MODULE 3

USES AND THREATS TO THE MARINE ENVIRONMENT

OBJECTIVE

1. To identify the potential benefits provided by the coastal and marine environment, as well as the threats to those environments.

2. To identify some of the basic reasons why the threats to the coastal and marine resources are difficult to control.

THEMES

3.1 The Sea as a Resource Base
3.2 The Caribbean Sea as a Resource at Risk
3.3 The Sea as a Common Property Resource

DELIVERY TIME

3 Hours

MODULE 3	USES AND THREATS TO THE MARINE ENVIRONMENT
THEME 1	The Sea as a Resource Base
OBJECTIVE	To generate a common understanding of how human beings use natural resources, as well as identifying the goods and services provided by the marine environment.
SIGNIFICANCE	In order to reduce the threats to the marine environment, it is first necessary to develop an appreciation of the actual and potential contribution of marine resources to human well being.
PRESENTATION	Lecture, Participant discussion
EQUIPMENT / MATERIALS	Overhead projector
EXERCISE 3.1	List all the uses that are made of coastal/marine resources, then rank the associated resources and/or ecosystems based on the perceived importance of the benefits provided.
TIME	1 Hour

INTRODUCTION

The human species utilise the goods and services provided by the natural environment at the levels of single resources and ecosystem functions. These goods and services can be grouped into three main categories:

1. **Provision of goods for direct consumption and for use as raw materials**
   a. Primary consumption - air, water, foods, drinks, etc.;
   b. Raw materials - jewelry, timber, ores, construction materials, fuel, medicine, etc.

2. **Provision of services**
   Transportation, recreation, education, waste treatment and disposal.

3. **Maintenance of life-support systems**
   Pest control, disaster reduction, production of oxygen, maintenance of atmospheric balance, etc.

As oceans, coastal waters, and estuaries cover 71% of Planet Earth, it can easily be understood why the marine environment provides a great abundance of and diversity of foods, raw materials, and services.

FOOD FROM MARINE SOURCES

Of the 99.5 metric tons of finfish and shellfish caught in 1989, 86% (85.8 metric tons) came from the marine environment, with the remainder from inland waters (FAO, 1991). It is believed that "*...the catch of finfish and shellfish is the world's largest single source of animal protein, exceeding production of beef, sheep, poultry, or eggs*" (Norse, 1993; P. 17).

Data compiled by the United Nations Food and Agriculture Organisation (FAO) shows that in the Western Central Atlantic (Caribbean and Central American region) increased from 0.7 million metric tonnes during the period 1950-1959 to over 2 million metric tonnes in 1994 (Table 3.1). The status of the fisheries in the Western Central Atlantic region is given as Appendix 3.1.

As the fisheries become over-exploited, more attention is being paid to mariculture as a means of maintaining marine fisheries production levels. Additionally, there has been a significant increase in the collection (from natural stocks) and cultivation of seaweeds. In the Caribbean, seamoss cultivation is being pursued primarily as a means of maintaining the incomes of fisherfolk.

Table 3.1: Marine Fish Catches ('000 t) (metric tonnes)			
Period	**Total Aquaculture**	**Total Production**	**Total Marine Capture**
1950-59	0	709	709
1960-69	0	1,181	1,181
1970-79	0	1,567	1,567
1980-89	82	2,076	1,994
1988	137	1,868	1,731
1989	136	1,799	1,664
1990	88	1,701	1,613
1991	113	1,822	1,709
1992	126	1,668	1,542
1993	110	1,908	1,797
1994	100	2,245	2,145
Source: http://www.fao.org/fi/publ/circular/c920/tab.3asp			

MEDICINES FROM THE SEA

Though medicines from plants and animals have historically been derived primarily from land sources, the discovery of anti-viral and anti-tumor agents from marine organisms has spurred greater interest in the potential of marine organisms for medical research. The Caribbean has made its contribution in this respect, as in 1978 extracts from *Trididemnum* sp. (a tunicate) were found to be strongly toxic to tumor cells (Norse, 1993).

The factor that makes the sea such a rich source of materials for use in medical research is the diversity of organisms, in form, function, and biochemical makeup. Norse (1993) states that of the 33 animal phyla, 32 occur in the sea, and 15 are exclusively marine (Table 3.2).

Table 3.2: Animal Phyla in Marine and Non-marine Ecosystems		
Exclusively Marine	**Marine & Non-marine**	**Exclusively Non-marine**
Placozoa Ctenophora (Comb jellies) Mesozoa Gnathostomulida Kinorhyncha Loricifera Phoronida Brachiopoda (Lamp shells) Priapulida Sipuncula (Peanut worms) Echiura Pogonophora (Beardworms) Echinodermata Chaetognatha (Arrow worms) Hemichordata (Acorn worms)	Porifera (sponges)* Cnidaria (Coelenterates)* Platyhelminthes (Flatworms) Nemertina (Ribbon worms)* Gastrotricha Rotifera (Wheel animals) Acanthocephala Entoprocta* Nematoda (Roundworms) Nematomorpha (Horsehair worms) Ectoprocta (Bryozoans)* Mollusca (Mollusks) Annelida (Segmented worms) Tardigrada (Water bears) Pentastoma Arthropoda Chordata (Chordates)	Onychophora
Total Phyla: 15	17	1
* = > 95 percent of species are marine Source: Norse, 1993		

RAW MATERIALS FROM THE SEA

In addition to the foods (that are directly consumed) and medicines, the marine environment provides a number of products that are used as raw materials for a variety of purposes. These include:

- Seaweed - Alginate/carrageenan/agar (for use in food and medical applications)
  - Fertilizer
  - Animal feed;
- Coraline materials - Coral skeleton (jewelry, building material)
  - Sand (beach nourishment, construction material for buildings and roads);

- Marine crustaceans - Chitin (agricultural, medical, dental, cosmetic, and wastewater applications)

SERVICES FROM THE SEA

In spite of the provision of a wide range of goods for consumption and as raw materials, the most significant contribution of the marine environment is in the form of ecosystem services. Such services include:

- Coastal protection - Mangroves, seagrass beds, coral reefs;
- Transportation - Cargo, passengers;
- Stabilisation of global climate (control of carbon dioxide concentration in the atmosphere by phytoplankton at the oceans' surface);
- Recreational/amenity value - Tourism, etc.;
- Waste treatment and disposal

The amenity value of the ocean forms the basis for the tourism industry in the Caribbean, as the product is still based on the "sand, sea, and sun" model. Although this perception of the product is slowly changing, anecdotal information from tourism actors suggests that tourists still spend 70-80% of their time on the beaches. The value of this service to the Caribbean can be estimated from the estimates of visitor expenditure (Table 3.3).

