Data fitting details

- Up to eight releases per reach
  - Not all reaches have data for eight releases
- Travel time data requires detection at beginning and end of a reach
  - Sample size varies among reaches
- Survival data uses entire multistate capture histories
  - Data augmented via MCMC methods

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Travel Time Data

Reach	Releases	No. recorded travel times
Upper Sacramento R. (1)	5	665
Upper Sacramento R. (2)	5	397
Sutter Slough	8	66
Steamboat Slough	8	48
Middle Sacramento R.	8	217
Georgiana Slough	8	124
Lower Sacramento R.	8	191
Interior Delta	8	46

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Model Comparison Process

- Which behavioral parameters improve fit to data? What are those parameter estimates?
- Begin with ‘null model’, where ePTM particles have no behavioral parameters (neutrally buoyant)
  - Estimate survival parameters for this model (lambda and omega)
- Add behavioral parameters one at a time as long as adding a parameter improves fit
  - Use twice the NLL (AIC scale) to guage fit to data
  - Also look at goodness of fit as measured by comparison of ePTM and data-estimated (MLE) travel times and survival

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Models

- A: Survival only (no behavioral parameters)
  - Parameters: λ, ω
- B: Add swimming behavior to model A
  - Parameters: λ, ω, $\mu(v)$, $\sigma(v)$
- C: Add STST holding to model B
  - Parameters: λ, ω, $\mu(v)$, $\sigma(v)$, $U(t)$
- D: Add mis-assessment of downstream to model C
  - Parameters: λ, ω, $\mu(v)$, $\sigma(v)$, $U(t)$, $P(dir)$
- E: Add diel holding to model D
  - Parameters: λ, ω, $\mu(v)$, $\sigma(v)$, $U(t)$, $P(dir)$, $P(day)$

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Model Parameters

Model	λ	ω	μ(v)	σ(v)	U(t)	P(dir)	P(day)	Total # pars
A	8	3	0	0	0	0	0	11
B	8	3	3	1	0	0	0	15
C	8	3	3	1	1	0	0	16
D	8	3	3	1	1	1	0	17
E	8	3	3	1	1	1	3	20

8: each reach has unique parameter
3: parameter unique to tidal region
1: single parameter across entire Delta

