Alternative tagging strategies and estimating collection efficiency

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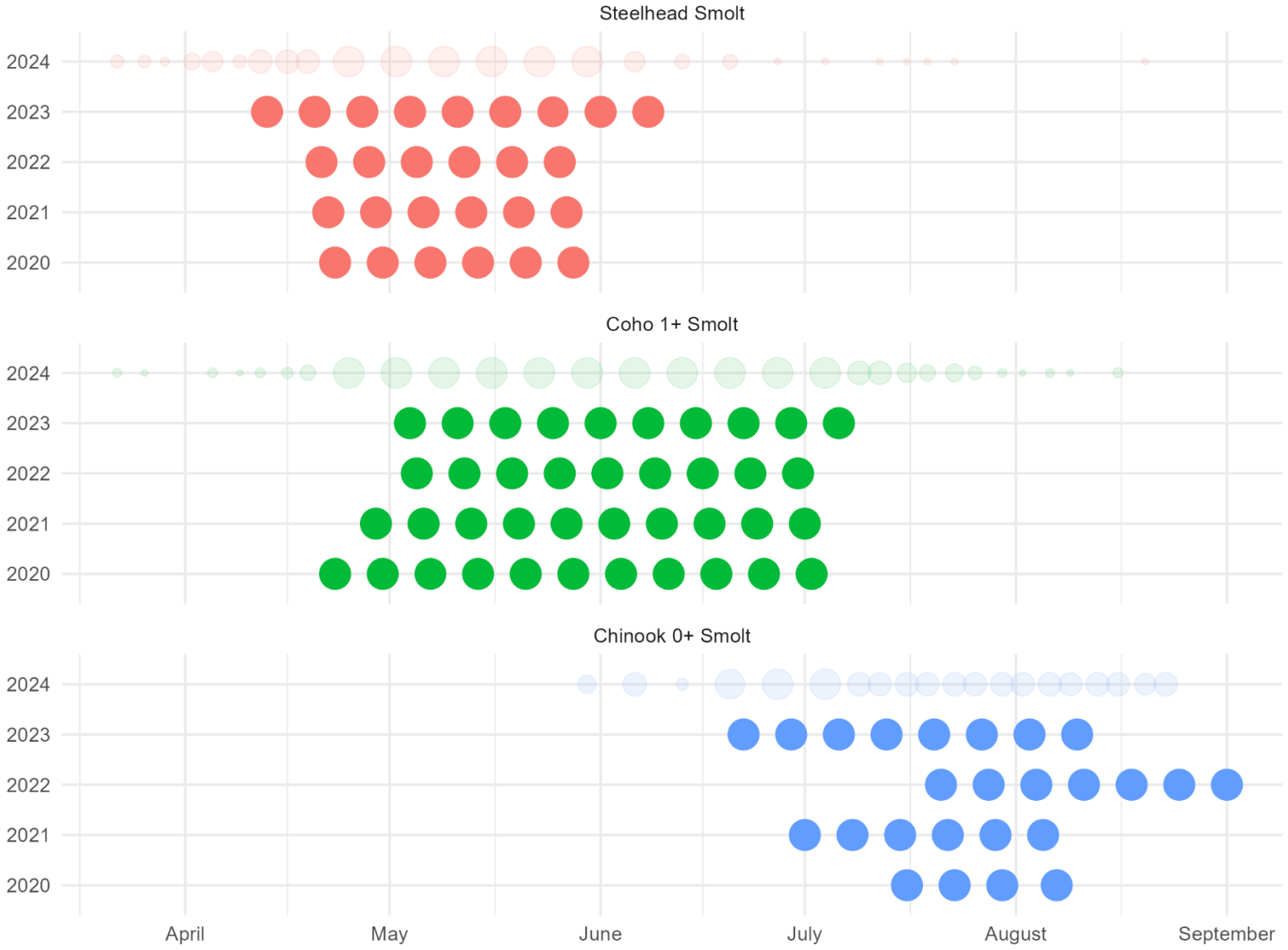
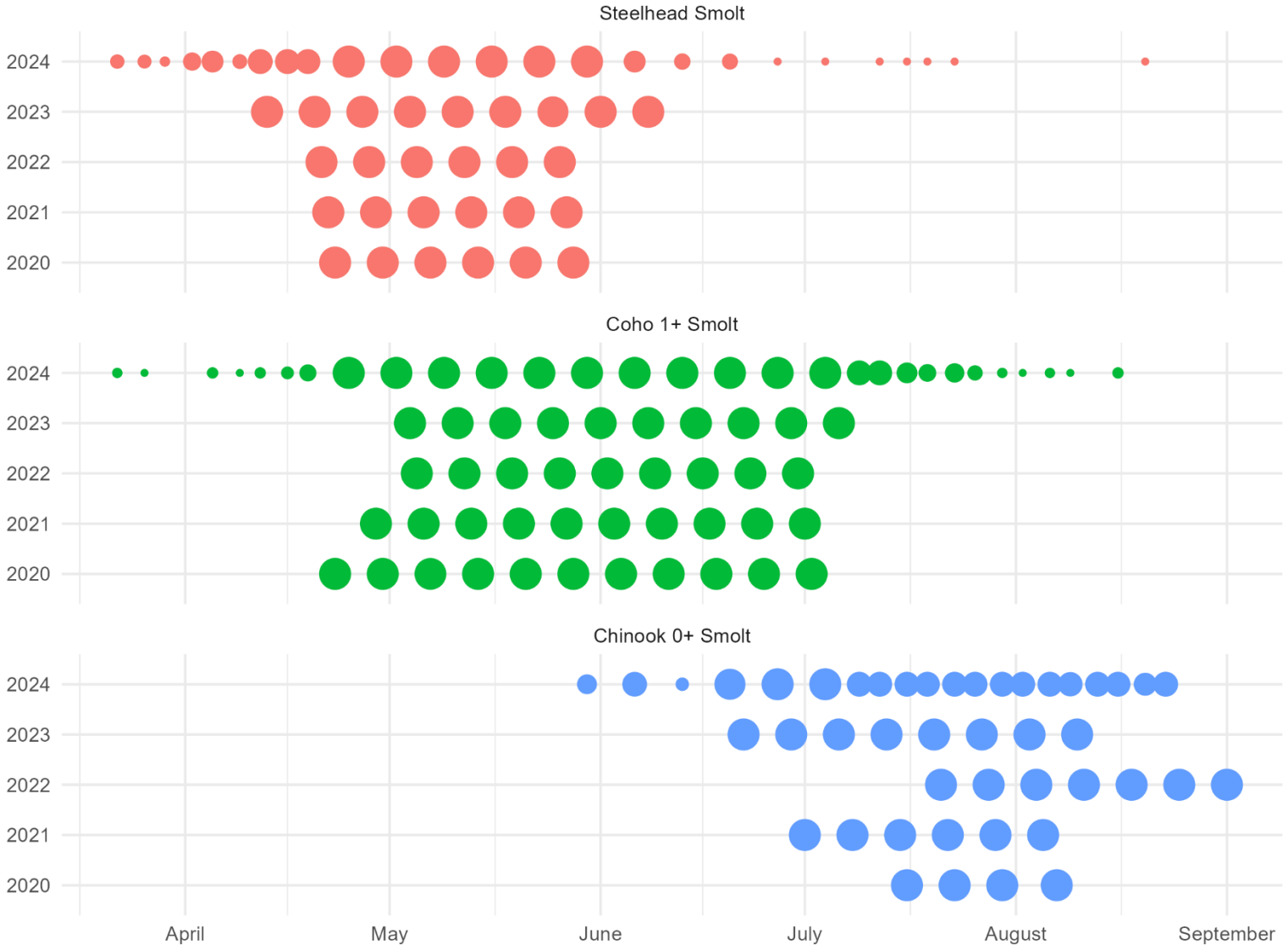
2024 Tagging Strategy

