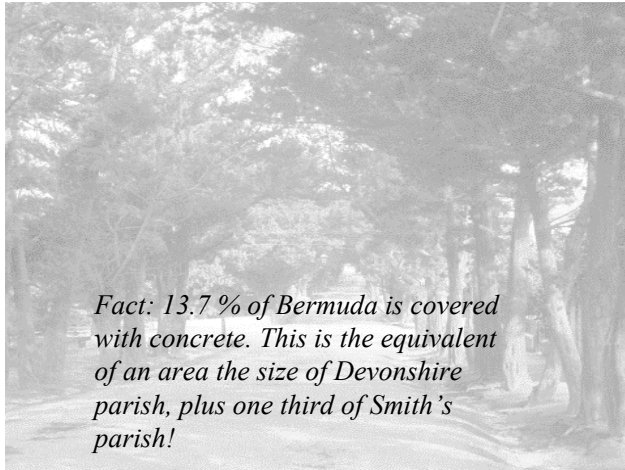


THREATS TO BERMUDA'S BIODIVERSITY



Habitat Destruction

Habitat degradation is one of the most significant threats to Bermuda's biodiversity and occurs both through human impacts, and from natural processes.

Storms and Hurricanes

Storm-induced coastal erosion along Bermuda's south shore is a significant threat to Bermuda's shoreline. The porous nature of the rocky coast means that large pieces of rock periodically give way during, or in the aftermath of high winds and seas. This poses a tremendous threat particularly to the integrity of the exposed Cahow breeding islands around Nonsuch Island, to the Longtail nest sites around the coast, as well as to the shoreline protecting Bermuda's largest remaining mangrove stand at Hungry Bay. Beaches are also affected by storm surge, and the practice of cleaning some

public beaches often results in the removal of stabilising components such as seaweed.



Plate 14. The surf hitting the rocky coast results in shoreline erosion. (Photo from BAMZ slide collection).

Further inland, it is usually the less wind-resistant, introduced tree species such as Casuarina and Fiddlewood that topple and leave conspicuous gaps in wooded areas.

Ship Groundings

The vulnerability of Bermuda's coral reef system was dramatically demonstrated in 1984, with the grounding of the fully laden super tanker *Aguila Azteca* on the reefs to the north of Bermuda. Carrying 196,000 tons of heavy Maya crude oil, this tanker could easily have created the largest oil spill in history, were it not for the unseasonably mild weather. However, it is not only the ships themselves, which damage the reefs when grounding but also the blasting that is often employed to

salvage them. About 70 ha (173 acres) of shallow outer reef (less than 10 m (33 ft) in depth) have been severely disturbed by groundings, representing about 1% of that reef zone¹. Long-term monitoring of the Mari Boeing grounding scar, created in 1978, has shown that recovery of the reef is very slow, on the order of 100 years or more.



Plate 15. Cruise ships stir up the sediment of shallow harbours and bays, smothering the corals with silt and greatly reducing the amount of light available to them. (Photo from BAMZ slide collection).

¹ Cook, C.B., R.E. Dodge, S.R. Smith. 1993. Fifty years of impact on coral reefs in Bermuda. Proceedings of the Colloquium on Global Aspects of Coral Reefs: Health Hazards and History, R.S.M.A.S., Miami. pp. 160-166.

Dredging^{2,3}

The construction of Kindley Air Force Base (the present-day airport) during the 1940's necessitated extensive dredging in Castle Harbour. This resulted in the destruction of once thriving seagrass beds, mangroves, and coral reefs. The construction required the bulldozing of a dozen islands and the dredging of sediments and near shore coral reefs to generate landfill. In all, approximately 24.4 ha (60 acres) of coral reef, 18.2 ha (45 acres) of seagrass beds⁴ and 5.7 ha (14 acres) of mangrove habitats were destroyed. The dredging, rock crushing and filling activity produced a tremendous quantity of fine silt material that spread over the entirety of St. George's and Castle Harbours choking the coral and permanently altering the marine environment. The new land restricted tidal flow and was insufficient in removing the silt that remains trapped and continually re-suspends to this day. The siltation is the primary reason why the reefs in Castle Harbour may never grow back to their pre-1940 condition. (Sedimentation resulting from daily boating traffic in the shipping channels Island-wide is also a significant problem for the adjacent reefs).

A dredging permit is compulsory for any dredging activity, but illegal dredging is a problem, and is of particular concern in seagrass beds.

² Sterrer, W. and D.B. Wingate. 1981. Wetlands and Marine Environments. In: Bermuda's Delicate Balance. S.J. Hayward, V. Holt Gomez, W. Sterrer (Eds.). Bermuda National Trust, Hamilton, Bermuda. 402 pp.

