

6.8 Invasion Crustacean

Story Extension for This Lesson:

This lesson is a 'thinker' task where students are required to consider what would happen to the waters of the arctic as climate change continues to affect ecosystems around the planet. The text passage that links this lesson is found at the end of the junior story. Here is the direct passage:

"It seems like there was less and less ice over the five years that Rae was searching for Franklin," Alex notes. "Could the climate be different now?"

"It certainly could," says their teacher. "The climate has changed over the last 160 years, so our trip will be different than Rae's. We will have to figure out what it's like now so we can prepare. We better start now!"

Grade: 6

Strand: Biodiversity

Big Ideas:

- Biodiversity includes diversity of individuals, species, and ecosystems. (Overall expectations 2 and 3)
- Classification of the components within a diverse system is a beginning point for understanding the interrelationships among the components. (Overall expectations 2 and 3)
- Because all living things are connected, maintaining diversity is critical to the health of the planet. (Overall expectations 1 and 3)
- Humans make choices that can have an impact on biodiversity. (Overall expectation 1)

Overall Expectations:

1. assess human impacts on biodiversity, and identify ways of preserving biodiversity
2. investigate the characteristics of living things, and classify diverse organisms according to specific characteristics
3. demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans

Specific Expectations:

1.2 assess the benefits that human societies derive from biodiversity and the problems that occur when biodiversity is diminished

2.4 use appropriate science and technology vocabulary, including classification, biodiversity, natural community, interrelationships, vertebrate, invertebrate, stability, characteristics, and organism, in oral and written communication

2.5 use a variety of forms to communicate with different audiences and for a variety of purposes

3.2 demonstrate an understanding of biodiversity as the variety of life on earth, including variety within each species of plant and animal, among species of plants and animals in communities, and among communities and the physical landscapes that support them

3.4 describe ways in which biodiversity within and among communities is important for maintaining the resilience of these communities

3.5 describe interrelationships within species, between species, and between species and their environment, and explain how these interrelationships sustain biodiversity

3.6 identify everyday products that come from a diversity of organisms

Inquiry Skills:

Searching, Comparing, Contrasting, Reporting

Instructions:

When John Rae travelled by sea from England to the Bering Strait, it was a dangerous journey. For Alex and Sam to replicate the journey of John Rae, they will have state of the art navigation and satellite systems to guide them on their way. They will also have modern fabrics to help them stay warm and lightweight equipment they can carry with them. However, their travels will pose a greater threat to the biodiversity of the arctic waters as the polar ice caps are melting at an alarming rate. Climate Change is putting the arctic at risk from invasive species.

Part 1:

To begin this lesson, distribute and read Arctic Invasion by Geoffrey Giller. After reading and discussing the article with your class, have your students complete an assignment on the reading. Refer to BLM - Arctic Invasion Assignment.

Part 2:

The Invasive Species Game

The origins of this game was created by Dr. Carol Stepien, Principal Investigator for the GK-12 Program from the University of Toledo.

- Link: <http://www.utoledo.edu/nsm/lec/gk12grant>

Students will experience, first hand, the effects of an invasive species in the arctic. To begin, there are four native species: one with a plastic spoon (CRABBY RED), one with a pair of chopsticks (CRABBY BLUE), one with a fork (CRABBY GREEN), and one with two forks in one hand (CRABBY YELLOW). The invasive species will have a big binder clip.

Eating Habits:

- CRABBY RED eats only white pom-poms
- CRABBY BLUE eats only white and red pom-poms
- CRABBY GREEN eats only blue pom-poms
- CRABBY YELLOW eats blue and red pom-poms
- CLIPPER CRAB eats white, red, and blue pom-poms.

Instructions:

1. Randomly distribute as many white, red, pink, and blue pom-poms on a piece of felt.
2. Each of the four native crabs have 30 seconds per round to collect as many pom-poms as possible using one hand.
3. Play three rounds before the invasive CLIPPER CRAB arrives.
4. Continue to play three more rounds with the CLIPPER CRAB eating all coloured pom-poms.

Scoring:

Each native species starts off with three lives represented by counters. At the end of each round, each crab needs five pom-poms to survive. For every three pom-poms beyond the first five, the crab produces an offspring. One offspring equals one additional life. Once the crab is out of lives, he/she becomes extinct and joins the CLIPPER CRAB by collecting pom-poms with a binder clip.

