# Transferring Fingerling Steelhead With and Without Water Conditioning at the Hagerman National Fish Hatchery

By the

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## Abstract

The Hagerman National Fish Hatchery compared survival of fingerling steelhead (65-80 mm average length) transferred from hatchery vats to raceways in hauling tanks with and without Vidalife water conditioner. Overall survival was not significantly different between the two treatments. We hypothesized that the relatively short hauling time (8.1 minutes) in the Vidalife water conditioner was not a long enough duration for the fingerlings to physiologically respond to the hauling tank additives. This result matched findings from Hanson (2009) that showed short duration salt-baths (10 minutes) caused additional stress response.

## Introduction

The Hagerman National Fish Hatchery (Hatchery) produces 1.46 million steelhead smolts annually under the Lower Snake River Compensation Plan (LSRCP) program. The steelhead are marked in a Mass Automated Marking System (MATS) trailers with adipose fin clips and Coded Wire Tags. The steelhead are crowded in hatchery tanks and rearing raceways before transfer via forklift tank, pump, or nets to the MATS trailers. All the aforementioned procedures have been documented to increase stress levels (Sharpe et al.1998).

The Hatchery experienced disease outbreaks just prior to release (11 months old) during Brood Years 2007 and 2008. Susan Gutenberger, Lower Columbia River Fish Health Center, and the Hatchery Review Team (HRT) recommendations have suggested stress during early hatchery tank rearing could compromise smolt disease resistance later in rearing. As an example, Eagle Creek and Willard National Fish Hatcheries have reduced disease problems in fingerling coho salmon by reducing early rearing densities. We hypothesized that any stress reduction during early rearing, regardless of early rearing density, may benefit smolt disease resistance later in the rearing cycle. As such, we proposed using a water conditioner to reduce stress during fingerling transfers from the early rearing hatchery tanks.

## Background

Fish exposed to handling stress produce epinephrine which increases the surface area on gills for oxygen absorption (Wedemeyer 1996). The resulting osmotic influx of water through the gills increases urine production. As a result, life-threatening blood electrolytes imbalances due to the loss of chlorides and other ions can occur. To counteract the loss of chloride ions, Wedemeyer (1996) recommended adding 0.1 to 1.0% sodium chloride (salt) to the hauling tank.

The Hatchery has not used salt during hauling on the facility because fish are typically held in tanks for fewer than ten minutes at a time and the Hatchery has had excellent survival after marking operations. In Brood Year 2008, the steelhead survival rate was

99.5% following the four months after MATS marking (September through December). Additionally, the Hatchery has had concerns of corrosion on Hatchery equipment and in the MATS marking trailer.

The Hatchery contacted Northwest Marine Technology (NMT), manufacturer of MATS marking trailers, in July 2009 out of concern about the effects of salt on the MATS marking trailers. NMT believes that a salt solution should not structurally or mechanically harm the trailer or the equipment used in the trailer, but screws may rust and some components may become discolored. NMT recommends flushing out the system at the end of the day with fresh water for several minutes if a salt solution is used for hauling. NMT is not aware of any marine operations using the trailers, but knows of an operation in California that uses salt in the main holding trough. They are not aware of the concentration used. NMT also feels that any water additives such as Propoly Aqua would not effect their equipment. Water conditioners such as artificial slime coats have been used in the trailers. However, no benefit was observed because too much water was flowing through the system and an adequate concentration could not be maintained.

Two types of water conditioners (Novaqua and Polyaqua) advertised to reduce handling stress and provide a synthetic slime coat were used during the marking operations of release year 1981 to determine if they could reduce handling mortality. A general comparison of total mortalities between treated and untreated groups showed no benefit, but this test was not formally evaluated. The Hatchery evaluated the use of Propoly Aqua during release year 1985. All fish in the test and control groups hauled well and looked similar at release. The control fish had a higher return rate of 0.762%, compared to 0.554% of the Propoly Aqua fish (Miller and Diggs 1986, Hagerman NFH Records). Even though there was no observed benefit of the Propoly Aqua, the authors believe that there may be a benefit in extraordinary situations such as stressed fish, marginal fish quality, or extended trucking.

The Hagerman Hatchery Evaluation Team (HET) compared transferring steelhead fingerlings using a commercial water conditioning solution and without any additives. This study provided a structured comparison of water conditioning during fingerling transport. The HET compared instantaneous and overall on-station survival rates of both steelhead fingerling transfer groups. The results will be used as guidance for future fingerling transfers.

