HOSTILE WATERS

A SEATTLE TIMES SPECIAL REPORT | PART FOUR

SOUND AND THE HUNT

How our noise is hurting orcas' search for salmon

By LYNDA V. MAPES
Seattle Times environment reporter

With a splash, the hunt was on.

Orca K35 dived to 100 feet, pulsing bullets of sound into the dark depths, exploring for prey. Scientists, recording his dive on a special device temporarily attached to his skin, could tell K35 had sensed something.

A chinook.

In this ancient drama of predator and prey, orcas that frequent Puget Sound prowl the waves and dive glacially carved fjords and bays, undisputed masters at hunting the salmon they co-evolved with.

Like fishermen everywhere, the J, K and L pods of southern resident orcas have deeply set patterns of how, when and where they hunt, depending on seasonal salmon migrations, tides and underwater land forms they use to capture a wily target.

But in some of their ancestral hunting grounds, the southern residents are losing out in a clash of two great maritime cultures: orca, and human.

Right where the orcas have over thousands of years learned to use the rock canyon along the west side of San Juan Island like a fish funnel to nail chinook returning to the Fraser River, humans have in just the last century created an echo chamber of industrial noise. The Haro Strait booms with ships, ferries, recreational boats and whale-watch tours.

See > SOUND, G2

This young resident killer whale, chasing a chinook salmon near Vancouver Island in September 2017, was photographed by researchers using a drone flown more than 100 feet above the water.

JOHN DURBAN / NOAA SWFSC; HOLLY FEARNBACH / SR3; LANCE BARRETT-LENNARD / VANCOUVER AQUARIUM, UNDER NMFS PERMIT 19091

HOSTILE WATERS

ORCAS IN PERIL

STEVE RINGMAN / THE SEATTLE TIMES

The teeth of southern resident orcas are up to 4 inches long, hard and dense as marble, and needle-sharp for shredding salmon. These teeth, kept at the Burke Museum of Natural History and Culture, belonged to Namu, who was captured in 1965 and became an attraction on the Seattle waterfront. Go to ***st.news/Capture-Era*** *to learn more.*

< Sound

FROM G1

More than 300,000 ferry sailings traveled the Salish Sea in 2018, while 6,330 cargo, container and passenger vessels and 1,134 oil tankers and barge tows also entered Washington waters. Much of that traffic is headed to the Port of Vancouver, the biggest port by cargo tonnage on the West Coast.

Ships are present in the Haro Strait in every season, day and night. Much of their noise is in the same sonic sweet spot orcas use to hunt and communicate.

Today the southern resident killer whales are headed to extinction, and scientists seeking to understand why have targeted the lack of regularly available, adequate salmon as the biggest threat to the whales' survival. Pollution adds to their troubles. So can noise masking the sounds orcas use to hunt. That makes their prey, already scarce, even more difficult to catch.

That is why state and federal policymakers are considering new restrictions on boat traffic, and the Port of Vancouver and other partners have been experimenting with voluntary slowdowns for ships.

Scientists have learned orcas forage less in the presence of vessels. The whales also raise their voices to be heard.

It can be hard for humans, so sight-oriented, to grasp how essential sound is to the southern residents, said Marla Holt, a research wildlife biologist with the National Oceanic and Atmospheric Administration's Northwest Fisheries Science Center in Seattle. Sound is critical to all of the orcas' essential life functions, from sticking together in a dark ocean, to finding mates, and hunting fish.

"We are asking them to do all these things in a way that is totally a game changer now," Holt said.

"They are trying to find these rarer and rarer fish. It would be like going grocery shopping and I am going to turn out the lights and you only have 20 minutes and I am going to take half the food away — good luck with that."

Anatomy of a hunt

K35 has just taken a deep breath, arched his back, and plunged deep below the surface.

Researchers eavesdropped on his hunt, capturing not only his clicks, buzzes and calls, but his movements, and the sounds around him, revealing the underwater world of an orca on the hunt.

The deeper he went, the darker it got. But that was no problem for K35. Water is a terrific medium for sound, which can travel more than four times faster in water than in air. In dark or murky water, sound is a much better tool for hunting than sight is.

An orca hears with its face and talks with its head: Plunging below 100 feet, K35 used phonic lips on either side of his blowhole as deftly as a horn player. Orcas use sound to search for prey much the way a bat uses sonar in the pitch black of the night sky.

K35 searched for fish, or good fish habitat, using his so-called echolocation clicks: bursts of sound focused through fat in a reservoir called the melon, at the front of his head. K35 flexed his melon as he swam, to point and focus his click train of sound like the beam of a flashlight.

As he homed in on a fish, K35 made faster clicks and urgent calls.

Suddenly, the echo from his clicks bounced back. Another fat-filled reservoir in his lower jaw received the echo, conducted to the middle ear, inner ear, and then hearing centers in the brain via the auditory nerve. K35 used this information to see inside what he had targeted: the swim bladder of a fish. The gas-filled sack is used to maintain buoyancy, and K35 recognized it as the size and shape for a chinook.

He switched to a rapid buzz and closed in, flushing the salmon out of hiding.

As the fish fled for its life, the device attached to K35 recorded the whoosh of water as he rolled, accelerated, stopped and started again, chasing his prey.

K35 can swim in bursts of 30 mph. For a southern resident killer whale, an average dive is 400 feet deep and 4 minutes long, and it's no problem to dive nearly 1,000 feet and stay down 10 minutes, Jennifer Tennessen and her co-authors at NOAA's Northwest science center found in a recent paper.

