Ocean Sense
Program

OCEAN NETWORKS CANADA

Lesson 2

Module:

Arctic Ocean Biodiversity

Time:

40 minutes

Learning pillars:

- Indigenous knowledge
- Ocean science
- Data exploration

Grade & curriculum connection:

- **BC Science 7**
  "Evolution by natural selection provides an explanation for the diversity and survival of living things."

Created with knowledge from:

Rebecca Ukullaq, Salomie Qitsoalik, Jimmy and David Qirqqut, Danny Aaluk, and Zoe Ohokannoak

A UNIVERSITY OF VICTORIA INITIATIVE

Ocean Ecology in Cambridge Bay

Examine Arctic ocean ecology in the waters of the Kitikmeot Region of Nunavut and play a wide game that helps measure species abundance, species richness, and biodiversity.

The seafloor near Cambridge Bay is an **ecosystem** that is home to many organisms, some of which share similarities to species found in the Pacific and Atlantic oceans along the Canadian coastline. Species that are found in the Arctic are **adapted** to the local waters through the process of **natural selection** over time. Ocean Networks Canada has collected data in collaboration with community members in Cambridge Bay since 2012 including data that highlight the amazing biodiversity in the Arctic.

Learning objectives

- Make observations aimed at identifying their own questions about the natural world.
- Identify a question to answer or a problem to solve through scientific inquiry.
- Demonstrate a sustained intellectual curiosity about a scientific topic.
- Use scientific understandings to identify relationships and draw conclusions.

Materials

- Computer with internet connection
- Projector, screen, and speakers
- Slide deck: **Arctic Ocean Biodiversity (bit.ly/SlidesAOB)**
- Activity: Abundant, Rich, and Biodiverse and all materials listed therein
- Access to Cambridge Bay Coastal Community Observatory **data dashboard (bit.ly/DataCamBay)**

Teacher preparation

- Preload the slide deck: **Arctic Ocean Biodiversity (bit.ly/SlidesAOB)**

- Prepare materials from activity: *Abundant, Rich, and Biodiverse*

- Preload the Cambridge Bay Coastal Community Observatory **data dashboard (bit.ly/DataCamBay)**

Classroom instructions

Hook

1. Share slide 17 and ask the students if they have heard of species abundance and richness. Discuss what they might know about these terms.

Step-by-step process

2. Share that the images on slide 17 have been taken by divers in the water around Cambridge Bay during trips made by the Ocean Networks Canada team.

3. Complete the activity *Abundant, Rich, and Biodiverse.*

4. Share slides 19-21 to summarize the terms learned through the activity and craft definitions for species abundance, species richness, and biodiversity.

5. Share slide 22 to revisit the image from the lesson hook to assign the label of species abundance or species richness represented in the image.

6. Discuss the following points:

   a. Biodiversity is defined as the variety of life in the world or in a particular habitat or ecosystem.

   b. Biodiversity can be measured in a variety of ways including species abundance and species richness.

   c. An ecosystem that lacks species abundance or species richness is not necessarily an unhealthy ecosystem.

   d. Biodiversity is one measure of health in an ecosystem, but it is not the only factor: many characteristics can contribute to the overall health of an ecosystem including energy flow, nutrient cycling, and resilience to disturbances in the ecosystem just to name a few.

7. Share slide 23 to reflect back to lesson 1 The Story of Sedna. Ask students to name the species represented in the illustration Nuliajuk by Danny Aaluk. Discuss potential reasons why the artist depicted mostly megafauna, including the beluga whale, narwhal, fish, seal. Some points to emphasize:

   a. The Inuit people have lived off the land from time immemorial and relied on the Arctic megafauna for food and materials for thriving in their environment.

   b. People hold different worldviews about the natural environment, and considering multiple worldviews can help us best understand an ecosystem.

   c. The only way to truly understand why Danny Aaluk depicted the specific species is to ask him.

8. Share the video on slide 24 which highlights the biodiversity in the waters by Cambridge Bay where Ocean Networks Canada has an underwater observatory.

9. Discuss what kinds of scientific questions can be studied using video data and the information about the observatory shared on the Cambridge Bay Coastal Community Observatory **data dashboard (bit.ly/DataCamBay).**

   a. Share slide 25 for some examples of questions. The image is Ocean Networks Canada's underwater camera and light platform that is currently deployed in Cambridge Bay.

