Marine Science Lesson Enhancements
based on **Grade 11 & 12 curriculum** in
Physics, Chemistry & Biology

Lessons explained

Ocean Explorer

Module 1

Bayworld Centre for Research & Education

BCRE

Overview

Oceanography research covers a wide range of disciplines, from ecology to cellular biology, from geology to atmospheric studies. In South Africa, we are surrounded by waters, the Atlantic Ocean on one side and the Indian Ocean on the other. Both offer an incredible array of experiences for our young generations.

This education cursus provides teachers and educators with a free to use material dedicated to science classes for high school grades 11 and 12. It offers insights into our wonderful ocean and coast biodiversity but also geology and climatology, guiding students through adapted lessons. These lessons have been designed with the help of talented educators, in order to achieve a compact and easy to use package. During development, one of the most important requirements was for the lessons to be adapted to the children's level with the aim to ease their understanding of difficult concepts.

The Ocean Explorer cursus also aims to encourage ecologically friendly comportments within younger generations, in the hope that their concern for nature will help to protect our marine wildlife in South Africa.

We hope that you and your students will enjoy these lessons as much as we enjoyed designing them !

Disclaimer : Although the contents of this cursus have been obtained from reliable sources, as part of the study programme, students are urged to verify all data they wish to use. The developers will not be held responsible for any incorrect or misuse of information.

2 - The authors

This array of lessons have been designed by BCRE in conjunction with PAAZA™.

BCRE is focused on education and research predominantly related to the marine environment through operational oceanography.

PAAZA stands for Pan-African Association for Zoos and Aquaria, and aims to protect and care for captive and wild animal populations. Its primary missions are conservation, education and research. As a result, this association takes part in managing captive breeding programs, releasing of captive animals, managing wild populations, developing animal welfare within captive facilities and more generally protecting the environment via any accessible mean.

Info +

Supplementary information in relation with the lesson and the oceanography.

3 - How to use this manual

A total of 15 lessons have been designed, each concentrating onto a specific field of study. It is possible to cover one lesson within 2 hours in class, which make a total of 30 hours of teaching. The lessons are numbered in a logical order for the children to progress. At the end of each lesson, an activity is proposed for the teacher to use. Results and further materials to this activity are available upon request.

Important points to memorise, or a way to retain information, are often linked to pictures. These help with the understanding of difficult concepts and give a visual cue to the student as to what is **important**.

Module 2 - Water

The chemistry of water

Intermolecular Forces

Geometrical Optics

Reflection and refraction in water

Diffraction

Module 3 - Waves and currents

Waves, Sounds and Light

Parts of a wave

Types of waves

Two-dimensional & three- dimensional wave fronts

Waves and Currents

Currents around South Africa

Module 4 - Coastal areas

Shaping the Coast

Coastal Zone

Coastal landforms

Types of Coasts

The colour of water

Coasts of South Africa

Module 5 - Climate part 1

What is "energy" ?

The transfer of energy and energy balance

Air masses

Global air circulation

Secrets of weather forecast

Module 6 - Climate part 2

Previous Eras

Africa's current climate

The role of Oceans in climate control

El Niño and La Niña

Module 7 - Climate shift

The greenhouse effect

Human impact and the enhanced greenhouse effect

Carbon footprint

Ozone depletion

Models of Earth's future climates

Module 8 - Human Impact on the environment

The relationship between resources and economic development

Exploitation & depletion of resources

Availability and quality of water

Poaching and Indigenous knowledge systems

Sustainable use of the environment

Module 9 - Ecology

Population Ecology

Estimating population size

Social organisation of populations

Ex. 1 : Herds and Flocks

Ex. 2 : Co-operative hunting in Packs

Risks factors for wild populations

Module 10 - Ecosystems

Interactions in the environment

Predation and competition

Specialization and parasitism

Mutualism and commensalism

Community change over time

Stratification and gradation

Module 11 - Evolution in action

The Evolution Theory

What is Natural Selection

Evolution in ecosystems and Theory of the red queen

Phylogenetic trees and classification

Homologies and Analogies

The position of Humans within the tree of life

Module 12 - Biodiversity - Algae

Algae classification

Photosynthesis and chlorophyll

Light-dependent Reactions - First stage of Photosynthesis

Calvin Cycle - Second stage of Photosynthesis

Harmful algal blooms

Anaerobic respiration

Module 13 - Biodiversity - Invertebrates

Phyla and body plans

Tissue layers in the body

Invertebrate classification

Importance of Invertebrates

Module 14 - Biodiversity - Fish & Amphibians

What is a fish/amphibian ?

Fish classification

How can fish breathe under water ?

From fish to amphibian

Amphibian classification

Module 15 - Biodiversity - Birds & Mammals

Marine birds

Mammal classification

Marine mammals

Module 16 - What is Marine Research ?

Understanding fieldwork

What does it mean to be a scientist ?

Working together

Various disciplines explained

Module 17 - Applied research in Oceanography

Coastal field exploration

Use of oceanographic features to explore maps

Application of GIS in oceanography

Buoy monitoring

5 - List of activities

This is a list of all the activities you will find in these lessons.
If you need assistance, you may contact us at : sophie@zoosafrica.com

Module 2 - Water

Activity : Conductivity of water

Module 3 - Waves and currents

Activity : Two-slits wave model

Module 4 - Coastal areas

Activity 1 : Weathering
Activity 2 : Name the landforms

Module 5 - Climate part 1

Activity : Your own weather forecast !

Module 6 - Climate part 2

Activity : Climates and Adaptations

Module 7 - Climate shift

Activity : Models and parameters

Module 8 - Human Impact on the Environment

Activity : Poaching and extinction

Module 9 - Ecology

Activity : Estimate a population size like a true scientist

Module 10 - Ecosystems

Activity : Tuna Sandwich

Module 11 - Evolution in action

Activity : Build a tree

Module 12 - Biodiversity - Algae

Activity : Grow algae !

Module 13 - Biodiversity - Invertebrates

Activity : Collecting Hydra

Module 14 - Biodiversity - Fish & Amphibians

Activity : Where to place this animal ?

Module 15 - Biodiversity - Birds and Mammals

Activity : Whales' "fingerprints"

Module 16 - What is Marine Research ?

Activity : Can you tell what this discipline is about ?

Module 17 - Applied research in Oceanography

Activity : Which data do you need ?

Virtual Biology Lab
http://virtualbiologylab.org
Live ecology, evolution and cell biology models online for students to play.

CFOO
www.cfoo.africa
Centre For in situ Observational Oceanography & marine species, research documents and education

PAAZA
www.zoosafrica.com
Pan-African Association of Zoos and Aquaria. Ressources on African Zoos and Aquaria, literature, news and legislation.

This list will be updated when new ressources are found.

7 - Acknowledgements

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