At 500 feet, K35 was still in hot pursuit.

The fish sped in a desperate run for the surface. But K35 let loose another burst of rapid-fire buzz sounds, and came in for the kill.

Then came the sound of a satisfying crunch.

With piercing calls, K35 brought in family members, perhaps to share the fish. Then his dive ended as it started, with a deep breath at the surface.

To stay healthy, an adult killer whale must catch about 18-25 salmon every day. Chinook don't school and must be chased down, whale by whale, and fish by fish. Salmon probably know when they have been targeted; pressure of the sound waves from an orca's echolocation clicks may be felt by the fish tactically, along its lateral line, a nerve that sensitizes its sides.

"You can hear the fish respond by diving deeper; they escape to the bottom — and the whale follows them," Holt said. "It's a prolonged chase. It's a lot of effort for the whales."

Yet orcas that Holt and her co-investigators tagged over four years were consummate salmon slayers, especially the males, according to a 2019 paper.

The southern residents don't always dive to the depths for a meal; some hunts end right on the surface.

Rare footage from a research drone shows us a glimpse of a J pod family relying on each other to find and share food — an integral part of orca culture — and how hard it is to catch even one fish.

In the video, the orcas surge in a white-water battle, circling, pitching and rolling.

Soon enough, the fish hangs out of both sides of the older whale's mouth, big as a log. She shakes her head hard, and shags off a piece, for her younger family member who zooms into the older whale's slipstream. It was gone in one chomp.

Orcas have carried on in their way of hunting and food sharing in these waters for generation after generation.

But it's not only the southern residents who are masters of the kill.

The Tyrannosaurus rex of the sea, orcas worldwide are devastating predators, ready to rip with a mouthful of conical interlocking teeth, up to 4 inches long.

In every ocean of the world, orcas have evolved to target specific prey they have learned to hunt, using local environmental features and seasonal patterns in the waters they dominate. Ruthless, precision carnivores, orca live up to their species name, *Orcinus orca*: from the realm of the dead. They get their kill wherever it is, whatever it takes.

With the orcas' cunning intelligence, swaggering power and martial-arts moves, no animal on their menu is safe. Worldwide, orcas target about 140 species. Stingrays. Sharks. Sea lions. Minke whales. Octopus. And much, much more.

Their teeth reveal their obsessions. Shark-killers' teeth become sanded down from taking on rough-skinned prey. Chinook shredders like the southern residents have needle sharp teeth and tear big fish in half with a shake of their heads.

They thrash their tails to karate-chop great white sharks in Australia, and rip their livers out. They chase down, ram and drown baby gray whales off the coast of California, and tear off their lips and tongues. They storm the beaches of Argentina, and snatch baby seals right off the sand. They body slam and hurl white-sided dolphins through the air in B.C., and herd herring in Norway into terrorized silvery torrents, the better to stun and gulp them by the thousands.

In the Antarctic, orca slash through the water, fast and powerful as packs of wolves. They work together to make waves that wash seals right off the ice, straight into their jaws.

Orcas have been on our planet getting good at what they do far longer than humans. For more than 6 million years, orcas — actually

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ABOUT HOSTILE WATERS

The Seattle Times' Hostile Waters series is exploring the plight of the southern resident killer whales, among the most enduring yet most-endangered symbols of our region.

In Part One, we traveled north to a land where another resident population of orcas is thriving in quieter, cleaner waters.

Part Two told how a generation of killer whales was taken from Puget Sound and shipped around the world — and who put a stop to it.

Part Three showed how scientists — and a dog — are working to understand how hunger hurts, even kills, when salmon runs crater.

With today's story, you can listen to an orca's hunt unfold, and hear the human sounds orcas must navigate through to find food.

Explore the series at *st.news/orca-series*

HOSTILE WATERS

ORCAS IN PERIL

STEVE RINGMAN / THE SEATTLE TIMES

Along the west side of San Juan Island, orcas hunt salmon headed for the Fraser River. Orca families pass on places and techniques for hunting salmon, generation by generation. When people fill those same places with ships and boats and noise, orcas have a harder time catching already scarce prey.

< Continued from previous page

not whales at all, but the ocean's biggest dolphins — have evolved into a single species of many types.

Each type has developed a learned culture, passed on family to family. That is why endangered southern resident killer whales won't eat seals or porpoise, though they can easily kill them, and are even seen packing them around, tucked under a pectoral fin, seemingly just for fun.

The southern residents will swim through an abundance of pink or sockeye salmon, saving their appetites for the prey they learned to hunt: big, fatty chinook, the most caloric prize for the hunting effort, and plentiful over the thousands of years during which this population of orcas evolved, since the ice-age glaciers melted in the northeastern Pacific.

But today, even for the ocean's top predator, the primal task of hunting salmon is getting harder. Given enough time, perhaps the southern residents could evolve to eat other prey. But their world is being changed by humans faster than an animal with a life span similar to our own can adapt.

Clash of maritime cultures

With a rhythmic thudding sound, the container ship powers into the north end of Haro Strait and down the west side of San Juan Island. Scientist Rob Williams of the nonprofit Oceans Initiative has a hydrophone underwater, playing the ship's noise over a speaker aboard the research boat Molly B.

The boat's pilot, Joe Gaydos, science director of the nonprofit SeaDoc Society, hears the ship from 10 miles away, long before he sees it.

