NIWA
Taihoro Nukurangi

Sea and Learn

Student Workbook

on board
RV *Kaharoa*

NIWA Information Series No. 14
ISSN 1174-264X
2000

Published by NIWA
Wellington
2000

Inquiries to:
Publication Services, NIWA,
PO Box 14-901, Wellington, New Zealand

ISSN 1174-264X

Citation:
Anon. 2000: Sea and Learn student workbook: on board RV *Kaharoa.*
NIWA Information Series No. 14. 48 p.

The National Institute of Water and Atmospheric Research
is New Zealand's leading provider
of atmospheric, marine,
and freshwater science

Visit NIWA's website at http://www.niwa.cri.nz

SEA AND LEARN
Student Workbook
2000

Prepared by:

Jason Rendle

Whangamata Area School

Lynn Rogers

Raglan Area School

Julie Hall

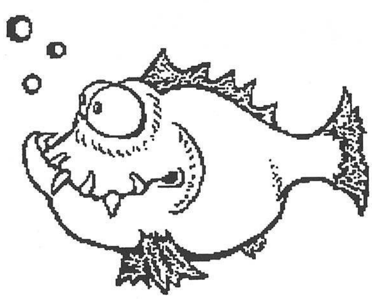
National Institute of Water & Atmospheric Research

Graham Foster

Glendowie College

Name: ____________________________________

TABLE OF CONTENTS

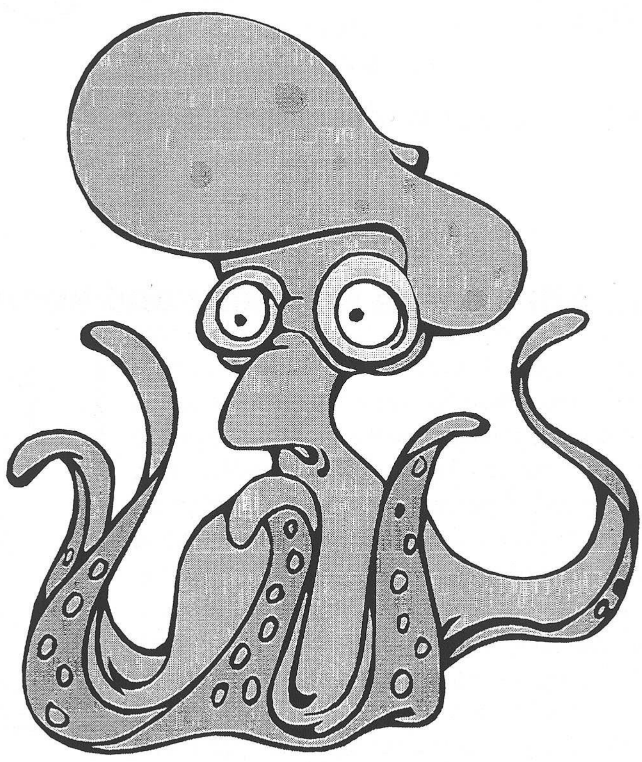


ACKNOWLEDGMENTS

We thank Whangamata and Raglan Area Schools for supporting Jason and Lynn and John Croall for reviewing the resource material.

We would also like to thank Lionel Carter, Janet Grieve, Michelle Morris, Steve O'Shea and Karl Safi from NIWA for producing keys and assisting with scientific material.

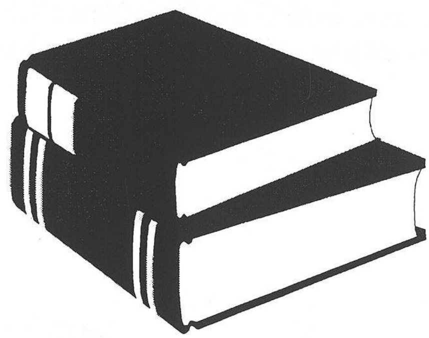
Our thanks also go to Clive Glover, John Hadfield and the crew of RV *Kaharoa* for their input into the programme and Nikki Pound for her work in desktop publishing of the resource.



WELCOME ABOARD RV *KAHAROA*

WELCOME TO THE SEA AND LEARN PROGRAMME

The Sea and Learn Programme has been designed to:



- provide you with an opportunity to experience 'real life' oceanography
- increase your knowledge and understanding of the marine environment
- enable you to interact with scientists

We hope you will have an enjoyable and interesting day.

NIWA SCIENTISTS INVOLVED IN THE SEA & LEARN PROGRAMME

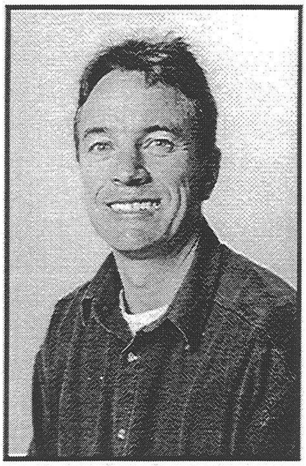
Dr Julie Hall

I have been a scientist with NIWA for the past 9 years. The primary focus of my research is investigating the microbial components of the food web. This involves working with bacteria, small phytoplankton and the small zooplankton which feed on the bacteria and phytoplankton. These very small organisms can play a very important role in the food web in many marine and freshwater ecosystems. I currently have research projects investigating these organisms in the open and coastal oceans around New Zealand and in the Southern Ocean. In the past I have also worked with these organisms in both New Zealand and Antarctic lakes. My job also involves working as an education liaison person for NIWA which is how I became the Coordinator for the Sea & Learn Programme. To become a scientist I studied at university for 9 years: 4 years at the University of Otago for my BSc Hons., and then 5 years at the University of Manitoba in Canada to gain my PhD. In my spare time I enjoy flying gliders by myself and also with my husband Trevor, riding my motorcycle and taking my dog Chimo for long walks.

Dr Rob Murdoch

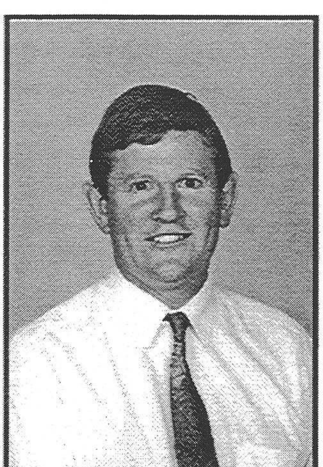
I have been a scientist with NIWA for the past 14 years. My primary research focus has been investigation of the factors that influence the survival of larval fish, and the influence of ocean currents and water masses on the distribution of zooplankton. Research projects to date have included study of the diet of hoki larvae during their life in the plankton at hoki spawning sites off Westland and within Cook Strait, and the movement of eggs and larvae by local currents. Other research projects have included assessment of the effects of oil wells, pipelines and effluent outfalls on marine life, both in New Zealand and Australia, the effects of mussel farms on phytoplankton concentrations in the Marlborough Sounds, and the study of food factors that influence successful breeding of penguins. My current role also involves coordinating NIWA's oceanographic and aquaculture research programmes. Prior to my appointment as a scientist I studied at the University of Otago for 8 years. Much of this time was based at the Portobello Marine Laboratory, and over this period I gained a BSc (Hons) and PhD. My main interests outside work include flying (having gained a commercial pilots licence and instructors rating), tramping, climbing, diving and skiing.

Mike Page



My primary research focus has been the investigation of marine invertebrates as a source of natural chemicals. These chemicals extracted from sponges, sea squirts, bryozoans and algae have potential uses as pharmaceuticals and agricultural chemicals. This work involves collection and identification of bottom dwelling species throughout New Zealand's exclusive economic zone (EEZ). Research projects that I have been involved in to date have included a study of the impact of harvesting and ecology of a deepwater sponge, sponge aquaculture, and environmental surveys of benthic fauna associated with oil fields, marine farms and marine reserves. My research has enabled me to work in environments ranging in latitude from Antarctica to the South Pacific islands. My current research topics are focused on developing aquaculture methods to grow native red seaweeds, and on the chemical ecology and the potential for aquaculture of a shallow water sponge. Prior to my appointment at NIWA, I studied at Canterbury University for 6 years completing a BSc and a MSc (Hons) degree in Zoology. When not working I spend my spare time diving, surfing and skiing.

Graham Foster



I have been Faculty Manager, Science, at Glendowie College for 10 years. My primary aims have been to find ways to help students learn ideas and skills more effectively, improve their achievement level, and to enjoy science. This has been done by using a wide variety of learning strategies that recognise the differences in learning style and ability. I have found it very important to provide students with positive, personal support, and challenge them to achieve realistic qualification levels. Outside college I am involved as an NZQA Physics Moderator. Involvement in the NIWA Auckland Science and Technology Fair has been very important to me over the past 5 years, and I was Chairman of the fair in 1998 and 1999. I studied Chemistry, Physics and Mathematics at Auckland University, and later studied Educational Administration through Massey University. Valerie and I have two 'children' – Matthew (17 yrs) and Caroline (15 yrs). In my spare time I enjoy gardening and reading. We have enjoyed travelling to the USA, Britain, Australia, Hong Kong and Singapore.

THE PLAN FOR THE DAY

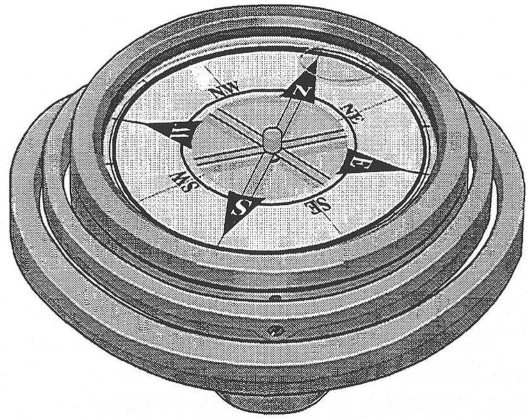
8.30 am.	Sail from port
8.30-10.00 am.	Introduction, Orientation, Safety. (2 groups of 6 students)
10.00-10.30am.	Morning tea
10.30-12.00pm.	Activity 1
12.00-1.00pm.	Lunch
1.00-2.30pm.	Activity 2
2.30-4.00pm.	Activity 3
4.00-5.00pm.	Discussion
5.00pm. (approx.)	Arrive back in port.

