

# Learning about ringed seal health from contaminants science and Inuit knowledge

Educational workshops 2016-2018

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Summary of workshops held in  
Resolute Bay, Nunavut (2016), and Sachs Harbour, Northwest Territories (2018)



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## Table of Contents

Introduction .....	4
Educational material and research tools .....	5
Workshop objectives .....	5
What we did .....	6
Student-led Inuit knowledge survey .....	7
Best practices and lessons learned .....	8
Workshop assessment .....	8
Best practices .....	11
Conclusion .....	12
Appendix I – Workshop activities .....	13
1. Presentations by scientific researchers .....	14
2. Ringed seal dissection .....	15
3. Interactive laboratory stations with plankton .....	16
4. Ringed seal stomach dissection activity .....	17
5. Arctic food chain tag .....	19
6. Ringed seal contaminants puzzle .....	20
7. Health puzzle .....	21
8. Ringed seal anatomy game .....	22
9. Ringed seal crossword quiz .....	23
10. Ringed seal art work .....	24
Appendix II – Student-led Inuit knowledge survey .....	25
Appendix III – Workshop assessment tools .....	27
1. Workshop assessment survey for students and school personnel .....	28
2. Instructor debrief guide .....	29

## Introduction

The ringed seal is a species of great cultural, economic and nutritional importance for Inuit. Scientists conducting research on ringed seal ecology and contaminants in Inuit Nunangat work towards better understanding the ecology and health of this species. This project addresses a shared interest among Inuit and scientific researchers in enhancing communications and northern community capacity building related to contaminants research on ringed seals in Inuit Nunangat. It engages scientific researchers, Inuit youth, elders, and community members in learning about ringed seals from both Inuit knowledge and scientific perspectives through educational workshops.

Since 2016, a team of researchers from Environment and Climate Change Canada (ECCC) has conducted educational workshops in partnership with local schools and Hunters and Trappers Organizations in Resolute Bay, Nunavut (2016), and Sachs Harbour, Northwest Territories (2018). These workshops allowed scientists working on contaminants in ringed seals to share information about their work with northern residents (Inuit youth, in particular). They also provided an opportunity for Inuit elders and hunters to share their knowledge with students and researchers in seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game. This project led to the development of innovative methods of Inuit community engagement around contaminants monitoring in wildlife. The experience and insights gained from this work can be helpful to scientific researchers, northerners, educators, and funding agencies interested in contaminants research on wildlife, and the development of educational opportunities linking Inuit knowledge and contaminants research.

This report offers a synthesis of educational material and research tools developed throughout the project. It also discusses best practices and lessons learned by workshop participants for engaging and communicating with Inuit youth as part of contaminants research and monitoring activities.



Group discussion (left) and art activity (right) during ringed seal health workshop held at the Inualthuyak School, Sachs Harbour, Northwest Territories, in January 2018.

## Educational material and research tools

### *Workshop objectives*

This project aimed to engage Inuit community members and scientific researchers in learning about ringed seal health from both Inuit knowledge and scientific perspectives through educational workshops held in northern schools.

In the short-term, the workshop pursued the following objectives:

- (1) provide an opportunity for scientists working on contaminants in ringed seals to share information about their work with northern residents (and youth, in particular);
- (2) provide an opportunity for knowledge exchange between Inuit elders, hunters, youth and scientists in seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game;
- (3) increase the engagement and interest of northern students in contaminants research and traditional seal harvesting;
- (4) develop and foster community engagement capacity and leadership among northern youth and early career researchers by having northern students and early career researchers co-lead the workshop; and
- (5) identify best practices for engaging and communicating with northern communities and Inuit youth as part of contaminants research and monitoring activities.

Over the long-term, it is hoped that this educational project will expand collaboration and communication between northern residents and scientific researchers working on contaminants in Inuit Nunangat.



In Resolute Bay, workshop instructors included (picture on the left, from left to right): Jennifer Provencher (ECCC), Magali Houde (ECCC), Mick Appaq (Nunavut Arctic College), and Dominique Henri (ECCC) (missing from picture). In Sachs Harbour (picture on the right, from left to right), workshop instructors included: Cassandra Debets (University of Manitoba), Mick Appaq, Magali Houde, Maeva Giraudo (ECCC) and Dominique Henri (missing from picture).



### ***What we did***

A team of researchers from Environment and Climate Change Canada (ECCC) organized educational workshops in partnership with local schools and Hunters and Trappers Organizations in Resolute Bay, Nunavut (2016), and Sachs Harbour, Northwest Territories (2018). These workshops took place over a period of three days and were structured as follows:

1. Day one – workshop preparation;
2. Day two – workshop delivery in local schools; and
3. Day three – workshop assessment with local partners.

Workshops instructors included ECCC researchers, one student from the Nunavut Arctic College Environmental Technology Program (ETP), local elders and hunters, one graduate student from the University of Manitoba, and interpreters. A student from the Arctic College ETP in Iqaluit, and a graduate student from the University of Manitoba co-led the workshops as a way to increase the capacity of northern students and early career scientific researchers to meaningfully engage with Inuit community members in contaminants research. Workshop participants included northern students (from kindergarten to grade 12), school principals and teachers, and other interested community members who were invited to join the events (e.g., representatives from local Hunters and Trappers Organizations).

Workshop programs were developed by ECCC researchers, in close collaboration with school principals and teachers. The workshops were comprised of diverse educational activities specifically adapted to different age groups and types of learners. Activities included a combination of short interactive presentations made by researchers, a ringed seal dissection led by local elders and hunters, laboratory observations, discussions, storytelling, games, and art activities to teach participants core concepts, methods and issues related to the study and understanding of ringed seal health from both scientific and Inuit perspectives. Appendix I describes workshop activities in more detail. Both workshops were evaluated through a series of discussions with participants and a written survey. This allowed identifying best practices for communicating information about and involving Inuit communities in contaminants research.



Workshops included hands-on laboratory activities (left), a ringed seal dissection guided by a local hunter (centre) and art activities (right).

### ***Student-led Inuit knowledge survey***

There is growing interest in developing innovative approaches to include Inuit knowledge in contaminants research. During the workshop held in Sachs Harbour, instructors implemented for the first time a pilot Inuit knowledge survey for collecting local and traditional knowledge that may be associated with contaminants in ringed seals. Survey questions were originally co-developed by students and researchers during the 2017 Northern Contaminants Program (NCP) Wildlife Contaminants Workshop held at the Nunavut Arctic College in Iqaluit (please refer to Appendix II for details). This survey was developed to be administered by local students to help increase their involvement in contaminants research and support youth involvement in community-based monitoring.

