

A New Perspective of Commercial Shellfish Growers use of Plastics in Marine Waters Including Henderson Inlet

The fact that plastics are adversely impacting on the world's natural environment including the Salish Sea is not controversial. There is a huge body of scientific work available that firmly establishes the threat of escaped plastic and their essential components. One has only to do a casual internet search to find thousands of research articles about the negative impact of microplastics (MPs) on the environment. Indeed, a 2022 study found 6608 research articles published since 2006.¹ That science is expanding rapidly, reflecting the alarm of the scientific community about the biologic impacts that are unfolding. Still, there are huge gaps in our knowledge of the effects of MPs on our ecosystems and, indeed, on our own bodies.

Given the time constraints of today's hearing, there is time to review only a small fraction of that literature, which I will do to emphasize the urgency of the problem. Because the health of humans is intimately related to the health of our environment and of the food products that come from that environment, it follows that the effect on marine animals is inseparable.

Please see the footnoted analysis by Dr Ronald Smith MD titled *Impact of Microplastics on Health* for a thorough and specific discussion about the scope of this problem. Here is the summary from Dr. Smith's research:

- Plastics and their breakdown products including microplastics are ubiquitous, occupying all portions of our world from the deepest oceans to the highest mountains; massive amounts are being created, dispersed and degraded, with no reasonable possibility of recovery at this time.
- Microplastics have been incorporated into the tissues of every living thing in our world.
- There are considerable known health impacts from the myriad of chemicals and heavy metals which are employed in the manufacture of plastics affecting the health of diverse life on earth, including humans.
- The intentional and unintentional placement of plastics in our oceans leads to formation of microplastics which are now notably present in seafood.
- At the apex of the food chain, it is likely that humans and other higher mammals such as Orca whales will suffer the greatest health impact from the fallout of plastics
- There is a high likelihood, given our early state of scientific knowledge, that the negative effects of microplastics on our health will be much more extensive than we currently imagine.

For additional reference, please see the book by noted researcher and author Shanna H. Swan, PHD *Count Down – How Our Modern World is Threatening Sperm Counts, Altering Male and Female Reproductive Development, and Imperiling the Future of the Human Race.*

Also note that the existing 1990 Thurston County Shoreline Master Plan (SMP) states in Section two, General Goals and Policies H. “Protection of public health is recognized as a primary goal. All applicants for development or use of shorelines shall be closely analyzed for their effect on the public health.” We will show that Taylor violates this principle.

Microplastics (MPs) are defined as synthetic solid particles or polymeric matrices, with regular or irregular shape and with size ranging from 1 µm to 5 mm, of either primary or secondary manufacturing origin, which are insoluble in water. In practical terms, that’s about the length of a bacterium to the width of a pencil. Nanoplastics (NPs), less than 1 µm in size are also coming under scrutiny.² MPs can be primary such as from cosmetics or contributed from clothing, but are more commonly attributed to breakdown products from plastic consumer and industrial products. By 2050 the total mass of plastic manufactured is expected to reach 33 billion tons with annual expected plastic waste to the environment reaching 67.8 million metric tons.

We can agree with Taylor Shellfish’s plastic expert that 80% of marine microplastic is actually terrestrial in origin, but there are increasing direct uses of plastics in marine industry, especially in aquaculture. The shellfish industry argues that their contribution of plastic is small relative to other sources. It is not. If PVC pipe is used at the Johnson Point Loop site the approximately 140,000 individual pieces of 6” pipe will have a total weight of about 70 tons. This contribution of plastic to the environment is staggering, likely representing the largest allowed by permit from any industry.

Importantly, they argue that their placement of plastics in the marine environment is temporary. For all practical purposes, it is not.

Taylor Shellfish claims, through their experts, that their plastics have no negative environmental impact. These arguments are false and even disingenuous.

It is well established that plastics, including Polyvinyl Chloride (PVC) and High-Density Polyethylene (HDPE) break down in the environment over time, and Taylor does not dispute this. However, they focus on only one mechanism of breakdown. There are actually three mechanisms for the breakdown of plastics into MPs and NPs as stated in this scientific analysis:

Wayman, Chloe, and Helge Niemann. “The Fate of Plastic in the Ocean Environment – a Minireview.” *Environmental Science: Processes & Impacts* 23, no. 2 (2021): 198–212.

