BENEFITS, THREATS AND SOLUTIONS

THE VALUE OF CORAL REEFS WORLDWIDE

Coral reefs enrich the life of our oceans. They provide food and shelter to countless thousands of species of plants and animals, and they exchange energy and nutrients with other marine ecosystems, such as the open ocean.

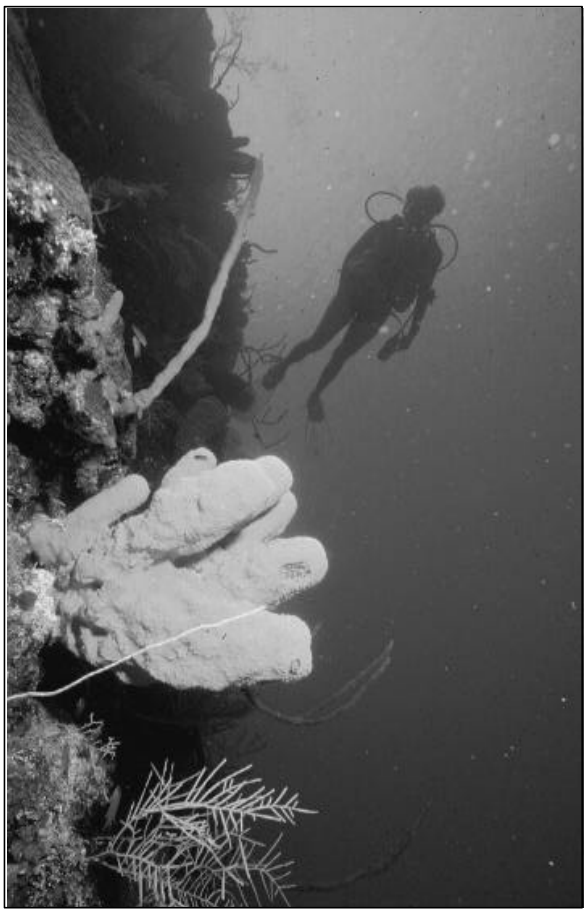


Figure 3-1. Scuba diver on the Cayman Wall. (Photo from DOE collection).

But people also directly benefit from reefs in many ways. Coral reefs break waves, protecting shorelines from erosion and keeping beaches and coastal communities intact.

Healthy coral reefs supply finfish and shellfish upon which many national economies depend. Reef-dependent fisheries include subsistence (providing a protein source in coastal people's diets), commercial (providing jobs through supplying the world market demand for fish), recreational (providing jobs through fishing and tourism), and ornamental (providing jobs and income for tropical fish gatherers). The world consumption of seafood exceeds that of either pork or beef.

Tourism is also an economic mainstay for many countries with coral reefs, as people come to dive, snorkel, boat and fish. There are an estimated four million divers around the world, many of whom make more than one dive trip each year (Figure 3-1). The Florida Keys and many other coral reef areas are economically dependent upon their reefs for tourism and fishing. In the Caribbean, coastal tourism generates about US $7 billion each year.

Treatments for cancer, AIDS, infection, arthritis, asthma, herpes, and even broken bones are being discovered in coral reef ecosystems around the world. For example, compounds derived from Caribbean sponges are being used in the treatment of cancer and herpes simplex (Figure 3-2). Compounds from sea squirts have been useful in treating tumors, viruses, and immune-related illnesses. Hard corals are being used to replace shattered bones as the human body more readily accepts coral than artificial replacements.

Many commercial products are also derived from coral reefs. Calcium carbonate from the skeleton of coral animals is used to produce lime which when added to mortar and cement helps it set more quickly. The internal shell of the cuttlefish, called cuttlebone, is sold in pet stores to cut calcium deficiency in the diet of pet birds. Chitin, derived from the shells of shellfish, crabs, lobster, and shrimp, is a component of chitosan, which is used in violin varnish to make it dry hard to provide good tone.

Much can be learned from reefs about historical conditions in the marine environment. Annual growth bands, elemental ratios, and isotopic signatures can be used to infer past sea levels, growing conditions, the effects of environmental management and other important phenomena.

Figure 3-2. Caribbean sponges are used in the treatment of cancer and herpes simplex. (Photo by Dept. of Environment).

The beautiful sand that makes up the beaches of tropical islands is another benefit from coral reefs, formed by the breakdown of dead corals and algae by reef life.

Like rainforests, wetlands and grasslands, coral reef ecosystems are integral parts of a healthy environment for all of the Earth's living creatures, including people.

THE VALUE OF CAYMAN'$ CORAL REEF$

The coral reefs around the Cayman Islands have made these islands world famous, providing substantial economic benefits to the country. They serve as a major attraction for thousands of residential and visiting divers, snorkellers and anglers. Cayman's reefs are still relatively healthy and for this reason Cayman has maintained its position as one of the world's best dive spots. Approximately 75-85% of our visitors ultimately dive or snorkel while on vacation in Cayman. The Madigan Pratt Report, *Diving in the Cayman Islands*, estimated in 1994 that between 30-40% of those surveyed, come here primarily to dive. In 1993 dive tourism contributed CI $69 million (US $86 million) to Cayman's total tourism revenue of CI $224 million (US $280 million).