## Materials and Methods

Brood Year 2009 eyed Sawtooth steelhead eggs for Yankee Fork release were received from Sawtooth Fish Hatchery and disinfected upon receipt in 100 ppm Argyntyne (PVP Iodine) solution. Eggs were enumerated using a displacement method following Hatchery SOP's and distributed to incubators in groups of up to approximately 30,000 in Hatchery Building #1. Each tank had one incubator. Eggs were received between 350-430 Temperature Units (TU's) and hatched at approximately 530 TU's (5 days). After hatching, the fry were kept in the incubator jars for 3-4 days. At that time, the fry were

poured into the tank through a minnow grader box to separate and enumerate egg mortality. Fry remained in the tank for another 6-7 days before initial feeding. Salmon Starter #0 was used for initial feeding. Fry were hand fed to satiation daily until raceway ponding. Fry were switched to #1 feed at 900 fpp, then #2 at 400 fpp, and #3 or 1.0 mm at 200 fpp. Hatchery tanks were cleaned daily.

Each treatment group was assigned five raceways (Table 1). Fingerlings (Average length 65-80 mm) in raceways 49-53 were transferred without any water conditioning additives and fingerlings in raceways 54-58 were transferred in a water conditioned solution.

We used Vidalife water conditioner manufactured by Western Chemical Incorporated for this study in lieu of salt (NaCl) or Propoly Aqua. Vidalife is formulated from a combination of a scavenger of heavy metals and polyvinylpyrrolidone (PVP). Vidalife is marketed as a specially formulated water conditioner for use in fish hatcheries, transport tanks, and on handling equipment, that when applied as directed, will help protect fish from stress and abrasions by preserving the fish's natural mucous layer and can be used whenever fish are handled or moved The recommended dosage is 1mL per 15 L of water (67 ppm). The dosage used during this trial was calculated as follows:

300 gallon transport tank = 1,135.6 L/15 = 75 mL of Vidalife per tank

Immediate mortality rates (handling mortality), 24 hour post-ponding mortality, and overall survival rates (transfer to release) were compared using a single factor ANOVA test and were considered significant if $p < 0.05$. Transfer time from the hatchery tanks to the final rearing pond was also recorded.

## Results

*Survival*

There was no instantaneous mortality for either treatment during the hauling/ponding process (Table 2). The 24-hour post-ponding survival rate for both treatments was 99.9%. The overall raceway survival rate for raceways that were ponded with fry hauled in non-conditioned water was 92.1%. The overall raceway survival rate for raceways ponded with Vidalife conditioned water was 93.0%. Overall survival rates were not significantly different ($p = 0.07$).

*Hauling Time*

Hauling time was recorded during the Vidalife treatments. The hauling times ranged from 5.8 minutes to 9.0 minutes with an average hauling time of 8.1 minutes. Hauling time was not recorded for the non-condition treatment.

## Discussion

The Hatchery experienced multiple disease issues and sporadic elevated mortality levels throughout the raceways in BY2009. All raceways in both treatment groups were treated with Romet feed on the week of 10/5/09 for furunculosis. Raceways 57 and 58 (Vidalife raceways) were then again treated for furunculosisis on the week of 11/26/09. During March and April 2010, all water conditioning and non-water conditioning study raceways were treated with potassium permanganate for columnaris (Table 3). The use of a water conditioner for hauling fry out to the raceways from the hatchery building did not appear to help overall raceway survival.

Hanson (2009) performed an evaluation of short term salt immersion on handling stress at the Hatchery. Steelhead fingerling stress response to handling was measured in fish that were immersed in a 1.0% saline solution for 10 minutes after handling and fish that were handled without a salt water immersion. This study suggested that fish subjected to the salt bath after handling were actually more stressed than by just handling alone.

The water conditioning trial performed by the HHET and the salt study performed by Hanson (2009) suggest that there is no benefit for the Hatchery to haul fry in salt or a water conditioner from the hatchery buildings to the raceways or marking trailers. The hauling time is to short for fish to physiologically recover, and these additives may actually be causing more harm than good.

