

YOU CAN STILL-FISH IN AMERICA 32

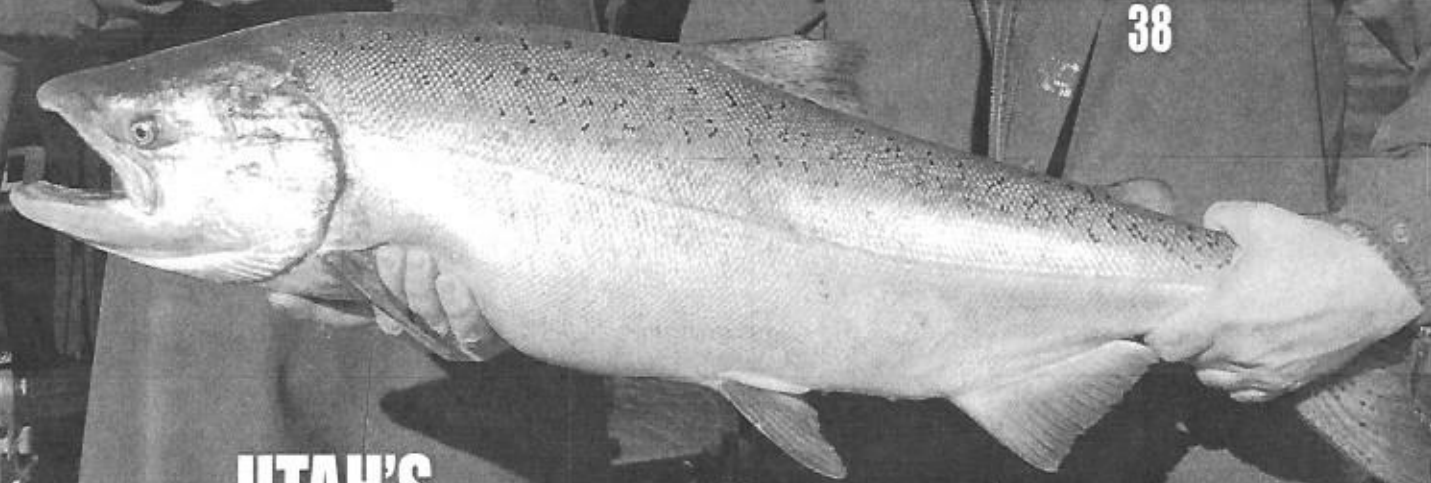
August-September 2023

# Salmon Trout Steelhead

WHAT IS PHOS 8

MCKENZIE MASTERS

38



UTAH'S GREEN RIVER

24

HANFORD EXPERIENCE

48

DISPLAY UNTIL OCTOBER 3, 2023

\$6.95 US \$6.95 CAN



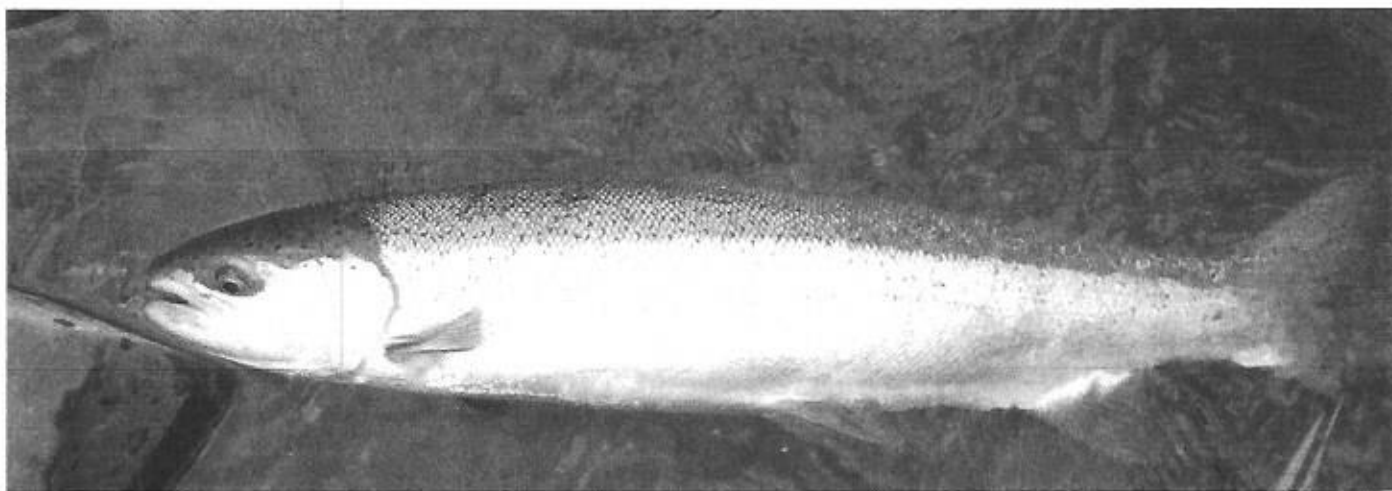
SalmonTroutSteelheader.com  
BROUGHT TO YOU BY THE PUBLISHER OF  
GREAT LAKES ANGLER

SPECIAL SUBSCRIPTION OFFERS!



## pHOS

### A TERM EVERY FISHERMAN SHOULD UNDERSTAND



I can remember the good old days back in the 70s and 80s when salmon and steelhead were abundant, and a fisherman had a reasonable expectation of bringing something home to eat when he went fishing practically anywhere in the Northwest. What sparked the great harvest opportunities were hatcheries complemented by a plentiful supply of wild fish. Adult fish entered a hatchery until production goals were met, then the entrance to the hatchery was closed and the rest were allowed to spawn in the river or sold commercially. In the late 1990s, some populations of anadromous fish began to decrease. This was not the first time as it is interesting to note that in the late 1800s, when the commercial gillnetting on the Columbia River was at its peak, there were down years too. In these early years there was no data on the status of river flows or ocean conditions, but these had to be important factors. Today, we now know the two most important natural phenomena that affect anadromous fish are drought and ocean conditions. We know there are multi-year variations of ocean temperatures associated with El-Nino. Warm ocean temperatures with El-Nino are harmful to the survival of Northwest anadromous fish.

