



HOSTILE WATERS

The Seattle Times





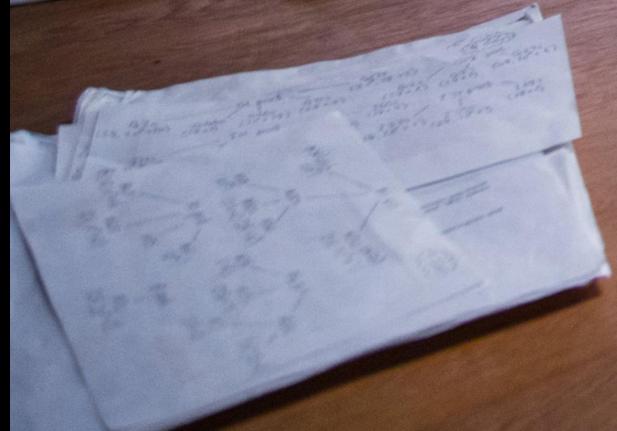
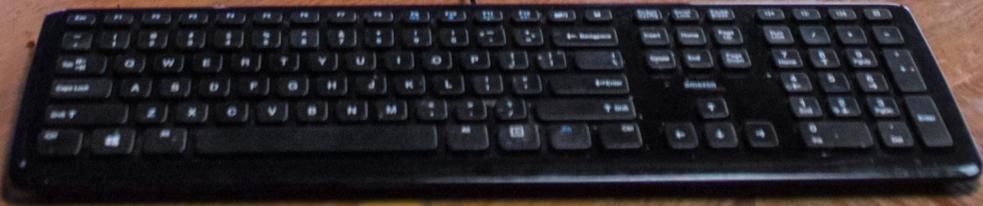
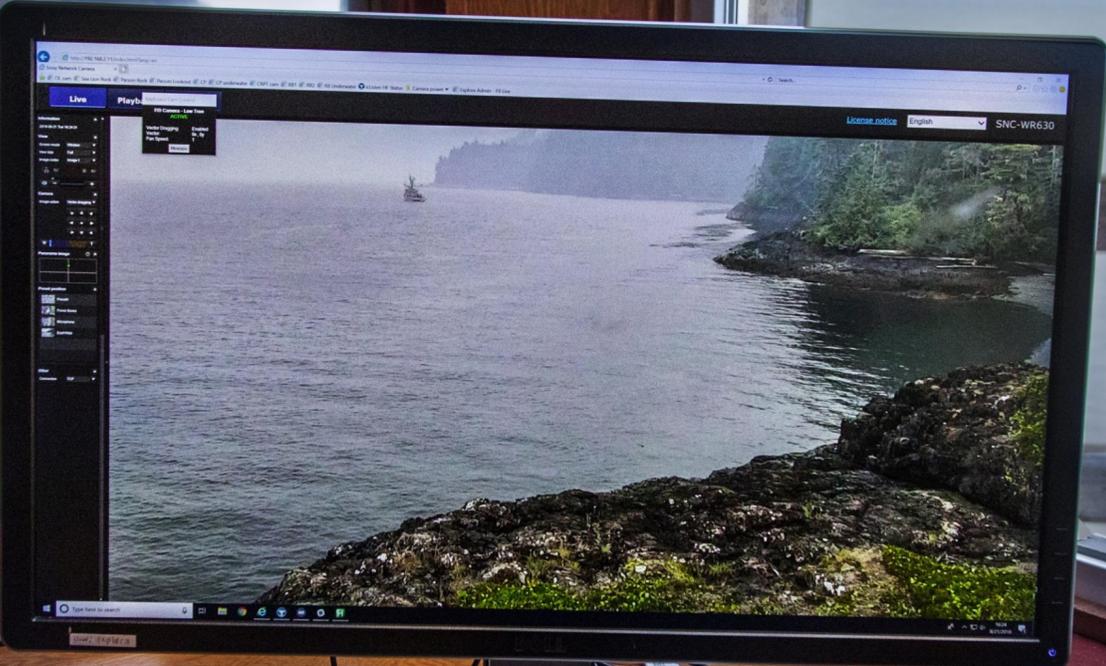








Welcome
HOME
Springer













Graphics

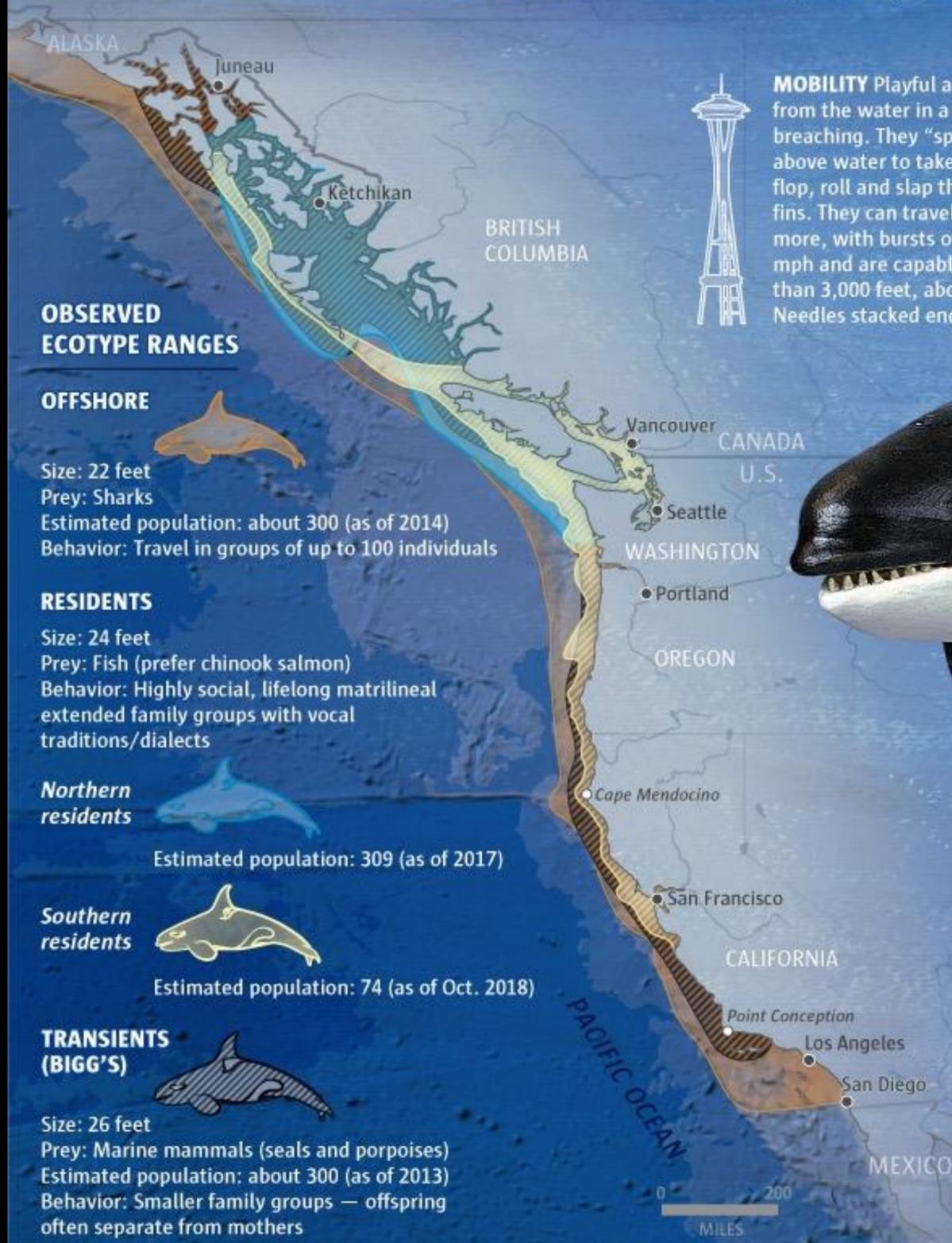
By Emily Eng

Killer whales, the oceans' top predator

Killer whales (*Orcinus orca*) are the most widely distributed whales in the world and found in every ocean. Three orca ecotypes reside in the waters of the northern Pacific

Coast. While their ranges overlap, they are not known to interact, and each ecotype is genetically distinct. They have unique foraging behaviors, dialects, diets and appearances.

