

# Columbia River Alternative Gear Studies: Preliminary Survival Estimates of Steelhead Caught and Released in Commercial Purse and Beach Seines

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## Abstract

Lower Columbia River commercial fisheries targeting salmon incidentally catch steelhead and fishers are required to release all steelhead back to the river. During the summer and fall commercial fisheries, gill nets are used to catch salmon. Although not empirically measured for steelhead, the release survival from these fisheries is believed to be low. This is an important issue since in 1998, all summer steelhead (*Oncorhynchus mykiss*) populations in the Columbia River were listed for protection under the Endangered Species Act (ESA). In 2011, the Washington Department of Fish and Wildlife (WDFW) in cooperation with local fishers evaluated a purse and beach seining program to estimate the survival of released steelhead using Passive Integrated Transponder (PIT) tags using a control/treatment design. A total of 299 fish were PIT tagged after beach seining fish with an additional 312 PIT tagged after purse seining. A second group of 457 steelhead were PIT tagged at the Bonneville (BON) Dam fish collection facility and transported downstream to an area adjacent to the fishery to serve as a control. The null hypothesis that there was no difference in recapture probabilities to BON between purse and beach seine fish could not be rejected (p-value = 0.686) and these groups were pooled for further analysis. The null hypothesis that the recovery probabilities of seined fish were greater than control fish to BON was also rejected (p-value = 0.147). Using Ricker's two release method, the survival of seined fish was estimate to be 98.3% with 95% CI from 95.8% to 99.8%. There was a 99.5% probability that the survival of seined fish exceeded 95%. Logistic regression was used to evaluate the potential effects of water temperature, origin, gear type, and length on recapture probabilities. The p-values for the full and all reduced model were above 0.05 suggesting the covariates were not significant predictors of recapture probability. Akiake Information Criteria (AIC) for model selection indicated the model with constant recapture probability was preferred.

## Background

Columbia River commercial fisheries targeting salmon incidentally catch steelhead during summer and fall fisheries. Steelhead bycatch must be released back to the river, post release survival from these fisheries is believed to be low. Vander Haegen et al. (2004) found that the survival rate of spring Chinook from gill nets was approximately 50% the rate of the control group. This suggests that the survival for ESA listed steelhead caught in the commercial fishery may have similar survival rates. Ruggerone and June (1996) noted that 98.9% of purse seine caught Chinook survived retention in net pens for three days. The 95% confidence interval for the survival rate was 93.2-99.6%. This suggests that the release survival of salmon and steelhead in the Columbia River may be improved by using alternative gear such as purse or beach seines as a live capture method.

## Objective

Evaluate the post release survival of steelhead released from purse and beach seines using Passive Integrated Transponder (PIT Tags).