³ Sleeter, T. Pers. Comm. Ministry of the Environment, Opportunity, and Development.

⁴ Smith, S.R. 1999. Impact of the construction of Kindley Field Airbase on the marine environment of Castle Harbour, Bermuda. Ministry of the Environment.

Moorings and Anchor Damage

The damage caused by boat mooring chains as they rotate to the surrounding seagrass has already been mentioned. Evidence of anchor and/or propeller damage can also be observed in many seagrass beds, whilst the destruction caused by anchors deployed on coral reefs has long been a cause for concern.

Dumping

Due to the association of mosquitoes with marshes, a policy of complete marsh reclamation was initiated by the Government that began around 1900 when there was a total of 121 ha (298 acres) of marshland⁵. By the 1930's garbage was being used as a cheap and easy solution to marsh reclamation. The edges of inland peat marshes were also cleared and filled to extend arable land.

Development

At present, development is the biggest overall threat to the Island's biodiversity. Over the last 10 years, 91.9 ha (227 acres) of land has been developed⁶, which equates to an area the size of Ferry Reach Park being lost to housing development every three years. Approximately, 13.7% of Bermuda is covered with concrete, of which 7.96% is accounted for by

buildings and 5.74% by roads⁷. This is the equivalent of an area the size of Devonshire Parish plus one third of Smith's Parish being solid concrete! Continuing at this rate, and given the current footprint of the average house on a building lot, an area the size of Ferry Reach Park will be covered in concrete approximately every 9 years. This does not take into account any industrial and commercial development.

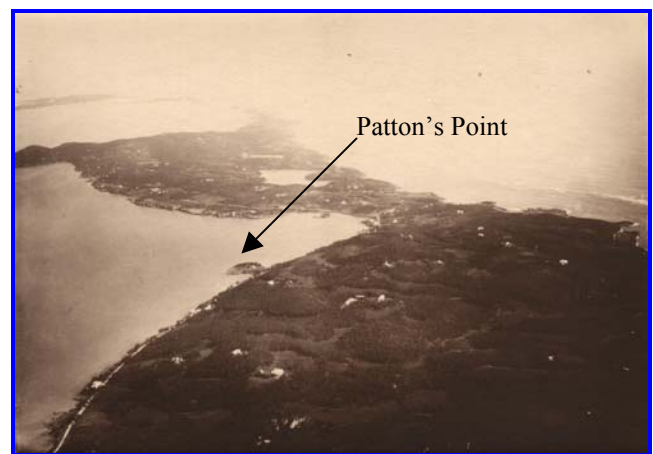


Plate 16. An aerial photograph circa 1920 of the Knapton Hill area. (Photo courtesy of B. Hollis).



Plate 17. A 1997 aerial photograph of the Knapton Hill area. (Photo courtesy of the Ministry of Works and Engineering).

⁵ Sterrer, W. and D.B. Wingate. 1981. Wetlands and Marine Environments. In: Bermuda's Delicate Balance. S.J. Hayward, V. Holt Gomez, W. Sterrer (Eds.). Bermuda National Trust, Hamilton, Bermuda. 402 pp.

⁶ Department of Planning, Ministry of the Environment, Opportunity, and Development.

⁷ Viney, T. Pers. Comm. Ministry of Works and Engineering.

Noise, traffic, and lighting are by-products of development that disturb wildlife and reduce the value of an area to support wildlife.

Pollutants

Trash

Illegal dumping is a major problem in Bermuda. Wooded areas, marshes, caves and wayside fields tend to have significant amounts of garbage. In the marine environment, plastics, ranging in size from large sheets to microscopic pieces, and helium balloons are a major problem. A number of marine turtles and seabirds are killed each year from ingesting plastics or becoming entangled in fishing gear. A Humpback Whale recently entangled in fishing gear off the south shore, had to be cut free by divers.



Plate 18. This juvenile Hawksbill Turtle with a massively bloated gut, died as a result of ingesting the plastics shown in the jar in Plate 19. (Photo courtesy of J. Gray).



Plate 19. Plastics removed from the gut of a dead Hawksbill Turtle (Photo courtesy of J. Furbert).