"It looks like a small city," he says as the ship, the Xin Los Angeles — flagged in Hong Kong and the longest container ship in the world when built in 2006 — barrels along at 22 knots. With a capacity for 9,600 containers stacked seven rows high, it is nearly twice as long as the Space Needle is tall. The ship obliterates the view of Lime Kiln Lighthouse and leaves a seething wake.

It's an ordinary moment in the Haro Strait, this long stretch of water that connects the U.S. and Canada and serves as a main drag for shipping traffic to and from Vancouver. But it's also an extraordinary disturbance for animals sharing the waters and soundscape. Loafing harbor porpoise chuffing at the surface scram.

As the Northwest grows, and its economy booms at the closest ports to the Pacific Rim, not a day — and scarcely an hour — passes without heavy industrial shipping traffic, recreational boaters, fishing vessels and ferries transiting critical habitat of the southern residents, including their prime foraging grounds in the summer.

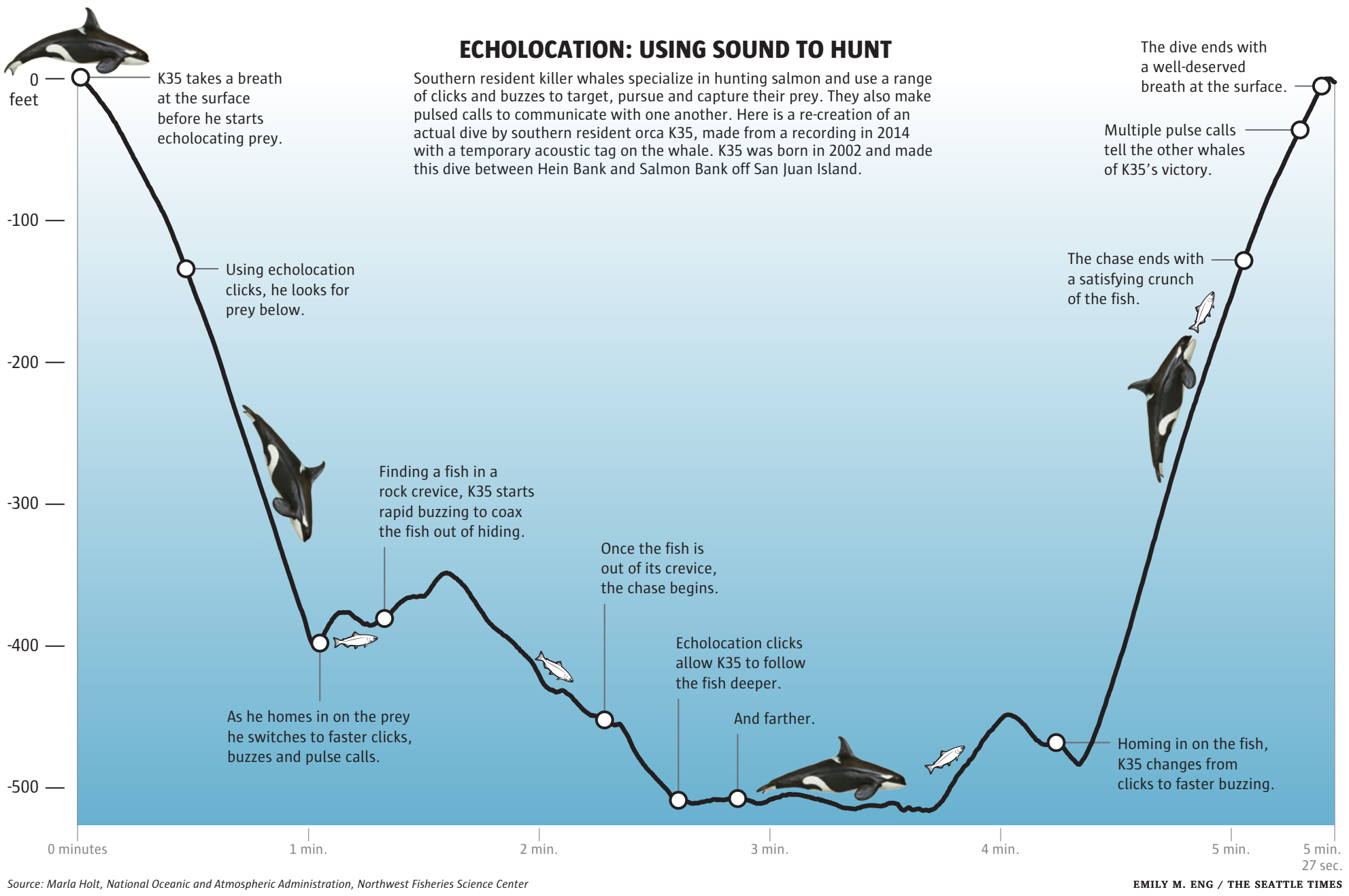
On this recent weekday, six ships

See > SOUND, G6

HEAR THE HUNT
Listen to K35 pursue and kill a fish at ***st.news/orcas-noise***

ECHOLOCATION: USING SOUND TO HUNT

Southern resident killer whales specialize in hunting salmon and use a range of clicks and buzzes to target, pursue and capture their prey. They also make pulsed calls to communicate with one another. Here is a re-creation of an actual dive by southern resident orca K35, made from a recording in 2014 with a temporary acoustic tag on the whale. K35 was born in 2002 and made this dive between Hein Bank and Salmon Bank off San Juan Island.



