Cooke Aquaculture Pacific
4019- 21st Avenue West Seattle, WA 98119 PO Box 79003 Seattle, WA 98119

The Department of Ecology (ECY) has been charged with evaluating the permit modification request by Cooke Aquaculture Pacific (CAP) to change operational practices in their cage operations by switching species under culture from Atlantic salmon (*Salmo salar*) to triploid rainbow trout (*Oncorhynchus mykiss*). ECY is tasked with determining if this species change would have an impact on waste discharges from the facilities in which the fish are being reared.

Cooke Aquaculture Pacific (CAP) has worked with fish nutrition experts as we studied this species change. Input from experts convinces us that changing from Atlantic salmon to rainbow trout will not produce any increase in currently permitted waste discharge or receiving water quality and may indeed provide improvements.

Let's examine the facts.

Feed is a major cost in aquaculture production. Throughout the world finfish producers have looked for ways to reduce waste outputs and improve feed conversion ratios. Nutritional strategies that have significantly reduced waste outputs of commercial aquaculture operations (Bureau and Hua, 2010) have become increasingly important to producers such as Cooke Aquaculture globally as we seek to find new ways to improve production efficiency. In fact, most global fish farmers work in a pre-competitive way to address such challenges such as feed conversion ratios, as FCRs have been used in the past to give aquaculture a "black eye." The fact is that today, FCRs have significantly improved in aquaculture, making it the most efficient form of protein production, when compared with beef, pork, or poultry.

Of particular importance for open cage systems, such as those utilized by CAP in its Puget Sound operations, has been the vast improvement in feeds and feeding technology. It is important to note here that over the years, feeding technology has improved markedly in the sector as the use of underwater cameras, sensors, and modern feed production formulations and feeding methods have advanced. Research by both the industry and academia over the years into the physiological, behavioural, and biological requirements that control feed consumption and therefore growth rates have substantially improved marine net pen operations.

Progress in feed formulation, together with the introduction of modern feed production technology (e.g., semi-dry feed pellets, heated and pressurized pellet extrusion, improving raw materials, etc.), has resulted in the production of feed with more highly digestible (or useful) nutrient densities, which enabled significant reduction in the amount of feed required to produce one unit of biomass (e.g. Cheng and Hardy, 2003). In the 1970s and early 1980s, feed conversion ratio (FCR, feed: gain) of 1.5 - 2.5 were common for market-size rainbow trout (1-2 kg) fed the commercial feeds available at that period in North America. Today, the use of more highly digestible nutrient-dense-extruded feeds [e.g. 40% digestible protein (DP), 25% fat, 419 MJ DE] allows FCR's of about 1 (ranging from 0.9 to 1.14) for these fish. This significant decrease in FCR was also accompanied by measurable, marked, and statistically significant decreases in total solid wastes, and solid and dissolved nitrogen and phosphorus wastes.

In studies of feeding assisted by technology, feed losses were found to be below 5% of the input (Cromey et al. 2002, Bureau et al. 2003, Reid et al. 2009). This improvement in feed utilization across the sector cannot be understated. Feed losses in modern salmon aquaculture, using camera-assisted feeding control and acoustic registration of lost feed pellets, are small compared with the supply of feed. Therefore, a feed loss rate of 1-3% has been widely adopted (regardless of species) in studies investigating nutrient output from aquaculture cages as suggested by Wang et al. (2012).

Comparative reviews of nutritional requirements of, and feeding strategies for, Atlantic salmon and rainbow trout (Storebakken T. 2002, Hardy, RW 2002) demonstrate the striking similarities in nutritional needs and digestion between the two species. Additional studies have reported upon the comparative abilities of rainbow trout and Atlantic salmon to digest and utilize feed nutrients. As an example, Krogdahl, et al. (2004) found that these two species are quite similar with respect to growth (as measured by Thermal Growth Coefficient, TGC), retention of dietary protein, and retention of dietary energy when fed the same diets. They also reported improved increased digestibility of feed for trout, both in fresh- and salt-water. A study comparing the use of metabolizable energy in the diet between rainbow trout and Atlantic salmon similarly found no difference in either maintenance energy requirements or the amount of energy above maintenance requirements that was deposited as lipid in the carcass (Azevedo, et al. 2005).

Nitrogen and phosphorus (N and P) are the nutrients most likely to induce environmental impacts like eutrophication in the water column. N and P are not toxins, but biogenic elements which are potentially harmful in the marine environment <u>only if</u> their supply exceeds the assimilation capacity of the ecosystem. All ecosystems have an inherent capacity of persistence, and smaller changes in nutrient supply are mitigated through adaptive responses of the communities. The scientific understanding of these processes and impacts in benthic ecosystems is well developed. Direct comparisons of modelled N & P outputs from scientific literature show extremely similar N and P for rainbow trout and salmon (Table 1). These studies are based on mass balance estimates of inputs, assimilation into fish, and outputs and have been well vetted in the scientific community.

Variable/ *Species*	**Referenced Study**		
	Bureau, et al. 2003	Olsen, et al. 2008	Davies 2000
	RBT	*AS*	*AS*
FCR	1.14	1.16	1.17
Dissolved N	38.0	30.1	35.6
Solids N	9.3	14.3	12.6
Dissolved P	1.7	3.0	-
Solids P	5.8	5.2	-
Total N	47.5	44.4	48.2
Total P	7.5	8.0	-

Table 1. Literature values of N and P waste outputs from cage farms rearing Atlantic salmon (AS) and rainbow trout (RBT). FCR = Feed conversion ratio (feed fed/total weight of fish produced). Nutrient values expressed in kg per tonne of fish produced.

It is clear from the scientific literature that rainbow trout and Atlantic salmon are very similar based upon feed digestion, growth patterns, and excretion of excess feed nutrients.

A review of the NPDES permit histories for the facilities now owned and operated by CAP are also clear on the performance of these facilities. All four active sites (Hope Island, Clam Bay, Orchard Rock, and Fort Ward), All four active sites (Hope Island, Clam Bay, Orchard Rock, and Fort Ward), have a demonstrated track record of meeting the monitoring requirements and sediment standards of the NPDES permits over the past 20 years. As a perspective, if a comparison is made to a nearby municipal sewage treatment facility such as the City of Bainbridge Island's Wastewater Treatment Plant, (to which marine cage aquaculture facilities are often erroneously compared by its critics), there have been 74 violations or triggers of Permit Actions of the City's NPDES permits during the same period. During this time similar, nearby Kitsap County facilities have a history of spills of untreated human waste and chemicals discharged directly into the marine environment from various sewer system failures.

Cooke Aquaculture Pacific understand that we have a lot of work to do regain the public trust in our marine aquaculture operations. No food production system is perfect, and all require some use of natural resources that has the potential to impact the nearby environment. The goal of food production systems is to understand those potential impacts, monitor them and work toward continually reducing them as best as possible. CAP's recent track record of working with the regulatory Agencies to improve our operations together and looking towards science-based solutions to potential impacts, shows our strong commitment to improvement and stewardship.

On behalf of our farm employees and contracted processing workers based in Seattle, along with our many suppliers, buyers, and consumers of our products we request that the modifications we seek to the NPDES permits should be granted. We believe that the scientific literature, combined with the track record of CAP's NPDES performance and willingness to work with ECY to constantly improve our operations speaks loudly and, we hope, convincingly toward that end.

Thank you.

Respectfully submitted this 8th day of June 2020,

Jim Parsons, General Manager
Cooke Aquaculture Pacific, LLC

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