



NUE-NE-PUEH

RESOURCE HEALTH REPORT

RESULTS FROM TISSUE SAMPLING



2010–2012

YUROK TRIBE ENVIRONMENTAL PROGRAM

- *“Understanding the Cumulative Effects of Environmental and Psycho-social Stressors that Threaten the Pohlik-lah and Ner’-er-ner Lifeway: The Yurok Tribe’s Approach.”*
- Contaminants Study: Methods, Results and Recommendations



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U.S. EPA - Science To Achieve
Results (STAR) Program

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AIY-YE-KWEE'

THE YUOK TRIBE ENVIRONMENTAL PROGRAM'S

(YTEP) mission is to protect the lands, air and water resources of the Yurok Reservation for the benefit of current and future generations of tribal members. YTEP staff utilize science, traditional knowledge and environmental regulation to enhance tribal sovereignty and expand the environmental regulatory authority of the Tribe to promote and protect these resources within the Yurok Reservation. YTEP Director, Kathleen Sloan and YTEP Environmental Specialist, Suzanne Fluharty served as the Principal Investigators on this study.

THE PURPOSE OF THE STUDY

The purpose of this study was to investigate concerns identified by the Yurok Tribal membership about the health and safety of Yurok waters, the Klamath River, and key aquatic species relied upon for culture, subsistence and economic benefits. Community concerns were identified in surveys conducted by YTEP in 2007 and the grant was funded by EPA National Center for Environmental Research in 2008. A large component of the study was to sample and test selected aquatic species for a range of contaminants that could impact resource and human health, including heavy metals, pesticides and bio-toxins. This brochure presents the study findings.

WE WISH TO GIVE SPECIAL THANKS TO...

The Yurok Tribal Council for their support of the project proposal and continued work on these issues. Also, the Yurok Tribal members who identified the goals and objectives of this study.



1. YTEP staff and Tribal Member,
Micah Gibson.

ADDITIONAL RECOGNITION AND APPRECIATION GOES TO...

The Culture Committee and Natural Resource Committee Elders and members, both past and current, and all the Tribal Members who gave of their time and shared their experiences of traditional harvest practices and places within Yurok Ancestral Territory.

All the Tribal fishermen and harvesters who helped donate their time, knowledge, and fish to this study: Micah Gibson, Emery Mattz, Nick McCovey, Arnold Nova, Keith Parker, Rob Ray, Tim Sanderson, Pete Thompson, and Tom Wilson.

The Yurok Tribal Fisheries Program staff for their advice and assistance in sample collection.

The Yurok Language Department for assistance with Yurok vocabulary and spelling.

The many talented photographers who helped fill these pages with their pictures: Arnie Nova (#13-14), Keith Parker (#18 & 28), Micah Gibson (#17, 23, & 27), Patrick Luke and the Yakima Lamprey Hatchery Program (#16), Tomas Dunklin (#12), and YTEP staff.

NUE-PE-PUEH RESOURCE HEALTH RESULTS FROM TISSUE SAMPLING



2. The mouth of the Klamath River showing 'O Rey-gas with her burden basket.

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River

Ocean

RESOURCE HEALTH 2010 - 2012

PROJECT OVERVIEW

THE YUROK TRIBE RESERVATION AND ANCESTRAL TERRITORY

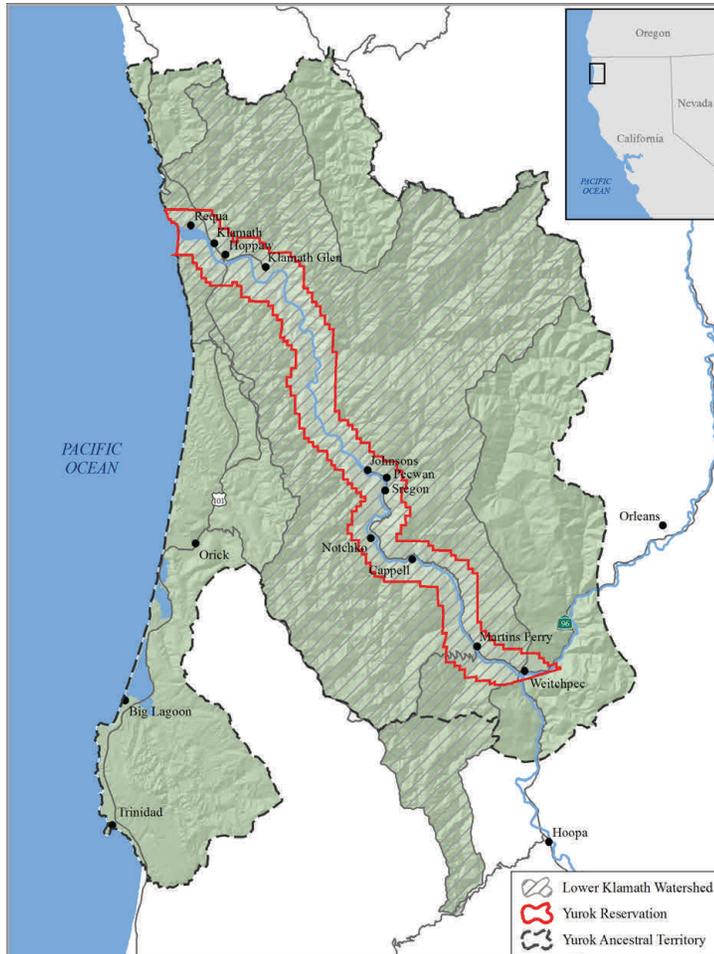
are areas of great subsistence, cultural, and economic value to the Yurok People who have relied on the region's abundant natural resources. Since time immemorial. The Reservation extends for one mile on each side of the Klamath River and runs from the mouth at the Pacific Ocean upriver for approximately 45 river miles. The larger Yurok Ancestral Territory includes the Lower Klamath River tributaries, estuary, coastal lagoons, and the Pacific Ocean coastline from Little River north to Damnation Creek.

RESEARCH OBJECTIVES

were to respond to questions and concerns from the tribal membership about the purity and health of tribal waters and key subsistence foods. YTEP staff tested water quality, and select aquatic species for a range of contaminants known to be present in the Klamath Basin. Samples were tested for all selected contaminants at the lowest detectable level by the San Jose State University Research Foundation, California Department of Fish and Game, Water Quality Control Laboratory.

THIS BOOKLET REPORTS RESULTS

from samples collected and analyzed beginning May 2010 through April 2012. A final technical report will be issued in March 2014.



3. Map of Yurok Reservation and Ancestral Territory.

“I was born and raised on the River. My life is woven with the river and its fish and people... it is our spirit and strength. It is not the simple fact of eating healthy food from the River that is important...It is the knowing in my mind, heart and spirit that the River it self is whole and healthy. We are merely a reflection of the river...”

(Yurok Tribal Member, 2006)

RESULTS FROM TISSUE SAMPLING



4. Yurok Tribe's Annual Salmon Festival.



5. Yurok Tribe Natural Resource Committee.



6. Sturgeon 'Hole' at Old Bridge Site.

SAMPLING DESIGN

THE SELECTION OF SPECIES

was based upon historical records, consultation with Tribal committees, and interviews with Yurok Tribal Members to choose aquatic resources that are critical to the continuation of Yurok subsistence, traditions, ceremonies, and lifeways. These included Chinook salmon, Coho salmon, green sturgeon, steelhead, pacific lamprey (eel), seaweed, mussels, clams, crab, and grey whale.

- * 293 INDIVIDUALS FROM 9 SPECIES**
- * 4 COMPOSITES OF 2 SEAWEEDS & * 6 RIVER FLOWS (SPRING AND FALL)**

THE SELECTION OF CONTAMINANTS

YTEP identified a range of contaminants documented as used within Ancestral Territory & the larger Klamath River Basin. Community priorities were for pesticides & biotoxins such as Blue Green Algae. We also tested for metals from historic mining and other natural and industrial sources. The study focused on contaminants with known adverse health outcomes such as cancer, birth defects, or act as endocrine disruptors. All contaminants were tested to the lowest detectable limit.

- PESTICIDES** - Carbamates, Dioxins, Organochlorines, Organophosphates, Triazines
- INDUSTRIAL/ANTHROPOGENIC** -PCB's, PAH's, PBDE's, PCP/TCP's
- BIOLOGICAL** - Microcystins, Domoic Acid
- METALS** - Mercury & trace elements.

