Fish Advisories for Sturgeon Lower Columbia and Lower Willamette Rivers

Combined Technical Report

Oregon Health Authority
PUBLIC HEALTH DIVISION

Contents

Overview

The Oregon Health Authority (OHA) issues fish advisories with meal recommendations for people to limit or avoid eating certain fish or shellfish to reduce exposure to contaminants like polychlorinated biphenyls (PCBs), mercury, dioxins/furans and others. OHA is able to issue advisories when state and federal environmental agencies, Tribes, commissions and environmental organizations make data about contaminants in fish or shellfish tissue available to OHA.

Before issuing an advisory OHA prepares a technical report. This report, among other things, summarizes available tissue data, assumptions about exposure to contaminants and provides information that supports development of an advisory. OHA evaluated the need for fish consumption advisories for sturgeon in the lower Columbia and lower Willamette rivers, and the findings of this technical report support issuance of such advisories.

Note: Dams, like Bonneville, significantly restrict the movement of sturgeon up and down river, which makes the populations found in each river reach unique. Therefore, the lower Columbia River sturgeon advisory does not extend to the mid-Columbia River. An advisory is currently in place for all resident fish in the mid-Columbia River reach. Be advised that the meal recommendations for the mid-Columbia River are more restrictive than those calculated for the lower Columbia River (see Table 4. Recommended meals for sturgeon: Mid-Columbia River, page 10).

Water body background

The lower Columbia and lower Willamette rivers are home to a variety of resident and migratory species of fish, including some protected under the Endangered Species Act. These rivers have been designated by the National Marine Fisheries Service as critical habitat for several salmon species that migrate through. The rivers are enjoyed for their recreational opportunities as well as fishing by different populations, including Tribal and subsistence fishers.

Both rivers are of cultural and spiritual significance to Tribes in the Pacific Northwest and many of these Tribes have ceded fishing rights in these rivers.

Due to historical and current activities including heavy industrial and chemical manufacturing, hydropower and agriculture, both rivers are contaminated with PCBs, dioxins, furans, pesticides, polycyclic aromatic hydrocarbons (PAHs), metals and other contaminants.

Sturgeon

Species background, habitat and range*

Sturgeon are North America's largest and longest-lived freshwater fish. They are a migratory species, although many have become isolated between dams or landlocked upstream of natural barriers like waterfalls making it nearly impossible for them to swim to the ocean. They grow slowly, can reach a length of 19 feet and 1,800 pounds and can live for more than a century. Sturgeon may not fully mature until they are somewhere between 11 and 25 years old, and females do not reach spawning maturity until about age 15. Females spawn only every two to 11 years after that. Because of this lifecycle, sturgeon harvest is limited by regulation and the fish is highly prized by commercial and recreational harvesters.

Sturgeon have very little true bone with most of their internal skeleton composed of cartilage. The exterior of a sturgeon is protected by bony plates, known as scutes, that lie in rows like armor across their scaleless skin. Their toothless mouth sits underneath their head and forms an extendible tube used for sucking food items off the bottom of the river or estuary. Because they have no teeth, larger food items are swallowed whole and crushed against a hard palate. Their unique spiral valve digestive system helps them absorb food and other nutrients. Their diet includes bottom-dwelling amphipods, worms, mussels, clams, shrimp, crab, crayfish, aquatic insects, fish eggs, snails, larvae, sludge worms, frogs and lamprey. Other foods include a variety of fish including flounder, anchovy, salmon, steelhead, lamprey, shad, herring and smelt. They will consume dead fish and will eat organic materials like sewage and pollution waste that gets into the water. Food depends on habitat, the health of the ecosystem and whether they can migrate to the ocean.

Two of the 27 identified species of sturgeon are native to the Columbia River Basin (the majority of which are in Oregon, Washington, Idaho and southwest Canada). These are green sturgeon and white sturgeon.

