



Name: _____ Date: _____ Group: _____

Coral Reefs and Climate Change

- 1 There are many different types of environments on the planet, and often many ecosystems within each environment. Ecosystems all contain a balance of abiotic and biotic factors that are interdependent. The organisms within each ecosystem rely on natural resources in that ecosystem for survival. Changes in the environment can affect both the stability and the equilibrium of that ecosystem. It is also important to note that the amount of natural space, food, shelter, and water within these ecosystems is limited. Species compete for these resources as they struggle to survive. These aspects are known as limiting factors. Limiting factors affect every level of organization, from organism to ecosystem.
- 2 One of the most diverse ecosystems on the planet is found in the ocean's coral reefs. Unfortunately, they are also one of the most threatened ecosystems. Why? The bounty of life that lives in these ecosystems is changing due to warming ocean waters and changing ocean currents. Coral reefs house over 25% of the ocean's marine species, yet are found in only one-tenth of the ocean's area. That is a lot of biodiversity for such a small space. If the delicate balance of shallow waters, light, and sea temperatures changes, this can threaten the equilibrium that holds this ecosystem together. In order to understand why coral reefs are so threatened, it is important to first understand what makes a healthy coral reef ecosystem.
- 3 The world's coral reefs are found in very specific areas in the world. They are only found in the zone 30 degrees south and 30 degrees north of the equator. The warm, shallow seas that the corals require for growth are found in these latitudes. Corals are very small animals that belong to the phylum *Cnidaria*. This same phylum contains other marine animals, such as jellyfish and sea anemones. They live in very large colonies. Corals reproduce by producing polyps that float in the sea until they reach a solid resting place. Once attached, they create a hard calcium carbonate structure that forms the backbone of the coral reef. Since each coral cannot move from its anchor spot, it feeds on passing debris by extending its tentacles. As the corals eat, they produce more calcium carbonate, increasing the mass of the coral backbone, and building the coral reef.





- 4 In a healthy coral ecosystem, the corals have a symbiotic relationship with a specific type of algae called zooxanthellae. Over time, the algae and the corals have adapted to work together. The algae lives inside the “skin” of the coral, performing photosynthesis in the light that shines through the water of the shallow seas. The sugars produced from the photosynthetic process are then available to the coral. In return, the corals house the algae, protecting them and giving them access to light. However, these algae can only live within a very narrow temperature range within the sea. Along with the zooxanthellae, corals and the reefs that they build provide important habitat for many other ocean creatures. The reefs provide shelter and food sources, and reduce wave action around the reef.
- 5 As the ocean organisms consume energy through eating corals and other food sources housed on and around the reef, energy flows from the sun through all trophic levels, creating a food web. If the corals die, then the entire system is affected. Unfortunately, this has been associated with a variety of environmental changes. In some places, the ocean waters near the reef are becoming warmer. In other places, the currents have changed, bringing different water temperatures and nutrients to the reefs. Temperature change is not the only problem. In some parts of the ocean, the water near reefs has become more acidic. The delicate zooxanthellae algae sometimes leave the corals, causing a phenomenon known as “coral bleaching”. The corals cannot survive without their symbiotic partners. As a result, the corals on the reef die. Erosion of soil or runoff of fertilizers that promote seaweed growth over the coral can also be a problem. As these types of environmental changes happen, the reef structures fall apart. Many marine creatures lose their shelter and food source. Fish and other reef inhabitants are forced to move, which then affects the entire balance of the coral reef ecosystem.
- 6 People are working to repair and rebuild coral reefs around the world. Many successful artificial reefs are being placed in locations where natural reefs had never developed before. Some are farther from the equator, outside the normal growth zone. Others are in deeper water, such as off the Texas coast in the Gulf of Mexico. There are two approaches to artificial reefs. The first is used in zones where natural reefs have been damaged or destroyed. The primary goal is environmental restoration. Pieces of healthy corals are attached to an artificial substrate, similar to a large metal cage. Within as little as a year, the corals will grow, and as they grow, marine animals will return to live in and around the structures. This has been a very positive step towards saving this important ecosystem.
- 7 A second type of artificial reef is created simply by sinking objects to the seafloor. Sometimes this includes the specially designed substrate, but more often this is a way to reuse items that be difficult to dispose of otherwise. This includes retired drilling rigs and cargo ships and large chunks of concrete from demolition projects. Coral polyps, as well as immature oysters and barnacles, will attach to the surfaces and begin to grow. Eventually, a reef system will develop. This will benefit the environment by providing new habitat.



- 1 According to paragraph 1, which of the following factors limits the abilities of populations within an ecosystem to survive?
- A The frequency of reproduction of each species.
 - B The number of organisms becomes too large.
 - C Availability of space, shelter, food, and water.
 - D Availability of a diversity of species.
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- 2 Corals are related to other commonly found marine animals. What other animals are found in the phylum *Cnidaria*?
- A Polyps
 - B Jellyfish
 - C Zooxanthellae
 - D They are not related to other marine animals



3 What external factors can affect the health of the coral reef ecosystems?

- A Rising ocean temperatures
 - B Changing ocean currents
 - C Increased acidification of the oceans
 - D All of the above
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4 The balance of the coral reef ecosystem is being affected by warming oceans, changing ocean currents, and what other external factor?

- A The acidification of the oceans
- B The light that enters the system
- C Marine animals leaving the reef
- D Not enough information is given



5 Why are coral reefs important?

- A** Coral reefs house over 25% of marine species.
 - B** Coral reefs provide important habitat for many ocean creatures.
 - C** Coral reefs create important food webs.
 - D** All of the above
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6 Healthy ecosystems depend on —

- A** a balance of abiotic and biotic factors
- B** coral reefs
- C** zooxanthellae
- D** warm oceans