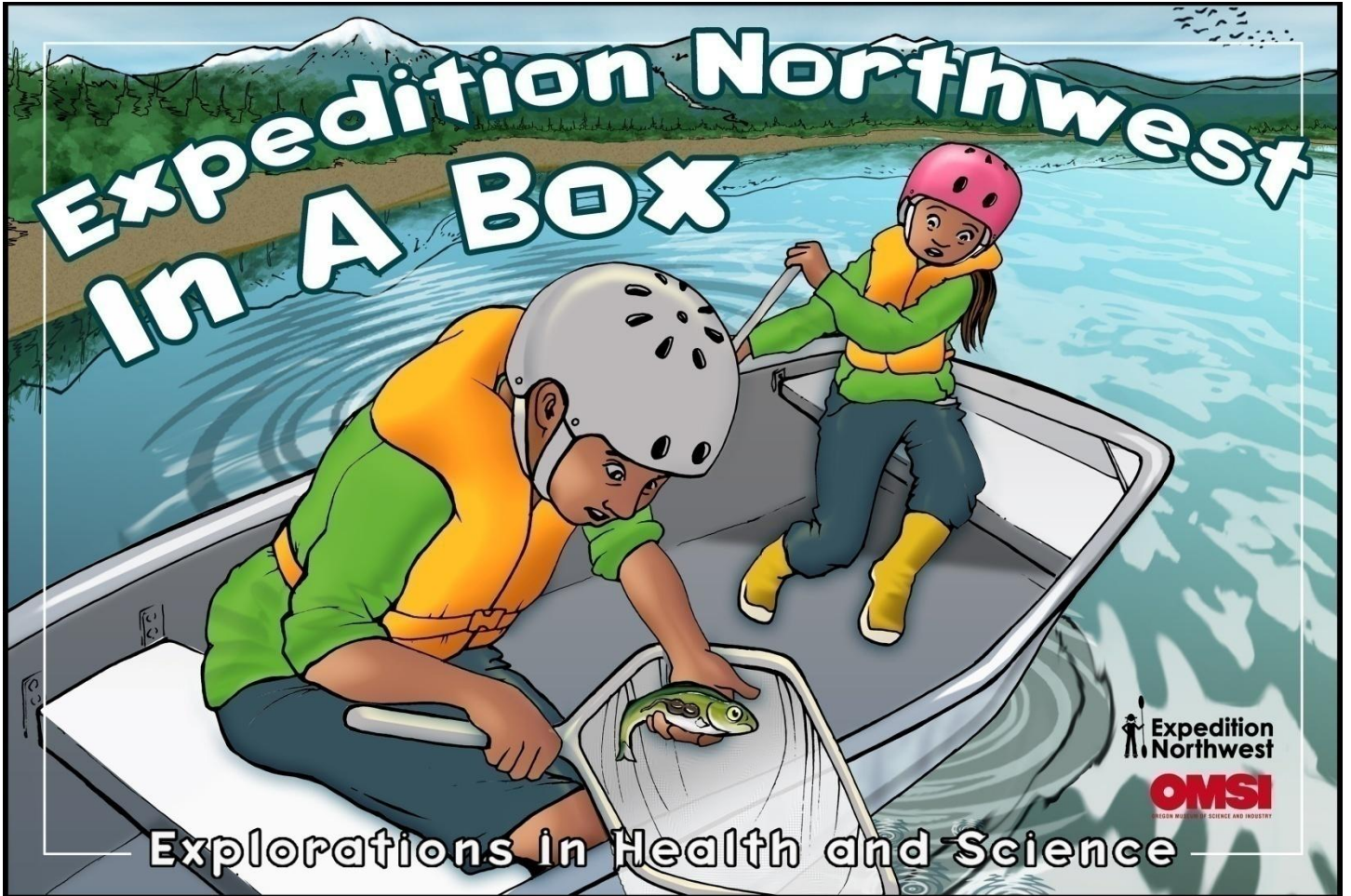


Teacher Handbook



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Welcome to the AHEC “In-A-Box” curricula. The curriculum for this box was created by OMSI (Oregon Museum of Science & Industry) and then adapted by OHSU (Oregon Health & Science) professionals to our In-A-Box series. Currently, there are Ear In-A-Box, Eye In-A-Box, Guts In-A-Box, Bones and Muscles In-A-Box and Brain In-A-Box as well.

