

NOVA SCOTIA AQUACULTURE REVIEW BOARD

IN THE MATTER OF: *Fisheries and Coastal Resources Act*, SNS 1996, c 25

- and -

IN THE MATTER OF: An Application by KELLY COVE SALMON LTD. for a boundary amendment and two new finfish aquaculture licenses and leases for the cultivation of Atlantic salmon (*Salmon salar*) – AQ#1205x, AQ#1432, AQ#1433, in Liverpool Bay, Queens County

Affidavit of Andrew Swanson, PhD affirmed on February 16, 2024

I affirm and give evidence as follows:

1. I am Andrew Swanson, PhD of Halifax, Nova Scotia, the Vice President of Research and Development at Cooke Aquaculture Inc, the parent company of the Applicant in this proceeding, Kelly Cove Salmon Ltd, which is the Canadian Farming Division of Cooke Aquaculture Inc. (“**KCS**”).
2. I have personal knowledge of the evidence affirmed in this affidavit except where otherwise stated to be based on information and belief.
3. I state, in this affidavit, the source of any information that is not based on my own personal knowledge, and I state my belief of the source.

Rebuttal Report

4. I have reviewed the report filed with the Nova Scotia Aquaculture Review Board prepared by Dr. Neil Hammerschlag, attached as Exhibit A to his affidavit sworn on January 19, 2024 (the “**Report**”).
5. My opinion to Dr. Hammerschlag’s Report are set out in my report attached as **Exhibit A**.
6. My CV is attached as **Exhibit B**.

AFFIRMED before me virtually on MS Teams with Dr. Swanson and me in Halifax, Nova Scotia on February 16, 2024.



Sara D. Nicholson
Barrister of the Nova Scotia Supreme
Court



Andrew Swanson, PhD

**KCS Application re AQ#1205X, AQ#1432,
AQ#1433 in Liverpool Bay, Queens County**

This is **Exhibit A** referred to in the Rebuttal Affidavit of Andrew Swanson, PhD virtually affirmed before me on February 16, 2024.



Sara D. Nicholson
Barrister of the Nova Scotia Supreme Court

Rebuttal Report for the Nova Scotia Aquaculture Review Board

With respect to the Application by Kelly Cove Salmon Ltd. for a boundary amendment and two new finfish aquaculture licenses and leases for the cultivation of Atlantic salmon (*Salmon salar*) – AQ#1205x, AQ#1432, AQ#1433, in Liverpool Bay, Queens County

Andrew Swanson, PhD

February 16, 2024

(1) BACKGROUND

1. On behalf of Kelly Cove Salmon Limited (“**KCS**”), I led a review by KCS’s technical staff of the affidavit and opinion of Dr. Neil Hammerschlag of Boutilliers Point, titled “*Potential Threats of the Proposed Salmon Farming on (Great) White Sharks, a species at risk,*” submitted by the Intervenor Region of Queens Municipality.
2. Dr. Hammerschlag’s opinion, unfortunately, only offers literature describing negative interactions with non-salmonid aquaculture farms, or wild fisheries. Further, Dr. Hammerschlag speculates, without proof, that behaviors of unrelated shark species will be identically shared by Great White Sharks (*Carchorodon Carcharias*; “**GWS**”), leading to what in my opinion is an inappropriate speculation that salmon marine aquaculture in Liverpool Bay will threaten GWS populations.
3. To address the specific concerns raised, I conducted a scientific review and consultation which includes more detail of KCS’s salmon marine farm operations, as well as recent, but omitted, scientific findings on this topic, and summarized historic data gathered from Cooke Aquaculture Inc.’s marine farm operators both regionally (New Brunswick, Newfoundland, and Maine), and globally (Australia, Scotland, Spain, and Chile) regarding GWS interactions. I also obtained and present important unpublished data provided to me by Department of Fisheries and Oceans (“**DFO**”) science experts of GWS behavior in Atlantic Canada.
4. As appropriate, this document specifically focuses on concern raised by Dr. Hammerschlag of potential impacts to Atlantic Canada GWS populations, particularly with respect to KCS’s current or proposed Liverpool Bay aquaculture operations.

5. Based on all available evidence and historic data for salmonid aquaculture, I conclude that GWS populations will continue to co-exist safely with the existing Coffin Island farm, as well as the new proposed farms in Liverpool Bay, Nova Scotia.

