Hugh Mitchell

This requested switch is whether Atlantic salmon waste and impact is different from Rainbow trout - pure and simple. Unfortunately, anti aquaculture ideology is behind many of the comments that are against the permit modification (see attached). These net pens have been operating for over 40 years through multiple domestic and foreign owners. Throughout that time, there is no evidence of significant impact on water quality or wild salmon populations. In fact there is ample evidence that there really is no impact. WE NEED TO SUPPORT SUSTAINABLE DOMESTIC AQUACULTURE PRODUCTION for the security of our seafood supply and food producing jobs in our state. I strongly support the permit modification.

THE SURPRISING AND ALARMING EMERGING IDEOLOGY AGAINST AQUACULTURE

We live in interesting times with today's ultra-connected society still being a mosaic of ideologies. An online dictionary (Collins) definition of ideology is: *"a set of beliefs, especially the political beliefs on which people, parties, or countries base their actions".*

*By: Dr. Hugh Mitchell **

How we arrive at these ideologies is probably a complex phenomenon for psychologists to tell us about. But, a lay-observation seems to indicate that the maintenance of an ideology is greatly aided by echo-chamber reinforcement of the internet. There, it is easy to find support and like-views to confirm any doctrine of your bias. Religious ideologies, especially fundamentalist ones are strong examples. Others that seem to be making headlines today include: anti-vaccines; pro-gun rights; "natural is better"; pro-life; anti-GMO; pro-free enterprise; anti-corporation; Climate change believers; Climate change deniers; Flat earthers; animals are sentient; veganism; animals are not sentient -they act on reflex; etc. etc.

With each of these, there is most often an uncomfortable reaction if any challenge is made, or any evidence presented that might contradict some of the basis for their beliefs. If they represent a dichotomy of opposing viewpoints, each side can accuse the other side of being unreasonable, ignorant, malicious and of extreme and unmovable bias. More often, there is a real hesitancy

An Alaskan stock enhancement net pen system. Hatcheries are responsible for about a third of the wild salmon catch in Alaska (see previous article on Aquaculture Magazine 45-3 June – July 2019).

to engage anyone who would even question or bring up an opposing view because of an anticipated and abrupt "hand in the face" reaction. We have all heard tales of, or experienced, the division within families precipitated by discussions at Thanksgiving dinner. Ideologies get set as dogma and people get absolutely convinced that these are definitive and obvious truths and if "you don't go along, then you just don't get it – case closed". Some contend that science itself has become ideological.

The Profiting- and Aesthetic Detractors of Aquaculture

With its roots regarding Atlantic salmon culture in the Pacific Northwest, there is also a developing ideology against aquaculture. Unfortunately, this is having a halo effect to all of farmed fish. Certainly, some of the same aspects against corporate terrestrial farming are mirrored, but the backlash against aquaculture has taken on a life of its own. There are some ulterior motives and side-ideologies behind some of the anti-farmed sentiments (commercial and tribal fishermen resenting the competition: "Taxis vs. Uber") or those who are morally against animal protein for food, but there still seems to be a specific anti-fish farm sentiment emerging.

Part of this detraction movement includes some Environmental Non-Governmental Organizations (ENGO's) and fisheries science researchers, and both groups seem to profit from fear-mongering the relatively new field of aquaculture as a threat to be saved from. These ENGO's and researchers portray themselves as the saviors from the threat (oldest marketing game in the book). ENGO's can actually benefit monetarily from frivolous lawsuits against fish farmers or government agencies that are responsible for regulating the farms. Researchers can fear-monger the threat to complex ecosystems way out of proportion in order to secure funding for continued research into the threat. Often, peer-reviewed articles are published in journals of various reputability levels ("peer-review isn't peer-review isn't peer- review"), with hypotheses being rhetorically argued into theory without being tested as the scientific method mandates. These hypotheses are then quoted in the popular media and online as if they are proven theories, often curiously promoted as such by the researchers themselves. This is an extreme portrayal, but various experiences in recent years certainly reinforce the insidiousness of their motives. I will label this entire group as the "Profiting Detractors" of aquaculture.