Information specific to sturgeon in Oregon, and in the lower Columbia and lower Willamette rivers specifically, are based on personal communication with Tucker Jones, Oregon Department of Fish and Wildlife (ODFW) Columbia River Program Manager, who is a sturgeon biologist and migration expert.

* Information from ODFW and individual research

Green sturgeon: According to ODFW, green sturgeon spawn in freshwater but spend most of their lives in estuarine or marine environments. The main spawning populations are in the Sacramento and San Joaquin rivers for the southern population and the Klamath and Rogue rivers for the northern population. Green sturgeon can and do swim up the Columbia River but not in large numbers and they are "rarely and incidentally" caught by recreational fishers. ODFW is not aware of any reports of green sturgeon in the lower Willamette River, but there is nothing to stop them from entering the river. Harvest and retention of green sturgeon are not allowed. Because the southern population is listed as threatened under the Endangered Species Act, green sturgeon cannot be harvested. This is why the samples collected from the lower Columbia and lower Willamette rivers were white sturgeon.

White sturgeon: White sturgeon inhabit the lower Columbia and lower Willamette rivers. These populations can be found as far south as California and as far north as the Puget Sound. Not all white sturgeon in these rivers spend time in the lower Columbia River Estuary, though they could. All references to "estuary" below refer to the Columbia River Estuary. ODFW acknowledged that the vast majority found in the estuary originated upstream in the Columbia or Willamette rivers. Based on a limited amount of pectoral spine microchemistry research ODFW has done, it appears that some white sturgeon head to the estuary and on to the ocean, others only go as far as the estuary and still others never go to the estuary at all. Unfortunately, ODFW does not have data on the proportion of each. White sturgeon are abundant in the estuary from May through July, after which a significant (but unknown) proportion move upstream into freshwater or downstream to marine environments. Their ability to tolerate saltwater is more a function of size than age. On average they need to be about 3 feet in length before their bodies can tolerate (osmoregulate to) the salinity. Given the variability in growth rates for white sturgeon, it could take from 5–10 years for them to reach this size. Until they reach at least 3 feet they will use freshwater habitats upstream of the salt wedge. White sturgeon swim upriver to spawn, spawning from about May to early July either in the Columbia River downstream of Bonneville Dam or in the Willamette River downstream of Willamette Falls.

Spawning and harvesting

Typically, sturgeon spend most of their adult lives in deep, soft-bottomed areas of estuaries, the lower reaches of rivers or the ocean, and migrate upstream in large freshwater rivers to spawn in cool, deep, swift-flowing river reaches over gravel and cobble bottoms. Juvenile sturgeon remain in the river for up to four years before following the current downriver to the estuary.

There are many nuances to harvesting sturgeon.

- Non-Tribal treaty commercial harvests occur:
  - » In the estuary, mainly in the winter and spring, and
  - » Upstream of the Lewis River (in Washington State) in August and September.
- Recreational harvests typically occur:
  - » In the estuary in May and early June
  - » Upstream of the power lines that cross the lower Columbia River at Wauna, OR in September and October, and
  - » Upstream of Bonneville Dam (in Bonneville, The Dalles and John Day reservoirs) between January and March.
  - » The Willamette River recreational retention season typically occurs in June, but this can change based on ODFW harvest information.
- Tribal harvests

  Tribes only harvest sturgeon upstream of Bonneville Dam (in Bonneville, The Dalles and John Day reservoirs) between January and March.

Generally, harvest season follows the same timeframes every year, although specific days may change. All fisheries are quota-based and will close once that quota has been reached. Information regarding harvest quotas can be found on the ODFW website or by contacting ODFW directly.

