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Comments on Washington Department of Fish and Wildlife's Draft State Environmental Protection Act Documents for Cooke Aquaculture Proposal to Commercially Propagate and Harvest *Oncorhynchus mykiss* in Puget Sound net pens.

Our Sound, Our Salmon
11/01/19 (TO BE SUBMITTED)

Under the State Environmental Protection Act (SEPA), this review requires a threshold determination of whether an action is likely to have a "significant adverse environmental impact." The State's current threshold determination of Mitigated Determination of Non-Significance (mDNS) is inadequate as an environmental review and fails to address many well-documented risks associated with farming salmonids in these exact pens. Industrial-scale, open-water finfish aquaculture poses significant environmental risks, and the transition from Atlantic salmon aquaculture to rainbow/steelhead trout aquaculture adds significant risks that cannot be adequately mitigated.

The State should withdraw their mitigated Determination of Non-Significance, issue a Determination of Significance, and draft an Environmental Impact Statement (EIS) to assess the full impacts of this transition. Furthermore, that EIS should incorporate into its no-action alternative the fact the cessation of operation of the pens (and cessation of any environmental risk) after the legislative non-native aquaculture phaseout takes effect.

The public needed more time to comment

The filing covers over 400 pages, including a lengthy bibliography that requires review and in some cases rebuttal, as well has hundreds of references within the text to review. In addition, it references and discusses material developed by two sources who are expert witnesses for Cooke Aquaculture currently preparing to testify in ongoing litigation regarding these net pens. Understanding their statements here requires consideration of expert testimony rebutting their claims from that ongoing litigation. Furthermore, the 1990 EIS (Environmental Impact Statement) on which the State is relying is woefully outdated, and addressing the environmental effects of this policy requires the public to integrate decades of new information regarding Puget Sound, wild salmonids and other native fish in the Sound, its endangered marine mammals, the behavior of tides and currents and tsunamis in the Sound, and the effects of net pens and industrial finfish aquaculture on the Sound.

The submission includes a 76-page document authored by Cooke Aquaculture staff and contractors, which purports to serve as a supplement to the 1990 Programmatic EIS. This self-interested document cannot stand on its own as a supplement to the state's EIS, and the document largely omits discussion of the specific environmental impacts of the net pens on the threatened and endangered species under discussion. Further, that there is so much additional information accumulated in those intervening decades — including multiple new federal and state listings of endangered and threatened species, newly-designated critical habitat, and substantial new evidence of the effects and risks posed by open-water salmonid aquaculture in Puget Sound — is a strong argument of the need for the appropriate state agencies to conduct a full SEPA analysis. Allowing the petitioner to write its own supplement to the 1990 Programmatic EIS rather than allowing the state to perform its own impartial analysis and offer the public the statutory amount of time for comment, represents a dangerous end run around key environmental protections.

Effects of escaped steelhead on wild steelhead genetics

The mitigated Determination of Non-Significance (MDNS) rightly treats the possibility of escape, both small and large-scale, as a real and serious threat that must be addressed before planting fish in the net pens. Escaped fish pose a range of risks to endangered wild salmonids, and to the ecology of Puget Sound and its watersheds. The recovery efforts following the 2017 collapse demonstrated inadequacies of the existing escape plan even for non-native species.

As DFW notes in the mDNS and their exchanges with Cooke in Attachment B, an escape on the scale of 2017 would have released a number of fertile female steelhead that "would have exceeded the number of wild steelhead returning to spawn in many rivers in Puget Sound." DFW's exchange with Cooke states that the use of eggs treated to induce triploid sterility "would reduce, but not eliminate the risk."

We note in the section on failure of triploidy-induction below that monitoring of escapes of farmed Atlantic salmon in Norway demonstrates that escaped farmed salmonids do survive and feed and grow in marine feeding areas at rates similar to wild Atlantic salmon, and survive to mature and return to Norwegian rivers to interbreed in significant numbers with wild Atlantic salmon, with known adverse population level impacts to the affected wild populations (Disreud et al. 2019, Glover et al. 2019, Karlsson et al. 2016).

In 2018, DFW's fish health specialist — Dr. Ken Warheit — testified before the state legislature that raising native fish in these pens would actually represent "a greater risk to the state's native wild and hatchery salmonid populations, than is Atlantic salmon marine aquaculture.” That risk should be considered through a full SEPA analysis.

Effects of escaped steelhead on wild salmonids’ prey

The escape of rainbow/steelhead from any of the Puget Sound aquaculture facilities, whether from small scale leakage or catastrophic facility failure, will pose risks to native salmonids rearing in nearshore marine habitats and rivers due to competition for food and foraging space.

This will be particularly true in the case of triploid individuals because, as noted in the SEPA checklist, they will have appetites that are likely to be considerably greater than rearing juvenile salmon and steelhead due to the faster inherent growth rate of these triploid fish.

