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***L. Davidson:***  
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***of the Wider Caribbean Region***

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## ENVIRONMENTAL OVERVIEW

The Wider Caribbean Region, as defined by the United Nations Environment Programme's (UNEP's) Convention for the Protection and Development of the Marine Environment, includes the Gulf of Mexico, the Caribbean Sea, areas of the Atlantic Ocean adjacent thereto and within 200 nautical miles of the Atlantic coasts of all the nations south of 30 degrees north latitude and north of the French Guyana-Brazil border. The region encompasses an area of approximately four million square kilometers and contains an approximate volume of 9.6 million cubic kilometers of water (UNEP 1987). The major flow of surface water is from southeast to northwest (Figure 1). The land masses are continuous along its southern, western and northern borders and are comprised of islands in eastern areas.

After centuries of colonial exploitation, mono-crop agriculture and military use, much of the region has been left with severely damaged terrestrial and coastal marine environments which today are under further stress because of growing populations, expanding tourism, waste disposal methods, industrial activities, oil tanker discharges, deforestation, erosion and over-fishing.

In addition, a number of recent changes in the region are having environmental consequences. The region has become a dumping grounds for hazardous-waste operators trying to evade new, stringent waste laws in industrialized nations. Renewed interest in oil exploration has resulted in plans to place significantly more oil drilling operations in the region. There is a risk of nuclear accidents from submarines, especially in areas where tanker traffic is heavy and offshore structures are prominent.

The increasing potential for environmental disasters spotlights the need for contingency planning and cooperation between nations.

### Water-borne Pollution

The Caribbean region is particularly vulnerable to water-borne pollution. The prevailing surface currents move the water very rapidly, linking together many nations which are not immediately adjacent. The deeper areas in the Wider Caribbean Region, which contain most of the volume of water, are under the sill depth and receive very little renewal or flushing (Atwood, 1977) posing a serious risk for accumulation of persistent pollutants.

Water-borne pollution can be traced to three principal sources: untreated sewage, agricultural run-off, and industrial activities, especially those of the oil industry.

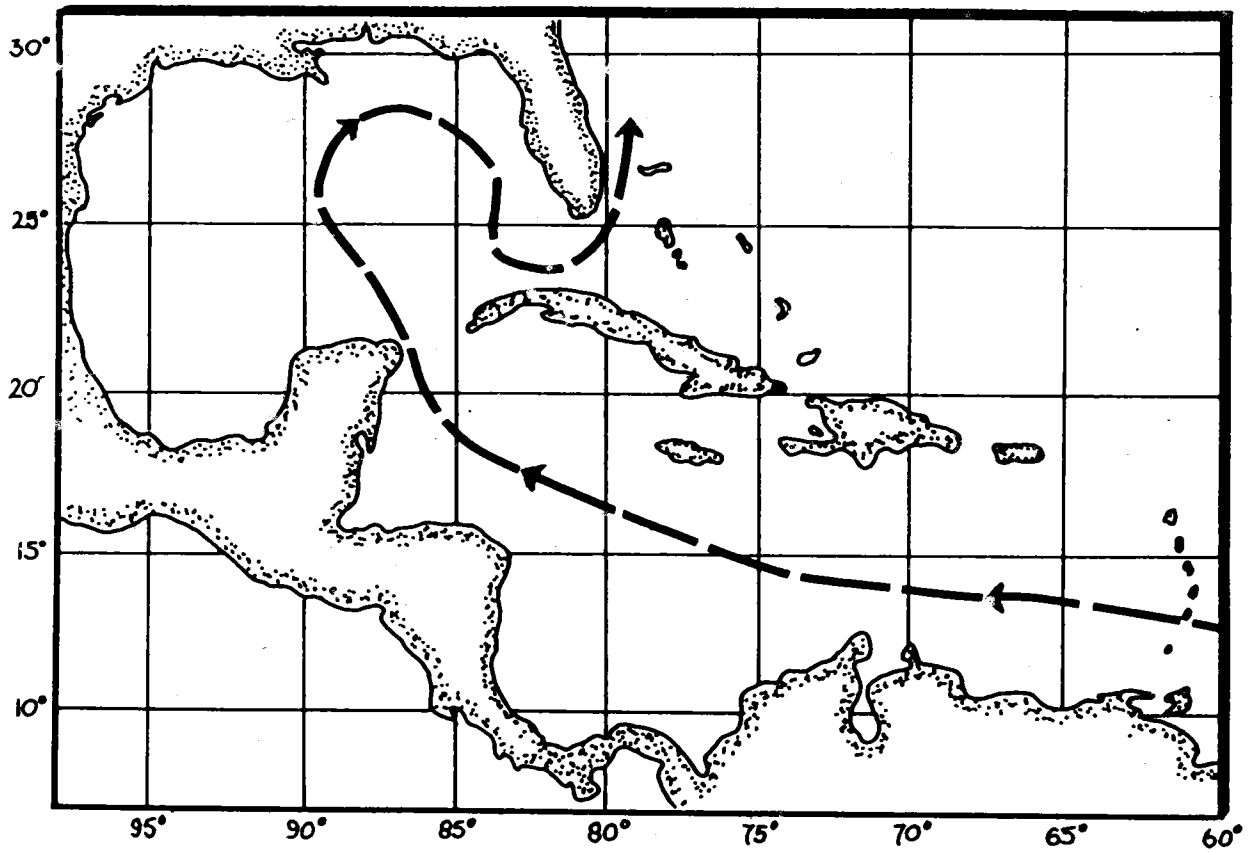


Figure 1: The heavy dashed line is a schematic representation of the major flow through the system when the Loop Current is intact in the Gulf of Mexico (Molinari et al, 1980).

The domestic wastes of approximately two hundred million residents (Table 1 shows Worldwatch's 1988 population and rate of natural increase figures) and more than ten million tourists are discharged annually into the water. A recent study indicates that less than ten percent of the population along the Caribbean basin is served by any form of sewage treatment. Discharge of untreated sewage can produce profound changes in water chemistry and quality when anoxic hazardous materials build up substantially. The capacity of the Caribbean waters to absorb the continual anoxic sewage wastes along with other chemicals is limited.

Agriculture is economically important to every nation in the region, and the use of agro-chemicals is steadily increasing. Pesticides have a diminishing value, however, when they contribute to the pollution of fishing grounds, poison livestock and adversely affect the public health through contamination of drinking water and food. Run-off of agricultural chemicals is estimated at more than one billion pounds per year. Agro-chemical residues are found in the estuarine and coastal sediments as well as in the water in dissolved form. They then enter the food web, progressing from microscopic life to humans. Run-off of nitrogen fertilizers, combined with pollution from sewage, also kills fish through "phytoplankton blooms" that cut off sun light to underwater plants, and reduce oxygen in the water as the plants die.

Most nations in the region allow industries to dispose of large portions of their waste in coastal waters. Coastal ecosystems that border industrialized areas have substantial concentrations of heavy metal contamination (UNEP 1987). The synergy of accumulated wastes with rapidly expanding oil and chemical industries is making the situation critical in some parts of the region.

Industries in the region include processing related to agriculture and fishing (tanning, fish-packing, sugar refining), oil exploration and refining, lumber pulping and milling, nuclear power, chemical factories as well as printing, textiles, automotive repair, and ship building and repair. All of them put large amounts of hazardous materials into rivers, estuaries, wetlands, and coastal waters.

Petroleum pollution is severe throughout the region. Floating tar as well as dissolved and dispersed petroleum hydrocarbons are chronic contaminants that result from oil tanker traffic and from offshore oil development. Windward-exposed beaches from Barbados to Florida are heavily contaminated with tar. The tar levels on many beaches either prevent recreational use or require expensive clean-up operations. Petroleum pollution in the water causes illness and death to marine animals, particularly to endangered sea turtles who feed on the floating tar, and to fish whose enzyme systems are affected, a condition associated with reproductive decline (CARIPOL 1980).

