SEMEP
SOUTH EASTERN MEDITERRANEAN SEA PROJECT

ENVIRONMENTAL INVESTIGATIONS OF THE MEDITERRANEAN SEA AND ITS SHORELINE

INSTRUCTIONS FOR STUDENTS

Introduction

Life within the sea and along the shoreline depends on an environment that provides suitable conditions. Animals and plants cannot live if the area is too polluted and this can upset the whole ecosystem.

By investigating the presence or absence of animals and plants, it is possible to obtain some idea of the suitability of the Mediterranean environment. Also testing the seawater can give an indication of its suitability to sustain a variety of aquatic animals and plants. Many varieties of fauna need to derive oxygen dissolved in the seawater. If this is too low, animals cannot survive. Increasing the temperature lowers the solubility of oxygen and hence temperature is an important factor. Light is necessary for plants to grow and hence visability is another important factor. pH will also affect the metabolism of animals and plants and finally the salinity is another crucial factor.

Preparing for the Investigation

You will both the set of instructions and the separate worksheet with you on your fieldtrip. You will also need a notebook in which you can record your results (you are advised not the complete the worksheet in the field but to complete it in school or at home).

As you may need to collect specimens and samples of seawater, make sure you have plenty of containers. Make sure containers for the seawater have a tight fitting lid.

Although the seawater may be quite cold, you will almost certainly wish to put your feet in the water. For this you will need to remove your socks and shoes. You will need to bring a towel to dry yourself afterwards.

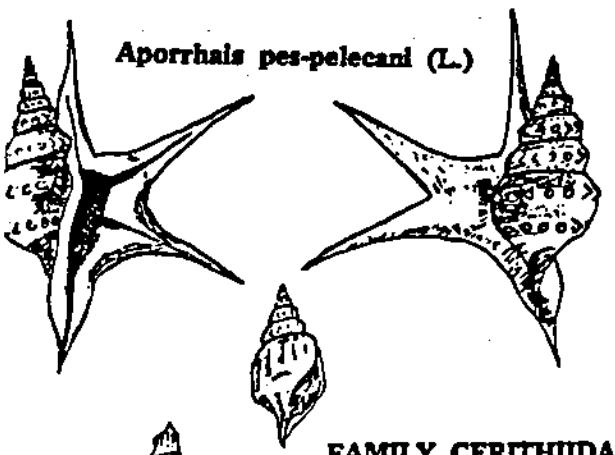
Identification Aid

(For additional descriptors, consult the Supporting Information Document)

GASTROPODA

FAMILY APORRHAIDAE

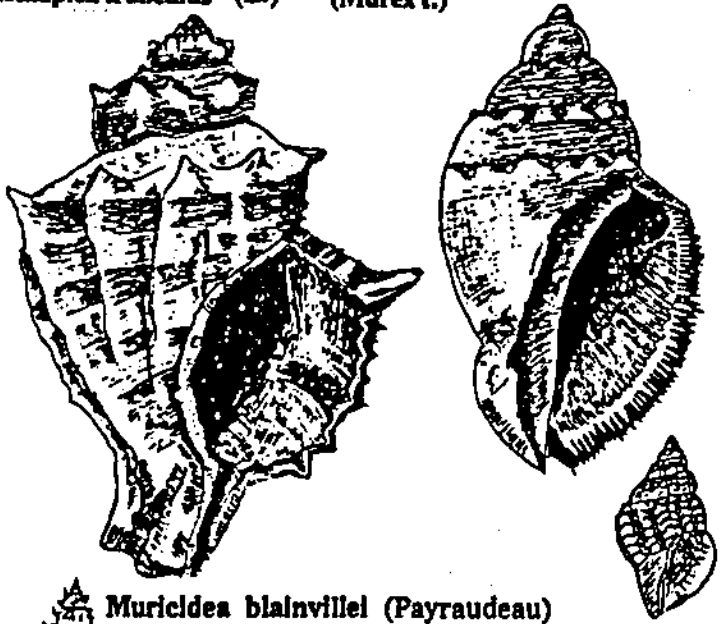
Aporrhais pes-pelecani (L.)