During the Sachs Harbour workshop, Mick Appaqaq (ETP student and workshop instructor) was responsible for asking survey questions to two local elders, Betty Haogak and John Keogak. With support from Magali Houde (ECCC), he led a discussion about local and traditional observations related to ringed seal health. He noted the answers provided by elders and produced a short report summarizing discussions. Mick Appaqaq worked with researchers to summarize what survey questions worked well, and which ones will need to be adjusted in future workshops. This approach was inspired by a research model developed by [Ikaarvik](#), which positions youth in northern communities as knowledge seekers, synthesizers and reporters in collaboration with researchers.



Inuvialuit elders John Keogak (left) and Betty Haogak (center) discuss with Mick Appaqaq (right) during the student-led Inuit knowledge survey. They shared their knowledge and observations about ringed seal ecology and health.

## **Best practices and lessons learned**

This project aimed to identify best practices for engaging and communicating with northern communities (and Inuit youth, in particular) as part of wildlife contaminants research and monitoring activities. We hope that experience gained and lessons learned from this project can inform the development of innovative methods of community engagement around contaminants monitoring in wildlife.

### ***Workshop assessment***

Upon completion of each workshop, instructors sought feedback from workshop participants and project partners through a combination of informal discussions and short surveys. The day after workshops were held, instructors visited schools to meet with principals and teachers to discuss how the workshops went. Discussion topics covered included: (a) what students learned; (b) what went well; and (c) how workshops could be improved in the future. Instructors also left a brief written *Workshop assessment survey* with participating teachers (see Appendix III – Workshop assessment tools). Teachers conducted the post-workshop survey verbally with students a few days after the workshop (once researchers had left the community). Teachers then provided instructor with a written summary of their discussions with students (to ensure confidentiality and anonymity). Lastly, after each workshop, all instructors completed an *Instructor debrief guide* to document their perspectives and impressions about the workshops (please refer to Appendix III for details). Through this feedback, workshop instructors were able to assess lessons learned from the workshops and identify best practices for using this method for engaging and communicating with Inuit youth in contaminants monitoring in wildlife. Constructive feedback received from the workshop assessment process helped us improved our approach for workshop planning and delivery. Here, we present a summary of the feedback received to date from students, school personnel, and workshop instructors.

### ***Feedback from workshop participants***

From my perspective, the students from grades 1 through 12 were very engaged in the presentations, and got much out of them. We are trying to raise awareness in students of science around us, and about how to become a scientist. As well, we are working to strengthen Inuktitut language skills in our students. The workshops helped with all three. Having an elder cut up the [ringed seal], with explanations, having our language teacher translate and focus on anatomy, and involving our older students in the dissection gave the students a good grounding. The follow-up presentations, activities, and interviews were all viewed positively by students and staff.

– Member of school personnel, 2016 workshop

Students and school personnel (teachers and principals) expressed an overall high degree of satisfaction with the workshops. Many students mentioned they had learned from the workshops, especially about Arctic food chains and contaminants. In Resolute



Bay, some students also indicated they had learned about the advisory currently in place in Nunavut relating to consumption of ringed seal liver and fat. Students who provided feedback highlighted their favorite workshop activities. The ringed seal dissection guided by a local hunter, the mock ringed seal stomach dissection activity (using Jell-O), the laboratory stations with plankton, and the Arctic food chain tag were most appreciated by students (for details about these activities, please refer to Appendix I; information sheets 2, 3, 4 and 5). These four activities were highly interactive and three of them involved direct manipulation of live organisms and scientific research equipment. According to teachers, the laboratory activity with plankton seemed to be most effective at explaining to students how contaminants are transported through Arctic food chains. Teachers involved in the Resolute Bay workshop also mentioned their appreciation of the session focusing on science careers, which provided high school students with an opportunity to learn more about how to become a researcher and environmental science career paths available to them. Most students commented that workshop instructors were interesting, engaging, fun and easy to understand. A majority of students also mentioned sharing information about the workshop with their family and friends.

School personnel and students also provided constructive comments on how workshop delivery could be improved in the future. Some students commented that they would like to participate in a dissection involving animals they have never seen dissected before (birds, caribou and polar bear were suggested by students). Teachers also encouraged instructors to take more time to introduce concepts that may be new to students (such as contaminants, bioaccumulation, and biomagnification), and to prepare additional teaching material and resources so that student learning about ringed seal health and contaminants could continue even after the workshops were over. In Sachs Harbour, teachers highlighted that instructors seemed surprised to learn that Sachs Harbour residents do not consume ringed seals very much, which suggested that instructors could improve their understanding of local customs prior to workshop delivery. Lastly, a few students did mention not enjoying the health puzzle game (see Appendix I; information sheet 7), during which students had to sit down and write their thoughts about what “health” meant to them. Our project team has started acting on all these recommendations by developing additional teaching material, adjusting some of the workshop activities, improving our understanding of local customs and cultural significance of ringed seals, and refining teaching styles and methods.

Overall, students and school personnel were thankful a workshop took place in their community. A member of school personnel involved in the 2018 workshop states:

Thank you from the staff and students [...]. We all appreciated your time and patience in teaching us about ringed seals, food chains, and so much more. You’ve prepared so many fun activities that we enjoyed and had so much fun, we didn’t even know we were learning. You may have inspired career paths for some, look for our names in the science journals.

### *Feedback from workshop instructors*

All instructors provided detailed comments relating to their workshop experience. In addition to provide specific suggestions on how to improve specific activities, instructors commented on the benefits and challenges associated with the workshops. Benefits and challenges outlined by instructors are summarized in the quotes and table below.

[This workshop] incorporates current NCP knowledge and shares recent data, it relies heavily on including elders and their experiences, and helps build relationships between community members and researchers. I think overall programs like this do a lot to strengthen the relationship and trust between [northern] communities and researchers.

– Instructor, 2016 workshop

These workshops are not only beneficial to the communities and students [...] the researchers who take part in these events learn a great deal from the community members and elders, but also it is a forum that allows them to practice and improve their own communication skills.