THE DORSAL FIN The orcas' most recognizable fin varies in size and shape by ecotype and gender. Males tend to have straighter, more upright fins, with male residents' occasionally having a forward-slant with a wavy back edge.



MOBILITY Playful and athletic, orcas can leap from the water in a spectacular behavior called breaching. They "spyhop" with their heads above water to take a look around, belly flop, roll and slap their dorsal and pectoral fins. They can travel 75 miles a day and more, with bursts of speed up to 30 mph and are capable of diving deeper than 3,000 feet, about five Space Needles stacked end to end.



SADDLE PATCH Its shape and pigmentation pattern helps identify individuals. The shape may be inherited and helps differentiate between ecotypes.

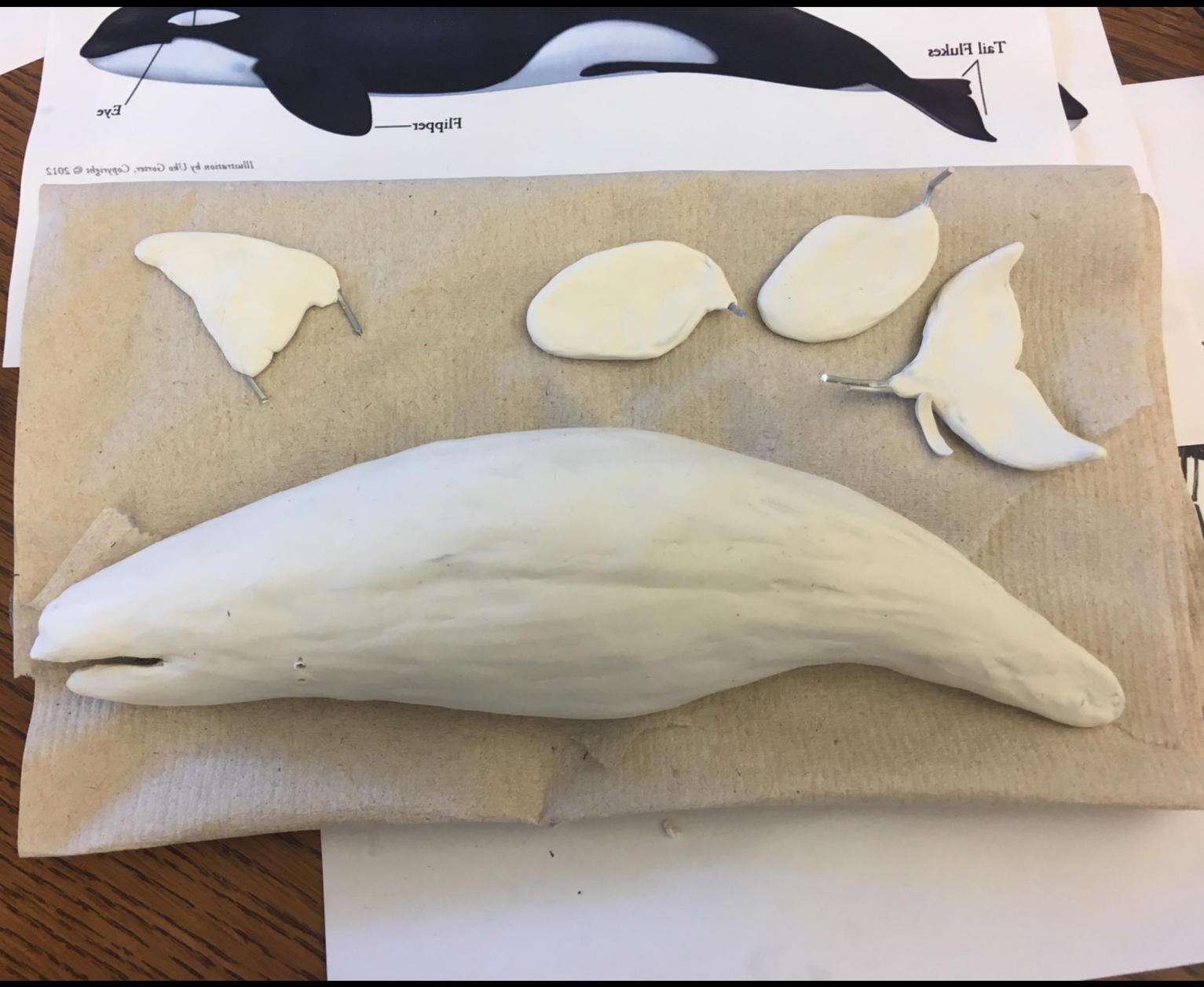
PATTERNING The distinctive black-and-white coloration varies by ecotype and helps obscure their outline as they hunt, providing camouflage.



LIFE HISTORY In this matriarchal society, female killer whales can live upward of 80 years, while males live 50 to 60 years. A female typically breeds from the ages of 15 to 40 and has four to six surviving offspring, giving birth every three to 10 years. The gestation period is up to 18 months. Babies nurse for about a year; almost half die before their first birthday.



At birth, calves are 7 to 8 feet long and weigh 300 to 400 pounds.





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.

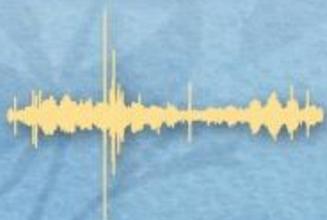
Whistles are continuous single tones at high frequencies used for close-range communication. Calls are made in lower frequencies, and can travel up to 9 miles. Pulse calls create rapid streams of sound and are the most common vocalization. These calls are used for finding and staying in contact with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