Diploid individuals that result from the failure of triploid induction will pose a significant risk of becoming sexually mature and interbreeding and/or competing with native rainbow and steelhead on the spawning grounds of native fish. The effects of recurrent, annual low level escapes on wild Atlantic salmon Norway is well documented, and similar impacts on native rainbow and steelhead in Puget Sound are to be expected (Diserud et al. 2019, Glover et al. 2019). Research in escapes of farmed Norwegian Atlantic salmon has also shown that escaped salmon survive to rear in the ocean for one or two years and return as mature fish to spawn in rivers of wild salmon (Olsen et al 2013, Karlson et al. 2016). Further, analysis of monitoring of escapes of farmed Atlantic salmon in Norway has shown that the actual number of escaped farmed salmon is two to four times greater than the officially reported annual number of escapes (Diserud et al. 2019, Skilbei et al. 2015). Of course, these potential risks will be greater the greater the magnitude of an escape and the greater the frequency of small scale leakage events. But, as is the case for wild Atlantic salmon in Norway and the north Atlantic in general, the risks posed by low level escapes should not be discounted.

A full SEPA analysis would allow for an updated Environmental Impact Statement that incorporates this and other new research on the effects of salmonid aquaculture, rather than relying on the prospective analysis conducted nearly 30 years ago, in 1990.

Effects of escaped steelhead on wild salmonids’ predators

Various operations at the net pens can attract threatened, endangered, and otherwise protected predator species to the vicinity, creating risks that those birds and mammals would be harassed, experience ship strikes, or become dangerously accustomed to human proximity. The process of feeding farmed rainbow/steelhead trout attracts wild fish, which in turn aggregates predator species. Predators will also be attracted by the outflow of shed skin and other parts from the penned rainbow/steelhead, and could be exposed to diseases and parasites through that proximity. The harvest process also results in the release of bycatch fish, blood, and other fish parts from harvested fish, which has been shown to attract marine mammals to close proximity to the pens and boats. A comprehensive SEPA analysis should examine the risks to these protected species from raising steelhead/rainbow trout in these net pens, and develop appropriate mitigation measures in consultation with federal, tribal, and international co-managers.

Farmed steelhead diseases could harm wild salmonids

Even if those diseases are endemic to the Sound, concentrated populations like this face greater risk of disease, parasitic, and viral amplification. When viral, bacterial, fungal, or parasitic diseases break out in net pens, the disease-causing organisms are rapidly amplified in number and leaked to the surrounding aquatic environment in large numbers. Because their conspecifics (and other salmonids of concern, including coho salmon, ESA-listed Chinook salmon and bull trout) will be swimming in close proximity to the pens, there is likely to be a spread of disease to endangered wild steelhead and other salmonids. In 2017, a B.C. study documented a strong correlational connection between disease prevalence in net pens and disease transfer to wild fish populations (Morton et al., 2017). Recent research in British Columbia found novel viruses in endangered salmon, and found evidence that these novel viral infections may originate from farmed salmonids (Mordecai et al., 2019).

As with terrestrial feedlots, the diseases that spread in and from net pens are likely to include the spread of antibiotic- and fungicide-resistant pathogens to wild steelhead and hatchery steelhead, which poses additional risk to hatcheries and the humans and wild species that feed on steelhead and other Puget Sound salmonids.

A comprehensive SEPA analysis should examine the risks to these protected species from raising biologically-engineered steelhead/rainbow trout in these net pens, and develop appropriate mitigation measures in consultation with federal, tribal, and international co-managers. That analysis should include an assessment of disease transmission to predator species, as well as the effects of these diseases on wild fish, and the potential for transmission of resistant strains to hatcheries.

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Fertility of steelhead eggs treated for triploid sterility

The Washington Department of Fish and Wildlife's (WDFW) mDNS October 1, 2019 Summary of key issues associated with Cooke's SEPA checklist ("Summary") (and Attachment A to Cooke's SEPA checklist) notes that the induction of triploidy in fertilized eggs at Cooke's hatcheries is imperfect. The likely adverse effects on native rainbow and steelhead from the escape of fertile aquaculture rainbow highlights the importance of providing firm risk-averse quantitative criteria and associated procedures regarding the estimation of the rate of triploid failure in each lot of eggs intended for production of smolts for outplanting to Cooke's marine net pen facilities. WDFW's Summary notes some concerns with the procedure Cooke employs to estimate the triploidy failure rate ("failure rate"). We believe WDFW's concerns are valid but that their recommendations do not go far enough to adequately reduce the risk posed by the presence of diploid (fertile) rainbow/steelhead in net pens in Puget Sound.

We recommend an alternative approach described in the following. The details in the approach we suggest also illustrate a robust general approach to risk assessment, particular in contexts of endangered species.

