

# An Incredible Journey



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## An Incredible Journey

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Requests for copies of this book should be addressed to:  
[wcr.education@noaa.gov](mailto:wcr.education@noaa.gov).



## NOAA Fisheries West Coast Region

NOAA Fisheries is responsible for the stewardship of the nation's ocean resources and their habitat. Our work is guided by two core mandates—to ensure the productivity and sustainability of fisheries and fishing communities through science-based decision-making and compliance with regulations, and to recover and conserve protected resources including marine mammals, sea turtles, and fish.

The West Coast Region of NOAA Fisheries works in Washington, Oregon, California, and Idaho. Our research, fisheries management, enforcement, and habitat restoration helps recover and conserve protected species such as abalone, salmon, sea turtles, Southern Resident killer whales, and Steller sea lions.

To learn more, visit:  
[www.fisheries.noaa.gov/region/west-coast](http://www.fisheries.noaa.gov/region/west-coast).



# NOAA FISHERIES



## About This Book

Throughout their short lives, salmon complete an incredible journey that is fraught with many natural and human-made challenges. While salmon used to return to rivers and streams in vast numbers every year, many populations are now threatened with extinction.

For thousands of years, communities across the globe have relied on salmon as a key component of their culture. Communities and governments are rallying together to save salmon from extinction and restore the habitat on which salmon depend.

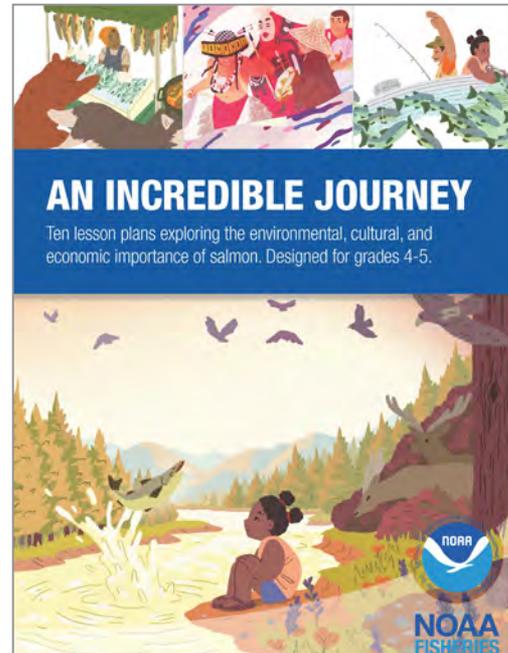
This book explores each of these topics through vivid illustrations and short text. So that students feel empowered to take action, the text is followed up with examples of students who are working to protect salmon and their habitat.

An detailed description of the salmon life cycle follows this page.

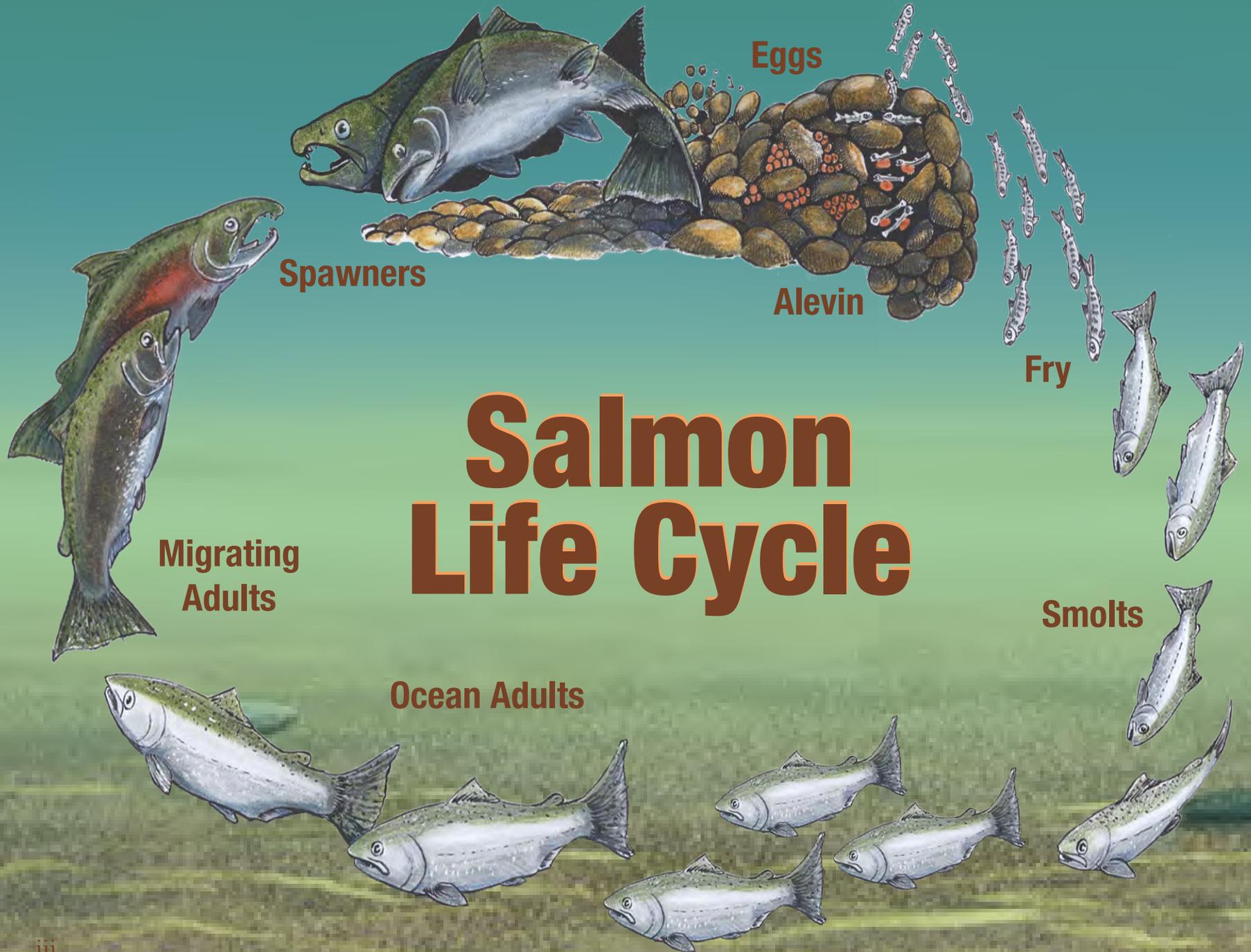
A glossary of supporting vocabulary words are defined on pages 34-35.