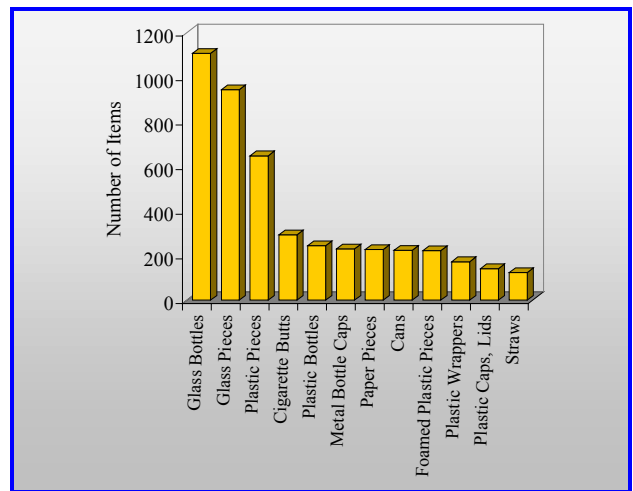


Figure 26. Items collected during the 1999 Keep Bermuda Beautiful (KBB) terrestrial clean-up⁸.

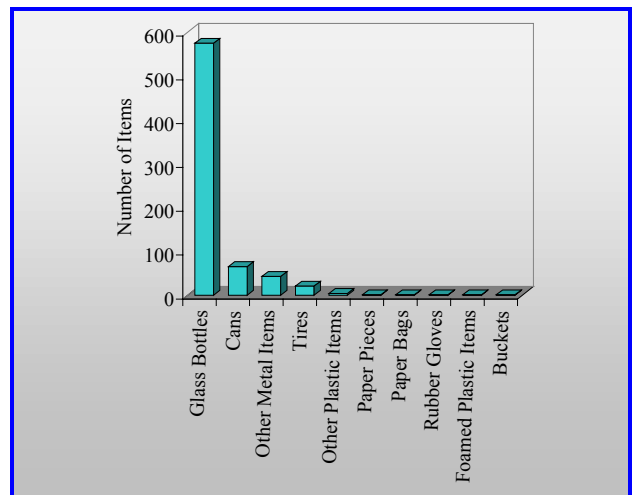


Figure 27. Items collected during the 1999 Keep Bermuda Beautiful (KBB) marine clean-up⁸⁹.

⁸ Boodram, L. Pers. Comm. Keep Bermuda Beautiful.

Pesticides

Pesticide use in Bermuda is quite liberal, and licensing of operators is not required. Historically there was widespread use of DDT and related pesticides to control mosquitoes and agricultural pests. DDT is especially known for its effects on birds, whose eggshells become brittle upon exposure, reducing reproductive success. DDT is no longer in use, although it is still present in the environment due to its persistent properties⁹.

Recent research has shown that Bermuda's toad populations experience unusually high rates of deformities¹⁰. Whilst the cause of these deformities is still unknown, the asymmetrical and unilateral nature of the deformities suggests that chemicals may be responsible. Pesticides that are known to cause such deformities in amphibians are used heavily on the Island, and research into any correlation is ongoing. DDE, heavy metals and evidence of immune system suppression in dead specimens of Bermuda's amphibians have been documented.



Plate 20. Deformed hand of a Giant Toad with only three (fused) digits. (Photo courtesy of J. Bacon).

Emissions

Despite being spared the polluting impacts of heavy industries, Bermuda is not immune from the problem of emissions. The main sources are the local electricity supply company BELCO, as well as the 51,258 road vehicles and approximately 5,500 powered marine vessels. As of 2002, all vehicles imported into Bermuda will be required to meet European, Japanese, or U.S. domestic emission standards. Testing of all road vehicles as a condition of licensing is in the feasibility stage with a pilot project being conducted in 2001¹¹.

Sewage and waste water¹²

Sewage disposal in Bermuda is accomplished for the most part by discharge into household soakaways or cesspits, there being no public sewer system other than in the Town of St. George's and the City of Hamilton. For the last 20 years, high-density

⁹ Ministry of the Environment, Government of Bermuda. 2000. Marine Resources and the Fishing Industry in Bermuda: A Discussion Paper. 495 pp.

¹⁰ Bacon, J. Pers. Comm. Bermuda Zoological Society.

¹¹ Sleeter, T. Pers. Comm. Ministry of the Environment, Development and Opportunity.

¹² Rowe, M. Pers. Comm. Ministry of the Environment, Development and Opportunity.

developments such as condominiums have been required to install septic tank treatment systems and deep sealed boreholes (“vertical leaching fields”) for effluent disposal. Meanwhile, the largest new housing and hotel developments, or re-developments are now required to implement secondary or tertiary sewage treatment.

Typical Bermuda limestone is a porous sandstone and, as such, is efficient at physically filtering and chemically absorbing many contaminants in any effluent, which percolates through it. Such “slow sand filtration” is recognised in the water industry as one of the most effective means of “polishing” wastewater.

