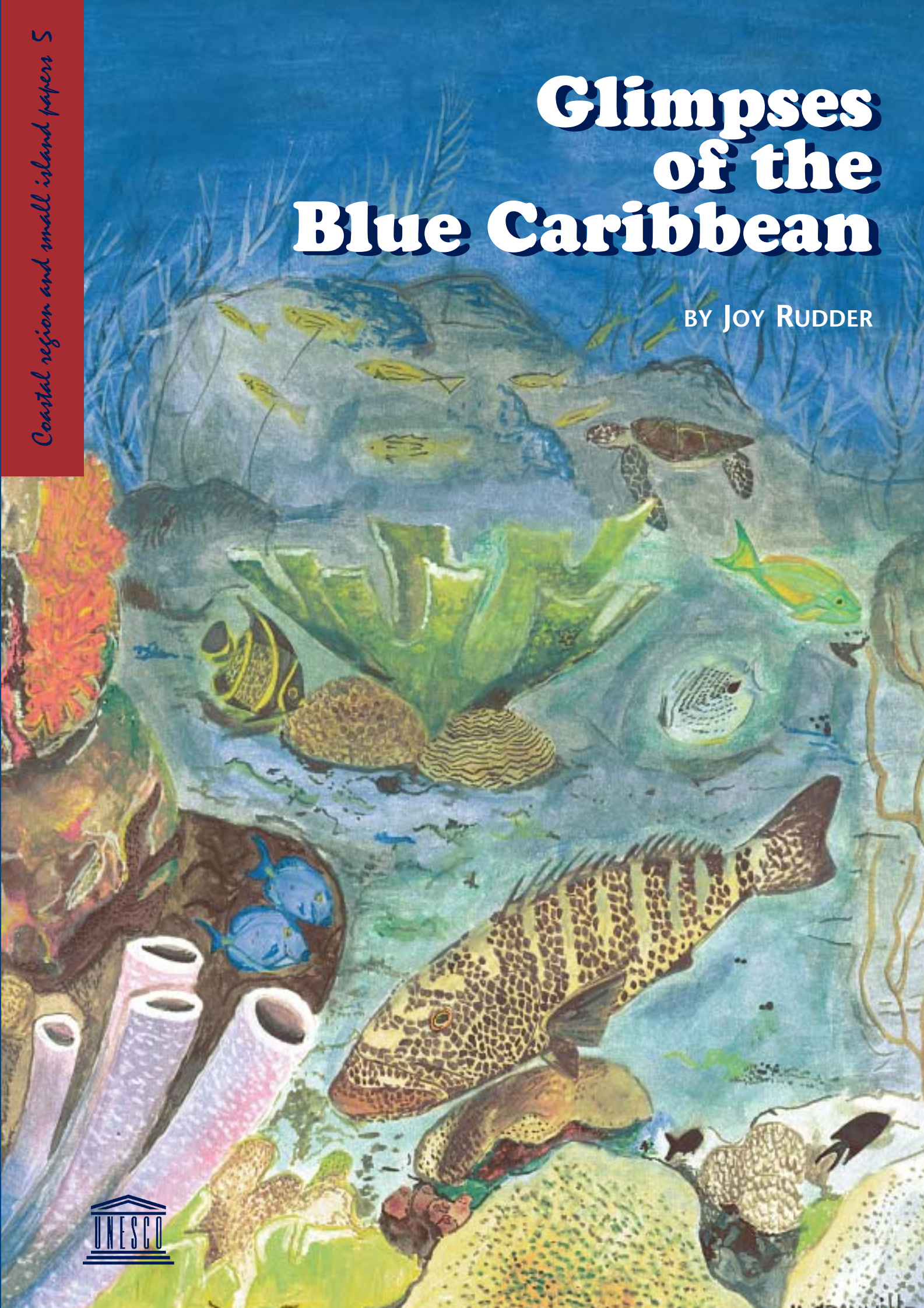


Glimpses of the Blue Caribbean

BY JOY RUDDER



Glimpses of the Blue Caribbean

Oceans, coasts and seas and how they shape us

**by
Joy Rudder**

**edited by
Gillian Cambers and Alexei Suzyumov**

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Caribbean Sea Project



Associated Schools Project

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Stories used at the start of the sections "Where are we?", "What do we have?", "What can be done?" and "What we want to happen" have been adapted from work first published by *Caribbean Week* newspaper in the Environment column by Joy Rudder between 1989 and 1991.

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Preface

A major underlying theme running across the wide-ranging scale of this Organization's programmes is education. Indeed, it is the initial domain encountered in the name: United Nations Educational, Scientific and Cultural Organization. UNESCO seeks, at every opportunity, to fulfil its mandate of contributing to the achievement of a better informed world society. The building blocks for such an endeavour should be laid in the minds of youth around the globe.

It is with particular pleasure that the Organization's intersectoral platform on Environment and Development in Coastal Regions and in Small Islands (CSI) provides an avenue for the dissemination of useful basic literature such as the present delightful booklet, which has been carefully designed to enlighten youth and the general public regarding the marvels of, and menaces to, the coastal marine environment and its resources in the Caribbean region.

We greatly appreciate the collaboration of our colleagues in the Associated Schools Caribbean Sea Project and the educational community working with them in the preparation of this booklet. It is hoped that this material will be of benefit not only to Caribbean schools, but that it might also interest a much wider readership.

DIRK G. TROOST

Chief, UNESCO-CSI

Foreword

Glimpses of the Blue Caribbean, in its shorter original version, was produced to serve initially as basic resource material for the first UNESCO Associated Schools Caribbean Sea Project (CSP) Environmental Education Workshop hosted by the Trinidad and Tobago National Commission for UNESCO and the Tobago House of Assembly, at Palm Tree Village, Tobago from 20 to 26 July 1998. It is expected, however, to have a life beyond the workshop and to be a valuable resource for schools participating in the CSP.

The UNESCO Associated Schools Caribbean Sea Project was launched in Trinidad and Tobago in November 1994 with the involvement of seven Caribbean territories: Cuba, Grenada, Jamaica, St. Vincent and the Grenadines, Trinidad and Tobago, Netherlands Antilles and Venezuela. In 1996 at the 3rd Regional Meeting of National CSP Coordinators in Aruba the following countries came on board: Aruba (host country), Cayman Islands, Colombia, Saint Lucia and the Bahamas. Costa Rica joined the project in 1997. At the 1st CSP Environmental Education Workshop in Tobago, Barbados, Haiti, Guyana, Dominica and St. Kitts and Nevis joined the project. The aim is, eventually to have schools in all territories washed by the Caribbean Sea, or possessing a Caribbean culture, actively involved in the project and with a heightened awareness of and appreciation for the resources and value of the Caribbean Sea and its coastal regions as well as for the culture of Caribbean people.

Joy Rudder, Consultant for the development of the present text, has provided teachers and students of the Caribbean with refreshing glimpses and different perspectives of the Caribbean Sea which everyone can enjoy and from which we can all increase our knowledge. It is hoped that with increased knowledge and more positive attitudes we will be better able to love and cherish the Caribbean Sea, to our own benefit and that of future generations.

This joint ASP/CSP-CSI publication contributes to the “Focus on the Caribbean” process launched by the Organization.

SANDRA GIFT

Sub-regional Coordinator, UNESCO Associated Schools (ASP) Project, and
Regional Coordinator, Caribbean Sea Project

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The original (1998) manuscript was edited, for the present version, by the following scientists: Alexei Suzyumov, of UNESCO's intersectoral endeavour on Environment and Development in Coastal Regions and in Small Islands (CSI) and Gillian Cambers, of the University of Puerto Rico Sea Grant College Program. Valuable assistance in the scientific revision was also provided by biologists George Grice and Ned Cyr, of UNESCO's Intergovernmental Oceanographic Commission, and by Douglas Nakashima, of CSI. The glossary and indexes, included herein, were prepared by Gillian Cambers. Revision and final adjustments to the layout were carried out by Eric Loddé.

Profiles of the Contributors

Joy Rudder (née Cobham) is a writer and photographer. Born in Trinidad, she completed a B.A. in Mass Communications and Social Sciences and a Diploma in Environmental Studies and Resource Management at the Jamaica and Barbados campuses of the University of the West Indies. Her first book, *Our Native Land*, was published in 1991 by the United Nations Environment Programme, Nairobi. She co-authored *A Strategy for Environmental Education and Communications for the Caribbean*, published by the Caribbean Conservation Association and the Canadian International Development Agency. She wrote an environmental column for Caribbean Week newspaper from 1989-91 followed by a later mini-series called *Travellers' Tales*. Joy has worked as a writer and short term environmental education consultant for the United Nations Development Programme, the Pan American Health Organisation, Panos and other developmental agencies. She has toured several European countries and, since marriage, has explored most of the Caribbean and much of North America extensively. At present, she is based in Vancouver where she is completing a Masters of Christian Studies, in the inter-disciplinary/Arts Thesis programme at Regent College in British Columbia.

Detta van Aardt was raised in Kenya, where early in life she developed a love and reverence for nature. She is a graduate of the Faculty of Art and Architecture of the University College of Nairobi. With her husband, the family moved to Jamaica, where she taught art. In Trinidad from 1978, Detta has settled into a life involving painting, producing artwork, teaching, caring for animals and the environment. She has worked for Caribbean organisations and others as a freelance illustrator. She has also tutored Advance Level art students. She works in a variety of media, watercolour, oil, lino print and batik. Some of her large mosaic pieces are in private collections in Kenya, and she exhibits in many art galleries and sells her work in Trinidad. Detta also finds time to operate a small wildlife rehabilitation/hospice unit she has set up at her home.

Yvette Louison lays claim to a unique Caribbean heritage. Her mother, an indigenous Dominican Carib, is a successful agriculturist and entrepreneur; her father, the famed Trinidad landscape artist Dermot Louison. A graduate of Holy Name Convent, Yvette has combined the worlds of art and business and is an accomplished computer graphic artist.

Guide to the Contents

Where are we? 1

Catching a future vision from our past (<i>Our Taino and Amerindian ancestors</i>)	2
Seeing the many as one (<i>The Caribbean Sea as a symbol of unity</i>)	3
Fiery earth currents (<i>Plate tectonics</i>)	4
From the sweltering latitudes (<i>Global wind systems</i>)	6
“Wind goes rippling the face of the deep...” (<i>Ocean currents</i>)	7
Seasonal storms of the Caribbean Sea (<i>Hurricanes and tropical storms</i>)	8
Celestial bodies and the swirling earth (<i>Tides and effects of the moon and sun</i>)	9
Boiling seas and angry mountains (<i>Tsunamis and volcanic activities</i>)	10
You take it from here (<i>Further student activities</i>)	13

Who are we? 14

Moulded by the sea (<i>The seas’ effects on our lives</i>)	16
Those who came over the seas (<i>Historical settlers from overseas</i>)	16
Stories in stone (<i>Sea fortifications</i>)	17
People who taught the world to sing (<i>Songs about the sea</i>)	18
Watchers for whales and jumping fish (<i>Artisanal fishing</i>)	20
Survivors on scattered shores (<i>Boat building and marine transportation</i>)	20
Hosts to the world (<i>Tourism</i>)	22
Oil that troubles our waters (<i>The oil industry</i>)	22
Outclassed competitors (<i>Threats from foreign industrial fishermen</i>)	23
Users of the shifting shore: Caring for what we enjoy (<i>Beaches and their uses</i>)	24
Forces that sculpt the beach (<i>Oceanographic processes, beach erosion and mitigation measures</i>)	26
Gentle divers of an ancient sea (<i>Anecdotal uses: Japanese women divers</i>)	30
Pictures of the ocean (<i>Linkages being human beings and the oceans</i>)	30
You take it from here (<i>Further student activities</i>)	31

What do we have? 32

From a drop to a thousand fathoms (<i>Microscopic life in the sea</i>)	34
More than a spider's web (<i>Food chains and food webs</i>)	35
Misunderstood mangroves (<i>Functions and value of mangroves</i>)	38
The beds where turtles feed (<i>Seagrass beds</i>)	40
The kingdom where coral reigns (<i>Coral reefs</i>)	41
Out in the open seas (<i>Life in the deep ocean</i>)	43
The beauty that is backdrop (<i>Extinction of species</i>)	45
A law that cares for life: The Convention on Biological Diversity	45
Sun, clouds or too much rain? Blanketing our earth with care (<i>Climate Change Convention</i>)	47
You take it from here (<i>Further student activities</i>)	49

What can be done? 50

Regulating our seas (<i>International regulations</i>)	52
Riding a new wave to change (<i>Law of the Sea</i>)	52
A critical Caribbean creation (<i>Cartagena Convention</i>)	53
Netting the wastes out at sea (<i>Prevention of Pollution from ships</i>)	55
Help through research and learning (<i>UNESCO's initiative on Environment and Development in Coastal Regions and in Small Islands</i>)	55
The UNESCO Associated Schools Caribbean Sea Project	57
You take it from here (<i>Further student activities</i>)	59

What we want to happen 60

Glossary	63
Subject index	67
Location index	69

Where Are We?

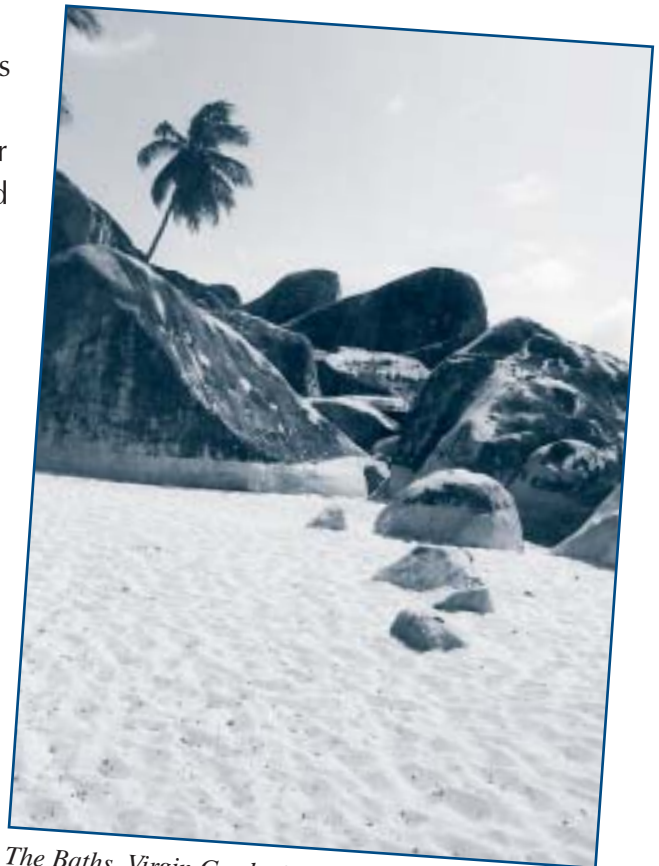
Here we stand, on islands and mainlands of the blue Caribbean Sea; Caribbean people, struggling as we seek to explore and to live out, the truest meaning of our independence. With joy and dread we seek to write our own narrative. But will it have a happy ending?

We are worried, because, looking over our shoulders, we are glimpsing the phantoms of our past - not just slavery or indentureship (those harassing spirits are forces to which we have grown accustomed). No, the terrors today, are more ghoulish and disguised.

We are poor – or so we think, and so we are eager to make alliances with the rich. But we buy projects for energy only to find we have befouled our land with toxic wastes. We are tormented by the fear of hunger and some of us already are starving, so with eager, humble hands we buy foreign technology to re-school ourselves in the planting and reaping and storing of things. We seek security from famine; but the very agents of progress cause our demise.

We drench our fertile furrows with needless pesticides and when the rains come, death courses downstream as rivers carry the heavy burden of the pesticides to the sea, down to the bays where we used to scamper and fish. And life in our waters dies.

As the rains pummel our hillsides, another murky phantom rises and rushes to the ocean. We stripped the hills of innocence, tore off their trees of virgin green, laughed, proud of our technology that we thrust and drove, down into the timid soil. Now, the mountains are sighing, disbanding, stumbling down, down to the sea. There, the ravished soils murder the reefs, sitting astride soft corals and strangling them... And the seas mourn.



The Baths, Virgin Gorda, British Virgin Islands

Catching a future vision from our past

All of us who live in the Wider Caribbean have inherited a mixed legacy from the past. Our lands were first homes to indigenous peoples, but to these shores many others have come.

Beyond all our dreaming, is a time we have only heard of – 50,000 years ago, when an Ice Age advanced as all the earth grew colder. Sea level dropped as waters froze, exposing bridges that linked lands once totally separated by oceans. Asiatic wanderers to the north, made their way across the Bering Strait, fanning out like a river at its delta, to live far and wide across the continents of North and South America and the land mass of Central America, that lay between.

Around about 2000 B.C., some of their descendants, set out from the mouth of the Orinico River in the place we now call Venezuela, to see what lay beyond. They paddled in their mighty, sea-going canoes till they reached nearby Trinidad, Tobago, and the more easterly Barbados. As the years went by, some of the them travelled north through the archipelago reaching as far as Cuba and Hispaniola and the islands of the Bahama chain.

Amongst these peoples were the now almost forgotten Taino – “the good people” as their collective name meant. Gentle and spiritual by nature the people of this tribe were the ones who first met the explorer Columbus and his able bodied seamen. The impact of that meeting set loose a short lived history of misery, disease and dying. In mere decades, these once numerous people all but disappeared. Smatterings of their civilization remain. In the excavated middens along the coasts and interiors of many islands, fragments of pottery turn up, or pieces of petroglyphs, buried basket work and the bones of fish of long forgotten dinners. While indigenous peoples have disappeared as distinct groups in most island nations, strong populations occupy many countries bordering the Caribbean. These include the Maya of Mexico, Guatemala and Belize, the Morquito Indians of Honduras and Nicaragua, the Kuna of Panama, to mention but a few of the numerous indigenous peoples that continue to occupy their homelands throughout the Wider Caribbean.

Today, we who live here, bordering this blue Caribbean Sea, strive, in a way to find some link to reunite us with the people of the past, to make a home for our true selves within the landscape that sustains us, beside the blue Caribbean Sea that still encircles. Our legacy is a mixture of triumph and pain as the blood of coloniser, slave and labourer runs together in so many of us. For some, the Spanish “conquistadores” were once their masters, for others, French “colonisateurs”, for others the Dutch or Danes or British. Today, we strive to find a unity that will embrace all of us.

In the 1950s, when several Caribbean territories sought to gain political independence from the ruling colonial power of Britain, there was much enthusiastic discussion about a West Indian Federation. A flag was designed, a capital appointed and Caribbean leaders contested to see who would be the region’s new Prime Minister. Even an anthem with lyrics and music was written!

Seeing the many as one

The Federation was short lived and the regional anthem became instead a national anthem for Trinidad and Tobago; but tucked away in its music is a phrase that still calls to mind the truer, lasting statement of our shared heritage:

**“...Side by side we stand,
Islands of the blue Caribbean Sea...”**

Our neighbours who inhabit much larger mainland areas, have this in common with the islands: we all indeed are touched, by the blue Caribbean Sea. In our world, it is our ocean. The Caribbean Sea has the potential for being a mighty symbol of our possible unity, as the late Tobagonian poet E.M. Roach describes:

**“..... So from my private hillock
In Atlantic I join cry:
Come, seine the archipelago;
Disdain the sea; gather the islands' hills
Into the blue horizons of our love.”**



Map of the Caribbean region

Beyond our blue waters...

The Caribbean Sea, is at once unique but also a vital part of a far larger whole. All oceans of the earth are connected, even while they exist in such different states of temperature, turbulence and salinity.