Mark-recapture trials

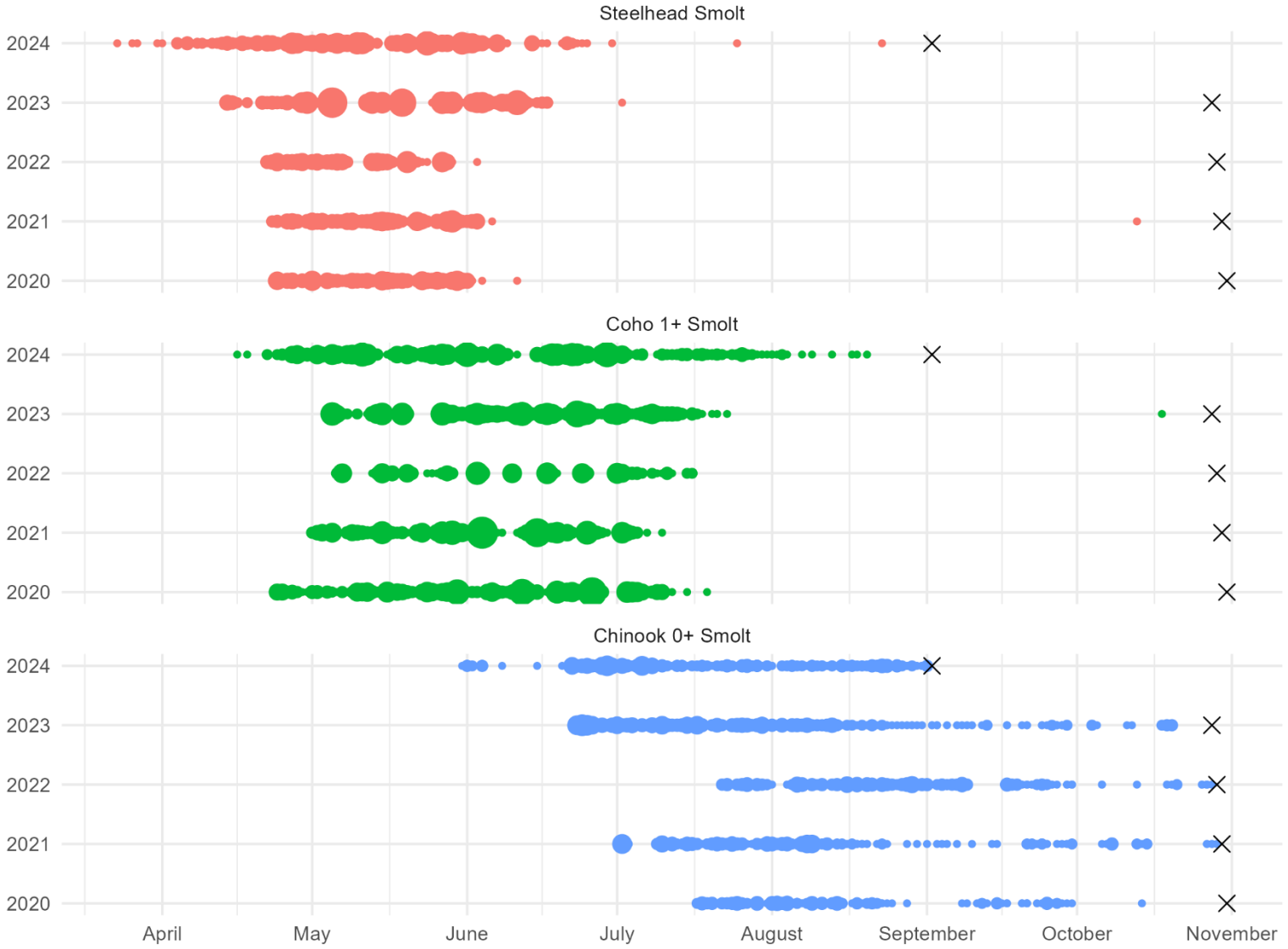


Mark-recapture trials

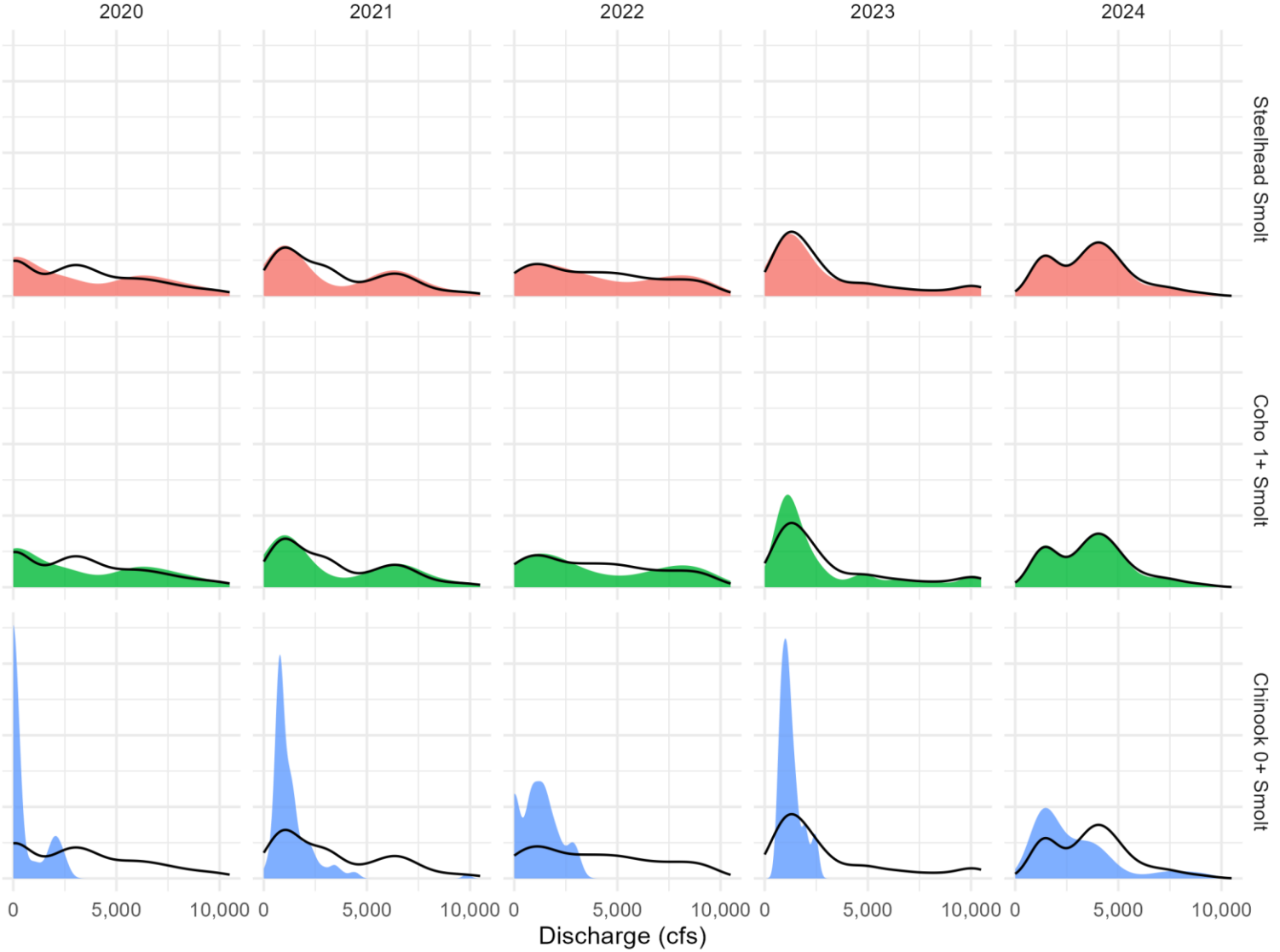


Number of tags deployed

Recaptures


Steelhead Smolt
2024
2023
2022
2021
2020
Coho 1+ Smolt
2024
2023
2022
2021
2020
Chinook 0+ Smolt
2024
2023
2022
2021
2020
April
May
June
July
August
September
October
November

Covariate coverage



What does this all mean?

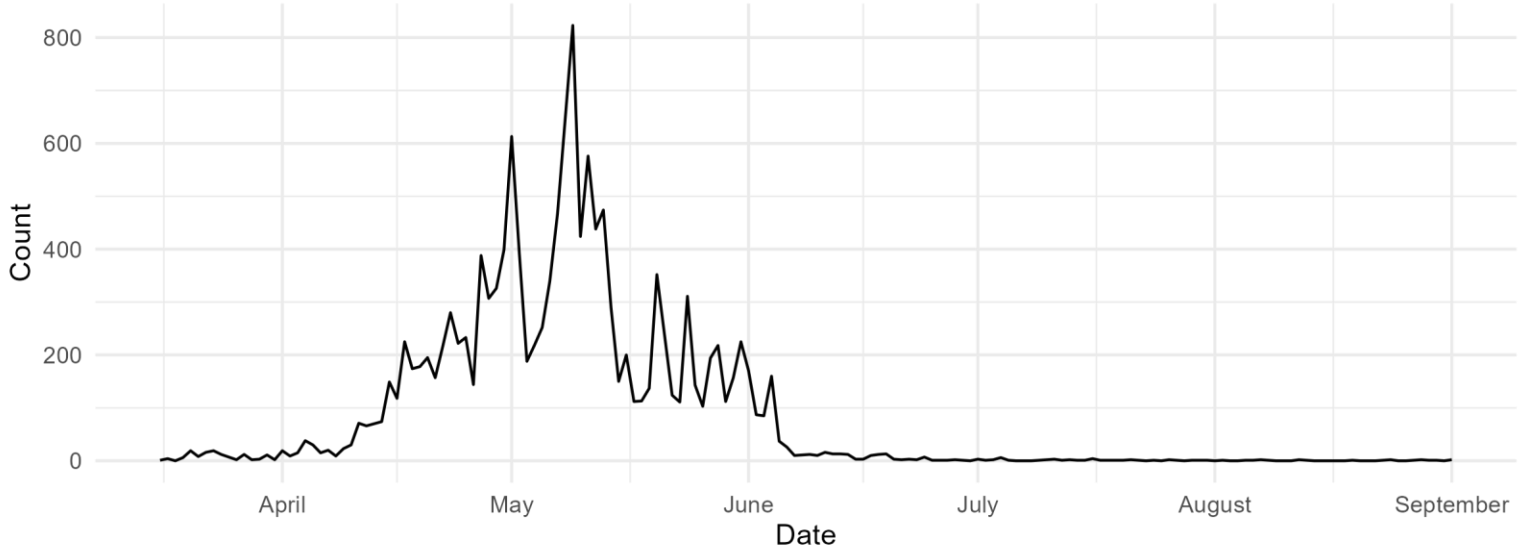
- More tags means more information
