

# UNIT 3

## THE NECHAKO WHITE STURGEON

*OUR LOCAL PREHISTORIC GIANT*

## Introduction to Unit 3

**Number of Lessons:** 6

**Duration of Unit:** 3 weeks

**Rationale/Overview:** The purpose of this unit is for the students to identify and gain a deeper awareness of the endangered Nechako white sturgeon and the many challenges the species currently faces. Students need to become aware of local issues in order to connect to the Nechako watershed.

**Background and Teacher Preparation Required:** It would be beneficial if the students have already learned about the Nechako River (Unit 1 Introduction and/or Unit 2 Watershed, Riparian Zones and River Habitat).

Additionally, at any point in the Unit, teachers are encouraged to show all or parts of YouTube Video: *Every Sturgeon Counts*. This video provides a great introduction about the importance of Nechako white sturgeon, particularly for First Nations, but also on the anatomy and safe handling procedures for sturgeon.

The teacher touches base with local expert(s), such as Cory Williamson or Brian Frenkel of the Nechako White Sturgeon Recovery Initiative ([www.nechakowhitesturgeon.org](http://www.nechakowhitesturgeon.org)).

**Unit Project:** Teachers are encouraged to have students complete a Unit Project. This project is additional to the curriculum, and can be done outside classroom time. Teachers are welcome to provide class time to work on this project. The project provides an opportunity for students to be creative and use all their learning to create a skit about the day in the life of a Nechako white sturgeon. See Handout.

**Cross-Curricular Connections:** Math, Fine Arts, Language Arts, Social Studies, P.E.

**Resources:** Bulletin board for art projects; art materials/dress-up clothes; Nature Guide of the Nechako Valley; PowerPoint Presentations; model of a sturgeon; Sturgeon life cycle poster; computers; science journals, SMARTboard, whiteboard, markers, maps of the Nechako, Fraser, Columbia and Sacramento watersheds; guests/local experts; outdoor clothing; cameras/phones; websites:

<http://www.uppercolumbiasturgeon.org>

<http://www.dfo-mpo.gc.ca>

<http://www.wildbc.org/publications-resources/waterstewardship/guide.pdf>

<http://www.deepspacesparkle.com>

<http://www.env.gov.bc.ca/wld/fishhabitats/sturgeon/index.html>

<http://www.youtube.com/watch?v=YhrEJUEi-ow> - YouTube video!

Brochure: 2010 Reducing By-Catch Brochure.pdf (available on thumb drive)

## Overview of Lessons

### LESSON 3-1: NECHAKO WHITE STURGEON ANATOMY - FORM & FUNCTION

**Time of Lesson:** 1 hour

**Instruction Objectives:** Student can identify 5-10 external parts of the sturgeon.  
Introduce Unit Project: *My Nechako white sturgeon*.

**Strategies and Activities:** Life size replica of the Nechako white sturgeon with worksheet, and display model. Introduce Unit Project and discuss.

**Materials:**

- SMARTboard PowerPoint presentation: *NWS External Anatomy*
- Handout: *Worksheet 3a - Nechako White Sturgeon External Anatomy*
- Handout: *Worksheet 3b - Venn diagram: Sturgeon versus Sockeye Salmon*
- Display: *Life-size Nechako White Sturgeon* replica available from NWSRI
- YouTube Video: *Every Sturgeon Counts - Part 5*  
(<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- Handout: *Unit Project - My Nechako white sturgeon*

### LESSON 3-2: LIFE CYCLE

**Time of Lesson:** 1 - 1.5 hours

**Instruction Objectives:** Students can illustrate the life cycle of the Nechako white sturgeon.

**Strategies and Activities:** Brainstorm about what students know about the life cycle of the Nechako white sturgeon. Use the 'Every Sturgeon Counts' video to inform students about real-life interactions with sturgeon. Use art activity and student lead discussion to promote understanding of each life cycle stage. Encourage work on Unit Project.

**Materials:**

- SMARTboard PowerPoint Presentation: *NWS Life Cycle*
- Handout: *Worksheet 3c - Nechako White Sturgeon Life Cycle*.
- YouTube Video: *Every Sturgeon Counts - Part 1*  
(<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- Class Activity: Art supplies including large paper, markers, scissors, cut-outs etc.

## LESSON 3-3: STURGEON HABITAT

**Time of Lesson:** 1 hour

**Instruction Objectives:** Students can explain the habitat requirements of Nechako white sturgeon.

**Strategies and Activities:** Discuss habitat requirements of the Nechako white sturgeon. Allow work on Unit Project.

**Materials:**

- SMARTboard PowerPoint presentation: *NWS Habitat and Food*
- Handout: *Worksheet 3d - Habitat & Food.*
- Handout or Interactive: *Worksheet 3e - Wordsearch Review*

## LESSON 3-4: STURGEON DECLINE

**Time of Lesson:** 1.5 hour

**Instruction Objectives:** Students can reflect on how the environment of the Nechako white sturgeon has changed over the past 100 years, and how that has affected the survival of the species.

**Strategies and Activities:** Discuss how the habitat in the Nechako River for the sturgeon has changed over time, from 10,000 years ago to 100 years ago to now. Brainstorm on the meanings of 'adaptation' and 'survival' and relate to human experiences, re-examine the life cycle and link life cycle, habitat and survival together. Review restoration projects currently occurring for Nechako white sturgeon. Allow work on Unit Project.

**Materials:**

- YouTube Video: *Every Sturgeon Counts - Part 4*  
(<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- SMARTboard PowerPoint presentation: *NWS Decline*
- Website: [www.nechakowhitesturgeon.org](http://www.nechakowhitesturgeon.org) for a list of current restoration projects.

## LESSON 3-5: GUEST SPEAKERS AND FIELD TRIP

**Time of Lesson:** 1.5 hours

**Instruction Objectives:** Students can demonstrate an overall understanding of Nechako white sturgeon life history and habitat needs and how these relate to overall survival of the species. Students participate in field trip and/or host guest speakers in classroom. Students can identify First Nations traditions in relation to the Nechako River and the Nechako white sturgeon.

**Strategies and Activities:** Have local experts attend class to speak in regards to the Nechako white sturgeon (local biologist and First Nations guest speaker), and/or go to Nechako White Sturgeon Conservation Centre for a tour. Discussion about the value the Nechako white sturgeon holds for the students and what it would mean to them if it became extinct. Allow work on Unit Project.

### **Materials:**

- Guest Speaker: Local First Nation speaker (contact NWSRI for contact details or contact local First Nation Band Office directly).
- YouTube Video: *Every Sturgeon Counts - Part 2* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- Field Trip: Nechako White Sturgeon Recovery Centre in Vanderhoof. Contact the Centre or the Nechako White Sturgeon Recovery Initiative for details and to book the tour. Extend the tour to a walk along the Nechako River to view the spawning site (just upstream of Burrard Avenue).
- If unable to get to the Recovery Centre, invite Guest Speaker to the classroom: Local biologist and/or White Sturgeon Recovery Centre coordinator (contact NWSRI for contact details or Contact the Centre or the Nechako White Sturgeon Recovery Initiative directly).

FUTURE CONSIDERATIONS: Sturgeon release event (fall 2014 and beyond).

## LESSON 3-6: PRESENTATIONS

**Time of Lesson:** 1.5-2 hours

**Instruction Objectives:** Students conduct oral presentations of Unit Project to class.

**Strategies and Activities:** Students present their Unit Project to the class.

### **Materials:**

- Projector, SMARTboard, whiteboard, etc. as needed for presentations.

# Every Sturgeon Counts

**Found at: <http://www.youtube.com/watch?v=YhrEJUEi-ow>**

This video was put together by the Nechako White Sturgeon Recovery Initiative and the Carrier Sekani Tribal Council. The objective of this project is to: 'assure that fisher families have the necessary tools in their fishing boats to allow for the successful release of live sturgeon caught in a gill net.'

Cora McIntosh of Saik'uz First Nation, narrates this informative video on the importance of Nechako white sturgeon to the Nechako River, First Nations and to the history of our area. The video is a very good addition to this curriculum and should be shown in part or its entirety during the course of this curriculum. Lesson suggestions are given below.