## Corresponding Curriculum

To further explore the concepts presented in this book, download a free copy of the *An Incredible Journey* curriculum from [www.fisheries.noaa.gov](http://www.fisheries.noaa.gov) or by contacting [wcr.education@noaa.gov](mailto:wcr.education@noaa.gov).



This curriculum is designed for grades 4-5, and can easily be adapted for grades 3 and 6. Each of the 10 lessons align to educational standards and contain extensions, action projects, and additional resources for students to learn more.



# Salmon Life Cycle

## Salmon Life Cycle

The salmon life cycle begins in freshwater, when a nest of eggs, called a redd, is fertilized. The **eggs** remain in the gravel throughout winter while the embryos develop. In the spring, eggs hatch and **alevins** emerge. These tiny fish have a yolk sac attached to their stomachs and stay near their nest. When they have consumed all of the yolk sac, the fish emerge from their nest and are considered **fry**.

After about one year, salmon begin their migration toward the estuary and become **smolts**. In the estuary they undergo smoltification. During this process, their scales turn a silvery color and their bodies begin preparing for life in saltwater. Estuaries, where fresh and saltwater meet, provide nutrient-rich habitats for growing smolts.

Once they are ready for life at sea, some salmon remain in coastal water. Others continue migrating further out to sea. Depending on the species, **ocean adults** may spend up to seven years in the ocean. During this time, they grow larger and stronger to make the journey upstream to their natal (home) stream. We do not know exactly how salmon detect their natal streams. It is suspected that scents and chemical cues play an important role.

Once **migrating adults** reach freshwater, they stop feeding. During the remainder of their journey, their bodies prepare for spawning. Males turn a reddish color and develop hooked noses in order to fight for dominance. This incredible journey—often hundreds or even thousands of miles—draws energy from their fat storage, muscles, and organs.

Upon reaching their natal stream, females build nests. They turn on their side and use their tail to dislodge stones or pebbles. Males fight with other males for spawning rights with a female. The dominant male will court the female. **Spawners** release eggs and milt (sperm) into the gravel. The female covers the eggs with loose gravel and moves upstream in order to prepare another redd. After spawning, both the males and females die, supplying the river habitat with nutrients and the start of the next generation.



## Dedication

This book is dedicated to you, our partners in salmon recovery. If you enjoy fishing for salmon on charter boats in the Pacific, if you partake in first salmon ceremonies with your tribal elders, if you cherish memories of watching spawning salmon swim in creeks on the farm where you grew up, if you enjoy salmon on your dinner table surrounded by family and friends---you have been touched by this iconic Pacific species, you appreciate its link to the fabric of our culture, and because of this you will play an indispensable role conserving salmon for future generations. Thank you for joining us on the road to salmon recovery, doing your part to raise awareness, and helping restore and protect healthy ecosystems in which salmon can thrive. We could not make this journey without your steadfast contributions, commitment, and support.

## Acknowledgments

The endless support and wisdom of Katherine Cheney of NOAA Fisheries West Coast Region and Emily Bosanquet of Pacific Northwest College of Art were essential to the completion of this book.

## Science in Studio Award

This book would not have been possible without the tremendous support of the Science in Studio Award. This award is a collaboration between NOAA Fisheries West Coast Region and the Pacific Northwest College of Art (PNCA).

The Science in Studio Award aims to harness the change-making power of art. Each fall, NOAA Fisheries highlights a pressing concern, such as watershed toxics or safe whale watching. Pacific Northwest College of Art students propose work that addresses the theme and creates a cultural consciousness around the issue.

A panel of expert judges selects awardees based on their early ideations, the strength of their portfolios, their interest in creative research and investigation, and their capacity for professional collaboration with NOAA officials, faculty, and fellow students.

Not only does Science in Studio help build community and inspire change, but it also transforms the artists themselves. Through the program, “artists have a unique ability to translate complex ideas into easily understood visual narratives,” reflects Stephanie Fogel, a 2016 awardee.

Through their making process and professional engagement with NOAA, students participate in the discourse and investigate the complex dynamics at the heart of many of the environmental and social-economic challenges we face as a community, adding their creative voices to the realm of science and policy.