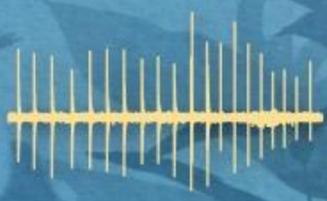
PULSE CALL

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



ECHOLOCACTION CLICK

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

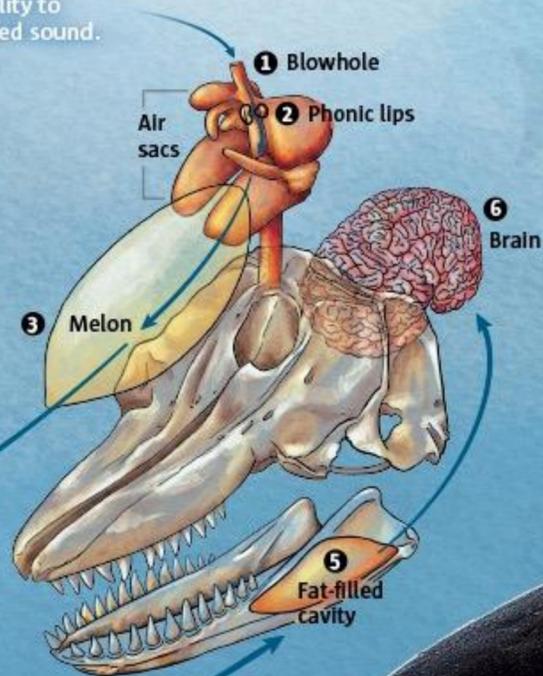


ECHOLOCAION

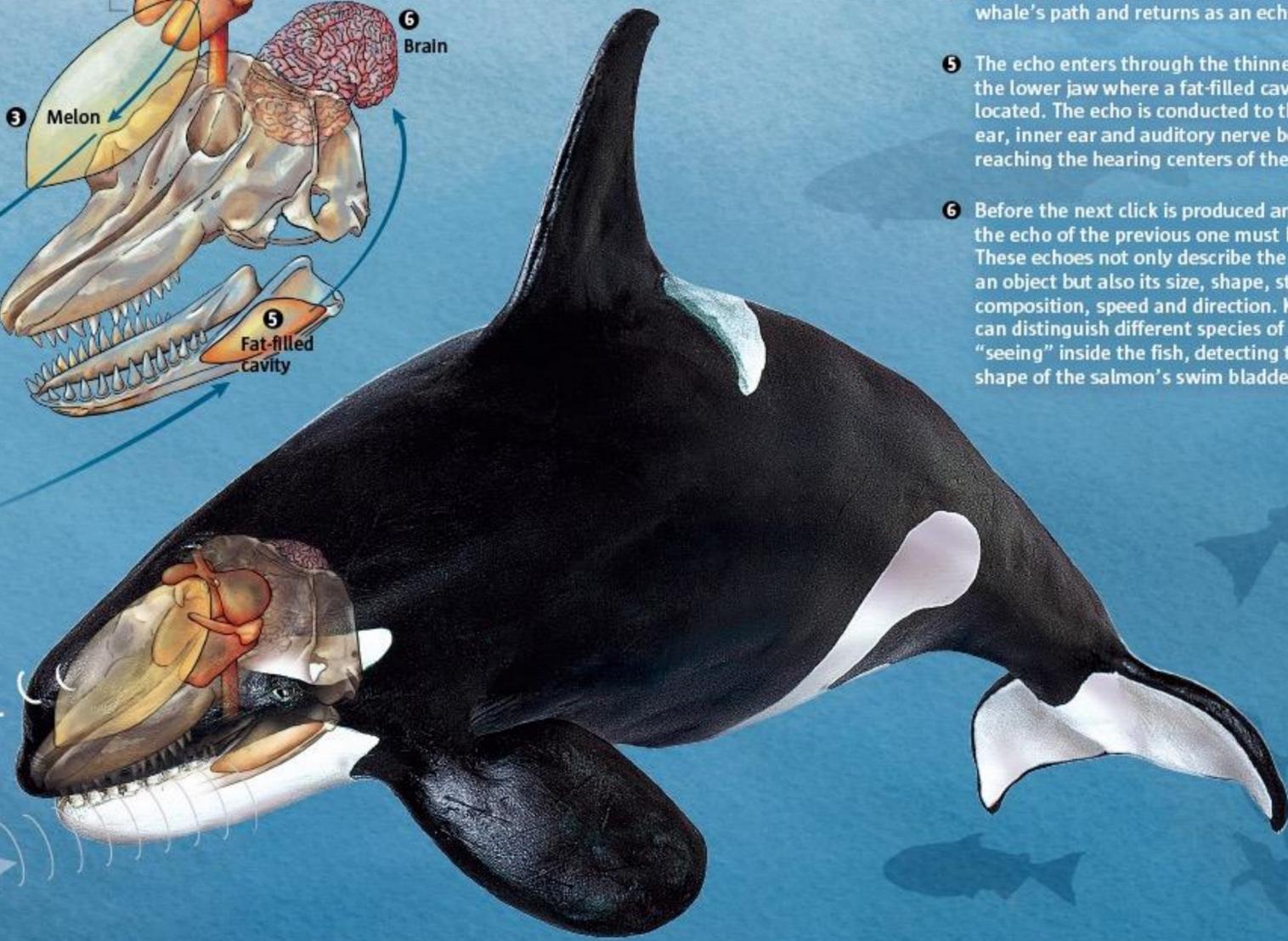
Toothed whales, including orcas, and most bats have the ability to locate and identify objects through echoes, which are reflected sound. For killer whales, echolocation is crucial for hunting salmon.

HOW IT WORKS

- 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.
- 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.
- 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.



- The sound wave bounces off objects in the whale's path and returns as an echo.
- 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.
- 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.



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

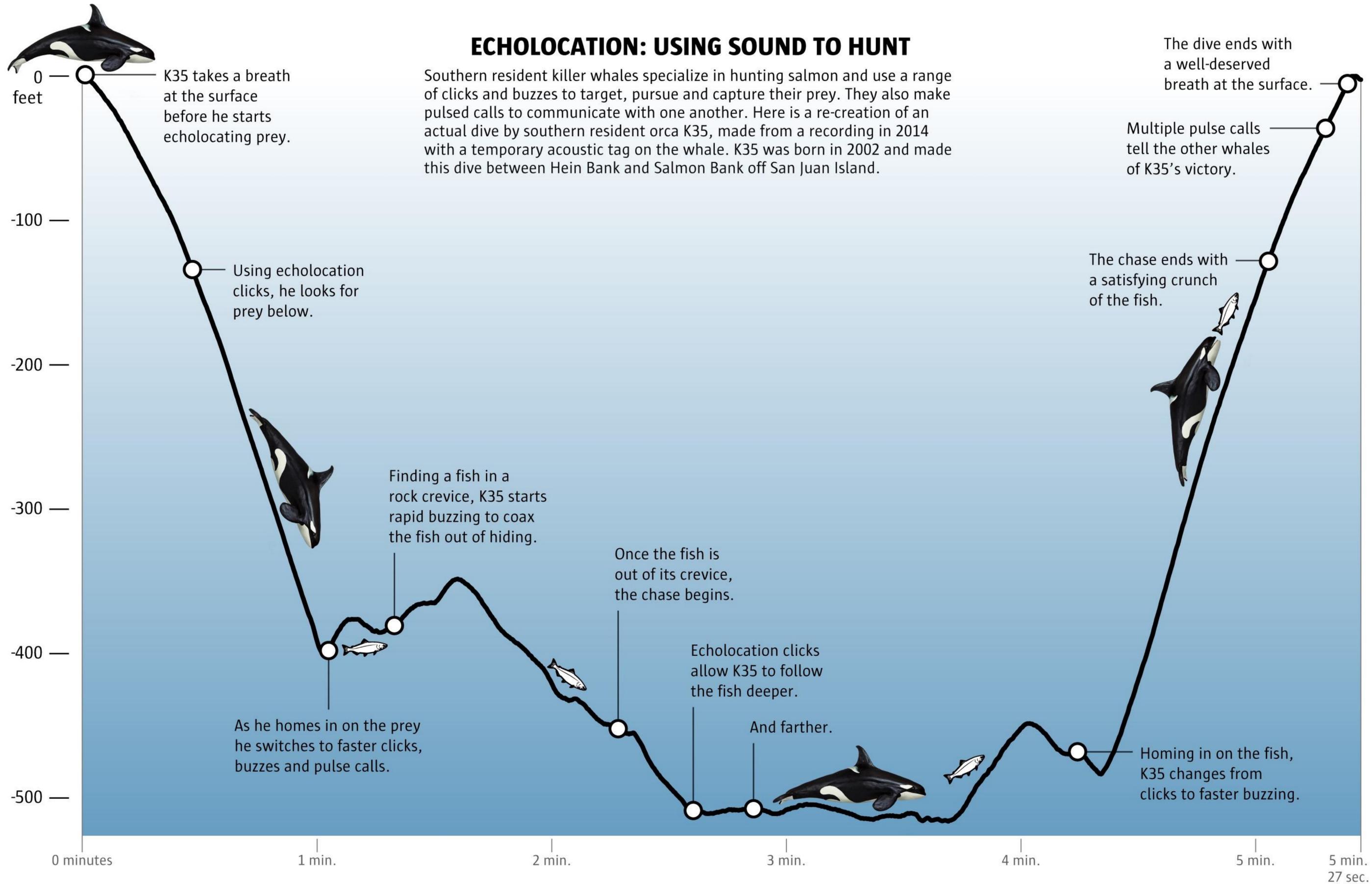
**29-foot aluminum monohull boat with twin 225-horsepower outboard motors.

