

Tracking salmon migration through music

Songs in the key of swim

By **COURTNEY FLATT**
Northwest Public
Broadcasting

Salmon researchers are turning to sound to learn more about the fish they're trying to understand.

There is a lot of data about salmon out there, and that data is complex and hard to process. But researchers hope setting fish migration patterns into notes and tones can make it easier to analyze.

Jens Hegg with the University of Idaho is the lead author of a study published in *Heliyon*. He wanted to distill the databases of salmon migration down to something that your brain can process more easily.

"It gives us this way to really explore the data before analysis and really figure out what's going on with the fish — in ways that we wouldn't otherwise be able to see," Hegg said.

The human mind processes sound differently, he explained; it's easier to hear the complicated sounds than if you had to analyze complex charts and graphs.

Turning data into sound is called "sonification." The process has been used to study data from deep space and deep in the ocean. Hegg said this is



Pacific Northwest National Laboratory
Adult fall Chinook salmon in the Priest Rapids Hatchery in Washington state.

the first time it's been used to study salmon migration.

To make the sounds, researchers had to figure out the migration timing. They used chemical data in the salmon's ears. The fish have bones in their ears called otoliths that store chemical information about where fish are — and when they swim through each place.

"It's a temporal record. It's their chemical record in these tree-ring-like bands inside their ear bone of the chemistry they experience," Hegg said.

Composers working at Eastern Washington University, the University of Tampere in Finland and the University of Virginia turned that information from the ear bones and into sound.

"Otolith data, that's huge," said Jonathan Middleton, professor of composition and department chair at Eastern Washington University. "Jens

was sending me Excel sheets that were so long, I didn't even know where I was in them."

It took quite a long time — years — and a lot of back and forth for Middleton and his grad students to finish the composed piece. Middleton has worked with data sonification since 2005 and has developed software to help researchers turn their data into sound.

"There are so many areas in science to explore by hearing data, and it just requires more collaborations of this kind," Middleton said.

This project studied 45 fish. Each fish was assigned a tone. A bell rings to represent each salmon moving downstream.

Layered together, the sound becomes messy as more and more fish get on the move. Toward the end of the track, the tones calm down. The last few fish left in the Lower Snake River head toward the ocean.

Hegg found people were able to hear when the sounds changed. The researchers asked people if they could hear the differences in pitch and tone as they played the sonification.

"People are very attuned to changes in pitch and changes in timing, and they were all able to pick out those transitions," Hegg said.

They found that the listeners as a group were more accurate in hearing the transitions than when they listened by themselves. People also understood the changes in pitch and tone better when the sound wasn't accompanied by an animated graphic.

With the sonification, researchers can see changes in data over large geographies and short time periods.

Hegg hopes they'll be able to detect patterns in salmon migrations that they wouldn't otherwise see from scanning large databases.

"You can come out with some really interesting findings that make you question: are there better ways to do what we're doing?" Hegg said.

Maybe one day, Hegg said, this type of research could be used to figure out why wildlife moves from place to place, especially if those animals have GPS tracking collars. It could also be used in research on other animals that migrate at certain times of the year — like monarch butterflies.

Northwest coastal wetlands won't survive high sea level rise

By **JES BURNS**
Oregon Public
Broadcasting

Over the next century, sea level rise is expected to wreak havoc on the U.S. coastlines — and a new analysis shows that the Northwest is not immune. Nearly all coastal wetlands in Oregon, Washington state and California will be swamped at the highest predicted sea level change.

Sea level rise is a byproduct of climate change. It happens as the world's oceans warm and physically expand. Melting glaciers and ice sheets are also contributing.

New research from the U.S. Geological Survey gives the first ever insight to how specific bays, marshes and harbors will fare.

"We wanted to collect data and build models at a smaller spatial scale. Really the scale of decision making," said ecologist Karen Thorne. "Like, 'I'm a refuge manager and I want to know what's going to happen to my wetlands' or 'I live in this town.'"

