Northwest Treaty Tribes
Protecting Natural Resources for Everyone
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Inside:
- Tribes respond to climate crisis
- European green crab spread
- Enhancing herring habitat
- NWIFC elects officers
To save the salmon, we must slow climate change

by Ed Johnstone
NWIFC Chairman

No one in the Pacific Northwest is exempt from the impacts of climate change.

Rising global temperatures are intensifying floods, droughts and warming waters. Last summer’s heat dome led to temperatures in western Washington as high as 110 degrees. We didn’t just break records—we obliterated all-time records over an incredibly hot four-day period. The ocean, the rivers and the streams ran hotter than ever.

Thousands of salmon died, and the people and animals that depend on them suffered.

As salmon disappear, so do dozens of other species dependent on the nutrition they provide. My mentor Billy Frank Jr. once said, “As the salmon disappear, so do our tribal cultures and treaty rights. We are at a crossroads, and we are running out of time.”

As the next few pages show, the tribes have been leading the way in adapting to and mitigating climate impacts. We are determined to make a difference. Tribes have bought land to protect and restore. We are installing carefully planned logjams in rivers to form salmon-friendly pools, planting thousands of trees and native vegetation along rivers and streams to replace riparian habitat and taking a lead role in opposing the causes of human-caused climate change.

But the sad truth is our efforts are nowhere near enough to keep up with the damage caused by seemingly endless development and ongoing onslaught to the environment.

Tribes have been calling for action in the fight against climate change for decades, and we have done what we could to deter its impacts. We need to be involved at all levels of climate policy.

More than 10 years ago, western Washington treaty tribes sponsored a symposium at the Smithsonian’s National Museum of the American Indian in Washington, D.C., to showcase our concerns and gather our collective strength to meet the climate change challenge.

Funding to help fight and adapt to climate change is forthcoming. The state’s new Climate Commitment Act, a cap-and-invest program for carbon polluters is projected to raise $8.4 billion by the end of state fiscal year 2040, with at least 10 percent of that funding climate investments supported by tribes. In addition, the state intends to spend at least $50 million per biennium to help mitigate climate impacts on tribes. The state operating budget includes more than $3 million to develop new guidance and model planning elements under the Growth Management Act to help local governments address climate change. The feds are kicking in too, with billions of dollars intended to turn the tide.

Throwing money at the problem is only part of the solution. Real progress will require strong will, follow-through and lifestyle change. People everywhere have got to take a good, hard look at the way they do things. They have to learn to respect the land and truly care about the world they are leaving for their children.

Everyone needs to understand why it’s so important to restore salmon in our rivers, and why they should conserve gas and turn to clean energy, use water sparingly and reduce plastic use. They need to support the efforts to fight climate change, and learn from the traditional knowledge of the tribes.

We all have to work together to truly make a difference.
Tribes in western Washington are on the front lines of climate change adaptation. The climate crisis threatens every aspect of natural resources management. For years, the treaty tribes have been gathering data to better understand vulnerable areas on reservations and tribal communities, including impacts to salmon, shellfish, wildlife, water resources, snowpack, traditional plants and tribal infrastructure.

Many of the necessary mitigation actions are ones tribes have been doing for years as part of their work to protect their treaty rights.

“Climate change is no longer a ‘tomorrow’ issue—we must address this challenge now,” said Puyallup Chairman Bill Sterud.

The Puyallup Tribe released its climate mitigation report in 2016. It’s one of many plans developed by tribes across the region that highlight the potential impacts of climate change and suggest adaptation options.

Warmer stream temperatures and reduced streamflows can increase risks of disease and die-offs among fish, particularly culturally important salmon. Ocean acidification may impair growth and survival of shellfish such as mussels and oysters. Culturally important sites, key transportation routes and other infrastructure may be threatened by rising seas and stronger storms.

The Puyallup report outlines steps toward adaptation including the continuation of current programs such as the tribe’s focus on restoring valuable habitat, monitoring water quality carefully, and managing hatcheries, fisheries and shellfish resources.

Future efforts could include protecting infrastructure by creating systems such as alternate transportation routes if another is flooded or damaged. To help plants and animals threatened by climate change, the tribe could create habitat linkages to enable migration to new and suitable habitats.

“We have confronted hardships in the past, and it was our strong connections to the land and each other that got us through,” Sterud said. “Our best chances of success in preparing for what climate change will bring is through our collective commitment to remain steadfast.” —Trevor Pyle

Suquamish Tribe salmon recovery biologist Steve Todd checks the water temperature on Wildcat Creek in 2021. Photo: Tiffany Royal

Warming Temperatures

For the past 20 years, the Suquamish Tribe has been monitoring water temperatures in the Chico Creek watershed, plus more than 25 other salmon streams in Kitsap County, to understand stream temperature patterns through the warmest and driest months and how they compare with the state’s water quality standards.

The data was used in a recent study with the University of Washington Climate Impacts Group that assessed changes to stream temperatures and flows in Chico Creek and its major tributary streams.

The study found that warmer air temperatures in coming decades will increase stream temperatures in all the monitored locations, said Steve Todd, the tribe’s salmon recovery biologist, leading to more summer days when temperatures exceed the state’s water quality standard, putting more stress on salmon and steelhead.