ECHOLOCAION MASKING

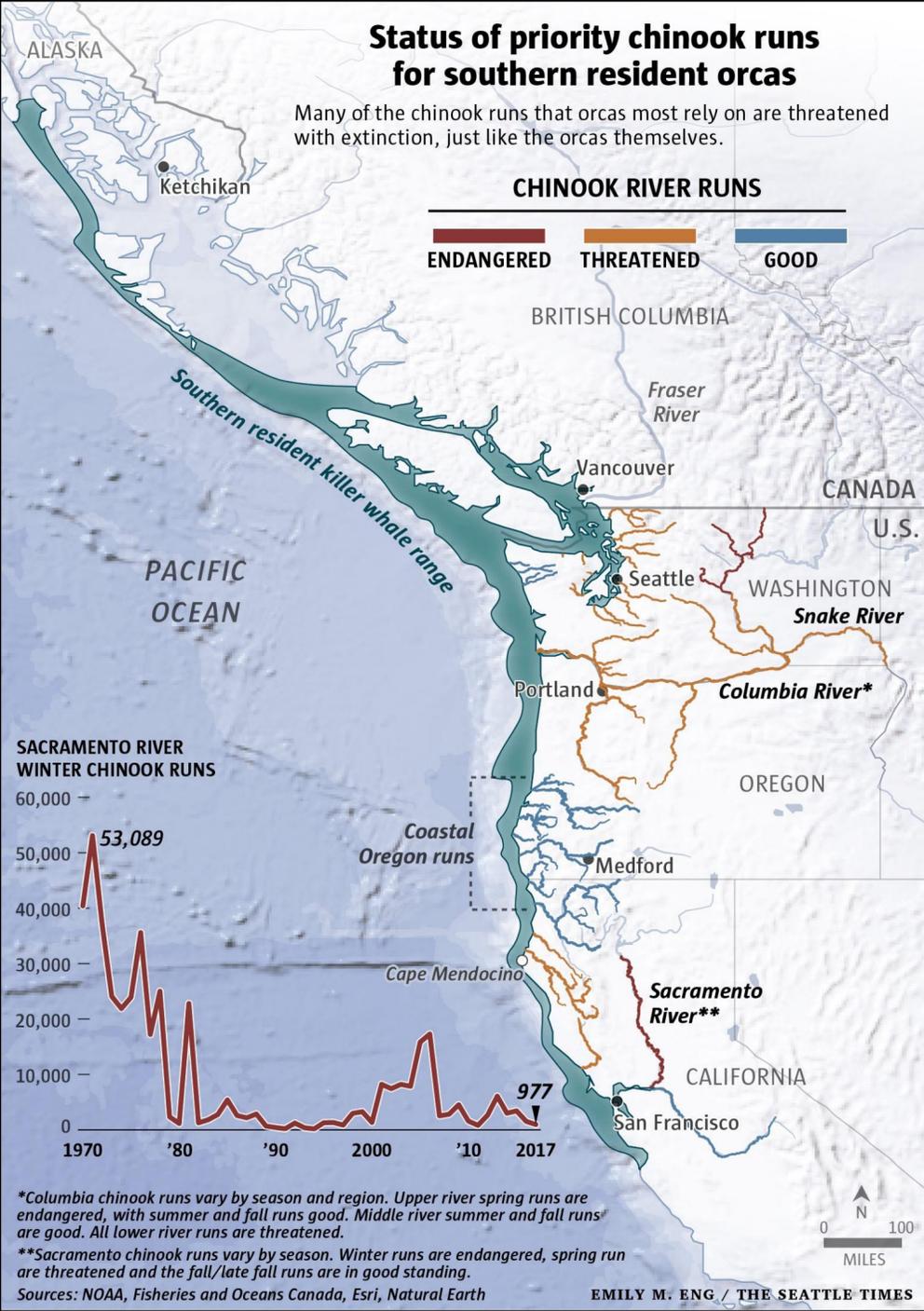
Human-caused noise limits the horizontal detection ranges of killer whales trying to echolocate chinook salmon. The shorter the detection range, the less likely the whale will locate and capture the salmon.

ECHOLOCATION: USING SOUND TO HUNT

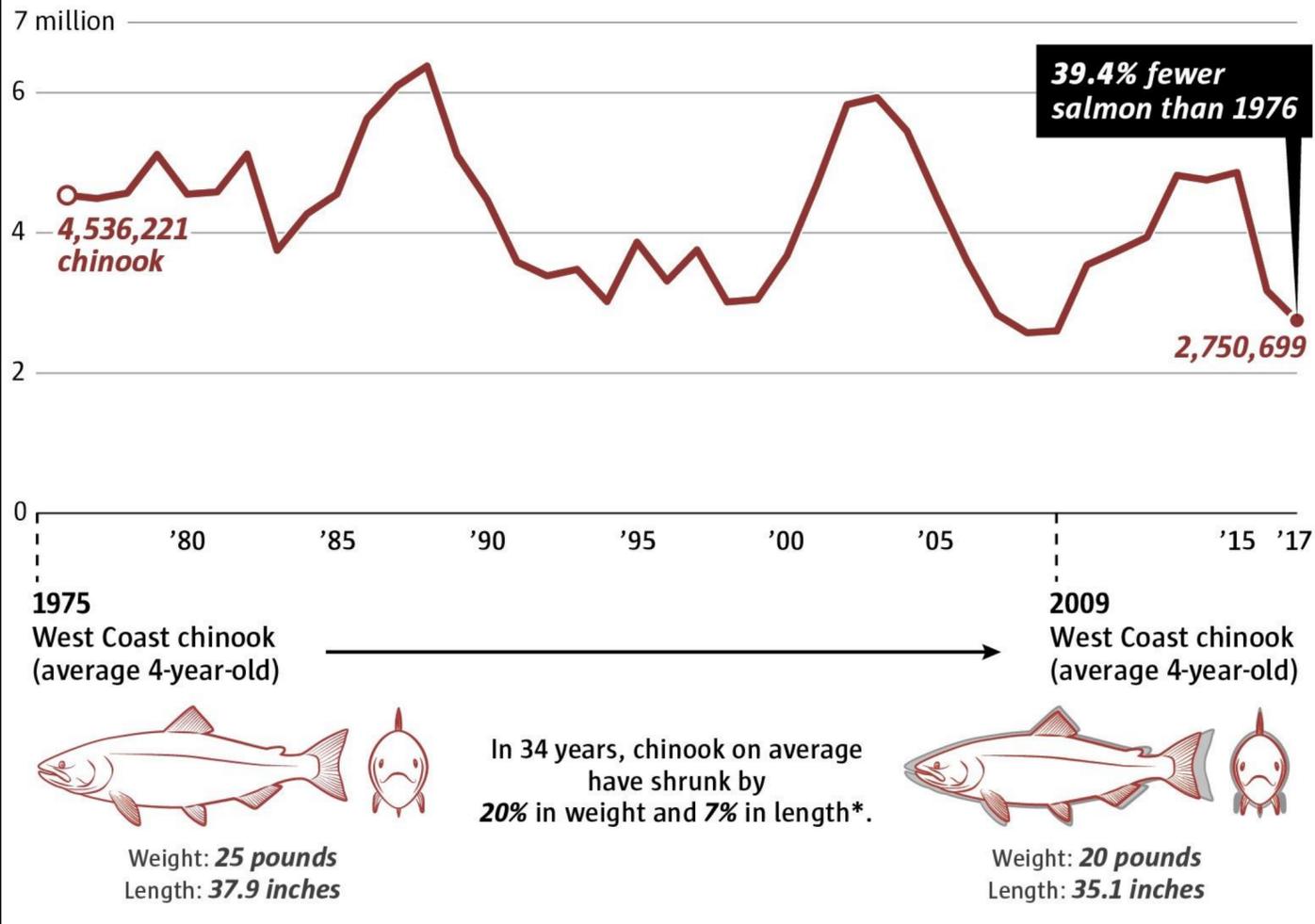
Southern resident killer whales specialize in hunting salmon and use a range of clicks and buzzes to target, pursue and capture their prey. They also make pulsed calls to communicate with one another. Here is a re-creation of an actual dive by southern resident orca K35, made from a recording in 2014 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