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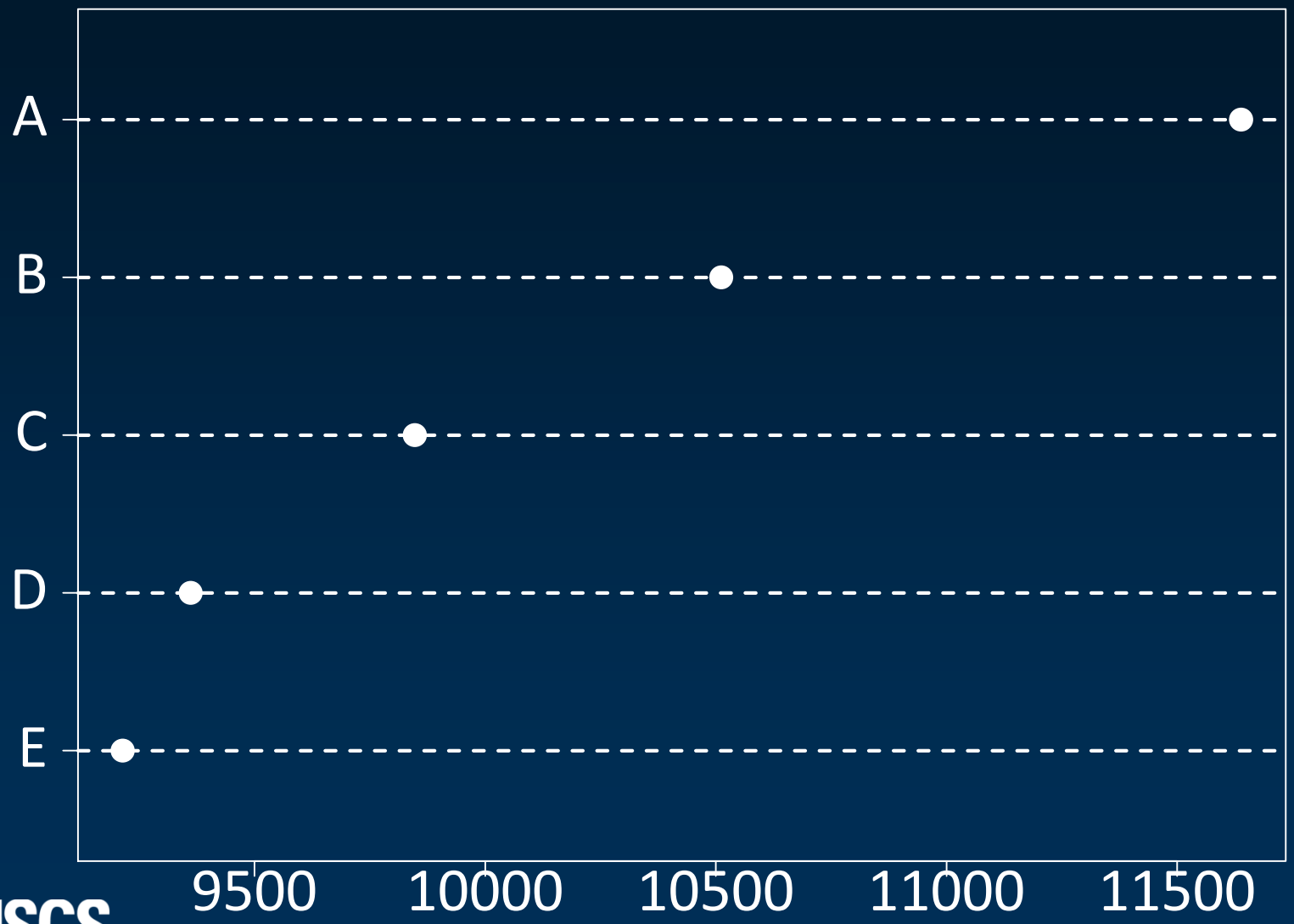
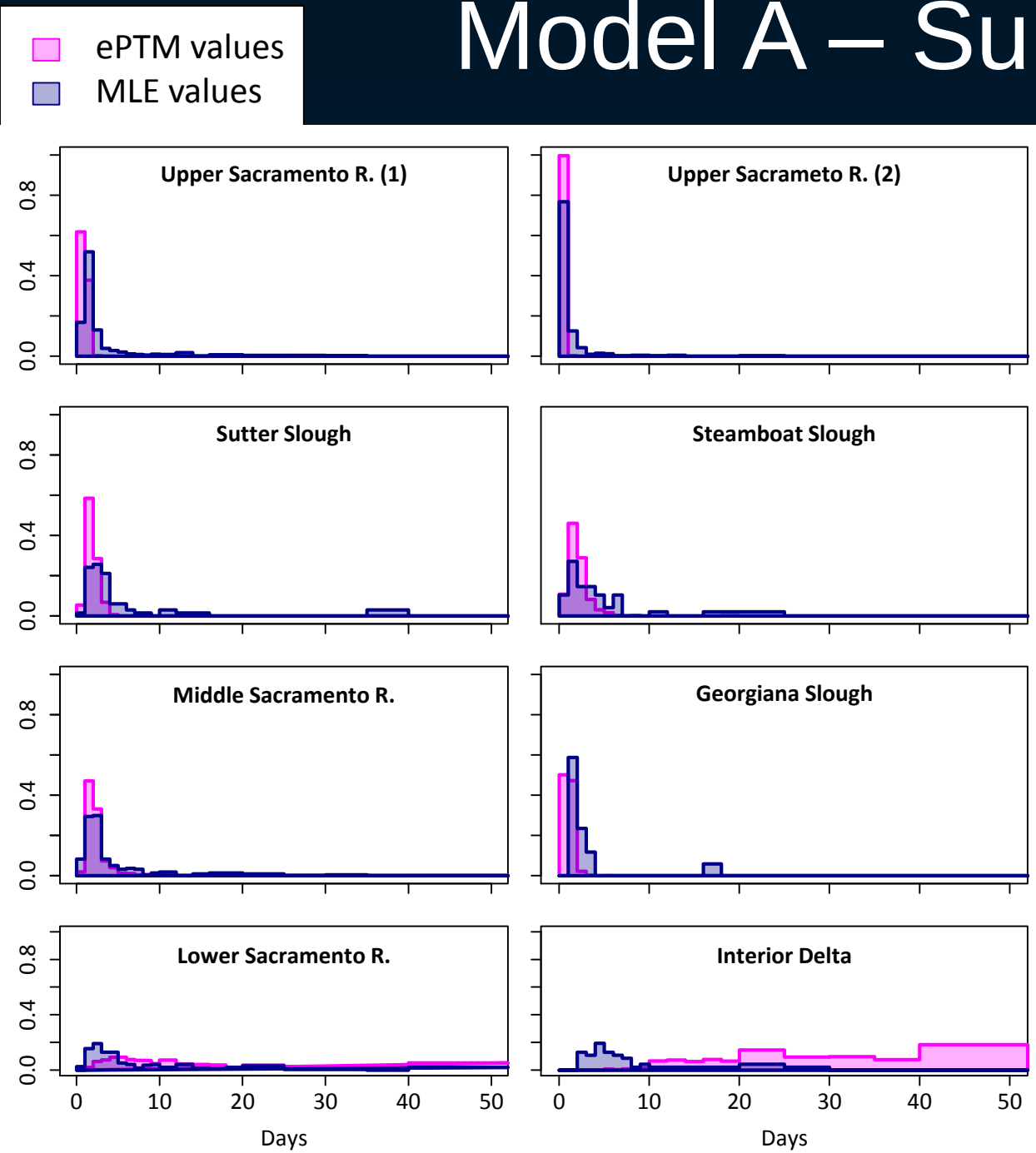
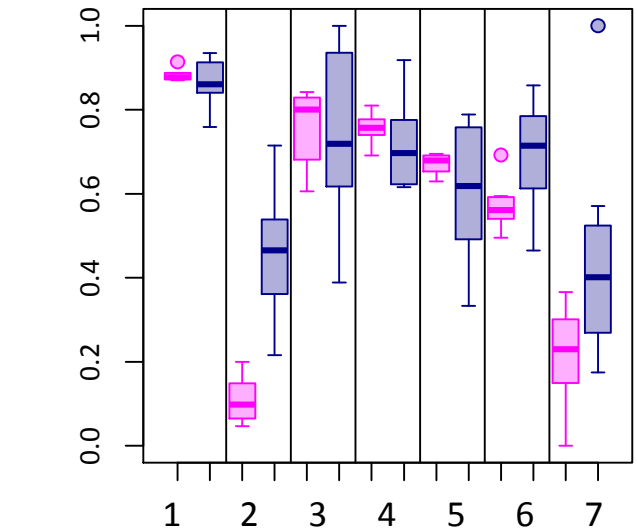
Model Comparison