FAMILY MURICIDAE

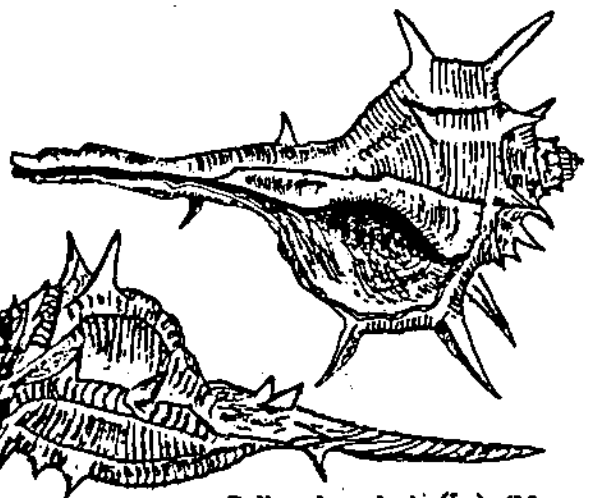
Hexaplex trunculus (L.) (Murex t.)

Thais haemastoma



Muricidea blainvillei (Payraudeau)

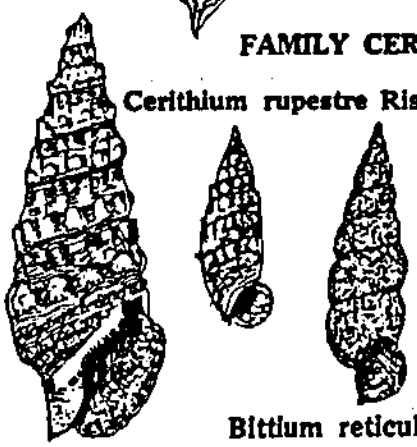
Ocenebra aciculata



Bolinus brandaris (L.) (Murex

FAMILY CERITHIIDAE

Cerithium rupestre Risso



Bittium reticulatum da Costa

rithium vulgatum Bruguiere

FAMILY LITTORINIDAE

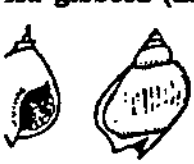
Littorina neritoides (L.)

Nassa mutabilis (L.)

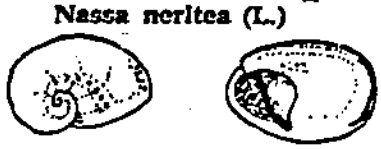
Nassa neritea (L.)

FAMILY NASSIDAE

ssa gibbosa (L.)



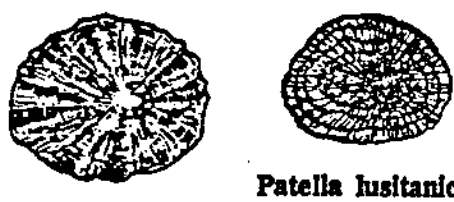
Nassa incrassata (Muller)



Nassa clathrata (Born.)

Nassa reticulata (L.)

FAMILY PATELLIDAE



Patella lusitanica Gmelin

Patella caerulea L.

FAMILY PYRENIDAE (COLUMBELLIDAE)

:one scripta (L.)

Columbella s.)

Pyrene rustica (L.) (Columbella r.)

FAMILY TROCHIDAE

Monodonta turbinata (Born)

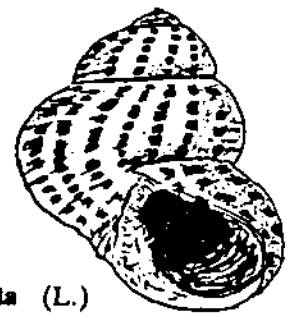
Clanculus corallinus (Gmelin)

Monodonta articulata (Lam.)