CHINOOK ABUNDANCE FROM ALASKA THROUGH CALIFORNIA



The **75 southern residents** would need at least **317,000** chinook per year to survive with a diet of only chinook. A recovered population would need at least **554,000***.



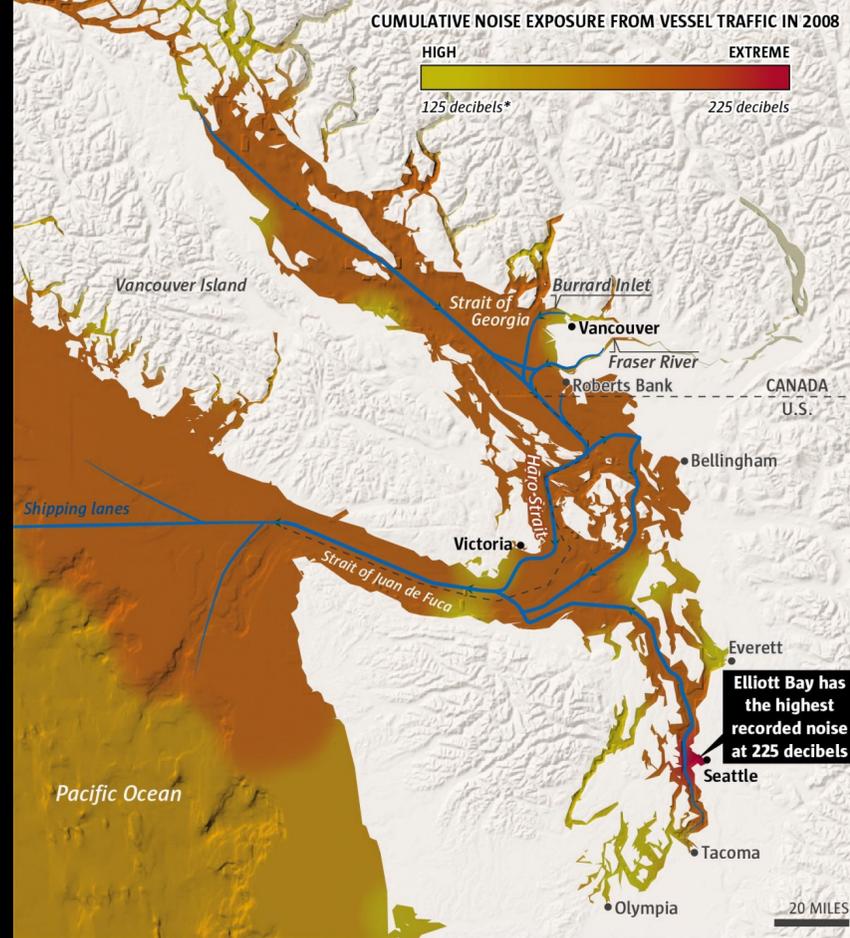
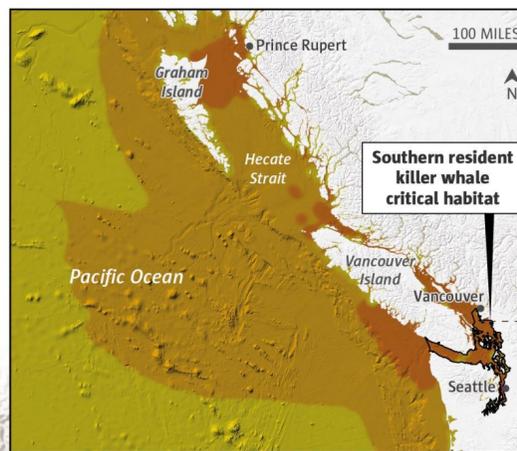
The **307 northern residents** would need at least **1,150,000** chinook per year to survive with a diet of only chinook.



THE SOUTHERN RESIDENTS' NOISY HOME

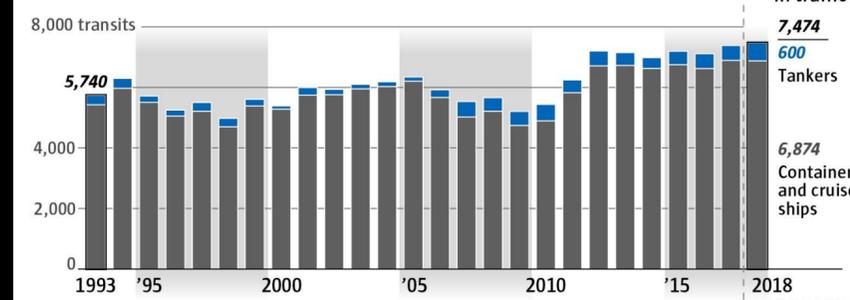
The endangered southern resident orcas that visit Puget Sound confront the noisiest waters in their critical habitat, including the west side of San Juan Island, the Fraser River Delta and the Strait of Juan de Fuca. Noise is caused by vessel traffic, especially commercial shipping.

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.