Healthy coral reefs sustain fisheries by providing habitat and food for important marine species. Reef species of commercial importance such as snapper, grouper, lobster and turtles we see when diving and snorkelling have provided food for many generations of Caymanians, and also millions of tourists who visit our islands each year.

Our coral reefs are also environmentally beneficial by providing shoreline protection against the erosive powers of storms and wave action. When reefs are healthy they act as natural self-repairing breakwaters, which is particularly vital on coastlines that are subject to hurricanes.

Reefs are also extremely important to our islands by providing beach sand through the breakdown or erosion of dead coral and algae by wave action. Burrowing animals such as worms, sponges, and bivalves make their homes by boring into the reef and in turn create sand that eventually gets deposited on the shore. Sand is also generated by certain species of fish (e.g. parrotfish) that eat algae and deposit sand grains on the reef. Our world-renowned Seven Mile Beach is a result of years of sand generation on our reefs and subsequent deposition on our shores.

The coral reefs around the Cayman Islands provide natural and economic benefits to the people of these islands. They protect us from storms and hurricanes, maintain fascinating marine life and fisheries that provide us with food and jobs, and enable us to earn valuable tourist dollars. National and global accounting systems frequently fail to recognise that reefs have an economic value. Nevertheless, this economic value is a powerful argument for conserving them. Their health and survival should therefore be a priority in our daily lives through national protection and conservation efforts.

DID YOU KNOW? The historical use of coral limestone in wattle and daub house construction is important in Caymanian culture. Traditionally daub was made by burning live coral rocks gathered from the reef flats with various woods in a lime kiln. The combination of wattle and daub provided a very strong wall some 4-6 inches thick. This use of coral is now not compatible with our present need to have pristine and diverse coral reefs in order to maintain our tourism industry and local fisheries.

THREATS TO CORAL REEFS

Corals are highly sensitive to environmental conditions. They grow best in shallow, clear water between 68ºF and 84ºF (20ºC and 29ºC) with normal oceanic salinity. Both natural and human-caused (**anthropogenic**) disasters threaten coral reefs worldwide. Today roughly 10% of the world's coral reefs have been degraded beyond repair. Up to 30% may be lost in the next decade if we do not act now to stop the destruction.

Natural Threats

Natural threats to coral reefs that occur on the longer geological time scale include **sea level changes** and **fluctuations in seawater temperatures**. In the shorter time frame **hurricanes, cyclones, abnormal weather patterns, heavy rains** that dilute salinity, **extreme low tides** that dry coral out, **disease**, and **predator population explosions**, such as crown-of-thorns sea stars, all affect coral reef growth, recovery from disturbance and survival.

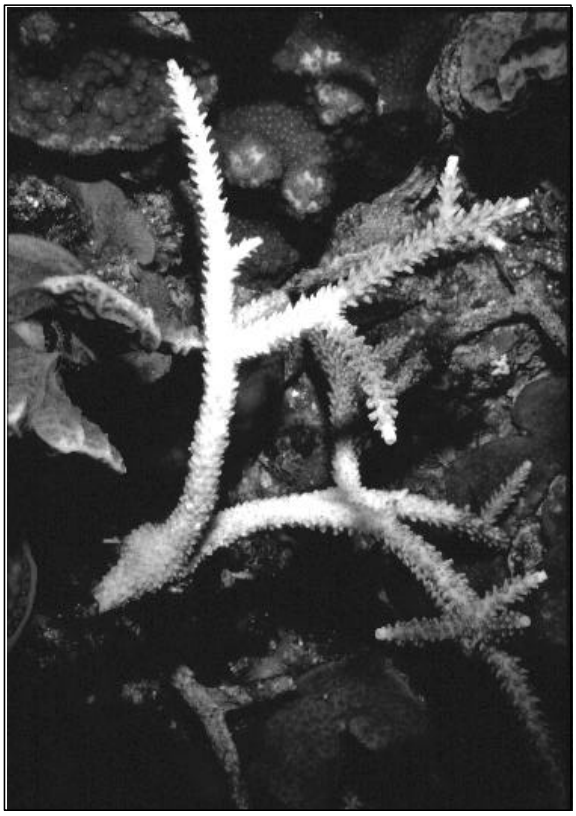
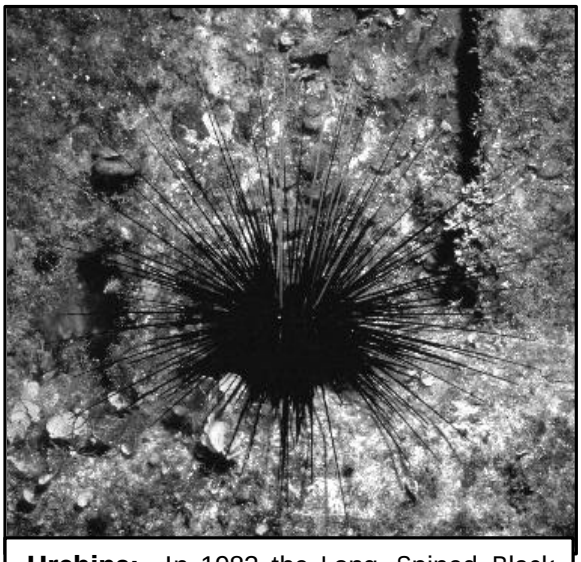


Figure 3-3. White band disease at the bottom of a stag horn coral. (Photo from DOE collection).