We look forward to your feedback as we launch In-A-Box so that it can be improved from year to year.

Funding for In-A-Box curricula was made possible by a Howard Hughes Medical Institute grant, Oregon Area Health Education Centers (AHEC), and OHSU.

Oregon Area Health Education Centers (AHEC) Program office

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The goal for this Box is to introduce Expedition Northwest, developed by OMSI and expand upon it by including a selection of materials covering Northwest salmon and watersheds, species survival, evolution of species, and the role of various interest groups in the use and protection of our Northwest ecology. To purchase the complete Northwest Expedition curriculum, please visit: www.oms.edu and click on Education/Teacher Resources, or call 503-797-4618.

Lesson Structure:




The three units included here do not need to be taught in any particular order. They are different lengths, so choose the order that suits your schedule.

Activity	Time	Materials
Ambassador (guest) scientist speaker (if arranged)	15 minutes	
Student pre-survey	5 minutes	Surveys in box
Northwest World	2 hours	See envelope Use web for research
Journey to Lost River	1.5 hours	See envelope
Mystery of the Disappearing Cottonwoods	45 minutes	See envelope
Student and teacher post surveys	5 minutes	Surveys in box
Lesson extensions		
Extensions are listed in each of the units	Various times for each activity	
Microscopes with specimen slides		Microscopes and slides in box
Salmon Run game		All game materials in box for six groups
Bill Nye Rivers and Streams video and curriculum	25 minutes	DVD player and curriculum
The complete Expedition NW curriculum can be purchased from OMSI and includes online access and updates		
Evolution DVD-2 one hour segments: Great Transformations and Extinction	120 minutes	DVD player

1. Choose which lesson/unit to start with
2. Make copies of masters and student copies
3. Have students complete pre survey
4. If an ambassador (guest) speaker has been arranged, he/she will share with students his/her chosen career in science, and then may stay for the lesson that day.

5. A post survey is completed by each student.
6. The Box contents, surveys and a teacher feedback sheet are returned to the AHEC education coordinator by the ambassador or picked up at the classroom by the coordinator.

Lesson Content and Objectives

Units	Activity	Resources	Lesson Objective
<p>Northwest World</p> 	<p>Students role-play employees designing a model of the Northwest region built around a river and its population of Chinook salmon.</p>	<ul style="list-style-type: none"> -Posters -Blank paper -Colored pencils 	<p>Students will understand that the health of a watershed, like any natural system, is affected by all of its component parts, including humans.</p>
<p>Journey to Lost River</p> 	<p>Creating a field guide focused on species evolution.</p>	<ul style="list-style-type: none"> -Field guides -Colored pencils -Hole punch -Cardstock for field guide cover 	<p>Students will learn how species evolve through the process of natural selection.</p>
<p>Mystery of the Disappearing Cottonwoods</p> 	<p>Explore the scientific mystery behind a disappearing group of trees by examining data and attempting to explain the decline.</p>	<ul style="list-style-type: none"> -Single hole punches -Colored construction paper -Colored butcher paper -Plastic cup -Meter stick -Blindfolds -Scotch tape -Index cards 	<p>Students will learn that a complex set of factors can influence populations of organisms in their environment.</p>

Options for different grade levels and extensions

- See the descriptions in each lesson

Additional Reading List: 7th/8th Grade

AR = Accelerated Reader

RL = Reading Level

Mystery of the Disappearing Cottonwoods

One Day in the Desert, by Jean Craighead George.

ISBN: 0064420388 RL: 5.5, 1 point (AR)

A flood will soon wash over the desert and will affect the wildlife and Native Americans who live there.

Rising Waters; a Book about Floods, (Amazing science series).

ISBN: 1404809260 Grade Level: K-4

Causes and precautions of floods. Accurate science content. Includes Internet and print bibliographies

Northwest World

Downriver, by Will Hobbs.

ISBN: 0440226732 RL: 4.9, 8 points (AR)

Jessie, 15, and her companions are sent to the Colorado Rockies to curb their anger and restlessness. All are tested by the river and each other, most are changed for the better.