Coastal wetlands are important for wildlife and nurseries for fisheries. They filter water and provide flood and erosion protection to coastal communities.

Thorne said under the lowest predictions of sea level rise — about 5 inches over the next century in the Northwest — wetlands will remain relatively stable.

But in higher scenarios that range anywhere from 2 to 6 feet, big changes are in store.

"You increase the water levels to a point that the plants start to die because they're flooded too often. So when the plants start to die, you start to lose the ability to build or maintain the elevation of these wetlands," Thorne said.

This starts off a negative feedback loop. What once was marsh becomes a mud flat.

The new models predict that many of the most profoundly affected wetlands in Oregon and Washington

state won't be able migrate inland to higher elevations. Their path has been blocked by human development and the natural topography of the rocky coast.

Wetlands at Bandon Marsh, Coos Bay and Siletz Bay in Oregon are expected to disappear entirely if the higher projections for sea level rise hold. Port Susan, Nisqually and Skokomish in Washington state will lose more than half their vegetation. Even at moderate rates of sea level rise, most of the coastal wetlands will look and function very differently.

But there are a few spots on Washington's coast that are expected to weather this symptom of climate change better than elsewhere. Notably, wetlands in Willapa Bay and Grays Harbor are expected to survive.

"Thankfully, Willapa Bay is one of those estuaries that are in a better place than some of the others," said Jackie Ferrier, manager of the Willapa National Wildlife Refuge.

"Because it's so influenced by the river, there's a large amount of sediment accretion that happens within the bay."

The sediment buildup continually raises the elevation of the wetlands and is projected to allow the marshes to keep pace with sea level rise.

Ferrier said the new information is helpful because of how localized it is. But she says the refuge will continue to rely on a range of predictive models to make decisions going forward.

The Willapa refuge is already taking action to improve the quality of the coastal area. The refuge is in the middle of a massive habitat restoration project that is expanding the salt-water wetland footprint.

"I think our restoration puts us in an even better place because it does increase that resilience to sea level rise," she said.

The results of the new research were published Wednesday in the journal *Science Advances*.

Oregon lawmakers seek plea bargain reform

Local attorney offers written testimony

By **ANDREW SELSKY**
Associated Press

SALEM — Some plea bargains presented to defendants deprive them of fundamental rights, say Oregon lawmakers who moved on Wednesday to make them fairer.

Defendants are sometimes even asked to give up habeas corpus — a right, dating back centuries, under which defendants face their accusers in court, according to testimony presented to the House Judiciary Committee.

Kirk Wintermute, an attorney

from Astoria, cited a practice of authorities requiring defendants in misdemeanor cases to waive that right to appear at trial if they miss a court date. These waivers are coercive because they're sought as a condition of release from jail or to stay out of jail, Wintermute said.

If the defense attorney doesn't know why his client is absent or hasn't had contact, the attorney is required to withdraw from the case, Wintermute said. A trial then proceeds with no one at the defense table, with a guilty verdict being inevitable, Wintermute told the committee in a letter.

"Once the court's warrant is served a defendant is brought back to court for a sentencing hearing, but does

not have the opportunity to face his accusers in court, cross examine witnesses, or present a defense," the lawyer said.

The House unanimously passed a bill on Wednesday that prohibits a release agreement from jail from being linked to a defendant's waiver of appearance at trial. It would also prohibit a plea agreement from being linked to a former law that was superseded by a legislation passed in 2017 that reduced sentences for certain crimes.

"I believe it is our job as legislators and policy makers to ensure we safeguard individual liberties and protect the basic rights of all our citizens," said House Majority Leader Jennifer Williamson, the chief sponsor of the

bill, in a statement after the vote. The bill now goes to the Senate.

Williamson said more needs to be done to remedy plea agreements.

