



PUBLIC HEALTH

**ALWAYS WORKING FOR A SAFER AND
HEALTHIER WASHINGTON**

Portland, Oregon
November 2, 2009

**2009 National Forum
on
Contaminants in Fish**

Eat Fish, Be Smart, Choose Wisely

Human Health Assessment
of Puget Sound Fish

Washington State Department of Health

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and Toxicology

Department of Health (DOH) Background

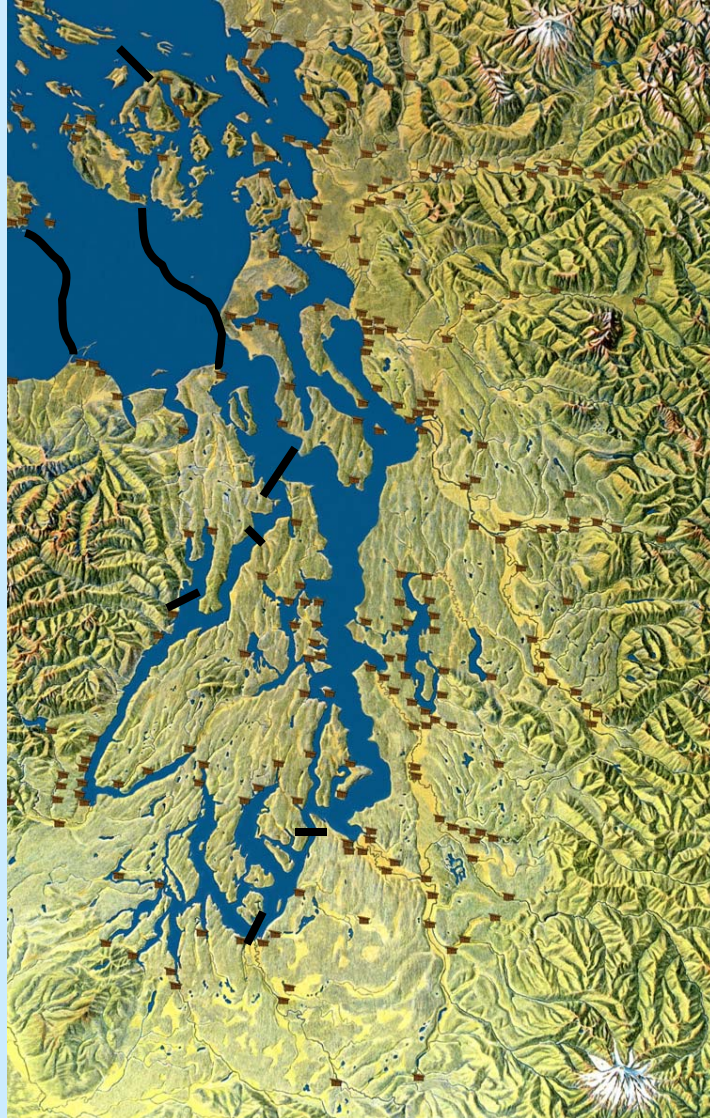
- Office of Environmental Health, Safety and Toxicology (OEHST)
- What does OEHST do?
 - Technical assistance to Local Health Jurisdictions
 - Food safety
 - Zoonotic diseases
 - Human health assessments

Puget Sound

- History of chemical contamination
 - Urban embayments



Puget Sound



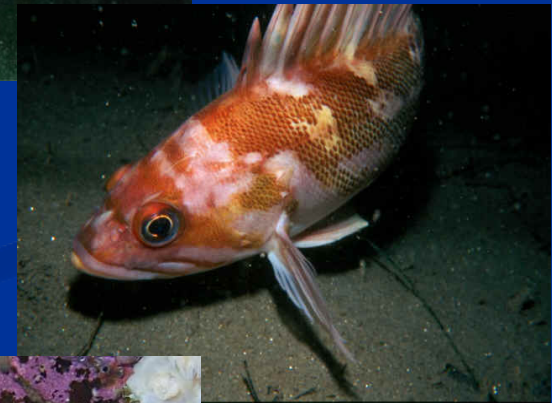
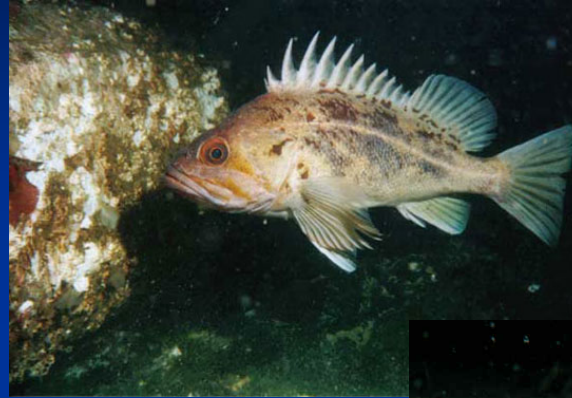
Puget Sound Assessment and Monitoring Program (PSAMP)

- Began in 1988
- Purpose
 - Monitor long-term contaminant trends
 - Biological Resources
 - Physical Environment and Habitat
 - Nutrients and Pathogens
 - Toxic Contaminants