Analyses of ground water in Bermuda indicate that some contaminants, notably nitrates, are attributable to cesspit seepage. However, the amount and rate of contamination has been low enough that we have been able to live with it safely. Nitrate levels over the past five years have stabilised and even decreased in some areas due to lower population growth and increased annual rainfalls.

Some of the larger hotels and the urban developments of Hamilton and St. George’s dispose of sewage effluent through ocean outfalls, which do not extend beyond the outer reef-line. Whilst studies have shown no alarming alteration of the reef ecology, probably due to the high levels of dilution and mixing, improved levels of treatment and re-use of this effluent are an ultimate objective.

Heated water from the incinerator and hyper-saline water from reverse osmosis plants is also pumped into the ocean. Monitoring has shown that such inputs have had little or no effect on the marine environment^{13,14}.

Oil spills¹⁵

Oil spills from ships are a major threat to Bermuda’s marine habitats. Since 1976 and the spilling of oil from the passenger liner *Statendam*, Bermuda’s oil spill response has been very effective. More than 135 oil spills have occurred in local waters since then, and of these 22 have been pursued in court, all of them leading to convictions. Bermuda was ahead of the U.S.A in employing oil “fingerprinting” techniques to trace offenders in the mid-1970’s¹⁶. On land, both oil companies (Esso and Shell) are in the process of installing state of the art equipment at all their service stations to help minimise the risk of spills or leaks. Keep Bermuda Beautiful is developing a campaign to encourage marine service stations and the boating public to adopt more careful fuelling practices.

¹³ Smith, S.R. 1999. Bermuda. In: Kjerfve, B. (Ed.) CARICOMP: Caribbean coral reef, seagrass, and mangrove sites. UNESCO Coastal Region and Small Island Papers. 3, 247-257.

¹⁴ Smith, S.R., D.C. Hellin, S.A. McKenna. 1998. Environmental impacts of the effluent released from the Tynes Bay incinerator and disposal of ash blocks in Castle Harbour. BBSR Special Publ. No. 35.

¹⁵ Sleeter, T.D., Knap A.H., Hughes, I.W. 1983. Oil spill contingency planning and scientific support coordination in Bermuda: A successful model. 1983 Oil Spill Conference. pp. 149-153.

¹⁶ Sleeter, T. Pers. Comm. Ministry of the Environment, Development and Opportunity.

Once a significant problem on the Island, the amount of tar washing onto beaches has decreased in recent years as a result of greater vigilance on board shipping vessels.

Anti-fouling Paints¹⁷

Metal-based anti-fouling paints used on boat bottoms are one of the main sources of metal contamination in the marine environment. Many of these paints contain TBT (Tri-butyl tin) which is highly effective as an anti-fouling agent. It is responsible for a condition termed “imposex” in gastropods, in which the female develops a penis and becomes infertile. There is evidence of imposex in older Harbour Conch in Bermuda¹⁸. This condition may pre-date the local ban on the importation and use of TBT-based paints in 1988. However, TBT is still used on cruise ships and most large ships. Concentrations of TBT in Bermuda’s inshore waters are still elevated despite the ban of anti-fouling paints and additives, as paint chips scraped off boats are often washed into the water and become buried in the sediment¹⁹.



Plate 21. A female Harbour Conch showing abnormal development of a penis. (Photo courtesy of M. Outerbridge).

The Bermuda Biological Station for Research Inc. is investigating the effects of Irgarol, a chemical that leaches from new bottom paints²⁰. It is used on large vessels and is at detectable levels in Hamilton Harbour. The chemical is persistent and is known to inhibit photosynthesis in plankton and corals.

Invasive Species

According to the United Nations, the biggest single threat to island biodiversity is from invasive species. Invasive species are organisms that (largely through human transport) successfully establish themselves in, and then overcome pre-existing native ecosystems. The impact is often catastrophic for the native species, whilst the costs to the local economies may be enormous. Invasive species can change light levels, decrease oxygen in water, change soil chemistry and increase surface run-off and erosion. They can affect nutrient cycling and

¹⁷ Ministry of the Environment, Government of Bermuda. 2000. Marine Resources and the Fishing Industry in Bermuda: A Discussion Paper. 495 pp.

¹⁸ Outerbridge, M. 1999. Unpublished report. Population Studies and Imposex of the Harbour Conch (*Strombus costatus*) in Harrington Sound. Bermuda Biodiversity Project, Bermuda Zoological Society.

¹⁹ Sleeter, T. Pers. Comm. Ministry of the Environment, Development and Opportunity.

²⁰ Smith, S.R. Pers. Comm. Bermuda Biological Station for Research Inc.

pollination cycles, and displace native species, even causing the extinction of local populations.

