Quantifying uncertainty in estimates of juvenile salmonid loss at the Central Valley and State Water projects

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What is loss?

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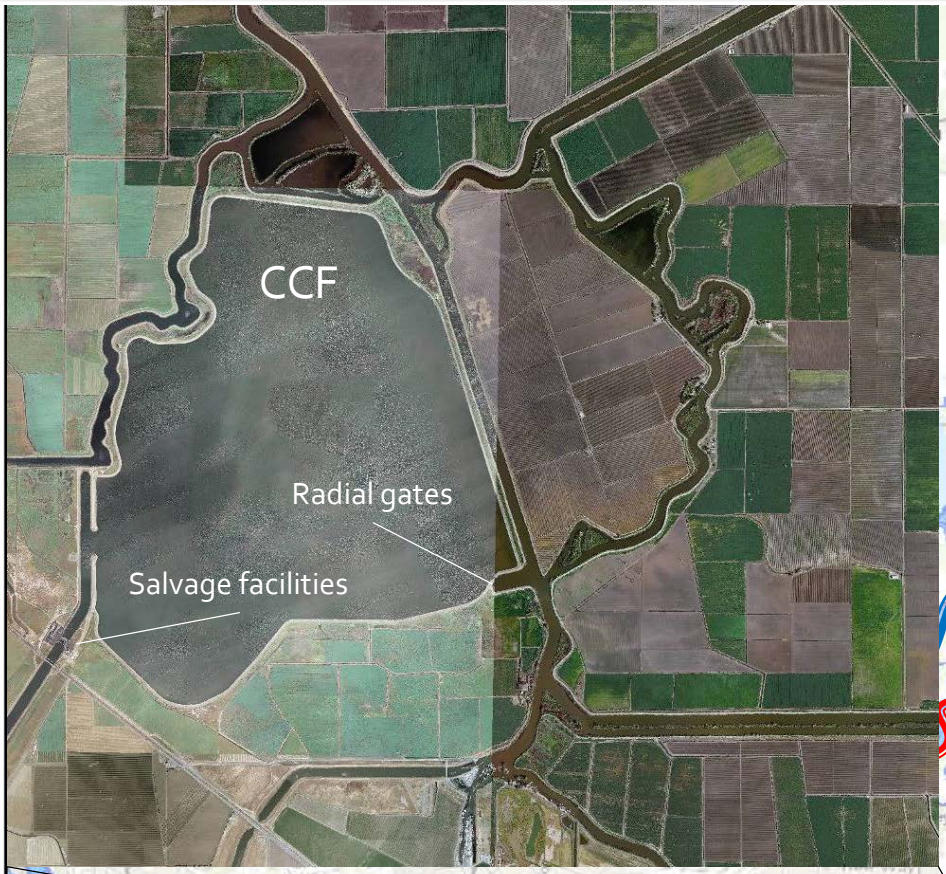
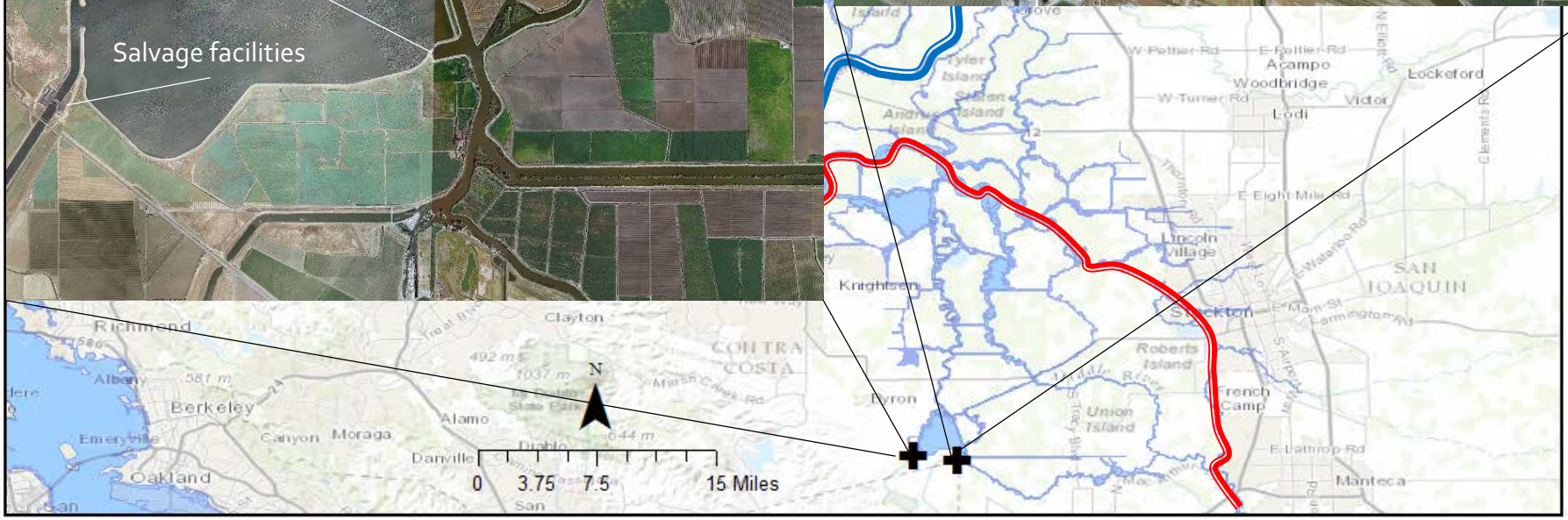
Where does loss occur?





Why is loss important?

- 2009 BiOp defines loss levels that trigger restrictions in water operations.
- May be serious ecological and economic impacts if triggers are exceeded.
- Estimates of loss need to be precise and accurate given consequences of triggered actions.

How is loss estimated?