Table 1:

## Worldwatch 1988 population and rate of natural increase figures

Caribbean nations	Population	Rate
Antigua and Barbuda	100,000	1 %
Bahamas	200,000	1.9%
Barbaços	300,000	.8%
Belize	200,000	3 %
Colombia	30,600,000	2.1%
Costa Rica	2,900,000	2.9%
Cuba	10,400,000	1 %
Dominica	100,000	1.6%
Dominican Republic	6,900,000	2.4%
France		
French Guiana	800,000	2.0%
Guadeloupe	300,000	1.3%
Martinique	300,000	1.2%
St. Barthelemy	-	-
St. Maartin	-	-
Grenada	100,000	1.9%
Guatemala	8,700,000	3.2%
Guyana	800,000	2 %
Haiti	6,300,000	2.8%
Honduras	4,800,000	3.1%
Jamaica	2,500,000	1.7%
Mexico	83,500,000	3.5%
Netherlands		
Aruba	-	-
Netherlands Antilles	200,000	1.4%
St. Martin	-	-
Nicaragua	3,600,000	3.5%
Panama	2,300,000	2.2%
St. Kitts and Nevis	40,000	1.4%
St. Lucia	100,000	2.2%
St. Vincent and the Grenadines	100,000	2 %
Suriname	400,000	2.1%
Trinidad and Tobago	3,100,000	2.2%
United Kingdom		
Anguilla	-	-
British Virgin Islands	-	-
Cayman Islands	-	-
Montserrat	-	-
Turks and Caicos Islands	-	-
United States		
Puerto Rico	3,400,000	1.2%
St. Croix	-	-
US Virgin Islands	-	-
Venezuela	18,800,000	2.4%
Global rate of natural increase		1.7%
Latin America rate of natural increase		2.2%
- = No figures available		

Hazardous materials from the more industrialized nations also are moving to the region--from accidental spills into the waters, improper waste disposal and from the export of foreign-produced toxic wastes. Among these exported materials, agricultural-chemicals and toxic wastes pose the most alarming threats.

Water-borne pollution is most severe in areas where large or rapidly growing populations live in coastal zones and is less severe in Central American nations where the Caribbean coastline is less densely populated.

### Living Resources

The living resources of the Caribbean--fish, agricultural produce, timber, and other native plants and animals--are diminishing. New laws to protect these resources need to be adopted and existing laws need to be more rigorously enforced.

The bays, estuaries, seagrass beds and coral reefs that serve as fish nurseries are being destroyed. Because of this habitat destruction, as well as excessive harvests and pollution damage, the number of commercial fish and shellfish are decreasing in many areas or are at a steady-state level despite recent efforts toward better management.

The progressive destruction of tropical forests has resulted in massive erosion causing siltation and turbidity in both inland and coastal waters. Farmlands and beaches are also eroding, producing similar results. Fresh water is being depleted, and fragile coastal environments such as mangrove forests and savannahs are disappearing.

Marine mammals and sea turtles are endangered and threatened throughout the region. The Caribbean Monk Seal is believed to have become extinct in the last decade. Manatee populations are seriously depleted throughout the region, and the decline is continuing. Entanglement in fishing gear, habitat loss and collisions with motor boats are primary causes of manatee mortality. Turtles are being killed for their commercial value and as the incidental result of shrimp trawling, and they are losing many of their nesting grounds because of beach development.

Alarming numbers of dolphins are being captured for display purposes throughout Europe and the Americas; and in 1987 a devastating disease, of unknown origin, killed a large percentage of the Atlantic bottlenosed dolphin population along the US Atlantic coast.

Two species of endangered great whales have breeding and calving grounds in the Wider Caribbean Region. What is done to preserve these grounds could well determine whether these great whales survive or become extinct.

## Management and Information Exchange

Many of the environmental management principles in the region are based on standards from industrialized nations, which assume that ocean discharges occur into large well-mixed ocean basins with resilient phytoplankton-based food chains (that exist near the surface). They also assume temperate zones, which are far more resilient to pollution. The Caribbean region is predominantly tropical with the upper Gulf of Mexico subtropical. Most of the fisheries-based food web occurs benthically (on or near the bottom), both for nearshore areas and the continental shelf. The ecosystem is of far greater value nearshore in the tropics, in proportion to total productivity, and is more sensitive to pollution. Environmental policies of temperate industrialized nations are inadequate to protect these more fragile tropical ecosystems.

Although marine expertise is increasing in the region, most environmental management agencies remain understaffed. Centers of learning in the region and in other nations are producing environmental experts, but because of low salaries and other conditions Caribbean governments are not always able to retain trained personnel.

Several organizations have undertaken environmental studies of the region in the past decade, but these studies and other educational materials have not been widely disseminated. Members of the media, and even government decision-makers, are often under-informed about environmental issues. Public libraries and schools do not have sufficient educational materials about the environment.

The funding to help develop regional strategies and programs is insufficient. Certain problems such as oil spills have received detailed planning, while other concerns such as status of fish stocks have not been thoroughly examined.

## Conclusion

The Caribbean is at a critical juncture. Given the present trends, the next several years will be a period of tremendous acceleration in the growth of local industry and population, resulting in serious environmental dilemmas and crises. International cooperation as well as leadership from national governments and environmental experts is required to prevent more pollution and resource depletion throughout the region. Stronger national and international policies and better enforcement of current policies are needed. Citizens, as well as governments, should be involved at a multi-lateral level.

The overall goal for international cooperation in the Wider Caribbean Region should be to promote sustainable development. Prevention and precaution should be the guiding principles in these efforts.



## RECOMMENDATIONS

A series of important environmental decisions face the delegates to the Caribbean Action Plan in September 1988. In the spirit of reversing presently adverse trends and putting development on a sustainable course, Greenpeace offers the following recommendations for immediate as well as long-term action:

### INTERNATIONAL CONVENTIONS

(a) Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention)--The Convention provides a broad framework that sets general priorities and obligations for environmental protection and management within the region. However to be fully effective, these general undertakings must be developed into specific programs. Greenpeace, therefore, urges the Parties to the Convention to develop and ratify, as a matter of urgency, specific protocols concerning: cooperation in establishing specially protected areas and wildlife; combating land-based sources of marine pollution, including the import and export of wastes; and, prohibiting the dumping and incineration of wastes at sea.

We further recommend immediately commencing a working group to prepare an annex making the necessary changes to the Protocol Concerning Cooperation in Combating Oil Spills to include spills of hazardous substances other than oil.

(b) Global Conventions -- All nations have a joint responsibility to protect the global environment. A number of organizations and conventions have been established to deal with the problems of global environmental pollution. To be comprehensive and effective it is essential that all countries participate in these international efforts.

Greenpeace, therefore, urges all nations of the Wider Caribbean Region to join and/or ratify the following: The International Maritime Organization (IMO) and its Convention for the Prevention of Pollution from Ships (MARPOL), The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC), The Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES), and The Vienna Convention on the Protection of the Ozone Layer. We also urge all Caribbean nations to participate in the efforts within UNEP to develop a global convention on hazardous wastes with the purpose of instituting a global ban on such trade.

(c) Pollution from Ships -- Greenpeace recommends that the Caribbean States, as Contracting Parties to the MARPOL Convention, demand that the Caribbean be classified as a "Special Area" under MARPOL Annexes I, II and V. This would restrict the

discharge of environmentally harmful substances from ships, such as the dumping of garbage and the release of oil during bilge and tank cleaning operations. The "Special Area" MARPOL classification would substantially enhance both water and shoreline environmental quality.

## PREVENTION

Because preventative environmental management is almost always less expensive than the cost of an environmental disaster, Greenpeace recommends the following steps be taken:

a) Early Warning System -- The early-warning system set by the Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region should be expanded to include other water-borne and air-borne pollution incidents.

b) Information Exchange--Journalists and science teachers in particular should receive special briefings and other educational information about pollution and the health of coastal waters. Educational materials, including videos, should be made available to public libraries and broadcasting stations.

c) Non-governmental Organizations -- Non-governmental organizations (NGO's) should be encouraged to participate actively in the United Nations Caribbean Action Plan, and to work closely with governments and citizens on environmental problems and education. The Island Resources Foundation, with offices in the US Virgin Islands and in Washington DC, has a comprehensive, updated list of NGO's located in the eastern Caribbean nations.

## WILDLIFE AND CRITICAL HABITAT

a) Marine Mammals--Breeding grounds for marine mammals, especially for manatees and whales, should be set aside as sanctuaries, and a comprehensive assessment of dolphin populations throughout the Caribbean region should be undertaken.

b) Sea Turtles--Greenpeace recommends that all Caribbean nations adopt and implement the Sea Turtle Resolution passed at the International Union for Conservation of Nature and Natural Resources (IUCN) General Assembly held in Costa Rica in 1988.

c) Fishing Practices -- We recommend regulation of fishing practices which now result in the incidental killing of marine mammals or sea turtles (e.g., shrimp trawling that kills turtles, or gill netting on rivers that kills river dolphins and manatees).

d) Coral Reefs, Mangrove Trees and Seagrass Beds -- Governments, scientists, environmental groups and fishermen need to share information and educate the public about the effects of human activities on reefs. Dynamiting and artificial bleaching

of coral reefs should be banned throughout the region so that further mass destruction does not occur.