There are two basic issues in regard to the risk posed by the failure of triploid induction:

1. the failure rate itself (i.e., how many diploids will be reared and released into each net pen per batch of fertilized eggs in the hatchery that have been subjected to the triploid-induction treatment (hydrostatic shock)?
2. The total number of diploids in a pen that would escape either via low level leakage or catastrophic failure.

The first (failure rate) in conjunction with the size (number) of fertile eggs subjected to the triploidy-induction procedure is relevant to determining the minimum sample size of eggs from each lot that should be tested for triploid failure in order to assure an appropriate low risk of diploids being released into the pens. The second determines the probability or likelihood that escapes – especially under conditions of a catastrophic failure – would survive in sufficient numbers to pose a significant threat to wild rainbow or steelhead. Here, we assume that 'significant threat' is one that would amount to a take of a threatened or endangered salmon, steelhead, and bull trout under the ESA.

Determining a risk-averse failure rate (issue 1) is dependent on determining the risk-averse probability that escapes under a catastrophic failure of a net pen would pose a 'significant threat' to ESA-listed salmonids from surviving escaped diploid rainbow/steelhead. This, in turn, requires, a determination of the maximum allowable number of diploids per total number of individuals out-planted to each farm facility. We follow WDFW in expressing this number per-million smolts outplanted.

On page 6 of the Summary, WDFW conducts a rough illustrative exercise estimating the numbers of diploids surviving to potentially interact with wild rainbow or steelhead on the spawning grounds. WDFW provides a lower estimate of 63 mature diploid fertile fish from a catastrophic escape from a pen initially planted with 1,000,000 smolts, given a variety of assumptions about intermediate rates leading from the initial escape to the presence of surviving diploids on the spawning grounds. WDFW calculates that there would be a total of 63 such fertile escaped rainbow/steelhead, under a presumed “low survival” scenario and 316 under a “high survival” scenario.

In order to be very risk-averse (in keeping with the high priority placed on protecting ESA-listed salmon, steelhead, and bull trout), suppose we adopt a maximum of 50 fertile diploid escapees from a total net pen failure of 1,000,000 rainbow/steelhead. Under the assumptions of the WDFW “low survival” scenario 1,000,000 rainbow/steelhead net pen rearing primarily sterile triploid fish would have to consist of a maximum of 1560 fish in which triploid-induction had failed (Table 1). 1560 escaped diploids would result in no more than 50 surviving with the potential to reach the spawning grounds of wild steelhead or rainbow, given the assumptions used in WDFW’s low-estimate scenario, which we adopt here for the sake of illustration.

In a total population of 1,000,000, 1560 diploids yields a point estimate of the triploid-induction failure rate of 0.00156. To be risk-averse with respect to ESA-listed fish, we argue that the number of fertilized eggs post-triploidy induction sampled and tested for triploid failure should be large enough to assure a probability of 0.95 (95%) or greater that the total number of diploids in the lot of 1,000,000 eggs is no greater than 1560. This requires a sample of approximately 3000 randomly selected eggs (per million eggs). The standard would require a random sample of at least 3000 be tested from each lot of one million fertilized eggs (or hatched fry) and result in no more than 1 triploid failure (figures 1 & 2).

In summary, the risk standard should be stated as a high probability that the outcome of a specified quantitative sampling protocol not exceed a specified quantitative upper bound judged sufficient to assure that an adverse outcome of management concern will not occur. Here, the quantitative upper bound is the number of triploid failures per 3000 random samples tested (here 1), which corresponds to a corresponding high probability that no more than some total number of triploid failures (here 1560) occur per batch of million fertile eggs or fry sampled. The latter maximum number (1560) is in turn derived from an appropriate estimation of the distributions of the quantities (parameters) required to estimate (with appropriately high probability) the total number of fertile escaped diploid farmed rainbow/steelhead that would survive following a catastrophic net pen failure, where the total number of surviving fertile escaped diploids is itself determined on the basis a similar assessment of the risk posed to ESA-listed steelhead by the presence of escaped diploid farmed rainbow/steelhead on the spawning grounds of wild steelhead. The determination of such a risk standard requires that full probability distributions of the relevant quantities of interest be calculated (estimated) so that risk-averse probabilities of attainment of a risk-averse standard can be specified as a probability from the relevant tails of the distributions. Picking a point estimate, such as the mean of a sample, as in the WDFW summary (picking the mean triploidy-failure rate of 0.0017 (0.17%)

from Cooke's sampling data (Attachment A to Cooke's SEPA checklist) is inappropriate and very likely to be insufficiently risk averse.

This analysis is necessarily limited given the short comment window. A fuller analysis of the genetic risks posed by escaped non-triploid rainbow/steelhead, and measures that might mitigate those risks, would be possible with a longer comment period, and should properly be undertaken as part of a comprehensive SEPA analysis.