PSAMP - Fish

■ Rockfish

- Brown rockfish
- Copper rockfish
- Quillback rockfish
- Yelloweye rockfish



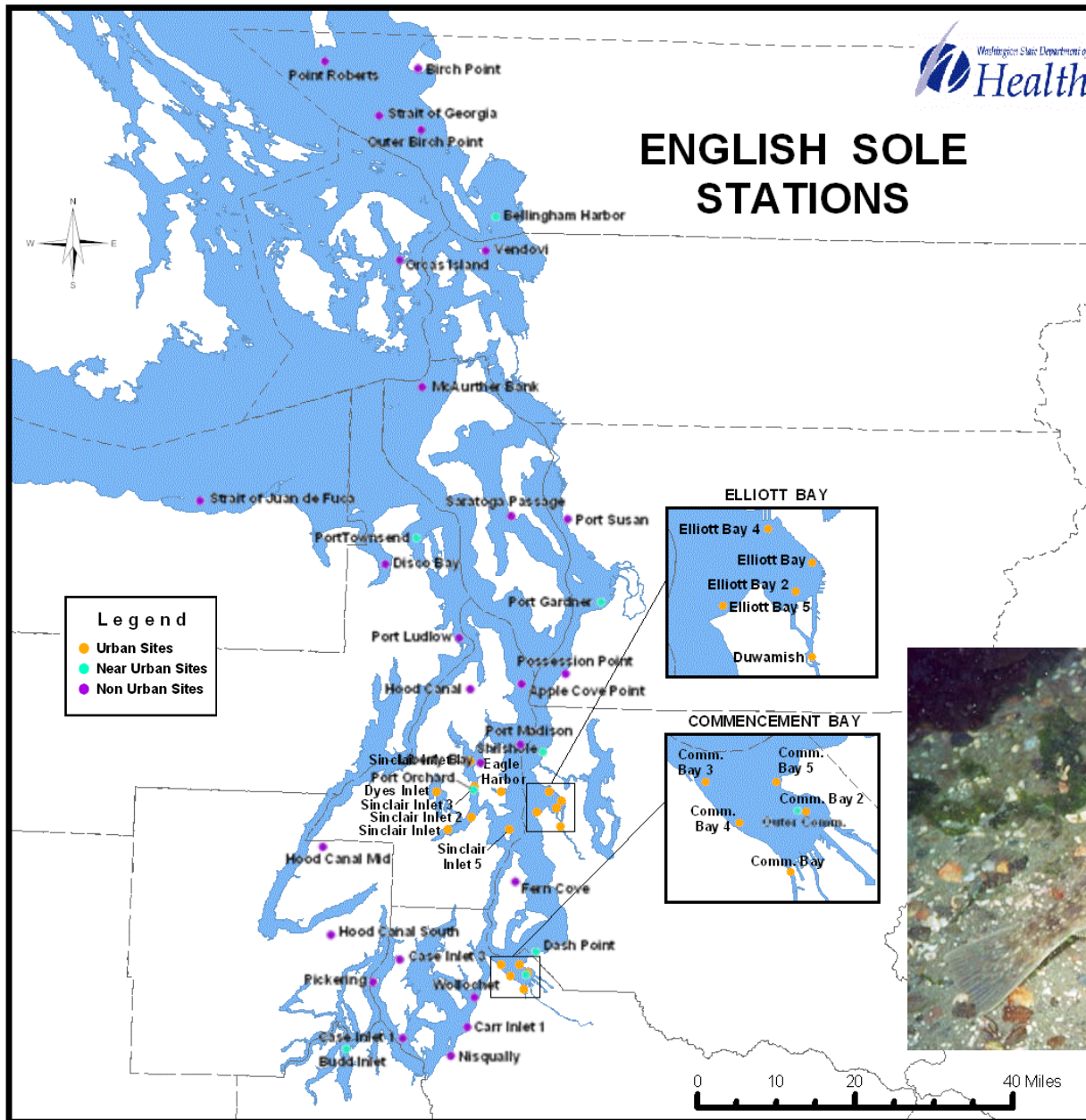
■ English sole

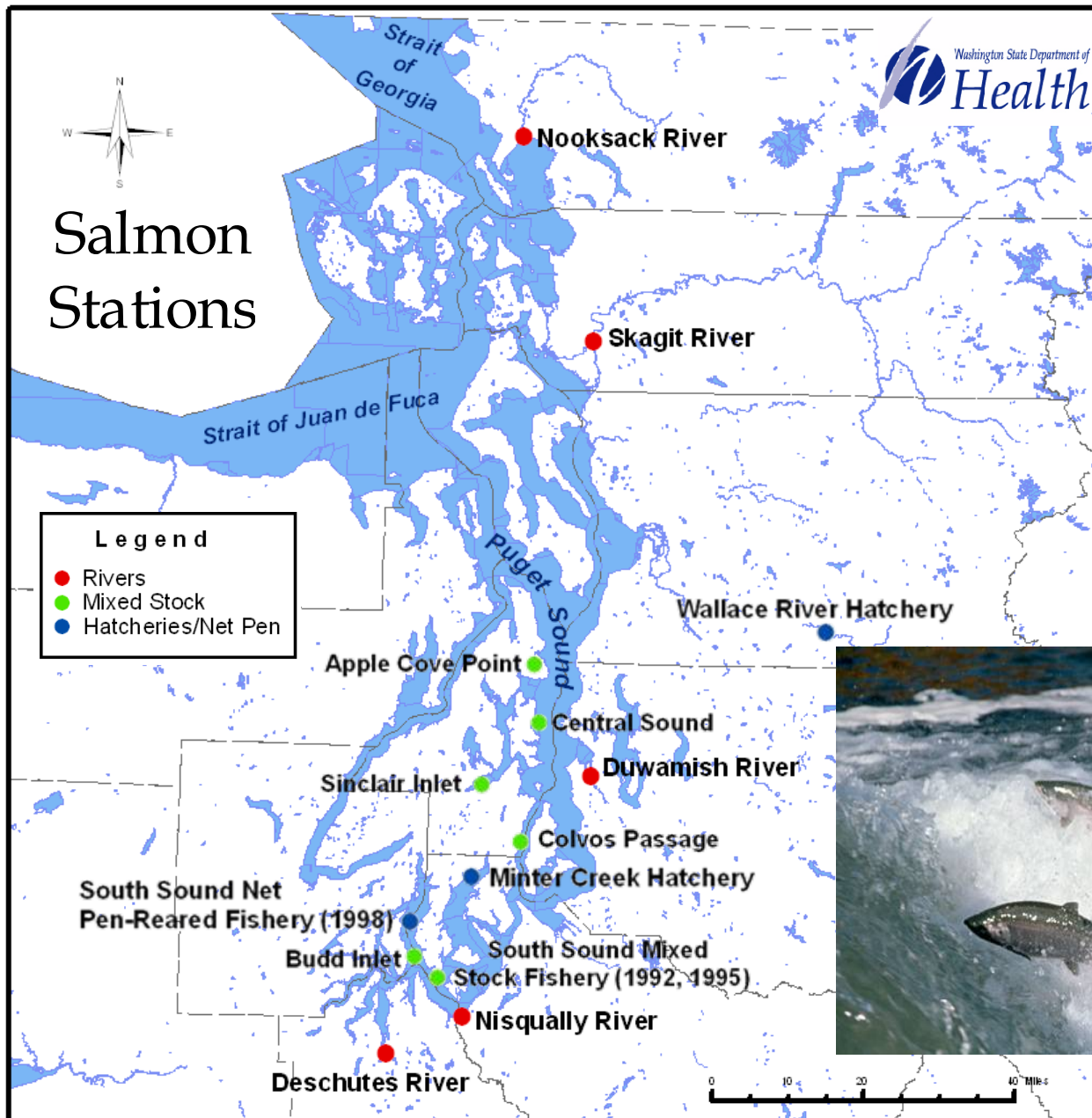
■ Salmon

- Chinook salmon
- Coho salmon



ENGLISH SOLE STATIONS

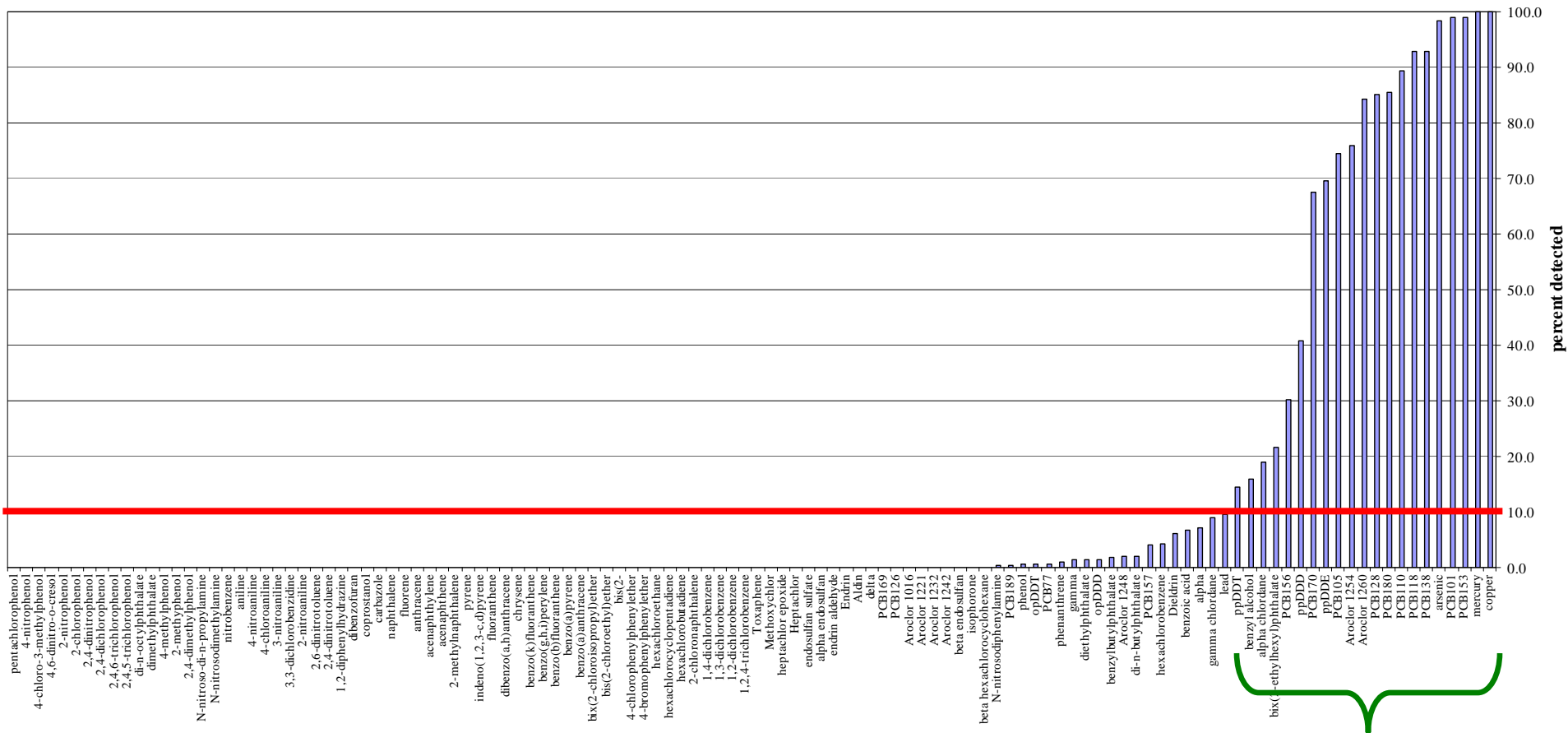




Step 1

Determine contaminant concentrations
in Puget Sound fish

Contaminant Screening



Contaminants of Concern Human Health

- Mercury
- PCBs
 - Arsenic
 - Benzyl Alcohol
 - Bis(2ethylhexyl)phthalate
 - Chlordane
 - Copper
 - DDD DDE DDT

Hg and PCBs in PS fish

	Hg (ppm)	PCBs (ppb) Total Aroclors
Rockfish	0.287	55.3
<i>Urban</i>	0.368	134
<i>Near-urban</i>	0.225	45.1
<i>Non-urban</i>	0.218	5.8
English Sole	0.060	38.6
<i>Urban</i>	0.072	73.6
<i>Near-urban</i>	0.053	17.2
<i>Non-urban</i>	0.051	9.3
Chinook	0.093	54.0
<i>In-river</i>	0.096	50.2
<i>Marine</i>	0.082	73.2
Coho	0.039	31.8
<i>In-river</i>	0.038	31.1
<i>Marine</i>	0.051	34.4

AGE - Hg

Length is not a good predictor of age
 Anglers rarely target a single species
 Species may be difficult to identify

