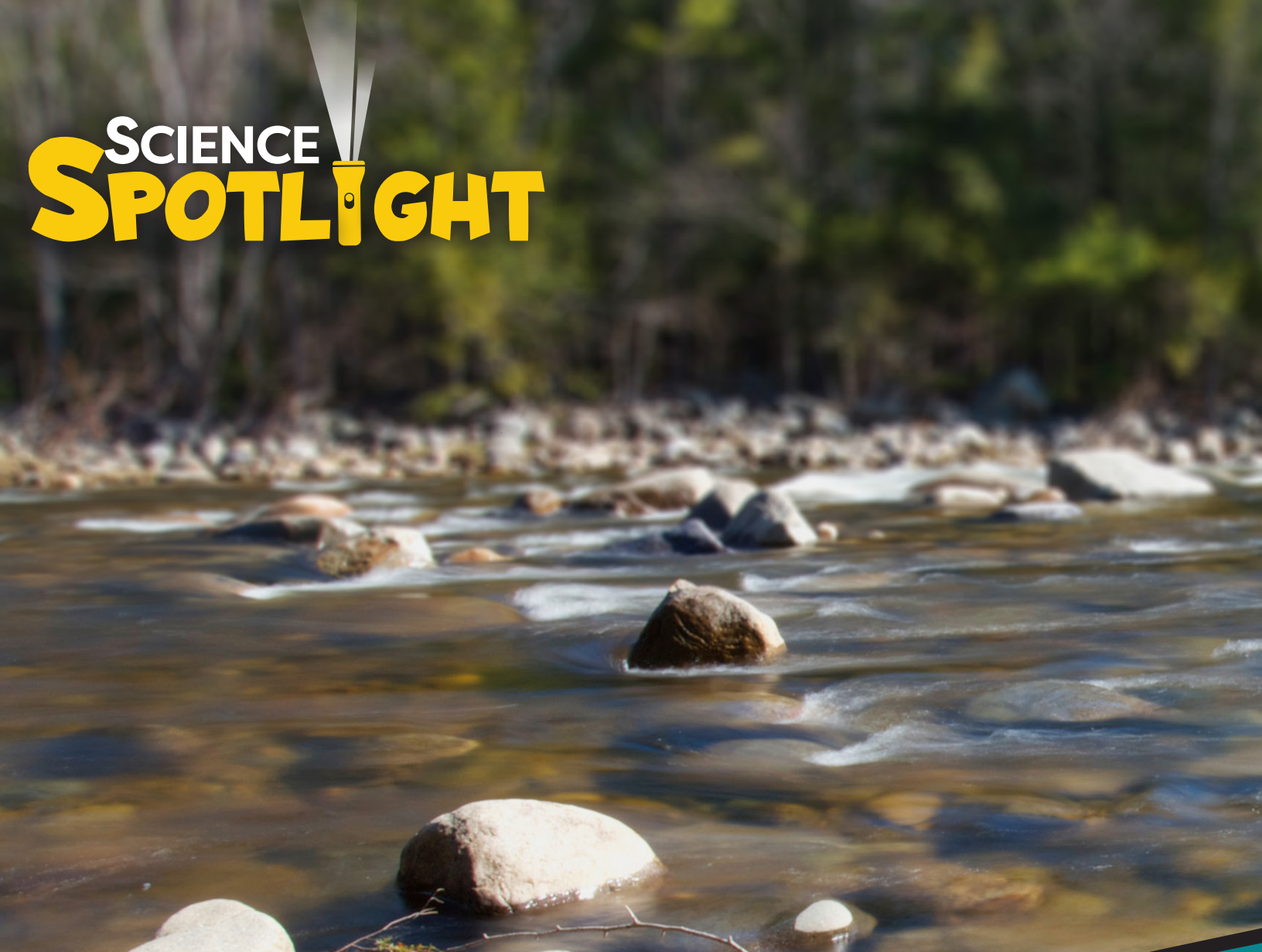
SCIENCE SPOTLIGHT



FISH-FRIENDLY FLOODGATES!

SAY THAT THREE TIMES FAST

GEN ACTION

This project was undertaken with the financial support of the Government of Canada.

Canada

Fraser River DISCOVERY CENTRE
The Voice of the Fraser

Fish-Friendly Floodgates! Say That Three Times Fast

Origin Story:

HOW DO COMMUNITIES ALONG THE FRASER RIVER PROTECT AGAINST FLOOD-ING?

Living on the floodplain of the lower Fraser River comes with the risk of flooding from both the ocean and upriver. Over time, the Fraser River has been engineered with different barriers to prevent floodwaters from reaching communities downstream.