- Better coverage of collection season
- Better coverage of covariates

State-space estimation model

Juvenile Abundance Model

- Arrive independently at rate λ_t
- Collected with probability p_t
- Observe number of unmarked fish collected u_t

$$u_t \sim \text{Poisson}(\lambda_t p_t)$$



Collection probability

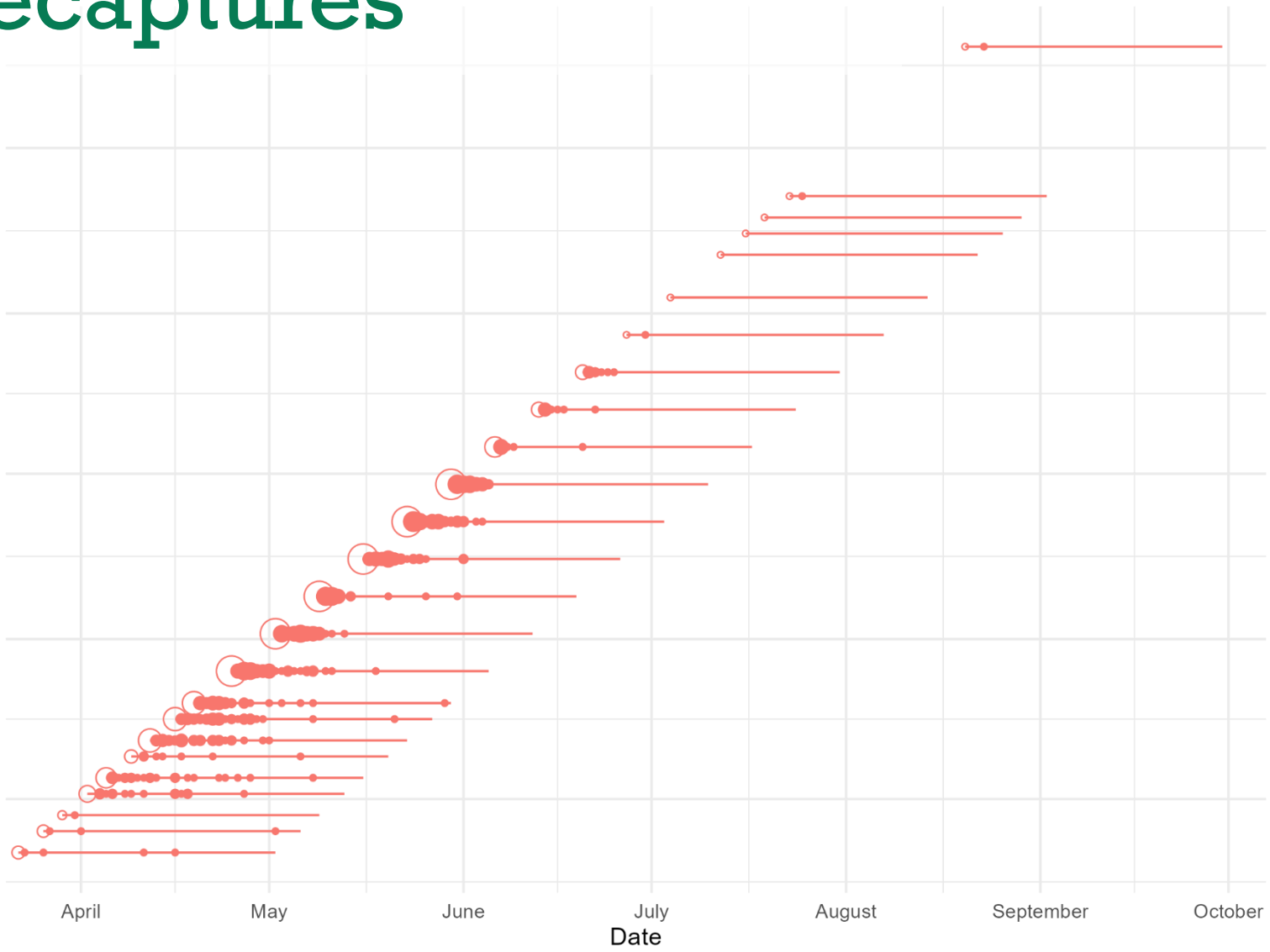
All fish (marked and unmarked) share the same probability of capture p_t on a given day