LOCATION - PCBs

LOCATION - PCBs

- Urban
- Near-Urban
- Non-Urban

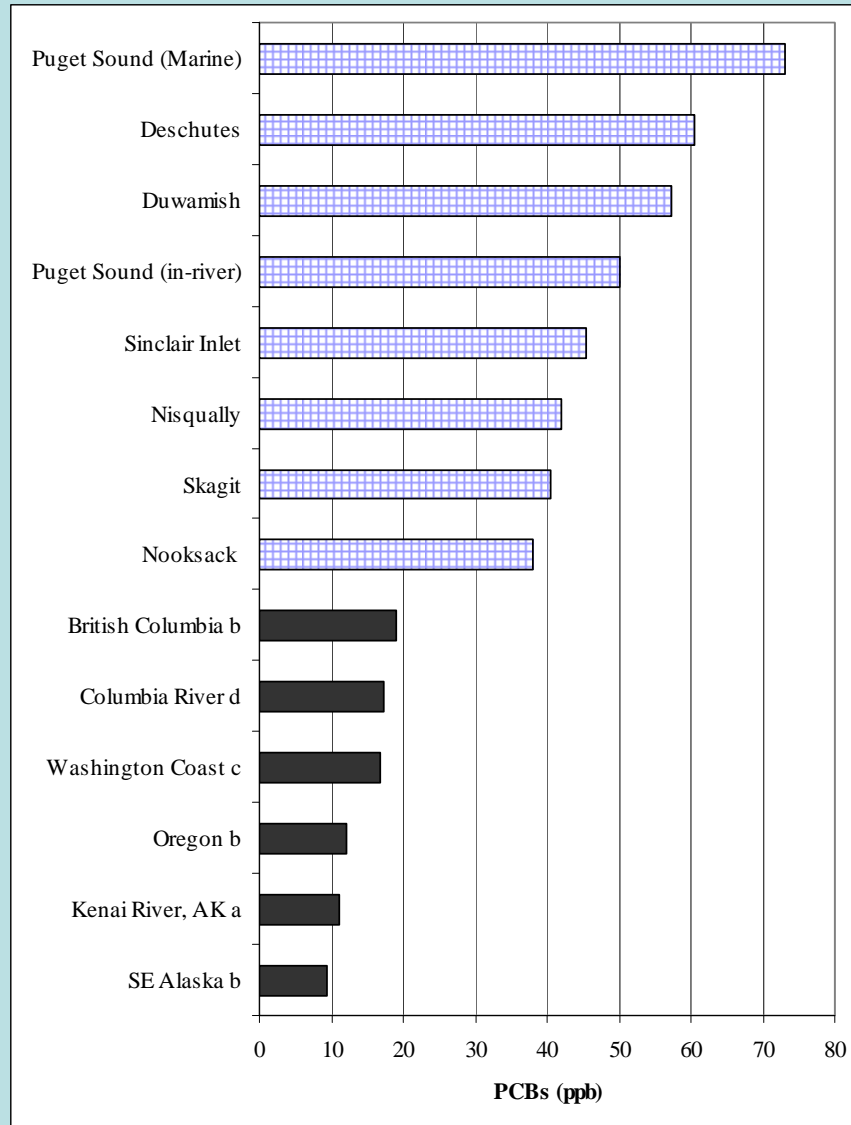
Chinook - Higher contaminant values

Higher trophic level
 Diet/life history/age
 Fat content

Coho - Lower contaminant levels

Trophic level
 Fat content
 Age/life history

PCB levels in Puget Sound Chinook vs Washington coast, Alaska, Oregon, and British Columbia (solid bars)



Step 2

Estimate the amount of Puget Sound
fish eaten by public

Consumption Surveys

- Tribes
 - Suquamish
 - Tulalip
 - Squaxin Island
- Recreational
- Asian & Pacific Islanders

Step 3

Estimate exposure doses to
contaminants from eating various
Puget Sound fish

Step 4

Determine if exposure dose exceeds reference dose (i.e. "safe" dose) or results in unacceptable cancer risk

Assessment Protocol

Step 1. Determine contaminant (i.e., mercury and PCB) concentrations in Puget Sound fish

Step 2. Estimate the amount of Puget Sound fish eaten by public (i.e. recreational anglers, Tribes, API)

Step 3. Estimate exposure doses to contaminants from eating various Puget Sound fish.

Step 4. Determine if exposure dose exceeds reference dose (i.e. “safe” dose) or results in unacceptable cancer risk.

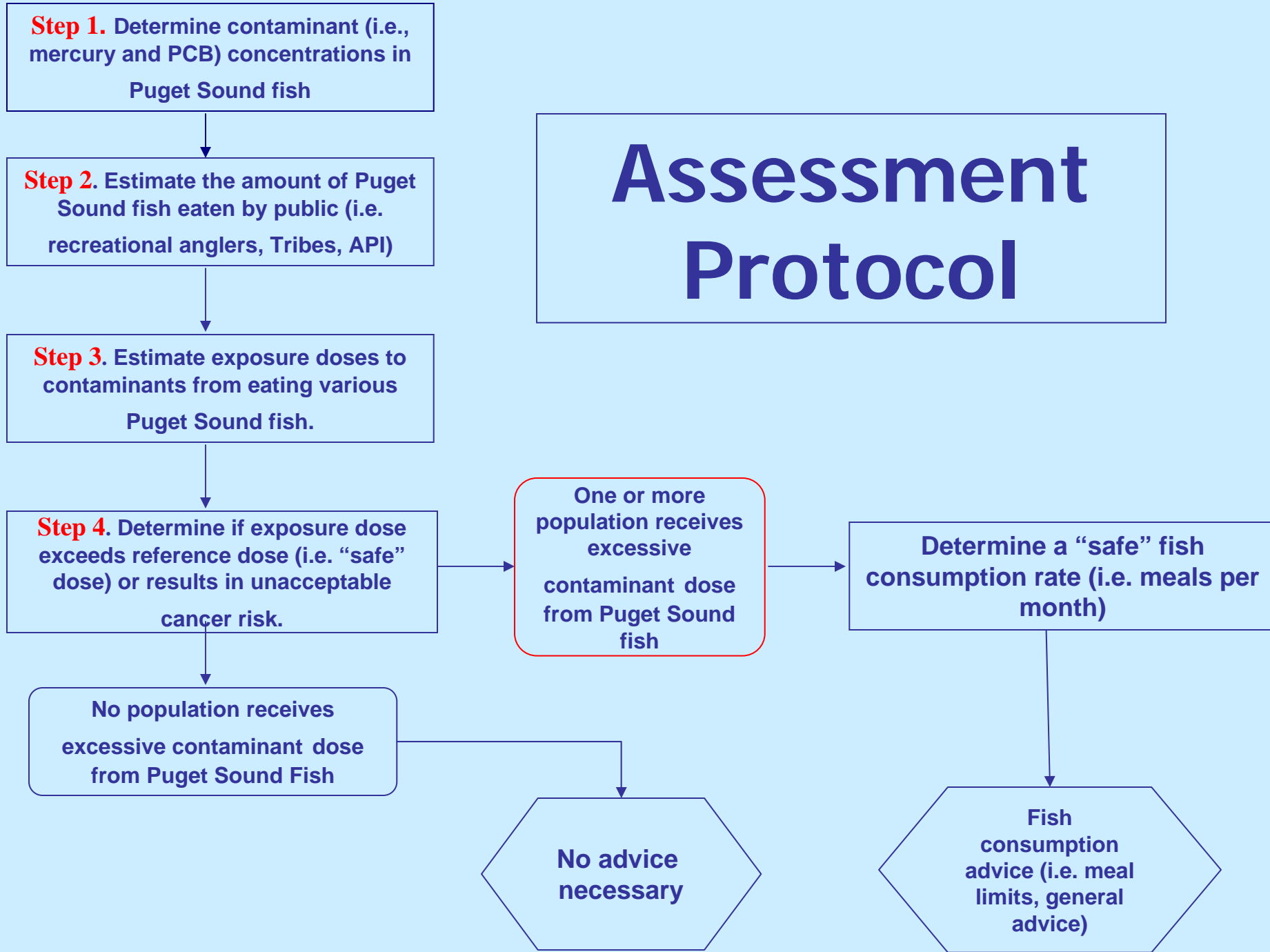
One or more population receives excessive contaminant dose from Puget Sound fish