The state’s standard for summer salmonid habitat is 16°C/60.8°F, measured by the seven-day average of the daily maximum temperatures.

The tribe hopes to build on this study by integrating the impacts of a growing population and land use development, along with climate change impacts, to assess the implications for watershed hydrology, stream temperatures, and salmon in Chico Creek and other Kitsap watersheds.

“If we are to recover and protect salmon for future generations, we need to use the best science available to understand how climate and land use changes are likely to impact our watersheds,” Todd said.

One focus will identify where protection and restoration of riparian vegetation is likely to be most effective given future development patterns and a warmer climate. The recently completed steelhead recovery plan for the East Kitsap area, along with several watershed restoration plans completed by the tribe, point to land use and climate change impacts as key pressures to address in salmon recovery. —Tiffany Royal

CLIMATE COVERAGE CONTINUES NEXT PAGE
Climate change brings melting glaciers, 

Moving to Higher Ground

For tribes on the Olympic coast, climate change is not a far-off threat. It’s already at their door—and threatening to seep in.

That urgency was recognized in an appropriations bill signed by President Biden in March 2022. The bill included funding for the Hoh and Quileute tribes and Quinault Indian Nation to undertake mitigation measures, including moving some structures to higher ground.

The funding package includes more than $1.6 million for the Hoh Tribe’s relocation development project, which will include funding the connection of water and sewer lines as the tribe relocates to higher ground.

It includes nearly $1.5 million for the Quileute Tribe’s Move to Higher Ground water system improvement project, which will finish development of a reliable water source as the tribe moves facilities and develops future housing on land that won’t be threatened by tsunamis and floods.

And it includes $500,000 for the Quinault Indian Nation’s relocation development project, which would help the tribe develop infrastructure for a seven-family neighborhood project to be built above a tsunami zone. The infrastructure eventually would be used for a school and water tank.

“Since time immemorial, the Quinault people have lived and thrived in the Taholah Village, which is along the Quinault River and the Pacific Ocean,” said Quinault President Guy Capoeman. “However, because of the threat of increased storm surge, continued riverine flooding due to climate change and threat from a tsunami, the Quinault Indian Nation has made the difficult decision to relocate the Taholah Village to higher ground for the safety of our citizens.”

The story map crystallizes a philosophy that drives home the importance of acting for the future: “We do not inherit the earth from our parents, but rather borrow it from our children.”

—Trevor Pyle

View the story map: nwtt.co/squaxinstorymap

Squaxin Island Tribe biologist Rana Brown, right, surveys a shellfish bed that reopened following a community effort to improve water quality. The tribe’s treaty right to harvest shellfish is threatened by sea level rise. Photo: Debbie Preston

Sea Level Rise

The potential effects of sea level rise are so large in scale they can be difficult to imagine.

The Squaxin Island Tribe’s Natural Resources Department created an online tool to educate people about the science of sea level rise and the potential impacts to natural and cultural resources. Users can navigate a series of tabs to watch rising waters carve Squaxin Island from one island into four. They can view a map that shows the tribe’s shellfish harvesting acreage—a crucial part of their culture—shrink.

To create the ArcGIS Story Map, the tribe’s climate change ecologist Candace Penn and GIS manager Brian McTeague collected mountains of data with the help of other staff, local partners and collaborators. It includes analysis, data, video, interactive images, maps and links to additional resources.

On one page, readers can read and explore for themselves the work undertaken to model future tidal levels. On another, they can read about the tribe’s connection to Squaxin Island: “Songs sailed out across the waterways as our ancestors paddled their magnificent cedar canoes on their way to gather, trade, or attend family potlatches there.”

Light Detection and Ranging (LIDAR) technology was used to create a digital elevation map of Squaxin Island. Atop that topographic base, the model predicted future sea level rise and its potential impact on shellfish and forage fish habitats and related salmonids that are culturally and economically important to all Northwest tribes.

The story map notes that the tribe already has taken steps to potentially mitigate future impacts, such as protecting and restoring estuaries to serve as buffers against sea level rise, identifying tribal areas that will likely be impacted by sea level rise, educating tribal members and the public about climate change effects, and highlighting traditional ecological knowledge and paths toward enhanced climate resiliency.

The story map crystallizes a philosophy that drives home the importance of acting for the future: “We do not inherit the earth from our parents, but rather borrow it from our children.”

—Trevor Pyle
**Rising Seas and Low Streamflows**

**Bluff Erosion**

Not only could sea level rise put tribal resources underwater, it also can erode habitat above ground.

The Port Gamble S’Klallam Tribe is evaluating bluff erosion due to sea level rise and more extreme storms during ever-increasing high tides.

The tribe has been studying its shoreline in Port Gamble Bay for the past few decades, analyzing specific areas and how the shoreline responds to sudden geographic events, said Paul McCollum, the tribe’s natural resources director. More recently, the tribe has been taking a broader view on how to address changes to the shoreline that maintain its function while also mitigating bluff slides.