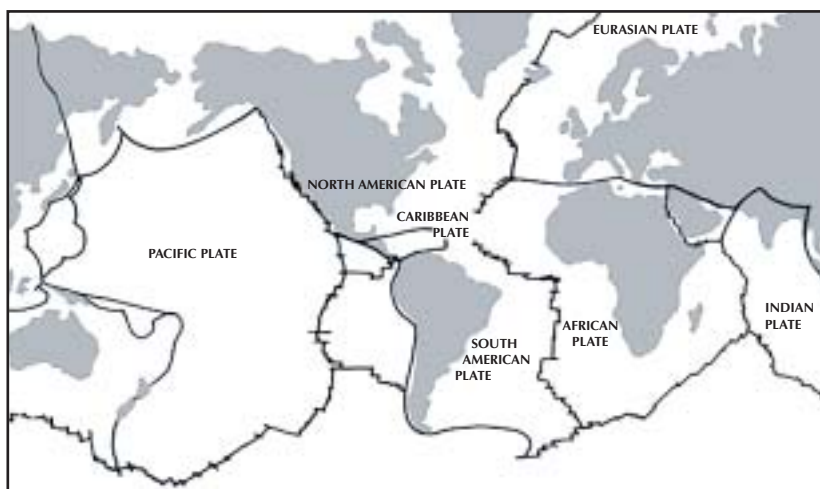
Geologists—scientists who study the records of the earth's ancient history from the story told in rocks and other landforms—now believe that 200 million years ago all the land on the planet was joined, forming a region referred to as Pangaea and all the seas were one.

Fiery earth currents

Before the existence of that ancient sea and land, they speculate that the planet had its origins in violent and explosive movements of rocks, water and matter. But the powerful underground currents that fuelled such majestic beginnings have not ended. Within the 20th century most scientists have come to believe that convectional currents driving molten material still operate within the core of the earth.

Forged by fire, water, wind

Scientists now understand that the crust of the earth itself comprises a series of plates which are in motion, propelled from earth's core by fierce inner forces of pressure and fiery heat. Where plates are in contact with each other any number of activities may be the outcome, most spectacularly earthquakes and volcanoes as regularly recorded in the history of the Caribbean. There can also be mountain building as seen at Trinidad's Northern Range and Tobago's Main Ridge. The formation of rift valleys occur where plates move apart. It is this type of activity that formed and still shapes the Great African Rift Valley. This land formation extends from the Red Sea to Mozambique and is a distinctive feature that can actually be seen from the moon. It includes a chain of huge lakes and beautiful waterfalls which run through Kenya, Rwanda, Burundi and Tanzania. Perhaps less known, but equally eye-catching are the resplendent Kaitour Falls of Guyana and dazzling Angel Falls in Venezuela. They are amongst many other features of the South American continent that have been sculpted into places of breath-taking beauty, by the deep movements of the earth. At sea, where converging movements



The location of the earth's tectonic plates

in the earth's crust takes place, deep-sea trenches are formed. The Puerto Rican trench and the Aleutian Trench are two examples of deep ocean trenches.

It is thought that the main archipelago of Caribbean islands formed along the area where the American Plate is being subducted beneath the thicker Caribbean Plate. Earthquakes have been common through recorded history, caused as plate material was submerged, heated and melted and then pushed violently upwards to burst out initially as submarine volcanoes then later emergent islands. "Kick'em Jenny", a submarine volcano, north of Sauteurs, Grenada, provides an actual exciting example for oceanographers and seismologists, who note that its growth towards the water's surface is occurring far more rapidly than their computer models had predicted.

Islands such as Nevis display starkly the shape of a typical volcanic island, with its accompanying features such as naturally occurring hot springs. The large, rugged island of Dominica, is thought to be made up of a convergence of several volcanic islands. Barbados, on the easternmost edge of the Caribbean Plate is too far away to show signs of volcanic action impelled by subduction but its outer edge is being raised as the American Plate pushes under it. The uniquely rugged features of the Scotland District in north-east Barbados, bear testimony to a geological history where sedimentary rocks were folded and compressed by the tectonic action, and raised, bearing more recent growths of coral reefs upon them. Tobago too, has an interesting geological history showing signs of landforms that have been shaped by ancient forces of heat and pressure, to form metamorphic rocks on which later coral grew. There is some speculation that there may have been an earlier period in geological history when subduction of the Caribbean Plate occurred, giving rise to another underwater ridge and an inner arc of smaller islands to those we know today.

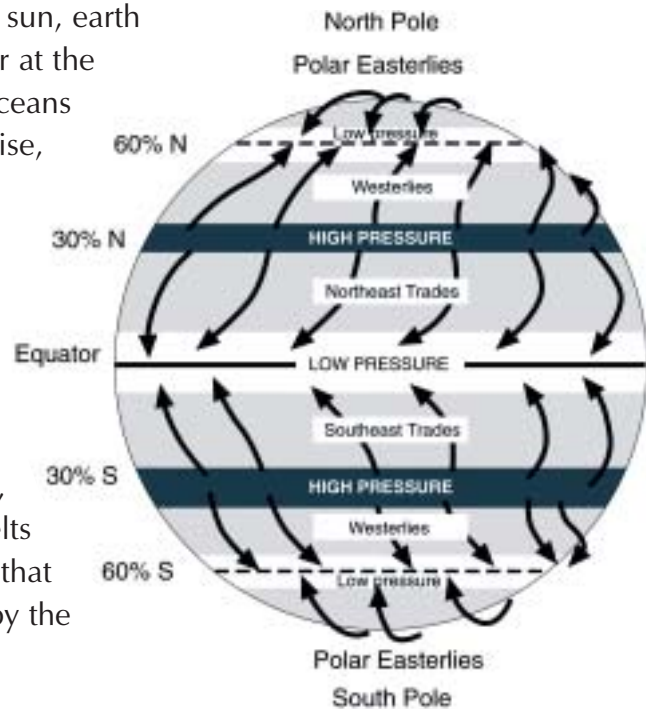
Between plates there can also be movements of divergence. This is most evident at the mid-Atlantic Ocean Ridge where the African Plate to the south and the Eurasian Plate to the North diverge from their neighbouring South and North American Plates, laying down a continuously expanding ocean floor. Transform boundaries occur where plates are sliding past each other, as at the well known San Andreas fault most active in California, where earthquakes are regularly felt and often with great severity. The southern edge of the Caribbean Plate is thought to be a transform boundary, but with much less recent activity than the San Andreas and with an inconclusive identification of its position.

Violent earthquakes in nearby South America proclaim the powerful forces at work, still sculpting the earth, even while at the surface, new patterns of wind and rain begin to leave their markings. Islands like Trinidad and Tobago have a long history of earthquakes while volcanic activity has been evident in several islands. There is the historic eruption of Mont Pelée in Martinique in 1902 and in our times grumbings and spewings from Soufrière in St. Vincent, mud volcanoes in Trinidad and most spectacularly Soufrière in Montserrat which disrupted the way of life of the entire island in 1995.

From the sweltering latitudes

While molten magma churns below the earth's crust, within the wide oceans and also up above them, another harmony of movement takes place. And the earth itself, is revolving.

Circled by the moon while orbiting the sun, earth turns on its axis at 1,000 miles per hour at the equator. The earth rotates, setting the oceans in motion, their waters swirling clockwise, north of the equator and anti-clockwise to the south. The sun's rays are nearest and most direct at the equator but at the north and south poles they reach the earth obliquely. This makes the oceans close to the equator heat up fastest, causing air above them to rise and move outwards, to the north and south. Global wind belts are in this way generated. These winds that blow around the world, set in motion by the ocean's temperatures, are named for the directions from which they blow.



Global wind systems

The cool prevailing winds that fan the Caribbean are known as the North-east Trades. It was these winds that propelled the sailing ships that crossed the Atlantic to the Caribbean. Sailors of centuries past made their way to trade here — whether in food or animals or human cargo!

**“The Trade winds blow over emerald seas
And the sun splashes white on the wall
Where the red poinsettia blazes and blows
And the dust flies up where the red road goes
And the cheerful keskidee calls...”**

*Caribbean Christmas carol.
Jennifer Mitchell Als.*

“Wind goes rippling the face of the deep...”

As the sun shines and the winds blow and the climates of earth's regions change subtly, warm and cold currents mix the waters of the planet's mighty oceans. Within these oceans a multitude of interchanges is constantly occurring.

Bands of warm water move westerly from the coast of Africa, through the Atlantic towards the Caribbean. The Canary Current off North-West Africa meets the major system of the North Equatorial Current flowing westwards to the Caribbean. Within the Caribbean Sea, the Equatorial Current flows westward through the Yucatan Channel, where it becomes the Florida Current, which carries water into the strong northerly moving Gulf Stream.

The flowing of this warm Gulf Stream to the colder northern climes has a profound effect on climate, as do all the currents of the ocean. Seasonal weather patterns as well as climatic abnormalities like “El Niño” are all precisely linked to the activities of winds, currents and the ocean. Behind all these though, more than 93 million miles away, powering the whole circuit, is the sun.

At much deeper ocean levels, currents and crosscurrents are constantly interacting though undetectable at the surface. Cold water at the Poles sinks and is replaced by the inflow of warmer surface water that comes from equatorial regions. Moving deep down within the oceans, this colder, denser water starts currents that move away from the Poles. Beginning in both the Arctic and Antarctic, the waters head towards the equator and continue past it. From the warm equatorial regions they then flow to opposite Poles, forever circling on what has been called a conveyor belt system. The voyage of one water molecule to circumnavigate the globe, may actually take centuries.



Sargassum fish disguised in Sargasso weed

Author Jean Rhys, sailed from her home in Dominica, catching the Gulf Stream, to cross the Atlantic and settle in England; but always she remembered, with nostalgia, the beauty of her true home. She immortalised the unique North Atlantic Ocean region that circles slowly in a mesmerising calm, off this Gulf Stream Current, in her book, *The Wide Sargasso Sea*.

When there's trouble in the wind...

Strange weather - stranger names

In a world where news travels faster than weather and network television spans continents and oceans, with live coverage of top news events, it's easy to lose a sense of history. None of us may ever find out why the strange phenomenon over land and ocean, was first named by Peruvian fishermen, "El Niño" the Spanish term for the Infant Jesus - the Christ Child. Perhaps it was because it was Christmas time when they first noted the radical reduction of their anchovy catch and, instead of dry cold weather, experienced unseasonal rains and untimely floods. El Niño has simply become the term that the world now knows for this not fully understood way the weather works. The local events first seen by Latin American fishermen, at least are being understood as having implications for the entire planet. In addition, a related weather pattern has now been called La Niña.

In normal years, Trade Winds blowing off South America, move east to west, pushing the warm surface waters towards Australia and Indonesia. The winds gather moisture by the time they near the land areas of Indonesia and Australia. Heavy with water vapour, they condense, bringing welcome rain to these dry areas. As this rain is falling, bringing life to dry lands, a cold Antarctic current heads north reaching to the ocean surface, just west off South America. Deep sea nutrients and living creatures are funneled to the surface like some upturned underwater cornucopia. The food chain of the sea is reinvigorated, bringing life to all the dwellers of the ocean and joy to Peruvian fishermen, who harvest their giant catches of anchovies.

In El Niño years, the pattern is reversed. Unbidden, the pattern changes and winds blow west to east. Australia and Indonesia, without the advent of the rains, experience severe drought. Even the moist rain forests grow tinder dry, sometimes spontaneously igniting and in no time raging into deadly, uncontrolled fires. Indonesia's entire population suffered in 1998 as forests were torched and residents battled against the advance of smoke and lived for months beneath smoggy skies. North-eastern Australia also fought with forest fires that raged out of control.

The winds that blow east instead of west also gather moisture over the water and then, bring unseasonal torrential rainfall and dangerous storms along South America's Pacific coast. Scientists already speculate that rising surface water temperatures, in the planetary framework of global warming, may be correlated to this reversal. And just as in normal years Antarctic currents bring benefits to coastal waters off western South America; with troubling reciprocity, a strange phenomenon occurs far north, in the Arctic, during El Niño years. Sea and land temperatures are thought to set off such disturbances in the upper atmosphere that airflows are radically altered bringing floods to Central Europe and droughts to South Africa.

In the Atlantic basin, the increasing frequency and intensity of hurricanes in the 1990's have been linked to cycles, covering 2-3 decades, when periods of increased hurricane activity are followed by periods of less hurricane activity. These cycles are linked to rainfall patterns in West Africa, upper level winds and other factors. Global warming may also influence hurricane frequency and intensity, but insufficient data exist at present to accurately predict such effects.

Seasonal storms of the Caribbean Sea

Earlier generations of Caribbean children may well have gone to bed with classical English stories like *The Wind in the Willows*, echoing through their heads. Yet, both the type of wind and perhaps the willows, would have seemed foreign in our Caribbean landscape. So while anyone can enjoy a good story, it has also been a step in the right direction, as many Caribbean writers have been writing novels with Caribbean weather and climate – and even disasters – as part of their stories' natural landscapes.

The Caribbean Sea, close as it lies to the equator and almost directly beneath the sun, becomes exceedingly hot by the middle of the year. As barometric pressure falls, and temperatures rise and a stillness settles over the sea, inhabitants of this region know to be on guard for hurricanes.

Jamaican writer Andrew Salkey, who lived for a time in England, evoked the ocean-influenced weather of his Caribbean home. One of his unforgettable children's stories is called Hurricane. Caribbean children know the vital refrain as they see the coming of the "hurricane months": *June too soon; July stand by; August come it must; September remember; October all over*. Though not necessarily meaning to teach the technicalities of plate tectonic theory, Andrew Salkey also created a sense of excitement and adventure in a companion novel, Earthquake.

Celestial bodies and the swirling earth

While catastrophic events have happened throughout Caribbean history, especially in the forms of hurricanes, volcanoes and earthquakes; at the cosmic level, a daily drama happens, heeded perhaps only by fishermen and meteorologists. This is the turning of the tides. Linked inextricably to the relative positions of earth, sun and moon, the waters of the entire planet, are continually in motion. Depending on the position of the moon, these diurnal ranges of water are either strong or weak. The resulting effects are called spring tides and neap tides. Spring tides are in effect at full moon and at new moon when the moon, earth and sun are in alignment. Neap tides are experienced during quarter moon phases when the moon is at right angles to the sun and earth and gravitational forces are not as strong, so tidal variations are lessened.

Scientists have discovered that the surface of the earth also swings and bulges, as gravitational pulls are exerted by the moon and sun as the earth spins on its axis through space. Thus, not just the waters bulge with the changing of the tides, but the earth's crust itself, but by gradations, which are far smaller than the unaided human eye, could see.

Boiling seas and angry mountains

Giant waves set off by earthquakes, underwater landslides or volcanic eruptions on the ocean floor are called tsunamis. These monstrous waves can roar across the oceans in a very short time, rushing catastrophe. Some people fear such outcomes from the ongoing volcanic upheavals associated with Soufrière in Montserrat.

The waters between Grenada and Carriacou are always choppy due to the effects of an active underwater volcano called "Kick 'em Jenny". Oceanographers have been amazed at how quickly its underwater volcanic cone has been growing, due to continuing eruptions. They expect a new island to break the surface of this part of the Caribbean Sea. With the rumblings of the watery volcano and the boiling up of the waters, seagoers in this part of the Caribbean know to always expect a rough crossing.



Solitary stroller, where the sea meets the land

Madman's dream or people's folly?

Preventing a tsunami disaster

In 1997 readers of a Barbados daily newspaper read with astonishment the printed predictions of imminent disaster that one local resident said he had seen. He was speaking futuristically, of course, and the explanation for this unusual doom-saying was shrouded in mystery – it had been revealed to him, he claimed by spiritual means. Whatever the skeptics and detractors said, the man had already put his personal plan of salvation into practice and relocated far inland in a Central American country. The vision he said that he had received spelled out the devastation of most of the Barbados shoreline by a ferocious giant wall of sea water. He implored his readers, passionately, to leave living on the coasts and head inland for higher ground – expectant of the peril soon to come.

The panicky prediction is not as far fetched as one might believe. A 500 year history of the Caribbean, details 88 tsunamis that have occurred here since 1498, just about the time of the last expedition of Christopher Columbus. The report makes for grisly reading for as many as 9,600 deaths have been recorded, related to tsunamigenic earthquakes and tsunamis combined. Just in the last century and a half, close to 2,000 deaths have been firmly linked to the inrushing over land, of giant waves of sea water generated by deep movements in the earth's crust.

There have been teletsunamis, tsunamis originating far away from where they strike, like the one after the great earthquake of Lisbon, Portugal, in 1761 which caused "an extraordinary flux and reflux of the sea at Barbados", several thousands of trans-Atlantic miles away.

Tectonic tsunamis are related to earth movements closer to where the sea is disturbed. In the year 1766, two such movements were recorded. On June 11, at Santiago de Cuba and Bayamo, Cuba, an earthquake hit, lasting up to seven minutes, in some places. In neighbouring Jamaica, there was a report that ships "7.2 km from the coast of Jamaica rolled so much that their gunwales were immersed in water". Mere months later in October that year, violent shocks at Cumana, Venezuela levelled the land while to the consternation of onlookers the entire island of Orinoco sank and disappeared. The waters were greatly disturbed.

Out at sea, tsunamis cause little disturbance to the surface of the sea because of the depth of the ocean. Only as the waters shallow and the waves approach land do they become dangerous. In these shallow nearshore waters, when tsunamis strike, not even a ship provides safety. These seismically generated waves are even more damaging than the normal hurricane surge, which itself wreaks great havoc. In October 1780 at Savannah La Mar, Jamaica, a hurricane and tsunami occurred and these effects were recorded:

The sea rose to 3 metres at 0.8 kilometres from the beach and swept away a number of houses. Ten people were killed by the wave and many more by the storm. All vessels in the bay were dashed to pieces or driven ashore.

In 1868, Harper's Weekly carried the historic painting of the Royal Mail Steamer *La Plata* that had been anchored 4 km off Charlotte Amalie, St. Thomas, U.S. Virgin Islands when a large tsunami struck. A massive earthquake originating between St. Croix and St. Thomas in the Anegada trough, generated several great sea waves that were witnessed from Puerto Rico in the northern Caribbean all the way south through the eastern Caribbean to Grenada. They were thought to possibly have affected the northern shores of South America, but no reports were received from there. The wave, 4.5 to 6 metres high, rushed in, after the initial retreat which was estimated at about 100 metres, at Charlotte Amalie, St. Thomas. Houses and people were swept away, areas far inland were inundated, boats were swamped and seamen drowned. This tsunami may have been generated by an underwater landslide.

Some tsunamis have volcanic origins. On a global scale, the most devastating tsunami linked to volcanic activity was associated with the eruption of Krakatoa, Indonesia, in August of 1883. 30,000 people were injured and the ripple effect of air waves resulting from the blast were felt in harbours as widespread as Hawaii, California, Alaska, South Sandwich Islands, Britain, Japan and Australia.

During the volcanic eruption of 1902 in Martinique, Heilprin reports:

...the devastating eruption of Mont Pelée, which sent a nuée ardente in St. Pierre, killing approximately 3,000 inhabitants. It caused fires on the ships in the harbour and hit some of them, overturning them...ship captains remarked about a material change in the course of currents sweeping along the west and north coasts of Martinique.

Many Caribbean areas have been hit by tsunamis throughout the centuries with the strongest effects recorded in places including Haiti, Cuba, Jamaica, the Virgin Islands, Guadeloupe, Grenada as well as parts of Central and South America. But it has been a long time since one has occurred and the greater the interval of time, the surer the likelihood of occurrence and the greater the devastation will be if we remain unprepared. Caribbean populations have multiplied from 3 to 30 million, since the great Virgin Islands tsunami of 1867.