Dredge and fill operations, especially with clay and compacted sediment, should be banned in and around mangrove forests, seagrass beds and coral reefs, and restoration programs for mangroves, seagrasses and corals should be instituted.

#### OCEAN MINING AND MARINE DEBRIS

a) Oil Development--Greenpeace recommends that governments oppose further encroachment of offshore oil development in the Wider Caribbean Region. We also recommend that nations take vigorous action to stop the pollution from oil in already heavily developed areas such as the Gulf of Mexico, the Gulf of Paria, Cartagena Bay and Lake Maracaibo.

b) Marine Debris--Greenpeace recommends that the Caribbean nations prohibit the abandonment of ships left in bay or coastal waters. Oil pollution and marine debris are major problems resulting from abandoned vessels. (See also recommendation on Pollution from Ships.)

#### LAND-BASED SOURCES OF POLLUTION

To begin to confront the very serious threats of land-based sources of marine pollution, Greenpeace recommends that nations in the region focus intensely on reduction and cleanup of untreated sewage, hazardous wastes and agricultural chemicals.

a) Sewage--Greenpeace recommends that waterless waste treatment practices be instituted wherever possible and effluent discharges into rivers, bays, estuaries and onto coral reefs be immediately halted.

b) Industrialization and Hazardous Materials--Greenpeace recommends that nations require industries to reduce--at the source--the amount of hazardous and toxic materials being discharged into the environment. Materials already produced should be stored and monitored on above ground sites that are the least vulnerable to accidents, spills or leaks. Industries should also be regulated to recycle their waste materials.

c) Agricultural Chemicals--Greenpeace recommends that the Caribbean nations prohibit the importing, production or use of pesticides and herbicides that are banned or restricted in industrialized countries because of their adverse environmental and health effects. (See the U.N. Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved by Governments.)

## DEFORESTATION

Countries in the region should develop national conservation programs and implement strategies which would: protect remaining rainforests, introduce better management of degraded watersheds, and attempt reforestation--using only native species.

We also urge nations to cooperate and participate in international organizations and programs such as the International Tropical Timber Organization, the Tropical Forest Action Plan and the designation of World Heritage Sites.

## NUCLEAR

Greenpeace recommends that the transportation of nuclear materials, nuclear weapons and nuclear powered vessels through or over the region be banned, including transit through the Panama Canal--with an exception for medical supplies and equipment.

## INTERNATIONAL CONVENTIONS

### CARTAGENA CONVENTION

a) Specially Protected Areas--Greenpeace recommends that a protocol concerning cooperation in establishing Specially Protected Areas and Wildlife be placed in effect as soon as possible. The protocol should be closely adapted to the needs and realities of the region and should embody fresh, creative approaches for the protection of critical habitats, critical ecosystems, and endangered species of flora and fauna.

To achieve its goals, the Protocol Area should not only include the coastal zone and contiguous offshore waters but the watersheds and inland waters whose maintenance is essential to the health of coastal ecosystems.

The scope of human activities subject to regulation under the protocol must be sufficiently broad to shield protected areas and wildlife from all probable threats. The protocol should have provisions that attempt to prevent deliberate killings and also the incidental or indirect killings from certain fishing operations, boat traffic, and from activities such as deforestation, dredging and waste disposal.

The protocol should contain a mechanism for assessing and (if necessary and to the degree possible) changing the flow of development loans and investment capital from projects that will damage or destroy irreplaceable resources to projects that will promote conservation and sustainable development.

The protocol should set up an independent Scientific Authority to gather and assess data from around the region for the purpose of advising the Parties on necessary measures. The Scientific Authority should have the authorization to raise funds from available sources for projects approved by the Parties. The Scientific Authority, in consultation with regional scientists, should, as a priority task, prepare a comprehensive inventory of rare or fragile ecosystems and other areas that merit special protection on a regional basis. (Table 2 shows existing marine protected areas in the Caribbean region).

To implement the protocol, it will be necessary for the Parties to find major new sources of funding. The resources thus far made available to the CAP trust fund have been woefully insufficient for successful implementation. Greenpeace recommends that a special committee of experts from the parties be convened in order to explore formulas for funding, such as the use of taxes, such as a tax on tourism or on development loans.

The protocol should be drafted so as to assure open discussion and decisions. The decision making sessions should be open to members of the press and observers. No nation's government may be forced to establish a protected area or protect

Table 2.

**EXISTING MARINE PARKS AND PROTECTED AREAS IN THE CARIBBEAN REGION**

Country	Protected Area Name	Estab.	Hectares	(Marine %)
Antigua	Diamond Reef Marine Park	1973	2,000	—
	Palaster Reef Marine Park	1973	500	—
Bahamas	Inagua National Park	1965	74,000	(10)
	Exuma Cays Land and Sea Park	1958	45,000	(80)
	Conception Island Land and Sea Park	—	810	(80)
	Union Creek	1965	1,813	—
Barbados	Barbados Marine Reserve	1980	—	(100)
Belize	Half Moon Caye Natural Monument	1982	4,144	(95)
UK Virgin Islands	Wreck of the Rhone Marine Park	1983	323	(96)
Colombia	Parque Nacional Corales del Rosario	1977	18,700	—
	Parque Nacional Natural Tayrona	1969	15,000	—
	Parque Nacional Natural Isla de Salamanca	1969	21,000	—
	Santuario de Fauna Los Flamencos	1977	7,000	—
Costa Rica	Cahuita National Park	1970	2,000	(35)
	Tortuguero National Park	1970	18,947	(16)
Dominican Republic	Parque Nacional del Este	1975	43,400	—
	Samana Bay - Silver Banks Marine Sancturay	—	—	—
Honduras	Rio Platano Biosphere Reserve	1980	350,000	—
Jamaica	Montego Bay Marine Pfark	1959	—	—
	Ocho Rios Marine Park	—	278	—
Martinique	Parc Naturel Regional de la Martinique	1975	—	—
Mexico	Isla Mujeres	—	—	—
	La Blanquilla	—	—	—
	Cancun-Nizuc-Isla Mujeres	—	—	—
	Arrecifes de Cozumel	1980	—	—
	Isla Contony	1960	—	—
	Ria Celestrum	1979	59,000	—
	Rio Lagartos	1918	47,840	—
Netherland Antilles	Bonaire Underwater Park	1983	—	(100)
	Curacao Underwater Park	1983	—	(100)
Saint Lucia	Maria Islands	1985	—	—
	Pigeon Island	1982	—	—
Trinidad and Tobago	Buccoo Reef and Bon Accord Lagoon	1970	—	(100)
	Caroni Swamp	1982	7,900	—
US Virgin Islands	Virgin Islands National Park, St. John	1963	6,073	(33)
	Buck Island Reef, St. Croix	1961	356	(80)
Venezuela	Parque Nacional Archipelago Los Roques	1972	225,143	—
	Parque Nacional Mochima	1973	94,935	—
	Parque Nacional Morrocoy	1974	32,090	—
	Laguna de Tacarigua	1974	18,400	—

Sources: IUCN, 1982; ICUN, 1985; Silva, et al., 1986; Van T Hoff, 1985.

a species within its territory without its consent, but it should be possible for any Party or any qualified non-governmental organization, that has provided timely notice of such intent, to nominate any area or species for protected status. This will help insure that issues are debated openly both within the protocol procedures and in the involved nations.

A major focus of the protocol should be education. To succeed, it must particularly enlist the cooperation and support of local inhabitants in areas affected by protocol decisions. Special importance should be attached to working amicably with indigenous peoples inhabiting the Caribbean coastlines.

b) Land-based Sources of Pollution -- At the Fourth-Intergovernmental Meeting and the First Meeting of the Contracting Parties to the Convention it was decided to actively pursue the development of a protocol concerning cooperation in combating land-based sources of pollution.

Greenpeace recommends that this project be given a high priority. A comprehensive protocol is needed to reverse the present trend and to restore areas suffering from pollution. The protocol should address discharges from urban areas, such as untreated sewage and hazardous wastes from industries; and run-off from rural areas, such as agricultural chemicals and soil erosion. The protocol should also contain provisions banning the import of foreign-produced hazardous wastes to the region, and the transport of such wastes through the region.