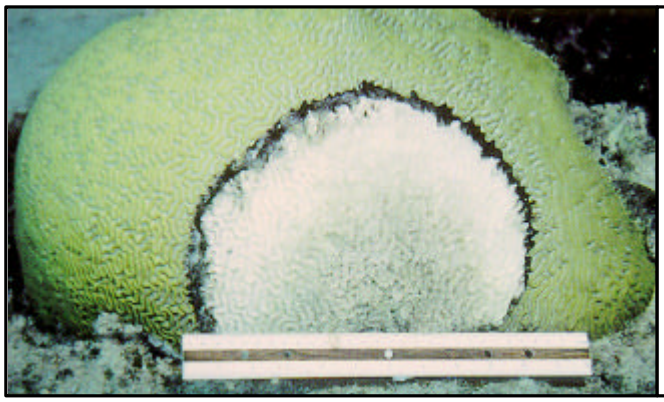
Urchins: In 1983 the Long Spined Black Sea Urchin suffered a Caribbean-wide mass mortality as a result of a waterborne pathogen. Numbers fell so low that the population is only now beginning to recover. However repeat outbreaks are still occurring. These creatures form an important function on reefs by feeding on algae that might otherwise overgrow the slow growing corals. Their disappearance meant that many reefs have been overgrown and killed by algae.

Reefs can sometimes recover from these seemingly disastrous attacks if human-caused stresses do not impede their recuperation process.

Human-Caused Threats

- **Global Warming - the Greenhouse Effect**

Greenhouse gases (carbon dioxide, methane, nitrous oxide and chlorofluoro-carbons) are accumulating in the atmosphere, trapping the heat from the sun and causing the Earth's atmosphere to become abnormally warm. These gases are increasing as people burn more fossil fuels for energy and cut down carbon-dioxide absorbing forests. The resulting increase in sea temperatures, sea levels, and violent storms negatively affect corals. The weakened coral then becomes more susceptible to disease (Figure 3-3). One of the effects, **coral bleaching**, (see box overpage) results when corals are stressed with higher than normal sea temperatures.



BLACK BAND DISEASE is an infectious disease of corals. The live coral tissue becomes infected with microorganisms that form a black ring that spreads over the coral killing it. Black band occurs at low levels naturally on the reef, however in stressed areas infections can reach epidemic proportions rapidly destroying huge areas of healthy reefs. As the world's oceans continue to become more polluted so do the levels and types of disease.

FACT: Climate change is a natural phenomenon that has been responsible for the Ice Ages and the interim warmer periods. There is a natural greenhouse effect that keeps the earth warmer than it otherwise would be. However, emissions from human activities are substantially increasing the atmospheric concentration of greenhouse gases, and have led to warmer global temperatures, thus the term **global warming**. Since 1860, around the start of the Industrial Revolution in Europe, there is evidence of human-induced warming of the earth's surface by 0.5ºC, which has caused mean sea level to rise by 15cm. The "business-as-usual" scenario (i.e. no change in current CO_2 emissions) produced by the Intergovernmental Panel on Climate Change (IPCC) forecasts that global mean surface air temperature will rise between 1ºC and 5.5ºC by 2100, while sea level will increase between 20-70cm by mid-2000. The ramifications of this warming effect will be the melting of the polar ice caps and sheets, subsequent influx of freshwater, and changes in salinity which all influence growth conditions of coral reefs. Global warming has far-reaching environmental, social, economic and political implications, especially for coastal areas and small islands. Hard engineering solutions to keep sea level rise and associated impacts at bay are temporary and could have potentially more harmful effects by disrupting dynamic natural processes even further.

CORAL BLEACHING is now almost certainly linked to extreme fluctuations in water temperature. Corals react by expelling their endosymbionts, leaving a white patch on corals. Sometimes, the whole colony may be bleached and may even die. In extreme cases, particularly during the hottest months from August to October whole tracts of reefs may appear bleached. In 1987 and 1996 reefs in Cayman experienced significant levels of coral bleaching when our sea temperatures rose approximately 1-2ºC above normal for an extended period of time. Normally sea temperatures in Cayman range between 25ºC and 29ºC.