As land became limiting for the disposal of hazardous wastes and sewage effluent, attention turned to the ocean. Though the disposal of hazardous materials at sea is discouraged by international multilateral agreements and treaties (e.g. MARPOL 73/78), the disposal of sewage effluent has increased. More urban areas in the Caribbean are constructing central sewerage systems, more hotels are being built in previously "unspoiled" areas, and the effluent from these systems is disposed of directly or indirectly to the sea.

In this, and many other ways, the human species continues to threaten the very resource upon which its survival depends.

EXERCISE 3.1

- Ask the participants to list all the uses that are made of coastal/marine resources (benefits should be more extensive than stated in the above text). Resources and/or ecosystems should then be ranked based on the perceived importance of the benefits provided.
- Note: This exercise is linked to Exercise 3.2

Table 3.3: Estimates of Visitor Expenditure* (US$millions)

Destination	1994	1995	1996	1997
Commonwealth Caribbean	**5,633.9**	**5,735.7**	**5,866.3**	**5,951.0**
OECS Countries	**805.1**	**778.5**	**810.7**	**852.5**
Anguilla	51.0	48.5	48.0	57.2
Antigua and Barbuda	293.4	246.7	257.9	269.4
Dominica	31.4	34.1	36.6	39.5
Grenada	59.3	58.3	59.5	59.4
Montserrat	23.6	19.9	9.7	5.4
St. Kitts and Nevis	76.9	65.1	66.8	67.3
St. Lucia	225.5	264.8	268.5	283.7
St. Vincent & Grenadines	44.0	41.1	63.7	70.6
Other Commonwealth	**4,274.0**	**4,444.8**	**4,704.1**	**4,879.7**
Bahamas	1,332.6	1,346.2	1,450.0	1,415.9
Barbados	597.6	661.8	684.9	717.0
Belize	71.4	77.6	83.6	88.0
Bermuda	525.3	487.9	472.3	477.5
British Virgin Islands	197.7	205.4	267.6	210.2
Cayman Islands	334.1	394.0	368.0	493.0
Guyana	85.0	78.2	70.3	59.6
Jamaica	973.0	1,068.5	1,100.0	1,131.0
Trinidad and Tobago	87.3	72.6	108.1	192.6
Turks and Caicos Islands	70.0	52.6	99.3	112.9
Dutch Caribbean	**1,089.4**	**1,082.3**	**1,155.5**	**1,289.3**
Aruba	450.7	521.2	605.8	666.1
Bonaire	32.4	36.9	42.3	44.2
Curacao	186.5	175.4	185.5	200.5
St. Maarten	419.8	348.8	321.9	378.5
French West Indies	**709.1**	**795.2**	**764.5**	**768.5**
Guadeloupe	330.2	380.4	353.9	371.5
Martinique	378.9	414.8	410.6	397.0
US Territories	**2,701.7**	**2,664.4**	**2,617.6**	**2,726.2**
Puerto Rico	1,782.3	1,842.1	1,930.2	2,125.0
US Virgin Islands	919.4	822.3	687.4	601.2
Other Countries	**3,487.4**	**4,272.4**	**5,227.3**	**6,059.4**
Cancun (Mexico)	1,339.0	1,370.6	1,704.6	2,051.8
Cozumel (Mexico)	110.9	146.4	281.2	327.1
Cuba	850.0	1,100.0	1,380.0	1,500.0
Dominican Republic	1,147.5	1,568.4	1,765.5	2,079.9
Haiti	27.0	56.0	58.0	57.0
Suriname	13.0	31.0	38.0	43.6
Total	**13,066.7**	**14,037.6**	**15,279.7**	**16,593.6**
CARICOM	**3,890.4**	**4,046.0**	**4,237.6**	**4,437.6**

* A number of the figures are provisional

Source: Modified from CTO, 1997

MODULE 3	USES AND THREATS TO THE MARINE ENVIRONMENT
THEME 2	The Sea as a Resource at Risk
OBJECTIVE	To provide an overview of the patterns of use of marine resources, as well as the threats to the marine environment.
SIGNIFICANCE	In order to reduce the threats to the marine environment, it is first necessary to develop an appreciation of the actual and potential contribution of marine resources to human well being.
PRESENTATION	Lecture, Participant discussion
EQUIPMENT / MATERIALS	Overhead projector, Slide projector
EXERCISE 3.2	List and rank all the threats to coastal and marine resources. Using the information from Exercise 3.1, review the ranking of threats based on the importance of the resource threatened.
TIME	1.5 Hours

INTRODUCTION

The Caribbean Sea and the resources it contains are threatened by a number of factors, some natural, most anthropogenic in origin. These sources can be grouped as follows:

- Natural events;
- Over-exploitation;
- Coastal development;
- Pollution derived from land-based sources;
- Maritime activities; and
- Population increase.

NATURAL EVENTS AS A SOURCE OF THREAT

The marine resource most at risk from natural events is the coral reef ecosystem. Sources of threat include:

- High temperature (coral bleaching);
- Flood events (transport large volumes of fresh water and sediments from land to the marine environment);
- Storms (structural damage);
- Sea level rise; and
- Disease (may also be induced by some human activities, such as pollution).

Some events, such as storms, also cause damage to other coastal and marine resources; including beaches, seagrass beds, and mangrove stands. Additionally, the impact of one event can increase the vulnerability of the resource to a different threat, or even act as the trigger for the other. The damage caused to corals by disease (White Band, Black Band, Yellow Band, and White Plague diseases) may increase the susceptibility of the coral reefs to hurricane damage, as well as contributing to post-hurricane mortality. Woodley (1999) suggests that coral diseases may thrive when the corals are already weakened by other stresses.

Global warming is one phenomenon that is projected to increase the frequency and intensity of some natural events, and may eventually change the weather patterns over large areas of the planet. The destruction of the (stratospheric) ozone layer may create a much larger problem. As Norse (1993) states, "*A major increase in ultraviolet radiation at the sea surface due to the depletion of stratospheric ozone could disrupt the sea's food webs on a scale dwarfing anything in human history*" (P. 87).

Caribbean countries are particularly vulnerable to sea level rise, given the concentration of infrastructure, urban areas, and commercial activities in coastal areas. Additionally, further

saline intrusion into valuable coastal resources (aquifers, wetlands, agricultural lands, etc.) would have a profound impact on the development opportunities and quality of life for significant proportions of the peoples of the Caribbean.

Coral bleaching in Caribbean countries, in response to high seawater temperatures, became apparent in 1987, and has occurred several years since. Though the majority of coral colonies recover, some do not. This widespread phenomenon is expected to continue, creating additional stresses for shallow-water corals reefs.

OVER-EXPLOITATION AS A SOURCE OF THREAT

The overexploitation of marine resources has been well documented, particularly the fishery resources for food. Related factors that exacerbated the problem include:

- Significantly high levels of by-catch, which was subsequently dumped;
- Destruction of habitats during the harvesting process (trawling for shrimp, dynamiting and chemicals for reef fish, etc.);
- Management of fisheries on a single-species basis;
- Inadequate enforcement capability;
- Inadequate protection of critical spawning/recruitment areas.