A review of Bermuda’s flora and fauna reveals a long history of invasions. Most have probably been introduced accidentally, but there have also been numerous intentional introductions, either for ornamental purposes, or as biological controls.

Terrestrial Invasives

Nowhere is the impact of invasive species more apparent than amongst the flora of the Island. Being better competitors for habitat space and more efficient seeders, invasives such as Brazil Pepper, Casuarina, Chinese Fan Palm, Allspice, Fiddlewood, and Surinam Cherry dominate Bermuda’s landscape.



Plate 22. The invasive Indian Laurel tree growing out of the side of a building. (Photo courtesy of H. De Silva).

Another species not yet widely recognised by residents as a problem is the Indian Laurel. Not only does this species threaten the endemic and native

flora, but its aggressive root system undermines the integrity of many of Bermuda’s man-made structures, including walls, pavements and roads. A recent survey noted that of 736 locations where individual Indian Laurels were found along Bermuda’s main roads, 133 were considered as hazardous in terms of the potential for structural damage caused by the tree²¹.

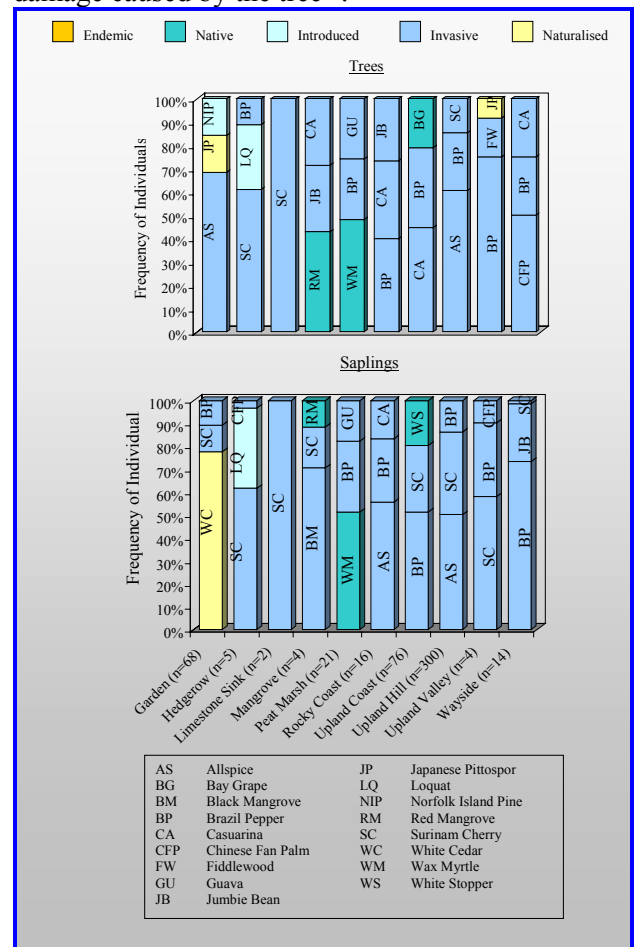


Figure 28. The dominant tree and sapling species in 10 different habitats, highlighting the prevalence of invasives²².

²¹ Anderson, C. 2000, Unpublished report. Survey of *F. microcarpa* (Indian Laurel) populations along Bermuda’s major roadways. Bermuda Biodiversity Project, Bermuda Zoological Society. 28 pp.

²² Bermuda Biodiversity Project. 2001. Unpublished data. Bermuda Zoological Society.

Of the resident birds in Bermuda the three most common, the European Starling, House Sparrow and Great Kiskadee, are all considered invasive pests. The latter were introduced in 1957 to reduce the populations of *Anolis* lizards, which were themselves introduced to control the Mediterranean Fruit Fly²³! The Giant Toad, was also intentionally introduced to control insect species, especially the cockroach. The two whistling frog species known locally were most likely accidental introductions.

The cedar blight in the 1940's triggered a rash of intentional introductions in a futile effort to try and control the scale insects responsible for the disease. Their failure was compounded by the loss of at least one endemic insect as a direct result of the introductions. Nowadays, species introduced as biological controls are usually host specific; however, once released, monitoring their subsequent ecological impact is difficult²⁴.

The Black Rat was accidentally introduced to Bermuda from a grain ship in 1613 and the Norwegian Rat was later introduced in the 18th century²⁵. They eat farm crops and take the eggs and chicks of nesting birds, including the Longtail. To control the rat problem, cats were released in Bermuda.