(2) SALMON AQUACULTURE INTERACTIONS WITH GREAT WHITE SHARKS – ATLANTIC CANADA

6. GWS are known to be present in the region (Bastien et al 2020).
7. The Coffin Island farm has operated in Liverpool Bay without a single GWS incident for 22 years (the last 13 years under KCS).
8. Further, for over 38 years, KCS and other Cooke Aquaculture Inc subsidiaries have operated salmon and trout marine farms across Atlantic Canada and the eastern United States without a single negative interaction with a GWS. This includes zero incidences of observed or suspected GWS entanglements, as well as GWS attacks on nets, salmon, or people.
9. KCS maintains rigorous monitoring and reporting programs for wildlife and endangered species encounters (see: Wildlife Interaction Plan¹). KCS monitors underwater infrastructure with underwater cameras, ROVs, and commercial diving teams, also reporting encounters as observed.
10. Although GWS have been recorded in our other Atlantic farming regions (New Brunswick and Maine), KCS staff at the Coffin Island farm have not yet recorded a GWS. Prompted by Dr. Hammerschlag’s concern, I contacted Dr. Marc Trudel, a research scientist at DFO, and learned that DFO has recently developed and deployed acoustic tagging technology which has collected data that confirms that GWS do utilize Liverpool Bay quite frequently, and in large numbers (M. Trudel, personnel communication).
11. DFO’s analysis of multiple years (2019 to 2021) of acoustic tracking data captured 48 tagged individual GWS utilizing both Liverpool Bay and Port Mouton Bay multiple times (167 unique events), with some individuals returning to these bays over multiple years. Visits to bays (not necessarily proximal to farms) were measured and found to be typically

¹ The Wildlife Interaction Plan is attached as Appendix E to the Liverpool Bay Development Plan for the Application prepared by SIMCorp for KCS dated March 6, 2019 (“**Development Plan**”), contained in the Application Package filed by the Department of Fisheries and Aquaculture (“**DFA**”) with the Nova Scotia Aquaculture Review Board.

less than 1 hour in duration. Importantly, DFO's combined dataset revealed no statistical difference between the number of GWS visits to bays when salmon farms were stocked or when they were unstocked (M. Trudel, personal communication; Figure 1 provided by M. Trudel).

