Introduction

Shouting Whales is a teacher resource for grades 6 to 8. It was developed jointly by Ocean Networks Canada and Open School BC in an effort to help teachers easily bring ocean science into the classroom. This package is intended to allow teachers to "plug in and play" an introductory inquiry unit in marine science, specifically in the fields of marine biology and acoustics.

Through this unit, students will investigate the science of sound as well as acoustical data collected by hydrophones on Ocean Networks Canada's underwater observatories. Using this data and additional evidence, students will be asked to think critically about how whales experience the marine soundscape. The unit focuses on various human-made sounds in the marine environment, and asks students to extrapolate on how marine mammals (specifically killer whales) may function in their changing ecosystem.

This unit culminates with a student-lead project in which students are challenged to come up with an action plan to inform, elicit action, or inspire legislation about the marine environment.

Key features:
> **Free and fully downloadable** – if you don't have Internet access in your classroom, you can download each lesson package and access everything from your local drive
> **Comprehensive** – contains all the media you need to implement the lesson plans as well as links to relevant websites, rubrics, student questions, and videos
> **Flexible** – lessons can be presented in any order and can be used independently or as a complete unit
> **Adaptable** – lessons and rubrics are provided in Microsoft Word format so they can be easily modified to suit your needs

The *Shouting Whales* resource includes:
> Seven lesson plans that outline activities and projects you can do with your class
> Video interviews with researchers from Ocean Networks Canada, the University of Victoria and the Vancouver Aquarium that relate directly to the lesson topics
> Acoustical data (audio, spectrograms, and waveform diagrams) from the Ocean Networks Canada hydrophone network, including whale calls, ship noises and other anthropogenic and natural sounds
> Relevant weblinks
> Assessment questions for each lesson
> Assessment rubrics for each project

Unit Overview

Title	Abstract
Lesson A: Human Sounds in the Ocean	This lesson explores noise in the ocean, with a special focus on human-made sounds. The lesson is divided into three sections, each focusing on a different intrusive sound. The lesson includes experiments, discussions, and sound clips that can be used collectively or independently. This lesson can be used as an introduction to noise in the ocean or can be used as a supporting lesson for understanding noise impact on whales. This lesson is intended to inspire an awareness of noise and its potential impacts in the ocean.
Lesson B: Properties of Sound	In this lesson, students take on the role of an atom and explore sound as a form of energy, and as a wave to better understand the movement of sound through the soundscape. Students use kinesthetic movements to explore the different components of sound. This lesson is intended to provide students with key vocabulary and concepts for the shouting whales unit. The lesson can be presented at any time during the unit.
Lesson C: Using Hydrophones for Research	In this lesson, students explore how hydrophones detect sound in the ocean, and how the data collected from hydrophones can be used to understand what is happening in the ocean. Students will listen to hydrophone data, which will lead them into the following lesson in which they explore how to read hydrophone data.
Lesson D: Visual Representations of Sound	In this lesson, students will look at data collected from hydrophones and compare waveform presentation of data and spectrogram presentation of data. Students will differentiate between the two forms and discuss the value and limitation of each. Also, students will compare what they learn by ear with what they can learn by eye. Throughout the lesson, the students will hear various aquatic sounds collected from hydrophones on the Ocean Networks Canada network.
Lesson E: The Role of a Researcher	In this lesson, students will explore how scientists identify and understand whale sounds and interactions. Students will explore different sounds both with audio and visual (spectrogram) interpretations. In the lesson, students will explore how researchers draw conclusions about whales and how they study the different types of whale calls. Students will also learn how researchers interpret hydrophone data, and how hydrophones are used to passively study large marine animals.
Lesson F: A Whale's Perspective	In this lesson, students participate in activities to try and understand 'what is it like to be a whale?' Using simple games, experiments, and a bit of imagination, students try and understand noise pollution from the whale's perspective. Students record their experiences with and without noise pollution in order to gain empathy for whales as they experience noise pollution from the whale's perspective.
Lesson G: Improving the Marine Soundscape	Throughout the unit, students have been exploring the science of sound as well as acoustical data collected throughout the Ocean Networks Canada hydrophone network. Students have been asked to think critically about how whales experience the marine soundscape, various human impacts on the marine soundscape, and how marine mammals (specifically killer whales) function in the marine environment. In this final lesson, students are asked to create an answer to the question "How can improvements be made to the soundscape of marine mammals through action, legislation, and information?" Students are tasked with coming up with an action plan to either inform, elicit action, or inspire legislation about the marine environment.

Guide to the Lesson Plans

Unit Questions	**Suggested Prior Lesson**
Lesson Question	**Suggested Subsequent Lesson**
Grade Level 6-8	**Time Required** *One session is equivalent to a one-hour block.*

Abstract
This section gives an overview of the lesson, including activities and intended learning.