– Instructor, 2018 workshop

Meeting face-to-face with people that are involved in NCP projects is priceless. Communicating results, answering questions, listening to [community] concerns are all important benefits to these meetings. Discussing about their wildlife, environment, reality and living it, even for just a few days, makes everything more real and understandable.

– Instructor, 2016 workshop

I have always believed that Inuit Qaujimajatuqangit and Qaujimajangit should be included in any studies conducted by researchers in the Arctic. It makes me happy to see that this was a part of this workshop.

– Instructor, 2018 workshop

<b>Benefits</b>
Northern communities and students can gain a better understanding of contaminants research and its relevance to northerners.
Workshops contribute to building trust and establishing positive relationships between researchers and northern communities.
Instructors can improve their scientific outreach and communication skills and learn from community members and elders.
<b>Challenges</b>
Developing teaching material adapted to various age groups and group sizes and being able to quickly adapt workshop program to changing circumstances.
Needing to think more critically and carefully about how Inuit knowledge and science can work together to solve questions that researchers and community members have.

***Best practices***

Through the workshops, we were able to identify a number of best practices for sharing information about contaminants research, including:

- ✓ having a flexible approach to workshop programming (being able to make last minutes changes depending on the interests and needs of students and teachers, and local circumstances);
- ✓ developing workshop activities that can be easily adapted to various age groups (and dividing students into smaller groups according to age for certain activities);
- ✓ developing workshop activities that re-enforce the use of vocabulary in English and Inuktitut, as well as numeracy skills;
- ✓ preparing additional educational material that can be left with teachers to consolidate student learning once workshop is over;
- ✓ taking the time to introduce new concepts through interactive activities;
- ✓ conducting a mix of interactive hands-on activities and short presentations; and
- ✓ ensuring that instructors have an adequate understanding of the local culture community customs prior to beginning the workshops.

## Conclusion

The active participation of students of various ages during the workshops, and the comments received to date from community members and scientific researchers indicated the interest of all parties to continue this work. This positive feedback has encouraged our project team to develop this workshop as a continuing event in all the northern communities that contributes towards the NCP ringed seal core monitoring program. In fall 2018, we will conduct a third educational workshop in Arviat, Nunavut, with financial support from the NCP. Our ultimate goal would be to hold ringed seal health workshops in all four communities that contribute to this core monitoring program: Sachs Harbour (NWT), Nain (Nunatsiavut), Arviat and Resolute Bay (Nunavut). Workshop rotation between these communities could be ongoing in the future.

We hope that the experience and insights presented in this report can be helpful to scientific researchers, northerners, educators, and funding agencies interested in engaging northern communities in contaminants research on wildlife.

Main project outcomes are:

- ✓ Collaboration among northern students, elders, school personnel, community members and scientific researchers to increase understanding of contaminants in ringed seals and learn from Inuit knowledge about seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game;
- ✓ Active engagement of northern students with several types of interactive classroom activities (presentations, laboratory activities, group discussions, storytelling, games, and art activities) and school personnel welcomed researcher engagement in the classroom;
- ✓ Participation of northern college and graduate students contributed to increasing the capacity of northern students and early career scientific researchers to meaningfully engage with community members in contaminants research in Inuit Nunangat; and
- ✓ Implementation of a student-developed hunter survey for collecting local/traditional knowledge that may be associated with contaminants in ringed seals.

## **Appendix I – Workshop activities**



### 1. Presentations by scientific researchers

Level	Kindergarten to grade 12
Material needed	PowerPoint presentation prepared by scientific researchers Laptop, projector, screen
Learning objectives	Learn about ringed seal ecology, contaminants, food chains, bioaccumulation and biomagnification
Time required	15-20 minutes (can be broken down into shorter modules)

#### *Activity description*

Researchers prepare PowerPoint presentations which they can adapt to different student age groups, ranging from kindergarten to grade 12. Presentation slides can include images, short videos, and hydroacoustic recordings of marine mammals. Use of words should be kept to a minimum on the slides, with content increasing in complexity for older students. Presentations can be divided into short modules that can be presented throughout the workshop. When presenting, researchers should emphasize interactions with students by asking them questions and inviting them to discuss certain topics. Short and interactive presentations work best. Modules can be structured as follows:

1. Researchers say a few words about themselves
2. Description of key aspects of ringed seal ecology (morphology, distribution, abundance, activities throughout the seasons, habitat, impacts of climate change)
3. What are contaminants and how they are transported to the Arctic
4. What are food chains and how contaminants enter them
5. Description of the concepts bioaccumulation, biomagnification
6. Contaminants and human health
7. Description of why contaminants research is important and how contaminants research is done (help of local hunters for sampling, types of sampling, how scientific analyses are done and what we can learn from them)



Cassandra Debets presenting to students from the Inualthuyak School (Sachs Harbour, NWT) about her research on ringed seals (left), and discussing with one of the students after the presentation (right). Student had the opportunity to learn about how scientists study seals using a variety of technologies, for example satellite telemetry tags or underwater passive acoustic monitors.

## 2. Ringed seal dissection

Level	Kindergarten to grade 12
Material needed	Ringed seal, plastic bags, scientific sampling kit (optional)
Learning objectives	Learn about: ringed seal anatomy; traditional methods for harvesting and processing seals, and identifying abnormalities in harvested game; and scientific sampling
Time required	Approximately 2 hours

### *Activity description*

This activity aims to teach students about ringed seal anatomy and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game. It can also be a good opportunity to familiarize students with tissue sampling methods. Local elders and/or hunters are invited to lead this ringed seal dissection activity. Ideally, the activity can be co-led by both male and female elders/hunters having diverse perspectives to share with students. Before this activity, teachers and researchers can help students prepare some questions to be asked to elders/hunters during the dissection. The elders/hunters process a ringed seal in front of students while explaining how it done and what different parts of the seal were used for in the past and how they are used today. The elders/hunters also discuss how to tell if a seal is healthy and good to eat. Students have an opportunity to ask questions. Once the dissection is over, students can help pack up small plastic bags with seal meat and organs that can later be distributed to elders in the community (with support from the local Hunters and Trappers Organization). This activity can be combined with a demonstration of ringed seal tissue sampling done by scientific researchers. Researchers can ask students to sample seal tissues themselves to make this more interactive.