Today a tsunami has the potential for devastation to life and property greater than that of all that was lost in hurricanes in the past 100 years. Based on previous history, a tsunami disaster will occur in the Caribbean. The Caribbean region is one of the last places with a documented history of tsunami disasters without a mitigation plan.

You take it from here...▶

1

NATURAL DISASTERS: HURRICANES

Experiment with oral traditions: listen to people's stories.

- Several Caribbean areas have suffered from natural disasters. Recreate the story by primary and secondary investigations. Talk to old people. Record their stories. Photograph the tellers of the tales.
- Check the landscape for signs of what happened. Find historical records in newspapers or other accounts. Learn the names of major hurricanes that have affected this part of the world, and when they occurred.
- In Tobago, the effects of Hurricane Flora in the early sixties can still be seen today and the island's entire development was altered by this disaster. Find out how. Other places will have their stories, for example Hurricane Janet in Grenada and Barbados, Hurricane David in Dominica, and Hurricanes Hugo and Luis that affected many islands of the northern and eastern Caribbean.

2

TAGGING THE TIDES

- Checking the weekly schedules for high and low tides, measure the levels of the sea at periodic intervals during the day. Correlate these to the phases of the moon as viewed at night.
- Note additional effects of tides, e.g. flotsam on the beaches and how human activity relates to these diurnal changes (e.g. activities such as fishing, bathing, surfing, beach combing etc.).
- The Hydrographic Unit in Trinidad, as well as meteorological offices throughout the region, may be able to provide some useful information.

3

BEWARE THE TSUNAMI!

- The word tsunami comes from two Japanese words: tsu - harbour - and nami - wave. Use your imagination to put into your own words (and actions), the stories of disasters that have been caused by tsunamis in Caribbean history. Try to highlight by story, poem, song or drama, the devastation that comes with this ocean generated phenomenon. Be sure to include ways in which we can prepare ahead of time for such events.
- Make materials that can help to make your classmates, neighbours and other community members aware of tsunamis: how to recognise when they are coming, e.g. if you are at the beach and see the water suddenly recede a considerable distance, leaving parts of the seabed dry – this could be the forerunner of a tsunami – run for higher ground; how to evacuate areas at risk as soon as possible; and how to plan to help people who will be most needy in the event of such a crisis.
- Find out what efforts are underway in your area, to have a sound, tsunami warning system in place. Plan and carry out a sustained lobby to have a national tsunami emergency action plan developed and put into action. Try to form links with similar groups in neighbouring territories as you do this work.

Who Are We... ?

By these shores I was born; sound of the sea came in
at my window, life heaved and breathed in me then
with the strength of the turbulent soil...

Edward Brathwaite, "South"

And I am an orphaned islander,
on a sandspit of memory
in a winter of bays.
I have no home

Wayne Brown, "On the Coast"

I was salt water, washing all alien shores,
Citizen of the world, calling no land home,
Creature of flux and change...
... No tides compel into this inland sea,
Out of my life, out of this land shall grow
Fruit strong with the salt's sharp bitterness,
Rose warm with the sun's red glow,
Song for eternity
Song for a synthesis...

G.A. Hamilton, "I was Salt"

Porque el siniestro día el mar termina un día,
ya la mano nocturna corta uno a uno sus dedos
hasta no ser, hasta que el hombre nace
y el capitán descubre dentro de si el acero
ya la América sube su burbuja
y la costa levanta su pálido arrecife
sucio de aurora, turbio de nacimiento
hasta que de la nave sale un grito y se ahoga
y otro grito y el alba que nace de la espuma.

Pablo Neruda, "Llega al Pacífico", Los Conquistadores,
Canto General, Losada

December 1, without water, fuel and food, we were pointing our bow on
a straight course toward Cuba, desperately seeking the lighthouse of Cabo Cruz.
At two in the morning, on a dark and tempestuous night, the situation
was worrisome. The watches moved about, looking for the beam of light
which did not appear on the horizon...

Che Guevara, Reminiscences of the Cuban Revolutionary War,
Translated by Victoria Ortiz

There are no borderlines on the sea. The whole thing looks like one. I cannot even tell if we are about to drop off the face of the earth. Maybe the world is flat and we are going to find out, like the navigators of old. As you know, I am not very religious. Still I pray every night that we won't be hit by a storm.

When I do manage to sleep, I dream that the winds come out of the sky and claim us for the sea. We go under and no one hears from us again.

Edwidge Danticat, *Krik? Krak!*

Krik? Krak! Somewhere by the seacoast I feel a breath of warm sea air and hear the laughter of children
An old granny smokes her pipe,
Surrounded by the village children....

We tell them stories so that the young ones
will know what came before them.

They ask Krik? We say Krak!

Our stories are kept in our hearts.

Sal Scalora "White Darkness/Black Dreamings"

Haiti: Feeding the Spirit

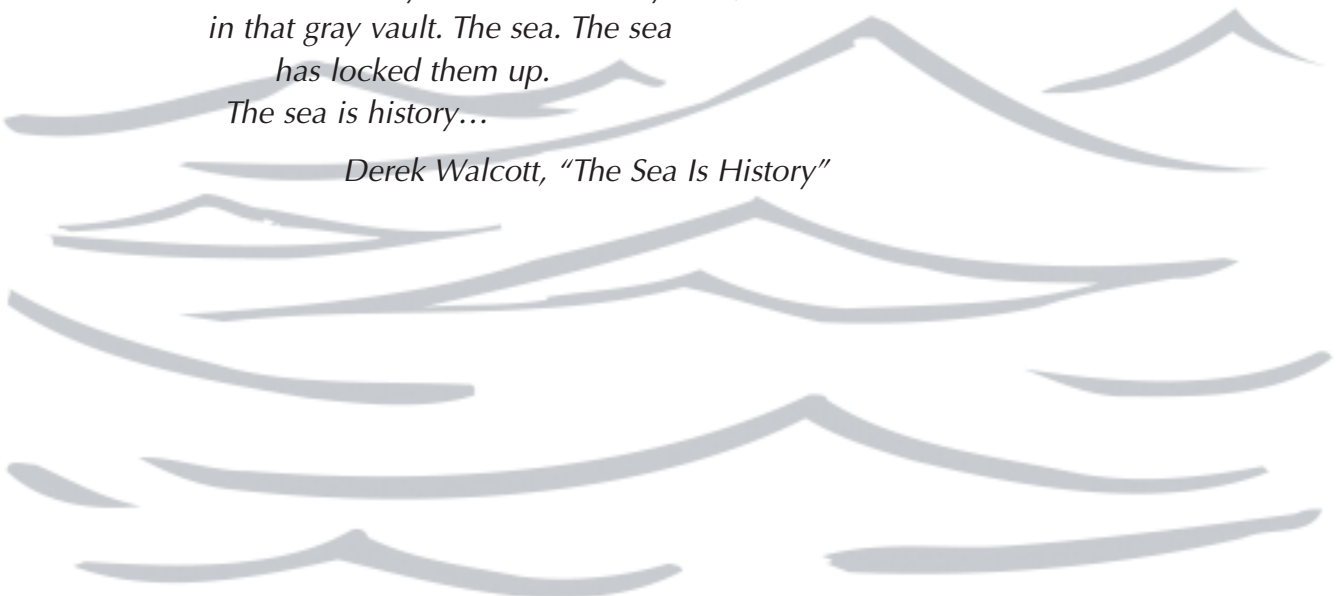


I watch the landscape of this island.... And you know that they could never hold people here surrendered to unfreedom. The sky, the sea, every green leaf and tangle of vines sing freedom...

Earl Lovelace, "Salt"

Where are your monuments, your battles, martyrs?
Where is your tribal memory? Sirs,
in that gray vault. The sea. The sea
has locked them up.
The sea is history...

Derek Walcott, "The Sea Is History"



Moulded by the Sea

Our histories, as Caribbean peoples have been overwhelmingly shaped by the sea; the Caribbean Sea that surrounds us, and wider oceans over which our ancestors came. With any reflection, the sea and oceans can never just be biological or geological entities; for our lives and our fates have been intrinsically bound to them. Our artists have always understood this, capturing the symbolism of the sea in their paintings, poems and songs. All those who settle here, are sooner or later struck by the sea's significance – from painters who etched the horrors of slave ships and dying slaves cast overboard in the Middle Passage, to the night club singers, who in warmer tones, evoke for tourists, romantic images of sea swept islands:



**“Oh island in the sun
willed to me by my father’s hand
All my days I will sing in praise
of your forests, waters and shining sands...”**



Those who came over the seas

Indigenous peoples from mainland America, rode on waves in their canoes to the Antillean islands. Columbus sailed over wide unknown waters and found a New World. European settlers followed in sailing ships. Some, by way of Africa, traveled with cargoes of enslaved Africans in all the wretchedness of that long voyage. Later, indentured labourers, were brought with artifacts of their heritage, along with their hopes, all the way from their homes on the Indian sub-continent. And so too have come other workers and settlers: French, Spanish, Scottish, Irish, Danes, and Portuguese; later Chinese, Jews and Arabs. In colonial times, the Dutch and other European nations plied the waters of the Caribbean, securing a lucrative trade, while buccaneers, pirates and privateers ravished another kind of living on the high seas.

One notorious schemer is remembered in a folksong:



**“On a little island, lived a buccaneer
Sam Lord was his name
He sunk many vessels laden down with treasure
Coming from the Spanish Main**

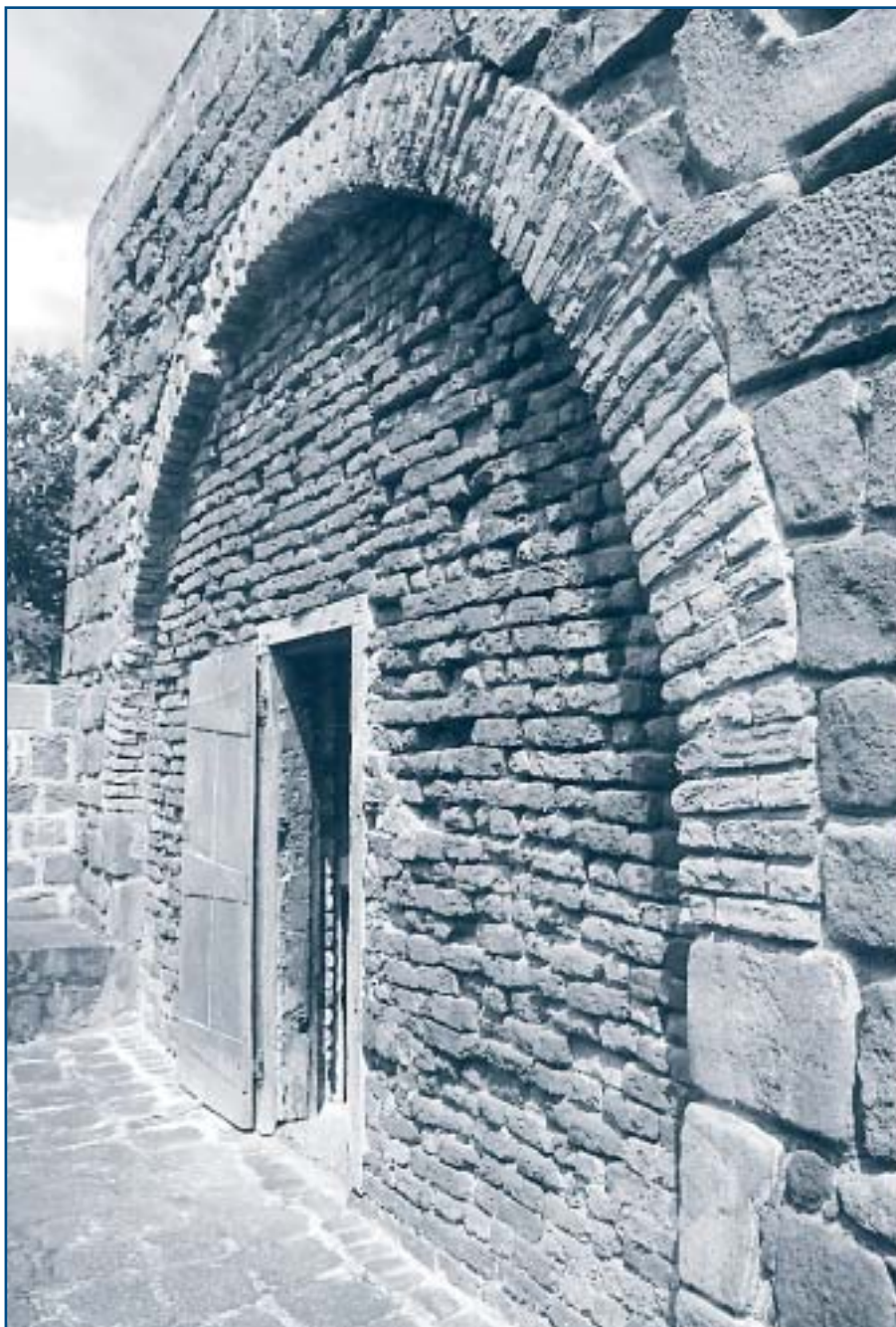


**...He used to hang the lanterns in the coconut trees
To lure the ships up on the reefs
And when the sailors thought they’d sighted town
Alas! they ran aground...”**



Stories in stone

Memoirs to those days are also written along the coasts of almost every Caribbean island: fortifications which changed hands between the French, Dutch, Spanish and English. Dark dungeons tell silently the tale of incarceration while weathered buckshot and cannon and rusty rifles bespeak the weapons of war from a different era. Many crucial battles were fought and lost at sea. Sites of such battles are stately Shirley Heights in Antigua and the beautiful Cabrits in Dominica, majestic Fort San Felipe in Puerto Plata in the Dominican Republic – now a World Heritage Site – and picturesque Fort King George above the town of Scarborough, Tobago. In all of these the weapons still point seaward, for this was the direction whence the troubles came.



*Archway to
ammunition,
Cabrits, Dominica*

People who taught the world to sing

Because the sea is part of our history it is also in our songs – work songs and songs of adventure. These songs reflect how the sea has featured in all our enterprises. For decades now, people from India to England, Africa and back to the Caribbean, have swayed and sung to the sweet lilting music of the Jamaican born Harry Belafonte:



**“Day-oh, day-oh
Daylight come and me wan’ go home..
Come Mr. Tally man tally me banana –
Daylight come and me wan’ go home...”**



This was another telling of the work and industry transacted beside the Caribbean Sea: the loading of banana boats by tired labourers, whose produce headed over the Atlantic to England. Over the years, the significance of such activities has grown more acute, as farmers in small islands have climbed even hillsides with dangerously steep gradients, to cultivate bananas on any and every type of land. The effects of soil erosion and the over-use of fertilisers and pesticides that make their way into ground water, rivers and finally to the sea, devastate reefs in nearshore areas.

Most recently, with changes in external trade arrangements, that have threatened old patterns of survival through banana cultivation, thousands of Caribbean banana cultivators have felt great anxiety and alarm. Maestro David Rudder, has made a people’s anguish into a lyrical lament:



**“The West Indian girl start to cry
Banana dead, banana dead, banana
The future dread, the future dread for banana...dead banana”**

*“The Banana Death Song”, from The Beloved,
by David Rudder.*





Coral reefs on the outer edges of our islands and coastal mainland areas feel the effects of damage done far inland.

Watchers for whales and jumping fish

Other livelihoods have been made by the sea, such as whaling in Bequia and even in Barbados, where remnants of whaling stations can still be seen. Fishing has been synonymous with the Caribbean islands and the coastal regions of South and Central America. Traditionally fishing has been done in many ways: whether by the communally pulled seine, the beautiful circular cast net or the slender bamboo fishing rods seen in many places such as Grand Courland Bay, Tobago. These are the implements of the artisanal fisherman.



Shared labour: a seine pulled at Englishman's Bay, Tobago

Island designs

Each place has its particular style of boat whether for fishing or transportation. In St. Lucia, great ceremony still attends the felling of the giant gommier tree of the forest for the making of the traditional fisherman's canoe. Nobel laureate Derek Walcott, re-creates the careful process of selecting the tree, cutting it and dressing the wood, in the opening pages of *Omeros*.



Artisanal fisherman with traditional St. Lucian canoe

Survivors on scattered shores

Wherever islands are in close proximity to each other, a brisk seaborne trade and transportation system evolves. In the Grenadines, the regular passage of the “Mail Boat” brings all kinds of supplies to tiny islands like Union and Canouan: from heavily laden trucks and construction equipment to cases of soft drinks and every variety of household supplies and foodstuffs. Boats like these may be motor vessels, like the *Snapper*. Others are schooners, still using sails to help their small engines, like the *Alexia II* that plies between Grenada and Carriacou.

On these vessels of all varieties, with their seasoned crews, are informal traders – often women – known as higglers in some places. Their items for trade may range from home made chocolate, cinnamon and nutmeg, to clothing, food and sometimes smuggled whisky. Ferries that ply the waters of the northern Caribbean from Anguilla to St. Martin or between the many islands of the British and U.S. Virgin Islands, also carry many people and goods.

Lovers of winds and sails

The sea also shapes lives by fun and pleasure. Many islanders enjoy the excitement and thrill of annual boat races. In Anguilla, agile crews race around the 35 square mile island (named by the French for its shape like an eel). They lean into the wind and toss heavy irons about their pitching vessels. With billowing mainsails, they compete to see who will be victorious.

In Antigua, boat racing has become a luxurious hobby with international competitors who seem almost to fly above the waves in the annual powerboat race. Trinidad and Tobago too, has its annual powerboat racing competition known as “The Great Race”. It begins in Trinidad and ends in Tobago.

Merriment and music

The lives of seagoers are perhaps best captured in all their raw humanity, vigour and camaraderie in the cultural traditions that have evolved beside the sea. What might be called a Caribbean Sea shanty, “Sloop John B” was made popular by the Barbadian group The Merry-men.



Anguilla boat racing

Its catchy rhythm and sweet melody evoke the longing that is common to all people who spend most of their time in foreign ports and out at sea:



“So h’ist up de jumbie sail
see how de main sail set
tell the Captain ashore I wan’ to go home
I wan’ to go home... I wan’ to go home
Oh lord, a feel so broken up
I just wan’ to go home!”



Such folksongs are also sung to visitors to our shores.

Hosts to the world

Tourism is a multi-billion dollar global industry. Throughout the Wider Caribbean, white sand beaches, aquamarine waters, coral reefs and inland rivers and forests with their wide array of wildlife, have become major tourist attractions. However, many negative environmental impacts can be associated with tourism ventures. Destruction of coral reefs and other habitats, coastal water pollution and sand mining, are just a few of these. Our challenge is to market these resources for our own human economic development, while carefully controlling tourism’s effects on them.

Oil that troubles our waters

Looming on our waters are also giant oil tankers, carrying cargoes worth millions through our vulnerable seas. Their cargoes could threaten the fragile ecosystems of our entire archipelago and continental coastlines. In St. Lucia, one oil company schedules regular visits of huge tankers. The industrial activity that the refinery creates here, must be weighed against the fearful possibility of a major oil pollution disaster that could cripple the island’s tourism industry.

Venezuela and Trinidad both have their own lucrative oil reserves on land and at sea. Foreign investors whose shares may greatly influence the rise and fall of the world stock markets, are deeply involved in these countries’ economies. Inevitably, with oil and gas explorations, the day to day activities at drilling sites and refineries, and ships cleaning their tanks at sea, the problem of chronic pollution surfaces at sea, along the shores, on land and in rivers.