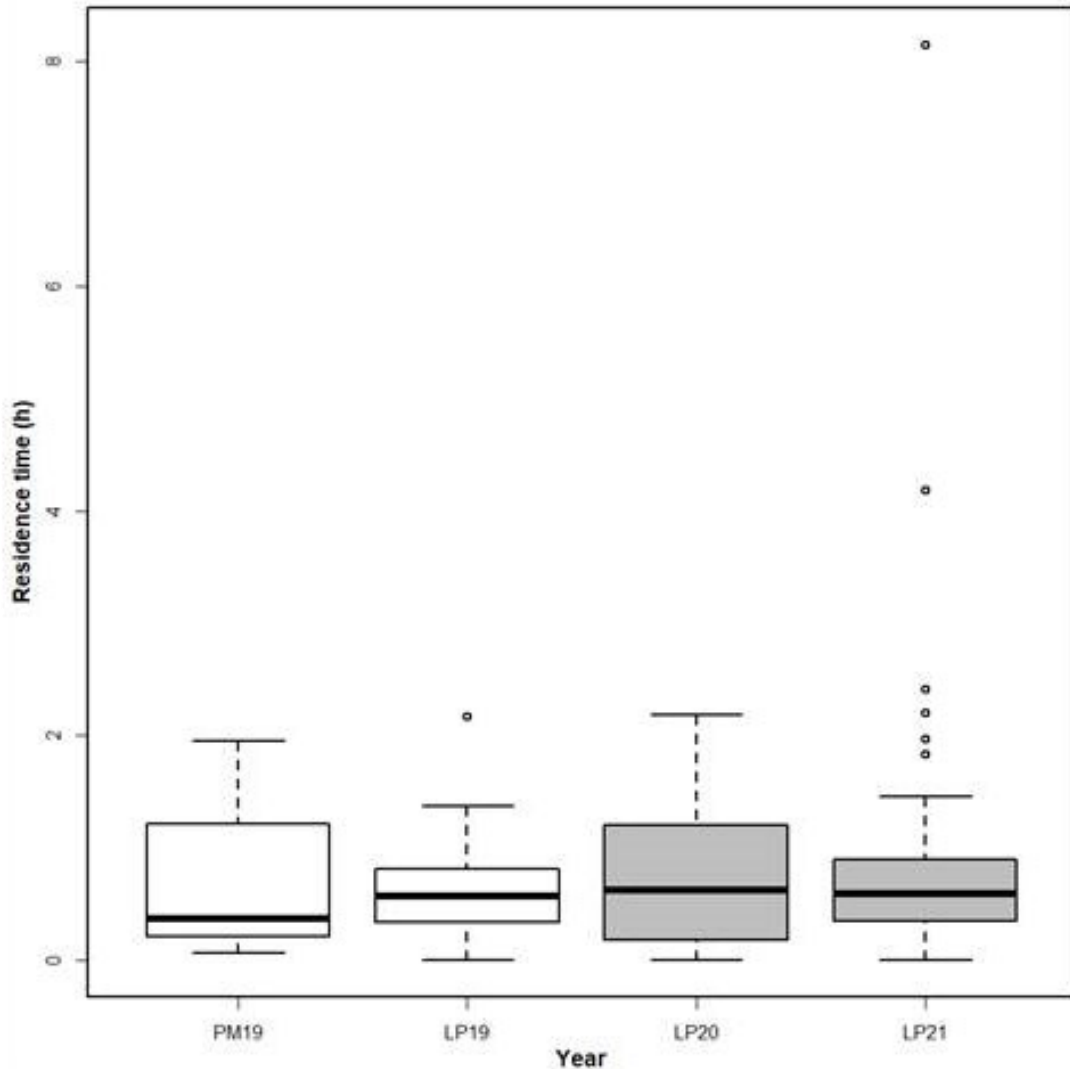


Figure 1. Residence time (hours) of Great White Sharks in Liverpool Bay (LP) and Port Mouton (PM), with stocked salmon farms (grey) or unstocked (white), with number denoting years 2019 (=19), 2020 (=20), and 2021(=21).

12. Although large numbers of GWS (estimated approximately 300 – 500 individuals) occur in Liverpool Bay and surrounding waters, based on the duration of time and their proximity to stocked marine cages, the GWS occurrences appear to be largely transitory in nature,

and not due to any specific stimuli or local attraction (M. Trudel, personnel communication).

13. I attach at Tab A the DFO Animation Liverpool GWS track dated November 2, 2021, provided to me by Dr. Trudel of DFO, that illustrates the co-existence of GWS with the existing Coffin Island farm. This animation tracks a GWS visit that occurred on November 2, 2021 in Liverpool Bay.
14. KCS's Coffin Island farm records from November 2, 2021 show that operations were typical, feeding had been occurring at normal near continuous rates and ration, and the farm was fully stocked with large salmon nearing harvest weights. Moreover, a commercial diving team were active in the water performing routine maintenance of the cage.
15. As visits by other GWS are typically recorded less than 1 hour, on November 2, 2021, the visit by a GWS to Liverpool Bay was noted as exceptionally long (approximately 8 hours; 5 am to 1 pm). However, despite the longer time period, this GWS spent less than approximately 4% of its time proximal (<100 m) to the Coffin Island farm, predominately swimming in other areas of the bay before safely departing area without harm (M. Trudel, personal communication), or detection by KCS staff or local fishermen.