Guiding Questions:

1. Were you able to compete with the other native species for food?
2. Were you able to compete with the invasive specie for food?
3. What were the consequences of having an invasive specie entering an ecosystem?

Part 3: Research Project

Students will conduct a research project on climate change and how it will impact the arctic. To help students organize their information, refer to BLM - Research Graphic Organizer.

Materials List:

Materials for Part 1:

- Arctic Invasion
- Arctic Invasion Assignment

Materials for Part Two (for groups of five):

- 5 cups
- 1 pair of chopsticks
- 1 plastic spoon
- 3 plastic forks
- 1 large binder clip
- 10 white pom-poms
- 10 red pom-poms
- 12 blue pom-poms
- 3 X 4 piece of felt
- 25 counters
- 1 timer

Materials for Part 3:

- Research Graphic Organizer

Connections:

This lesson can be used in conjunction with the Language curriculum under the reading, writing, and communication strands. To complete this activity, students are required to produce a multimedia report of what they have learned.

Assessment Strategy:

It is recommended you focus your assessment on process skills. To help get you started on this path, a series of charts have been provided for you.

- Process-Skill-Searching-5
- Process-Skill-Comparing-21
- Process-Skill-Contrasting-19
- Process-Skill-Reporting-10

Handouts/Assessments:

- Arctic Invasion
- Arctic Invasion Assignment
- Research Graphic Organizer

Subject Area:

Environmental, English

Connects to:

Grade 6



Large ships use ballast tanks to keep themselves level. These tanks also transport a whole range of marine life. Photo by Ashley Cooper/Corbis

Arctic Invasion

Invasive species are making it to the Arctic, they just can't survive there—yet.

by Geoffrey Giller

Published December 8, 2015

There's an Arctic invasion underway.

Not a military invasion ([hopefully](#)), but a biological one.

Already, as the water warms and sea ice melts, [shipping in the polar north is increasing](#)—a trend that's expected to continue [as the region goes ice free](#). More shipping means more large ships [discharging ballast water](#) and, likely, more invasive species being flushed into the Arctic Ocean.

Potentially invasive species are already making their way to the Arctic, but for now it's still too cold for them to survive. Yet [as new research shows](#), warming over the next century could mean that many of the species that

are today being flushed into the sea to die will instead start calling the Arctic home.

Working in Svalbard, an archipelago far north of the Norwegian mainland, researchers took samples of the ballast water from ships coming in to port. They identified 23 non-native species, including crabs, barnacles, and copepods, in the ballast water. Of those, the team focused their attention on eight, assessing whether they can survive in the conditions in Svalbard today, and in the conditions predicted for 2050 and 2100.

Right now, only one of the eight species, [a small crustacean](#), can theoretically survive in Svalbard based on existing information about its temperature requirements. But by 2050, five of the eight might find some southern ports in the archipelago more welcoming, and by 2100 six should feel right at home across much of Svalbard.

But even this may underestimate the changes that could soon be coming to the Arctic ecosystem. There wasn't enough existing data about the physiological requirements of the other 15 species the researchers found in the ballast water to evaluate how they would do in the warming ocean. And "there's potentially a whole lot more biodiversity in these ballast tanks, hanging out in the sediment [at the bottom]," says Reuben Keller, an expert on invasive species who was not involved in the research.

Predicting which species may eventually become established residents of the Arctic is nearly impossible, says [Chris Ware](#), who led the study. But one of the species they found, the [European green crab](#), is considered among the [100 worst invasive species worldwide](#) by the International Union for the Conservation of Nature.

This crab "is known to cause substantial impacts," says Ware, including eating native species of shellfish and plankton, competing with native crabs, and even introducing new types of parasites.

While it may seem like 2050 or 2100 is a long way off, these species are already being transported to the Arctic. And "once established, invasive marine species are notoriously difficult to eradicate," says Ware.

This buffer of time "should be viewed as an opportunity to act in order to prevent inevitable species invasions," Ware says, "rather than an opportunity to delay any response."

Just like with military invaders, if these species are given a chance to dig in, it will become even more difficult to drive them out.

Source: <https://www.hakaimagazine.com/article-short/arctic-invasion>

Arctic Invasion

Name: _____

Date: _____

Read the article, "Arctic Invasion." When you are finished reading, answer the following questions below.

