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Laurie Niewolny, Water Quality Program
Washington State Department of Ecology
PO Box 47600, Olympia, WA 98504

Dear Ms. Niewolny

I am writing in support of the issuance by the Department of Ecology (DOE) of final NPDES permits for the rearing of steelhead (O. mykiss) in net pens by Cooke Aquaculture at all four sites (Clam Bay, Fort Ward and Orchard Rocks (all in Rich Passage) and Hope Island in Skagit County.

I have been involved in fisheries science, research, policy, and law since the late 1970s. During that time, I have worked for state, federal and multi-jurisdictional agencies as well as in private industry in fisheries and aquaculture. I have worked in North and South America in these endeavors and I am knowledgeable regarding the practices of the salmon and trout aquaculture industry. I support efforts to ensure a sustainable environment in the Puget Sound area and throughout Washington. I support efforts to ensure that efforts are made to preserve and sustain wild salmon stocks. I also support efforts to support sustainable aquaculture in Washington and efforts to produce healthy seafood whether through wild capture fisheries or aquaculture – whether finfish, shellfish, or marine and aquatic plants.

As noted by the DOE -- the public should keep in mind that the draft NPDES permits involve a proposal to rear *sterile* native steelhead in *substitution for* Atlantic salmon previously reared at these sites. From an environmental perspective there is, to my knowledge, no evidence that this change will result in any substantive change in feed quality or quantity that will be used or effluent quality or quantity from the baseline condition – which was through the rearing of Atlantic salmon. Moreover, on an absolute basis the issuance of the revised NPDES permits will, in my view have no probable significant adverse effect on the environment.

The trout proposed to be reared will be sourced from Troutlodge, a trout egg production company located in Bonney Lake, Washington. I am now retired but I previously worked at Troutlodge hatcheries from 2007 through 2018. I thus have knowledge of Troutlodge procedures and practices. The sterile eggs produced by Troutlodge are made using organic measures, (pressure) to create triploid eggs. The resulting batches of eggs are virtually 100 percent sterile (greater than 99.5% sterile) based on years of testing results at Washington State University. Further, trout at Troutlodge have been domesticated and bred over many decades for hatchery production and in the event any trout should escape from the net pens, these trout will not fare well in the wild environment. They will likely be caught by anglers, seals, sea lions, or orcas or die from starvations as they are very unlikely to identify and capture wild prey items.

Moreover, the broodstock at Troutlodge is subject to a robust fish health and biosecurity program. Each year thousands of samples are taken and analyzed for a suite of pathogens and parasites. The analyses are conducted independently at the Washington Animal Disease Diagnosis Laboratory (WADDL) at Washington State University. The samples and preparations thereof are supervised by a USDA-approved veterinarian. If WADDL identifies any reportable pathogen, those results must be reported to the U.S.D.A. Animal Plant Health Inspection Service (APHIS) and Washington Department of Fish and

Wildlife (WDFW). Fortunately, the biosecurity and fish health program at Troutlodge has been instrumental in preventing the introduction of aquatic animal pathogens at Troutlodge. Based on the sampling and diagnostic results at WADDL and the facility inspections conducted by APHIS itself, APHIS has been able to certify that the eggs Troutlodge complies with the pathogen-free standards and criteria of the World Organization for Animal Health pathogen standards and that Troutlodge meets the requirements set out by WDFW.

The United States and the State of Washington have robust environmental laws and regulations that are rigorously enforced. Moreover, many private aquaculture companies such as Troutlodge and Cooke Aquaculture and others aquaculture companies meet additional environmental performance requirements through independent private entities -- GLOBALGAP, Global Aquaculture Alliance BAP, and others. These organizations establish best practices and standards for environmental sustainability as well as labor and community/social practices. To be awarded certification, companies must undergo third party independent audits to demonstrate adherence to applicable laws, rules, and standards. Both Troutlodge and Cooke Aquaculture have met either or both GLOBALGAP and BAP certification.

Moreover, for a number of other reasons, enumerated below, DOE should support aquaculture in all its forms, whether finfish, shellfish, kelp or seaweed and whether at-sea, in the shoreline, whether on land in traditional flow through operations or recirculating aquaculture systems.

1) WORLD POPULATION GROWTH AND THE LAND WATER AND FOOD GAP:

Currently, the world's human population is about 7.5 Billion. Already, land-based agriculture uses 75% of the world's developed land. Land-based agriculture uses 70% of the world's freshwater resources. By the year 2050, the U.N. estimates the world human population will reach 9.8 Billion and they are will have a higher life expectancy. See Word Resource Institute [1].

