ROCKY SHORE – TRANSECT SURVEY METHOD

INTRODUCTION

Every year in New Zealand hundreds of schools collect excellent data on the distribution and abundance of marine intertidal organisms found on their local rocky shores. Brought together, this information could tell us so much about the rocky intertidal zones of New Zealand, yet it is rarely put to use outside the classroom.

Many secondary schools survey the rocky shore for NCEA Level 2 Biology achievement standard 91158: Investigate a pattern in an ecological community, with supervision. If data from different sources are to be comparable, then the method used to collect this data needs to be kept the same. To this end we have produced a method and data collection sheet that can be used to collect distribution and abundance data to enable valid and reliable geographical comparisons to be made. This method has been developed with the guidance of marine scientists, with the specific needs, constraints and goals of a senior biology class survey at the fore.

The survey protocols will help you gather data of sufficient quality and quantity to not only describe rocky intertidal zonation patterns for 91158 in a valid way, but also to produce scientifically-robust data for use in monitoring the distribution and abundance for many intertidal species around New Zealand.

Although this survey method is designed to meet the school curriculum, it could be used by any group interested in doing a more extensive survey of their shoreline. The data can be uploaded to our new website (Mm2.net.nz) as a simple pre-formatted spreadsheet. Contributing groups will not only be able to submit, store, view and graph their own survey data, but display and compare their results with the survey data from other times and sites around New Zealand. This will allow schools to access large amounts of quality data that they can use for both historical and geographical comparisons.

This guide to carrying out a transect survey is taken from *"Ecology of the New Zealand Rocky Shore Community: A Resource for NCEA Level 2 Biology*", published by the New Zealand Marine Studies Centre. Darren Smith developed this resource when he was on the Endeavour Teacher Fellowship, New Zealand Science, Mathematics and Technology Teacher Fellowship Scheme 2012. This scheme was funded by the Ministry of Science and Innovation and administered by the Royal Society of New Zealand. Darren Smith was hosted by the New Zealand Marine Studies Centre, Department of Marine Science, University of Otago.

For further resources and information about the Marine Metre Squared project go to Mm2.net.nz. For more information about the New Zealand Marine Studies Centre go to marine.ac.nz or email marine-studies@otago.ac.nz.

WHY STUDY THE ROCKY INTERTIDAL SHORE?

New Zealand is a coastal nation. It has one of the largest coastlines relative to our land area in the world. Our coast is under pressure from many different users. The intertidal border between the sea (marine) and land (terrestrial) environments are susceptible to impacts from both the land and the sea including pollution; overfishing; mineral extraction and dredging; invasive pest species like *Undaria* seaweed; nutrient enrichment and increased sediment in rivers from run-off; habitat loss and alteration; and the global effects of climate change that include rising sea level, increased air and sea temperatures, disrupted weather systems and ocean acidification.

The intertidal border between the land and the sea is a productive and diverse habitat. It has a high biodiversity and is home to many slow-moving or sessile species that are relatively easily quantified for monitoring changes. Collecting data on species distribution, abundance, community structure and biodiversity will provide a useful baseline for detecting any future changes.

HOW TO CARRY OUT THE SHORE SURVEY

The aim for the class will be to construct a table that shows the mean density and distribution of intertidal organisms from the upper limit of the tide's influence to the low water mark.

A class will set up 3-5 randomly placed transects that will run from the upper limit of the high tide's influence (the splash zone) down the shore to the water's edge at low tide. Each group of 3-4 people will be responsible for surveying one transect.

Along each transect there will be 11 sampling points. At these points a quadrat will be placed to measure the abundance of all[1] of the animals and plants found there. The sampling points will be evenly spaced along the transect at regular intervals of 1/10 the total transect length. Each sampling point will correspond to a different tidal level *i.e.* quadrat 1 (Q1) will always be at the upper limit of the high shore; Q5 will be the mid shore sample, and Q11 the lowest of the low shore samples (Figure 1).

As each group will use the same method, their data can be pooled. At the end of the survey the pooled data can be used to calculate the mean density at each shore level for all species found in the survey.

Using a standardised method means that results from different times and places can be compared.

[1] You should not assume that you know what the dominant or important species in an intertidal community are before you survey it and choose to count only those species; a valid method for a community survey would collect data on <u>all</u> species that can then be analysed for patterns that might suggest significant interactions between different species.