Feral Species

A feral species is an animal that was once domesticated, but was released and lives in the wild. Feral species present a significant threat to Bermuda's native and endemic species. Dog control was initiated in 1971 and is no longer a major problem²⁶. Cats first introduced by the settlers in the 1600's to control rat populations have since become feral, preying on bird populations as well as threatening domesticated cats through transmission of infectious diseases such as feline leukaemia and various viruses²⁷. Populations of feral chickens have increased and can decimate large areas of habitat very quickly²⁸. More recently, pigeons have become a problem in Bermuda as they are taking over nesting areas from Longtails and can be found all over the City of Hamilton. The number of feral ducks is also on the rise, and even guinea pigs have been released at Spittal Pond²⁹.

Of potential concern are species brought in for the local aquarium trade. These include the Red Eared Slider Turtles, which often become too large for their owners who then release them into the wild (often into the ponds on local golf courses). Research is needed to determine whether these

²³ Wingate, D.B. 1995. Breeding Birds of Bermuda. Bermuda Zoological Society, Project Nature Eco File. 10 pp.

²⁴ Jessey, C. Pers. Comm. Department of Agriculture and Fisheries.

²⁵ Wingate, D.B. 1994. Bermuda Rats. Bermuda Zoological Society, Project Nature Eco File. 2 pp.

²⁶ Benevides, J. 1993. Dog control in Bermuda. Monthly Bulletin Department of Agriculture and Fisheries. 64 (2), 9-14.

²⁷ Burnie, N. 1991. Feral cats. Monthly Bulletin Department of Agriculture and Fisheries. (4), 26-27.

²⁸ Burnie, N. 1990. The problem with chickens. Monthly Bulletin Department of Agriculture and Fisheries. 61 (6), 49-50.

²⁹ Daniels, S. 1990. Guinea pigs on the run! Monthly Bulletin Department of Agriculture and Fisheries. 61 (6), 45-48.

imported species pose a threat to native and endemic species such as the Bermuda Killifish.

The issue of feral animals, particularly cats, is highly volatile within the local community.

Marine Invasives³⁰

The marine environment has had far fewer introductions generally, and is therefore less plagued by invasive species. Invasive marine species could potentially come in with ballast water used to stabilise ships when they have no cargo. However, in Bermuda, merchant ships typically arrive fully laden and leave empty, thereby minimising the threat.

The predatory snail, *Trunculariopsis trunculus*, introduced in the 1960's from the Mediterranean became locally established and may have contributed to the decline of the Calico Clam in Harrington Sound.

In 1924, there was an unsuccessful attempt to establish populations of commercially viable marine fish species³¹. However, one introduced freshwater species, the Mosquito Fish was successfully established in the inland marshes and ponds to control the mosquito population. The failure of most local marine introductions suggests that the marine

environment is more resilient to exotic and invasive species than the terrestrial environment.

Knock-On Effects (Chains Of Extinction)³²

In 1983 and 1984, a water-borne pathogen decimated the Caribbean and Bermudian populations of the Long-spined Sea Urchin, as it was transported throughout the region by ocean currents. On a healthy reef, sea urchins function as important grazers of algae, but their sudden disappearance reduced the number of available grazers throughout the region. In Jamaica, where overfishing had already dramatically reduced the numbers of grazing parrotfish, the loss of 98% of the urchin population resulted in a decline in coral cover from 52% to just 3% and an increase in algal cover from 4% to 92%! Bermuda was more fortunate in that there were sufficient grazing fish to prevent algal over-growth on the reef, but Jamaica's tragedy provided a sharp reminder of the precarious balance of nature.

Over-Harvesting

Since colonisation in the 1600's, the Island's fauna and flora, both terrestrial and marine, has been subject to intense harvesting, although this is less of a problem nowadays.

For example, the endemic Cahow was so dramatically reduced in number that it was thought

³⁰ Ministry of the Environment, Government of Bermuda. 2000. Marine Resources and the Fishing Industry in Bermuda: A Discussion Paper. 495 pp.

³¹ Smith-Vaniz W. F., B. B. Collette, B. E. Luckhurst. 2000. Fishes of Bermuda: History, Zoogeography, Annotated Checklist, and Identification Keys. American Society of Ichthyologists and Herpetologists, Kansas. 424 pp.

³² Lessios, H.A., D.R. Robertson, T.D. Cubit. 1984. Spread of *Diadema* mass mortality through the Caribbean. Science. 226, 335-337.

to be extinct for nearly 300 years until it was rediscovered in 1951³³! Numerous other species have been extirpated through overharvesting. By the 19th century, the West Indian Top Shell could no longer be found and initial attempts to re-introduce the mollusc in 1901 failed. A recent reintroduction appears to have been much more successful³⁴; however, reports of illegal harvesting reveal that many residents are unaware that this shellfish is protected.