<https://doi.org/10.1039/D0EM00446D>

- “Fragmentation - In the marine environment, plastic fragmentation is induced by mechanical stress, e.g. due to wave action. Furthermore, fragmentation is accelerated through weathering and potential biological degradation, as these make plastics more brittle. Fragmentation leads to a change in Plastic Marine Debris (PMD) size distribution,

² Frias and Nash, “Microplastics: Finding a Consensus on the Definition.”

and while fragmentation does not remove PMD from the environment, it can accelerate physicochemical and biochemical reactions at the PMD surface because the surface to volume ratio of smaller particles is higher. Progressive PMD fragmentation also leads to the formation of particle sizes $<1\ \mu\text{m}$, i.e. nanoplastics, through multiple mechanisms.

- Photooxidation (i.e. exposure to sunlight) of plastics comprises free-radical reactions and chain scission initiated by (solar) UV radiation. The basic mechanisms and photochemical reactions are well known including differences in the degradation pathway of different polymers. Assuming that the residence time of PMD at the ocean surface could be in the order of years (half-life estimates of 220-380 years), and/or that PMD might oscillate in the water column and periodically re-surfaces, preliminary results show that photooxidation may indeed account for a substantial transformation of PMD into smaller chain scission products and nanoplastics.
- Plastic biodegradation entails the assimilation and mineralization of plastic-derived carbon mediated by microorganisms, leading to its eventual removal from the natural environment. As such, plastic biodegradation can proceed as a two-step process where physicochemical processes initially break down the polymer matrix into more labile daughter products that may be degraded further through microbes. Both mechanical forces, and probably more importantly, photooxidation are known to degrade polymers. It seems very likely that a reduction in particle size leads to an increase in microbial degradation velocity because of the increase in surface to volume ratio when the particle becomes smaller.”³

Taylor’s experts ignore mechanical and biologic breakdown mechanisms, and attempt to discount UV light as a cause. Their arguments are false for several reasons:

1. While partially implanted on a geoduck plantation for only approximately two years of the roughly 7-year planting cycle, they are always exposed to degradation , never fully shielded from UV light (We all know about long summer days with very low tides), never shielded from the harsh elements of the beach, never away from biologic agents.
2. Tubes are saved for further use and are stored in the open, partially or fully exposed to daylight and therefore subject to cumulative degradation. Please see photographic evidence of how geoduck tubes are actually stored.

³ Wayman and Niemann, “The Fate of Plastic in the Ocean Environment – a Minireview.”