**Total length of the video is 45:35 minutes.** It is broken down into several sections.

- **Defining the Problem, Recruitment Failure:** 00:00 to 04:10  
A quick and clear overview of the plight of the Nechako white sturgeon. Useful to be viewed in Unit 1 Lesson 1-1 Introduction, or Unit 3 Lesson 3-2 Life Cycle.
- **Salmon, Sturgeon and First Nations** 4:10 to 16:40  
This section focuses on local First Nation culture and history with the Nechako River, salmon, Stuart Lake, and Nechako white sturgeon. A good addition to Unit 1 Lessons 1-1 and 1-2; Unit 3 Lesson 3-5.
- **About the Sturgeon Release Kit and Program:** 16:40 to 21:25  
Details about this program operated by the NWSRI.
- **Procedure for Releasing Sturgeon Safely:** 21:26 to 31:20  
Recommended to show this section during Unit 3 Lesson 3-4 Sturgeon Decline. This section highlights the impact humans can have on sturgeon as well as showing students how to reduce the risk of injury or death of the animal if it is caught in a net. Also demonstrates a practical use of science and research that leads to conservation of a species.
- **Sturgeon Anatomy:** 32:57 to 34:10  
Overview of sturgeon anatomy using a live sturgeon in the river. Fits nicely with Unit 3 Lesson 3.1 External Anatomy.
- **Patching a Gill Net:** 34:13 to 43:17  
A detailed lesson on repairing nets.
- **Closing Remarks about being Stewards of the Sturgeon:** 43:18

Unit Project:



# A day in the life of my Nechako white sturgeon

As individuals or in small groups, write and act out a **skit about a typical day in the life of a Nechako white sturgeon** - your Nechako white sturgeon. Use what you have learned throughout this unit, as well as other units about sturgeon to create your skit.

The skit **must** include:

1. the name and general description of your sturgeon (include an image that can be a real photo or an image your create).
2. where your sturgeon lives (be specific).
3. at minimum three things that happen to your sturgeon, or that your sturgeon does in his/her day.
4. your script (e.g. a journal entry) handwritten on paper that you hand in to your teacher. Your script has to include everything you are going to do in your skit.

### Other Requirements:

- It should be no longer than 3 minutes long.
- You can use graphics, the SMARTboard, props etc.
- You are allowed to do further research on Nechako white sturgeon for more information, but you must show where you found your information if you learned it outside the classroom.

### Things to consider:

- are there any issues or concerns for your sturgeon?
- is your sturgeon from now, long ago or the future?
- use your imagination!!! It can be a fantasy, but it has to include real elements that you learned in class, e.g. things happening to sturgeon today in the Nechako River.

BE CREATIVE AND SPECIFIC!!! HAVE FUN!!!

**This project is due:** \_\_\_\_\_



Unit Project:

# A day in the life of **my Nechako white sturgeon**

Select either individuals or in small groups for this project. Students can work in or outside classroom time for this project.

The skit **must** include:

1. the name and general description of your sturgeon (include an image that can be a real photo or an image your create).
2. where your sturgeon lives (be specific).
3. at minimum three things that happen to your sturgeon, or that your sturgeon does in his/her day.
4. your script (e.g. a journal entry) handwritten on paper that you hand in to your teacher. Your script has to include everything you are going to do in your skit.

### Other Requirements:

- In addition to the requirements already included, add your own requirements as suitable for your classroom and class population.

### Encourage students to:

- be creative - think outside the box
- seek outside information - particularly from First Nation family or community members
- set their story in another time period or do a comparison between the past and now, or now and the future
- if the student is shy, encourage an exceptional written product and the use of graphics and the SMARTboard to do the talking for the oral component

HAVE FUN!!!



## Lesson 3-1: Nechako White Sturgeon External Anatomy - Form & Function

**Time of Lesson:** 1 hour

**Rationale:** The purpose of this lesson is to describe the external anatomy of the Nechako white sturgeon and relate its form with how it lives in its environment (function). This lesson introduces the Unit Project, which will allow students to summarize all they have learned about the Nechako white sturgeon.

**Instructional Objectives:** Student can identify 5-10 external parts of the sturgeon. Introduce Unit Project: *My Nechako white sturgeon*.

**Strategies and Activities:** Life size replica of the Nechako white sturgeon with worksheet, life cycle poster, art project. Present Unit Project and discuss.

### **Materials:**

- SMARTboard PowerPoint presentation: *External Anatomy of Nechako White Sturgeon*
- Handout: *Worksheet 3a - NWS External Anatomy* (double-sided)
- Display: *Life-size Nechako White Sturgeon* replica available from NWSRI
- YouTube Video: *Every Sturgeon Counts - Part 5* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- Handout: *Unit Project - My Nechako white sturgeon*

### **Student Assessment:**

- Observation and participation in class and small group activities.
- Ability to identify the external parts of the sturgeon and relate those to function.
- Completion of Handouts.

## LESSON PLAN

### Introduction (5 minutes)

Introduce the new Unit and the rationale:

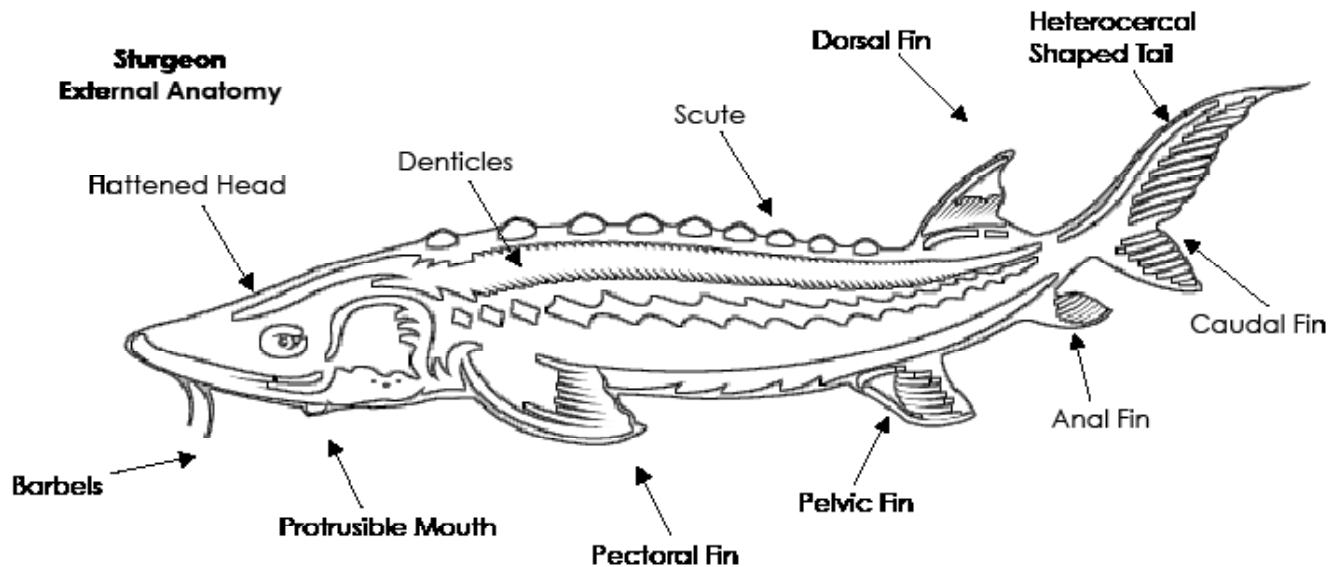
- To identify the shape and life cycle of the Nechako white sturgeon and relate this information to how and where it lives and what it needs to survive.
- To gain a deeper awareness of the endangered Nechako white sturgeon and the many challenges the species currently faces.

### Activity (5 minutes)

Introduce the Unit Project: *My Nechako white sturgeon* and provide Handout. Answer any questions about the project. Give a clear timeline for the project.

### Activity (10 minutes)

Show the plush display model of the Nechako white sturgeon. Have students gather round, touch it and name as many parts of the sturgeon that they know already.



### Activity (10 minutes)

On SMARTboard bring up YouTube Video: *Every Sturgeon Counts* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>). Scroll to Part 5 at the 32 minute and 57 second mark. Watch the roughly 2 minute video on sturgeon external anatomy.