There is also a group with an ideology against fish farming because they simply believe it is wrong. This group doesn't have any clear financial benefits for their viewpoints, which are largely derived by the onslaught of what they see and then propagate in traditional and social media. I will call these: "Aesthetic Detractors", because their views are more visually-based - superficially derived using a more subjective than thorough and quantitative analysis. Unfortunately, many of these "Aesthetic Detractors" get "exploited" by the "Profiting Detractors" and the two, with overlapping members between them, have become a formidable force against fish farming, especially against net pen Atlantic salmon aquaculture. Hatcheries that produce stock-enhancement native fish species have also been caught in their crosshairs (i.e.: nothing but naturally reproducing fish are acceptable). This latter topic warrants a whole separate essay.

As an industry, although many of us aren't in this field primarily for the financial aspect ("Q: How do you make a million-dollar fish farm? A: Invest 2 million"), we have to be careful we don't get caught up in our own echo-chamber trap. Most of us involved in this field got into it for several reasons: it is an exciting frontier agriculture-sector; it is a noble supplement to our insatiable seafood appetite; it is a way of conserving our wild fish and aquatic ecosystems; it is THE most efficient

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The salmon is a mystical animal and domestication is some sort of gross perversion.

"They aren't playthings for their two-legged fellow creatures to move about and do with as they will. They are sacred creations of an almighty God, placed here to be used and conserved – and enjoyed … Again, a noble resource would be treated like a flock of chickens that man can shoo around and haul at will? The Atlantic salmon is to the waters as the eagle is to the air or the grizzly bear is to the land …"

Editor, Maine Sunday Telegram, 1993.

The enhancement of marine flora and fauna around and under net pens is not fully appreciated. Fish farm net pens attract all sorts of marine wildlife which can actually enhance their populations. In Maine, the author has seen an abundance of lobster and scallops underneath the pens. In Puget Sound, Washington State, Turnbills from Alaska temporarily use the mooring and piping structures of net pens as a winter base.

and eco-friendly way of producing animal protein, etc. etc. etc. Most of us who have dedicated our careers to the development and success of aquaculture are perplexed by the backlash (within our pro-aquaculture ideology!).

What is annoying and frustrating about this is that allegations against fish farming are often fueled by repeated visceral imagery and non-quantitative or pseudo-quantitative/scientific arguments with limited context. The discussion ends up about changing hearts versus heads (a defining characteristic of ideology). Many of us involved in this field are rooted in scientific background and procedure and we can be steadfast in the notion that "truth will prevail". Unfortunately, it appears that, increasingly, facts may not matter and "truth" still has to be sold or it can be out-marketed.

In order to understand the mistruths, beliefs, and approaches behind the detractors' ideology, let's briefly examine some of their many allegations against aquaculture. Most of these are against net pen Atlantic salmon of the Pacific Northwest, but, again, the "halo effect" follows somewhat to the entire "farmed fish" brand.

"That traditional view of science no longer holds. Over an increasing range of fields of science and medicine there are knowledge monopolies that have become hegemonic: ideological, dogmatic, unscientific in the sense of ignoring competent minority opinion and the significance of undisputed evidence; unscientific in declaring an issue closed even as un-contradicted evidence calls for open minded reassessment".

Henry H. Bauer (2012) from: "Dogmatism in Science and Medicine: How dominant theories monopolize and stifle the search for truth".