The Bermuda Cedar was extensively utilised by colonists for housing furniture, shipbuilding, and export. Laws were made to protect cedars as early as 1622³⁵. Nowadays, demand for cedar products results in occasional illegal harvesting of cedars from nature reserves and national parks. Another endemic tree, the Bermuda Palmetto, was also extensively utilised by colonists for roof thatch, basketry, food and drink.

Turtles, which once nested abundantly in Bermuda, were over-harvested by the early colonists with records showing catches in excess of forty turtles per day. The first conservation act was passed in 1620 against the killing of young turtles but the population continued to suffer until 1973 when the

turtle fishery finally closed. There is no breeding population left.

Groupers (mainly the Nassau Grouper) were the major targets of fish pots. Large numbers of groupers could be easily captured at their spawning sites, which were usually fished from May until mid-July. Through the 1960's groupers remained the dominant fish in fish pots, but by the late 1980's, the fishery had collapsed. A number of grouper species are now believed to be locally extinct.

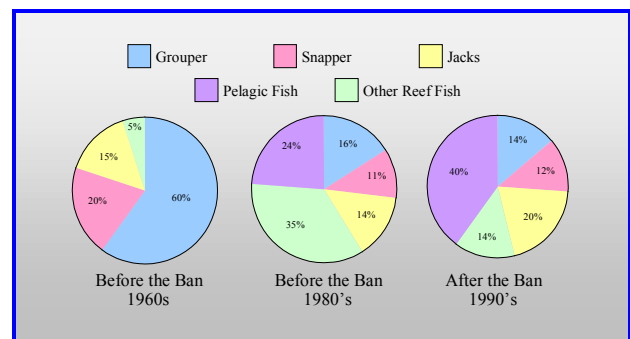


Figure 29. Percentage of fish caught locally before and after the fish pot ban³⁶.

Climate Change

There is convincing evidence that suggests that the global climate is changing at an alarming rate. The addition of gases such as carbon dioxide to the atmosphere trap heat and cause the earth to warm³⁷. This can have long term effects, such as melting of glacier ice caps and rising sea levels. There has been an estimated sea level rise of about 10-12 mm

³³ Wingate, D.B. 1995. Breeding birds of Bermuda. Bermuda Zoological Society. Project Nature Eco File. 10 pp.

³⁴ Cattell, N. 2000. Population survey of the geographical and age distribution of the West Indian Topshell, *Cittarium pica*, in Bermuda. Unpublished report. Bermuda Biodiversity Project, Bermuda Zoological Society.

³⁵ Durham G. 1996. Trees of Bermuda. Bermuda Zoological Society. Project Nature Eco File. 13 pp.

³⁶ Data derived from information at the North Rock Exhibit, Bermuda Aquarium, Museum, and Zoo.

³⁷ Anon. 1989. The earth as a greenhouse. Oceanus. 32 (2), 35.

over the past 100 years³⁸. The consequences for the low-lying islands of Bermuda are obvious. Whilst the sea surface temperature has not shown any obvious increase locally, the relative sea level has risen.

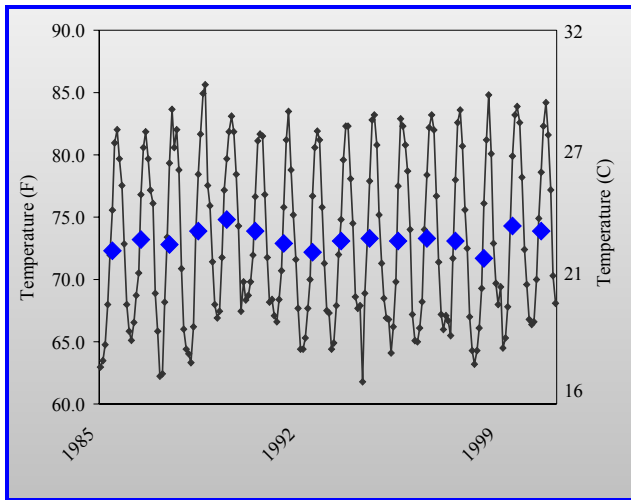


Figure 30. Monthly mean change and yearly mean change (blue diamonds) in sea surface temperature over the last 15 years³⁹.

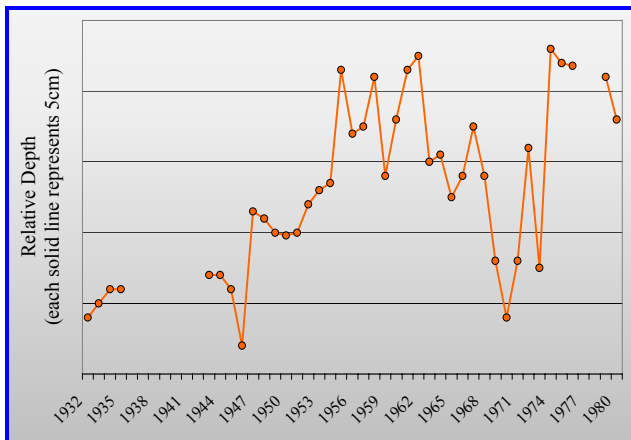


Figure 31. Relative changes in sea level from 1932 to 1980⁴⁰.