Outclassed competitors

In our waters, foreign interests other than oil companies, seek to net their profits. In all the oceans of the world, fishing can now be done by highly equipped crews and vessels, and the



Caribbean is no exception. Satellite monitoring can identify where schooling fish are to be found, while other boats have sonar detectors. Some ships are equipped as floating sea food processing plants, capable of harvesting anything from giant whales to thousands of sardines. Whales are now protected by an international moratorium on commercial whaling. Deep sea fish are hooked by the hundreds, using long lining techniques. Fine meshed, nearly invisible drift nets have been depleting fish stocks, trapping myriad more creatures than commercial fish. Juvenile



fish, turtles and marine mammals are also killed. Drifting fragments of these nets continue to kill. Trawlers' gear drags along the sea floor disturbing and destroying many forms of sea life, while harvesting fish. In these nets turtles and dolphins also drown. All of these techniques may be used in the Caribbean, often illegally by foreign fleets.

Caribbean fishermen are obtaining bigger boats with more sophisticated equipment and attempting to reduce fishing net mesh sizes. Growing numbers of fishermen compete for dwindling resources. Some use dynamite illegally, destroying numerous fish of all sizes and ages in an attempt to harvest those that are commercially valuable. Competition



comes from foreign fishing vessels. Pollution originating from the land also leads to the reduction of fish habitat and therefore declining fish stocks. The seas, once the domain of the solitary fisherman must now be shared by a multitude of users. In a quest for food and ultimately survival, there is a growing need for a communal approach for the use and management of living and non-living resources of the seas.



Driftnet fishing



Parrot fishes

USERS OF THE SHIFTING SHORE

Caring for what we enjoy

As constant as the coming and going of waves along the shore are the changes that occur where land and ocean meet. The process never stops. Sand or rocks or rubble as well as pieces of organic material – seashells, moss or weed and even sea creatures are continuously being added to the beach (accretion) or being taken away (erosion).

Beaches themselves also differ. There are the idyllic tropical beaches that tourists dream of, strewn with glistening white sands like Jamaica's famous sandy stretches at Negril or Grenada's wide and beautiful Grand Anse. Others may be rocky: St. Martin's Bay, Barbados, is littered with wave-rounded cobbles that hiss and pop, each time the waters roll up and back. Some shorelines are swampy – beaches in the making – like much of Trinidad's Gulf of Paria coast, typified by the murky waters and mangrove-lined shorelines of the Caroni Swamp.



Tourists' treasure? The beautiful Caribbean queen conch, reaped for its meat as well as its ornamental shell, has been harvested to near extinction off many Caribbean islands.

There is no permanent stability at the shore. Even coral limestone cliffs that appear to be resistant are gouged at their bases with the pounding of majestic high waves. The unique formations of Barbados' Atlantic seacoast, well loved at Bathsheba, give testimony to the strength of insistent prevailing breeze and wind-whipped waters.

The shoreline is such a place of unexpected change and flux, that if it is not carefully and consistently managed, it is easy to make spontaneous changes that will disrupt the centuries old cycles that are as delicately balanced as the most intricate mobile. Not all changes happen overnight, though when hurricanes hit, an entire beach may disappear, even if just temporarily, within a day. But even then, imperceptible events may also take place offshore and out at sea, the effects of which may only impact the shore the year after.

Caribbean shorelines are witness to many a clash of rival users who seek to make a living there or to secure a lasting place of refreshment or of solitude. The hotel developer's dreams are far different to the contemplative's or the fisherman's. Drying fishing nets may be an eyesore to idealistic tourists more bent on securing wind surfing gear and sun tan lotion. People who live permanently on these islands, traditionally have used the beach for recreation and pleasure: a game of "wind ball" cricket, sea bathing, harvesting of seaside molluscs like chitons (called *sea beefs* or *pacra*, in some islands) or shell fish like "chip chip" that have washed up along the shore. Michael Anthony, Trinidadian novelist and historian, records these traditions from his childhood at Mayaro on Trinidad's east coast in his book, *The Chip-chip Gatherers*.

Modernisation is impacting these shorelines in swift and destructive ways. Not only are the old ways being lost, but uses of these shores, which never occurred before are being implemented, sometimes even to the exclusion of local residents. The change from construction of buildings mostly from wood to steel and concrete demands large inputs of sand, leading to the often illegal sand mining, bringing the inevitable destruction to the beach. Massive, unregulated sand mining was once rampant at Richmond and Goldsborough in Tobago. On the sparsely populated island of Barbuda a large sand mining project for export, is underway. The removal operation for commercial profit irreversibly scars the land. On countless Caribbean beaches, the sheer pressure of numbers of tourists multiply footsteps on fragile dunes, destroying the natural vegetation and diminishing the natural protective function of the dune. In a haphazard scramble to save sand from drifting from beaches a patchwork of protective actions to try to save coastal properties are undertaken; permanent beach structures are introduced. Ignorant of the ways of wind and water and the natural processes that shape the beach, much damage has been occurring, for there has been much unwise building on the sand.



The vertical "cliffs" of sand and the exposed plant roots testify to the dune erosion caused by a hurricane.

FORCES THAT SCULPT THE BEACH

Natural processes are constantly at work: tidal currents, wind waves, ocean swells, winter frontal systems moving in from the North Atlantic and seasonal disturbances of tropical storms and hurricanes. There are also global shifts such as El Niño and the worldwide rise in sea level.

Construction of hotels and homes: often in a rush to lay claim to the best beach or the most pleasing vista, a development consortium or private home owner may build as close to the shore as they can. Part of the beach is destroyed by the actual construction while processes of natural accretion and erosion are permanently disrupted, often with disastrous effects. People's delight in the view, as well as their access to and enjoyment of the beach are often lost.

The building of structures to trap sand to make new beaches or to halt the perceived threat of erosion can lead to new problems. Consulting with professionals who study beach dynamics is needed to help make informed environmental impact assessments, before the building begins. Even structures like jetties, constructed to enhance marine transportation, can have drastic effects on shoreline dynamics.

Sometimes protective measures established to create a new beach or to slow sand loss, spells disaster further down the coast where severe erosion occurs to balance the unnatural accumulation of sand, elsewhere. It may be possible to intervene along the shore, if the implications are studied beforehand and beach management alternatives are investigated.



*Beachcomber's find:
bivalves found on a
Caribbean sea shore*

Where coral reefs are damaged, shorelines suffer. Coastal pollution caused by untreated waste from hotels, factories and homes, affects the biological life offshore.

Unsafe forms of fishing, such as the use of bleach and dynamite as well as pressures of overfishing cause damage to offshore coral reefs which, when healthy, provide a buffer against strong wave action on the shore and thus prevent beach erosion. Healthy coral reefs are also the source of coralline sand which makes up many of the region's beaches. So too, the careless activities of boaters who drop anchor on coral reefs or divers who carelessly damage or intentionally remove coral, all affect the reefs' protective ability.

Left to the careless competition between users of the shore, beaches can become degraded and even eventually disappear. Natural processes have been at work for eons of time and a complex balance exists to provide the beauty and rich diversity we take for granted today. A few sound principles properly applied can help to begin to promote the wiser management of our beaches.

Opportunities for beach erosion can be reduced, short-term destruction stopped and future harmful actions avoided. It is within our power to care for our beaches by wise, advance planning. The future of tourism, the resilience of many of our national economies and the quality of our personal lives will be determined by these choices.



Coastal vegetation helps stabilise sandy shores.

IF YOU CARE ABOUT THE BEACH....

Here's what you can do

*** Be careful to observe**

Beaches vary with the seasons and through special occurrences like storms and hurricanes. Any plans to introduce changes should be based on long term knowledgeable observation of the place. Consultation with people who know the beaches or have made long term scientific observations, is essential. These will include planners, coastal experts and also local residents including fishermen who have lived close to the beach and used the sea for many years.

*** Explore engineering options**

Many protective measures can help prevent erosion or alternatively, increase sand build up on a beach. None of these should be attempted without careful advice based on scientific as well as local knowledge. Environmental and human impacts should be factored in, before final choices for "solutions" are made.

Choices for beach protection may include the building of seawalls, bulkheads or rock revetments; the use of groynes can help trap sand while gabions can stave off the impact of erosion. Other "soft" engineering options include beach nourishment (the introduction of sand from elsewhere) and the rehabilitation of sand dunes. However, all engineering options, both "soft" and "hard", require careful planning and control. And it is far better not to have to resort to such radical and expensive alternatives by siting new developments a safe distance back from the shoreline.

*** Consider the environmental alternatives**

People can work in many ways to protect and rehabilitate damaged beaches. Sand can be transported back to the beach instead of being used for construction, when blown inland in large quantities by storms or hurricanes. Damaged dunes can be revitalised and rehabilitated by planting appropriate dune vegetation.

Hardy plant varieties include native beach grasses, such as seashore drop seed (*Sporobolus virginicus*) or the common trailing vines known as beach morning-glory (*Ipomoea pes-caprae*). Trampling by beach goers can be discouraged by providing boardwalks over fragile dune systems, to lead down to the sea. Good planning advice can also be heeded by siting future construction, far back from the vulnerable shore.

* MOST OF ALL - KEEP COMMUNITY!

Nothing can replace the value of respecting each other and being open to listen and negotiate in difficult situations. The coastal strip of Caribbean islands is all too often the place of fiercely clashing interests and unveiled hostilities: rich vs. poor, traditional users vs. tourism developers or industrialists; worst of all, imagined tourists' interests vs. those of local residents. A commitment to letting all users of a beach area have a say in major decision making can lead to wise management choices and long term co-operativeness. Fisher, diver, swimmer, boater, hotelier, developer, home owner, planner and sea goer, each have a right to be heard and their perspective considered in overall planning for the use and enjoyment of our beaches. How we decide to use them today can ensure that we still have them to use for many a tomorrow.

A detailed discussion of these problems and the many choices for solutions can be found in UNESCO's *Coastal Management Sourcebook 1: Coping with Beach Erosion*; by Dr. Gillian Cambers; Environment and Development, UNESCO Publishing, 1998.

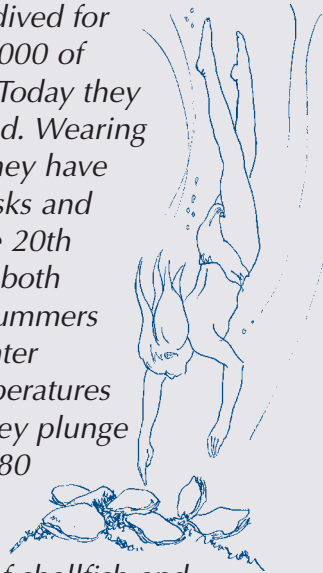


Friends at the seaside

GENTLE DIVERS OF AN ANCIENT SEA

The late Jacques Cousteau, who brought the world of the ocean into focus, in a way that could be popularly understood through his thousands of filmed undersea journeys, tells an amazing story of the Ama women divers.

For 1500 years in ancient Japan, as well as neighbouring Korea, these women have traditionally dived for pearls. At least 30,000 of their kind remain. Today they mostly dive for food. Wearing only a loincloth, they have begun to wear masks and snorkels within the 20th century. They dive both during the warm summers and the cooler winter months when temperatures can reach 50°F. They plunge to depths of 20 to 80 feet – sometimes 100 – to gather food, in the form of shellfish and seaweed, which they place in a net around their waists. They learn to dive around puberty and do not stop till they are about 60 years old. They are known to dive right up to the point of childbirth and having given birth, resume shortly after, nursing their infants between dives!



A similar group of women once dived in the wave tossed waters off Tierra del Fuego. They descended completely naked, through waters averaging 42°F to collect clams and crabs for food.

PICTURES OF THE OCEAN

The question of who we are, is not just answered in being a people whose histories, pleasures and livelihoods are shaped by the sea. We ourselves are pictures of the ocean, the ocean that in fact covers seventy-one percent of the earth.

Elisabeth Mann Borgese, youngest daughter of the celebrated author Thomas Mann and Chairman of the International Ocean Institute in Malta, gives a picture of who we all are as humans as well as where we all essentially live our lives. It is a vision that transcends our particular location in the Caribbean. The description is evolutionary in outlook yet filled with a sense of wonder that supercedes the merely biological. In *The Drama of the Oceans* she writes:

“Every woman’s womb is a micro-ocean, the salinity of its fluid resembling that of the primeval waters; and every microcosm restages the drama of the origin of life in the gestation of every embryo, from one-celled protozoa through all the phases of gill-breathing and amphibian, to mammalian evolution.

And every human, in turn, is a planet ocean, for 71 percent of his substance consists of salty water, just as 71 percent of the earth is covered by the oceans.”

You take it from here...▶

1 FINDING BEAUTY IN A PAINFUL PAST

The horrors of the Middle Passage for enslaved Africans snatched from their homeland, may evoke a haunting memory; bloody battles fought at sea amongst colonial powers have their own melancholy, and pirates' tales may seem sordid. But all these have been part of our history, and eloquent voices – in architecture, art, songs and written histories, have helped to record them. Many tales of human ingenuity and unforeseen progress, are hidden within the fine details.

- Explore the sea-shaped history of the Caribbean, by visiting historical sites, researching the work of painters and writers who lived and worked in the Caribbean as well as the histories recorded in books.
- Produce your own artistic responses to these themes: write your own songs, poems and stories; paint pictures; develop dramatic presentations on chosen themes.
- 1998 was designated the United Nations International Year of the Ocean. During that year Portugal commemorated one of its earliest ocean-going world travellers, the navigator Vasco da Gama. Many festivities have been mounted in Portugal and information on this great man of history, whose discoveries also influenced explorations in the Caribbean, can be found on the Internet.

2 SEEING THE “INVISIBLE” SEA

The sea is present to us in myriad ways, yet often, many of these, we overlook. From the image of an embryo, enveloped in amniotic fluid *in utero*; to the crowded ports and mining industries located near our shores; to the daily routines of local and foreign fisherfolk, connections can be made to the sea.

- Map the coastal regions of your country, taking into account your neighbours on other lands and see the ways in which the sea shapes livelihoods, pleasure seeking, tourism and industry. What are the main activities in your coastal zone?

3 LIFELINE OR DEADLY PERILS – ASSESSING THE RISK OF OIL

Oil producing nations depend on this industry as the basis of their economic survival. Countries that have oil refineries, also place great value on the foreign exchange earned.

- How does petroleum exploration and production affect the environment on a day-to-day basis?
- What provisions exist locally, regionally and internationally for dealing with a major disaster in the petroleum industry (on land or at sea)?
- What are some of the useful downstream products that we use from the petroleum industry?

What do we have?

Imagine an island, fringed by the most magnificent underwater world. Where startled travellers humming in occasionally on small planes, look with disbelief and wonder at fringing reefs that seem to stretch for miles from this low-lying land. Imagine a place where just a decade ago, simple fishermen, in the abundance they enjoyed each day, would bait their fish traps and fertilise their gardens, with freshly caught lobster! Today, the waters are still unpolluted, reflecting the azure of brittle skies above, and mirroring the pale pure sands beneath them. Here, the fishes of the coral reefs are still abundant, though they have been fished for years. The brilliant tones of parrotfish, the reds of snappers, the darker hues of groupers and the multi-coloured varieties of angel fish and sergeant majors are just a few that make up the underwater rainbow that includes countless corals, many coloured sponges, seaweeds and seagrasses.

Along the shores, signs of large white sea urchins can be found; some wash ashore still living, when the seas are rough. There is no shortage here, of these creatures that are so highly prized in other Caribbean islands, where they have been overharvested and grow only small and sparsely in polluted coastal waters. But not on this island. In the waters around the reefs the beautiful queen conch, which is close to extinction in many parts of the Caribbean, is still seen in great abundance. At a quiet cove at the end of one wide beach, a wide long hill of conch shells is carefully piled - astonishing reminders of the rich harvest of food and income that the sea has provided. The conchs, most of them large and thick-lipped from age, lie weathered by the salty air and the woman whose husband harvested them, tells of the many other beauties that they have looked upon, in the waters just outside their home.



Boy with an emperor helmet conch

The boat that has been their means of livelihood for all these years, is double bowed and scarcely four feet long, but the woman tells how they have tussled with a shark, outwitted crafty sea turtles and brought ashore wonderful seaside treasures on this little craft. Inside, amongst the homely clutter, the prize catches are shown by the old lady and her attentive grandson: male and female emperor helmet conchs, huge enough to adorn the head of the most imperious warrior.

Upon other shorelines, birds fill themselves with fish, swooping and diving for their prey. Pelicans with breathtaking wingspans soar above then plunge into the surf; magnificent frigate birds sail majestically on the air; bridled terns, like red lip-sticked ladies seem to converse quietly amongst themselves on the most seaward sides of rocky promontories. Just behind the sand dunes, other bird life emerges: squat wild ducks appear occasionally and little blue herons, startled by the presence of human intruders, flap off, perhaps perturbed.

In the shallow salty ponds that form in the gentle depressions just inland, a host of winged waders feed and fly. These are for the most part, amazingly tame. Without a memory of bird hunting on this island, hoards of these birds congregate, especially in the evenings, walking on their elongated legs and dipping their long thin bills into the salty sands which teem with microscopic life. Sandpipers, plovers and stilts, are just some of the birds you can find there. Most outstanding amongst them are some of the larger birds which, when they take to flight on their starkly coloured black and white wings, look like a crowd of tuxedo-dressed gentlemen on the wing!

Shorebirds at the water's edge

But here on this island, changes are slowly coming and the clean waters and the pristine reefs, the wide, peaceful salt ponds and the tame shore birds will not remain untouched. The environment is slowly changing; not just through the force of hurricane surges or unexpected rains; long lasting human-induced changes are coming to this environment. Large hotels have already been erected and now in the



bays where once only fishermen came, larger luxury vessels are seeking a mooring. On distant sandy cays out in the ocean, yachtsmen weigh anchor, careless of the corals they may smash or the fish that they may spear during a day's leisure-filled activities. On the beaches, not only sea urchins or abandoned conch shells are found, for now the litter is not just driftwood and shale but plastic bags and bottles that have drifted in perhaps from some nearby "more developed" island. Uneasy inhabitants wonder how long it will be before the poisonous outcomes of unbridled economic development will scrawl their tired tales of pollution and despoliation on their own island.

Already many of the local gardens have been abandoned for the ease of grocery shelves, packed tight with foreign goods, and the good earth, for the most part, lies fallow. In garbage bags piled beside the houses, the waste that bulges with wrappings and cans, reflects new preferences for imported goods and tastes. In some places, sand is stealthily stolen from beaches to be used in construction, sometimes under the cover of night. As the dunes crumble and the waters gradually wash in, old haunts of Sunday picnickers are being permanently destroyed, while huge houses, take root on the dry hillsides. New roads are being built and now trucks speed loudly where once people walked, in quiet.

This is a true story of an island in the Caribbean, whose natural environment has been peculiarly preserved for much longer than many of her neighbours. But the story of this island stands like a parable for the rest of us in the Caribbean, where strides to economic development have been made at the expense of the same natural resources on which this development depends.

From a drop to a thousand fathoms

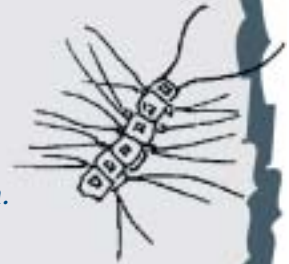


Our Caribbean islands and mainlands share many features. Receiving abundant sunshine, commonly identifiable ecosystems consist of mangrove swamps, seagrass beds and coral reefs. Beyond the reefs, the seabed drops sharply to the ocean depths. Different living creatures inhabit each domain, ranging in complexity from single-celled organisms to the giants of the sea.



“One droplet of sea water under a microscope can reveal a magical realm of tiny flashing bracelets, pendants, needles and anchors. Each infinitesimal creature manufactures its own exquisitely formed house from the minerals in the sea around it, building the shining walls out of the same silica that sand is made of...”

LIFE Nature Library, 1969. The Sea.