Past projects have addressed nearshore habitat of juvenile salmon (2013/14), watershed toxins (2014/15), safe marine mammal watching (2015/16), salmon culture (2016/17), and sustainable seafood (2017/18).

To learn more, visit: [www.westcoast.fisheries.noaa.gov/education/pnca\\_water\\_quality.html](http://www.westcoast.fisheries.noaa.gov/education/pnca_water_quality.html)

**PACIFIC  
NORTHWEST  
COLLEGE OF  
ART**



**NOAA  
FISHERIES**

# An Incredible Journey

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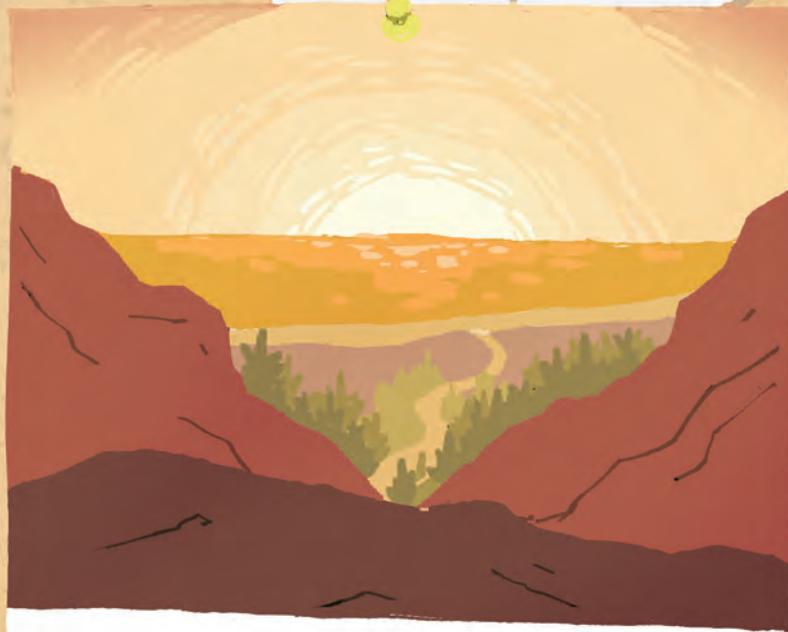
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eggs  
apples  
rice  
Salmon  
oatmeal

REMEMBER  
Habitat  
Restoration  
THURSDAY



19.95  
22.85  
3.27



# JUNE

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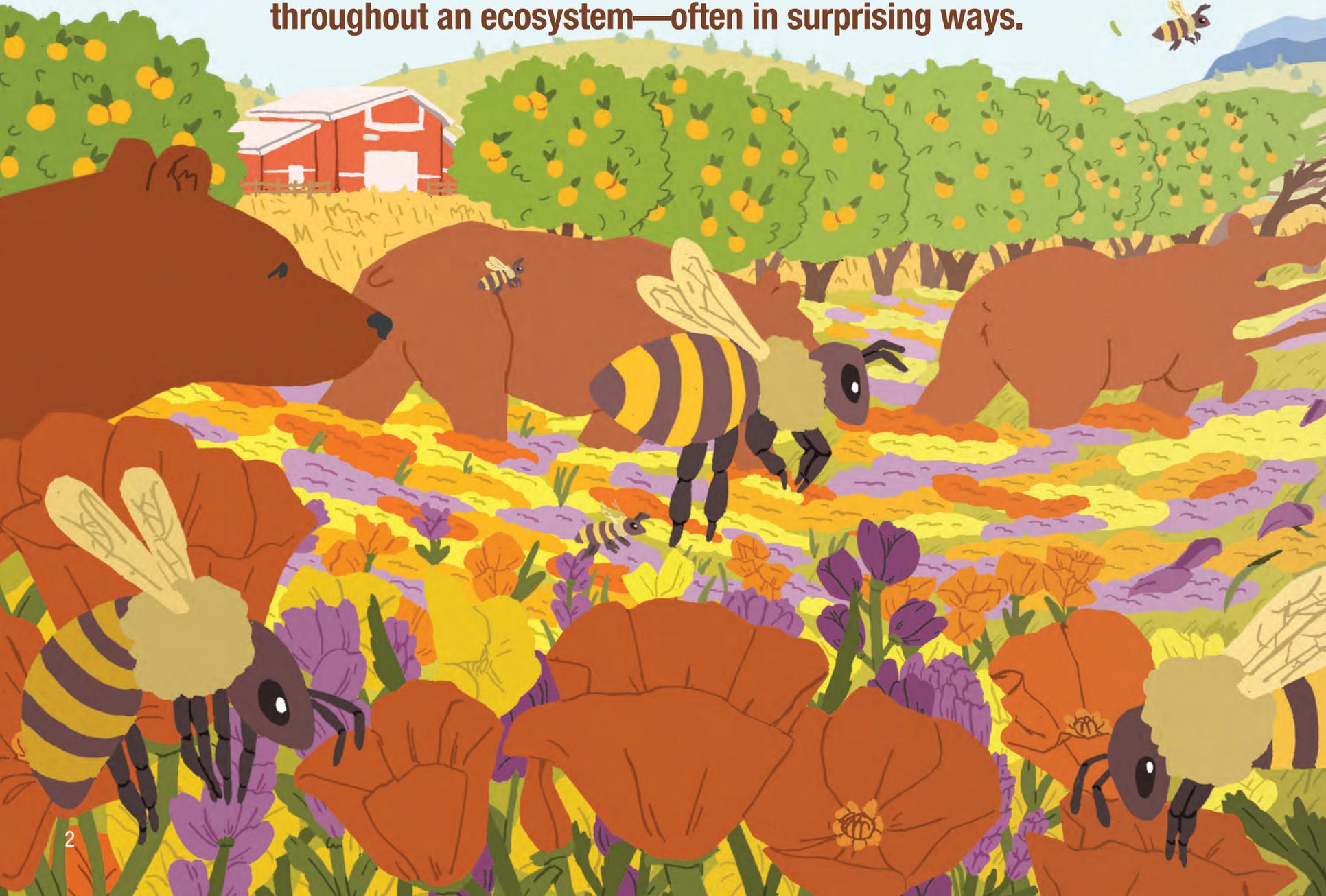