The use of improved fishery-management techniques in recent years (gear, closed seasons, etc.) has apparently slowed the rate of exploitation, but recovery of stocks does not appear to be likely in the near future.

COASTAL DEVELOPMENT AS A SOURCE OF THREAT

Many sectors utilise coastal resources, and therein impact on coastal resource viability. In fact, many activities that take place far from coastal areas may impact on coastal and marine resources (Table 3.4, see section on land-based pollution). However, coastal development is considered to rank among the most significant human threat.

Threats from coastal development may include the following:

- Construction and operation of harbour facilities (damage or loss of habitat, suspension of sediments, loss of sessile organisms, alteration of current patterns in locale, etc.);
- Construction of shore protection structures (alteration of sand budget/movement resulting in erosion, alteration of currents in locale, etc.);
- Dredge and fill (loss of sessile organisms, destruction or loss of habitats, transportation of sediments to sensitive marine ecosystems);

- Drainage of wetlands (damage to wetland, reduced productivity, loss of important species, transportation of sediments to sensitive marine ecosystems);
- Road and infrastructure construction (disruption of ecosystem functioning, loss of habitat, transportation of sediments to sensitive marine ecosystems);
- Construction of residential, resort, commercial, and industrial developments (loss of resources and habitats, transportation of sediments to sensitive marine ecosystems).

In addition to the direct impact of these activities, studies have shown that these land-based activities can exacerbate the impacts of storms on nearshore coral reefs (Nowlis, et al, 1997).

Table 3.4: Activities Utilizing or Affecting Coastal Resources

Activities Often Specifically Related to the Coastal Zone or Ocean	**Activities Rarely Specifically Related to the Coastal Zone but may have Direct Impacts**
1. Naval and other national defense operations (e.g. testing, coast guard, customs) 2. Port and harbour development (including shipping channels) 3. Shipping and navigation 4. Recreational boating and harbours 5. Commercial and recreational fishing 6. Mariculture 7. Tourism and recreation 8. Marine and coastal research 9. Water supply 10. Waste disposal 11. Industrial and commercial developments 12. Oil and gas facilities	1. Agriculture; aquaculture 2. Forestry 3. Wildlife management 4. Parks and recreation 5. Education 6. Public health (mosquito control, food) 7. Housing 8. Water and pollution control 9. Water supply 10. Transportation 11. Flood control 12. Oil and gas development 13. Mining 14. Industrial development 15. Energy generation 16. Waste disposal

Source: Modified from Awosika, et al. (1993)

LAND-BASED POLLUTION AS A SOURCE OF THREAT

It is generally agreed that within the Wider Caribbean Region, the land-based sources of pollution (point and non-point sources) form the most significant threat to the marine environment. The main sources have generally been identified as the following:

1. Point sources (industrial, sewage, and solid waste);

2. Urban non-point runoff (stormwater runoff and combined overflow discharges);

3. Non-urban non-point runoff (cropland, pastureland, and forestland runoff);

4. Upstream sources (pollutants carried into the coastal zone as part of a river's streamflow); and

5. Irrigation return flows (irrigation water return to lake, stream, or canal).

Though the pollution inputs from land-based sources have not been fully quantified, the impacts on the nearshore and marine environment are well known; encompassing degradation and destruction, of the nearshore habitats, reducing bathing water quality (sometimes resulting in the temporary or permanent closure of bathing beaches), and generally creating public health hazards (UNEP, 1987).

Programmes to deal with point sources of pollution concentrate primarily on pollution reduction through the development of effluent limitations (including permit and licence systems), particularly with regard to industrial pollution.

Seemingly more problematic than the point sources of pollution are the non-point sources (Table 3.5). Mounting volumes of solid waste overwhelm the collection and disposal systems, and landfills (mostly dumps instead of properly designed landfills) produce leachate that contaminate the coastal ground water and the marine environment. Additionally, the urban inputs through the drainage system are significant, and difficult to address.

However, the activities taking place in the watersheds produce significant negative impacts on the marine environment. The watershed-generated inputs are transported to the marine environment via large river systems (Table 3.6), and may be transported "…*from as far distant as the Andes and the northern Great Plains of North America*…" (UNEP, 1989, P. 27).

Table 3.5: Non-Point Sources of Pollution

Medium Impacted	Sources	Factors	Impacts
Soil	1. Industry 2. Agriculture 3. Atmospheric fallout	1. Toxic compounds 2. Pesticides 3. "Acid" rain	1. Decreased productivity 2. Health problems
Water (ground/ surface/ marine	1. Sewage disposal 2. Agricultural run-off 3. Atmospheric fallout 4. Urban surface run-off 5. Commercial and residential activities 6. Shipping and other marine activities	1. Sediments 2. Sewage effluent 3. Oils/hydrocarbons 4. Pesticides 5. Fertilizers 6. Marine debris 7. Solid waste 8. Toxic compounds 9. Wastewater 10. "Acid" rain	1. Health problems 2. Contamination of water supply systems 3. Decreased amenity value 4. Ecological disruptions 5. Decreased fisheries production
Air	1. Agriculture 2. Commercial activities 3. Residential activities 4. Waste disposal 5. Industry 6. Motor vehicle exhaust 7. Recreational activities 8. Construction activities	1. Noise 2. Particulates 3. Gases (oxides of sulphur, carbon, nitrogen, etc.)	1. Property damage 2. Health problems 3. Crop damage

Source: Gardner, 1999

Table 3.6:
Pollutant Loads Discharges from some Rivers in the Wider Caribbean Region

River	Country	Q (m^3/s)	BOD_5 (t/y)	TSS (t/y)	TN (t/y)	TP (t/y)
Rio Cobre	Jamaica	10	6.3×10^3	1.3×10^4		
Yaracuy	Venezuela	16	5.5×10^3	3.5×10^4	8.5×10^2	7.8
Ozama	Dominican Republic	48	3.6×10^4	1.3×10^5		
Reventazon	Costa Rica	247	6.8×10^4	1.3×10^6	1.1×10^4	
Coatzacoalcos	Mexico	420	6.7×10^4	3.5×10^7	1.7×10^4	
Grijalva	Mexico	795	1.3×10^5	2.2×10^6		
Magdalena	Colombia	7,000	2.8×10^5	6.8×10^7	1.3×10^5	1.4×10^4
Mississippi	USA	17,800	4.5×10^5	3.2×10^8	3.4×10^5	6.9×10^4

Q = Discharge rate BOD = Biological oxygen demand
TSS = Total suspended solids TN = Total nitrogen
TP = Total phosphorus t/y = Tons per year

Source: UNEP, 1994

Main Impacts of the Selected Parameters (Table 3.6)

a. Suspended solids impact on marine ecosystems and recreational activities in the following ways:
   - Smothering of benthic flora and fauna;
   - Reducing productivity of benthic flora by increasing turbidity and reducing the illumination;
   - Reducing the productivity of corals by smothering, reduction of illumination, and requiring the coral to waste energy in keeping itself clean;
   - Reduced amenity value from reduced visibility and aesthetic appeal.

b. The major impact of nutrient (nitrogen and phosphorus) enrichment to the marine environment is the stimulated growth of macroalgae, which already form a significant percentage of the cover on many of the coral reefs in the Caribbean.

c. Biological oxygen demand levels are generally derived from primary production processes. As such, high concentrations of nutrients and organic matter usually result in elevated levels of BOD. In areas experiencing pollution, the combined effects of BOD and chemical oxygen demand can lower dissolved oxygen concentrations to the point where oxygen become limiting to other marine organisms, sometimes resulting in fish kills.