1 Plastic tubes at Taylor's Kennedy Creek site in 2023



2 Geoduck tubes stored for many months in Henderson Inlet

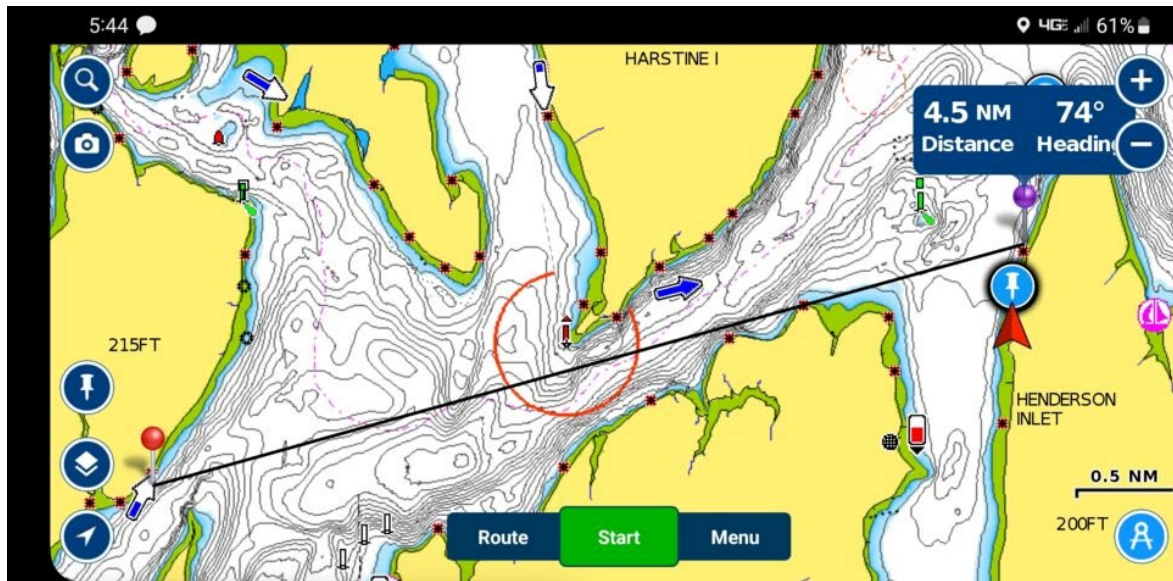


3 Massive piles of geoduck tubes at TaylorTown by Satellite



4 Large pile of geoduck tubes stored in open Xia site in Henderson Inlet

3. In testimony before the Thurston County Planning Commission in 2021, Taylor made arguments that the plastic tubes used in aquaculture have no expiration, and may be used indefinitely. Their stated plan is to use the product for 20+ years. Given the perpetual nature of the requested permit, these plastic materials will be degrading in our environment for decades.
4. It is acknowledged by the County, the Corps of Engineers, and industry that plastic will be displaced from the intertidal planting site, prompting federal and local mitigation requirement for recovery. Unfortunately, there is no data for how much plastic is expected to be permanently lost to the environment, as Taylor does not report this, and there is NO monitoring program in place by Thurston County. Since PVC is denser than water and sinks, it is more difficult to recover when displaced by growing geoduck, requiring Scuba, usually only done once per year.
5. The Johnson Point Loop site is one of the most exposed sites geographically in the South Puget Sound, directly impacted by storms from the west over a fetch of 4.5 nautical miles and tangentially from northerly storms over an 11-mile stretch. 3 to 4-foot waves can impact the beach during a severe storm. There is great risk of loss of geoduck tubes at this site.



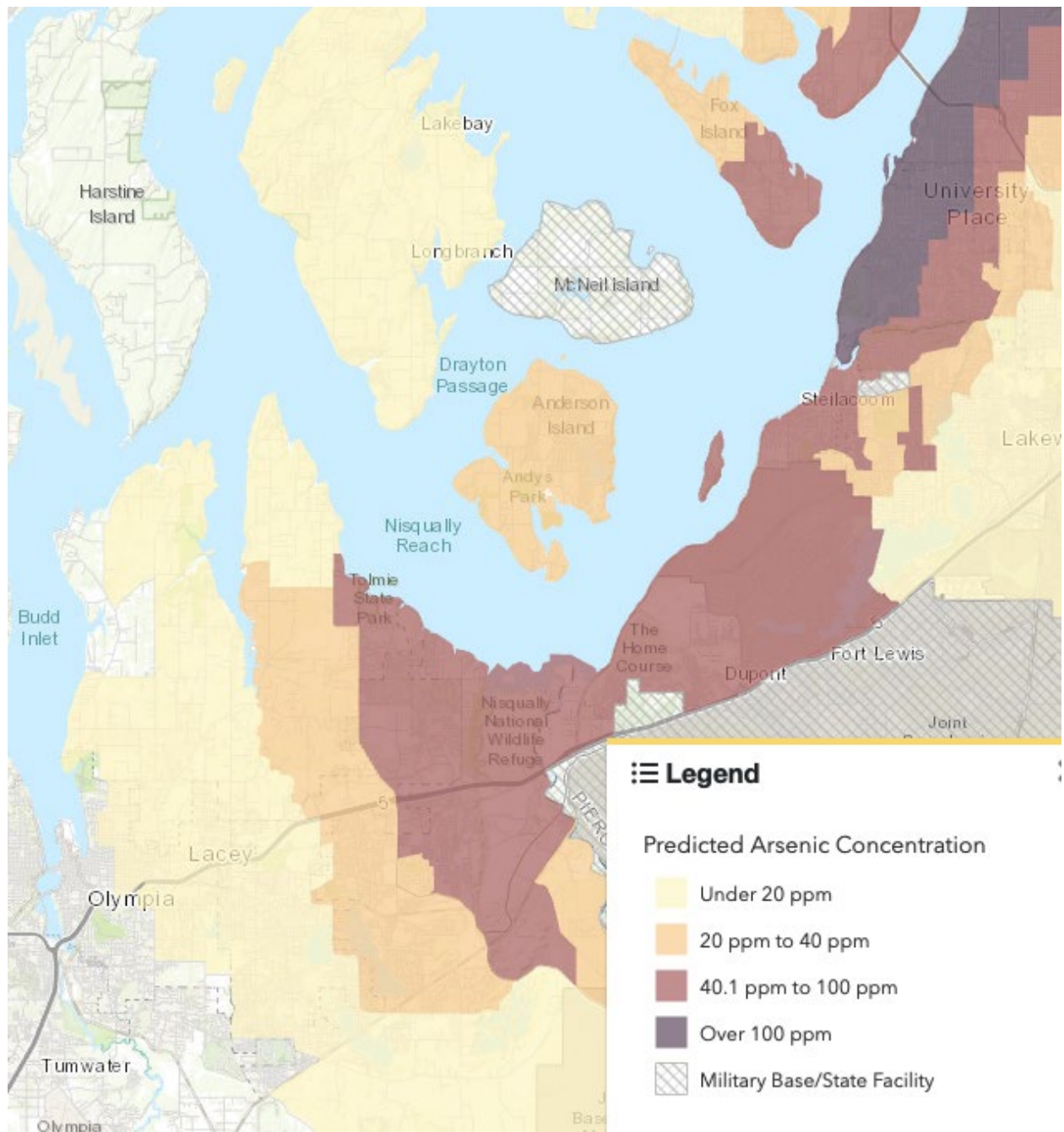
5 Nautical map showing 4.5 miles of open water from westerly storms