Roster for activities

Activity times	Sampling	Bridge Watch	Analysis
10.30-12.00	Groups 1&2	Groups 3&4	--------------
1.00-2.30	Groups 3&4	---------------	Groups 1&2
2.30-4.00	---------------	Groups 1&2	Groups 3&4

The class should be already arranged into 4 groups of 3 students. For the Orientation and Safety, Sampling and the first part of the Analysis, these groups will combine to form 2 groups of 6.

> "Pooped out" originally described the condition of seamen caught on the poop or aft deck after a wave from heavy seas crashed down upon it.



ORIENTATION

AND

SAFETY

INTRODUCTION TO *KAHAROA*

RV *Kaharoa* is a purpose-built research vessel designed primarily for coastal surveys but also capable of operating throughout New Zealand's Exclusive Economic Zone. *Kaharoa* was built in Whangarei
and launched in 1981.

Kaharoa's principal features are:

Length	28 metres
Beam	8.2 metres
Draft	3.2 metres
Displacement	300 tonnes
Fuel capacity	48,800 litres
Freshwater tank capacity	21,300 litres
Cruising speed	10 knots
Accommodation	6 crew
	5 scientific staff

Types of work *Kaharoa* conducts:

Oceanographic Research
In recent years *Kaharoa* has been used as an oceanographic research vessel, undertaking investigation of the physical, chemical and biological nature of the coastal ocean around New Zealand. The vessel has two laboratories which are used to house specialised equipment which is loaded onto the vessel for each voyage.

Trawling
Kaharoa can trawl down to a depth of 600 m and has surveyed most inshore species off the east and west coasts of both the North and South Islands. There is a selection of purpose-built trawl nets designed to catch various target species. Electronic monitoring systems give information on gear depth, doorspread, net opening and fish in the mouth of the net.

Acoustic Surveys
Kaharoa has been used for acoustic measurement of fish abundance. A towed body fitted with a specialised transducer is operated by experienced acoustic personnel. Data are recorded on a purpose-built computer housed in the dry lab.

Marine Surveys
The vessel is also suitable for marine surveys for mineral, oil and gas exploration, for the studies of pipeline and underwater cable corridors and for environmental impact assessments, such as required for harbour and dredging works.

Legend has it that an umbrella aboard ship is unlucky.

Support Vessel
Kaharoa is also used as a diving support vessel often working in remote areas. The vessel can carry a 6.1 m dive tender on a cradle mounted on the stern.

The officers and crew of *Kaharoa* include:

Captain ....

First Mate ....

Second Mate ....

Engineer ....

Cook/Deckhand ....

Deckhand ....

For your visit the Scientist and Teacher on board are:

________________________________ and ________________________________

Slush funds were once the personal funds of ship cooks, who earned them by skimming off the fat, or "slush," from cooking and selling it when the ship came into port.

ORIENTATION ON KAHAROA

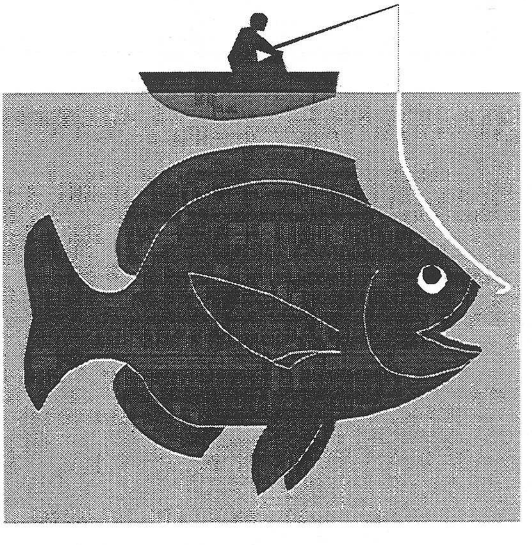
You will have a tour of the ship

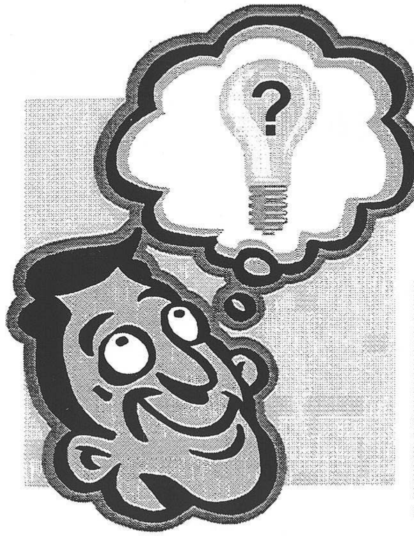
During and after this tour you need to find the information to fill in the following sheets. These are designed to help you get to know *Kaharoa*. It is important when in a specialist environment like a ship that you are aware of common terms used on board, know your way around and are aware of certain safety equipment and procedures.

Ship terms and important places to know

During your orientation tour, the person acting as your guide will outline the places you need to know and use on *Kaharoa* and will answer any questions you might have about the layout of the ship.

On the following sheets you will find maps of the layout of *Kaharoa*. Some of these places will be well known to you by the end of the day and others are out of bounds.





ACTIVITIES

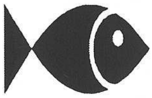
Diagrams 1 to 4 show the layout of each deck. Diagram 1 shows the lower deck which is out of bounds except in an emergency. Diagram 2 shows the main deck where you will spend most of your time.

The upper decks are shown in diagrams 3 and 4.

1. On the following diagrams identify the location of the places indicated in the keys.

2. In the table below, write a brief definition of the following terms:

Galley	
Mess	
Bridge	
Monkey island	
Gantry	
Wet lab	
Dry lab	
Beam	
Draft	
Displacement	



Scottish law once required fishermen to wear a gold earring, which was used to pay for funeral expenses if they were drowned and washed ashore.

DIAGRAM 1. LOWER DECK, BELOW WATER LINE

Key:

Bow

Stern

Port

Starboard

Out of Bounds

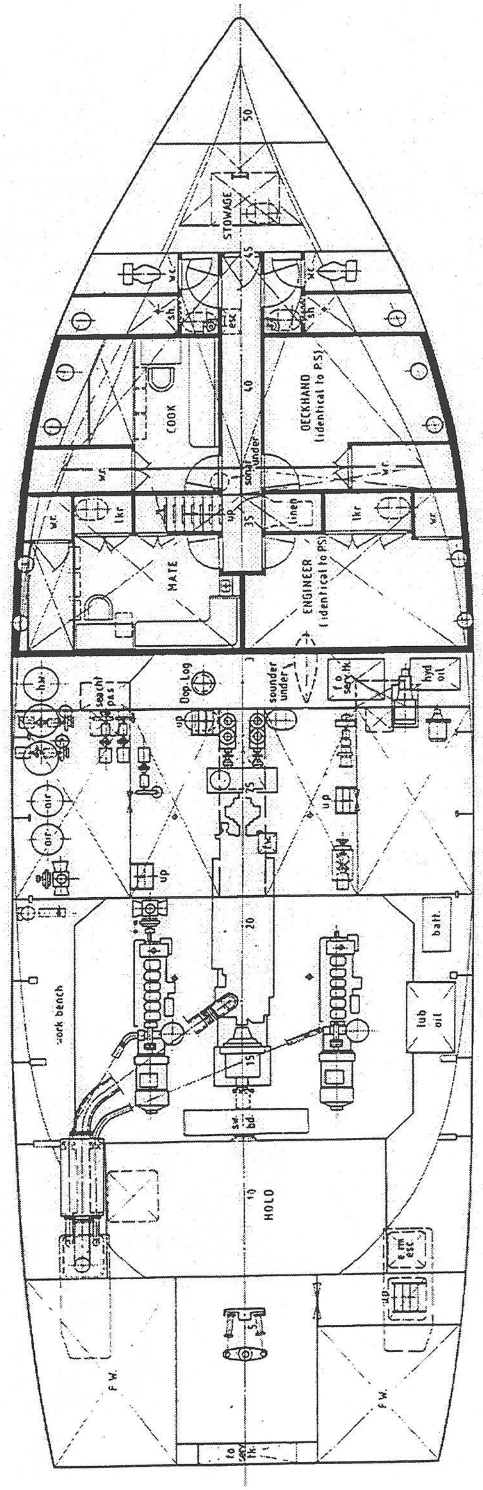


DIAGRAM 2.
MAIN DECK

Key:

Galley

Mess

Wet Lab

Dry Lab

Toilet

Muster Station

Out of Bounds

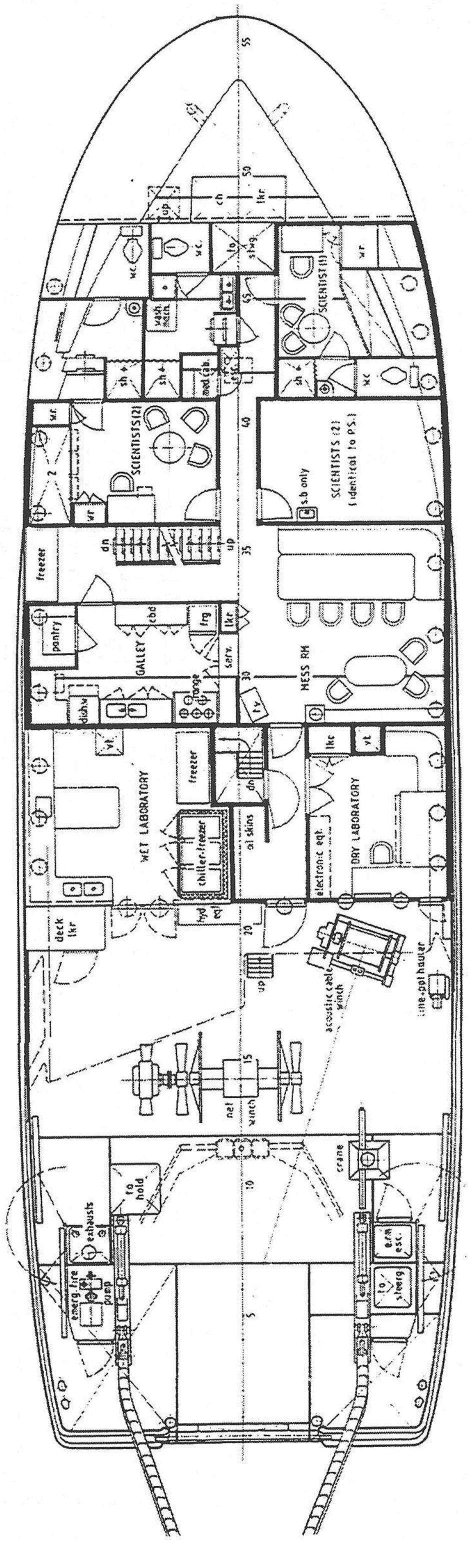


DIAGRAM 3. BRIDGE DECK

Key:

Bridge

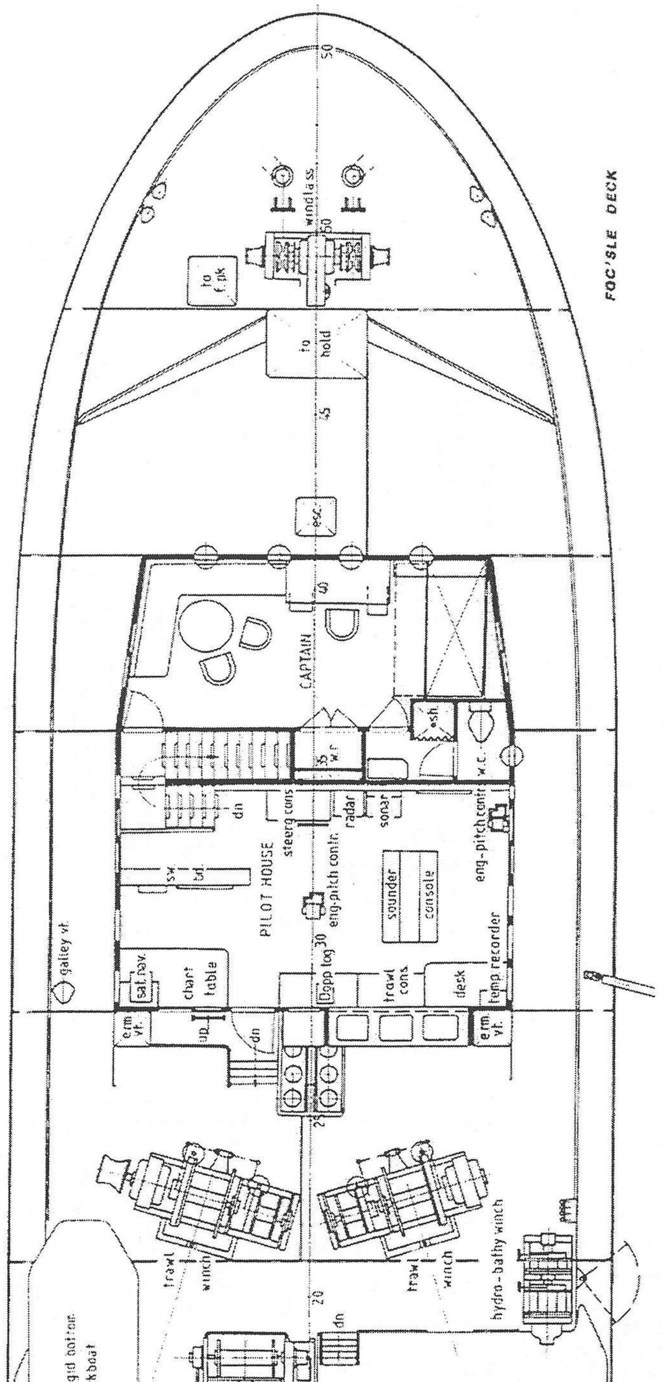
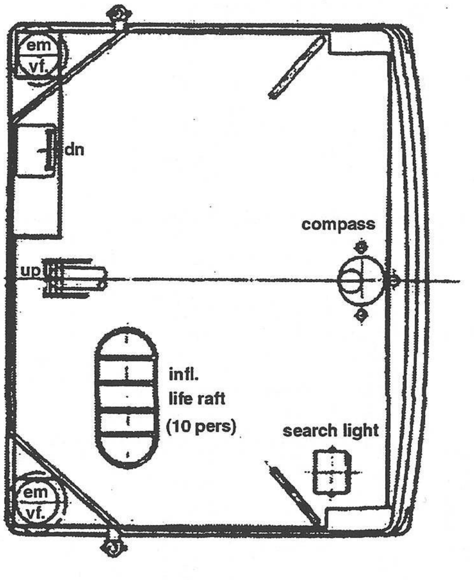
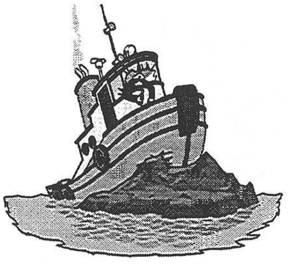


DIAGRAM 4. UPPER DECK
MONKEY ISLAND

Key

Monkey Island





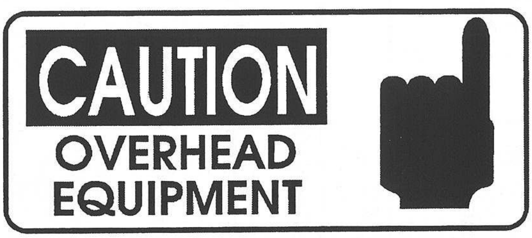
Stranded vessels were ones that had drifted or run aground on a strand or beach.

SAFETY ON *KAHAROA*

There are several hazards on board which are specific to this vessel, as well those hazards which may be found on board any ship.

In the Risk Assessment activity done before coming aboard, you will already have thought about how to minimise the risks posed by these hazards.

How do your ideas compare with ours, shown on the next page?



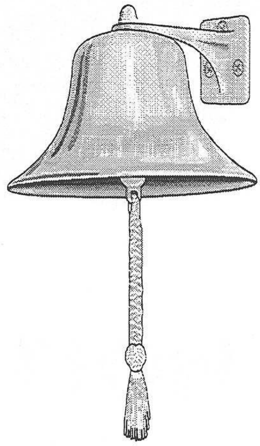
RISK ASSESSMENT ACTIVITY

RISK	MINIMISING ACTIONS
• **Vessel's motion**	*Take sea sick pills, if you get sea sick. Don't eat lots of junk food before or after boarding. Stay on deck and get heaps of fresh air. Beware of the inertia of the ship when moving or putting objects down (they may slide off!)*
• **Deck machinery (winches, pulleys, etc)**	*Don't stand near this equipment when operational, be aware of your hands (keep them away from the machinery). Tie up long hair and tuck in loose clothing.*
• **Water and sediment on deck**	*Be aware that these risks plus the movement of the ship may cause you to slip. Wear correct foot wear. Remove all sediment ASAP as this tends to be more slippery than water.*
• **Protrusions from deck**	*Look around during orientation and be aware of these hazards. Do not run on deck. Correct footwear will prevent injury.*
• **Winch wires when in use**	*Do not stand under or near moving wires at any time. Be aware that these wires can rise and fall rapidly without warning. Do not touch wire and cables.*
• **Overhead equipment**	*Hard hats must be worn when on deck. Do not stand underneath any equipment, particularly when it is being raised back on deck. Be careful when moving through doorways as these are usually lower than normal.*
• **Falling overboard**	*Don't go near side of ship, especially if railing is down. If you are feeling unwell please let the teacher or scientist on board know.*
• **Hazardous chemicals *(formalin)***	*Don't leave formalin bottle open. Wearing appropriate clothing (supplied) when using the formalin (be aware – it's a carcinogen).*
• **Fire/Collision/Grounding/Man Overboard**	*Students to follow instructions on emergency procedures as issued by the "Vessel Safety Officer" and as detailed in their Induction Training.*
• **Movements on board the vessel**	*Where possible, hold on to railings and ship superstructure while moving about vessel. When climbing down outside steps always proceed facing the steps with both hands on the rails.*

The best way to prevent injury is to listen to all instructions, go where you are supposed to go, and don't touch items you have not been cleared to touch.

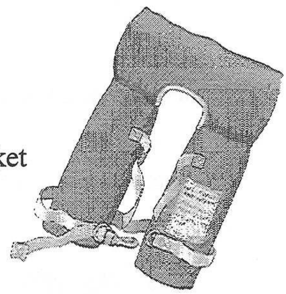
SAFETY EQUIPMENT AND PROCEDURES

The *Kaharoa* has a variety of safety equipment on board. Please read the following information carefully. A crew member will go through this information with you. If you have any questions about safety, please ask.



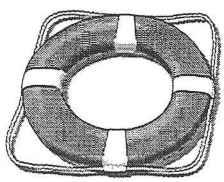
Emergency Signals
In an emergency situation at least seven (7) short and rapid rings on the alarm bells followed by one prolonged ring will be sounded. Continuous sounding of the fog horn and/or siren also means that there is an emergency.

Initial Action on Hearing Emergency Signal
Put on plenty of warm clothing and footwear. Woolly clothing is best; as many layers as possible with wet weather gear as the outer layer. Report to muster area with life jacket.