**From rainforests to deserts and mountains to coral reefs, Earth is home to many different ecosystems.**



**Some animals and plants, known as keystone species, play very big roles in their ecosystems. Keystone species help keep an ecosystem in balance. A change in the population of a keystone species can cause big changes throughout an ecosystem—often in surprising ways.**









**Salmon swim thousands of miles from their home stream to the ocean and back again. This unique life cycle makes salmon an important keystone species in many different ecosystems.**

**More than 130 different species—from insects to killer whales—depend on salmon for part of their diet.**







**People around the world also depend on salmon for food, jobs, and culture.**

**For thousands of years,  
communities have  
celebrated the return of  
salmon through dances,  
festivals, and art.**



**At one time, millions of salmon  
returned to their home rivers.**





**Even though salmon are resilient, challenges like climate change, habitat loss, and overfishing are pushing them to the brink of extinction.**

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SAMAKI

Somon

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If salmon disappear, what does that mean for the communities and ecosystems that depend on them?

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People are working together to make sure salmon have what they need to thrive:



Logs so salmon do not get swept away in strong currents.



Shade to keep water cool.



Insects to eat.



Enough water to swim and build nests.



Rivers without barriers so salmon can migrate.



**To save this keystone species, communities are working together to slow climate change, stop pollution, and help salmon overcome barriers.**

Even families, schools, and individuals are making a real difference by planting trees, conserving water, and driving less.







**The choices we make today affect salmon and all the species that depend on them. When we work together to protect salmon, we also protect ecosystems, food, and our culture.**



**Keep reading to learn how kids  
like you are making a difference!**



# Student Stewards

Around the world, people are working together to build stronger communities, create healthier environments, and raise awareness of endangered species. The following case studies highlight kids who are actively promoting water conservation, climate change solutions, salmon habitat restoration, and marine debris prevention. Each of these projects can ultimately contribute to watershed restoration and the recovery of salmon.

If you are feeling inspired by these young heroes, get out in your community and make a difference. It will take all of us working together to save our salmon!



# The Grey Water Project

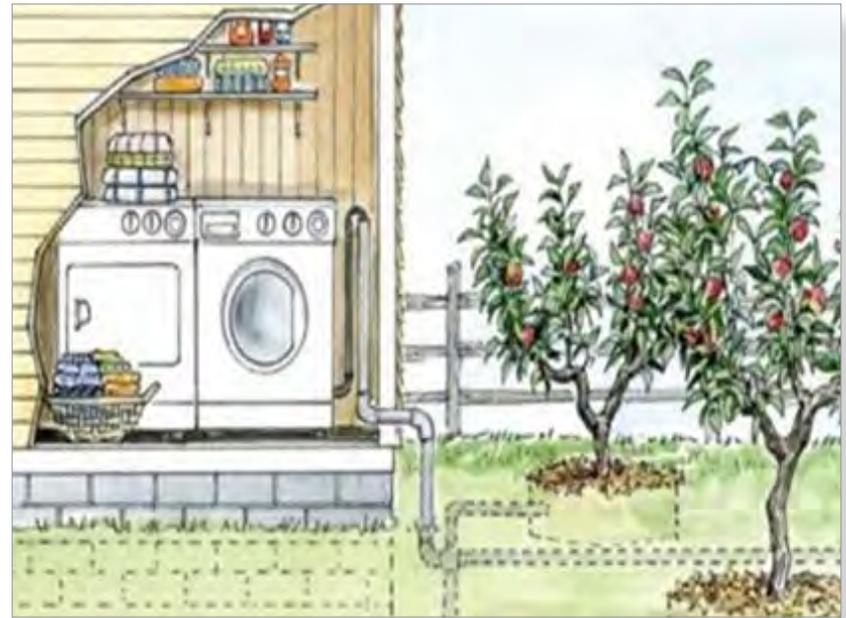
## Fremont, California

Around the world, drought affects millions of people. Because of droughts, some people might not have enough water to drink or to shower. Farmers may not have enough water for their crops or farm animals. Climate change is likely to make droughts become more regular and severe.

Drought not only affects people, but it also impacts aquatic plants and animals. If there is not enough water in rivers and streams, salmon cannot migrate to or from the ocean. Salmon also need enough water to lay their eggs. If there is not enough water in streams or rivers, the water can become too warm for salmon to survive.