Although hatchery origin fish (HO) were incriminated for the decline of natural origin spawning fish (NO), researchers did not include information on external factors such as ocean conditions, drought, or the pedigree of the hatchery fish in their research documents. Pedigree

is the genetic history of a species. Pedigree could include excessive inbreeding and can result in population decline. No doubt this could have been a real concern when early research was conducted on HO fish. Today, most hatcheries use updated methods of reproduction (Outbreeding) to keep quality high and the risk to NO fish is less than in the past. Since the fish all look alike, the relationships of each fish to each other at the time of spawning in a hatchery are unknown. Using broodstock retrieved from the same river offers the best chance for greater gene diversity and healthier offspring. The common belief among some researchers is that hatchery fish spawning with natural origin (NO) fish will only have half the reproductive success of NO x NO spawning. Other researchers have reported considerably better reproductive success. Percent Hatchery Origin fish Spawning (pHOS) was developed to identify the degree of this negative influence. Early consensus among some scientists suggested that a pHOS greater than 10% was a concern.

In most instances today, hatchery fish and the associated natural origin (NO) fish come from the same watershed. If it had an adipose fin, by definition, it was a "wild" fish. How "wild" is a question when you consider hatcheries may not have fin clipped all their releases. The use of hatch boxes in the past further complicated the genetic history of wild anadromous fish if hatchery derived eggs are used. Obviously, there was no fin clipping for fry derived

from a hatch box.