"Because of the current relatively good shoreline health, the best way to maintain function will be to avoid building new hard features or structures on the shorelines, while maintaining or improving upland vegetation that helps stabilize soft sediments," McCollum said. "At the same time, there are some parts of the tribe’s coastal bluffs that are concerning, and are at a high risk of a slide that could affect a primary structure or valuable resources.” —Tiffany Royal

**Low Streamflow**

The Nooksack Indian Tribe has been monitoring the recession of the Sholes glacier for the past 10 years. Since 2012, the Sholes glacier on Mount Baker has receded by 400 feet, said Oliver Grah, the tribe’s water resources program manager.

The loss of glacial ice in the North Cascade Mountains has increased concerns about high temperatures and low summer streamflows in the South Fork Nooksack River. Overall, glaciers on Mount Baker have receded more than 1,000 feet in the last 20 years.

Protecting mature forests can help preserve summer streamflow lost to glacier recession, because mature trees use less water than younger regenerating trees in harvested areas.

To that end, the Nooksack Tribe is part of the proposed Stewart Mountain Community Forest Initiative, which aims to acquire and steward 6,000 acres in the South Fork Nooksack River watershed. The effort is one of 140 high-priority actions in the tribe’s Climate Change Adaptation Plan.

"All of these changes to how we manage our forests will take time, but if we are to offset the impacts of climate change on streamflows and water supply, we better get started now before those impacts get progressively worse into the future,” Grah said.

As a result of low flows and high temperatures, salmon returning to the Sauk and Suiattle rivers have been delaying spawning by waiting for cooler fall water temperatures, said Scott Morris, the Sauk-Suiattle Tribe’s water quality coordinator.

Fisheries managers can help mitigate the impact of glacial melt by identifying and protecting cold water refuges where deep groundwater upwells into streams. Restoring native plants and building engineered logjams also improve salmon habitat.

“In addition to providing refuges for young salmon, logjams slow streamflows into side channels and prevent erosion,” said Sauk-Suiattle natural resources director Jason Joseph.

—Richard Walker

**Carbon Neutrality**

The Jamestown S’Klallam Tribe is investigating a possible carbon neutral strategy after updating its greenhouse gas emissions inventory and attending a climate change camp with the Affiliated Tribes of Northwest Indians.

Already on hydroelectric power—which has its own set of issues—and knowing the tribe’s current carbon footprint, the next step is to figure out what more can be done, said Hansi Hals, the tribe’s natural resources director.

In parallel to carbon-reduction efforts, Jamestown is interested in alternative micro-grid options such as solar, wind or marine energy.

"In some ways, it’s comparable to the offset market. How do you reduce it? Can you take a bus, can you take a bicycle? I mean, it sounds trite, but it’s real,” Hals said. "Once you know our carbon footprint that we’re having a hard time scrunching lower, what do we do about it? Are there ways to assure carbon sequestration at the same rate of the generation?”

The tribe also wants to create a resiliency hub—an environmentally friendly way to protect the community during heat waves, especially the elders.

“How do we keep ourselves safe and healthy?” Hals said. “Last year’s heat dome was a bit of a wake-up call.” —Tiffany Royal
The Skokomish Tribe’s recent salmon habitat restoration project on a working farm shows how such work can benefit both fish and farms.

The tribe purchased more than 100 acres of the old Bourgault farm in the Skokomish River Valley in 2011. The farm regularly floods during significant rain events as the Skokomish River cuts through the property at river mile 5, regularly spilling over the riverbank and sending fish into flooded hayfields.

While the tribe can’t prevent flooding, work was done in 2020 to redirect the water with a 2,500-foot-long and 12-foot-wide overflow channel that was dug through the farm to alleviate the flooding.

Now when the fields flood, most of the water stays within the channel and fish are able to take refuge, then go back to the river as needed, said Lisa Belleveau, the tribe’s habitat biologist.

“The channel is taking in flow that would have spread out on the farm, stranding tons of fish,” Belleveau said. “There were fish in the field all the time after major floods and they just ended up as bird food.”

The other end of the channel feeds into a wetland complex, where dirt mounds and large woody debris help slow the water flow, adding floodplain roughness to the habitat, Belleveau said. The mounds are made of fill from the channel and held in place by woven cedar mats. Large woody debris structures were installed on the river-facing side of the mounds, and then native trees, such as spruce, fir and cedar, were planted on the mounds.

“The couple dozen floodplain roughness mounds with woody debris promote forest recovery and habitat diversity,” she said. “When the channel becomes activated at about 15 feet, 5 inches, it diverts the flow into the wetland complex. Once the overflow channel fills, the flow hits those mounds and doesn’t scour the farmland as much as before, slowing down the water, then later funneling it back to the river.”

The channel is beginning to scour from overflow, which is expected and will naturally carve the channel deeper over time, carrying even more flow into the wetland complex rather than across the field, she said.

The primary goal of the project is to restore salmon habitat and create a functional floodplain while minimizing disturbance to the land that is still used for farming hay, Belleveau said.

To further support the salmon habitat, the tribe established a riparian buffer of 75 feet on each side of the overflow channel that has been planted with nearly 8,000 native shrubs and trees. Plants include willows, cottonwoods, cedars, red osier dogwood and salmonberry, and seem to be establishing well, she said.