Peter Amarualik Sr. (left) showing students how to process a seal during a workshop held at the Qarmartalik School in Resolute Bay, Nunavut. Betty Haogak (centre), an Inuvialuit elder, and Magali Houde (right), research scientist with ECCC, shared their knowledge about ringed seals with students during a workshop in Sachs Harbour, NWT.

### 3. Interactive laboratory stations with plankton

Level	Kindergarten to grade 12
Material needed	Station 1: magnifying glass, light table, plankton (daphnids), pipettes Station 2: microscope, plankton, algae, pipettes
Learning objectives	Learn about Arctic food chains
Time required	Calculate 10 minutes per student for observing/feeding plankton

#### Activity description

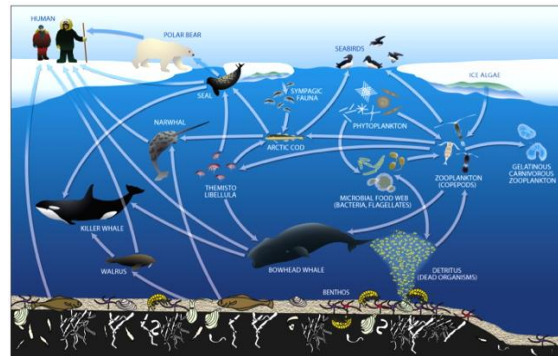
For this activity, two interactive laboratory stations are set up by the instructors. Students are divided into small groups (e.g., younger vs. older group) and rotate between stations. Before students begin their observations, the instructors can discuss what Arctic food chains are, using some slides (see example below).

#### Station 1 – Plankton observation

Students can observe plankton (*Daphnia magna*) using two types of instruments: a magnifying glass and light table; and a microscope.

#### Station 2 – Plankton feeding

Students can feed plankton with green algae.



Example slide for discussing Arctic food chains

During this activity, instructors can discuss food chain transfer with students. This activity is generally particularly popular with students. At the end of the activity, plankton can be kept in the classroom if a fish tank is available and fed with commercial yeast.



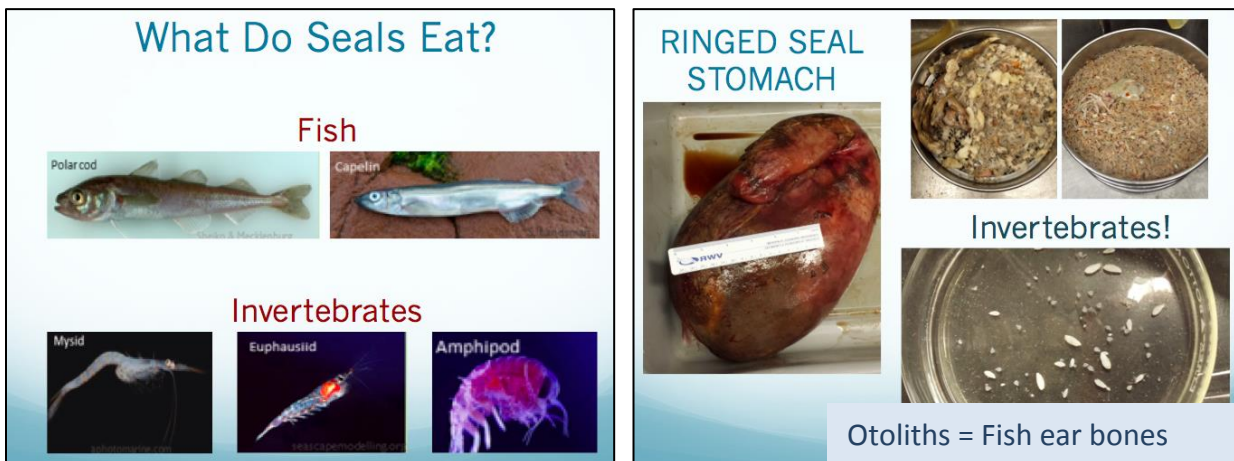
Inualthuyak School (Sachs Harbour, NWT) students feeding plankton (daphnids) with algae and observing plankton using a magnifying glass and light table with the assistance of Mick Appaqaq (left) and Magali Houde (right)

#### 4. Ringed seal stomach dissection activity

Level	Kindergarten to grade 12
Material needed	One aluminum cookie pie pan per 4-5 students (smaller and deeper ones are best), 2 Jell-O packets (combinations of red, purple, and orange are best to mimic seal stomach), beads of 5-10 different styles, latex gloves (one pair per student), forks (one per student), datasheets for students with prey items that are being used (one bead type = one prey type), PowerPoint slides, laptop, projector, screen
Protocol	Follow instructions on package to make the Jell-O and divide the liquid among the aluminum pie plates that are being used for the activity. Add beads into the pie tins. This can be done where each one is different and the pie tins can represent either different locations or years. Or the pie tins can all contain the same combination and number of beads.
Learning objectives	Learn about ringed seal diet
Time required	30 minutes

##### *Activity description*

This activity simulates a ringed seal stomach dissection that would be done in a lab to determine seal diet. The students will learn that in order to study ringed seal diet, researchers need tissue samples from the seal (blubber, muscle or liver) to do chemical analyses or, if ringed seal stomachs are collected, the contents of the stomach can be sorted and counted to get an idea of what the seal most recently consumed. Before doing this activity, students should be familiarized with what are Arctic food chains and should have some ideas of what ringed seals would eat.

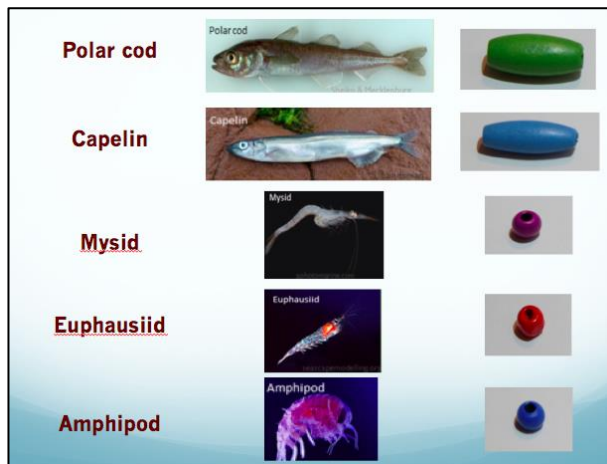


(Left) Example slide showing typical ringed seal prey types (note that prey types can change this depending on the community where this activity is taking place)  
 (Right) Example slide showing typical ringed seal stomach and stomach contents.