MARITIME ACTIVITY AS A SOURCE OF THREAT

Shipping and maritime activities also contribute to the degradation of the marine environment through dry-docking operations, ballasting and tank washing, harbour operations, and oil spills from exploration, production, and shipping. UNEP (1989) indicates that many beaches in the Caribbean have experienced tar concentrations in excess of 100 g/m of shore, making them unfit for recreational uses.

Cruise tourism, one of the beneficiaries of a pristine environment, also contribute to the problem, through the disposal of solid and sewage wastes. Though the contribution from this latter source is thought to be less than that from land-based sources, the fines levied by the United States Government on a well-known cruise line as late as 1999 indicates that the problem continues.

EXERCISE 3.2

- Ask the participants to list all the threats to coastal and marine resources. The threats should be ranked based on the perceived level of impact.
- Using the information from Exercise 3.1, review the ranking of threats based on the importance of the resource threatened.

MODULE 3	USES AND THREATS TO THE MARINE ENVIRONMENT
THEME 3	The Caribbean Sea as a Common Property Resource
OBJECTIVE	To stimulate an understanding of the prevailing attitudes that influence the current patterns of exploitation of coastal and marine resources.
SIGNIFICANCE	Success in the management of coastal and marine resources must be based on an understanding of the social, economic, and political factors that influence patterns of exploitation.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	NA
EXERCISE 3.1	NA
TIME	0.5 Hours

INTRODUCTION

A Common Property Resource is one that cannot be owned exclusively by one person or company. In the case of the Caribbean Sea, this non-exclusivity of ownership extends to countries.

Hardin (1968) is well known for his articulation of the "tragedy of the commons", in which he makes the case that common property resources are likely to be used to exhaustion. Even though the parameters that Hardin used were later thought to be overly simplistic (Rees, 1990), there is ample evidence to support the theory that resources exploited in common tend to be misused and overused. At the national level, resources such as forests and fisheries are routinely overused, while resources such as wetlands and surface waters are misused.

For the Caribbean Sea, the problem of unregulated use at the national level is often complicated by competing exploitation at the international level. The Caribbean Sea is therefore being treated as an international common property resource.

Though, neither private nor public ownership of renewable resources guarantees that the resources will be used in a sustainable manner, some form of state intervention is usually required. The forms of government intervention relevant to management of natural resources includes the following:

1. Traditional Management Approaches

- National Physical Plans
- Land Use Plans
- (Regional) Development Plans
- Sectoral Plans
- Sanctuaries/Reserves/Parks
- Closed Seasons
- Protected Species Listing
- Use of Regulatory Instruments

2. More Recent Policy & Management Approaches

- National Conservation Strategies
- Country Environmental Profiles
- National Environmental Action Plans
- Integrated Planning/Creation of Umbrella Environmental Management Agencies
- Protected Areas System Planning
- Integrated Coastal Area Management
- Disaster/Contingency Planning
- Environmental Reporting
- Use of Regulatory Standards

- Environmental Impact Assessment
- Public Education/Environmental Curriculum Development
- Restoration of Degraded Ecosystems
- Use of More Economic/Financial Instruments
- Wider Partnerships with Civil Society

The above approaches affect national exploitation of, and impact on, an international common property resource, but do not automatically translate into management of the resource. Management of international common property resources is achieved through international agreements between affected/interested nations. Such agreements cover both multilateral environmental agreements (treaties/conventions) and programmes (Appendix 3.1). Within this mix of arrangements, the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (Cartagena Convention) is the only regional convention that focuses on the management of the Caribbean Sea.

RELEVANT MULTI-LATERAL AGREEMENTS

Putney (1994) indicated that few Caribbean islands participate fully in major conventions and programmes of relevance to protected area management. Though there is scope for a definition of "full" participation, the level of participation has increased in the past five years.

Governments of the Region are usually aware of the measures necessary to ensure compliance with global multilateral environmental agreements (MEAs). However, that awareness is often restricted to one or two agencies and in many cases widespread support is absent. Additionally, the general public is highly informed of only a few MEAs, such as the Biodiversity Convention and CITES. In such cases, awareness resulted from public awareness programmes implemented by both public and non-governmental organisations.

There is very limited enactment of national laws to enable compliance with the obligations of global MEAs. In the cases where such laws exist, such as those dealing with protected species, the laws were often enacted prior to ratification of the related MEA. However, related policies continue to be developed, as confirmed by the proliferation of national environmental strategies.

Regulatory measures and mechanisms were developed primarily to address national environmental problems, instead of the obligations assumed by ratification of the global MEAs.

No new national institution has been created specifically for the implementation of global MEAs, neither at the national nor regional levels. However, based on the regulatory and scientific focus/requirements of CITES, related inter-agency coordinating mechanisms have

been established in a few countries. Regional coordination mechanisms were devised in response to regional MEAs. The single exception involves the Climate Change Convention, in which eleven Caribbean Community (CARICOM) countries that are parties to the Convention are collaborating to implement the Caribbean Planning for Adaptation to Global Climate Change Project. This project involves a combination of national pilot/demonstration activities, regional training, and technology transfer.

Overall Trends

For the international treaties adopted by Caribbean Countries, most have not been supported at the national level by drafting and implementation of legislation. However, it is usual to find a small number of related projects being undertaken at any one time. It is anticipated that with nine countries now preparing national biodiversity strategies, national implementation of the Biodiversity Convention will be supported by legislation, clear institutional mechanisms, and adequate resources. Given that the environmental programmes in Caribbean countries are driven more by bilateral and multilateral funding arrangements than by MEA obligations, it is difficult at this time to determine the level of impact/effectiveness of global MEAs in the protection of the environment.

There are a number of barriers to treaty adoption and national implementation of treaty commitments. Case studies from four Caribbean countries (Caribbean Law Institute, 1998) have identified these constraints for treaty adoption as:

- Limited financial, technical, and human resources;
- Lack of political priority towards environmental protection and sustainable development;
- Lack of information and understanding of treaty benefits and costs; and
- Lack of a national focal point responsible for treaty acceptance.