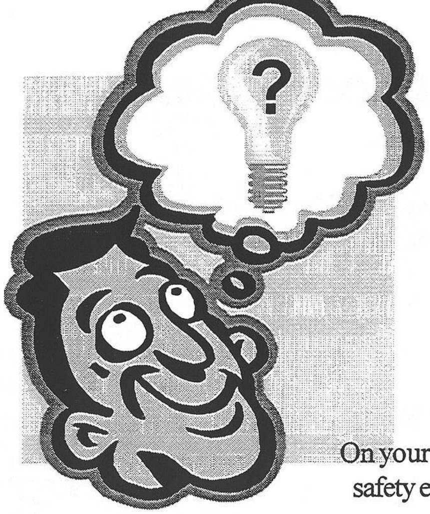


Lifejackets
Ensure lifejacket is correct way round, the longer part is the front
Place over head with arms through top tapes
Pull top tapes tight and fasten firmly at front
Pass bottom tapes around body, cross over at back and fasten at front of jacket
Activate the light by removing plastic cover and squeezing the lever hard

Life buoys (with line)
Ensure line is free and not made fast to ship, throw overboard.



> It was in the early days of the British Navy that guns were first fired in salute. Since they could not be reloaded quickly, the act of firing a gun in salute assured those receiving the salute that those who fired had disarmed themselves, and could do no harm. The more guns that were fired, the greater the assurance of disarmament, and the higher the respect offered to those being saluted. The largest ships of the fleet held twenty-one guns along one side, therefore the highest mark of respect was a twenty-one gun salute.



ACTIVITIES

On your diagrams 1-4, mark in the location of the following items of safety equipment:

Fire extinguishers	(4)
Fire alarms	(1)
Fire hydrants	(3)
Fire hoses	(2)
Escape hatches	(2)
Life rafts	(3)
Life rings	(4)
Chemical spill kit	(1)

- Identify on Diagram 2 the **Muster station** and cupboard where the **life jackets** are stored.

- What should you do in the event of a man overboard?

____

____

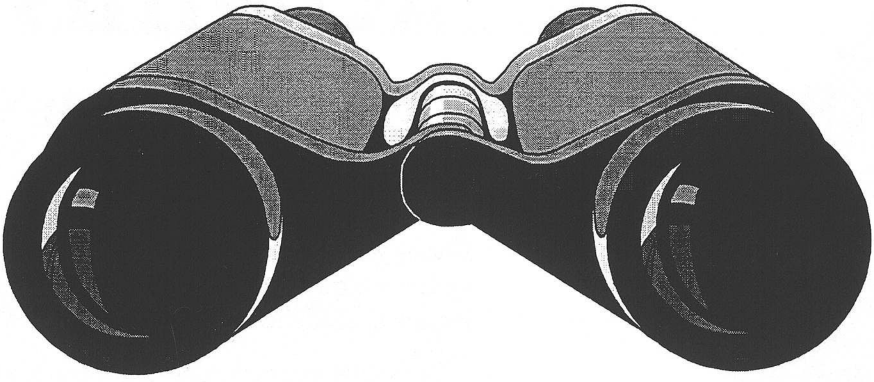
____

- What should you do if you are feeling queasy?

____

____

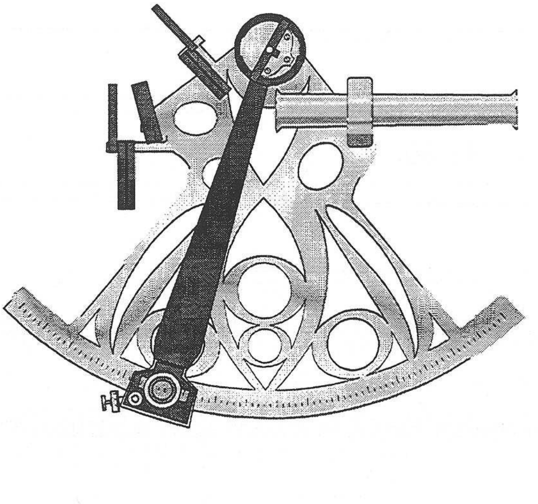
____

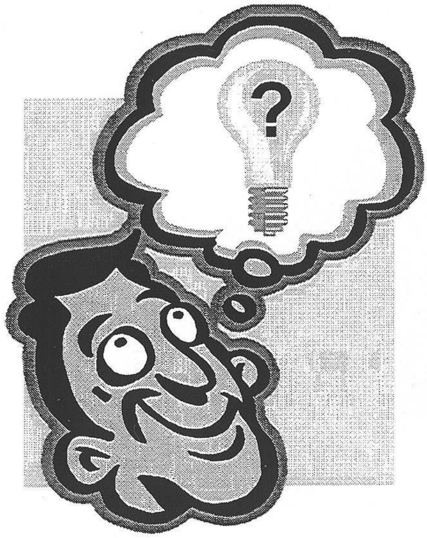


OCEAN OBSERVATION

AND

SHIP TECHNOLOGY





ACTIVITIES

BRIDGE WATCH

Ships technology

During your Bridge watch you will be able to see and have explained the use of several pieces of important equipment. Some of these you will get to use.

- Fill in the following table regarding the two pieces of named equipment and one of your choice.

Equipment	What is it?	What is it for?	How does it work? (briefly)
GPS			
Echo-sounder			

Which instruments use electromagnetic waves? ____________________

Which instruments use sound waves? ____________________

Describe two main differences between sound waves and electromagnetic waves. ____________________

____

____

Briefly explain the navigation of the ship.

____

____

Over the course of the day you will use the equipment on the bridge to gather the data needed to plot our journey on a chart.

1. Take a reading of our position from the GPS and water depth from the echo sounder every hour of our journey.

2. Use the sheet on the chart table on the bridge to record your data.

3. Plot this information onto the chart provided for your group.

4. How do the water depth readings you took compare with those printed on the chart?

____

____

SONAR

SONAR is a mnemonic. What does it stand for? ______________________

What frequencies are available on this ship's SONAR? ______________________

Why are there different frequencies on the SONAR? ______________________

____

COMMUNICATIONS

What methods are used for everyday communications?

____

____

____

What systems would be used in an emergency?

____

____

____

The oceans cover 71 percent of the Earth's surface and contain 97 percent of the Earth's water. Less than 1 percent is fresh water, and 2-3 percent is contained in glaciers and ice caps.

MEET THE WEATHER MAP

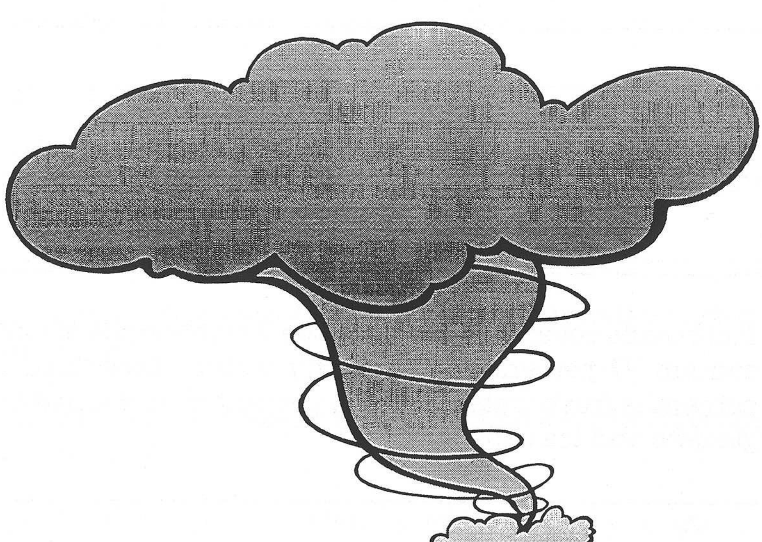
While on your watch, you will receive a "MetFax". This fax shows a satellite image of the country with isobars arranged on it. Being able to read these images and make forecasts from the information supplied form an important part of oceanographic work.

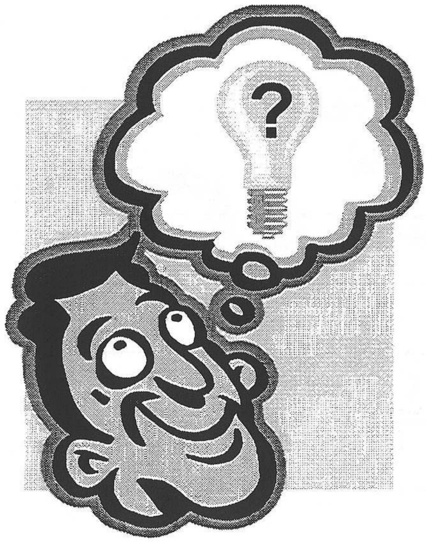
Before you make a forecast, here's some information that will assist you.

HIGH : highs are areas of high air pressure associated with sinking air, and marked with an 'H'. Air moves in an anticyclonic (anti-clockwise) direction around highs, often dragging warm northerly winds onto the country.

LOW : Lows are areas of low air pressure associated with rising air marked with an 'L'. Air travels in a cyclonic direction around lows, often drawing cold southerly winds into the country.

ISOBARS : Isobars join places where the air pressure is the same. The numbers on the isobars is the air pressure measured in hectoPascals (hPa). The closer together the isobars the stronger the winds are likely to be.





ACTIVITIES

Referring to the Marine MetFax and the information above, make a general forecast for the areas we will be in today. You don't need to give a full-on 'Jim Hickey' version, just use relative terms like strong, moderate, cloudy or sunny, etc).

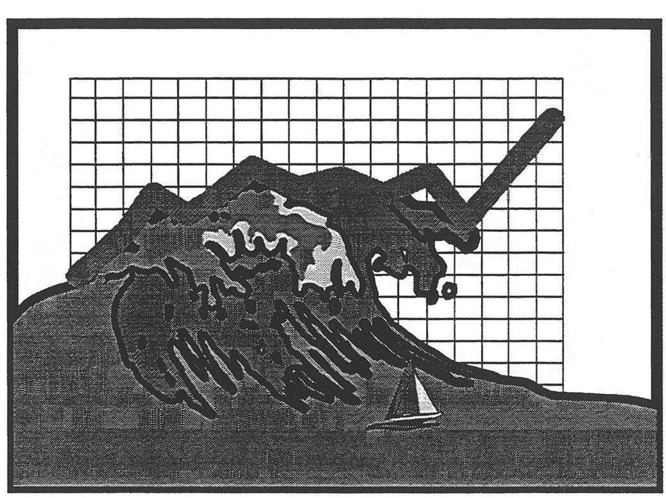
General forecast for ……/……./2000

Wind direction =

Wind speed =

Cloud cover =

Sea state relative to wind speed =



Were there any notable events that occurred while you were on watch? If so, jot down here what you observed.