After discussing briefly that ringed seals consume mainly fish and invertebrates, students should be introduced to ways researchers can study diet. Using a slide or a video to show how stomach dissections are done (see example above) is the best way to explain the method to students in the absence of real seal stomachs. The conversation should center on stomach contents. Asking students what they think a ringed seal stomach looks like and what the “food” inside looks like is a great way to get them involved, particularly when discussing how researchers identify preys found in seal stomachs. The presenter should explain what fish and invertebrate otoliths are, because that is most commonly what is found in seal stomachs (not whole organisms). Otoliths are found in different sizes and shapes and used to identify which fish or invertebrate species the seal ate.

Once students have a good understanding of how researchers use stomach contents to study ringed seal diet, they are asked to put on latex gloves, take a fork and look for beads representing otoliths of organisms consumed by the seal in a mock stomach made of Jell-O. Prior to starting the activity, students should be shown a slide that will act as a key (see example below). The key will ensure that students can identify what prey species the beads represent. Larger beads can be used for fish otoliths and smaller ones for invertebrates. Students then identify preys (beads) and record their observations on datasheets. The slide can be left on the screen while students sort through the Jell-O stomachs.



Example slide of the ‘key’ students can use to identify the prey items in the Jell-O stomachs. For older students, the activity can be made more challenging by selecting beads that are very similar for the invertebrates so that students need to carefully sort the beads to accurately count preys.



Inualthuyak School students put on their gloves to dig in a ringed seal stomach (made of Jell-O) looking for preys (beads)



## 5. Arctic food chain tag

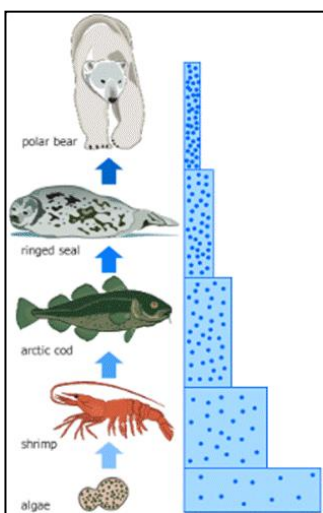
Level	Kindergarten to grade 6
Material needed	Special card deck for food chain tag (each card shows one of the following species: polar bear, ringed seal, Arctic cod, shrimp, algae), small poster illustrating species and food chain shown on the cards, five plastic jars (labeled with: polar bear, ringed seal, Arctic cod, shrimp, algae), elastic bands (five or more per student)
Learning objectives	Learn about contaminants biomagnification in an Arctic food chain
Time required	10-15 minutes

### *Activity description*

This activity can be used to ensure there is a balance between presentation time and active play during the workshop, especially for younger students. Before playing this game, the instructor should discuss the following concepts with students in plain language: food chain, bioaccumulation, and biomagnification. The instructor places a small food chain poster (see below) on the wall/board, lines up the five labeled plastic jars on a desk or on the floor, and then explains the rules of the game.

Each student gets one card that they should not show to anyone else. As in nature, there should be fewer polar bears than algae – the number of cards distributed to students should diminish as we go up the food chain. Each student also gets the same amount of elastic bands (five or more per student) that they wear around their wrist. When the game begins, they will “tag” each other. If the space is small, students can tag each other by shaking hands instead of running around. When a student is tagged by another, both students show their cards.

Whoever is above the other in the food chain wins the tag and gets one elastic band from the other (i.e., a polar bear will always win the tag and get many bands; an algae will always lose; a cod will win only if he gets a shrimp or an algae).



Food chain poster

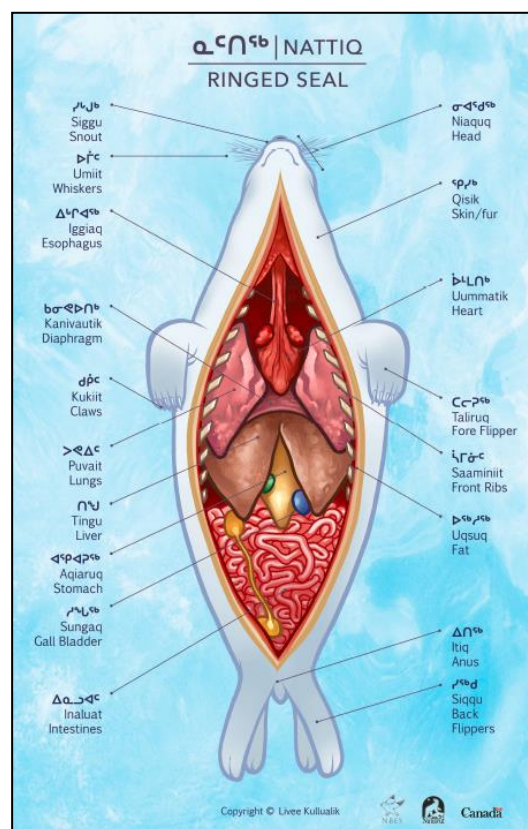
After about 5-10 minutes, the instructor asks students to bring the elastic bands they have left (if any) in the jars labeled with their card (e.g., students having a ringed seal card will drop their elastic bands in the jar labeled “ringed seal”). The instructor then discusses with the students the results shown in the jars. Normally, the highest amount of elastic bands should be in the polar bear jar, even if there were fewer bears in the group to begin with. The instructor connects these results with the concept of biomagnification. The game can be played more than once.

