Before You Read

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How Climate Change Can Affect Aquatic Ecosystems

1. (Circle) the word **TRUE** if the statement is TRUE **or** (Circle) the word **FALSE** if it is FALSE.

   a) The greenhouse effect traps ozone in Earth's atmosphere.
   TRUE **FALSE**

   b) Carbon dioxide is a greenhouse gas.
   TRUE **FALSE**

   c) Coal is a fossil fuel.
   TRUE **FALSE**

   d) When Earth gets warmer, ocean level rises.
   TRUE **FALSE**

   e) Animals that cannot adapt to changes may become extinct.
   TRUE **FALSE**

   f) Global warming decreases evaporation.
   TRUE **FALSE**

   g) Rising temperature will cause most salt lakes to get deeper.
   TRUE **FALSE**

   h) Using gasoline as a fuel releases greenhouse gases.
   TRUE **FALSE**

2. **Put a check mark (✓) next to the answer that is most correct.**

   a) **Which of these is a fossil fuel?**
   - ○ **A** wood
   - ○ **B** ethanol
   - ○ **C** natural gas
   - ○ **D** hydrogen gas

   b) **Which process determines the evolution of species?**
   - ○ **A** water cycle
   - ○ **B** fossilization
   - ○ **C** photosynthesis
   - ○ **D** natural selection

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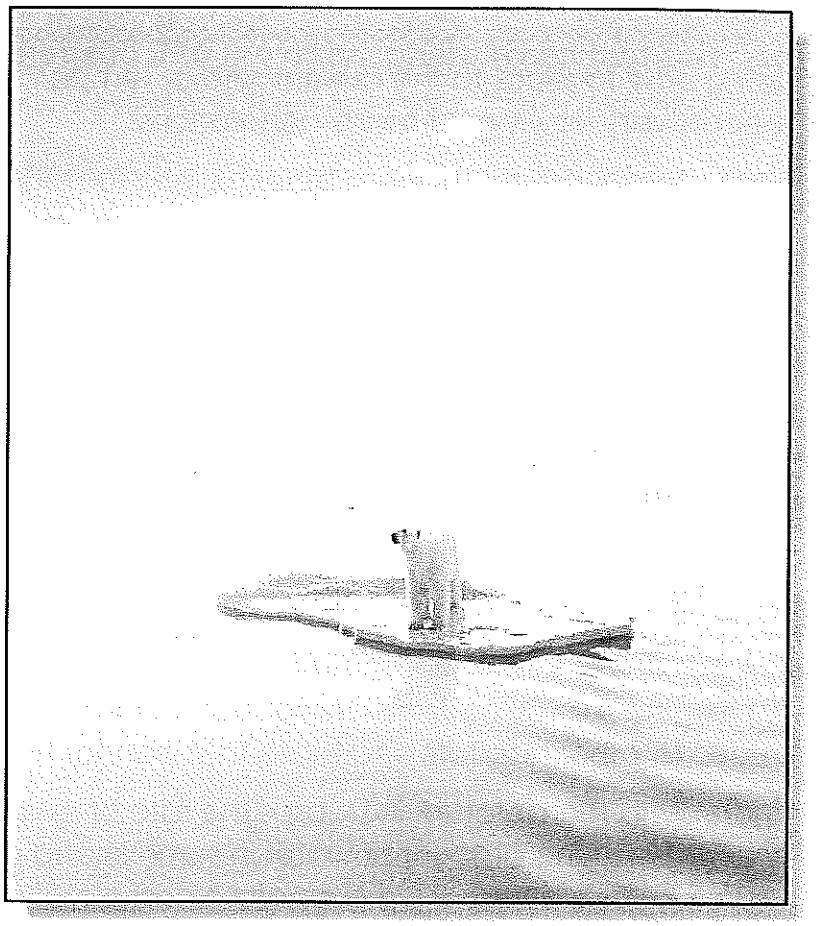

Earth's climate has changed continuously throughout our planet's history. Climate change can be understood by looking at how average global temperature changes. For an aquatic ecosystem, a change in temperature will change other abiotic factors, which leads to a change in biotic factors.