*** 258 TOXINS**

THE SELECTION OF SITES

Sampling locations were identified and selected through consultations with the Natural Resources Committee and tribal member participants during scoping sessions. Samples were collected from select locations based upon this information.

*** 27 LOCATIONS COASTAL & RIVER**

TIMING OF SAMPLING

was timed to bracket and coincide with peak subsistence uses of the River, when Klamath River flows were safe, the targeted species available, and tribal members harvest them.

*** ALL 4 SEASONS**

CONTAMINANTS OVERVIEW

HEALTH THRESHOLD LINES IN GRAPHS -----

Each contaminant has different health guidelines based on their different impacts to human health and are established by federal agencies, including the US Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA). Where different agencies have established different guidelines we have used the most protective level to show in the graphs in this booklet. These guidelines are at the level where negative health impacts would typically begin to occur at rates above normal. Only look at the line in the same color as the bar representing the matching toxin to see where the test results fall compared to the established health thresholds. If no health threshold line is displayed, it is because no federal agency levels have yet been established. Results of tissue analysis are reported in parts per billion (ppb) wet weight of the sample.

BIOTOXINS-

DOMOIC ACID

Produced by red algae; accumulates in shellfish & algae eating fish such as smelt. The health threshold is 21,000 ppb.

***POSSIBLE HEALTH IMPACTS:**
Disorientation & permanent short-term memory loss; seizures, coma, & death in severe cases.

***CONTAMINATED SPECIES:**
Found at very low levels in Dungeness Crab, Freshwater Mussels, Lamprey, Marine Mussels, Razor Clams, Steelhead.

MICROCYSTINS

Produced by blue-green algae & released into river water where it can accumulate in filter feeders. Threshold set at 24 ppb in fish; 51 in mussels by Australia Health Dept.

***POSSIBLE HEALTH IMPACTS:**
Skin rash; vomiting, diarrhea, abdominal pain, convulsions & death.

***CONTAMINATED SPECIES:**
Fresh Water Mussels.

METALS

Metals occur naturally & are necessary for of a healthy diet but at high levels can have negative impacts on human health. Some can be released into the environment from industry or mining activities. Health threshold levels have only been set for the following: 1,000 ppm for aluminum; 86 for arsenic; 4 for chromium; 1 for mercury; 80 for nickel; and 2 for lead. The only metal found in excess was manganese in fresh water mussels (based on calculations by the US Center for Disease Control). The higher levels in the marine species is normal and reflects the high mineral content of ocean water.

***POSSIBLE HEALTH IMPACTS:**
Different metals in excess may cause a wide range of problems particularly in children including cancers & normal brain development.

***CONTAMINATED SPECIES:**
A natural part of all plants & animals.



7. Burning transforms and releases toxins into the environment, affecting the air, soil, and water .

PAHS- POLYCYCLIC AROMATIC HYDROCARBONS

PAHs are residues from burning. Approximately 15% of PAH's in California are from residential use such as wood stoves, 35% are from improper burning of fuel in mobile sources such as cars, trucks, and boats, but **the majority of environmental PAHs are from forest fires and TRASH burning.** US agencies are currently reviewing standards and have no established limits, however the European Union has set limits on the carcinogenic PAHs in food to no more than 2 ppb in fish; 5 in crustaceans; & 10 in bivalves .

***POSSIBLE HEALTH IMPACTS:**
Highly carcinogenic including increased incidences of lung, skin, & bladder cancers.

***CONTAMINATED SPECIES:**
Different levels were found in ALL species except for the fresh water mussels, some levels were above the health threshold.

RESULTS FROM TISSUE SAMPLING



8. Run off and sediment flowing into the river move toxins into the aquatic environment.



9. Illegal dumping can expose broken fixtures and engines and allow toxins to drain into the environment.



10. Herbicides can be taken up into plant tissues and excess spray may migrate into soils or run off into water.

PBDES- POLYBROMINATED DIPHENYL ETHERS

These toxins are wide spread, chemical compounds that are used as flame retardant in building materials, electronics, furnishings, motor vehicles & airplane cushions, plastics, polyurethane foams, and textiles. In 2006 California began prohibiting the manufacture, distribution, and processing of flame-retardant products but they persist in the environment.

***POSSIBLE HEALTH IMPACTS:** Impairs development of nervous system and increases hyperactivity, attention deficiencies, & lowered IQ; endocrine system disruption with associated insulin resistance, obesity and type II diabetes; increased cancers of breast, testes, prostate, & thyroid; and reduced fertility in humans.

***CONTAMINATED SPECIES:** Extremely low levels were found in Chinook, Coho, Steelhead, & Sturgeon.

PCBS- POLYCHLORINATE BIPHENYLS

PCBs were banned in the late 1970s but are still in some old equipment, lubricants, caulk, & old fluorescent light fixtures. They persist in the environment today because they take a long time to break down. They are found in some high-fat fish and animal products. The US FDA has set the health threshold at 200 ppb.

***POSSIBLE HEALTH IMPACTS:** May cause cancer of the liver & biliary tract; dermatitis and skin lesions; irregular menstrual cycles and reduced fertility; lowered immune response; stomach & thyroid gland injuries; anemia; and endocrine disruption.

***CONTAMINATED SPECIES:** Low levels were found in all species except the whale blubber that exceeded health advisory thresholds. The next highest levels were only about 1/3 of the threshold level and were in the fattier lamprey & sturgeon.

PESTICIDES

The term “pesticides” includes chemicals designed to control pests and includes common insecticides and herbicides but also rodenticides and fungicides. Of all the ones we tested for, there were only low detections from the legacy of DDT, the more common of the organochlorine insecticides and the manganese based fungicides. Threshold levels are set US FDA at 100 ppb for chlordanes & 5,000 for DDTs.

***POSSIBLE HEALTH IMPACTS:** Principally neurotoxic effects including hyperexcitability, seizures, and convulsions; possible carcinogen for liver & some breast tumors; immune disruption including non-Hodgkin lymphoma; & endocrine disruption.

***CONTAMINATED SPECIES:** Low levels in Chinook, Coho, Crab, Lamprey, Marine Mussels, Seaweed, Steelhead, & Sturgeon. The grey whale blubber was the only species above health threshold levels.

RESOURCE HEALTH 2010 - 2012



'OH-POS KING SALMON/FALL RUN CHINOOK *ONCORHYNCHUS TSHAWYTSCHA*

SAMPLE DESCRIPTION

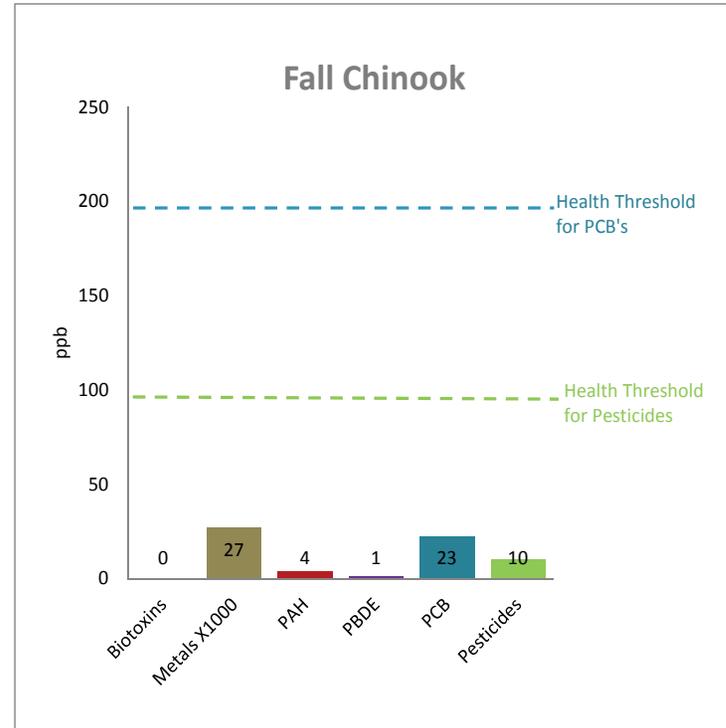
Six fish were caught by gill nets during September & October 2010; 2 each from the mouth, Notchco stretch, and near Weitchpec- at Ben's Creek outlet. Following research protocol, whole fish for sampling were sized within 25% of each other in order to maintain comparability and representation within the sampled population. There were no significant variations in the fish caught at different sites. The average fork length was 87cm or 34 inches and their average weight was 13 pounds. Their lipid (fat) content was 11 %.