Chemicals in the lower Columbia and lower Willamette rivers and risk factors for sturgeon

Contaminants in the lower Columbia and lower Willamette rivers can come from both in-sediment and upland sources. PCBs, dioxins and furans are prevalent in waterways of formerly industrial areas and rivers with hydroelectric dams where PCBs were historically used in transformers, capacitors and other electrical equipment. PCBs were used as coolants and lubricants because they provided chemical stability, a high boiling point, high electrical insulation strength and were nonflammable. Since the early 1900s, numerous facilities on the lower Columbia and lower Willamette rivers have released oil, PCBs, heavy metals, pesticides and other hazardous substances into each river. Upland sources of nonpoint pollution have also contributed to pesticides and additional contaminant loading through runoff.

PCBs, dioxins and furans are persistent in the environment. These contaminants are toxic, bioaccumulative, nonbiodegradable and difficult to dispose of. Mercury and arsenic can come from natural sources, but also industrial byproducts and agricultural processes. All of these contaminants can accumulate within individual species, eventually moving up through the food chain. Ingestion of contaminated fish and shellfish by people is the primary risk pathway of concern.

Species characteristics (for example, long lifespan and large size), habitats, diet and feeding habits, how they forage for food and, in some cases, their inability to migrate to the ocean can make sturgeon more prone to the bioaccumulation of certain types of contaminants. Lipophilic* contaminants like PCBs, dioxins and furans accumulate in sturgeon due to the fat content of their tissue, time spent near the sediment where they suck up food from the riverbed and the contaminants present in several species of their prey. PCBs in sturgeon are higher than in other species of anadromous fish in the lower Willamette, and although much lower in sturgeon from the lower Columbia river, PCBs are the contaminant of concern in both rivers. Consumption of sturgeon with elevated levels of PCBs can be a health issue that can impair reproduction, cause neurobehavioral and developmental deficits in children, impair the immune system and thyroid function and increase lifetime cancer risk.

* Combine with or accumulate in the fatty portions of fish and shellfish tissue

Metals like arsenic and mercury (in the form of methylmercury) can also bioaccumulate within sturgeon fillets, although analysis of tissue samples from sturgeon in the lower Columbia and lower Willamette rivers has determined that mercury and arsenic are not contaminants of concern in this species.

Note: *Because PCBs and mercury have additive health effects,† OHA calculates meal recommendations for each contaminant and then for both contaminants together.*

† The combined effect produced by the action of two or more contaminants, being equal to the sum of their separate effects

Determination of each sturgeon advisory boundary

Historical sturgeon ranges have been modified substantially by past overharvesting, and habitat changes due to dams and other human and natural changes in the river systems that have affected habitat quality, suitability and connectivity. Dams affect the seasonal movement of sturgeon in many river systems, with those in the Columbia River Basin being a large contributor to shifts in their distribution and movement. Because fish ladders were not designed for sturgeon, dams in the basin have largely blocked their upstream and downstream movement. Although downstream passage of sturgeon through these dams has been reported, the only possible routes are through operating turbines, open spill gates, and the ice and trash sluiceways.

The following information is representative of sturgeon populations in Oregon and Washington according to ODFW.

- "Although there is nothing physically prohibiting sturgeon from the lower Columbia River from moving in and out of the lower Willamette River, and many do, there is some degree of variability in the size of their home range, meaning some sturgeon will move back and forth regularly and others will establish a home range and stay relatively close to that area."
- "There isn't much transfer across the dams (about 1% move up and 5% move down). Any white sturgeon caught from anywhere in the Columbia or up and down the OR and WA coast (including into Puget Sound) are probably representative of the same population."

Lower Columbia River boundary: Only a tiny percentage of sturgeon can get through the Bonneville Dam. For this reason, the dam makes a manmade barrier at the eastern end of the lower Columbia River. Because the sturgeon's range can be large and many spend the bulk of their lives in the Columbia River Estuary and/or the Pacific Ocean, the mouth of the Columbia River makes a natural western barrier. Taking these factors and the information from ODFW into consideration, and with the consensus of the Washington Department of Health,* OHA determined that the advisory boundary would be from the mouth of the Columbia River upstream to Bonneville Dam (see Figure 1).