The tiniest sea creatures

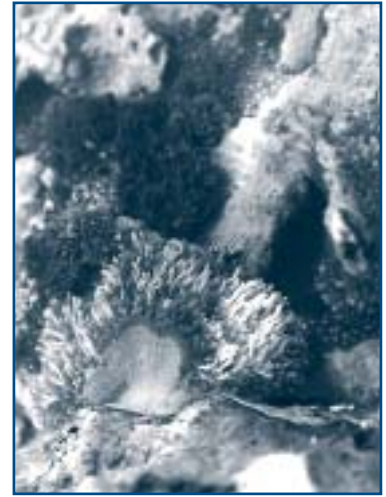
At the elemental meeting of water and sun, the tiniest of living creatures of the sea are to be found. Some of these propel themselves freely through the water like animals, while manufacturing their own food directly from the sunlight, as do all plants. They are called dinoflagellates. Other single celled-plants are actually various types of algae many of which belong to the group of single-celled living creatures called diatoms.

“The diatom is ‘the meadowgrass’ of the sea, and thousands of kinds of animals, from protozoans to whales, graze its pastures. The diatom reproduces at so rapid a pace that in a month it may have a billion descendents.”

LIFE Nature Library, 1969. The Sea.

Shrimp in the “flowers” and grasses

Sea anemones resemble bunches of flowering plants but are in fact small marine animals. Many types of anemones have small creatures living amongst their flower-like tendrils. Some of these relationships represent a type of “commensalism”, which literally means, “eating at the same table”. The spotted cleaner shrimp is often found associated with a variety of anemones: the corkscrew, the branching and the giant anemone, commonly known as the pink-tipped anemone. Sometimes purple-grey in colour or else green, the arrow shrimp blends in well amongst purple sea plumes or green turtle grasses where it prefers to feed.



Sea anemone

More than a spider's web

A constant criss-crossing of relationships occurs between creatures on the hunt (the predators) and those that fail to escape them and get eaten (the prey). Other relationships occur between animals that live and feed together. There's a wide choice of menu, that varies with the seasons, times of day or night as well as the health of the entire system that the creatures inhabit. This is part of the living food web.



Rooted to the sun

Food webs in the upper ocean are dependant on the sun. As the sun's heat causes water to rise and clouds to form, ocean currents to swirl and winds to blow to and fro', so the sun's light provides “the first morsel of food” in the intricate feeding cycles. Plants – from the tiniest phytoplankton floating in the open ocean to the tallest tree – all contain chlorophyll, the unique substance that makes plants green and captures the sun's energy; so that through the process of photosynthesis, plants turn water, carbon dioxide and other minerals into food.



It is this energy and biotic matter, that passes from one living creature to another. Animals cannot make their own food, so the entire world of consumers, including human beings at the top of the food pyramid, depends on plant life to provide the basic source of their sustenance. Animals get energy from eating plants directly, or by eating other animals that have consumed plants. However, on the ocean bottom around hot vents found on mid-ocean ridges, another form of life does exist which does not depend on photosynthesis. As their energy source, these deep-sea ecosystems use chemical synthesis, produced by bacteria, of hydrogen sulfide which comes from the earth's interior.

Links in the chain of life

These all form the basis of life in the sea and, along with other plants found there (like sea weeds and turtle grasses), are recognised as the primary producers manufacturing their food directly from the sun. Animals of all sizes and categories belong to the groups of secondary and tertiary consumers depending on how far up they participate in the food chain. A very simple food chain that shows the dramatic stages through which food and energy pass from producer to consumer, can be found in the cold Antarctic region. It starts with diatoms and dinoflagellates. These are eaten by simple crustaceans, such as krill which later are devoured by blue whales.



During the blue whale's six month feeding period it grows by 90 pounds a day, consuming up to 3 tons of krill within 24 hours and eating over 500 tons of these two inch long crustaceans by the time their feeding phase is over.



Feasting at the banquet table

In most living environments there are many choices of food on which creatures may feed. Though a food chain gives a good idea of how feeding occurs, from the simplest life forms to the largest, a better picture of what actually happens is that of a food web. Unlikely partnerships occur where alliances happen to enhance the search for food and for survival. Some of these are symbiotic – where more than one creature lives together in a mutually helpful situation. This is the case with tiny organisms called zooanthellae, that live within the tentacles of coral polyps. These microscopic animals give corals their colours, while also finding a safe shelter amongst them.



Corals and sea urchins in a tidal pool

Eviction notice?

In recent years, rises in sea water temperatures have been linked with some corals' expelling of their resident zooanthellae. When this happens, the corals lose their colour in a process not yet fully understood, termed "coral bleaching".

Limits beyond the light

But though the sun may seem to be an infinite source of energy and light, its benefits are not limitless. Apart from the fact that some scientists believe that one day the sun may burn out – perhaps millions of years from now – there is another factor. The web of life depends on plants that use the sun. If these primary producers were destroyed, the web of life would collapse. If they are badly damaged the web of life will suffer, on land as in the sea. Plants, big and small, must remain in a healthy condition to keep on making food from the sun. The recycling of this energy through the food web must never end, if all creatures are to continue to live.

Munchers of the dead

Within the food web there are also creatures who live on dead or dying things. Their job, although it may seem repulsive, actually provides an important function, cleaning the environment of decaying and dangerous matter and recycling the energy and nutrients within these things, back into usable forms. These “decomposers” as they are called, break down complex plant and animal material into simple elements, like carbon and nitrogen. These can then be reabsorbed by plants. When these are combined with energy from the sun and other needed elements, plants grow and there is a “new” recycled food supply for hungry creatures.

Zones for specialised living

Food webs occur in specialised locations. These natural habitats are linked systems, so that what happens in one will inevitably impact others. Many of the vital activities which relate to Caribbean people’s livelihoods and survival, depend on these ecosystems.

Misunderstood mangroves

Most people regard them as a nuisance: smelly, filled with mosquitoes, useless for normal agriculture or development. Relatively few may use them to support their livelihoods, gathering oysters, trapping fish, using their wood for timber or tanning, or simply enjoying their quiet beauty or bird life. Mangroves in fact provide an invaluable purpose to whole islands and coastline communities. Their special roots that can grow in brackish and salt water conditions, help trap silt and gradually extend the coastland into the sea. The forests of red, black, white and button mangroves, protect shorelines from tidal changes and hurricane surges. When floods occur from inland rivers, their roots help to slow silt-laden waters, so providing protection for organisms that would otherwise be damaged, in the nearshore area. Water purification, peat formation and the conservation of soil as well as groundwater, are included amongst the physical functions of the mangrove swamp. Without them, coastal erosion, loss of property and land can result.



Red mangroves

Mangroves provide an entire world for communities of living creatures that spend part or all of their lives in them. Many sea creatures come here to spawn. In the quiet still waters of the mangrove swamp their young can grow in a protected area, which is abundant in suitable food. Part-time visitors include lobster, shrimp and various fish species.

Many decomposers continuously feast on the decayed mangrove leaves. Barnacles, oysters, worms and some crustaceans all dine on the sodden mangrove forest floor. Microscopic organisms, finish off the task of recycling the energy and nutrients that first were manufactured in mangrove leaves.

In contrast, a variety of birds come and go according to migratory cycles or patterns of feeding, mating and nesting. Many of these waterfowl provide attractions for locals and tourists, who enjoy viewing wildlife.

WINGED GIANTS OF THE BLUE LAGOON

On the quiet island of Barbuda, the half-forgotten sister isle of Antigua, an awesome colony of magnificent frigate birds is thriving.



Numbering in the hundreds, these birds roost resplendently amongst the mangroves. Little economic activity has disturbed their ancient habitat. These birds were named by land-sick sailors of a by-gone age, travelling in frigates, who watched their soaring flight on wings that might reach as wide as seven feet. They now re-create ancient seasons of mating and nesting. Males inflate large red balloon-like pouches beneath their bills, to catch the eye of potential mates, in this spectacular courting ritual. Visitors may travel quietly amongst this colony of birds, in small shallow draught boats guided slowly through the water. In this mangrove swamp, other wonders can be seen like the curious upside-down mangrove jellyfish that looks like some miniature garden swirling on a tiny lost planet. Other pleasures may include lunching on fresh lobster, chosen from a stash of live creatures from the blue lagoon.

A many sided giver

Like some magnanimous benefactor, the mangrove habitat benefits the land on its inshore side, the seas and reefs on its ocean side as well as a host of creatures that live within its intricate system of leaves, trunks, branches and roots. Merely as a place of re-creation and enjoyment, this habitat is vital to our existence.

Short term vision

“Developers” and others with eyes set on short term economic gains, without a sense of their overall function, see mangroves as being better suited for sites of garbage dumps, rice cultivation, land reclamation – even road building and housing or airport development. In so using mangroves, they fail to calculate longer term economic, social and cultural losses.



Lobster

The beds where turtles feed



Seagrass

As open pastures give a grazing ground to cows and goats and sheep, and a place where seed-eating birds chirp and jump and eat, so the seagrass beds of the nearshore waters provide a grazing area for numerous creatures. Producing their food from direct interactions with the sun, these flowering underwater plants flourish and provide a food supply for various life forms.



Young conch

Grazing in these grasses are tiny snails that cling to their leaves and spectacular conchs such as the roostertails, the tritons and the beautiful queen conchs. Prickly sea urchins like the slate-pencil urchin can be found here or the edible West Indian sea egg. Flat sand dollars often feed here too along with grub-like looking sea cucumbers. Some star fish will be among the feeders.

But perhaps the most welcome visitors are those mysterious migrants, the sea turtles, who are known to traverse the oceans of the earth repeatedly, throughout their long lifetimes but choose these shallow beds of turtle grass, as one of their favoured places to feed. Jellyfish, another favourite turtle food, may sometimes float into these areas, providing an extra treat. Altogether, these seagrass beds with their inhabitants, form yet another critical habitat linked to the ocean.



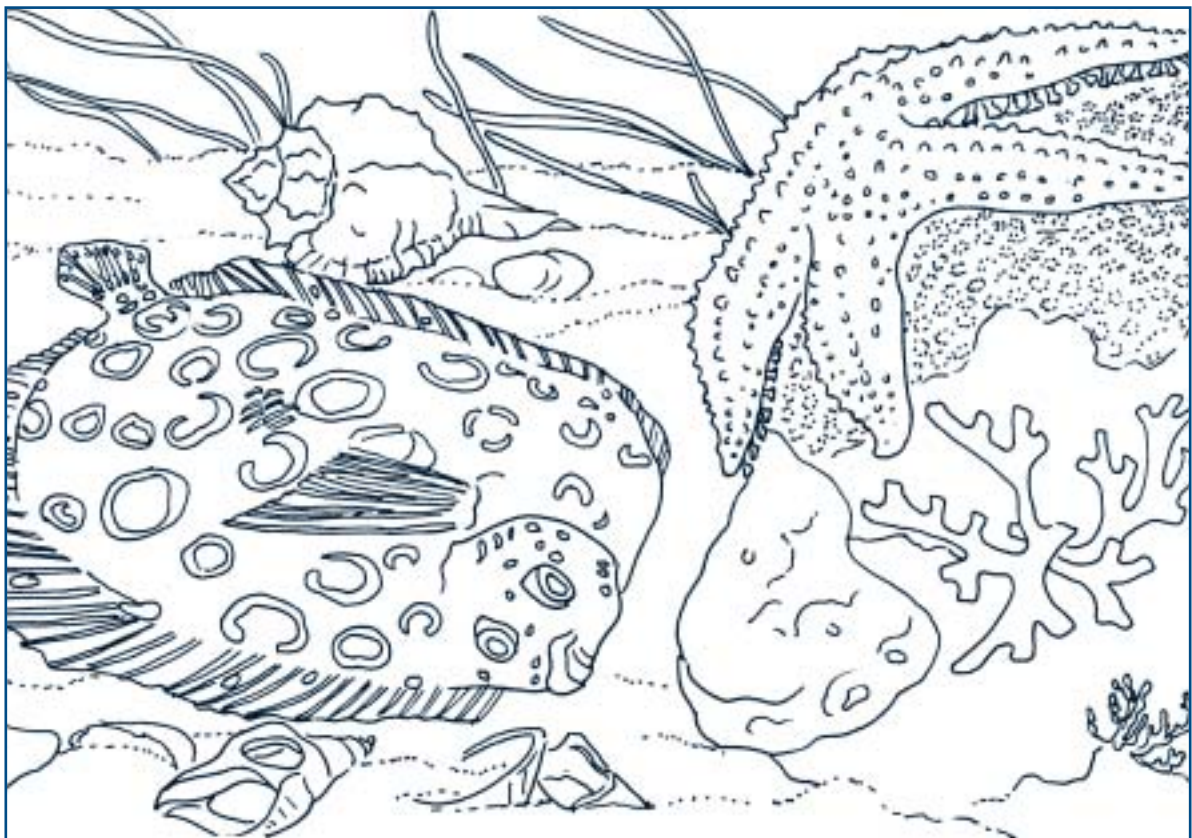
Sea urchins



Sand dollars

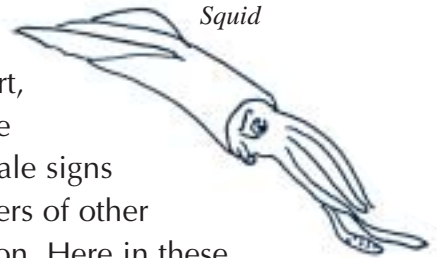


Life on the seagrass bed



The kingdom where coral reigns

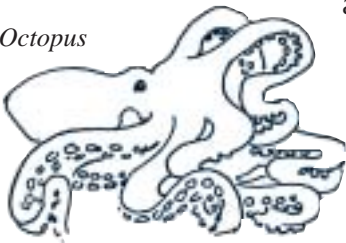
The Caribbean Sea, is seen by biologists, as a virtual desert, when compared to the seas and oceans of more temperate countries. The clear blue waters and white sands are tell-tale signs of low productivity when compared to dark coloured waters of other seas with rich productivity. But coral reefs are the exception. Here in these spectacular underwater domains, live thousands of creatures, in an intricate web of life.



Squid

In terms of structure, reefs may be one of three varieties. Fringing reefs, run adjacent to the shore. These can be seen at Speyside, Tobago or off Virgin Gorda, British Virgin Islands. Barrier reefs form further offshore, with a deep lagoon between the sea and land. The Great Australian Barrier Reef is the largest of its kind in the world, but in our own region the spectacular reef off Belize, provides an outstanding example. Buccoo Reef in Tobago is also a barrier reef. Other reefs may form independently of any mainland area, typically on a raised underwater “mountain” and breaking the surface to form a near circular coral formation. Such reefs are known as atolls and are common in the Polynesian islands of the South Pacific as well as the Indian Ocean islands such as the Maldives.

Octopus



Whatever their structure, they are all equally fragile. It is thought that reef building creatures called coral polyps have taken centuries if not millennia, to build reefs the size

we see today. Varieties of corals grow in differing areas of the reef, for instance the tall elkhorn corals on the deep ocean-side reef walls and the huge mounds of brain corals on the shore-side sea bed. Some, like the finger corals, even colonise shallow inter-tidal pools on rocky seaside cliffs. A dazzling array of corals can be found, for instance the many types of star corals. Getting to know and name the coral types is a challenge in itself.

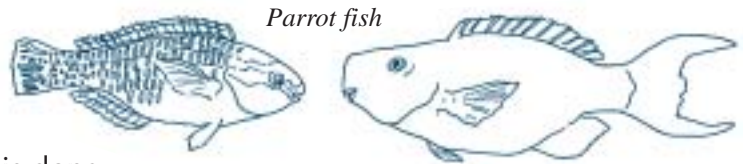


Spotted nurse shark



Soft and hard corals

The reefs are a scene of never ending colour, movement and life. Myriads of species swim and snoop and graze throughout the day and at night a different bevy of creatures come out to forage for food. Like mangrove swamps, coral reefs also provide a nursery function for some creatures, including many species of commercially harvested fish and shell fish. They also protect the shoreline, particularly from huge ocean swells associated with hurricanes, and provide a source of sand for many beaches. Here the action between predator and prey is stealthy and swift and all is done with blazing colour and intriguing camouflage.



Parrot fish

Parrotfish nibble at the reef itself, processing tiny bits of coral and passing them out as sand. This sand is then moved by the waves to the beaches. Parrotfish come in a variety of bright colours and have sharp teeth that seem to be fixed in a permanent neat smile. Other toothy reef creatures are the varieties of moray eels that lurk in their crevices and shoot out a sharp mouth to snatch the unsuspecting passerby. At night these reefs are often cruised by sharp-toothed barracuda. Several other reef fishes sport an amazing array of spots and bands and daubs all of bright colours. The tinier creatures of the reefs are by no means outdone with their brilliant markings. Sea stars and sea whips, sea eggs and conchs, may also travel between seagrass beds and the reefs.



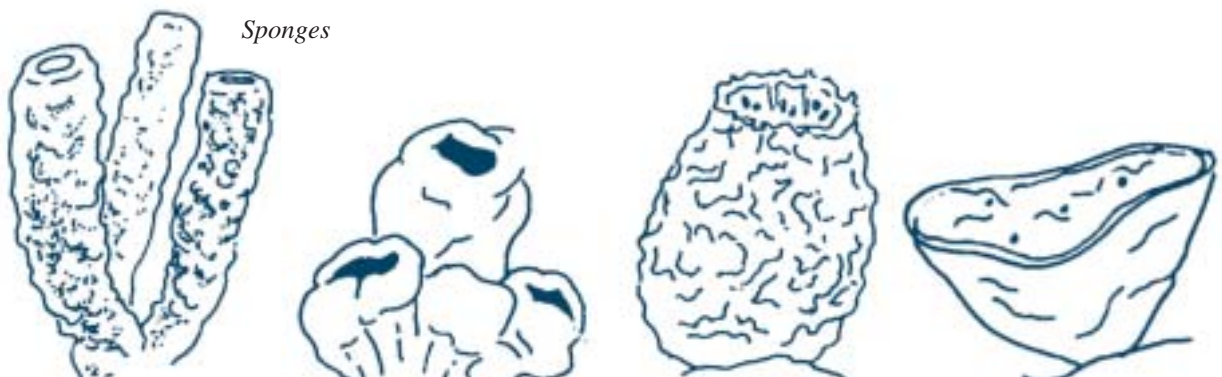
Anemones

Sponges of spectacular shapes, sizes and colours and swaying sea fans, gently moving tube worms and many tentacled anemones, root themselves at points on the reef's floor or in other niches.



Rays

Dwellers from the wider ocean come to visit, often in search of food. Groupers and snappers may seek out smaller fishes here to eat. Sharks may also come searching. Some larger creatures such as the friendly manta rays may stay permanently close to the reefs, as they do at Speyside, Tobago, if the habitat remains healthy and they are left unharmed. For human visitors, the reef provides a place to fish for food but also to relax and enjoy its beauty, find pleasure in boating, swimming, diving or snorkeling and generally to refresh the soul.



Sponges

Out in the open seas

Fewer creatures inhabit the wide oceanic realms. Here where the waters are deep, seagrasses cannot take root, for they could not get light enough to grow at such depths. Instead the dinoflagellates, provide the ocean's free floating "sea meadows". Some fishes complete their life cycles here, including the "pelagics" that swim near the surface like dolphinfish and flying fish and the "demersals" like red fish, snapper and grouper that feed nearer to the sea floor.

The darkening world below

Fascinating life forms are found in the graded margins that go from half exposed beaches to the often unseen darkest depths of the ocean. Many of these zones have been given intriguing names from Greek mythology including the neretic, bathyal, abyssal and hadal realms. Each of these areas is now known to support life – some in ways previously thought to be impossible.

Song for Ivor the Diver

Oh how I long, to swim out to sea
Breakers out there – beckoning me
There I can float, in pools blue and green
Bob like a boat, in worlds so oft' unseen

Not known to those who stay in the bay
Are treasures below, washed by the waves so gay
Gulping the air, now I make my descent
All here is dear, corals magnificent!