## 6. Ringed seal contaminants puzzle

Level	Kindergarten to grade 6
Material needed	Ringed seal poster, puzzle pieces (2 sets; 1 yellow / 1 red)
Learning objectives	Learn about ring seal anatomy and how ringed seals accumulate contaminants in different parts of their body; discuss health benefits and risks associated with consuming ringed seal
Time required	20-30 minutes

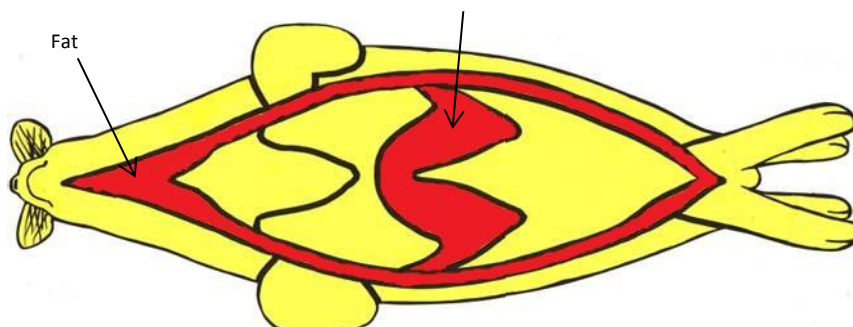
### Activity description

Students sit on the floor around the ringed seal poster. The instructor asks them to assemble the puzzle (start with one color) on top of the poster and to name puzzle parts in Inuktitut or English as they put them together. The instructor invites students to talk about what they know about seal anatomy and how their family uses different seal parts. The instructor then explains to students the concept of bioaccumulation (the longer seals are exposed to contaminants, the more contaminants they accumulate), and discusses how contaminants accumulate differently in different parts of the seal body. The instructor asks students to discuss and choose whether they think a specific piece (or body part) accumulates more or less contaminants. Students choose a yellow piece for “less contaminants” and a red piece for “more contaminants”. The instructor explains that ringed seals accumulate more contaminants in two specific places: their fat and their liver. The instructor and students discuss health benefits and risks associated with consuming ringed seal. At the end of the discussion, the puzzle should look like this, with two pieces only in red:



Ringed seal poster

Liver



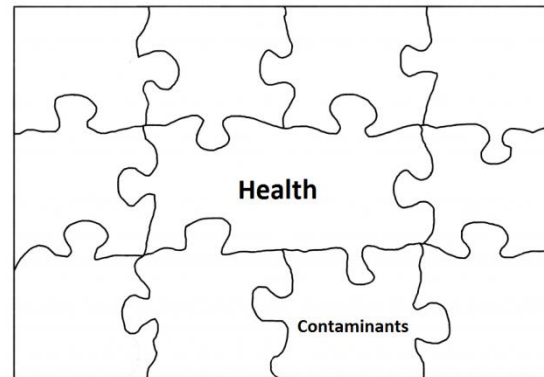
## 7. Health puzzle

Level	Grade 7 to grade 12
Material needed	Blank 'health puzzle' (one per student or group of students)
Learning objectives	Learn about the nutritional benefits of country food and discuss human health and contaminants
Time required	20-30 minutes

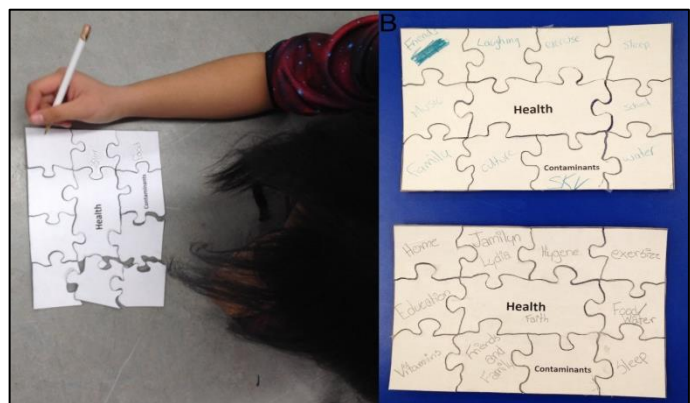
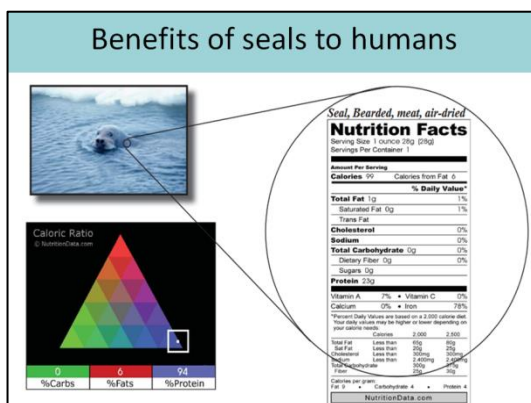
### Activity description

This activity emphasizes the nutritional benefits of country foods (and ringed seal, in particular) and allows for a discussion about human health, country foods and contaminants. Activity content can be adapted to specific age groups. Teachers can advise researchers on age-appropriate content.

The instructor begins with presenting some information about the nutritional benefits of consuming ringed seal (see example slide below), and discusses these benefits with students. In regions where a seal liver advisory is in place (Nunavut), this topic can be discussed as well. Students are then encouraged to discuss different aspects of their lifestyle that contribute to their health and well-being (e.g., sleep, exercise, family, friends, country food), and are invited to write down their thoughts on a piece of the ‘health puzzle’ (see both blank and completed puzzles below). Students can fill puzzle pieces individually or as a group and assemble puzzle pieces. The instructor encourages students to share their thoughts with the group.



Blank heath puzzle distributed to students



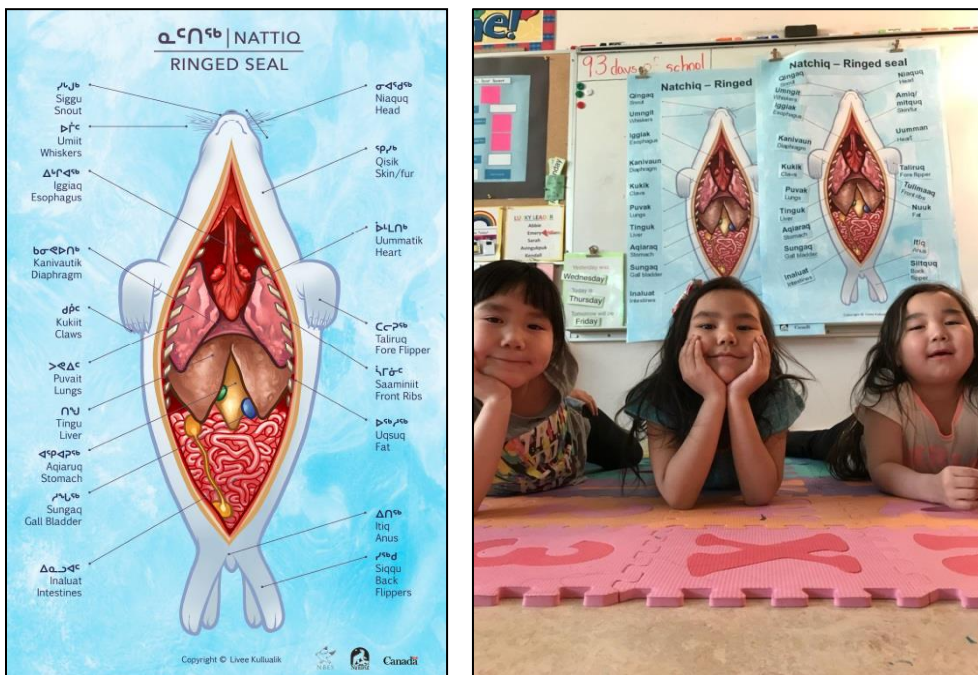
Example of slide illustrating the nutritional value of ringed seal (left), and student completing the 'health puzzle' activity (right)