Source: Marla Holt, National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center

EMILY M. ENG / THE SEATTLE TIMES

Southern resident orca J27 is dwarfed by the hull of a ship in the Haro Strait. The west side of San Juan Island is a primary foraging ground for the southern residents but also a shipping route for container ships, oil tankers, and other commercial traffic to and from the Port of Vancouver, the busiest by tonnage on the West Coast.

KEN REA / SPECIAL TO THE SEATTLE TIMES

UNDERWATER SOUNDS

As orcas chase prey into deeper, darker and more turbid waters, their ability to see declines. So orcas use sound as their primary sensory system for communication, navigation and finding prey.

TYPES OF SOUNDS

Killer whales make three different types of sounds: whistles, calls and clicks. Whistles and calls are used for communication, while echolocation clicks help with navigation.

Whistles are continuous single tones at high frequencies used for close-range communication. Calls are made in lower frequencies, and can travel up to 9 miles. Pulse calls create rapid streams of sound and are the most common vocalization. These calls are used for finding and staying in contact with one another and coordinating movement.

Calls that always sound the same are called discrete or stereotyped calls. Pods that share a number of discrete call types form an acoustic clan with its own unique vocal tradition. Even within a clan, different groups can have their own unique way of making certain calls and forming their own dialects. These dialects are distinct enough that no two are the same.

Sounds are so important to whales that within days of birth calves begin to vocalize. Around 2 months old, calves can send pulse calls similar to the adults. They selectively learn calls from their mother as they mature.

WHISTLE

Frequency: 2,000 - 50,000 Hz
Duration: 60 to 18,000 miliseconds

PULSE CALL

Frequency: 500 - 30,000 Hz
Duration: 600 to 2,000 miliseconds

ECHOLOCATION CLICK

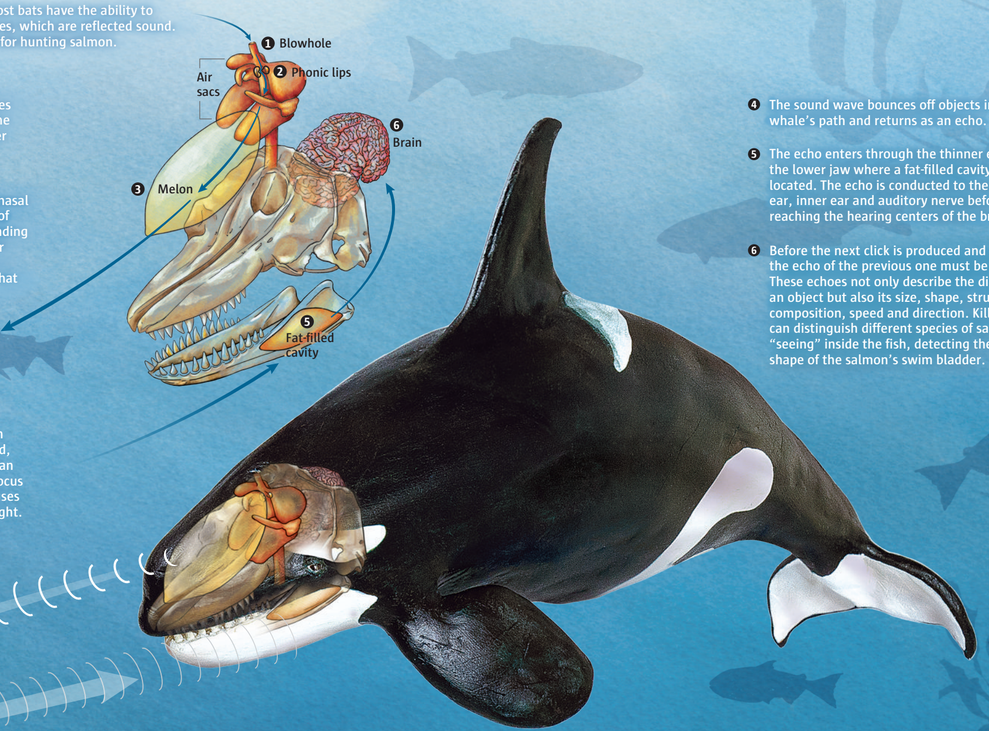
Frequency: 10,000 - 100,000 Hz
Duration: 0.1 to 25 miliseconds

ECHOLOCATION

Toothed whales, including orcas, and most bats have the ability to locate and identify objects through echoes, which are reflected sound. For killer whales, echolocation is crucial for hunting salmon.