* Dave McBride, Toxicologist, Fish and Environmental Contaminants, Washington Department of Health, Personal Communication, September 14, 2021.

Lower Willamette River boundary: Willamette Falls on the lower Willamette River near Oregon City creates a natural barrier for sturgeon migration, making the falls a practical southern boundary for the advisory. Sturgeon in the lower Willamette River can also migrate north to the lower Columbia at Kelly Point Park and down through the Multnomah Channel to its confluence with the Columbia River at Columbia View Park in St. Helens, Oregon. OHA, in consensus with ODFW, determined these two parks would encompass the two northern boundaries of the advisory. These are easily recognizable boundaries and should encompass much of the moveable range of sturgeon in the lower Willamette River (see Figure 2).

Figure 1: Lower Columbia River Boundary Map: Mouth of the Columbia River (A) to Bonneville Dam (B)

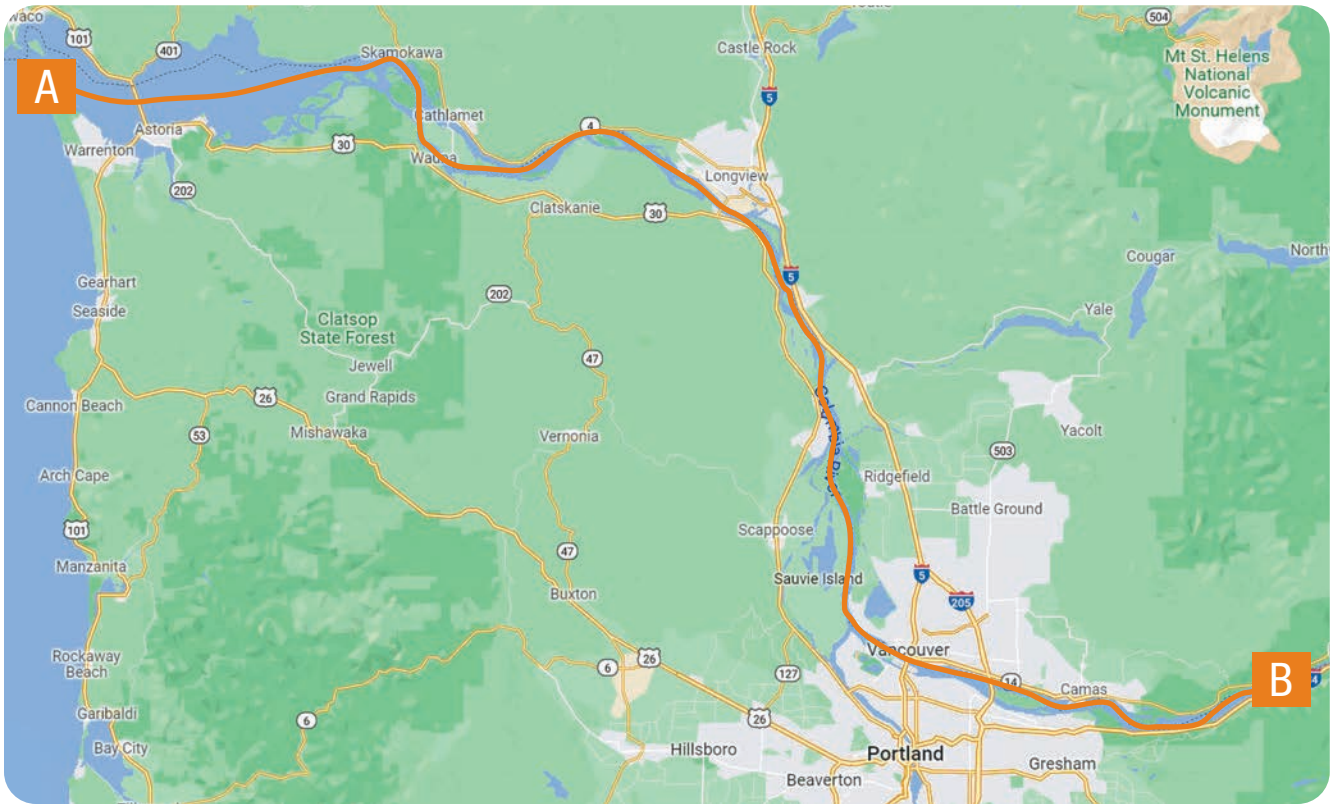
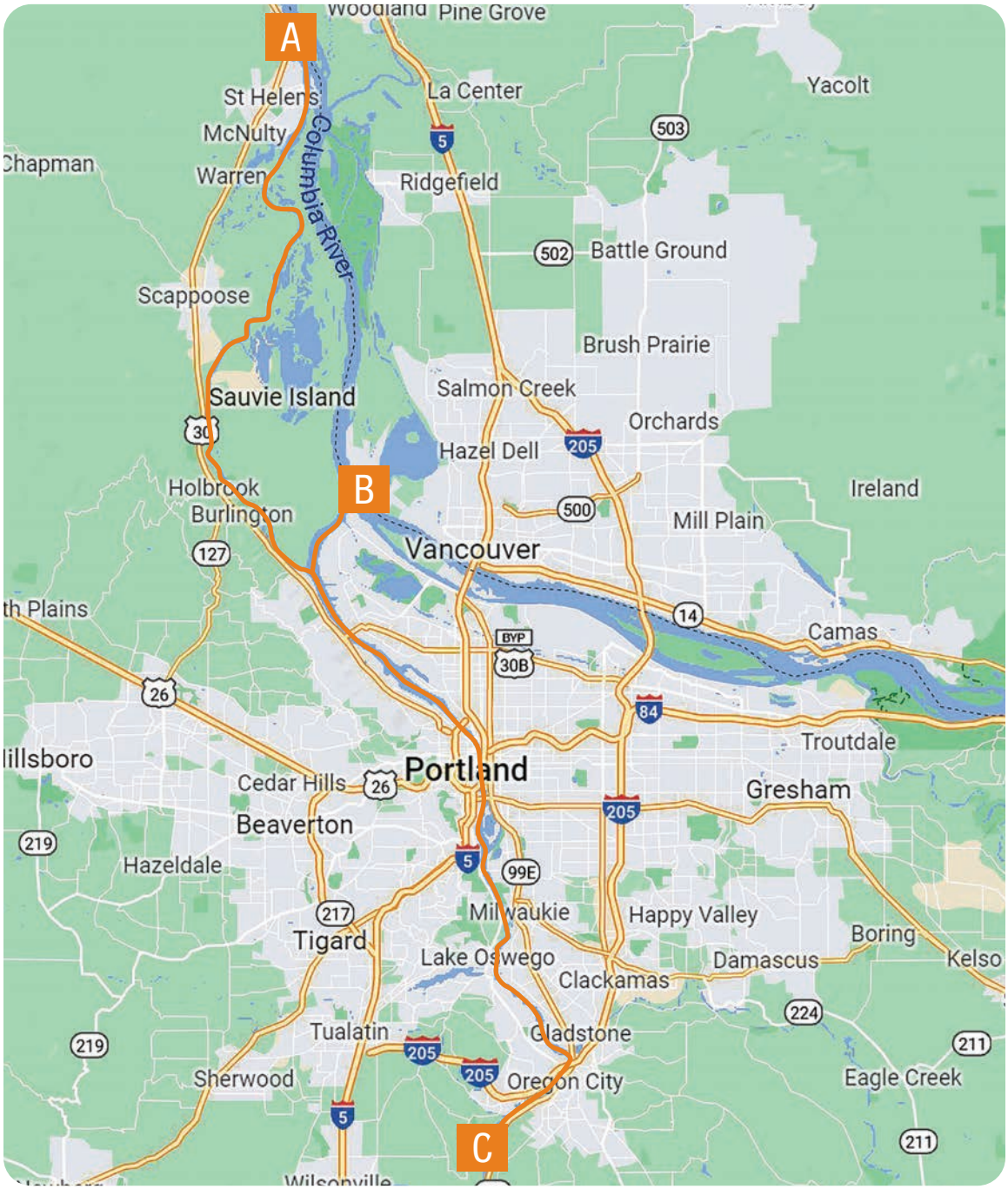