One method is creating dikes (also known as levees), a barrier that is constructed to raise the height of the banks of rivers, lakes, or coastal shores. The construction of dikes in this region began around 1864, however after the historic flood of 1894 (the largest flooding event along the Fraser River on record) the use of dikes increased as a main form of defense against rising waters.

Another method is installing floodgates, which are located between the main channel of the river and a smaller creek that drains into it. The gate opens and closes depending on the water height on either side of the gate; they close during a major flooding event. Six hundred kilometres of dikes and four hundred floodgates have been constructed in the lower Fraser region alone!

METHOD 1 - DIKES

METHOD 2 - FLOODGATES

Flood Protection vs. Wildlife Protection:
ARE FLOODGATES AFFECTING FISH HABITAT AND PASSAGE?

It is necessary to protect communities living on the coastal floodplain of the lower Fraser River from floods, but it is also important to consider how flood protection barriers can affect ecosystems. Ecosystem connectivity is the ability of wildlife to move without being trapped in a certain area. This is especially important for fish species that live in the Fraser, as many migrate to and from the tidal creeks that connect to the main river channel.

Two of these fish species are chinook salmon (Oncorhynchus kisutch) and coho salmon (Oncorhynchus tshawytscha) which use wetland and tidal creeks during their juvenile stages as a nursery. However, fish typically pass through installed floodgates to access these key habitats. This creates a problem during seasonal flooding events, as the floodgate will remain closed to prevent excess water from entering from either side of the gate.

Floods are also expected to both increase in intensity and frequency because of climate change, as warmer temperatures contribute to higher sea levels, more rainfall, and faster snowmelt. Scientists Rebecca E. Seifert and Jonathan W. Moore decided to test how often these floodgates were opened to determine if closed floodgates were harming both fish species and the quality of fish habitat.

What the scientists discovered from the camera footage was that nearly 40 percent of the floodgates only remained open for 10 percent of each day.

This means that fish were rarely able to travel through 40 percent of all floodgates! Scientists determined that floodgates that remained closed had less available oxygen in the water, making it difficult for fish to survive. Closed floodgates were primarily located in areas that used to have wetlands but had been built over. However, floodgates that were opened more often had a much higher diversity of species and better water quality conditions.

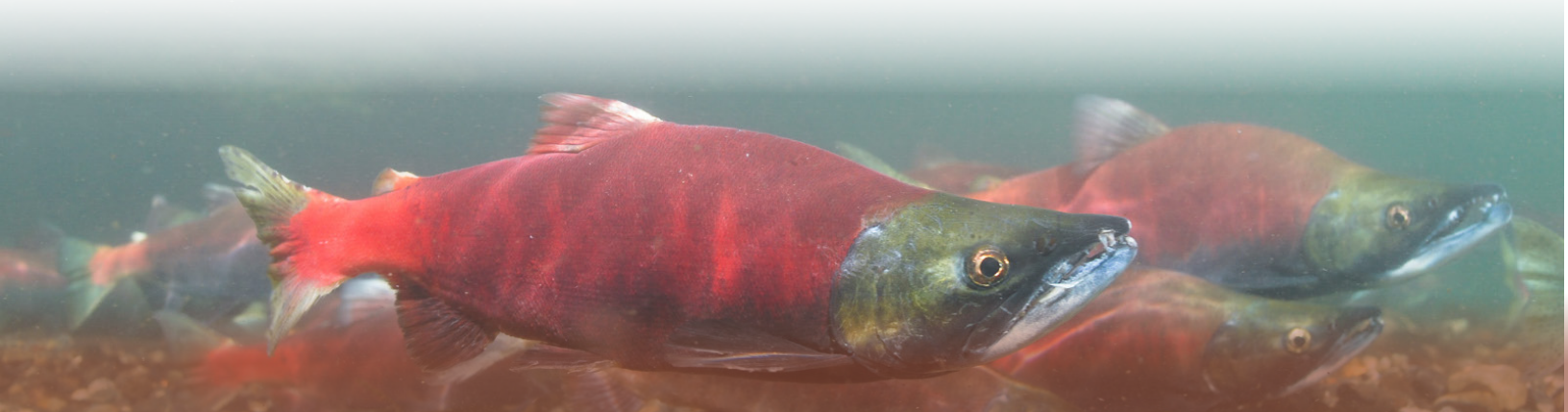
Because of climate change, flood patterns are changing, and flood protection barriers will have to be updated. It is important to think about how our flood infrastructure is affecting the wildlife that call the river home, and how we can design it with ecosystem benefits in mind.

Time for GENACTION!