Prior Knowledge/Background for Students
This section suggests prior knowledge for students. Where appropriate, other lessons in this unit are suggested.

Objectives *Lesson objectives are highlighted in this section. Educators are invited to explore lesson objectives further and add their own.*	**Materials** *This section lists all the materials you'll need for this lesson.*	**Suggested Links and Downloads** *Here you will find a list of all downloads and external links referred to in this lesson.*

The "Hook" (Suggested Introduction)
Introductory hooks are intended to engage students in the initial problem and start thinking. Hooks can also be used as part of the activity section or to summarize activities.

Activity Outline
The Activity Outline is broken into Activity, Resources, and Suggested Teaching Points. Educators are invited to modify lessons as appropriate for their class. Links to media and external websites can be accessed as direct links in the lesson.

Researcher Interviews
This section references video interviews with researchers from Ocean Networks Canada, Vancouver Aquarium, and the University of Victoria. Each researcher shares comments on questions similar to those explored by students, summarizing key concepts and ideas from each lesson. Teachers are encouraged to use the videos as part of wrapping up each lesson or concept. Videos range from 2-8 minutes.

Suggested Summary
The summary is intended to recap and close the lesson. Summary questions can be used to inspire further inquiry and/or as a form of assessment. Teachers may also choose to assign summary questions to allow students to show what they know.

Show What You Know

This section is intended to allow teachers to assess students' understanding. Each activity is intended to be open-ended enough that teachers can determine how long their students work on one of the sections below. Teachers may choose to end each lesson with a quick written piece, short role-play, or poster, or they may choose to give students several days to complete their work. Teachers are also able to choose one task for all their students or allow the students to select one of three tasks. Teachers may also choose to combine all six tasks from one section (i.e. writing) to create a portfolio. All tasks can also be completed in groups or individually.

Make a Written Piece	Make a Media Presentation	Take on a Role
These tasks are intended to allow students to share their knowledge through writing. Each piece can be done as a quick write or as an extended piece.	*These tasks are intended to allow students to show what they know visually. Teachers may choose how large each media piece is, depending on time and engagement.*	*These tasks are intended to allow students to put themselves in the mantle of the expert and think critically from alternative perspectives. Students can perform their roles, or present them in written form.*

Assessment Options

Assessment-probing questions are intended as checklist-style assessments for teachers (i.e., yes/no per student). Teachers may also choose to assign probing questions as written work for deeper assessment of learning outcomes.

Show What You Know assignments include assessment rubrics that reflect assignment criteria.

Teachers may also choose to assess participation using the participation rubric found here in the Teacher's Guide on the following page.

Participation Rubric

Criteria	4	3	2	1
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard.	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Quality of Work	Provides work of excellent quality.	Provides high quality work.	Provides work that occasionally needs to be checked/redone by other group members to ensure quality.	Provides work that usually needs to be checked/redone by others to ensure quality.
Attitude	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is publicly critical of the project or the work of other members of the group. Usually has a positive attitude about the task(s).	Often is publicly critical of the project or the work of other members of the group. Often has a negative attitude about the task(s).
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

Exploration Activities

King's Chair
Place a chair at the front of the room. Ask the discussion question, and invite students to come to come sit in the chair and share their feelings/ thoughts. As king, they are allowed to say anything, without being challenged. When they are finished speaking, they must leave the chair. As soon as they leave the chair, another student may take the place of the king, becoming the new king. The idea is that students all get a chance to speak, without being challenged or interrupted.

Think/Pair/Share
Students are asked to consider a point (Think). After some time thinking, they find a partner or group (Pair) and discuss the point as a group (Share). Alternatively, after the students think and pair, they can share their ideas with the whole group, creating a class discussion from the small groups.

Fish Bowl
Five chairs are placed in the middle of the room in a circle. The rest of the students gather around the outside of the chairs in a circle. Five students sit in the chairs and discuss the question or point. After a seated student has spoken, the student gets up and joins the standing circle of students standing around the outside. Any student from the outside standing circle can then move into one of the open chairs, and contribute to the discussion.

Round Table
Students break into groups (often with specific stances on the issue being discussed), and talk about their feelings/ideas/stance on the issue or point. After some time, each group sends a representative to the 'round table' who will represent the group's views on the issue. All groups will be given a chance to speak, and after all representatives have spoken, they will return to their group to come up with their next point or contribution.

> **Optional**: the round table can be held within earshot of the groups so that students from each group can hear the direction of the round table.

> **Optional**: the round table can be held out of earshot of the groups so that their representative is the only contact the groups have with the round table. This option may be used to draw parallels between instances where it would not be feasible to have all group members present at a discussion. For example, at a business meeting, each department is represented by a manager, not every employee in the company.