## References

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Sharpe, C., D. Thompson, H. Blankenship, and C. Schreck. 1998. Effects of Routine Handling and Tagging Procedures on Physiological Stress Responses in Juvenile Chinook Salmon. The Progressive Fish-Culturist 60(2): 81-87.

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## Tables and Figures

Table 1. Summary of tank inventory and raceway stocking of fry used in on-station hauling with or without water conditioning, Hagerman NFH BY09.

| Raceway | Number of fry | Hatchery Tank | fish per pound | Hauling Time | Treatment |
|---|---|---|---|---|---|
| 49 | 22,937 | 5 | 150 | | None |
| 50 | 23,001 | 5 & 8 | 175 | | None |
| 51 | 23,026 | 8 & 16 | 220 | | None |
| 52 | 23,703 | 16 & 22 | 220 | | None |
| 53 | 23,878 | 22 | 191 | | None |
| 54 | 22,939 | 30 | 205 | 8:45 | Vidalife |
| 55 | 2,476 | 30 | 205 | 5:45 | Vidalife |
| 55 | 20,419 | 37 | 252 | 9:00 | Vidalife |
| 56 | 5,766 | 37 | 252 | 8:43 | Vidalife |
| 56 | 18,928 | 50 | 137 | 7:25 | Vidalife |
| 57 | 24,513 | 55 | 152 | 8:05 | Vidalife |
| 58 | 23,885 | 57 | 212 | 8:42 | Vidalife |

Table 2. Summary of mortality levels observed during the use of on-station hauling with or without water conditioning, Hagerman NFH BY09.

| Race way | Treatment | Starting inventory (#) | Date Ponded | 24-hr post ponding survival (%) | Date Released | Overall survival (%) |
|---|---|---|---|---|---|---|
| 49 | Control | 22,937 | 7/28/09 | 100 | 5/5/10 | 94.36 |
| 50 | Control | 23,001 | 7/28/09 | 99.99 | 5/5/10 | 94.06 |
| 51 | Control | 23,026 | 7/28/09 | 99.99 | 5/6/10 | 93.03 |
| 52 | Control | 23,703 | 7/28/09 | 100 | 5/7/10 | 86.95 |
| 53 | Control | 23,878 | 7/28/09 | 100 | 5/7/10 | 92.14 |
| 54 | Vidalife | 22,939 | 7/28/09 | 99.99 | 5/10/10 | 88.40 |
| 55 | Vidalife | 22,895 | 7/28/09 | 99.97 | 5/11/10 | 94.99 |
| 56 | Vidalife | 24,694 | 7/28/09 | 99.99 | 5/11/10 | 95.89 |
| 57 | Vidalife | 24,513 | 8/17/09 | 100 | 5/12/10 | 96.62 |
| 58 | Vidalife | 23,885 | 8/17/09 | 99.99 | 5/12/10 | 89.49 |

Table 3. Summary of chemical treatments for columnaris, Hagerman NFH BY09.

| Raceway | Water Conditioner | Therapeutic Chemical | Dates Treated* | Treatment Rate (ppm)** |
|---|---|---|---|---|
| 49 | None | Potassium Permanganate | 4/14-16/2010 | 0.5, 1.0, 2.0 |
| 50 | None | Potassium Permanganate | 4/5-7/2010 | 0.5, 1.0, 2.0 |
| 51 | None | Potassium Permanganate | 3/31-4/2/2010 | 0.5, 0.5, 1.0 |
| 52 | None | Potassium Permanganate | 3/31-4/2/2010 | 0.5, 0.5, 1.0 |
| 53 | None | Potassium Permanganate | 3/13-15/2010 | 0.5, 1.0, 2.0 |
| 54 | Vidalife | Potassium Permanganate | 3/23-25/2010 | 0.5, 1.0, 2.0 |
| 55 | Vidalife | Potassium Permanganate | 3/31-4/2/2010 | 0.5, 0.5, 1.0 |
| 56 | Vidalife | Potassium Permanganate | 3/31-4/2/2010 | 0.5, 0.5, 1.0 |
| 57 | Vidalife | Potassium Permanganate | 4/5-4/7/2010 | 0.5, 1.0, 2.0 |
| 58 | Vidalife | Potassium Permanganate | 3/31-4/2/2010 | 0.5, 0.5, 1.0 |

*Treatments consisted of three consecutive days

**Treatments rates started low and were gradually increased throughout the three day treatment