River Thunder, by Will Hobbs. (sequel to Downriver)

ISBN: 0385323166 RL: 5.0, 7 points (AR)

Jessie and her companions return to the Grand Canyon for a run down the big rapids. Troy claims to want to prove himself and make up for past mistakes. It will take all of them pulling together to survive.

Watersheds: A Practical Handbook for Healthy Water, by Clive Dobson and Gregor Gilpin Beck.

ISBN: 1552093301 Grade Level: 5-12

Simplified format provides up-to-date scientific information about essential elements of water ecology and wetland ecosystems. Includes bioregions, aquatic habitat, water and nutrient cycles, water and air pollution, invasions of exotic species, habitat loss, and ecological restoration. Beautifully illustrated.

Journey to Lost River

Wild Man Island, by Will Hobbs.

ISBN: 0380733102 RL: 5.1, 7 points (AR)

A violent storm blows Andy's kayak off course and washes him ashore on Admiralty Island. Struggling to survive, Andy sees a man toting a stone-tipped spear and later discovers Stone Age tools and weapons.

Jackie's Wild Seattle, by Will Hobbs.

ISBN: 06881747444 RL: 4.6, 8 points (AR)

Shannon and Cody visit their Uncle Neal who drives an ambulance for a wildlife rescue center. After Uncle Neal is injured, Shannon summons the courage to start rescuing the animals herself. Her little brother is having nightmares about the events of 9/11. Everything is uncertain and home is very far away.

One Day in the Prairie, by Jean Craighead George.

ISBN: 0690045646 RL: 5.0, 1 point (AR)

On the grassy mounds, a herd of buffalo moves restlessly. Henry Rush doesn't notice, he is intent on taking a photo of a prairie dog doing a back flip. But a storm is approaching and it will send Henry and the animals scrambling for safety.

Incident at Hawk's Hill, by Allan W. Eckert.

ISBN: 0553266969 RL: 7.2, 9 points (AR)

In 1870, Ben MacDonald wanders away from home and gets lost. He is adopted by a mother badger for the summer. Fiction story, but based on a true event.

One Day in the Woods, by Jean Craighead George.

ISBN: 0064420175 RL: 5.4, 1 point (AR)

Rebecca spends a day looking for the ovenbird and is enchanted by all of the wildlife she observes.

The Cry of the Crow, by Jean Craighead George.

ISBN: 0064401316 RL: 5.1, 7 points (AR)

Mandy finds a helpless baby crow that she tries to raise in secret because her father and brothers shoot crows to keep them from the farm's valuable strawberry crop.

There's an Owl in the Shower, by Jean Craighead George.

ISBN: 0064406822 RL: 4.3, 3 points (AR)

Mr. Watson is a logger, and he's unhappy when he finds out that Borden has a spotted owl in his house.

Evolution, by Joanna Cole.

ISBN: 0064450864

Scientists "read" the story of changing life from fossils.

Life Story, by Virginia Lee Burton.

ISBN: 0395520177

Charming picture book of how life has changed over the millenniums.

Oregon Content Standards

4th Grade	Disappearing Cottonwoods	Northwest World	Journey to Lost River
4.1 Structure and Function Living and non-living things can be classified by their characteristics and properties.		✓	
4.2 Interaction and Change Living and non-living things undergo changes that involve force and energy.	✓		✓
4.3 Scientific Inquiry Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	✓		
4.4 Engineering Design Engineering design is a process of using science principles to solve problems generated by needs and aspirations.		✓	

5th Grade

5th Grade	Disappearing Cottonwoods	Northwest World	Journey to Lost River
5.1 Structure and Function Living and non-living things are composed of related parts that function together to form systems.	✓		✓
5.2 Interaction and Change Force, energy, matter, and organisms interact within living and non-living systems.	✓	✓	✓
5.3 Scientific Inquiry Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.	✓		
5.4 Engineering Design Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.		✓	

6th Grade	Disappearing Cottonwoods	Northwest World	Journey to Lost River
6.1 Structure and Function Living and non-living systems are organized groups of related parts that function together and have characteristics and properties.			✓
6.2 Interaction and Change The related parts within a system interact and change.	✓		✓
6.3 Scientific Inquiry Scientific inquiry is the investigation of the natural world based on observation and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.	✓		
6.4 Engineering Design Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.		✓	

