Transects and quadrats, Huh?
Lesson 2/2 for C3

Abstract:
This lesson explores the use of transects and quadrats as tools for cataloging and documenting species in a given area. Students will observe the differences between the methods using each tool and explore examples of Arctic species, especially those found in Cambridge Bay.

Objectives:

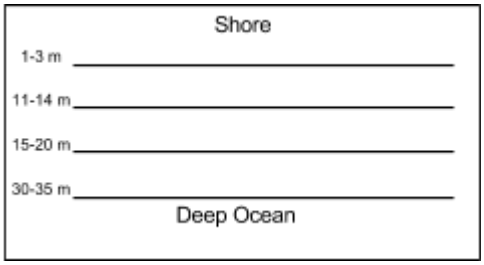
- Students will explore what transects and quadrats are and how researchers use them.
- Students will also explore how benthic (seafloor) diversity changes with depth.

Materials:

- 4 x 5 m ropes or string
- 2 X 4 sets of species cards sets with coinciding depth markers (provided)
- Shore and deep ocean signs (provided)
- 2–4 hula hoops
- Field or open space
- Transect overview sheet (provided)
- Pencil/pen and paper

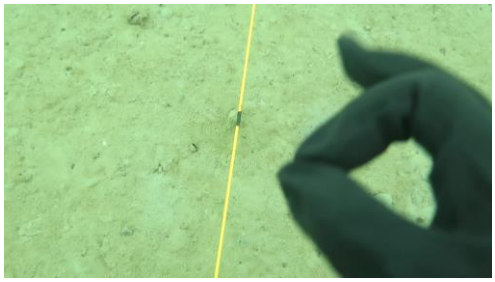
Preparation for the teacher

- Setup 4 transects, running parallel to each other and ropes approximately 1–2m apart. At the end of each place a depth marker accordingly, i.e., Rope 1 with two of Card Pack 1: 1–3 m. Set the cards along each coinciding depth transect randomly. It can be very helpful to establish other “area” markers for the students to imagine. For example, the shallowest rope could be near shore, and the furthest one is at depth. See visual for clarifi
- Divide the students into working groups of 4–5 students



Background information for the teacher:

Transect: A survey line, often defined by a rope of a predetermined length, that stretches between two identified marked points. The rope can have marked measurements for observation locations.



In this photo you can see an Ocean Networks Canada diver “okaying” the transect point or mark on a transect in Cambridge Bay. This 100m transect ran parallel to the shore and was marked every metre. Transects are often used to establish plots for quadrats.

Quadrat: An item used to mark off a study area or sub-plot. Quadrats are often four-sided, such as a square metre, but could also can be circular like a hula hoop, as long as the total area of the marked region for data collection is known. Quadrats of the same size are used along a transect to quantify size of species, species distribution, species abundance, species richness, and biodiversity of an area.

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Why use transects and quadrats?

Sub-plots are used to quantify observation in a small area in order to estimate the same variables over a larger area. For example, if you counted 20 students in one class in a school, and there are 20 classes in the school and you know the number of students per class is around the same you can determine that there are approximately 400 students in the school without counting each individual student. Similarly, if a scientist is on a beach with a transect running parallel to the shore for 100 m and in one 1 x 1 m quadrat they counted 80 barnacles, 78 barnacles in another, and 82 in another they can calculate the average as 80 barnacles per square metre. They can then multiply 80 by 100 and get an estimate that there are about 8000 barnacles along their transect. (Please note: These are simplified examples, in practice, multiple samples would be taken to form a population estimate and a hypothesis.) With that data, the scientists can also go back seasonally or yearly to the same places to see any changes. They may notice that there are fewer barnacles but an increase in sea stars. This would provide data to investigate further questions about the behaviour of the sea stars and barnacles: for example, the hypothesis that the sea stars are eating the barnacles and impacting the population.

LESSON PLAN

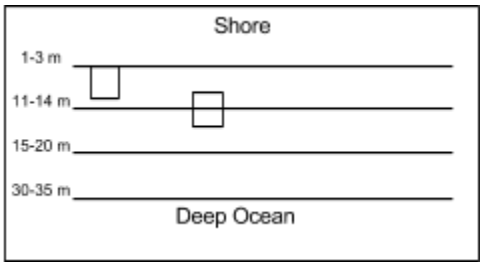
Hook/ Preamble

1. Ask the students to think about their desks (or lockers, or cubbies) in the classroom for a moment. Choose 2–3 students as examples and have them list a few items from their space. Discuss with the class, are any items likely to be in other places, too? For example, if the students say they have a textbook, an eraser, and a ruler, how likely are these to be found in other cubbies/desks/lockers? How likely are these to be in places like a restaurant? Explain to students, a transect/quadrat is a scientific way of recording one space, and using it to make educated guesses about another. For example, the students' cubbies might not be identical, but they will be reasonably similar. Likewise, the restaurant is so different, it's very unlikely to be similar the kids cubbies/lockers.
2. Explain to students, in this activity, they will be completing a mock transect study for different areas of Cambridge Bay and the Coronation Gulf. This activity is based on real data from a study done by Vancouver Aquarium and Polar Knowledge Canada in 2016.

Activity sequence:

1. Take the students to the transect area and divide them into groups of 4. Each person in the group is responsible for 1 transect and will be expected to report back to their group.

Part 1 – What is a transect?



1. Introduce activity to the students posing this question: "How do scientists actually study biodiversity?" (*if you have done the "Are you abundant or rich?" lesson you can refer to what the students did.) One common way is to use transects and quadrats.
2. Explain what a transect is and that you have set out 4 parallel transects at 4 different depths (1–3m, 11–14m, 15–20m and 30–35m) along the "ocean floor". One person from each group will go along each transect and identify and count the species. After each person has collected their data, discuss why different people found different species on each transect. Ask how it might be different if the transects ran perpendicular to the shore, i.e., starting off shallow and going deeper.

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Part 2 – What is a quadrat?

Review the concept of a quadrat (similar to a transect but different in that it is a confined, measurable area) and explain that students are going to uses hula hoops as quadrats.

1. Explain that in order to compare their results and for scientific validity the class has to decide as a whole, how they are going to place their hula hoops along the transect. Two common ways are to have the transect run through the middle of the quadrat or right beside the quadrat.
2. Using the transects from the previous activity, have one student per group place the hula hoop (quadrat) along their transect in the way determined by the class remember, they all need to be the same, for example, in the middle to be scientifically sound, if they are random, it can impact the results and is not accurate to how researchers use them.
3. Explain that their group's hula hoop is their study area. Have the students identify and count species in each quadrat. Compare results to the other groups in the class.
4. Compare and contrast the transect study to the quadrat study. Can they make any conclusions from their experiments? Anything related to biodiversity?

*After each part you can have students calculate species abundance and species richness, as well as graph the data they collected.

Live Dive:

Ask the students during or after the Live Dive: "Can you determine if the diver is going parallel or perpendicular to the shore? Why or why not?" "Are they doing a transect or quadrat study?"

Extensions:

- Discuss why different species are found at different depths.
    - Discuss what human impacts could change where a species would live.
- Students can investigate a particular species to learn about its range and habitat.
- Discuss if the students think the biodiversity would change seasonally for different species.

References: Heywood, J., Kent, D., Gibbs. D., Borden, L., Neale, M., Lisaingo, J., Banwait, R. Caughlan, D. (2016). 2016 Nearshore Ecological Survey Final Report August 3–27, 2016 Cambridge Bay, Nunavut. Vancouver Aquarium Marine Science Centre.