

Phenology Teachers' guide



Background information

As with budburst and blooming of plants on land, plants in the oceans go through growing and reproductive cycles. Seaweed reproductive phases are an example of plant phenology. The study of when these phases occur can help scientists better understand how these plants respond to climatic factors. With time, seaweed reproductive phenology can be used to study the effects of climate change.

The seaweed species that can be used in this study are:

Ascophyllum nodosum

Fucus distichus

Fucus spiralis

Fucus vesiculosus

Pelvetia canaliculata

Fucus serratus.

Distribution of Selected Seaweed Species

These species are known as 'brown' seaweed. They are found in the intertidal zone of the shore. This is the area of the shore that is covered and uncovered on a daily basis by the seas

Ascophyllum nodosum is distributed in the North Atlantic. On the European coast it is found from Portugal in the south and northwards to northern Norway. It grows around the UK and Ireland, Faeroe Islands, Iceland, Jan Mayen, and southern Greenland.

Fucus distichus is found in the North Atlantic and the North Pacific. It grows along the coast of Norway north to Spitzbergen. It grows on the west coast of UK and Ireland, Faeroe Islands, Iceland, Jan Mayen, and West Greenland.

Fucus spiralis has its distribution range in the North Atlantic and the North Pacific. It is found in the Azores and Portugal and from there its distribution extends northwards to northern Norway and Bear Island. *F. spiralis* is found around UK and Ireland, Faeroe Islands, and Iceland.

Fucus vesiculosus is found in the Azores and along the Atlantic coast of Europe from Portugal to northern Norway and Spitzbergen. It is found around the coast of UK and Ireland, Faeroe Islands, Iceland, and Greenland.

Pelvetia canaliculata is found along the coast of Europe from Portugal in the south to northern Norway. It is found around the coast of UK and Ireland, Faeroe Islands and southwestern Iceland

Tides

Tides are caused by the gravitational pull of the moon and the sun on Earth. Because the moon is so much closer to Earth than the sun, the moon exerts the greater pull.

The most extreme tides, called spring tides occur during full and new moons when Earth, moon, and sun are in a line. During quarter and three quarter moons, the moon, Earth and sun form a right triangle and the tidal range (the difference between high and low tides) is the smallest. These tides are called neap tides.

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You need a tide table calculated for the local area to determine the tides in your area. The tide table will give you the dates, times and water levels for high and low water. These are available from government agencies, private fisheries and tourist agencies. They can also be found on the web, in newspapers, or published as booklets.

Because tides vary each year with the lunar cycle, it is necessary to use a tide table calculated for the current year. Tides also vary with each locality, so try to get a tide table for the exact area you are observing, or for the closest area for which tide tables are available.

Most areas have two low and two high waters per day with one set of high and low more extreme than the others. The two high and low water levels occur over approximately 24 hours with each high and low approximately six hours apart.

Tide cycles actually occur over a lunar day, which is 24 hours and 50 minutes long. The two low tides in a day occur on average every 12 hours 25 minutes. The time of the first low tide each day occurs on average approximately 50 minutes later than the day before. Local topographic features may cause these times to vary.

GLOBE activity

Students will classify and count the reproductive phases of seaweed plants within a 1-meter x 1-meter plot in the inter-tidal zone, once a month for four months in a row during low tides

Site Selection

The site needs to be an easily accessible rocky shore. It is preferable to have the site away from areas with industrial or residential activities for pollution and human activities may affect when seaweed reproduces so that the seaweed reproduction does not reflect regional climatic influences. The object of the study is to learn connections between the seaweed phenology and climate factors. Your students will be visiting the site four times (once each month). The students need to visit the same plot each time. To do this, you need to establish a permanent marker. If there is a distinctive feature on the beach (such as an unusually large boulder), use the feature to identify your location. Or, you could pound a reinforcing bar into the beach.

Preparation

Find out what species of seaweed are in your area.

Find out what the tidal range is for your area.

Make colour photocopies of the reproductive stages of the seaweed species your students will be observing.

Familiarise students with the parts of seaweed plants Practice identifying the different reproductive phases using the photos provided for the species in your area before going to the site to collect data.

Practice using tide tables to determine when you should sample.

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Equipment

GPS receiver
Compass
Camera
Clinometer
Ruler in millimetres
Mapping your Hydrology Study Site Sheet
Seaweed Phenology Site Definition Sheet
Seaweed Reproductive stages photographs
Seaweed Reproduction Data Sheet
2 - 4 Meter sticks or a 1 x 1 m quadrat

Extra activities

Connections to Other Protocols

It is not required, but would be very helpful to the scientists to have hydrology measurements taken, in particular water temperature, transparency, and salinity.

Further investigations

How does water temperature affect when the reproductive phases occur?
Do you expect much difference in when the reproductive phases occur from one year to the next?
Do storms affect when the reproductive phases occur?
Does the transparency of water affect seaweed reproduction?

Useful contacts and publications

Field studies Council – Simple guide and key to seaweed
www.field-studies-council.org/publications

The Seaweed Site

This site has a lot of information on all aspects of seaweeds and marine algal biology.
<http://seaweed.ucg.ie>