Pre-screen

Facility

SWP
37.3

85% mortality

Louvers
5.6

90% efficiency

Salvage
5

4% mortality

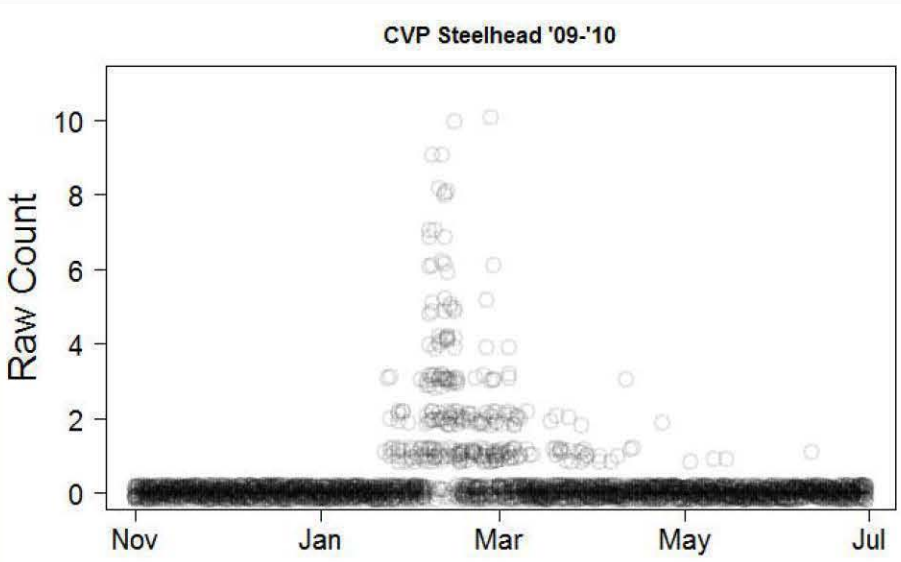
Release
4.8

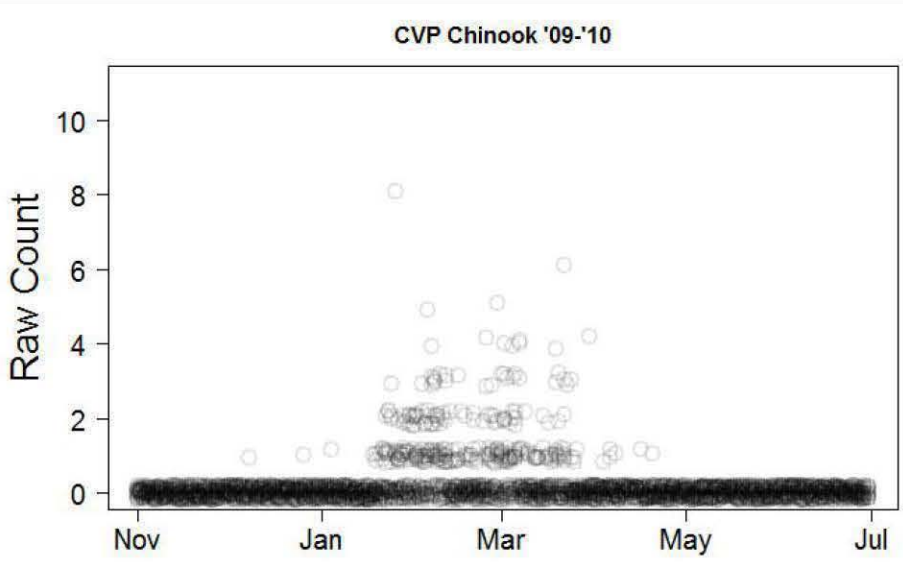
Loss = 37.3 – 4.8 = 32.5

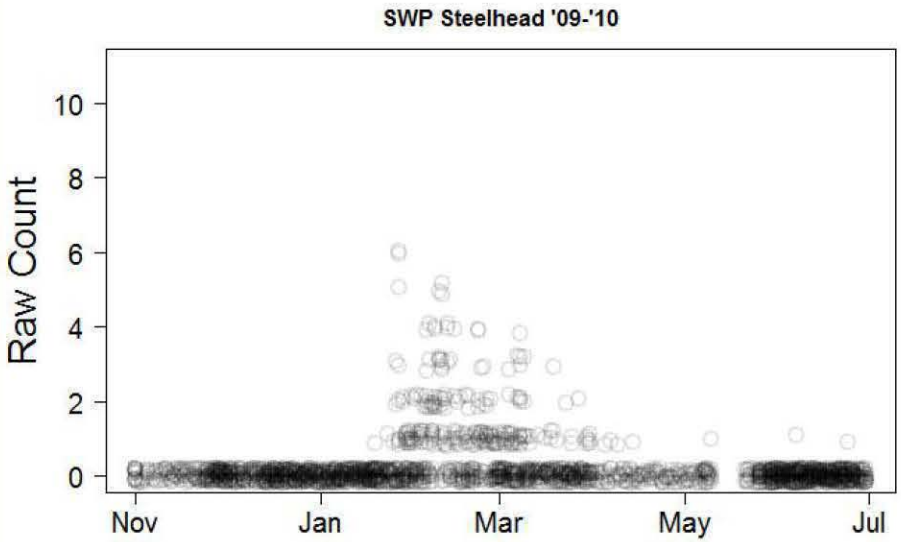
Criticisms

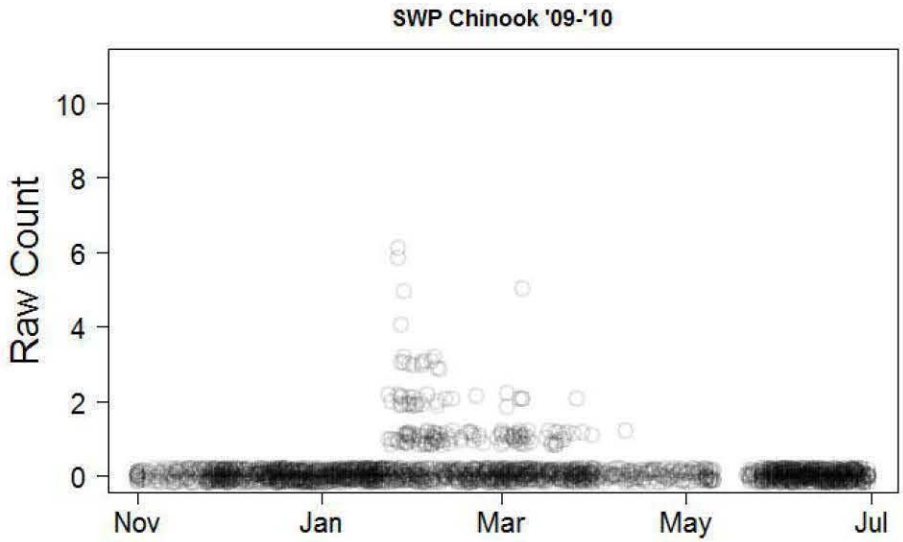
- Considerable uncertainty in data used for expansion but not included in estimate.
- Calculation does not reflect time scale or process of loss.
- Does not estimate loss when salvage is zero.
- Low certainty in stock identity