## Activity (20 minutes)

Have PowerPoint presentation *NWS External Anatomy* on the SMARTboard. By looking at an animal, we can learn a lot about how it lives by the shape of its body. Start a short discussion about **Form & Function**. Write on white board the students' comments.

### Key Points

Every animal (and plant) has a shape that is made up of a number of body parts. Each body part has a FORM or SHAPE. The form (e.g. shape of the head) of the body or body part determines how the animal will move, eat, mate, protect itself etc. This is the FUNCTION.

Form influences function and function influences form.

Over a very long, long time form-function can change depending on changes in the environment. If the change in the environment is 'sudden', the animal may go extinct.

Go through *NWS External Anatomy* on the SMARTboard. Stop where necessary to discuss the content. Handout *Worksheet 3-1a External Anatomy* prior to or after working through the slideshow.

### Ask

What does the body form of the Nechako white sturgeon tell us about how it moves, eats, and protects itself?

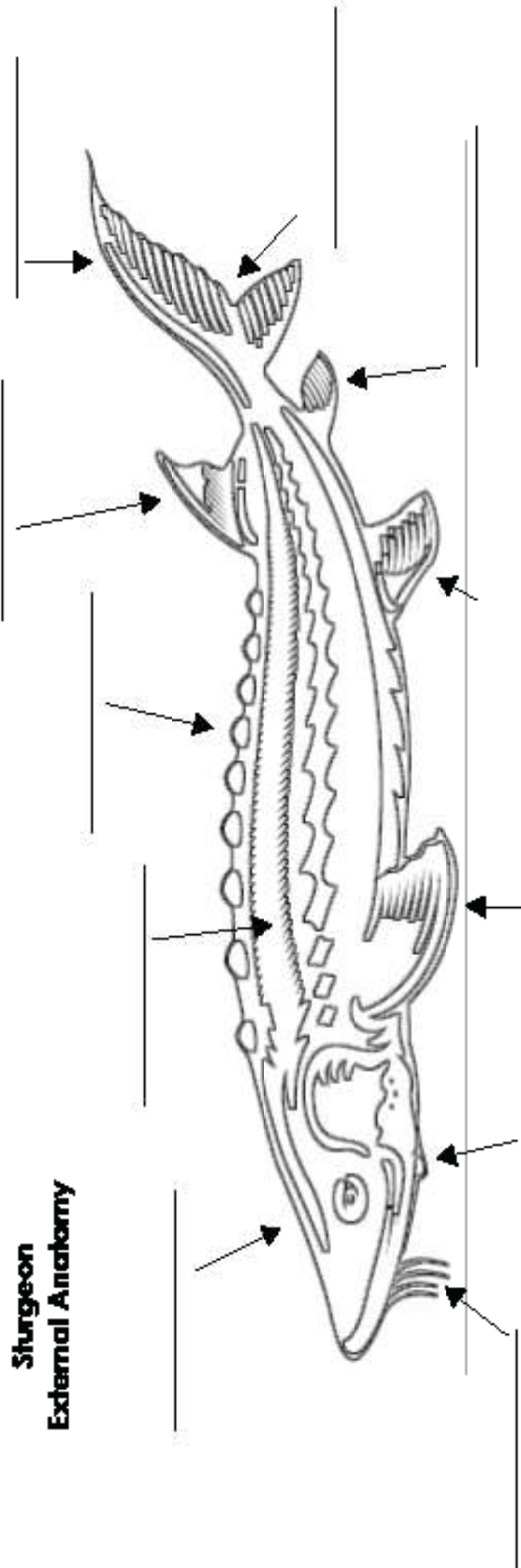
Form	Function
<b>Flattened Head</b>	Shaped for bottom feeding.
<b>Protrusible Mouth</b> - comes out of the body.	Mouth comes out of body and suctions food off the river bottom.
<b>Barbels</b> - 4 located under the head ahead of the mouth.	Sensory. Used to smell for food. Useful in murky or dark water.
<b>Dorsal Fin</b> - fin on the back of the sturgeon.	Used for stabilizing and preventing rolling.
<b>Caudal Fin - heterocercal</b> , meaning that the top is longer than the bottom.	Used for propulsion.
<b>Anal Fin</b> - located near the anus.	Used for stabilization
<b>Pelvic Fin</b> - located ahead of the anal fin.	Used for stopping and turning and movement up and down the water column
<b>Pectoral Fin</b> - fins closest to the head.	Used for stabilization and downward movement.
<b>Denticles</b> - type of small toothlike plate - no scales on a sturgeon.	Used for protection against other fish. Smooth in one direction (head to tail), rough in the opposite.
<b>Scute</b> - large sharp scales. There are five rows of scutes on the body of a sturgeon.	Used for protection. Sharper in juvenile sturgeon because they are smaller and have more chance of predation. Easy to cut your hand on a scute.

Sturgeon do not have bones, but a **cartilaginous skeleton**.

# Nechako White Sturgeon External Anatomy

Fill in the body part names of the sturgeon. Colour your sturgeon as it would look in nature.

Does the sturgeon have a bony or cartilage skeleton? \_\_\_\_\_



# Nechako White Sturgeon External Anatomy

Fill in the boxes with the body FORM and its FUNCTION.

FORM	FUNCTION

## Lesson 3-2: Nechako White Sturgeon Life Cycle

**Time of Lesson:** 1.5 hours

**Rationale:** The purpose of this lesson is to introduce the life cycle of the Nechako white sturgeon to further develop the students' understanding of the Nechako white sturgeon. Understanding the life cycle of a species helps foster a greater respect for all sizes of animal as well as time of year, as well as make the connection between animal, habitat and season.

**Instructional Objectives:** Students can illustrate the life cycle of the Nechako white sturgeon.

**Strategies and Activities:** Brainstorm about what students know about the life cycle of the Nechako white sturgeon. Use the 'Every Sturgeon Counts' video to inform students about real-life interactions with sturgeon. Use art activity and student lead discussion to promote understanding of each life cycle stage. Encourage work on Unit Project.

### **Materials:**

- SMARTboard PowerPoint Presentation: *NWS Life Cycle*
- Handout: *Worksheet 3b - Nechako White Sturgeon Life Cycle (2 page Handout)*.
- Handout: *Worksheet 3c - Venn diagram: Sturgeon versus Sockeye Salmon*
- YouTube Video: *Every Sturgeon Counts - Part 1*  
(<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- Class Activity: Art supplies including large paper, markers, tape etc.

### **Student Assessment:**

- Observation and participation in class and small group activities.
- Ability to identify the stages of the life cycle.
- Participation and quality of work in class activity.
- 'Ticket out the Door' "Tell me one stage of the life cycle of the Nechako white sturgeon."

## LESSON PLAN

### Activity (5 minutes)

Brainstorm about what the students already know about the life cycle of fish in general or specifically the Nechako white sturgeon.

### Activity (10 minutes)

Call up the YouTube Video: *Every Sturgeon Counts* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>) on the SMARTboard. Watch Part 1 (00:00 to 04:10). This video provides a simple and clear introduction to the life history of the Nechako white sturgeon as well as the issues it faces for continued survival.

#### *Key Points*

Nechako white sturgeon are endangered, there are less than 350 animals in the river.

The factors leading to the observed **recruitment failure** (the number of young surviving to adulthood and reproducing) is not completely understood. Research and education continue.

### Activity (25 minutes)

Handout *Worksheet 3b - Nechako White Sturgeon Life Cycle*. Draw attention to the life cycle diagram and point out the 5 main stages - Adult, Spawning, Eggs, Larvae and Juvenile. Have students follow along as they watch the PowerPoint presentation. Show *Nechako White Sturgeon Life Cycle* PowerPoint presentation.

#### *Ask*

What life cycle stage is causing recruitment failure and the decline of the species? *The egg to juvenile stage. Very few young sturgeon currently in the river.*

### Life cycle facts

Because sturgeon are so long lived they reach maturity at a much later age than most species. **Female reach maturity at 40 years of age, males reach maturity in their 20-25 years old.**

Mature sturgeon spawn between **May to July** when the water temperature is between **14-18°C**.