In the following paragraphs we offer some information and suggestions related to the movement of waste through the region and the run-off of agricultural chemicals.

With the enactment of hazardous waste laws in European countries and in the US and Canada, a great deal of pressure is being put on waste disposal operators to comply with the law. As their expenses become greater, disposing of wastes in foreign territory will become an increasingly seductive notion. (See appendix "Waste Trade in the Americas" by Greenpeace.) Payments to Caribbean governments to use their countries for waste sites will be small compared to expenses in the industrialized world.

Disastrous results for long-term public health and resource management could occur if the Caribbean governments allow imports of wastes into the region. Wastes that escape into drinking water or into other public areas could cause damage for hundreds of years. The legal ramifications of liability in such cases would be much more complex than they presently are within individual nations.

In order to prevent such problems, action should be taken immediately, before there are more incidents such as the recent one in Haiti (see appendix, "Burnt Offerings 2" by Greenpeace). Time is of the essence since many privately owned waste sites in

the US and elsewhere will be declared closed by the fall of 1988 and alternative means of disposal will rapidly be sought.

We recommend prohibiting the movement of wastes from country to country within, over or through the Wider Caribbean Region by air or ship transport. Prohibited wastes should include incinerator residues, sewage sludge, waste oils, household garbage, infectious hospital wastes, nuclear wastes and other types of hazardous and toxic wastes.

To achieve its goals, the protocol should also include the following measures with regard to agricultural chemicals: a ban on the importing, production and use of agrochemicals that have been banned, severely restricted or are not registered in industrialized nations; and a withdrawal from the market and prohibition on sale of those pesticides whose handling and application require the use of protective clothing and equipment inappropriate for the climate and/or whose expense is inordinate for small farmers.

The Food and Agriculture Organization (FAO) Code, Article 3.5, recommends that a number of pesticides should be avoided, and many have been identified and so classified by the World Health Organization (WHO). We recommend that pesticides of the WHO classifications 1a and 1b (Extremely Hazardous and Highly Hazardous, respectively) be no longer used.

The protocol should also adopt restrictions of pesticide exports to nations which do not enforce laws governing their purchase, use and distribution; and should give full support to effective procedures for Prior Informed Consent being drafted by UNEP and FAO working groups.

The protocol should also establish an independent regional Pest Control Commission. The Commission's role would be to harmonize pesticide regulatory laws, and incorporate integrated pest-management and alternative biological pest control research and planning into regional strategies.

The Pest Control Commission should, as a priority task, monitor the rigorous enforcement of the FAO's International Code of Conduct on the Distribution and Use of Pesticides in all countries. A pesticides and herbicides toxicity testing program on marine and freshwater fish and critical habitat species should also be undertaken.

A major focus of the protocol should be on education. Priority should be given to programs which warn about the dangers of pesticides, encourage their safer and more rational use, and promote alternative pest control methods which are non-chemical or involve only minimal quantities of toxic chemicals. Programs regarding pesticide disposal also need to be developed.



c) Dumping and Incineration of Waste at Sea--The recommended protocol on land-based sources of pollution will, if effectively drafted and implemented, drastically reduce the pollution load in coastal areas and in the region as a whole. However, there is also a need to strictly prohibit the direct dumping and incineration at sea of hazardous or toxic materials and waste products. This includes the dumping of industrial waste, sewage, garbage, dredge spoils, and radioactive wastes.

It also includes the abandonment of ships in bay or coastal waters. Oil pollution and marine debris are major problems resulting from abandoned vessels.

Greenpeace recommends that a dumping protocol be developed along the lines outlined above. For the development of this protocol it should be taken into account that in other regions, such as the North Sea, governments have decided to stop ocean incineration as of 1994 and stop dumping industrial waste in 1989.

## GLOBAL CONVENTIONS

A) International Maritime Organization (IMO)--IMO is the international UN organization that deals with maritime matters. Through a number of international conventions for which IMO is responsible, objectives are set to improve maritime safety and the prevention of marine pollution.

The IMO's Marine Environment Protection Committee (MEPC), is responsible for coordinating the Organization's activities in the prevention and control of pollution of the marine environment from ships. Through its MARPOL Convention, IMO deals with pollution by oil, chemicals and other harmful substances such as garbage and sewage.

The IMO also has a comprehensive technical assistance program which is set up to help developing countries to ratify IMO conventions and to reach the standards contained in the conventions and other instruments.

b) London Dumping Convention (LDC)--The IMO also provides secretariat services for the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, usually called the London Dumping Convention. The LDC regulates the disposal at sea of waste and other material including ships and platforms. The disposal of particularly harmful substances such as organohalogen compounds, mercury, cadmium, plastics, mineral oils and high-level radioactive wastes is prohibited.

The Convention also contains a specific moratorium, in effect since 1983, on the dumping of low-level radioactive wastes; and a proposal for a global ban on incineration of waste at sea will be decided upon at the eleventh session in early October 1988.

c) The Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES)-- This Convention, concluded in 1973, has approximately 100 contracting parties. The Convention regulates trade in species threatened with extinction and species that may become extinct unless subject to strict trade regulations, it also lists species subject to regulation within the jurisdiction of its parties.

d) The Vienna Convention on the Protection of the Ozone Layer--The Convention and its "Montreal" protocol on the control of emissions of chlorofluorocarbons was negotiated under the auspices of UNEP. The depletion of the stratospheric ozone layer that protects the earth from damaging UV-B radiation from the sun is a major global environmental issue. Increased UV-B radiation is likely to cause more incidence of skin cancer and have serious negative impacts on marine ecosystems by damaging zooplankton and phytoplankton production. Ozone holes detected over the Antarctic, as well as the Arctic, indicate the urgency of the problem. Participation in the Convention is thus of vital importance to the global community.

Table 3:

Status of participation by Caribbean states in international fora.

Caribbean Nations	CAP	MARPOL	LDC	CITES
Antigua and Barbuda	*	*	-	-
Bahamas	-	*	-	*
Barbados	*	-	-	-
Belize	-	-	-	-
Colombia	-	*	-	*
Costa Rica	-	-	-	*
Cuba	-	-	*	-
Dominica	-	-	-	-
Dominican Republic	-	-	*	-
France	*	*	*	*
Grenada	*	-	-	-
Guatemala	-	-	*	*
Guyana	-	-	-	*
Haiti	-	-	*	-
Honduras	-	-	*	-
Jamaica	*	-	-	-
Mexico	*	-	*	-
Netherlands	*	*	*	*
Nicaragua	-	-	-	*
Panama	*	*	*	*
St. Kitts and Nevis	-	-	-	-
St. Lucia	*	-	*	*
St. Vincent and the Grenadines	-	*	-	-
Suriname	-	-	*	*
Trinidad and Tobago	*	-	-	*
United Kingdom	*	*	*	*
United States	*	*	*	*
Venezuela	*	-	-	*

CAP = Caribbean Action Plan (Cartagena Convention)  
(27 Oct. 1987)

MARPOL = International Convention for the Prevention of  
Pollution from Ships

LDC = London Dumping Convention (30 Oct. 1987)

CITES = Convention on International Trade in Endangered Species  
of Wild Fauna and Flora

\* Nation has ratified the Convention

- Nation has not ratified the Convention

## POLLUTION FROM SHIPS

Greenpeace recommends that the Caribbean be classified as a "Special Area" under the International Maritime Organization's (IMO's) MARPOL Convention. A Special Area is defined as "a sea area, where for recognized technical reasons in relation to its oceanographical and ecological condition and to the particular character of its traffic, the adoption of special mandatory methods for the prevention of sea pollution by oil (as in Annex I), noxious liquid substances (as in Annex II), or garbage (as in Annex V) is required."

Under the MARPOL Convention Special Areas are provided a higher level of protection against discharges from ships than other sea areas. Certain criteria must be satisfied in regard to oceanographic conditions, ecological conditions and vessel traffic characteristics before Special Area status is granted.

Oceanographic conditions in the Caribbean that concentrate or retain pollutants in the waters or sediments and which meet the basic criteria are: circulation patterns, such as the loop currents off the coast of Panama and in the Gulf of Mexico that tend to retain pollutants in the region; a long residence time, that in the Caribbean is caused by low flushing rates in bottom waters; and adverse wind conditions, such as those caused by seasonal hurricanes.