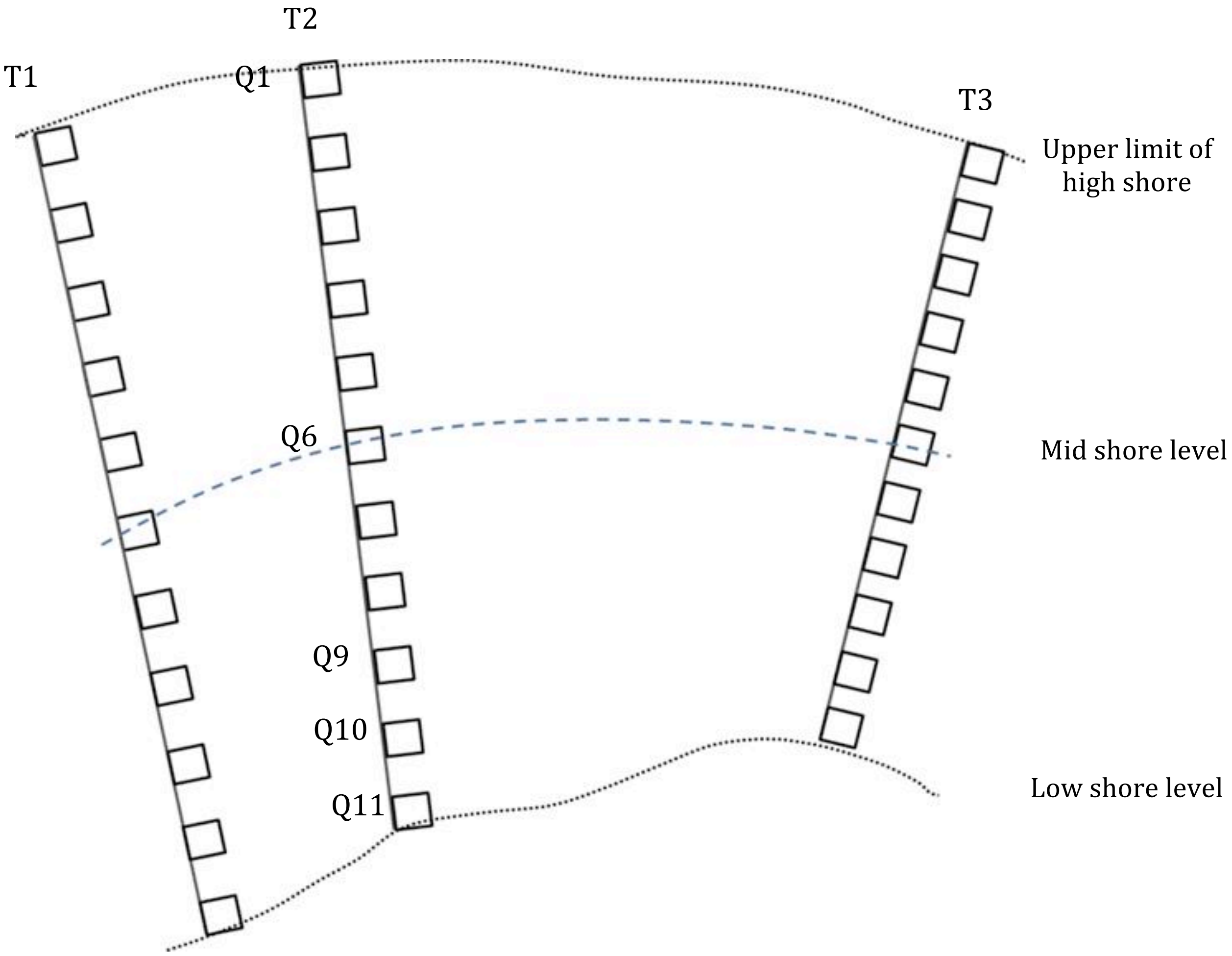

Figure 1 An example of a survey area (planform view) showing three transects, T1 – 3, each with 11 quadrats (Q1 – 11) at regular intervals of 1/10 of each transect's total length.

Why is the quadrat sampling interval always one tenth of each transect's total length?

Most shorelines are irregular shapes and it is unlikely that any two transects will be the same length. Some transects may lay on more steeply sloping parts of the shore than others. To calculate an average density for a species at a particular tidal level, data from different transects need to be pooled together - but how do you know which quadrats are at approximately the same tidal level? The quadrats at the very top and bottom of the transect will be equivalent as the high and low tide levels are easy to fix. You could also assume that the quadrats in the middle of each transect are at the same tidal level – at the mid tide. But how can you make sure that quadrat 3 on transect 1 is at an equivalent tidal height as quadrat 3 on the other transects? The solution is to place quadrats at the same *relative* distances along their transects; these distances are found by dividing each transect into the same number of lengths and placing a quadrat at each of these points. This will enable you to pool quadrats at approximately equivalent tidal heights.

A shore profile diagram should always be drawn so that any exceptionally high or low quadrats can be ideitified and analysed later. A convenient number to divide the transect by is 10. This will give 11 quadrats in total, which will provide sufficient data to show the presence of any pattern in species distribution along the transect.

EQUIPMENT LIST

The following is essential equipment:

Figure 2 The NZ Rocky Shore Guide

- Quadrat: 0.5 x 0.5 m square frame with a total area of 0.25 m2
- Transect: Measuring tape: 30 – 50 m plastic, reeled
- HB pencil
- A4 hardcover notebook or A4 clipboard in a clear plastic bag
- NZ Rocky Shore Guide (Figure 2)[2].
- Sunscreen, hat, water and sensible footwear

You may also find the following equipment useful:

- Thermometer: stainless steel probe, -10˚C – 50˚C range
- Digital camera and 30 cm white plastic ruler for scale
- Data recording sheet (see 'Survey Data Sheet', Appendix 1)
- Tent pegs for securing each end of your transect
- Hand lens for identifying small organisms
- Small plastic 'sandwich' bags for collecting small samples of seaweed for preserving or identification after the survey

SURVEY METHOD

1. Aim to begin surveying at low tide. Arrive at the shore at least 30 minutes before low tide so that you have time to mark out your survey area.

