

# OHRC Research Ideas from Hatchery Staff

- **Parr Rearing:** Can we collect wild Coho (or other species) parr during the summer months and hold in hatchery through the summer, fall, and winter and release as smolts. Results in NE suggest over summer and winter survival of wild ChS parr is about 25%. Hatchery captive brood parr is >95%. If wild produced and hatchery summer/winter reared parr performance to adult returns is similar to their wild counter parts, this could be a useful tool for supplementation or harvest augmentation in populations with strong wild components.
- **Moist Air Incubators:** Do they work? Are they worth the investment? (We are working this!)
- **Triploid Summer Steelhead:** Do they smolt? Do they return to spawn? What affect do they have on the wild populations? (This project was put on hold due to being rank a low priority by ODFW Fish Division).
- **Internal Fungus:** How can we prevent Internal Fungus in juvenile salmonids? Pathology recommended a peroxide bath. Feed low nutritional diet rather than high protein/ high fat?
- **Disease Resistance:** Is there a difference in disease resistance comparison between F1 & traditional hatchery broodstocks (Alsea). Hold two Broodstocks at densities and compare mortality and “ich” resistance.
- **Coho/Rainbow Hybrids?:** IHN is problem for our rainbow trout legal stocking program. Coho seem to be less susceptible to the disease. Can we pressure induce hybrid (rainbow x Coho) would be well suited for propagation and harvest (put-and-take) and resistant to IHN. Con public perception of the production and potential for being labeled as “genetically engineered.”
- **Ecological Impacts of Triploid Trout:** There is significant thought in the scientific community that triploid males, though sterile, may still display spawning behavior and displace viable males on the spawning redds. What affect do triploid rainbow from Roaring River have on native populations?

- **Satiation Feeding:** The method I use for satiation feeding is to calculate the feed needed for a month in order to obtain the desired growth, then break the amount equally into the 4 weeks of the month. The fish are then fed that amount as quickly as they will eat it. If they eat the ration in one feeding, they are done for the week. The advantages I have found are:
  1. An ability to further regulate growth and maintain healthy fish. I have fed winter steelhead a daily average of .3% Bdy Wt without any negative effect.
  2. More uniform growth. When properly applied, this method of feeding can eliminate the need to grade most fish by not allowing more aggressive fish to out compete less dominate fish in the population.
  3. In captive brood it may improve egg quality by reducing or eliminating chronic social stress on less dominate individuals
  4. Maintains quality fins by reducing constant competition for feed under light feeding regimes.
  5. Reduces the time effort needed by personnel to feed fish and allows more time to be spent feeding fish that are more difficult to rear.
  6. Helps maintain a wild type reaction to humans in some fish, particularly aggressive feeders such as Coho.

I don't know if this one is really worth study, but there could possibly be some contribution to smolt survival in more aggressive species. "This is an interesting study applied on salmon. It works on parrs but not in juveniles. When done in juvenile steelhead it causes size variation and increases dorsal fin erosion. It works on fish above 15-20 fish per pound."

- **Asta in smolt feed:** Though developed to simply color the flesh, I have noted a marked increase in stress resistance and stamina of fish that are fed a diet containing astaxanthin. They also store a lot of oils in the flesh and the flesh is much firmer than fish without asta. When trout are fed a diet with 40ppm asta, it takes roughly 12 weeks for the flesh to obtain a nice natural orange color but at 6 weeks they are beginning to show some coloration, increased stress resistance, and stamina. . Based on this, for the last 6 or 7 years if have fed all my smolts a diet containing astaxanthin for the final 6 weeks prior to release. Oddly enough smolts do not appear to incorporate the asta into their flesh, but utilize it some other fashion. I have fed summer steelhead on demand with a diet containing asta for a period of 4 months and not seen any coloration of the flesh, though it is very firm and opaque in appearance. I know there is a researcher in Washington State that is looking at asta, but he is looking at it for other reasons, such as its effects on chromataphors. This is a hot topic in the private sector and it seems to work as a stress reducer and energy inducer.