7th Grade

7.1 Structure and Function Living and non-living systems are composed of components which affect the characteristics and properties of the system.	✓		✓
7.2 Interaction and Change The components and processes within a system interact.	✓	✓	✓
7.3 Scientific Inquiry Scientific inquiry is the investigation of the natural world based on observation and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.	✓		
7.4 Engineering Design Engineering design is a process of identifying needs, defining problems, identifying constraints, developing solutions, and evaluating proposed solutions.		✓	✓

8th Grade

8.1 Structure and Function Systems and their components function at various levels of complexity.			✓
8.2 Interaction and Change Systems interact with other systems.			✓
8.3 Scientific Inquiry			

Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.			
8.4 Engineering Design			
Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.			

Restocking and Ordering

The Expedition NW Box needs to be returned to the AHEC education coordinator for restocking, but we encourage you to share this resource with your fellow teachers. Pass along your AHEC education coordinator’s phone or e-mail for ordering. In-A-Box from AHEC also offers Brain In-A-Box, Guts In-A-Box, Eye In-A-Box, Bones and Muscles In-A-Box, and Ear In-A-Box for grades 4-8.

Loan periods- You may keep your Box for up to three weeks if you would like to explore use of the videos, *Rivers and Streams & Evolution*, utilize the extension lessons, follow the web links (under Resources) for student activities, etc.

Box Contents

Please use your contents check sheet as you repack the box for return. Some items are replenishable, and AHEC will do this. Please be sure all other materials are checked off and in the box.

Three lesson envelopes:

- **Northwest World:** Lesson, blue construction paper, colored pencils, glue, science background, student procedure, photocopies of map pages, photocopies of research notes and Wacky Wanda.
- **Lost River:** Lesson, white drawing paper, colored pencils, hole punch, cardstock, field guides, science background, student procedure, templates and sample species pages, and the Story of Lost River.
- **Disappearing Cottonwoods:** Lesson, index cards, colored paper, colored butcher paper, six blindfolds, tape, meter sticks, plastic cups, student procedure, and research sheet.

Student pre and post surveys- these help us evaluate the effects of In-A-Box curriculum and are to be placed in the box at completion.

Teacher feedback form- Please fill this out at the conclusion of your use of In-A-Box.

Artifacts:

Expedition NW In-A-Box- This poster is yours to keep for the classroom.

Bill Nye *Rivers and Streams* DVD and curriculum

Water Resource poster

The Story of the Pacific Northwest Salmon poster

Magnificent Journey booklet

Evolution video- This two hour long NOVA video has two separate one hour segments. The first is on transformation of species, the second on extinction.

Three microscopes- students can take turns looking at the specimen slides. These and the enclosed slides support the evolution of species focus in the Lost River lesson.

Six specimen slides-

Salmon Run game- there are six game boards with pieces so that the whole class can play in groups. This game was created by a teacher. This game is a good pre or follow up activity to the NW World lesson.

Books:

- **Come Back Salmon:** reading level ages 9-12
- **Life in a River** ages 9-12
- **Evolution** ages 9-12

Family Involvement Ideas

- Ask students to invite any relatives to class who work with natural resources such as dams, fish and wildlife, water treatment, or the park system.

Each lesson has a glossary and resource section

The Bonneville Power Administration also offers many free teacher and student resources for investigation of energy use, rivers and streams, salmon, electricity, and more. Resources can be downloaded from:

<http://www.bpa.gov/Corporate/KR/ed/page6.htm>

Salmon Run Game

Kit Contents

Item Quantity Description

5 Game boards

6 Dice

5 sets/5 Game pieces (green, yellow, blue, red, white)

5 sets Game cards — each complete set of cards includes:

10 Egg cards (cards #1-10)

10 Fry cards (cards #11-20)

9 Smolt cards (cards #21-30)

14 Adult cards (cards #31-45)

13 Return up the River cards (cards #46-58)

8 Spawner cards (cards # 59-66)

1 Instructions (this booklet — pages 1-4)

Additional materials needed:

Pencils and paper, to keep track of scores (salmon population)

Optional- calculators

Overview / SUGGESTIONS FOR USE

It's hard work being a Pacific salmon. You've got to overcome predators, man-made hazards (dams, pollution, overfishing, etc.), fatigue, physiological changes, and countless other challenges, as you develop in a stream, make your way to the ocean, and then return to your stream to mate before you die of sheer exhaustion.