Determine a “safe” fish consumption rate (i.e. meals per month)

No population receives excessive contaminant dose from Puget Sound Fish

No advice necessary

Fish consumption advice (i.e. meal limits, general advice)

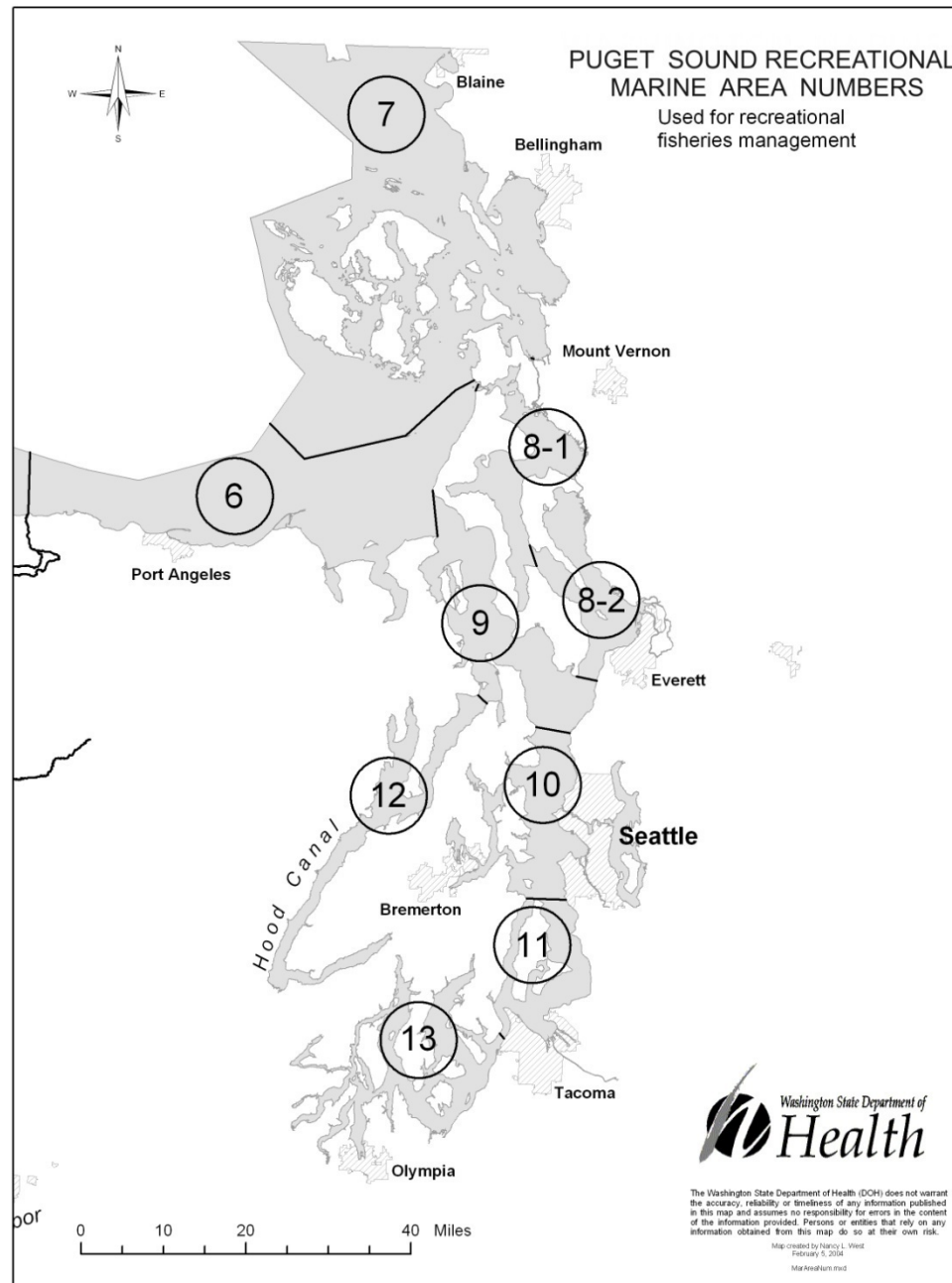


How Do We Develop a Fish Advisory?