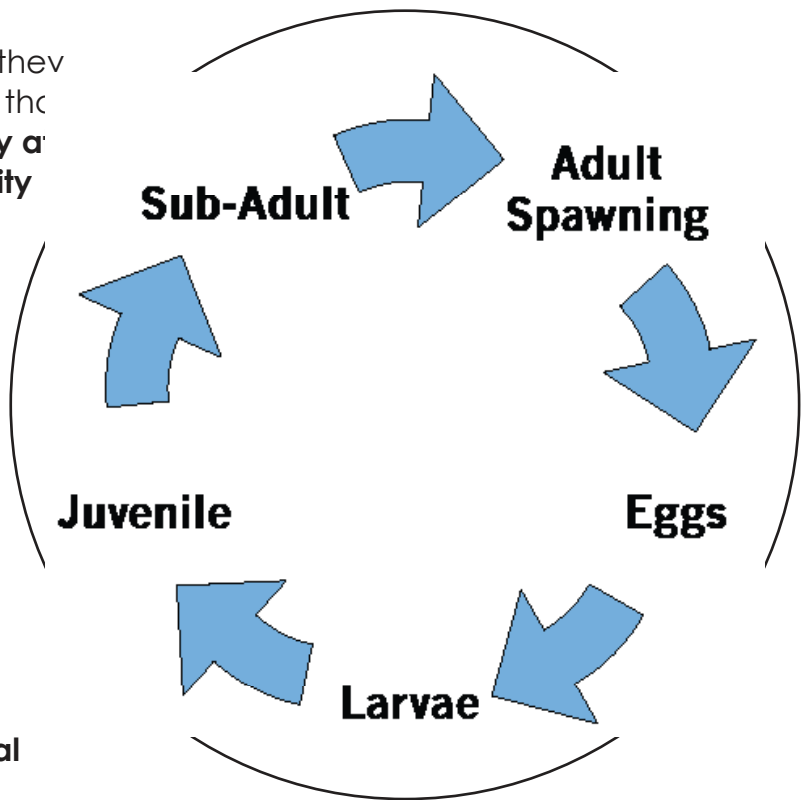
**High-quality spawning habitat** needs the following conditions:

- substrate – **clean stones-gravel to large rocks**, not sand
- water velocity – **swift flowing water**
- depth – **deep water**

A single female can produce **several million eggs**. They **spawn every 3 to 6 yrs**. **Whether a female spawns depends on having an adequate spawning site, and the proper water temperature**. If conditions are unfavourable she will **reabsorb** her eggs and miss spawning that year.

Female sturgeon **broadcast (releases) their eggs into water**, one or more male sturgeon then fertilize the eggs. In the Nechako River, only one known spawning site has been identified - in proximity to the bridge in Vanderhoof.

Once fertilized **eggs sink to the bottom and adhere to plants and rocks**. If too much sand is in the gravel, the eggs can not adhere and they drift downstream. Also, they get covered with sand and can not 'breathe' so they choke and die.



**Eggs hatch between 7 and 10 days** (cooler temperatures cause them to hatch later) into **tadpole like larvae**. The larvae hide in the gravel and live off their **yolk sac for the first 12 days** and then start to feed on **aquatic insects and zooplankton**.

After **20 days larvae develop into juveniles and emerge to find habitat in the river**. They resemble their parents with a full set of scutes, and fins.

White sturgeon are vulnerable throughout their egg and larvae stage. In areas of poor habitat they are **susceptible to predation, and lack of food. Less than 0.1 percent of juveniles survive past their first year.**

**Lack of young sturgeon surviving to reproductive again = recruitment failure.**



**Activity (20 minutes)**

Gather craft supplies including large paper, markers and tape. Have students split into groups of 2 or 3. Each group selects a life cycle stage and illustrates their paper with words and images of key points from that life cycle stage (note, more than one group will have each life cycle stage). After 10 minutes have the groups tape their papers around the room, in the order of the life cycle. Have the students cycle around the room to view each other's work, or the teacher can walk around and read out each group's responses and have a class discussion considering the following questions:

Ask

How important is habitat and river conditions to sturgeon spawning and egg development?

How much impact do predators have on sturgeon survival?

What things do we do along the Nechako River and in the watershed that may impact sturgeon spawning conditions?

**Activity (15 minutes)**

If the class has covered the salmon life cycle recently and/or is familiar with the salmon life cycle, Handout *Worksheet 3-1c Venn Diagram: Sturgeon vs. Sockeye Salmon*. Have the class work in small groups or as a class to complete the Venn Diagram. See the answer key of the worksheet for hints.

*Key Points*

Nechako white sturgeon have a very different life cycle and spawning behaviour than salmon.

Sturgeon and salmon both require clean gravel and swift water for successful spawning.

**OPTIONAL CONTENT: Aging Sturgeon**

Offer this information to students if time permits and/or interest from the class.

*How to age a sturgeon:* Because a sturgeon does not have scales, scientists use a small piece of the **sturgeon's pectoral fin to determine their age**. The rays are finger like pieces of bone which give a fin its strength. Like the rings of a tree, **layers are added to a ray each year**. These layers can then be counted to provide the sturgeons' age. Like a tree the space between the layers show how fast the sturgeon is growing.

*Procedure for collecting fin sample for aging:* To provide consistency, sampling of the fin ray is always done in the same place and in the same way. A small section of the left pectoral fin ray is cut using a hacksaw blade. Once this is done a scalpel is used to completely remove the sample from the rest of the fin. Finally, using a jeweller's saw the sample is cut into 4 to 6 cross sections. Cross sections are then mounted onto slides, which can be viewed under a microscope.

**Closure (5 minutes)**

Review the five stages of the sturgeon life cycle.

Ask how the information learned today can add to their Unit Project.

# Nechako White Sturgeon Life Cycle

## SUB-ADULT

What defines a sub-adult? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_.

## ADULTS & SPAWNING

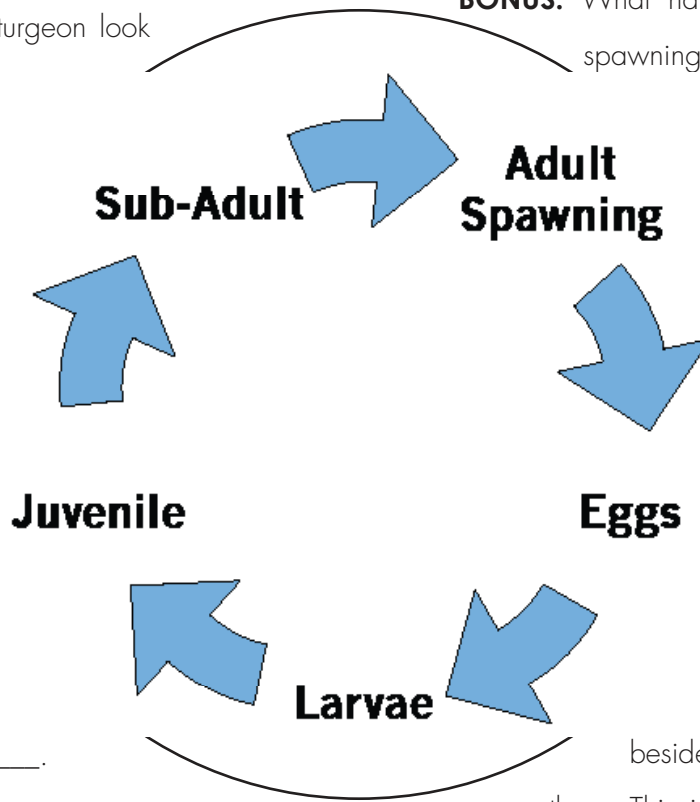
Female Nechako white sturgeon spawn at \_\_\_\_\_ years old. Males at \_\_\_\_\_ years old. Sturgeon spawn when river conditions are just right!  
 Time of year: \_\_\_\_\_  
 Water temperature: \_\_\_\_\_  
 Substrate: \_\_\_\_\_  
 Water Speed: \_\_\_\_\_ Depth: \_\_\_\_\_

## JUVENILE

Juvenile sturgeon look like \_\_\_\_\_  
 What percentage juvenile sturgeon survive past their first birthday?  
 \_\_\_\_\_.