Riparian buffers on salmon-bearing streams provide bank stability, shade, pollution control and the woody debris that salmon need to survive, she said. It’s part of the overall salmon habitat restoration work needed to support salmon populations. —Tiffany Royal
The Northwest Indian Fisheries Commission held annual elections during its May meeting.

Ed Johnstone, Quinault, was re-elected chairman. He has been the chairman since he won a special election in December, filling out the remainder of Lorraine Loomis' term following her passing in August.

“I am honored to continue the work of Billy Frank Jr., Lorraine Loomis and others who have come before me, such as Guy McMinds and Joe DeLaCruz,” Johnstone said. “Billy always told us to ‘Stay the course.’ We have to tell others who we are and what we stand for, remind our federal trustees of their responsibilities, and forge enduring partnerships to succeed. Tribes need to be a strong and growing force for change.”

Lisa Wilson, Lummi, was elected vice-chair.

“Seven years ago when I was the first recipient of the Billy Frank Jr. Endowment Scholarship at Northwest Indian College, I was working on a documentary that included the history of the Northwest Indian Fisheries Commission,” Wilson said. “I want to acknowledge the late Dutch Kinley, who was part of the NWIFC’s inception. My heart is here and ready to keep the work moving. We don’t have any time left. We can’t be complacent with our treaty rights.”

Patrick DePoe, Makah, was re-elected NWIFC treasurer.

“It’s a privilege to sit at the table with leaders from the other NWIFC tribes who are willing to take bold action to protect our spiritual and cultural values,” DePoe said. “I feel blessed to continue the important work that has been done by the warriors that came before us.”

—Kari Neumeyer

Tribal Habitat Conference returns

Stillaguamish biologists Charlotte Scofield and Scott Rockwell lead a tour of the restored zis a ba estuary. The field trip was the culmination of NWIFC’s three-day Tribal Habitat Conference, hosted by the Stillaguamish Tribe.

Restoration projects such as this are essential to recovering salmon populations and providing opportunities for tribal and nontreaty fishermen to fish.

The lack of salmon in the Stillaguamish River weighs heavily on the tribe’s culture, said Shawn Yanity, former Stillaguamish chairman and retiring NWIFC vice chair.

“It’s hard to accommodate 30 fishers when you only have 17 chinooks,” Yanity said at the habitat conference. “We have a need now. We have to stay on our heels and push, push, push the state to fix the damage they’ve allowed to be done to habitat.”

Photo: Richard Walker
Aging geoduck by their shells

Like rings on a tree trunk, the rings on a geoduck shell reveal the age of the bivalve.

With some geoduck living to nearly 200 years, that’s a lot of rings to count.

The Suquamish Tribe is working with its state co-manager to do just that to better understand the geoduck population age structure in Puget Sound.

“Geoduck is a unique species of shellfish in our traditional diet, with a distinctive flavor and texture,” said Suquamish Chairman Leonard Forsman. “It has also become an important commercial opportunity for our people.”

Knowing the age range and natural mortality rates of geoduck in Puget Sound helps the treaty tribes and state co-manage the harvest, said Viviane Barry, the tribe’s shellfish program manager.

“Geoducks live almost 200 years, and the tribes have only co-managed them with the state since the mid-1990s,” she said. “Three decades is nothing for a geoduck. Scientists 200 years from now will have a much better handle on what’s going on and will hopefully benefit from the data that we’re collecting for them today.”

Using similar methods as the Washington Department of Fish and Wildlife’s (WDFW) geoduck aging studies from recent years, the tribe collected nearly 800 geoduck from an unharvested 2-acre tract in the Port Orchard shellfish growing area this spring. The area has not been studied much for its geoduck population, Barry said.

The Suquamish Seafoods dive team collected the geoduck from 32 sample sites. Individual geoduck were numbered, weighed and had their shell length measured. The siphon and body were removed from the shells and set aside for the tribe’s elders meal program.

The shells then were dunked in boiling water to help remove remaining tissue and set aside to dry. The shells will be sent off to a state lab later this year to be processed, where they will be aged using a technique that includes shaving thin slices from the shell, then reading the slices like one reads tree rings to determine age.

The results from this work will add to the WDFW data used to design the model that has set harvest rates for the tribes and the state since 2000.

“The more data we have to inform geoduck natural mortality values in different regions of Puget Sound, the more informed we’re going to be about setting harvest rates using this model,” Barry said. —Tiffany Royal

Green crab declared emergency

The Makah Tribe’s European green crab invasion has hit yet another alarming benchmark, with more than 1,200 crab captured within the first two months of the trapping season.

“We caught more in April and May this year alone than we have by the end of whole seasons of trapping,” said Adrianne Akmajian, the tribe’s marine ecologist. In 2021, the tribe caught more than 1,400 when trapping efforts ended in October.

“In the Tsoo-yess River channels, you can find 20 or 40 of them within a span of 5-10 minutes in very small tidepools or under patches of algae or eelgrass,” she said.

Thousands of the invasive green crab have been found within the tribe’s primary waterways since 2018, and they’ve spread into Puget Sound. Tens of thousands of the invasive crab were found in Lummi Nation’s sea pond in fall 2021, and the first invasive green crab was captured in May in Hood Canal, the southernmost spot where they’ve been found in Puget Sound.