Constraints for national implementation of treaty commitments were identified as:

- Lack of expertise and inadequate financial/human resources in line departments to "champion" legislative follow-up and enforcement;
- Tendency of international financial institutions to support projects rather than long-term institutional capacity-building;
- Other political priorities; and
- The lack of comprehensive, framework environmental legislation.

The only regional environmental convention in place is the Cartagena Convention, and its attendant protocols (Table 3.7). The Cartagena Convention was adopted in 1983, providing the legal instrument for the implementation of the Caribbean Action Plan; itself adopted in 1981 by thirty-three governments of the Wider Caribbean Region.

Table 3.7: Status of the Cartagena Convention

State	Cartagena* Convention		Oil Spills† Protocol		SPAW‡ Protocol		LBSP§ Protocol	
	Sig.	Rat.	Sig.	Rat.	Sig.	Rat.	Sig.	Rat.
Antigua and Barbuda		x		x	x			
Bahamas								
Barbados	x	x	x	x				
Belize								
Colombia	x	x	x	x	x	x		
Costa Rica		x		x		x		
Cuba		x		x	x	x		
Dominica		x		x				
Dominican Republic		x		x		x		
European Union	x							
France	x	x	x	x	x		x	
Grenada	x	x	x	x				
Guatemala	x	x	x	x				
Guyana								
Haiti								
Honduras	x		x					
Jamaica	x	x	x	x	x			
Mexico	x	x	x	x	x			
Netherlands	x	x	x	x	x	x	x	
Nicaragua	x		x					
Panama	x	x	x	x	x	x		
St. Kitts & Nevis								
St. Lucia	x	x	x	x	x			
St. Vincent & Grenadines		x		x	x	x		
Suriname								
Trinidad & Tobago		x		x	x			
United Kingdom								
United States of America	x	x	x	x	x		x	
Venezuela	x	x	x	x	x	x		

Sig. = Signed Rat. = Ratified or acceded

* The Convention entered into force on October 11, 1986

† This Protocol entered into force simultaneously with the Convention on October 11, 1986

‡ This Protocol awaits ratification by 2 more signatories (to reach the 9 required) before its entry into force

§ This Protocol opened on October 6, 1999, and will remain open for signature until October 7, 2000

Source: Modified from UNEP-CEP Website: http://www.cep.unep.org

Table 3.8: Caribbean Signatories to Relevant Environmental Conventions						
State	**UNCLOS**	**WCNH**	**Bio-diversity**	**Climate Change**	**Ramsar**	**CITES**
Antigua & Barbuda	16-Nov.-94	1-Feb.-84	29-Dec.-93	21-Mar.-94	x	x
Bahamas	16-Nov.-94	x	29-Dec.-93	28-Jun.-94	x	18-Sep.-79
Barbados	16-Nov.-94	x	10-Mar.-94	21-Jun.-94	x	9-Mar.-93
Belize	16-Nov.-94	x	30-Mar.-94	29-Jan.-95	x	x
Dominica	16-Nov.-94	4-Jul.-95	5-Jul.-94	21-Mar.-94	x	2-Nov.-95
Grenada	16-Nov.-94	x	9-Nov.-94	9-Nov.-94	x	x
Guyana	16-Nov.-94	20-Sep.-77	27-Nov.-94	27-Nov.-94	x	25-Aug.-77
Jamaica	16-Nov.-94	14-Sep.-83	6-Apr.-95	6-Apr.-95	x	x
Montserrat[1]	x	x	x	x	x	x
St. Kitts & Nevis	16-Nov.-94	10-Oct.-86	29-Dec.-93	21-Mar.-94	x	15-May-94
St. Lucia	16-Nov.-94	14-Jan.-92	29-Dec.-93	21-Mar.-94	x	15-Mar.-83
St. Vincent & the Grenadines	16-Nov.-94	x	3-Sep.-96	2-Mar.-97	x	28-Feb.-89
Suriname	x	x	11-Apr.-96	x	22-Nov.-85	15-Feb.-81
Trinidad & Tobago	16-Nov.-94	x	30-Oct.-96	22-Sep.-94	21-Apr.-93	18-Apr.-84
Anguilla	x	x	x	x	x	x
British Virgin Islands	x	x	x	x	x	x
Turks & Caicos	x	x	x	x	x	x
Haiti	30-Oct.-96	18-Apr.-80	24-Dec.-96	24-Nov.-96	x	x
Dominican Republic	x	12-May-85	5-Jul.-94	x	x	17-Mar.-87

UNCLOS = United Nations Convention on Law of the Sea
WCNH = World Cultural and Natural Heritage Convention
x = Not yet acceded/ratified
Source: http://sedac.ciesin.org/prod/charlotte

[1] The United Kingdom may have signed on behalf of Montserrat, Anguilla, British Virgin Islands, and Turks & Caicos.

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Appendix 3.1
State of the Fisheries in the Wider Caribbean Region

FAO Fisheries Circular No. 920 FIRM/C920
Rome, 1997

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REVIEW OF THE STATE OF WORLD FISHERY RESOURCES: MARINE FISHERIES
by
Marine Resources Service,
Fishery Resources Division,
Fisheries Department,
FAO, Rome, Italy

WESTERN CENTRAL ATLANTIC
FAO Statistical Area 31

Introduction

The waters incorporated in Area 31, the Western Central Atlantic, centered on the Caribbean and Central American States, include a diverse array of fisheries and harvested fish species. The FAO FISHSTAT system has records of 147 species or species groups being caught in these waters between 1950 and 1994. The species groups reported include categories such as "marine molluscs: not identified" and "finfishes: not identified", so the actual number of species harvested is likely to be much higher. A total of 26 states from the area have recorded landings on the system and many of these would include fisheries ranging from artisanal to commercial operations within their national fisheries. The oceanography of the region is heavily influenced by the runoff of the major river systems of the Mississippi, Orinoco and Amazon rivers. These river systems, demonstrating mesoscale variability in runoff, contribute to inter-annual variability within the marine system which is also influenced by other climatic factors, including hurricanes.

The fisheries of the region have been characterized by generally increasing catches in recent decades as fishing pressure has risen. However, knowledge of the status of the stocks being harvested is generally poor, and sustainable levels of fishing mortality are essentially

unknown for most species. There is a common belief that many stocks are being fully or over-exploited and there is concern for the status of species such as Nassau grouper Epinephelus striatus and jewfish E. itajara, the spiny lobster in some regions, and the queen conch. The greatest need in the region is for improved knowledge of the status and potential productivity of the stocks and of the fisheries harvesting them, to enable implementing appropriate management action.

Profile of Catches

The total fish landings from the area have increased fairly steadily since 1950, reaching a peak at over 2.5 million tonnes in l984 before falling until 1992, followed by a recovery in 1993 and 1994. In 1994 they stood at over 2.1 million tonnes, compared to an average of less than 1.5 million tonnes between 1950 and 1994.

