

# What is Marine Research

## Ocean Explorer

Module **16**



Bayworld Centre for Research & Education





# Overview

- 1 - Understanding fieldwork
- 2 - What does it mean to be a scientist ?
- 3 - Working together
- 4 - Various disciplines explained
- 5 - Activity : Can you tell what this discipline is about ?



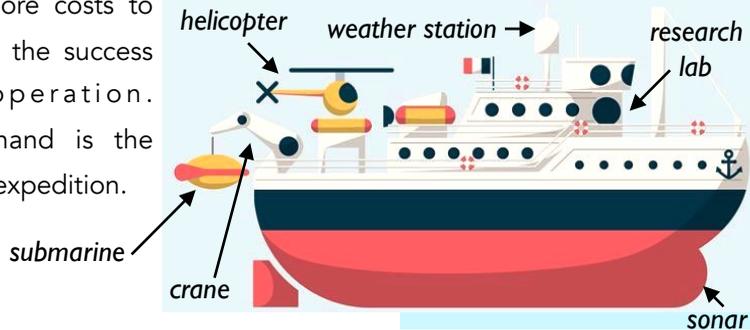
# 1 - Understanding fieldwork

When scientists go on a mission to explore the ocean, it requires proper preparation, specialised instruments and material and of course money. A single trip on a boat can easily overcome a million rands in fuel only, without adding the cost of equipment or manual labour !

This is the reason why the numerous steps taken in preparing the field trip are so important. Because once the boat is at sea, there is no return to the harbour to fetch one forgotten tool. It would delay the mission, add more costs to the trip and reduce the success of the whole operation. Preparation beforehand is the key to any scientific expedition.

## Info +

Research vessels are fully equipped to take samples, measure weather conditions, load special machineries or even launch helicopters or mini submarines !



## How to prepare for a scientific expedition ? Follow the steps !

- Define the question to be researched - *What do you want to know and why ?*
- Research - *Does anybody already know the answer or has researched the same thing in the past ? If no answers have been found, are there methods to find them today ?*
- Gather the equipment / funds - *What equipment would you need for your expedition ? How can you buy / rent it ? Who could give you fundings for your expedition ?*
- Gather your team - *Which persons do you need on your team ? Do you need other competencies (skipper to drive the boat, skilled diver to retrieve something from the sea floor...)*
- Book the expedition date - *Is everybody OK with the date ? Is the weather OK to go at sea ?*
- Make sure everything is ready before departure - *Make a checklist*
- Go explore !

## 2 - What does it mean to be a scientist ?

A scientist's life is not always going out in the field to find animals, plants or data. In fact, it is far away from this ! A scientist's life is usually spent in an office or in the lab, trying to figure out what to do with the samples they collected and writing scientific papers. The "expedition" side only takes about 5% of the scientist's schedule for a year. In total, a scientist might go out in the field for a couple of weeks a year, but they often don't leave their labs for a few years ! So if you are prepared to stay between 4 walls and still give research your best, welcome to the scientist's world !

Research doesn't mean being alone and trying out plenty new experiments in a lab to see what works. Research is a long process that includes exchanges between scientists and a strict application of the **scientific method**. Without this method, no results are valid ! So be careful when drafting an experiment : if it doesn't comply with the scientific method's steps, the experiment will not be approved !



\* THIS IS SURPRISINGLY CLOSE TO HOW REAL SCIENTISTS ACT AT CONFERENCES.

The scientific method. To be applied in every research experiment !



### 3 - Working together

Scientists are highly intelligent people, but due to the incredible amount of knowledge this position requires they are often specialized in one field only. Different researches need different knowledge bases, so scientists often work together in order to cover a larger range of samples and observations.

This leads to **cross-field works**.

By working with a person having a different point of view on the matter at hand, researchers also increase their chances of success. The second person might see something that the first one hasn't because his/her mind is not set this way. It is also a very good way to learn more and evolve as a scientist !

#### The benefits of being in a Team !

- Speed up the rate of discovery
- Different skills for different problems
- Junior members gain access to mentors
- Intellectually stimulating !



Various disciplines exist that explore seas and oceans. To cite a few :

- Marine Ecology
- Hydrobiology
- Maritime Archeology
- Climatology
- Chemical Oceanography
- Geological Oceanography
- Marine Biology
- Phycology
- Physical Oceanography



## 4 - Various disciplines explained

### Physical Oceanography

Physical oceanography is the study of the physics of marine systems. It includes the distribution of temperature and salinity, water mass formation and movement, ocean currents, interior and surface mixing, energy inputs and dissipation, surface and internal waves, and surface and internal tides.

As water is a fluid, this discipline is linked to the **Physic of Fluids** that explores any type of fluids and their properties, and to the **Climatology** that studies climates.

*How this impacts our daily life : weather monitoring.*

### Chemical Oceanography

Chemical oceanographers and marine chemists study the composition of seawater, its processes and cycles, and the chemical interaction of seawater with the atmosphere and the seafloor. Their work may include analysis of seawater components, the effects of pollutants, and the impacts of chemical processes on marine organisms. They also use chemistry to understand how ocean currents move seawater around the globe and how the ocean affects climate.

This discipline works hand in hand with **Climatology** for climate studies but also **Physical Oceanography** and **Hydrobiology** for water quality and relations between chemicals and life.

*How this impacts our daily life : weather monitoring, discovery of new medicines, water quality control.*

### Geological Oceanography

Geological oceanographers and marine geologists explore the ocean floor and the processes that form its mountains, canyons, and valleys. Through sampling, they



look at millions of years of history of sea-floor spreading, plate tectonics, oceanic circulation and even climates. They also examine volcanic processes, mantle and hydrothermal circulation, magma genesis, and seafloor formation. The results of their work help us understand the processes that created the ocean basins and the interactions between the ocean and the seafloor.