³⁸ Ellison, J.C. 1993. Mangrove retreat with rising sea-level, Bermuda. *Estuarine, Coastal, and Shelf Science*. 37, 75-87.

³⁹ From data collected by the Bermuda Weather Service.

⁴⁰ Wanless, H.R. 1982. Sea level is rising – So what? *Journal of Sedimentary Petrology*. 52 (4), 1051-1054.

In addition to rising sea levels, global climate change could also affect rainfall patterns, causing periods of severe drought, as well as increased storm activity, which would also present an enormous threat to the Island’s biodiversity.

The increased reports of coral disease and bleaching in many parts of the world have also been linked to climate change. Coral diseases, such as the black band disease (BBD), white band disease (WBD)⁴¹, and yellow band disease⁴² can be observed in corals on Bermuda’s reefs. BBD is caused by the blue-green alga *Oscillatoria submembranacea* in association with bacteria and primarily infects brain coral, whilst WBD seems to be the physiological response of the coral tissue to certain trauma. Yellow band disease is prevalent in Bermuda on Small Star Coral. Sea fans and other soft corals can be affected by the fungus *Aspergillus sp.*¹²³.

To date, Bermuda has largely escaped the massive coral bleaching events observed in many parts of the world, including the Caribbean. Short-term, localised bleaching has been reported, but the corals appear to have recovered.

Natural Pathogens

In the 1940s, two scale insects, the Juniper Scale and the Oyster-shell Scale, were accidentally introduced on shipments of ornamental junipers from the US.

⁴¹ Rützler, K, D.L. Santavy. 1983. The black band disease of Atlantic reef corals. *Marine Ecology*. 4 (4), 301-319.

⁴² Weil, E. and S.R. Smith. Pers. Comm. Bermuda Biological Station for Research Inc.

In the absence of biological controls, the scale insects quickly destroyed 95% of the remaining Bermuda Cedar population, leaving only the hardest to survive. More than 25 species of ladybird beetles were introduced to try to stop the decimation. Naturally resistant individuals were subsequently nurtured and their progeny are being successfully replanted around Bermuda today. Natural pathogens remain a persistent threat to Bermuda's biodiversity.

Lack of Awareness

Potentially the biggest threat to Bermuda's biodiversity is a lack of environmental awareness. In the 2000 Bermuda Omnibus Survey, only 2 out of 400 people surveyed considered the environment to be the single most important issue facing Bermuda today!

On a more encouraging note, in a recent survey conducted of over 2,000 local students aged 5 to 14+, 33% said that the environment was what they would most like to change in the world⁴³. However, whilst 80% of the students felt that people were to blame for the problems, only 56% indicated that people could help solve the problems. Only 7% suggested that they themselves could do something! Most of the children (63%) said they learnt about the environment at school, 20% through the media, and 13% at home.

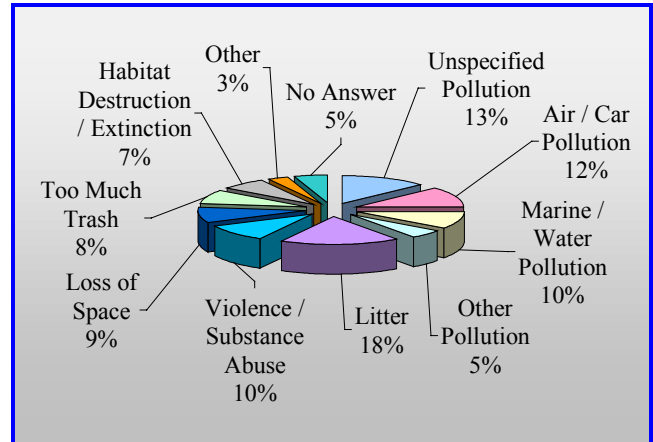


Figure 32. Results of a survey highlighting the top environmental concerns of local school children¹²⁴.

There is a need for studies to investigate the effect of ethnicity, wealth and level of education on environmental attitudes. This would enable the design of effective programmes that promote community-wide appreciation of environmental issues.

⁴³ Youth Environmental Conference. 2000, Unpublished Report. Bermuda Zoological Society.