To add more confusion, it is also natural for anadromous species to stray from one river to another. Straying is natural and a positive influence as it historically added diversity to the local gene pool and repopulated streams where resident salmon may be extinct or near extinction. Straying could include both hatchery and natural spawning fish. With all these factors, estimating the genetic influence of hatchery fish in a specific river is complex and subject to several variables:-

With the attention on hatchery fish and their reported bad influence on NO fish, there needed to be a way to quantify the problem on the spawning grounds. In other words, how bad was the problem. Census pHOS was the answer. The following is a direct quote from a fisheries document: *"The Hatchery Science Research Group (HSRG) based in Washington state, developed a model to determine how much influence a hatchery program should have on a wild population. The model was based on the theory of genetic introgression of hatchery genes into a wild population. The HSRG used the proportion of natural origin (pNOS) and hatchery origin (pHOS) spawners on the natural spawning grounds to estimate the allowable level of introgression that would not significantly impair the productivity of the wild population. The model assumes that wild and hatchery fish are equally distributed and randomly spawning with each other, and thus uses pHOS as*

a measure of introgression.” (Remember this equal distribution concept).

As mentioned earlier, the foundation for pHOS is that HO x NO mating was theorized to cause a lesser quality offspring and less chance of the offspring returning as an adult. But there were exceptions to the reported negativity associated with HO fish. When total counts of a species of salmon in a particular tributary reach near extinction level, hatchery fish may be used to boost the natural population. It is called “supplementation” and has been used to reestablish fish runs in several states. The process allowed adult hatchery salmon or hatchery smolts to be transplanted in the upper tributaries of a river to reestablish a run. Hatchery fish spawning with natural origin fish was ok in this instance and not additive to the extinction concern. From a genetics perspective, trying to make sense when one circumstance is ok, and another is not, is perplexing.

With salmon, the field methods for determining pHOS employ visual observations both from above and underwater combined with subsequent carcass counts. ODFW has a team of people who do most of this work. They have a calendar and on appointed days are on or in a certain river looking for fish or carcasses. Carcass counts play a heavy role with salmon since they die after spawning. They note if the carcasses had an adipose fin or could not tell due to decomposition. The river mile is also noted in the surveys where carcasses were identified. From this data, the percentage of hatchery fish, dead or alive were compared to the number of NO fish to establish pHOS. It is not uncommon that the tabulation might be limited due to weather, flood conditions, and scavengers. For example, high winter flows might push the carcasses further down river or simply destroy them. The resultant pHOS error potential can be high since these fish spawn in the late fall when weather conditions might be poor. One author theorized that 80% of coho carcasses were lost due to the late season spawning.

To further complicate the statistical results, HO fish may return before the NO fish come in and they may spawn at locations away from natural spawning (NO) fish but still be counted in the survey. There was no potential for gene flow to NO fish if the HO fish were not spawning with NO fish. In addition, doing carcass counts close to a HO fish release site such as a hatchery adds considerable bias, but it is not uncommon. This is contrary to the equal distribution statement.

The problems of pHOS were readily

apparent in the recent Umpqua River summer steelhead debacle that stopped the hatchery summer steelhead program and left 78,000 hatchery smolts in limbo for a time. The official statement from the 2022 ODFW Review of the North Umpqua Summer Steelhead Program was that the hatchery program did not influence the recent decline in native origin steelhead. Despite these conclusions, the Oregon F&W Commission ignored the findings of their own scientists that stated hatchery fish were not a problem for the NO fish and bent to the politics of anti-hatchery groups. They voted to close the hatchery program and suggested the 78,000 hatchery smolts be placed in a lake somewhere that had no outlet or be destroyed. Fortunately, due to public pressure, a revote was taken at another commission meeting and the smolts were finally released into the river.

Perhaps it is time to look at the 2022 ODFW Umpqua Steelhead Report and the numbers reported. Going back to the data in the report, one needs to take a long look at the pHOS values reported. The hatchery for the North Fork Umpqua summer

number of hatchery fish spawning in the North Umpqua was excessive. The chart below is from the 2022 ODFW Assessment of the North Umpqua Summer Steelhead Program and lists the pHOS for each tributary of the North Umpqua River. Each location has a story.