Gov. Jay Inslee issued an emergency order in January 2022, and in March, the state Legislature approved $8.6 million in emergency funding to control the spread.

While we now have extra money from the state to increase staff capacity to help, it’s only for the short term,” Akmajian said. “There needs to be long-term funding for trapping and monitoring if we’re going to try and control the invasion through removal trapping efforts.”

The tribe caught its first female with eggs this spring, confirming for Akmajian that local reproduction is happening within local waters.
invasion emergency

“We have no idea where they came from though since their larvae spend several months in the ocean and are dispersed by ocean currents, so the crabs here could have easily come from populations to the south or north of us,” she said. “And there’s no way we’re going to be able to catch them all.”

European green crab are a threat to Dungeness crab, oyster and clam fisheries as the invasive species feeds on native crab, clams, oysters, marine worms and small crustaceans. They destroy nearshore habitat by burrowing into the mud and damaging eelgrass beds. On the East Coast, European green crab are blamed for the collapse of the eastern softshell clam industry in Maine.

While the tribe has been trapping for five years, it’s been frustrating to have this big pulse show up, Akmajian said.

“Climate change is a real concern with these crab,” she said. “Warmer winters lead to more crab settlement. Even if we did a really good job removing them locally, we could have larvae come up from Oregon and have another pulse.” —Tiffany Royal

Identifying European green crab
It is illegal to remove or possess a European green crab. They can be distinguished by the five spines on either side of their eyes. If you find one, send photos and detailed location information, such as geographic coordinates, to crabteam@uw.edu. More info: nwtt.co/egc.

Freshwater mussels hard to find

The Stillaguamish Tribe is documenting the western pearlshell mussel in the Stillaguamish watershed to track how the once plentiful but now threatened riverine species is faring amid warmer stream temperatures and habitat degradation.

“The tribe’s natural resources department is doing the work as funding and time permits,” said Franchesca Perez, Stillaguamish Tribe shellfish biologist. Perez hopes more funding will be available for study, monitoring and habitat improvement if another freshwater mussel species—the western ridged—is listed under the federal Endangered Species Act.

Shellfish biologists surveying western ridged mussels could also survey western pearlshell and floater mussels while doing the work, Perez said. All three freshwater mussels are found in western Washington, although only the western pearlshell and floater species have been found in the Stillaguamish watershed, Perez said.

The U.S. Fish and Wildlife Service is reviewing the status of the western ridged mussel to determine whether to list it under the Endangered Species Act.

While the other two mussel groups are not considered endangered, their populations are precarious. The western pearlshell mussel is rarely found in its historical range and is listed as a “species of greatest conservation need” by the state of Washington.

Western pearlshell mussels were found during a creek restoration in the Stillaguamish watershed in 2017. Photo: Stillaguamish Tribe Natural Resources Department

Stillaguamish natural resources staff found western pearlshell mussels in the Stillaguamish watershed in 2017 during a creek restoration project.

Since then, they have attended freshwater mussel field training and symposiums, joined the Pacific Northwest Freshwater Mussel Workgroup, and adopted best management practices for freshwater mussels during restoration project planning and implementation, Perez said.

In summer 2021, the tribe offered a freshwater mussel workshop to regional tribes and other local governments, funded by the U.S. Bureau of Indian Affairs’ Tribal Climate Resilience Program.

“Each summer, natural resources staff also provide a presentation to department leadership, new hires and tribal youth interns about this important aquatic health indicator species,” Perez said. “When capacity allows, we bring our interns out on stream snorkel surveys. The mussels are so cryptic, it is like an Easter egg hunt underwater.”

It’s been a long time since Coast Salish people have been able to harvest freshwater mussels, which Lushootseed speakers know as tulqw.

“The Washington Department of Fish and Wildlife now prohibits harvest of any freshwater mussels or clams,” Perez said. “When capacity allows, we bring our interns out on stream snorkel surveys. The mussels are so cryptic, it is like an Easter egg hunt underwater.”

—Richard Walker
Caring for the water and the creatures that call it home is a way of life for the members of the Quileute Indian Tribe. “Every fish matters for the Quileute people,” said Tony Foster, a Quileute tribal council member. “We need to preserve what we have for future generations to come. This is home to us. This is where we belong.”

Now an innovative project taken up in conjunction with the Environmental Protection Agency (EPA) will make sure details of that stewardship are a mouse-click away.

The tribe and government agencies joined forces for a story map—an online, interactive tool that allows readers to learn about the tribe’s history and efforts to monitor and maintain water quality. A team-up between Quileute water quality biologist Nicole Rasmussen and EPA Region 10 Tribal 106 coordinator Krista Mendelman, the story map took three years of work, with the COVID-19 pandemic slowing the pace of the project.

The effort was worth it, Rasmussen said. “Not enough good information about what the tribes are doing gets out there,” Rasmussen said. “There’s a lot of good work being done by tribes, a lot of good fisheries management.”