## 8. Ringed seal anatomy game

Level	Kindergarten to grade 6
Material needed	Ringed seal poster (version without names of body parts), ringed seal body parts card deck (each card showing the name of one body part), blue tack (to stick cards to poster)
Learning objectives	Learn about ring seal anatomy and vocabulary in Inuktitut and English
Time required	10-15 minutes

### Activity description

This activity has been designed to provide an opportunity to students from kindergarten to grade 6 to review and consolidate the knowledge they have acquired during the workshop. It can easily be led by teachers without the presence of researchers. The instructor installs the ringed seal poster (version without body parts names) on a wall or board in front of the class. The instructor asks students to come stick body parts cards on the poster in front of the class and to say the name of their card in English and applicable Inuktitut dialect. The instructor can either distribute cards randomly to individual students (or pair of students) and then ask each student (or pair of students) to come up front to stick their card on the poster or go over the card deck, one card at the time, and ask for a volunteer to come up front for each card. Here is how the poster will look like at the end of the game:



Ringed seal poster with name cards (left) and students from the Inualthuyak School paying the 'Ringed seal body parts game' in Sachs Harbour, NWT (right)



## 9. Ringed seal crossword quiz

Level	Grades 7 to 12
Material needed	Crossword sheets (one per student or team), crossword puzzle key, prize for winning student or team (optional)
Learning objectives	Review and consolidate knowledge acquired during the ringed seal health workshop
Time required	20-30 minutes

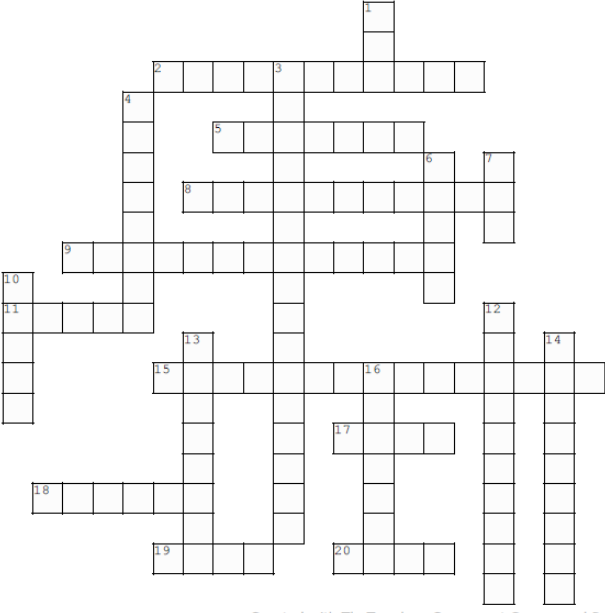
### Activity description

This activity has been designed to provide an opportunity to students from grade 7 to 12 to review and consolidate the knowledge they have acquired during the workshop. It can easily be led by teachers without the presence of researchers. The instructor distributes crossword sheets to individual students or teams of students. Once students have completed the crossword, the instructor asks individual students or teams to give their crossword to another student or team which will act as corrector/reviewer. The instructor discusses answers provided by students for each crossword item. Students or teams of correctors/reviewers rate the answers provided their peers. The student or team that gets the highest number of answers correctly wins the quiz!

Name: \_\_\_\_\_

### What we know about Ringed Seal / Nattiq

Complete the crossword below.



Created with TheTeachersCorner.net Crossword Puzzle Generator

#### Vertical

1. Type of fish that the ringed seal really likes to eat. (**cod**)
3. Process by which contaminants accumulate at higher levels in organisms that are higher in the food chain. (**bioaccumulation**)
4. Ringed seals use them to sense fish moving under water. (**whiskers**)
6. The Government of Nunavut advises pregnant women to avoid eating this part of the ringed seal body. (**liver**)
7. Protects the ringed seal against cold temperatures. (**fat**)
10. Ringed seals uses them to dig through ice. (**claws**)
12. Inluat (in English). (**intestines**)
13. Traditional Inuit game using a seal skin target (in English - two words). (**highkick**)
14. Top predator (two words). (**polarbear**)
16. Type of contaminant which can be found in ringed seals. Also the name of a planet. (**mercury**)

#### Horizontal

2. Sungag (in English - two words). (**gallbladder**)
5. A summary of the feeding relationships among plants and animals (two words). (**foodweb**)
8. Scientific name for ringed seal (in Latin - two words). (**pusanispida**)
9. Aglu (in English - two words). (**breathinghole**)
11. Ringed seals use them to hold their breath for up to 30 minutes underwater. (**lungs**)
15. The accumulation of a contaminant in an organism through time from all sources (e.g. food, water, air). (**bioaccumulation**)
17. Seal meat is a good source of this essential mineral. Also the name of a mineral that is mined in Nunavut. (**iron**)
18. First name of one of the ladies (scientists) who came to the school to talk about ringed seals. (**megali**)
19. Part of the seal used to make kamik. (**skin**)
20. Seals use them to see in low light condition underwater. (**eyes**)

Crossword quiz (left) and crossword puzzle key (right)



## 10. Ringed seal art work

Level	Kindergarten to grade 12
Material needed	Seal-shaped paper for drawing (minimum one per student), paint and/or crayons, prize for winning student (optional)
Learning objectives	Let student express through art what they have learned from the ringed seal workshop
Time required	45 minutes (or more if needed)

### *Activity description*

This art activity has been designed to provide an opportunity to students from kindergarten to grade 12 to review and consolidate the knowledge they have acquired during the workshop. It can be led by teachers without the presence of researchers. All teachers interested in participating in this activity can coordinate their efforts to ensure that student artwork is posted in one place or assembled on a giant poster at the end of the project. This activity can be turned into an art contest with prizes for best drawings/paintings.