Modifications and adaptations

- Rather than a relay, the activity *Abundant, Rich, and Biodiverse* can be done with each student having a complete set of the *Abundant, Rich, and Biodiverse* activity cards.

Final remarks to the educator

Defining species abundance, species richness, and biodiversity is one place to start in understanding and documenting an ecosystem. Although this can be helpful, it doesn't give a holistic understanding of the environment. For example, more detailed analysis is needed to understand the relationships between the species in an ecosystem and the impacts of changes (e.g. seasons, pollution, humans, predation, etc.) on an ecosystem. It is also important to note that the concepts introduced in this lesson are based on a worldview focusing on documenting and categorizing. Other worldviews may describe or document biodiversity in different ways and with different methods. Using, including, and being open to multiple worldviews can help us best understand an ecosystem.

Assessment

- How do you define species abundance, species richness, and biodiversity?

- How do multiple worldviews help us best understand an ecosystem?

Extensions

- Formulate a hypothesis and analyse the camera data viewable on the Cambridge Bay Coastal Community Observatory **data dashboard (bit.ly/DataCamBay)** over a period of time to answer a scientific question.

- Launch an inquiry into natural selection and adaptation.

Glossary

Adapted: The process by which a living organism becomes better able to live and reproduce in a particular environment.

Biodiversity: The variety of living organisms in a particular ecosystem.

Ecology: The scientific study of the relationship between living organisms and their physical environment.

Ecosystem: An interactive community of living organisms and their physical environment.

Natural selection: Natural process by which certain traits that have a greater fitness for their environment lead to a reproductive advantage; this process happens within a population over time because of genetic variation.

Species abundance: Many individuals of one species within an ecosystem or given area.

Species richness: Many species, independent of the number of individuals per species.

References

Aaluk, D. (2018). *Nuliajuk* [Illustration]. Ocean Networks Canada, Victoria, BC, Canada.

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Activity 1

Module:

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Abundant, Rich, and Biodiverse

Explore the difference between species abundance (many individuals of one species) and species richness (many species, independent of the number of individuals) with this fast-paced wide game. This activity uses examples of Arctic marine species from Cambridge Bay.

Materials

- 16 x coloured *Abundant, Rich, and Biodiverse cards*
- Field or open space
- Whistle
- Timer
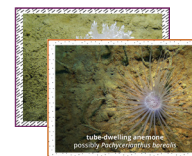
Teacher preparation

- Print 16 copies of the *Abundant, Rich, and Biodiverse cards* file (16 pieces of paper)
- Cut out the *Abundant, Rich, and Biodiverse cards* (64 cards in total)
- Determine the area of play and out of bounds in the large play space such as a field or gym
- Divide the students into small groups of 3-4

Procedure

1. Ask the students to randomly spread out the species cards with the image facing up in the designated playing area.

2. Explain that the game's goal is to explore the concepts of species richness, species abundance, and biodiversity.

Round 1

3. Assign each group a background colour/pattern of card to search for. Note that multiple groups can have the same colour/pattern.

4. On "go," each group has one minute to collect as many of their colour/pattern of cards as they can in relay fashion; one person from each group collects one card and comes back before the next person can go.

5. After one minute, ask the groups to count how many cards of their colour/pattern they have collected and share it with the class. Ask the groups to share what species their cards picture.

6. Ask the students if they think this round of the game represents species richness, species abundance, or biodiversity. Share that as they picked up only the same species and we are counting multiple individuals of the same species, this round represents species abundance.

   a. Each group could have up to 16 cards.

7. Share that the term population is used to describe the number of individuals of the same species.

Round 2

8. Return the cards, image facing up, to the field in random order.

9. Instruct the groups to collect cards of each of the different background colour/pattern.

10. On "go," each group has 30 seconds to collect a card of each colour/pattern in relay fashion; one person from each group collects one card and comes back before the next person can go.

    a. Explain that duplicate cards (i.e. same background colour/pattern and species) should be returned to the play area before the next person can go.

11. After 30 seconds, have the groups count how many different colours/patterns of cards they have collected and share it with the class. Ask the groups to share what species their cards picture.