Cantharidus striatus (L.)

Calliostoma zizyphinus (L.)

Gibbula adansoni



Gibbula divaricata (L.)

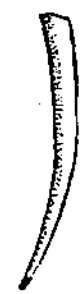
Gibbula varia (L.)

SCAPHOPODA

FAMILY DENTALIIDAE

Dentalium vulgare da Costa

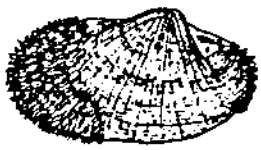
Dentalium dentale L.



Dentalium rubescens Deshayes

LAMELLIBRANCHIATA

FAMILY ARCIDAE

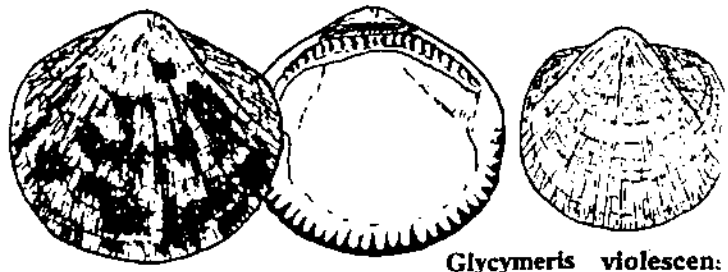


Arca barbata L.

rca noae L.

Arca lactea L.

FAMILY GLYCYMERIDAE



Glycymeris pilosa (L.)

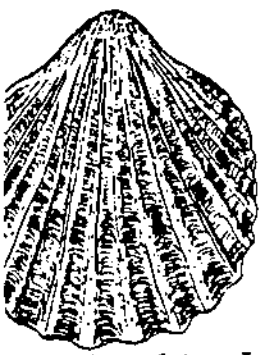
Glycymeris violescens

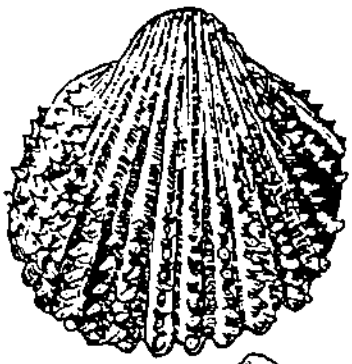
Mactra corallina L. (M. stultorum

FAMILY MACTRIDAE

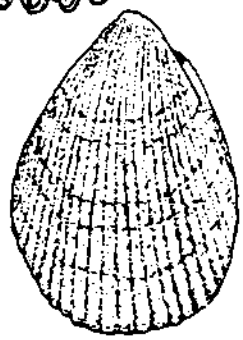
MILY CARDIIDAE

Cardium echinatum L. (Acanthocardia e.)





lum tuberculatum L.

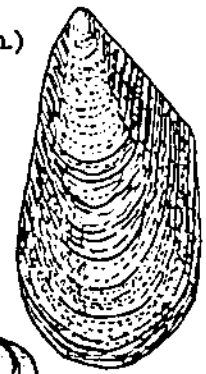


stoderma edule L.

Laevicardium oblongum (Gmelin)

FAMILY MYTILIDAE

Modiolus adriatica (Lam.)

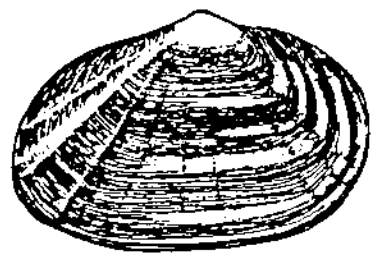


Modiolus barbatus (L.)

Mytilus edu

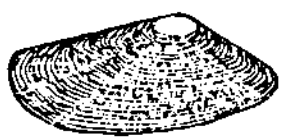
Lithophaga lithophaga (L.)