**BONUS:** Name four potential predators that feed on juvenile sturgeon. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_.

**BONUS:** What happens if the conditions for spawning are **not** adequate? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_.



## EGGS

Female white sturgeon release \_\_\_\_\_ eggs into the water umn and the male swims beside and release milt to fertilize them. This is called \_\_\_\_\_ spawning. The eggs then \_\_\_\_\_

## LARVAE

larvae look like \_\_\_\_\_. They get their food from their \_\_\_\_\_ for the first \_\_\_\_\_ days. After that they eat \_\_\_\_\_. After another \_\_\_\_\_ days they are called juveniles.

**BONUS:** Where do you think larval sturgeon are found in the river? \_\_\_\_\_.

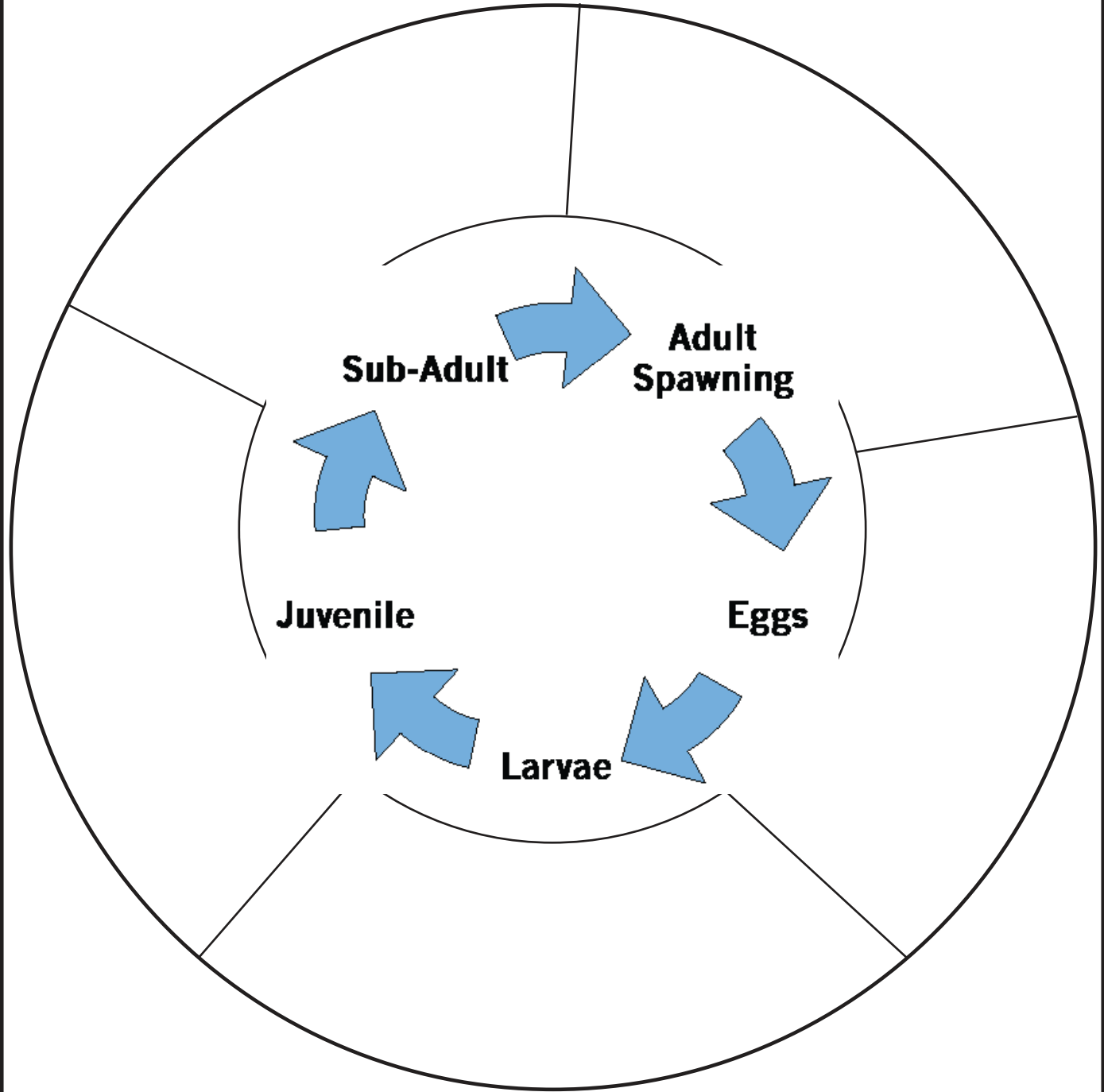
\_\_\_\_\_ on the river bottom. Eggs hatch within \_\_\_\_\_ days.

**BONUS:** What water condition causes the eggs to take longer to hatch? \_\_\_\_\_.



# Nechako White Sturgeon Life Cycle

Draw a picture of a Nechako white sturgeon at each life cycle stage: Adult-Spawning, Eggs, Larvae, Juvenile and Sub-Adult. BONUS: At each life cycle stage include what habitat is needed by Nechako white sturgeon.



# Nechako White Sturgeon Life Cycle - Answer Key

**ADULTS & SPAWNING** Female Nechako white sturgeon spawn at **40** years old. Males between **teens to 20s** years old. **BONUS:** Why? **Because they are a long lived species.** Sturgeon spawn when river conditions are just right!

Time of year: **May-July** Water temperature: **14°-18°C** Substrate: **Clean gravel to rocks, no sand (if too much fine substrate the eggs do not survive)** Water Speed: **fast** Depth: **deep**

**BONUS:** What happens if the conditions for spawning are **not** adequate? **The female resorbs the eggs and waits from 4-5 years later to spawn.**

**EGGS** Female white sturgeon release **million** eggs into the water column and the male swims beside and release milt to fertilize them. This is called **broadcast** spawning. **The eggs then sink to the bottom and adhere to rocks and plants** on the river bottom.

Eggs hatch within **7-10** days. **BONUS:** What water condition causes the eggs to take longer to hatch? **Colder water temperatures.**

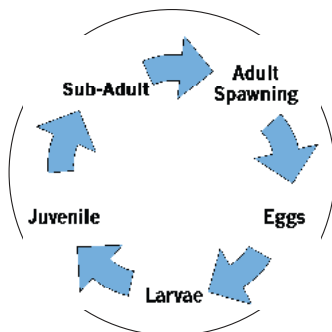
**LARVAE** Larvae look like **tadpoles**. They get their food from their **yolk sac** for the first **12** days. After that they eat **aquatic insects and zooplankton (microscopic invertebrates in the water column)**. After another **20 days** they are called juveniles. **BONUS:** Where do you think larval sturgeon are found in the river? **In the gravel and vegetation. Hidden from predators.**

**JUVENILE** Juvenile sturgeon look like **adult sturgeon with their scutes and fins etc..** What percentage of juvenile sturgeon survive past their first birthday? **0.1 percent = 1000 per million eggs.**

**BONUS:** Name four potential predators that feed on juvenile sturgeon. **salmon, trout, mergansers, kingfisher birds, gulls, osprey, other fish, larger sturgeon, otters, etc.**