- **Harmful Fishing Practices**

While coral reefs cover a global area approximately the size of Texas, they are home to over 25% of the marine life in the world's oceans, including nearly one-third of the world's fish catch. Coral reefs provide habitat for marine life, such as fish, turtles, octopus, bivalves (mussels, clams), gastropods (snails, conchs), spiny lobster, shrimp, echinoderms (sea cucumbers, urchins). These are sources of food and income for many coastal people, as well as large commercial fishing operators. Around the world, more and more fisheries are collapsing (species of fish are disappearing from many areas) due to damaging fishing techniques and over-fishing (more fish being harvested than the area can reproduce). Over half of the known spawning aggregations of Nassau grouper in the Caribbean have now disappeared due to over-fishing.

Figure 3-4. Fish trap. (Photo from DOE collection).

In many places, traditional fishing methods have been replaced with super-efficient modern technologies, often with damaging long-term effects. The introduction of motorised boats and SCUBA gear, such as masks and fins, has increased the catch, often to unsustainable levels. Biodegradable traps and nets woven from vegetable fiber or coconut fronds have been replaced with non-biodegradable nylon, metal and wire(Figure 3-4). When lost these nets often become dangerous: entangling and injuring or killing marine life, breaking corals, or continuing to catch fish that will never be collected.

In Cayman, traditional small, single-funnel traps are being replaced with large double-funnel traps with small mesh size. These traps can collect large numbers of the small grazers that are important for cleaning and maintaining the reef. Coral reefs are then more likely to become overgrown with rapidly-growing algae with the absence of these herbivores.

Cyanide poison is used by fishers in Indonesia, the Philippines, and other island nations to stun fish, making them easier to catch. **Chlorine bleach** and **quinaldine** are used in the United States. Hunting for food or aquarium fish, the fishers shoot the chemical solutions at reef fish or into coral enclaves where they live. The poisonous residue kills coral, invertebrates, and other fish.

Fishers in the Pacific and southeast Asia often blast reefs with **dynamite** or other explosives that rupture fishes' air bladders so they can scoop them up as they float to the surface. The explosions destroy reef formations, kill non-target fish (by-catch), and often kill or maim the fishers themselves.

Some fishers also use **'Muro-Ami'**, which is the name of the net that fish are driven into when hundreds of boys pound on the coral and wave white plastic streamers. Again, this technique damages the coral and results in huge quantities of by-catch.

- **Mariculture**

Mariculture, the farming of marine plants and animals, is becoming more popular in the tropics, often in response to the loss of wild stocks. Giant clams, fish, conch, seaweed and shrimp, are among the many farmed species. Unfortunately, while mariculture provides a means of employment and reduces pressure on overexploited stocks, it can have a negative impact on the reef. In many areas, entire mangrove forests have been bulldozed to make shallow ponds for these farms, eliminating juvenile fish nurseries and habitat for marine birds and animals. In addition, these farms siphon already short fresh water supplies, poison the water with chemicals and antibiotics, and cause a decrease in wild fish populations. Ultimately, the coastal people are left with little

protein source since they are unable to afford the mariculture product.

The Cayman Turtle Farm is Cayman's only commercial mariculture establishment and is the only captive breeding site of green sea turtles in the world.

- Damage from Boats

In areas that are popular with recreational, diving or fishing boats, the reef is subject to damage from accidents and carelessness. Anchors and chains dropped onto the reef destroy the fragile coral (Figure 3-5), dislodging entire coral colonies and killing the thin veneer of living tissue. The absence of mooring buoys can result in damage from anchors. While the Cayman Islands' Department of Environment provides over 250 public moorings around the three islands, the health of the reefs at popular dive sites depends upon charter operators using these moorings. Boats and ships that run aground on the reef can destroy hundreds of corals in an instant. Propellers churn up sediments that smother the reef. Boat bilges and toilets are discharged, dumping an overload of algae-causing nutrients into the water. Some cruise ships and recreational boats have been documented dumping their trash overboard, despite international laws against ocean dumping. The Cayman Islands is party to the International Convention for the Prevention of Pollution from Ships known as MARPOL.
In Cayman, cruise ships are responsible for major damage to the coral reef in the George Town Harbour and Spotts docking area. In George Town Harbour, for a distance of over 1½ miles the medium and deep reefs are 97% bare rubble due to the damage caused by cruise ship anchors. One cruise ship in a single day destroyed an area of untouched reef the size of five tennis courts during one anchoring event at Spotts Reef. Eighteen months later there was still no sign of new coral growth. Therefore the need for permanent mooring buoys for cruise ships is crucial to the survival of the remaining reef.

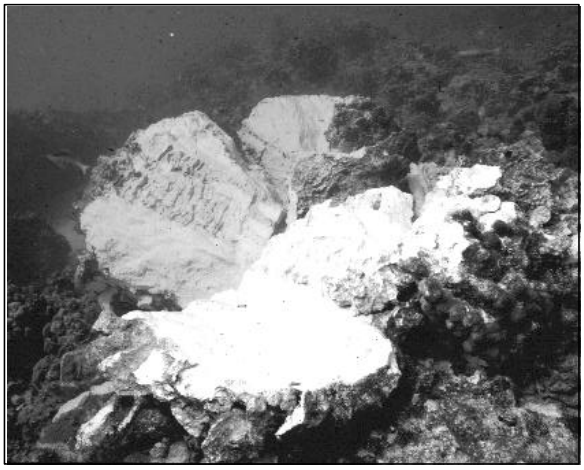


Figure 3-5. Massive coral broken in half by boat anchor. (Photo from DOE collection).