Then underwater there, silence surrounds me
And I will have no fear, of creatures around me
Shark smiles as he goes by, following a tuna
And reef fish dash away, from barracuda

Turtles appear at last, flippers are flapping
Feeding on turtle grass, on this bright morning
Octopus stops to think, if I might harm him
Gives me a splash of ink, as he's departing

Long spotted moray eel, smiles from his crevice
He will not bite my heel, I won't alarm him
Parrotfish, brittle star, prickly sea urchin
I would stay with you, but to the shore I'm turning

by Joy Rudder, from "The Anguilla Collection: 1992"



Moray eels on the reef

The beauty that is backdrop

“...walk out into the fields and look at the wildflowers, they never primp and shop, but have you ever seen colour and design quite like it?...”

The Message, Eugene Peterson.

“And he sailed off through night and day and in and out of weeks and months and almost over a year to Where the Wild Things Are...”

Where The Wild Things Are, Maurice Sendak.

“There are some who can live without wild things, and some who cannot...”

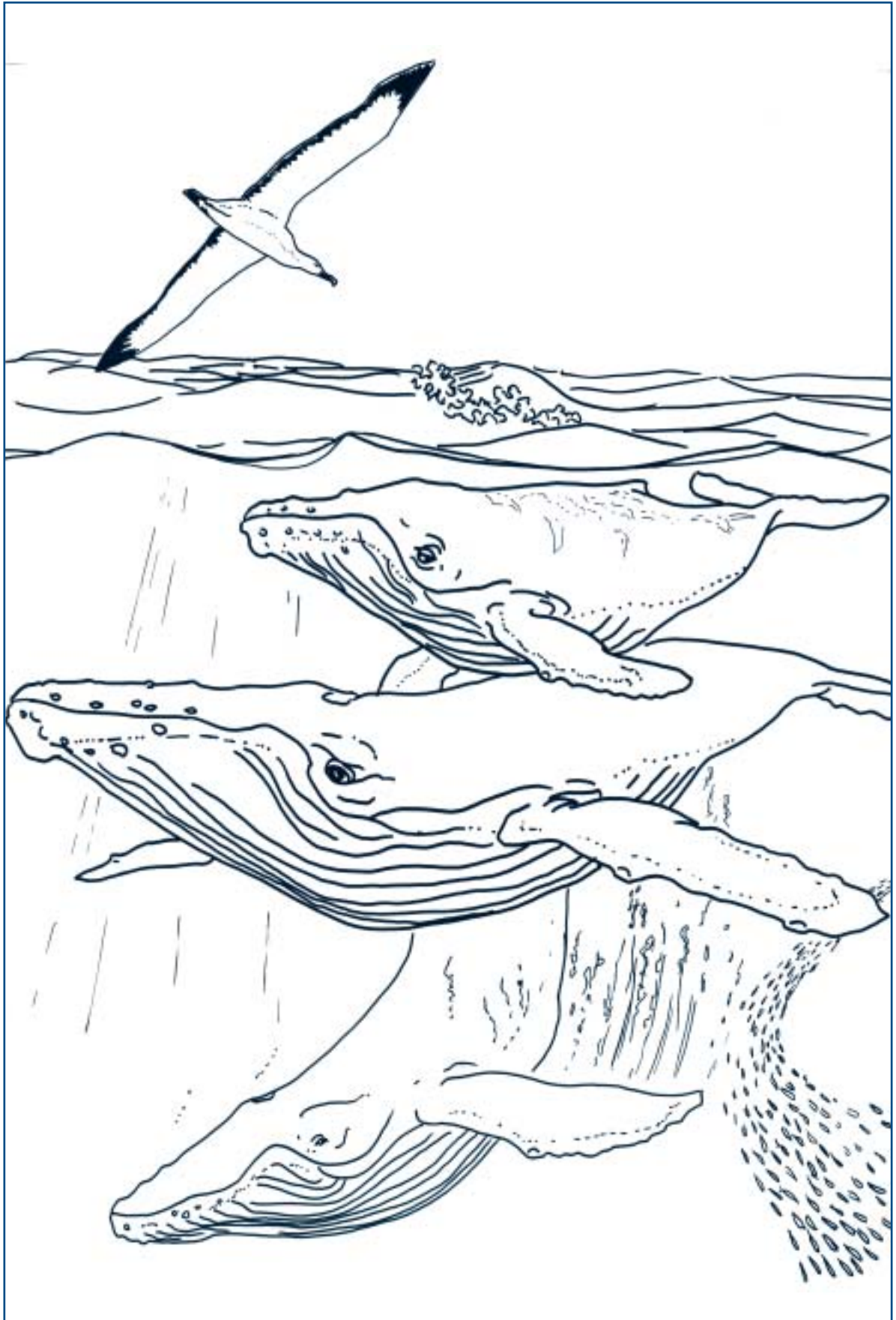
A Sand County Almanac, Aldo Leopold.

It is easy to forget, in a world of buses and buildings, computers and communications, fast foods and supersonic transportation, that our lives still ultimately depend on things that we did not make ourselves. We may be unaware of what is happening in a jungle or on the deep sea bed, on high mountains or tiny islands, in the upper levels of the atmosphere or on the surface of the planet where we walk, but all of these spheres can be affected by our actions and in turn they influence the quality of life we know. Another name for all of life on earth, on which our existence depends is biological diversity, the amazingly varied, delicately balanced, life-giving complex of all that is here. Estimates of the number of species of living things that exist on our planet vary from a low of 5 million to a high of 100 million. To date 1.7 million species have been identified, 90% of these in tropical forests. But current rates of deforestation alone, suggest that two to eight per cent of Earth's species will disappear over the next 25 years. Then also there are the losses on other parts of land and in the seas. At least 40% of the world's economy and 80% of the needs of the poor are derived from biological resources.

A law that cares for life

The Convention on Biological Diversity

At the First United Nations Conference on the Human Environment held at Stockholm, Sweden, in 1972, the Governing Council of the newly formed United Nations Environment Programme identified the “conservation of nature, wildlife and genetic resources as a priority area.” This was the beginning of international law-making that would seek to protect everything that lives: from the giants of land and sea – gommiers or great redwoods and grey whales and walruses, to crop seeds and chromosomes and microscopic genes. This law seeks to protect not just individual threatened species but the entire ecosystems within which they dwell. Two decades later, in 1992, at the historic “Earth Summit” – the United Nations Conference on Environment and Development, after lengthy technical and legal preparations, the Convention on Biological Diversity was opened for signature at Rio de Janeiro, Brazil. It entered into



From the giants of the sea to the microscopic creatures they consume, the Convention on Biological Diversity seeks to protect all that lives in earth and air and sea.

force on 29 December 1993. The conservation of biological diversity is now recognised as essential for global sustainable development. It balances requirements for conservation with sustainable use. It spells out both rights and obligations of its participating countries concerning scientific, technical and technological cooperation.

Sun, clouds or too much rain?

Blanketing our earth with care

Another international agreement which seeks to guide our progress in planetary proportions, is the Framework Convention on Climate Change. Drought in sub-Saharan Africa, late-forming monster hurricanes hitting the Caribbean islands and the North and Central American coasts, severe droughts alternating with winter storms in northern countries all point to the phenomenon of climate change. Weather always varies and disasters do periodically occur but in recent decades scientists have been cautiously beginning to note that something alarming, new, profound and potentially permanent is underway. An Intergovernmental Panel on Climate Change has been established that is carefully noting the trends.

Where we choose to live as we seek to make out livelihoods has often made the effects of these severe weather changes even worse – for instance, poor people who had erected thousands of flimsy shacks on muddy unstable hillsides in Honduras, felt the fatal impact of Hurricane Mitch in 1998 which killed thousands, followed by the floods of the next year which bore away many hundreds more. As one publication questioned, regarding the pattern of carnage normally left in the wake of natural disasters worldwide, were these Acts of God or acts of man? (*Natural Disasters: Acts of God or Acts of Man*; Anders Wijkmon & Lloyd Timberlake; An Earthscan Book, New Society Publishers, Philadelphia, PA 1984)

Intense climatic events are often necessary in our planetary place: fires in eastern mountains or central prairies of North America though potentially life threatening are also the sole means by which some tree and shrub species can be regenerated. Tropical hurricanes in sweltering summer months serve to disperse heat and energy to northern latitudes. But soberly, scientists now see that man-made impacts are drastically altering flows of energy between the sun and our planet in both directions with dire effects. Greenhouse gas emissions include carbon dioxide (CO₂), a by-product of our domestic and industrial uses of coal, oil and natural gas; methane (CH₄) and nitrous oxide (N₂O) which are produced in huge quantities in industrial-scale livestock rearing and rice cultivation. Together, these with other greenhouse gases are changing the quality and capability of earth's atmosphere. The results of these occurrences include global warming, sea level rise, an increase in severe weather systems and predicted shifts in climate and vegetation belts in years to come. These would be largely unfavourable to humans as well as other living creatures, resulting in widespread failure of crops, loss of life, hunger and even for some species, extinction.

The United Nations Framework Convention on Climate Change is the centrepiece of global efforts to combat global warming. Adopted in 1992 at the Rio "Earth Summit", its ultimate objective is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

A Conference of Parties oversees this complex Convention which attempts to persuade all world players to participate, sharing responsibilities equitably between rich countries and poor. The rich, whose industrial activities largely worsened the problem and have done the most harm are asked to make the biggest changes and bear the greater financial responsibilities; the poorer countries, which lack resources and are just making fledgling efforts towards industrial advancement, are given time to strive for sustainable development and are asked to give financially, in proportion to their



Rice cultivation, Guyana: one of the non-industrial processes that produces gases

resources. The Global Environmental Facility is the financial mechanism that co-ordinates the financial arrangements necessary, which run into billions of dollars. The Convention also has related legal instruments such as the Kyoto Protocol, (adopted in December 1997), which strengthens the international response to climate change.

Related international legal systems preceded this Framework Convention and continue today, to deal with specific issues; these include the Vienna Convention for the Protection of the Ozone Layer, adopted in March 1985 and its subsequent Montreal Protocol on Substances that Deplete the Ozone Layer adopted in September 1987.

You take it from here...▶

●●●●●●●● 1 ▶ **TELL THE LIFE STORY**

Choose a habitat in your area for exploration from the list described: mangroves, seagrass beds and coral reefs.

- See how many living creatures you can find and name there.
- Identify what stresses may now be affecting these areas.
- If “development” projects are being promoted for any of these places, try to identify the possible environmental impacts that may occur.

●●●●●●●● 2 ▶ **THE MAKING OF A MARINE PARK**

Coastal zone managers and conservationists in many islands and on mainland coasts, are beginning to identify special nearshore areas that they want to preserve.

- Locate a mangrove or coral reef precinct which you would recommend for preservation as a nature sanctuary or a marine park.
- List the reasons for your place of choice, noting its various values (e.g. recreational, nursery, coastal protection, natural beauty etc.)
- Identify the various people who may be affected if this area becomes a sanctuary (e.g. local spear fishermen, who may be banned from harvesting conch or shooting reef fish, boaters who normally anchor and destroy corals; tour boat operators who let people walk on fragile coral reefs).
- By talking with the various people who want to use this chosen place, find a way to settle their differences and to work out a community management plan.

●●●●●●●● 3 ▶ **OLD AND NEW TECHNOLOGIES – TO THE SEABED AND BEYOND!**

While much is now known of our living resources especially in the areas close to land and in shallow sea beds, a world awaits to be discovered, at the deepest bottom of the sea. Careers in the 21st century may well take workers to live for extended periods on the deep sea bed.

- Today’s history was the science fiction of yesterday. Read the classic story written by French inventor and author Jules Verne, *Twenty Thousand Leagues Under the Sea*.
- Find out what actual experiments were tried and proved successful to take both individuals and groups to the ocean’s floors.
- Submarines have been put to use in times of peace and times of war. Research the facts and retell these stories in your own words. You might like to add your own futuristic ideas of how they could be used.
- Mining of the deep seabed by the use of robots is a key area of applied research for technologically advanced countries. Find out as much as you can about this as well as the resources to be exploited (e.g. manganese nodules) and their industrial usefulness.

What can be done?

When the first hint of daybreak promises light to the eastern skies, I can be sure that outside, fresh breezes will be awakening the casuarinas which, however, are not local to the Caribbean. These towering, shaggy giants are known as “Mile Trees” in Barbados, and “Whispering Pines” elsewhere. When I first came to “South Drift”, this house beside the sea, I would awake on mornings, throwing the doors open, hardly daring to believe that the beauty of the trees and cliffs and breakers would still be there.

Offshore, the fishermen, like a chain of waterborne commuters ride on the swells, heading their boats for the channel through the reef. In the early light, their lanterns wink and their bright yellow raincoats beam through the spray and fading darkness. It will be afternoon before they turn for home again. But against the faithful pattern of tides and moody waves, subtler changes disturb this landscape. The sun rises on signs of human disarray.



Casuarina trees, seen here in Middle Caicos, Turks and Caicos Islands, although fast growing, are not recommended planting for beaches because they discourage the growth of ground cover which stabilises the sand.

Beside the major hotel in the area, a wastewater pipe drips onto rocks, feeding green algae, the telltale sign of polluted water. It is the same and worse on other coasts of this small island and many more throughout the Caribbean. The scientists, like quietened prophets, occasionally utter their pronouncements: to any who would still hear, of dying reefs and polluted coastal waters.

It is strange to walk these cliffs in the morning, trying to picture what might have been. On a vacant peninsula, a few scattered blocks lie amongst the man-made sea defenses. I’m told a house once stood here, 40 years ago. And those who were children then remember how they would play, sliding on high dunes and watching red crabs scuttle in the morning. They heard tales from elders, that once this narrow beach was sandy and wide. From the house which is now no more than a few ruined, wave-washed stones, the seawater then, could be barely seen for the beach was so full of trees.

There was good fishing in those days: lines tossed from cliff tops at Ananias Point, where chubs and grunts and porgies played when the waves were high. Scuttling bullheads and gaping moray eels darted amongst the rocks at low tide. Today, fishermen still cast a line from the cliffs; but perhaps they come more to enjoy the coolness of the breeze, the sound of ocean waves booming in the caverns below, rather than for a plentiful catch.

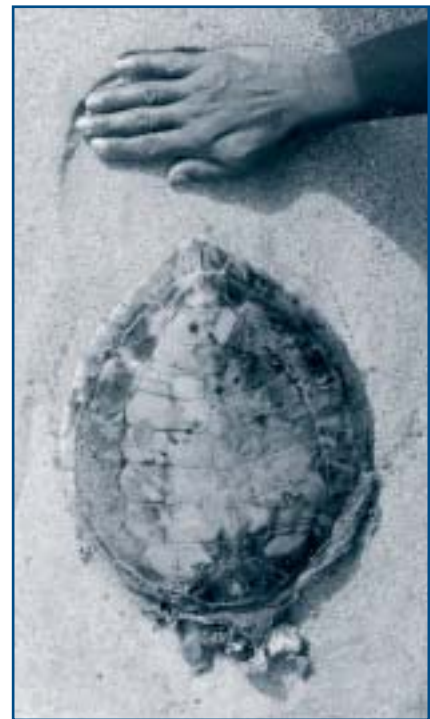
On the beach in the morning, anything can be found. Sometimes a brilliant Portuguese man 'o war, stranded by a receding tide, balloons its pink sail in the breezes, unable to skid to the water. More often, there are plastics freely blowing. Like all the other man-made flotsam that rides the tides, they are the castaways of sun tanning tourists or careless locals. Sometimes in the morning, the overnight finds have been appalling: a bloated pig, a hollow refrigerator, a plastic nappy and miscellaneous items of household garbage. For further up the coast, others mistook the sea for a disposal area, with the changing of the tide – the environment throws back!

This morning, bracing against the wind, I walk until warm and dash for the breakers, just as the sun rises. The water is cool and the drift is strong. Later, walking the beach, I pause momentarily, seeing half buried plastic in the sand – wondering whether to retrieve it. Returning to the sea it might choke a turtle or block some creature's gut. But what is one action worth on an empty beach on a morning, when there is so much that needs removing from the waste that washes ashore?

But this is the beach where turtles surprise walkers whose eyes are keen for just a glimpse of them. Offshore, despite the pollution from boats, hotels and houses, beds of turtle grass still flourish and sometimes turtles come to feed. It is strange to hear other tales, of how in years gone by, they too were plentiful and rich gun-owning locals on the look out, delighted in shooting them from the cliffs and hauling in their edible carcasses. Sometimes on a beach, a disemboweled shell may still be found.

This creeping squalor that seeks to overcome a still beautiful seascape, can raise despairing thoughts, for those who seek to salvage the inheritance of creation. On a cool morning, caught between breaking waves and windswept litter, one well might say with longing, like the late Guyanese poet Martin Carter:

**“I wish this world would sink and drown again
So that we build another Noah's ark
And send another little dove to find
What we have lost in floods of misery.”**



Saddening find: slaughtered turtle

But, to borrow a phrase from African-American novelist James Baldwin, there may only be “the fire next time”. So while we have beaches and fishing boats and turtles that still elude the choking plastics, while we have time for hope, we must take action.

Regulating our seas

The first United Nations Conference on the Law of the Sea (UNCLOS) was convened after World War II to attempt to find a meeting ground for defining and delineating how nations' approaches to the use of the oceans and seas could be regulated. Four new conventions were adopted:

- The Convention on the Territorial Sea and Contiguous Zone.
- The Convention on the Territorial Sea and the Continental Shelf.
- The Convention on Fishing and Conservation of the Living Resources of the High Seas.
- The Convention on the High Seas.

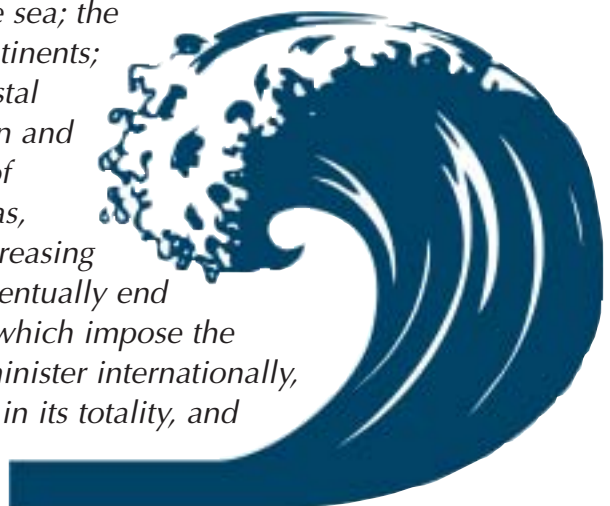
Riding a new wave to change

On November 1, 1967, the Delegate from Malta, Ambassador Arvid Pardo, rose to address the United Nations General Assembly on a matter which opened the flood gates to modern day discussions amongst all nations on how to share, protect and utilise, the resources of the sea.



