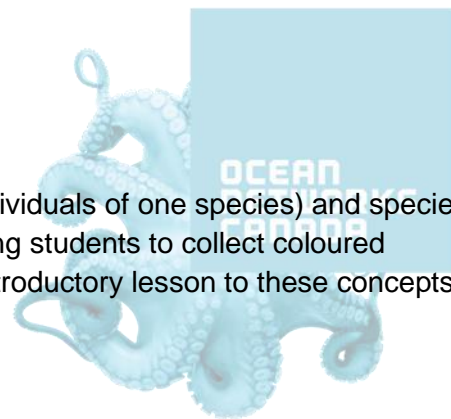


Are you Abundant, or are you Rich?
Lesson 1/2 for C3



Abstract:

This lesson explores the difference between species abundance (many individuals of one species) and species richness (many species, independent of the number of individuals) by asking students to collect coloured cards. This lesson uses examples of arctic species and could be a good introductory lesson to these concepts.

Objectives:

- Students will experience an example of biodiversity.
- Students will explore the difference between species abundance and species richness.

Materials:

- 4x 4 sets of coloured animal cards (provided, each colour/species will have 16 cards)
 - Red – tube-dwelling anemones
 - Yellow – arctic saxicaves/nestler clams
 - Green – green sea urchins
 - Blue – arctic shannies
- Field or open space
- Whistle or signal

*Note: Coloured stickers can be applied to white cards as an alternative to coloured paper.

Preparation for teacher

- Designate a large playing area in which the students will collect cards.
- Spread the coloured cards out, with the colours randomly distributed throughout the space.
- Divide students into groups so that the number of GROUPS is divisible by 4. For example, 8 groups of 3 is ideal.

Background information for the teacher:

Species: a group of organisms that can produce fertile offspring. Some examples are polar bears, caribou, arctic char or green sea urchins.

Species Abundance: number of individuals of a single species.

Species Richness: number of different species in an ecosystem.

Ecosystem: a community in which biotic and abiotic elements interact.

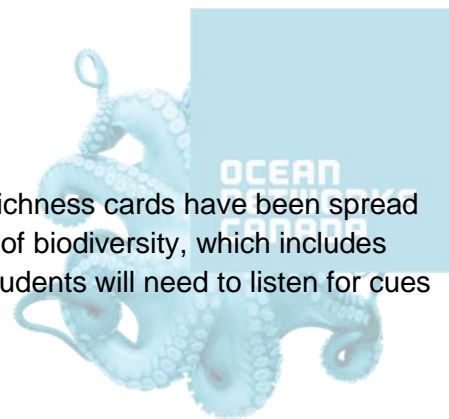
Biodiversity: Biodiversity refers to the variety of living organisms in an ecosystem. In order to have and maintain good/strong biodiversity there must be a balance of species abundance and species richness.

With high species abundance, individuals can easily reproduce and work together. However, abundance alone is not enough to ensure survival as they rely on other species for food, energy, and in some cases protection. If there is a large variety of species (species richness), but low abundance, the ecosystem may work fine for a while but without abundance to reproduce, eventually a species may die off.

LESSON PLAN

Hook/Preamble

1. Brainstorm with students: what does it mean to be “rich?” what does it mean to be “abundant?” Record the students’ ideas on the board. In this activity, students will find out how these terms apply to biology.
 - The teacher is encouraged to record all the students’ ideas, as the class will refine them at the end of the activity. This can help students identify their own misconceptions and how they change as they learn.



Activity Sequence:

1. Take the students into the playing area where the abundance and richness cards have been spread out. Explain that the end goal is for students to explore the concept of biodiversity, which includes richness and abundance by picking up cards for each round. The students will need to listen for cues as to which cards to collect.

Note, that each colour represents a different species.

Part 1 – What is Species Abundance?

1. During this round of the game, groups will gather an abundance of the same colour/species but not a variety representing high species abundance and low species richness.
2. Assign each group a colour (multiple groups can have the same colour, as this is a group dependent, not class dependent activity). On “go,” each group has to find their colour in a relay fashion. One person from each group finds one coloured card and comes back before the next person can go. They have two minutes to collect as many of the same coloured cards as possible.
3. After two minutes, have the students count how many cards of their colour they have. This number represents species abundance as it is the same species and we are counting multiple individuals of the same species.
 - a. Each group could have up to 16 cards.