1. In your own words, summarize the article, "Arctic Invasion."

2. What is the main idea of this article? Explain your thinking.

3. “Arctic Invasion.” is a nonfiction article. List three characteristics that show that this is nonfiction writing. For each characteristic, give an example from the article to support your answer.

4. The article begins with Geoffrey Giller stating “There’s an Arctic invasion underway.” What purpose did this sentence serve? Explain your reasoning.

5. How successful is Geoffrey Giller at presenting his perspective about how climate change is a threat to the arctic? Explain your thinking.

Name: _____

Topic: Climate Change and Invasive Species in the Canadian Arctic

Research Question: _____

Source:	Source:	Source:	Source:
Facts:	Facts:	Facts:	Facts:

Process Skill - Searching

Process Skill	Students	Teachers	What This Skill Should Lead To
Searching	☐ locating their own sources of information based on their own questions ☐ re-framing their current understanding in light of new evidence ☐ evaluating the reliability of sources of information ☐ identifying potential sources of error and/or bias ☐ developing and using criteria to establish relevance, accuracy, and reliability of information ☐ discussing research with peers and teachers to gain additional perspective and construct new meaning ☐ developing and using strategies to collect, organize, and communicate relevant research ☐ developing and using strategies to interpret scientific vocabulary	☐ giving students sufficient time and resources for research ☐ giving students guidance and activities to develop research skills ☐ developing criteria for reliability ☐ giving students opportunities to discuss and question their research ☐ guiding the development of strategies to interpret scientific text	☐ critical literacy skills that enable assessment of information for accuracy, reliability, and relevance ☐ strategies for interpreting and understanding scientific text ☐ cooperative learning (through discussion of research with peers)

Teacher Notes:

Process Skill - Comparing

Process Skill	Students	Teachers	What This Skill Should Lead To
Comparing	☐ carefully examining two or more samples (objects, events, behaviours, or data) ☐ utilizing all five senses, as appropriate, to find similarities ☐ paying attention to finer details ☐ may involve graphic organizers to sort ideas ☐ may be influenced by prior knowledge, schema, or cultural perspective	☐ done by students, though you may need to provide prompts depending on their ages and abilities ☐ personal and individual to each student (consider previous experiences and cultural perspectives) ☐ differentiated for each student	Students will become better able to find patterns and commonalities, and thus become better and more keen observers of the natural world.

Teacher Notes:

Process Skill - Contrasting

Process Skill	Students	Teachers	What This Skill Should Lead To
Contrasting	☐ carefully examining and determining differences between two or more samples (objects, events, behaviours, or data) ☐ sorting samples in multiple ways ☐ using graphic organizers (e.g., T-chart, Venn diagram, fishbone diagram) with headings to help sort or using the Frayer Model (focusing on differences) to help organize thinking and improve understanding of scientific content and concepts ☐ using differences in data to analyze and interpret results	☐ giving students many opportunities to distinguish samples based on their differences ☐ using instructional strategies (e.g., gallery walk) so students can share their contrasting with other students ☐ allowing students to select samples and data that they can contrast. It is best if these come from student-directed inquiries ☐ differentiated for every student	Students will become better able to find subtle differences in samples and thus become better at making quality observations. They will also generate better conclusions based on differences found in their inquiries. Through contrasting, students will learn useful descriptive vocabulary as well as develop higher-order thinking skills, such as the use of similes and metaphors, to communicate their understanding.

Teacher Notes:

Process Skill - Reporting

Process Skill	Students	Teachers	What This Skill Should Lead To
Reporting	□ sharing ideas, based on facts and evidence, with others □ using creative and original presentation formats □ using an extensive vocabulary, yet writing or speaking succinctly □ giving others the opportunity to understand the world as the reporter does	□ encouraging connections, inferences, and predictions □ promoting the sharing of ideas and evidence in a logical and concise manner □ encouraging creativity and the use of technology □ differentiated. Permitting and encouraging different presentation formats allows all students to successfully communicate their findings. □ scaffolding the process for students. Students can start by using a structured report format which evolves into a more sophisticated self-structured format. □ a natural literacy link	Students acquire research, speaking, and presenting skills through reporting. It is this step in an inquiry that establishes the factual and investigative background that informs their investigation. They gain an improved sense of logical sequences and often improve their ability to use vocabulary. A skilled reporter knows how to summarize background information and present it in a manner that piques the audience's interest.

Teacher Notes: