



Synonyms: Aspergillosis, black band disease, Caribbean ciliate infection, red band disease, ulcerative white spots, white band disease, white patch disease, white plagues, yellow band disease

## KEY FACTS

**What are coral diseases?** Coral diseases are a number of diseases that lead to the damage of corals and their structure. The diseases are multifactorial in nature and lead to the production of lesions on the coral. The exact origin and cause of these diseases is often unknown and where agents have been identified they are often part of complex interactions with the environment and other organisms. The diseases can be described as pigmented band diseases, focal or multifocal tissue loss without distinct pigmented band, annular or linear tissue loss without distinct pigmented band, discolouration and growth anomalies.

**Causal agent** Virtually all of the most pervasive threats impacting coral reef ecosystems (including land-based and marine pollution, overfishing, global climate change, and ocean acidification) have been suggested as synergists or facilitators of infectious disease. Factors shown to stress the coral or lead to compromised health (e.g. predation) increase the likelihood of disease occurring. The causes of coral diseases are multifactorial and have often not yet been fully identified. Pathogens that have been suggested as causal agents of disease in corals include bacteria (e.g. *Vibrio spp.*), fungi (e.g. *Aspergillus spp.*) and protozoa.

**Species affected** Many species are affected – most falling into either the Subclass Octocoralia (soft corals) or Order Scleratinia (true stony corals).

**Geographic distribution** Worldwide (including the Western Atlantic, Indo-Pacific, East Africa, the Red Sea and Australia) with the Caribbean described as a hotspot because of rapid emergence and spread of virulent diseases. Diseases in Pacific-based corals have been increasingly reported as more surveys have been carried out in different locations.

**Environment** Marine ecosystems.

## TRANSMISSION AND SPREAD

**Vector(s)** Coral predators and humans may transfer diseases between corals.

**How is the disease transmitted to animals?** These diseases can be spread between corals by direct contact or, potentially, by coral predators and humans. Disease often occurs secondary to environmental changes or trauma.

**How does the disease spread between groups of animals?** Direct contact between corals, water-borne contact, environmental changes, human interaction.

**How is the disease transmitted to humans?** These diseases are not thought to be zoonotic.

## IDENTIFICATION AND RESPONSE

<b>Field signs</b>	Lesions on coral – both of known or unknown cause. These lesions can include tissue loss, bleaching, pigmentation changes ( <i>e.g.</i> in bands or patches) and growth anomalies.
<b>Recommended action if suspected</b>	If a lesion is present, record host affected, whether or not there is a known cause ( <i>e.g.</i> fish predation, gastropod predation, galls, algal abrasion/overgrowth, Crown of Thorns Starfish predation, sediment damage <i>etc.</i> ). Also record lesion type ( <i>e.g.</i> tissue loss, growth anomaly, tissue discolouration, overlying pigmented material) and also lesion pattern (focal, multifocal or diffuse), rate of progression (rapid, moderate or not progressing), colour, and lesion margin (describe colour, thickness, shape and border type <i>e.g.</i> discrete or diffuse). Develop a monitoring programme to help address impacts of disease on coral communities ( <i>e.g.</i> determine how widespread the disease is, how fast it is spreading and if the disease is fatal to the animals affected). Depending on local arrangements, report suspected cases to national authorities.
<b>Diagnosis</b>	<p>Liaise with appropriate experts regarding collection of samples for laboratory investigations prior to any samples being taken. If tissue loss is visible look for potential predators in the surrounding area.</p> <p>Samples may be taken for histology and microbiology. These can include coral tissue, coral surface mucus and water, and sediment together with other flora or fauna associated with the diseased corals.</p> <p>Historic and background information should also be provided, together with photographic documentation of the lesions and area. All samples should be collected using the sterile techniques suggested by the experts to whom they are to be sent. Permits are often required for collection and transportation of samples and these vary between locations.</p>