Planet Earth is sometimes referred to the "Blue Planet" and it would be more aptly named, Planet Water. Over 70% of the earth's surface is covered by water, more specifically, salt water. Of our planet's water, by volume, 97.5% is seawater and only 2.5% is freshwater and of that freshwater only 1% of that water is easily accessible. Of the 30% of the land surface on our earth, only 11 % is arable and capable of growing crops. As our population grows, less land per unit population is available for food production.

A significant and critical worldwide food and land gap is growing. We will need to increase by food calories by 56% and protein production will need to increase by 70% to meet this gap. To do this with land-based agriculture, an additional 2.3 million square miles (roughly equivalent to 74% of the contiguous U.S.) of agriculture land is needed. Clearly, we cannot manufacture new agricultural lands. However, we can take advantage of our oceans and brackish water – right here in Washington State -- to grow healthy seafood. The growing land, freshwater and food gap is a fundamental reason why the DOE should approve the four draft NPDES permits under consideration.

2) CLIMATE CHANGE -- GLOBAL WARMING AND SEA LEVELS ARE RISING

The land, water and food gap referenced above will only worsen due to global warming. The Intergovernmental Panel on Climate Change (IPCC), the World Resource Institute and U.N. FAO have

[1] https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html

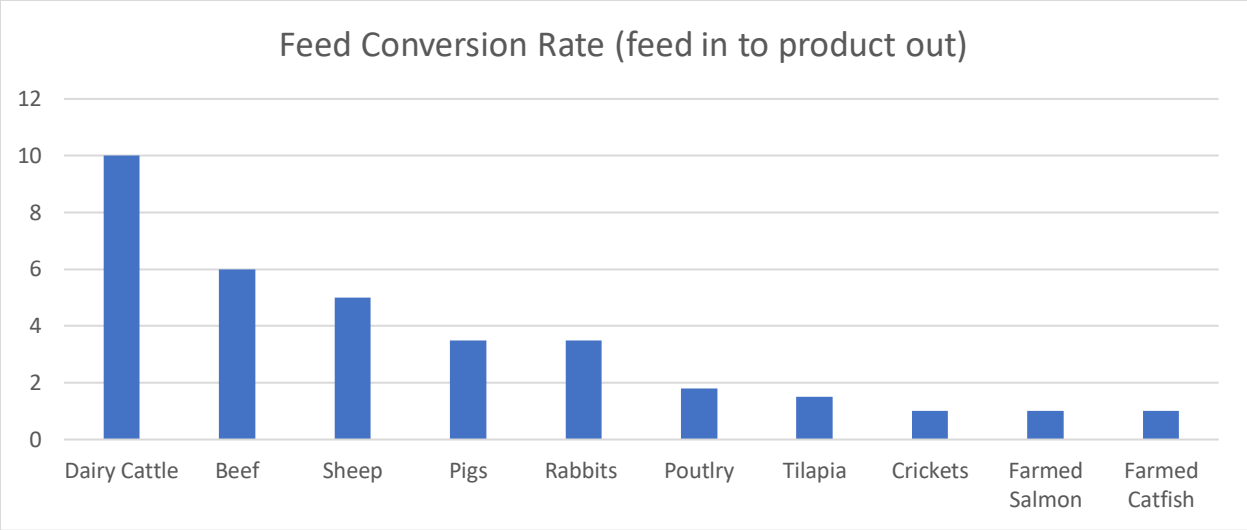
documented that the worldwide food crisis will continue to grow, not only because of population growth, but for several other reasons. These other factors include climate change, rising sea levels, salt water intrusion, extremes in rainfall and temperature, snow, wind, floods, intense heat weaves and droughts, colossal forest fires, more and stronger hurricanes and generally less freshwater where it is needed. For example, a sea level rise of only three feet is expected to destroy 40% of the Mekong Delta, Vietnam's rice basket. In terms of temperatures, five of the warmest years recorded from 1880 to 2019 all occurred after 2015 and nine out of ten of the warmest years ever recorded occurred since 2005. Global warming is widely expected to adversely affect land-based agriculture. In view of global warming and anticipated effects on agriculture, Washington State needs a State aquaculture plan. Further, in view of the anticipated effects of global warming on land-based food production, DOE should approve the four draft NPDES permits under consideration.