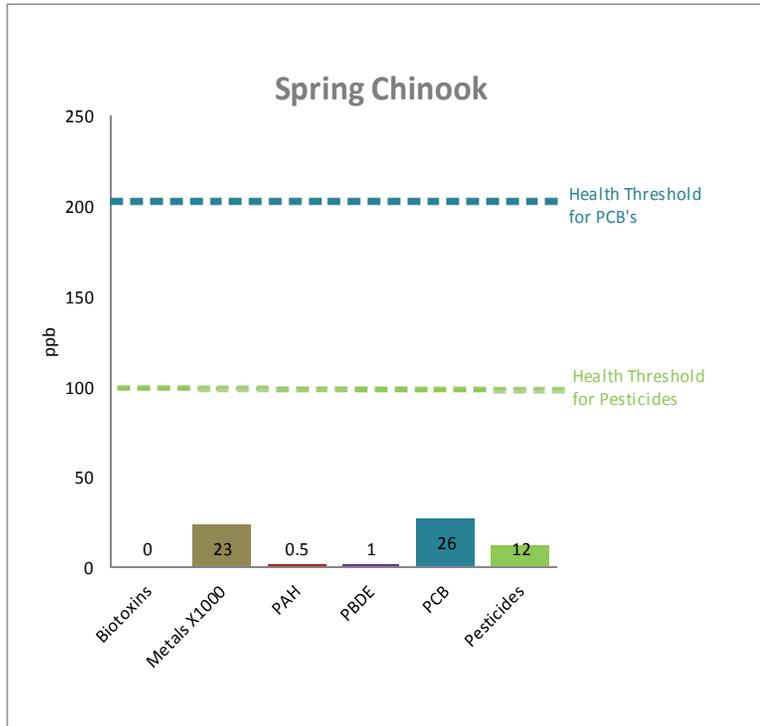
SPECIES' ANALYSIS

Fall run Chinook had **no** detections for biotoxins, carbamates, pentachlorophenols (PCP), triazines, trichlorophenals (TCP), pyrethroids, nor the class of organophosphate pesticides. Detections in general were low but did include dioxins, metals, organochlorine pesticides, PCBs, and PAHs. The only contaminant level of concern is with the PAHs, the class of poly-aromatic hydrocarbons that result from burning.

The **good news** is that for both runs, the bulk of the metal detections came from zinc which is within levels normally contained in fish. Methyl-mercury (the form that is readily absorbed by humans) was extremely low, only 0.03 ppm. This is 100 times **less** than the criterion for protection of human health in fish set by the US EPA.



RESULTS FROM TISSUE SAMPLING



NUE-MEE NEY-PUY SPRING CHINOOK *ONCORHYNCHUS TSHAWYTSCHA*

SAMPLE DESCRIPTION

Six Spring Chinook were caught in a gill net set above Starwain Riffle on May 24, 2011. The average fork length was 79 cm or approximately 31 inches and weight averaged close to 15 1/2 pounds. Their lipid (fat) content was 15.6%, nearly a third more than the 2010 year's Fall run. Not only were they 2 1/2 pounds heavier but also three inches shorter.

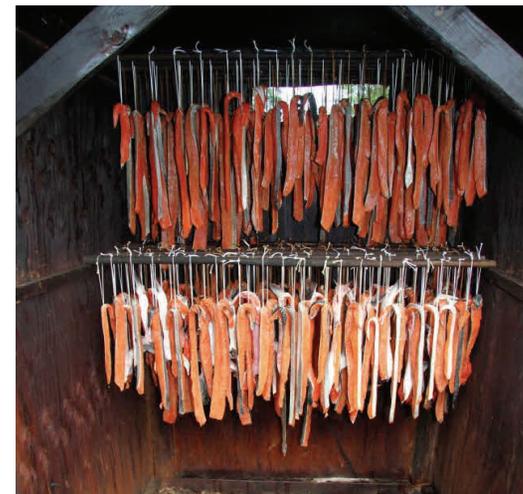
SPECIES' ANALYSIS

Results for Spring Chinook salmon were a near match to the Fall Run results with no biotoxins, carbamates, pentachlorophenols (PCP), triazines, trichlorophenals (TCP), pyrethroids, nor the class of organophosphate pesticides. Similarly, they had detections of low level dioxins, metals, organochlorine pesticides, PCBs, and PAHs. The only real difference is that quantified PAHs were almost non-existent! Most of the detections of pesticides were from the legacy use of both DDT as an insecticide and hexachlorobenzene, a fungicide. Both of these were banned in the 60's and their levels consistently lessen each year but remain as part of the persistent organic pollutants.

They hold up as one of the cleanest fish available!

NO detections exceeded any current public health limits.

11. Bottom Left: Drift net fishing. 12. Far Right:: Smokehouse from Blue Creek Ab Pab Wellness Village.



RESOURCE HEALTH 2010 - 2012



CHEY-GUEN COHO SALMON

ONCORHYNCHUS KISUTCH

SAMPLE DESCRIPTION

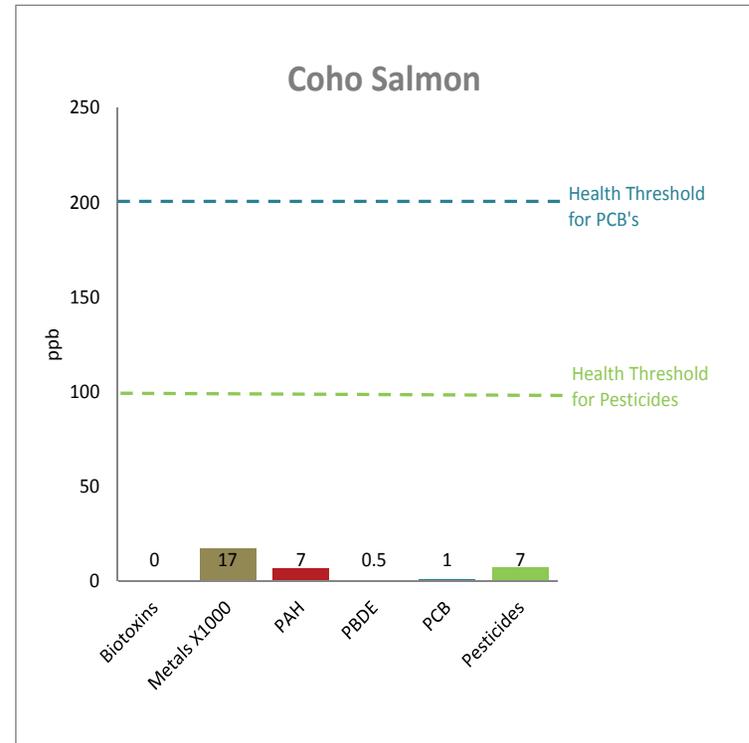
Six whole fish were netted between September 15 and October 7, 2010 for analysis as both composite and individual samples. They were selected on their lengths being within 25% size of each other and averaged 82 cm or 32 inches fork length. Their weight averaged close to 10 1/4 pounds but had a large range, from a little over 6 pounds for one caught at the mouth to more than 14 for one near Notchko! Their lipid (fat) content was 11.6 %, about the same as the Fall Chinook.



