PEOPLE OF A FEATHER

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EDUCATIONAL PACKAGE

LESSON PLANS AND CLASS ACTIVITIES TO ACCOMPANY THE FILM

Published by The Arctic Eider Society
www.arcticeider.com

Introduction

BACKGROUND AND APPROACH

OVERVIEW

The People of a Feather Educational Package was created to provide a resource that would facilitate further discussion of the themes raised in the film and allow educators to create opportunities for students to explore them. The lesson plans cover topics including Arctic sea ice dynamics, anthropological filmmaking, traditional and modern technology of Inuit, and the ecology of the Hudson Bay Common Eider. The eider represents the 'canary in the coal mine' for environmental change in Hudson Bay and the species Inuit on the Belcher Islands rely on for food and clothing. Students can also explores the impact of hydroelectric projects on the marine environment of Hudson Bay and consider solutions to energy management and distribution that work with the seasons of the hydrological cycle.

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INTRODUCTION

The lesson plan package includes an appendix listing links between lesson plans and relevant sciences, humanities, social justice and visual arts curriculum. Skill development includes: critical thinking, using the processes of science and technically precise language, conducting research, representing and interpreting information from maps and diagrams, and working corroboratively.

Much of the content for the lesson plans is presented in the film *People of a Feather* (52 and 90 minute versions available), special features, or in "backgrounders" which have been developed specifically for each lesson plan. A list of links to books, articles, websites and multi-media resources relevant to each lesson plan is provided to facilitate additional research by students or teachers.

The lesson plans have been designed in a flexible modular format and can be used independently, in any order, or even simultaneously. Most of the lesson plans can be completed in 40-90 minute periods (after the film viewing), or over the course of a few periods depending on the age group, level of research conducted by students, and depth of class discussions. Educators may decide to assign the "research", "discussion questions" or "extensions" as homework and follow up with a class discussion. The discussion questions may also be used as tools for assessment. "Student worksheet" templates and "answer keys" for activities within each lesson have been provided at the end of each lesson plan.

Enjoy exploring the many layers of *People of a Feather* with your students!

TABLE OF CONTENTS

1 **Polynya & Floe Edge Habitats**
COMMUNITY BASED MONITORING AND INUIT SEA ICE KNOWLEDGE.....1

2 **Hydroelectricity and Sea Ice**
SOLUTIONS THAT WORK WITH THE SEASONS OF THE HYDROLOGICAL CYCLE.....15

3 **Inuit Ingenuity**
TECHNOLOGIES AND ADAPTING TO CHANGE..... 29

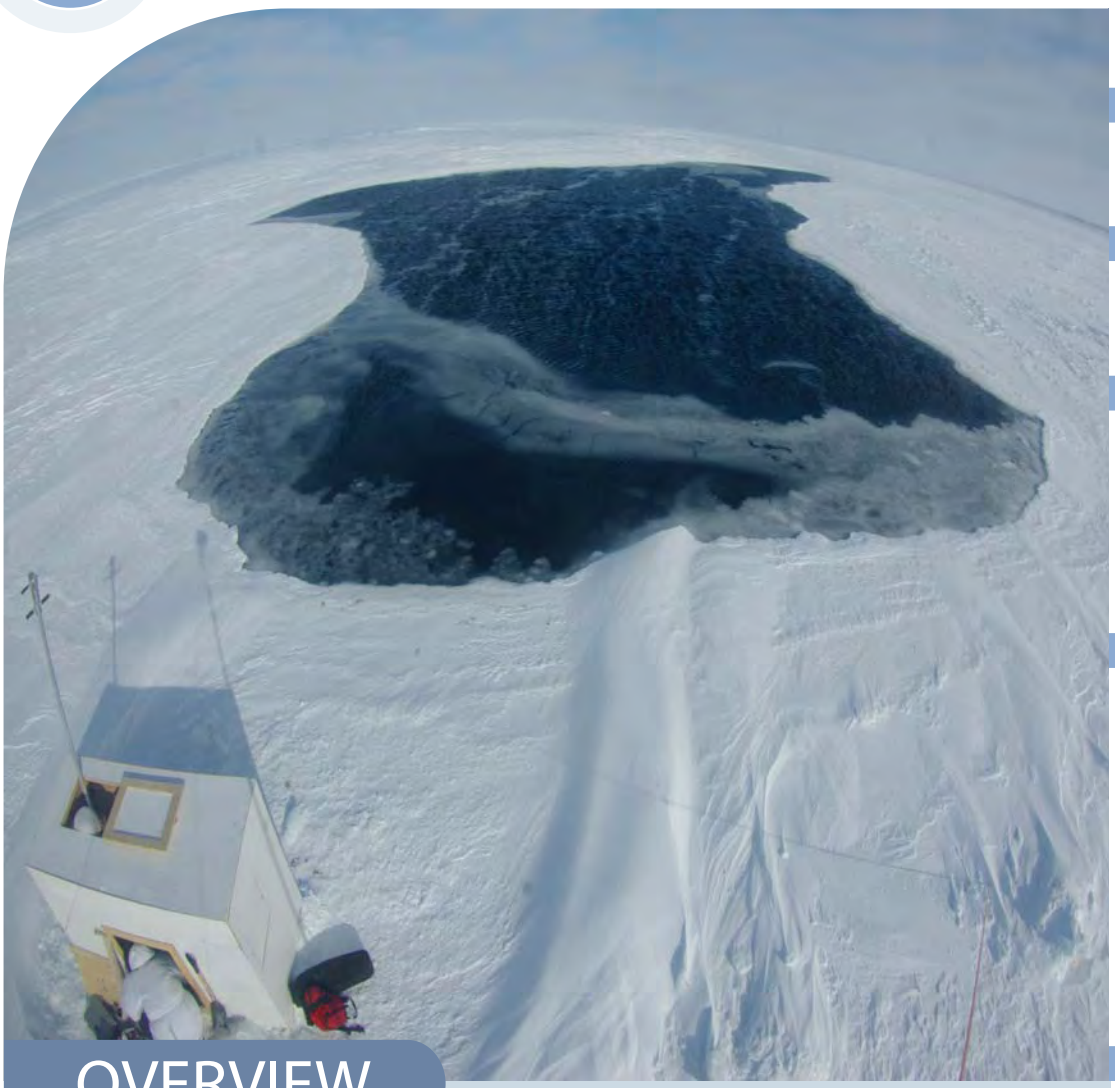
4 **Ecology of the Arctic Eider**
DIVING AND SURVIVING IN WINTER SEA ICE HABITATS..... 53

5 **Anthropological Filmmaking**
ROLE OF THE FILMMAKER AND COMMUNITY IN CAPTURING CULTURE..... 69

A **Appendix: Curriculum Links**..... 79

1 Polynya & Floe Edge Habitats

COMMUNITY BASED MONITORING AND INUIT SEA ICE KNOWLEDGE



GRADE LEVEL

Grades 8 - 12

ACTIVITY TIME

40 - 60 minutes

SKILLS

- Communicating results
- Working corroboratively
- Research
- Technical language
- Interpreting diagrams

CONCEPTS

- Sea ice habitats
- Tools and techniques for sea ice research
- Community based monitoring programs
- Integrating science and Inuit knowledge

LEARNING OUTCOMES

- Understand characteristics of sea ice habitats
- Learn about research techniques in arctic environments
- Understand benefits of using various sources of knowledge

CURRICULUM LINKS

- Science
- Oceanography
- Culture / Social Science
- Biology

OVERVIEW

Students will learn about the characteristics of "polynyas" (arctic oases) and "floe edge" sea ice habitats within the marine environment of Hudson Bay. They will examine how each habitat is formed, the kinds of wildlife that depend on them, and the various methods and tools used to study and monitor the ecology and oceanography of these unique environments. Community based monitoring programs and the integration of scientific and Inuit knowledge about sea ice are also explored.

BACKGROUND

POLYNYA AND FLOE EDGE HABITATS

The polynya and floe edge environments are both important habitats for many species within the Hudson Bay marine ecosystem, including species such as the Common Eider, seals, and polar bears.

Polynyas (*ikirassa*, *sarvait* or *aukkarniit* in Inuktitut) are areas of open water that are surrounded by sea ice and do not freeze over during the winter months. A polynya can be thought of as an "Arctic oasis" in a desert of sea ice. Their location is often consistent from year to year, though their size and shape can vary depending on environmental conditions.

The Floe Edge (or *sinaaq* in Inuktitut) refers to the edge of the landfast ice (*tuvaq*) where solid ice attached to land meets the open water. The location of the floe edge can change throughout the season depending on environmental conditions. The open water near the floe edge may contain moving ice which has broken off from the floe edge and is in a state of constant change, opening and closing with changing tidal currents and wind. In some cases, they can quickly close or freeze over depending on factors including temperature, salinity and currents. Many die-offs of eider have occured when floe edges closed and didn't reopen.

Both polynya and flose edge environments are characterized by a number of biotic and abiotic factors. For example, polynyas tend to be places with very high biological productivity, particularly in early spring. This is as a result of the combined effects of fast-moving currents, which bring nutrients to the surface of the open water, and sunlight, which promotes rapid and abundant growth of phytoplankton.

The formation and breakup of a polynya from fall through spring was featured in the closing sequence of People of a Feather. Images such as these are also used to track changes in sea ice for research purposes.

BACKGROUND

RESEARCH

As highlighted in the film, conditions within the marine ecosystem of Hudson Bay have changed, affecting the polynyas and floe edges which are important habitats for wildlife and the local Inuit. Community based monitoring programs supported by the Arctic Eider Society promote Inuit knowledge about sea ice and provide meaningful employment training opportunities for community members who have become involved in modern research programs. These programs allow a better understanding of environmental changes, address environmental issues, and promote community sustainability.

For more details see www.arcticeider.com/research/

Simeonie and Daniel measure salinity using oceanographic equipment deployed through a seal breathing hole. Through programs like this, knowledgeable hunters are training youth in sea ice knowledge and environmental research that addresses local issues.

RESEARCH TECHNIQUES

A number of research tools are used to collect data from the Hudson Bay marine environment and several are profiled in the film.

Salinity Profiler: An instrument that helps observe the depth and stratification of fresh and salt water in the water column. It can be deployed in seal breathing holes (as done by Simeonie and Daniel while seal hunting in *People of a Feather*) or other openings in the ice. Data is collected by repeated sampling at a number of sites to compare results over time and between regions.

MATERIALS

- Student Worksheet
- Projector to view Film
- Internet access for students (www.sikuatlas.ca) or printed and photocopied pages from the website
- Flip chart paper or roll of mural paper and markers

PREPARATION

- Review background
- Set up the TV and DVD
- Photocopy worksheet, one per student
- Preview film

BACKGROUND

RESEARCH TECHNIQUES (CON'T)


A winter timelapse station

Aquadopp Current Meters: Deployed in the water column under the ice, this instrument measures water velocity at 10 minute intervals and can be used to track changes in ocean currents over time.

Inuit Knowledge: Local hunters and Elders observe the environment throughout the year and provide a detailed understanding of the local systems and long term changes.

Underwater Cameras: Used to collect underwater footage of diving and feeding behaviour of Eider ducks and distribution and abundance of prey species, such as mussels and sea urchins.

Timelapse Monitoring Stations: Photographs can be used to capture changes in sea ice extent and distribution and abundance of wildlife over time. Cameras can be programmed to capture images at specified intervals, for example, every 20 seconds for several days or once every 20 minutes over an entire season. As shown in the film *People of a Feather*, these stations were important for documenting the phenomenon of freeze-over mortality events which can happen over several days or weeks.

Underwater time lapse cameras can monitor community ecology over time. In the case of eider ducks foraging, this includes the spatial and temporal distribution and abundance of eiders, sea urchins and mussel. This information is important for understanding how eiders deplete populations of their prey.

Aerial Surveys: Surveys by plane are used to quantify population size and distributional changes in wildlife over time.

Satellite Imagery: Satellite imagery is used to assess large scale and long term patterns, particularly changes in the distribution and abundance of sea ice habitats.


A floe edge with both newly forming ice and older floating ice that has broken from the landfast ice edge.

PROCEDURE

INTRODUCTION

1. Review the definitions of a floe edge and polynya as featured in the film (90 minute version: Polynya: 26:10 min; Floe Edge 44:37 min; 52 minute version: 14:00 min & 29:54 min, respectively) and discuss their similarities and differences. Ask students to write a definition of each on their student worksheet.

ACTIVITY

2. Create two groups and assign one group the "polynya" habitat and the other the "floe edge" habitat.

3. Ask students in each group to research the kinds of sea ice that can be found in each habitat at www.sikuatlas.ca and then create sketches of their assigned habitat on mural or flip chart paper. Diagrams should include:

- labels in both English and Inuktitut
- explanations of how the habitat is formed.
- [optional] sidebars which explain what species (e.g., seals, polar bears, eider ducks) use these habitats and what habitat characteristics make them appealing (or not) and why.

Deploying underwater timelapse

4. Present group sketches to the class. Afterwards ask students to create a simple sketch of both habitats on their student worksheet.

5. Based on several techniques featured in the film and listed in the Background section, brainstorm research tools and methods that could be used by The Arctic Eider Society and the community based monitoring team to document changes in polynya and floe edge habitats. Record ideas on the chalkboard and ask students to record notes on their worksheets.

6. Discuss how each tool is useful for collecting data on wildlife, habitats, marine environments, seasonal changes, and changes over time. What types of questions do each of these tools and techniques help answer? Ask students to record notes on their student worksheets.

VOCABULARY

Polynya - An area of open water surrounded by sea ice that remains open throughout the winter due to strong currents. An "arctic oasis".

Floe Edge - The intersection of shoreline ice and open water that moves with wind and currents.

Community Based Monitoring - programs where community members are involved in research with scientists. In Sanikiluaq, this includes providing Inuit knowledge and observations about sea ice environments, guiding and conducting scientific research through collaboration and deploying oceanographic and ecological equipment.

PROCEDURE

CONCLUSION

7. Discuss the following questions as a class:

a. Based on the film *People of a Feather*, what are the current priorities for research and monitoring of the Hudson Bay marine environment? Why?

b. Why do you think community-based monitoring, where Inuit are involved in running research programs and providing traditional and local knowledge, is an important approach? What benefits might these programs have for the community and their cultural heritage?

8. Provide students with an opportunity to make notes of the discussion questions on student worksheets.

RESOURCES

BOOKS AND ARTICLES

Gilchrist, HG., Heath, JP., Arragutainaq, L. et al. 2006. Combining scientific and local knowledge to study common eider ducks wintering in Hudson Bay In: Riewe, R. and Oakes, J. [Eds.] Climate Change: Linking Traditional and Scientific Knowledge. Aboriginal Issues Press, Univ. Manitoba. pp 284-303.

Gilchrist, HG & Robertson, GJ. 2000. Observations of marine birds and mammals wintering at polynyas and ice edges in the Belcher Islands, Nunavut, Canada. Arctic 53, 61-68.

Stirling, I. 1997. The importance of polynyas, ice edges, and leads to marine mammals and birds. Journal of Marine Systems 10:9 –21.

Stirling, I., and Cleator, H., ed. 1981. Polynyas in the Canadian Arctic. Occasional Paper 45. Ottawa: Canadian Wildlife Service. 73 p.