Fortunately, this game turns the hard work of a being a salmon into a fun learning tool for students. In the game, each player starts out with a population of 30,000 hypothetical salmon eggs. By rolling the die and following instructions on cards, players simulate the journey of their salmon population along either the Snake or Columbia River, to the ocean, and then back to the spawning site. Along the way, each player's salmon will encounter many hazards and obstacles (dams, pollution, predators, etc.) that will diminish their numbers. (Out of 300,000 eggs, approximately 200 or fewer salmon may live to return to the spawning grounds.) The winner of the game is the player who completes the entire life cycle of the salmon and returns to the spawning site with the most adult salmon. By playing this game, students gain an appreciation of the remarkable, yet vulnerable life cycle of these amazing fish.

This kit contains materials for up to 5 groups of players. The recommended group size is 4-5 players per game board.

Grade Level

Grade 4 and up

Time Allotment

It takes approximately 5 minutes to set up the game, and approximately 30 minutes to play the game.

CONTENT AREA

- Teaches about the phases of the life cycle of a creature, and the challenges faced by Pacific salmon during each of these life phases.
- Simulates an authentic salmon migration. When playing Salmon Run, students are living out the complete life cycle of a group of Pacific salmon, from birth to death. (You may want to compare this to the migration of other creatures, such as Atlantic salmon or birds, which will complete several full migrations during their life cycles.) The hazards and obstacles the students (salmon) encounter are those that Pacific salmon might realistically face during each phase of their life cycle.
- Shows how abiotic and biotic factors affect migration.

- Reinforces the concepts of ecology, interdependence among species, and species vulnerability. Many predators depend on and benefit from the natural timing of each phase of the salmon life cycle. Changes in the natural distribution and habitats of the salmon will also affect the populations of these interdependent species.
- Illustrates why so many populations of salmon are threatened, due to human influence.
- Discusses the phenomenon of imprinting. Salmon rely on their sense of smell to recognize and return, years later, to the river and stream from which they originated.
- Opens the door for discussion of the reason migration occurs. Salmon have to leave the source tributaries and streams because there isn't enough food to sustain them through adulthood. Food is much more plentiful in the ocean. You may want to discuss how this differs from the migration of other species; for example, many species of birds migrate because of weather conditions (they fly to warmer climates for the winter).
- Can be used to compare survivorship curves of salmon, which start off with thousands of eggs and end up with few survivors, versus animals who have fewer offspring but a higher rate of survival.

Background and terminology

Before playing this game, students should have some background on each stage of the Pacific salmon's life cycle. (This information is easily found on many Internet sites, in reference books, etc.).

You may also want to discuss pros and cons of damming rivers, introducing non-native and/or artificially bred species of salmon and fish into rivers, etc.

Students should be familiar with the following terms that are used on the game cards. Note that the illustrations on the backs of the cards roughly depict what the salmon looks like at that particular phase of its life.

Life cycle — the sequence of developmental stages through which an organism passes from its initial state (egg) to the same state in the next generation. Key stages in the life cycle of a salmon are:

Egg — the first stage of a salmon's life. After they are fertilized, the eggs are covered in gravel and remain covered as the embryos develop. When the eggs hatch, they are called alevins, or yolk-sac fry. The alevins do not leave the protection of the gravel until their food source (the yolk sac) is used up.

Fry — young salmon that emerge from salmon eggs; once the yolk-sac fry emerge from the gravel, they swim up to the surface, gulp air to fill their swim bladders, and begin to feed. Fry grow in the freshwater streams and rivers as they make their way to the ocean.

Smolt — pre-adult ("teenage") salmon; smolts live in estuaries, where they eat new types of food found in the brackish water, and undergo many physiological changes before they can live in the saltwater of the ocean.

Adult — adult salmon live in the ocean (for varying amounts of time, usually ranging from 1-7 years, depending on the species). When the conditions are right, an unknown signal tells the adult salmon to begin the migration upstream, back to the stream of their birth, where they will spawn.

Spawner — a salmon that is in the reproductive phase of its life cycle. After spawning, all Pacific salmon die, usually within two weeks.