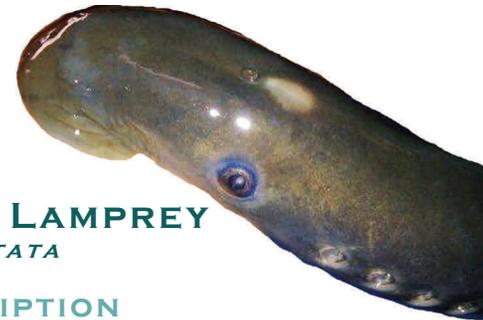
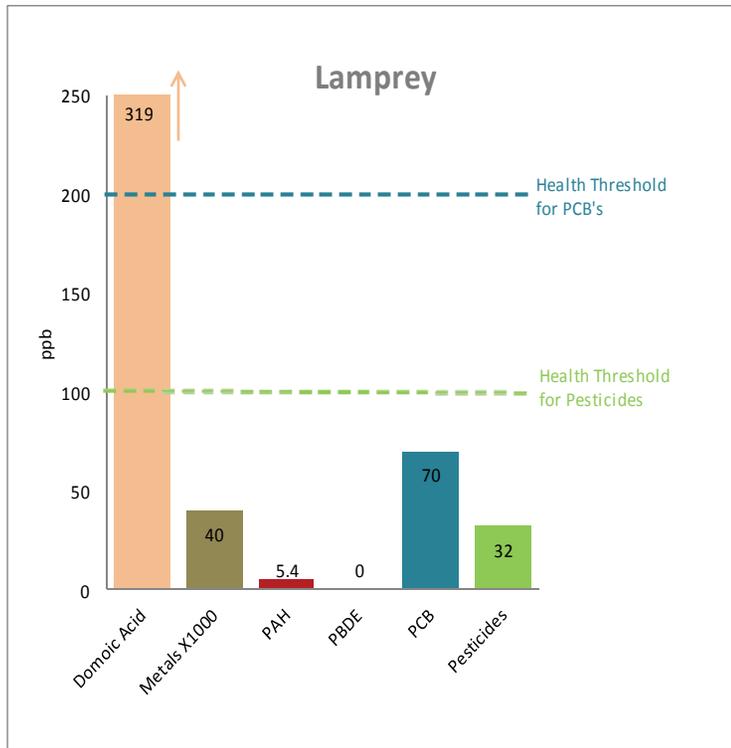
SPECIES' ANALYSIS

The Coho were identical to the other tested salmon with no detections of biotoxins, carbamates, triazines, trichlorophenals (TCP), pyrethroids, nor the class of organophosphate pesticides. With the exception of PAHs everything that was detected (dioxins, metals and organochlorine pesticides) were lower than the Chinook, such as the 30% drop in the pesticides and almost no PCB residues. While the health limits for PAHs in fish can be as low as 2ppb, this is based on the known carcinogen, benzo(a)pyrene which was detected in Coho by the lab, but at levels so low that it could only be estimated, not quantified. The majority of the other PAHs that were detected in the Coho were principally from lighter compounds that are not carcinogenic but that the US Fish and Game (Eisler 1984) classify as toxic. Individually they were at low levels and scientists are still debating if a cumulative effect occurs. Total PAHs were the highest of all the species we tested.

13. Far Left: Backbones, napes, and heads cooking on traditional redwood stakes.



RESULTS FROM TISSUE SAMPLING



KEY¹-WEEN EEL, PACIFIC LAMPREY *LAMPETRA TRIDENTATA*

SAMPLE DESCRIPTION

Nine individual lamprey were hooked as they entered the river from the ocean, near the north rocks at the mouth of the Klamath. Six of them were within the required 25% size range of each other and were sent for composite sampling. All 9 were also analyzed as individuals to establish a wider range of detections within the population. They averaged 63.13 cm; close to 25 inches, but varied between 23 and almost 30 inches in length. Their weight averaged just over one pound, but the largest was 1 1/2. Although their fat content was nearly 19.4% (nearly twice the Coho and Fall salmon) this was not consistent across the population. There were shorter, fatter ones and long lean ones!

SPECIES' ANALYSIS

Results of the laboratory analysis of the lamprey follow the trend in other Klamath species of having no reported detections for any pesticides with carbamate, organophosphate, or triazine based compounds. They also had no detections of pentachlorophenols (PCP), nor PCBs. Domoic Acid, responsible for Amnesiac Shellfish Poison, was high compared to other tested fish, however the health threshold for this is 21,000 ppb! So no worries there. The bulk of the detections were from the agricultural legacy of insecticides and fungicides of the 60's such as 19 ppb from the legacy DDT, (as the breakdown compound DDE)- nearly twice the Spring Chinook, but 1/3 less than the sturgeon fillets. Unfortunately, this is the only fish with carcinogenic PAHs (3.3ppb) detected above the health threshold of 2ppb. However, there was a correlation between total PAH levels and their lengths- **so keep and eat the shorter ones!**



14. Right: 'Luemon'-basketry eel trap.
15. Above: 'Flattening' eels before cooking.
16. Top right: When they enter the estuary, eels have clear eyes that cloud up as they move upriver to spawn.

RESOURCE HEALTH 2010 - 2012



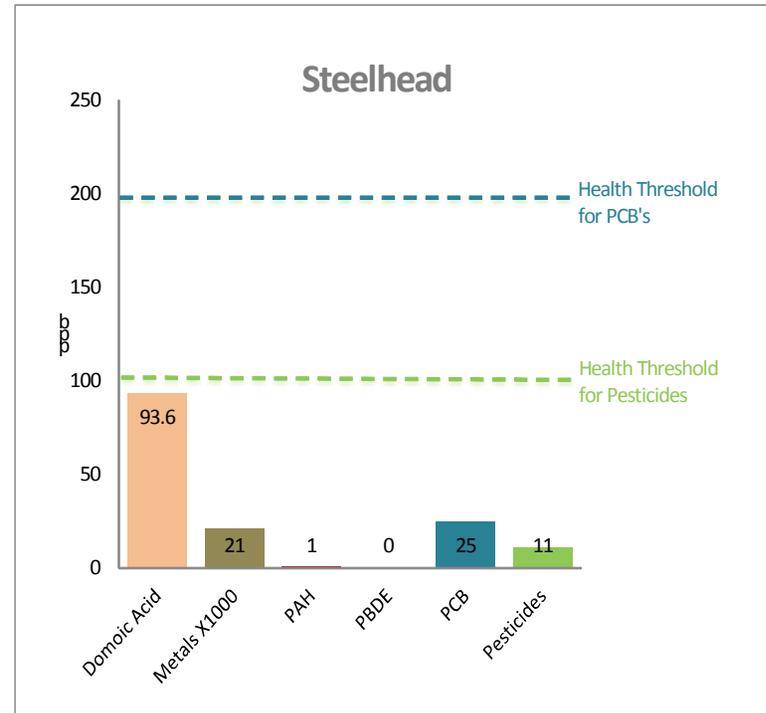
CHKWOHL STEELHEAD, *ONCORHYNCHUS MYKISS*

SAMPLE DESCRIPTION

Six steelhead with an average fork length of 66 cm or nearly 26 inches, were caught January 11 -20, 2010 from three locations on the Klamath River: in the estuary by the Old Bridge Hole, near the Glen at Dave's Rock, and just off the Weitchpec bar.



17. Top: Prior Fisheries staff and Tribal Member, Scott Gibson holding catch. 18. Above: Oven smoking. 19. Left: Drift net fishing off the spit.

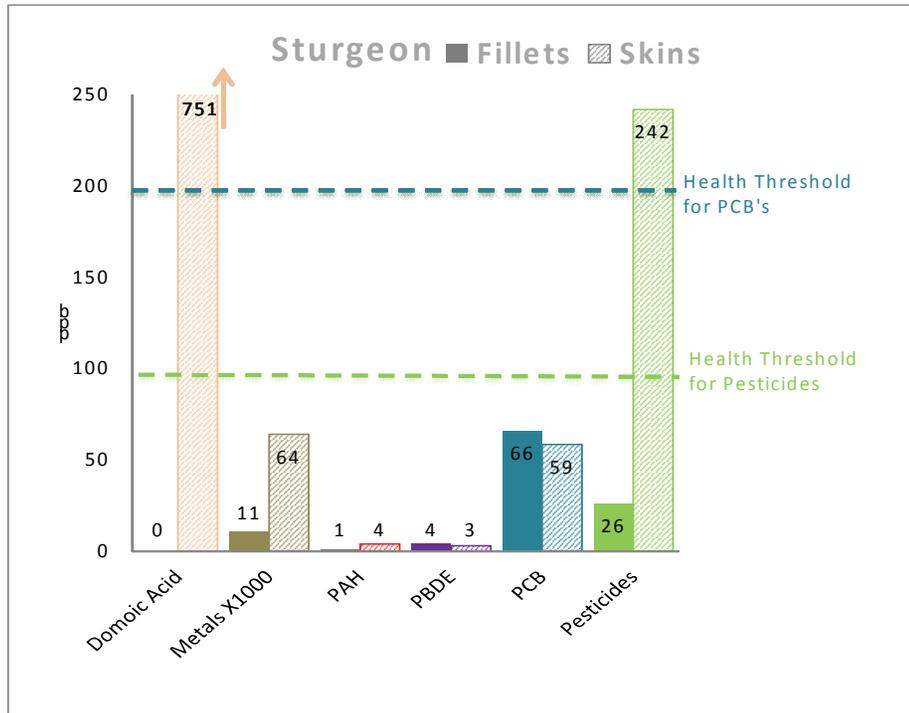


SPECIES' ANALYSIS

Steelhead came in as the second overall cleanest fish species tested, just behind the Coho salmon. Coho had not accumulated any PCBs while the laboratory analysis of the steelhead had detections on a par with the Chinook but still nearly 10 fold less than the health threshold. However, the PAHs were some of the lowest detections of any fish. The good thing is that like other fish, there were no detections for any carbamates, pentachlorophenols (PCP), triazines, tri-chlorophenals (TCP), PBDEs, PCBs, pyrethroids, nor class of organophosphate pesticides but did include very low level dioxins.