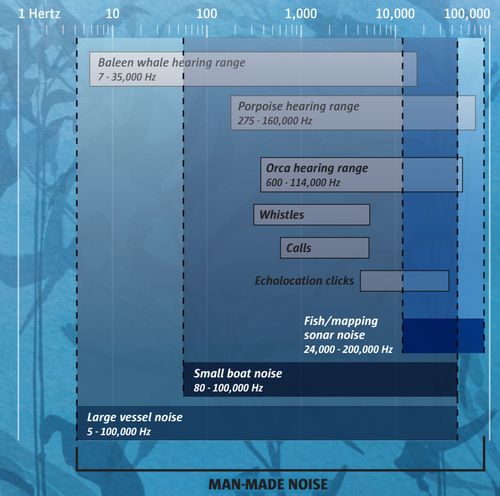
HOW IT WORKS

1. Breathed air enters the blowhole, goes through the nasal passage and fills the first set of air sacs. During underwater dives, a nasal plug closes the nasal passage to the blowhole.
2. Below the top air sacs in the narrow nasal passage are phonic lips on each side of the blowhole.The whale uses surrounding muscular structures to manipulate air flow that causes the phonic lips to vibrate, resulting in acoustic pulses that sound like clicks.
3. The clicks pass through the melon, an organ at the front of the whale's head, made of specialized fats. The whale can change the shape of the melon and focus the sounds into an acoustic beam it uses to scan its environment, like a flashlight.
4. The sound wave bounces off objects in the whale's path and returns as an echo.
5. The echo enters through the thinner end of the lower jaw where a fat-filled cavity is located. The echo is conducted to the middle ear, inner ear and auditory nerve before finally reaching the hearing centers of the brain.
6. Before the next click is produced and sent out, the echo of the previous one must be received. These echoes not only describe the distance of an object but also its size, shape, structure, composition, speed and direction. Killer whales can distinguish different species of salmon by "seeing" inside the fish, detecting the size and shape of the salmon's swim bladder.



SOUND VERSUS NOISE

A sound is an acoustic signal that is important to the listener. Noises are unwanted sounds that interfere with the reception and transmission of sounds. Different qualities of sound, like the frequency (rate of vibrations measured in hertz), loudness (amplitude in decibels) or duration, can all be impacted by noise. A sound wave can travel almost a mile per second under water — more than 4 times faster than in air, with low frequencies traveling farther than high frequencies.



VESSEL NOISE

80-85% of vessel noise is generated by ship propellers. The rest is created by propulsion machinery including the engine, and by water flowing over the hull. Large vessels create lower frequency noise that can travel hundreds of miles underwater. Noise also increases with speed and proximity. Faster, closer vessels create more noise.

ACOUSTIC MASKING

Since the 1950s, underwater ambient noise has doubled each decade (3 decibels every 10 years). This forces orcas to increase the loudness (one decibel for each decibel of noise) or length of their calls. Being louder comes at a cost of increased energy required for sound production and increased stress levels. A noisier environment also decreases the distance at which orcas can detect prey, causing whales to work harder to find food.

Many salmon runs also already are depressed. In this way the threats to orca survival combine and interact to cause a greater overall peril: Noisier water makes it harder to find increasingly rare fish, which results in bigger exposure to pollutants for whales that don't get enough to eat. Hungry whales burn the fats in their bodies where pollutants are stored. That exposes them to toxics that harm reproductive capacity and reduce ability to fight disease.

EMILY M. ENG / THE SEATTLE TIMES

ECHOLOCATION MASKING

Human-caused noise limits the horizontal detection ranges of killer whales trying to echolocate chinook salmon. The shorter the detection range, the less likely the whale will locate and capture the salmon.

The closer a ship is, the louder the noise is.

Ambient Haro Strait — *0% reduced range*
Echolocation-detection range: 1,300 feet*

Container ship moving at 21 knots

Distance: 656 feet away
Detection range: 66 feet — *95% reduced range*

Distance: 1,450 feet away
Detection range: 197 feet — *85% reduced range*

*Echolocation click frequency of 50 kHz at the surface seeking a chinook 213 feet below.

The faster the boat goes, the louder the noise.

Ambient Haro Strait — *0% reduced range*
Echolocation-detection range: 1,300 feet*

Boat** 328 feet away from the whale

Speed: Cruising at 24 knots
Detection range: 66 feet — *95% reduced range*

Speed: Below 24 knots
Detection range: 164 feet — *88% reduced range*

**29-foot aluminum monohull boat with twin 225-horsepower outboard motors.

Sources: Marla Holt, National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center, Veirs, Scott, et. al, "Ship noise extends to frequencies used for echolocation by endangered killer whales," PeerJ

HOSTILE WATERS

ORCAS IN PERIL

STEVE RINGMAN / THE SEATTLE TIMES

Shipping traffic in the Haro Strait creates noise that makes it harder for southern residents to hunt salmon and communicate in their primary summer foraging grounds.

< Sound

FROM G3

in five hours traveled the Haro Strait flagged in four nations. There were the container ship Xin Los Angeles; one vehicle carrier; two cargo carriers; one bulk carrier; and one Canadian military training vessel, the steel-hulled Renard — dubbed Orca Class — with a rooster tail of water shooting behind it. A blazing fast crab boat was so far away it took binoculars to see, but could be heard for miles.

The Northwest is a major maritime hub. The ports of Seattle and Tacoma together are the fourth largest container gateway in North America, with $73 billion in international trade, according to the Northwest Seaport Alliance. In Washington state alone, the maritime sector employs nearly 70,000 workers and generates more than $21 billion in revenue, according to the state Department of Commerce.

The Port of Vancouver sustains trade with more than 170 economies around the world and supports more than 96,000 jobs in B.C. alone. In 2018, 147 million tons of cargo moved through the port, valued at $200 billion. The Port of Vancouver saw record-breaking traffic in 2017, and again in 2018.

Current demand forecasts in a study for the Port of Vancouver anticipate container trade to double in the next 10-15 years and nearly triple by 2030.

Waters already loud could get even noisier. The port wants to build another major container terminal at the Fraser River delta — right where orcas hunt. That proposal is under environmental review by the government of Canada, which also is poised to increase oil tanker traffic sevenfold in the Burrard Inlet to serve an expansion of the TransMountain Pipeline, boosting oil tanker traffic from about 60 to more than 400 oil tanker trips per year. All of those oil tankers would get to Canada through the southern residents' primary summer foraging grounds.