FAMILY TELLINIDAE



Tellina planata (L.)

FAMILY DONACIDAE

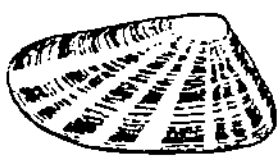


onax venustus Poli

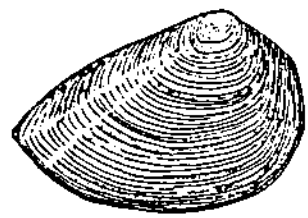
Donax semistriatus (Poli)

Tellina incarnata (L.)

Tellina pulchella Lam.



Donax trunculus L.



Gastrana fragilis (L.)

INSTRUCTIONS FOR COMPLETING WORKSHEETS

These instructions refer (unless otherwise stated) to undertaking the investigation on the seashore.

Investigation 1 Searching for and Indentifying Benthos Animals

Equipment

Part (a) Water net, tape measure (or any other means to measure distances in metres), a collection of specimen tubes or plastic tubs with lid

Part (b) Spade, sieve, cylinder sampler

Procedure

Part (a) - looking on the beach or in sea bottom

1. Examine the seashore and shallow water for molluscs. It is suggested you limit your area of search to 1 metres above and 4 metres below the water line.
2. Note the length (in metres) of beach area you cover with your search. Hence determine the number of square metres covered].
3. Try to identify the molluscs from the pictures and names given.
4. On your workshcct (or first in your notcbook) usc thc column 'observed on seashore' and record ++ for frequently occuring groups, + for a single mollusc and 0 for a group not present in your area of study.
5. Examine the seashore and the sea bottom for other animals. Examine the sea bottom by pulling the water net carefully over the shallow parts of the bottom (and among any plants present). Do this over a stretch which is roughly 5 metres long and repeat the action a few times.
6. Collect the organisms in a plastic tub, or even better, make a preliminary sort into several containers.
7. Determine species present and mark ++ for frequently occurring groups, + for single individuals and 0 when the group is absent. Also record this in the 'observed on the seashore' column.

Part (b) - searching within the sea bottom

8. Choose 5 testing sites in shallow water (depth approximately 0.5 metres).
9. Press the cylinder sampler approximately 20 cm into the bottom material. Turn the tube to loosen the contents.
10. Dig around the tube and lift the tube with the contents up to the sieve using the blade of a spade.
11. Drag the sieve to and fro on the surface of the water to get rid of sand and mud.
12. Collect animal specimens and sort into containers.
13. Determine the species from the 5 sites and count the number of individuals in each group.
14. Calculate the number of individuals per square metre you sampled and from this determine the number of expected individuals per square metre of sea bottom under test. Record this in the column 'observed in bottom sample'.

Investigation 2 Searching for and Identifying Plants in the Sea

Equipment

Measuring tape, measuring line/stick

Procedure

1. Locate an area where algae/plants are growing. [If this is not possible then omit this investigation].
2. Collect speciments of algae/plants growing along a profile line at right angles to the shoreline from 0 metres to as deep as possible.
3. Note the depth at which each species of plant/algae grows and the distance from the shoreline.
4. In the worksheet record ++ for frequently occurring species, + for single individuals and 0 for groups species not found during the investigation.

Investigation 3 Determining the Temperature of the Sea

Equipment

Water sampler with thermometer (preferably 0-50°C) attached to a string with knots spaced 1 metre apart.

Procedure

How deep it is necessary to test before there is a drop in temperature of the seawater ?

1. Collect seawater in the sampler at different depths from 0 metres to as deep as possible.
2. Do this by keeping the sampler at the required depth for at least 5 minutes. Then pull it up quickly and read the temperature as accurately as possible.
3. Repeat measurements at each depth to test for consistency.
4. Record the temperature at the various depths on the worksheet.