Martin, S. "Polynyas." In Encyclopedia of Ocean Sciences, 2241–2247. Elsevier, 2001. http://polar.ocean.washington.edu/PAPERS/Polynya_encyclo.pdf

Background information on polynyas. "Ocean News | Issue 7 | Climate Change" by Jennifer Provencher, http://oceanlink.island.net/ONews/ONews7/polynya.html

WEBSITES

www.sikuatlas.ca

"Sea Ice Knowledge and Use (SIKU) - International IPY - Inuit Sea Ice Use and Occupancy Project - GCRC Wiki", http://gcrc.carleton.ca/siku

"Polynyas" by Ole Nielsen, http://my.opera.com/nielsol/blog/2009/06/17/polynyas

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

POLYNYA AND FLOE EDGE SEA ICE HABITATS

Polynya (pol-lin-ya) definition:

-an area of open water surrounded by sea ice, which does not freeze over due to strong currents
- an oasis in the sea ice where wildlife can access air on the surface and dive for food

Diagram:

Floe edge (flo e-je) definition:

- The intersection of landfast shoreline ice and open water.
- The floe edge can open and close, and change location depending on wind, currents and other environmental conditions.
- Provide extensive open water habitats for wildlife, though sometimes less predictable than polynyas

Diagram:

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

COMMUNITY BASED MONITORING AND SEA ICE RESEARCH

How can each tool be used for research and what questions about changes in polynya and floe edge habitats can it help to answer?

Tool	Wildlife	Habitats	Marine Environment	Seasonal Changes	Long Term Change
Salinity Profiler	determine influence on food availability	how does salinity affect the dynamics of sea ice habitats	role of salinity in ecology of different regions	how freshwater plumes from hydroelectric dams change seasonally	changes in salinity with increasing hydroelectricity production
Aquadopp Current Meter	how do currents affect diving behaviour and distribution	how do currents affect dynamics of polynyas and floe edges	how do currents affect oceanography of region and sea ice extent	changes through the winter and over the lunar cycle	changes in currents among years affected by hydroelectric production
Inuit Knowledge Interviews	detailed knowledge about ecology and long term changes	knowledge about ice and changes in habitat availablity	track ecosystem changes	understand how environment changes seasonally	multi-generational knowledge about sea ice and wildlife
Underwater Cameras	track diving behaviour of wildlife and energetic requirements	compare behaviour and abundance among species and habitats	evaluate biodiversity of different regions and their characteristics	track changes in feeding and prey abundance over the winter months	repeated measurements year to year can document long term changes
Time-lapse Imaging	track changes in distribution and abundance	compare sea ice dynamics and wildlife among habitats	deployments in multiple regions can provide ecosystems data	study formation and break up of sea ice throughout the winter	track changes over multiple years & across environmental conditions
Satellite Imagery	track changes in areas available for wildlife	quantify structure of habitats and availability	allows large scale information gathering-about sea ice ecosystems	gather information about seasonal changes on sea ice habitats	compare imagery from multiple years to determine habitat change

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

DISCUSSION QUESTIONS

1. Based on watching the film *People of a Feather*, what are the current priorities for research and monitoring of the Hudson Bay marine environment? Why?

-changes in salinity and extent of freshwater plume from season to season and over the long term
-changes in the characteristics and dynamics of the sea ice
-changes in wildlife populations, range, characteristics and behaviours
-role of freshwater from Hudson Bay on Labrador Current
Why:
-changes in sea ice and wildlife populations affect safety and food security for Inuit
-changing sea ice influences viability of wildlife populations
- preserving the integrity of sea ice ecosystems is a critical concern for biodiversity, it plays an important role through albedo effects and through freshwater entering the Labrador Current which is a critical process for ocean circulation and global climate regulation.

2. Why do you think community-based monitoring, where Inuit are involved in running research programs and providing traditional and local knowledge about sea ice ecosystems is an important approach? What sort of other benefits might these programs have for the community and their cultural heritage?

Benefits for research:
- important for understanding the details of local systems and long-term changes in the region.
Benefits for community and cultural heritage:
-Locals can see the value of scientific data collection and contribute their knowledge to the process
-provides meaningful employment to local Inuit using their skills to address local issues
-empowers community to deal with environmental issues
-support for working on the land supports preservation of sea ice knowledge and transfer to younger generation
-gets people out on the land which promotes subsistence hunting of local free range resources and less reliance on imported food
-youth training and education programs engage them in research and environmental issues

Eiders pack into open water habitat among the moving sea ice

STUDENT WORKSHEETS

POLYNYA AND FLOE EDGE SEA ICE HABITATS

Polynya (pol-lin-ya) definition:

Diagram:

Floe edge (flo e-je) definition:

Diagram:

STUDENT WORKSHEETS

COMMUNITY BASED MONITORING AND SEA ICE RESEARCH

How can each tool be used for research and what questions about changes in polynya and floe edge habitats can it help to answer?

Tool	Wildlife	Habitats	Marine Environment	Seasonal Changes	Long Term Change
Salinity Profiler					
Aquadopp Current Meter					
Inuit Knowledge Interviews					
Underwater Cameras					
Time-lapse Imaging					
Satellite Imagery					

STUDENT WORKSHEETS

DISCUSSION QUESTIONS

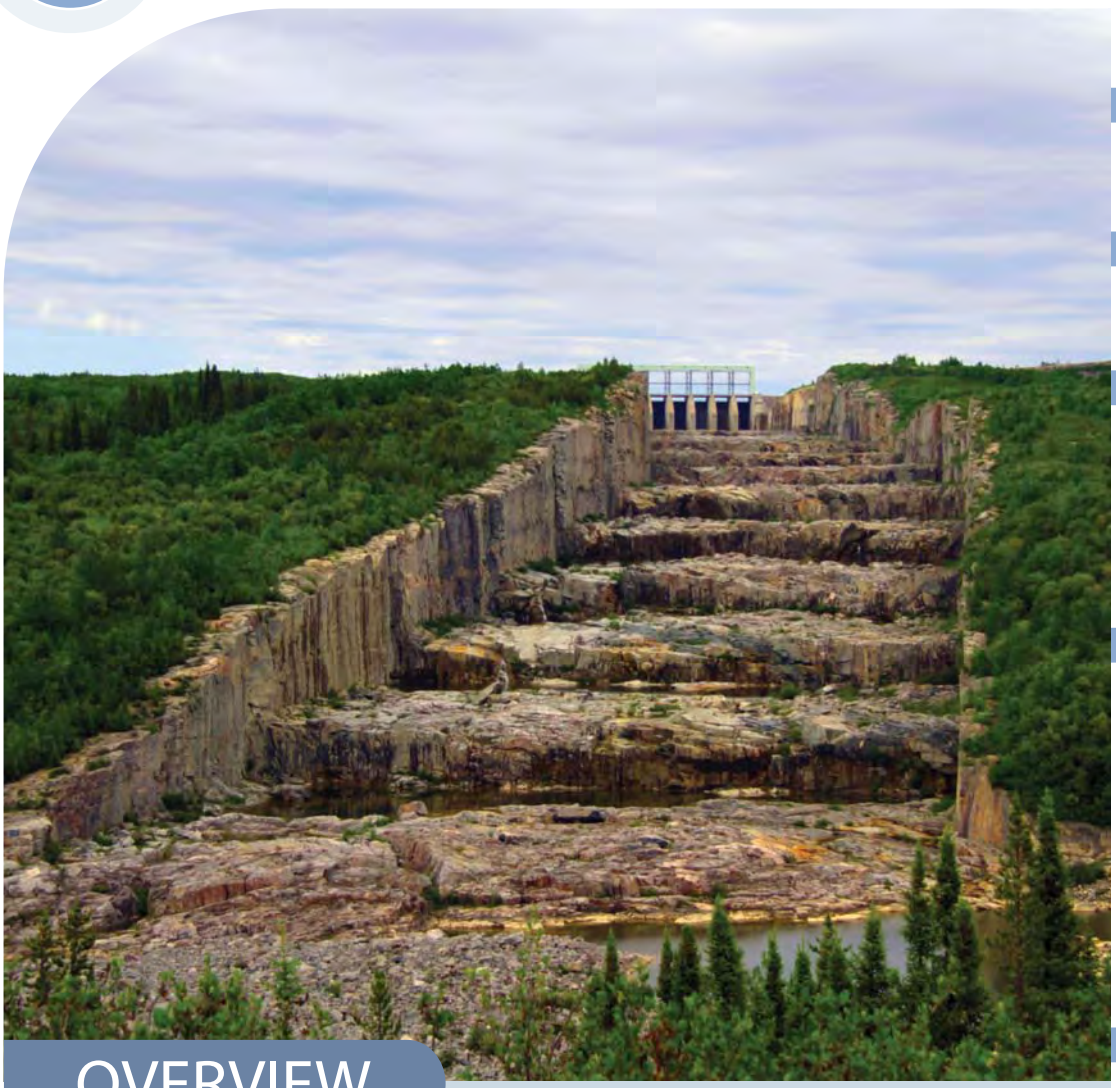
1. Based on watching the film *People of a Feather*, what are the current priorities for research and monitoring of the Hudson Bay marine environment? Why?

2. Why do you think community-based monitoring, where Inuit are involved in running research programs and providing traditional and local knowledge about sea ice ecosystems is an important approach? What sort of other benefits might these programs have for the community and their cultural heritage?

NOTES

2 Hydroelectricity and Sea Ice

SOLUTIONS THAT WORK WITH THE SEASONS OF THE HYDROLOGICAL CYCLE



GRADE LEVEL

Grade 11-
Post Secondary

ACTIVITY TIME

40 - 90 minutes

SKILLS

- Critical thinking
- Working corroboratively
- Research
- Technical language
- Interpreting diagrams

CONCEPTS

- Cumulative impacts
- Hydroelectric production and its relationship to the hydrological cycle
- Energy solutions that work with nature
- Challenges to Inuit way of life

LEARNING OUTCOMES

- Understand cumulative impacts of hydroelectricity on marine environments
- Think critically about solutions to energy storage and distribution challenges
- Understand impacts of industry on communities

CURRICULUM LINKS

- Environmental studies
- Physics and Oceanography
- Biology
- Energy solutions

OVERVIEW

Students will have the opportunity to take part in small group and class discussions concerning the impacts of hydroelectricity production on sea ice habitats, the marine ecosystem, and Inuit way of life. Students will discuss the concept of cumulative impacts, consider interactions between multiple biotic and abiotic factors, and will discuss alternative methods of storing and distributing hydroelectric energy that more closely coincide with the natural timing of the hydrological cycle.

BACKGROUND

In the film *People of a Feather*, viewers are presented with several examples of how hydroelectric developments can impact sea ice habitats and the marine ecosystem of Hudson Bay. Through the observations of residents of Sanikiluaq, viewers can begin to understand the changes to the physical characteristics of sea ice, effects on wildlife populations, and resulting safety and food security concerns of the local Inuit.

PROCEDURE

INTRODUCTION

1. Introduce the Film as a documentary which focuses on the Inuit way of life on the Belcher Islands, and the challenges created by nearby hydroelectric mega-projects.

2. Distribute the student worksheets and discuss the note taking required: as students watch the film, they should list impacts of hydroelectric production on the marine environment, local wildlife, and the Inuit of the Belcher Islands.

3. View the film as a class.

ACTIVITY

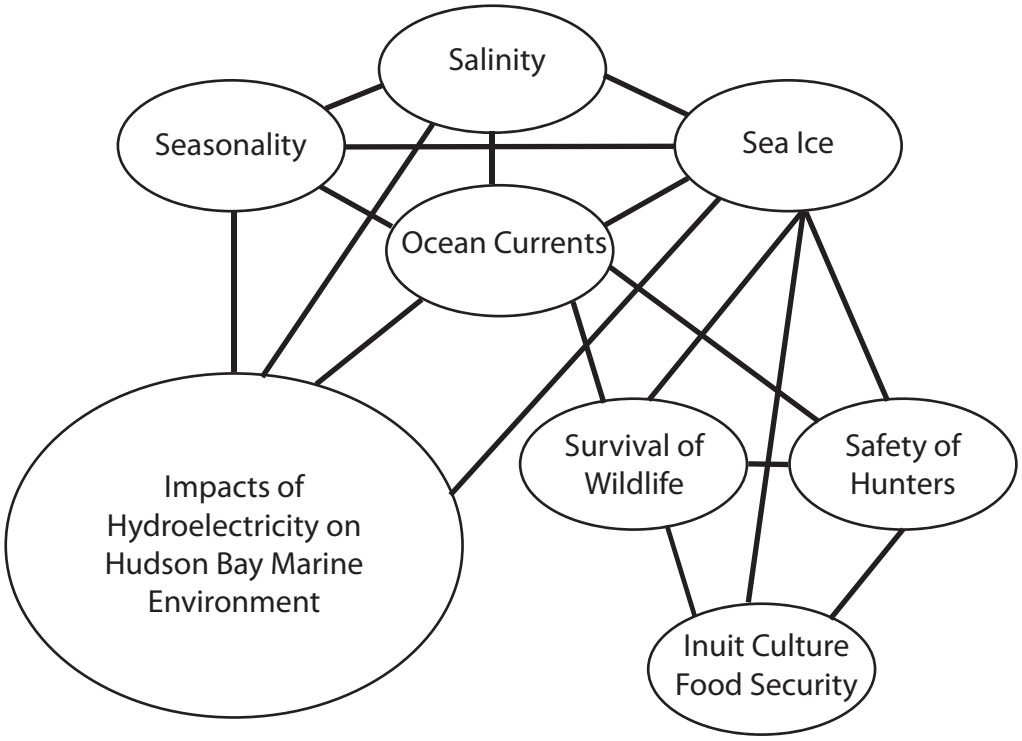
4. Create groups of 4 or 5 students

5. In small groups ask students to brainstorm the various impacts of hydroelectric production on the marine environment, wildlife, and the local Inuit, as outlined in the film

6. Distribute the "Hydroelectricity and Hudson Bay Backgrounder". Review and discuss vocabulary list. Ask students to update their worksheet if any points have been missed.

7. Ask each group to share their brainstorm lists with the class and create a mind map which illustrates these impacts (see example below). Include multiple links between impacts as a way to introduce the concept of "cumulative impacts". Provide time to make mind maps on their student worksheets.

PROCEDURE



Example 'Mind Map' demonstrating cumulative impacts on the marine environment

8. Discuss the concept of "cumulative impacts".

9. In small groups ask students to discuss the following questions (and record on student worksheet):

a) What are the pros and cons of developing hydroelectric mega-projects in our current social, economic, and ecological environments? Consider environmental costs and benefits and economic value to local communities, industry and governments.

b) What are the implications of the cumulative impacts of hydroelectricity production on the marine environment, wildlife, and the local Inuit way of life?

c) What course of action would you recommend for the people of Sanikiluaq?

d) Consider sources of electricity in Sanikiluaq, your community, and urban centres in eastern North America. What energy demands in these regions do/do not coincide with natural spring runoff and the timing of the hydrological cycle?

MATERIALS

- Student Worksheet
- "Hydroelectricity and Hudson Bay" Backgrounder
- Projector to view Film
- Chalkboard or whiteboard with markers
- Internet access for students

PREPARATION

- Review "Hydroelectricity and Hudson Bay" Backgrounder
- Set up the TV and DVD
- Photocopy Worksheet and Backgrounder
- Preview film

•NOTE: Discussion questions may be assigned as homework or as more as more in-depth research projects.