RESULTS FROM TISSUE SAMPLING



SAMPLE DESCRIPTION

Due to their large size, sturgeon were the only exception to our sampling protocol of analyzing whole fish. Tribal fishermen donated the tail section behind the last bony plate. At the lab, these were further filleted, with the meat tissue and skins analyzed separately. This allowed potential health risks from *tektekeh*, traditional sturgeon skin glue to be discovered. Whole, their average fork length was 160.5 cm or roughly 63 inches. Surprisingly, both meat and skin had 5.5% lipids, differing by only 0.04%.

SPECIES' ANALYSIS

Results of the laboratory analysis show significant differences between meat versus skin tissues in levels of domoic acid, metals, and pesticides. Of the metals, arsenic and chromium were not detected in either fillet or skins and most (86%) of the metal detections in the skins came from zinc & chromium. None were great enough to pose a health risk. Similarly, even though the domoic acid appears high, the health threshold in fish is 21 thousand ppb! Perhaps these detections result from their diet that includes small invertebrates that are algae eaters- and algae produce the toxin. Sturgeon fillets were overall very clean. **The pesticides detected in the skin, however were above recommended levels so it should NOT be eaten** and care should be taken if used to make glue. Sturgeons' long life span make them vulnerable to the effects of bioaccumulation and the majority of the pesticide residues were from the legacy of DDT and chlordane insecticides. It is encouraging that since being banned, detections of these pesticides in the environment has trended to be at lower levels each year; 3% of pesticide residues were from current herbicides.



20. Above: Carrying sturgeon caught in the surf zone along river spit.

KAH-KAH
STURGEON
ACIPENSER
MEDIROSTRIS

Wero-y - River

RESOURCE HEALTH 2010 - 2012



PEE¹-EEH YURS LITTLE MUSSELS *MARGARITIFERA FALCATA*

SAMPLE DESCRIPTION

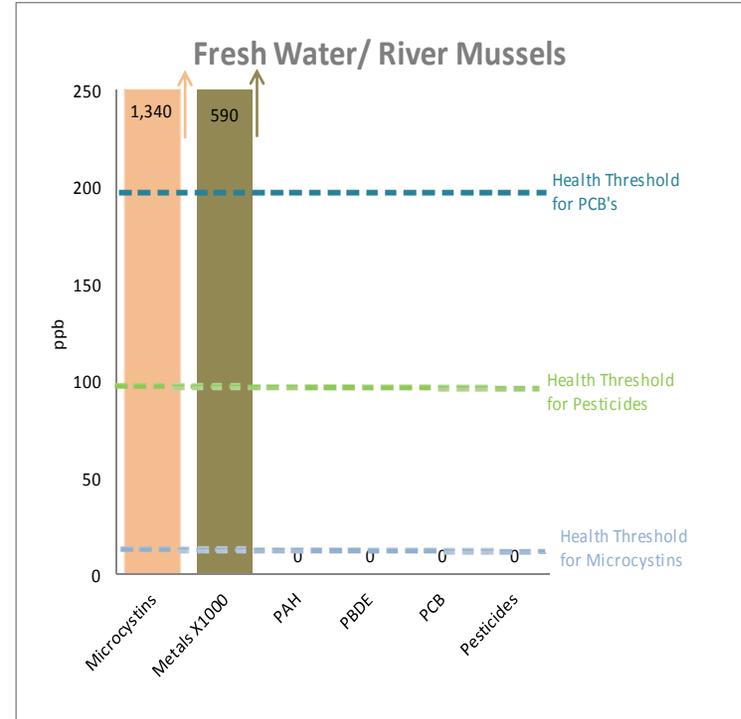
To maintain comparability and representation, mussels were taken within 25% of each other: the average length was 99 mm representing an average age of 41 years (Howard & Cuffey 2006). During October three different beds were sampled; 30 individuals from each.

1. Upper Reservation Klamath River site, near Weitchpec
2. Mid Reservation Klamath River site, below Cooper's
3. Lower Reservation within Klamath estuary across from Blake's

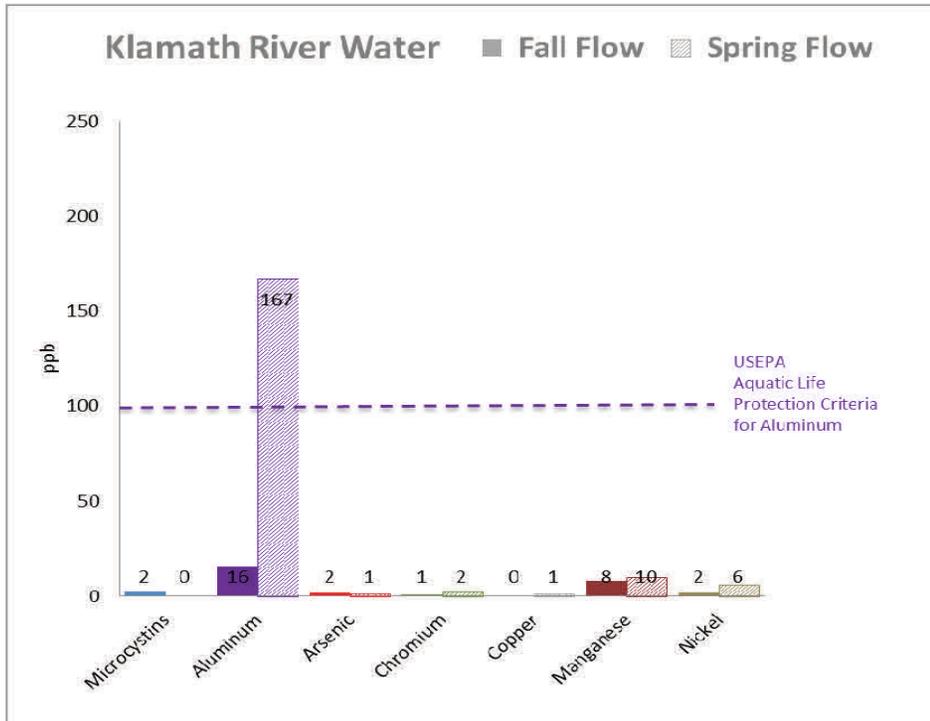
SPECIES' ANALYSIS

Results of the laboratory analysis of the fresh water mussels have no detections for any carbamates, pentachlorophenols (PCP), triazines, trichlorophenals (TCP), PBDEs, PCBs, pyrethroids, organochlorines, nor the class of organophosphate pesticides. Detections in general were low but did include microcystins, dioxins, metals, and PAHs. There was no significant differences between locations in three metals- cadmium, silver, and total mercury. However the mussel bed above Weitchpec was the cleanest of the three sites, countering the generally accepted notion that high metal concentrations come down the River. There were significantly higher metal concentrations of aluminum, chromium, arsenic, copper, manganese, nickel, lead, selenium, and zinc in the mid-river beds, these generally dropped further down river. It's recommended to **limit eating fresh water mussels** due to potential health impacts of two contaminants- manganese levels were as high as 5.68 ppb and microcystin LA peaked at 1,322ppb. California EPA OEHHA consumption threshold for Microcystins is 10 ppb for shellfish.

Manganese and microcystins exceeded current public health limits.



RESULTS FROM TISSUE SAMPLING



HEYHL-KEEK 'WE-ROY
KLAMATH RIVER WATER



'We-roy - River

SAMPLE DESCRIPTION

An isokinetic depth-integrated sampler was used following equal width increment (EWI) methodology to ensure representative cross section samples of the Klamath River. This was collected at 3 sampling location during fall (Sept-Oct) and spring (June) flow regimes.

ANALYSIS

Due to laboratory error, only metals and biotoxins were analyzed. Of these, aluminum was the only metal that exceeded a guidance level. It's Spring concentrations were above the EPA's Aquatic Life Protection Criteria at all sites. Blue green algae was present in both Spring and Fall flows with *Microcystis* cell counts peaking 36,420 cells/L on September 30, 2009 compared to the US EPA Guidelines for Safe Recreational Waters of 40,000 cells/L.