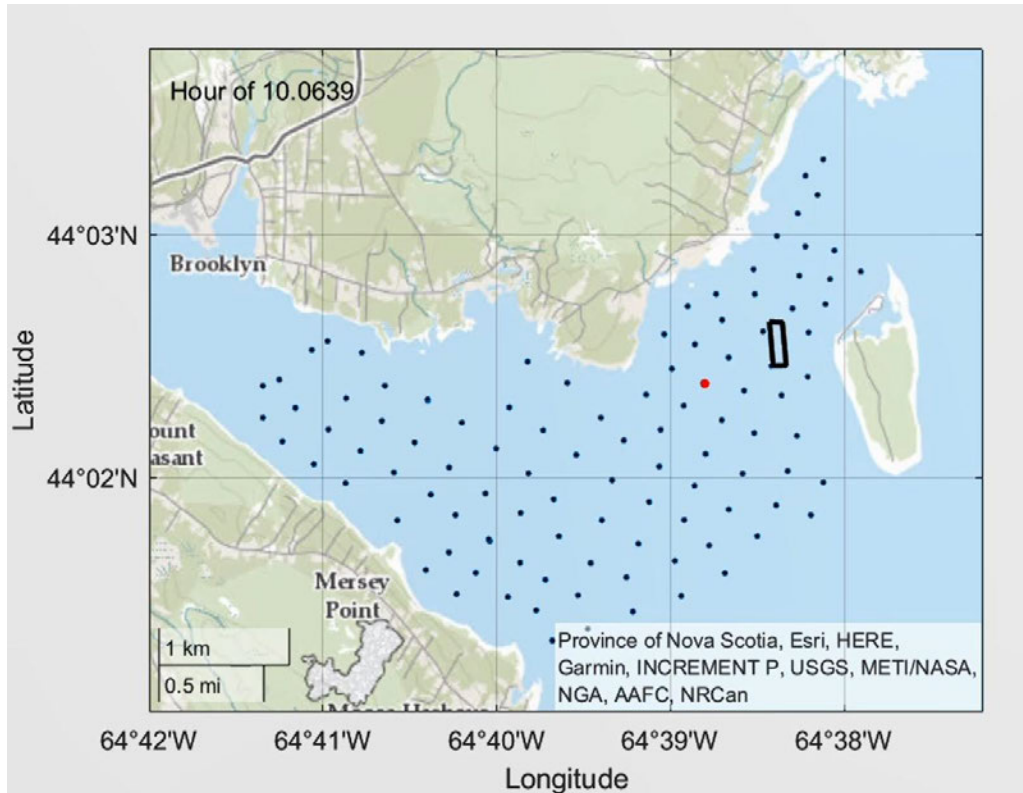


Figure 2. Screenshot of “Animation Liverpool GWS track November 2, 2021), with location of an acoustically tagged Great White Shark (red dot) detection, in comparison to stationary array of Liverpool Bay sensors (blue dots), and Coffin Island salmon farm (black rectangle).

16. Along with previous evidence, I conclude that attraction, if any, of this GWS to the salmon farm was minimal at best, reinforcing our opinion that the Liverpool Bay salmon farms do not pose any measurable concern for GWS, and highlighting our current successful co-existence with GWS in Liverpool Bay.
17. My review of the results of parallel DFO studies in the Bay of Fundy (New Brunswick), which is a much larger production region with over 90 salmon marine farms, also demonstrates that GWS, estimated to be between 300 - 700 in number, were unharmed despite higher numbers of salmon farms (M. Trudel, personal communication). Specifically, between 2021 to 2022, 70% of marine farms with detectors were approached to within a distance of 800m a total of 813 times, by at least 59 tagged GSW individuals.
18. Similar to Nova Scotia, most (94%) of these visits were brief, typically less than 1 hour in duration (M. Trudel, personal communication). Despite a larger number of salmon marine farms, there have been no reports of negative interactions with GWS in nearly 40 years of New Brunswick salmon farming. Since the proposed expansions for Liverpool Bay farms

would be in no way different, regarding farm methods, equipment, or protocols, I am strongly of the opinion that the expansion of the number of Liverpool Bay farms will not likely adversely affect the GWS.

19. In summary, to the concern expressed by Dr. Hammerschlag that existing or future salmon marine farms will attract and potentially endanger GWS, the Liverpool specific datasets provide important evidence to the contrary. Specifically, from a multi-year data set which recorded tens of individual GWS, it is clear that salmon aquaculture farms do not measurably attract GWS. Further, given that large numbers of GWS that are utilizing Liverpool Bay, without any entanglements or net attacks, I can also safely conclude that current methods of salmon aquaculture do not endanger GWS in Liverpool Bay.

(3) SALMON AQUACULTURE INTERACTIONS WITH GREAT WHITE SHARKS - GLOBALLY

20. My discussions with all our global marine farm operators also revealed no reports of GWS interactions from Scotland, Spain, or Chile, despite these all being within the reported habitat range of GWS.
21. Salmon farm operators in Australia (Tassal) offered that although GWS are reported around their farms, it is relatively rare occurrence, and they are not a concern. Importantly Tassal (Cooke Aquaculture Inc) began operations there in 2014, and no negative interactions with GWS have occurred. This co-existence of salmon farms in Australia with GWS is well documented, and is an important auditable component of Tassal's wildlife impact reporting and compliance in order to meet the rigorous standards of the Aquaculture Sustainability Certification (ASC). It is also publicly disclosed within Tassal's sustainability reports.
22. These observations of our modern salmon farmers in Australia, as well as from data generated by the DFO for Nova Scotia (M. Trudel, personal communication) also supports the findings of a recent study conducted in Australia. Huveneers et al. (2022) summarized that over a 5-year tracking period, acoustically tagged GWS showed no increased attraction or prolonged residency around aquaculture marine farms as compared to adjacent waters.
23. The authors of this 2022 paper state, "*Although aquaculture pens can produce stimulus and cues that can attract sharks, for example, large fish biomass, fish mortality, or feeding events, we found no clear evidence of white sharks or bronze whalers being preferentially*

attracted to or spending extended time around the pen.” This finding was also shared by an earlier Australia study (Rogers and Drew, 2018) that was unable to show any important influence of commercial aquaculture pens on GWS.