- **Damage from Divers**

Although recreational divers are often the greatest advocates for protection of coral reefs, careless diving can present a hazard to the ecosystem. Popular dive spots often attract more visitors than is healthy for the area. Grand Cayman's ten most popular dive sites, the majority of which are located on the west side of the island, receive between 10,000 and 20,000 dives each year. These numbers are well in excess of the suggested sustainable carrying capacity of only 2500 dives per site per year derived from a study of Bonaire's reefs.

Unscrupulous dive charters may also use food to lure fish or stingrays toward their customers, disrupting their normal feeding and behaviour patterns. Divers and snorkellers who take souvenirs, touch coral, let their fins and other equipment bash into it, or even kick up excess sediments contribute to the demise of the very

Figure 3-6. A careless diver grabs a coral head. (Photo from DOE collection).

reef they came to enjoy. Data from the Department of Environment's Diver Impact Study show that divers can and do have a significant influence on coral communities they visit and the level of impact is related to the diving intensity for each site.

- **Coral Mining**

Coral mining is a problem in countries with few resources for construction. Iron bars are used to dismantle entire sections of reef to build roads, walls, homes and office buildings.

- **Coral Harvesting**

Coral is also harvested to make jewelry, gift store curios, coffee table knickknacks, and aquarium habitat. Under optimum conditions, many corals take tens to hundreds of years to regenerate.

DID YOU KNOW? The Cayman Islands have Marine Conservation legislation which make it illegal to take any marine life anywhere while on SCUBA or to take any corals, sponges, etc. from Cayman waters.

- **Pollution**

Approximately three-quarters of marine pollution originates from the land. After it rains, storm water run-off carries trash, oils, chemicals, particle emissions from factories and automobiles, and other undesirables from the land (especially from streets and parking lots) enter the sea. These substances make up nearly half of the overland run-off that contributes to marine pollution. Fertilisers, pesticides, and herbicides from agriculture also wash out of fields into streams and into the ocean, along with animal droppings, soil, leaves and litter. **Chemicals**, such as chlorine-based cleaning solutions, PCBs and DDT, heavy metals, and minerals from mining and other industrial pollution are known to be poisonous to marine animals.

Insufficiently treated or raw **sewage** introduces excess nutrients on the reef. Algae, as a natural part of the reef system, use these nutrients to support their growth. In a short period of time the presence of excess nutrients proliferate the growth of nuisance species of algae, which can cover significant areas of coral.

Warm water discharges from power and desalination plants cause corals to bleach. Large sections of reef off Guam and Taiwan have been destroyed by this **thermal pollution**.

Corals are vulnerable to **oil pollution** caused by spills, leaks in tanks or pipelines, ships flushing their tanks and bilges, offshore oil exploration and land-based sources, such as refineries and gas stations. Roughly 147 million gallons of crude and waste lubricating oil are illegally discharged into the Caribbean annually. The Cayman Islands are classified as a "high risk area" for a major oil spill as tankers carrying 4½ million gallons of crude oil pass these Islands daily.

Trash from fishing vessels, cruise ships, recreational boaters, ocean dumping and beach visitors inflicts damage on beaches, reefs, and marine animals. Some turtles and seabirds

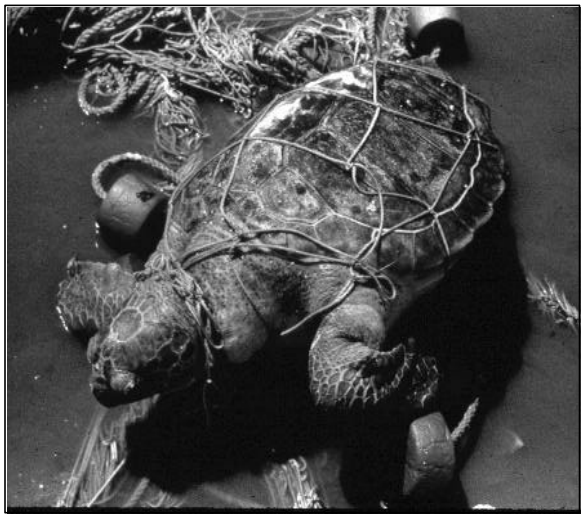


Figure 3-7. Turtle caught in discarded net. (Photo from DOE collection).

often make the deadly mistake of eating plastic bags and debris because it resembles one of their favourite foods, jellyfish. Every year many marine animals and fish are entangled in nylon fishing nets, six-pack rings and other garbage. The threat of marine debris is more far-reaching than most people realise: in 1991, over 950 pieces of trash were found on a 1½ mile stretch

of beach on an atoll in the Pacific some 3,000 miles from the nearest continent.

Radioactive pollution, including nuclear bombs, accidents and leaks at nuclear power plants, and nuclear testing, whether atmospheric, underground or underwater, all are known to kill a wide range of reef life.

