Boulder Investigations

Level

8+

Key question

How do we use hypothesis testing to find out about habitats?

Key outcomes

Compare the factors affecting the survival of plants and animals in their natural habitats.

Undertake a scientific investigation into boulder habitats on a rocky shore and use the data collected.

Adapted from Underwood and Chapman by Kylie Butler & Michele Hollaway, University of Queensland; and Lin Fairlie, Brisbane Girls Grammar, & Jan Oliver, Queensland Department of Environment..

Boulders which accumulate on a shore often provide a habitat for numerous plants and animals, particularly those which are sessile (not moving). If the boulders are turned over, the animals living under them are exposed to light and drying conditions, so it is very important to return the boulders carefully to their original position.

What you need

A rocky shore with numerous boulders
Field guides to major species
Magnifying glasses
Field sheets and pens for each pair

What you do

Students can be grouped into pairs. Each pair selects three boulders at random over the area. These can be marked on a rough sketch map of the area. Pairs then carry out the following observations.

1. Record the species on the top of each boulder.
   - Note the coverage of algae – is one species dominant?
   - Is the entire top covered in some type of algae?
   - Are most foliose (leafy) or encrusting?
   - Make a sketch of the top of the boulder looking down, and show the coverage of main species.

2. Carefully lift the boulder up and turn it over. Quickly note if any animal moves away or hides. Then examine the underneath of the boulder carefully. Typical species will include worms, bryozoans (colonies of individuals living in very small, hard skeletal boxes), sponges, sea-squirts, anemones and hydroids. Identify the most numerous species; note the dominant colouring visible. Are all the species sessile or are some moving?

3. Now examine the area under the boulder, referring if necessary to observations initially made when the boulder was turned over. Note the material on which the boulder rests. Is the area wet? Is sediment present? Mobile animals are likely to be chitons (which move very slowly), snails, limpets and crabs.

The animals, plants and patterns will vary depending on the location of the boulder-field. Some areas may be dominated by barnacles, others by mussels and algae. Cunjevoi are more

likely on warmer temperate shores.

4. A comparison can be made now between the three boulders. Can a model be developed based on the predictions/hypotheses – see accompanying information sheet.

The whole class group can be reassembled and all recordings made of the sample boulders compared. Use these questions as a guide:

- Are there noticeable differences between boulders in any area?
- Is there more life on top, under, or on the ground below a boulder?
- Do some boulders lack visible life?
- Where are the boulders with the most life visible on top?
- Where are the boulders with the most life clinging to the underside?

Can you provide an explanation for the distribution you have found. As it is based on your field observations, it is most likely to be true, so your model will be true.

Other hypotheses can be tested in the field and further explanations suggested. For example:

- The boulders closest to the water and the most smooth, contain most life on top.
- The boulders are evenly scattered across the slope.
- The boulders are largest closer to the cliff.
- The boulders in the middle area between the cliff and the high tide mark have the most life immediately under them.

A fuller analysis of the observations can be made back in the classroom.

Extension

Do Field Activity 51, Homing Chitons? in *Project ReefEd*. Apply the model to the‘Beach, Water and Cliff’ activities.

Reference

Underwood, A.J. and Chapman, M.G. (eds.) 1995, *Coastal Marine Ecology of Temperate Australia*, University of NSW Press, Sydney.

Boulder Investigation

Information sheet on Scientific Method

The method described here is scientific and can be used by any person. Even young children can make observations and draw conclusions using these procedures.

The method, called *falsificationism,* is described in Underwood and Chapman 1995, pp. 5-13. It is used to demonstrate that possible explanations (models) for particular things observed in nature might be wrong by testing predictions which are made from these explanations or models (use Figure 1 to follow this argument).

1. Propose a model predicting what is happening in the boulder field. Further test this explanation/model by altering one of the circumstances affecting the boulders. For example, a proposed model states that competition for space explains the pattern of distribution of two species on a boulder. Is this correct when one of the species is removed?

2. Use field experiments and test if the prediction about the distribution is true or false.

3. If true, then the model is correct. If false, then the model is incorrect and a new model or explanation should be developed and tested.

Field experiments can be set up to test the prediction of the model under a variety of conditions. An area where the conditions remain unchanged forms the 'control'. The experiments should be able to be repeated to verify the findings. In a fragile coastal area, it may not be advisable to set up too many experiments requiring manipulation of animals and plants, so some of the hypothesis testing may have to be done by observation. Some experiments will take some time (e.g. removal of one species to allow another to spread further) and long term observation posts may be needed.