Shreya Ramachandran, a middle schooler in California, has seen these effects of drought first hand. “I talked to people whose wells have run dry, leaving them waterless,



*Grey water systems use water from washing for other purposes, such as irrigation*

and farmers who have lost their years’ crops,” said Shreya. “I was touched, and I wanted to find a way to help conserve water.”

Soon after witnessing the effects of drought in California, Shreya traveled to India. In India, she noticed that the droughts were so severe that people had to abandon their farms or villages. She also noticed that many Indians had adapted to living through droughts.

“I learned about the many ways locals save water, including rainwater collection systems which are mandatory in every household,” explained Shreya. “However, I was particularly interested in reuse of grey water (which is lightly-used water), especially from the laundry.”

In India and other countries with frequent droughts, people often reuse water. Water from showers, bathtubs, kitchen sinks, and laundry is fairly clean. It can be saved to water gardens or flush toilets. This helps save water and money.

After returning to the United States, Shreya's interest in reusing grey water continued to grow. Shreya was particularly interested in using grey water from laundry. After some research, she found that some laundry detergents can be toxic to plants and aquatic life. If people are watering their gardens with grey water, they have to make sure it is safe for the environment.

After talking with her grandmother, Shreya found out about soap nuts. Soap nuts are a natural laundry detergent that comes from a berry. Shreya wanted to find out if this type of laundry detergent would harm plants and aquatic life too.

After a series of tests, Shreya found that soap nuts do not harm plants or wildlife. She was surprised to learn that grey water with soap nuts even helped the plants grow! This was a great finding since soap nuts cost less than most natural laundry detergents.



She presented her findings at local water districts. She also won several awards at regional, state, and national science fairs. Shreya's work has inspired so many people that she won the President's Environmental Youth Award. Way to go, Shreya!

After this discovery, Shreya formed The Grey Water Project. This program encourages Californians to conserve and reuse water. Through social media, Shreya shares information about conserving water and using grey water. She also gives presentations at local schools, water boards, libraries, and community events.



The Grey Water Project also hosts a water conservation challenge for kids. The challenge encourages kids to take shorter showers, turn off faucets when brushing their teeth, use grey water to water plants, and more.

# Pigtails Art

## Sioux Falls, South Dakota

Bria Neff has always had a passion for art. She first started drawing animals at age four. By second grade, she was entering and winning art competitions.

The Animal Action Education's 2015 Art and Essay Contest changed Bria's life. Her painting of an African lion was one winner of the contest. Bria was so inspired by winning this contest that she wanted to do more to protect endangered species. After the contest, she began asking her mom questions about why animals were endangered and what that meant.

"She wanted to know what endangered meant, how many animals were endangered and above all else—why? Why were they dying, why were they hunted, and what could she do to save them?" remembers Amity Neff, Bria's mom.

Bria's original goal was to raise \$10,000 by her 11th birthday. The first painting she sold was a depiction of two lions, titled "Brotherly Love." This painting sold for \$125. In her first year alone, she raised more than \$5,000!

Bria's artistic process is thorough. Before painting an animal, Bria first finds pictures of the species and studies them. She even researches each animal at the library or by watching documentaries. To compliment her art, she writes a report about each species!

Bria likes to paint animals with detailed eyes and vivid expressions. As Bria explained, "I wanted to give them a face so people would know how important they are."

Through her research, Bria has learned a lot about endangered species. She has learned that it is important to protect both animals and their habitats. She has also found that every species has an important role to play in its ecosystem. Habitat loss, deforestation, and climate change are some of the major problems leading to extinction.

By the time she was ten years old, Bria had painted over 200 species and donated \$10,560! She gives the money to her favorite charities, including International Fund for Animal Welfare, The Wolf Conservation Center, and The Jane Goodall Institute.





of the zoo's 24 endangered species, and messages about protecting animals.

The coloring book is sold at the local zoo. The profits are donated to the zoo's conservation programs. Bria hopes that her coloring books inspire other kids to make a difference. "I hope they can learn that they can help and save the animals, and they can change the world," she said.

Since Bria has inspired so many people with her art and generosity, she was awarded the 2017 International Youth Eco-Hero Award. Way to go, Bria!

To further raise awareness about endangered species, Bria has hosted art shows, published coloring books, and created social media campaigns.

In celebration of Earth Day 2016, Bria started a campaign called Chalk the Walk Earth Day. On social media, she asked people to make sidewalk art representing love for Earth. She then asked people to take pictures of their sidewalk art and post the pictures on social media. Bria plans to continue this campaign every Earth Day.

One of her coloring books is titled "Endangered Faces of The Great Plains Zoo." The book features coloring pages



# The Solutionaries Project

## Burlington, Vermont and Mzuzu, Malawi

Sometimes the news can make us feel overwhelmed. Hearing about big events like climate change can even make us feel powerless. When people hear bad news, they often shut down instead of taking action.

Students from Vermont Commons School were feeling overwhelmed after hearing about climate change disasters in their classes. Instead of ignoring climate change, the students made a plan.

*“It’s about seeing what is wrong with the world, and taking the steps to make it better—no matter how small those steps are.”*

Maggie Homer, The Solutionaries Project

The students set out to use the news to empower people, rather than paralyzing them with fear. Students from Vermont Commons School worked with students from Mzuzu Academy in Malawi, a small country in southeastern Africa, to create a podcast series. A podcast is like radio show on the internet.



Together, they launched The Solutionaries Project. During their podcasts the students interview local people who are taking action. Most of the podcasts focus on climate change. Others focus on community issues like poverty, happiness, and agriculture.