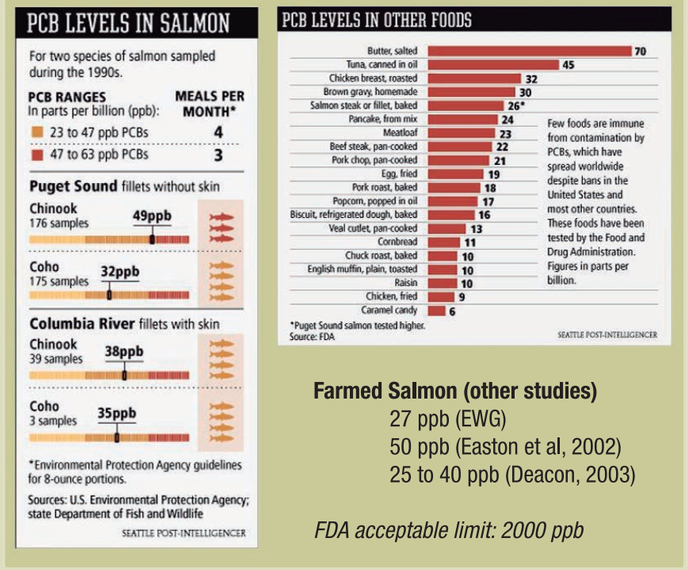
Some Allegations Against Aquaculture by the Detractors

The anti-movement certainly seems to have a lot of time to volley a litany of fish farm hazards allegations. What is not genuine about their efforts is that they often use these unquantified "hazards" as reasons why a particular aquaculture industry should be banned, instead of framing the risks. A more constructive and genuine approach would be a call to get together, assess, and quantify real and perceived risks, and then work to mitigate the risks to as low as reasonably achievable and acceptable, instead of calling for the elimination of the hazard (indicative of an ideological motive).

The unreasonable "Precautionary Principle" calls for "no risks are acceptable" or "prove the negative" and is not how society works. It is a rhetorical tactic, not a reasonable and workable one. We don't eliminate automobiles or airplanes because they crash, we work at reducing the risks of accidents or the consequences of accidents. Below are some of the areas where detrac-

CONTEXT NOT INCLUDED IN Hites et al, 2004, Science 203(226-229) reported PCB values:

Farmed Salmon: 36.6ppb
Wild Salmon: 4.8 ppb ***Why so low?



Farmed Salmon (other studies)
27 ppb (EWG)
50 ppb (Easton et al, 2002)
25 to 40 ppb (Deacon, 2003)

FDA acceptable limit: 2000 ppb

tors have flung mud with the overall goal of trying to portray some forms of aquaculture as unacceptable hazards. Some quick comments are provided with perspectives on how real each alleged hazard actually is. Each one could justify more thorough discussion.

1) Too much of aquaculture is "factory farming" by large corporations

For various reasons, there is a repugnance from a portion of society against today's animal agriculture. Within this ideology, there seems to be a tier of acceptability: "backyard" and "mom and pop" animal husbandry is far more preferred than larger operations, especially those owned by large corporations. Part of this comes from the mindset that although we adore technology as it is applied to transportation, communication and entertainment technology, a portion of society does not seem to have a palate for technology when it comes to our food, which corporate farming is more able to finance and embrace. The central notion seems to be that larger operations cannot have as sound animal welfare or environmental impacts, and animals housed are more prone to disease and therefore require more antibiotics and medicines.

This is simply not true. Although this author is not aware of any specific study, larger facilities are more visible, especially to regulatory authorities, and their welfare and environmental standards need to be more extensive than with smaller operations. Furthermore, health and welfare go hand in hand and, together with the expense and production disruption of medication, there is tremendous incentive to strive for good husbandry with larger operations. On the disease front, one example of where larger operations are actually at less risk is the poultry sector. Backyard chickens are far more at risk and problematic for some of the controlled diseases transferred to and from wild birds, than the strict air-controlled and sanitized larger operations.

In general, "factory fish farms" are not as "evil" as portrayed by the detractors. As for the corporate part, unfortunately, that seems to be the direction all businesses go: amalgamation of smaller ones as the industry matures. Paradoxically, in aquaculture, regulations have had an effect to help precipitate this effect by forcing larger operations and economies of scale in order to survive and afford complying with an almost overwhelming set of requirements and regulations (see below). Detractors should be made to point out what regulations applied to corporate aquaculture are inadequate, with risk-based justification.