DISCUSSION QUESTIONS

10. Discuss how hydroelectric projects store energy by holding water in reservoirs, and flow regimes are therefore determined by electricity demands, which peak in winter. In contrast, river flow would naturally peak during spring run-off.

11. Introduce students to the idea that other countries like Iceland have considered options for converting hydroelectric power to hydrogen fuel, which could power the shipping industry (see Resources: Renewable energy in Iceland). Similarly, hydrogen fuel is also being used to store transient wind power in Denmark. Considering these examples, students can conduct research projects on how hydroelectric power is currently managed, and how it might be stored and distributed in alternative ways. How might these alternative approaches allow hydroelectric projects to coincide with the natural flow regimes of rivers and alleviate some of the impacts on the marine environment? List the websites from the resources section on the board and suggest the following as starting points:

- store energy in electric vehicles
- during the spring run-off, power areas that currently depend on coal to generate electricity
- storing energy as hydrogen fuel rather than holding water in reservoirs
- powering the shipping industry with hydrogen fuel produced from hydroelectric dams

CONCLUSION

12. Have students present their research and discuss the pros and cons of each with the class.

Sea ice forming in the harbour of the community of Sanikiluaq, Nunavut during the fall

EXTENSIONS

1. Conduct a formal debate focused on the costs and benefits of hydroelectric production.

2. Research and present how different industries (hydroelectric, transportation, shipping, manufacturing) could work together to store and distribute energy differently.

3. Winter is the critical period for the formation of cold water currents in the North Atlantic. Research the role of the freshwater entering the Labrador Current on the thermohaline processes that drive the Atlantic Meriodional Overturning Circulation (AMOC). How does the AMOC influence global weather and climate patterns? How might warm fresh water from reservoirs entering during winter instead of cold spring run-off influence this process?

VOCABULARY

Cumulative Impacts - combined effects of multiple abiotic and biotic factors and their overall impact on an ecosystem. Can also refer to combined impacts of multiple industrial developments

Hydrological Cycle - global cycle of freshwater including rainfall, snow melt, spring run-off, ocean inputs and evaporation/condensation

Polynya - area of open water surrounded by sea ice, maintained by strong currents

Salinity: continuous measure of the salt content of the water, from fresh to saline, often based on measuring conductivity.

Seasonality: the timing of physical and biological processes over the annual cycle

Sea Ice Dynamics: formation, movement and characteristics of sea ice over space and time.

Thermohaline circulation: large-scale, density-driven ocean currents caused by differences in temperature and salinity.

RESOURCES

BOOKS & ARTICLES

Dery, SJ. et al. (2005) Characteristics and Trends of River Discharge into Hudson, James, and Ungava Bays, 1964–2000. Journal of Climate 18: 2540-2557.

McDonald, M., Arragutainaq, L, Novalinga, Z. (1997) Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion. Canadian Arctic Resources Committee & Environmental Commitee of Municipality of Sanikiluaq. Full Color, 98pp.

Rosenberg, DM. et al. (2000) Global-scale environmental effects of hydroelectric alterations. Bioscience 50: 746-751.

WEBSITES

"Renewable energy in Iceland" Wikipedia http://en.wikipedia.org/wiki/Renewable_energy_in_Iceland

"Publications About the Project | Hydro Quebec" http://www.hydroquebec.com/rupert/en/publications.html.

"New York Public Radio Looks at Environmental Cost and Cultural Impact of Rupert River Diversion", http://northernwaterways.com/blog/?cat=27

"Hydro-Quebec Project", http://www.jamesbayroad.com/hydro/

MULTI-MEDIA

"James Bay: the wind that keeps on blowing" (1991) The Nature of Things with David Suzuki, Canadian Broadcasting Corporation. 94 minutes.

"Power" (1996) The National Film Board of Canada, 76 minutes.

Hydroelectricity and Hudson Bay

BACKGROUNDER

INTRODUCTION

Hydroelectric technology has provided innovative methods to capture and store energy in order to meet increasing human demands for electricity around the world. When compared to coal and diesel generated power, hydroelectricity has been considered a cleaner alternative in terms of its perceived minimal environmental impacts

Hydroelectric projects in Canada have involved the damming and diversion of many rivers in order to power major cities, particularly in eastern North America. Canadian river systems are now highly interconnected and driven by electricity demands. Turning on a light switch in New York and Quebec can have a cascade of impacts on rivers, the marine environment of Hudson Bay, as well as ocean currents and climate patterns around the globe.

IMPACTS ON THE MARINE ENVIRONMENT

As documented in the book Voices from the Bay, Inuit and Cree have observed a number of changes in sea ice and ocean habitats in Hudson Bay. These changes have affected the climate, wildlife, and Inuit way of life in this unique and fragile environment. Their observations include:

Seasonality: The hydroelectric industry currently stores spring run-off water in order to meet high winter energy demands, thereby reversing the seasonal timing of river inputs into Hudson Bay.

Ocean Currents: In addition to tides and wind, outflow from rivers is a major factor driving ocean currents. Inuit across multiple communities in Hudson Bay have observed that ocean currents are slowing down along the entire east coast of Hudson Bay to the Hudson Straight.

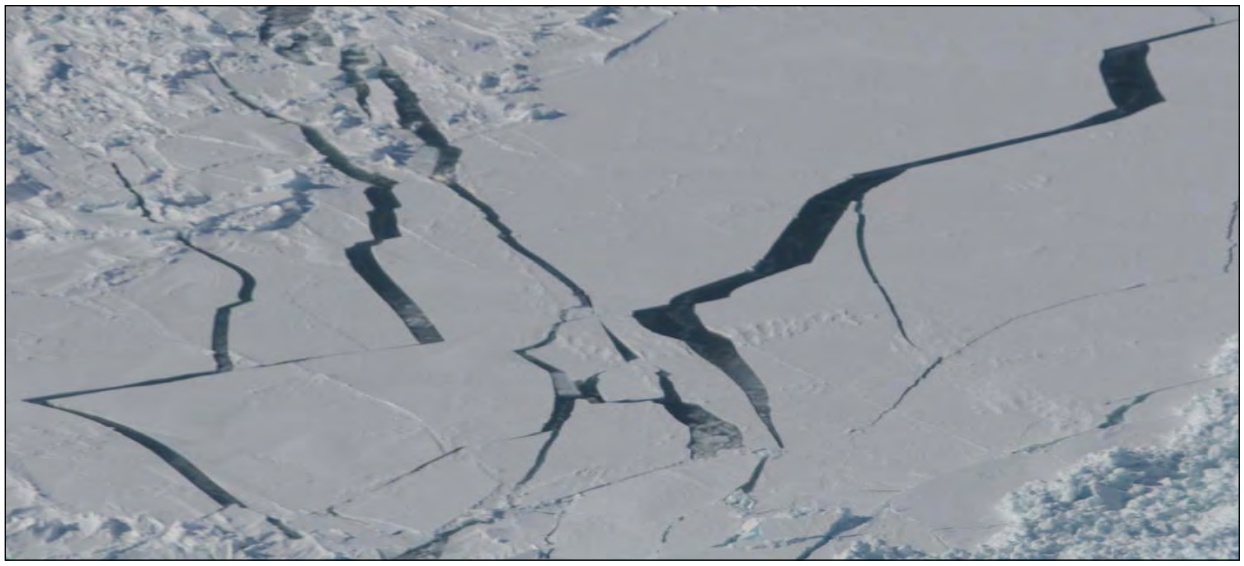
Ocean Mixing: Freshwater plumes from rivers spread much more extensively under a layer of sea ice than in open water, affecting the extent of surface freshwater transport and mixing.

Various forms of salt water ice formation (left) and frozen freshwater from the surface of a lake (right) demonstrating the substantial differences in the physical properties of fresh and salt water ice

IMPACTS ON THE MARINE ENVIRONMENT

Ice Melt: When warm fresh water that has been trapped in reservoirs during the summer months is dumped into Hudson Bay during mid-winter, the normal freezing and thawing patterns of sea ice are impacted. This can result in less sea ice as warmer water may delay ice formation during the fall, or cause it to melt more quickly during the spring.

Ice Structure: Frozen freshwater has a different structure than frozen salt water. Freshwater ice tends to fracture or shatter, whereas salt water ice is less brittle and more elastic, causing it to break differently and under different pressures.



Sea Ice breaks and changes in complex ways depending on the salinity of the water during the freezing process

Cumulative Impacts

When researchers examine cumulative impacts they are examining combined impacts of multiple industrial developments (in this case hydro dams), or are attempting to determine how a combination of individual factors such as salinity and currents can combine to have larger overall impacts on an ecosystem. Studies of cumulative impacts of hydroelectric production on the marine environment have been recommended during environmental impact reviews, but have yet to be conducted.

Changing Sea Ice Dynamics

The individual impacts described above interact with each other in complex ways to influence the dynamics of sea ice ecosystems. During certain times of year, some areas may experience a decrease in sea ice due to warm water input, while at other times of the year, areas with decreased salinity can freeze up quickly and to a greater extent than usual, often catching wildlife by surprise. These changing and unpredictable conditions are challenging for wildlife including seals, whales, eider ducks and polar bears, and for Inuit that rely on these species for food and depend on safe ice conditions for travel. As illustrated in the film, major die-offs of eider ducks resulting from changes in sea ice dynamics serve as a warning for the ecosystem changes happening in the marine environment of Hudson Bay.

IMPACTS ON THE MARINE ENVIRONMENT

Impacts on Hunting

"Hunters have noticed that seals sink more than they used to. When we shoot seals, we often lose them these days." - Simeonie Kavik

The phenomenon of sinking seals is another example of a cumulative impact. Based on their body fat composition, seals have different buoyancy in fresh water than in salt water. Fresh water from hydroelectric dams can cause hunters to lose their catch when the seal sinks and comes to rest several meters below the surface in the water column underneath the freshwater plume. Less predictable sea ice conditions also impact safety while traveling during hunting expeditions.

An Inuit hunter points out a dangerous spot in the ice that would typically be safe to travel over.

Biological Effects

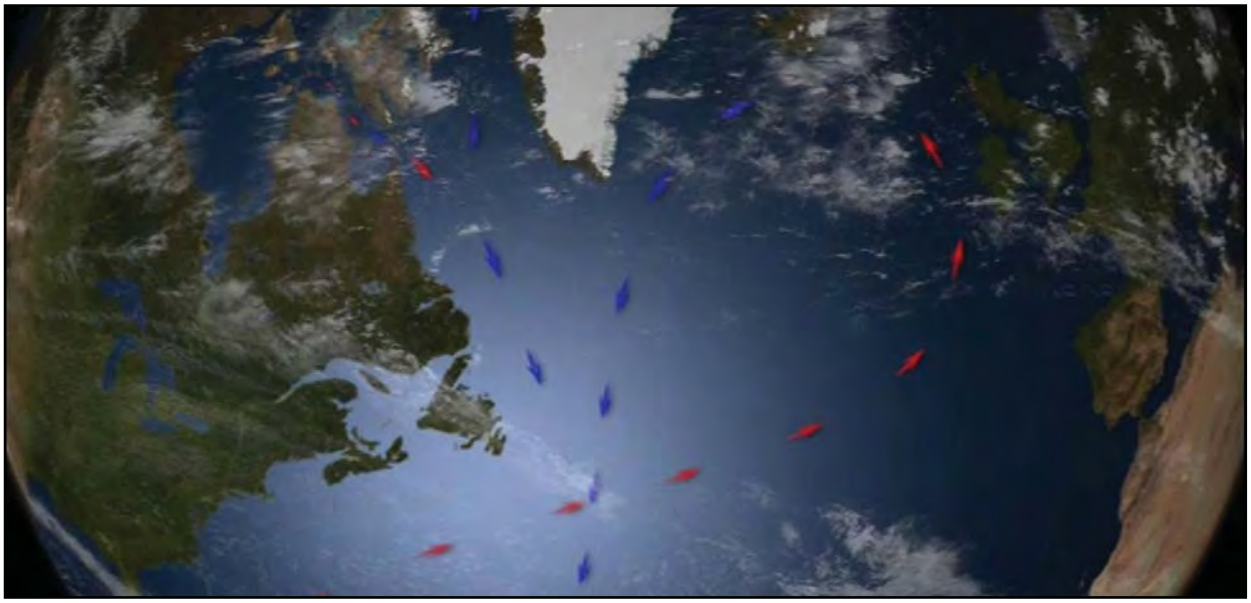
Many benthic invertebrates, fish, and other species have specific tolerances for salinity levels and are affected by changes to the marine environment. For example, certain species of phytoplankton are better adapted to freshwater than saltwater conditions. To date, there have been no in-depth studies to determine how the changes in salinity levels, currents, and sea ice have impacted the local marine organisms of Hudson Bay.

An Arctic Fox exploits a group of starving eiders trapped in closing sea ice which was the site of a former floe edge

IMPACTS ON THE MARINE ENVIRONMENT

Global Climate Concerns

The Labrador Current is a major ocean current driven by cold salty water sinking (thermohaline circulation), which in turn drives the Gulf Stream to Europe and has a major impact on global climate. Previous changes in freshwater inputs are known to have caused rapid and significant climate shifts such as experienced during past ice ages. Scientists have observed that the Labrador Current is slowing down, due in part to increased fresh water from melting glaciers and sea ice in summer. The situation is likely being compounded by the input of warmed fresh water from hydroelectric projects entering the Labrador Current during the winter months, which is the critical period for cold water formation and therefore thermohaline circulation. The dynamics of the hydrological cycle are being changed by hydroelectric projects all over the world, and the role of these cumulative effects on ocean circulation and climate require urgent and substantial research.



SOLUTIONS THAT WORK WITH THE SEASONS

The current approach to hydroelectricity involves massive infrastructure, diverting rivers and storing water behind dams as potential energy. River flow is based on electricity demands. Capturing energy in phase with the hydrological cycle could be achieved by storing and distributing it in alternative ways. For example, the east coast of North America has major energy demands for electricity and shipping that do coincide with the hydrological cycle. By storing energy in other forms besides water behind the dam, hydroelectric projects could work with the timing of the natural hydrological cycle and at the same time provide the capacity for other industries like shipping companies to transition to cleaner energy sources. Alternative approaches could also help many small communities in direct proximity to hydroelectric developments that still rely on diesel fuel to generate electricity. Our distribution models for hydroelectric energy need to be coordinated to make economic and environmental sense locally, before they can be sustainable at large scales. Hydroelectricity projects that work with the seasons of the hydrological cycle, could be a key element in the solution to our many global energy challenges.

