

Biological Fish Injury and Survival Evaluation at Green Peter, Oregon, 2017

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Background

- Study conducted to provide the Corps with direct survival/injury information for consideration when designing fish bypass systems at high head dams.
- Third high head study at Green Peter (2015, 2016, present).
- Study conducted at Full Pool (1,011 fmsl) and at the deeper elevations (910 and 935 fmsl).
- This provided a higher operating head than in previous years.

Conditions

- Fish were released into the 12-inch bypass pipes located at elevations 910 and 935 fmsl.
- The 12-inch bypass pipes intersected a 24-inch bypass pipe that traverses the downstream side of the dam.
- Three operation conditions were tested at 100, 75, and 50% gate settings for juvenile Chinook Salmon and 100 and 50% for YOY Steelhead.
- Control fish were released at the end of the 24" bypass pipe.
- Juvenile Chinook Salmon (average total length = 175 mm).
- Young-of-the-year (YOY) Steelhead (average total length = 55.5 mm).
- Fish were obtained from the South Santiam Fish Hatchery and Oregon State University.

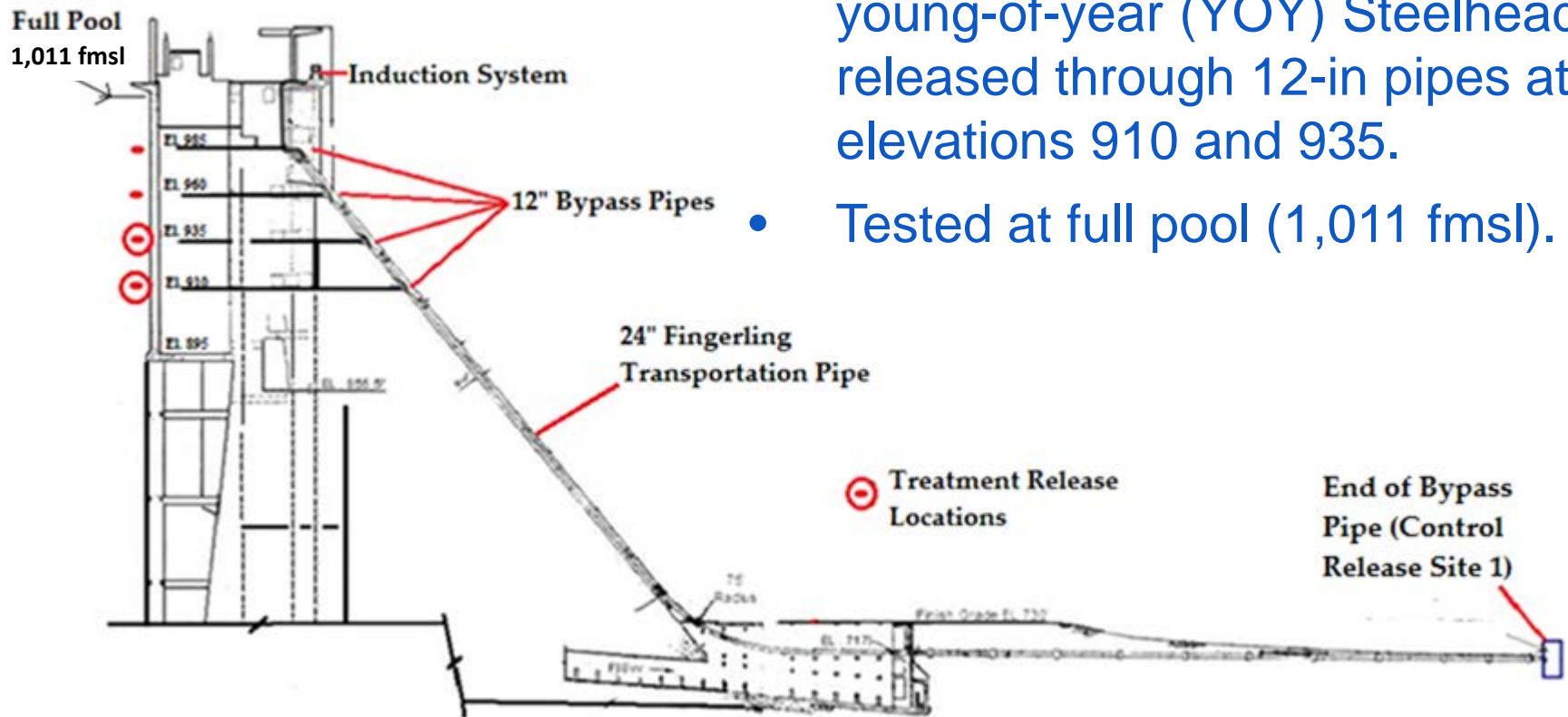
Pictures of Release System



- Fish treatment release system and 12-in pipes at elevations 910 and 935 fmsl.

Schematic of Migrant Bypass Pipe

- Juvenile Chinook Salmon and young-of-year (YOY) Steelhead released through 12-in pipes at elevations 910 and 935.
- Tested at full pool (1,011 fmsl).



Sample Size

	<u>No. Treatment</u>		No. Control	<u>Total Length (mm)</u>	
	Pipe 910 fmsl	Pipe 935 fmsl		Range	Average
Chinook	600	592	201	151-241	175
YOY Steelhead	201	203	44	41-70	56

48-hour Survival Results

Juvenile Chinook Salmon

	Gate Opening		
	100%	75%	50%
Pipe (fmsl)	48 h Survival		
910	95.0	96.4	96.7