**SUB-ADULT** What defines a sub-adult? **Greater than 1 metre in length but NOT reproductive.**

deep river water, Stuart, Fraser or Takla lakes



back eddies, gravel and vegetative cover



clean gravel, aquatic vegetation

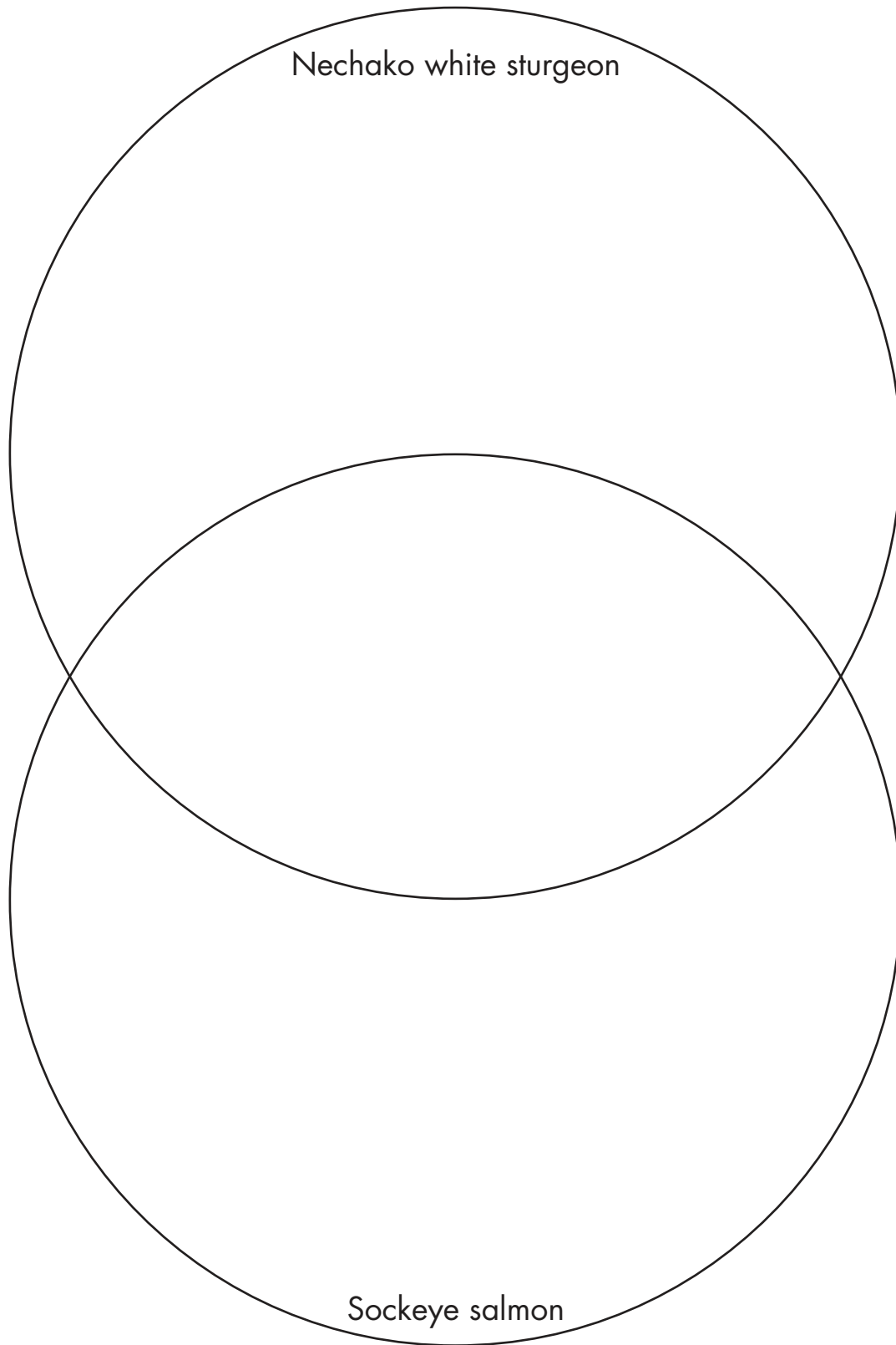


clean gravel, aquatic vegetation. This image is an example of an egg that is smothered by fine sand substrate and dies.

clean gravel, swift moving water, deep water, water 14-18°C

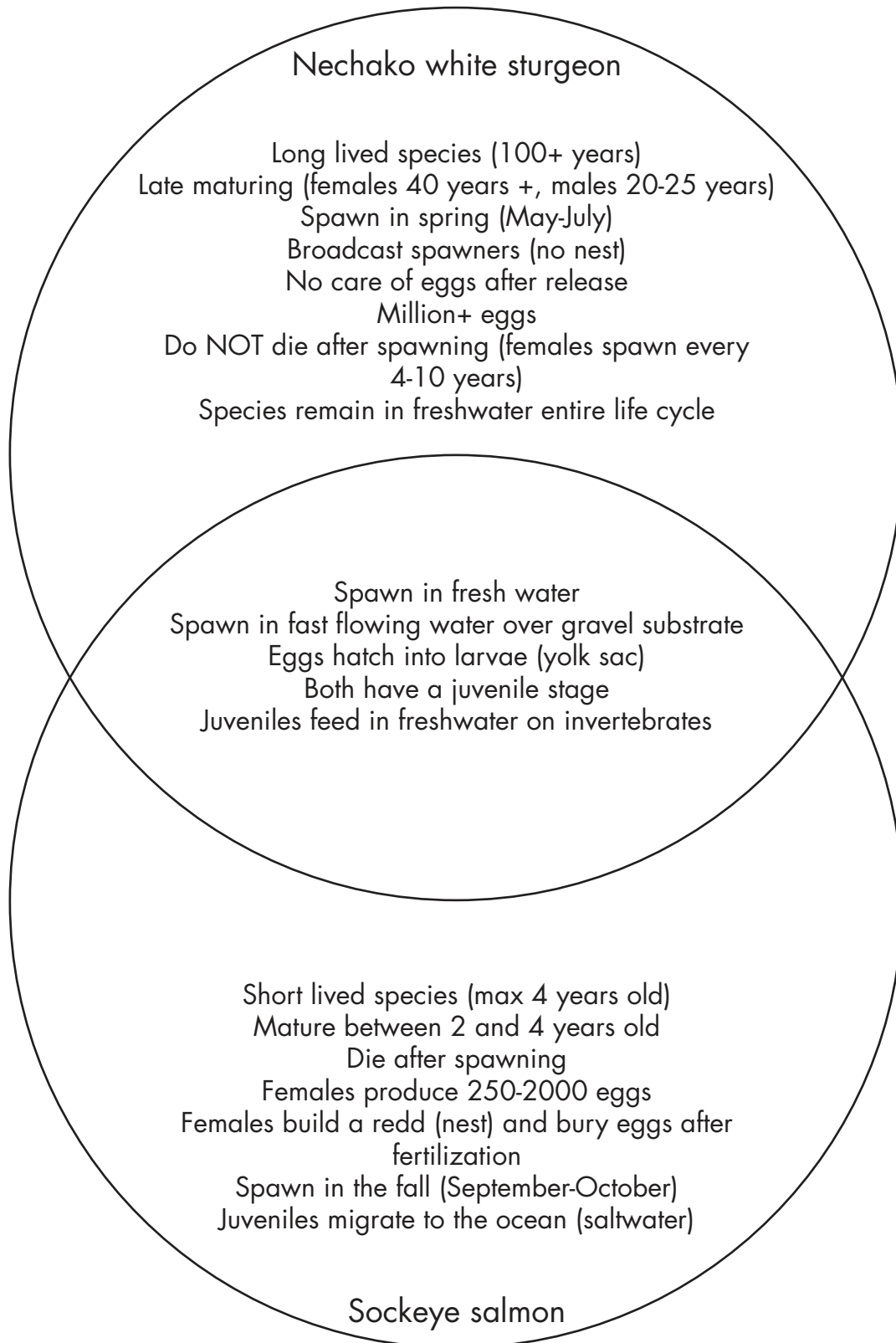
# Venn Diagram: Sturgeon Vs. Sockeye Salmon

Fill in the circles of the Venn Diagram to determine SIMILARITIES and DIFFERENCES between the life cycles of the Nechako white sturgeon and sockeye salmon.



## Venn Diagram: Sturgeon Vs. Sockeye Salmon - Answer Key

Fill in the circles of the Venn Diagram to determine SIMILARITIES and DIFFERENCES between the life cycles of the Nechako white sturgeon and sockeye salmon.



## Lesson 3-3: Sturgeon Habitat

**Time of Lesson:** 1 hour

**Instruction Objectives:** Students can explain the habitat requirements of Nechako white sturgeon.

**Strategies and Activities:** Discuss habitat and food requirements of the Nechako white sturgeon. Allow work on Unit Project.

**Materials:**

- SMARTboard PowerPoint presentation: *NWS Habitat and Food*
- Handout: *Worksheet 3d - Habitat & Food T-Chart.*
- Handout or Interactive: *Worksheet 3e - Wordsearch Review*

**Student Assessment:**

- Observation and participation in class and small group activities.
- Ability to name habitat and food needs of Nechako white sturgeon.
- Ability to define terms from Unit.



