

EXPERIMENT INSTRUCTIONS FOR SHIP CRUISES

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Aims

- To study the physics, chemistry and biology of seawater
- To develop and acquire important scientific skills
- To acquire a taste for scientific cruise work

Introduction

These instructions are based on activities that the Bjerknes Centre for Climate Research and the Geophysical Institute at the University of Bergen carry out with school pupils during one day cruises.

Prior knowledge

Theory on marine carbon cycle, oceanography (e.g. currents, salinity, and temperature), marine biology, or how to formulate a hypothesis.

Materials

The experiments 1a and 1b require a ship equipped with a CTD profiler, plankton net, equipment for sampling benthos, and magnifiers.

Experiment 1b also requires bottles for water samples, analytical instruments for dissolved oxygen and inorganic carbon, and access to the CO₂ Calculation Program CO₂SYN.

1. One-day cruise to an ocean (costal) site

a) Short version

This activity includes preparation, one day on a research vessel, and writing reports.

Procedure

1. Visit school prior to cruise to give introductory lecture to pupils
2. Visit an ocean site
3. Measure temperature, salinity, and dissolved oxygen in the water column using a measuring device (CTD)
4. Collect plankton species using a plankton net and examine them using a magnifier
5. Collect benthos species
6. Write report based on data collected and observation performed during the cruise

Main question

What do we expect to find during this time of year in the seawater?

Additional questions

- Which instruments are used onboard and how do they work?
- How does the salinity/temperature/oxygen concentration change as a function of depth?
- What is the cause of the observed variations in salinity, temperature, and oxygen?
- Which main groups of plankton and benthos are found?

b) Long version

This activity includes preparations, one day on a research vessel, post cruise laboratory analyzes and writing reports.

Procedure

1. Visit school prior to cruise to give introductory lecture to pupils
2. Visit two ocean sites (e.g. shallow and deep water, hard bottom)
3. Measure temperature, salinity, and dissolved oxygen in the water column using measuring device (CTD) at the two sites
4. Collect water samples at the two sites (8 samples at each site)
5. Collect plankton species (at one of the sites) using a plankton net
6. Collect benthos species at the two sites
7. Post cruise analyses and calculation
8. Write report based on data collected and observation performed during the cruise and post cruise analyses

Main question

What are the differences between the two ocean sites?

Additional questions

- Describe the safety routines onboard
- Describe at least two of the instruments onboard: what are they used for and how do they work?
- How do the temperature, salinity, and oxygen vary with depth at the two sites? Explain the variations.
- Describe and try to classify four of the plankton species sampled.
- Describe differences and similarities in the benthic material collected from the two different locations, and try to classify four species from each location.
- Describe the methods used to analyze inorganic carbon and alkalinity.

- How does the inorganic carbon and alkalinity vary with depth at the two sites? Explain the variations.
- Using the Lewis&Wallace CO₂ calculation program calculate the pCO₂ of surface water from inorganic carbon and alkalinity.
- Find (from the web etc.) a reasonable value for the atmospheric pCO₂ content.
- Compare the pCO₂ in atmosphere and surface water. Which of these are the largest and in which direction do you think the transport of carbon dioxide will go (from the water into the atmosphere or opposite)? Are the different ocean sites sources or sinks for atmospheric CO₂?
- Calculate the amount of the transport of carbon dioxide (flux) between the atmosphere and sea surface.
- Enter all the data (date, year, depth, temperature, salinity, oxygen, inorganic carbon, alkalinity, pCO₂, flux, etc.) into a data base (Skolelaboratoriet/CarobSchools web site; **"The sea in front of out door"**), and comment on if you see any differences between the years.