2) Aquaculture pollutes the lakes, rivers and oceans

It has been stated that aquaculture is one of the most environmentally benign industries. With the visual and visceral rhetoric against net pens like "floating pig farms" or "sewage like a small city" there appears to be a stark dichotomy in perception. The fact is that the only real significant waste from a fish farm are fish feces and urine, or organic nitrogenous effluent and that this is processed by the ocean's own natural biofilter. Nitrogen is a required nutrient for primary production at the bottom of the food web. The key is to keep the amount to a level that is: 1) insignificant to all other sources; and 2) doesn't overload the nearby surrounding aquatic system.

Allegations against fish farming are often fueled by repeated visceral imagery and non-quantitative or pseudo-quantitative/scientific arguments with limited context.

First of all, it is in the farm's and the fish's best interest that this doesn't happen because poor water quality is expensive to an operation. Secondly, net pen leases require continuous monitoring and net pens have been moved if overloading is detected. Third, several studies have looked at the level and impact of nitrogenous wastes released from net pens and it is insignificant. Any benthic enhancement is temporary (and often positive!), with minimal footprint, and studies have shown that any signs disappear 6 months after net pen removal. Detractors should be made to document why current environmental monitoring protocols and regulations are inadequate.

3) Aquaculture spreads diseases to wild fish

This is not a significant risk, and by far, the transfer of pathogens is from wild fish to the farmed stock. See my 3-part article starting in Aquaculture Magazine April 2018 for more details on this. The specter of disease is a scary one, and Hollywood certainly has helped stoke the fears. One of non-medical detractors' favorite targets is to portray an epidemiologically naïve picture of disease organisms multiplying exponentially until all wild fish are wiped out. They fail to take into account disease transfer principles as outlined in the Reed-Frost concept of herd immunity, where diseases are limited as they move through populations that become no longer naïve. Farmed fish have naïve immune systems to most wild pathogens. Vaccines help to reduce immune naivety to some diseases, but they don't work for all.

For wild fish, they are most often continually exposed and populations have both herd immunity and are carriers to known and unknown pathogens. So-called "amplification" from farms back to these wild fish is really not a proven concept and doesn't make much sense using epidemiological principles. First instinct is a flippant visceral reaction to suggest that detractors should be made to attend an accredited veterinary school, and have some background beyond that in epidemiology. Suffice it to say, unqualified or pseudo-qualified detractors should not be allowed to fear-monger on this topic without being held accountable by the medical community, which needs to be transparent, inclusive and realistic about disease risks and potential consequences.

4) Aquaculture needs to be regulated more stringently

Sebastian Belle of the Maine Aquaculture Association has put out a typical list of regulations and agencies that the Maine industry is governed by, and it is pretty substantial. Dr. Carol Engle has published her studies showing the costs of regulations to US aquaculture, and the conclusion is that they are contributing to the industry's burden and lack of growth (https://onlinelibrary.wiley.com/doi/epdf/10.1111/jwas.12604). Suffice it to say, the quality and suitability of the regulations to adequately cover concerns are never specifically addressed by detractors with the purpose to reduce any perceived or real risks. In fact, it appears that most detractors are ignorant of the regulations or choose to ignore them, not wanting them to get in the way of their ideological or vested interests.

Most aquaculturists would agree that too many redundant and senseless regulations have been imposed on them and their fish. The intended effect of many of these regulations to protect the environment and the seafood consumer are either inconsequential or unnecessary impositions. Whether detractors or regulators, the need for specific regulations needs to be justified, impacts measured, and sunset clauses put in place.