2. Measure the width of your survey area along the high shore, either by paces or using a tape. The transects should run down the shore from the upper limit of the sea's influence where the splash zone ends. Finding this region can be difficult, but there are some indicator species that can be used *e.g.* littorinid or periwinkle snails (*Austrolittorina antipoda*) and encrusting marine lichens. Find the height where these organisms are no longer consistently found and let this represent the absolute upper limit of the tide's influence and the start point for your transect.

3. Generate up to 5 random numbers[3] between 0 and the width of your survey area. Each of these numbers is a starting point for your transect in the high shore and the location of your highest shore quadrat, Q1.

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[2] Free download for Northern and Southern regions available from the "Resources" section of the New Zealand Marine Studies Centre website http://www.marine.ac.nz/

[3] Random numbers can be generated using a standard scientific calculator, iGenerate Random Numbers iPhone/iPod 'App' or online at http://www.random.org

4. Hold the measuring tape at the highest sampling point (Q1) for the transect at the high shore region and run out the measuring tape down the shore to the water's edge to form a line that is approximately perpendicular to the shoreline; this is your transect line. Walk with the tape on your left hand side – this will help you to walk to the right of the transect and avoid trampling your survey area.

5. Measure the total length of the transect. Divide this number by 10 to find the sampling distance between quadrats along the transect.

6. The first quadrat to sample is in the low shore at the water's edge. This is numbered "Q11" on the survey sheet. Place the quadrat onto the substrate with the top left corner of the quadrat's outer edge on the sampling point on the transect (when facing **up** the shore towards the high tide zone).[4] This quadrat is sampled first.

   Always face the sea while counting so you can watch for large waves!

7. Starting in the top left corner, systematically search the entire habitat within the quadrat and record the abundance of all macroscopic organisms. Here are some guidelines to help you record abundance:

   - Record abundances for overlying canopy species first. The canopy species can then be lifted or moved aside to record abundances of the understorey species living beneath them. Remember to look inside crevices and under rocks and weed.
   - Animals should be recorded using a tally to produce a total count or frequency.
   - Seaweeds should be recorded as percentage cover.
   - For small, encrusting animals that form colonies (such as ascidians, bryozoans and sponges) and/or cover a large area (such as barnacles and little black mussels) you can either count the individual colonies, or treat them like seaweeds and record their percentage cover.
   - Where an animal's abundance is much greater than 100 (*e.g.* species like horn snails, blue banded periwinkles and barnacles), you can do a rough count in one part of the quadrat and multiply this up (extrapolate) to represent the whole quadrat.
   - If a relatively large organism is directly beneath or touching the quadrat frame, then you need to count it differently. Only count the organism if more than half of the organism is inside the quadrat.

   When you have finished searching the quadrat remember to replace any rocks to their original orientation and position.

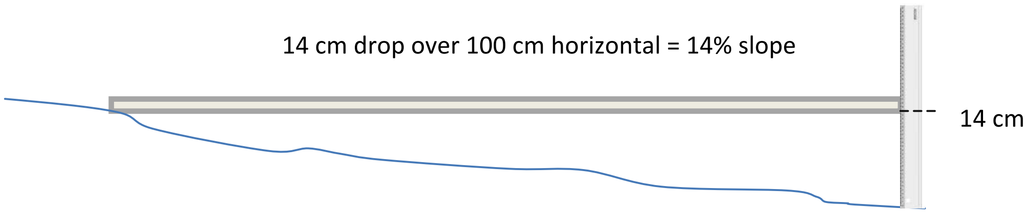
[4] Sampling starts at the low shore and works up the shore with the incoming tide following behind.

8. Record the substrate type in the quadrat. The underlying or base substrate is recorded as either rock, cobble, mixed (loose assorted stones) or pool of water.

9. If you have time, photograph the quadrat from above for visual reference. Include the quadrat, transect and site number, and a 30 cm white plastic ruler for scale in each photograph.

10. Record environmental information about the site. This could include:

- GPS coordinates or map grid reference
- Air and sea temperature.
- Aspect. This is the compass direction the shore faces *e.g.* north facing.
- Exposure level. This is a measure of how exposed the shore is to wind and wave action *e.g.* sheltered, very exposed, etc.
- Shore gradient or slope. This can be *estimated* by measuring the drop down the shore in 1 horizontal metre. For a more accurate measurement, this can be done several times along the entire length of the transect and averaged for a steadily sloping shore, or used to help create a shore profile diagram where the shore slope changes.



- Significant features: these are any features that you think might influence the survey area *e.g.* large boulders, storm water drain outfall, stream or creek outlet, grazing animals, rock fall, wreckage or rubbish, pipeline, etc.
- Photographs, video or sketched profile diagrams of the survey area so that you or someone else can locate your sampling area again later.