The ecological criteria are whether endangered, threatened, or depleted coastal and marine species are in the area (Table 4 shows the distribution and status of endangered and threatened Caribbean coastal and marine species); whether there are commercially and recreationally important fisheries, which the Caribbean has; whether high productivity areas exist, such as the spawning, breeding and nursery grounds found along the coasts of Florida and Central America; and whether rare and fragile ecosystems are in the area, such as the coral reefs, seagrass beds and wetlands found throughout the Caribbean.

The shipping traffic in the Caribbean, particularly in the Panama Canal, is such that it meets the MARPOL criteria. In fact, it is so extensive throughout the Caribbean that the region would be best served if it were in its entirety declared a Special Area. As long as ships are allowed to discharge harmful substances under the less stringent rules currently governing the region, all natural resources will be threatened.

Greenpeace believes that a Special Area MARPOL classification would substantially enhance both water and shoreline environmental quality. We recommend that Parties to the Convention submit a proposal to the IMO's Marine Environment Protection Committee, for the designation of the Wider Caribbean Region as a Special Area.

Table 4.

## DISTRIBUTION AND STATUS OF THREATENED CARIBBEAN COASTAL AND MARINE ANIMAL SPECIES

Species (Common Names)	Status	Country
<i>Monachus tropicalis</i> (Caribbean Monk Seal, West Indian Seal)	E	Mexico, Bahamas
<i>Trichechus inunguis</i> (Amazonian Manatee, S. American Manatee)	V	Col., Ven.
<i>Trichechus manatus</i> (Caribbean Manatee, N. American Manatee)	V	Mex., Bah., Cuba, D. Rep., Haiti, Jam., P. Rico, Trin./Tob., C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Pterodroma hasitata</i> (Black-capped Petrel, Diablotin)	V	Haiti
<i>Caretta caretta</i> (Loggerhead Turtle, Tortuga de mar, Cares, Tartaruga domar, Uruana, Suruana)	V	Mex., Antig./Barbud., Bah., Cuba, D. Rep., Jam., Ne. Ant., P. Rico, Trin./Tob., C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Chelonia mydas</i> (Green Sea Turtle, Tortuga Verde del Atlantico and Pacifico, Tortuga Blanca)	E	Mex., Antig./Barbud., Bah., Cay. Isl., Dom., D. Rep., Gren., Guad., Haiti, Jam., Mart., Ne. Ant., P. Rico, St. Luc., St. Vin., Trin./Tob., USVI, Belize, C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Eretmochelys imbricata</i> (Hawksbill Turtle, Carey, Tortuga Carey, Tartaruga verdadera and de Pente)	E	Mex., Antig./Barbud., Bah., Cay. Isl., Cuba, Dom., D. Rep., Gren., Guad., Haiti, Jam., Ne. Ant., P. Rico, St. Luc., St. Vin., Trin./Tob., USVI, Belize, C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Lepidochelys kempii</i> (Kemp's Ridley, Atl. Ridley Sea Turtle, Tortuga Lora)	E	Mex.
<i>Lepidochelys olivacea</i> (Olive Ridley Turtle, Pacific Ridley Turtle, Tortuga verde, Parlama)	E	Mex., Cuba, P. Rico, C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Dermatemys mawii</i> (Central American River Turtle)	V	Mex., Belize, C. Rica, Guat., Hond., Pan., Col., Ven.
<i>Dermochelys coriacea</i> (Leatherback, Leathery Turtle, Luth, Tortuga Tora, Barriguda, Tarataruga)	E	Mex., D. Rep., Grenadines, Guad., P. Rico, Trin./Tob., BVI, USVI, Belize, C. Rica, Nica., Pan., Col., Ven.
<i>Caiman crocodilus crocolilus</i> (Spectacled Caiman)	V	Trin./Tob., Col., Ven
<i>Caiman crocodilus fuscus</i> (Brown caiamn)	V	Mex., Cuba, Nica., Pan., Col., Ven.
<i>Crocodylus acutus</i> (Amer. Crocodile, Crocodilo, Lagarto Negro)	E	Mex., Bah., Cay. Is., Cuba, D. Rep., Haiti, Jam., Ne. Ant., Belize, C. Rica, Guat., Hond., Nica., Pan., Col., Ven.
<i>Ameiva polops</i> (St. Croix Ground Lizard)	E	USVI
Family <i>Anthipathidae</i> (Black Corals)	CT	Caribbean Region
<i>Strombus gigas</i> (Queen Conch)	CT	Caribbean Region
<i>Panilurus argus</i> , <i>P. guttatus</i> (Spotted Spiny Lobster)	CT	Caribbean Region

Status Key: E - Endangered; V - Vulnerable; CT - Commerically Threatened; Source: IUCN/CMC, 1987.

## PREVENTION

### EARLY WARNING SYSTEM

The countries of the Wider Caribbean Region are directly linked by water and air currents. There have been extensive oceanographic studies of the region during the past forty years (Summarized by Wust, 1964; and Atwood, 1977). It is well established that major surface currents flowing from the mid-Atlantic enter the southeast portion of the region through the Lesser Antilles Islands, flow through the major Caribbean basin and separate into two portions: one forming the Gulf of Mexico, the other forming the "Gulf Stream" which comprises most of the coastal waters along the eastern US coast. Eddy or loop currents develop seasonally in locations such as in the Gulf of Panama and the Gulf of Mexico.

Oceanographers are continually researching the high variability of seasonal surface water currents (especially loop currents), as meteorologists are researching air currents. The predictability of where contaminants in water or air may go is much less than one hundred percent. Therefore, all nations within the potential route of pollutants should be alerted when accidents occur.

The early-warning system set by the Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region should be expanded to include pollution incidents other than oil spills. Warnings should be given for hazardous substances that are about to escape national boundaries or that are detected in international waters or in air masses. Because of the rapid speed of water and air currents, a large number of potentially toxic substances could be transported within days, hours, and in some cases minutes, from one nation to another.

The several predominant seasonal patterns show that wind-borne contaminants can very quickly be transported between several nations. Air-borne contaminants could include acid rain, industrially produced particles, nuclear fallout from industrial or laboratory accidents, or naturally produced particles such as volcanic ash or sand.

An expanded early-warning system in the Caribbean, would be of great benefit to all nations. Governments would be able to commence preparation for emergency plans and monitoring that could save lives and improve public and environmental health.

## INFORMATION EXCHANGE

The environmental education of the general public and of government decision-makers has lagged behind efforts at environmental policy-making and management in the Wider Caribbean Region. Unfortunately, the relatively low funding for environmental education--given present levels of national indebtedness, foreign exchange, export-import difficulties and other problems faced by most Caribbean governments--is not likely to increase significantly in the near future. Therefore, Greenpeace recommends that journalists, teachers and certain government officials be singled out for programs of environmental education so that they, in turn, can pass on the information to the general public. Libraries also need more and better materials.

Media--Television satellite facilities exist between countries; and radio stations, periodicals and journals are numerous and high in quality. Because many nations in the region do not have citizen groups to focus attention on environmental concerns, frequently the media already play that role. Periodic press releases on important subjects related to both general and specific environmental problems should be the responsibility of national environmental agencies and non-governmental organizations within the region.

Schools--Teachers in most Caribbean nations lack maps, texts, workbooks, slides, videotapes, films and reference books with which to teach environmental subjects. Elementary students probably would benefit the most from such materials. The teachers themselves also would benefit from environmental-education programs that could be set up through well-established networks of teacher-training institutions within the various countries.

Libraries--Environmental sections at public libraries should be established, and there should be greater solicitation of existing materials from groups in Europe and North America. Organizations which have in their possession a variety of videotapes and other educational materials should be solicited for copies both for public libraries and public broadcasting stations. Videotapes of environmental subjects could also be made available from a central library at the UNEP's Regional Coordinating Unit in Jamaica.

Data Exchange--Non-governmental organizations could benefit immensely from a regional computer data network. Exchange of information between organizations in the region is slow, and conflicting data is difficult to verify. An agreed upon "bulletin board," with mailboxes for participating parties would contribute to speed and accuracy of information exchange.

## WILDLIFE AND CRITICAL HABITAT

### MARINE MAMMALS

a) Whales -- Two species of endangered great whales (humpback and right whales) have mating and breeding grounds in the Wider Caribbean Region.