24. Similarly, Dr. Marc Trudel of DFO stated, based on DFO’s research discussed above, that while white sharks can regularly be detected near aquaculture farms in Canadian waters, entanglement has not happened yet despite hundreds of animals coming into the area each year and therefore the likelihood of a shark to become entangled with an open net as currently operated in eastern Canada is “remote.” Dr. Trudel further stated that there are other potentially more serious threats to sharks, like bycatch in various fisheries, herring weirs in particular (M. Trudel, personal communication).
25. In summary, all data regarding GWS suggests that this species is not, and will not be endangered by salmon marine aquaculture, particularly in Liverpool Bay, Nova Scotia.

(4) MITIGATING THREATS TO GREAT WHITE SHARKS

a. GWS Attraction

26. KCS (& Global Cooke Inc) has developed and refined many farming methods and technologies to co-exist with large marine predators. KCS farmers have benefited from decades of collective staff experiences, service providers, and universities partners, successfully operating hundreds of marine farms across North America, Europe, South America, and Australia, similarly free from negative GWS interactions.
27. From these operations, it is well known that predator attraction is greatly reduced by facilitating rapid removal of any mortalities from cages, and by minimizing over-feeding of salmon.
28. Due to significant investments in vaccination, animal welfare and nutrition, our state-of-the-art farms typically experience very low mortalities.
29. For biosecurity and farm health, mortalities are rapidly removed by equipment capable of managing any volume necessary. This is conducted by provincial dive teams, mortality collecting ROVs, or by pump equipped support vessels. Passive mortality collection pumping systems for individual cages, which remove mortalities daily, are being trialed.

30. KCS's rapid mortality removal acts to prevent disease spread, but also would prevent decay processes, reducing any potentially associated sensory cues to GWS.
31. Harvest operations follow the latest harvest SOPs designed for animal welfare which minimize the time fish are in the seine, which would also minimize any potential sound attraction to GWS.
32. Harvest vessels isolate and transport contained fish, blood and mucus volumes. Contained mortalities are transported safely to on-land disposal sites in leak proof vessels, further reducing attraction to the farm.
33. Underwater feed cameras are used when feeding to minimize any feed waste. On-going investments in artificial intelligence driven feed cameras are further reducing any feed waste, reducing attraction to area.

b. GWS Exclusion

34. KCS uses state-of-the-art steel core reinforced nets, specifically designed to be abrasion, and cut resistant to marine predator attacks (tearing and biting).
35. From experience, secondary predator netting has not historically been required during the period that GWS are known to be present in Nova Scotia waters (Bastein et al 2020). As this is also a period of heavy net biofouling, which impacts the health of salmon, I do not consider that deployment of such secondary netting is merited when one considers the benefits versus the risk of mortality (and potential attraction by GWS). Nonetheless, an extended seasonal deployment of this secondary exclusion tool could be undertaken if GWS behaviors change from what has been observed to date.
36. Inspections of nets and cage integrity via underwater cameras, divers or ROVs are conducted daily. Repair of any discovered damage or suspected weakness is completed immediately.
37. Although individual net fibers are not able to withstand an ideally positioned bite strength force by a GWS, aquaculture nets are designed with materials to withstand significant storms, tidal forces, and mechanical impacts, and spread energy across the entire structure making them much stronger than just the individual fibers. Tightly maintained aquaculture nets are severally weighted across the entire structure to maintain proper

shape and volume. For the jaw of a GWS to apply their full bite strength, their upper and lower jaw would first have to move tons of weighted net together to fully engage down onto net fibers, which is highly unlikely.