What does climate change have to do with salmon? Climate change can increase the temperature of water. If water is too warm, salmon eggs will not hatch. Another effect of climate change is ocean acidification. Ocean acidification makes it harder for salmon to detect predators and prey. Climate change can also cause more severe droughts. Without enough water, salmon can not migrate.

In one climate change-focused podcast, students interviewed Duane Peterson. Duane is a



cofounder of a solar panel installation company called SunCommon. This company works to make solar panels cheap and easy to install. By making solar panels cheaper, more people can buy them. Instead of burning fossil fuels, solar panels use energy from the sun to create electricity. This reduces carbon dioxide emissions, a major cause of climate change.

In another episode, students interviewed locals about deforestation in Malawi's Chikangawa Forest. So many trees have been cut from the forest that the region has more droughts and floods than normal. Students interviewed workers from Raiply, a factory near the forest. This factory is working to plant trees and protect the biodiversity of the forest. They also interviewed local villagers whose livelihood is being impacted by deforestation.

*"It is our duty to preserve the environment and its resources for future generations, rather than using them all up..."*

Spencer Reed, The Solutionaries Project

The Solutionaries also write essays about their vision for a positive future. In these essays, students think about how their own choices impact the environment. They give advice for staying optimistic when there is too much negativity on the news. Students discuss what a positive future looks like and how we can achieve this future.



*"I want my children to live in a better world, but one that values the environment as an equal to technological advancement."*

Peter Larsen, The Solutionaries Project

While The Solutionaries are working on their podcasts, they are gaining valuable skills. Students learn about different career opportunities. They work on their writing and editing skills. Maybe most importantly, they get to know members of their community.



# Students Saving Salmon Club

## Edmonds, Washington

Willow Creek, Shellabarger Creek, and Shell Creek are small creeks in Western Washington State. These creeks empty into Puget Sound, which leads to the Pacific Ocean. The creeks are home to insects, amphibians, and fish.

Members of the Students Saving Salmon Club (SSSC), want to learn more about the health of these creeks and how the water quality is impacting salmon. Students conduct hands-on research at these creeks to test the oxygen levels, water temperature, bacteria levels, pH, and nitrates.

After they collect, analyze, and graph their data, students meet with the city council and other community groups. They tell community members about the condition of local creeks, and offer different solutions to improve habitat for salmon.

Salmon currently spawn in only one of the three creeks—Shell Creek. SSSC members volunteer with the Edmonds Stream Team to find out about water quality in all three creeks to determine if that might affect salmon. Club members compare the data from local creeks to data from healthy salmon creeks.

The other two creeks, Willow and Shellabarger, drain into the Edmonds Marsh, which currently drains to Puget Sound through a 1,600-foot pipe. This long stretch of pipe

likely prevents salmon from returning. The City of Edmonds is undertaking a feasibility study to replace the pipe with a tidal channel to allow salmon to enter the Marsh and streams.

The group has been able to make a big impact because of their enthusiastic members and mentors. As Taylor Blevins said, “Everyone is hardworking

and has a determined attitude. Everyone who is volunteering wants to be there and truly make a difference for the salmon and to help out streams.”

The group’s enthusiasm and efforts are paying off. Students have broadened their efforts and have begun working with homeowners. Students go door-to-door and talk with homeowners about landscaping and how it impacts salmon. Even though this process can be





knowledge of what homeowners can do to prevent contamination and improve stream habitat.”

It’s not only the salmon who are benefiting from SSSC. By working with scientists, students learn how to properly sample and record data. Through data analysis and graphing, students improve their math skills. When students present data to the city council, they learn about local politics. By reaching out to homeowners, students learn important communication and outreach skills. The SSSC has become a great way for students to learn new skills, explore future career paths, and work alongside experts.

challenging, club members find it rewarding, “It took longer than we expected to go from door-to-door and not everybody was willing to talk to us,” said Taylor Blevins. “Nevertheless, we were able to reach all the houses we wanted to and came back at a later date to talk to the people we had missed.”

After students survey the homeowners, they work with them to plant salmon-friendly plants along the creek. These plants help keep the water cool, prevent erosion, and provide cover for salmon to hide from predators.

Jared Yu, club secretary, found that working with homeowners really stretched his skills. “It was hard to have to talk to strangers at first but it helped build my confidence and communications skills,” Jared said. “It was encouraging that a lot of the residents were already taking measures to be safe, and we can help by spreading



# Youth Leadership Program - TreePeople

## Los Angeles, California

Los Angeles has been experiencing more frequent droughts. These droughts have greatly impacted the city's trees. Drought can cause burned leaves, slow growth, and a loss of roots. Trees that have experienced long-term droughts are more vulnerable to pests and diseases.

TreePeople, a nonprofit organization in Los Angeles recognizes that the city's trees need help. "After five years of historic drought and extreme heat, many of LA's trees are thirsty and vulnerable," said Caitlin Dunham from TreePeople. "And without healthy trees shading campuses and communities, students suffer."

Why do trees matter so much? Trees provide many environmental benefits, including cleaning our air. Trees remove carbon dioxide from the air and store large amounts of carbon in their wood. Carbon dioxide is a major cause of climate change.