Each winter thousands of humpback whales migrate from feeding waters in the North Atlantic to traditional mating and breeding grounds on the wide banks of the Caribbean. The largest wintering concentration of humpbacks in the world assembles annually on Silver Banks, at the end of the Bahamian chain. This area, along with Sonoma Bay, has been set aside as a whale sanctuary by the government of the Dominican Republic, and this humpback group, in its breeding and calving grounds at least, appears secure.

However, a much smaller group of humpbacks that winter in waters between St. Vincent and Grenada is subject to losses from an open boat whaling operation located on Bequia Island. The Bequia humpback whale fishery is the only one left in the Caribbean and is monitored by the International Whaling Commission. The taking of three humpback whales each year is permitted, but only when the meat and the products are used exclusively for local consumption. Nevertheless, this population is still severely depleted.

Right whales are considered the world's most endangered great whale species. The best available estimate is that fewer than four hundred are left in the north Atlantic Ocean. Right whales were hunted to the brink of extinction, and despite international protection since 1937, the species has not recovered.

In the winter, right whales migrate south to a calving ground at the northern end of the Wider Caribbean Region. Right whales prefer coastal waters, placing them at particular risk, for it is in this region that man's offshore activities are most highly concentrated.

Exploitation of whales throughout the region should be brought to an end. Whale sanctuaries in these waters are urgently needed, and the loss in income from the Bequia whaling operation could be replaced with a whaling museum and other tourist attractions.

b) Dolphins--Status of dolphin stocks is a growing concern in the region. Although direct killing is declining, a growing number are being captured for display markets in Europe. It was estimated in 1982 that at least one thousand five hundred bottlenosed dolphins had been removed from the waters of the southeast US, Mexico and the Bahamas for public display and



scientific research purposes (Leatherwood and Reeves 1982). Fishing nets are also a menace for the regions small cetaceans, particularly those such as the fresh water dolphin that enter the river systems.

The US National Marine Fisheries Service estimates that more than fifty percent of the Atlantic bottlenose dolphin population has died since 1987 due to a mystery ailment. More than seven hundred fifty dolphin carcasses have washed ashore along the US east coast. It is suggested that the animals suffered from compromised immune systems which allowed for massive bacterial and viral invasions. The primary agent responsible for weakening the immune system is as of yet undetermined, however many suspect pollution.

Greenpeace recommends a comprehensive assessment of the dolphin populations in the Caribbean region, in order to assess the need for regulation and control with which to protect the species.

c) Manatees--Laws against deliberate killing of manatees are in place in every country hosting the species, but in countries such as Honduras the fines for killing a manatee are far less than the black-market value of its meat and therefore are not a deterrent. The laws should be strengthened sufficiently and then should be fully enforced (which often is not the case) to discourage poaching. More wardens are needed, and they should be equipped with boats and short-wave radios.

A major source of manatee mortality in Mexico and Central America is incidental capture in gill nets which are strung across the mouths of rivers and, to a lesser degree, in trawls. This is believed to have supplanted deliberate killing--in some regions--as the chief threat to the animals existence.

Collisions with motorboats are the leading cause of manatee deaths in Florida, and the problem continues to worsen as the number and size of the boats increase. The state of Florida has established speed limits for boats in about ninety miles of inland waterway, but the same restrictions need to be extended over a far greater area. At the same time, urbanization in Florida is rapidly destroying manatee habitat and better land use planning is needed.

Elsewhere, deforestation and erosion that create sand and mud bars at the mouths of rivers and that smother seagrasses are ruining manatee habitat. Oil pollution is a danger to the manatee in Lake Maracaibo and in the Gulf of Mexico. In the upper Usumocinta River on the Mexico-Guatemala border, a proposed dam poses a threat.

## SEA TURTLES

The sea turtle population in the Wider Caribbean Region consists of the following six species, of which many populations are severely depleted: Kemp's Ridley, Olive Ridley, Hawksbill, Green, Leatherback, and Loggerhead.

The Kemp's Ridleys, the most endangered of all the sea turtles, nest almost exclusively on one beach--Rancho Nuevo beach in Mexico--but they travel throughout the Gulf of Mexico and along the Atlantic coast to Massachusetts. The Olive Ridleys are small turtles that eat crustaceans, fish eggs and some vegetation. They have one important nesting site in Suriname, which is eroding. The Leatherback is the largest of all marine turtles and unlike other turtles has a soft outer shell characterized by seven long ridges. It lives throughout the Caribbean and its diet consists entirely of jellyfish. The Hawksbill inhabits coastal waters around coral reefs, consuming jellyfish, sponges, crustaceans and sea grasses. Their colored shell, highly valued for jewelry, is the most serious threat to their survival. Green turtles named for the color of their fat, feed on now depleted seagrasses and seaweeds. They have been found throughout the Atlantic and Pacific oceans, but two of their major Caribbean rookeries are in Costa Rica and Aves Island, Venezuela. The Loggerheads also are migratory, and Florida continues to be their most important nesting ground in the Western Hemisphere. Loggerheads feed on mollusks, crabs, fish and jellyfish.

Some of the problems facing the sea turtles include: killing for the export of their shell and shell products; shrimp trawling operations that accidentally drown about eleven thousand turtles a year in U.S. waters alone; bright lighting along the nesting beaches, disturbing gravid females and causing disorientation of the young at hatching; development and dredge-and-fill operations along shores that bury nests; tar balls from oil operations that cause injury or death when ingested; and floating plastic, especially lost or discarded monofilament fishing lines in which the turtles become entangled.

Concerned about the decline of sea turtle populations, the International Union for Conservation of Nature and Natural Resources (IUCN) passed a resolution at its seventeenth session in San Jose, Costa Rica, in February 1988, urging that governments enact and enforce national legislation that better protects the turtles. Greenpeace recommends that all Caribbean nations adopt and enforce the Resolution on Sea Turtles from the IUCN General Assembly (see enclosure).

## **RESOLUTION PASSED AT IUCN GENERAL ASSEMBLY 1988**

### **SEA TURTLES**

**RECALLING** that Kemp's Ridley (*Lepidochelys kempii*) sea turtle was included in the IUCN/SSC's list of twelve most endangered species in 1987, and that their continued decline is largely due to the numbers drowned in shrimp trawlers;

**FURTHER RECALLING** the effectiveness of the Turtle Excluder Device (TED) in the prevention of sea turtle incidental catch by shrimp trawlers;

**CONSIDERING** that legal action has been taken to invalidate the US Government's promulgation of the TED Regulations;

**CONCERNED** that many sea turtle populations continue to decline as a direct result of human exploitation;

**FURTHER CONCERNED** that the level of international trade in sea turtle products, particularly of the shell and skin, remains very high, and that in many countries the level of national trade, particularly in meat and eggs, continues unabated;

**RECOGNIZING** that there are many other contributing factors to population declines, such as disturbance and destruction of the nesting and foraging habitats, ingestion of ocean debris and toxic pollutants, and incidental catch in different types of fishing gear;

**CONSIDERING** that scientists are currently unable to predict sustainable levels of exploitation due to insufficient knowledge of vital parameters of sea turtle biology;

**NOTING** that the immature states of the life cycle are the most susceptible to natural predation, it is the breeding adults, rather than the young, that are most important for the survival of the population, and therefore most damaging to exploit;

**RECALLING** that most examples of sea turtle management have followed traditional fishery patterns and established minimum size limits to protect the juvenile age classes;

**The General Assembly of IUCN at its 17th Session in San Jose, Costa Rica, 1-10 February 1988.**

- 1. URGES** the US Senate to oppose any delay in implementation of federal regulations requiring the use of TEDs needed to prevent the capture and drowning of the critically endangered Kemp's Ridley sea turtle or any other species of sea turtle;
- 2. URGES** Member Governments to enact and enforce national legislation to increase the conservation of sea turtles:
  - a. Institute MAXIMUM** size limits to ensure that no turtles of breeding age are killed and study the possibility of establishing quotas for the capture of juveniles, where it is culturally inappropriate to provide full protection for all age classes of sea turtles;
  - b. Restrict egg collection** to minimize the negative impact on the population where it is culturally inappropriate to prevent the collection of sea turtle eggs altogether;
  - c. Protect the nesting beaches and foraging habitats** to minimize disturbance, damage and other disruptive activities to sea turtle reproduction;
  - d. Where sea turtles are present, require use of TEDs by shrimp trawlers and control all other fishing methods as needed** to minimize incidental catch, particularly off the nesting beaches during the breeding season;
- 3. RECOMMENDS** that IUCN Members initiate research programmes in consultation with the IUCN/SSC to determine the long-term trends in the sea turtle populations wherever exploitation occurs, in particular, the impact of exploitation on the different age classes;
- 4. FURTHER RECOMMENDS** that IUCN Members initiate education programmes in sea turtle conservation to ensure the understanding and participation of the local people in the implementation of the above;
- 5. CALLS UPON** Member Governments in accordance with CITES to cease all commercial international trade in sea turtles, their parts and derivatives, especially tortoiseshell derived from the hawksbill sea turtle (*Eretmochelys imbricata*).