3) ENVIRONMENTAL FOOTPRINT OF AQUACULTURE IS RELATIVELY LOW

It is widely acknowledged that human-caused Greenhouse Gases (GHGs) are responsible for global warming. However, the global appetite for reducing GHGs is quite low. In part, this stems from our dependence on fossil fuels and because the lag time from GHG emissions and their effects on the environment are on the scale of a century. This makes the politics of reducing GHG emissions very difficult.

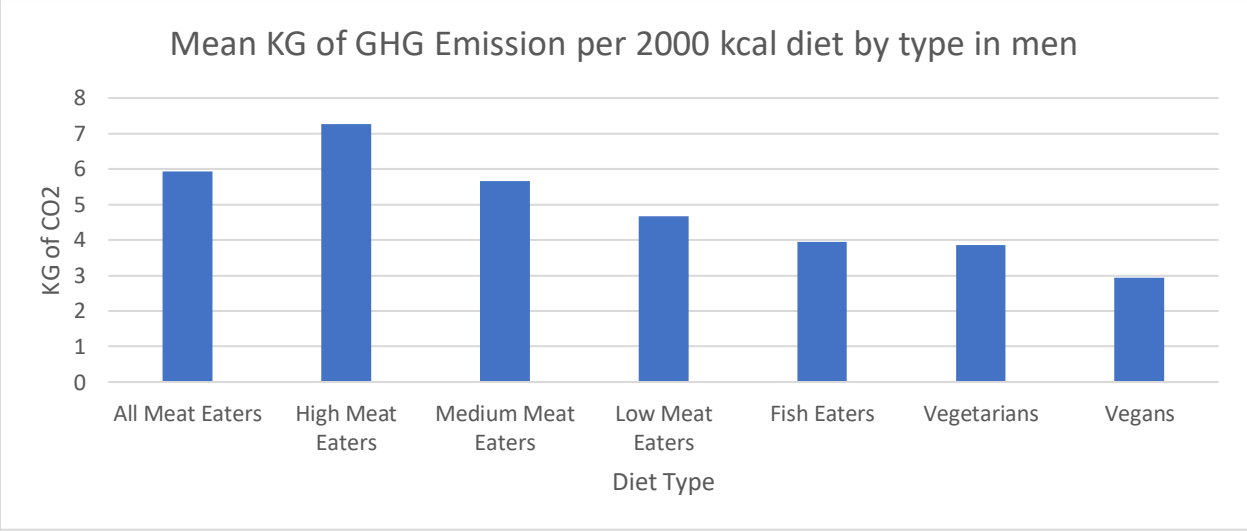
However, we know that various types of activities do result in GHG emissions. All food production systems result in environmental impacts including GHG emissions. Traditional land-based agriculture accounts for about 12 percent of methane emissions, a potent GHG.

Fortunately, aquaculture is the most efficient form of animal protein production. Aquaculture is environmentally efficient for several reasons but primarily because fish and shellfish are ectotherms -- they do not spend energy to maintain a constant body temperature (like most mammals). Secondly fish and shellfish do not fight gravity. Fish are neutrally buoyant and movement in the water column is almost effortless and most shellfish, through most of the life cycle, are sessile, affixing themselves to once place and staying there. Because these animals do not fight gravity, they either do not have an internal bony support structure or have a very small one. For this reason, the edible portion of fish is very high – say 70%-80% for trout and salmon as opposed to only 40% for cattle. Moreover, the feed conversion efficiency in fish is very high relative to other forms of animal protein production.



Aquaculture and finfish aquaculture in particular require very little water consumption. For example, to grow 1 kilogram (2.2 lbs) of salmon requires about 900 liters (240 gallons) of water whereas 1 kg of beef quires 15,000 liters (4,000 gallons) of water.

The graph below shows that consumers who eat fish produce much lower carbon emissions on a dietary basis than say, meat eaters.[2]



Aquaculture is also spatially efficient. Because fish and shellfish can be grown throughout the water column, a very small surface footprint is needed to produce large numbers of finfish or shellfish.

Moreover, if fish are produced locally, either in the wild or via aquaculture, then the carbon and environmental footprint of that production is even lower, as the fuel cost and emissions produced when transporting seafood from local areas to local markets is much lower than importing such products from, for example, Norway, Chile or China.