Daily variation

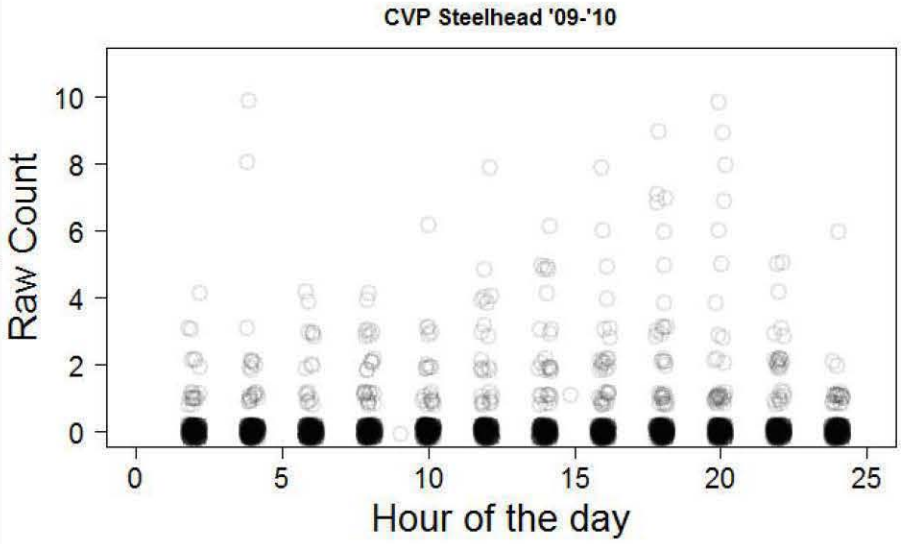


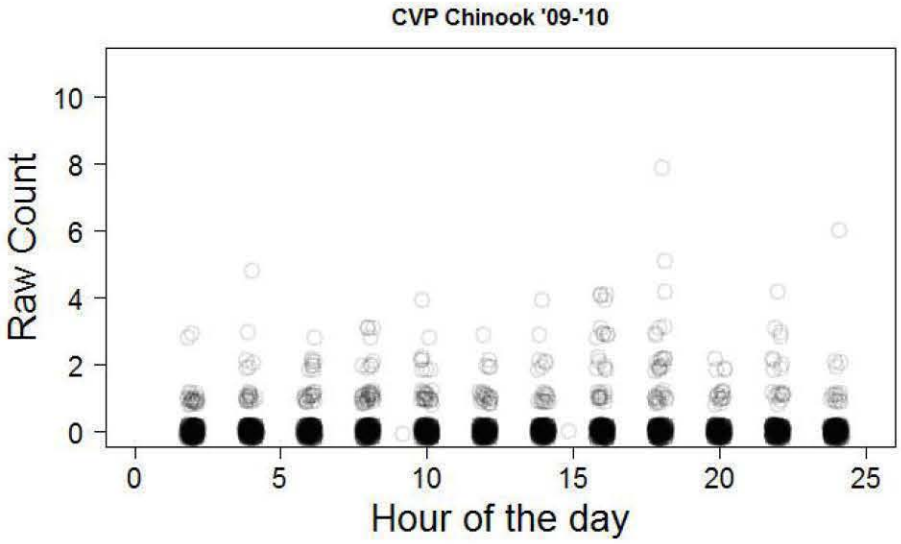


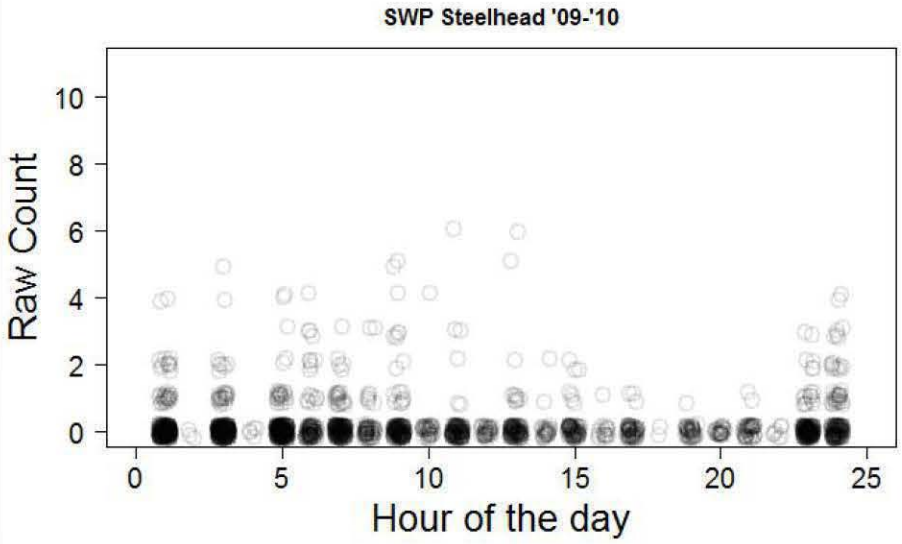


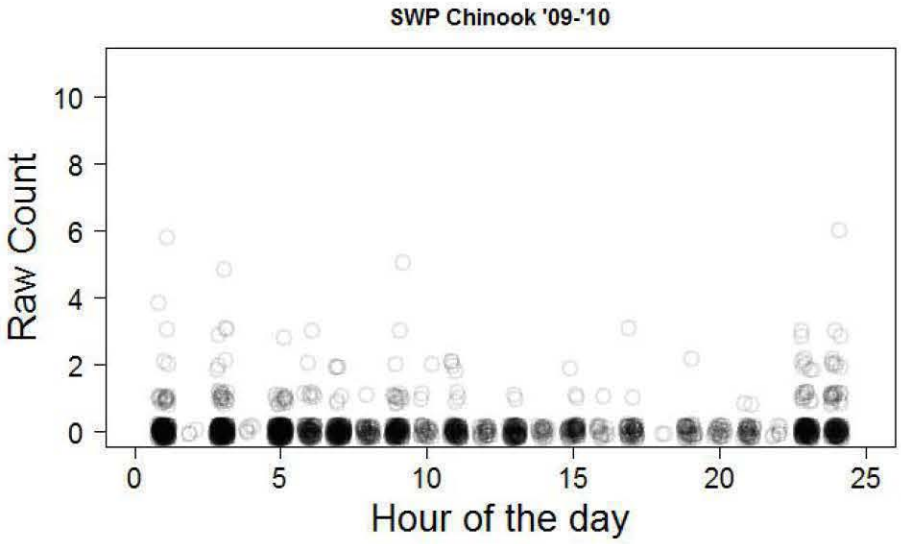


Diel variation

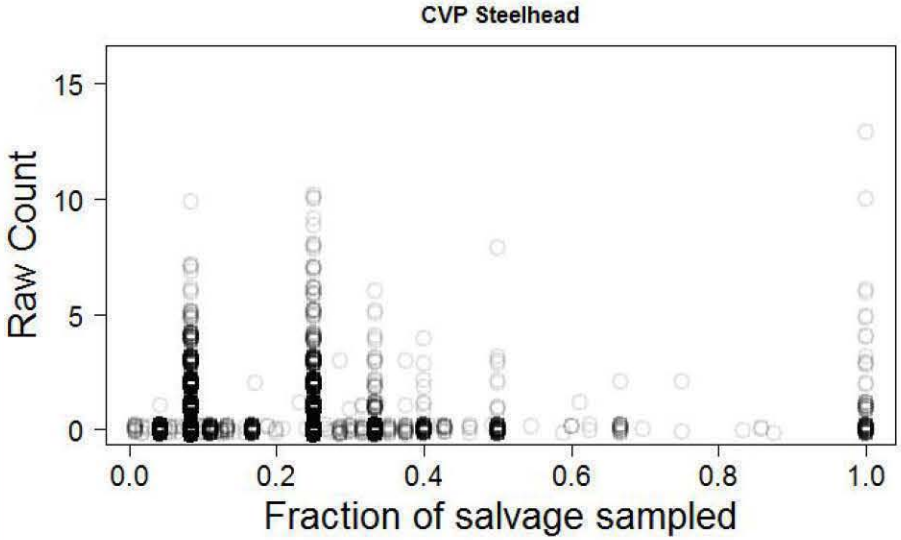


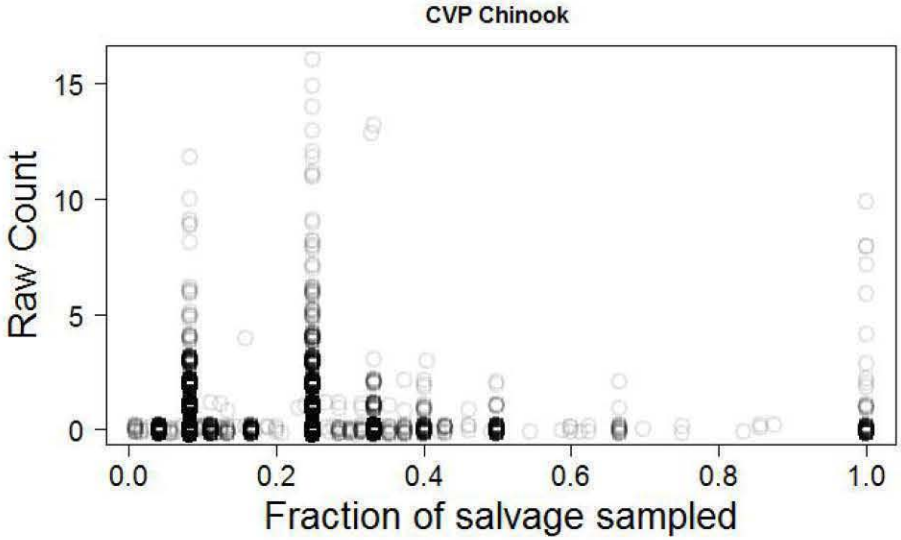


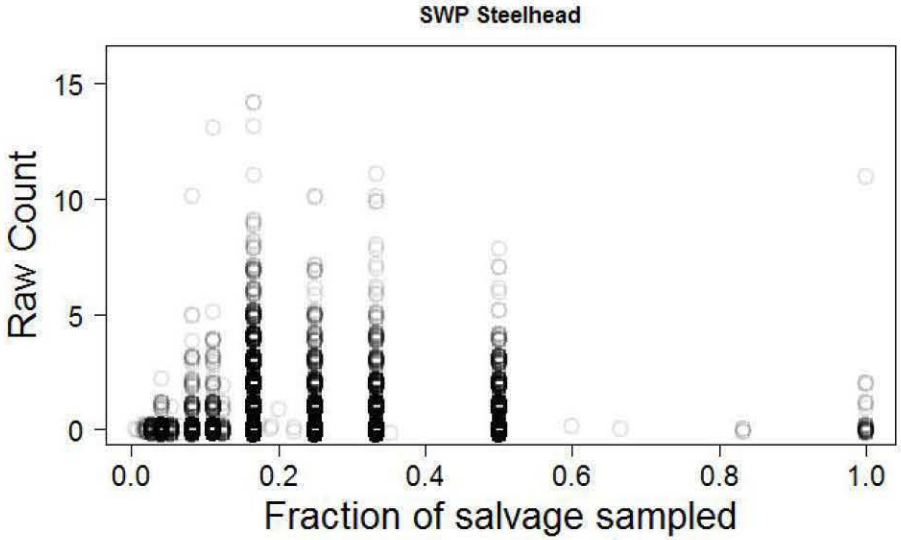


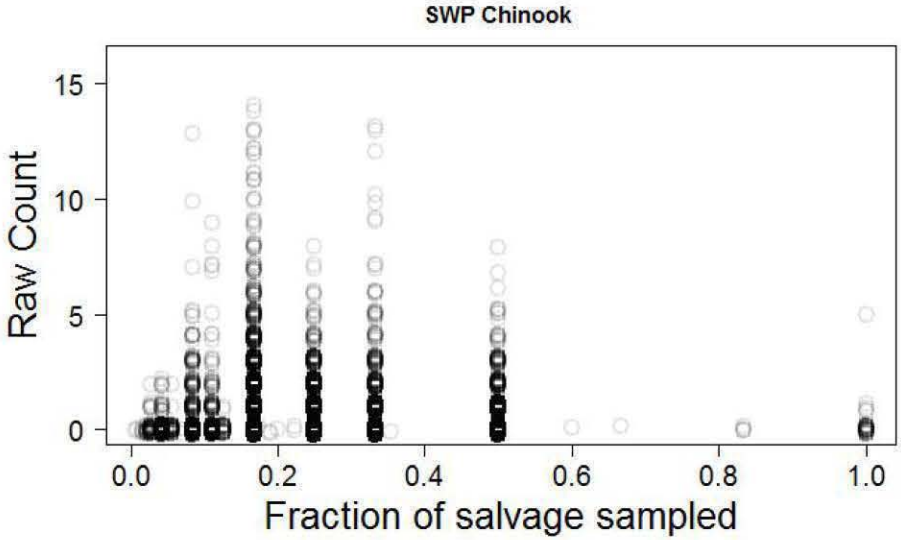


Variation in sample fraction

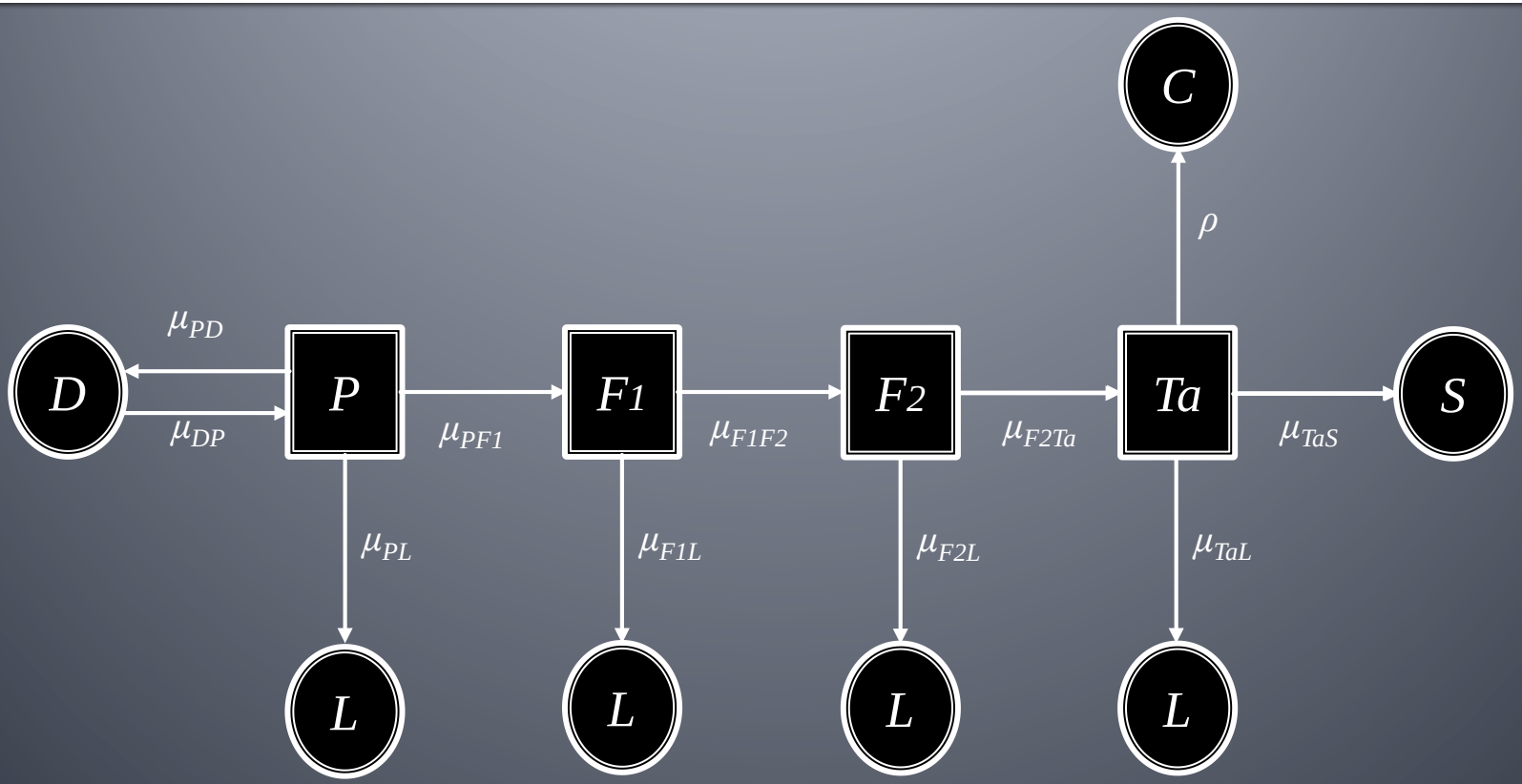






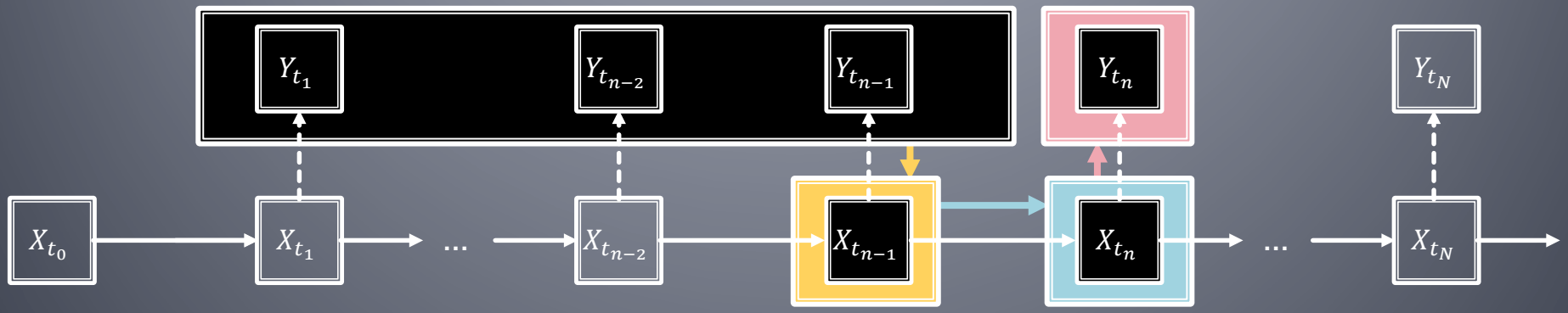