### Chart #1

So, let’s break down the North Umpqua summer steelhead issue. According to the report, the majority of the “wild” summer steelhead spawn in Little River and Steamboat Creek. So, there is a spatial difference between the spawning of hatchery and natural origin fish to start. No hatchery fish in Steamboat or Little River, all NO fish reported. The high pHOS listed for Rock Creek is probably all hatchery fish. Again, pHOS is about the opportunity of hatchery fish spawning with NO fish. Hatchery X Hatchery does not meet the pHOS definition relating to gene flow into the “wild” fish population. Keep in mind, each year the offspring of HOxHO spawning would return to Rock Creek as unclipped hatchery origin adults. These

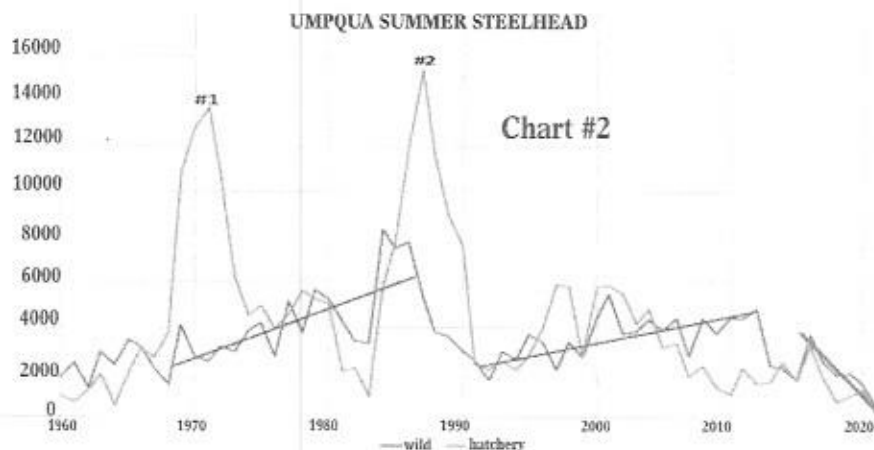
Run Year Lower N. Umpqua	Percent Hatchery Origin Spawners (pHOS)				Chart #1	
	Rock Creek	Little River	Upper N. Umpqua	Steamboat Creek		
2013	39	79	0	23	0	0
2014	50	83	0	31	0	0
2015	47	82	0	28	0	0
2016	45	83	0	27	0	0
2017	41	78	0	24	0	0
2018	25	62	0	13	0	0
2019	32	70	0	18	0	0
2020	45	81	0	27	0	0
2021P	30	75	0	16	0	0
Average	39	77	0	23	0	0

steelhead is located at Rock Creek. A trap was installed at Rock Creek years ago to prevent the hatchery fish from straying upstream past the hatchery and spawning naturally, but due to funding constraints, the trap was never staffed. For years some hatchery fish were able to bypass the hatchery and move upstream to spawn. In the report, pHOS for Rock Creek was listed as 77%. The report failed to mention the unclipped fish spawning in Rock Creek were probably all previous generation hatchery origin fish. By definition, pHOS only relates to hatchery fish spawning with NO fish, as a rough measure of gene flow. This result in the report caused a skew in a final pHOS value for the entire North Umpqua River which was listed at 17%. With a recommended limit in the Comprehensive Management Plan of 10%, the conclusion by the commission was the

are hatchery offspring indistinguishable from fish considered “wild.” The result, fish counts rise to the dubious 77% value and by definition, comparable in application to anywhere else in the river where “wild” fish are found. If the hatchery fish are in locations away from the natural origin fish, the pHOS criteria is not met. A simple solution to this problem would have been to staff the trap on Rock Creek.

Steelhead listed as “Lower N. Umpqua” below the hatchery in chart #1 should not be counted as these fish could still move up and enter the hatchery. As far as the percent hatchery fish in the “Upper N. Umpqua,” one earlier study found that some hatchery fish move upriver to colder water and later move down into the hatchery when the water temperature in Rock Creek drops. It is certainly possible some HO x NO spawning took place in the upper

river. But one must ask, when counts were taken in the upper river, were the hatchery steelhead seeking cooler water or were they planning to spawn there? Remember these are live fish counts as steelhead carcasses are rarely found. Considering all the problems and the true definition for pHOS, the only columns in Chart #1 that may be accurate are Steamboat and Little River where the "wild" fish are known to spawn. Instead of a pHOS of 17% for the Umpqua River, the pHOS value should be at or close to 0%. Clearly, the pHOS generated for the Umpqua River was totally without regard to problems such as the spatial distribution found in tributaries.



### Chart #2

The basic chart #2 above is also from the ODFW Umpqua Steelhead report and reflects adult returns over Winchester Dam of hatchery and wild summer steelhead. The red population trend lines were additional. Notice in the years after peak #1 and peak #2 (hatchery fish), the number of wild fish increased for several years after these peaks. If one considers the increase seen in the two red lines from a genetics standpoint only, the relative reproductive success for the hatchery summer steelhead appears to be high. If the hatchery naysayers were correct and increased numbers of these hatchery fish spawned with NO fish, there should have been a decline in NO fish returning 3-4 years after peaks #1 and #2.

The green line reflects the decline in both hatchery and wild fish in recent years and is a concern. But this decline was similar in other summer steelhead programs in the Northwest as seen in chart #3. Positive peaks were seen around 2003 and 2012 and reflected also in Chart#2. When all the summer steelhead programs are affected in the same manner, the only possible common denominators are the ocean or the weather. The Rogue River (the dotted line) was the exception.

### Chart #3

Steelhead offer more difficulties in spawning assessment as they normally do not die after spawning and carcass counting is ineffectual. In a 1999 report by ODFW on evaluation of steelhead spawning ground surveys, the following paragraph described the problem:

*Methodologies for monitoring Chinook O. tshawytscha and coho O. kisutch salmon in Oregon coastal basins are based on observation of live adults and the recovery of carcasses on the spawning grounds (Jacobs and Cooney 1997). This approach is not entirely applicable to steelhead because 1) steelhead spend only a short time on spawning beds,*

*2) fish not actively spawning are elusive, and 3) hard to count and steelhead do not necessarily die after spawning. In addition to difficulties associated with their behavior in spawning streams, the extensive temporal and spatial spawning patterns exhibited by coastal winter steelhead stocks create challenging survey conditions. The spawning season is generally quite protracted, lasting up to 6 months. Furthermore, steelhead have basin-wide spawning distribution, spawning in higher gradient headwater streams, as well as larger tributaries and mainstem areas.*

In a discussion on pHOS an OSU fisheries professor responded to one of my emails on pHOS and wrote the following:

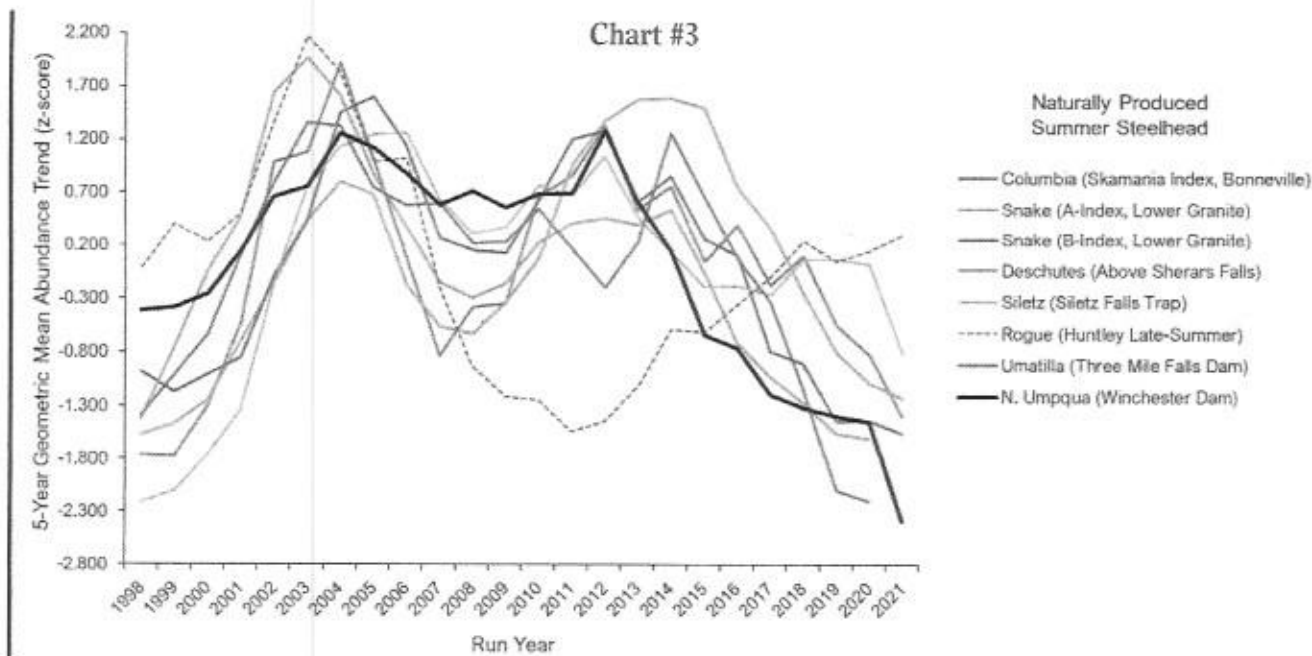
*Jim's email regarding pHOS is correct concerning the potential for error in estimating pHOS and the theoretical examples given are spot on. What is unclear to me is why people don't appear to know that ODFW and federal fishery agencies are clearly aware of errors associated with the calculation of pHOS, and that their reports make every effort to account for them. These reports are public documents. They discuss the error. Reduction in error really comes down to sampling, and that's very expensive. ODFW does the best it can to try and reduce error by the design of their sampling tactics. Other than sampling frequency I suspect there could*

*be some error if HO and NO aren't equally distributed throughout a watershed, like maybe NO's disperse further upstream than HO's where it can't really be sampled because of terrain. I suspect ODFW has some data on this.*

To demonstrate an exception to his comments, let's look at the Morgan Creek Hatchery near Coos river. The hatchery normally releases pre-smolt fish into the estuary in the spring. It was decided by ODFW a few years ago that 200,000 juveniles would be raised to smolt stage at Cole Rivers Hatchery, acclimated in Daniels Creek for two weeks and released into the estuary in June. At the announcement of the project, I raised issues with the water quality and temperature in Daniels Creek that late in the year. Sure enough, when the fish arrived for acclimation, the creek was too low and warm to hold them. As a result, the delivery truck took the fish to the boat landing across from Daniels Creek and dumped 200,000 smolts directly into the estuary. There was no acclimation. Studies have shown that acclimation is required to reduce straying of adults when they return. This single action would have a direct effect on subsequent pHOS when the adults return with increased numbers of fish straying.

I have a great deal of respect for this professor and his comments about pHOS relevance. In a science environment such as OSU, I understand his stance. In the real world where nonscientists and political action groups are using pHOS, the numbers are used as absolute and expected to reflect reality.

For example, in the last CMP meeting for the South Coast, special interest groups wanted pHOS for winter steelhead to be lowered from 10% to 5%. Attempting a change like this is nearly impossible from a field standpoint and basically would require the closure of hatchery programs. But the special interest groups probably knew that. The good OSU professor might have found the meeting interactions interesting and enlightening. If it were not for the scientific review panel of the Oregon Anglers Alliance, the special interest groups would probably have pulled it off and more hatchery programs would have been in peril. If you are a fisherman and do not belong to a political action group, let this be an example of how close you came to losing the ability to catch and keep a winter steelhead on the Rogue River and other south coast streams. What is certain, using pHOS as the measurable, the results may not reflect reality. Parity to native origin fish will never be reached with this



method in our political climate.