TEACHERS ANSWER KEY

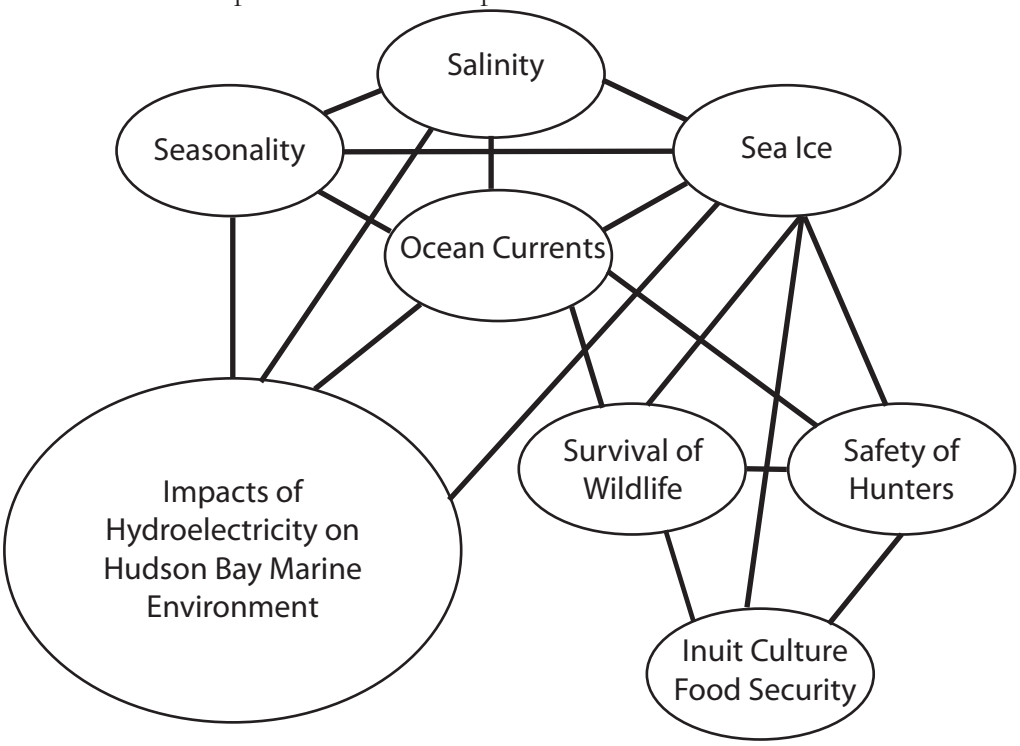
STUDENT WORKSHEETS

1. IMPACTS OF HYDROELECTRICITY ON THE MARINE ENVIRONMENT

List the impacts of hydroelectric projects in the appropriate column of the following table:

Marine Environment	Wildlife	Inuit
-freshwater plumes in winter (seasonality, salinity) -slowing currents -sea ice dynamics and predictability -freezing/melting less predictable - sometimes more ice, sometimes less ice (depending on the time of year)	-wildlife trapped in freeze-ups -freeze overs limit food for eiders and cause die-off events -sea ice habitats less predictable for animals -changes in salinity and currents can affect the whole food web including phytoplankton, fish and benthic invertebrates as well as eiders seals, whales and polar bears	-safety travelling over sea ice (Elijah almost went through the ice) -seals sinking below freshwater plume due to buoyancy of freshwater (losing catch during hunting) -hunting areas have changed with changing ice -eider duck die-off impacts an important source of food and clothing for Inuit -winter hunting season shorter due to dangerous/melting ice

2. Sketch a 'mind map' of the various impacts and their inter-connections



TEACHERS ANSWER KEY

STUDENT WORKSHEETS

3. DISCUSSION QUESTIONS

a) What are the pros and cons of developing hydroelectric mega-projects in our current social, economic and ecological environments? Consider environmental costs and benefits and economic value to local communities, industry and governments.

Pros:
-relatively inexpensive electricity
-smaller carbon footprint than fossil fuels
-short term job creation for construction
-economic income for governments

Cons:
-Nearby communities still burning diesel
-Provincial electricity costs subsidise cheap exports
-few economic benefits for local communities
-impacts on rivers, land and oceans & wildlife
-impacts aboriginal subsistence lifestyle
-current approach works against hydrological cycle

b) What are the implications of the cumulative impacts of hydroelectricity production on the marine environment, wildlife and the local Inuit way of life?

-major changes in the hydrological cycle, marine fresh-water inputs, dynamics of sea ice ecosystems, and potential impacts on thermohaline circulation in the North Atlantic and global climate.
-less predictable sea ice habitats affects survival of wildlife including eiders, polar bears, whales and seals.
-changes in safety, ice readability, and ability to catch food influences food security, subsistence harvesting and ability to continue traditional culture and knowledge in Inuit communities

c) What course of action would you recommend for the people of Sanikiluaq?

- continue monitoring and recording salinity levels to assess the extent and dynamics of the freshwater plume
-continue observing and recording changes to currents, ice and wildlife
-raise awareness of the changes in the marine environment through outreach
-seeks ways to involve industry in community based monitoring and discussing solutions

d) Consider sources of electricity in Sanikiluaq, your community, and urban centres in eastern North America. What energy demands in these regions coincide/do not coincide with natural spring runoff and the timing of the hydrological cycle?

Sanikiluaq and other communities in proximity to dams still burn diesel for electricity. Many places in eastern North America are still burning coal throughout the year. Some of these demands occur during spring coinciding with spring runoff peak flows in rivers. Demands such as energy for heating in winter occur out of sync with the hydrological cycle.

STUDENT WORKSHEETS

1. IMPACTS OF HYDROELECTRICITY ON THE MARINE ENVIRONMENT

List the impacts of hydroelectric projects in the appropriate column of the following table:

Marine Environment	Wildlife	Inuit

2. Sketch a 'mind map' of the various impacts and their inter-connections

STUDENT WORKSHEETS

3. DISCUSSION QUESTIONS

a) What are the pros and cons of developing hydroelectric mega-projects in our current social, economic and ecological environments? Consider environmental costs and benefits and economic value to local communities, industry and governments.

b) What are the implications of the cumulative impacts of hydroelectricity production on the marine environment, wildlife and the local Inuit way of life?

c) What course of action would you recommend for the people of Sanikiluaq?

d) Consider sources of electricity in Sanikiluaq, your community, and urban centres in eastern North America. What energy demands in these regions coincide/do not coincide with natural spring runoff and the timing of the hydrological cycle?

NOTES

3 Inuit Ingenuity

TECHNOLOGIES AND ADAPTING TO CHANGE

GRADE LEVEL

Grades 6 - 12

ACTIVITY TIME

40 - 60 minutes

SKILLS

- Critical thinking
- Working corroboratively
- Representing information

CONCEPTS

- Ingenuity and adaptation
- How technologies change over time

LEARNING OUTCOMES

- Learn about Inuit technologies and how they have changed over time.
- Compare technological adaptation in Inuit and southern communities
- Consider challenges to traditional ways of life

CURRICULUM LINKS

- Cultural Heritage
- Science and technology

OVERVIEW

Students will reflect on how and why technologies change over time by comparing and contrasting historic ways of life both in their local community, as well as for the Belcher Islands Inuit. Students will also reflect on the concepts of ingenuity and adaptation.

BACKGROUND

"Layer upon layer, these same feathers have kept us warm for hundreds of years. The technology of the eider stores our energy and keeps out the cold." - *People of a Feather*

The film *People of a Feather* features many examples of ingenuity in both modern and traditional Inuit life. Resourcefulness, creativity, and skills refined over centuries have allowed the Inuit of the Belcher Islands to adapt in times of scarcity and change.

The eider duck parka, as described in the quote above, is an example of how nature's innovative "technology" has been used by Inuit to survive in a cold climate. The unique shape, size, and configuration of the eider duck's feathers allow it to resist cold in a harsh, wet climate, while allowing it to dive and stay buoyant in the water. Eiders provide many resources to the Inuit people; eider down is used to keep Inuit warm, eider meat and eggs are important sources of food, and even the wing feathers are used as musical instruments. Resources are used efficiently and typically there is little to no waste. Inuit, past and present, have used designs from nature to survive in the hostile Arctic climate.

Sewing Traditional Eider Skin Parkas in Sanikiluaq, Nunavut

PROCEDURE

INTRODUCTION

1. Write "ingenuity" on the board and ask students to share situations in their own life when they have come across examples of "ingenuity".

2. As a group, create a definition of the word "ingenuity".

3. Introduce the film as demonstrating several examples of 'ingenuity' by Inuit from the Belcher Islands, Nunavut.

An inukshuk used for wayfinding

4. Introduce the student worksheet and ask students to take notes based on the topics outlined on the student worksheet.

View film (90 or 52 minutes) and/or special features including those listed in the Resources section below.

ACTIVITY

After viewing the film and/or special features:

5. Ask students to share their findings about Inuit technologies from their notes and relate this to their definitions of ingenuity.

6. Ask students to create a Venn diagram and list examples of Inuit ingenuity as outlined on the student worksheet. Discuss as a class.

7. Create 5 groups, one for each of Food, Shelter, Clothing, Transportation and Entertainment (for smaller classes, groups can work on more than one).

MATERIALS

- Student Worksheets
- Projector to view film and/or special features
- Chalkboard, whiteboard or flip chart & markers

PREPARATION

- Review background
- Set up the TV and DVD
- Photocopy worksheet, one per student
- Preview film/special features

PROCEDURE

8. Ask each group to compare a day in the life of a 12-18 year old living in Sanikiluaq and a day in their own life (also include what both would have been like 100 years ago (from the film) and presently). Ask each group to focus on their assigned basic needs (food, shelter, clothing, transportation, entertainment). Direct students to record their answers on the student work sheet and chalkboard or flip chart

9. Ask a student from each group to present their "day in the life of" charts to the class.

DISCUSSION QUESTIONS

10. Ask students to provide written answers to the following discussion questions:

a) What has been the most significant change in the lives of people within your community over the past 100 years? How has your community adapted? What are examples of ingenuity and adaptation in your community over the past 100 years?

b) What challenges have the Inuit of the Belcher Islands had to their traditional way of life 100 years ago? What has caused these challenges? What is their greatest challenge?

c) How have the Inuit adapted to these challenges? (refer to student worksheets)

d) In the past 100 years who has had to adapt their lifestyle more, members of your community, or the Inuit of the Belcher Islands? Why?

CONCLUSION

12. Discuss student answers as a group.

EXTENSIONS

1. In small groups ask students to "agree" or "disagree" with the following statements, as well as defend their position:

a) Environmental change in Hudson Bay (for example, changing ice conditions due to the production of hydroelectricity and climate change) has negatively affected the local people's way of life and cultural identity.

b) Our way of life in our community (for example, our major modes of transportation and the food we eat) is generally adaptive and makes good use of our natural resources.

c) New technology is usually better than old technology.

2. After viewing the "special features" ask students to create a plan for making an eider parka, or building an igloo or kayak, including: materials, tools, budget, and time needed.

VOCABULARY

Ingenuity – displaying creativity when problem solving

Technology - application of knowledge for practical purposes

Adaptation - the adjustment or changes in behaviour or characteristics that allow becoming more suited to an environment

RESOURCES

BOOKS AND ARTICLES

Kaplan, SA. (2012) Labrador Inuit Ingenuity and resourcefulness: Adapting to a complex environmental, social and spiritual environment. IN Settlement, Subsistence and Change Among the Labrador Inuit. Natcher, DC. et al. [Eds.] University of Manitoba Press

Krupnik, I., Dyanna, J. (2002) The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change. Frontiers in Polar Social Science. 383 pages.

Oakes, J. (1991) Coats of Eider. University of Manitoba, Aboriginal Issues Press. 28 pages.

MULTI-MEDIA

Inuit Knowledge and Climate Change (2010) Isuma TV, 54 min.
http://www.isuma.tv/lo/en/inuit-knowledge-and-climate-change

People of a Feather Special Features and Behind the Scenes Sequences:

"Building an Igloo"
"Making Eider Parkas"
"Building a Qayaq"

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

INUIT INGENUITY: USE OF NATURES TECHNOLOGY

Ingenuity (in- jen –oo- i- tee) Class Definition:

displaying creativity when problem solving

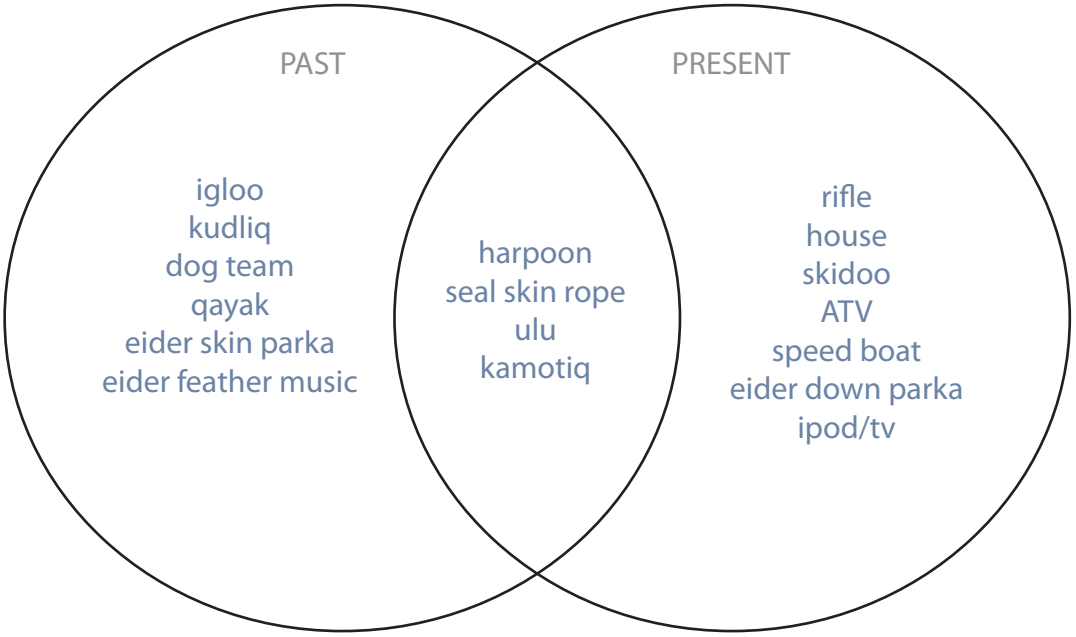
While viewing the film complete the table by listing technologies used by Inuit in Sanikiluaq

	100 Years Ago	Presently
Food & Hunting	harpoon (animal products) seal skin rope ulu smoking and drying	harpoon (metal and wood) seal skin rope ulu smoking and drying rifle
Shelter	igloo kudliq (seal oil lamp/heater) ice window	house stove & central heating double pane glass
Transporation	walk dog team qayak kamotiq	skidoo ATV speed boat airplane kamotiq
Clothing	eider skin parka seal skin boots (kamiks) seal skin gloves	eider down parka boots with rubber and firs synthetics leather handmade gloves
Entertainment	eider feather instrument throat singing	mouth harp throat singing ipod hip hop tv

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

1. Create a Venn diagram to illustrate Inuit past and present technologies related to food gathering and preparation, shelter, clothing and clothing manufacturing and transportation



2. List examples of Inuit ingenuity and how the Inuit have adapted their technology in the past 100 years.

-transition from eider skin parkas to collecting and cleaning eider down for use with modern textiles.