5) Aquaculture feeds fish to fish and is therefore unsustainable

This is an interesting allegation, as it contains cannibalistic connotations with its intended notion of unsustainability. Yes, fish and/or fish meal are necessary for carnivorous fish, including both wild and farmed salmon. Salmon farmers really feed planktivores to carnivores. The "closer to the sun" smaller fish are usually from sustainable fisheries, and not as sought after by seafood consumers. Although a substantial portion of fish meal and oil is used in global aquaculture, a greater proportion goes to less elegant and efficient uses such as lubricants and fertilizers.

Nevertheless, the backlash has precipitated feed companies to seek alternative sources. This has resulted in a continual decrease in the amount of fish weight used in meal to produce a pound of farmed fish. For salmon, it approaches 2 to 1. Interestly, for wild salmon the amount of fish needed for this carnivorous

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species is that of the movement through a trophic level, or 10:1!

Added to this is that fish do not need to produce heat or fight gravity. Fish are some of the most efficient animals at converting feed. Detractors need to be reminded that feed conversion has to be kept in context with other (wild) sources of seafood (which consume public resources).

6) Farmed fish isn't as healthy or wholesome

There is a continual barrage from detractors on this front, with some glaring examples of real "below the belt" tactics.

a. Fed antibiotics and chemicals

All production food animals need to be given antibiotics and medicines from time to time. Diseases are natural and take advantage of a production setting. A farmer's job is to avoid the risk factors that lead to this, as the result is both expensive and causes production disruption. There is a lot of misunderstanding about use and abuse of antibiotics in food animals. Suffice it to say, their approval and use are strictly controlled, and have been through exhaustive human and environmental testing. There are tremendous disincentives to use them, and when used, strict scientifically-established withdrawal periods are mandated by law in order to make sure there are no residues in the final food product. Detractors and the lay-public need to be educated on what antibiotics are, what they do and the judicious use principles that are in place.

b. PCB's and Mercury levels in the flesh

The allegations of farmed fish having higher levels of contaminants in their flesh are simply not true. One example of fraudulent scientific research involves a study that was a published note in Science in 2004. Headlines came out that farmed salmon have Polychlorinated Biphenyls (PCB's) levels 10 times that of wild salmon, after the researcher published the article. The research paper failed to contextualize that this environmentally persistent industrial organic pollutant (banned in 1974) was of low acute toxicity and in most foods below 100 ppb, with an US Food Drug Administration limit of 2000 ppb. The authors also failed to mention that previous studies found levels of salmon, both wild and farmed were between the acceptable ranges of 25 to 50 ppb. This was consistent with their measurements of farmed salmon. Their summary for wild salmon was an inexplicably low 5 pbb, until careful examination showed that they "cherry-picked" most of their wild fish from returning low-fat pink and chum salmon and included very little fatty, fish-eating Chinook, Coho and Sockeye, skewing their results. Nevertheless, the headlines and the devil without the details stuck with the perpetuation of this false dogma, being in the interest of the detractors.

What is often left out of the discussion is that if anything ever IS a concern, contaminated fish meal and oil in the farmed diet can be "washed" of these and nutritional content altered. This is not possible with wild fish. Detractors' junk science with an obvious agenda needs to be exposed. Aquaculture ideologues should be careful not to commit the same egregious bias.

Sowles and Churchill – lease requirements of benthic monitoring of Maine industry for 15 years + - no permanent damage

WA Dept. of Fisheries:

- Modeled **worst case scenarios** (5 farms in an embayment area):
  - **0% increase in dissolved N above ambient in summer**
  - **0.57% increase in winter**
  - **0.22% increase in phytoplankton & zooplankton in summer**
  - **0% increase in winter**

Rensel (1988):

- Worst case scenario – Large farm in shallow passage in Puget Sound
  - Monitored phytoplankton density & growth rates on farm with and without fish.
  - Monitored nitrogen levels downstream from farm.
- **No diff. In #1 & some N increase was seen in one tial flushing but no other; 30 m downstream 80% ammonia was nitrite – therefore rapid decomposion.**

Husa, et al (2012):

"Regional impact from fin-fish farming in an intensive production area (Hardangerfjord, Norway)" Marine Biology Research 10:3 – 241-252.

