# Experimental Grading of Washington Steelhead
## Les Resseguie, Salmon River Fish Hatchery                    09/13/2018

Uniform growth of steelhead (*Oncorhynchus mykiss)* has historically been a challenge at Salmon River Fish Hatchery (SRFH). Typically, there is a large size variation in fish produced making it difficult to accurately estimate the number of fish on hand, as well as maintain appropriate tank densities and feeding rates. This results in the production of undesirably small fish. We have been considering grading (sorting by size) these fish for several years. In 2018, with guidance from staff at Vermont's Ed Weed Fish Culture Station, we graded the steelhead held at SRFH with the hope of improving steelhead production at this facility.

In June of 2018 a Minnow Saver™ minnow grader was purchased along with a #10 and a #12 screen. Vermont grades their steelhead with a #10 screen when the fish are between 500 to 700 fish per pound (f/lb). During the week of 7/2/18 the steelhead at SRFH averaged 670 f/lb and grading began the following week.

A large portable tank was set up at the head of the start-tank containing the juvenile steelhead. Water was supplied from one of the two valves feeding the start-tanks to create a flow-through system, while the other valve was turned up to maintain approximately 15 gallons per minute on the ungraded fish. A divider was placed in the middle of the grading tank and one oxygen diffuser fed from a large oxygen bottle was placed in the tank to help mitigate stress. The fish in the start-tank were crowded and three samples were taken to provide a pre-grade average size. Small netfuls of fish were poured into the grader. It was observed that small netfuls, approximately 2lbs, graded much better than larger netfuls. Some experimentation was necessary to determine the best method to effectively grade the fish.

**Trial 1** - When we processed the fish in the first tank we shook the grader three times. The fish that remained - the "bigs" - were then transferred to the opposite side of the divider. This was repeated until all the fish in the start-tank had gone through the grading process. The "bigs" were then sampled and inventoried back into the original start-tank. The smalls were sampled and inventoried into an empty start-tank dedicated for that size class. The first tank's pre-graded sample was 502 f/lb; the "bigs" sampled at 499 f/lb, while the "smalls" sampled at 554 f/lb. This first attempt of "three shakes" did not produce the desired result as it appeared that this amount of agitation forced too many of the large fish through the grader and they were in with the "smalls".

**Trial 2** - No agitation was used when we graded the second tank. The fish were netted into the grader, as before, and it was just lifted and the remaining "bigs" were dumped above the divider. The pre-graded sample was 527 f/lb; the "bigs" were 532 f/lb and the "smalls" were 638 f/lb. No agitation seemed to produce a better outcome than the three shakes method, but since the "bigs" sampled out smaller than the pre-grade sample it was felt that too many "smalls" had stayed in the grader and had remained with the "bigs".
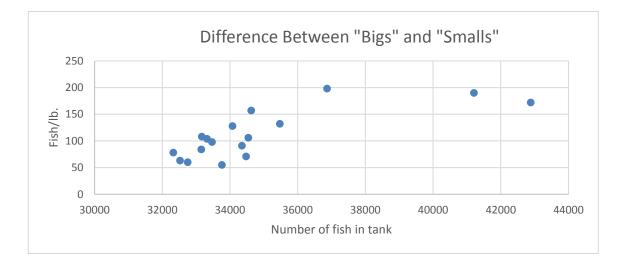
**Trial 3** - Fish from the third tank received a little more agitation. With the fish in the grader, it was rocked back and forth once or twice and shaken lightly once. This method produced much more desirable results. The pre-graded sample was 570 f/lb, while the "bigs" sampled out at 524 f/lb and the "smalls" were 652 f/lb. It was decided that this would be the method to be used for the remaining start-tanks. Sampling the tanks before they were graded was abandoned at this point. In the remaining tanks, the

"bigs" were graded out, sampled, and inventoried back into their original tanks. Once three start-tanks were graded, the "smalls" were then sampled and transferred into a "smalls" start-tank.

Once the grading and inventory was completed, the start-tanks were evened out to maintain a desirable density. Six additional start-tanks were populated to accommodate these size classes and lighter densities. Prior to grading, 18 tanks were running with 32,000 to 42,000 fish per tank. Once an inventory was established, all tanks were evened out so that there were 20 "bigs" tanks at 26,625, and 4 "smalls" tanks at 24,100 fish per tank. The largest fish graded were 468 f/lb, and the smallest were 723 f/lb. Mortality temporarily increased the day following the grading process with a loss of approximately 2,100 fish, but mortality in all tanks was back to single digits two days later. All tanks were treated with the therapeutant Chloramine T for three consecutive days following the grading to help mitigate disease outbreaks due to stress.

It took staff three days to grade 654,900 fish, which is not excessive considering it was our first attempt at doing this. In the process of grading fish, we discovered that there was a positive relationship between the number of fish started in a start tank and the size difference between the "bigs" and "smalls" (Figure 1). It appears that by reducing initial numbers of fish placed into the start tanks we can reduce the size differential between the "bigs" and the "smalls" and possibly reduce the total number of "smalls". Another positive aspect of the grading process is that we completed an inventory approximately four months earlier than we have in the past. This will be quite useful in identifying surpluses and shortages early on, and maintaining more accurate record keeping. In this instance, the pre-graded inventory was 592,300 fish, and once graded, 654,900 fish were found to be on hand (62,300 more than previously believed). The inventory numbers of these graded fish will be more precise than in the past and the tank populations will be much more uniform. This uniformity will increase the accuracy of estimated fish numbers and ensure that appropriate feeding rates are applied. Within two weeks' time, the "smalls" caught up to the "bigs" due to decreased competition for food between the two size classes. We believe this is a step in the right direction, and are hopeful that this simple process will improve the health and performance of steelhead produced at Salmon River.

**Figure 1.** Plot of the difference between the two sizes of fish graded in regard to the number of fish in the start-tank prior to the grading process.