[2] Data summary Scarborough et al. 2014

The State of Washington is committed to reducing GHG emissions and combating global warming – as it should be. Consequently, DOE should support aquaculture as the most efficient means of producing animal protein and having a low environmental and carbon footprint – particularly when we raise the seafood products are produced right here in Puget Sound. For this reason, DOE should approve all four of the finfish aquaculture draft NPDES permits.

4) U.S. CONSUMERS SHOULD EAT MORE SEAFOOD

Seafood is high in protein which is critical for our body composition and the building of muscle, bone, cartilage, other tissues. This protein comes from amino acids, nine of which are considered "essential" amino acids. All plants lack at least 1 amino acid. However, by eating a balanced diet of vegetable matter, sufficient protein can be obtained. In addition to being high in protein, seafood is high in vitamins A, B12, and D; and seafood is comprised of many micronutrients like iron; zinc; magnesium; phosphorous; and potassium. Seafood, particular oily fishes, like salmon and trout, are high in Omega-3 fatty acids, (e.g., eicosapentanoic acid and docosahexaenoic acid) and these nutrients are critical for fetal development, heart health, cognitive performance, etc.

Salmon and trout reared via aquaculture are also be high in carotenoids, which give them the red color of the flesh. These carotenoids (astaxanthins), are the same natural compound that causes leaves to turn red and yellow in the fall. The astaxanthins are also an antioxidant and are found in most health food stores as an antioxidant intended directly for human consumption. The astaxanthins are typically harvested from algae and added to the fish feed and is naturally taken up by the fish. In short, the astaxanthins are good for the fish and good for humans.

Many epidemiological and nutrition studies have shown that eating finfish produces many health benefits. Among them are the following:

a) 84,000 premature deaths could be avoided if more seafood was eaten in the U.S. https://hms.harvard.edu/news/burden-calculated-preventable-causes-death
b) Increased cognitive scores, reduced ADD hyperactivity disorder, better academic performance in children whose mothers at between 4 oz and 12 oz of seafood per week during pregnancy. Almost all of the studies on seafood consumption during pregnancy and lactation reported beneficial outcomes for children, including five that found that compared to children of mothers who ate none, those whose mothers ate more than 12 ounces of seafood a week had significantly higher verbal I.Q. scores. In children, the benefits of eating seafood were apparent as early as 14 months. The studies variously found that seafood eaters had lower risk of attention deficit hyperactivity disorder, better school grades, and higher I.Q. by as much as 9.5 points compared with their peers who ate no fish. The highest intakes — more than 8 to 12 ounces a week — were associated with the greatest benefits. https://www.plefa.com/article/S0952-3278(19)30192-9/fulltext Relationships between seafood consumption during pregnancy and childhood and neurocognitive development: two systematic reviews. Hibbeln, CAPT Joseph R. et al. (Journal of) Prostaglandins, Leukotrienes and Essential Fatty Acids, Volume 0, Issue 0, 2019. https://www.plefa.com/article/S0952-3278(19)30192-9/fulltext see also https://www.nytimes.com/2019/10/30/well/eat/children-pregnant-women-eat-fish-seafood-brain-smarter.html We conducted two systematic reviews, evaluating the relationship between seafood consumption in pregnancies and in childhood on neurocognitive development using methodologies detailed by the Dietary Guidelines for

Americans Scientific Advisory Committee 2020-2025. •This evaluation of seafood inherently integrates any adverse effects from neurotoxicants, if any, and benefits to neurocognition from omega-3 fats, as well as other nutrients critical to optimal neurological development. •No adverse effects of seafood consumption on neurocognition were found in 44 publications reporting on 102,944 mother-offspring pairs and 25,031 children. •Benefits to neurocognitive development began at the lowest amounts of seafood consumed in pregnancy (~4 oz/wk) and up to >100 oz/wk, with benefits to age appropriate measures of neurocognitive development including an average increase of 7.7 IQ points. •Consumption of >4 oz/wk and likely >12 oz/wk of seafood during childhood had beneficial associations with neurocognitive outcomes. •A clear understanding of the effects of seafood consumption on neurocognition can have significant public health implication