## FISHERIES

The Inter-American Development Bank (IDB) reported that Caribbean fishery production in 1980 amounted to nine million metric tons, with an overall landed value of three billion dollars. The IDB estimates that two million people are engaged in fishing activities in the region, with an average annual productivity of about three tons per fisherman. The bulk of the fish are either exported or processed for indirect use. These figures do not include the use of inappropriate technologies such as shrimp trawling, where discarded by-catch has been estimated to account for as much as three hundred to five hundred thousand tons of fish.

In the last few years there has been a rapid expansion of longlining activities in the region by Japan, Taiwan and South Korea. The National Coalition for Marine Conservation has raised concerns about the potential threat to stocks of tuna and billfish in the region. Population estimates of billfish in the southeastern Caribbean are much lower now than they were in the early 1970's.

The longline fishermen are reported to stay on the high seas for months at a time, returning to a "mother" ship for fuel, supplies and offloading. Observers rarely go on these boats and conservation quotas are routinely bypassed by delivering the catch to ports outside the region. The Asian fleets fish twenty-four hours a day, and are attributed with a large by-catch of pelagic gamefish. An uncontrolled expansion of longline fishing could deplete severely many gamefish populations.

Overall the fishery resources of the Caribbean are not large enough to replenish themselves if they are over-exploited, and the potential for fishery development is not promising on a large scale. Destruction of fish resources in the region are caused by the use of dynamite; trawling in shallow areas, which results in the destruction of seagrasses; and over-exploitation of stocks, such as the lobster and turtle fisheries where unrestricted and illegal exploitation of animals and reproducing females has resulted in the decimation of populations.

Priority should be put on maintenance of fish resources for future generations. Migratory and shared stocks require management on a regional basis. Enforceable measures need to be adopted to reduce by-catch. Through better management it is possible that fisheries can help to alleviate protein deficiencies in the region, increase income and provide employment. Protection of highly productive areas such as mangrove swamps, coastal lagoons, estuaries, coral reefs and sea grasses is urgently needed.

## CORAL REEFS, MANGROVE TREES AND SEAGRASS BEDS

Coastal waters of the Caribbean contain some of the world's most diverse and productive ecosystems, including coral reefs, mangrove trees and seagrass beds. A delicate physical, chemical and biological linkage creates and maintains these ecosystems.

a) Coral Reefs--The region's coral reefs are extremely susceptible to both natural and human-induced damage. The reefs are important as tourist attractions, as habitats for various marine species, and as break-waters that aid in storm protection. Exploitation of reefs for jewelry, anchor damage from the fishing and tourist industries, and turbidity and toxins from land runoff, all have a serious impact on the reefs. The corals are also suffering from other serious problems, such as the use of bleach and dynamite by fishermen and treasure hunters.

During the last two years large numbers of hard coral throughout the Caribbean have expelled the algae necessary for their survival. Scientific opinion is divided on the cause, although unusually high temperatures throughout the region appear to be a factor. If the situation continues to worsen, mass mortality of coral could occur.

Serious efforts at protection of coral should be made throughout the region. Greenpeace recommends that nations begin by banning the dynamiting and artificial bleaching of coral.

b) Mangrove Trees and Seagrass Beds -- Mangroves and seagrasses are being decimated by a number of human activities: shoreline dredging and back-filling operations for industrial development; turbidity from soil erosion; urban and sewage runoff; and toxic substances from agriculture and waste disposal. Spilled oil is particularly damaging to mangroves as it disrupts the oxygen supply to the root system of the trees.

Mangrove trees comprise a high percentage of the leeward or low-energy natural shorelines in the Caribbean. These trees filter water through their root systems and provide habitat for a wide variety of marine species, including commercially valuable species of fish, lobsters, crabs, mussels, and oysters. They also provide shoreline stabilization and protect against erosion.

Seagrass beds provide about eighty percent of the breeding and nursery grounds for a large variety of fish and shellfish in the Caribbean, and thus provide an essential link in the food web. The grasses also catch and hold nutrients and other substances from the water that passes through them.

This ability to filter water, as well as to feed and shelter much of the Caribbean marine life, makes these ecosystems vitally important to the region. Greenpeace recommends that nations ban dredge-and-fill operations in and around mangrove trees and seagrass beds, and introduce conservation and restoration programs where species are depleted. (Thorhaug 1985 and 1986.)

## OCEAN POLLUTION

### OIL DEVELOPMENT

Offshore oil development poses a serious danger to the environmentally sensitive Caribbean region. Chronic leakages of oil into the marine environment are day-to-day problems associated with these offshore activities.

Drilling an offshore well can produce more than a million gallons of wastes. Every time a well is drilled, up to two thousand tons of drilling fluids (which lubricate the drill bit and maintain down-hole pressure) and drill cuttings (pieces of rock ground by the bit) are discharged into the ocean. These discharges contain heavy metals such as mercury, cadmium and other toxic materials, which are discharged into the ocean and contaminate the water. Research has shown that components of drilling fluids are highly toxic to marine life.

During the oil exploration process, seismic testing vessels blast air guns every five or six seconds, dispersing nearby fish from their normal habitat and feeding grounds. Fish catch has been shown to diminish considerably in the presence of seismic vessels.

Seagrasses can be destroyed by many forms of pollution, especially phosphorous, nitrogen compounds and suspended solids that accompany oil drilling. Coral reefs can be damaged and potentially destroyed not only by pollution but by changes in oxygen supply, the intensity of light and temperature. Oil development can cause these alterations, killing the very sensitive polyps that form the basic life structure of a reef.

In addition, the possibility of a devastating oil spill always exists. In 1979 an exploratory well, Ixtoc I, blew out in the Bay of Campeche, in the Gulf of Mexico. By the time it was capped--two hundred and ninety days later--more than four hundred seventy five thousand metric tons of oil had spilled. The oil covered sandy beaches, barrier islands and shallow lagoons for hundreds of miles. More than thirty thousand metric tons landed on Mexico's beaches and thousands of metric tons traveled north with the currents to land on the beaches of Texas (Jernelov and Linden, 1981).

The risks to the environment inherent in offshore oil development outweigh the potential gains from production of this non-renewable resource. Greenpeace recommends that nations vigorously oppose the further encroachment of offshore oil development in the region, and strengthen environmental regulations in areas where the industry already operates.

## MARINE DEBRIS

Enormous quantities of marine debris enter the Caribbean from offshore activities. Discarded nets from fishing vessels, packing from merchant shipping vessels, garbage from cruise ships and tar and trash from petroleum development all contribute to the load. Inappropriate solid waste management practices, as well as litter thrown in rivers and left on beaches supplement the problem onshore.

The tons of garbage dumped into the region daily are having major detrimental impacts on coastal and marine environments. Habitats such as rookeries and wetlands are being seriously degraded by the garbage. Large numbers of turtles, dolphins, birds, fish and other wildlife are dying by ingesting or becoming entangled in discarded plastics. The garbage is also having a negative impact on tourism in some areas.

Since the establishment of Padre Island National Seashore in 1962 in the US State of Texas, ninety-nine percent of the complaints received by the staff have been in regard to the beach litter. On 20 September 1986, during a beach cleanup effort in Texas, volunteers picked up more than one hundred twenty-four tons of garbage from one hundred twenty-two miles of beach. On 25 April 1987, volunteers picked up an additional one hundred forty tons of trash from one hundred fifty miles of beach (Atkins 1987).

Beach clean-up efforts are not the answer to marine debris problems but they are effective "anti-litter" public awareness campaigns. The Texas program encourages citizens groups, industry, and individuals to assist in cleaning up the hundreds of tons of trash currently covering the regions beaches by "adopting" a particular beach (or segment of coastline) and agreeing to clean it a minimum of three times a year. The program is operated at the local level through volunteer coordinators.

Costa Rica and Texas held a joint beach clean-up day last year and plan another one for the the 24th of September 1988. They are encouraging Gulf and Caribbean states to take part in their program. A region wide effort could go a long way toward cleaning up the existing debris and raising public awareness about the problem (see appendix "Memorandum of Understanding between Camara de Turismo de Costa Rica and the Texas Land Office).

