Littorina obtusata on *Ascophyllum nodosum*
Photo Bo Johannesson

Do periwinkles have a favourite wrack (brown alga)?

Objectives:
Through observations and manipulative studies examine the relation between herbivore and plant.

Subjects: biology⇒ecology, mathematics, (language arts), (art), (social studies)
Application: This lesson can be done using common mobile herbivorous invertebrates that live on/of plants, such as insect larvae, ladybirds and snails.
Duration of experiment: 2 days (effective work: 4h)
Group Size: practical work preferably in small groups, but can be done with whole class
Key words: ecology, food web, grazer, herbivore, habitat, primary producers, consumers, feeding

Scientific protocol (⇒link to "How we do it")
Observation:
The flat periwinkle (*Littorina obtusata*) is often seen on only a few species of wrack.
Explanation model:
The snails have a favourite wrack
Hypothesis:
If individual snails are presented to plants of different species of wrack from their habitat, they will reside on their preference.
Null hypothesis:
If individual snails are presented to plants of different species of wrack from their habitat, they will not show any preference for specific species.
Experiment:
Snails in aquaria are presented to different species of algae. (See point 8 under *Procedure* for details)
Interpretation:
If we get:
⇒Support for the hypothesis: We have shown that the flat periwinkle occupies a favourite wrack.
⇒Support for the null hypothesis: The flat periwinkle does not have any preferences for a specific wrack.
(See *Extension* for discussions on arguments for the results.)

***Equipment**:*
Aquaria/containers, stones, string, chosen plants and herbivores
(sea water or artificial seawater ⇒ find the formula on the net or buy the mineral medium "instant ocean" in zooshops)

***Procedure**:*

1. Establish comprehension for the term "ecology" and discuss associations between animals and plants (or algae).
2. Discuss what kinds of preferences animals can have for certain plants.
3. Try and observe animal-plant associations in your near surroundings. Decide upon grazing invertebrate and what plants to use.
4. Prepare for your specific investigation by thinking about all the steps in the *Scientific protocol* above. Make sure you design the experiment so that you only get two outcomes, (support for either the hypothesis or the null-hypothesis)?
5. Forming a hypothesis for the study according to the *Scientific protocol* above.
6. Discussion on how to conduct the experiment and what equipment to use?
7. In the field: Decide upon numbers of organisms, find the invertebrates and the chosen plants (preferably at least three). Be sure to use organisms that are allowed, non-toxic and non-allergic.
8. Implementation of experiment:
    a) Set up the aquaria or containers.
    b) Fix the plants/algae to the bottom with for example: blue tag.
    c) Place invertebrates in the containers at a spot with equal distance from the plants/algae. Cover with a net if the animals might escape. For organisms living in water: Arrange so that the organisms have either running water or change the water every time you collect the animals
    d) Let the animals move freely for 6 h.
    e) Observe and register where the individuals are found. Use camera or video.
    f) Collect them and place them in the starting spot.
    g) Repeat d-f as many times as you have to your disposal.
9. Discussion on how to report the results.
10. Discussion on the meaning of our results (see *protocol Interpretation*)

***Extension**:*
The study will or will not give an indication of an association between a grazer and a plant/alga. Try to strengthen the argumentation and search for information in the library, on the web and through articles.
An extension of this study could be to:
⇒ If an association is observed: Try and connect the pattern to a preference (perhaps feeding).
⇒ If no association is observed: Questions to ask: Was our observation relevant? Could the results be because of bad experimental design /implementation? Does scientific research support the null-hypothesis? Try to find alternative explanations for the observation.

***Assessment**:*

1. Report what you have done (drawings, photos and video).
2. Show your result in a table, figure, as photos or drawings.
3. Write about primary producers and herbivores and how they can interact.
    What harm can small animals do to plants?
    How can plants defend themselves?
    Try to list reasons for herbivores to choose some plants over others.
    Can you think of benefits for plants to have invertebrates on them?

Background information:

There can be several motives for herbivores to associate with a plant or alga. The plant or alga can be a good surface to live on. Plants and algae with cavities, curly and ondulated parts can give protection from attack by predators and also be good nurseries. But the most common reason for a grazing animal to associate with a plant or alga is that it's a provider of food for the animal.
Grazers can be generalists and feed on many different plants. But some are choosier and specialize in their choice of food.

References : books ⇒ Nybakken JW (1997) Marine Biology – An Ecological Approach

Background information for the specific study at the Sea Me workshop:

The flat periwinkle (*Littorina obtusata*) is reported to prefer a few species of wrack (brown seaweed). One reason for this preference could be that they like to feed on specific wrack. Their feeding apparatus is specialized to be able and penetrate tough tissue like the thallus (bodypart) of wrack. Another reason for the periwinkle to associate with specific algae could be that the female prefers to deposit her eggs on an alga that can be advantageous for the offspring. In this case it might not be obvious that adult snails show a preference for a certain species other then when it needs a nursery.

References: web-sites ⇒ www.aquascope.tmbl.gu.se