Investigation 4 Visibility

Equipment

A white, weighted, metal/plastic disk (25 cm diameter) attached to a strong with knots tied every metre.

Procedure

Visibility in the Mediterranean Sea is usually described as good. How good is the visibility ?

1. For this investigation you will need to go onto a jetty, or use a boat
2. Try to work in the shade to avoid reflection problems.
3. Lower the disk into the water. Be careful the disk descends vertically and does not drift away in the water.
4. Count the number of knots that enter the water until the disk can no longer be seen.
5. Lower the disk further and then pull it up slowly. Note the depth at which the disk becomes visible.
6. Determine the visibility depth as the mean of these two measurements
7. Repeat the experiment a few times to obtain a mean value.
8. Record your observation on the worksheet.

Investigation 5 Determining Oxygen Content

Equipment

Part (a) water sampler, length of rubber/plastic tubing, a screw top bottle (e.g. 'coke' bottle), manganese chloride solution, sodium hydroxide solution

Part (b) as per (a) plus conical flask, glass pipette, burette, alkaline sodium iodide solution, phosphoric acid, standardised sodium thiosulphate solution, starch solution.

Procedure

The oxygen content will be affected by the physical conditions such as temperature and movement of the sea (especially waves). If possible test the seawater in a place where there is little movement.

Part (a) - Simplified method

1. Fix a length of rubber tubing to the outlet of the sampler bottle.
2. Collect a sample of water at a predetermined depth (noting temperature) using the water sampler.
3. Pour water from the sampler into a bottle with a screw top (a coke bottle or a similar container). For this the rubber tubing should be at the bottom of the bottle. Overfill the bottle about 3 times the volume of the bottle and let the water continue to flow when you remove the rubber tubing. This will ensure the bottle is completely full with no air bubbles.
4. Add 1 cm^3 of manganese chloride solution using the dropping pipette. by keeping the end of the pipette in the water whilst the solution is being addcd.
5. Add 1cm^3 of sodium hydroxide solution, again using a dropping pipette and keeping the end of the pipette in the water during delivery.
6. Careful fit the lid to the bottle. Make sure no air bubbles are trapped.
7. Mix the contents of the bottle by turning the bottle upside down a few times.
8. Let the bottle stand for about 10 minutes. A precipitate will form in the bottle and its colour can be determined.
9. Record the colour of the precipitate.

Part (b) Titration method

1. Fill a bottle from the water sampler, as before. Overfill the bottle about 3 times and let the water flow as the rubber tubing is removed from the water in the bottle.
2. Add 1 cm^3 manganese chloride solution and 1 cm^3 alkaline iodide solution. Keep the pipettes in the sampling water when the solutions are added.
3. Carefully tighten the top on the bottle making sure no air bubbles are trapped.
4. Keep the bottle in the dark until analysis is performed in the laboratory.

The following part should be performed in the laboratory

5. Remove the top of the bottle and add 1 cm^3 phosphoric acid to dissolve the precipitate. The sample will turn a pale yellow colour.
6. Measure accurately, using a pipette, 100 cm^3 of the acidic solution into a flask. Titrate this with 0.0100 mol dm^{-3} sodium thiosulphate solution.
7. When the yellow colour becomes pale after adding sodium thiosulphate solution, add 1 cm^3 starch solution to the flask to form a deep blue colour. Continue titrating until the blue colour just disappears.
8. Record the volume of sodium thiosulphate solution added.
9. Calculate the oxygen content in mg dm^{-3}.

Investigation 6 Determining the pH of the Seawater

Equipment

Part (a) pH indicator paper (or solution), dropper
Part (b) pH meter, plastic/glass container

Procedure

Part (a)

1. Collect a sample of seawater.
2. Using a dropper, spot drops of the seawater on the pH paper (if using pH solution, add a few drop to the seawater).
3. Determine the pH by checking the colour obtained against the scale.