-bigger kamotiq's now pulled by skidoo, high technical ability to fix machines

-carving skills from soapstone adapted to create art and to metal machining for e.g. harpoon

-incorporate throat singing and Inuktituk into modern music

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

FOOD		
	100 Years Ago	Now
Inuit of Sanikiluaq	local free range resources -eider eggs -eider meat -seal	local free range resources (~ 50%): - eider eggs - eider meat - seal imported food (~50%): - fried chicken -junk food/pop etc.
My Community	locally produced fresh food -preserves made in house -home cooked meals -some restaurants for wealthier people	imported food, less dependant on seasons -ethnic foods -prepackaged -restaurants

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

CLOTHING		
	100 Years Ago	Now
Inuit of Sanikiluaq	locally manufactured -eider skins -seal skins	locally manufactured -eider down parka -seal skin boots Imported -textiles -"Bling"
My Community	manufactured locally -more formal clothing -few pieces of clothing in closet	modern clothing, fleece, down jackets, T-shirts, jeans -imported clothing, manufactured far away -abundant inexpensive clothing in closet -clothing is more casual

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

TRANSPORTATION		
	100 Years Ago	Now
Inuit of Sanikiluaq	-dogsled -kayak -travelled around the islands, shorter distances -walking	-dependent on fuel -power boats -skidoos -aircraft
My Community	-rail -horseback -horse and buggy -a few cars for wealthier people -bicycle -walking -ships -stayed local, very few people had opportunity to travel great distances	-automobile for many, fuel dependent -aircraft -ferry -bus -subway -bicycle -walking

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

SHELTER		
	100 Years Ago	Now
Inuit of Sanikiluaq	-igloo -temporary settlements depending on the seasons, hunting, gathering -small fires / seal oil for light and heat - little cooking	-wooden structures -permanent settlements -dependent on electricity for heating and light -running water -TV, music machines, computers, telephones
My Community	-wooden homes, brick homes -apartments -some had electricity and running water -some may have had a telephone -dependent on neighbours -self reliant if in smaller communities, less infrastructure i.e. firefighters, postal delivery, policing -larger proportion of people living in rural areas	-wooden, brick homes -concrete apartments and condominiums -all have electricity and running water -most have telephone, internet, computers, TV, music machines -less dependent on neighbours -most have infrastructure i.e. firefighters, postal delivery, garbage pickup, street maintenance, policing -larger proportion of people living in urban or suburban areas -loss of farmland to development

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

ENTERTAINMENT		
	100 Years Ago	Now
Inuit of Sanikiluaq	-fireside -traditional music and stories	-traditional music and stories in community hall -music, internet, TV, movies; access to entertainment and news from all over the world
My Community	-live music -spending time with friends -community dances -local county fairs -reading	-less live music -music, internet, TV -movies; access to entertainment and news from all over the world -more time spent alone in virtual world -social networking at a distance -international art scene

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

DISCUSSION QUESTIONS

1. What has been the most significant change in the lives of people within your community over the past 100 years? How has your community adapted? What are examples of ingenuity and adaptation in your community over the past 100 years?

transportation, speed, availability, cars make it possible to move quickly and independently, vehicles made it possible for the rise of suburbs
-food, goods, and services from all over the world, food available out of season
-very little manufacturing locally, few cottage industries, import most goods
-loss of farmland to development, rapid urbanization
-home entertainment, access to news from anywhere in the world at anytime
-consumptive lifestyle based on inexpensive imported goods
-rapid way of life made possible by internet, automobile, mobile phones

2. What challenges have the Inuit of the Belcher slands had to their traditional way of life 100 years ago? What has caused these challenges? What is their greatest challenge? List examples of Inuit ingenuity and how the Inuit have adapted their technology in the past 100 years.

-moving from nomadic to settling in a community
-challenges caused by changes in sea ice dynamics
-shift from traditional ways of knowing & language to schooling systems
-maintaining traditional knowledge and ingenuity: how to make kayak, igloo, clothing, hunt, language, culture, songs, stories, read the ice
-greatest: adapting to novel environmental change while maintaining sustainable subsistence lifestyle and culture

3. How have the Inuit adapted to these challenges? (refer to worksheet)

-travel further to catch food
-more cautious traveling on sea ice
-incorporated culture programs into schools
-school and community programs teaching traditional skills
-studying ice, teaching sea ice and hunting skills to youth, community based monitoring programs

4. In the past 100 years who has had to adapt their lifestyle more, members of your community or the Inuit of the Belcher Islands? Why?

There is no right answer but it a great exercise in brainstorming and formulating arguments
-consider: communities south of Sanikiluaq 100 years ago already had experienced: permanent settlements, some modern forms of transportation, some basic infrastructure, international news, multiculturalism

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

EXTENSION ACTIVITY

Do you "agree" or "disagree" with the following statements? Defend your position.

1. Environmental change in Hudson Bay (for example, changing ice conditions due to the production of hydroelectricity, and due to and climate change) has had a negative impact on the local people's way of life and cultural identity.

AGREE
- hunting has become more difficult
-mortality events affect wildlife populations which can affect hunting
-unpredictable ice makes travel dangerous
-changing ice makes it hard to teach traditional ways of knowing

DISAGREE
- dependent on modern food, (but not as healthy)
-modern clothing is more comfortable and practical
-no need to travel on the ice to hunt and gather because can purchase food at store
-warmer is better in this cold climate

2. Our way of life in our community (for example, or major modes of transportation and the food we eat) is generally adaptive and makes good use of our natural resources

AGREE
-have adapted to long distances by creating superhighways
-efficient farming, harvesting techniques
-creating jobs through resource extraction makes economy stronger

DISAGREE
-food and goods imported from far away, are less healthy, and have larger carbon footprints which is not considered a good use of resources
-large carbon footprint to access foods that are out of season
-planned obsolescence and disposable goods do not make good use of resources

3. New technology is usually better than old technology.

AGREE
-typically more efficient and faster
-allows us to have wider access to information and more quickly
-up-to-date
-makes life easier

DISAGREE
-can be more durable, new technology can be disposable and have short life span
-can be more resilient
-requires us to be more creative
-reliable when modern technologies fail (power outage)

STUDENT WORKSHEETS

INUIT INGENUITY: USE OF NATURES TECHNOLOGY

Ingenuity (in- jen –oo- i- tee) Class Definition:

_____

_____

_____

_____

While viewing the film complete the table by listing technologies used by Inuit in Sanikiluaq

	100 Years Ago	Presently
Food & Hunting		
Shelter		
Transporation		
Clothing		
Entertainment		

STUDENT WORKSHEETS

1. Create a Venn diagram to illustrate Inuit past and present technologies related to food gathering and preparation, shelter, clothing and clothing manufacturing and transportation

2. List examples of Inuit ingenuity and how the Inuit have adapted their technology in the past 100 years.

STUDENT WORKSHEETS

FOOD		
	100 Years Ago	Now
Inuit of Sanikiluaq		
My Community		

STUDENT WORKSHEETS

CLOTHING		
	100 Years Ago	Now
Inuit of Sanikiluaq		
My Community		

STUDENT WORKSHEETS

TRANSPORTATION		
	100 Years Ago	Now
Inuit of Sanikiluaq		
My Community		

STUDENT WORKSHEETS

SHELTER		
	100 Years Ago	Now
Inuit of Sanikiluaq		
My Community		

STUDENT WORKSHEETS

ENTERTAINMENT		
	100 Years Ago	Now
Inuit of Sanikiluaq		
My Community		

STUDENT WORKSHEETS

DISCUSSION QUESTIONS

1. What has been the most significant change in the lives of people within your community over the past 100 years? How has your community adapted? What are examples of ingenuity and adaptation in your community over the past 100 years?

2. What challenges have the Inuit of the Belcher slands had to their traditional way of life 100 years ago? What has caused these challenges? What is their greatest challenge? List examples of Inuit ingenuity and how the Inuit have adapted their technology in the past 100 years.

3. How have the Inuit adapted to these challenges? (refer to worksheet)

4. In the past 100 years who has had to adapt their lifestyle more, members of your community or the Inuit of the Belcher Islands? Why?

STUDENT WORKSHEETS

EXTENSION ACTIVITY

Do you "agree" or "disagree" with the following statements? Defend your position.

1. Environmental change in Hudson Bay (for example, changing ice conditions due to the production of hydroelectricity, and due to and climate change) has had a negative impact on the local people's way of life and cultural identity.

2. Our way of life in our community (for example, or major modes of transportation and the food we eat) is generally adaptive and makes good use of our natural resources

3. New technology is usually better than old technology.

NOTES

4 Ecology of the Arctic Eider

DIVING AND SURVIVING IN WINTER SEA ICE HABITATS

GRADE LEVEL

Grade 8 -
Post secondary

ACTIVITY TIME

40 - 90 minutes

SKILLS

- Scientific inquiry/process
- Representing data and interpreting results
- Research
- Technical language
- Problem solving

CONCEPTS

- Winter survival, feeding and energetics
- Indicator species
- Linking the ecology of individuals to population dynamics

LEARNING OUTCOMES

- develop understanding about the scientific process
- Formulating questions, hypotheses and identifying independent and dependent variables
- Explore the natural history of the Common Eider

CURRICULUM LINKS

- Process of Science
- Biology
[Physiology, Bioenergetics, Behaviour, Zoology, Ecology]
- Oceanography
[Tides, Currents]

OVERVIEW

Students will have an opportunity to demonstrate their knowledge of the scientific process by conducting research on an Arctic specie, *Somateria mollissima*, the Common Eider. Eiders are an important component of the marine food web, and can provide a good indicator of the health of sea ice ecosystems. Recent die-off events represent the proverbial "canary in the coal mine" for the changes happening in Hudson Bay. Students will learn how research focussed on the diving and foraging ecology of eiders can provide a better understanding of their winter survival, and the factors affecting die-off events. Through this process, students will understand how to evaluate and assess the impacts of environmental change on wildlife populations and sea ice ecosystems.

BACKGROUND

In order to understand how environmental change (as shown in the film *People of a Feather*) could affect Arctic species such as the Hudson Bay common eider, biologists must gain a clear understanding of the species' natural history and factors affecting their survival during different times of the year. These studies can focus on habitat, ecology, morphology (the form or shape of the organism), physiology (the function of the different body systems of the organism), adaptations, breeding patterns, behaviour, and interactions among individuals as well as with other species.

The common eider has been relatively well-researched across its global range and there now a good understanding of its natural history in sea ice habitats. Recent studies conducted by Dr. Joel Heath (Director of *People of a Feather*) with Environment Canada and the Community of Sanikiluaq, have contributed significantly to our understanding of the ecology of the Hudson Bay Common Eider population. These studies examined the energetics of diving in strong currents, foraging for and digesting prey, such as mussels (*Mytilus edulis*) and sea urchins (*Strongylocentrotus droebachiensi*), and timing daily activity patterns with tidal currents at various stages of the lunar cycle (for more information see Resources). This information is being used to better understand changes occurring in sea ice ecosystems and how different environmental changes can affect winter survival and eider population dynamics.

In this activity, students will learn about the process of scientific inquiry through a case study of the eider duck. Working corroboratively in groups, students will formulate research questions and hypotheses about the factors affecting the eider's ability to survive the winter months.

An eider gets ready to dive at the edge of a wind swept polynya during mid-winter in Hudson Bay

PROCEDURE

INTRODUCTION

1. Watch the "Eider Studies" section of the film and ask students to make notes about various biological factors important to life history of eider including food, habitat, behaviour, and physical characteristics.

ACTIVITY

2. Discuss the types of research questions that biologists could address about the natural history of eiders in each of the worksheet categories: food, habitat, behaviour, and physical characteristics.

Possible responses:
-*What do they eat?* (Mussels, Sea Urchins, and other species)
-*Where is their food found?* (on the sea floor - i.e. benthic)
-*How do they access their food?* (dive under the sea ice, must have open water)
-*How are they able to swallow prey items such as sea urchins?* (handle them on the surface to break spines; muscular crop to mechanically process prey)

Further discussion possibilities:
-*What are their main predators?* (foxes, owls, humans)
-*What is their global distribution?* (northern hemisphere, multiple sub-species)
-*How do they stay warm?* (eider down insulation, huddle in groups, feeding)
-*What kind of habitat do they need for breeding?* (islands with no predators)
-*What kind of habitat do they need during winter?* (open water sea ice habitats)
-*What do the different sexes look like at different stages of their lives? (*adult and juvenile females are mottled, adult males are black and white, young males transform from mottled to black and white over first winter)

3. Write the following focus question on the board: "How much energy does an eider duck need in order to survive the winter?"
Discuss possible ways to break down the scope of this question, such as:
-*How do eiders get energy* (food: mussels, urchins)
-*How do they spend energy?* (flying, diving, thermoregulating, etc.)
-*What factors could cause eiders to run out of energy and starve?* (depletion of food, closing sea ice, competition, inability to find open water habitats)
-*What conditions could provide more (or less) energy?* (temperatures, wind, currents, food abundance, food quality)

MATERIALS

- Student Worksheets
- "Eider Research" Worksheets
- Projector to view Features
- Chalkboard or whiteboard

OPTIONAL
- Internet Access for students

PREPARATION

- Review Eider Research Backgrounders
- Set up the DVD to the "Eider Studies" featurette
- Photocopy Student Worksheets, one per student, and Eider Research Worksheets, enough for each group.
- [Optional] Preview and prepare to show students the underwater videos of eiders diving and feeding under the sea ice: www.arcticeider.com/diving/

PROCEDURE

4. On the board, create a list of factors which may influence winter survival/energetic, such as:

- *temperature/environmental conditions*
- *predators*
- *amount of open water available*
- *abundance of food*
- *currents*

5. Discuss how the above factors are related and create complex energetic scenarios. For example:

- Currents are useful for providing open water habitats like polynyas, however they also require eiders to dive into the currents to access food, thereby increasing energy needs.
- Food may be plentiful, but if it is too deep or far under the ice, it may be inaccessible to eiders.
- Abundant prey can only be eaten so fast. Eiders have a limited stomach size and must take time to process mussel shells and urchin tests. These must be ground up in their muscular gizzard before they are consumed.

6. Review process of scientific inquiry. Include the concepts of formulations questions and hypotheses, identifying dependent and independent variables, and experimental design.

7. Create three groups and ask each group to consider one of the following sets of questions:

Group 1.

-How does current speed influence the time and energy costs of getting to the bottom?

-Given eiders have to come to the surface to breathe, how long are they able to feed on the bottom and how does this change with changes in current speed over the tide cycle?

Group 2.

-To balance energetic costs and benefits, at what current speed should eiders stop diving and rest on the ice?

-What is the most beneficial time to dive during a tide cycle?

Group 3.

-Given eiders swallow mussels and urchins whole, could digestive processing limit the amount of energy they can consume in a particular period?

-How might digestive limitations influence patterns of feeding activity? For example, should eiders feed slowly and continuously or should eiders divide their time into periods of active feeding followed by resting and digestion periods?

For larger classes, other groups may be added to consider questions such as:

-How does the size of a polynya affect the ability of an eider to access energy?

-How does prey availability influence energy intake?

8. Ask students to identify the dependent and independent variables in their questions, create a formal hypothesis (If… Then statement), as well as a list of predictions to test their hypothesis.

PROCEDURE

9. Distribute the Eider Research Worksheets for each group. Ask each group to consider the validity of their predictions and hypotheses in relation to the data and information presented on the worksheet.

10. Beginning with group one, ask each group to present their questions (including independent and dependent variables), hypothesis, predictions and findings.

11. Following student presentations, summarize the inquiry on the board by discussing a "day in the life of an eider" using the following topics. (students can make notes on their student worksheet). The topics are organized in increasing duration or time scale from short term to long term.