12. Ask the students if they think this round of the game represents species richness, species abundance, or biodiversity. Share that as they picked up only one card of each colour/pattern, and therefore species, this round represents species richness.

    a. Each group should have collected four cards, one of each of the background colour/pattern and species.

Round 3

13. Return the cards, image facing up, to the field in random order.

14. Instruct the groups to collect as many cards as they can.

15. On "go," each group has 30 seconds to collect cards in relay fashion; one person from each group collects one card and comes back before the next person can go.

16. After 30 seconds, have the groups count:

    a. how many different species they have collected.

    b. how many individuals of each species they have collected.

17. Ask the students if they think this round of the game represents species richness, species abundance, or biodiversity. Share that as this round represents biodiversity because both species abundance and species richness is represented.

18. Discuss that different ecosystems have different balances of species abundance, species richness, and biodiversity.
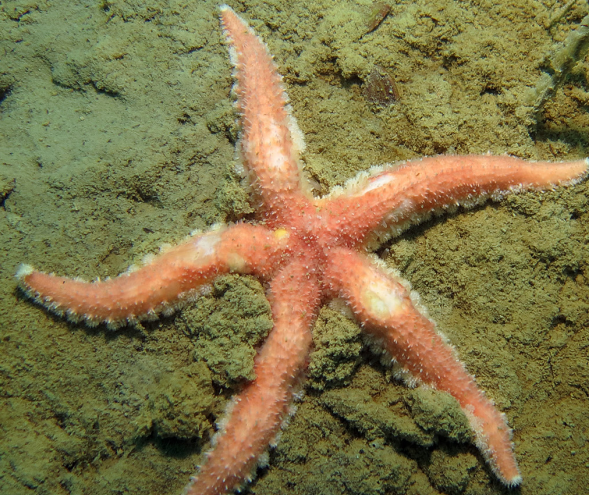
Conclusion

The third round is important to play in order to share that different ecosystems have a different balance of species abundance and species richness. In other words, there is no right way for an ecosystem to be biodiverse. Species have evolved over time by natural selection, both within a population and an ecosystem.
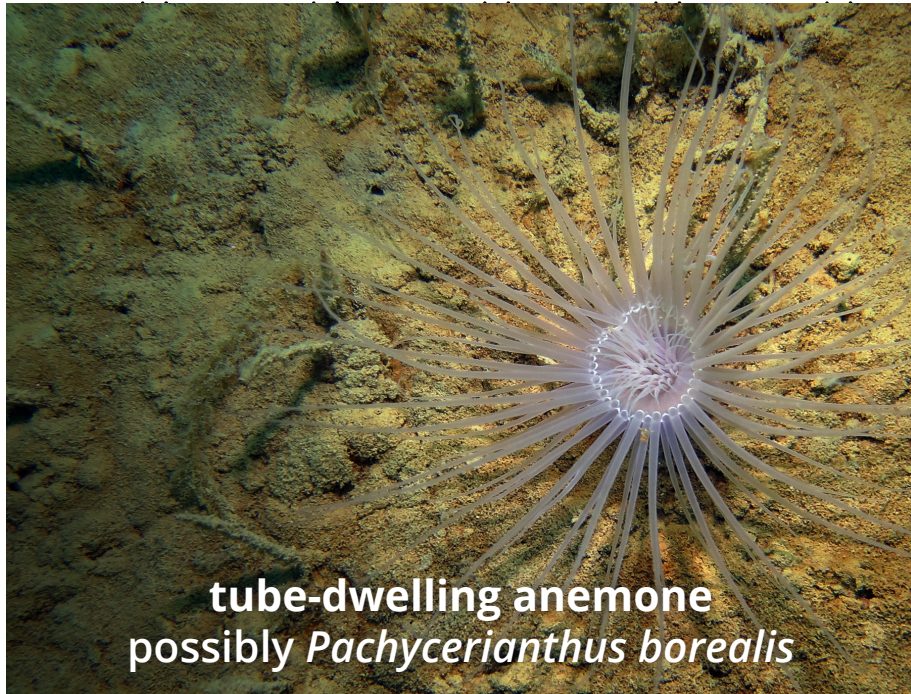
nudibranch
species unknown

frilled sea star
possibly *Urasterias lincki*

tube-dwelling anemone
possibly *Pachycerianthus borealis*

green sea urchin
Strongylocentrotus droebachiensis