Try This at Home:
WATER QUALITY TESTING

To test whether the water was suitable for healthy fish habitat, the scientists in this study used a YSI device to measure water quality. These devices can measure lots of factors all at once and are quite expensive. However, you can measure water quality by yourself with an at-home water testing kit! These kits come with small strips that change colour after being exposed to a water sample. The colour of the strip shows the pH of the water, or how acidic/basic the sample is. pH is measured on a scale from 1 to 14, where the higher the acidity of the sample, the lower the pH number (lemon juice has a pH of 2).

On the other hand, the more basic the sample is, the higher the pH number (drain cleaner has a pH of 14). These tests can also measure water hardness, or the amount of minerals in a sample. A good first place to start is by testing the tap water that comes out of your own kitchen sink! The normal pH of tap water changes depending on where you live in the world, yet according to Health Canada's Guidelines for Canadian Drinking Water Quality, tap water should range between a pH of 7 to 10.5. After testing the tap water in your own home, you can then test to see how the pH changes across samples from other sources of water, such as a local stream or lake.



Climate Action:
THE IMPORTANCE OF LOCAL RESEARCH

The First Nations Fisheries Legacy Fund (FNFLF), comprised of Katzie, Kwantlen, Kwikwetlem, Musqueam, Tsawwassen and Tsleil-Waututh First Nations, was created to help First Nations, government, and private companies work together to help protect and restore environments along the Lower Fraser River and Burrard Inlet.

The FNFLF undertakes projects that can help restore critical salmon habitat. Recently, the FNFLF has been using a combination of geospatial technologies, or technologies that monitor the land from above, along with local fish habitat knowledge to map out areas of concern along the Fraser River. The FNFLF is currently monitoring the "fish-friendly" floodgate, observing how the water conditions differ on either side. The floodgate that the FNFLF is monitoring has a different design; shaped like a corkscrew, it allows fish to easily travel.

Geospatial Technologies

Local fish habitat knowledge

You can also practice monitoring ecosystems as a form of citizen science, where through consistent observations you can help contribute to scientific knowledge. If you live close to an aquatic ecosystem such as a river, stream, lake, or wetland, what can you observe that may be impacting fish habitat? This could look like structures such as closed floodgates, dams, or weirs, or as various types of pollution. Just as how the FNFLF is mapping out areas at risk, you can log in a notebook of where you observe that fish habitat is threatened.

This Science Spotlight was written based on Seifert, Rebecca E., and Jonathan W. Moore. 2018. "Floodgate Operations and Fish Communities in Tidal Creeks of the Lower Fraser River (British Columbia, Canada)." Estuaries and Coasts, 41: 1206-1221.

Climate Change
Past, Present, and Future

Earth is the only planet in the solar system known to support life. What makes our home so special? Earth has an atmosphere, a layer of gases between our planet and space. Some of these gases, like carbon dioxide, are called **greenhouse gases**. They are crucial parts of our atmosphere; they trap in the heat of the sun, similar to how heat is trapped in a greenhouse, or in a car on a hot day. This process, called the **greenhouse effect**, keeps Earth's temperature warm enough for living things to thrive.

The sun's rays hit our round, tilted planet unevenly. This uneven heating of Earth's surface leads to differences in temperature, which drives weather patterns. We call the patterns in temperature and weather over long periods of time **climate**. Different parts of the world have vastly different climates; it depends on how much heat they receive, as well as what landscape features are nearby. Water, mountains, ocean currents, and forests all impact our climate. In turn, living things around the world have adapted to the climate they live in.

Something, though, is changing. Over the past two hundred years, humans have been burning fossil fuels, such as coal and oil, to make energy to power our daily lives. Fossil fuels are made from decomposed plant matter and microscopic life millions of years old. This matter is full of carbon, and, burning it releases, or emits, billions of tonnes of **carbon dioxide** gas into the atmosphere every year. When too much carbon dioxide is emitted, the delicate balance of greenhouse gases maintaining