The Quileute Reservation covers 2,172 acres at the mouth of the Quillayute River before it flows into the Pacific Ocean. It contains one of the last remaining watersheds without endangered or threatened salmon runs, in which the salmon don’t require the protection of the Endangered Species Act.

Caring for the watershed in the face of climate change, water quality degradation, invasive plant growth and negative impacts from timber harvests is a daunting challenge and a lot of work. Some of the tribe’s efforts are fueled by funding through the EPA’s Region 10 Clean Water Act Section 106 Tribal Program.

Both the work and the challenge are explained through the story map. It not only explains how water quality is evaluated—such as monitoring water temperatures, stream sediment and other factors—but puts readers at the scene with photos and videos.

There are even interactive features. With one, readers can click arrows to take a kayak tour down a stretch of the Quillayute River on a sunny day. With another, readers can explore results from water-quality monitoring sites, clicking and dragging to customize the data.

“I don’t know how the EPA did the webpage design, but it was awesome,” said Rasmussen. “I hope people understand all the things tribes are doing to protect their treaty resources.” —Trevor Pyle

Above: Quileute water quality biologist Nicole Rasmussen, right, and Youth Opportunity Program member Ruby Sheriff gather insects in 2019 to test water quality in Bear Creek. Photo: Debbie Preston. Left: The mouth of the Quillayute River. Photo: Krista Mendelman
It sounds like the fusion of a science-fiction story and a detective novel: a tool that allows scientists to detect fish and wildlife’s presence in an ecosystem, even if they’re not there when the testing is performed.

But environmental DNA, known as eDNA, is real and tribes on the Olympic coast are using it to learn more about vital ecosystems and manage treaty-protected resources.

Recently developed, it allows scientists to collect DNA from samples such as shed hair, mucus and feces. The samples are then tested to learn more about what species—sometimes expected, sometimes surprising—have been in the environment.

John Hagan, NWIFC coastal habitat biologist, closely tracked the development of eDNA over the last decade as it broke free from its laboratory confines to a larger presence in field work.

“It’s changed rapidly, it’s become commonly used,” Hagan said. “But here on the coast, no one was using it three years ago.”

In 2020, Hagan received funding from the marine conservation group Oceanic for a year-long pilot project. So far, he has worked with the Hoh and Quileute tribes and Quinault Indian Nation to use the technology in their data gathering.

The tribes gathered 146 eDNA samples at 61 sites in six river systems to analyze for species presence. Of those, 75 samples were analyzed using Next Generation (NextGen) metabarcoding, which analyzes all DNA that’s been swept up in a sample. This technique detected 193 aquatic species in these 75 sites, including 90 Pacific salmon DNA markers, indicating multiple Pacific salmon species present at several sites.

The other 71 samples were analyzed using quantitative polymerase chain reaction, which looks for specific markers. This testing confirmed 83 Pacific salmon DNA markers, which also indicated multiple Pacific salmon species at several sites.

Some samples were analyzed with both techniques.

The program included work at 58 field sites with no previous documentation of fish surveys in the Statewide Washington Integrated Fish Distribution database. In two locations, Pacific salmon were detected miles above the farthest point anadromous fish are known to travel upstream, known as the end of anadromy.

The Quinault Nation used eDNA testing in four rivers: the Raft, Queets, Moclips and Quinault. Chinook salmon DNA was found in two locations in Hee Haw Creek on the Upper Queets, five miles above the end of anadromy, data that proves this species uses the upper habitat of the river.

The eDNA also will help the tribe make decisions as it plans to restore a historic oxbow off the Quillayute River, Rasmussen said. Testing for eDNA will help scientists answer questions such as whether coho are using the area as refuge, what invasive fish may dwell there, and whether species of interest such as mud minnows can be found.

“We want to know how fish will use that turn,” Rasmussen said.

The project has led to the development of low-cost tools to perform eDNA sample collection, and Hagan is looking forward to increased use of the technique to build baseline profiles of local ecosystems.

“eDNA is an important tool,” he said. —Trevor Pyle
The Nooksack River flowed low and slow near the Lummi Reservation, giving fishermen in each boat about eight minutes to set net and drift before turning around to avoid the large snag at the Marine Drive bridge.

“I told you to catch six,” Lummi Nation deputy fisheries director Frank Lawrence joked to John Phair as the veteran fisherman returned with three chinook salmon after one set. Another boat headed out upon Phair’s return. Other fishermen warmed themselves by a small fire, watched for jumpers and waited for their turn to go out.

Lummi Nation’s spring chinook subsistence fishery began in April and continued to July, one day each week depending on returns.

Sacrifice and patience by the tribe made subsistence fishing of spring chinook possible, Lawrence said. He credits the work of Lummi’s Skookum Creek Hatchery and decades of voluntary closures with making fish available.

If it weren’t for hatchery fish, there’d be no fishing at all. Lummi hasn’t had a commercial spring chinook fishery in 40 years and resumed subsistence spring chinook fishing three years ago after a six-year closure, said Ben Starkhouse, Lummi Nation harvest manager.

The spring chinook population is closely monitored and the fishery tightly enforced.

“Every fish is accounted for,” Starkhouse said.