Boulders provide a useful testing ground as there are usually so many of them that valid comparisons based on observation alone can be made without having to remove animals, nor relocate these on to other boulders.

The following statements can be tested in a boulder-field to see if each is true and if the proposed model applies.

Boulders provide three different habitats for inter-tidal species:

- The top of the boulder may have algae, often ungrazed because wave action dislodges any snails or sea urchins.
- The undersurface of the rock, occupied by sessile and juvenile species.
- The dark, shady area of shore covered by the boulder. This may consist of sand or rock or small pebbles and provides shelter for some mobile animals such as brittle stars, small crabs, limpets.

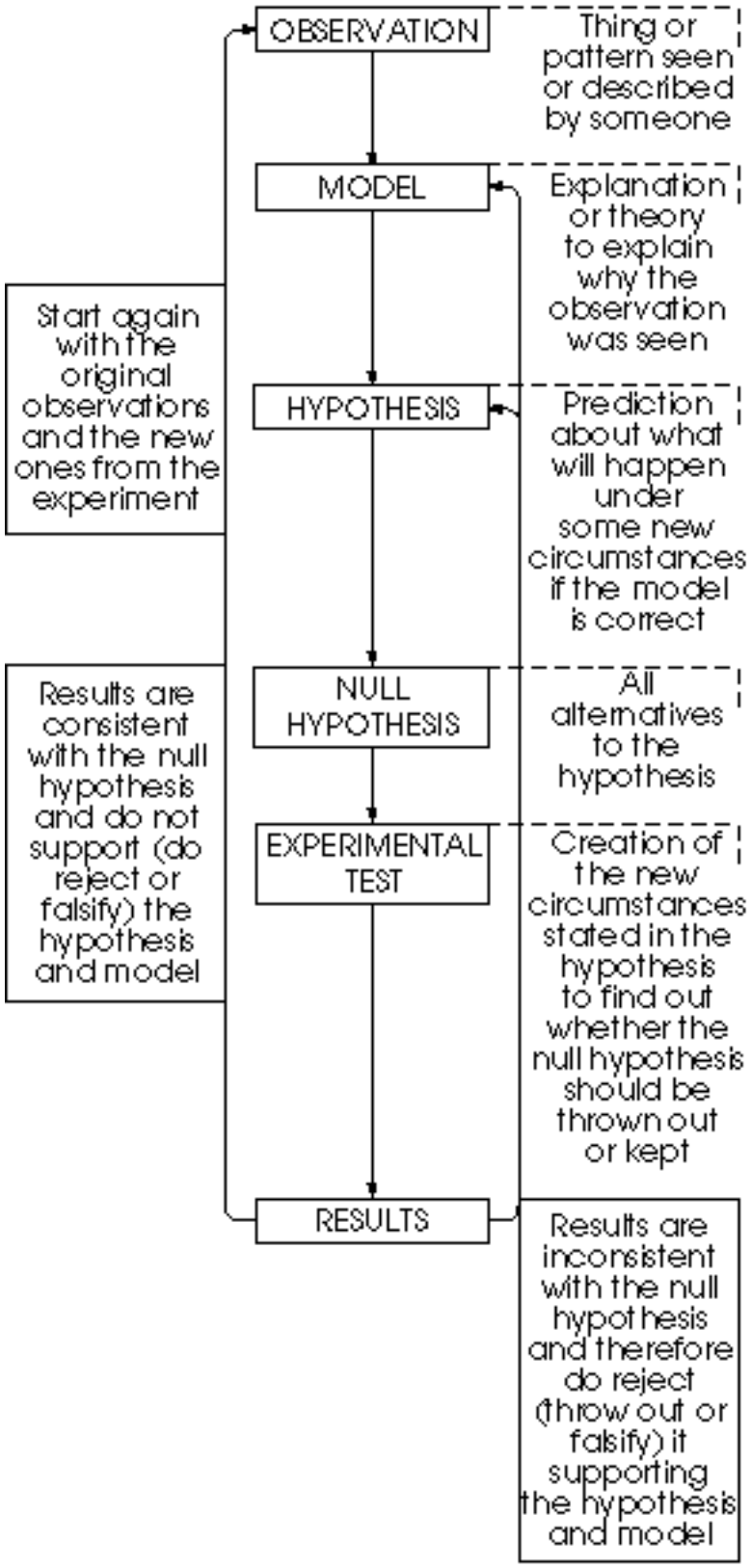

Figure 1. Method used to examine predictions about particular things observed in nature (from Underwood & Chapman, p. 5).