The "no-recovery" option for escapes as an unmitigated environmental risk requiring SEPA review

SEPA review requires a threshold determination of whether an action is likely to have a "significant adverse environmental impact." As the Department of Ecology SEPA FAQ notes, "An impact may be significant if its chance of occurrence is not great, but the resulting environmental impact would be severe." The FAQ explains further that an agency may issue a "mitigated DNS in lieu of preparing an EIS when there is assurance that specific enforceable mitigation will successfully reduce impacts to a nonsignificant level."

In this case, one of the forms of mitigation required by the DNS seems to acknowledge that there are risks that cannot reduce impacts to a nonsignificant level. Regarding escape recovery plans, including scenarios for recovery after a catastrophic failure of the pens, the mDNS states:

> It is conceivable that an attempt to recover fish after an escape event may negatively affect native Pacific salmonids more than no attempt to recover fish. Cooke is required to work with WDFW, Ecology, and DNR to include a no-recovery option in the 2020 Fish Escape Prevention, Response, and Reporting Plan, to be finalized December 2019. This option should include when, where, and under what conditions a recovery effort should not be attempted. A no-recovery option would be triggered by the state, in consultation with co-managers and federal agencies for the purpose of protecting native Pacific salmonids. A no-recovery option can be triggered by Cooke if the attempted recovery would put the health and safety of its employees at risk.

This scenario exceeds the scope of an mDNS and demonstrates the need for a finding of significance and an environmental impact statement.

The mDNS rightly treats the possibility of escape as a real and serious threat that must be addressed before planting fish in the net pens. Escaped fish pose a range of risks to endangered wild salmonids, and to the ecology of Puget Sound and its watersheds. The recovery efforts following the 2017 collapse demonstrated inadequacies of the existing escape plan even for non-native species. As DFW notes in the mDNS and their exchanges with Cooke in Attachment B, an escape on the scale of 2017 would have released a number of fertile female steelhead that “would have exceeded the number of wild steelhead returning to spawn in many rivers in Puget Sound.” DFW’s exchange with Cooke states that the use of eggs treated to induce triploid sterility “would reduce, but not eliminate the risk.”

To mitigate that risk, DFW requires Cooke to prepare an escape recovery plan.
That escape recover plan itself could pose environmental risks. DFW recognizes that significant risk and imposes a further mitigation, one in which no recovery is attempted. This option could be triggered by the state in consultation with federal and tribal partners, but also can be triggered by Cooke based on its assessment of risk to its crew.

This creates a risk that there would be no mitigating effort taken to address the adverse environmental impacts of an escape. DFW’s own arguments in the mDNS lead to the conclusion that this impact cannot be mitigated, and that it is inappropriate to proceed with a mitigated Determination of Non-Significance. To assess the risks of this projects requires a full SEPA analysis.

The pens’ structure is likely to be unsafe for prevailing conditions in Puget Sound

The joint DFW/DOE/DNR investigation of the Cypress Island net pen collapse of 2017 identified failures of maintenance and engineering which resulted in the collapse of that ten-cage net pen and the release of hundreds of thousands of farmed fish. In the course of ongoing litigation resulting from that collapse, Wild Fish Conservancy contracted an independent marine engineer to provide expert testimony evaluating the collapsed pen and assessing the risks posed by the surviving pens.

Like the state’s own investigation, Dr. Tobias Dewhurst’s assessment found evidence that the net pen had not been adequately cleaned, and that there had been a persistent failure to confirm the soundness of the pens and their anchoring systems, despite those cleanings and inspections being required by permits and industry best practices prevailing before 2017. In addition, Dr. Dewhurst compared manufacturers’ ratings for the surviving pens with conditions at the sites where they are currently deployed, and found “conditions at each of its eight sites exceeded the maximum rated conditions specified by the net pen manufacturer. Based on Cooke’s documentation that I have reviewed to date, these issues persist at many of the remaining net pen sites. Thus, the remaining net pen systems may be at risk of partial or catastrophic failure during instances of extreme environmental loading, which could result in fish escapement.”

He concluded: “As a result of excessive loads on the net pen system created by:

- currents and net sizes exceeding those specified by the net pen manufacturer,
- biofouling levels potentially exceeding design values, and
- mooring system installations that deviate from manufacturer recommendations and were not approved by a marine engineer, pens and cages operated by Cooke were at risk of complete failure. One pen, Cypress Site 2, did experience a catastrophic failure.”

DFW and its partner agencies should not regard it as sufficient mitigation of risk to permit these pens to transition to rainbow trout/steelhead without new engineering plans in place. The current mitigation proposal would allow these pens to operate without “engineered mooring and anchoring plans and site-specific engineered drawings stamped by a structural engineer” until 2021, and would allow them to operate without a third-party inspection for periods as long as two years.