Partially observed Markov Process model (POMP)



The particle filter

Estimating POMP likelihood



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Web application

Parameter set:

Chinook-CVP | Chinook-SWP | Steelhead-CVP | Steelhead-SWP

Parameter Values

Parameter	Min	Mean	Max
Entrainment Rate	0.14	11.02	22026.47
Pr(P->D)	0.00	0.00	0.00
Pr(P->F1)	0.00	0.11	0.37
Pr(P->L)	0.63	0.89	1.00
Pr(F1->F2)	0.26	0.50	0.83
Pr(F1->L)	0.17	0.50	0.74
Pr(F2->T)	0.97	0.99	1.00
Pr(F2->L)	0.00	0.02	0.03
Pr(CTa->S)	0.99	0.99	0.99
Pr(CTa->L)	0.01	0.01	0.01
Pr(NCTa->S)	0.99	0.99	0.99
Pr(NCTa->L)	0.01	0.01	0.01

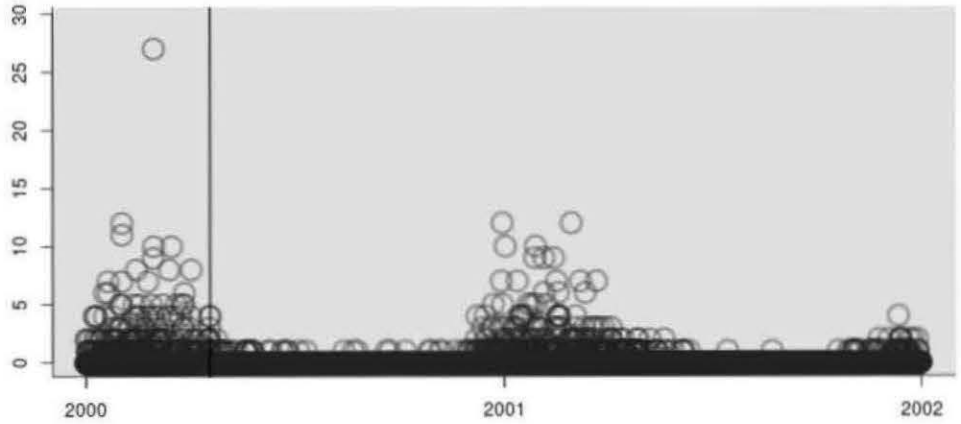
Adjust Parameters | Help

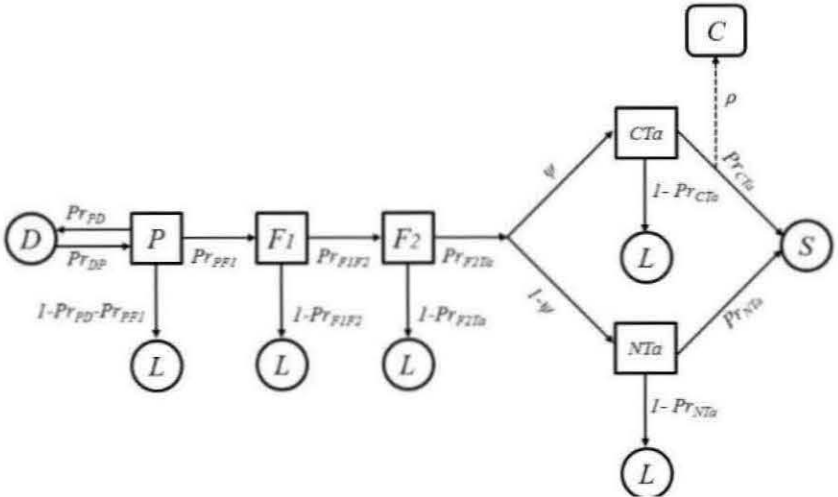
Build New Model

Model built in 0.01 minutes

Model Time Frame

[Drag or use arrow keys]





Web application

Dataset | Build Model | Estimate Loss

Estimate Type:

Fixed Variable

Number of Random Parameter Sets to Run:

3

Value of Loss to Estimate

50

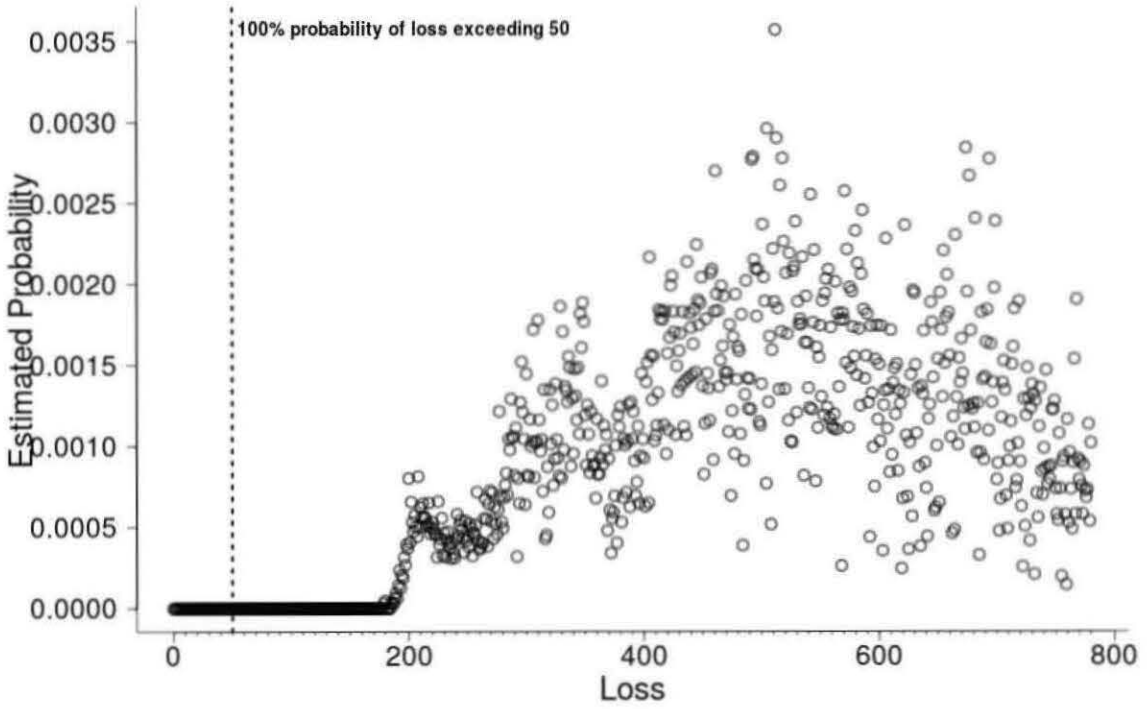
Display Quantiles:

2.5 — 97.5

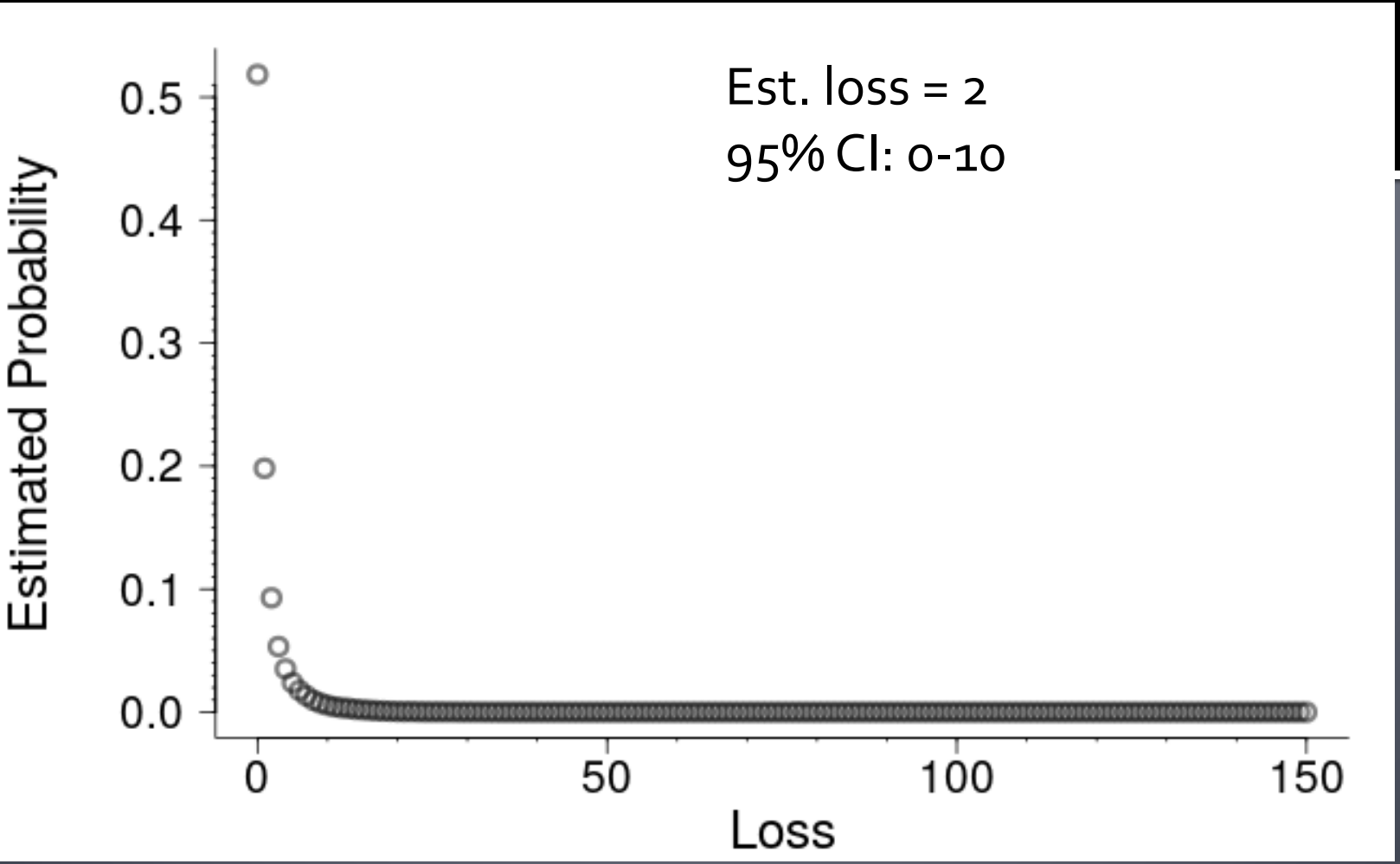
0 10 20 30 40 50 60 70 80 90 100

Run Loss Estimate

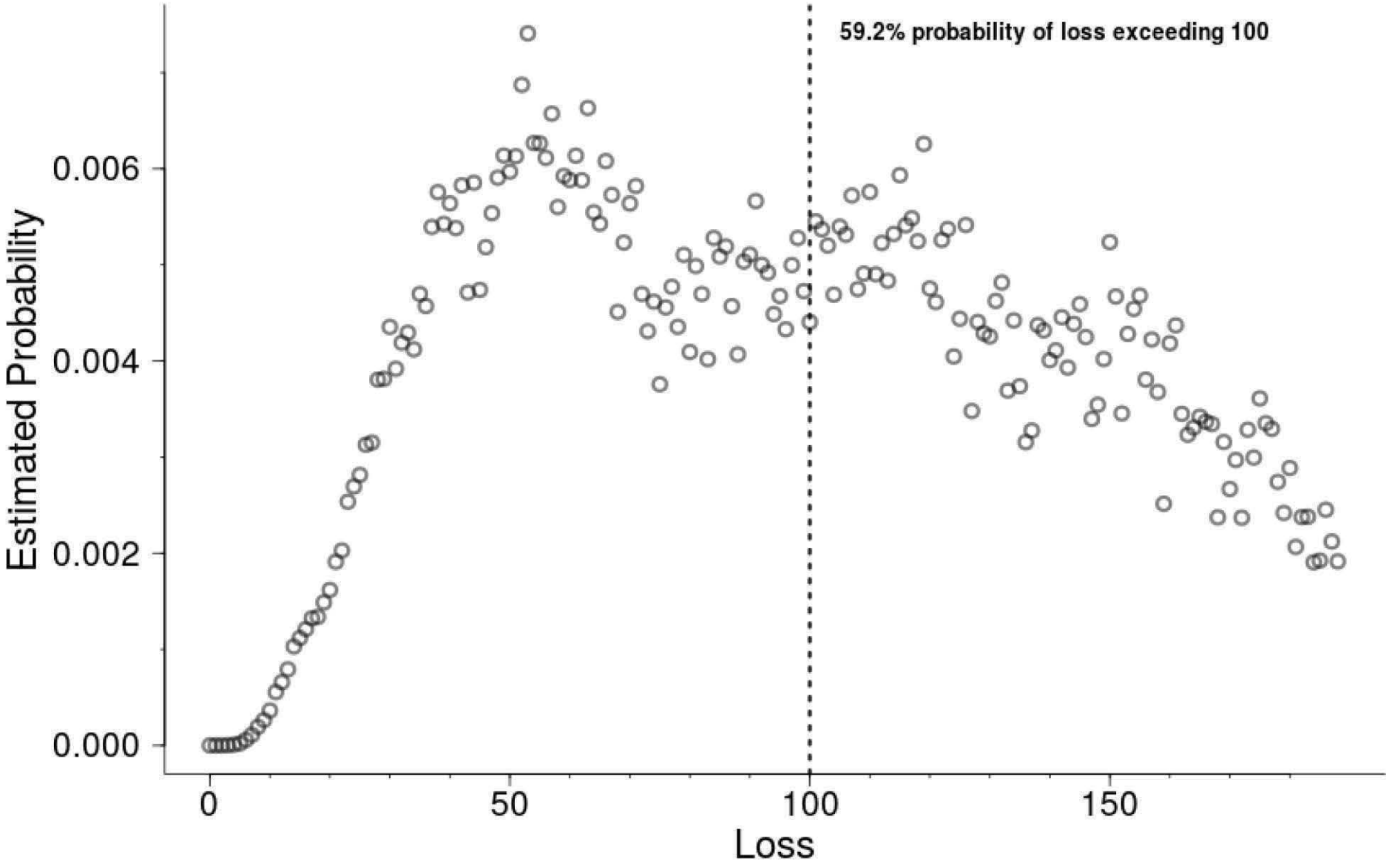
Results for variable parameter estimate:
Expected Loss: 730.03
Variance: 164568.02
Quantile 2.5 %: 245
Quantile 97.5 %: 1741
Probability of exceeding 50 : 1



Lessons learned
Zero salvage



Variability matters



Lack of relevant data

- Entrainment is unknown
- Survival-operations relationships
- Abundance near the facilities
- Survival-environment relationships
- Species specific parameters