If you reread the last sentence in the OSU professor's communication, the following brings the problem into focus. The last example on PHOS problems comes from a recently released document dated 2018 from the Charleston ODFW office. Studies were conducted over several years that included live fall Chinook and carcass counts. The result was a PHOS value for several years exceeding the 10 percent number. The research showed that two creeks were used for the surveys over the study years. Both creeks were low in the watershed and flowed into or near tidewater. Why does that matter? Hatchery fish return to a hatchery or acclimation site based on a scent homing system. As the tide moves in and out, it is reasonable that the scent moves with the tide also. As a result, hatchery fish may move in and out within the upper tide limits. Fisheries biologists tell me that if hatchery fish are going to spawn in the river, they will usually select the first good spawning stream they encounter above tide since the homing scent is no longer a factor. If these streams are selected for survey, the results would be a false high PHOS compared to the upper end of the watershed. Remember, for PHOS to be relevant, the formula for PHOS assumes a random and equal distribution of fish within the watershed. This did not happen in this study. The studies should have been conducted or included the upper watershed where most of the wild fish would be found. The HSRG requirement for PHOS also excludes exceptions to spatial and temporal issues within a watershed when researchers know they exist. One must ask

the question, where are stream surveys performed in other watersheds? It is up to you as sportsmen to find out.

The PHOS problem is further compounded when one assumes there are differences between hatchery and wild fish within a specific watershed. But what is the degree of that difference? In over 20 years of research concern about HO fish, no one has established a system of measurables. How do you proceed toward resolution if you cannot measure your research results? If it cannot be measured, when will anyone ever know when hatchery and wild fish reach parity? The only solution offered to the HO problem seems to be reduction in HO fish numbers.

In 2022, ODFW honestly reported that hatchery fish did not impact the wild summer steelhead in the North Umpqua River, yet the result did not fit the F&W Commission political beliefs. The commission did not follow the science within their own agency and voted to close the Rock Creek hatchery for summer steelhead.

There are political action groups and government staff who oppose all hatcheries and your ability to catch and keep a salmon or steelhead. We worry, and justifiably so, about the extinction of our anadromous fish. But all of us should also worry about the extinction of us as sport fishers.

I never met a sportfisherman that was not concerned for the environment and the importance of preserving what remains of the wild fish stocks. PHOS is supposed to identify the potential for genetic exchange between HO and NO fish to protect the wild fish. If the unclipped NO fish in the same watershed have historic hatchery origin, recognize that PHOS does not measure

any genetic change. We should manage to improve natural spawning habitat but not at the expense of hatcheries. Most people are not aware that during the COVID years, hatcheries suspended manual fin clipping when automated instruments were not available. The juvenile fish were released unclipped. These are now "wild" fish.

In the future with increased human populations, there will be less fish habitat despite our best efforts and more pollution added to our streams from our human presence. Hatcheries will become more important to provide for and sustain anadromous populations. If you have any doubt, check out any river near a populated area where hatchery fish have been removed. Often the remaining "wild" fish struggle to maintain their numbers and usually cannot sustain any recreational harvest. Embracing hatcheries as a solution is unpopular in the current political climate but looking down the road perhaps 100 years, the rapidly growing human population will consume more habitat and generate more pollution. Research must embrace this issue and seek an acceptable hatchery product instead of planning for the elimination of hatcheries.

Fisheries managers and the public should also realize PHOS has been hijacked from its original intention. The future depends on clear identity of any differences between hatchery and wild fish and quantitating those differences. Without a system of measures, we do not know the degree of the problem, cannot identify a course of action, and will never know when hatchery fish are equivalent to the wild fish in the same watershed. After all, isn't that what we all want?