A tagged fish from group r is available for recapture on day t with probability α_{rt}

Observed number of recaptures n_{rt} is

$$(\boldsymbol{n}_r, l_r) \sim \text{multinomial}(p_1\alpha_{r1}, \ldots, 1 - \sum_t p_t\alpha_{rt})$$

Recaptures



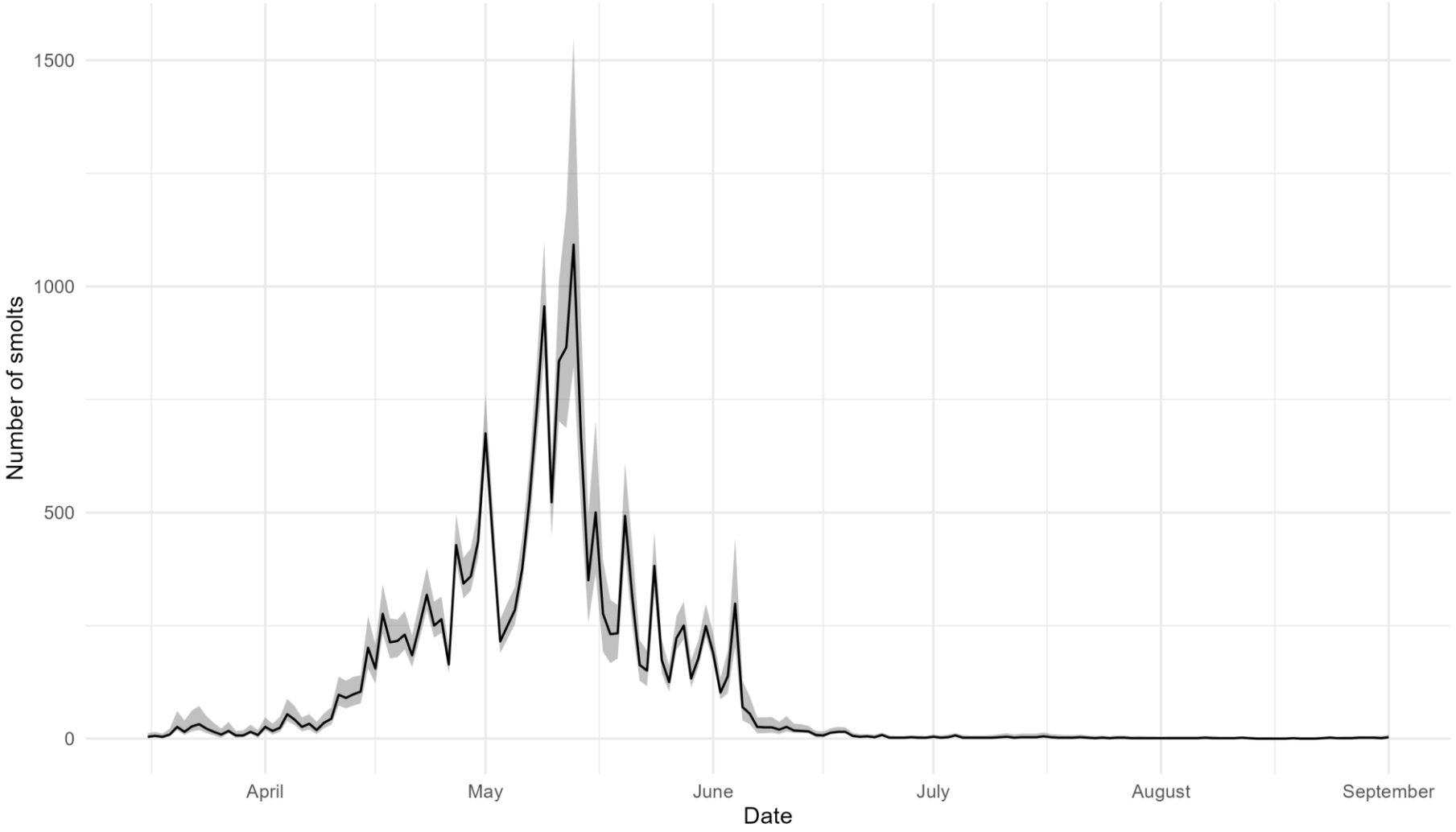
The three models

1. Unmarked arrival rate
2. Probability of capture
3. Post-release availability

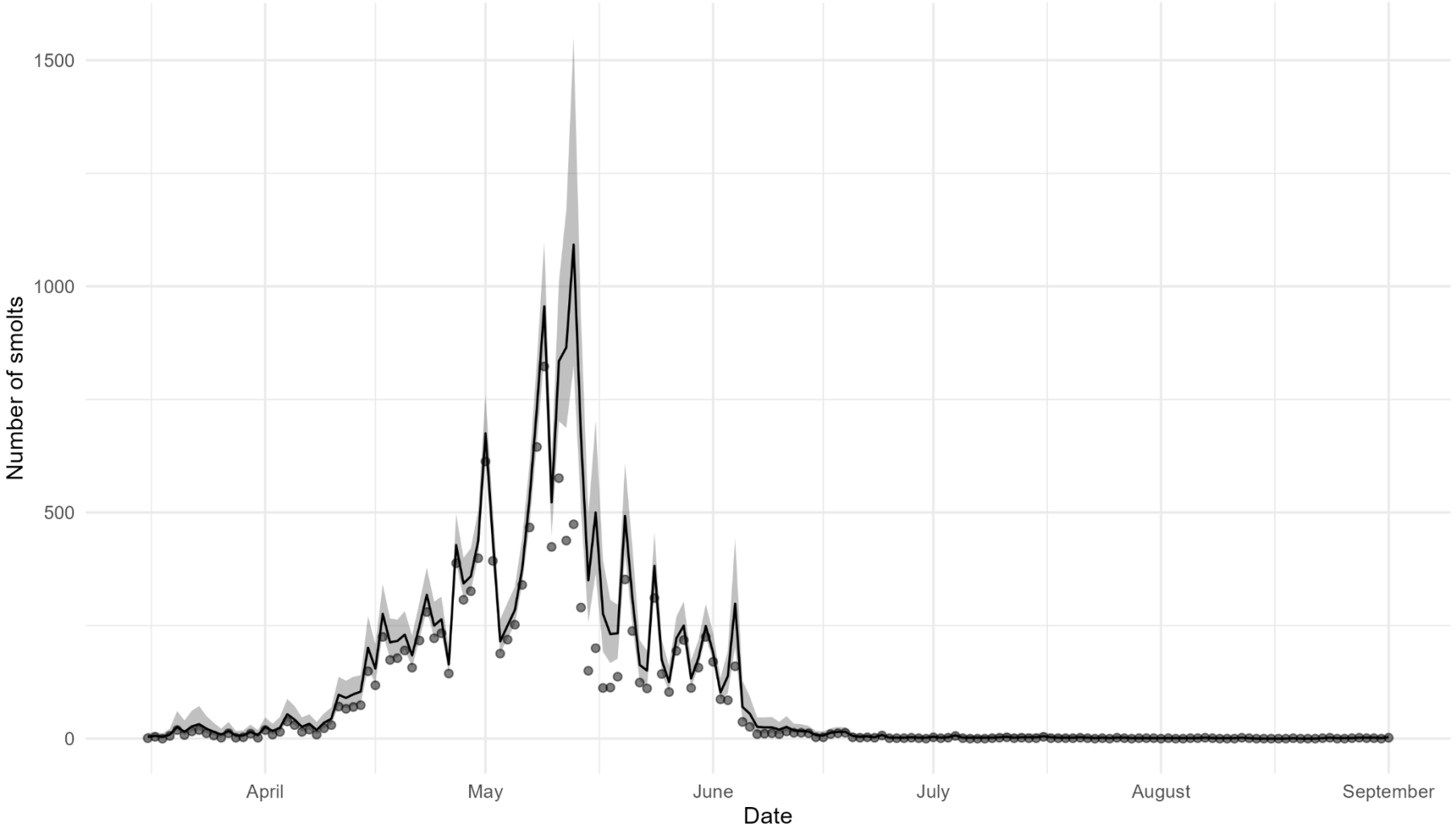
- Can include fixed or random effects
- Random effects allow temporal correlation

