

What does Lake Washington's warming mean for its future?

February 19 2024, by Amanda Zhou, The Seattle Times



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The region's cold, watery heart is nestled between Seattle and the Eastside. It uniquely supports two major roadways atop floating bridges, has offered beachgoers a summertime respite for decades and is central to the identity of the Seattle area's culture.

But Lake Washington is changing—by over half a degree Fahrenheit

each recent decade. In fact, since 1963, the lake's surface from June to September has warmed about 4.3 degrees, according to data collected and analyzed by King County and the University of Washington.

While some of the lake's warming can be attributed to natural, long-term climate variations in the Pacific Ocean, [global climate change](#) due to greenhouse gas emissions is definitely playing a role in heating up the lake, said Curtis DeGasperi, a King County water quality engineer who manages the lake's monitoring program.

The lake has warmed up earlier in the year and taken longer to cool down in the fall and winter months, which have even shown a modest warming trend, DeGasperi said.

"It's not going to be the same lake. It's going to change, and trying to anticipate and prepare for it requires people to sit around and think about it," he said. "We know, it's definitely going to be warmer. There is no doubt about that."

It's not clear exactly what the warming trend will mean for the hundreds who flock to Lake Washington each summer for easy access to swimming and boating. Even with the region's population growth, the lake has become cleaner. With wastewater infrastructure, the nutrients that feed algae, which can cause blooms and adverse conditions, have declined in the past two decades, bucking the trend seen in most urban waterways.

But warmer waters are decidedly harmful for endangered salmon that rely on cold, well-oxygenated water to survive, and Lake Washington has seen more days when its surface water has risen above what salmon can tolerate.

In each of the past 10 years the lake has experienced more than 40 days

each summer when its surface has exceeded 68 degrees Fahrenheit. That can be compared with only three years of such warm temperatures between 1960 and 1980, according to an analysis by the county and University of Washington.

That [surface water](#) is what ends up flowing into the Ship Canal, which connects the lake to Puget Sound through the Ballard Locks, DeGasperi said. During the summer and fall months, that warm water in the roughly 30-foot-deep commercial and recreational passageway becomes a migration barrier for the adult and [juvenile salmon](#) trying to pass through—either vying for a chance to reproduce upstream or swimming toward their adult lives in the ocean.

What did it used to look like?

Lake Washington wasn't always like it is today.

Between the 1940s and 1960s, over 20 billion gallons of untreated sewage flowed freely into the lake each year. People could barely see a few feet into the water, beaches were closed frequently and algae blooms turned the lake a "reddish" color, King County Ecologist Daniel Nidzgorski said.

The lake experienced a near-miraculous reversal after King County built two wastewater treatment plants—one at Discovery Park and the other in Renton.

By the 1980s, the pollution streaming into the lake shrunk to 2.3 billion gallons a year, and last year, 1.7 billion gallons of untreated stormwater and sewage flowed into Puget Sound and Lake Washington. Ongoing projects aim to decrease that amount further.

Lake Washington is a success story that's equal parts luck and municipal

planning, Nidzgorski said.

Investments in stormwater infrastructure have paid off, and now decades later the water is cleaner and clearer than it's ever been in modern Seattle history. In a round of budget cuts in 2009, the county even stopped analyzing bacteria in its samples, concluding that the levels weren't changing enough to make it worth measuring, he said.

"What we're doing is actually working," Nidzgorski said. "It's really good news that we've been putting in a lot of new regulations, better technology, just better practices."

But that doesn't mean challenges for the future won't exist. Longer summers mean that the lake's period of stratification—when the water column forms distinct layers that barely mix—will be longer. Currently this has primarily been a problem in Lake Sammamish, where kokanee salmon and their predators are forced into a narrow band of breathable water between the warm surface and the bottom layer with little oxygen.

However, one potential risk of a longer stratification period for all lakes is its potential to affect both nontoxic and toxic algae blooms later in the fall, said DeGasperi. When the bottom layer of a lake during the summer loses oxygen, that can trigger a release of phosphorus from the sediment. That phosphorus—which can aid algae growth—later becomes mixed into the lake when fall temperatures arrive.

Future challenges for the Ballard Locks

A pinch point exists at the Ballard Locks and broader Ship Canal, which salmon traverse. Before the Locks were built, and the entirety of the water system was replumbed in the 1910s, Lake Washington was 8 feet higher and its annual rise fluctuated with mountain flows.

Now, the level of the lake is carefully engineered by people at the Ballard Locks.

As the lake is expected to warm with climate change, government officials and engineers are exploring plans to cool down the Ship Canal so salmon can still rely on it to migrate during the hottest months of the year.

For spawning salmon and juveniles migrating to the sea, the only spots with reliably cool and well-oxygenated water are at each end of the 7-mile canal: one in cold Puget Sound, just west of the Ballard Locks, where opportunistic seals camp out, and the other in Lake Washington, where the water drops to over 200 feet at its deepest portions and warm-blooded fish like yellow perch and bass have gotten hungrier as the water has warmed.

The sudden change from oxygen-rich saltwater to warm freshwater is a shock for salmon at the Locks, said Lauren Urgenson, a former King County coordinator for the Lake Washington, Sammamish and Cedar watershed. Often adult Chinook salmon looking to spawn will cycle through the fish ladder multiple times or wait upstream for weeks, losing energy and risking attacks from predators, she said.

The salmon get a breath of oxygen-rich cold water each time the Locks open and close to ferry kayakers and boaters through the engineered dam. In the past, engineers experimented with "false lockings," or opening and closing the Locks even when boats were not around, but found it only increased the oxygen a short distance and not for very long, Urgenson said.

Each time the Locks are operated, the higher freshwater side of the Locks loses water. Drought and decreased river flows due to climate change are expected to affect operations at the Locks, said Kyle

Comanor, senior water manager for the Army Corps of Engineers' Seattle District. The Locks are the only outlet from Lake Washington, and engineers must keep the water level of the lake steady and not let too much saltwater mix inward, he said. To conserve water in the future, wait times for boaters at the Locks may increase or become scheduled, among other management options.

Meanwhile, adult sockeye salmon have been trucked around the canal and [lake](#) to boost their survival. During and after the record-breaking heat wave of 2021, dead salmon were observed in the Locks' fish ladder. While salmon won't venture into water warmer than 70 degrees, any water above 59 degrees is considered "sublethal," stressing the fish and making them susceptible for disease and developmental issues.

To get cold water into the entire length of the Ship Canal, tribes, federal and local [government officials](#) and members of Long Live the Kings, a Seattle nonprofit dedicated to salmon recovery, have proposed and are evaluating solutions.

These ideas include various ways of pumping cool water from the depths of Lake Washington directly into the Ship Canal with a series of pipes and valves or using a heat exchanger to cool existing water in the canal.

"If we want salmon here—and salmon have done so much for our region and for us—we need to address this issue," Urgenson said. "Seattle without salmon is not a great future."

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Citation: What does Lake Washington's warming mean for its future? (2024, February 19) retrieved 2 May 2024 from <https://phys.org/news/2024-02-lake-washington-future.html>

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