Greenpeace recommends nations take steps to stem the release of solid waste, fishing gear, etc. into the water. Analysis of the collected trash show that most of the debris is from offshore vessels and steps should be taken to regulate them (see recommendation on Pollution from Ships).



## LAND-BASED SOURCES OF MARINE POLLUTION

### SEWAGE

Sewage generated by an estimated resident population of two-hundred million and an annual tourist population of more than ten million can not continue to be assimilated into the Caribbean without profound effects on water quality and human health. The discharge of sewage is already causing severe imbalances in coastal marine ecosystems throughout the region. Overloading of sewage into water systems leads to a condition known as anoxia. This condition produces foul-smelling waters, massive fish kills, dissemination of bottom-dwelling marine communities and severe human health hazards. Detailed case studies exist throughout the region--from Havana Bay, Cuba, to Cartagena Bay, Colombia (Escobar et al, 1985)--but very little is being done to alleviate the situation.

Sewage treatment plants in the region, where they exist at all, are commonly overloaded and inadequately maintained. A recent study prepared by the US National Oceanographic and Atmospheric Administration concludes that less than ten percent of the population in the Caribbean is serviced by any sewage treatment facilities.

Since 1981, the Institute of Marine Affairs and the Ministry of Health of Trinidad and Tobago have monitored the extent of sewage pollution at several locations around the country. Rivers flowing into the sea receive fecal wastes from two major sewage treatment plants as well as from some inland treatment plants, farms and numerous pit latrines of poor construction. Significantly elevated levels of sewage-associated bacteria have been found in several coastal areas including popular beach areas.

Around Barbados, sewage and other pollutants are causing stress on the fringing reefs; and, around Jamaica, coral reefs exposed to sewage reveal heavy algal overgrowth and dense solid waste litter on the nearby sea floor (Chow, 1985). Oceanographers have warned that oxygen depletion from untreated sewage now "raining" down into deeper waters of the region may at some future time re-emerge to surface waters through storms, upwellings or seasonal rain and wind patterns. At that point there may be a substantial impact on public health, tourism, fisheries, and on reefs and beaches.

Greenpeace encourages the use of policies that advocate waterless waste treatment. Nations in the region should also immediately institute programs that would eliminate sewage disposal into rivers, bays, estuaries and on coral.

## AGRICULTURAL CHEMICALS

The World Health Organization (WHO) conservatively estimates that five hundred thousand to one million people are injured by pesticides each year--five thousand to ten thousand fatally. Most of these poisonings occur in the Third World, where inadequate regulations and the lack of training programs directly imperil farm workers and their families.

Natural resources also are being harmed by pesticides. Analysis for DDT and DDE in the tissue of reef-dwelling groupers in the Gulf of Mexico and Grand Bahamas revealed detectable levels of these compounds in 1974 (Giam, 1974). A variety of shrimp and fish in the Northern Caribbean and Gulf of Mexico showed that DDT was widely distributed. Shellfish and fish contamination within Cartegena Bay have also been associated with pesticide run-off (Ali 1978).

Nations in the region should support adoption of Prior Informed Consent-procedures (PIC) now being drafted for presentation at the UN Food and Agriculture Organization (FAO) Conference in November, 1989. They should also eliminate government subsidies for pesticides (including insecticides, herbicides, fungicides, and rodenticides). Governments should designate a national authority to regulate pesticides, receive notification from the country of export, and give import consent as stipulated in the PIC provision.

National legislation incorporating the provisions of the FAO Code, should be established for the importation, registration, distribution, labeling, packaging, storage, disposal, advertising and use of pesticides.

Adoption of national legislation will provide the framework for more effective pesticide management, but it needs to be accompanied by technical expertise and funding for enforcement. Participation in the U.S. Environmental Protection Agency regional workshops on Technical Assistance to Developing Countries on Pesticide Regulatory Process and Procedures, to be held during 1988 and 1989, is recommended.

Pesticides that have been banned or severely restricted in their nations of origin should not be exported to countries that do not presently have adequate laws to protect human health and the environment. Such products include persistent and toxic synthetic chemicals such as DDT, aldrin, dieldrin, and acutely toxic chemicals such as paraquat. Pesticides not registered in the country of export should also be prohibited.

A World Resources Institute study found that government subsidies for pesticides annually amounted to forty-four percent in Colombia and twenty-nine percent in Honduras. Such subsidies should be phased out.

A rigorous public campaign for educating farmers to the hazards of pesticides, and their safe application, should be initiated throughout the region. At the same time countries should make a commitment to reduce dependency on agricultural chemicals. Research, training and extension in integrated pest management and biological pest control offers the best protection from pesticides, and will at the same time help farmers maintain yields while reducing the cost of production. Caribbean governments should make it a priority to promote sustainable farming systems and undertake joint research into biological pest control methods. Cooperation between countries to research and implement biological pest control and integrated pest management programs should be a high priority. A framework for such cooperation exists with the Technical Committees for Plant Protection in nearly twenty Caribbean countries.

## DEFORESTATION

Tropical rainforests contain the world's most biologically productive and diverse habitats and are a crucial part of the global ecosystem. Tropical forests are home to more than half of the earth's animal and plant species. They provide the genetic bank for food staples such as bananas, corn, potatoes, and chocolate. They lessen the risk of floods, and help to stabilize the earth's climate. They are a source of food, medicines (such as antibiotics), wood, fibers, fuel and a long list of industrial products. Tropical forests are also a source of scientific discoveries.

An ever growing demand for more land, more fuel, and more marketable resources threatens to destroy the tropical forests. The main causes of deforestation are commercial logging and cattle ranching (a major problem in Central America where significant quantities of beef are produced for the US market), slash and burn agriculture, hydroelectric projects, colonization, fuel-wood collection and mining.

The continued loss of this biological diversity threatens the ecological stability of the entire planet. It also causes immediate local problems such as alteration of rainfall patterns, loss of soil nutrients, and increased soil erosion; which in turn causes sedimentation which destroys coral reefs and local fisheries.

Colombia, Costa Rica, Haiti, Jamaica, Nicaragua, Panama and Venezuela all suffer from loss of tropical rainforests. These countries can not afford to ignore the dangers to their soil and water resources. We therefore urge nations to take conservation measures to protect remaining forests, implement programs of reforestation (using native species), and introduce better management of degraded watersheds.

## NUCLEAR

Of the approximate nine hundred nuclear reactors in the world, more than five hundred of them are at sea, propelling Soviet, US, UK, French and Chinese naval vessels. These reactors are constantly in motion and frequently operate under perilous conditions. Since the first one was launched in 1954, nuclear-powered vessels regularly have run aground, sunk, and suffered fires, floods, mechanical breakdowns, as well as collided with tankers and other warships.

It is known that one vessel had a reactor meltdown at sea, five nuclear reactors have been abandoned on the ocean floor, and more than twenty nuclear missiles have been lost in the oceans. According to the US Navy, there were six hundred twenty-eight "incidents" and two more serious accidents involving nuclear weapons aboard its ships between 1965 and 1985.

The Soviet record for nuclear accidents at sea is considerably worse, according to independent studies. At least two hundred nuclear-related accidents have occurred on Soviet vessels since 1977, several of them involving radiation injuries. Another very real threat is of nuclear accidents in the air. In 1966 an airborne collision above Palomares, Spain, scattered radioactive material on land and sea.

The dangers of nuclear weapons and nuclear reactors on naval vessels goes beyond even accidents. There is a real possibility that nuclear vessels will become involved in a conflict in which they could be destroyed or sunk. The UK mobilized a number of nuclear attack submarines in the Malvinas/Falklands war, and the US did the same with its nuclear submarines in its actions against Libya in 1986.

The London Dumping Convention, which regulates the disposal of non-military materials at sea, has declared a moratorium on the ocean dumping of all radioactive waste. There is, however, no international regulation or scrutiny of naval nuclear reactors even though they are a constant source of radioactive pollution to the ocean environment.

The movement toward nuclear free zones is accelerating. While it is true that these zones have not so far restricted naval operations, there clearly is support all over the world for more constraints and controls on nuclear activity.

Greenpeace, therefore, recommends that the transportation of nuclear materials, nuclear weapons and nuclear powered vessels through or over the Wider Caribbean Region be banned--with an exception for medical supplies and equipment.

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