

CLIMATE CHANGE LESSON PLAN - Oceans and Climate Change

For Grade 9

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Description of Activity: The learners read the two articles about Oceans and the effects of Climate Change silently. Learners then take turns to read aloud to the class. They make notes about the important issues in each article. The second lesson requires discussion about the text.

This lesson should be completed over 3 40 min lessons or over 1 week.

Learning Area/s: English Language	Learning Outcomes: English Language: LO2, LO3, LO4 & LO5
Assessment Standard/s: LO2: AS1 learner is able to communicate ideas and feeling creatively, expressively and imaginatively; able to demonstrate basic interaction skills by participating actively in group discussions, debates and conversations LO3: AS1 Learner able to read both silently and aloud LO4: AS4 Learner is able to analyse own and peers' writing and evaluates and makes recommendations showing sensitivity to other LO5: AS4 Process information - learner is able to develop note-making skills LO5: AS6 uses language to reflect - reflects and then asks critical questions and challenges views on what is seen, heard, and read	Subject Integration: Natural Science, Life Orientation
Background knowledge required by learners: Acknowledgement of different writing styles, grammar and punctuation Basic understanding of climate change	Materials Needed: Appendix A and B (Source of articles: World Oceans Day newspaper supplement, Department of Environmental Affairs, 2010) Writing material (paper and pen)
Activity Procedure: Lesson 1: Learners are provided with a copy of Appendix A and Appendix B. Learners must read each article and make a summary of each. Learners must take note of their grammar and punctuation while writing their summary. They must make sure the note the pertinent points in each article. Lesson 2: Learners take turns in reading sections aloud to their educator and peers. Educator encourages learners to raise questions about the text and its content. Some of the more controversial or sensitive issues may be debated.	

Lesson 3: In pairs learners review their peers' summary of the two articles. They make comments that are constructive and sensitive.

Assessment Method: Educator assessment of learners reading abilities
Educator assessment of learners conversational, discussions and debating abilities
Peer assessment of written work

of climate change on SA

South Africa is not immune to climate change. South Africa has a coastline, made of rocky, sandy and mixed beaches. The coastline is more than 3 000 km long and runs from Namibia's border in the west to Mozambique in the east. The Indian Ocean (east), Atlantic Ocean (west) and the Southern Ocean (south) contribute to the difference in climates experienced in these regions.

Because this country's coastal areas are so beautiful and have a high level of biodiversity, they are home to around 30% of the population.

The coastal areas are one of the biggest attractions for both local and international tourists. In fact, the coastal zone and oceans play a big role in the socio-economic well being of this country.

Experts predict that the impact of climate change to South Africa's oceans and coasts will be:

- a rise in the sea level;
- increased frequency and intensity of storms and floods;
- an increase in droughts;
- ocean acidification;
- ecosystem changes which will affect various species;
- impacts on industry and areas where people live; and
- an increase in diseases.

These impacts have far-reaching consequences for South Africa's coastal regions.

Extreme storms on the South African coast are becoming more frequent and more intense. An example of this is the devastating storm that hit the Kwa-Zulu Natal coast in March 2007. The damage to coastal services and infrastructure cost more than R1 billion.

IMPACTS ON LIVING MARINE RESOURCES

Changes in water masses (oceans



The extinction of many species is a devastating consequence of continued climate change to South Africa's oceans and coasts. That is aside from a rise in sea level, increased frequency and intensity of storms and floods, increased droughts, ocean acidification and changes to the ecosystem.

Photo: LEON HARMSE

IMPACTS ON MARINE BIODIVERSITY

The influence of climate on South Africa's marine biodiversity may be direct or indirect. Direct influences on marine biodiversity include:

- storms washing over islands where seabirds breed, and recently this was seen at Lambert's Bay and Bird Island in Altona Bay.

- ecosystems could include:
- large shifts in the distribution of organisms; and
- noticeable changes in the condition of organisms such as the Cape gannets that moved from Namibia to South Africa.

The eastward shift in the distribution of anchovy and sardines, have resulted in a severe mismatch in:

- the distributions of areas where breeding takes place; and
- large decreases in predator numbers.

As another example, between 2004 and 2008 numbers of African penguins breeding off western South Africa decreased by almost 70%. Cormorants (large seabirds) off South Africa's Western Bank, decreased at northern colonies and increased in the south, because of changes in the distribution of rock lobsters, their main food in this region.

IMPACTS ON COASTAL COMMUNITIES

Coastal zones, with their increasing populations and improper development, are especially vulnerable to the impacts of a rise in sea level and increases in the intensity of storms.

Ecosystems and natural resources are vulnerable to climate change impacts, which are made worse by human settlement in the following ways:

- habitats being broken up;
- a severe decrease in resources;
- blocked migration routes and;
- pollution which results in the extinction of many species.