- Calculate meal limits
 - 8-oz meals per month or week
 - Based on PCBs, Hg, and additive endpoints
- Consider benefits of eating fish
- Create a clear message

Rockfish Meal Limit Calculations

Location	Average Mercury concentration (ppm)	Average PCB concentration (ppb)	Calculated meals per month based on mercury	Calculated meals per month based on PCBs	Calculated meals per month based on additive endpoint
Non-urban locations	0.218	5.8	3.7	28	3.4
Near-urban locations	0.225	45.1	3.6	3.6	2.2



Puget Sound Rockfish



Rockfish consumption advice is based on contaminant levels in brown, quillback, and copper rockfish from Puget Sound. In addition to contaminant concerns, non-tribal harvest of yelloweye and canary rockfish is prohibited for conservation purposes.

Puget Sound Rockfish

Marine Area/ Location		Rockfish Species	Consumption Advice	Exceptions
6 thru 13	All Puget Sound Marine Areas	Yelloweye Rockfish*	No consumption	None
6 thru 13	All Puget Sound Marine Areas	Canary Rockfish*	No consumption	None
6	East Juan de Fuca Strait	Rockfish	No more than 1 meal per week	None
7	San Juan Islands	Rockfish	No more than 1 meal per week	None
8.1	Deception Pass, Hope Island & Skagit Bay	Rockfish	No more than 1 meal per week	None
8.2	Port Susan/ Port Gardner	Rockfish	No more than 1 meal per week	Yes
	Mukilteo-Everett/ Port Gardner	Rockfish	No more than 2 meals per month	
9	Admiralty Inlet	Rockfish	No more than 1 meal per week	None
10	Seattle-Bremerton	Rockfish	No more than 1 meal per week	Yes
	Elliot Bay	Rockfish	No consumption	
	Sinclair Inlet	Rockfish	No consumption	
11	Tacoma-Vashon	Rockfish	No more than 1 meal per week	None
12	Hood Canal	Rockfish	No more than 1 meal per week	None
13	South Puget Sound	Rockfish	No more than 1 meal per week	None

* Non-tribal harvest of yelloweye and canary rockfish is prohibited for conservation purposes.

English Sole & Other Flatfish

The following advice applies to consumption of Puget Sound flatfish including English sole, starry flounder, and rock sole. No restrictions means you can eat 2 to 3 meals per week.

Puget Sound English Sole & Other Flatfish*

Marine Area/ Location	Consumption Advice	Exceptions
6 East Juan de Fuca Strait	No restrictions	None
7 San Juan Islands	No restrictions	None
8.1 Deception Pass, Hope Island & Skagit Bay	No restrictions	None
8.2 Port Susan/ Port Gardner	No restrictions	Yes
Mukilteo Ferry Dock to City of Everett	No more than 2 meals per month	
9 Admiralty Inlet	No restrictions	None
10 Seattle-Bremerton	No restrictions	Yes
Duwamish Waterway	No consumption	
Elliott Bay	No more than 2 meals per month	
Eagle Harbor	No more than 1 meal per week	
Port Orchard Passage	No more than 1 meal per week	
Sinclair Inlet	No more than 1 meal per month	
11 Tacoma- Vashon	No restrictions	Yes
Inner Commencement Bay	No more than 2 meals per month	
Outer Commencement Bay	No more than 1 meal per week	
12 Hood Canal	No restrictions	None
13 South Puget Sound	No restrictions	None

*Recommendations for consuming other bottomfish such as lingcod, are not included in the above advice.

Estimated PCB Levels

- No data for Bellingham Bay, Budd Inlet, Everett Harbor, and Port Angeles.

$$[mPCB] = e^{1.64*[sPCB]^{0.35}*e^{0.13*Age}}$$

Where:

- mPCB = concentration of PCBs in muscle as sum of 3 Aroclors, ng/g, wet wt.,
- sPCB = concentration of PCBs in sediments as sum of 3 Aroclors, ng/g, dry wt.,
- Age = fish age in years.

Estimated PCB Levels in E. sole based on Matched PCB Sediment Concentrations

Location	Sediment N	Sediment PCB concentration (ppb, dry wt.)	Predicted E. sole concentration (ppb, wet wt.)	Meals per month
Bellingham Bay	45	14.8	29.9	5
Budd Inlet	9	13.9	29.3	5
Everett Harbor	33	355	91.0	2
Port Angeles	22	12.7	28.3	6

Puget Sound Salmon



Puget Sound Salmon		All Puget Sound Marine Areas
Marine Area	Salmon Species	Consumption Advice
6 thru 13	Chinook	No more than 1 meal per week
6 thru 13	Chinook (Blackmouth)	No more than 2 meals per month
6 thru 13	Coho*	No restrictions
6 thru 13	Chum, Pink, Sockeye**	No restrictions
* High-end consumers (more than 2 meals per week) should follow DOH's fish preparation recommendations.		
** Chum, pink, and sockeye salmon were not sampled as part of PSAMP. Data from other sources show that these species tend to have low PCB levels.		

Chinook Salmon Recommendations

- Puget Sound Chinook salmon may be consumed once (eight ounces) per week.
- Anglers who catch resident Chinook salmon (blackmouth) in the Puget Sound winter fishery should limit their consumption to two eight-ounce meals per month.



Consumption Advice for All Fish

- General advice
 - Choose fish with lower contaminant levels
 - Grill, bake or broil/ remove skin
 - Choose a variety of species



**Make Better
Choices**

Sylvia Earle

National Geographic Explorer-in-Residence



Risk Communication

- Media
- Signs
- Internet
- Printed materials
- Health care providers
- Tribes and local health jurisdictions
- Community groups