Diving locomotion (seconds)
Breathing (minutes)
Digestion (minutes-hours)
Tidal currents (hours)
Day/night behaviours (daily)

If time permits, you can also discuss:
Lunar cycle - affects strength of tidal currents (weeks)
Surviving winter and changing environments (seasons, years)

An eider feeds on the bottom of a polnya while others dive from above

VOCABULARY

• Hypothesis - a testable statement or proposed explanation of a given phenomenon often stated in the form of: "IF a particular Independent Variable is changed, THEN there well be a change in a specified Dependent Variable."

Prediction - a statement of what is expected to happen if the proposed hypothesis is true.

Independent Variable - the variable that is expected to affect a process or cause a response in the Dependent Variable.

Dependent Variable - the variable that is expected to respond or be a result of changes in the Independent Variable.

PROCEDURE

CONCLUSION

12. Discuss how the more specific questions asked by each group inform the original broader question: How much energy does an eider duck need to survive the winter?

Key Ideas:

- eiders need to dive to get food, but it is energetically expensive.
- eiders can only hold their breath so long, affecting how much food they can retrieve per dive.
- as they have to process food with shells, eiders can only consume food at a limited rate
- as the profitability of diving changes with the speed of currents over the tide cycle, eiders attempt to time their activities in relation to digestive processing and current speed in order to maximize their energy intake over the tide cycle.
- eiders can only adapt within the limits of their physiology, morphology and behaviour.
- the ability of eider populations to gain sufficient energy and avoid die-offs is dependent on the amount of prey, the extent of the sea ice, and changes in the sea ice during the winter months

13. Discuss how all of these findings can be combined to create a greater understanding of energetics. For example, a formal model of feeding energetics could be used to predict survival rates in different environmental scenarios.

Explain that this approach allows researchers to assess population responses to changing sea ice conditions and allows eiders to be used as an informative indicator species for the health of sea ice ecosystems.

RESOURCES

BOOKS AND ARTICLES

Goudie RI, Roberston GJ, Reed A (2000) Common Eider (Somateria mollissima) IN: The Birds of North America. no. 546, 32 pp.

Robertson GJ & Gilchrist HG (1998) Evidence of population declines among common eiders breeding in the Belcher Islands, Northwest Territories. Arctic 51, 378-385.

Gilchrist HG, Heath JP, Arragutainaq L, et al. (2006) Combining scientific and local knowledge to study common eider ducks wintering in Hudson Bay IN: Riewe R and Oakes J [Eds.] Climate Change: Linking Traditional and Scientific Knowledge. Aboriginal Issues Press, Univ. Manitoba. pp 284-303.

The following articles can be found at: www.joelheath.ca/academics/

Heath JP, Gilchrist HG, Ydenberg RC (2010) Interactions between rate processes with different time scales explain counter-intuitive foraging patterns of arctic wintering eiders. Proceedings of the Royal Society B 277: 3179-3186.

Heath JP, Gilchrist HG (2010) When foraging becomes unprofitable: energetics of diving in tidal currents by common eiders wintering in the Arctic. Marine Ecology Progress Series 403:279-290.

Heath JP, Gilchrist HG, Ydenberg , RC (2007). Can diving models predict patterns of foraging behaviour? Diving by Common Eiders in an Arctic polynya. Animal Behaviour 73:877-884.

Heath JP, Gilchrist HG, Ydenberg RC (2006). Regulation of stroke patterns and swim speed across a range of current velocities: diving by Common Eiders wintering in polynyas in the Canadian arctic. Journal of Experimental Biology 209, 3974-3983.

Energy acquired during winter can affect breeding condition the following summer. Female eiders rely on their fat reserves while sitting on their nest for extensive periods during incubation, leaving only briefly to drink.

Eider Research Worksheet

GROUP 1: DIVING

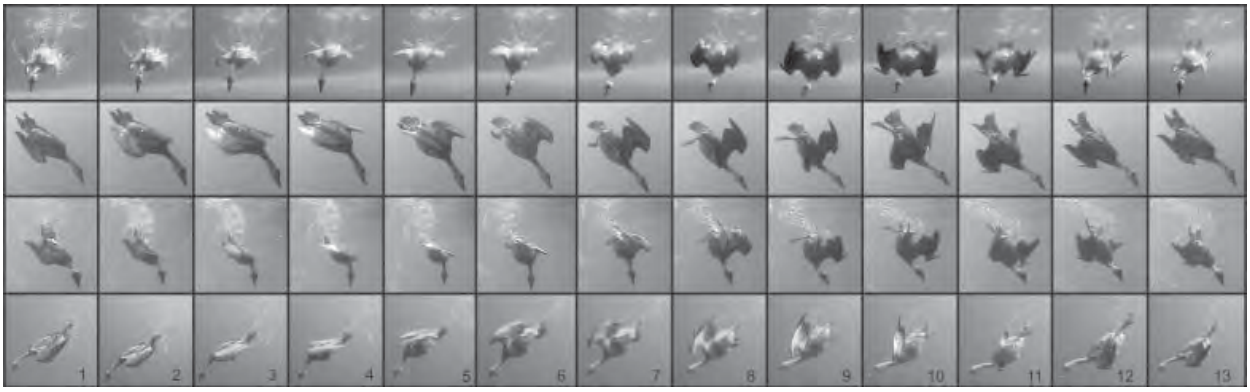
QUESTIONS

• How does current speed influence the time and energy costs of getting to the bottom?

• Given eiders have to come to the surface to breathe, how long are they able to feed on the bottom and how does this change with changes in current speed over the tide cycle?

BACKGROUND RESEARCH

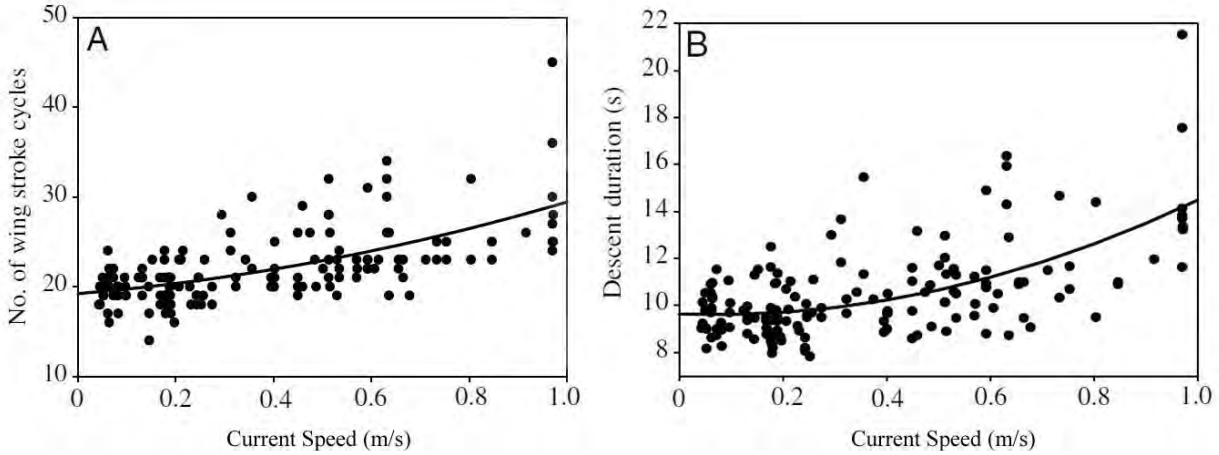
Eiders feed primarily on benthic invertebrates including mussels and sea urchins which live on the ocean floor (i.e., the 'benthos'). In order to capture their prey, eiders must dive to the bottom, search for food, and return to the surface again to breathe. In the winter, sea ice covers a large portion of benthic habitats, and eiders require open water habitats such as polynyas and floe edges to gain access to their food. Ocean and tidal currents can keep these habitats ice free and available for eiders' feeding activities, however diving in currents can be dangerous and energetically costly.



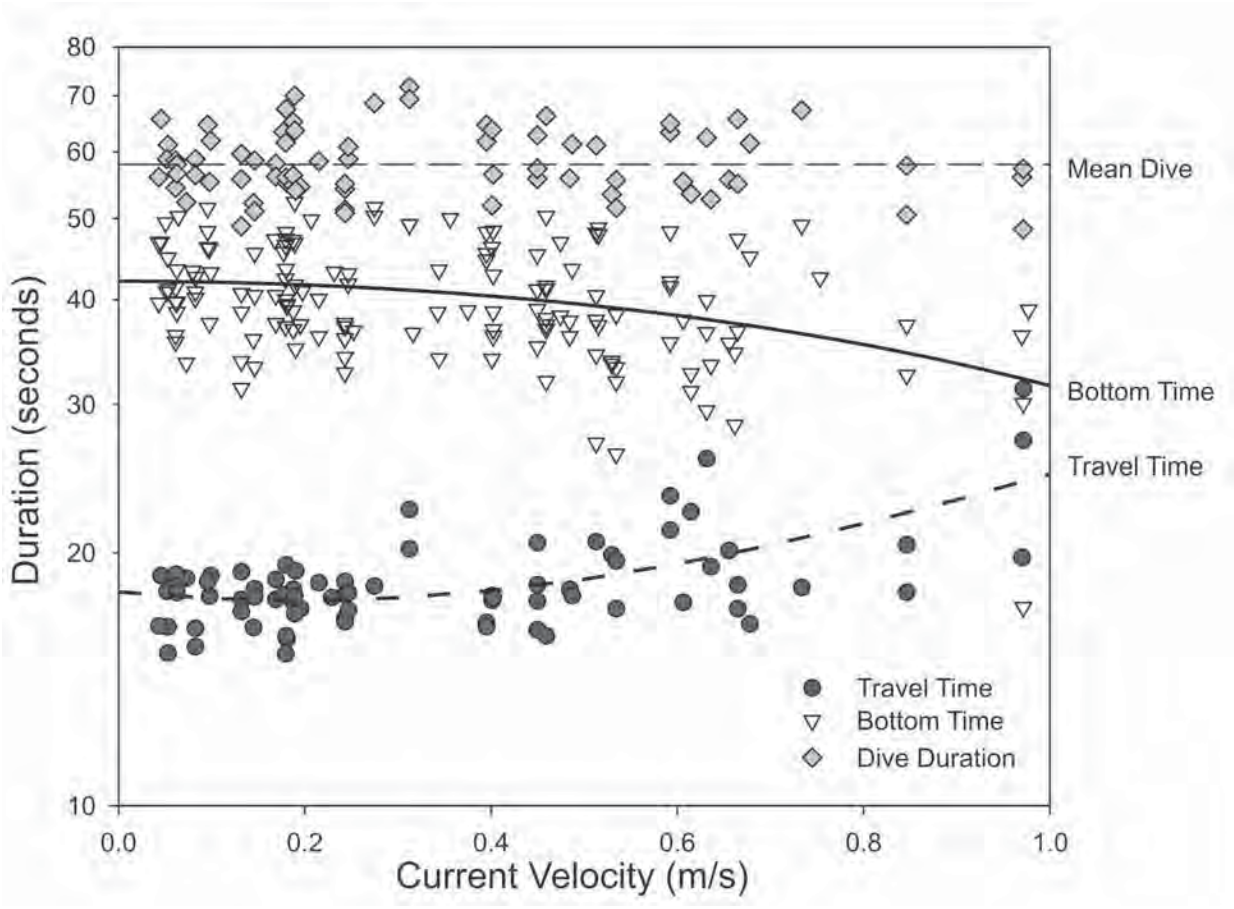
Various stages of a wing stroke cycle for a diving eider during descent (1 – 8 upstroke; 9-13 downstroke)
Visit www.arcticeider.com/diving/2002/ to watch an uneditied video of an eider diving under the sea ice.

Eiders often dive at the ice edge into oncoming currents. Speeds of the currents change in relation to the tidal cycle. Using video footage of eiders diving in currents of various speeds, it was possible to determine the influence of currents on the energetics of diving. It was also possible to determine how the speed of the currents influence the number of wing flaps and the time required to reach the bottom to feed. Figure A on the following page shows how the number of wing flaps it takes to reach the bottom changes with current speed. Figure B shows how the time it take to reach the bottom changes with current speed.

BACKGROUND RESEARCH



Given that eiders must return to the surface to breathe, the amount of time they can spend underwater on a given dive is limited. While quicker dives are possible, eiders typically dive for approximately 1 minute. The figure below shows how travel time (descending and ascending from the bottom) changes with current speed, and how this influences the time available to feed on the bottom.



During faster currents, eiders spend more time travelling and therefore have less time feeding on the bottom during a dive.

Eider Research Worksheet

GROUP 2: ENERGETICS

QUESTIONS

- To balance energetic costs and benefits, at what current speed should eiders stop diving and rest on the ice?

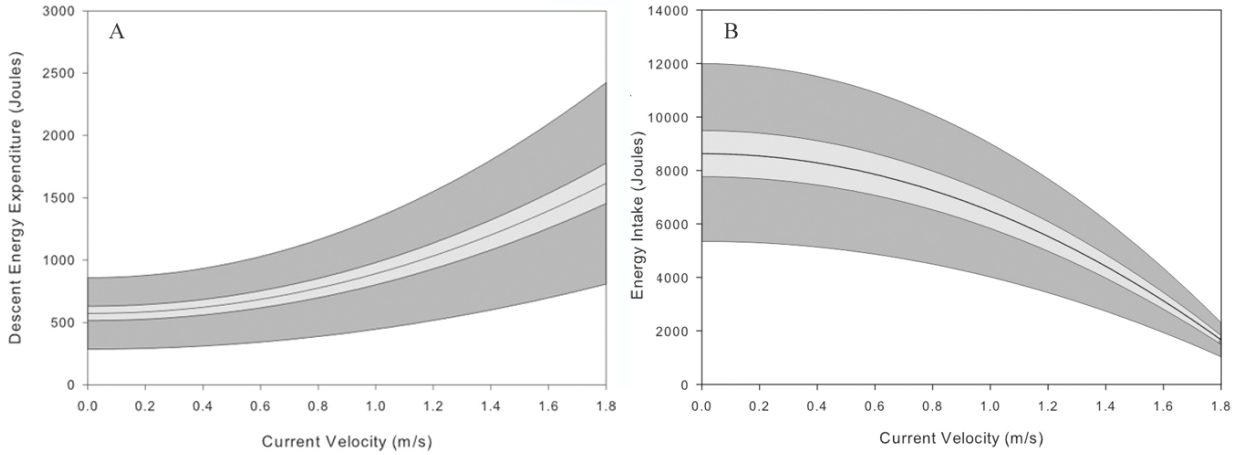
- What is the most beneficial time to dive during a tide cycle?

BACKGROUND RESEARCH

Eiders feed primarily on benthic invertebrates including mussels and sea urchins which live on the ocean floor (i.e., the 'benthos'). In order to capture their prey, eiders must dive to the bottom, search for food , and return to the surface again to breathe. In the winter, sea ice covers a large portion of benthic habitats, and eiders require open water habitats such as polynyas and floe edges to gain access to their food. Ocean and tidal currents can keep these habitats ice free and available for eiders' feeding activities, however diving in currents can be dangerous and energetically costly.

Using underwater video footage, it was determined that more wing flaps and a longer travel time to the bottom are required in faster currents. Given that eiders can only hold their breath for about one minute, this limits the amount of time available for feeding.