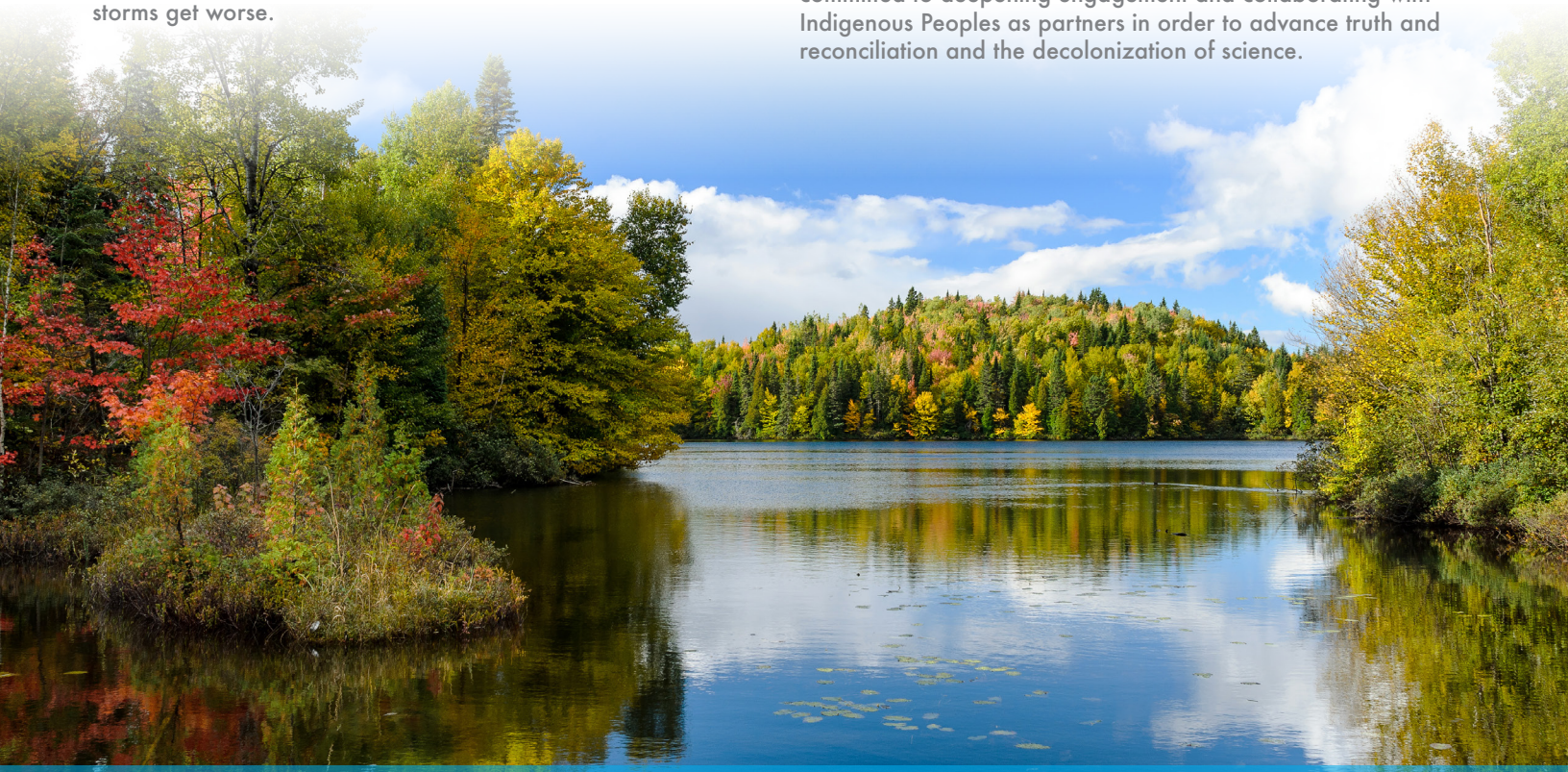
Earth's climate is upset. More and more heat is trapped, causing the planet to warm. Weather patterns change, water levels rise, storms get worse.

Climate has changed many times throughout Earth's history, from ice ages to periods much hotter than today. So why is this time any different? Scientists agree on two things. One, temperatures are rising faster than they ever have in documented climate history. Two, this climate change is driven by human activities, due primarily to greenhouse gas emissions.
Climate change is already impacting people's ways of life all over the world. Powerful storms, droughts, forest fires, and floods are threatening people's access to food, water, and safe homes.

The most important step we can take to prevent serious climate change is to reduce greenhouse gas emissions. Incredibly brave and caring people around the world are finding new ways to reduce emissions and make our communities climate resilient every single day. And you can join them! These Science Spotlights are here to help us learn more about climate change and how you can take action.

Our Commitment to the Decolonization of Science

Institutions of GenAction initiative respect and affirm the inherent and Treaty Rights of all Indigenous Peoples across what we now know as Canada. We give thanks to the Indigenous Peoples who care for this land since time immemorial and pay respect to their traditions and ways of knowing. We acknowledge their many contributions to innovations in Science, Technology, Engineering, and Mathematics, past and present, and are committed to deepening engagement and collaborating with Indigenous Peoples as partners in order to advance truth and reconciliation and the decolonization of science.



Climate Change: Past, Present, and Future is based on...Delmotte, Masson, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, et al. 2021. "Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." Intergovernmental Panel on Climate Change. Cambridge University Press. In Press.