935	100	98.1	100

- Survival estimates were higher at pipe 935 than at pipe 910.
- Lowest 48 h survival for juvenile Chinook Salmon at pipe 910 and 935 were at 100% and 75% openings, respectively.
- Eight of the 201 control juvenile Chinook Salmon were dead at 48 h.

Malady-Free (MF) Results

Juvenile Chinook Salmon

	Gate Opening		
	100%	75%	50%
Pipe (fmsl)	Malady-free estimate		
910	88.2	91.7	88.3
935	99.5	93.6	100

- MF estimates adjusted for eight (4%) control fish with maladies, ranged from 88.2% to 100% for juvenile Chinook Salmon.
- MF estimates were lower for the juvenile Chinook Salmon passed through pipe 910 (88.2% - 91.7%) than pipe 935 (93.6% - 100%).
- The lowest MF estimates for juvenile Chinook Salmon of 88.2% and 93.6% at pipes 910 and 935 were at 100% and 75% gate openings, respectively.

Injury Results

Juvenile Chinook Salmon

- Two of the 201 (1.0%) control fish had visible injuries; both had a minor eye hemorrhage.
- Dominant injury at pipe 910 was eye hemorrhage (4.7%) followed by opercula damage (2.7%).
- Dominant injury at pipe 935 was operculum damage (2.5%) followed by eye hemorrhage (1.5%).
- Causes of the injuries were primarily mechanical and shear forces and a combination of these two forces.

48-hour Survival Results

YOY Steelhead

	Gate Opening	
	100%	50%
Pipe (fmsl)	48-h Survival	
910	100	99.0
935	98.0	99.0

- Generally, survival rates were higher for YOY Steelhead.
- 48 h survival estimates were nearly 100% for all test conditions.
- YOY Steelhead control fish were all alive at 48 h.

Malady-Free YOY Steelhead

	Gate opening	
	100%	50%
Pipe (fmsl)	Malady-free estimate	
910	98.0	99.0
935	97.0	94.1

- MF estimates were all high: 97.0% to 99.0%, except after passage through pipe 935 at 50% gate opening, which was 94.1%.