SAFE TO EAT 2-3 MEALS PER WEEK		OR	SAFE TO EAT 1 MEAL PER WEEK		AVOID DUE TO MERCURY
<p>Follow this advice to reduce your exposure to mercury, PCBs, and other toxics:</p>					
<ul style="list-style-type: none"> ♥ Anchovies Butterfish Catfish Clams Cod (Pacific) (Atlantic) Crab (Blue, King, Snow) (US, CAN) (imported King) Crab – Imitation Crayfish (imported farmed) Flounder/Sole (Pacific) (Atlantic) ♥ Herring ♥ Mackerel (canned) ♥ Oysters Pollock/Fish sticks 	<ul style="list-style-type: none"> ♥ Salmon (fresh, canned) ♥ Chinook (King) (coastal, AK) ♥ Chum (Keta) ♥ Coho (Silver) ♥ Farmed* ♥ Pink (Humpty) ♥ Sockeye (Red) ♥ Sardines Scallops Shrimp/Prawns (US, CAN) (imported) Squid/Calamari Tilapia (US, Central/South America) (China, Taiwan) ♥ Trout Tuna (canned light) 	<ul style="list-style-type: none"> ♥ Black sea bass Chilean sea bass ♥ Chinook salmon (Puget Sound) Croaker (white, Pacific) Halibut (Pacific) (Atlantic) Lobster (US, CAN) (imported Spiny Caribbean) 	<ul style="list-style-type: none"> Mahi mahi (imported longline) Monkfish Rockfish/Red snapper (trawl-caught) ♥ Sablefish/Black cod ♥ Tuna, Albacore (fresh, canned white) (WA, OR, CA troll/pole) (longline – except Hawaii) 	<p>Women who are or may become PREGNANT, NURSING MOTHERS, and CHILDREN should NOT eat:</p> <ul style="list-style-type: none"> Mackerel (King) Marlin (imported) Shark Swordfish (imported) Tilefish (Gulf of Mexico, South Atlantic) Tuna Steak Bluefin Bigeye (imported longline) Yellowfin (imported longline) 	
<p>♥ Highest in healthy omega-3 fatty acids</p> <p>ORANGE TEXT: Overfished, farmed, or caught using methods harmful to marine life and/or environment</p> <p>* For environmental and health information, visit www.doh.wa.gov/fish/farmedsalmon</p>					<p>A seafood serving or "meal" is about the size and thickness of your hand, or 1 oz. for every 20 lbs. of body weight.</p> <p>160 lb. Adult = 8 oz. / 80 lb. Child = 4 oz.</p>



Fish Facts for Healthy Nutrition

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Eat Fish, Be Smart, Choose Wisely

Fish is brain and heart food - but trying to balance its health-boosting benefits with concerns about contaminant level can leave you floundering! Sad and true, contaminants are in most foods, but don't give up on fish, because fish are still an excellent health choice.

The American Heart Association recommends eating fish twice a week. **Why?** Because fish are a great source of protein, vitamins, and nutrients. Fish are loaded with omega-3 fatty acids, which provide protection from heart disease and are great brain food for you, your children and if you are pregnant, for your unborn child. It is important to continue to eat fish to gain the healthy heart and brain benefits. The key is to make smart choices and choose fish that are low in mercury, PCBs, and other contaminants.



[Advice for Women and Children Who Eat Fish](#)



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[How Contaminants Get in Fish](#)



[What is Washington Doing to Reduce Contaminants?](#)

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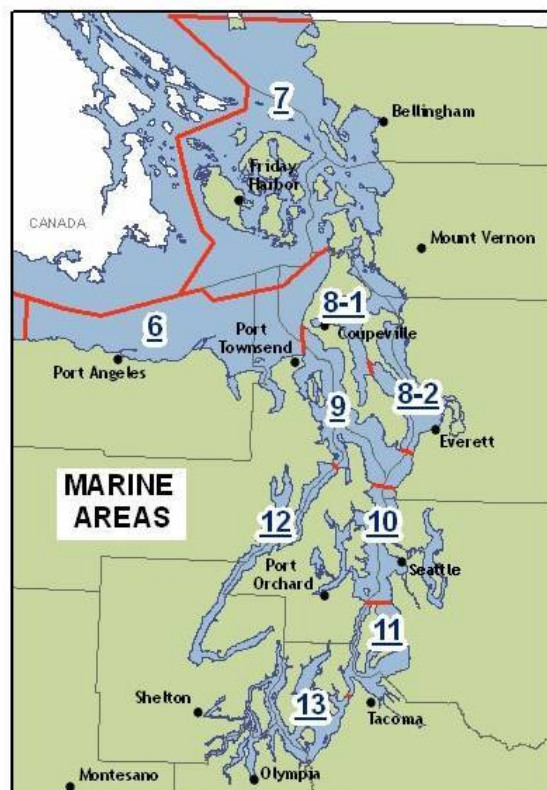
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Puget Sound Fish Consumption Advisory Areas



The Washington State Department of Health (DOH) has completed an assessment of contaminants in Puget Sound fish. The assessment considered data gathered by the Washington State Department of Fish and Wildlife under the Puget Sound Assessment and Monitoring Program (PSAMP). DOH has used this assessment to update advice on eating fish as part of a healthy diet. To learn more read our [fact sheet](#).

Main Contaminants

The main contaminants of concern are polychlorinated biphenyls (PCBs) and mercury which, once released into the environment, move up through the food chain into fish, marine mammals, and humans. Mercury and PCBs have been shown to cause behavioral and learning deficits in children exposed in the womb, so meal limits of certain fish are especially important for women of childbearing age and young children.

Choose Salmon

While Washingtonians are encouraged to choose salmon as an excellent choice for a meal, the report recommends limiting Puget Sound Chinook salmon to one meal per week and resident Chinook (blackmouth) to two meals per month. The report provides consumption advice for flatfish (e.g., English sole, flounder, sanddab) and rockfish based on the Fish and Wildlife's recreational marine areas as identified by the map on this page.

Eat fish, be smart and choose wisely

"It's good to know that many fish in Puget Sound, especially our salmon, remain a

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Puget Sound Fish

Puget Sound Fish Consumption Advisory Recreational Marine Area 10

Seattle/Bremerton

The Washington State Department of Health (DOH) has issued a number of fish consumption advisories for fish caught in various water bodies across the state. Our advice will minimize exposure to contaminants while maintaining fish as part of a healthy diet. Our advice focuses primarily on protecting women of child-bearing age, infants and young children.

For healthy choices from your grocery store, see our [Healthy Fish Eating Guide](#)

Visit the [Washington State Department of Fish and Wildlife Marine Area Rules \(pdf\)](#) for fishing seasons and catch limits.