**Activity (30 minutes)**

During the life cycle lesson, students learned about some of the habitat requirements for Nechako white sturgeon. Review the life cycle as a class.

On the SMARTboard put up the PowerPoint presentation *Habitat and Food*. Using *Worksheet 3d - Habitat & Food T-Chart* go through the habitat requirements for each life cycle stage and include their food needs (see Answer Key for information).

*Key Points*

Have the students call out their ideas of what sturgeon eat at each life stage before advancing the slide.

**Activity (15 minutes)**

Allow students time to review all they have learned to date.

Bring up on the SMARTboard the interactive *Wordsearch Review* (*Double-click the index.html file in the 'Wordsearch Review Interactive' folder. Allow the page to open in a browser like Explorer, Safari, Firefox etc. To solve the puzzle, click, hold and drag over the letters of the word you are solving. Ask for hints if necessary*). Hand out the hardcopy versions of the wordsearch *Worksheet 3e - Wordsearch Review* so the students can finish on their own, or work along with the class.

As the students find the words, ask for definitions for each word.

**Activity (15 minutes)**

Allow students to work on their Unit Project.

# Habitat & Food T-Chart

Fill in the following chart with what you have learned about sturgeon habitat and food requirements at each life stage.

	<i>Nechako white sturgeon habitat requirements</i>	<i>Nechako white sturgeon food requirements</i>
<i>Egg</i>		
<i>Larval</i>		
<i>Juvenile</i>		
<i>Adults</i>		

# Habitat & Food T-Chart - Answers

Fill in the following chart with what you have learned about sturgeon habitat and food requirements at each life stage.

	<b><i>Nechako white sturgeon habitat requirements</i></b>	<b><i>Nechako white sturgeon food requirements</i></b>
<b><i>Egg</i></b>	<p><i>clean gravel and rock substrate</i></p> <p><i>fast flowing water</i></p> <p><i>water temperature between 14-18°C</i></p> <p><i>relatively deep</i></p>	<p><b><i>None! They are developing within the egg.</i></b></p>
<b><i>Larval</i></b>	<p><i>clean gravel and rock substrate</i></p> <p><i>fast flowing water</i></p>	<p><i>for the first 12 days or so they feed from their yolk sac.</i></p> <p><i>after the yolk sac is gone, they feed on macro-invertebrates (organisms that are large enough to be seen with the naked eye and have an exoskeleton)</i></p>
<b><i>Juvenile</i></b>	<p><i>deep areas in the river</i></p> <p><i>slow back eddies</i></p> <p><i>fast flowing sections (areas for finding food and spawning)</i></p> <p><i>lakes</i></p> <p><i>cool areas of the river</i></p>	<p><i>feed primarily on benthic (bottom) invertebrates and fish</i></p> <p><i>invertebrates include: amphipods, isopods, mysids, clams, snails</i></p> <p><i>fish include: sculpins and other juvenile fish and fish eggs</i></p>
<b><i>Adults</i></b>	<p><i>deep areas in the river</i></p> <p><i>slow back eddies</i></p> <p><i>fast flowing sections (areas for finding food and spawning)</i></p> <p><i>lakes</i></p> <p><i>cool areas of the river</i></p>	<p><i>large fish including salmon (the large salmon runs in the Nechako River are thought to be highly important annual food sources for sturgeon)</i></p>

# Wordsearch - Review!

Now that you know everything about Nechako white sturgeon, try and find some important terms you learned in the box below.

R	V	P	R	E	H	A	B	I	L	I	T	A	T	I	O	N	K	F	E
J	R	K	V	N	T	A	W	A	R	E	N	E	S	S	H	C	B	Q	N
B	D	I	B	I	E	X	Z	T	R	D	E	S	A	L	M	O	N	J	D
W	H	S	Y	A	W	C	N	B	E	R	X	I	A	G	H	D	G	U	A
A	A	F	I	D	R	P	H	W	O	G	T	N	F	O	Y	E	B	V	N
V	T	I	B	L	K	B	S	A	A	V	I	V	P	S	M	E	S	E	G
G	C	S	D	W	T	L	E	M	K	H	N	E	H	Z	C	P	X	N	E
F	H	H	Z	M	K	A	T	L	Q	O	C	R	X	H	U	U	U	I	R
G	E	E	S	Q	R	R	F	P	W	Q	T	T	A	L	D	R	T	L	E
Y	R	R	P	U	D	V	P	Z	A	S	O	E	J	J	R	E	O	E	D
I	Y	Y	A	J	A	A	T	C	T	T	H	B	E	T	E	C	Q	F	T
G	A	G	W	H	K	E	Y	U	E	U	A	R	Y	U	C	R	O	J	O
L	A	O	N	F	M	C	Z	X	R	R	B	A	O	R	O	U	T	O	G
T	R	I	B	U	T	A	R	Y	S	G	I	T	L	B	V	I	P	C	R
W	S	U	U	X	T	C	E	B	H	E	T	E	K	I	E	T	P	Q	A
N	R	I	V	E	R	B	B	B	E	O	A	Y	S	D	R	M	J	X	V
M	S	A	M	E	I	O	T	P	D	N	T	Q	A	I	Y	E	B	E	E
P	R	E	D	A	T	O	R	D	H	K	T	J	C	T	K	N	L	D	L
N	C	S	U	R	V	I	V	A	L	W	U	T	L	Y	C	T	S	L	U
O	G	C	O	O	L	V	F	H	L	S	L	D	A	M	E	U	C	M	U

- |              |          |             |                |
|--------------|----------|-------------|----------------|
| AWARENESS    | SALMON   | DAM         | REHABILITATION |
| RIVER        | YOLKSAC  | FISHERY     | PREDATOR       |
| EXTINCT      | NECHAKO  | RECRUITMENT | ENDANGERED     |
| SILT         | BARBEL   | TRIBUTARY   | HABITAT        |
| HATCHERY     | RECOVERY | SURVIVAL    | WATERSHED      |
| INVERTEBRATE | SCUTE    | JUVENILE    | STURGEON       |
| SPAWN        | COOL     | LARVAE      |                |
| TURBIDITY    | GRAVEL   | DEEP        |                |



## Lesson 3-4: Sturgeon Decline

**Time of Lesson:** 1.5 hour

**Instruction Objectives:** Students can reflect on how the environment of the Nechako white sturgeon has changed over the past 100 years, and how that has affected the survival of the species.

**Strategies and Activities:** Discuss how the habitat in the Nechako River for the sturgeon has changed over time, from 10,000 years ago to 100 years ago to now. Brainstorm on the meanings of 'adaptation' and 'survival' and relate to human experiences, re-examine the life cycle and link life cycle, habitat and survival together. Review restoration projects currently occurring for Nechako white sturgeon. Allow work on Unit Project.

### **Materials:**

- YouTube Video: *Every Sturgeon Counts - Part 4* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- SMARTboard PowerPoint presentation: *NWS Decline*
- Website: [www.nechakowhitesturgeon.org](http://www.nechakowhitesturgeon.org) for a list of current restoration projects.

### **Student Assessment:**

- Observation and participation in class discussion and activities.
- Ability to identify at least two restoration projects for Nechako white sturgeon.
- Participation in Speed Quiz.

**Activity (20 minutes)**

Bring up on the SMARTboard YouTube Video: *Every Sturgeon Counts - Part 4* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>). Scroll to 21:26 and watch this section of the video: **Procedure for Releasing Sturgeon Safely** (21:26 to 31:20).

*Key Points*

This video highlights the impact humans can have on sturgeon.

There are safe ways to reduce the risk of injury or death of the animal if it is caught in a net.

The people in the video use science and research as a practical means that lead to conservation of a species.

**Activity (40 minutes)**

Bring up on the SMARTboard the PowerPoint presentation: *NWS Decline*. This presentation reviews the factors that affect sturgeon survival and reintroduces the term recruitment failure.

*Key Points*

The low survival rate of young sturgeon is the leading reason why the species is endangered and at risk of becoming extinct in the next twenty years.

Altered habitat, human impacts, pollution, and climate change are all factors that impact young sturgeon survival.

These factors affect their ability to hide from predators, affect their food source, and affect their general habitat.