DID YOU KNOW? Many industrialised countries such as France ship their nuclear waste through the Caribbean via the Panama Canal for disposal in other countries like Japan.

- **Deforestation and Mangrove Reclamation**

Over half of the world's original coastal marshes and mangrove forests are now farms, industrial parks and residential areas. The clearance of mangroves associated with **development** projects not only destroys mangrove habitat but also damages coral reefs offshore. When these projects involve activities like dredging and infillling, they can completely destroy reefs. The destruction of mangroves and seagrass beds may have a significant impact on neighbouring reefs when increased siltation and disruption of nutrient cycling and other essential processes occur. Degraded coral reefs are more susceptible to disease and either take longer to recover from a disturbance or never recover at all. In turn the effectiveness of the reef in providing vital habitat and shoreline protection is severely reduced.

- **Dredging**

Dredging is the removal of material from the sea floor using cutter and suction dredges or hydraulic excavators. It is typically carried out to clear channels for shipping, marinas, and ports, or to mine coral rock, sand or marl for a variety of uses on land. These activities cause immediate and long-term impacts on the marine environment and related organisms. In Cayman, dredge-and-fill operations since the late 1960s have been responsible for mangrove habitat destruction as these wetlands are reclaimed and converted to canal lot developments. Another widespread and visible consequence of dredging is the generation of excess silt in the water known as **turbidity** (Figure 3-8). Turbidity has both acute (short-term) and chronic (long-term) effects. In addition, artificially created channels and canals can damage corals, as they not only trigger changes in water circulation, tidal flow, and water levels, but allow saltwater intrusion and augment the likelihood of anoxic waters in canal beds.

Figure 3-8. Sediment plume associated with dredging in North Sound, Grand Cayman. (Photo from DOE collection).

FACT: The North Sound has a long controversial history of dredging for marl that has created numerous borrow pits. There is evidence today of serious damage as a result of such activities. The water is permanently murky due to the continuous resuspension of dredged sediments. Since the 1970s, boats traveling through the North Sound have left behind trails of silt stirred up by their propellers, which has been compounded in recent times by increasing boat traffic as sediments are unable to settle out or be stabilised by the seagrass. Very little recovery or recolonisation of marine organisms has occurred in or near dredged borrow pits. There has been a decline in seagrass health and it is believed that coral reef health has also been affected by years of fairly continuous dredging in this lagoonal ecosystem. The effects of chronic sedimentation on the survival of larval stages if many fish, molluscs (eg conch) and crustaceans (eg lobsters) are unknown.

- **Channel Creation**

Cutting channels through the reef stirs up silt causing immediate damage to the area and changes the flow of currents which can have far-reaching and unpredictable effects on shorelines and reefs. These include changes in beach dynamics and movement of sand from the beaches back out to sea. Recent examples in Cayman of widening and deepening channels through the reef have resulted in the creation of dangerous currents and severe beach erosion, such as that at the Bodden Town Public Beach (Figure 3-9).

Figure 3-9. Bodden Town Beach erosion. (Photo from DOE collection).

MANAGING CAYMAN'S MARINE ENVIRONMENT

The **Marine Conservation Law** and the **Marine Parks Regulations** together comprise the main management strategy currently in use to protect and manage the marine environment of the Cayman Islands.

The Marine Conservation Law

The Marine Conservation Law of 1978 prohibits the taking of any marine life while on SCUBA and outlaws the use of noxious substances for the taking of marine life. It also sets a catch limit for queen conch, and a catch and size limit and a closed season for spiny lobsters. Under the Law the use of spearguns and nets is regulated, the collection of coral and sponges is banned, and the displacement or breaking of any coral or underwater plant formation during construction or dredging is prohibited unless licensed by government. There is a restriction on the taking and export of marine species, and the discharge of harmful effluent and raw sewage into the sea is illegal. Regulations are in place protecting female sea turtles and their eggs during the months of May through September. In recognition of the significant role which turtle fishing plays in the history and culture of the Cayman Islands, traditional fishermen can apply for a licence which permits them to take with a net up to six turtles per year in specified areas during the open season, November through April. Size limits also apply. The Cayman Islands Turtle Farm has a release programme where yearling and hatchling turtles are returned to the wild each year; since 1980 over 22,000 turtles have been released locally.

Coxswain Bank, roughly 3 km off the east coast of Grand Cayman, and similar areas off the east coasts of Cayman Brac and Little Cayman are restricted fishing areas. Nassau grouper congregate on the banks every year at the same time to spawn; only local fishermen are permitted to enter the area and they may only use hand lines. The Department of Environment has been collecting data on the grouper fishery for nearly a decade and has used these data to produce a management strategy which is currently being considered for implementation by government.

Marine Parks

In 1986, after a period of public consultation and in recognition of the need for even greater protection of the marine environment, Marine Parks were established in the three Cayman Islands. The **Cayman Islands Marine Parks** system utilizes a zoning technique in order to cater as much as possible for traditional activities, and to attempt to reduce user conflicts. Three types of zones were established: Marine Park Zones, Replenishment Zones and one Environmental Zone.