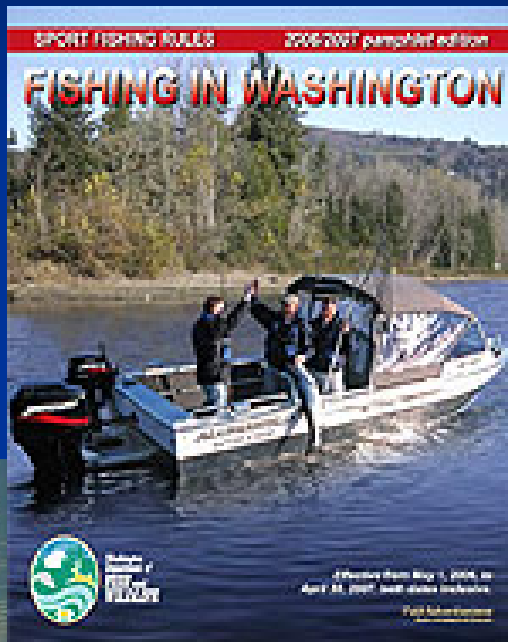
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RMA 10 - Seattle/Bremerton		
Species	Guidance / Advice	Exceptions
Rockfish	No more than 1 meal per week	No consumption: Elliott Bay and Sinclair Inlet
Flatfish (e.g., sole, sanddab, and flounder)	No meal limit	No consumption: Duwamish Waterway No more than 1 meal/month: Sinclair Inlet No more than 2 meals/month: Elliott Bay No more than 1 meal/week: Eagle Harbor and Port Orchard
Salmon		
Chinook	No more than 1 meal per week	No more than 2 meals/month: resident Chinook (blackmouth)
Coho	No meal limit	None
Chum, Pink, and Sockeye	No meal limit	None
NOTE: No consumption of any seafood (except salmon) from Duwamish River		

Meal size equals eight ounces of uncooked fish.

Outreach to anglers



THE DUWAMISH RIVER

Within this urban waterway beats the heart of a living river. Home to a variety of sea and river creatures, the tidally influenced Duwamish River is slowly being restored through the dedicated efforts of community members.

Years of industrial pollution and sewage have left some species unsafe to eat. Fish that spend most of their lives in the river can accumulate many chemicals. **Do not eat any resident fish, crab, or shellfish from the Duwamish River including seafood pictured here.** Salmon are not considered resident fish because they spend most of their lives in the ocean and generally have lower levels of chemicals. PCBs are chemicals that can build-up in fish tissues and are especially harmful to the developing fetus and to young children. Pregnant women and women who plan to have children should pay special attention to this important health message.

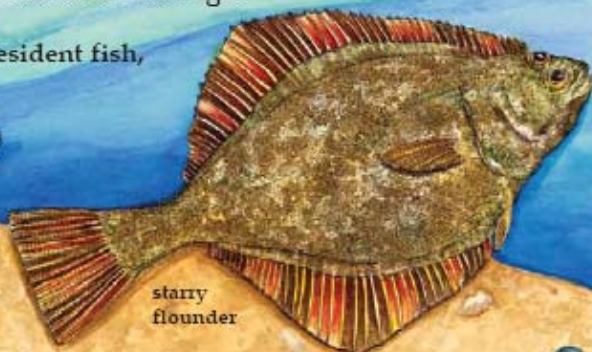
Fish is healthy food – but please do not eat any resident fish, crab or shellfish from the Duwamish River!

English sole

Dungeness crab



starry flounder



Some bottom-dwelling creatures accumulate PCBs from the sediment and become food for fish, marine mammals, birds and people.

mussels



bent-nosed clam



red rock crab



heart cockle



eastern soft-shell clam



rockfish



perch



The following steps can reduce your exposure to PCBs and some other contaminants commonly found in salmon:

Cut away fat along back

Cut away dark fatty tissue along sides

Trim off belly fat

Remove skin

Fillet your fish, or if cooking with the bones in, remove internal organs and skin. Do not use organs or skin in soups or chowders.

Trim away fatty portions of the fish.

Do not eat the eggs. They are very high in fat.

Bake, grill or broil your fish on a rack and let the fat drip away. Do not use the juices.

Metal contaminants such as mercury and lead cannot be cleaned or cooked out of fish.

Contact your state and local health departments for more information.

Data Gaps

- Obtain contaminant data in crab, shrimp, and bivalves
- Confirm levels in chum, pink and sockeye
- Obtain dioxin/furan data in PS species
- Assess PBDE levels in fish species
- Conduct a “market basket” survey of PCBs

Puget Sound Partnership

- A community effort of citizens, governments, tribes, scientists and businesses working together to restore and protect the Sound
- Goal is to make P.S. healthy again.
- Roadmap to get it done is the “Action Agenda”

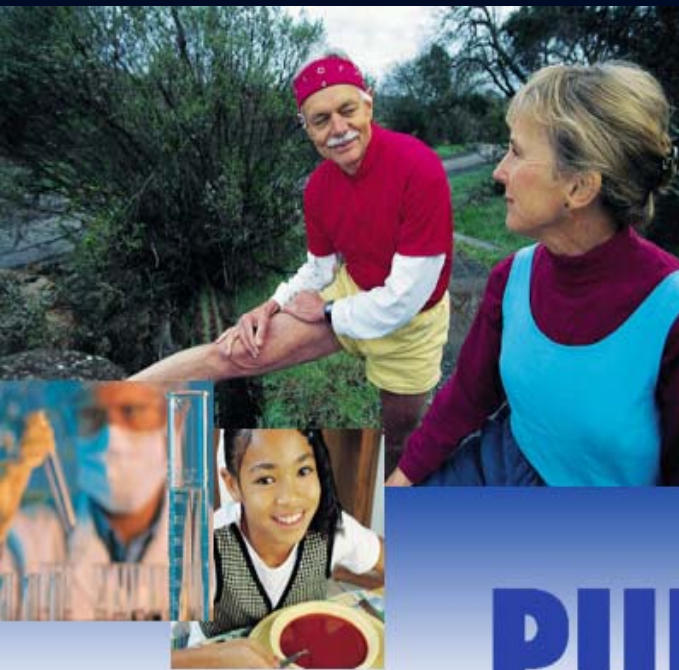
PugetSoundPartnership
our sound, our community, our chance

Eat Fish

- American Heart Association – 2 meals/wk
- Eat a variety of fish, especially oily fish
- Benefits
 - Reduces cardiovascular disease risk
 - Beneficial effects on fetal development

Resources

- State of Washington
 - <http://www.doh.wa.gov/fish>
 - <http://www.doh.wa.gov/ehp/oehas/fish/ps.htm>



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