21. Left: Interior of shell used for it's luster in ornamentation. 22. Top Right: Martins Ferry Bridge. 23 & 24. Middle and bottom right: YTEP Water Division staff during sampling. Hanging from the boom at front of boat is the 'bomb' used to collect water for integrated depth sampling.



RESOURCE HEALTH 2010 - 2012



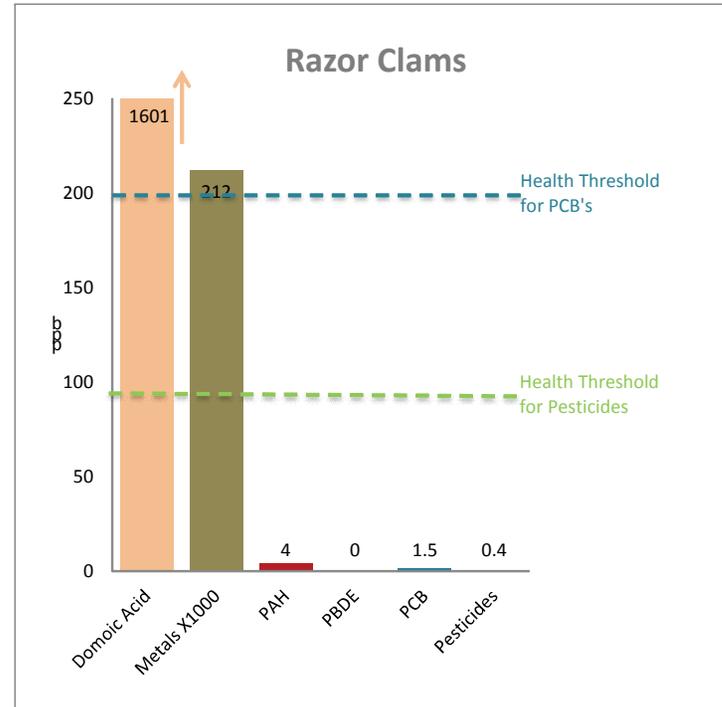
CHPER-GER¹ RAZOR CLAMS *SILIQUA PATULA*

SAMPLE DESCRIPTION

Twenty razor clams were dug on April 22, 2011 from Clam Beach and sent for analysis. Following sampling protocol, individual specimens had their lengths within 25% of each other in order to maintain comparability and representation within the sampled population. The average length was 9.54 cm or 3 3/4 inches.

SPECIES' ANALYSIS

Results of the laboratory analysis of the had NO detections of pesticide residues from triazines, trichlorophenals (TCP), organochlorines, nor the class of organophosphate pesticides. There were extremely low detections of pyrethroids, and dioxins. Although the total quantified PAHs were up to 4 ppb, the carcinogenic compounds were detected at only 3/4 of one ppb. The health threshold for shellfish is 5 ppb. Domoic acid, the toxin responsible for Amnesiac Shellfish Poison was detected but again, below the health threshold of 20,000 ppb. The levels of metals were as expected for marine species and none were over current public health limits.



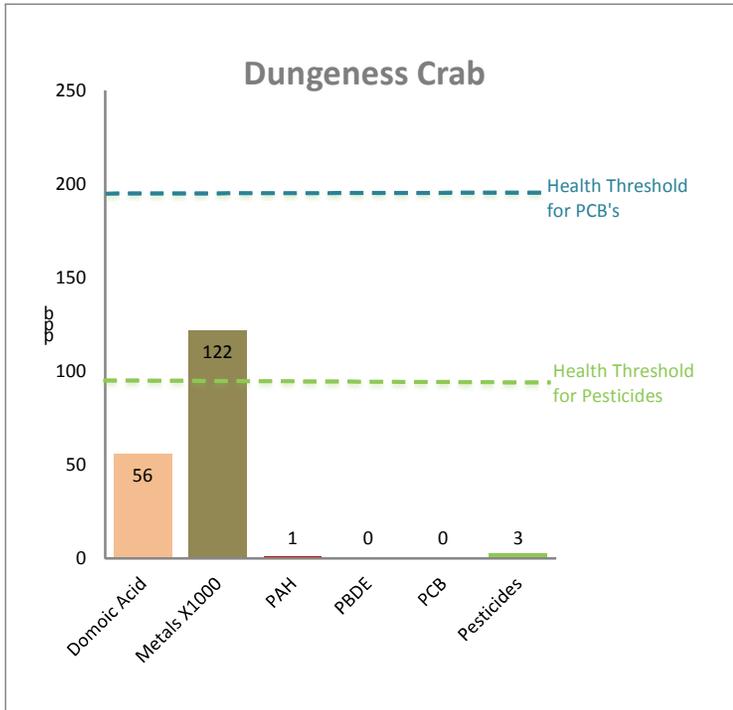
25. Far Left: Clam Beach where harvesting rights were shared with Wiyot Tribe.

26. Left: Looking northward toward Trinidad Bay region where the ancestral villages of Chue-rey and Srey-puer had clamming as an integral part of life.

27. Right: Crab pot with fresh catch.

28. Right top: Cooked crab.

RESULTS FROM TISSUE SAMPLING



KO¹-SES
CRAB, DUNGENESS
METACARCINUS MAGISTER



SAMPLE DESCRIPTION

Six crabs averaging two pounds each or 0.917 kg were caught on February 11, 2011 off the mouth of the Klamath River. Their lipid content was just above the clams, at an extremely low of only 1.5 percent.

SPECIES' ANALYSIS

The Dungeness crab results came back very clean. The low level pesticide detections were predominantly from the legacy DDT family and pyrethroids. The domoic acid level was low and if the guts and 'butter' are cleaned away, the meat is not affected. All metals were within normal levels.

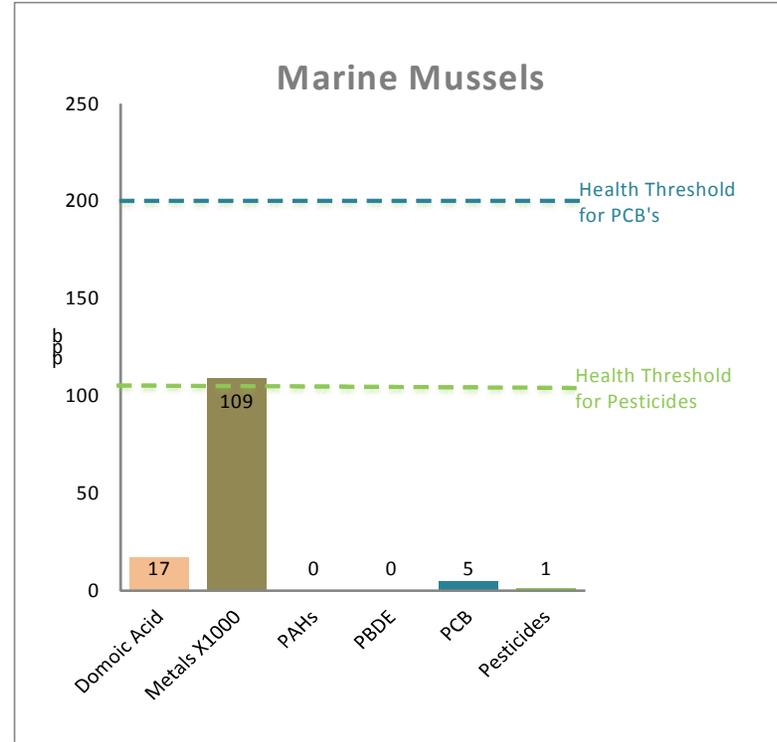
RESOURCE HEALTH 2010 - 2012



PEE'-EEH MARINE MUSSELS *MYTILUS CALIFORNIANUS*

SAMPLE DESCRIPTION

In total, 14 traditionally harvested mussel beds were inventoried to characterize their general condition from within coastal Yurok Ancestral Territory. Mussels from seven sites were sampled for laboratory analysis. During June 2010, ten mussels each, from three sites were analyzed: Wilson Beach, north of Redwood Creek, and from the north side of Trinidad head. There was a wide range in sizes across the rocks and only medium ones were harvested. These averaged 13.37cm, or 5 1/4 inches. In June 2011, four additional sites were sampled: Moonstone Beach, rocks from the northern edge of Stone Lagoon, south of Dry Lagoon, and at Hidden Beach. They were the least fatty of any of the species tested in this study with only 0.69 % lipid content.