Marine Park Zones were created to protect the coral reefs and associated marine organisms in our most heavily used diving areas. In all cases the designation extends from the mean low water mark to the dropoff, or 80ft depth contour. In these zones, taking of marine life, alive or dead, is prohibited except that line fishing from

shore and beyond the dropoff is permitted. Seine nets, spearguns, pole spears and fish traps are totally prohibited. Anchoring is also prohibited except that boats 60ft or less may anchor in the sand as long as neither the chain nor the rope lies on the coral. Anchoring is also permitted within the designated Port Anchorage area.

Replenishment Zones were created in an attempt to ensure protected breeding and nursery areas for marine life, especially the queen conch and spiny lobster. Spearfishing and fishtraps are strictly prohibited in these zones but anchoring and line fishing are allowed. All Replenishment Zones occur within the shallow water lagoons, or sounds, and the designation extends from the mean low water mark to the edge of the outer edge of the fringing reef. The Department of Environment undertakes annual surveys of the shallow water conch populations in an effort to gauge the effectiveness of these zones. Results to date indicate that conch populations in the sounds are not increasing and may be decreasing. Further management initiatives such as reducing catch limits and establishing a closed season are necessary.

In an attempt to ensure the preservation of a portion of the undisturbed mangrove-fringed North Sound environment, a single **Environmental Zone** was established. All fishing and anchoring are prohibited and no in-water activities are allowed. A speed limit of five knots or less applies in the zone. The zone encompasses all of Little Sound and extends to the limit of tidal influence in the fringing mangrove.

DID YOU KNOW? Directives issued by the Marine Conservation Board making spearfishing a licensed activity were passed simultaneously with the Marine Parks legislation. Applicants must fulfill certain age and residency requirements and must produce a clean Police Record.

After the introduction of the Marine Parks legislation, the Cayman Islands Government financed the implementation of a system of permanent moorings for dive boats and recreational vessels: there are now over 250 such moorings in the Cayman Islands.

In 1988 new regulations were passed making it an offence for a vessel of any size to anchor such as to cause damage to coral anywhere in Cayman's territorial waters. Also in 1988, regulations were passed giving the Marine Conservation Board the authority to control access to Bloody Bay Wall, one of the Caribbean's most popular dive sites. The Board has gazetted Directives that are used to control entry to and use of the area.

Measures have also been taken to increase the public's awareness of our marine conservation laws, to promote an appreciation for the local environment and stress the importance of its conservation. The marine park boundaries have been marked, information signs have been erected all over the three islands and maps and brochures showing the location of the parks and detailing the rules which apply are widely available. In addition a "Diver Damage" brochure outlining strategies which divers can use to minimise their impact on the reefs has been produced.

DID YOU KNOW? In 1993 the penalties for violating the Marine Conservation Law and Regulations were increased: a judge may now impose a fine of up to CI$500,000.00, a term of imprisonment of up to one year, and may order the confiscation of all equipment and vessels used to commit the offence.

Continuing threats to Cayman's Reefs

Cayman's reefs are still in relatively good shape in comparison to other Caribbean islands. Nevertheless, the tremendous rate of economic growth and accompanying development of the islands are beginning to place considerable pressure on the natural environment. While much has already been done to ensure the protection and conservation of our natural environment, some difficult and potentially serious problems remain.

Ever-increasing numbers of divers on our coral reefs will inevitably result in deterioration of the very resource that attracts divers in the first place. This reality demands that we begin to determine the critical level of visitation to dive sites above which the physical impact becomes

significant - what is commonly known as the **environmental carrying capacity** of the reefs. The Bonaire Marine Park in the Netherlands Antilles has conducted extensive research into diver damage and has set a recommended carrying capacity based on a critical threshold of 4500 dives a year. In 1994, on Grand Cayman alone, 50 of our dive sites exceeded this level, with the top 20 dive sites receiving over 5000 dives a year. Results from a study conducted by the Department of Environment in Grand Cayman show that dive sites with higher numbers of divers have lower coral cover.

The damage done to the reefs by anchoring cruise ships in the George Town Harbour and at Spotts has been documented. In the main anchoring area in Hog Sty Bay, cruise ship anchoring has led to almost 100% destruction of the reefs in a 1.15km^2 area. Sedimentation caused by the dropping and pulling of the anchor has caused additional damage up to 1km away from this area. Based on other countries' experience, these reefs are not expected to recover from this damage in less than 50 years, if at all, as complex reef communities take hundreds of years to fully develop. The demise of Spotts reef can only be prevented through the installation of deep-water permanent moorings.

Another cause for concern is the current scale of dredge-and-fill mangrove reclamation in order to create canal and waterfront real estate, especially on Grand Cayman. This concern has arisen from the effect of the loss of fringing mangrove, and the dredging activity itself on the ecology of the North Sound, and the increased susceptibility of the low-lying West Bay Peninsula to inundation during storms and hurricanes. When one considers the prospect of global climate change and predicted sea-level rise, this practice is even more worrying. In 1995 of the 2,243 canal lots reclaimed from mangrove areas on Grand Cayman only 357 had been built on. This means that less than 20% of the land cleared for canal-front development has been developed to date.