In an example of a plea agreement she cited that shows other problems, prosecutors in Portland offered to drop two of four charges against a woman, but only if she agreed to waive her rights to due process, to challenge the conviction if exculpatory evidence was later found, to challenge a sentence as unconstitutionally cruel and unusual, and the right to file a writ of habeas corpus.

The bill was endorsed by the American Civil Liberties Union and opposed by the Oregon District Attorneys Association.

State Senate passes 'Equifax bill' to help counter data breaches

Bill aimed at consumer protection

By **PARIS ACHEN**
Capital Bureau

SALEM — The state Senate has unanimously passed a bill to protect consumers when hackers steal their personal information from credit reporting bureaus and other companies.

The legislation requires companies to notify consumers within 45 days after discovering a data breach of their personal information and prohibits companies from charging consumers for a security freeze. A security freeze is one of the best ways to secure a breached account and stop identity theft, according to the Oregon Department of Justice.

Under Senate Bill 1551, consumers would be entitled to place a credit freeze with each credit reporting agency free-of-charge at any time for any reason. Companies also would be prohibited from charging for removal of a freeze, or a temporary lifting of a freeze.

"Consumers protecting themselves when their personal data is compromised should be as easy and inexpensive as possible," said state Sen. Floyd Prozanski, D-Eugene, who carried the bill on

the Senate floor Wednesday. "When there is a data breach, credit freezes should be granted right away, at no cost, to help people protect themselves from financial hardship due to identity theft."

Dubbed the "Equifax bill," the legislation — along with a nearly identical proposal in the state House — responds to a mass cyber theft at the Atlanta-based credit reporting agency last September. The data breach compromised private information, such as Social Security and driver's license numbers, of 145 million consumers in the United States, Canada and the United Kingdom. About 1.7 million Social Security numbers were jeopardized in Oregon alone, according to the Department of Justice.

Equifax discovered in July that cyber thieves had accessed consumers' names, addresses, birthdates, Social Security numbers and driver license information, but the breach wasn't reported to consumers until September, according to media reports. A letter this month to U.S. Sen. Elizabeth Warren, D-Massachusetts, of the U.S. Senate Banking, Housing and Urban Affairs Committee, showed that additional consumer information was exposed, including tax identification numbers, email addresses and additional driver's license information.

Like the House bill, the proposal passed by the Senate Wednesday would require companies to reveal a breach within 45 days unless law enforcement determines doing so would impede a criminal investigation. Prozanski and Rep. Paul Holvey, another Democrat from Eugene, co-sponsored both pieces of legislation.

Companies would have to report all data breaches to the state Department of Justice.

Oregonians reported losses of \$12.8 million from cyber-crimes in 2016, according to the FBI's Internet Crime Complaint Center. Data breaches fuel those crimes, according to the state.

Equifax offered free credit monitoring services to affected consumers but by accepting the offer they were forced to accept arbitration and a waiver of any lawsuit connected to the breach. "They and other credit reporting agencies steered consum-

ers away from credit freezes, and into other pay-per-month type services," according to testimony from the state Department of Justice.

Freezing credit is one of the best preventative measures a consumer can take to protect their credit from fraudulent uses, but ordering a freeze required a fee.

"No company should be able to make money by helping someone protect themselves because that company didn't adequately protect the consumer's data," Prozanski said. "This bill will ensure

consumers have adequate tools and protections in place in the unfortunate circumstance that this type of massive breach happens again."

Oregon has had its own share of data breaches.

In January, Oregon's State Accident Insurance Fund Corp. revealed that it may have inadvertently exposed confidential information of more than 1,750 people.

The information, including the individuals' names and Social Security numbers, was compromised in November when a hacker gained access

to a SAIF auditor's email account. That account contained emails which included personal information on employees for six companies who get their workers' compensation insurance through the quasi-public agency. Among those affected are some substitute teachers and school classified workers in the Portland area.

The bill now heads to the House for consideration.

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