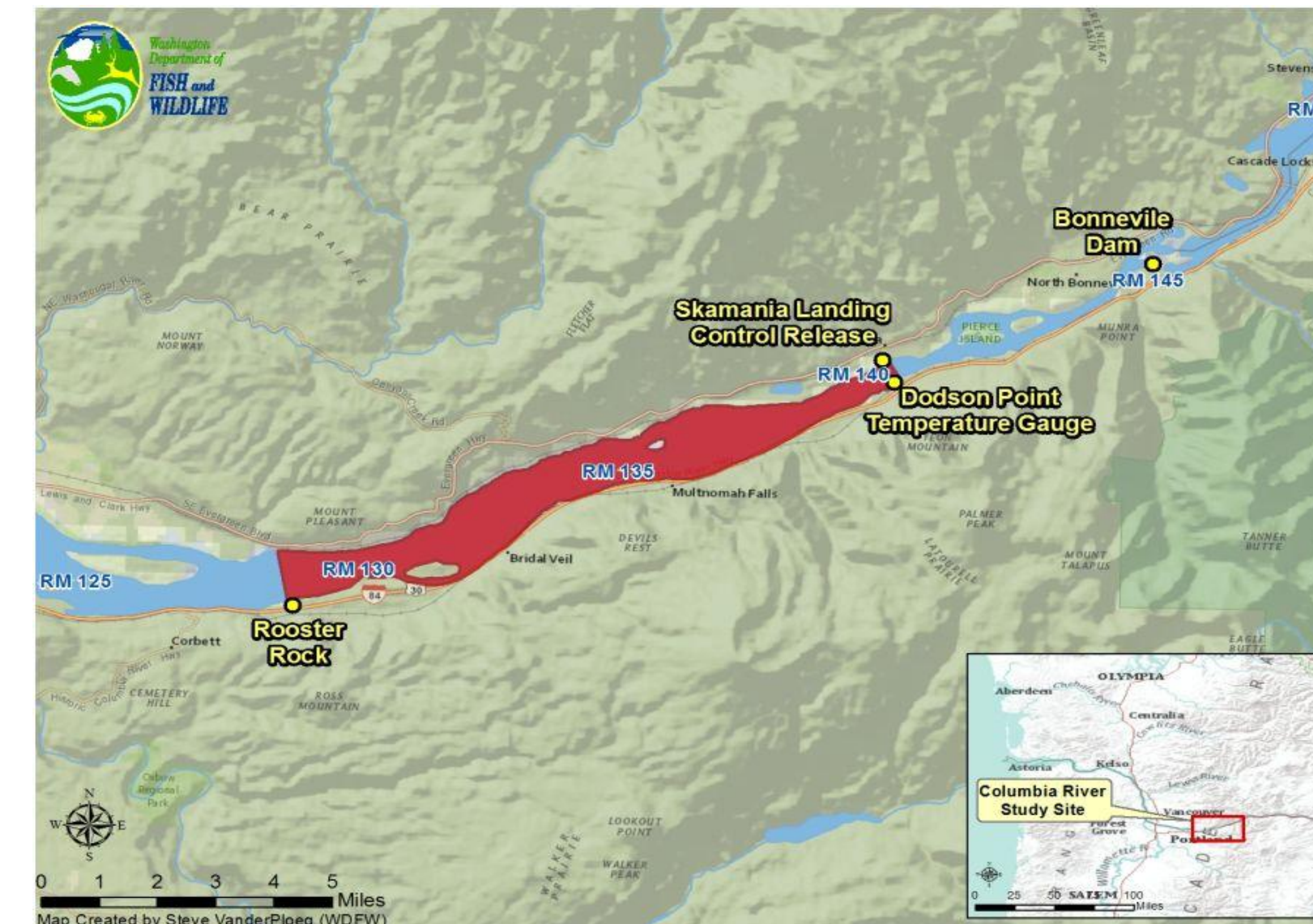
## Methods

**Study duration:** August 24–October 28, 2011

**Treatment:** Steelhead were captured using beach and purse seines, PIT tagged and released immediately.

**Control:** Steelhead collected at the Bonneville Dam Adult Fish Facility, PIT tagged and transported for release into an area adjacent to the fishery.

PIT tag detections at Bonneville Dam were the metric for short term survival.



**Study Area** River Mile 129 to Bonneville Dam (RM 145) on the mainstem Columbia River.

## Assumptions to estimate survival

- Fate of each fish is independent
- Control and treatment have the same tagging and handling mortality
- Control and treatment have same rate of tag loss
- Control and treatment have same recovery probability (PIT tag detection at Bonneville Dam)
- No transport mortality caused by downstream transport of control group
- Control and treatment subject to same additional mortality (marine mammals, harvest etc.)

## Logistic Regression

Test covariate statistical significance such as length, origin, water temperature, date and gear type.

## Results

Gear Type	Tagged Fish	Fish not Recaptured	Recaptured Fish	Probability of Recapture	95% CI
Beach Seine	229	12	217	94.80%	91.1% to 96.9%
Purse Seine	312	14	298	95.50%	92.6% to 97.3%
BON Ladder	457	15	442	96.70%	94.7% to 98.0%
All Seines	541	26	515	95.20%	93.0% to 96.7%
<b>Total</b>	<b>998</b>	<b>41</b>	<b>957</b>	<b>95.90%</b>	<b>94.4% to 97.0%</b>

**Adult steelhead (>51cm) PIT tagged and interrogated at Bonneville Dam by gear type**

## Tested two null hypothesis using Chi-Square Test

**1:** There is no difference in recapture probabilities between purse and beach seined fish; ( $\chi^2= 0.1637$ ,  $df = 1$ ,  $p\text{-value} = 0.68580$ )

**2:** The recapture probability are less for the control compared to treatment group. This was rejected with a  $p\text{-value}=0.1473$ .

A binomial distribution was used to estimate the probability of recapture.

## Ricker's two release method

Used to estimate the survival of the treatment fish relative to the control. This method estimated tagged steelhead survival at 98.3% with 95% CI from 95.8 to 99.8. There was 95.5% probability that the survival of seined fish exceeded 95%.

## Logistic Regression:

Shown that no covariates were statistically significant, although control and purse seine fish are 1.7 and 1.4 times more likely to be recaptured than beach seine fish.

## Discussion

This represents a preliminary survival assessment of beach and purse seined steelhead PIT tagged, released and detected at Bonneville Dam. Given the short reach of the study area, it is not surprising that survival and detection was high. A more meaningful measure is long term survival and detection to McNary or the upper Columbia /Snake River Dams. Since steelhead will not complete their spawning migration until June, these results will not be available until later.

## Conclusion

High detection rates at Bonneville Dam demonstrate a high initial survival of released fish from both the treatment and the control groups. Also high detection rates reflect tagging efficiency by project staff and excellent capture condition of fish landed by the fishers. The final long-term survival rates derived from this research are a key biological factor in developing an implementation plan for selective commercial fisheries on the lower Columbia River. The data indicates that purse and beach seines show promise as gear types that can be effectively used in the lower Columbia River to target hatchery salmon while minimizing impacts to released steelhead.



Columbia River Gillnet



Beach Seine



Purse Seine Catch



Purse Seine



Bonneville Dam Adult Fish Facility

## Acknowledgements

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## References

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