Model results

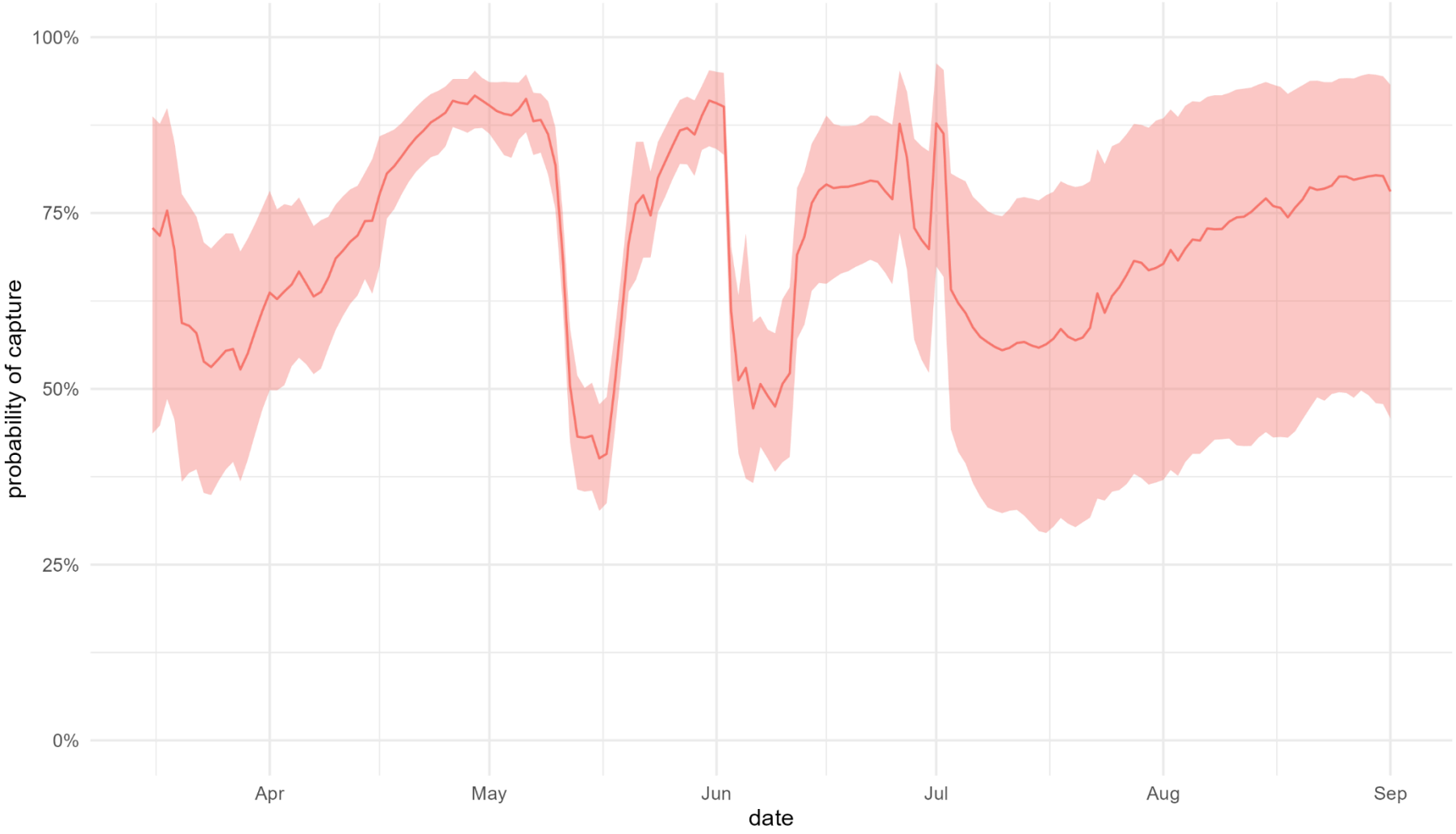
Smolt abundance



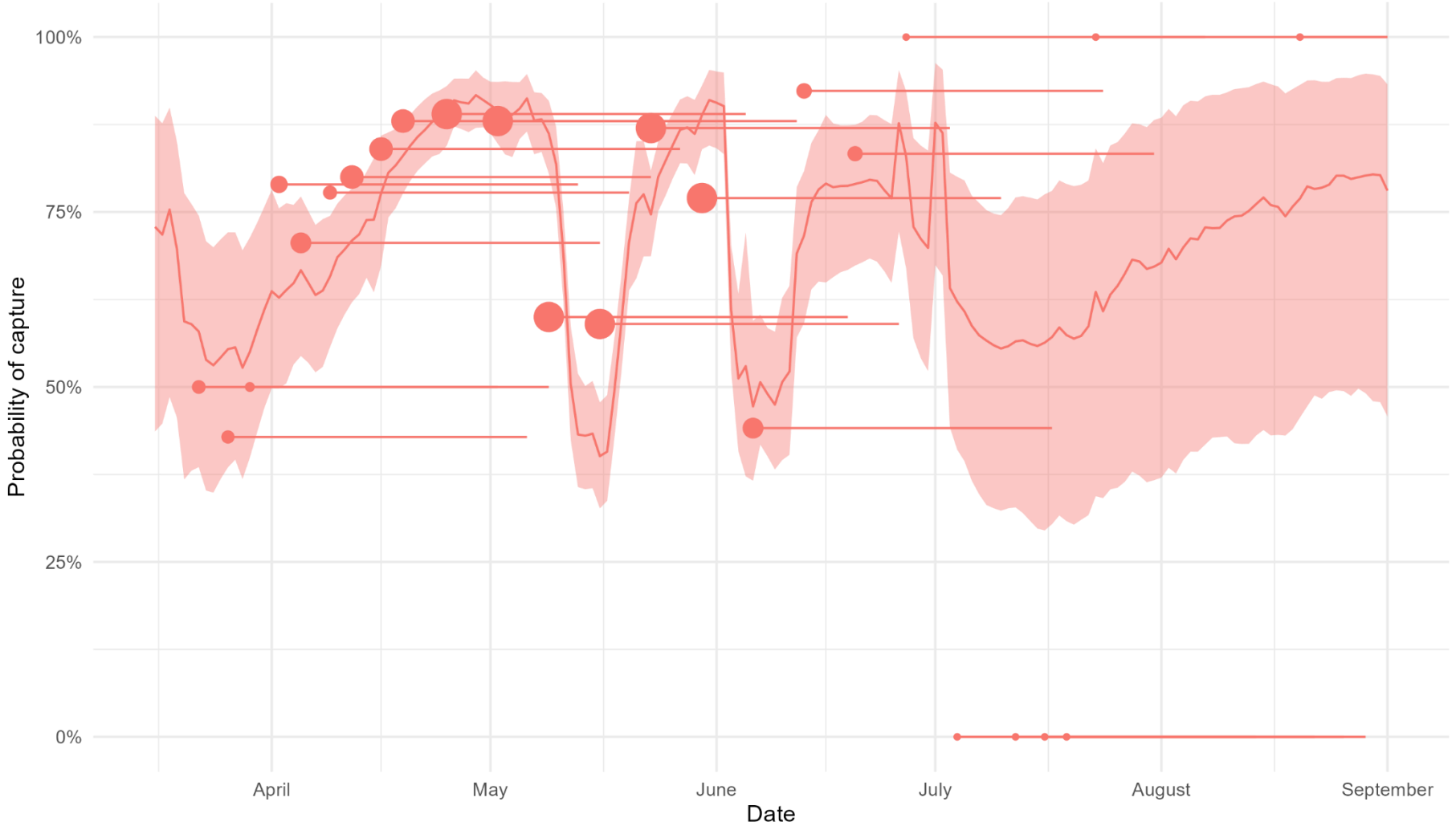
Smolt abundance