The single major contributor to the landings at the ISSCAAP Group level is the pelagics of Group 35 (herrings, sardines and anchovies, etc.). Of these, ranking first and third respectively in terms of 1994 landings were the Gulf menhaden and the Atlantic menhaden. The landings of these two species in 1994 were 767 000 t and 37 500 t respectively, the former showing some recovery after the decline in landings in the late 1980s and early 1990s, while those of the latter remained substantially lower than the peak of the early 1980s. Combined, they represented 80% of the landings of pelagic species in ISSCAAP groups 34 and 35, and 38% of total landings from the region. There has also been a generally increasing trend in landings of small pelagics since the early 1970s. The small pelagics from Group 35 providing the largest landings, apart from those of menhaden, are largely clupeoids, particularly round sardinella and Atlantic thread herring. Within Group 34, the unidentified mullets and the Flathead gray mullet yielded the greatest landings in 1994 followed by the Caranx species.

In 1994 the largest landings of large pelagics in ISSCAAP Group 36 (tunas, bonitos, billfishes etc.) came from yellowfin tuna (28 000 t), Atlantic Spanish mackerel and king mackerel (19 000 t and 9 000 t respectively) and skipjack tuna (8 000 t). Landings of ISSCAAP Group 36 species have shown substantial increases over the period 1950 to 1994.

Contributing substantially less than the small pelagics in terms of landed weight, but certainly of considerable total economic value, are ISSCAAP Group 45 (shrimps, prawns etc.), Group 33 (redfishes, basses, congers etc.), and the other higher value species groups. A cause for concern is the substantial increase in ISSCAAP Group 39 (miscellaneous marine fishes). This group accounted for approximately 40% of total finfish landings in 1994, excluding menhaden. Without accurate data on the species composition of landings, and associated information on effort, it is impossible to assess the status of the stocks, and better

identification of fish landings should be given a high priority by those countries in the region which are failing in this regard.

The fisheries for crustaceans in this area are dominated by those for the Caribbean spiny lobster and penaeid shrimps, the latter particularly from the Gulf of Mexico and the Guianas-Brazil subregion. Landings of the spiny lobster have increased fairly consistently since 1950, while the total annual shrimp catch from the region has fluctuated around approximately 170 000 two decades The production of shrimps and prawns by aquaculture has grown substantially in recent years, reaching over 11 000 t in 1994 or 7% of the total shrimp production, including aquaculture, from the region.

Several mollusc species support valuable fisheries in the area, in particular the fisheries in the USA for cupped oysters and calico scallops. In 1994, recorded landings for these species were 59,000 t and 74,000 t respectively, the latter showing recovery after the dramatic decline of the early 1990s. Production of cupped was supplemented by the culture of nearly 90 000 t of the species in Mexico and the USA in that year. Landings of queen conch have increased substantially over the last 25 years but declined somewhat after a peak at nearly 8,000 t in 1984. In 1993 landings again rose above 8,000 t, but declined to just more than 7,000 t in 1994. The status of the stock is currently causing concern.

Resource Status and Management

Despite a scarcity of hard information and few rigorous assessments, there is general concern for a number of the species and stocks in the region. One such group is that of the sharks and rays, in which landings have increased substantially in recent years, reaching a peak of nearly 34,000 t in 1994, over double that landed, on average, between 1950 and 1994. The nations taking the largest landings of these species in 1994 included Mexico, Venezuela and the USA, all of which have shown increasing landings in recent years. In addition, many species of reef fish have been reported as being fully or overexploited, including Nassau grouper and jewfish. Within ISSCAAP groups 33 (Redfishes, basses, congers etc.) and 39 (Miscellaneous marine fishes), which include most of the reef-fish species, the two highest landings categories, together accounting for nearly 70% of the total landings for the group, were unidentified marine fishes and finfishes. Clearly there is little hope for rigorous management for sustainable utilization as long as this problem remains. Of the identified landings, the greatest landings were made of unidentified groupers (Epinephelus spp.), unidentified snappers and jobfishes (Lutjanidae), unidentified weakfishes (Cynoscion spp.) and unidentified sea catfishes (Ariidae). In all of these groups landings for 1994 were above 10,000 t.

The demersal fishes of the region support important fisheries. The most important commercial fishery utilizes hook and line and occasionally traps to catch the deep reef fishes, particularly snappers and groupers, while trawl fisheries catch mainly the croaker and drum multi-species category. Considerable attention is being given to reduction of finfish bycatch in the shrimp fishery, particularly through the use of bycatch reduction devices, but finfish bycatch, including substantial proportions of juveniles, is still cause for concern.

The pelagic fisheries of the area may be divided into large offshore pelagics with oceanic distribution, large coastal pelagics with a regional distribution and small pelagics. The first group includes fish such as the billfishes, tunas and swordfish. Most of these species are assessed by he International Commission for Atlantic Tunas (ICCAT) and most are considered by the Commission to be fully or over-exploited. Any plans to expand the fisheries for these species within the region should therefore be made within the ICCAT framework, and proper representation of the smaller nations within WECAFC on this body should be seriously considered by fisheries departments in the region. This is clearly an example where regional cooperation is urgently required. In contrast to the stocks falling under ICCAT, the status of the stocks of the more common locally distributed large pelagics, such as mackerel Scomberomorus species, blackfin tuna and common dolphinfish is unknown. The round sardinella and Atlantic thread herring are generally caught close to the continental mainland and the larger islands such as Trinidad and Jamaica. Fisheries for small pelagics on the smaller islands making up the lesser Antilles largely make use of beach seine nets and are locally important providers of employment and food. They tend to be based on carangidae, that is the jacks and scads, such as Selar crumenophthalmus and Decapturus spp., and halfbeaks (Hemiramphus spp.).The flyingfish (Hirundichthys affinis) makes up only a low proportion of landings of small pelagics, but is important to the southeastern Caribbean states. Only two countries, Barbados and Granada, have recorded catches of this species on FAO FISHSTAT, but at least seven island states have fisheries for the species and there is considerable interest in increasing exploitation.

The main crustacean fisheries are those for spiny lobster and penaeid shrimps. Total landings of spiny lobster in 1994 amounted to nearly 30,000 t, with the fishery dominated by Cuba (9,700 t) and the Bahamas (7,800 t). The USA, Nicaragua and Honduras also recorded landings of over 1,000 t. The resource is generally considered to be over-exploited in many countries and a more holistic and effective management strategy is required for the region. Steps are being taken in this direction and, for example, both Cuba and the Bahamas have taken active steps to implement appropriate management measures. A workshop aimed at undertaking a regional assessment of these resources is scheduled for the first half of 1997.