Given the history of these net pens, the consequences of the mismatch between their manufacturers’ ratings and conditions in Puget Sound, and the inadequate maintenance and inspection preceding the 2017 collapse, these pens should be required to have adequately-engineered structures before transitioning to rainbow trout/steelhead. The engineering plans should be incorporated into a full SEPA analysis, allowing independent engineers to review the plans and assess the risks posed by the re-engineered pens and anchoring systems. Without that information, how can DFW and its partner agencies, or the voting public and elected leaders who reacted with outrage to the 2017 collapse, assess the risk and sufficiency of this current move to circumvent the non-native finfish aquaculture phaseout?

The pens’ structure is unsafe for foreseeable conditions in Puget Sound

Puget Sound is a seismically active area, with structures facing threats of significant damage from shaking in an earthquake, and from tsunamis caused by local earthquakes and those traveling from more distant quakes up and down the coast. A substantial tsunami is likely to occur during the life of these pens, and much state policy has been directed in recent years to make high-risk structures safe from seismic risks. While the exact time of such a tsunami is not predictable, there is a substantial likelihood of such a tsunami in the foreseeable future, and much attention and policymaking effort has been dedicated to incorporating that risk into planning.

Unlikely as that risk might be, it is necessary to consider here because, as noted in the Depart of Ecology SEPA FAQ: “An impact may be significant if its chance of occurrence is not great, but the resulting environmental impact would be severe.” Since there is evidence that the net pens are already operating at or past their engineered limits, and since the people of

Washington State have seen the tremendous harm done when these pens fail, understanding low-probability/high-risk events that threaten further collapses is critical in addressing the pens' full environmental impact.

Modeling by Washington's Department of Natural Resources and NOAA recently examined consequences of tsunamis for Puget Sound. Tsunami waves in some ways simply amplify the existing concerns about the structural soundness of the net pens, and add to the likelihood of a partial or complete collapse of one or more pens already considered as part of Dr. Dewhurst's engineering study. The forces generated by tsunami waves may differ in more than just intensity from routine tidal flow, in part due to the intense oscillation and the rebound of waves off of nearby shores. This risk deserves additional concern and scrutiny as part of a comprehensive SEPA analysis. A full-blown analysis of these forces is impractical given the limited time available for public comment.

To help understand the consequences of tsunamis, we requested simulated wave amplitudes and current velocities for the net pen sites. The DNR/NOAA simulations show significant added risk to all of the sites in the event of a tsunami within Puget Sound. The Fort Ward and Clam Bay sites see modeled wave heights nearly 20 feet high, as does the Port Angeles site, while the Cypress Island sites would face a wave over 10 feet high. The Skagit Bay site and Fort Ward site would face variable currents, with current speeds as high as 14 knots and rapid changes in direction and intensity. This oscillation in the course of a tsunami seems likely to generate forces outside those in normal engineering assumptions, and call for further consideration of anchoring systems and structural integrity. There is no reason that a seismic catastrophe should be allowed to place Puget Sound's wildlife at needless risk due to inadequate planning and preparation. Just as state law requires hazardous waste storage sites to be evaluated for seismic risks, these facilities should be subjected to a full SEPA analysis that includes consideration of the seismic risks that they uniquely face as semi-permanent, in-water structures containing farmed fish whose escape would cause significant environmental risks.

Water withdrawal and discharge into Puget Sound

The SEPA checklist states "No surface water withdrawals or diversions are required to implement the species change proposal, or to continue operations at existing floating net pen facilities." This is incorrect, since routine operations — including harvest — entail drawing water out of the pens, extracting the fish on board the harvest ship, and then allowing the water to flow back into the Sound after sluicing across the ship. This process adds pollutants including fish blood, damaged fish parts, and injured bycatch fish to the water before it returns to the Sound. A full SEPA analysis would consider the environmental impacts of that removal and addition of water to the Sound.

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Pollution from the pens would be harmful to the plants and animals in nearby waters, including to endangered and threatened species

Open water net pens raising salmonids routinely disperse large volumes of feed into public waters within the boundaries of the net pens as sustenance for their farmed fish. Some portion of the feed dispersed may not be consumed by fish in the pens, and thus makes its way into, and have an impact upon, the surrounding marine environment. The high-energy tidal zones in which these net pens are located may cause wide dispersal of unconsumed feed. This dispersal of feed into public waters represents a continuous and constant act of “chumming,” and attracts native fish species into or near the pens.