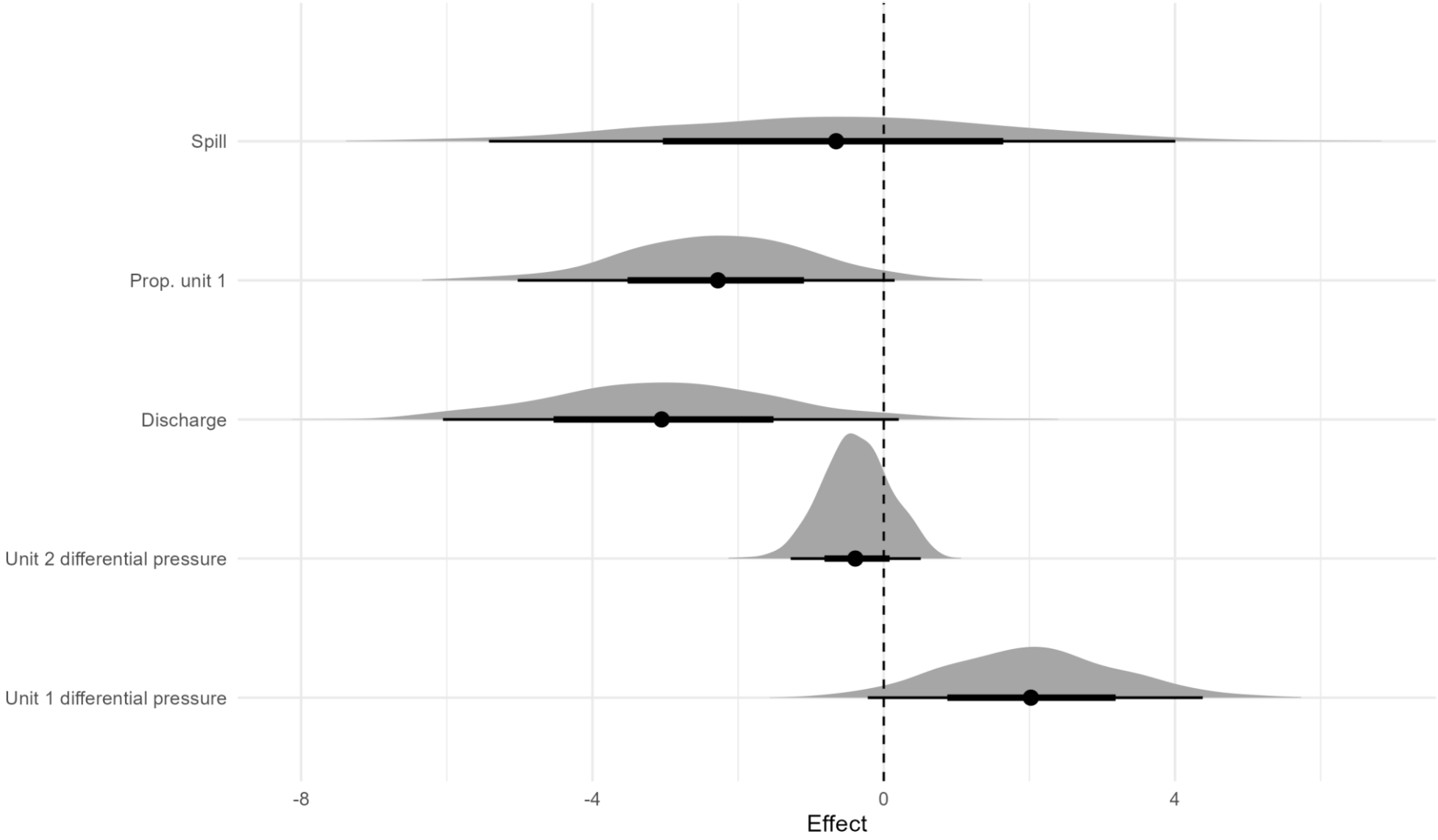
Probability of capture



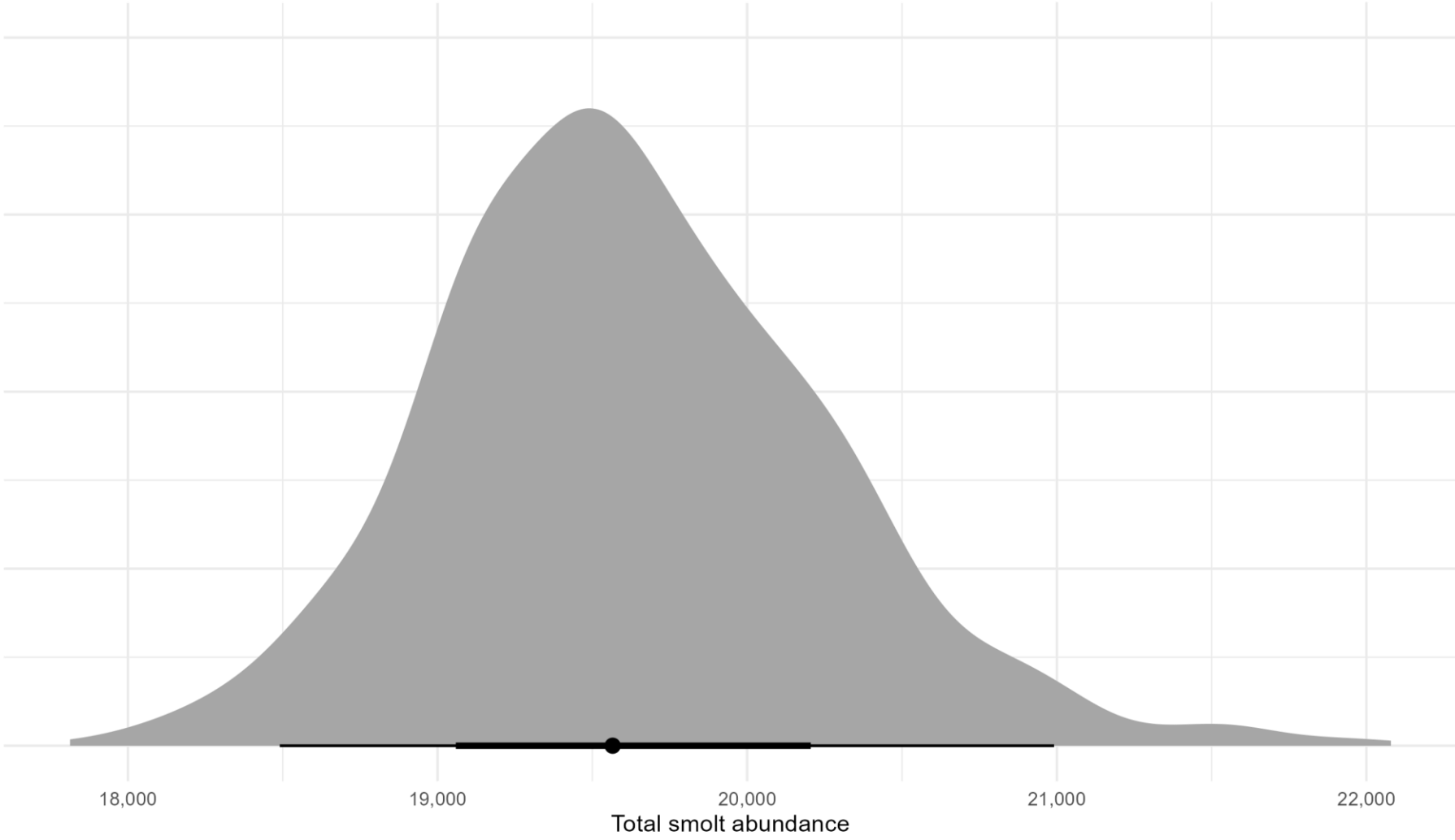
Probability of capture