In 1994 the total shrimp catch from the region was over 160 000 t. Of this, and including aquaculture, the USA accounted for over 100 000 t. Other major producers included Mexico (23 000 t), Venezuela (14 000 t), Colombia (9 000 t) and Guyana (7 000 t). Probably the

major concern with this fishery is the issue of bycatch, both of finfish and of turtles. Finfish species taken as bycatch include species such as croaker (Micropogonias spp.), snapper (Lutjanus spp.) and dog trout (Macrodon ancylodon).

Several mollusc species support valuable fisheries in the area, in particular the fisheries in the USA for cupped oysters and calico scallops. In 1994, recorded production of these species, including aquaculture, was 146 000 t and 74 000 t respectively, the latter showing some recovery after the dramatic decline of the early 1990s. The queen conch fishery is cause for some concern, and the stock is considered to be over-exploited in most countries in the area. As a result, the species has been listed on Appendix II of CITES. Mexico has the largest landings of this species. Serious attempts are being made to assess the status of the species and determine appropriate management responses. An "International Queen Conch Conference" was organized by the Caribbean Fishery Management Council in mid-1996 to consider approaches to assessment and management of the species.

Environmental degradation presents cause for concern in some areas and fisheries within the region. The coastal habitats are vulnerable to on-going coastal development and to impacts from inland developments such as pollution and damming of rivers. The Committee for the development and Management of Fisheries in the Lesser Antilles of WECAFC recently called for investigations into the impacts of environmental degradation as a priority. Loss of important coastal nursery areas such as mangrove and sea grass habitats, are specific examples of problems being experienced. Coral reefs, important habitats in the region of substantial socio-economic importance through both tourism and fisheries, are also being degraded. The Final Report of the International Coral Reef Initiative Workshop in 1995 reported on incidences of declines in reef fish populations and coral cover across the region. These changes were being brought about by factors such as terrestrial runoff of both sediments and nutrients, direct physical damage to the reefs in a number of ways, and overexploitation of fish resources. Clearly, attempts to sustainably utilize the renewable marine resources must incorporate appropriate environmental management.

Appendix 3.2
Regional Programmes/Projects 1992-1999

The Caribbean Environment Programme

The thirty-three (33) governments of the nations and territories of the Wider Caribbean Region established the Caribbean Environment Programme (CEP) in support of efforts to promote the integration of environmental considerations into development planning. Years of work by governmental and non-governmental representatives of the Caribbean community, assisted by the United Nations Environment Programme (UNEP) and the Economic Commission for Latin America and the Caribbean (ECLAC), resulted in the preparation of the Caribbean Action Plan. This Plan, which was adopted in 1981, included the following:

- Assistance to all countries of the Region, recognising the special situation of the smaller islands;
- Co-ordination of international assistance activities;
- Strengthening existing national and sub-regional institutions; and
- Technical cooperation in the use of the Region's human, financial, and natural resources.

The CEP one of UNEP's Regional Seas Programmes, and presently serves as the primary mechanism for regional cooperation in the protection of the marine environment.

In 1983, the Cartagena Convention was adopted as the legal instrument for the implementation of the Action Plan. The Convention is a framework agreement setting out the political and legal foundations for actions to be developed. These actions are directed by a series of operational Protocols that are designed to address special issues and to initiate concrete actions.

- **The Oil Spills Protocol** concerns cooperation among countries in the region in combating oil spills and the preparation and updating of contingency plans.
- **The Specially Protected Areas and Wildlife (SPAW) Protocol** deals with conservation measures to protect, preserve, and manage sensitive marine areas, as well as threatened or endangered species of flora and fauna.
- **The Land-Based Sources of Marine Pollution (LBSMP) Protocol** deals with environmental pollution reaching the marine environment from land-based sources and activities.

The Caribbean Regional Coordinating Unit (CAR/RCU) located in Kingston, Jamaica, was created in 1986 to serve as the Secretariat to CEP. The objectives of the Secretariat are to:

- Provide assistance to all countries of the region, with the implementation of the Cartagena Convention, its Protocols, and in meeting its objectives;
- Strengthen national and sub-regional institutions which are working towards the sustainable management of coastal and marine resources;
- Co-ordinate international assistance; and
- Stimulate technical regional co-operation among countries.

The CEP is composed of several Sub-Programmes, serving the Cartagena Convention and its protocols:

- The SPAW sub-programme supports activities for the protection and management of sensitive and highly valuable natural marine resources. This sub-programme is responsible for the regionalization of global conventions and initiatives such as the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species (CITES) and the International Coral Reef Initiative (ICRI). A Memorandum of Cooperation exists between the CBD Secretariat and UNEP-CAR/RCU to assist with the implementation of the CBD at the regional level.
- The assessment and management of environmental pollution (AMEP) sub-programme addresses the needs of the LBSMP and Oil Spills Protocols. AMEP supports the activities required for the establishment and enforcement of necessary measures to prevent, reduce, and control marine pollution and to assist in the development of integrated environmental planning and management of coastal and marine areas. This sub-programme is responsible for the regionalization of global agreements such as the Global Program of Action (GPA), the Basel Convention, and the Convention on Climate Change, and maintains close collaborative arrangements with the International Maritime Organisation (IMO) for the implementation of the Oil Spills Protocol.
- The information sub-programme (CEPNET) concerns information management systems, giving technical support to the management of environmental information arising from other sub-programmes. CEPNET also aims to strengthen the information systems for the management of coastal and marine resources by countries of the region. The Sub-Programme is responsible for the regionalization of global information systems such as INFOTERRA, GRID, and ENRIN.
- The Education, Training and Public Awareness (ETA) sub-programme concerns mainly the development of activities to strengthen human capacity and sensitisation at all levels.

Website: http://www.cep.unep.org/

SIDS Programme of Action

The Programme of Action resulting from the conference on Small Islands Developing States (SIDS/POA) can be considered as having the widest scope of the regional programmes. The SIDS/POA identifies fourteen (14) priority areas for action, and suggests the main national, regional, and international actions that should be undertaken in support of initiatives in these priority areas. The priority areas are:

i. Climate change and sealevel rise;
ii. Natural and environmental disasters;
iii. Management of wastes;
iv. Coastal and marine resources;
v. Freshwater resources;
vi. Land resources;
vii. Energy resources;
viii. Tourism resources;
ix. Biodiversity resources;
x. National institutions and administrative capacity;
xi. Regional institutions and technical cooperation;
xii. Transport and communication;
xiii. Science and technology; and
xiv. Human resource development.

The SIDS/POA has influenced, to a large degree, the activities of most of the funding and technical cooperation organisations. The Secretariat for the SIDS/POA is provided by the Port of Spain (Trinidad and Tobago) office of the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC).