Physically small fish species, such as baitfish species and out-migrating and rearing salmonids (including ESA-listed Chinook and steelhead), may be attracted by net pen feed to the point where they physically enter a net pen facility and are vulnerable to predation from farmed rainbow trout/steelhead in the pens. The constant dispersal of feed may also cause disruptions in the natural migratory patterns of native salmonids, as the pens provide a constant and unnatural food source that may cause salmonids to occupy a single location for a longer period of time than is typical, and deter rearing or migrating salmonids from developing key feeding strategies which are critical to their early growth and development. This constant source of broadcast feeding, otherwise known as “chumming” is also likely to draw native species (including ESA-listed Chinook and steelhead) from their protective shallow nearshore habitats to net pen locations located in deep water, increasing their exposure to both avian and aquatic predators within and outside the pens.

Additionally, feed dispersed by these rainbow trout/steelhead net pens may have detrimental nutritional impacts on native fish species, as fish competing for survival in the wild may have distinct nutritional requirements from those being grown in an isolated facility.

In order to treat specific diseases or fungal occurrences, or to prevent infection, chemicals and pharmaceuticals are often applied by the industry to the fish, water, or feed in the net pens. Among the potential and likely harmful impacts to designated uses of surrounding water is the use of these chemical or pharmaceuticals for treating infections, parasites or diseases where the U.S. Food and Drug Administration (FDA) requires a waiting period before treated fish may be approved for human consumption. Native fishes in the immediate vicinity of the treated pens may also be exposed to or consume the very same chemicals and pharmaceutical treatments (including fish that may enter the pens attracted by the presence of feed and fish odors). These fish may then be caught in recreational or commercial fisheries and unknowingly be consumed by the public within FDA’s required waiting period. A full SEPA analysis would assess the risks posed to wild fish and their human and non-human consumers by outflows of food or medicine, and from exposures of native fish entering the pens.

In the SEPA checklist, Cooke refers in passing to the use of unspecified probiotics in net pens. These unspecified introduced microbes are likely to colonize the microbiome of native fish and the environment near net pens. Given the growing scientific appreciation of the role of the microbiome in health and development of fish and other animals and plants, this practice deserves greater scrutiny than is practical in the limited comment period available. A full SEPA analysis would assess the risks posed by artificial probiotics to the microbial biodiversity of the Sound and its wild denizens.

Bycatch of fish entering pens or in harvesting and escape recovery efforts

All native fishes — including but not limited to baitfishes such as Pacific herring and potentially migrating or rearing juvenile salmon (including ESA-listed Chinook salmon, steelhead, and bull trout) — may be attracted to the net pens due to the presence of feed and odor of rearing rainbow trout/steelhead. Native fish that have entered the pens attracted by the large volumes of feed may then be entrained in the suction harvest machinery during the harvest of adult farmed rainbow trout/steelhead. There are (at least) two issues that DFW and its partner agencies needs to address with regard to this issue in the permits as part of a full SEPA analysis:

1. A comprehensive accounting of species composition as well as total numbers of non-target fishes entrained during each net pen harvest period in which adult farmed rainbow trout/steelhead harvest occurs. This is required, among other reasons, in order that any take of ESA-listed salmon and steelhead may be accounted. All harassment injuries and mortalities of all individuals entrained in the vacuum pump harvesting equipment — including but not limited to direct mortalities of ESA-listed individuals — must be accurately determined and reported to state agencies and NOAA and available for public review.
2. All non-target fish entrained (sucked up) by the harvest operations are commonly disposed of by being thrown from the upper deck of the harvester ship back into the water on the outside of the nets. The volume of native fish is often so extensive it requires the harvester staff to use snow shovels to scoop them up from the landing area on board the harvest vessel. Pinnipeds and gulls are routinely observed in the water and air adjacent to the net pens, feeding on the native fish as they are being discarded in violation of state and federal laws prohibiting the feeding of pinnipeds. There are three additional issues here that DFW and partner agencies must address as part of a full SEPA analysis:

- Indirect predation on ESA-listed juvenile Chinook salmon, steelhead, and bull trout (take).

- The illegal feeding of pinnipeds, which provides an additional attraction for the pinnipeds that increases the likelihood of their predating on ESA-listed Chinook salmon, steelhead, and bull trout in the vicinity of the pens.
- The harvester crew and/or net pen operator must obtain a fishing license or permit that would allow them to harvest native fish as described above.

Air and noise pollution impacts to adjacent lands

Net de-fouling and cleaning operations have been found to cause fouling of the air and significant noise. Residents on shoreline properties near the Fort Ward facility, for example, cannot conduct normal outdoor activities, particularly during warm months, during net cleaning operations due to the foul smell of the air that directly results from the operations and the loud noises associated with generators, pumps, and other industrial equipment. This air and noise pollution causes severe depression of local residential property values, apart from human respiratory impacts. A full SEPA analysis would allow DFW and partner agencies to determine appropriate maximum levels of airborne particulates, odor-causing chemicals, and noise levels, and require facility operations to monitor and maintain appropriate airborne pollutant and sound levels.