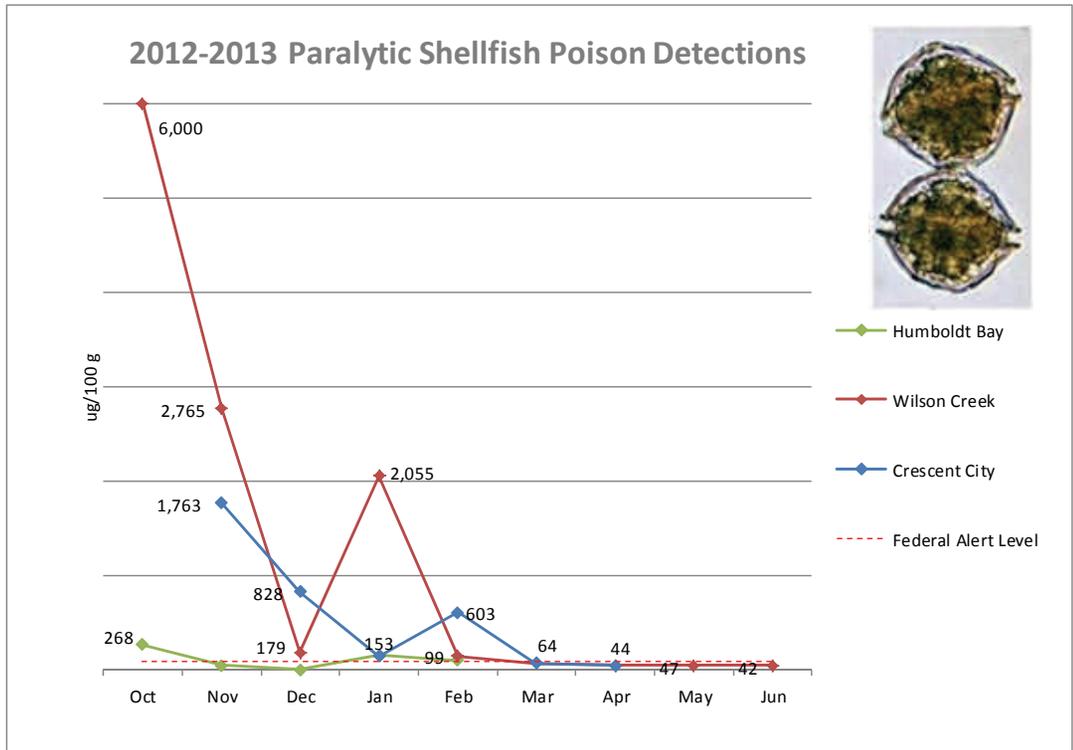


SPECIES' ANALYSIS

In general, results of the laboratory analysis of marine mussels had no detections for carbamates, PBDEs, carcinogenic PAHs, pentachlorophenols (PCP), triazines, trichlorophenols (TCP), nor organophosphate pesticides. Dioxins, organochlorines, and pyrethroids were detected at extremely low levels. Nearly all metal detections were for aluminum that returned nearly 100 ppb, however that is only a tenth of the total contaminant load allowed by the US Food and Drug Administration. In 2010-11 the only other detections were low levels of domoic acid, produced by diatoms of *Pseudo-nitzschia*, that can produce health problems at higher levels. Not only have marine mussels been an important part of the traditional Yurok diet, but remain one of the healthiest subsistence foods when not impacted by paralytic shellfish poison.

29. Right: Tribal member and staff, Emery Mattz, harvesting mussels near the sites of *O tme-kwoovr* & *See-we'ch*.

RESULTS FROM TISSUE SAMPLING



30. Above: Looking southward across Stone Lagoon toward the traditional village area of Chab-pek.

31 & 32. Below: Marine Mussel beds.



PARALYTIC SHELLFISH POISON (PSP) TOXIN ANALYSIS

Historically, algae blooms are periodic events that happen when cold water upwelling slows and warm surface waters remain undisturbed. However, in Fall 2012 a red tide appeared along the coast of the Pacific Northwest states from high concentrations of the dinoflagellate *Alexandrium* that causes paralytic shellfish poisoning. Levels of PSP in October 2012 were the highest ever recorded and the longest lasting; the California State Quarantine was only lifted for one month (mid-March to mid-April). Also in contrast to past years, in 2013 once detections of PSP dropped below the Federal Alert Level it still remained present at low levels. Mutual concern for public safety has created a strong working relationship between the CA Department of Public Health, who provides laboratory analysis of the marine mussels and YTEP, who provides the local mussel samples from Yurok Territory. Together, they continue monthly testing. The PSP testing as presented in this brochure was not funded by EPA NCER but is included for informational purposes.

RESOURCE HEALTH 2010 - 2012



KEY-WEEN WE CHEY-GEL' SPRING SEAWEED *PORPHYRA SPECIES*

SAMPLE DESCRIPTION

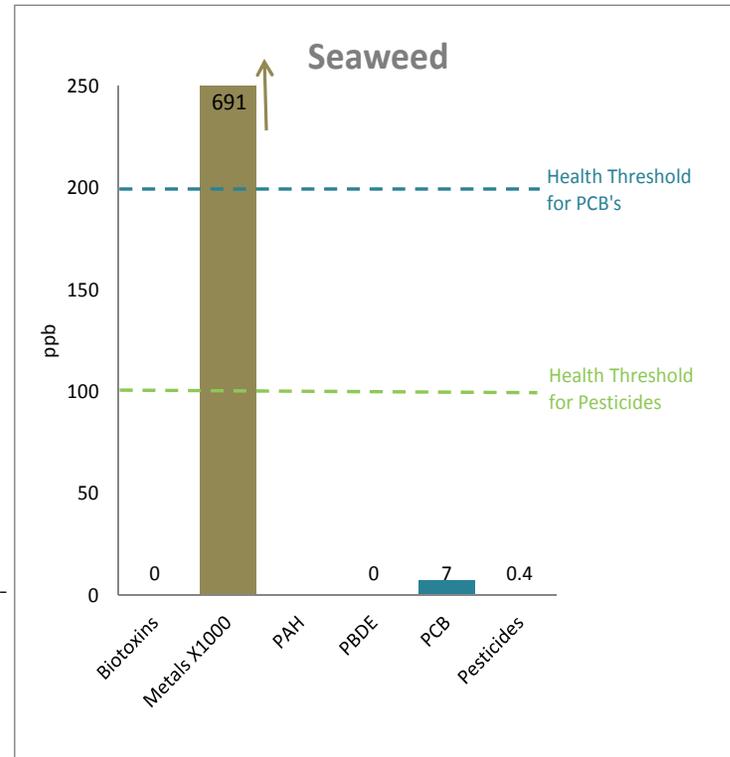
Approximately one liter of seaweed was collected as composite samples from five sites: three in June 2010 and two during April-June 2011. In 2010, the sample was from the edible *Palmaria* species and in 2011, from *Porphyra*, the most commonly harvested species.



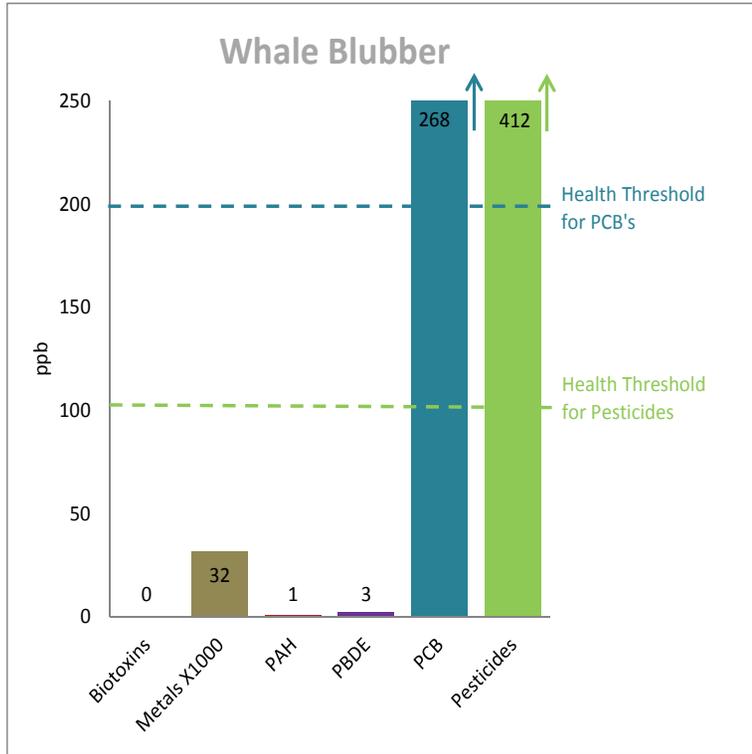
33 & 34. Top: Seaweed can grow as individuals from one holdfast or during good years to cover entire rocks. 35. Above: Looking towards 'Er Hler-ger' (False Klamath Rock) near the location of traditional village of O'men-Hee-puer.