Injury Results

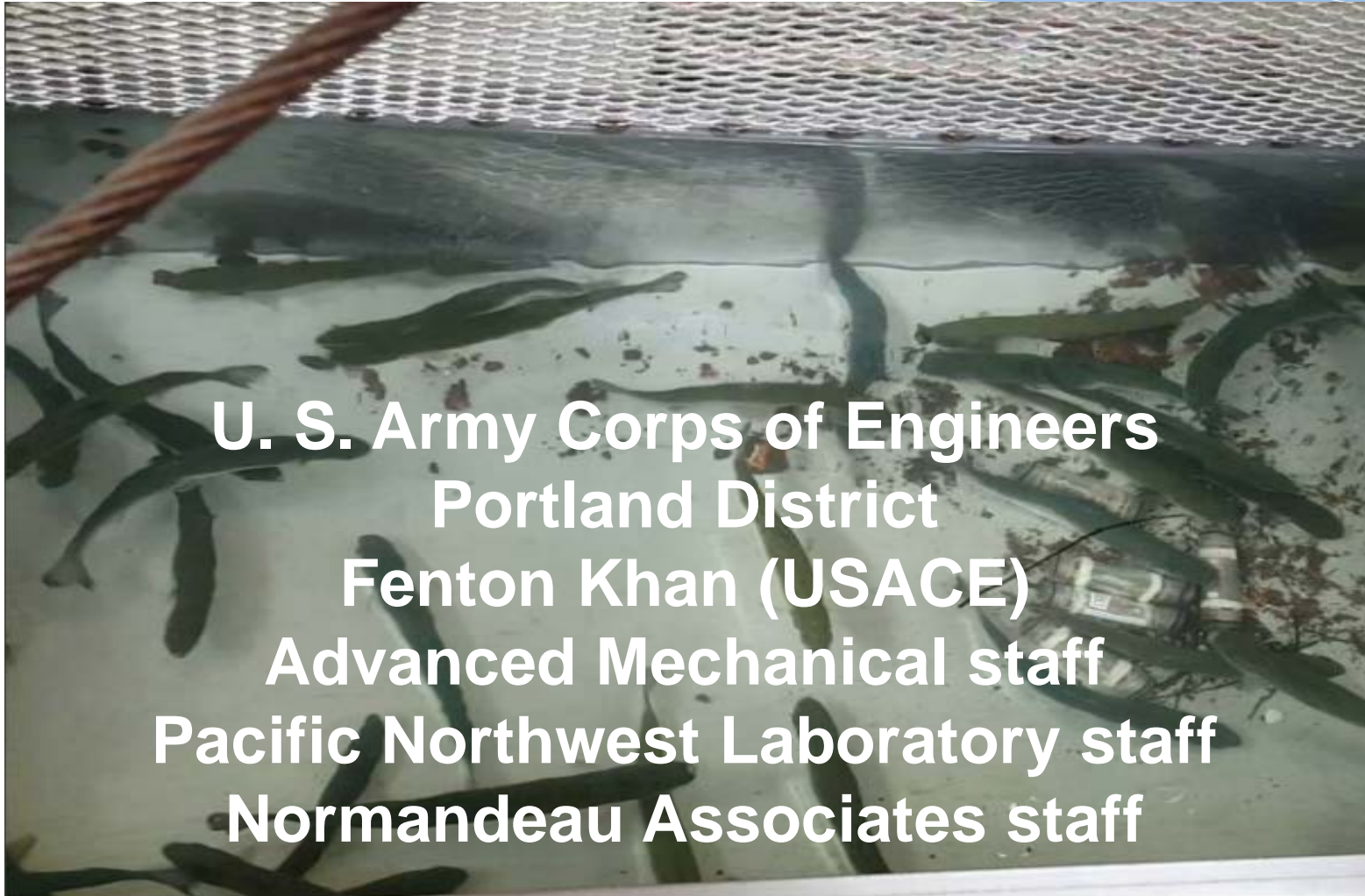
YOY Steelhead

- Visible injury rate was lower for pipe 910 (1.5%) than pipe 935 (3.9%) for all gate settings combined.
- None of the 44 control fish displayed injuries.
- The dominant injury type observed at both pipes was hemorrhaged eyes (all 3 injuries at pipe 910 and 7 of 8 injuries at pipe 935).
- Injuries were attributed primarily to shear forces.

Summary

- All fish were recaptured.
- 48 h survival estimate for the juvenile Chinook Salmon passed through pipes 910 and 935 in 2017 ranged from 95% to 100%.
- 48 h survival estimate for the YOY Steelhead passed through pipes 910 and 935 in 2017 ranged from 98% to 100%.
- Higher incidences of injuries were observed in the present study.
- Conditions in the bypass (higher head) and/or fish release systems were less fish-friendly than during the 2015 and 2016 evaluations.

Acknowledgements/Questions



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