These effects, on top of the social and economic impacts such as the loss to property and livelihoods and businesses affected by infrastructure loss and tourism, have both short-term and long-term consequences.

- temperature (how hot or cold it is) in areas where nests are can influence the sex of hatching turtles or the breeding success of penguins; and
- temperature can also influence the distribution of organisms.

Indirect influences of climate on marine diversity takes place through the effect climate has on the food web. Impacts on marine

change is occurring but oceans can act to ease this change



hat is climate change?

Climate change is the long term change that you can see happening in the weather patterns. Examples include changes in the wind, temperature, rainfall, ice cover and ocean currents.

Although there are natural variations in the climate such as the changes you see when the seasons change, modern society's use of oil and coal for energy and transport is causing an increasing amount of noticeable change in the earth's climate system.

According to the Intergovernmental Panel on Climate Change (IPCC), the earth is already warming (global warming). The truth is that even if society put a stop to all their harmful activities today, changes in the climate would be experienced for a long time into the future.

The major cause of global warming is the increasing concentrations of greenhouse gases (GHGs) in the atmosphere. These gases enhance what is called the greenhouse effect, by absorbing and trapping most of the energy from the sun that bounces off the land and the ocean.

The natural greenhouse effect makes earth a place where human beings and other creatures are able to live. Without the natural greenhouse effect the average temperature on earth would be about -19°C. But with the extra greenhouse gases coming from modern society's industrial activities, the global temperatures are going to rise to unacceptable levels.

increase in carbon dioxide is a concern for people throughout the world, and it demands urgent attention.

Recently, scientists have suggested a process called ocean fertilisation as another way that carbon dioxide can be removed from the atmosphere. Ocean fertilisation works by changing the chemistry of the surface seawater in the ocean.

During this process, iron is added to the sea surface water to increase the production of phytoplankton. More phytoplankton means enhanced photosynthesis.

Photosynthesis is the process whereby phytoplankton uses CO₂ to create food in the presence of light.

Depending on the amount of phytoplankton in the surface waters, carbon dioxide is extracted from the atmosphere and into the sea surface water where it will be used by phytoplankton as they grow.

When one of the required nutrients is used up, phytoplankton will die and sink.

Scientists think (but aren't sure) that when the phytoplankton sink they remove carbon dioxide from the surface waters. It is not known if ocean fertilisation is a long term solution to the problem or just temporary relief from it.

But, human beings can make a big difference by doing their bit to

limit acidification by reducing their carbon footprint.

OCEAN ACIDIFICATION

The continuous release of CO₂ into the atmosphere will mean an increase of CO₂ in the oceans.

This in turn means a change in the chemical composition of the seawater.

Carbonic acid is formed when seawater and CO₂ combine, and the process is known as ocean acidification.

Ocean acidification can negatively affect most marine life.

Acidic seawater (seawater with a low pH level) dissolves calcium carbonates. Calcium carbonates are the basic chemical building blocks needed by some marine creatures such as shell-fish to survive.

Coral reefs use calcium carbonate to produce their skeletal structure. The decrease in the available calcium carbonate because of the decline in the pH level of the seawater is a very big threat to the survival of coral reefs.

The more acidic the ocean is, the more disruptive it is to the ocean's ecosystem. Species could be endangered, and this would impact negatively on the fishing and tourism industries.

The pH level in the surface water around South Africa is about 8.13. Lower and more acidic waters of about 7.95 are found in tropical waters as nearby as Angola.

As more and more carbon is burned, the carbon dioxide in the atmosphere is expected to increase, and the oceans will gradually become more acidic.

Coral bleaching is a process that refers to the whitening of coral, caused by the loss of symbiotic, algae-like protozoa. The loss of the protozoa is caused by the stress of increasing sea temperatures, pollution and ocean acidification.

Photo: PROVIDED

CLIMATE CHANGE IN THE OCEANS

Oceans are a key part of the climate system because of their ability to absorb, store and release large amounts of heat and carbon dioxide that comes from the atmosphere.

Oceans are both affected by climate change and have the ability to ease climate change. Ways in which oceans are affected by climate change include:

- warming and acidification of the surface waters;
- the strength and distribution of winds and currents; and
- the ocean's level of productivity.

The oceans are able to ease climate change by removing heat and carbon dioxide from the atmosphere.

All over the globe, the temperatures of the surfaces of the sea have risen and the increase of carbon has led to the ocean becoming more acidic.

Oceans surrounding South Africa clearly show regions where consistent and significant warming of the sea surface and the acidification of seawater has taken place.

OCEAN FERTILISATION

The change taking place in the ocean environment because of an