Water Watch

You should try to measure the frequency and wavelength of the waves when the boat is stationary, and calculate the speed of the waves.

Frequency (no. of waves per second hitting the bow of the boat), **f**

Wavelength (distance between crests), λ

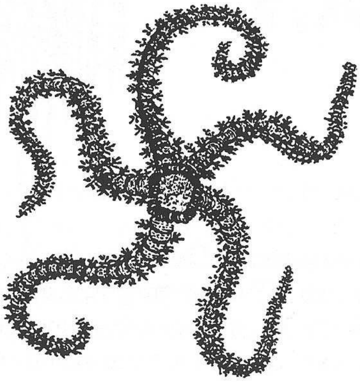
Speed of wave = frequency x wavelength = $f \times \lambda$ = ms^{-1}

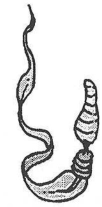
What happens to the apparent wavelength when the boat is moving into the waves?

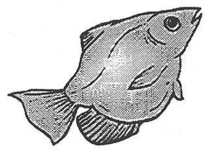
What is the name of this effect?

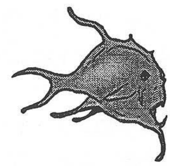
Give another example of this effect that you may know about.

At the deepest point in the ocean the pressure is more than 8 tonnes per square inch, or the equivalent of one person trying to support 50 jumbo jets.

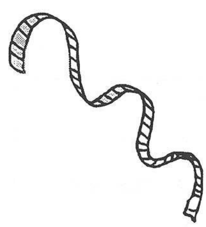


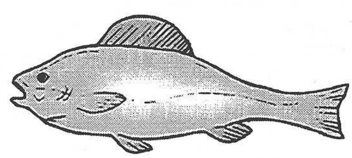


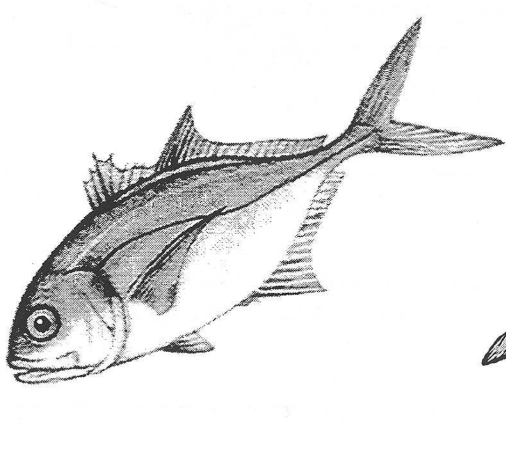


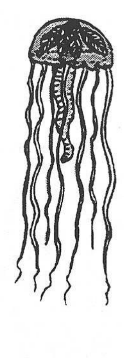


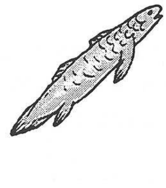
SAMPLING THE OCEAN



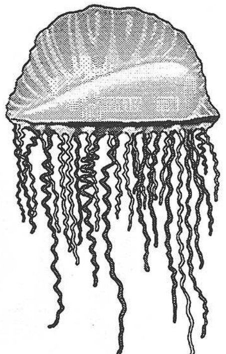








MARINE BIOLOGY



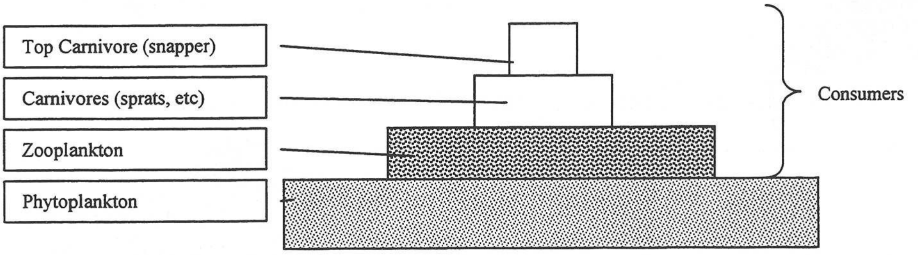
Life in the Oceans

The marine environment supports an abundant and diverse range of organisms. These organisms occupy virtually every nook and cranny of the world's oceans. Scientists are still discovering new and never before seen species. The sheer volume and diversity of life within the ocean is mind-boggling. In this section, you will be able to sample a small range of these organisms and use keys to try to identify them. We will also be looking at how the abiotic (non living) factors vary within a set depth of ocean

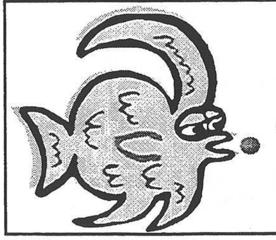
When we consider marine life, we all think of whales, fish and shellfish. However, for life to exist in the oceans there must be a number of primary producers (autotrophs) converting sunlight into chemical energy that other organisms can exploit. Marine plants (such as seaweed) form an important part of this food web, but look around - we are kilometres out to sea, what plants live out here?

Most marine ecosystems depend on microscopic plants called ***Phytoplankton***.

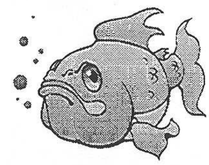
Phytoplankton are small, microscopic organisms capable of photosynthesis. Most of the marine biomass (the weight of all the living organisms) is composed of phytoplankton. There are literally billions of them underneath the ship at the moment!



A generalised ecological pyramid showing the trophic levels in a marine food chain

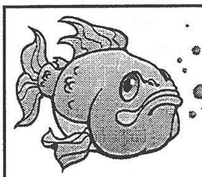


Many fish can change sex during the course of their lives. Others, especially rare deep-sea fish, have both male and female sex organs.

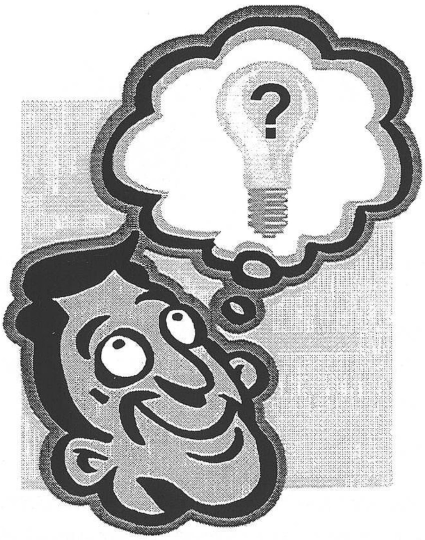


Phytoplankton are grazed upon by marine herbivores known as ***Zooplankton***. Although Zooplankton contains fewer species and constitutes less of the biomass than phytoplankton, they are a more diverse group – at least nine phyla are represented within this group! Zooplankton range in sizes from microscopic to over a metre in diameter and includes organisms such as jellyfish, and larval crustaceans (crabs and shrimps) as well as many microscopic organisms.

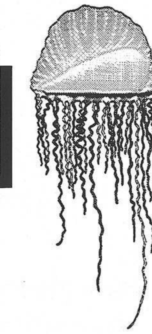
Life on the sea floor
Bottom dwelling organisms (***Benthos***) occupy a variety of niches and are nearly as diverse as the plankton. Benthic organisms occupy various modes of life. Some are ***sessile***, or attached. These organisms have no mobility and rely on currents to bring food to them (sea anemones, sponge, coral, etc). While others are ***Vagrant*** (able to move around) like starfishes and bottom dwelling fish species. These vagrant species also show a number of feeding habits. Some actively prey on other organisms, while others feed on the crumbs (detritus) left by others.



Oils from the orange roughy, *Hoplostethus atlanticus*, a deep-sea fish from New Zealand, are used in making shampoo.



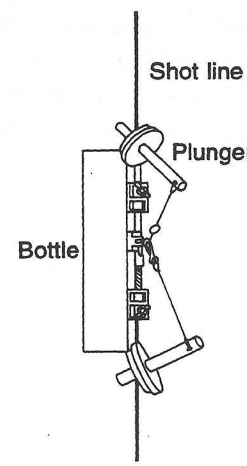
A group of herring is called a siege. A group of jelly fish is called a smack.



ACTIVITIES

COLLECTING PHYTOPLANKTON

A van Dorn bottle is used to collect water samples. The ends of the bottle are held open while the bottle is lowered to the required depth on a wire or rope. To close the bottle and collect a sample a messenger is sent down the wire to trigger the bottle to close. The bottle is then brought back on board. Empty the sample bottle in to the containers provided: you will need one sample for each group.



To preserve phytoplankton cells so that they can be observed later, add Lugol's Iodine (a mixture of iodine and glacial acetic acid) to the sample. Once the sample is fixed in this way it can be kept for many months.

COLLECTING ZOOPLANKTON

The zooplankton net is lowered bucket end first over the side of the ship on a wire to a predetermined depth. Once that depth is reached, the net is hauled back to the surface by the winch at a speed of 1 ms^{-1}. Once on board the net is washed down to make sure all the animals are in the bucket. The bucket is then removed from the net and rinsed out into the container provided. The sample will be split in two, one to be observed on board and one to be fixed for you to take back to school. Zooplankton samples are fixed in formalin at a 5% concentration. (Be careful formalin is a hazardous chemical.)

Conductivity
Temperature
Depth

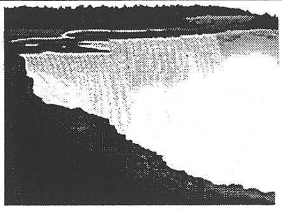
CTD PROFILES

The ocean around New Zealand is a continuous body of water, yet it has quite variable water properties depending on location and depth. An obvious example of this is that the surface waters north of New Zealand are significantly warmer than those surrounding Stewart Island.

