) y el Programa Ambiental del Caribe (PAC) del Programa de las Naciones Unidas para el Medio Ambiente (PNUMA). Una mencion especial amerita el enfoque de la Comision de Desarrollo y Medio Ambiente de America Latina y el Caribe, coauspiciada par el Programa de las Naciones Unidas para el Desarrollo (PNUD) y el Banco Interamericano de Desarrollo (BID), la cual da preferencia al termino "desarrollo sustentable", asi camo quedo acunado en su informe, titulado "Nuestra Propia Agenda" (1990).

En Venezuela, donde la ocupacion del territorio costero, asi coma la del resto del pais, se ha llevado a efecto de manera generalmente anarquica, es decir sin seguir planes preestablecidos, par la que existen tremendos conf lictos para el usa del espacio y sus recursos naturales, en particular los turisticos y pesqueros, estos asuntos han venido siendo objeto de interes particular desde la entrada en funcionamiento del Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR) en 1977, apoyandose para ella en un cuerpo de leyes marco o leyes organicas, leyes ordinarias, leyes especiales, decretos, reglamentos y resoluciones.

De hecho, en Venezuela, el proceso dinamica que es la ordenacion de las areas marinas y costeras, se lleva a cabo segun una metodologia que puede esquematizarse en los tres puntos siguientes:

(i) El diagn6stico de la situaci6n actual, el cual consiste en determinar el estado en que se encuentran en este momento, desde el mayor numero de puntos de vista pero de manera integrada, los espacios marinos y costeros, asi coma sus recursos naurales en general y los renovables en particular. Este inventario permite identificar los entes competentes al respecto, las lagunas de informacion, las potencialidades y los requerimientos.

(ii) El escenario tendencial, que os la suposicion de la que ocurriria de aqui al ano 2015 (iapso fijado par los organismos de planificacion competentes ) en un espacio dado o con un determinado recurso natural,en casa de que se permita la continuacion de la situacion actual sin tomar medidas correctivas significativas.

(iii **El escehario deseable y posible** o **imagen objetivo**, que es la hipotesis de la que ocurrirSa de aqui al pano 2015 en un espacio dado o con un determinado recurso natural marino y/o costero en el supuesto casa de que exista la voluntad politica, par parte de los organismos de decision al mas alto y demas niveles, para aplicar las medidas de mitigacion, correccion o prevision (incluyendo la formacion de los necesarios recursos humanos calificados), establecidas y recomendadas par un grupo multidisciplinario e interinstitucional de especialistas y contenidas en planes de ordenaci6n (ordenacion integrada y desarrollo sustentable) elaborados a las escalas adecuadas mediante una amplia consulta participativa, en que intervienen todos los actores posibles, desde los oficiales a nivel nacional, regional y local, hasta los ciudadanos a titulo individual, pasando par los representantes del sector privado, los medias academicos y las organizaciones no gubernamentales.

**Discussion**

Mr. Enrique Mandelli asked if the two UNEP-sponsored Coastal Zone Management studies mentioned were closely related to IPID.

Mr. Perez Nieto responded positively and stated that IOCARIBE is increasing its involvement in Coastal Zone Management issues.

## THE PROTECTION OF THE MARINE AND COASTAL ZONES IN THE FRAMEWORK OF THE CUBAN NATIONAL PROGRAMME ON ENVIRONMENT AND DEVELOPMENT

by Armando Blanca

**Resumen**

Durante mas de tres decadas, a partir del triunfo de la revolucion cubana, se ha instrumentado un conjunto de acciones dirigidas a la proteccion ambiental y dentro de elias las orientadas a la proteccion de las zonas costeras y marinas dado el caracter insular del territorio cubano.

A la luz de los acuerdos de Rio de Janeiro (CNUMAD, 1992), y especSficamente con la propuesta de un plan de accion global, regional y nacional (Agenda 21), la politica ambiental del pais se reorienta con los nuevos conceptos del desarrollo sostenido, elaborandose un programa de acean (Programa sabre Medio Ambiente y Desarrollo) que representa la adecuacion cubana a ese documento.

A partir de las condiciones ambientales del pais evaluando las premisas economicas y sociales que intervienen en esta estrategia, camo son: la voluntad politica, el basamento legislativo, la capacidad institucional, el nivel de concientizacion, as capacidades cientifico-tecnicas y economicas financieras en su interrelacion con la estrategia de desarrollo econ6mico del pais, se elaboro el Programa Nacional baja los nuevos conceptos del desarrollo sostenido.

La vinculacion del desarrollo economico del pais con las zonas costeras y marinas, aclquiere especial relevancia en los lineamientos para la accion que el Programa prevee, con un caracter integral e intersectorial, fundamentalmente a traves de la actividad legislativa, de ordenamiento territorial, de la evaluacion de los impactos ambientales, del sistema de inspeccion estatal, de las practicas de producciones limpias, del trabajo en las cuencas hidrograficas, de los planes de contingencias en areas costeras y marinas y el control de las fuentes terrestres de contaminacion.