38. As GWS are ambush predators, commonly propelling themselves rapidly upwards towards a surface prey, such as seals, the comparatively shallow depth of Nova Scotia salmon farms and proximity of nets to the bottom would likely act to deter GWS ability to functionalize any attack. Interestingly, shallow depth of farms in Australia was also highlighted as a possible reason why GWS were not observed to interact with aquaculture farms (Huveneers, C. et al 2022).

c. GWS Release

39. Aquaculture nets are designed with materials to withstand significant storms, tidal forces, and mechanical impacts, and so require tough, inflexible netting. Furthermore, aquaculture nets are weighted to maintain proper shape and volume. As such, without loose ropes or nets it is highly unlikely a GWS would be able or become entangled.
40. Given zero breaches by GWS in over 38 years of operations, there are no specific protocols in our farm plan for GWS, however, if any entanglement occurrence is discovered, given the similarities, the GWS would be safely released using the well-practiced procedure by our farm operators in the event of a seal entrapment (see: Wildlife Interaction Plan, Section 8.2.1).

(5) SUMMARY

41. On balance, based on historical and current operational experiences, available literature, and with input by regional experts, I am of the opinion that Kelly Cove Salmon's aquaculture practices in Atlantic Canada will not negatively affect the endangered Great White Shark, nor cause any harm to the population's regional recovery. Our company's mandate focuses on being good stewards of marine resources and the ocean environment. Much like our investments in wild salmon conservation, we are pleased to be assisting regional biologists, and any other willing groups towards efforts to preserve endangered Great White Shark populations.

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TAB A

DFO Video titled, "Animation Liverpool GWS track November 2, 2021."

Secure link provided to the ARB under separate cover.

**KCS Application re AQ#1205X, AQ#1432,
AQ#1433 in Liverpool Bay, Queens County**

This is **Exhibit B** referred to in the Rebuttal Affidavit of Andrew Swanson, PhD virtually affirmed before me on February 16, 2024.



Sara D. Nicholson
Barrister of the Nova Scotia Supreme Court

ANDREW K. SWANSON, PhD, MSc

Professional

- **Vice President - Research & Development, Cooke Inc.** (2019 - Present), Saint John, NB, Canada - *Aquaculture & Fisheries; Bio-products; Food Science & Manufacturing; Sustainability*
- **Advisor - Innovation & Commercialization, Ocean Frontier Institute** (2019 - Present), Halifax, NS, Canada - *Atmospheric-Ocean Science; Oceantech; Fisheries & Aquaculture; ESG*
- **Adjunct Professor**
 - **Memorial University** (2021 - present), St. John's, NL – *Physiology, Aquaculture*
 - **Dalhousie University** (2015 - 2019), Halifax, NS – *Sustainability, Food Science*
- **Associate & Mentor, Creative Destruction Lab** (2019 – 2021), Halifax, NS, Canada – *Oceantech, AI, Fisheries & Aquaculture, Entrepreneurial Incubator*
- **Vice President / Research & Partnerships Director, AeroFarms Inc.** (2017 - 2019), Newark, NJ, USA – *Hydroponics, Vertical Farming; Sustainability; Food Manufacturing, BioProducts*
- **Chief Executive Officer, Verschuren Centre for Sustainability** (2012 - 2017), Sydney, NS, Canada - *Contract R&D, Commercialization Consultancy, Aquaculture, Fisheries, Oceantech, Cleantech, Nanotech; Sector HQP Training*
- **Project Manager, Energy Focus Corporation** (2012), Solon, OH, USA – *Illumination & Fixture Manufacturing; Smart Sensor, Energy Efficiency Tech & Commercialization*
- **Vice President - Research & Development, Phycal Corporation** (2008 - 2012), Highland Heights, OH, USA – *Fuel & Feed Manufacturing; Fermentation; Water Technology*
- **Chief Executive Officer & Co-Founder Limnos Energy LLC** (2007 - 2008), Kirtland, OH, USA - *Aquaculture & Aquaponics; Food, Feed & Fuel Products*
- **Business & Technology Consultant, HydroPartners LLC** (2006 - 2007), Solon, OH, USA - *Clean Energy; Site Development; Civil Engineering*
- **Assistant Professor – Biology, Case Western Reserve University** (2003 - 2007), Cleveland, OH, USA - *Marine and Freshwater Biology, Physiology; Molecular Biology; Global Change*
- **Research Scientist, Ministry of Agriculture & Agri-Food Canada** (2000 - 2002), London, ON, Canada - *Functional Genomics; Molecular Biology & Biochemistry*

Education

- **Ph.D.** in Biological Sciences, Simon Fraser University, Burnaby, BC, Canada
- **M.Sc.** in Plant & Environmental Sciences, Western University, London, ON, Canada
- **B.Sc. (Honors)** in Biology, Western University, London, ON, Canada

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