Temperature and salinity differences cause density differences, which in turn drive ocean currents, which in turn drive our weather patterns. Dense water formed at the surface sinks below lighter waters. Near the surface, the properties of the water are fairly uniform due to the mixing effects of waves and wind, but this only reaches down to a certain level. These characteristics can be measured using an instrument known as a CTD.

The CTD is an instrument that is able to measure conductivity, temperature and depth very accurately. This information helps us understand the physical and chemical nature of the water column (a water column is section of water extending from the sea surface to the sea floor). To give us a measure of the amount of phytoplankton in the water column we have added a fluorometer to the instrument. This measures the amount of chlorophyll which tells us how much phytoplankton is in the water column.

The CTD is lowered on a wire and is set to measure the conductivity, temperature, depth, and fluorescence every 0.1 m. When the CTD is brought back on board, the data are downloaded onto a computer. You will analyse the data collected during your data and sample analysis session.



A slow cascade of water beneath the Denmark Strait sinks 2.2 miles, more than 3.5 times farther than Venezuela's Angel Falls, the tallest waterfall on land.

MARINE GEOLOGY

MARINE SEDIMENTS

There is great variety in the sediment that composes the floor of the ocean. This variety includes the composition, source and size of the sediment particles.

Origin and Composition of Sediments

There are essentially four major sources of marine sediment.

(a) Lithogenous Sediment, which is derived from existing rocks, usually from land as products of runoff or erosion.

(b) Biogenous Sediment, which is composed of the skeletal remains of marine organisms (shells, etc).

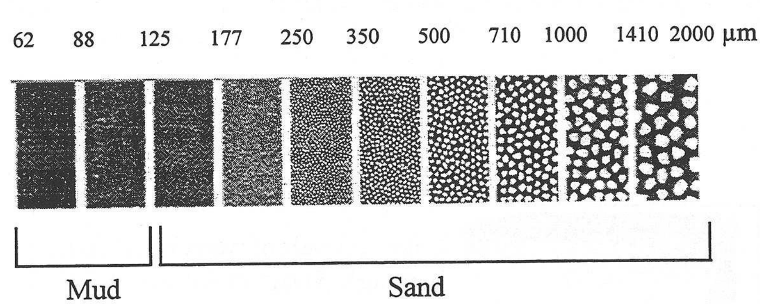
(c) Hydrogenous Sediment, which is the result of direct precipitation from the water in the marine environment, and

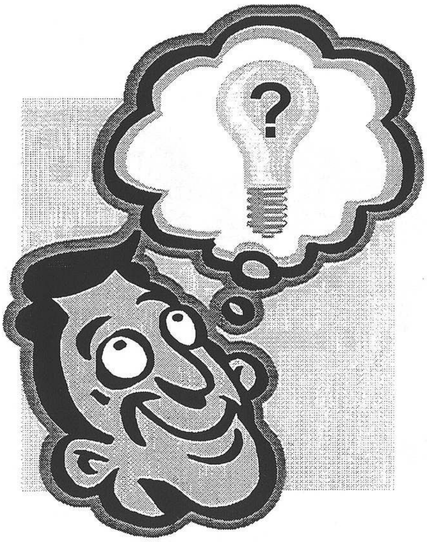
(d) Cosmogenous Sediment, where the sediment is derived from extraterrestrial sources from outside the Earth's atmosphere. This type of sediment is very rare but never the less does form a small amount of the marine sediment. Most cosmogenous sediments come from the thousands of meteorites, which fall to earth each year, but they are so dispersed that they are undetectable in most sediment.

Sediment Size

Sediments can also be classified according to the size of the individual grains within a sample. Samples of sediment are usually sieved and sorted according to size. Percentage composition values can then be derived to classify the sediments.

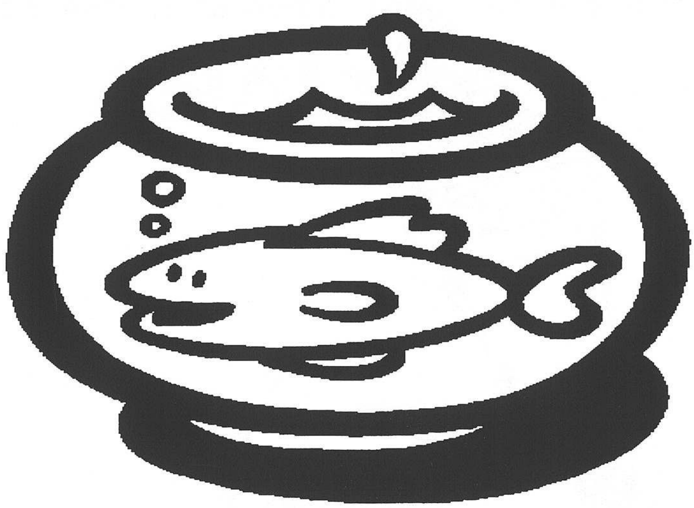
Grain Size



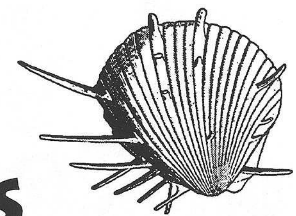


ACTIVITIES

Pipe Dredge
A pipe dredge is a very small dredge and as its name suggests is pipe-like with a chain bridle. The pipe dredge is towed slowly along the bottom so that it fills with sediment; it is then winched back on board. Place the sediment collected in the dredge in a bucket for analysis later.



Earth's longest mountain range is the Mid-Ocean Ridge, which winds around the globe from the Arctic Ocean to the Atlantic, skirting Africa, Asia and Australia, and crossing the Pacific to the west coast of North America. It is four times longer than the Andes, Rockies, and Himalayas combined.



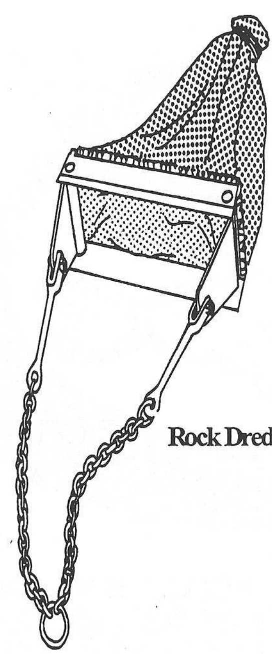
ACTIVITIES

COLLECTING BENTHOS

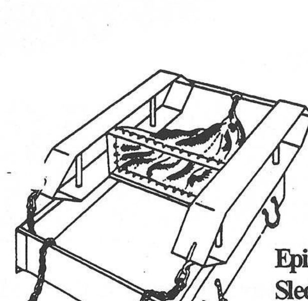
In this next activity, you are going to sample the benthos using one of two devices.

Epibenthic Sledge and Rock Dredge

The epibenthic sledge and the rock dredge are used to collect organisms from the seabed. They are attached to a wire and lowered onto the sea floor, as the ship is moving slowly forward. After the sample has been collected the sledge/dredge are winched back on board. The epibenthic sledge is used when the bottom is sandy or muddy and the rock dredge is used on rocky and rough surfaces

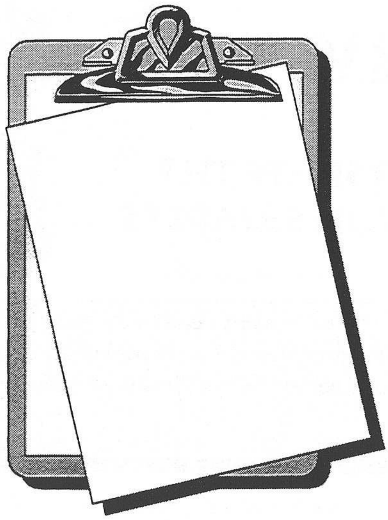


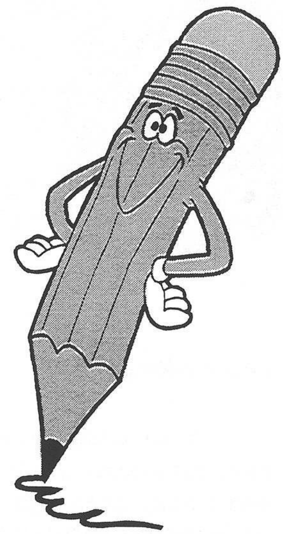
Rock Dredge



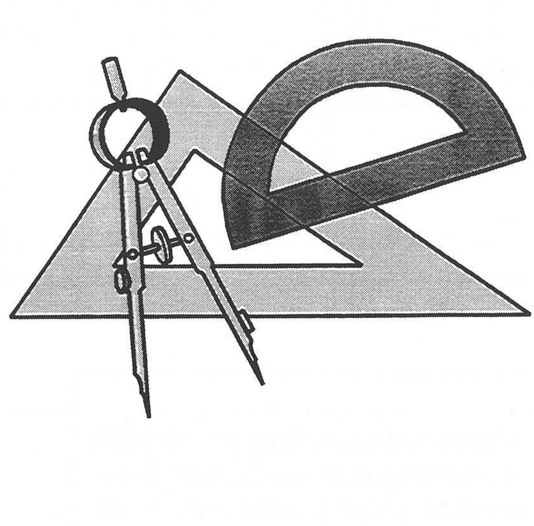
Epibenthic Sledge sitting on top of the wooden sorting box.

Once the sample has been obtained, sort the organisms collected keeping an individual of each species for each group. Put these in a bucket of sea water to keep them alive for analysis. Return the extra organisms to the sea.

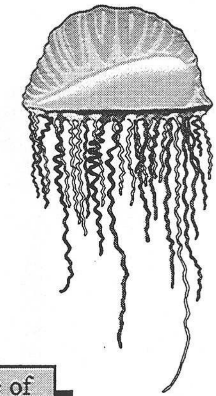




SAMPLE AND DATA ANALYSIS



ACTIVITIES



ANALYSIS OF THE PLANKTON SAMPLES

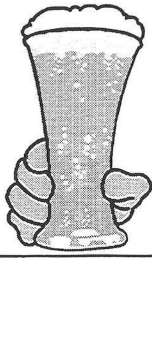
Your group will have two samples (one of phytoplankton and one of zooplankton). Make sure they are labelled with your group name.

