Salmon Skin is Healthier If Allowed Brackish Water Transition

Dr. James J. S. Johnson

Once again, results are better when aquaculture practices more closely copy the natural life cycle of Atlantic salmon.(1),(2) In other words, the closer fish farmers get to copying God's natural program for anadromous fish life cycles, the healthier it is for the fish being farmed.(3) This is no surprise for biblical creationists, but for secular scientists this has been a new learning experience.

> Smolt that have been kept in brackish [slightly salty] water for two weeks in their hatcheries before being transferred to marine nets pens are less susceptible to skin ulcers caused by *Tenacibaculum*. So concludes new research organised by [Norwegian aquaculture giant] Cermaq R&D and the University of Bergen (UiB), which tested various smolt production strategies in relation to *Tenacibaculum* susceptibility.(1)

In the wild, salmon smolt travel downstream, to brackish estuarial waters, where freshwater streams mix with tidal saltwaters. Living in the brackish (i.e., slightly saline) waters for a while, the smolt (then becoming post-smolt) acclimate to the salinity changes, then head out to sea where it the salinity is at ocean strength.(3)

However, in the aquaculture industry, this transitional acclimation phase has not been mimicked, so the farmed fish have been dumped form freshwater tanks into marine netpens, thus being deprived of the advantages that God programmed into the transitional brackish waters phase.(4)

> Ensuring smolt adapt successfully after transfer to marine sites is notoriously difficult, but Virginia Iglesias of the Fish Vet Group offers some valuable insights into failed smolt syndrome and how to minimise it. The failure to adapt between freshwater (hypo-osmotic medium) and seawater conditions (hyper-osmotic medium) and return to normal feed, due to either inadequate fish development or alteration of osmoregulatory capacity in smolts, constitutes one of the main causes of losses in farmed Atlantic Salmon (***Salmo salar***). The potential causes of this syndrome are complex and not yet fully understood, with no simple recommendations on how to address the problem.(4)

The disadvantages of "skipping" this key ecological stage in the salmon's natural life cycle had been noticed, in past studies, as causing osmoregulatory problems.

> Several factors can lead to failure in the osmoregulatory process – both directly after transfer to seawater and in the period just after the populations have been transferred to a new environment. The time of transfer appears to be a major determinant, with salmon smolts transferred to sea either prematurely (before the beginning of the physiological transfer window) or too late (while exceeding their window) commonly presenting reduced osmoregulatory ability in saltwater.(4)

Tenacibaculum infection ulcers are particularly prevalent in salmon living in colder oceanwaters, such as the coastwaters of Bergen in northern Norway.(2) Until the recent Nofima aquaculture research in Bergen, it was not known that farmed salmon's immune defenses, if (as post-smolt) deprived of time in brackish waters, were extra vulnerable to *Tenacibaculum* infection ulcers.

> Normally, post-smolt are transferred directly from fresh water to seawater shortly after smoltification. Other strategies include keeping the fish in fresh water for longer periods, or adding saltwater before transferring them to the sea. … [The **Nofima-Cermaq** research team] took samples of smolt before and after infection. This was done to investigate what happens in the skin when fish are infected. The trials were carried out at the Industrial and Aquatic Laboratory (**ILAB**) in Bergen. After the fish were smoltified, post-smolt weighing 70 grams, 100 grams and 150 grams - in both fresh water and in brackish water (26 parts per thousand of salt) - were transferred to seawater and infected with the *Tenacibaculum* bacterium.(1)

The University of Bergen research team analyzed the salmon tissues to determine how *Tenacibaculum* infection occurred.

> The team, which was led by UiB researcher Marte Fredriksen, used various histological tools to investigate where in the tissue the bacterium was located. … The study showed that the skin of salmon farmed in freshwater developed differently compared to the fish reared in brackish water.(1)
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> The surface of the skin of the freshwater salmon was also weaker than the skin of the brackish water salmon when transferred to seawater, explains Christian Karlsen, an aquamedicine scientist at Nofima and Fredriksen's supervisor: "The most obvious effect was more damage to the epidermis of the freshwater fish, which worsened when the fish became infected. By putting this in context with the trial's mortality rates, we believe that the transition to full-strength seawater is a greater strain on freshwater fish than on brackish water fish. This suggests that the fish can be acclimatised to seawater by keeping them in brackish water before transferring to seawater, therefore reducing the risk of tenacibaculosis."(2)

In other words, God equips the salmon immune systems by programming them to practice an anadromous lifestyle—that includes transitioning in brackish estuarial waters before 'heading out to sea'—so that the young salmon are prepared for interacting with saltwater-hosted planktonic bacteria like *Tenacibaculum.*

Once again, careful research has proven the astonishingly complicated and spectacularly providential details of the Atlantic Salmon.(5)

All of this should immediately remind us to glorify God, as ICR's Dr. Jeff Tomkins does, for how He has made this magnificent fish.

> This fish [*Salmo salar*] is born inland in freshwater streams miles from the ocean, migrates to live in the salty sea, and then returns to fresh water so it can spawn.
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> The salmon has a unique ability to maintain a constant healthy level of saltiness. Its internal cellular and organellar systems adjust automatically in response to environmental tracking systems that monitor external salt levels. Chief among these engineered systems are specialized sodium pumps embedded in the cell membranes. The pumps' activity is coordinated not only within the internal apparatus of the cell but also with other systems in the salmon's various organs, especially those on the forefront of osmoregulation (the maintenance of body-fluid pressure) such as the gills and kidneys. In addition to these integrated cellular systems, the salmon has built-in behavioral traits to also manage its salt levels. Instead of immediately charging into the ocean or back into fresh water, it pauses to temporarily equilibrate its body in transitionary zones between the two.(6)

If we take the time to learn, even salmon can teach us examples of God's caring and careful genius, as swimming exhibits of God's providential programming, filling parts of the earth that such fish are fitted for.

> Or speak to the earth, and it will teach you; and the **fish** of the sea will explain to you: Who among all these does not know that the hand of the LORD has done this?(7)

References

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3. Salmon (and steelhead trout) begin life in freshwater streams, survive a shocking salinity change as they migrate to oceanic saltwater, and then brave a reverse version of salinity shock as they return to their native freshwater streams to reproduce. Regarding the Atlantic Salmon's natural life cycle, including the transition from freshwater stream to oceanic saltwater, see Johnson, J. J. S. 2020. Salmon Young Take the Plunge in May. ***Creation Science Update*** (May 13, 2020), posted at https://www.icr.org/article/salmon-young-take-the-plunge-in-may . Salmon depend on photoperiodicity as phenological data in order to physiologically time key changes within their life cycle sequences. See Johnson, J. J. S. 2015. The Moon Rules. ***Acts & Facts.*** 44(9):21, posted at https://www.icr.org/article/moon-rules . See also Behnke, R. J. and J. R. Tomelleri. 2002. ***Trout and Salmon of North America***. New York: Simon & Schuster, page 7.
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7. **Job 12:8-9.**