The instructor distributes seal-shaped drawing paper to students (minimum one seal per student) and asks them to draw or paint their seal. Their drawings or paintings can be inspired by many themes, including:

1. What have I learned from or liked about the ringed seal workshop?
2. What do seals mean to me, my family and my community?
3. What I like about seals.



Ringed seal drawings made by students from the Inualthuyak School (Sachs Harbour, NWT) and the Qarmartalik School (Resolute Bay, Nunavut) during ringed seal workshops

## **Appendix II – Student-led Inuit knowledge survey**

Student-led Inuit knowledge survey																								
<b>Part I – General questions to elders and hunters participating in workshop</b>																								
<p>1. a) For how many years have you been hunting ringed seals?  b) Have you noticed any changes over the last 20 years in the following:</p> <ul style="list-style-type: none"> <li>i. ringed seal habitat                      YES or NO</li> <li>ii. ringed seal diet                      YES or NO</li> <li>iii. the taste of ringed seal           YES or NO</li> <li>iv. the health of ringed seal           YES or NO</li> <li>v. the number of infections ringed seals have   YES or NO</li> <li>vi. the average size of ringed seal   YES or NO</li> </ul> <p>If you answered yes to any of the above, please explain.</p> <p>2. Do you have any other concerns about ringed seals health in this region?</p>																								
<b>Part II – Questions to the hunter who harvested the seals used for dissection activities</b>																								
<p>3. What were the ice conditions when this seal was hunted? (Circle all that apply.)</p> <table border="0"> <tr> <td>No ice</td> <td>Thin ice (<math>\leq 1.5\text{m}</math>)</td> <td>Thick ice (<math>\geq 1.5\text{m}</math>)</td> </tr> <tr> <td>Wet</td> <td>Slushy</td> <td>Brittle</td> </tr> <tr> <td>Multi-year ice</td> <td>First year ice</td> <td>New ice</td> </tr> </table> <p>4. Did the ringed seal show any signs of parasites or injuries? (Circle all that apply.)</p> <table border="0"> <tr> <td>Skin infections</td> <td>Fused or deformed bones</td> <td>Internal parasites</td> </tr> <tr> <td colspan="3">Nodules or unusual bumps on any organs</td> </tr> <tr> <td>External parasites on the skin</td> <td colspan="2">Skin infections</td> </tr> <tr> <td colspan="3">Organs that were an unusual color or texture</td> </tr> <tr> <td colspan="3">Other: _____</td> </tr> </table> <p>If you circled any of the above, please explain.</p> <p>5. Is there anything nearby that could affect the health or diet of this seal?  (e.g., sewage outflows or moored vessels.)</p>	No ice	Thin ice ( $\leq 1.5\text{m}$ )	Thick ice ( $\geq 1.5\text{m}$ )	Wet	Slushy	Brittle	Multi-year ice	First year ice	New ice	Skin infections	Fused or deformed bones	Internal parasites	Nodules or unusual bumps on any organs			External parasites on the skin	Skin infections		Organs that were an unusual color or texture			Other: _____		
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## **Appendix III – Workshop assessment tools**

1. Workshop assessment survey for students and school personnel

Upon workshop completion, instructors distributed this short written survey to teachers who participated in the workshops, and asked them to discuss survey questions with students who attended the workshops (once instructors had left the community). Teachers then provided written summaries of their discussions to instructors.

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**Workshop assessment survey – Ringed seal health workshop**

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**Your feedback is important to us!**

We are interested in knowing what you and your students think about the ringed seal workshop that just took place at the Qarmartalik School. Your feedback will help us improve our work and allow us to share information with other researchers about best practices for engaging and communicating with Inuit youth as part of wildlife contaminants research.

The information you provide as part of this evaluation process will remain anonymous. It will be used only in reports, presentations and posters associated with this project.

We thank you in advance for your valuable collaboration!

The Environment and Climate Change Canada team

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**Please take a few minutes to discuss the following questions with your class, ideally the day after the workshop. We suggest that you note down student impressions as well as yours. Workshop instructors will contact you to gather your feedback and comments.**

1. What did you learn during the workshop? What do you remember?
2. What activity did you like the most? Why?
3. Is there an activity that you did not like? Which one? Why?
4. What did you think about the researchers who came here to present? Were they interesting? Were they easy to understand?
5. What could researchers do better if they came to visit again?
6. Did you discuss what you learned with your friends or family?



## 2. Instructor debrief guide

### *Instructors Debrief Guide*

Shortly after each workshop, all instructors completed in writing a detailed debrief guide to document their perspectives and impressions about the workshops.

### **Instructor debrief guide – Ringed seal health workshop (2018 version)**

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**Based on your workshop experience, please answer in writing the following questions.**

1. How does this workshop meet NCP's program objectives?
2. How does this workshop fit into your professional objectives?
3. What is it about this workshop that motivated you to become involved?
4. The main objective of this workshop is to teach students about ringed seal using both Inuit knowledge and science.
  - a. To what degree, do you think, this workshop does this?
  - b. If any, what challenges and difficulties do you recognize in meeting this workshop objective? (in regards to organization, content, timing, resources)
5. What other benefits/opportunities/advantages are there for you as a researcher to coming to this workshop in person?
6. During the 2018 Ringed Seal Contaminants workshop, instructors administered with students a pilot Inuit knowledge survey.
  - a. What worked well? (e.g., survey methods, type of questions asked, how questions were asked, who was involved, how translation was done, number of questions)
  - b. How could this survey be improved? (e.g., survey methods, type of questions asked, how questions were asked, who was involved, number of questions, how translation was done)
  - c. How can survey results contribute to the ongoing ringed seal monitoring program? What kind of information generated through the survey is most useful to monitoring efforts?
7. Understanding that this program is new, but may continue, what would you do the same as this year?
8. Understanding that this program is new, but may continue, what would you do different as this year?
9. Please write down all feedback *received from people* in Sachs Harbour (e.g., what workshop participants liked, what could be improved, how we could work with Sachs Harbour in the future).
10. Would you like to add anything else?