What does climate change have to do with salmon? Climate change can increase the temperature of water. If water is too warm, salmon eggs will not hatch. Another effect of climate change is ocean acidification. Ocean acidification makes it harder for salmon to detect predators and prey.



Climate change can also cause more severe droughts. Without enough water, salmon can not migrate.

In order to get kids involved, TreePeople created the Youth Leadership

Program. This program teaches young people how to care for trees in their communities. The program was started in 2014, and in three years volunteers have cared for more than 600 trees!

TreePeople's programs are unique because volunteers continue to care for trees five years after they were planted. This helps ensure the trees survive long into the future.

Throughout the summer, students will make sure that the trees are taken care of properly. In addition to watering the trees, students mulch and re-stake trees when needed. They also learn how to remove suckers from trees. Suckers are plants that grow near the trunk of the tree or small branches that grow from major

branches. They are called suckers because they “suck” nutrients from the trees. Students also look for ants. Lots of ants traveling on the trunk or on branches can indicate there is something wrong with the tree.

Trees are not only important for the environment, but they are also important for people. Living near trees can reduce neighborhood crime. Trees can increase the value of your home. They also keep temperatures cooler in summer, which reduces cooling costs. Research has shown that people who have access to trees and nature have higher academic achievement and less stress.

While some neighborhoods in Los Angeles have plenty of trees, others have almost none. TreePeople works to ensure that low-income neighborhoods have trees too. “In urban areas, extreme heat is a social justice issue,” said Jessica Jewell of TreePeople. “Low-income communities



and people of color are at highest risk, as they tend to live in neighborhoods with less trees, more heat-retaining surfaces, poorly-insulated housing and limited access to air conditioning.”

By working with people of all ages from neighborhoods around the city, TreePeople hopes to create a healthy urban environment for all everyone.



# Youth Media for Trash Free Waters

## New York, New York

There are 5,250,000,000,000 (trillion) pieces of plastic debris in the ocean. And this number is growing every day! What can kids do about such a huge problem? Members of Youth Media for Trash Free Waters are setting an example for students around the world. In this program, kids produce creative videos that tackle issues like waste and litter.

But what does litter have to do with salmon? When litter reaches the ocean, it is broken into smaller and smaller pieces. Salmon, and other animals, can mistake this trash for food. When animals eat too much trash, they can get sick or die. About 25% of fish sold at markets have trash in their guts.

Students in the Youth Media for Trash Free Waters program first learn about litter and how it impacts animals in the ocean. They then work with professionals to learn how to tell interesting stories. Some of their stories include animations, dances, songs, or interviews with scientists. After students conduct interviews, collect data, create story ideas, and decide on a video style, they work with professionals to develop short videos.

In addition to making videos, students collect and analyze data. While students and local community members clean up beaches, they count the amount and types of trash they find. This information is shared with neighbors, community groups, and local governments. They also share this data with elected officials so that they can better understand litter issues.

The kids want to make sure that their neighbors understand that litter on their streets winds up in the ocean. To demonstrate this, students compare the litter they find on their local streets with the litter they find on beaches. They then share this information with their neighbors.





To help spread the word about these litter and marine debris issues, the videos include a take action message and a social media campaign. Some students have even given talks at press conferences. Others have met with elected officials to share their knowledge.

Some students have even started campaigns to reduce waste. They work with local restaurants and grocery stores to reduce single-use plastics. Single-use plastics are things like straws, candy wrappers, and plastic bags



that are thrown away after being used just one time. Single use plastics are a big source of litter and marine debris.

Other students have chosen to get involved with microbeads. Microbeads are tiny pieces of plastic that are in products like face wash or toothpaste. Microbeads get washed down the sink, and eventually into the ocean. Students in one video show people how to make their own skincare products without microbeads.

Not only are students helping minimize waste and stop litter, but they are gaining valuable skills. Throughout this program, students learn creative storytelling through visual and performing arts. They also learn how to produce professional-looking videos. Through data collection and outreach to the public, students learn about citizen science and civic engagement.

This program was funded by a grant from the U.S. Environmental Protection Agency (EPA) Region 2. Local partners—such as NYC Department of Environmental Protection, Brooklyn College, local community centers, and libraries—were key to the success of this program! If you have an idea for a program in your community, you can work with your teachers or parents to apply for a grant from NOAA's Marine Debris Program or your Regional EPA.



# Supporting Vocabulary

## Abiotic factor

A nonliving environmental media (e.g., water, soils, sediments) or nonliving environmental characteristic (e.g., light, temperature, pH, humidity).

## Alevin

A newly hatched salmon that is entirely dependent upon its yolk sac for nutrition.

## Anadromous

Fishes that migrate as juveniles from freshwater to saltwater and then return as adults to spawn in freshwater.

## Biodiversity

The variety of life in a particular habitat or ecosystem.

## Biotic factor

A living part of an ecosystem (e.g., animals, plants, and microorganisms).

## Commercial fishing

Catching fish for commercial profit.

## Culture

The behaviors, beliefs, arts, and products (things) of a community or group of people.

## Ecosystem

A community of organisms (plant, animal, and other living organisms) and the abiotic parts of their environment.

## Egg

An animal reproductive body consisting of an ovum or embryo together with nutritive and protective envelopes.

## Endangered species

Animals or plants that are in danger of extinction.

## Environmental stewardship

Responsible use and protection of the natural environment through conservation and sustainable practices.

## Extinct

A species, family, or other larger group having no living members.