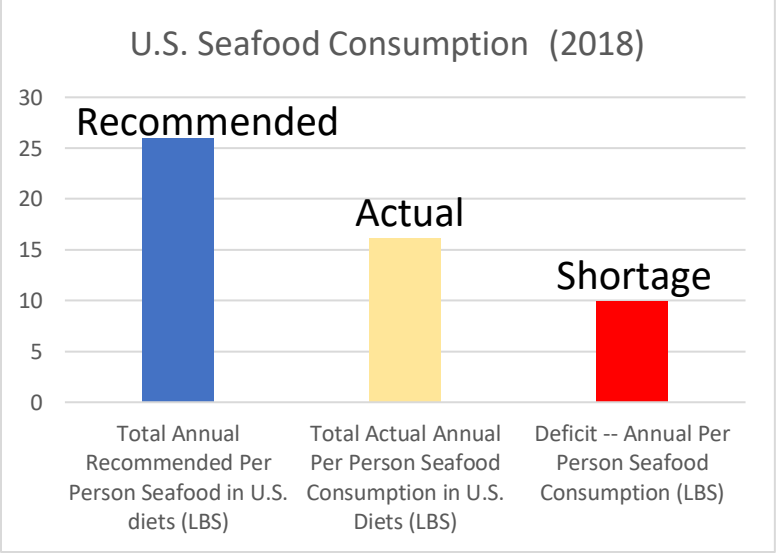
c) Reduced incidence of heart attack and strokes (40,000 men in study had 15% lower risk of heart disease by eating on serving of seafood per week) L Diousee et al. Fish consumption, omega-3 fatty acids and risk of heart failure: a meta-analysis J. Clinical Nutrition (Dec. 2012). An analysis of 20 studies involving hundreds of thousands of participants indicates that eating approximately one to two 3-ounce servings of fatty fish a week—salmon, herring, mackerel, anchovies, or sardines—reduces the risk of dying from heart disease by 36 percent. Mozaffarian D, Rimm EB. Fish intake, contaminants, and human health: evaluating the risks and the benefits. JAMA. 2006; 296:1885-99. https://www.hsph.harvard.edu/nutritionsource/fish/#1
d) Fish contains nutrients crucial during neural development. Omega-3 fatty acids are essential for growth and development. The omega-3 fat docosahexaenoic acid (DHA) is especially important for brain and eye development. changes in brain concentrations of DHA are positively associated with changes in cognitive or behavioral performance. “Is docosahexaenoic acid, an n-3 long-chain polyunsaturated fatty acid, required for development of normal brain function? An overview of evidence from cognitive and behavioral tests in humans and animals”. J.C. McCann and B.N. Ames Am J. Clin. Nutr. Aug 2005. Caution for some fish species high on food chain due to mercury.
e) Increase seafood consumption slows rate of mental decline. Many studies suggest that people who eat fish have slow rates of age-related mental decline. Fish consumption and cognitive decline with age in a large community study M.C. Morris et al. Arch Neurol. Dec 2006. And they have more gray matter – the brains functional tissue. “Weekly consumption of baked or broiled fish was positively associated with gray matter volumes in the hippocampus, precuneus, posterior cingulate, and orbital frontal cortex even after adjusting for covariates. These results did not change when including omega-3 fatty acid estimates in the analysis”. Regular fish consumption and age-related brain gray matter loss. C.A. Raji, et al. Am. J. Prev. Med. Oct. 2014.
f) Less depression in those who regularly eat fish Omega-3 Fatty Acids and Depression: Omega-3 Fatty Acids and Depression: Scientific Evidence and Biological Mechanisms. G. Grosso et al. March 2014 Oxidative Medicine and Cellular Longevity. Also improves treatment results when antidpressive medicines used.
g) Reduced risk of autoimmune diseases, like Type 1 Diabetes; T1D occurs when immune system attacks cells in beta cells Pancreas. Several studies link Ω3 or fish oil with reduced risk to T1D in children and autoimmune diabetes in adults. L.C. Stene et al. Use of cod liver oil during first year of life is associated with lower risk of childhood-onset type 1 diabetes: a large, population

based, case-control study. Am, J. Nutrition. Dec. 2003; J.E. Lofvenborg et al. Fatty fish consumption and risk of latent autoimmune diabetes in adults. Nutrition & Diabetes Oct. 4(10) 2014

h) Seafood consumption may help prevent asthma in children. Studies show that regular fish consumption is linked to a 24% lower risk of asthma in children. Y. Huan, X. Pengcheng, and H Ka. Fish and Fish Oil Intake in Relations to Risk of Asthma: A Systematic Review and Meta-Analysis. PLoS 2013 (8)11. Other studies generally show, even in adults, that vegetable oils substituted for marine oils in the diet increases the risk of asthma by 67%. Shahieda et al. **Relationship between Serum Omega-3 Fatty Acid and Asthma Endpoints**. *International Journal of Environmental Research and Public Health*, 2018; 16 (1).