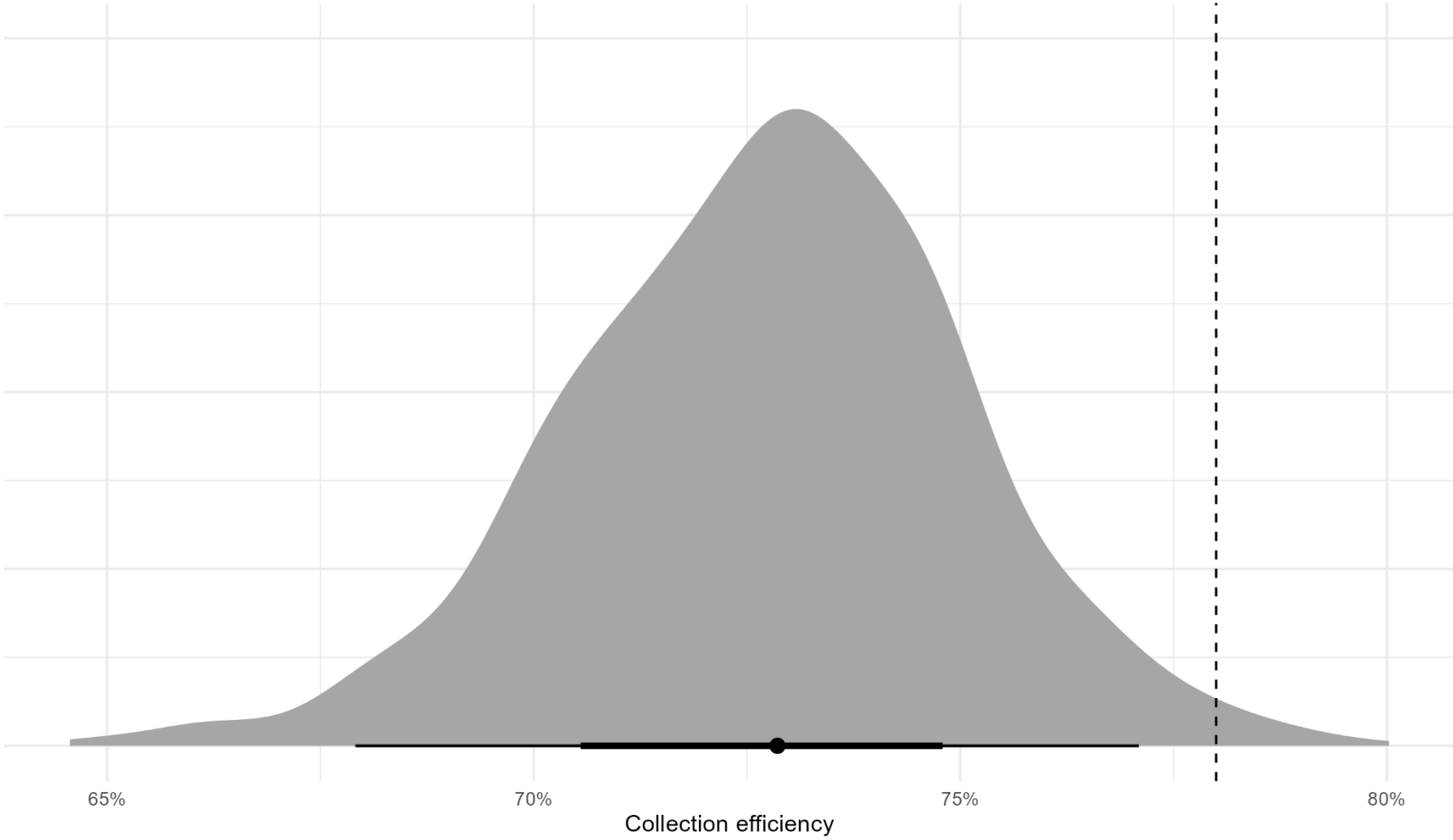
Probability of capture covariates



Smolt abundance



Collection efficiency



Why consider a new model?