When the fishery closes for the day, tribal harvest biologists document each fish’s length, weight and sex. They take scale samples to determine age. If the fish has a clipped adipose fin, that means it originated at a hatchery and those fish are scanned for a coded-wire tag that identifies its hatchery and brood year.

Biologists then remove the otolith from each fish’s inner ear. The bony growth develops differently in fresh and salt water, and it helps biologists determine information such as how much time the fish spent in a certain habitat, Starkhouse said.

—Richard Walker
The Nooksack Tribe held its First Salmon Ceremony in May to show gratitude to the salmon that feed the people.

The Nooksack Tribe is actively working to improve salmon habitat, said George Swanaset Jr., the tribe’s natural resources director. The honoring is an important part of the tribe’s work to ensure salmon is available to meet the people’s needs. The first salmon, set aside to be ceremoniously returned to the water, is a scout and will tell the other salmon that it was treated with respect and to come back, Swanaset said.

“Honoring our salmon is important to our people,” Swanaset said. “Our natural resources are our responsibility and our culture is the law of the land. It is what ties us to everything. Our fish and wildlife, our clean water and our forestlands are disappearing and with them our way of life.

“It is important for us to hold accountable those responsible for protection of what little is left, while educating ourselves as to what we can do as individuals.”

Sockeye was filleted and grilled by Trevor Delgado, Nooksack tribal historic preservation officer, and Jeremiah Johnny, the tribe’s treaty protection advocate. Tribal members Sharon Starzak and Leah Zapata pitched in, applying just the right amount of salt and pepper before turning each fillet.

Nooksack drummers and singers opened the table with an honor song, followed by remarks from tribal elders. A group of Nooksack tribal members then escorted the first salmon to the Nooksack River, where it was placed on a bed of cedar boughs and returned to its natal waters.

“A long time ago, we were prohibited from doing our ceremonies,” said Peter Joseph, a former tribal council member. “Our ways of life were almost gone. Yet here we are today. We are reviving our ceremonies and reviving our culture.”

—Richard Walker

This photo of tribal fishermen preparing salmon was taken in approximately 1895 on the mainstem of the Stillaguamish River. The area is now known as Big Rock or Blue Stilly. 

Photo: Stillaguamish Tribe Archives
The Port Gamble S’Klallam and Nisqually tribes are studying herring spawning in Puget Sound, with hopes of eventually rejuvenating the population.

Herring are a crucial food source for other species, including juvenile and adult salmon. They are high in fat, which juvenile chinook salmon need when migrating to the ocean, said Hans Daubenberger, the Port Gamble S’Klallam Tribe’s senior research scientist. Juvenile salmon often feed on herring larvae in Port Gamble Bay during spawning season.

The Port Gamble S’Klallam Tribe supplemented herring habitat in the bay this spring by dropping tree branches into the water and experimenting with traditional methods of harvesting herring eggs, he said.

Tribal members used to hang branches off floats or logs in Port Gamble Bay. Herring spawned on the branches, which were then pulled out by tribal members to harvest the eggs.

“It’s a really nutritious food source,” Daubenberger said. “It’s not just nutritious for wildlife, it’s a great food source for humans too.”

The tribe used hemlock boughs, some attached to buoys with rope, some attached to a floating PVC pipe, to create a surface area for herring to spawn. The tribe also observed kelp lines in the bay, which is another natural habitat where herring spawn.

Washington Department of Fish and Wildlife surveys of the winter spawning season in the bay reported very light spawning events this year, said Heather Gordon, an ecology consultant working with the tribe.

Historically Port Gamble Bay had one of the largest herring stocks in Puget Sound, but it started to rapidly decline in 2000, to the detriment of the region’s marine food web and ecosystem, Daubenberger said.

The idea for the project came from the salmon recovery organization Long Live The Kings and the Nisqually Tribe, who are working to restore herring populations in South Sound. Unfortunately, neither effort has succeeded so far in attracting herring to spawn in the tree branches.

That doesn’t mean the effort won’t be fruitful in the future, said Nisqually salmon recovery biologist Jed Moore.

Herring populations can be fickle where they spawn, he said.

“Herring shift spawning locations. Their timing is reliable, but they make choices to maximize egg survival,” he said. “So there are a lot of factors interacting in ways we don’t yet understand. The herring can seem picky. Some years they spawn heavily in an area, other years they’ll ignore it completely. Sometimes they’ll shift, sometimes they’ll come back.”

The Nisqually Tribe launched two efforts last year to study herring: sinking trees to attract spawning, and rake surveys to search for eggs in beds of eelgrass or other materials known to be popular with herring.

The work is meant to supplement the state’s larger-scale studies, Moore said.

“Can we find smaller spawning events in areas that have flown under the radar of the state’s studies, which are examining larger trends?” Moore said. “The Nisqually Tribe and Long Live the Kings, our research collaborators, are trying to find more localized trends.”

This year, the Nisqually Tribe is adding a third effort. They’ll catch herring with a technique called jigging, where lured hooks are lowered trailing off a lead weight. A grant from the nonprofit SeaDoc Society will fund genetic analysis of about 200 samples, to be conducted at the University of Washington.

The goal is to learn more about the herring’s spawning timing, which is driven by genetics, Moore said.