- **Rearing Densities:** Historically the approach to fish production has been that more is better and in many cases hatcheries have been asked to rear fish at very high densities. I feel that there is a point of diminishing returns. Experience, observation, and intuition tell the fish culturist when the line has been passed and there is a decline in fish health prompted by the stress of over crowding. This likely creates a fish that is less fit for survival after initial release into the wild and translates into lower adult returns. Each species has different tolerances and it would be valuable to have actual smolt density guidelines for each species.
- **Steelhead Smolt Size Criteria:** All steelhead are produced under a mandated smolt size derived from a narrow scope of study. Because of this, in many cases steelhead are constantly stuffed to the gills with feed which makes them "weigh in" but have fat condition factors at release. Other studies indicate that steelhead should have a lean condition factor for best survival. I would suggest that a majority of rearing environments do not produce wild smolts in the 4-6/lb range(or in a single year) and would like to focus more on healthy, natural type smolts that fit the environment that they come from rather than forcing them to fit some study that was conducted elsewhere. I still think there are natural smolts in the 5-6/fpp range. The most important factor is the weight-length ratio and their fitness as smolts.
- **Incubation Temperature:** Temperature units are used to monitor/determine egg and fry development. We know that embryos develop faster in warmer water AND reach developmental stages at fewer temperature units. Can we develop a "sliding scale" for predicting develop based on predicted water temps? (i.e. growth model for incubation and early rearing).
- **Optimal feed rates for smolts prior to release:** My experience indicates that steelhead will generally begin to take themselves off feed when they begin to smolt, while Chinook and Coho will begin to display a declining physical condition unless they are fed at a relatively high rate during smolting, particularly in the fall when water temperatures are higher. In keeping with the idea that natural type fish are going to perform the best, I think it would be valuable to look at feed rates and condition factors for smolts. In nature feeding tends to drop in the winter, time at which the smoltation process begins. My experience indicates fish should have enough fatty tissue before the smoltification process begins.

- **Acclimation Periods:** 2 weeks seems to be the universally accepted time to acclimate smolts. While this may be appropriate, I think the timing of acclimation is also important, especially with Coho and Chinook. While steelhead populations apparently smolt over a relatively long period of time(1-2 months?), Coho and Chinook will smolt (I think the intent here is to talk about out migration, not just “smolting”) seemingly overnight. It might be of value to determine a timeframe in which to move salmon to acclimation prior to, and in anticipation of, smolting in order to gain the most benefit.
- **Release Strategy:** What release strategy can we develop to increase freshwater survival? ... Release lean and fit smolts... so they will not residualize ... the stream/river is just the freeway for them to get to the ocean. Release fish at night early morning.
- **Predation:** How can we better prepare hatchery smolts for the treacherous journey downstream? Smolt conditioning (exercise)? Predator conditioning?
- **Hands off approach to fry culture:** In my experience, at least in recent history, egg and fry culture evolved with an intensive hands on approach. Many times eggs are picked at the viable stage and fry are picked regularly to remove the dead eggs or fry. Also the only fear of light is outside light with no consideration given to flipping inside lights off and on regularly. This causes the fry to startle and actively seek shelter. I do not concern myself with viable egg loss and after eyed eggs are picked and inventoried they are trayed down with a substrate in the trays and put in a dark environment where they are disturbed at an absolute minimum until they are ready to pond. This seems to produce larger healthier fry that are less prone to CWD.
- **Reproductive Success:** RRS is calculated based on progeny produced from a given brood year. Bearing that in mind, we also now understand that in the wild only 10% of the returning adults produce 90% of the next generation. In simple terms that means in the hatchery 90% of the fish we produce would not exist if the adults reproduced naturally. Additionally, we suspect that brood fish held in captivity for many generations lose their urge to spawn naturally. Perhaps this potential phenomenon is at least some part of the explanation for the 10/90 equation and the reduced RSS in hatchery produced fish. If it is true that we breed out the natural desire to spawn it wouldn't bode well for captive brood stock programs Putting these points together causes me to consider a couple of questions;

- 1) What if the reduction in RRS in hatchery produced fish isn't entirely related to genetics but is partly due to the fact that we are producing offspring from fish that for whatever reason would not have tried to reproduce naturally? (I have caught Cedar Creek traditional stock fish that were ocean bright and spawned out, with out any physical indication that they had dug a redd) 2)
- 2) Also, could it partially explain the lack of, or minimal, introgression of traditional stocks into wild populations, both resident and anadromous? 24 stock StS and Big Creek StW are about as domesticated as they come, it would be interesting to see if they would spawn in your channels.

- **Steelhead:** Are they really *Oncorhynchus*, or are they actually *Salmo* ?? Just kidding.