Zooplankton

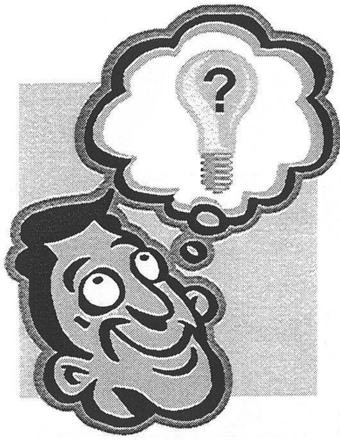
Using the dissecting microscope and the key provided, identify at least three individual specimens from the zooplankton sample, listing the distinguishing features (adaptations) of the organism. Take special note of their feeding appendages. Try and determine whether the animal is a filter feeder, a scavenging detrital feeder (feeding on the crumbs and small particles of other animals), or whether they are active hunters.

Zooplankton

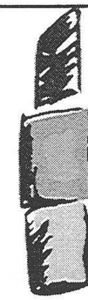
Name of organism	Adaptive Features (structural and behavioural)	Observation of Feeding Type



Alginates, derived from the cell walls of brown algae, are used in beer, frozen desserts, pickles, adhesives, boiler compounds, ceramics, explosives, paper and toys.



The remains of diatoms, algae with hard shells, are used in making pet litter, cosmetics, pool filters and tooth polish.



Phytoplankton

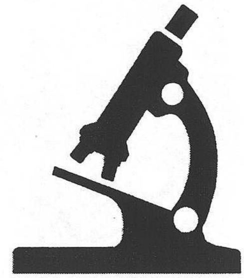
Phytoplankton cells range in size from 0.2 to 200 µm which makes them difficult to see without a high power microscope. Using this type of microscope at sea is difficult and we suggest that you take the phytoplankton samples collected back to school.

To look at the phytoplankton in your sample you will need to concentrate the cells.

1. Take a 250 ml measuring cylinder and add 250 ml of your sample.
2. Place cylinder out of the way and leave for 24 hours to allow the cells to settle.
3. Using a pipette remove the top 240 ml of water and discard.
4. Mixing the remaining 10 ml of sample thoroughly and take a small sub-sample and place on a microscope slide.
5. Cover drop with a cover slip.
6. Observe the cells at x200 to 400 magnification.
7. Using the key provided, what groups of phytoplankton can you identify?
8. Which are the most abundant cells in the sample?.

Phytoplankton Group	Abundance

ECOLOGICAL NICHE



Describe the ecological niches of several of the organisms you have observed.

Benthic organism: ______________________________

Name: ______________________________

Ecological Niche: ______________________________

____

Pelagic organism: ______________________________

Name: ______________________________

Ecological Niche: ______________________________

____

Above-surface organism: ______________________________

Name: ______________________________

Ecological Niche: ______________________________

____

ANALYSIS OF SEDIMENT SAMPLE

Classify your sample by identifying its origin as either one of the four examples given previously and (p30) note any organisms found within the sample.

Then sieve your sample. To do this you need to sieve the sample through each sieve in turn starting with the largest gauge sieve and moving to the smallest. Do not forget to have a container underneath the sieve to catch the fine sediments. Using the table, determine what percentage of the sample is caught by each sieve.

Sediment Analysis Table based on a simplified Wentworth Grain Size Scale with the major Textural Categories.

Particle Size (mm)	Description and Size Class		Percentage from sample
250	Boulders	Gravel	
150	Cobbles		
75	Pebbles		
4	Granules		
2	Very Coarse Sand	Sand	
1	Coarse Sand		
0.5	Medium		
0.25	Fine		
0.125	Very Fine		
0.064	Silt/Clay	Mud	

- Our sample is of ______________________ origin. *(Refer to page 30).* It is composed of

_______________ percent gravel, ________________ percent sand, and______________ percent mud.

- Write a brief statement relating the type of benthos found, to the sediment sampled. Can you make further conclusions about what type of feeders are found in or over certain sediments?

____

____

____

____

- Once you have sieved your sediment sample take a small sample of the material retained in the 1mm sieve and examine it using a hand lens.

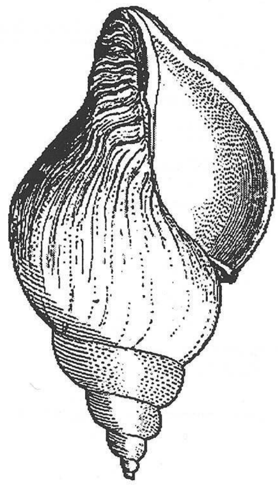
  Using the sheets provided, see what minerals you can identify.

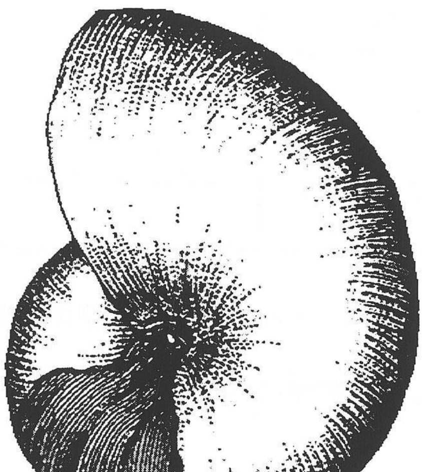
____

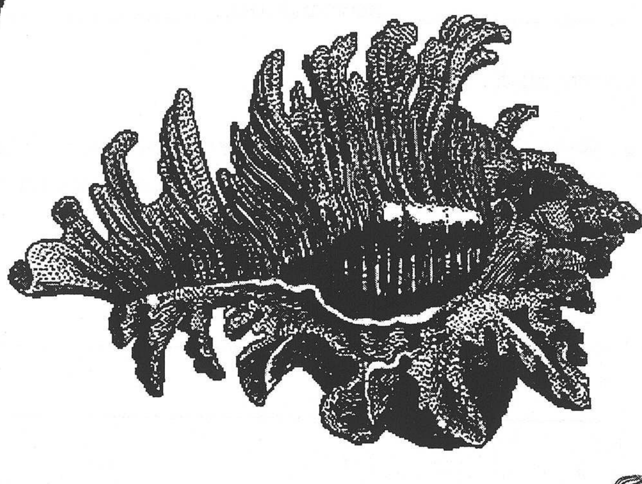
____

____

____



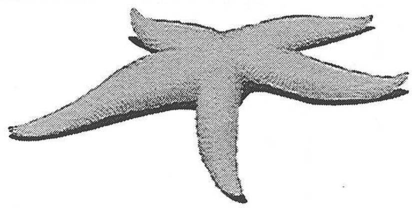


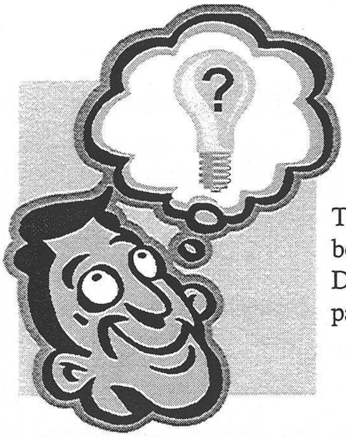


ANALYSIS OF THE BENTHOS SAMPLES

You need to sort and then identify the organisms in your sample using the Benthos key. We want you to identify everything to a taxonomic Group level. You also need to identify how they feed. Look carefully at their structural feeding adaptations and make an educated guess as to whether they filter particulate material from the water, scavenge detritus, or actively prey on other organisms. Use the table provided below to assist you recording your observations.

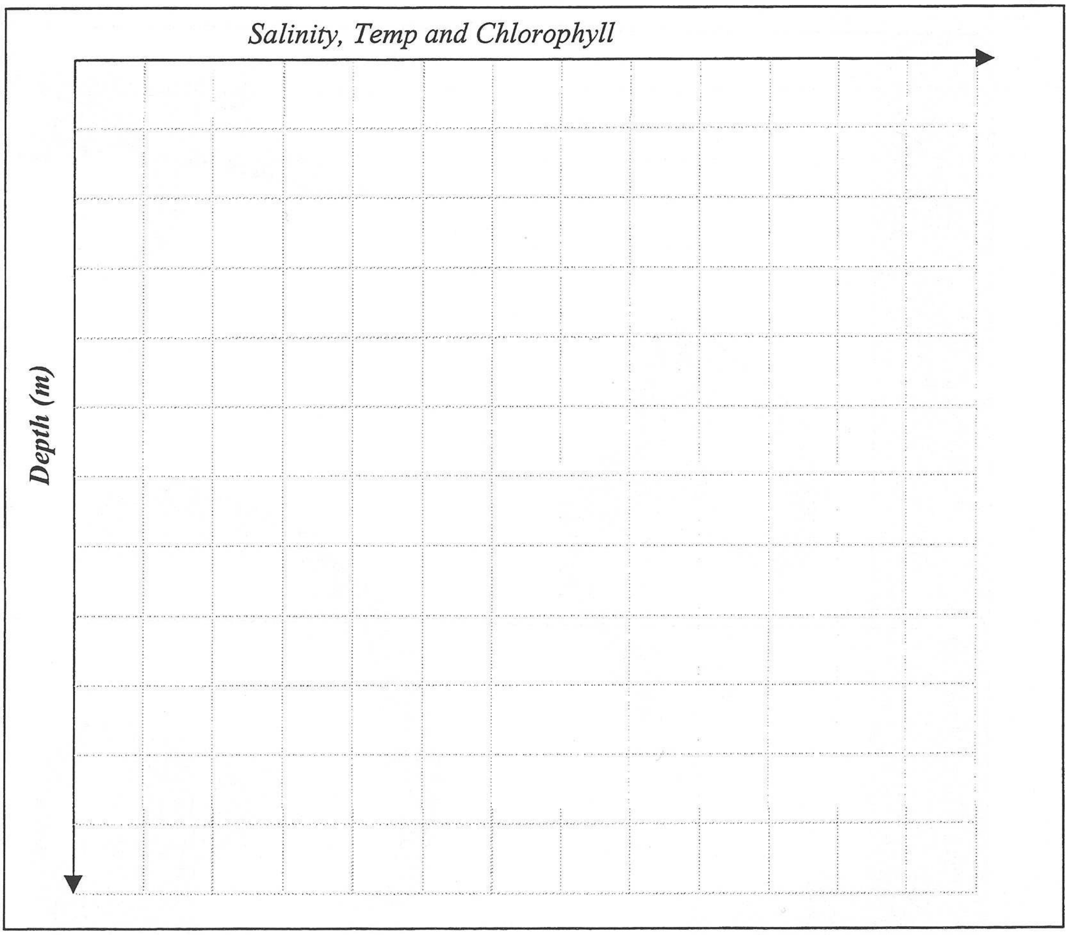
Common Name	Taxonomic Name	How they eat ? (filter, detrital, active predation)