Figure 2: Lower Willamette River Boundary Map: Multnomah Channel (A) from Columbia View Park, St Helens to the Willamette River. Willamette River (B) from Kelly Point Park to Willamette Falls (C)



Sturgeon tissue and contaminant data

Lower Willamette River data were collected by ODFW and analyzed by the Oregon Department of Environmental Quality (DEQ) under EPA oversight as part of the EPA Superfund Portland Harbor Remedial Investigation. White sturgeon were collected from the lower Willamette River from river mile (RM) 2.3 near Sauvie Island to RM 9.5 at Swan Island. Sturgeon collected by the Washington Department of Ecology and ODFW in the Columbia River were caught from Baker Bay near Chinook, WA at the mouth of the Columbia up through RM 48 east of Puget Island near Flandersville, WA.

The DEQ Laboratory and Environmental Assessment Division coordinated collection and sampling from the lower Columbia River. Fillet and whole body tissue were analyzed from sturgeon in the lower Willamette River.† For the lower Columbia River, only fillets were analyzed.

Data from the lower Willamette River allowed OHA to compare levels of PCBs in whole body and fillet tissue. The comparison of the two tissue types indicated little difference in the level of PCBs, mainly because sturgeon fillets are high in fat and PCBs are lipophilic contaminants. For this reason, and because sturgeon have cartilage and armorlike scutes (instead of scales) that make it impossible to eat the entire fish, OHA did not develop separate meal recommendations for whole body and fillet-only consumption as usually done with other fish species.

PCBs in sturgeon tissue are the primary contributor to the health risks of consuming sturgeon from both rivers. However, PCBs in sturgeon tissue from the lower Willamette River are higher than in tissue analyzed from sturgeon in the lower Columbia River.‡ Elevated levels in the lower Willamette River drive the calculated meal recommendations down much lower than those calculated for the lower Columbia River, resulting in the decision to issue a separate advisory for each river as mentioned earlier.

Tables 1 and 2 summarize the data OHA used to calculate meal recommendations for each river. Although the levels of mercury in the sturgeon tissue from either river

† Windward Environmental LLC and Integral Consulting Inc., Feb. 29, 2008, Portland Harbor Remedial Investigation/Feasability Study, Round 3 Pre-Breeding White Sturgeon Tissue Data Report

‡ PCB contamination in this species is not confined or necessarily related to the area of the Portland Harbor Superfund site.

was not found to be a health concern, OHA always calculates the additive effects of mercury and PCBs because they have the same health effects on our vulnerable populations (pregnant women, nursing mothers, children and the elderly).

Table 1. Concentration of contaminants of concern — Sturgeon in the lower Columbia River

Tissue type	Analyte	No. of fish	Mean (mg/kg)	Min (mg/kg)	Max (mg/kg)	Stnd Dev (mg/kg)
Fillet	PCBs	20	2.31E-02	2.60E-03	7.44E-02	1.71E-02
	Mercury		9.10E-03	8.0E-03	1.0E-02	6.86E-04

Table 2. Concentration of contaminants of concern — Sturgeon in the lower Willamette River

Tissue type	Analyte	No. of fish	Mean (mg/kg)	Min (mg/kg)	Max (mg/kg)	Stnd Dev (mg/kg)
Whole body + fillet[§]	PCBs	20	0.16	0.07	1.0	0.2
	Mercury		0.10	0.03	0.32	0.10
	Dioxins/ Furans		1.04E-06	4.92E-07	1.57E-06	3.58E-07

§ OHA did not convert whole body data to fillet-only data due to the physical characteristics of sturgeon and because there was little difference between the calculated meal recommendations.