A 2017 study commissioned by the Vancouver Fraser Port Authority of vessel noise from May to September in the whales' critical habitat, including the Haro Strait, found increasing noise has the potential to affect the southern residents by changing their behavior; displacing them from their range; masking their communication; decreasing their foraging efficiency and creating hearing damage and stress.

Overall, southern residents potentially lose as much as 20 to 23% of each day, or up to 5½ hours of foraging time from May through September, because of vessel noise, with approximately two-thirds of those effects due to large commercial vessels, and one third due to whale watching boats, according to the study.

In trials sponsored by the port in 2017 and 2018, some shippers voluntarily slowed their speed of travel in the Haro Strait to reduce how much noise they make. The effects of the slowdown have yet to be determined.

Retired physicist Val Veirs, of San Juan Island, and his son, oceanographer Scott Veirs, found that large ships have the biggest influence on the orcas' ability to hear, both because ship traffic occurs just about every hour of the day year-round, and because ship sound frequencies overlap with the orcas'.

Scott Veirs, of Seattle, maintains the OrcaSound network of hydrophones in the Salish Sea, including right off the beach at his parents' house on the west side of San Juan Island. Sounds stream in: The breathing of harbor seals. Groans of fish. Even the sound of airplanes overhead, heard through the water. But mostly, the sound of ships.

The whales notice.

In 2009, Val and Scot Veirs and Holt with other co-authors documented that orcas raise their voices above vessel noise, the way humans would by the side of a highway.

In a paper published in 2016 Veirs and his co-authors found ships are raising noise levels at the frequencies that are right in the sweet spot of killer-whale hearing.

"The most complicated thing they do is hearing the echo off the swim bladder on a chinook that is 50 to 100 meters away in dark, cloudy water, where they can't see more than a whale's body length," said Scott Veirs.

"They are masters of sounds, and the entire heads are miraculous mechanisms for both generating sound and receiving it. But they need to be able to receive a very faint sound, the echoes off a little organ full of air inside a salmon."

In addition to finding prey, southern residents need to hear one another. The southern residents have their own unique dialect and each pod has favorite calls. The southern residents are known for their chattiness, carrying on an unending conversation with one another. Traveling with the southern residents, it's not uncommon to hear their calls bubble up to the surface.

While big ships have been singled out as the noisemakers that matter most, whale watching and other small-boat traffic can have an effect, depending most of all on the speed of travel. Speed is the single most important predictor of sound that will be received by the whales, Holt and her co-authors found in a 2015 paper.