SPECIES' ANALYSIS

Results of the laboratory analysis from both years of seaweed show it very clean with no detections of any biotoxins, carbamates, pentachlorophenols (PCP), triazines, trichlorophenols (TCP), PBDEs, PCBs, pyrethroids, organochlorines, nor the class of organophosphate pesticides. Detections of contaminants were very low but did include PCBs and a slight trace of the pesticide chlordane that was often used for termite control. All uses of chlordane in the US were banned in 1988 however it is very slow to break down. For comparison, the most stringent threshold for chlordane was set by the US EPA to be no greater than 2 parts per million (ppm) in drinking water and the seaweed only had less than 1/4 of one part per BILLION (ppb)! The PAHs in the *Porphyra* species were significantly different between sites with Trinidad seaweed having the highest detections of 7 ppb versus Wilson Creek with PAH detections of only 1 ppb. No individual metals were over health advisory thresholds and since many metals are required as part of a health diet its one of the reasons for harvesting seaweed!



RESULTS FROM TISSUE SAMPLING



SPECIES' ANALYSIS

Both the whale blubber and liver were sent for laboratory analysis. The liver had very low detections of contaminants however the blubber had high levels of PCBs and pesticides, probably because these are mostly stored in the fatty, high lipid tissues. Both exceed the recommended limits for contaminants in food and as such, would have been a high risk should it have been eaten. There were no detections for any carbamates, pentachlorophenols (PCP), triazines, trichlorophenals (TCP), PBDEs, PCBs, pyrethroids, nor the class of organophosphate pesticides. Of particular concern to many Tribal members was whether microcystin toxins could have played a role in the death of the mother whale. None were detected in either the blubber, nor the liver where they would have been stored.



HEYKW-SA'
WHALE
ESCHRICHTIUS ROBUSTUS

SAMPLE DESCRIPTION

Although Yurok traditions include harvesting of stranded whales, concerns over the cause of death prevented Tribal members from utilizing the whale from the Klamath River during this study. Northwest Fisheries Science Center (Gina Ylitalo), the Marine Mammal Center (Denise Greig), and representatives of Yurok Tribal Council oversaw the respectful sampling of the mother whale that entered the estuary in June 2011 with her calf and died several weeks later. Her calf successfully swam out to sea on July 23. The National Oceanic and Atmospheric Association (NOAA) reported that her skin had multiple abrasions, cuts and a fungal infection. One fin was badly infected and had dead tissue. Her cause of death was listed as resulting from secondary infection due to her skin problems, possibly blood poisoning.



RESOURCE HEALTH 2010 - 2012

KEY FINDINGS

- ◆ **Organophosphate, carbamate, pentachlorophenol (PCP), triazine, or trichlorophenol (TCP), based pesticides were NOT detected in ANY of the species tested.**
- ◆ **Very low levels of dioxins WERE found in ALL species.** These are formed as a bi-product of certain manufacturing processes and during combustion processes such as forest fires and backyard trash burning.
- ◆ **Mercury levels** in ALL Klamath River fish were **very low**.
- ◆ **PCBs were detected in ALL species** but generally at levels of about 1/8th the health threshold for foods. Our results support the findings that PCBs bio-accumulate and are usually stored in fatty tissue; the longest lived species, the sturgeon had the highest levels followed by lamprey that have the highest fat content. **ONLY** the whale blubber had levels of concern. The Dungeness crab, Coho salmon, and razor clams had the least, just barely detected at extremely low levels of less than one thousandth of one part per billion.
- ◆ **DDT residues were found in ALL species** except for razor clams and fresh water mussels.
- ◆ The blue-green algae toxins, the **microcystins were found at HIGH levels in the fresh water mussels**- 6X the recommended CA EPA OEHHA shellfish consumption level.
- ◆ **The main contaminants found at levels for concern are in the family of poly-cyclic aromatic hydrocarbons (PAHs).** However the most dangerous ones that cause cancer were generally NOT present. However, according to the World Health Organization's 2010 report, Persistent Organic Pollutants Impact on Child Health, there are still health risks from the non-carcinogenic PAHs including disruption of the endocrine, reproductive, and immune systems; neurobehavioral disorders; and obesity.

BENEFITS OF EATING FISH

- ◆ **Fish is a vital part of a healthy diet.** Fish is high in protein, low in fat, and full of nutrients. The American Heart Association recommends eating fish at least 2 X per week.
- ◆ **Fish is good for your heart** and can help prevent heart disease and stroke by reducing blood pressure, inflammation, and blood clotting. Eating fish could cut the risk of death from heart disease by a third.
- ◆ **Fish is an excellent source of omega-3 fatty acids,** which are not found naturally in our bodies. They are especially important during pregnancy for the healthy development of a child's brain, retina, and nerve tissue.

REFERENCES

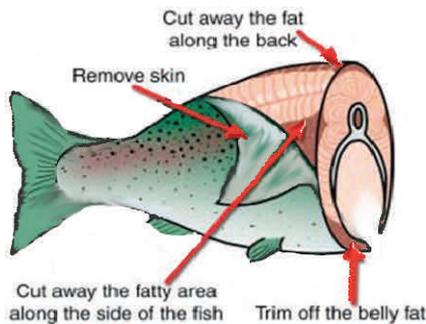
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RESULTS FROM TISSUE SAMPLING

RECOMMENDATIONS

Protection of the environment is important to protecting tribal health, the health of the Klamath River and the health and abundance of aquatic species important to Yurok culture, economy, and subsistence. The highest contaminant levels identified were PAH's which are by-products from the burning of trash and other carbon-based materials. **Please DO NOT BURN your garbage. Today's trash has more plastics and other things made with chemicals than in the past. Burning does NOT get rid of them but only transforms them. The toxins produced from trash burning will end up in your foods, your river, and your body!**

Most exposures to persistent organic pollutants (POPs) are through consumption of contaminated food and these pollutants are accumulated in animal fats, so reducing the amount of animal fats that you eat may reduce the risk of diabetes. Also, PAHs are found in almost all organs with the highest levels in the guts, skin, and the belly flaps of fish. **If you limit the amount of these parts from the fish that you eat, you will also be reducing your exposure to these contaminants.**



Considerable differences in PAH levels are found in how foods are cooked. PAHs become concentrated and others added by the longer the food is exposed to direct flames and by the closeness to hot heat such as flames. In contrast, meat cooked with coals, angled to allow the melted fat to drip away but NOT into the flames, shows that additional POPs on the meat can be prevented and those contaminants that in the fat, reduced (Lijinsky and Ross 1967). **In other words, cooking fish the traditional way (on sticks) is a good way to protect your food and body from these contaminants.**

Yurok Traditional Subsistence Foods tested in this study are healthy foods. They are in good condition and are safer from contaminants than many non-organic foods you buy in a

PREPARE FISH

If you are concerned about these toxins, or are preparing fish for children, pregnant women, and or the elderly consider removing the skin and fatty regions when cleaning the fish.

DDTs, PAHs, and many other contaminants collect in the fatty parts of fish and can be reduced by up to 50% if you:

- ◆ Consume younger, smaller fish (keep within legal limits).
- ◆ Avoid all internal organs. Do not use for sauce or gravy.
- ◆ Grill, bake, or broil fish so that the fat drips away while cooking without dropping into the fire.

R E S O U R C E H E A L T H R E P O R T

**The Yurok Tribe
Environmental Program**

15900 Highway 101 N
PO Box 1027
Klamath, CA 95521



The Yurok Tribe Environmental Program (YTEP) Is headquartered to the east of HWY 101 in the old Forest Service Lodge, 4 miles north of the Tribe's Main offices. We're just after the Fire Station Offices but south of Wilson Beach and the Redwood Villas and store. If you have any questions or want additional information- *Please visit our website, email or call.*

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