Especial significado dentro del Programa Nacional sabre Medio Ambiente y Desarrollo, son las acciones que se preveen en el marco de la colaboracion regional vinculadas al Plan de Accion del Caribe y fundamentalmente en los marcos de CEPPOL, donde actualmente se participa activamente en los proyectos regionales dirigidos a la lucha contra la contaminacion par plaguicidas, de efluentes de la actividad minera-metalurgica, sabre la calidad de aguas de bano y cria de ostiones, asi camo en otros proyectos vinculados a las areas costeras y marinas, camo son la proteccion *de* bahamas y puertos, la proteccion y conservacion e recursos naturales marinos, coma par ejemplo el coral negro y el manejo integrado del archipielago Sabana-Camaguey en los marcos del financiamiento del Fonda Global Ambiental (GEF).

Mr. Douglas Lipka asked if the 389 guidelines were voluntary to which Mr. Blanca responded that they were.

Mr. Henry Salas asked if there was much public participation in the program, to which Mr. Lipka responded that there was widespread public participation throughout the various communities.

Mr. Ajai Mansingh expressed his contentment with the participation of children in the programme.

## THE CEPPOL PROGRAMME IN AN INTEGRATED COASTAL ZONE MANAGEMENT CONTEXT

by Enrique Mandelli and Stefan Andersson

**Abstract**

Based on the principles of the CEPPOL Programme and after four years of implementation, the programme has provided regional frameworks to prevent, abate and control coastal marine pollution. It is necessary to point out the completion of the LBSP inventories from point sources. Within the context of coastal zone management plans, many countries of the Wider Caribbean Region (WCR) such as the U.S.A., Mexico, Colombia, Venezuela, Cuba, Jamaica and Trinidad and Tobago, as well as some Territories of the WCR, are making a concerted effort to control the degradation of coastal areas.

Conflicting land-use interests such as urban expansion, industrial development, agriculture and tourism are threatening increasingly limited coastal resources. Moreover, human activities in-land, contribute significantly to the degradation of the coastal environment. In order to eliminate degradation, several strategies as well as those of CEPPOL, are already in place in the different sub-regions.

Due to the diversity in development, coastal zone management plans are at different stages of progress as a result of the oppressive conditions associated with socio-economic problems. Keeping in mind the above-mentioned differences, the problem will be examined in the following five (5) sub-regions, selected at random: Gulf of Mexico, Mexico, the Caribbean, Central America and the greater and lesser Antilles. Within these sub-regions, the small islands of the WCR represent a special case due to the uncontrolled development of the tourism industry which threatens pristine coastal environments.

Within this complex framework of different needs for coastal zone management, the CEPPOL Programme should use its scarce resources to provide basic information for coastal planners in the above sub-regions. Moreover, CEPPOL should also promote the enforcement of global and regional legislation such as the Annex of MARPOL and the future LBSP Protocol of the Caribbean Environment Programme (CEP).

## AN INTERGOVERNMENTAL APPROACH TO RESOLVING ENVIRONMENTAL PROBLEMS IN THE GULF OF MEXICO

by Douglas Lipka

**Abstract**

The Gulf of Mexico is one of North America's most valuable natural resources. Due to increasing signs of deteriorating environmental quality, and increasing conflicts among the various users of the resource, the United States Environmental Protection Agency (EPA) initiated an intergovernmental effort called the Gulf of Mexico Program to provide a mechanism for addressing complex problems in the Gulf that cross state, Federal, and international boundaries. The institutional structure of the Program provides improved coordination among the myriad of policy makers, managers, scientists, user groups, educational institutions and the general public in the development of a long term management plan for the Gulf of Mexico. This paper describes the current strategy, goals, and organizational structure of the Gulf of Mexico Program as well as emerging actions, and outreach efforts for the Wider Caribbean.

**Enhancing Interagency Cooperation through Harmonious Integrated Programmes and Activities in the Region. - Round Table Discussion**

All participants in the Symposium were present at the Round Table discussions and Mr. Raul Mederos Baez, the CEPPOL Co-ordinator, took this opportunity to thank those persons who were involved in the preparations for the meeting as well as the participants in the meeting.

## 3. RECOMMENDATIONS

(i) The results of the CEPPOL Programme will be published and distributed.

(ii) Symposiums such as this one should be held at least every two years.

## 4. CLOSURE

The Symposium was closed at 3:00 p.m. on Friday, 15 April 1994 by Mr. J. Michael Bewers, Vice Chairman of the IOC-UNEP-IMO Committee for GIPME, who expressed his appreciation to the hosts, organizers and all participants.

# ANNEX I

## AGENDA

1. **OPENING**

2. **CONTRIBUTIONS BY PARTICIPANTS**

3. **RECOMMENDATIONS**

4. **CLOSURE**

**ANNEX II**

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