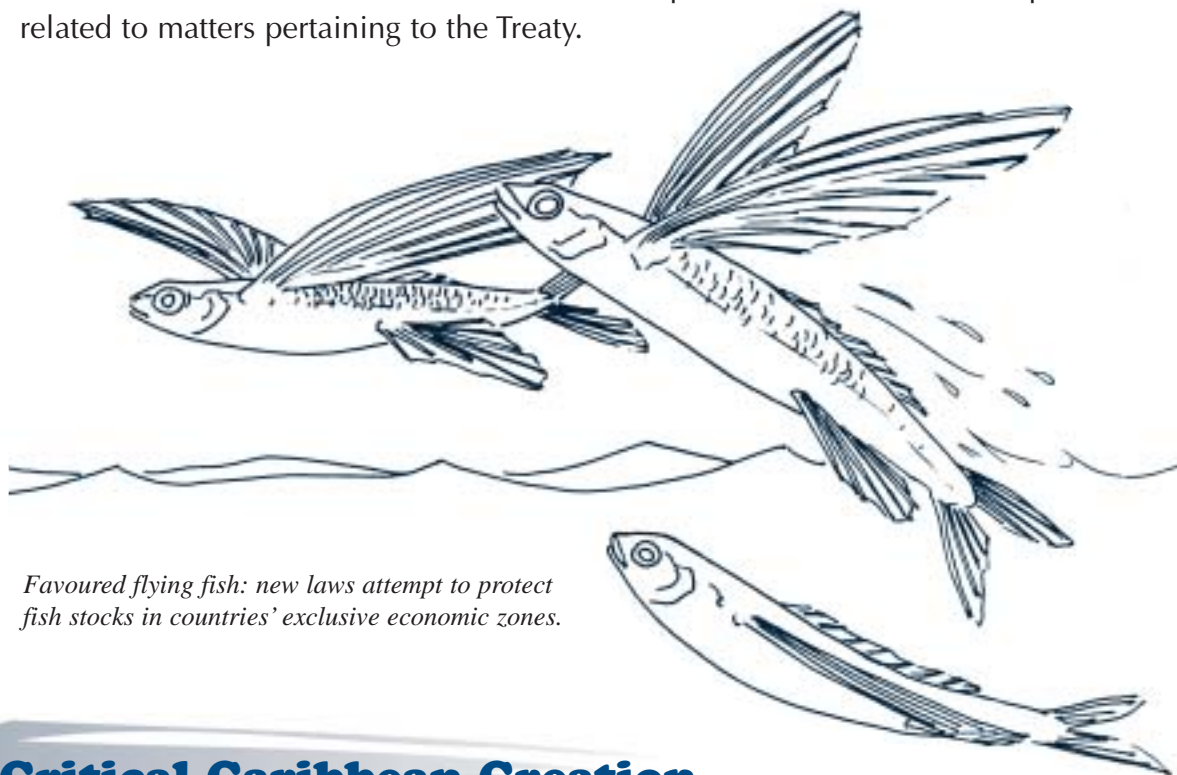
The first global conference on the Law of the Sea was held in 1974 in Caracas, Venezuela lasting from June through August. Mexico's President, Luis Echeverria addressed the nations of the world describing the basis for the new global vision on oceans:

"Man's entire attitude with regard to the sea must change. The dramatic growth of the world's population, and the consequent increase in demand for food from the sea; the expanding industrialisation of all continents; the congestion of populations in coastal areas; the intensification of navigation and the ever more frequent deployment of 'supertankers', containers of liquid gas, and nuclear-powered vessels; the increasing use of chemical substances which eventually end up in the seas – all these are factors which impose the necessity to regulate globally. To administer internationally, the uses of the oceans... and the sea in its totality, and the atmosphere above it, form one ecological system. All these interactions demand a global and integrated vision and treatment of the marine environment."



Finally in 1982 Member States officially adopted the UN Convention on the Law of the Sea. The United States of America has been conspicuous in its abstention in this global agenda. It argues that its billion dollar research expeditions into deep seabed mining should not be automatically shared with all the countries of the world. However, many highly industrialised countries with special interests in deep seabed mining, including Canada and France, have actively participated.

Further work continues in the establishment of the International Seabed Authority to supervise deep sea mining and lead the way for the appointment of the International Tribunal on the Law of the Sea for peaceful settlements of disputes related to matters pertaining to the Treaty.



Favoured flying fish: new laws attempt to protect fish stocks in countries' exclusive economic zones.

A Critical Caribbean Creation

While work has proceeded over the last decades on global concerns of the uses of oceans, countries of the Wider Caribbean have felt a need to focus on their very special concerns. Under the United Nations Environment Programme (UNEP), a legal framework suited specifically to the Wider Caribbean has come into being. The Convention for the Protection and Development of the Marine Environment is usually called the Cartagena Convention. It is so named for the famous city in Columbia where it was signed. It was adopted in 1983 and came into force in October 1986. It has been ratified by 20 countries and seeks to engender regional co-operation on a number of marine matters.

Finding our own solutions

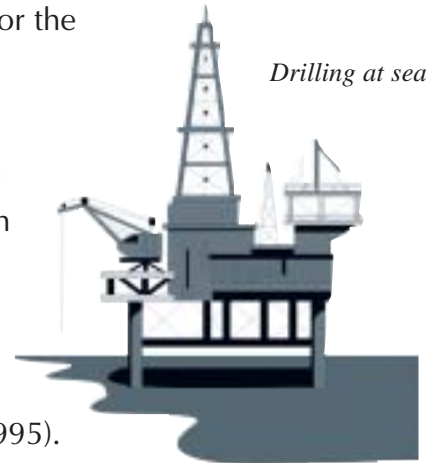
From the start, the Cartagena Convention has defined specific areas of focus that affect the Caribbean Sea: pollution from ships; dumping of wastes; land-based sources of marine pollution; sea-bed activities; airborne pollution; specially protected areas.

Some of the protocols to the Cartagena Convention have already been developed, which give detailed directions as to how problems can be handled at regional, national and local levels. The goal is to change actions for the better, that will affect our Caribbean Sea. These include:

- The Oil Spills Protocol
- The Specially Protected Areas and Wildlife Protocol
- Protocol on Land-based Sources of Marine Pollution (presently being developed)

On the world-wide level, the Global Programme of Action on the Protection of the Marine Environment from Land-based Activities was adopted (Washington, 1995).

It underlies the major threats of land-based activities to the health, productivity and biodiversity of the marine environment. Together with the Convention on Biological Diversity (in force since 1993), these conventions provide the background for the conservation and sustainable use of biodiversity, the sharing of benefits and access to information. Both conventions are very important for the Caribbean region, with its intense human pressures on the environment.



“The ultimate prize is special area status... a designation that will put the Caribbean into an exclusive league of protected waters that includes the Mediterranean Sea, the Baltic, the Red Sea and the Gulf, the North Sea and the Antarctic.”

*“The Caribbean Sea – A Very Special Area;
Wider Caribbean Initiative for Ship-Generated Waste”; IMO.*

Netting the wastes out at sea

The United Nations International Maritime Organisation has coordinated the establishment of a special convention to deal with the problem of waste at sea. This International Convention for the Prevention of Pollution from Ships, is known as MARPOL 73/78. Regulations are outlined for the safe standards for the disposal of various wastes at sea, in separate Annexes of the Convention. These include: Annex I – Oily wastes; Annex II – Noxious Liquid Substances in Bulk; Annex III – Harmful Substances in Bulk; Annex IV – Sewage; Annex V – Garbage. All but Annex IV have entered into force. Under the Wider Caribbean Initiative for Ship-generated Waste, which ran from 1994 to 1998, 22 countries of the Wider Caribbean region sought to find ways to tackle these problems. Most of the major concerns remain unsolved as controlling of dumping within the Caribbean Sea is difficult to manage and the concept of creating specialised facilities in various ports is fraught with problems. Countries are reluctant to receive wastes from unknown external sources and plans for recycling can only be profitable if co-ordinating occurs on a regional scale.

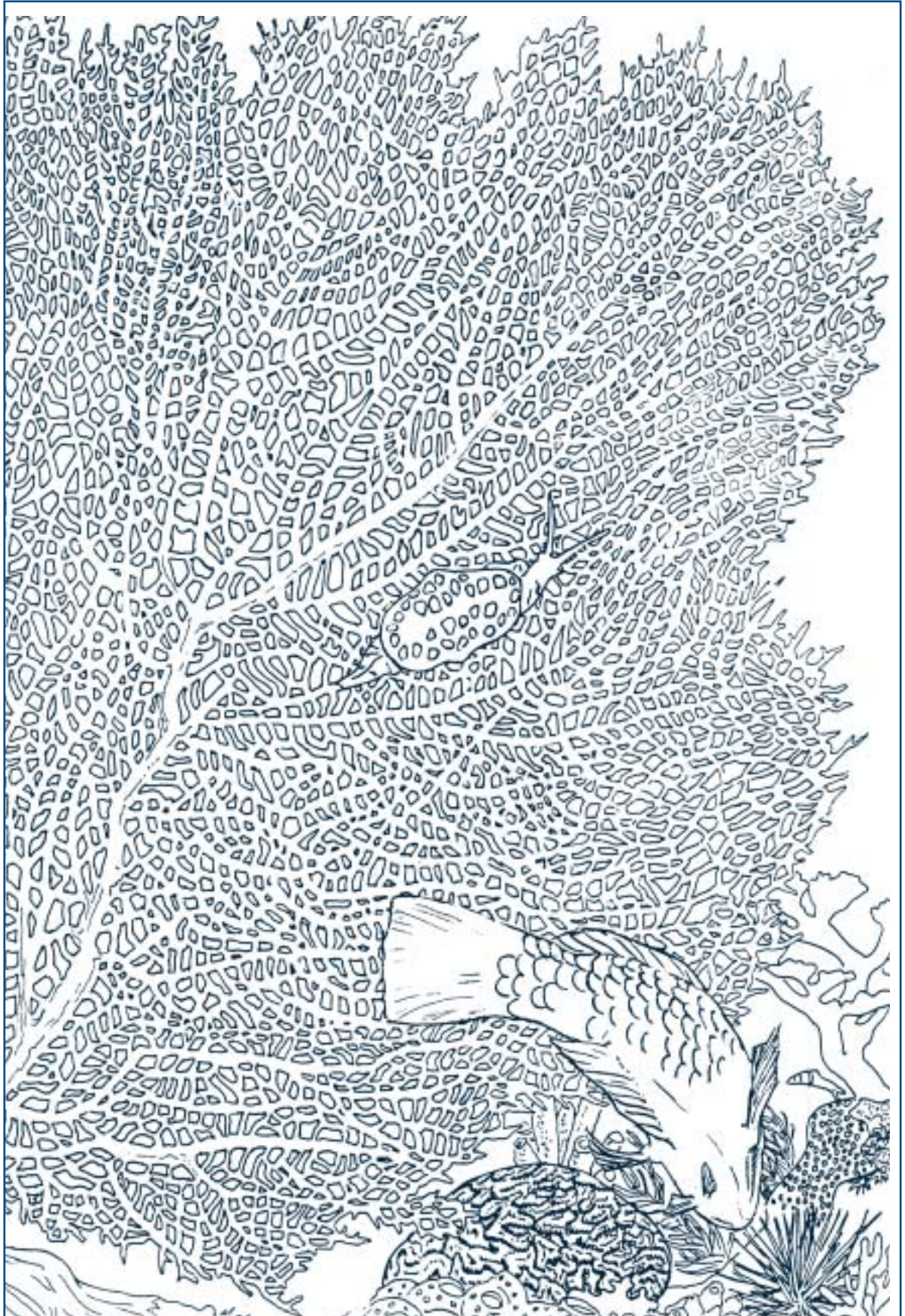


Plastics and other materials on the high tide mark of a Caribbean beach

Help through research and learning

Following the decisions of the UN Conference on Environment and Development (Rio de Janeiro, 1992) and the UN Global Conference on Sustainable Development of Small Island Developing States (Barbados, 1994), the United Nations Educational, Scientific and Cultural Organization (UNESCO) responded with a new endeavour in 1996 geared to Environment and Development in Coastal Regions and in Small Islands (CSI). The initiative addresses inter alia the subject of sustainability in the development of Small Island States, many of which are located in the Caribbean. It also pays particular attention to issues within the islands' coastal zones. An inter-sectoral approach to finding solutions is being used by those involved in this initiative, including scientists from all disciplines, cultural heritage experts, educators, communicators, developers, the private sector and the general public.

Many project activities are already underway within the Caribbean area. Assistance is being given to Jamaican and Haitian fishermen in the community-based management



A gently swaying sea fan is home to the incredibly camouflaged flamingo tongue snail.

of coastal resources. In the eastern Caribbean the emphasis has been on the mitigation of the effects of natural disasters such as hurricanes. These natural forces typically wreak havoc on coastal properties as well as beaches which are so vital to the tourism-based economies of many islands. In addition, the monitoring of coastal ecosystems is under way and efforts are being made to relate management and conservation to the ongoing concerns of food security.

This initiative by UNESCO is linking knowledge to management by ensuring that scientific information is being brought to the attention of key decision makers and stake holders at the local level. Amongst the many means being used to inform people are public awareness campaigns and environmental communications channeled through radio and television. These consciousness raising techniques together with actions on the ground are helping to empower local populations towards creative problem solving in environment and development issues.

The CSI initiative also focuses on traditional environmental knowledge. This renewed interest in the knowledge and practices of local communities stems from the recommendations of the World Conference on Science held in Budapest, Hungary in 1999.

Another body, the Intergovernmental Oceanographic Commission (IOC) has been established by UNESCO to promote the scientific study of the oceans. IOCARIBE is the regional IOC office for the Wider Caribbean, located in Cartagena, Colombia.

The UNESCO Associated Schools Caribbean Sea Project (CSP)

At another level, students from the Caribbean are being mobilised to play new and important roles that will enhance the careful use of the Caribbean Sea. One of the four main themes of the UNESCO Associated Schools Project Network (ASPnet) is the environment. Other themes include human rights, inter-cultural learning and the role of the United Nations in addressing world problems. There are now approximately 5,500 educational institutions across 160 countries in the ASP network.

Students and teachers are being mobilised in the service of the ideals of UNESCO: education for international understanding, cooperation and human rights and the promotion of a culture of peace, through the ASPnet. Special projects have been launched in different parts of the world, focusing on the vital importance of territorial seas. The Caribbean Sea Project (CSP) is one such project, with counterpart projects including the Baltic Sea Project, the Blue Danube River Project and the Western/Eastern Mediterranean Sea Project. The Caribbean Sea Project now involves 17 countries of the Wider Caribbean.

Informed and enthusiastic Caribbean teachers act as catalysts amongst students who belong to UNESCO Associated Schools and UNESCO clubs, promoting knowledge about the Caribbean Sea, its resources, problems and ways in which it can be used sustainably. As student members increase throughout the Spanish, French, Dutch and English speaking Caribbean, more and more communities will be touched by the concern and care of ASP/CSP participants. From the work, studies and activities of students and teachers, Caribbean school communities can be influenced, for the better, to act wisely in their use and enjoyment of the Caribbean Sea.

You take it from here...▶

●●●●●●●● **1** ▶ **COSTUMED CONTROVERSIES**

Recreate the setting of the United Nations, imagining and presenting the conflicting views of represented states. Issues should cover critical concerns including fishing rights, foreign marine exploitation, the potential for deep seabed mining to put miners of poor countries out of jobs, whaling... and there are many more. Persuasive and eloquent techniques are to be encouraged.

●●●●●●●● **2** ▶ **MAP THE MISCHIEF**

Select a coastal area on your island where there are conflicts amongst resource users (e.g. fisherfolk, hoteliers, developers, water sports operators and people who simply use the beaches for pleasure, fun or recreation). Carefully document the issues at stake, by talking to representatives from each group, as well as relevant governmental and non-governmental personnel (e.g. planners, waste disposal authorities, conservation groups etc.). Recreate a "town council" type meeting where the voices of all interested parties can be heard. Try to determine the best combination of management alternatives that could be worked out between the parties, if each is willing to compromise.

●●●●●●●● **3** ▶ **STAGING THE SET UP**

Develop a street theatre type drama that portrays at the local level of a sea-side village or town, the problems of regulating conflicting uses of the coastal land areas and the sea. Highlight the human dilemmas that can face law makers and the urgent need to have inputs from all stake holders, from the start.

What we want to happen...

Some of us dare to say that we can see and so we cry out to others. Our call is not so much a proclamation issued from a high tower of reason, but a whisper to fellow sufferers, to feel for the end of the tunnel, to escape the horror that stealthily stalks us. We want to embrace new values arming ourselves with new ways of thinking so that when we walk somewhere in the distant future, we will have with us the methods and strategies to make the right choices; to wage good war and never again be slaves on the treadmill of decay that today we have placed ourselves upon. And we want this not just for ourselves but for the children – the pre-schoolers and the older ones and the children yet to come. We want it for the rich and the not-so-rich (for perhaps if we do it right, there will not be so many poor). We want it for all peoples everywhere, that they would all be granted vision and that in time, their hearts might change.



Who will do it?

We have many helpers. It matters not where they come from or how they come, just that we may join our hearts together and then our hands in action. If they come unprepared but willing, we will welcome them. We long to have the teachers for, faithful to their daily duties, they can ignite imaginations and inspire countless thousands and their words are remembered almost to eternity.

And then there are the players with dots and dashes, from morse codes to morning television talk shows. The media, from press room to distant satellite, all wait for our command. Animated though they may seem, they are but tools in powerful hands of those who use and own them, programming messages which inject the minds of myriad peoples. So we too should use them.

Do not forget the singers and dancers, the woodcarvers and the story tellers, the whispers of ancestors' voices in the wise sayings of the long departed. Let us dance the message to the old drumming, let us sing our story to the quiet children, let us carve it on mahogany and green heart, that a monument to the wisdom of tending our land and seas may be erected. Let it be painted in the murals of the city and on the small canvas on the artist's easel. And though some may distrust them, we must still serve the politicians as they rule our land. Their decrees reach us, whether for torment or ease and we abide by them. So let us teach the politicians to see the vision. Do not forget the preachers, for though some may scorn and scoff at them, revile and even abandon them, they are the best leaders of this pilgrim band.

How will we do all this?

We will do it by trying. By starting with what we have: in the schools at every level; sharing what is there and hidden. We will persuade the politicians. If they want facts and figures we will give them. If they worry about money, we will help them to remember that once these lands and seas were beautiful and rich. We will feed our morsels to the singers, to the players and to the actors. We will bring wood for the sculptors and with prayers and hope, wait for the thrilling tale, the rapturous dance, the giddy monument, the song, the skit, the vision that may persuade more followers to come.

We will drop our message at the street corners. Shove it into the whispers and rumours that scamper through our cities and our villages. Let it be shouted across the open fields, let it become a byword even among beggars and vagrants, for even their lot might change if the chorus rises rich and real enough across this land. We may have to write books and poetry and television commercials, radio scripts, sermons, songs and notes for choreographic scores....And we can.

When will it happen?

It is happening even now and we seek to be the catalysts, the bringers of the epiphany. It will happen first mostly with the willing, so that we may not be too soon discouraged. Then as we count our successes, we will take on tougher trials as our endurance increases and our muscles grow stronger.

Where will it happen?

It will happen throughout the Caribbean. Down by the quayside and in the quiet harbour. Among the sandwiches and teas of high Government officials' meetings; on top the files of bureaucrats and underneath the tables of industrialists. It will be happening with large toys and loud songs in the pre-schools and on-stage and back stage and in the rehearsal rooms; in sleepy afternoon schools and between bristling boots and armoury; in pews and on kneelers; before altars and incense, bells and candlesticks, placards, voters' ink and registration. It will happen everywhere that the Blue Caribbean kisses, urging a resurrection and an awakening.