Taylor's expert will give testimony, as they have in the past, that PVC and HDPE are resilient and that they use only high-quality plastics, which do not contain or release harmful chemicals. This is false for the following reasons:

- Unlike the European Union and other countries of the world, the United States does not require that manufacturers disclose the contents of their plastics. While Taylor's experts may guess what additives they contain (*plastics cannot be made without additives*), they don't know exactly what is in them.
- Taylor's frequent claim to use only "Marine Grade" plastics is misleading, as there is no published standard for such. Taylor does not disclose their manufacturer and there is no outside monitoring. Certainly, some plastics are inferior to others. We don't know what they are actually using or where they got it.
- Taylor Shellfish's plastic experts cite literature about resilience of the plastics used in the environment which are based on observation in new material, ignoring the effect of degradation in the environment, which we have described.
- Taylor admits problems with PVC and claims that they are moving away from it, but in this permit application they specifically ask to allow its use.
- We agree that mesh HDPE tubes are a more resilient and better choice for several reasons, but insist it be recognized that HDPE deteriorates in the environment over time by the same mechanisms as PVC.
- Data about the extent of microplastic contamination of Puget Sound is very limited, as well as extent of leaching of chemical additives.

Finally, in any discussion about effects of heavy metals and chemical contaminants, it must be recognized that the proposed aquaculture site is within the plume path of the Tacoma Sarco Smelter, which spewed toxic waste for 100 years and which is a known superfund cleanup site. Of particular concern is arsenic and lead. There is no soil survey reported for this site, nor is there any known research available to assess whether geoduck, which commonly burrow to 3-foot depths on the beach would assimilate arsenic and lead. This is a huge oversight.

<https://ecology.wa.gov/spills-cleanup/contamination-cleanup/cleanup-sites/tacoma-smelter>



6 Henderson Inlet is shown in the range of the toxic plume from Sarco up to 40ppm

In summation,

- There is major concern in scientific circles about the impacts of plastics on the marine environment
- marine pollution by industry including the shellfish industry is a significant contributor.
- Taylor misrepresents the durability of its materials
- Taylor inadequately protects that material from environmental degradation.
- Their irresponsible actions violate the principle of *no net loss of ecological function*.
- Taylor bears the burden of proof to show that their practices meet established criterion, and that they do not place Henderson Inlet at risk. They cannot provide that proof.
- There is no proposed mitigation for these affects
- The Thurston County SMP requires that projects be evaluated for possible risks to the health of the people. This has not been done.