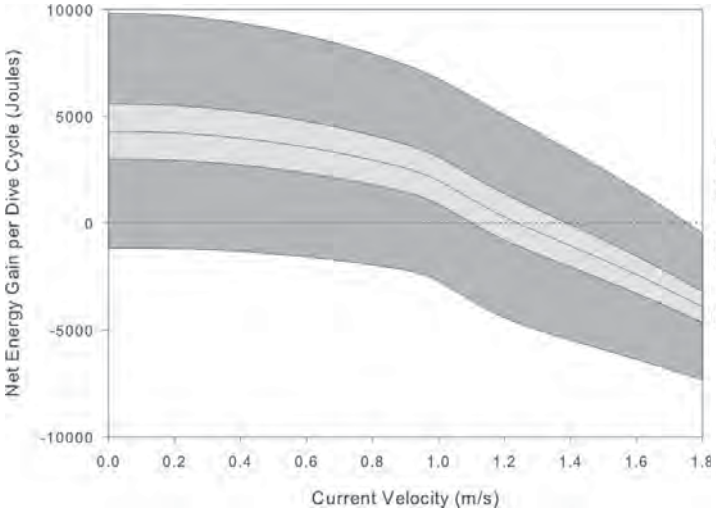
Research in laboratory settings provides data on the energetic costs of various activities such as diving, swimming, and resting on the ice. The Energetic costs (joules/second) of a given activity can be multiplied by its duration to determine the energy budgets of various decisions. By considering the energetic costs of diving, swimming and feeding on the bottom, the energetic costs of different activities can be determined in relation to currents.

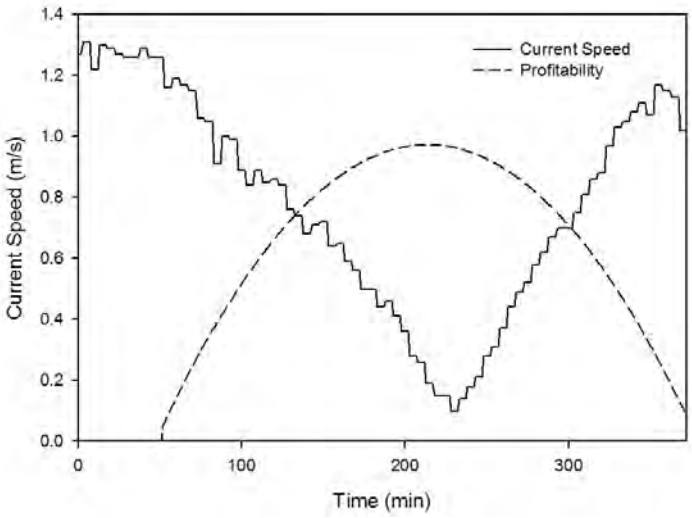


BACKGROUND RESEARCH

Part A of the figure on the previous page indicates that the energetic costs of getting to the bottom increase with current speed (the grey areas represent a range of possible energetic values depending on environmental conditions). To determine how much energy can be obtained on a given dive, it is also necessary to consider how much food can be obtained, and how much energy can be extracted from that food into a usable form. The energetic gain on a given dive is shown in part B of the figure on the previous page.

By subtracting all of the energetic costs from the energy gain, we can determine the net energy gain of a dive for a given current speed, as indicated in the left figure below.





The figure on the left above indicates that there is a non-linear change in the energy gain as currents increase. The grey area indicates a 'sensitivity analysis', which takes into consideration that energy costs can be slightly higher or lower depending on environmental conditions (e.g. temperature, wind speed), or if prey is variable in energy content. The shape of the graph is important, and it illustrates that a similar amount, approximately 5000 joules, can be obtained for a dive in currents between about 0 to 0.5 meters per second (m/s). Net energy gain then declines more and more rapidly with increasing currents, particularly at about 0.8 m/s. At 1.2 m/s it crosses the zero line, indicating that in faster currents it actually costs more energy to dive than can be obtained from feeding given the limited time available. Diving is therefore not profitable in fast currents. Eiders are known to get out of the water and rest on the ice edge in currents of about 0.8-1.0 m/s

Currents vary systematically over the tide cycle, with the strength depending on the phase of the moon. The right figure above shows a profile of current speed over a tidal cycle. The profitability of diving as taken from the figure on the left can be plotted over the tide cycle as shown on the right. This data indicates that diving is not profitable in the fastest currents of this tide cycle (when eiders should rest on the ice edge), and that the most profitable time to feed is in the slack currents.

Eider Research Worksheet

GROUP 3: DIGESTION AND FEEDING PATTERNS

QUESTIONS

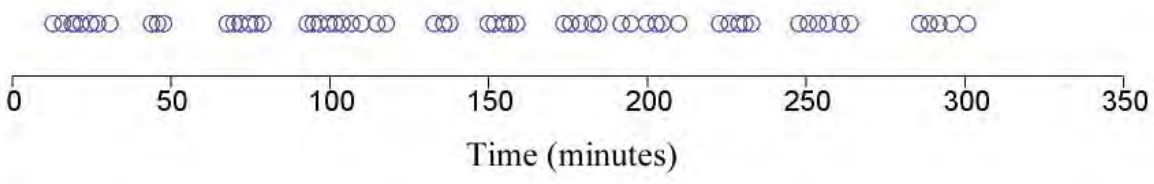
- Given eiders swallow mussels and urchins whole, could digestive processing limit the amount of energy they can consume in a particular period?
- How might digestive limitations influence patterns of feeding activity? For example, should eiders feed slowly and continuously or should eiders divide their time into periods of active feeding followed by resting and digestion periods?

BACKGROUND RESEARCH

Eiders feed primarily on benthic invertebrates including mussels and sea urchins which live on the ocean floor (i.e., the 'benthos'). In order to capture their prey, eiders must dive to the bottom, search for food , and return to the surface again to breathe. In the winter, sea ice covers a large portion of benthic habitats, and eiders require open water habitats such as polynyas and floe edges to gain access to their food. Ocean and tidal currents can keep these habitats ice free and available for eiders' feeding activities, however diving in currents can be dangerous and energetically costly.

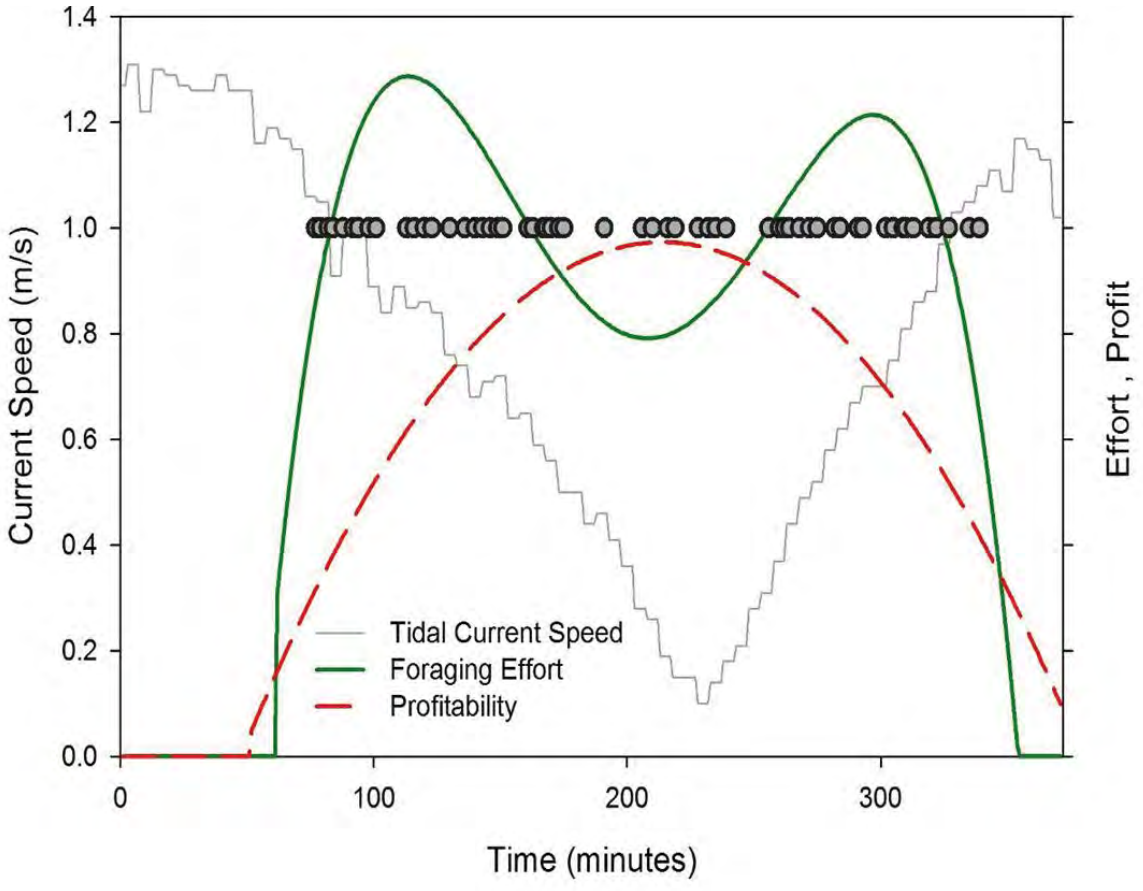
Eiders swallow their prey whole, grinding up the shells of mussels and sea urchins in their muscular gizzard. This is made possible by their extremely resilient digestive system. In addition to the time it takes to swallow prey, time is needed to grind up a meal in their gizzard causing a bottleneck in energy intake. Even if prey is abundant, the consumption rate of prey will be limited by the digestive processing limit of the eider. This digestive bottleneck includes both the time required to crush prey and the capacity of the digestive system (how much food they can contain in the esophagus and gizzard at a given time).

The rate of energy intake will therefore be limited by digestion. Eiders could feed at a consistently slow rate that doesn't surpass the digestive processing rate, or they could feed in bouts of activity, alternating between periods of intensive feeding until they have reached the capacity of their digestive system, and periods of resting and processing their gut load. When other factors have a minimal impact, eiders and other animals tend to structure their behaviour in bouts of activity alternating between feeding and digestion. This behaviour is documented on the figure below using data from the activities of a single eider during weak currents where each blue dot represents a dive. Cyclical patterns of feeding activity can be observed and are related to the digestive processing time



BACKGROUND RESEARCH

Issues surrounding feeding activities are more complex in the presence of other influential factors. For example, in order to maximize energy gain over a longer period, eiders must coordinate their digestive cycles within a tide cycle so that they can get as much energy as they can before they have to rest on the ice edge in very fast currents. This means that as currents get slower, eiders can get into the water with an empty stomach and begin feeding. When they are full, they must stop feeding and digest their prey, even if conditions for feeding are favorable. The figure below shows current speed over a tide cycle during a full moon when currents are particularly strong. The red curve indicates the profitability of a single dive at that current speed, which peaks in slack currents. Dives are indicated by grey dots, and the green curve indicates the intensity of diving, or foraging effort. In this case, eiders tend to feed most often during medium currents and have to spend the most profitable slack currents digesting their prey. Before the currents get too strong, eiders have digested enough food to feed again, and can fill up once again before they have to get out of the water and rest on the ice edge. While it may seem counter-intuitive, because of the digestive bottleneck, the best strategy for eiders can be to rest and digest during the most profitable feeding time (slack currents) so that they can fit as many digestive cycles as possible into a tidal cycle. Therefore it is not always best to dive and feed during the most profitable time. This indicates the importance of considering a variety of biological and environmental factors when evaluating the ability of a species to obtain energy for survival.



LESSON 4: ECOLOGY OF THE ARCTIC EIDER

STUDENT WORKSHEETS

NATURAL HISTORY OF THE HUDSON BAY COMMON EIDER

1. Complete the following table while viewing the Eider Studies featurette by listing various features of their natural history in each category

Food	Habitat	Physical Characteristics

2. How do the following factors (occurring at different time scales) influence a day in the life of an eider? In what ways do they influence an eider's ability to maximize energy intake?

Diving Locomotion (seconds): _____

_____

Breathing (minutes): _____

_____

Digestion (minutes-hours): _____

_____

Tidal Currents (hours): _____

_____

Day/Night Behaviours (daily): _____

_____

TEACHERS ANSWER KEY

STUDENT WORKSHEETS

NATURAL HISTORY OF THE HUDSON BAY COMMON EIDER

1. Complete the following table while viewing the Eider Studies featurette by listing various features of their natural history in each category

Food	Habitat	Physical Characteristics
-mussels -sea urchins -sea cucumbers -smaller crab and fish	- polynyas - floe edges - sea ice habitats where open water provides access to sub-tidal areas that aren't too deep	-feathers (eider down, surface feathers) -large body size (up to 3kg) -muscular crop for grinding food

2. How do the following factors (occurring at different time scales) influence a day in the life of an eider? In what ways do they influence an eider's ability to maximize energy intake?

Diving Locomotion (seconds): the time and energy costs of diving change with current speed and depth, influencing time spent feeding on the bottom and therefore the profitability of diving .
Breathing (minutes): eiders dive on average for about one minute before returning to the surface to breathe. This limits time available to feed and therefore the energetic profitability of a dive.
Digestion (minutes-hours): eiders spend time and energy handling prey and processing them in their digestive system, which places a bottleneck on the rate of energy gain obtained from feeding.
Tidal Currents (hours): current speed and direction change with the tides, influencing the energetic profitability of diving and foraging. Eiders must rest on the ice during fast currents.
Day/Night Behaviours (daily): Eiders generally feed only during the day, during which they must obtain enough energy to survive the cold arctic nights resting on the ice edge.

NOTES

5 Anthropological Filmmaking

ROLE OF THE FILMMAKER AND COMMUNITY IN CAPTURING CULTURE

GRADE LEVEL

Grade 10 -
Post Secondary

ACTIVITY TIME

40 - 60 minutes
+ additional viewing time

SKILLS

- Creative process
- Interpreting multi-media
- Understanding contexts
- Perceiving and responding to images
- Understanding materials, technologies, and processes used in image development

CONCEPTS

- Philosophy of filmmaking
- Cinematography techniques (Reflexivity, Cinéma vérité)
- Portraying history and culture in documentary film

LEARNING OUTCOMES

- Think critically about the process of presenting culture through filmmaking
- Consider evolution of documentary filmmaking over the last 100 years
- Understand responsibility of documentary filmmakers in communicating ideas

CURRICULUM LINKS

- Cultural Heritage
- Creative Arts
- Multi-media / Filmmaking
- Communications

OVERVIEW

Students will consider the process of representing culture in anthropological filmmaking. They will compare and contrast *People of a Feather* with *Nanook of the North,* a film created 100 years earlier by Robert Flaherty. Often considered the first documentarian, Flaherty began filmmaking on the Belcher Islands, but lost his footage and made *Nanook* elsewhere. The film was a huge success, though the authenticity of his approach has been an important debate in anthropological filmmaking and cinema history. This debate is revisited by considering how *People of a Feather* was made on the Belcher Islands 100 years after Flaherty's initial visit.

Portrait from the Belcher Islands, archives of Sir Robert Flaherty

BACKGROUND

"Our land lay undiscovered by the modern world until 1913 when explorer Robert Flaherty arrived. It was here that Flaherty, the Grandfather of documentary, began his filmmaking career. But he lost his footage from the islands. Our story was never seen. Now we have created new footage of our past, based on our memory and oral history…" [from *People of a Feather*]

Robert Flaherty (1884-1951) was an explorer, surveyor, and prospecting mineralogist who developed an interest in filmmaking while working in the Canadian arctic. He once described his early interest by stating, "the only thought I had in connection with the use of the motion camera was to compile visual notes of the exploration".