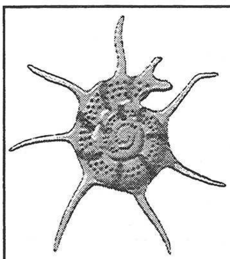




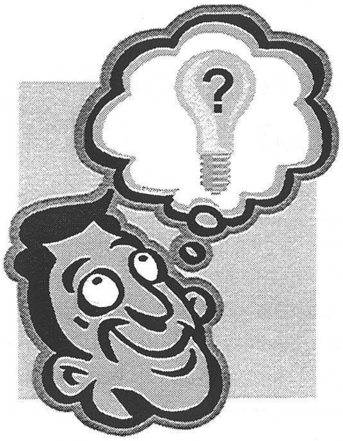
ANALYSIS OF CTD PROFILE

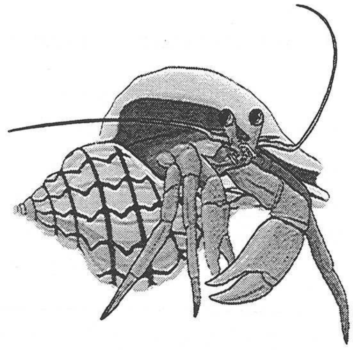
The data from the CTD will be graphed for you. Using the space provided below, sketch the graphs of salinity, temperature and chlorophyll 'vs.' depth. Don't worry about plotting scales on the axis, just try and sketch the general pattern shown.





One study of a deep-sea community revealed 898 species from more than 100 families and a dozen phyla in an area about half the size of a tennis court. More than half of these were new to science.

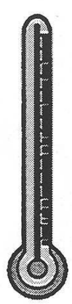




During the discussion of the results, answer the following questions.

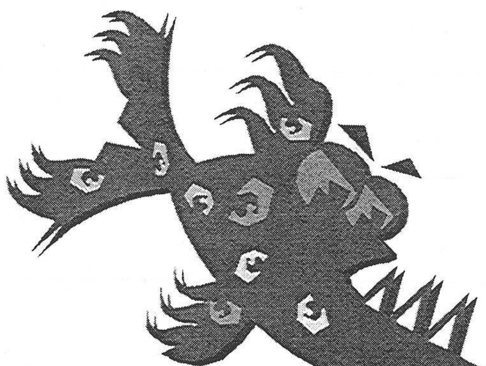
- Describe the pattern of Salinity with depth:

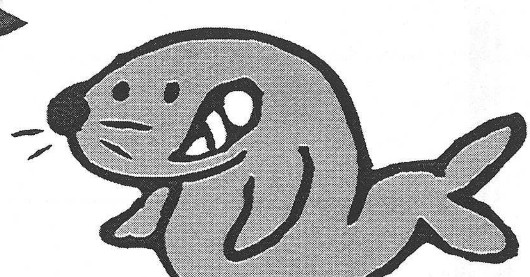
- Describe the pattern of temperature with depth:



- How does this relate to the concentrations of phytoplankton in the water column?

- What is the most productive region of the water column? Why?





SEASONAL EFFECTS AND NUTRIENT LIMITATION ON THE FOOD WEB PATHWAYS

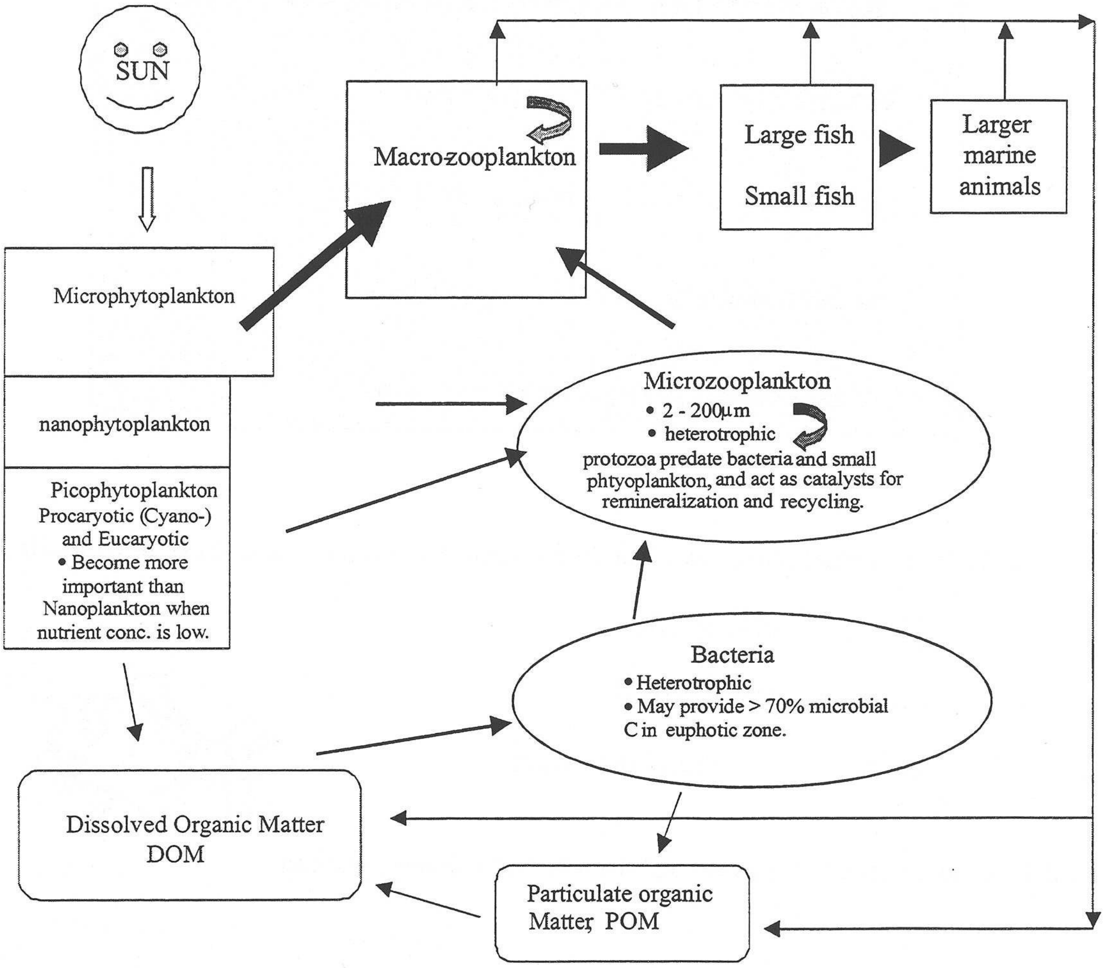
The diagram below shows the relative amounts of energy flowing through the pelagic food web in mid spring. This is a period of rapid phytoplankton and zooplankton growth and a relatively fast increase in numbers. The size of the box represents the relative biomass of each group of organisms. The thickness of the arrows is approximately proportional to the amount of energy flowing through that link. In mid spring there is little energy flow through creation of DOM, bacteria, and microzooplankton. Most of the energy flows through direct links from microphytoplankton to macrozooplankton to fish.

1. *Copy this diagram and change it* to show the energy flow through the pelagic food web in autumn when overall production is lower.

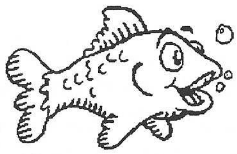
2. *What changes in abiotic factors* most cause this change in energy flow?

3. *Which group of organisms* will show the biggest change in biomass between spring and autumn?

4. *Which path* shows the greatest energy flow in autumn?



FURTHER INFORMATION



If you are interested learning more about the ocean you may find the following websites interesting.
http://www.seasky.org/sea.html - A NASA page run in association with the Cousteau Foundation. Contains numerous virtual activities including games, and a virtual lab.

http://www.cnmoc.navy.mil/educate/neptune/neptune.htm - Neptune's Web. A large site containing over 30 interactive and hands-on activities. Sponsored by the U.S. Naval Meteorology and Oceanography Command.

http://seawifs.gsfc.nasa.gov/ocean_planet.html Ocean Planet from the Smithsonian Museum

RELEVANT NEW ZEALAND SITES

http://www.niwa.cri.nz/ - NIWA's home page

http://www.maf.govt.nz/MAFnet/index.htm - MAF

http://www.rsnz.govt.nz - Royal Society of New Zealand

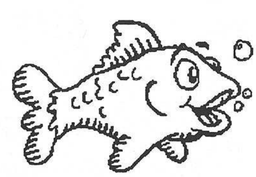
http://www.doc.govt.nz - Department of Conservation

If you have any further questions about the days activities please phone, fax or e-mail Julie Hall

Phone: (07) 856 1709

Fax: (07) 856 0151

email: j.hall@niwa.cri.nz



If Julie can't answer your questions' she will find someone who can.