Website: http://www.community.wow.net.eclac

The Caribbean Coastal Marine Productivity Programme (CARICOMP)

CARICOMP was established as a "regional scientific effort to study land-sea interaction processes, to monitor for change, and to provide appropriate scientific information for management". The UNESCO programme on Coastal Regions and Small Islands supports the programme, which consists of a network of 25 marine laboratories and protected areas in 21 countries. Financial support from other sources has been received periodically. The initiative presently focuses on productivity studies and status assessment on coral reefs.

The Centre for Marine Sciences of the University of the West Indies (Jamaica) houses the central Data Management Centre for the programme.

Website: http://uwimona.edu.jm/centres/cms/caricomp

Caribbean Planning for Adaptation to Global Climate Change

The Caribbean Planning for Adaptation to Global Climate Change Project is a four-year project (1998-2001) that is being executed through the cooperative efforts of the eleven Caribbean countries that are CARICOM parties to the Climate Change Convention. The project is being funded by the Global Environmental Facility Trust Fund, with the General Secretariat of the Organization of American States (GS/OAS) as the executing agency and the University of the West Indies as the implementing institution.

The regional approach of the project involves a combination of national pilot/demonstration activities, regional training, and technology transfer. The approach "seeks to strengthen regional cooperation and institutions, and to provide cost-effective means for adaptation planning, data collection, and sharing of information, skills, and project benefits". The project has the following components:

i. Design and establishment of a sea level/climate monitoring network;
ii. Establishment of databases and information systems in participating countries;
iii. Inventory of coastal resources and use;
iv. Formulation of a policy framework for integrated coastal and marine management;
v. Coral reef monitoring for climate change (in three countries);
vi. Coastal vulnerability and risk assessment (in three countries);
vii. Economic valuation of coastal and marine resources (in three countries); and
viii. Formulation of economic/regulatory proposals (in two countries).

Website: http://www.cpacc.org/

COSALC 1

The programme on Coast and Beach Stability in the Lesser Antilles (COSALC 1) was founded in 1985 in response to requests from the smaller islands in the Eastern Caribbean sub-grouping. The programme was sponsored initially by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as part of its Coasts and Small Islands Programme. In 1993 the University of Puerto Rico Sea

Grant College Program joined the programme as a co-sponsor, providing the coordinating centre.

The goal of COSALC 1 is "to develop in-country capabilities so that island states can measure, assess, and manage their own beach resources within an overall framework of integrated coastal zone management". The programme consists of a network of government agencies and non-governmental organisations in ten countries, in which each country has established a beach monitoring programme focused on surveying beach cross sections on a regular basis.

Future plans for COSLAC include:
i. Extending the network to other developing island states in the region; and
ii. Expanding the programme to include measurements of oceanographic processes such as waves, currents, and sea level.

Fisheries Resource Assessment and Management Program

The Fisheries Resource Assessment and Management Program (CFRAMP) is an initiative of twelve member states of CARICOM, which is jointly funded by CIDA and the participating countries. The programme, which was started in 1992, was set up to "improve the long-term contribution of fisheries to socio-economic development of the region". The programme is organised in six thematic areas:
i. Fisheries management information systems;
ii. Resource assessment;
iii. National fisheries resource management;
iv. Regional fisheries mechanism and community involvement; and
v. Long-term training.

REGIONAL NETWORKS

Caribbean Ecotourism Support Network (CESN)

The Caribbean Ecotourism Support Network (CESN) emerged out of the ecotourism conferences organised by the Caribbean Tourism Organization (CTO). The network, which was formalised in 1996, consists of national focal points (in the CARICOM and ACS countries). This network is coordinated by a regional secretariat, which is presently being relocated to the University of the West Indies Centre for Environment

and Development (UWICED). The objectives of the Network is to: clarify definitions of ecotourism; prepare guidelines for ecotourism; site development and operations; promote the concept of ecotourism; support ecotourism initiatives in the participating countries; and develop a mechanism for monitoring the status of ecotourism sites.

Caribbean Energy Information System (CEIS)

The Caribbean Energy Information System (CEIS) network resulted from the Regional Energy Action Plan approved by CARICOM Heads of Government in July 1983. CEIS, which became operational in February 1987, is a cooperating networking system committed to the pooling and exchange of information related to energy. The "hub" of the system is the Regional Focal Point, provided by the Scientific Research Council (Jamaica), which is responsible for compiling a bibliographic database of information on technologies, resource assessments, management and planning, energy markets, and the legal aspects of energy use, production, and development in the Caribbean. This information is contributed by the fifteen (15) National Focal Points. The database provides support for energy sector use and development in the participating countries, by making energy information available to public and private sector users, including teachers, service providers, and students.

Caribbean Environmental Reporters Network (CERN)

The Caribbean Environmental Reporters Network (CERN) is a "loose" network of reporters that have an interest in environmentally related news and issues. The Network produces a radio series that is distributed across the region via CANA radio. CERN's operations, such as the radio programmes, funding for journalists on assignment, and training is facilitated by the Panos in the Americas, in association with other groups. Online operations, including the web-news, and publicity is coordinated by one of the founding members, presently based in the United Kingdom.

Wider Caribbean Marine Protected Areas Management Network (CaMPAM)

CaMPAM was formed in December 1997, during a workshop on cooperation in marine protected area management that was hosted by the Biscayne National Park and the Regional Coordinating Unit, UNEP/CEP. The Network has adopted as its mission, the "enhancement of marine and coastal area management in the Wider

Caribbean Region through sharing and collaboration to strengthen the national and regional systems of existing and future marine and coastal protected areas". Participants from twenty-two (22) countries of the Wider Caribbean Region initially joined the Network, and the number of participating individuals and institutions continue to increase. The Biscayne National Park, with support form UNEP/CEP/RCU and IUCN, presently coordinate the Network.

Caribbean Youth Environmental Network (CYEN)

The Caribbean Youth Environmental Network (CYEN) started in the early 1990s as the unofficial "youth arm" of the CCA. The Network is comprised of individuals, and is open to youths from the Caribbean. It is concerned primarily with environmental education and community projects conducted by its members. The Caribbean Policy Development Centre (CPDC) presently provides secretariat support to the Network.

Caribbean Community Ocean Sciences Network (CCOSNET)

The Caribbean Community Ocean Sciences Network (CCOSNET) evolved out of the Caribbean Oceanography Resources Exploration Project, and became functional on December 12, 1990. CCOSNET is "a mechanism for marshalling the oceanographic science resources of CARICOM Member States". The Network, which is coordinated by the Institute for Marine Affairs (Trinidad), has the following responsibilities; the establishment and maintenance of a regional ocean sciences database; the establishment and maintenance of an inventory of human and physical resource needs in ocean sciences in the region in the short to medium term; facilitating the procurement of berths and coordinating the use of ships of opportunity and other data-gathering sources in systematically acquiring knowledge in the region; facilitating access to relevant marine and environmental-related data and information regionally and inter-regionally; and providing a forum to facilitate the exchange of information, experience, and expertise in areas of mutual interest.