Earth's average temperature is affected by the **greenhouse effect**. **Greenhouse gases** in the atmosphere let light in more easily than they let heat out. This effect causes Earth to be warmer than it would be without these gases in the atmosphere. Carbon dioxide, CO_2, is one of the most important greenhouse gases. The amount of carbon dioxide in the atmosphere has increased greatly over the last 100 years because it is produced when humans burn **fossil fuels**. Because use of fossil fuels has increased greatly, the greenhouse effect has become stronger, and global temperatures have risen.

All the organisms in an aquatic ecosystem have adapted to a certain temperature range. When temperature increases, the plants and animals must either move, **adapt**, or become **extinct**. In the open ocean, fish and other animals can move to cooler areas farther from the equator. Most plants and animals in inland habitats cannot move because they cannot travel overland. Other organisms that cannot move to cooler climates are those that are already living near the North or South Poles.

Adaptation to climate change is not an option for many organisms. For many organisms, the process of adaptation through **natural selection** (that is, **evolution**)

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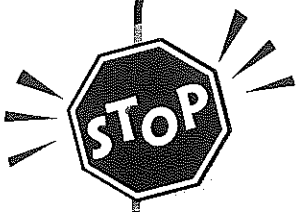
is too slow to react to the current rate of temperature increase. Evolution usually occurs very slowly over many generations.

Rising temperature changes other abiotic factors in an ecosystem. Rainfall patterns change, ocean currents change their course, **evaporation** increases, and melting polar ice causes sea level to rise.



A sudden change in the environment can cause a species to become extinct. Identify two other possible outcomes for a species facing a sudden environmental change.

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Changing rainfall patterns and ocean currents will cause some plants and animals to move to other habitats and those that cannot move or adapt to become extinct.

Increasing temperature increases the rate of evaporation. This can cause a decrease in the amount of water in some inland aquatic ecosystems. In some cases, bodies of water will evaporate completely, leading to the extinction of any organisms that cannot travel overland. This will happen most often to inland salt lakes that have no connection to the ocean.

Polar bears are land animals, but they are part of the marine food web because they prey on seals that live in the Arctic Ocean. Melting Arctic sea ice is making it difficult for these bears to get to the seals. If polar bears decrease, the seals will increase, and the fish the seals eat will decrease. This is a good example of how changing one abiotic factor (temperature) can set off a chain of events that affects all the living things in an aquatic ecosystem.

Melting polar ice will also cause sea level to rise all over the world. This will cause changes in aquatic ecosystems, but it will be less of a danger to aquatic organisms. The ecosystems along shorelines will move inland, as the sea rises, but the movement will be slow enough for most plants and animals to move with the rising water.

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1. Put a check mark (✓) next to the answer that is most correct.

a) Which is a greenhouse gas released into the atmosphere when humans burn fossil fuels?

- ○ **A** ozone
- ○ **B** methane
- ○ **C** carbon dioxide
- ○ **D** calcium carbonate

b) Climate change affects all of these, *except*:

- ○ **A** sea level
- ○ **B** rainfall patterns
- ○ **C** volcanic activity
- ○ **D** course of ocean currents

c) Which of these is *most* likely to increase in population if all the ice in the Arctic Ocean melts?

- ○ **A** fish
- ○ **B** seals
- ○ **C** whales
- ○ **D** polar bears

2. Draw a line from each word or words on the left to its meaning on the right.

1	evolution	transmits light and holds heat	A
2	evaporation	change through natural selection	B
3	extinction	disappearance of a species forever	C
4	greenhouse effect	water changing from liquid to gas	D

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3. Answer the questions in complete sentences.

a) Describe the relationship between fossil fuels and climate change.

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b) Explain why polar bears are part of an aquatic ecosystem.

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Extensions & Applications

a) Explain why an ocean fish could adapt to global warming more easily than a fish living a small freshwater lake.

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b) Explain how greenhouse gases are similar to glass in a greenhouse in terms of light and heat.

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