Estuary — juncture where river meets ocean. This combination of fresh water from the stream and salt water from the ocean produces the brackish water found in an estuary. In the brackish water of the estuary, smolts eat new types of food and undergo many physi-

ological changes before they can live in the saltwater of the ocean. Adult salmon returning from the ocean to the river also spend time in an estuary, where they readjust to freshwater before swimming upstream to spawn.

Predator — an animal that hunts and seizes other animals for food. Salmon predators include bears, other fish, humans, and birds (terns, ospreys, cormorants, eagles, herons).

Dam — a barrier, built across a stream or river, which obstructs the flow of water. Hydroelectric power is harnessed by turbines in dams on fast flowing bodies of water (such as the Columbia and Snake Rivers). Dams also provide more control of the flow of water from bodies of water.

Fish ladder — an engineered site found on many dams, which allows fish to bypass the dam; steps on the ladder help the fish swim upstream on a gradual incline, as they pass around and then over the dam.

Attraction water — water at the base of a fish ladder, moving swiftly in a direction opposite the fish. Attraction water helps fish find the entrance to the ladder.

Parasite — an animal or plant which lives in or on another (the host) and draws its nutriment directly from the host, usually harming the host in the process. Salmon parasites include Pacific lampreys and sea lice.

Redd — nest, about 12-16 inches deep, dug in the gravel bed of the stream, by the tail of the female salmon. A few hundred eggs are deposited in the redd by the female, and then fertilized by the male. After fertilization, the female covers the eggs with gravel as she digs another redd nearby. This continues until the female has laid all of her eggs (usually between 1,500 and 12,000).

Imprinting — the phenomenon which causes a creature (especially a young creature) to accept or recognize a person, animal, or thing as the proper object of an innate response. It is thought that young salmon imprint the scent of the river in which they are born; as adults, the salmon seek out and follow this scent, until they find their spawning site.

Salmon run — the term applied when salmon travel up a river in great numbers, en route to their birth streams.

SETTING UP THE GAME

This kit contains materials for up to 5 groups of players. The recommended group size is 4-5 players per game board.

Before playing the game for the first time, you will need to separate all of the cards from the perforated sheets, and organize the cards into 5 complete sets. (The cards are numbered; each complete set should include cards 1-64.)

Each group of players should have the following items:

1 game board

1 die

1 set of game pieces (1 green, 1 yellow, 1 red, 1 blue, 1 white)

1 complete set of game cards (cards numbered 1-64)

1 sheet of paper and 1 pencil per student (plus optional calculators) for scorekeeping

For each set of cards: Place all cards of a single color, face (text side) down, on the space of the matching color on the board. (For instance, all of the egg cards [card numbers 1-10] are pink; these should be placed on the pink space labeled “Salmon Eggs” on the board.)

Playing the game

1. Each player selects a game piece, which s/he will move around the game board according to the roll of the die and directions on various cards.
2. Each player begins on a “Start/Finish” space of his/her choice (at the headwaters of either the Columbia River or the Snake River). Each player will travel along the path of the river, out to the Pacific Ocean, and then back up the river to the same “Start/Finish” space where s/he began. Players travel along their journey as indicated by the direction of the arrows on the board.
3. Each player starts out with 30,000 salmon eggs. This initial population will decrease as the player follows the instructions on the cards. The player subtracts each loss when it occurs.
4. To start play, each player rolls the die. The player with the highest roll starts. After the first player finishes his or her turn, play proceeds clockwise.
5. If a player lands on a colored space, s/he picks up a card of the same color, reads the card out loud, and follows the instructions on the card. Some of the spaces contain two colors. Follow the colors from pink (eggs) to gray (fry) to green (smolts) to blue (adults) when traveling toward the ocean and the colors from blue (adults) to yellow (return up the river) to red (spawners) when traveling back toward the spawning grounds.
6. At the end of the player’s turn, the player returns his/her card face down, to the bottom of the pile from which it came, unless instructed to do otherwise by the card. The player’s game piece remains on the space it occupies and is moved from that point during the next turn.
7. Two or more game pieces may rest on the same space at the same time.
8. The player who gets back to the finish space with the most adult salmon (that is, the highest score) wins the game. In the rare event that no players make it back to the finish space, the last player with some surviving salmon wins.