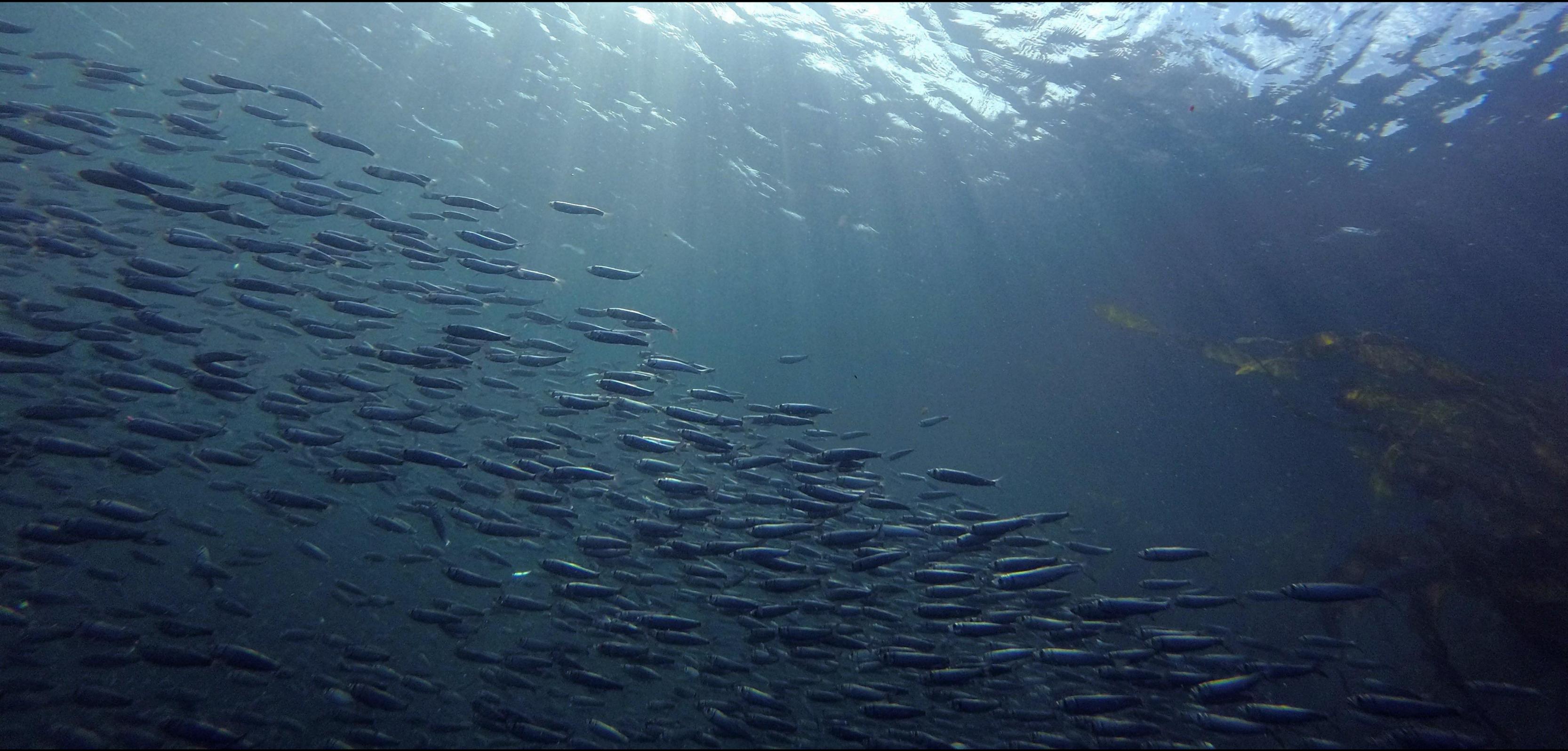




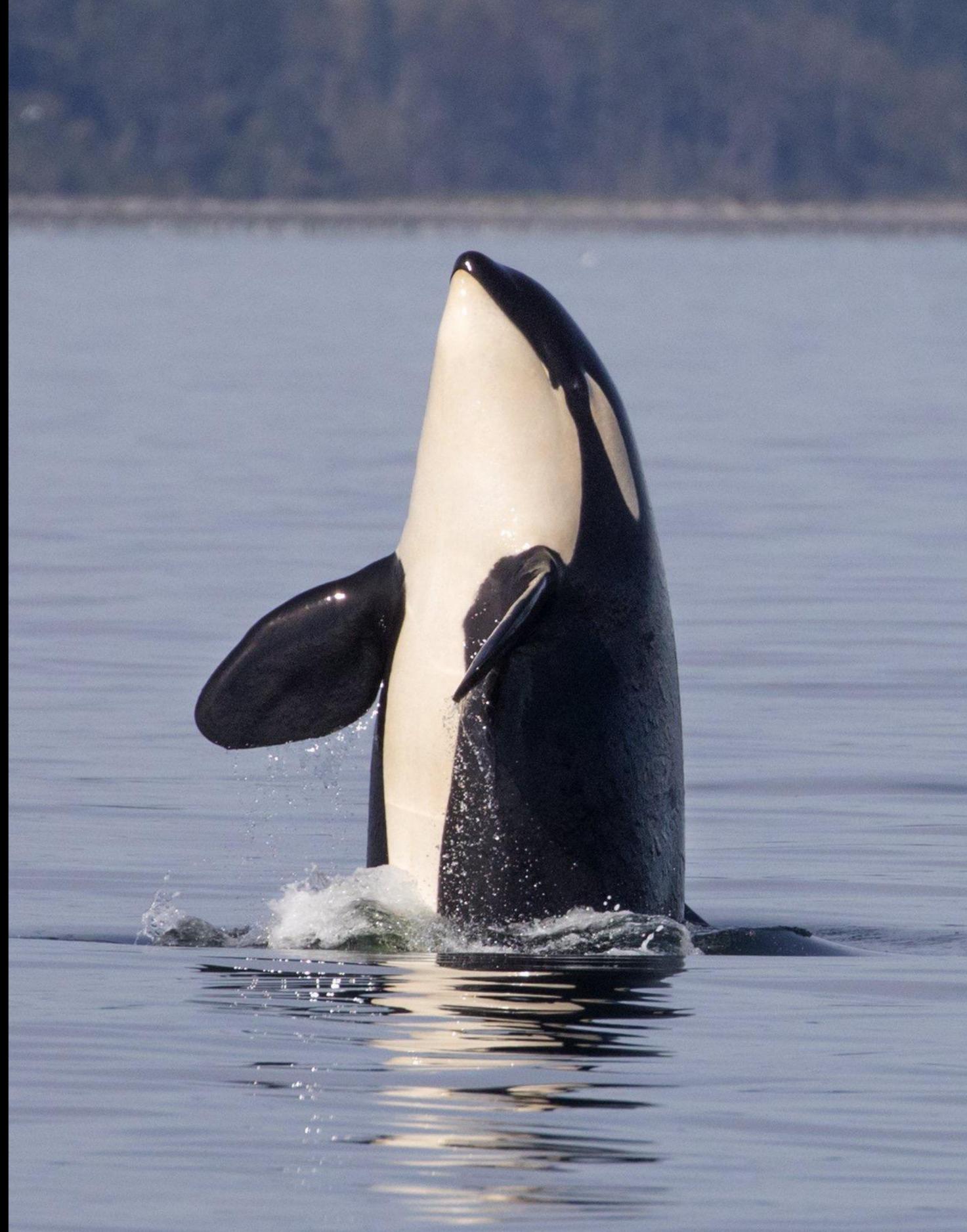


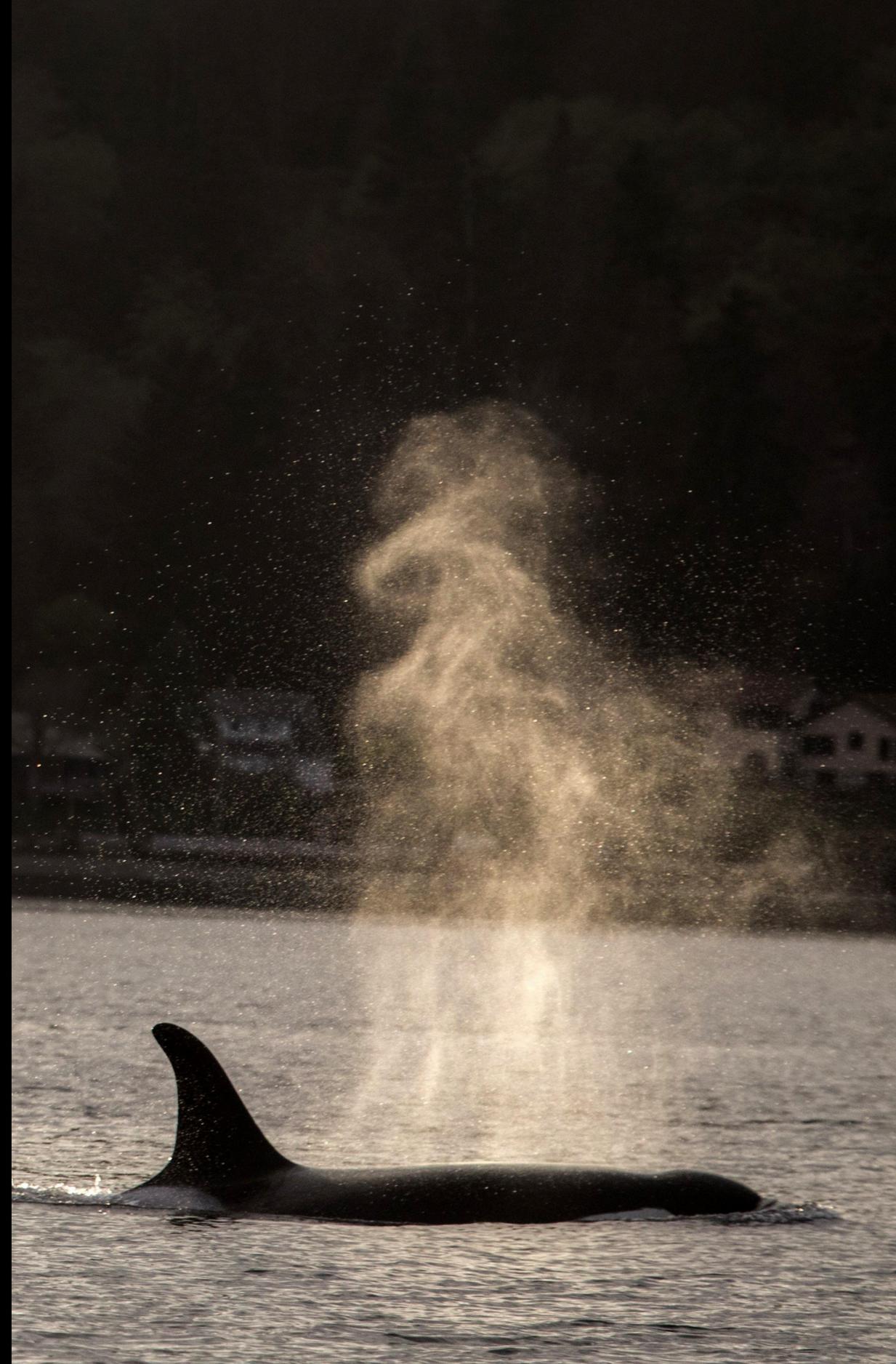






















XIN LOS ANGELES
HONGKONG
IMO 9307217



























Photo courtesy of Center for Whale Research

J50, SR3/NOAA

May 2017

August 2018







NOAA Fisheries Permit #18786-03



Photo courtesy of Katy Foster / NOAA Fisheries



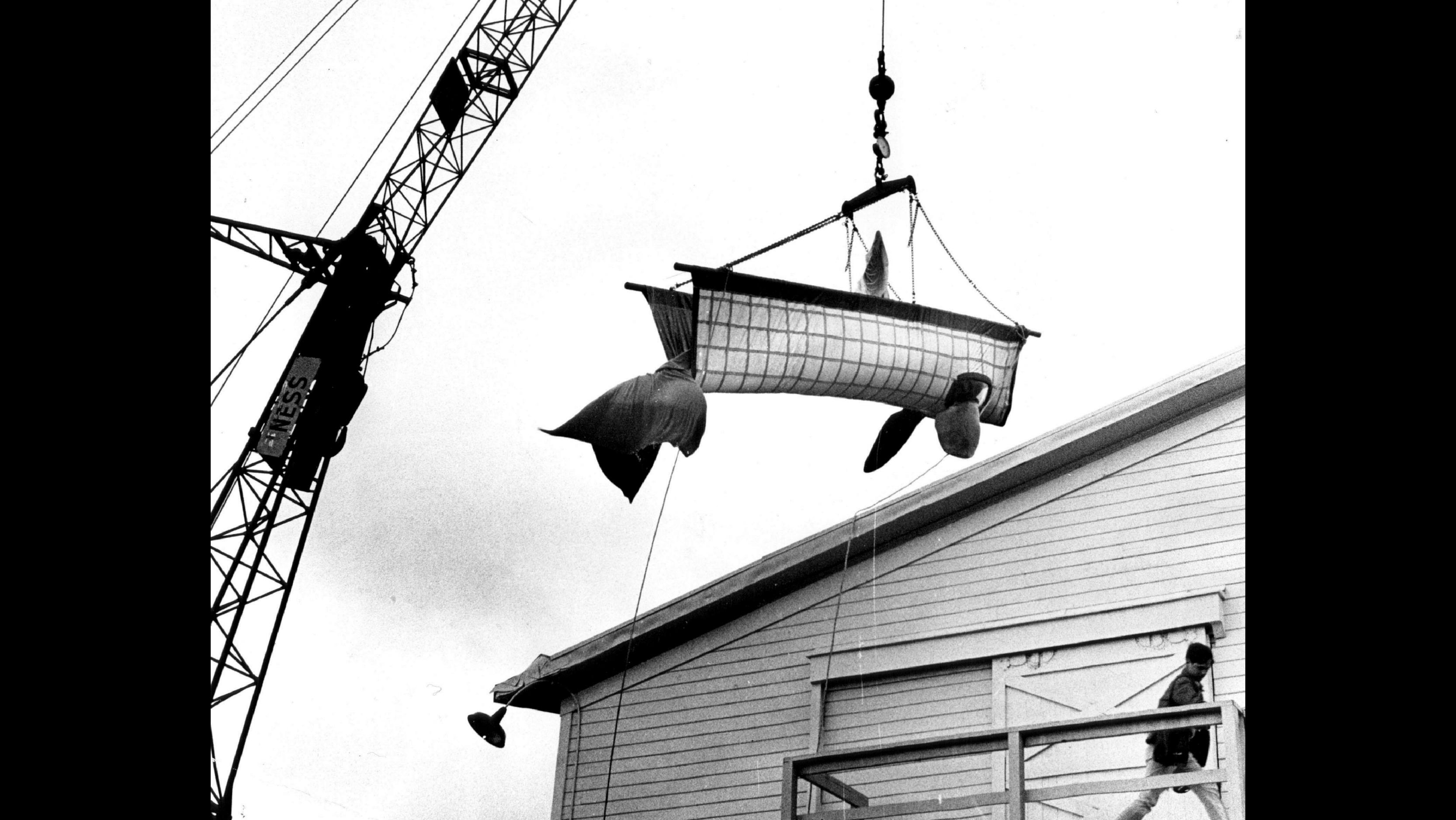




















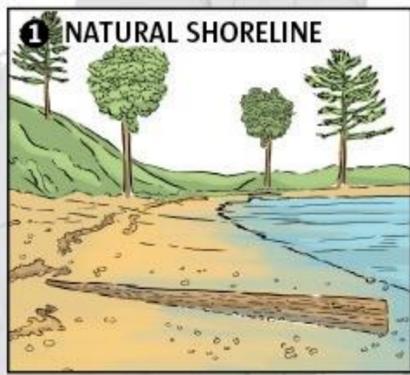












1 NATURAL SHORELINE
Natural bluffs feed beaches. Forage fish lay their eggs on beaches while young salmon and birds use beaches and shallow waters for feeding on insects and other prey.
Example: Fort Lawton Beach (Seattle)



2 ARMORED SHORELINE
A hardened shoreline lacks shrubs and trees, deflects waves, narrows the beach and erodes it. Biodiversity, including crucial habitat for forage fish, shorebirds and baby salmon is lost.
Example: North of Des Moines Beach Park