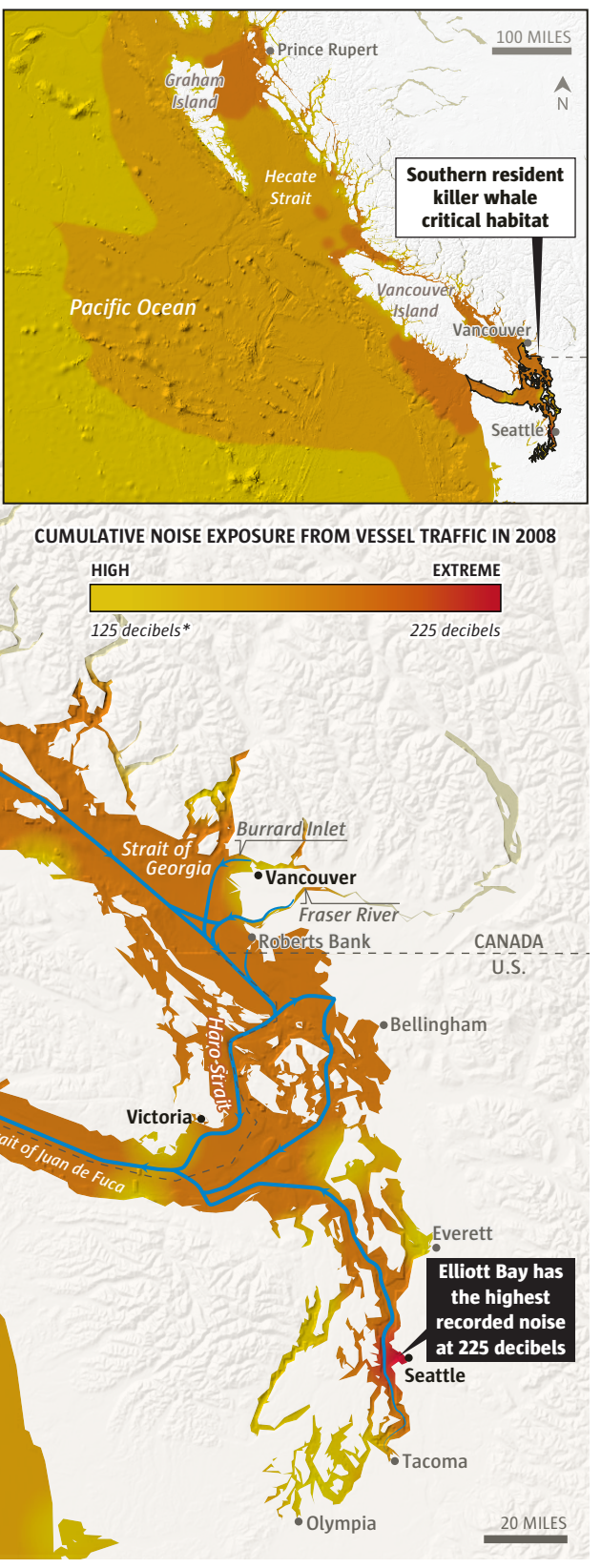
Whale watching has been target-

Continued on next page >

THE SOUTHERN RESIDENTS' NOISY HOME

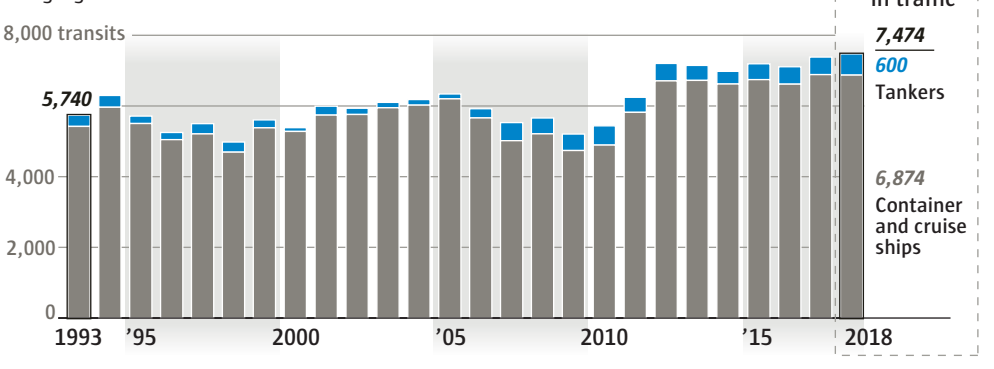
The endangered southern resident orcas that visit Puget Sound confront the noisiest waters in their critical habitat, including the west side of San Juan Island, the Fraser River Delta and the Strait of Juan de Fuca. Noise is caused by vessel traffic, especially commercial shipping.

Their habitat in all of the Salish Sea has underwater noise levels that would be out of compliance with noise-pollution limits that are recommended by the European Union.



A BUSIER HARO STRAIT

Busier means noisier: More tankers, container ships and cruise ships bring more noise confronting endangered southern resident orcas in their core summer foraging habitat in Haro Strait.



*Calculated with a reference of one microPascal squared times one second

Sources: Erbe, Christine, et. al, "Mapping cumulative noise from shipping to inform marine spatial planning," The Journal of the Acoustic Society of America, Washington State Department of Ecology

EMILY M. ENG / THE SEATTLE TIMES

HOSTILE WATERS

ORCAS IN PERIL

STEVE RINGMAN / THE SEATTLE TIMES

Speed is a top factor in the amount of noise received by orcas from vessel traffic. This boat heads back to port after an evening of whale-watching along San Juan Island.

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ed to quiet Washington water for the whales, both with legislation and new regulations. Whale watching in San Juan County waters has a $216 million economic impact in the Puget Sound region, according to 2018 economic impact study of whale watching commissioned by the SeaDoc Society.

The industry has burgeoned to 32 companies in 19 ports in Washington and B.C. and draws half a million people every year from all over the world, thrilled at the possibility of seeing a whale. Whale watching generates more than $12 million in state and local tax revenue annually and supports over 1,800 jobs.

Ten years ago, the industry depended on the southern residents. Today a surge in humpback whales and marine-mammal-eating transient, or Biggs', killer whales keeps the customers coming, said Jeff Friedman, U.S. president for the Pacific Whale Watch Association.

The southern residents make up only 10 to 15% of the whale-watch business because they are here less. One likely reason is the chinook the whales seek returning to the Fraser River have declined.

"And that is where all these risk factors intersect: If there is plenty of food, maybe vessel noise doesn't matter that much," Holt said. Noise alone isn't the issue; physical disturbance also matters, Holt said. "It is a combination of things, keeping track of all these other obstacles in my environment, especially if I have to move very quickly and rapidly, those physical challenges are going to be an extra challenge."

Some noise is overwhelmingly disruptive. Ken Balcomb, founding director of the Center for Whale Research, filmed an infamous incident in 2003 when the Navy vessel USS Shoup let loose piercing bursts of sonar that sent J pod fleeing nearly up the beach, apparently trying to escape the noise.

The incident was a black eye for the Navy. Its testing program, including sonar exercises and detonating explosives, remains controversial. The Navy has proposed for public comment a new testing program beyond 2020 for Puget Sound and the outer coast that predicts effects to tens of thousands of marine mammals, including the southern residents.

U.S. naval training and testing activities in the Northwest using sonar have the potential to temporarily disrupt behavior or cause temporary or permanent hearing impairment in marine mammals, said Jennie Lyons, spokeswoman for NOAA. "No mortalities for southern residents, or any other marine mammal, [are] anticipated or authorized," she added.

STEVE RINGMAN / THE SEATTLE TIMES

Scientist Rob Williams, left, of the nonprofit Oceans Initiative, and Joe Gaydos, senior scientist of the SeaDoc Society, use a hydrophone to hear the underwater racket of industrial shipping in Haro Strait. Six ships travelled the strait in five hours.

KEN BALCOMB / CENTER FOR WHALE RESEARCH

Sonar testing by the USS Shoup, top left, in 2003 was likely loud enough to drive away members of J pod, according to a National Marine Fisheries Service report. Those whales, seen here off San Juan Island, clumped together and headed toward the beach.