## Food web

Including many interconnected food chains, a food web is a more realistic representation of consumption relationships in ecosystems.



**Fry**

Salmon become fry when they have absorbed their yolk sac and emerge from their gravel nest (redd).

**Homing**

An animal's ability to return to a place or territory after traveling a distance away from it.

**Keystone species**

A species on which other species in an ecosystem largely depend, such that if it were removed, the ecosystem would change drastically.

**Life cycle**

The series of stages through which a living thing passes from the beginning of its life until its death.

**Migration**

The relatively long-distance movement of individuals, usually on a seasonal basis.

**Natal stream**

A salmon's home stream; where a salmon hatched.

**Pollution**

The release of substances into the environment that adversely affects the health of an organism, the health of an ecosystem, or the usefulness of a resource.

**Recreational fishing**

Harvesting fish for personal use, sport, or challenge (e.g. as opposed to profit or research). Recreational fishing does not include sale, barter, or trade of all or part of the catch.

**Redd**

A gravel nest made by a spawning female salmon.

**Society**

A community, nation, or other group of people who have common interests, institutions, or culture.

**Smolt**

A young salmon that assumes the silvery color of the adult and is ready to migrate to the sea.

**Spawner**

A mature salmon that is migrating back to its home stream to lay eggs or milt.

**Stormwater runoff**

Rainfall, melted snow, or irrigation water that flows across the ground's surface and is eventually returned to streams. Runoff can pick up pollutants from air or land and carry them to receiving waters.

**Subsistence fishing**

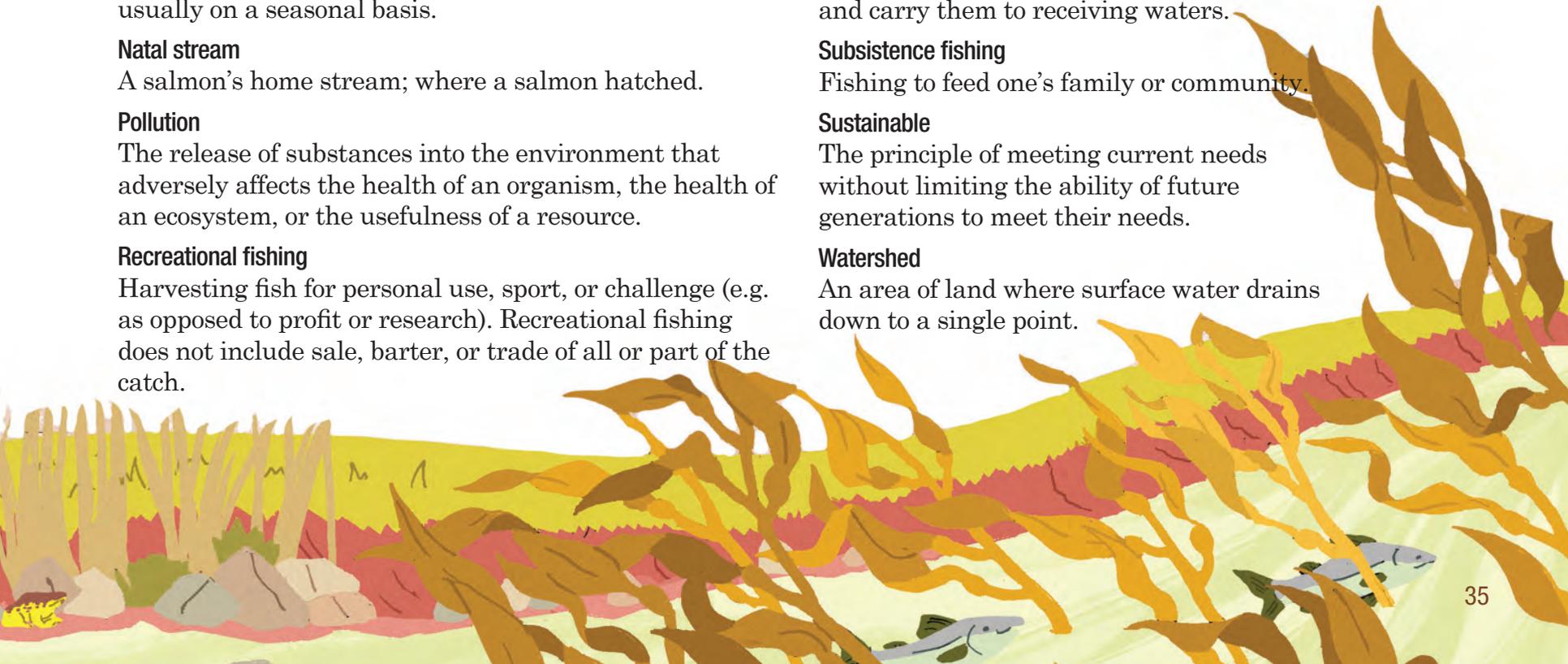
Fishing to feed one's family or community.

**Sustainable**

The principle of meeting current needs without limiting the ability of future generations to meet their needs.

**Watershed**

An area of land where surface water drains down to a single point.



# Photos & Illustrations

Story illustrations by Anke Gladnick, Pacific Northwest College of Art, except where noted.

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## Page iii

Illustrations: Blane Bellerud, NOAA Fisheries

Background: Beryl Allee, Science in Studio/Pacific Northwest College of Art

## Page v (top to bottom)

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