Construction of hotels, golf courses and marinas result in the dredging and destruction of seagrass beds, mangrove wetlands and coral reefs. Golf courses require tremendous amounts of irrigation water, herbicides, pesticides and fertilisers that often wash out to the reef zone. Many beach developments can alter the shorelines on which they are built, especially if sufficient building setbacks are not enforced through planning regulations. The result is often long-term beach erosion, which is compounded when hard engineering solutions, such as erecting seawalls and groynes, is introduced. These incidents typically serve to perpetuate or worsen the initial beach destabilisation process.

The Cayman Islands must now look toward proactive rather than reactive management strategies. Proactive management involves making hard decisions based on a precautionary principle. Such a management approach also includes implementing and enforcing the international conservation agreements the Cayman Islands are party to, especially those that carry an obligation for full environmental impact assessments to be conducted whenever a mangrove wetland is changed to another use.

The Department of Environment

The Department of Environment plays a vital role in the management and conservation of the environment. It is working on drafting more comprehensive and stronger environmental legislation. National and regional research and monitoring programmes are in place, which are geared toward identifying key problems and detecting changes in the natural environment. The Department has five marine enforcement officers whose job it is to enforce Cayman's marine conservation legislation. The public can also help to protect our marine environment by becoming involved in some of the solutions listed below.

SOLUTIONS

What you can do:

- Join letter-writing or E-mail campaigns to speak out on the importance of protecting Cayman's marine environment.
- Do not buy saltwater tropical fish or other live reef animals, including coral, unless you are sure they were collected in a sustainable way.

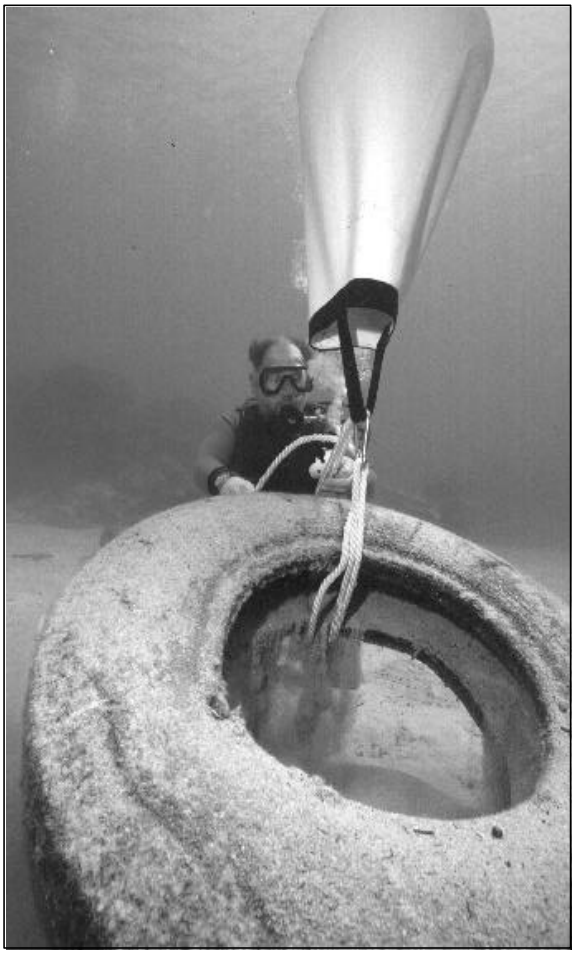


Figure 3-10. Underwater reef clean-up: coral reef sweepers. (Photo from DOE collection).

- Do not buy marine curios as dried (dead) coral, pufferfish, or giant clam shells.
- Do not feed or touch marine animals. It disrupts their normal feeding and mating behaviour and may introduce disease or provoke aggressiveness (e.g. Stingrays).
- Participate in a coastal or underwater clean-up (Figure 3-10).
- Be a responsible diver, snorkeller, and boater. Charter with businesses that respect the ecosystem. Ask about proper training, equipment, anchoring and sewage discharge.
- Try to conserve energy whenever possible in order to reduce global warming. Take public transportation, walk or ride a bike whenever possible. Plant a tree. Work toward protection of the mangrove forest.
- Stay informed about species of finfish or shellfish that are harvested unsustainably and avoid buying them. For example, most jumbo and tiger shrimp are farmed in areas where mangroves have been clear-cut.
- Support Cayman's Marine Parks where no harvesting is permitted in order to allow the fisheries and the entire ecosystem to recover (Figure 3-11). Assist the Department of Environment in enforcing the marine parks regulations by calling and reporting violations.
- Support training program and educational materials for fishers.
- Support a ban on spearfishing.
- Learn all you can about coral reefs, marine life, and the threats they are facing, then educate others.
- Join the **National Trust for the Cayman Islands** and other environmental organisations to stay informed and support conservation efforts.

Figure 3-11 Marine Parks signs (Photo by Fraser Allen).

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