Glossary

- Accretion:** increase or extension of land by natural forces, such as waves, currents, and winds; a build-up of sand.
- Algae:** class of almost exclusively aquatic plants including seaweeds and their fresh-water allies. They range in size from single cell forms to giant seaweeds several metres long.
- Anthropogenic:** caused by man.
- Archipelago:** large group of islands.
- Artifact:** object made by human workmanship, usually for a practical purpose.
- Atmosphere:** the mixture of gases that surround the earth or other planetary body.
- Atoll:** circular, or near circular coral reef appearing as a low coral island or a ring of closely spaced coral islets encircling a shallow lagoon in which there is no pre-existing land, and surrounded by deep water of the open sea, formed above an underwater volcano.
- Barometric pressure:** a measure of the force exerted by the atmosphere used to forecast the weather.
- Barrier reef:** coral reef roughly parallel to the shore and separated from it by a lagoon of considerable depth and width, or in some cases by several kilometres of open sea.
- Beach:** a zone of loose material extending from the low water mark to a point landward where either the topography abruptly changes or permanent vegetation first appears. Beaches may be composed of clay, silt, sand, gravel, cobbles, boulders, coral pieces or any combination of these.
- Beach nourishment:** artificial process of replenishing a beach with material from another source which lies either inland or may be dredged from offshore.
- Beach structure:** man-made construction to protect beaches from erosion.
- Biodiversity:** totality of genes, species and ecosystems in a region.
- Bivalve:** mollusc with a shell composed of two distinct and usually movable parts that open and shut.
- Brackish water:** freshwater mixed with seawater.
- Bulkhead:** structure that retains or prevents the sliding of land or protects land from water damage.
- Catalyst:** an agent which helps forward a chemical reaction without itself suffering any chemical change.
- Chlorophyll:** green pigment contained in the leaves of plants.
- Chromosome:** minute thread-shaped body, which carries the genetic code, found in the nuclei of all living cells.
- Cliff:** high steep bank at the water's edge, usually composed primarily of rock.
- Climate:** general weather conditions of a region.
- Cobble:** naturally rounded stone, 77-256 mm (3-10 inches) in diameter, or a size between that of a tennis ball and that of a volleyball.
- Commensalism:** a type of interaction involving the joint utilisation of food, although the relationship is rarely equal, generally one member provides the food and the other consumes some part of it.
- Conservation:** the political/social/economic process by which the environment is protected and resources are used wisely.
- Convection:** transfer of heat through a liquid or gas by the actual movement of the liquid or gas; associated with large-scale, vertical movements within the atmosphere, or movement and mixing of water masses in the ocean, or vertical and lateral movements of a subcrustal material in the earth's mantle.
- Convention:** formal agreement, often involving different countries.
- Convergence:** come together and meet at a point.
- Coral reef:** complex tropical marine ecosystem dominated by soft and hard (stony) corals, anemones and sea fans. Stony corals are microscopic animals with an outer skeleton of calcium carbonate that form colonies and are responsible for reef building.
- Coralline:** made of coral.
- Crustacean:** animal, usually aquatic, with two pairs of antennae on the head, jointed legs and a hard shell.
- Current:** flow of air or water in a given direction.
- Deforestation:** clearing of trees.
- Delta:** fan-shaped, depositional area formed at the mouth of a river.

- Demersal:** (fish) found near the sea/ocean bottom.
- Diatom:** unicellular algae with shells made of silica.
- Dinoflagellate:** marine plankton that include luminescent forms, important in marine food chains.
- Divergence:** act of going in different directions, branching off.
- Dredging:** excavation, scraping, digging, draglining, suction dredging to remove sand, silt, rock or other underwater sea bottom material.
- Drift net:** fishing net often miles in extent arranged to drift with the tide or current and buoyed-up by floats or attached to a boat.
- Dune:** accumulation of wind-blown sand in ridges or mounds that lie landward of the beach and usually parallel to the shoreline.
- Earthquake:** violent tremor of the earth's crust which originates naturally and below the surface.
- Ecosystem:** organisation of the biological community and the physical environment in a specific geographical area.
- Environmental impact assessment:** detailed studies, which predict the effects of a development project on the environment. They also provide plans for the mitigation of the adverse impacts.
- Equator:** imaginary circle on the surface of the earth, lying midway between the poles.
- Erosion:** wearing away of the land, usually by the action of natural forces.
- Extinction:** dying out of a species.
- Famine:** desperate shortage of food in an area; starvation, hunger.
- Fault:** a fracture plane in rocks, along which the rock-mass on the one side has been moved relative to the rock-mass on the other side.
- Fertiliser:** substance added to the soil to increase its productivity.
- Food chain:** linear scheme of feeding relationships, which unites members of a biological community. The number of stages in a chain does not usually exceed five, and usually involve plants, herbivores and one or two successive sets of predators.
- Food pyramid:** pyramid-shaped diagram which shows feeding relationships within a food chain, e.g. that herbivores are smaller, more numerous and faster breeding than the predators that feed on them.
- Food web:** scheme of feeding relationships, resembling a web, which unite the member species of a biological community, and within which species may occupy different positions during their lives.
- Flotsam:** wreckage or discarded material e.g. garbage, found floating on the surface of the sea or washed up on the beach.
- Frigate:** vessel smaller than destroyer; cruiser; fast sailing ship smaller than ship of line.
- Fringing reef:** coral reef closely associated with the land; it may be joined directly to the beach or separated from the beach by a shallow, narrow lagoon.
- Frontal system:** weather system where there is a line of separation between cold and warm air masses, usually associated with strong winds.
- Furrow:** narrow trench cut by a plough.
- Gabion:** wire mesh rectangular container filled with stones, often used in sea defense structures or to provide slope stability.
- Gene:** unit of hereditary material, which make up a chromosome.
- Geology:** science of the composition, history and structure of the earth's crust.
- Global warming:** an increase in the earth's temperature due to man's activities e.g. the use of fossil fuels, and/or natural processes e.g. air pollution resulting from volcanic eruptions, thus increasing the *Greenhouse effect*.
- Greenhouse effect:** term for the role the earth's atmosphere plays in insulating and warming the earth's surface. Without this effect the earth would be a frozen planet with an average temperature on the surface of about -18°C (about 0°F). The greenhouse effect is a natural function; however, it is impacted by man's activities, which are leading to an increase in the atmosphere of gases such as carbon dioxide, methane, nitrous oxide and water vapor, the so-called "greenhouse gases", which contribute to *Global warming*.
- Groyne:** shore protection structure built perpendicular to the shore, designed to trap sediment.
- Habitat:** usual natural surroundings and conditions of plants and animals.
- Heritage:** something possessed as a result of one's natural situation or birth; something transmitted by or acquired from a predecessor.

Hurricane: intense, low pressure weather system with sustained surface wind speeds that exceed 118 km/hr (74 mph).

Hurricane surge: a rise in the sea surface on an open coast, often resulting from a hurricane.

Indentureship: state of being such that a person is bound to an employer for a given period of time.

Indigenous: native, belong naturally to.

Jetty: structure projecting into the sea for the purpose of mooring boats.

Land reclamation: process of creating new, dry land on the seabed.

Long lining: type of fishing involving a heavy fishing line, which may be several miles long and has baited hooks in series.

Limestone: sedimentary rock consisting essentially of calcium carbonate.

Magma: naturally occurring molten rock, generated within the earth's crust or in the upper mantle and capable of intruding (being thrust into) the earth's crust or penetrating it and erupting through volcanic craters.

Metamorphic rocks: igneous or sedimentary rocks, which have been altered by high temperature, strong pressure or by a combination of these.

Meteorology: scientific study of the weather and of atmospheric processes.

Midden: pile of refuse.

Middle Passage: the Atlantic crossing between Africa and the Americas where countless enslaved Africans died en route.

Mid-ocean ridges: a common name for a 60,000 km-long system of ridges on the sea floor separating crustal plates; divergent boundaries (see *Divergence*) in *Plate tectonics*.

Migration: act of moving from one region to another especially at regular seasonal intervals.

Millennium: one thousand years.

Mitigation plan: a proposal to reduce or alleviate potentially harmful impacts.

Mollusc: common name for members of a phylum (sub-section of the animal kingdom) of soft-bodied animals, with bodies usually covered by a hard external shell. Some molluscs, like the octopus, do not possess a shell.

Monitoring: systematic recording over time.

Mythology: system of traditional stories embodying ancient religious ideas.

Neap tide: tide of small range occurring twice per lunar month during quarter moon phases. See also Tide.

North-east Trade Winds: dominant wind regime in the Caribbean region, the winds blow from directions between north and southeast.

Nuée ardente: cloud of superheated gases generated during a volcanic eruption.

Nutrient: dissolved salts essential to life.

Ozone layer: a layer of the atmosphere between 10 and 40 km above the earth's surface, called the stratosphere, where ozone molecules absorb dangerous ultraviolet radiation from the sun.

Peat: fibrous substance formed of partly decayed plant material.

Pelagic: (fish) which inhabit the main body of the water mass.

Pesticides: chemical substances used for destroying animal pests in agriculture, forestry, warfare and home gardens.

Petroglyphs: drawings or carvings, usually on the surface of rock or caves, created by past civilisations.

Photosynthesis: process by which green plants form organic compounds from water and carbon dioxide in the presence of sunlight.

Plate tectonics: geological theory whereby the earth's crust and the upper mantle is divided into seven large and a few tens of small plates, which float on the middle mantle and much of the earth's seismic and volcanic activity occurs at convergent (see *Convergence*) or divergent (see *Divergence*) boundaries of these plates.

Pollution: the action of contaminating (an environment) especially with man-made waste.

Polyp: sedentary form of aquatic animal.

Proclamation: formal announcement.

Productivity: the quantity of organic matter (in the form of living matter, stored food, waste products, and material taken by consumers), or its equivalent in dry matter, carbon or energy content, which is accumulated during a given time period.

Protocol: first draft agreement for a treaty; rules of diplomatic procedure.

Protozoan: animal consisting only of one cell with a well-defined nucleus.

Revetment: shore protection structure made with stones laid on a sloping face.

Rift valley: valley formed by sinking of land between two faults.

Salinity: proportion or amount of salt in water.

Saltpond: low, wet area periodically or continuously flooded by brackish or salt water to a low depth, characterised by specific plants such as grasses, low plants and sometimes mangroves.

Sand: rock particles, 0.08-4.6 mm (0.003-0.18 inches) in diameter.

Sand mining: removal of large or small quantities of sand from the beach, by machine or by hand, usually for building purposes.

Sea level: average height of the sea surface, usually measured over a period of years.

Seagrass bed: area of the offshore sea-bottom colonised by seagrasses.

Seawall: massive structure built along the shore to prevent erosion and damage by wave action.

Sediment: particles of rock covering a size range from clay to boulders (0.004 mm to 256+ mm).

Sedimentary rocks: rocks, which have been deposited in layers, often by water, and consist of material worn away from pre-existing rock.

Seismology: science of earthquakes.

Shore: narrow strip of land in immediate contact with the sea.

Silt: fine rock particles, 0.004-0.08 mm (0.00015-0.003 inches) in diameter.

Sonar: apparatus emitting high-frequency sounds used in locating objects under water by measuring direct and reflected sound pulses.

Spring tide: tide of large range occurring twice per lunar month during full and new moon phases. See also *Tide*.

Storm surge: a rise in the sea surface on an open coast, often resulting from a hurricane.

Subduction: the process whereby the edge of one crustal plate descends below the edge of another.

Swamp: low-lying area, frequently flooded and supports vegetation adapted to saturated soils e.g. mangrove swamp.

Swell: waves that have traveled out of the area in which they were generated.

Symbiosis: association of dissimilar organisms to their mutual advantage.

Tectonic: natural processes that build up the earth's crust and are responsible for its various deformations.

Tide: periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.

Topography: configuration of a surface including its relief and the position of its natural and man-made features.

Toxic waste: poisonous products.

Transform boundary: a boundary between two crustal plates formed as they slide past one another in opposite directions without converging (see *Convergence*) or diverging (see *Divergence*).

Trawler: fishing vessel that uses an open-mouthed fishing net drawn along the sea bottom.

Tropical storm: low pressure system forming in tropical latitudes with sustained surface wind speeds between 61 km/hr and 118 km/hr (38 and 73 mph).

Tsunami: wave caused by underwater earthquake or landslide, can rise to great heights and cause catastrophic damage near coasts.

Turbulence: a state or quality of being violently disturbed or agitated.

Volcano: mountain or hill built up by the eruption of molten rock and ash from the earth's interior.

Weather: condition of the atmosphere at a certain time and a certain place.

Wind waves: waves formed in the area in which the wind is blowing.

Subject index

- A**griculture 8
- Algae 34
- Amerindians 2
- Artists 16

- B**arometric pressure 9
- Bananas 18
- Beaches 22, 24-28, 32, 42
 - Accretion 26
 - Changes 24
 - Conflicts 28
 - Erosion 26, 27, 50, 57
 - Nourishment 28
 - Observations 28
 - Structures (see Sea defences)
 - Types 24
 - Users 25, 29
- Biological diversity 45
 - Convention on 45, 47, 54
- Birds 32, 33, 39
- Bivalves 26
- Boat races 21
- Boats 20, 23, 27, 32, 33

- Building construction 26, 33

- C**anary Current 7
- Caribbean Sea Project 57-58
- Cartagena Convention 53
- Cliffs 24, 50
- Climate Change 47
 - Framework Convention 47-48
- Columbus, Christopher 2, 11, 16
- Commensalism 35
- Community management 29, 49, 58, 59
- Conch 32, 33, 40
- Conflict resolution 25, 28, 29, 59
- Conservation 49
- Conventions, international 45-48, 52-53, 54, 55
- Coral bleaching 36
- Coral reefs 1, 18, 19, 22, 24, 27, 32, 33, 34, 41, 49
 - Atolls 41
 - Barrier reefs 41
 - Fringing reefs 41
- Currents, oceanic 7

- D**eforestation 1, 45
- Diatoms 34, 36
- Disasters 9, 22, 31, 57

- Divers 27, 29, 30
- Dunes 25, 28
 - erosion 25, 50

- E**arthquakes 4, 5, 9
- Economics 22, 27, 31, 33, 39, 47, 57
- Ecosystems 34, 37, 45, 47
- El Niño 7, 8, 26
- Environmental impact assessment 26
- Equator 6, 9
- Equatorial Current 7

- F**amine 1
- Faults 5
- Fertilisers 18
- Fish 23, 32, 38, 42, 43
 - Habitats 23, 38, 42
 - Species 23, 32, 38, 42, 43
 - Stocks declining 23
- Fishers 8, 9, 20, 25, 28, 29, 32, 33, 55
- Fishing 8, 20, 23, 27, 50, 59
 - Anchovy 8
 - Artisanal 20, 50
 - Bleach 27
 - Commercial 23
 - Drift net 23
 - Dynamite 23, 27
 - Foreign 23, 59
 - Long lining 23
 - Trawlers 23
- Floods 8, 38, 47
- Florida Current 7
- Food chains 35, 36
- Food webs 35, 36, 37
- Forest fires 8, 47
- Forests 22
- Forts 17
- Frontal systems 26

- G**eology 4-5, 24
- Gommier tree 20
- Global Environmental Facility 48
- Global warming 8, 47-48
- Greenhouse gases 47-48
- Groundwater 18
- Gulf Stream 7

- H**uman rights 57
- Hurricanes 8, 9, 12, 13, 24, 25, 26, 28, 38, 42, 47, 57

- I**ce Age 2
- Indigenous people 2, 16
- Intergovernmental Panel on Climate Change 47

- J**ellyfish 40, 51
- Jetties 26

- L**a Niña 8
- Law of the Sea 52

- M**angroves 24, 34, 38, 42, 49
- Marine parks 49
- MARPOL (Convention for the Prevention of Pollution from Ships) 55
- Metamorphic rocks 5
- Middle Passage 16, 31
- Mitigation plan 12, 13
- Molluscs 25

- N**orth Equatorial Current 7
- North-east Trade Winds 6

- O**cean, International Year of 31
- Oil 22, 23, 31
 - Exploration 22, 31
 - Refinery 22, 31
 - Tankers 22
- Ozone layer 48

- P**angaea 4
- Parrotfish 42
- Pesticides 1, 18
- Petroglyphs 2
- Pirates 16
- Planning 28, 29
- Plate tectonics 4-5,
- Photosynthesis 35
- Plankton 35
- Poems 3, 14-15, 51
- Pollution 22, 23, 27, 50, 51, 54, 55
 - Land-based 23, 27, 51, 54
 - Oil pollution 22, 54, 55
 - Water pollution 22, 50
- Population 12
- Protected areas 54

- R**ecreation 25, 42
- Rift Valley, African 4
- Rivers 1, 18, 22

- S**an Andreas Fault 5
- Sand mining 22, 25, 33
- Sargasso Sea 7
- Satellite monitoring 23
- Science 9, 28
- Sea anemones 35, 42
- Sea defences 25, 26, 28
 - Bulkheads 28
 - Groynes 28
 - Seawalls 28
- Sea level 2
 - Rise 26, 47
- Seabed mining 49, 53, 59
- Seagrass beds 34, 35, 40, 49
- Seaweed 30
- Sedimentation 1
- Shell fish 25, 30
- Shrimp 35, 38
- Slavery 1, 2, 16, 31
- Soil erosion 18
- Songs 3, 6, 16, 18, 22, 43
- Springs, hot 5
- Sustainable development 55-57
- Symbiosis 36

- T**aino 2
- Tides 9, 13, 38
 - Diurnal 9
 - Neap 9
 - Range 9
 - Spring 9
- Tourism 16, 22, 25, 27, 29, 57
- Toxic wastes 1
- Trade 18, 20
- Tsunamis 10-12, 13
- Turtles 23, 32, 40, 51

- V**egetation 25, 28, 47, 50
- Volcanoes 4, 5, 9, 10

- W**arning systems 13
- Waves 24, 26, 27, 42
- West Indian Federation 2, 3
- Whales 20, 23, 34, 36, 45
- Winds 6, 8, 9
- World Conference on Science 57
- World Heritage Site 17

Location index

- A**frica 7, 8, 16, 47
- Alaska 12
- Aleutian Trench 5
- Anguilla 20, 21
- Antarctic 7, 8
- Antigua and Barbuda 17, 21, 25, 39
- Arctic 7, 8
- Atlantic Ridge 5
- Australia 8, 12, 41

- B**ahamas 2
- Barbados 2, 5, 11, 13, 20, 21
 - Scotland District 5
- Belize 2, 41
- Bequia 20
- Bering Straits 1
- Brazil 45
- British Virgin Islands 12, 20, 41
- Burundi 4

- C**anouan 20
- Carriacou 20
- Columbia 53
- Cuba 2, 11, 12

- D**ominica 2, 5, 7, 13, 17
- Dominican Republic 17

- E**urope 8, 16

- G**reat Britain 2, 9, 12, 18
- Grenada 12, 13, 20, 24
 - Kick 'em Jenny 5, 10
- Guadeloupe 12
- Guyana 2
 - Kaiteur Falls 4

- H**aiti 12, 55
- Hawaii 12
- Hispaniola 2
- Honduras 47

- I**ndia 16, 18
- Indonesia 8, 12

- J**amaica 11, 12, 24, 55
- Japan 12, 13, 30

- K**enya 4
- Korea 30
- Krakatoa 12

- M**aldives 41
- Martinique 5, 12
 - Mount Pelée 5, 12
- Middle Passage 16, 31
- Montserrat
 - Soufrière 5
- Mozambique 4

- N**evis 5,

- O**rinoco Island 11
- Orinoco River 2

- P**eru 8
- Portugal, Lisbon 11, 31
- Puerto Rico 5, 12
 - Puerto Rican Trench 5

- R**ed Sea 4
- Rift Valley, African 4
- Rwanda 4

- S**t. Lucia 20, 22
- St. Martin 20
- St. Thomas 12
- St. Vincent and the Grenadines 2, 5, 20
 - Soufrière 5
- San Andreas Fault 5
- Sargasso Sea 7
- South Africa 9

- T**anzania 4
- Trinidad and Tobago 2, 4, 5, 12, 13, 17, 20, 21, 24, 25, 41
- Turks and Caicos Islands 50

- U**nited States of America 53
- United States Virgin Islands 12, 20

- V**enezuela 2, 11, 52
 - Angel Falls 4

- Y**ucatan Channel 7

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