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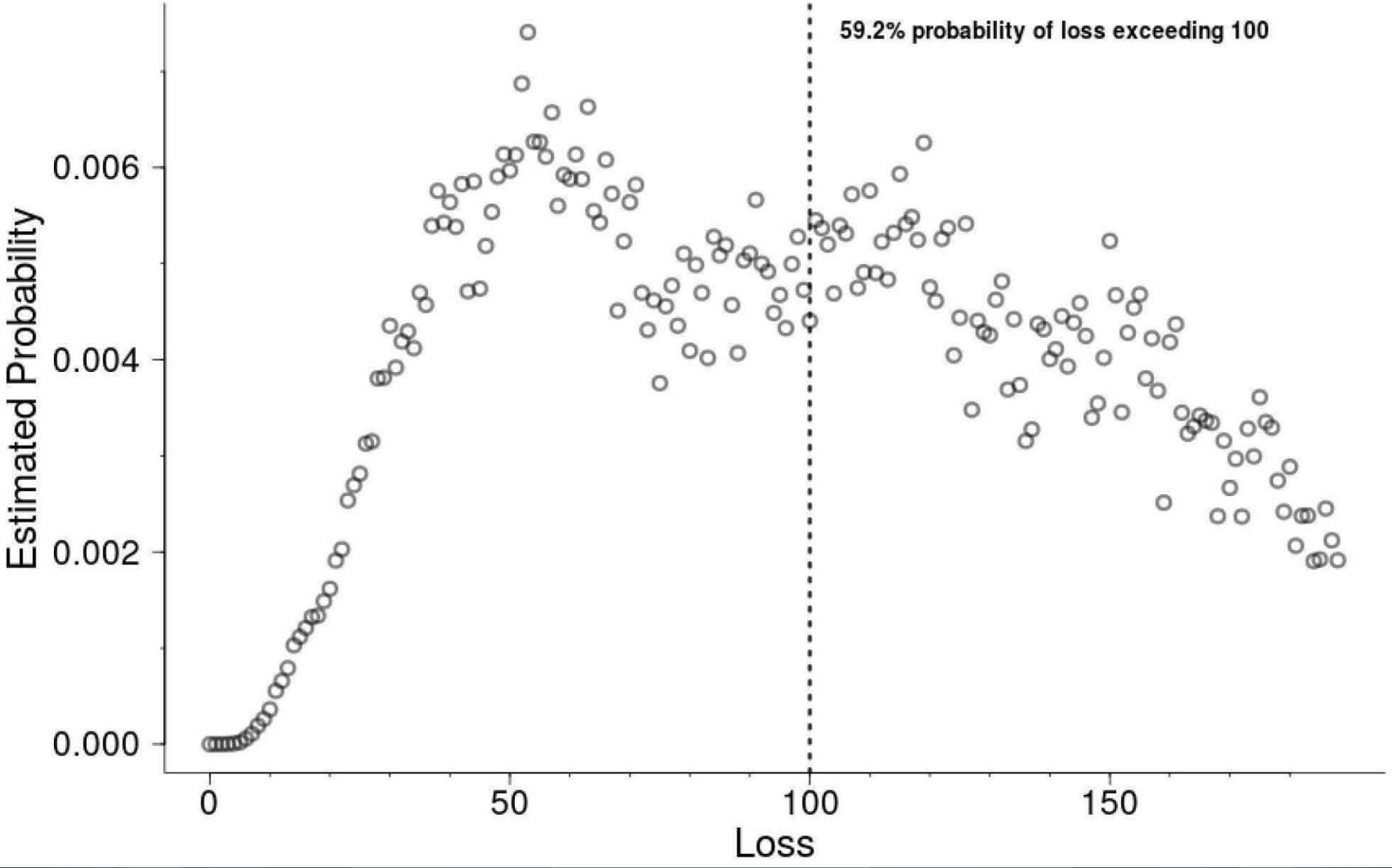
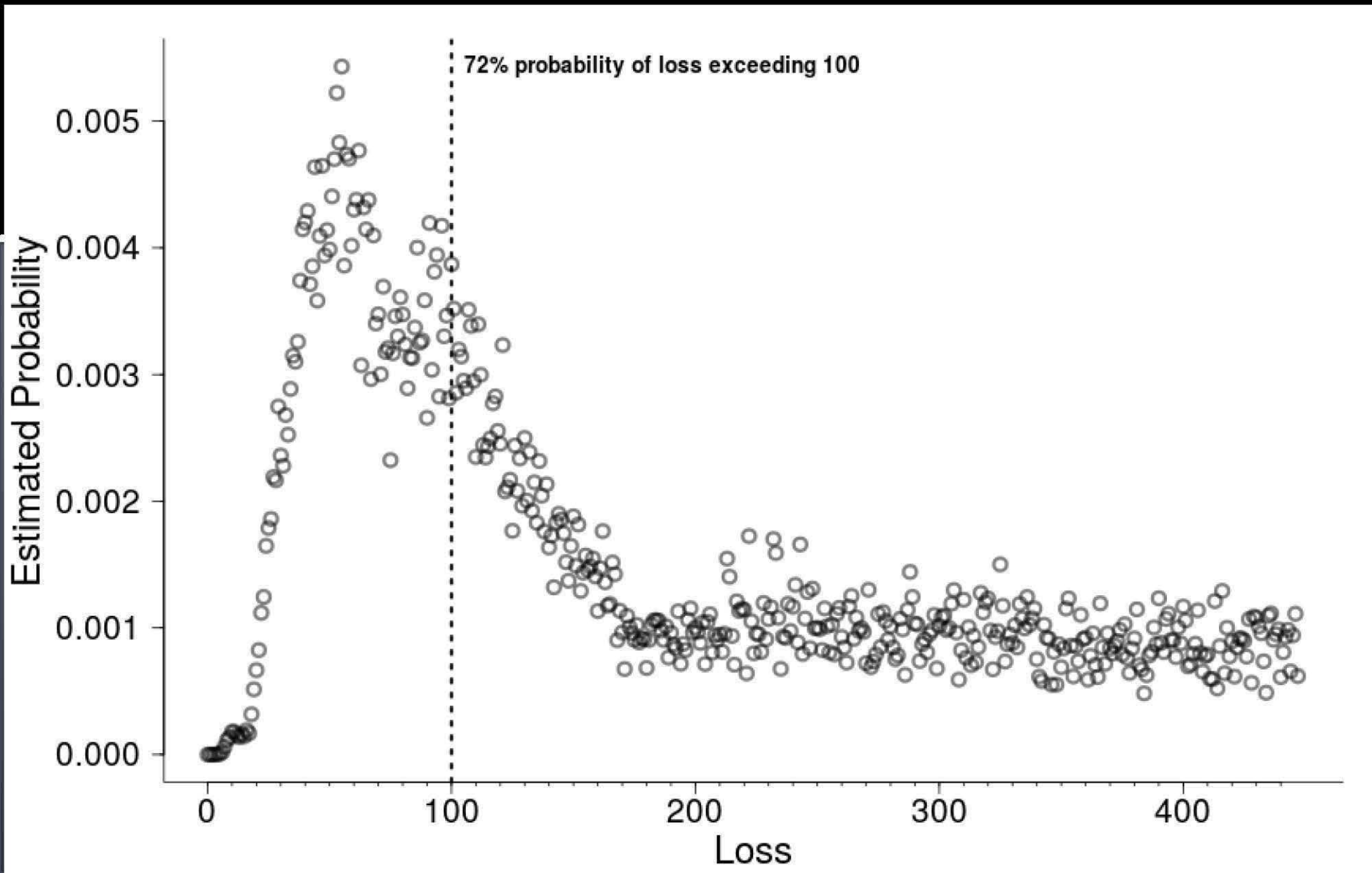
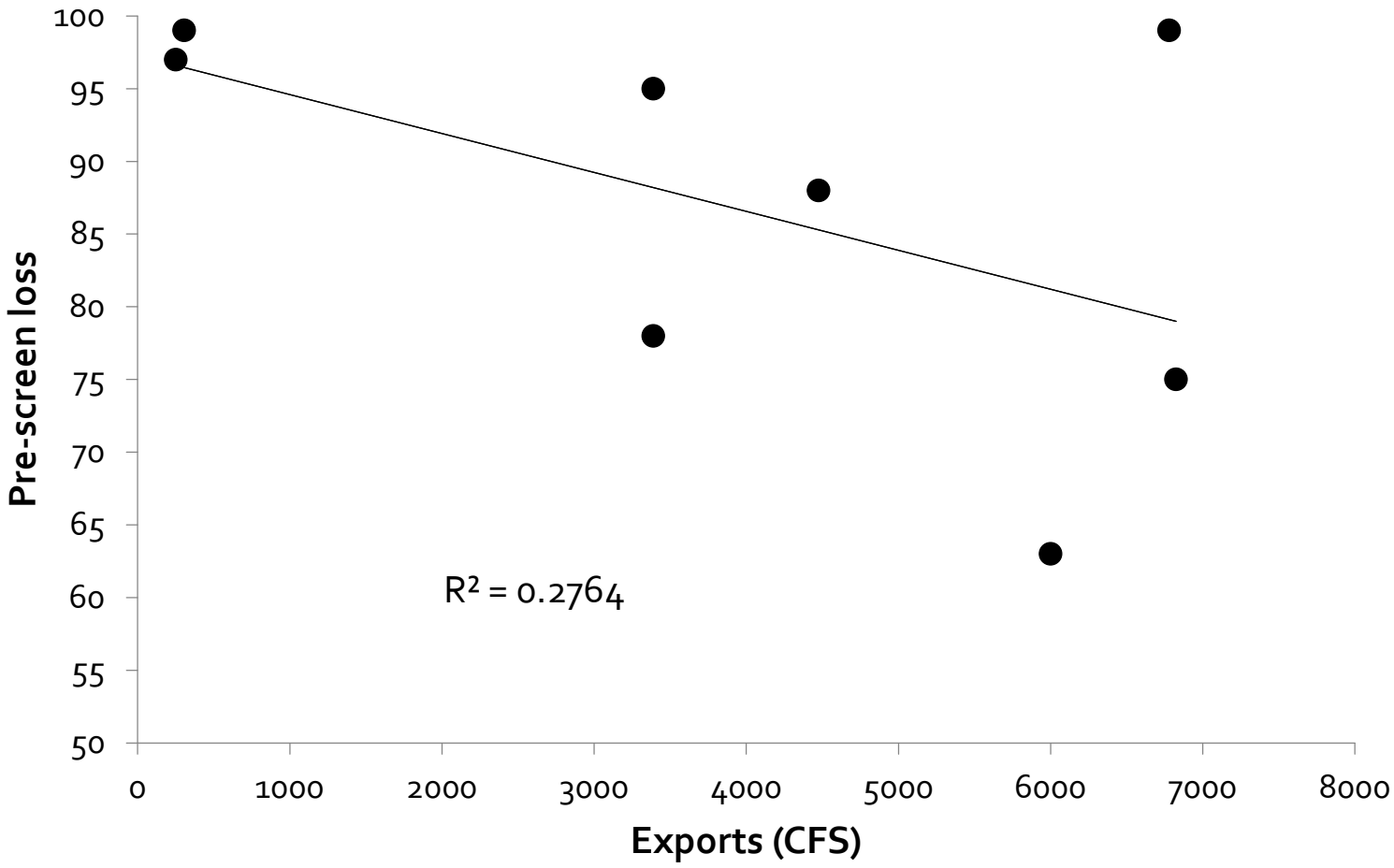
Entrainment 0-22000



Entrainment 100-500



Survival-operations



Data from Gingras 1997

Abundance near the facilities

Are operations or abundance driving variation in loss?

Population context: numbers mean little without scaling.

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No information

Survival-environment relationships

Species-specific parameters

1. No data for steelhead at CVP

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Implications

- High uncertainty in loss estimates.
- Loss estimate methods not comparable
- Daily loss may be a poor metric.

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Next steps

Study recommendation report

Independent review of the model

Acknowledgements

- T&C 2a Workgroup
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- BOR
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- DFW
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