*Ask*

What factor or factors do you think are the ones that are most responsible for the recruitment failure?

Is the population recoverable - can we save it from extinction?

Introduce the term 'adaptation'.

Adaptation: a change by which an organism or species becomes better suited to its environment.

Many species over time are able to adapt to changes in their environment, so they are able to survive over the long term. Nechako white sturgeon are adapted for a particular habitat and river condition (habitat and food). However, the habitat of the Nechako white sturgeon has changed dramatically over the past 100 years.

Continue with the slideshow to view a quick overview of the work the NWSRI is doing to help protect and recover the Nechako white sturgeon population. Begin a class discussion about this work. Visit [www.nechakowhitesturgeon.org](http://www.nechakowhitesturgeon.org) for an up-to-date project list.

Ask

Of the projects you just saw, which ones do you think are the most important for helping Nechako white sturgeon? Why?

What can **we** do to help the Nechako white sturgeon?

### Activity (20 minutes)

Allow students to work on their Unit Project.

### Closure (10 minutes)

Play Speed Quiz. Split the class into two groups. Have one student from each group go in turn and compete to see who can answer the following questions correctly (the first to put up their hand gets to answer first).

What does endangered mean? *at risk of going extinct*

How large is a Nechako white sturgeon? *3 m long*

How many sturgeon are in the river? *350 or less*

What food do juvenile sturgeon eat? *macro invertebrates*

What is the fin on the back of a sturgeon called? *dorsal*

Sturgeon do not have scales, they have \_\_\_\_? *scutes*

Name one tributary to the Nechako River. *Murray Creek, Stoney Creek, Nautley, Stewart*

At what ages does a female sturgeon start spawning? *40 years old*

Sturgeon spawn in deep turbid water over clean \_\_\_\_\_? *gravel or rocks*

Where is the only known spawning site for Nechako white sturgeon?  
*in Vanderhoof, upstream of the Burrard Ave bridge, in the Nechako Migratory Bird Sanctuary*

What is the main food source for adult sturgeon? *salmon*

The shape of their tail - heterocercal - helps the sturgeon stay where in the water column? *at the bottom*

What life stage comes after the egg hatches? *larval, larvae*

What is the area adjacent a river called? *riparian zone*

What is the word to describe how an animal changes over time to changes in their environment? *adaptation*

## Lesson 3-5: Guest Speakers and Field Trip

**Time of Lesson:** 1.5 hours

**Instruction Objectives:** Students can demonstrate an overall understanding of Nechako white sturgeon life history and habitat needs and how these relate to overall survival of the species. Students participate in field trip and/or host guest speakers in classroom. Students can identify First Nations traditions in relation to the Nechako River and the Nechako white sturgeon.

**Strategies and Activities:** Have local experts attend class to speak in regards to the Nechako white sturgeon (local biologist and First Nations guest speaker), and/or go to Nechako White Sturgeon Conservation Centre for a tour. Discussion about the value the Nechako white sturgeon holds for the students and what it would mean to them if it became extinct. Allow work on Unit Project.

### **Materials:**

- Field Trip: Nechako White Sturgeon Recovery Centre in Vanderhoof. Contact the Centre or the Nechako White Sturgeon Recovery Initiative for details and to book the tour. Extend the tour to a walk along the Nechako River to view the spawning site (just upstream of the bridge).
- Guest Speaker: First Nation speaker (contact NWSRI for contact details or contact local First Nation Band Office directly).
- YouTube Video: *Every Sturgeon Counts - Part 2*  
(<http://www.youtube.com/watch?v=YhrEJUEi-ow>)
- If unable to get to the Recovery Centre, invite local biologist and/or White Sturgeon Recovery Centre coordinator (contact NWSRI for contact details or Contact the Centre or the Nechako White Sturgeon Recovery Initiative directly) to the classroom.

FUTURE CONSIDERATIONS: Sturgeon release event (fall 2014 and beyond).

### **Student Assessment:**

- Observation and participation in class discussion and field trip.



### Preparation (15 minutes)

Have students prepare 5-10 questions as a class for the guest speaker. Assign students to ask these questions.

During the field trip and/or class guest speaker have the students take notes. Encourage students to include what they learn in their Unit Project.

### Field Trip to the Sturgeon Facility in Vanderhoof (1-1.5 hours)

The Nechako White Sturgeon Recovery Centre is located in Vanderhoof. It is where the Nechako white sturgeon hatchery program occurs.

Before heading into the Recovery Centre, be sure to review the rules of conduct:

- no touching unless instructed by the facilitator
- ask questions with hands up
- walk do not run
- stay with your group, do not wander away from the group

### Optional Activity

After the tour, walk down to the Nechako River and follow the walking path under the bridge and upstream until you reach a sign that states "Sturgeon Spawning Habitat". This is the location where sturgeon have been recorded spawning. Start a discussion.

Ask

Describe what this site looks like. Does it look like good sturgeon spawning habitat? *Fast flowing, murky, gravel substrate, deep in sections.*

What potential human impacts put this site at risk of pollution, disturbance or alteration? *Boating, boat engines, pollution from roads and bridge, run-off from residential and farm land etc.*

### Class Guest Speaker (1 hour)

Have ready on the SMARTboard the YouTube Video: *Every Sturgeon Counts - Part 2* (<http://www.youtube.com/watch?v=YhrEJUEi-ow>): **Salmon, Sturgeon and First Nations** 4:10 to 16:40. This section of the video focuses on local First Nation culture and history with the Nechako River, salmon, Stuart Lake, and Nechako white sturgeon. Play this to augment the guest speaker if need be.

Invite a local First Nation speaker into the classroom to speak about the importance and traditions around sturgeon and First Nations (contact NWSRI for contact details or your local First Nation Band office directly). Have them speak about the salmon fishery and the by-catch of sturgeon.

As well, encourage the guest speaker to talk about the relationship between First Nation traditions and the plants and animals found within the riparian zone (hunting, fishing, medicinal plants, trapping etc.).

## **Lesson 3-6: Presentations**

**Time of Lesson:** 1.5-2 hours

**Instruction Objectives:** Students conduct oral presentations of Unit Project to class.

**Strategies and Activities:** Students present their Unit Project to the class.

**Materials:**

- Projector, SMARTboard, whiteboard, etc. as needed for presentations.

**Student Assessment:**

- Quality of presentation in regards to aesthetics, information presented, flow of the story, etc.
- Ability to present project effectively to the class (oral presentation skills).
- Observed knowledge of subject topic, and ability to answer questions from the class.

### **Activity (1.5-2 hours)**

Have students present their Unit Project one at a time. Allow 5 minutes total for the presentation, including set-up and take down, as well as questions.

This is the students' opportunity to show the teacher and class what they have learned about Nechako white sturgeon.

Depending on the number of students in the class, the presentation may take two days.

## UNIT 3 TEST

A number of test questions have been developed for this Unit. The questions include matching, labelling, True-False, and short answer in this document. Please feel free to customize the test for your class, considering the topics or materials you covered or focused on during the Unit.

You can find test questions for this Unit on the thumb drive that accompanies this curriculum:

- *Unit\_3\_Test.docx*

GRADE: \_\_\_\_\_ TEACHER: \_\_\_\_\_ SCHOOL: \_\_\_\_\_

## **Feedback Form for Unit 3**

**Please fill in the information below and return to the NWSRI. Please feel free to email any questions or comments to Lana Ciarniello at [aklak@telus.net](mailto:aklak@telus.net).**

### **Background Information:**

Is the information presented age appropriate and presented in an age appropriate manner? Yes or No

Was there enough information provided to conduct the lessons successfully?  
Yes or No

If no, what additional information and/or resources would be useful?

### **Activities:**

Were the activities engaging to the students? Yes or No

Was the timeline of the activities a good estimate?  
Too Long \_\_\_\_ Too Short \_\_\_\_ Just Right \_\_\_\_

Any comments?

### **Worksheets:**

Were the worksheets effective in teaching and/or reviewing the unit material?  
Yes or No

Were the answer keys helpful? Yes or No

### **Additional Resources:**

If used, were the resources suggested or provided for this unit useful? Yes or No

What else would you suggest be needed for this unit?