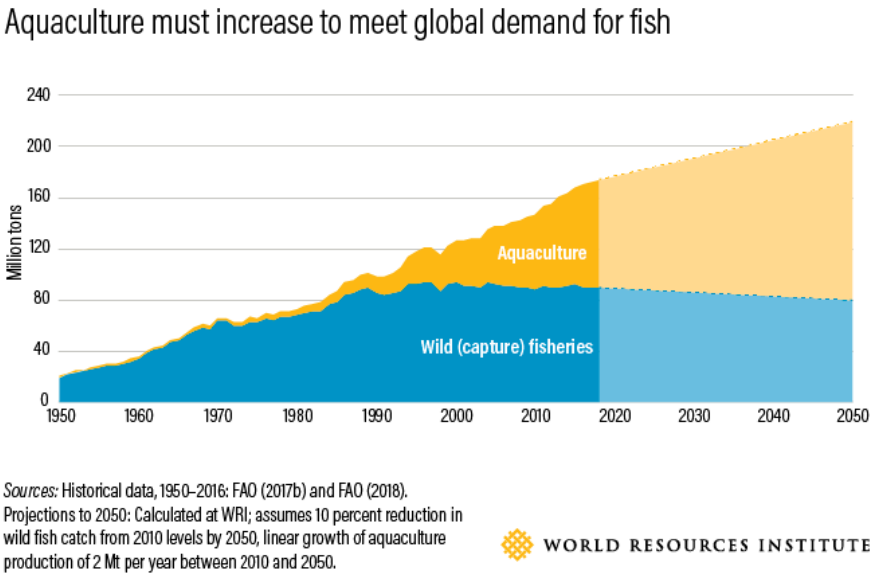
i) Fish and related Ω3 fatty acid consumption may protect adults from age-related macular degeneration and vision impairment and blindness. Regular fish consumption can decrease risk of AMD in women by 42% - 53%. Dietary ω-3 Fatty Acid and Fish Intake and Incident Age-related Macular Degeneration in Women. Christen, W et al. Arch Opthalmol. 2011 Jul; 129(7) 921-929. Further eating oily fish at least once per week compared with less than once per week was associated with a halving of the odds of AMD. Oily fish consumption, dietary docosahexaenoic acid and eicosapentaenoic acid intakes, and associations with neovascular age-related macular degeneration. C. Augood, et al. Am J. Clin Nutr Aug 2008 88(2) 398-406.

The U.S. Department of Agriculture (USDA), based on nutrition and epidemiological studies like those cited above, recommends that consumers should eat two 4-ounce seafood meals per week. The USDA weekly seafood consumption recommendation equates to about 26 pounds of seafood per year. However, U.S. consumer eat only about 16 pounds per capita (2016) so the per capita seafood consumption needs to increase by about 10 pounds. The graph below reflects the USDA seafood consumption recommendation vs. actual consumption and the shortage of seafood consumption.



However, there is not enough wild seafood to meet this need. Data collected by the UN FAO show that most wild fisheries are completely exploited, with some of these fisheries over-exploited. On the other hand, aquaculture is growing everywhere at very high rates -- except the United States. The graph below shows that on a worldwide basis, aquaculture accounts for half of all seafood produced