SONAR BLAST
Hear the USS Shoup incident at ***st.news/orcas-noise***

Balcomb is convinced it is the lack of salmon driving the whales to decline, not ordinary boat traffic.

He remembers when there were more fish in these island waters — and more fishermen chasing them. "It was like a village out there, full of lights, seal bombs going off, boats everywhere," Balcomb said.

He has drone footage of orcas traveling the waters near his house without a flinch as a clueless boater blasts close by. "They are acclimated," Balcomb said.

Another explanation, Williams said, is that it depends not only on the noise, but what the whales are doing: The whales are bothered by boats more when feeding. He and other co-authors found in a 2009 paper that whales would be more likely to stop foraging when they encounter a boat, but will continue traveling in the presence of boats, taking little notice.

In a 2013 paper Williams and other authors also found the areas where orcas can effectively communicate was greatly reduced by noise, with their world shrunk in the loudest places to just a few usable spots.

Analysis of stress hormones in southern resident whales' scat has shown that the biggest contributor to pregnancy loss and mortality is lack of adequate food for the whales.

Reducing vessel noise to increase orca hunting efficiency is one thing people can do right away to buy time for the whales, while also working hard to build up chinook runs, Williams said. "Noise is a problem because lack of chinook is a problem.

"We are trying to save the final 75 and we need every tool in the box," Williams said of the southern residents, at their lowest population since the capture era in the 1970s. "This population of whales is critically small. It has nothing left to give."

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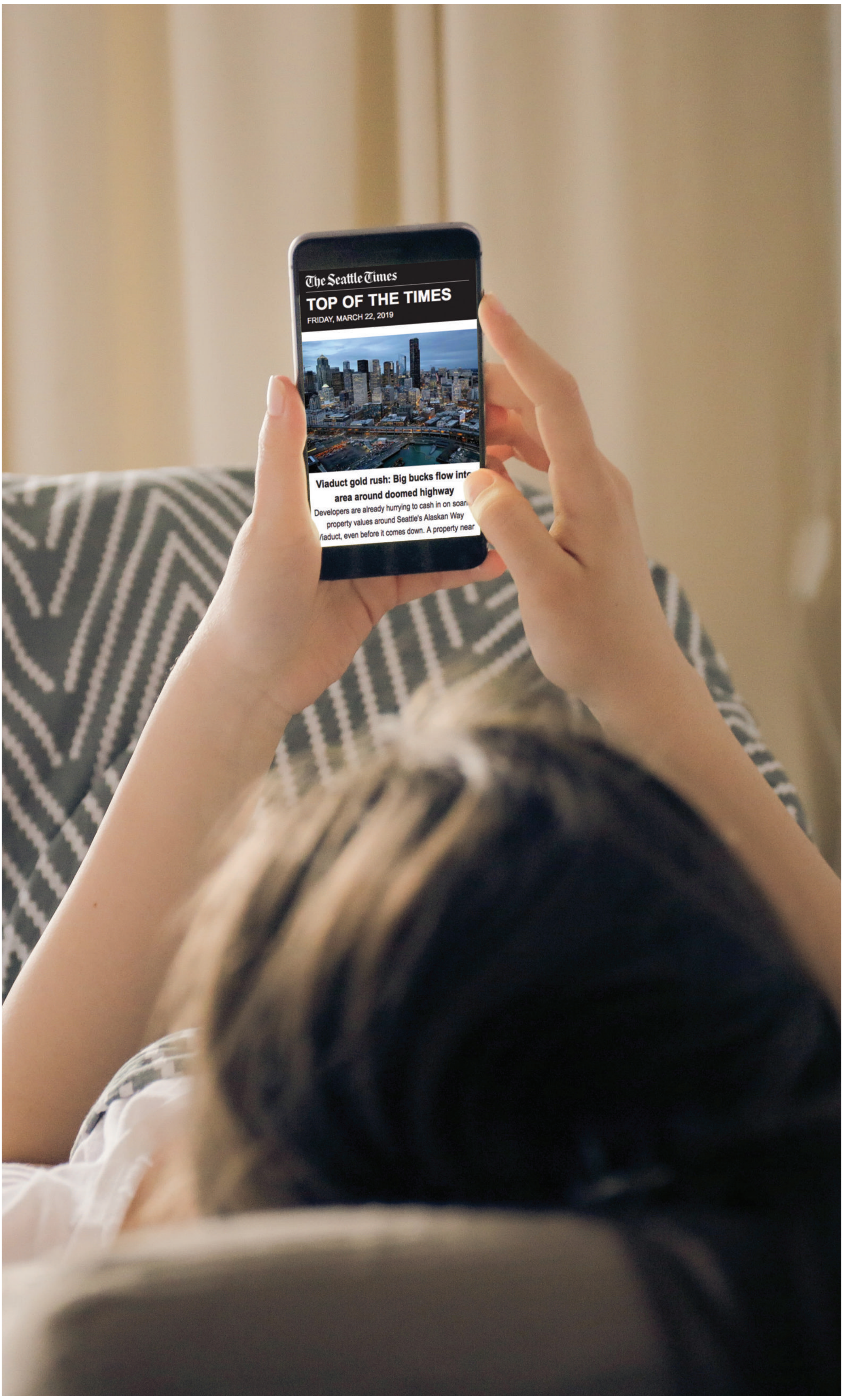

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