On Flaherty's first Arctic expeditions, he made several attempts to travel to the Belcher Islands to discover their extent and mineral resources. When he finally arrived, his ship was wrecked and he spent the winter exploring and mapping the islands, as well as compiling motion picture footage which he later edited into a travelogue film. Unfortunately, a misplaced cigarette destroyed all the negatives captured in the Belcher Islands. Only a few still photos from the Belchers survived (e.g., the portrait featured on the cover of this lesson plan). Inspired by his experience, Flaherty travelled to the northern community of Inukjuak (Port Harrison), and worked together with the local Inuit community to create *Nanook of the North*, a film which many consider to be the first documentary film ever made. Flaherty has since been awarded the iconic title "Grandfather of Documentary Cinema".

Traditional igloo recreation from People of a Feather featuring a family in eider skin clothing made for the film

BACKGROUND

Flaherty spent 16 months in Inukjuak, finally returning south to edit the film *Nanook of the North*. Although the film was considered to be a great success, 100 years later its anthropological value continues to be hotly debated.

Working in close collaboration with the Inuit, Flaherty was determined to present to the world what he considered to be their unique and "savage" lifestyle. In an attempt to accomplish this goal in an engaging style, Flaherty set up scenes and in some cases reenacting Inuit traditions that had not been practiced in over a century. One example was a walrus hunting scene which depicted the Inuit using spears that had long before been replaced by European rifles. Another scene shows Nanook, the main character on whose life the film is based, pretending to bite a phonographic record album because he is unsure of what it is. As a result of this staging of scenes, many film historians consider *Nanook of the North* to be a film documenting a culture that never really existed.

Almost 100 years after Flaherty captured Nanook's way of life on film, Dr. Joel Heath found himself in similar circumstances. While travelling to the Belcher Islands to study the winter ecology of the Hudson Bay Common Eider, Heath was not expecting to become a filmmaker. However, as a result of his newly formed relationship with the local Inuit, and his experience filming ducks diving under the sea ice, Heath was inspired to work with the community to create the film *People of a Feather*. Their objective was to capture local culture and raise awareness about environmental concerns facing Inuit and sea ice ecosystems.

The Belcher Islands lacked caribou, and local Inuit developed a unique practice of using eiders for clothing and food instead. Profiling their relationship with the eider duck became one of the central elements of the film. Through traditional recreations of 100 years ago, Heath was able to uncover the knowledge and skills to create clothing from the eider skins. The film highlights the traditional relationship with the eider, and considers how these traditions have changed and adapted around the use of the warmest feather in the world: the eider down.

The scenes depicting the traditional way of life in *People of a Feather* were recreated by oral histories gained through a series of interviews with elders and through community consultation. Modern sequences were primarily *ciéma vérité*, capturing actual events as they occurred, with minimal interference. Members of the community were actively involved in creating the sequences and props (e.g., clothing, qayaq, tupik, etc.) throughout the production and post-production processes.

MATERIALS

- Student Worksheet
- Projector to view Film
- Chalkboard or whiteboard with markers
- Internet access for students (or assigned for homework)

PREPARATION

- Review lesson background
- Set up the TV and DVD
- Photocopy worksheet and Backgrounder
- Preview films
- Nanook of the North screening can be assigned as homework in advance for students with internet

BACKGROUND

While there are many parallels between the processes of capturing footage for *People of a Feather* and *Nanook of the North*, some compelling differences exist. A comparison of the two filmmaking processes provides an opportunity to revisit the long standing debate of the role of the filmmaker in anthropological filmmaking

PROCEDURE

INTRODUCTION

1. [optional] Before viewing the film, hand out worksheets and ask students to watch for and record examples of recreated scenes that may have been staged and those captured in the *cinéma vérité* style in both *People of a Feather* and *Nanook of the North*. Provide time for students to review the questions before viewing the film, ask any questions, and make additional notes after viewing each film.

ACTIVITY

2. In *Nanook of the North*, there is a similar style of filmmaking throughout, and it is sometimes difficult to distinguish what scenes were scripted and recreated versus those that were shot cinéma vérité and actually represented the culture of the time. In contrast, *People of a Feather* used a variety of cinematography techniques to capture traditional and modern culture, as well as the natural history of eider ducks and sea ice ecosystems. After watching *People of a Feather,* ask students to share their notes about how different scenes may have been created, and/or discuss the different filmmaking approaches that were used with the class.

The qayaq sequence in People of a Feather was in part a 'tip of the hat' to Flaherty's efforts 100 years earlier

PROCEDURE

FILMMAKING TECHNIQUES IN PEOPLE OF A FEATHER

List the following headings on the board and discuss with the class:

Traditional Recreations: scripted sequences recreating historical culture of the Belcher Islanders approximately 100 years ago. Traditional clothing and artifacts were created in conjunction with high school culture programs and through close consultation with the community.

Cinéma vérité: modern sequences captured within town or during hunting expeditions where actual events were documented by the camera with little interference or chances for a second take.

Reflexivity: sequenes of the director speaking to camera, explaining his perspective as the filmmaker and scientist, providing insight into the filmmaking process.

Natural History: wildlife sequences compiled from extensive footage collected over many years (underwater, from a hide, etc.) and woven together to tell the story of the eider and its struggle adapting to changes in sea ice ecosystems.

Time Lapse: photography over extended periods used to capture the dynamics of sea ice ecosystems at a variety of time scales not typically experienced by a human observer.

Specific Examples to Consider:

a) The Kavik family watches an episode of The Nature of Things about the impact of hydroelectric projects on sea ice. The technique used in this example is *cinéma vérité* because this was the first time the family had seen this episode. This cinematic device was also used to review the history of the issue without using narration.

b) The SKQ hip-hop video was shot as a music video using a song the youth had written for the film about their community. The music video style lends itself to more creative freedom that may not be considered true *cinéma vérité*, however the sequence did allow capturing genuine perspectives from a group of youth from Sanikiluaq. The full video can be viewed on You-Tube (see the link under 'Resources')

VOCABULARY

Cinéma vérité - "truthful cinema" is a style of documentary filmmaking that attempts to capture real moments on camera. It may or may not involve the audience being aware of the cameras presence (the latter is sometimes referred to as 'Direct Cinema')

Reflexivity - acknowledging the role of the filmmaker in capturing a culture on film, in order to provide the audience with a more genuine perspective on the content and how it was created.

DISCUSSION QUESTIONS

'Discuss the following questions as a class or create small groups of students and assign each group one of the questions. Have them present their responses to the class.

a) Do the scripted recreation scenes in each film add to the message of the film? Explain your perspective.

b) Consider the difference between capturing recreation sequences and actual events as they happened in a *cinéma vérité* style. How might the processes of preparation and shooting differ between these two forms of filmmaking and what differences are apparent in the results? Compare this to the process of Natural History filmmaking.

c) Flaherty initially travelled to the Arctic as an explorer. Heath initially travelled to the Arctic as a scientist. Both became filmmakers as a result. A filmmaker travelling to a community for the first time with the primary of intention of documenting culture might make a very different film. How do you think these different approaches might impact the outcome of a film?

d) The footage for *Nanook of the North* was captured with film cameras that did not include sound, were susceptible to the elements, and only allowed for limited recording times. In what ways do you think that the modern technologies which captured the sights and sounds of the Arctic during the filming of *People of a Feather* helped to communicate the messages of the film?

e) Robert Flaherty is never seen in his film though viewers see descriptive title cards that they assume are his thoughts. Conversely Heath is a character that directly addresses the audience in *People of a Feather*. What are the advantages and disadvantages of both approaches?

f) *Nanook of the North* was funded by French Fur Trading Company Revillon Freres, while *People of a Feather* was funded primarily through a Canadian government grant for education and outreach during International Polar Year (with proceeds going towards charitable activities of The Arctic Eider Society). How might private versus public interests affect the outcome of a film?

EXTENSIONS

1. Ask students to consider ways they might capture their own local culture on film, and justify the various filmmaking approaches they would include.

2. Ask students to capture a local event at school or in their community, considering the necessary planning, techniques, production, and editing. Share the sequence with the class and discuss various challenges encountered and why certain approaches were more effective than others.

Creating recreation sequences for People of a Feather provided an opportunity for youth to connect with their traditional culture and learn skills from elders during the process.

RESOURCES

BOOKS & ARTICLES

Ruby, J (1980) An exploration of the role of filmmaker in making "truth" and the responsibilities that come with that. IN: Exposing Yourself: Reflexivity, Anthropology, and Film. Semiotica 30: 153–179. www.antropologiavisual.com.ar/archivos/Exposing%20yourself.pdf

"A Re-examination of the Early Career of Robert J. Flaherty - Jay Ruby", http://astro.temple.edu/~ruby/ruby/flaherty.html

"Robert Flaherty" http://sensesofcinema.com/2002/great-directors/flaherty/#3

Robert Flaherty's "Nanook of the North" Written by Alain Silver www.oneworldmagazine.org/seek/nanook/nanotext.htm

Flaherty recounts filming Nanook of the North in his own words. "How I Filmed Nanook of the North", http://astro.temple.edu/~ruby/wava/Flaherty/filmed.html

MULTI-MEDIA

Nanook of the North: http://www.youtube.com/watch?v=kaDVovGjNOc

SKQ Hip Hop Video: http://youtu.be/BQr0_Fmlrl8

STUDENT WORKSHEETS

1. What scenes were created using scripted recreations and which were cinéma vérité? What techniques were used to capture each?

	People of a Feather	Nanook of the North
scripted		
"cinéma vérité"		

STUDENT WORKSHEETS

2.DISCUSSION QUESTIONS

Discuss the following questions with your group and present your responses to the class

a) Do the scripted recreation scenes in each film add to the message of the film? Explain your perspective.

b) Consider the difference between capturing recreation sequences and actual events as they happened in a *cinéma vérité* style. How might the processes of preparation and shooting differ between these two forms of filmmaking and what differences are apparent in the results? Compare this to the process of Natural History filmmaking.

c) Flaherty initially travelled to the Arctic as an explorer. Heath initially travelled to the Arctic as a scientist. Both became filmmakers as a result. A filmmaker travelling to a community for the first time with the primary of intention of documenting culture might make a very different film. How do you think these different approaches might impact the outcome of a film?

STUDENT WORKSHEETS

2.DISCUSSION QUESTIONS (CON'T)

d) The footage for *Nanook of the North* was captured with film cameras that did not include sound, were susceptible to the elements, and only allowed for limited recording times. In what ways do you think that the modern technologies which captured the sights and sounds of the Arctic during the filming of *People of a Feather* helped to communicate the messages of the film?

e) Robert Flaherty is never seen in his film though viewers see descriptive title cards that they assume are his thoughts. Conversely Heath is a character that directly addresses the audience in *People of a Feather*. What are the advantages and disadvantages of both approaches?

f) *Nanook of the North* was funded by French Fur Trading Company Revillon Freres, while *People of a Feather* was funded primarily through a Canadian government grant for education and outreach during International Polar Year (with proceeds going towards charitable activities of The Arctic Eider Society). How might private versus public interests affect the outcome of a film?

CANADIAN

ONTARIO MINISTRY OF EDUCATION	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Aboriginal Peoples in Canada, Grade 10, Open			■		■
Science, Grade 9, Academic, Applied	■	■	■	■	
Science Grade 10 Academic, Applied	■	■		■	
Biology, Grade 11 University Preparation	■	■		■	
Environmental Science, Grade 11, University/College Preparation, Workplace Preparation	■	■		■	
Physics, Grade 12, University Preparation, College Preparation	■	■	■		
Challenge and Change in Society, Grade 12, University/College Preparation					■
Media Arts Grade 10, 11, 12					■
Geography of Canada, Grade 9 Academic, Applied	■	■	■		
The Americas: Geographic Patterns and Issues, Grade 11, University/College Preparation	■	■			
Physical Geography: Patterns, Processes, and Interactions Grade 11, University/College	■	■		■	
Geographics: The Geographer's Toolkit, Grade 11, Workplace Preparation	■	■		■	
Canadian and World Issues: A Geographic Analysis, Grade 12, University Preparation	■	■		■	
The Environment and Resource Management, Grade 12, University/College Preparation	■	■	■	■	
Geomatics: Geotechnologies in Action, Grade 12, University/College Preparation			■	■	
The Environment and Resource Management, Grade 12, Workplace Preparation	■	■	■	■	

CANADIAN

BRITISH COLUMBIA	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Visual Arts: Media Arts 11 and 12					■
Science 8		■		■	
Science 9				■	■
Science 10		■		■	
Earth Science 11		■		■	
Biology 11	■				
Sustainable Resources 11		■			
Social Studies 11		■	■		
Geography 12	■	■			
Social Justice 12			■		

CANADIAN

ALBERTA	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Science: Grade 7	■	■	■	■	
Science: Grade 8	■	■		■	
Science: Grade 9	■	■	■		
Knowledge and Employability: Science 8	■	■			
Knowledge and Employability: Science 9	■	■		■	
Science: Grade 10	■	■			
Science 14	■	■		■	
Science 24		■			
Knowledge and Employability: Science 20-4		■			
Science 20	■	■			
Science 30	■	■	■		
Biology 20	■	■		■	
Career and Technology Studies: ENS1010, ENS1020, ENS1040, ENS2130, ENS3040	■	■	■		
Art 11-31 (Senior High)					■
Cultural and Physical Anthropology 30					■

UNITED STATES

CALIFORNIA	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Biology/Life Sciences: Grades 9-12	■	■			
Earth Sciences: Grades 9-12	■	■			
Science: Investigation and Experimentation, Grades 9-12		■		■	
Visual Arts: Grade 8					■
Visual Arts: Grades 9-12, Proficient					■
Visual Arts :Grades 9-12, Advanced					■

OREGON	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Eighth Grade Science	■	■		■	
High School Science	■	■		■	
Eighth Grade Arts					■
High School Arts					■
Eighth Grade Social Sciences	■	■	■		
High School Social Studies		■	■		

UNITED STATES

NEW YORK STATE	1. Polynya and Floe Edge Habitats	2. Hydroelectricity and Sea Ice	3. Inuit Ingenuity	4. Ecology of the Arctic Eider	5. Anthropological Filmmaking
Intermediate Science	■	■	■	■	
High School: Living Environment, Grades 9-12	■	■	■	■	
High School: Earth Science, Grades 9-12	■	■		■	
Intermediate Social Studies			■		
Intermediate Visual Arts					■
High School: Visual Arts, Grades 9-12					■

Detailed learning outcomes are available from the Arctic Eider Society for some regions. Curriculum links for additional regions will be provided online when available.

People of a Feather Educational Package

Contact the Arctic Eider Society for updates,
licensing, and access to the electronic version.
info@arcticeider.com

The Arctic Eider Society is commited to sustaining the integrity of sea ice ecosystems. The society was created to further development of community based research, monitoring and education programs in the Canadian Arctic. Working directly with Inuit, this supports the use and preservation of sea ice knowledge to study environmental change in Arctic ecosystems, providing meaningful employment that addresses local and global issues. Our interdisciplinary education and outreach initiatives combine Inuit, scientific and filmmaking approaches to document and broadly disseminate knowledge about sea ice ecosystems and environmental change in the Arctic.

visit www.arcticeider.com to learn more about our additional educational resources and charitable programs.