## PREVENTION AND CONTROL IN WETLANDS

<b>Environment</b>	<p>Management of the environment is a challenge for these disease processes, but certain aspects of coral life history may lend themselves to disease control if they are incorporated into a management strategy.</p> <p>Corals, unlike most other wildlife species of concern, are immobile. Once a diseased colony has been found, it will not move and can be counted and monitored (and potentially treated, if viable methods are developed). Corals also have the potential to re-grow over dead skeleton by re-sheeting and in this way they function more like plants.</p> <p>There has been some success in controlling the spread of black band disease (BBD) during warming anomalies by aspirating the band using large syringes or pumps. Clay or underwater epoxy putty can then be placed directly over the band.</p> <p>By <b>reducing the amount of anthropogenic stressors</b> on reefs, it is also possible to try to optimise conditions favourable for reef health and coral growth.</p> <p>Ensure that divers collecting samples or visiting sites always visit healthy sites before those considered to be diseased.</p> <p>All samples should be placed in <b>double containment</b> and divers should</p>
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**disinfect** SCUBA gear and equipment in 5% bleach solution (or other disinfectant) and then rinse in fresh water between sites.

There is evidence to suggest corals that survive a bleaching episode may later succumb to opportunistic infections, as their resistance is lowered by the stress of bleaching. In such cases, imposing a **quarantine** on a reef acutely impacted by either bleaching or disease may be worthwhile. The reef can be closed to human activity by prohibiting diving, snorkelling and fishing for a period of time. Managers should make every effort to **disseminate** to the public locally-relevant information on coral diseases and their potential impacts. Managers may also focus their attention on target groups who interact regularly with the reef: fishers, recreational divers, and diving tourism operators and their clients

In the longer term a number of actions can help to prevent disease and its spread between corals:

- Restrict translocation of corals to prevent movement of disease.
- Provide guidance for proper handling and containment regimes during coral disease experiments.
- Monitor proposed coral management and research activities, as well as rehabilitation or remediation activities, to minimise or avoid ethical and legal problems with the potential spread of disease.
- Promote the use of universal precaution measures when dealing with diseases in the field.
- Encourage ethical behaviour and improved sanitary practices among divers and other users of the marine environment.
- Communicate and report disease outbreaks and interventions.
- Harnessing enthusiasm among divers will provide managers with additional observers underwater, and the only efforts that are necessary are some initial training and regular communication.

#### Livestock & humans

None

#### Wildlife

Experiments have shown that black band disease can be eliminated and the rate of appearance of new infections can be reduced through re-introduction of herbivorous urchins *Diadema antillarum* into habitats where they were formally abundant.

### IMPORTANCE

#### Effect on wildlife

Infectious disease in corals has increased in frequency and distribution since the early 1970's and since then there has been an exponential increase in numbers of reported diseases, host species and locations with disease observations. This rate of change has resulted in a global reduction in coral cover. In addition to the loss of coral tissue, disease can cause significant changes in reproduction rates, growth rates, community structure, species diversity and abundance of reef-associated organisms.

#### Effect on livestock & humans

None

#### Economic importance

The revenue earned from fishing, tourism, recreation, education and research associated with coral reefs is of major importance to many local and national economies and can be severely affected by diseases of the coral in these areas.

## FURTHER INFORMATION

### Useful publications and websites

- ☐ Coral Reef Targeted Research & Capacity Building for Management. **Coral disease: an emerging threat to the world's remaining reefs.** <http://www.gefcoral.org/LinkClick.aspx?fileticket=h6EdRoHvUgY%3d&tabid=3260&language=en-US> [Accessed March 2012].
- ☐ Stoskopf, M.K. (2006). **Coelenterates.** In: Invertebrate medicine (1<sup>st</sup> Ed.). Lewbart, G. A. (ed.), Blackwell Publishing, (2006), pp.327.
- ☐ Great Barrier Reef Marine Park Authority, Australia. **A reef manager's guide to coral bleaching.** <http://data.iucn.org/dbtw-wpd/edocs/2006-043.pdf> [Accessed March 2012].
- ☐ The Global Coral Disease Database (GCDD). <http://coraldisease.org/> [Accessed March 2012].
- ☐ The Coral Reef Targeted Research Program - Coral Disease Working Group. [www.gefcoral.org](http://www.gefcoral.org) [Accessed March 2012].

### Contacts

- ✉ The Coral Disease and Health Consortium (CDHC): [cdhc.coral@noaa.gov](mailto:cdhc.coral@noaa.gov)
- ☐ For a full list of experts, see [www.gefcoral.org](http://www.gefcoral.org) [Accessed March 2012].