- Abundance estimates
- Flexibility
- Informative covariate relationships

Acknowledgements

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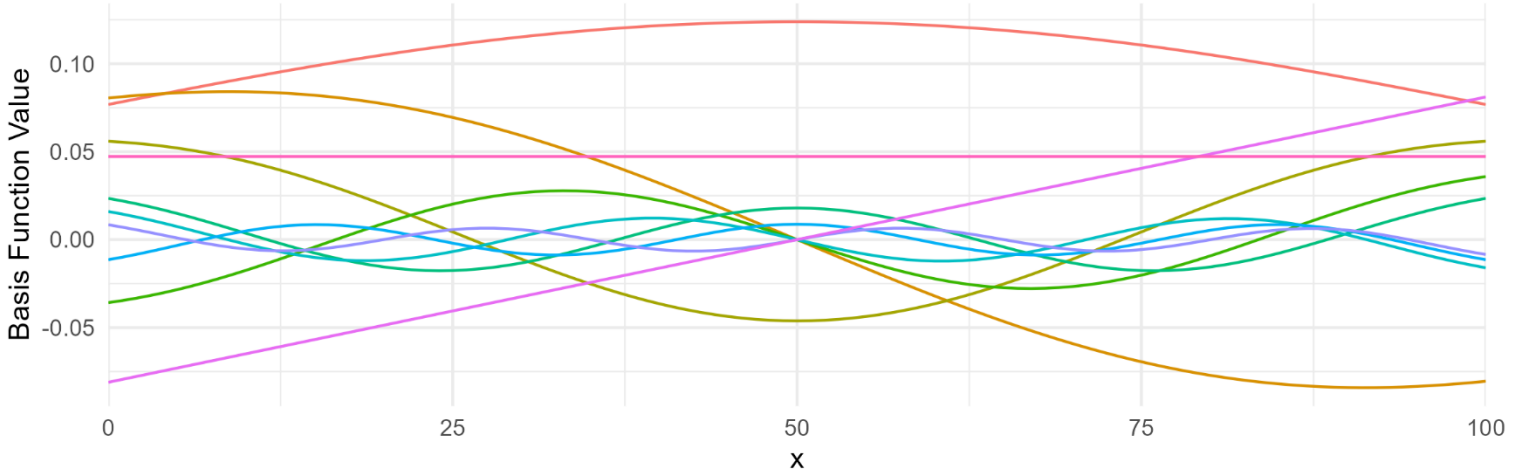
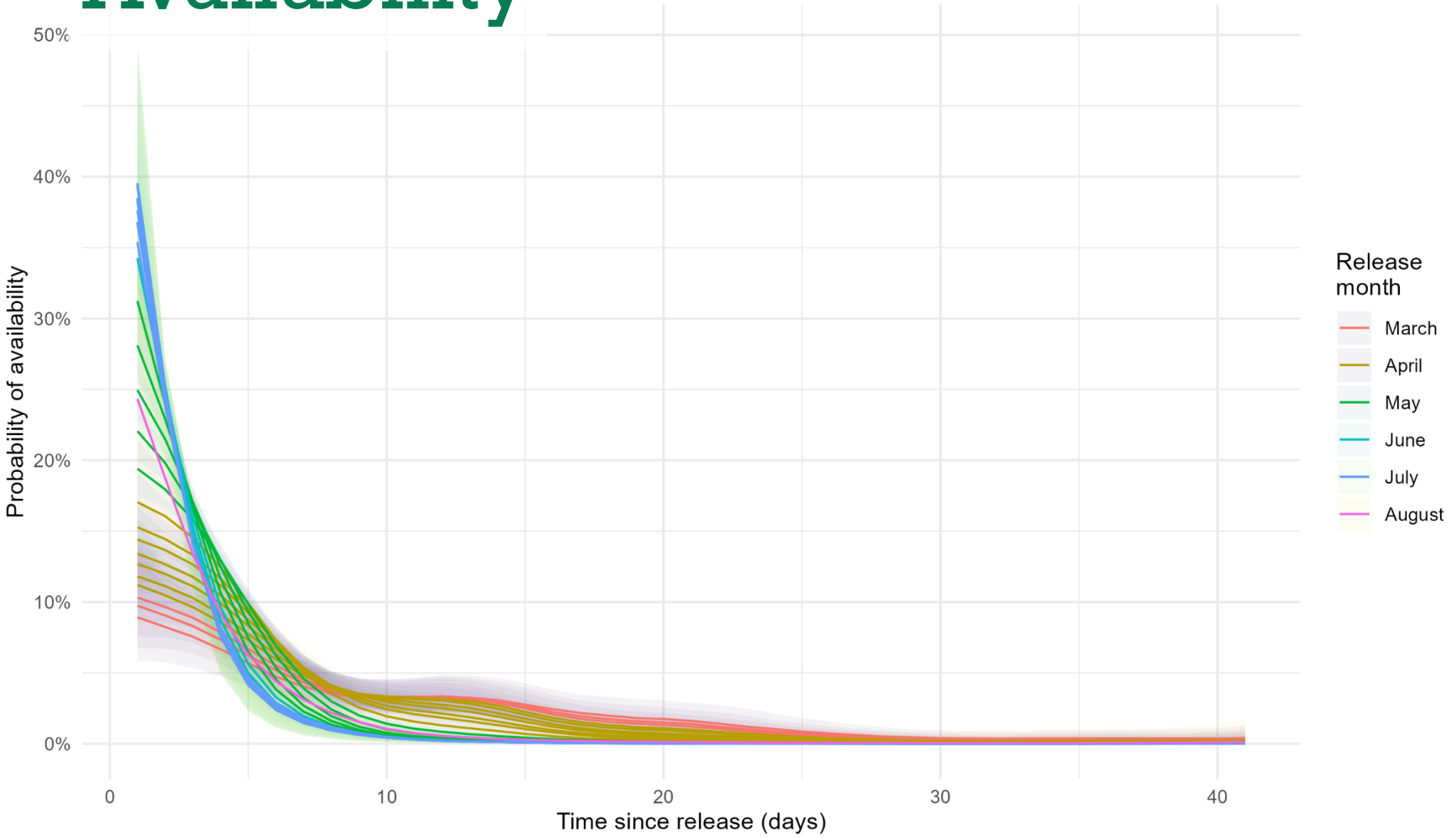
- Michelle Stantial
- Erika Rubenson

The three models

$$\log \boldsymbol{\lambda} = \boldsymbol{X}_\lambda \boldsymbol{\beta}_\lambda + \boldsymbol{Z}_\lambda \boldsymbol{\gamma}_\lambda$$
$$\text{logit}(\boldsymbol{p}) = \boldsymbol{X}_p \boldsymbol{\beta}_p + \boldsymbol{Z}_p \boldsymbol{\gamma}_p$$
$$\text{softmax}(\boldsymbol{\alpha}_r) = \boldsymbol{X}_\alpha \boldsymbol{\beta}_\alpha + \boldsymbol{Z}_\alpha \boldsymbol{\gamma}_\alpha$$



Availability



Availability