Meal recommendations

Based on available data, the advisory meal recommendations outlined in Table 3 represent the most consistent health-protective approach possible for sturgeon in the lower Columbia and lower Willamette rivers, while encouraging the use of the fishery for its health benefits. As more fish tissue data for sturgeon become available in the future, OHA will evaluate those data and update this advisory as warranted.

The following is an example of language OHA will use in its sturgeon advisories:

"Be careful not to eat too many meals of fish that contain harmful levels of PCBs. PCBs can build up in the body and be passed to infants through breast milk. If you eat fish from the lower Willamette River, OHA advises you to follow the meals per month guidance in the advisories for sturgeon and other resident fish."

***Note** that OHA fish advisories always include information about the many health benefits of consuming fish and that advisories are intended to help people gain these benefits while protecting themselves from contaminants in some fish and shellfish.*

Recommendations for reducing exposure to PCBs can be found on OHA's website at https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/RECREATION/FISHCONSUMPTION/Pages/Fish-and-PCBs.aspx.

Table 3. Recommended meals for sturgeon: Lower Columbia and Lower Willamette Rivers

River zone	Meals/month recommended consumption rates*	Affected populations
Lower Columbia River: Mouth of the river to Bonneville Dam	7	Pregnant women, nursing mothers, children, the elderly
	8	Men, women beyond childbearing age
Lower Willamette River: Multnomah Channel from Columbia View Park in St Helens to the Willamette River Willamette River from Kelly Point Park to Willamette Falls	1	Pregnant women, nursing mothers, children, the elderly
	1	Men, women beyond childbearing age

* A meal is about the size and thickness of you or your child's hand. Adult = about 8 oz. and a child = about 4 oz.

This advisory and this technical memo apply only to white sturgeon. When fishing in the to lower Columbia River, lower Willamette River and the Multnomah Channel, OHA advises fishers to refer to the OHA fish advisory webpage for information about advisories for other fish in these waterbodies. OHA's fish advisory webpage can be found here: https://www.oregon.gov/oha/ph/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx

For advice on the types of fish people can purchase and consume to reduce their exposure to contaminants, refer to EPA's "Choose Fish and Shellfish Wisely" webpage: http://water.epa.gov/scitech/swguidance/fishshellfish/outreach/advice_index.cfm

Limitations

There is some uncertainty associated with developing an advisory for each river when sturgeon have large home ranges and can move up and down either river, providing the potential for fishers to catch a sturgeon from the lower Willamette within the lower Columbia. However, relying on information provided by ODFW's sturgeon expert, OHA believes this potential to be small enough and the difference in meal recommendations large enough that an advisory for each river is warranted. In addition, there is variability in the amount of contaminant sturgeon are exposed to over their lifetime and where these exposures occur since they are long-lived and have large home ranges.

OHA's use of the arithmetic mean in calculating meal recommendations assumes that fishers, over a lifetime, will catch a random distribution of fish over the entire distance of either the lower Columbia or lower Willamette rivers covered by this advisory. This may or may not reflect the actual practice of fishers along these rivers. It is possible that a person regularly fishing in one spot over a lifetime could get fish that are consistently higher or lower than the mean used to calculate this advisory.

Note: *Table 4 provides information on recommended meal consumption rates for sturgeon from the mid-Columbia River and are not part of the lower Columbia advisory.*

Table 4. Recommended meals for sturgeon: Mid-Columbia River advisory

River zone	Meals/month recommended consumption rates	Affected populations
Mid-Columbia River: Ruckel Creek (upstream of Bonneville Dam) to McNary Dam	4 All resident fish (including sturgeon)	All populations (including vulnerable groups)

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