Part 2 – Species Richness

1. During this round of the game groups will gather a variety of colours/species but not more than one of each, representing high species richness and low species abundance.
2. Return the cards to the field (students can do this to make it random). Tell each of the groups that they are now tasked with collecting one of EACH colour of cards. Similar to above this will work in a relay. One person from each group can collect one colour card at a time. They need to pay attention as so to not to collect the same coloured card more than once. The number of different colours they collect represents species richness. This time, the students have an example of a “rich” but not very abundant ecosystem.
 - a. Each group should have collected 4 cards, one of each colour.

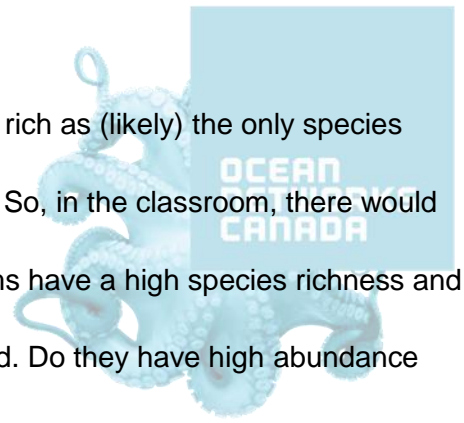
Part 3 – Biodiversity

1. Have the students return the cards to the field, again, trying to be random.
2. During this round of the game groups can collect any cards. Continuing in a relay fashion, one student from each group can go at a time and bring back a card to the group. After the two minute period, have the students determine which species are abundant and if the ecosystem is rich.
3. Tell the groups that biodiversity is achieved by finding a balance of species abundance and species richness. Discuss if they think they achieved biodiversity or what they might need to do to have a more “perfect” ecosystem.
 - a. Students may want to strategize and try again.

Wrapping up:

1. Revisit the students’ original brainstorm about richness and abundance. After the activity, what ideas do they want to reshape, change, or eliminate?
 - Listen for and add as needed: Rich in a biological context, means to have lots of different species in one area. Students may need help remembering that “rich” refers to the number of species, so even if only one individual is present from multiple species it may still be a biologically rich area. One example

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that may help is your classroom. The classroom is NOT biologically rich as (likely) the only species present are humans.

- Abundance refers to the number of individuals present per species. So, in the classroom, there would be an “abundance” of humans, but very little species richness.
- The two terms are not mutually exclusive. The healthiest ecosystems have a high species richness and high species abundance.
- Ask the students to reflect on natural environments they have visited. Do they have high abundance and/or diversity of organisms? Why not?

Live Dive:

Ask the students before or after the Live Dive: “Can you see examples of species abundance or species richness during the Live Dive?”

Extensions:

- Have the students calculate a simple biodiversity index from their data.

By dividing species richness by the total number of species you get a simple biodiversity index. Biodiversity indices are used by scientists to determine species variety in a specific area. A more diverse population has a larger chance of including individuals that may be able to adapt to a changing environment. A high biodiversity index is “1”. As the number decreases so does biodiversity.

$$\frac{\text{Species richness (the number of colours collected in Part 3)}}{\text{Total number of species (the total number of cards collected in Part 3)}}$$

- Have the students discuss threats to biodiversity.
 - [Bearly Any Ice activity](#)
- Discuss the ideas of genetic diversity and ecological diversity.

Step It Up For Advanced Students:

- Usually when species abundance is seen in the natural environment individuals of the same species are found in groups. Being in a group provides safety, greater opportunity to find food and easier access to mates. Even solitary species can be found in the vicinity of other individuals for the purpose of finding potential mates. This can be “set-up” for the students in Part 1 of the activity by grouping some of the same coloured cards together. Bring this to the students’ attention and discuss why this may occur.
- In the natural environment species richness does not occur as perfectly as we have set it up in this example. This concept can be shown to the students by manipulating their chances of getting one of each species in Part 2 of the activity. One way would be to limit the number of coloured cards so that each group will not be able to collect one of each colour. This can lead to the discussion of threats to biodiversity. Another way would be to add one card of a fifth colour so only one group can obtain it. You can discuss the students’ thoughts on the question: “Do you need one of each colour to have species richness?”
- You may also want to discuss or explore the concept of “keystone species” as this is also a strongly related topic in biodiversity and ecosystems.
 - Keystone species: a species that other species depend on and if removed would change the ecosystem drastically: for example, polar bears.