



Shoe crab (*Carcinus maenas*)
Photo Erik Selander

Do crabs choose a specific shelter when being scared?

Objectives:

Through observations and manipulative studies examine the response to a potential threat in a motile animal.

Subjects: biology ⇒ ethology, mathematics, (language arts), (art), (social studies),

Application: This lesson can be done using small motile invertebrates and vertebrates, such as beetles, mice and lizards.

Duration of experiment: 1-2 hours

Group Size: practical work preferably in small groups, but can be done with whole class

Key words: ecology, ethology, escape, shelter, predator, prey

Procedure according to the scientific protocol (go to: “How we do it”)

Observation:

The shore crab (*Carcinus maenas*) often hides in the brown algae when being frightened.

Explanation model:

The shore crab prefers to hide in brown algae when being frightened

Hypothesis:

If presented with a choice of brown algae and rock when being frightened, the shore crab will choose to hide in the brown algae.

Null hypothesis:

If presented with a choice of brown algae and rock when being frightened, the shore crab will choose to hide under the rock or not show any preference.

Experiment:

Crabs in containers with both algae and rocks are frightened using an object to create a disturbance in the water.

Interpretation:

If we get:

⇒ Support for the hypothesis: We have shown that the crab prefers to hide in brown algae when being frightened

⇒ Support for the null hypothesis: The crab does not show a hiding preference for the brown algae.

(See *Extension* for discussions on arguments for the results.)

Equipment:

Aquaria/containers, stones, plants/algae, other possible objects for animals to hide under, means to scare (e.g. with the hand or a stick), experimental animal (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 “ethology” and discuss different kinds of behaviour in animals.
2. In the field: Try and observe animal reactions to potential threats.
3. Prepare for your specific investigation by thinking about all the steps in the *Scientific protocol* above.
4. Forming a hypothesis for the study according to the *Scientific protocol* above.
5. Discussion on how to conduct the experiment and what equipment to use. How many individuals of the experimental animal? With several individuals you will get a stronger, more general result. If you have less than three individuals you could execute the experiment by exposing the same animal for “the threat” several times. However you will then only be able to say something about the behaviour of individuals. You will not get any general results for the species you’re using.
6. Collection in the field: Be sure to use organisms that are allowed, non-toxic and non-allergic.
7. Implementation of experiment:
 - a) Set up the aquaria or containers.
 - b) Put algae and rocks at opposite sides in the containers
 - c) Place one animal in each container at a spot with equal distance from the algae/rocks. Cover with a net if the animals might escape.
 - d) When the animal is positioned with equal distance from the shelter, make a disturbance in the water (also at an equal distance from the shelters, near the animal and not between the animal and the shelter).
 - e) Observe and register how the animals behave. Use camera or video.
 - f) Repeat if you have chosen that method.
8. Discussion on how to report the results.
9. Discussion on the meaning of our results. What conclusions can you draw if you find support for the hypothesis or for the null hypothesis? (see *protocol Interpretation*)

Extension:

The study will or will not give an indication of a hiding preference. 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 the animal’s environment e.g. habitat.

⇒ 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 from the experiment in a table or in a figure. You can also use drawings, photos and video.
3. Try to explain why it could be important for an animal to choose where to hide.
4. Escape is one way of defence. Write about other defence strategies.
5. Write about the differences in defence between animals that can move and sessile animals (=animals that are attached to a surface).

Background information:

Most animals need to have strategies to cope with attacks from other animals. Often it's to avoid being food for other organisms. There are many different kinds of such defence strategies. Motile animals can for instance flee and hopefully escape the enemy. Their morphology can also be such that a predator has difficulties finding and/or eating the prey. The prey can for example have spikes, be slimy, blow up in size or have a hard shell. Some animals change colours so they blend in with the surroundings or look "scary". Some choose specific hiding places, hard for predators to find or get to.

For sessile animals that can't run away it's even more important to have an effective defence strategy. Some have morphological strategies. There is another, often very efficient way for sessile animals to defend themselves, and that is to have a chemical defence.

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

The shore crab (*Carcinus maenas*) has several ways to avoid being taken by predators. Their colours blend in with their environment. They can burrow into the bottom sediment or hide in the algae or under a rock. Since they are territorial they know their habitat well and can quickly find a place to hide. They are good runners.

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