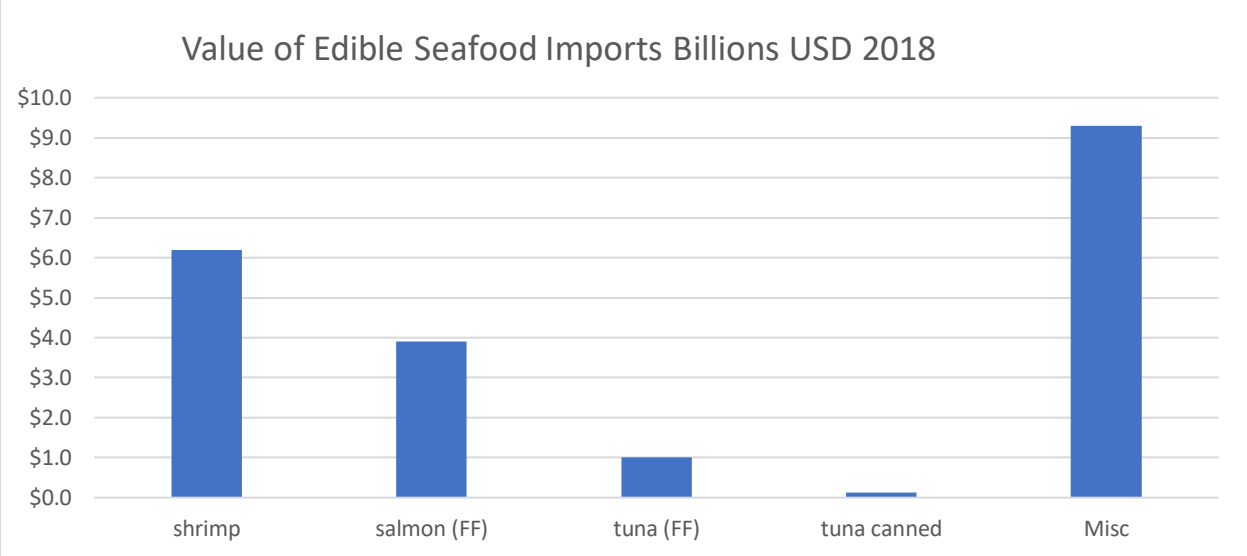
worldwide and, in the future, we need more aquaculture to meet the worldwide nutritional demand for seafood.



To increase U.S. consumption of seafood to meet U.S.D.A. standards, seafood must be more accessible and affordable to those of modest means. To achieve this goal and facilitate making the U.S. population healthier through seafood consumption, DOE should approve all four of the finfish aquaculture draft NPDES permits.

5) U.S. IMPORTATION OF SEAFOOD AND THE RELATIONSHIP TO JOBS IN RURAL AREAS

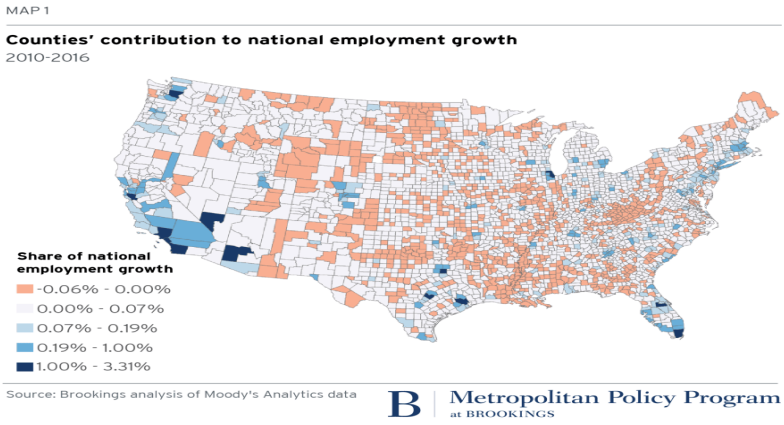
According to data supplied by NOAA, the U.S. imported nearly $4 billion worth of salmon in 2018.



While importation of seafood is currently very much needed, the U.S. and Washington State in particular, have the know-how, the desire, the resources, and the workers ready and willing to raise seafood. Consequently, reliance on the importation of salmon to meet our needs represents a forgone

opportunity. Aquaculture is typically carried out in rural areas where family wage jobs are rare and even rarer in the CV-19 environment. If salmon aquaculture were to be actively promoted in Washington, hundreds if not thousands of new and good-paying jobs could be created where they are desperately needed – in our rural counties.

While much pre-CV-19 job growth occurred in Seattle and Redmond corridor, Washington had virtually no job growth in the rural areas such as Clallam County. Moreover, Tribal Governments have been hard hit by the lack of jobs and opportunities to make good on federally guaranteed Treaty rights to harvest fish and shellfish in their usual and accustomed areas. The graph below demonstrates the lack of job growth in rural areas.



If the DOE is interested in improving the health of Washington's residents and U.S. consumers, and helping Tribal communities, then it should support sustainable aquaculture and DOE should approve all four of the finfish aquaculture draft NPDES permits.

6) CONCLUSION

In conclusion, for the reasons set out above, the DOE should approve each of the four revised NPDES permits at four locations to allow Cooke Aquaculture to raise all-female, sterile rainbow trout.

Sincerely,

John Dentler