Part (b)

1. Collect a sample of 100-200 cm^3 seawater in a plastic or glass container.
2. Calibrate the pH meter according to the instructions provided with the meter, noting the temperature.
3. Place the electrode in the seawater.
4. Read the pH on the meter.

Invesigation 7 Determining the Salinity of Seawater

Equipment

Part (a) Evaporating basin, measuring cylinder, heater, balance

Part (b) Burette, volumetric flask, conical flask
0.100 mol dm^{-3} silver nitrate solution, 0.25 mol dm^{-3} potassium chromate solution, calcium carbonate solid, spatula

Procedure

For this investigation collect a sample of seawater (fill a soft drink bottle) and bring back to the laboratory for testing.

Part (a)

1. Weigh an empty evaporating basin.
2. Add 50 cm^3 seawater to the basin.
3. Evaporate to dryness. Take great care to avoid spitting when the last liquid is being evaporated (use a very low flame) and be careful not to char the solid.
4. Cool the evaporating basin and reweigh.
5. Calculate the percentage of solid in the seawater. Take the density of the seawater as 1 g cm^3.

This will determine the total solid dissolved in the seawater. To determine chloride content (which is usually associated with salinity), it is necesary to undertake part (b).

Part (b)

1. Undertake a blank test first as this gives the excess silver nitrate that is required for the colour to become reddish brown by
   (a) pouring 20 cm^3 distilled water into a flask, adding a spatula tip of calcium carbonate and about 1 cm^3 potassium chromate solution;
   (b) titrating with silver nitrate solution until a reddish brown colour is obtained;.
   (c) recording the volume of silver nitrate solution added.

2.. Pour 20 cm^3 of seawater into the conical flask. Add 1 cm^3 potassium chromate solution.
3. Titrate with silver nitrate solution until the same reddish brown colour is obtained as in the blank test.
4. Determine the volume of silver nitrate solution added
5. Calculate the chloride ion concentration of the seawater, adjusting for the excess silver nitrate required.

Investigation 8 Determining the Redoxclin

Equipment

Large 1.5 dm^3 plastic drink bottle with bottom cut off.

Procedure

The plastic bottle is chosen for this experiment because it should be possible to see the layers throgh the plastic.

1. Select a spot where the sea bottom is soft.
2. With the top removed, push the bottom of the plastic bottle approximately 15 cm into the bottom sediment
3. Screw on the cap and carefully pull up the bottle.
4. Measure the height of the aerobic zone (the yellowish-brown layer) in cm.
5. Repeat the test in other sites.
6. Record your measurements on your worksheet.

Investigation 9 Determining the Water Content of the Sea Bottom

Equipment

5 Plastic bags, plastic drink bottle with bottom cut off, evaporating basin, source of heat (oven, solar box), balance

Procedure

1. With the top removed, push the bottom of the plastic bottle approximately 5 cm into the bottom sediment
2. Screw on the cap and carefully pull up the bottle. Put a plastic bag over the end as the bottle is raised, if necessary.
3. Pour the seawater away and collect the sediment in the plastic bag
4. Repeat at 5 testing sites.

In the laboratory

5. Weigh an evaporating basin.
6. Mix the sample carefully and drain of excess water. Transfer an amount (estimated to give about 500mg when dry) to the evaporating basin and weigh.
7. Allow the sample to dry by an appropriate means (oven at 105°C, in a solar box, etc) and reweigh.
8. Repeat for all samples.
9. Calculate the percentage by weight of water in each sample.

Investigation 10 Determining Organic Material in the Sea Bottom

Equipment

As per water content plus oven to heat to 600°C

Procedure

In the laboratory

1. Take the dried, weighed samples from the previous investigation (investigation 9 - water content).
2. Put each in an oven at 600°C for 1 hour to incinerate the organic matter.
3. Allow to cool and reweigh.
4. Calculate the organic content of the sediment in each sample.
5. Determine the percentage of organic content in the sediment.