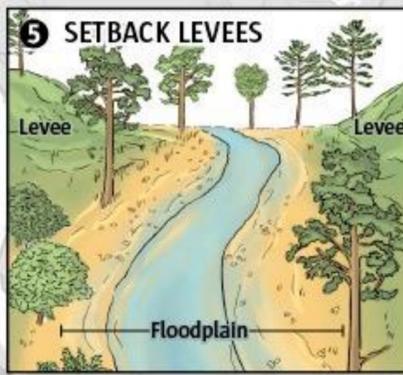
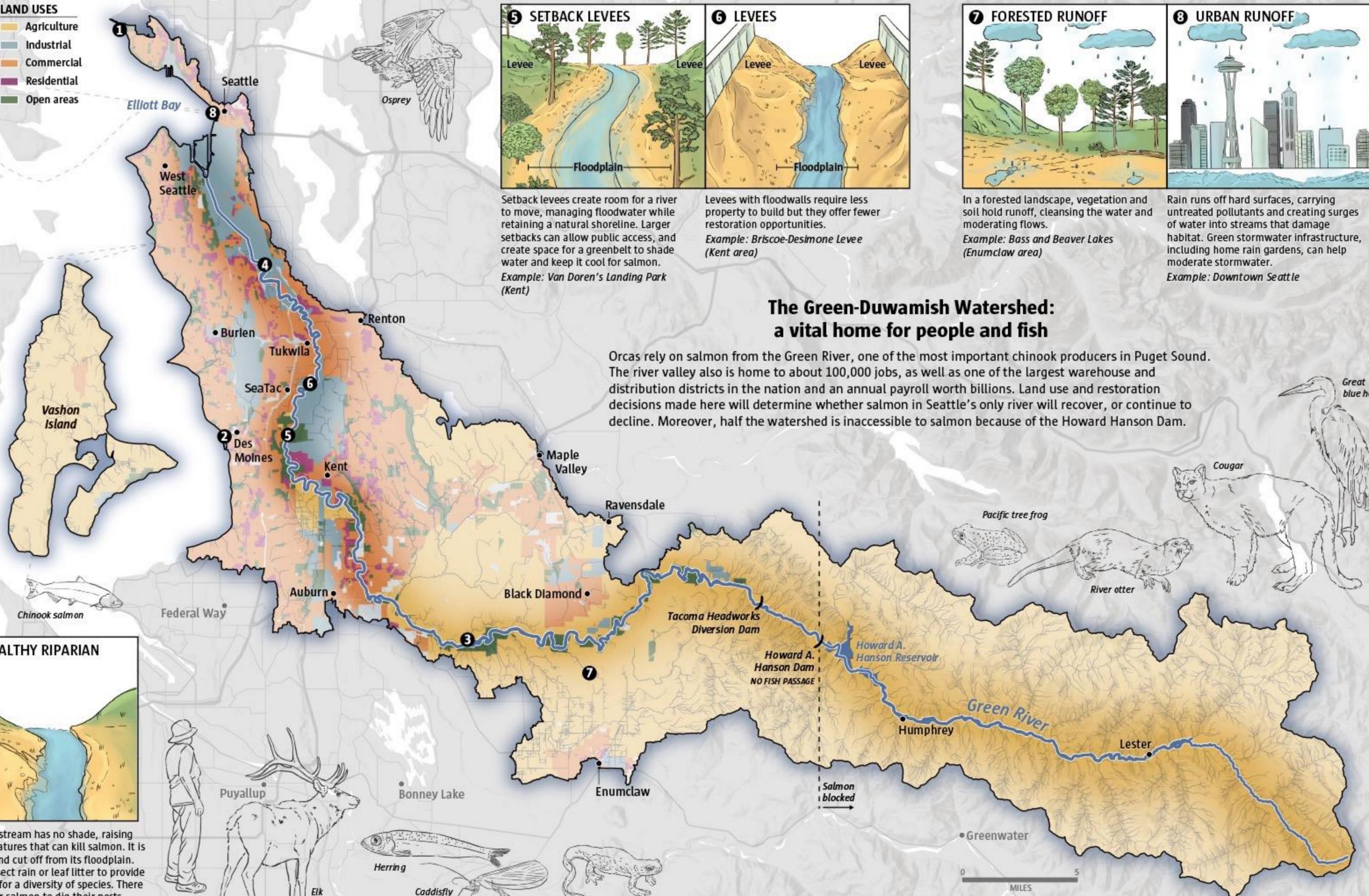


3 HEALTHY RIPARIAN
A healthy stream is shaded by native plants, cooling the water. The shoreline meanders through its floodplain as water levels change seasonally. Gravel provides material for salmon to dig their nests.
Example: Doreen Johnson Conservation Area (Auburn area)

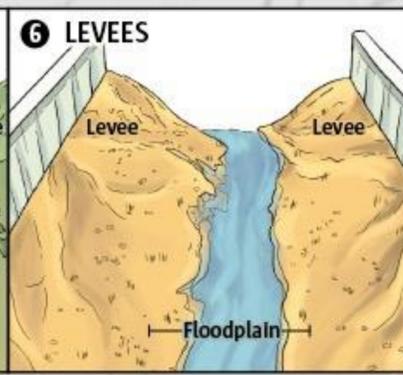


4 UNHEALTHY RIPARIAN
An unhealthy stream has no shade, raising water temperatures that can kill salmon. It is channelized and cut off from its floodplain. There is no insect rain or leaf litter to provide a food source for a diversity of species. There is no gravel for salmon to dig their nests.
Example: Desimone Oxbow (Tukwila)

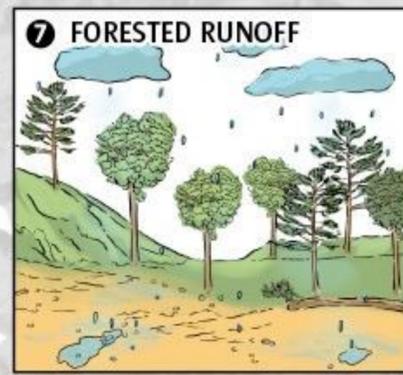
- LAND USES**
- Agriculture
 - Industrial
 - Commercial
 - Residential
 - Open areas



5 SETBACK LEVEES
Setback levees create room for a river to move, managing floodwater while retaining a natural shoreline. Larger setbacks can allow public access, and create space for a greenbelt to shade water and keep it cool for salmon.
Example: Van Doren's Landing Park (Kent)



6 LEVEES
Levees with floodwalls require less property to build but they offer fewer restoration opportunities.
Example: Briscoe-Desimone Levee (Kent area)



7 FORESTED RUNOFF
In a forested landscape, vegetation and soil hold runoff, cleansing the water and moderating flows.
Example: Bass and Beaver Lakes (Enumclaw area)



8 URBAN RUNOFF
Rain runs off hard surfaces, carrying untreated pollutants and creating surges of water into streams that damage habitat. Green stormwater infrastructure, including home rain gardens, can help moderate stormwater.
Example: Downtown Seattle

The Green-Duwamish Watershed: a vital home for people and fish

Orcas rely on salmon from the Green River, one of the most important chinook producers in Puget Sound. The river valley also is home to about 100,000 jobs, as well as one of the largest warehouse and distribution districts in the nation and an annual payroll worth billions. Land use and restoration decisions made here will determine whether salmon in Seattle's only river will recover, or continue to decline. Moreover, half the watershed is inaccessible to salmon because of the Howard Hanson Dam.

Note: All illustrated scenes are general examples of landscape conditions. Animals not shown to scale. Source: King County Department of Natural Resources and Parks