- **70,000 MT annual production of farmed Atlantic salmon**
  - (vs. Puget Sound had 8000 MT at its maximum)
- **One of most intensively farmed areas in the world (309 sq. miles)**
  - (Vs Puget Sound surface area is over 1000 square miles)
- **Overcrowded low deep water flow fjord**
- **Studied impact between 2008 and 2010**
- **Studied intertidal macroalgal and benthic communities and chlorophull – a values**
- **Findings: good ecological conditions of parameters studied**
- **Little evidence of regional impact despite intensive production level**

c. Color-added

Without anti-oxidant nutritive carotenoid pigments in their diet, wild and farmed salmon flesh is white. They obtain this from crustaceans/zooplankton or algae in fish stomachs that they eat. Farmed salmon have these same molecules put in their diet, which is formulated to approximate their nutritional requirements. Detractor activists noticed that the Food Drug and Cosmetic Act required foods to be labelled "Color-Added" and sued the FDA to require this of farmed salmon product. The connotation to consumers that salmon farmers dipped their fish in some red dye, instead of a natural nutrient carotenoid was deliberate. These kinds of Detractor tactics need to exposed and publicized. Laws need to be changed so that these kinds of loopholes don't get falsely utilized for ulterior motives.

Solution to Fending off the Detractors

Combatting ideologies is a tough thing to do. Facts don't matter without a good publicity campaign. And sometimes, with a good campaign, facts don't matter either. So, how do aquaculture proponents promote our message more effectively and stave off this emerging anti-aquaculture sentiment?

> **We absolutely** need both stock enhancement and "egg to fork" aquaculture. The narrative must be retaken.

First, again, we have to be careful not to fall into confirmation bias as the detractors seem to. It's an affliction that we all possess. We need to make sure that we are backed up with legitimate and unbiased facts when we put forth our belief that aquaculture is the answer to saving the oceans … not the threat! We need to insist on and use legitimate and contextual metrics in order to make a case. We need to double check and challenge our own assumptions and biases. We have to admit when there are legitimate concerns. We should insist that scientific details are presented, not just rhetoric, and that we engage the detractors in addressing the risks of a hazard, not just calling for the elimination of that hazard (e.g.: planes because they crash and kill people).

Next, we have to take a lesson from the detractors, and "Marketing 101". We like to take the high road and present all the good about aquaculture. Unfortunately, most of the "feel good" stories are not noticed. "They don't sell". So, what sticks out is the opposite – dirty laundry and risky stuff. The anti-aquaculturists know this and that is why there is a continual litany of bad press. We pay attention and even shop for the "lowest risk" product, not the best, so the best marketing strategy is one which portrays a product as the least risk choice (i.e.: the false idea that farmed fish is more risky, … etc). Also, marketers know that the more something is repeated, the more we tend to believe it (whether it is true or not).

The notion of how critical aquaculture is to both our seafood supply and saving our aquatic ecosystems is a right and just one. Stock enhancement aquaculture is absolutely essential for the maintenance of wild sport and commercial species. It is naive to think that wild habitat and ecosystems can be restored so that natural runs of salmon and other species will fully meet our expanding seafood demands, or that this trend can be curbed. We absolutely need both stock enhancement and "egg to fork" aquaculture. The narrative must be retaken and a litany of real science-backed, vivid messages, soundbites and memes generated, with a continual barrage to drive home the ideology that "the risk to our future is too great if we don't farm aquatic species". em

Hugh Mitchell, MSc, DVM is an aquaculture veterinarian with more than 25 years of experience, who provides services and fish health tools to fish farmers across the US and Canada. His practice is AquaTactics Fish Health, out of Kirkland, Washington, specializing in bringing a comprehensive professional service/product package to aquaculture, including: vaccine solutions, immune stimulants, sedatives, antimicrobials and parasiticides.
website: www.aquatactics.com;
contact: hughm@aquatactics.com