“I don’t think many people are aware of how important herring and other small fish are to the ecosystem of Puget Sound,” Daubenberger said. “At the end of the day, we’re trying to restore these species and this habitat, so that our tribal community continues to live as part of that natural environment.”

—Trevor Pyle and Tiffany Royal

Hans Daubenberger, Port Gamble S’Klallam Tribe senior research scientist, checks an evergreen branch retrieved from one of the tribe’s herring habitat systems in Port Gamble Bay. Photo: Tiffany Royal
The Jamestown S’Klallam Tribe and its state co-manager, Washington Department of Fish and Wildlife (WDFW), hope learning about the condition of the Dungeness River bull trout population also will inform them about the health of the river.

While the tribe does not fish for bull trout, it can have a major impact on species the tribe does harvest, as bull trout prey heavily on juvenile salmon and steelhead.

“Bull trout are a unique species and exhibit a number of complex life history strategies,” said Chris Burns, a Jamestown S’Klallam Tribe natural resources technician. “Very little is known about them in the Dungeness, but they’re part of the circle of life in the river. Bull trout depend on cold, clear water for survival, and without it, they don’t exist. They also depend on healthy salmon runs for food.”

“Bull trout are listed as threatened under the Endangered Species Act, and therefore of great interest to co-managers,” said Kathryn Sutton, lead fish biologist for WDFW in the Strait of Juan de Fuca. “A lot of collaborative work has been done in the Dungeness the last couple of years on numerous projects, and these collaborations are integral in making these projects successful.”

The tribe, WDFW, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, U.S. Forest Service, and a private environmental contractor have been using several tools to gather genetic and population data on the river’s bull trout population. These include in-river netting and angling, and a large-scale snorkel survey that covers all areas that a sea-run fish can access from natural barriers, such as cascades or falls, all the way downstream to the river mouth.

Sampling bull trout during netting and angling surveys involves collecting several types of information. A small part of a fin is clipped for genetic analysis. Most are tagged with FLOY tags—a small colorful tag with a numeric code that can be referenced later should the fish be caught again. Pectoral fin rays are sampled to learn age, home stream and whether the fish uses fresh or salt water. This data is similar to the information biologists learn from scale or otolith samples from salmon and steelhead.

Bull trout stomachs also are pumped to study their diets, which can include juvenile salmon.

During the snorkel survey in the late summer, scientists and technicians snorkel the Dungeness and Gray Wolf rivers. The bull trout that were FLOY-tagged during the netting and angling efforts are observed and counted to calculate a population estimate in the Dungeness system, Sutton said.

“There has been quite a bit of interest lately in how salmon and bull trout interact with each other and that is one of the drivers for our work,” Burns said. “The better we understand bull trout, the better we understand the complexities of salmon recovery and river health.”

—Tiffany Royal
Makah tribal member Vincent Cooke, 53, passed away May 2. He was born Oct. 16, 1968.

Cooke served in several capacities for the tribe throughout his life. From 1991 to 1994, he was instrumental in the recovery of the Tenyo Maru oil spill on the shores of the tribe’s reservation, then supervised the oil spill cleanup until 1995.

He was then appointed by the Makah Tribal Council as environmental division manager until 2009. During his time, he improved the tribe’s oil spill response capacity in Neah Bay by helping the tribe acquire its own oil spill trailer and a Neah Bay-based rescue tugboat stationed on site from the fall through spring.

Cooke was involved in shutting down the Warmhouse Beach dump and was the lead on designing and building the Makah Transfer Station.

He served as the acting social, health and education director and acting social services manager until 2008, after which he pursued his education at The Evergreen State College. He obtained his bachelor’s degree and then worked as the planner for the tribe’s Economic Development department.

In 2019, Cooke began serving as the acting general manager for the tribe, becoming the permanent general manager in September 2020 until his passing.

He was preceded in death by his father John Cooke. He is survived by his mother, Loretta Cooke, and siblings.

Suquamish tribal member Merle Allen Hayes Jr., 80, passed away June 12.

He was born Jan. 3, 1942, in Tulalip to Margorie Hayes and Merle Allen Hayes Sr.

Hayes was a Suquamish tribal elder who spent his life on the Suquamish land. In 2017, he retired from the tribe’s fisheries department, where he spent two decades as a fisheries policy liaison.

His life’s passion and dedication were based on protecting the tribe’s treaty rights and respecting the salmon. NWIFC recognized him in 2018 with the Billy Frank Jr. Leadership Award for his work to uphold sovereign treaty rights and protect natural resources.

He was preceded in death by his parents, sons Merle Allen Hayes III and Carnegie Hayes, daughter Tamara “Tammy” Hayes, granddaughters Sophia Solomon and Victoria Russell, and many loved ones.

He is survived by his children Bernadette “Bernie” Hayes Abuan, Elaina Rose Hayes, Holli Hayes, Mia Hayes Bennington and Bonita Hayes Palafax (Jacob); sisters Margaret Henry-Hayes, Rose Wade, Nina Holten, Susan Martin and Teresa Jones; brother Ernie McBride (Kimberly); and many grandchildren, great-grandchildren, family and lifelong friends.