Without geology, **Climatologists** couldn't use old weather data to model the future of our Earth's climate.

*How this impacts our daily life : prediction of future climates, prevention of earthquakes and volcanoes, fossil fuel findings*

## **Climatology**

It is the science that deals with climates and their phenomena. A climate is defined as the mean weather conditions at a location over a period of time. A climatologist attempts to discover and explain the impacts of climate so that society can plan its activities, design its buildings and infrastructure, and anticipate the effects of adverse conditions.

Climatologists work closely with **Meteorologists** to design models to predict the weather according to the latitude and longitude and the past conditions. But Climatologists are not interested in what the weather will be like tomorrow, they are interested in general trends.

*How this impacts our daily life : prediction of future climates, climate change studies*

## **Maritime Archaeology**

Maritime Archaeology is the study of how we as human beings have interacted with the oceans, lakes and rivers. It goes back tens of thousands of years, as people harvested goods from the sea, learned how to fish, built the first canoes to cross the oceans, to today's modern times when

big massive ships ply the oceans carrying goods or large numbers of people.

Maritime Archaeologists work in conjunction with Terrestrial Archaeologists in order to link the human expansion at sea to the human expansion on land.

*How this impacts our daily life : contribution to our knowledge on human history, re-discovery of lost techniques and ideas*

### **Marine Biology**

Marine biologists study plants and animals in the marine environment. They are interested in the numbers of marine organisms and how these organisms develop, relate to one another, adapt to their environment, and interact with it. To accomplish their work, they may use field observations, computer models, or laboratory and field experiments. Marine biology is divided into more precise fields to cover the entirety of marine life : **Hydrobiology, Marine Zoology, Phycology, Marine Ecology** etc.

*How this impacts our daily life : Food sources, discovery of new species, aquaculture, maintenance of marine species in aquariums for display and education, study of life evolution*

### **Marine Ecology**

Marine ecology is the study of living things in the ocean and how they interact with their environment. It is an interdisciplinary science that combines biology with physical sciences (e.g. **Geology, Chemistry, Physical and Chemical Oceanography, Geophysics, Statistics**).

*How this impacts our daily life : understanding human interactions with the marine environment.*



## Marine Zoology

A Marine Zoologist studies animals that live in the water. **Marine Biologists** study all aspects of the marine environment, from plants to protozoa, while Marine Zoologists concentrate on animal life. Marine Zoologists work with animals in all types of water environments, from oceans to freshwater estuaries. **Ichthyologists** study fish such as sharks and skates, **Marine Mammalogists** study dolphins and whales, and **Marine Ornithologists** study sea birds.

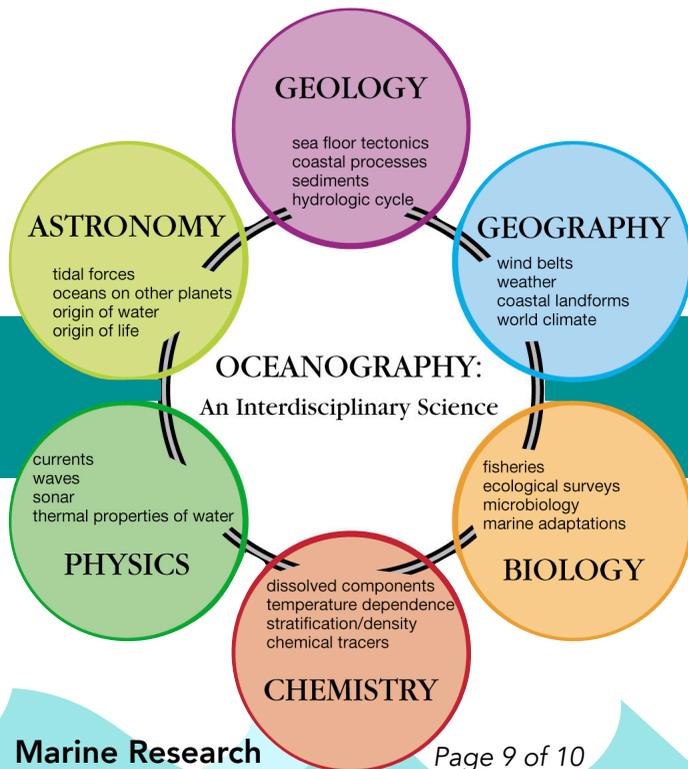
*How this impacts our daily life : better knowledge of all marine species, protection of endangered species and use of non-endangered ones.*

## Phycology

Phycology is the scientific study of algae. Also known as **Algology**, Phycology is a branch of **Marine Biology**, often linked to **Botany**.

*How this impacts our daily life : algaculture (culture of algae) for food or fuel*

All disciplines work together !





## 5 - Activity : Can you tell what this discipline is about ?

Sometimes scientific disciplines have complicated names and one does not always understand where they are coming from. Here, we will try to unravel the mystery over a few strange names...

### Questions

- 1 - "Oceanography" is a term derived from two words : "ocean" ("ocean") and "graphy" ("to write"). Find out which language they come from.
- 2 - Which other language is often used to name disciplines and animals (scientific names) ?
- 2 - Take a look at the table below. A few discipline's names are written. Do some research and fill in the table with your findings.

Discipline	Ethymology (which words are they made of)	Meaning
Limnology		
Helminthology		
Malacology		
Pedology		
Helioseismology		

The origin of a word and the historical development of its meaning is called "Etymology".