As part of a full SEPA analysis, DFW and partner agencies should commission an appropriate sociological survey of resident households within one-half mile of the shorelines of the locations of each net pen facility. The survey should interview residents to assess the degree and frequency (times of day, times of year) that normal and desired residential activities (e.g., outdoor family activities and social events such as dinner parties) are disrupted and/or prevented by air and noise pollution.

Fish flesh discharge

Open-air salmonid net pens chronically discharge particles of decaying fish flesh that are often consumed by native fish and birds. These particles may be contaminated with pathogens, parasites, pharmaceuticals or chemicals that may be ingested by native fishes, including conspecific steelhead and other salmonids. Studies have shown that these particles are potential vectors for pathogens.

This fish flesh also serves as an attractant for protected marine mammals, and a full SEPA analysis should be undertaken to assess the harm this may do to those protected species.

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Tables.

Table 1. Estimate of number of the maximum number diploid individuals per million farmed rainbow/steelhead outplanted to a net pen that would result in no more than the number of mature escapees surviving to sexual maturity (bottom row) given the assumptions in WDFW's mDNS Summary, page 6.

Number of Fish	1000000
Proportion Diploid	0.00156
Number Diploid Outplanted	1560

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Probability of Escape	0.82
Number of Diploid Escapes	1279.2
Probability of Non-Recovery	0.77
Number Diploids Not Recovered	985
Proportion Sexually Mature_High Estimate	0.5
Number Mature Diploids_High Estimate	493
Proportion Sexually Mature_Low Estimate	0.1
Number Mature Diploids_LowEstimate	99
Proportion Fertile Surviving to Spawn	0.5
Number of Mature survivors_High Estimate	**247**
Number of Mature survivors_Low Estimate	**50**

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Figures

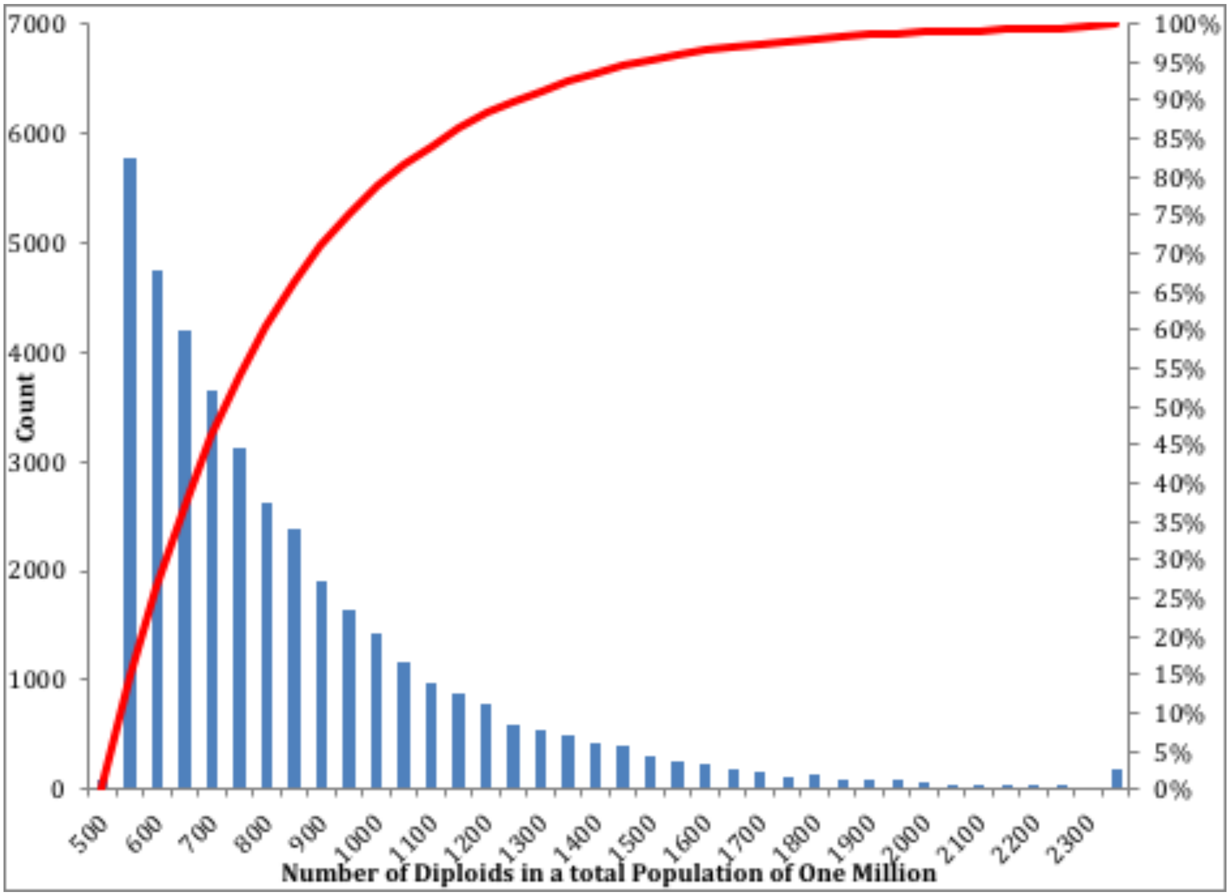

Figure 1. Distribution of the number of diploids (triploid-induction failures) in one million eggs when the number of diploids in a random sample without replacement of 3040 is zero. 95% of the distribution is less than 1500, 96.5% of the distribution is less than 1600, closely satisfying a risk-averse criteria that 95% of the distribution of possible values be no greater than 1560 diploid per million eggs or fry.

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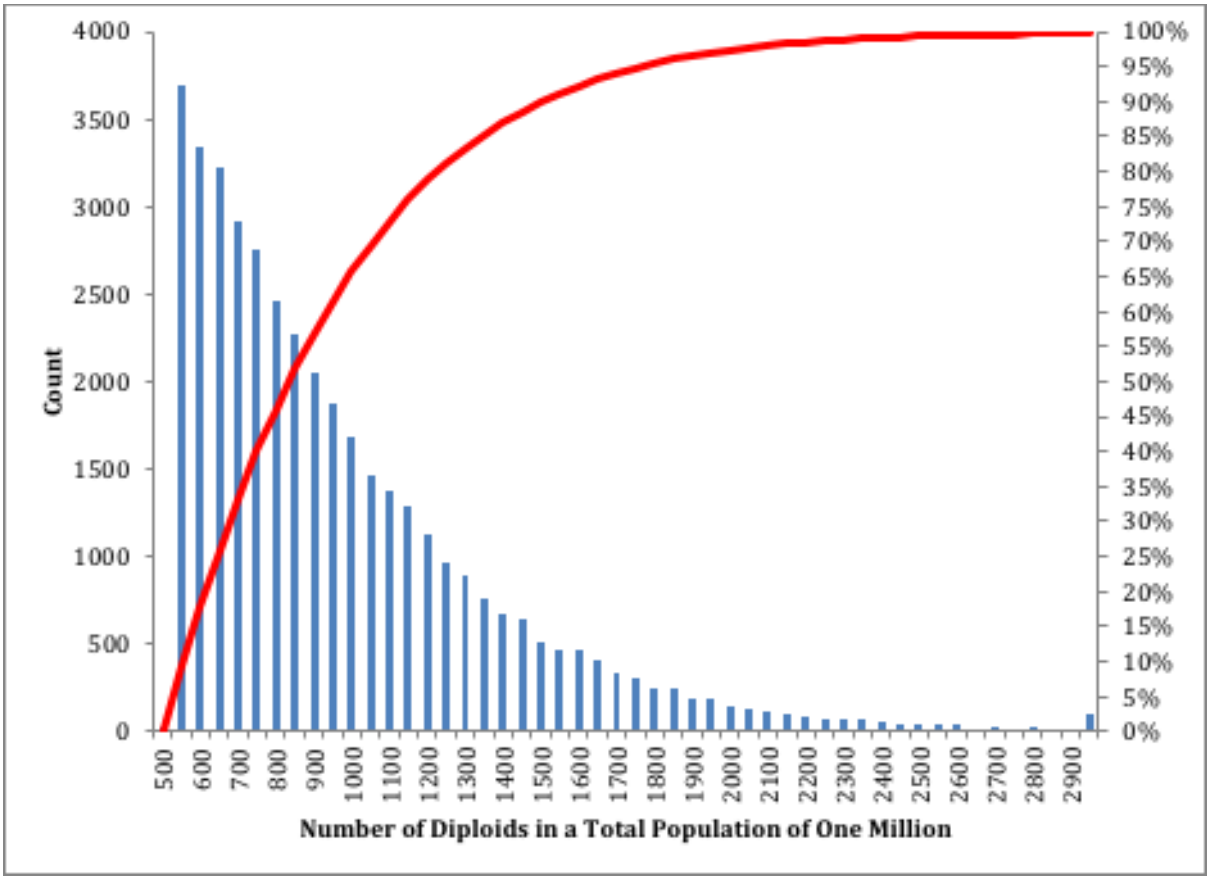

Figure 2. Distribution of the number of diploids (triploid-induction failures) in one million eggs when the number of diploids in a random sample without replacement of 3040 is one. 95% of the distribution is less than 1750 and 91% is less than 1550, closely satisfying a risk-averse criteria that 95% of the distribution of possible values be no greater than 1560 diploid per million eggs or fry.

These comments are being submitted under the banner of the Our Sound, Our Salmon campaign and are jointly-supported by the following organizations, businesses, and individuals:

Groups and individuals who sign on to be added before final submission.