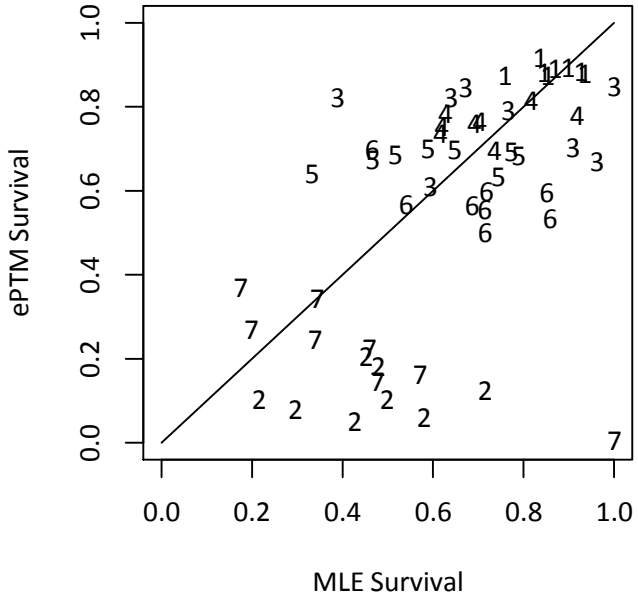


Better Fit

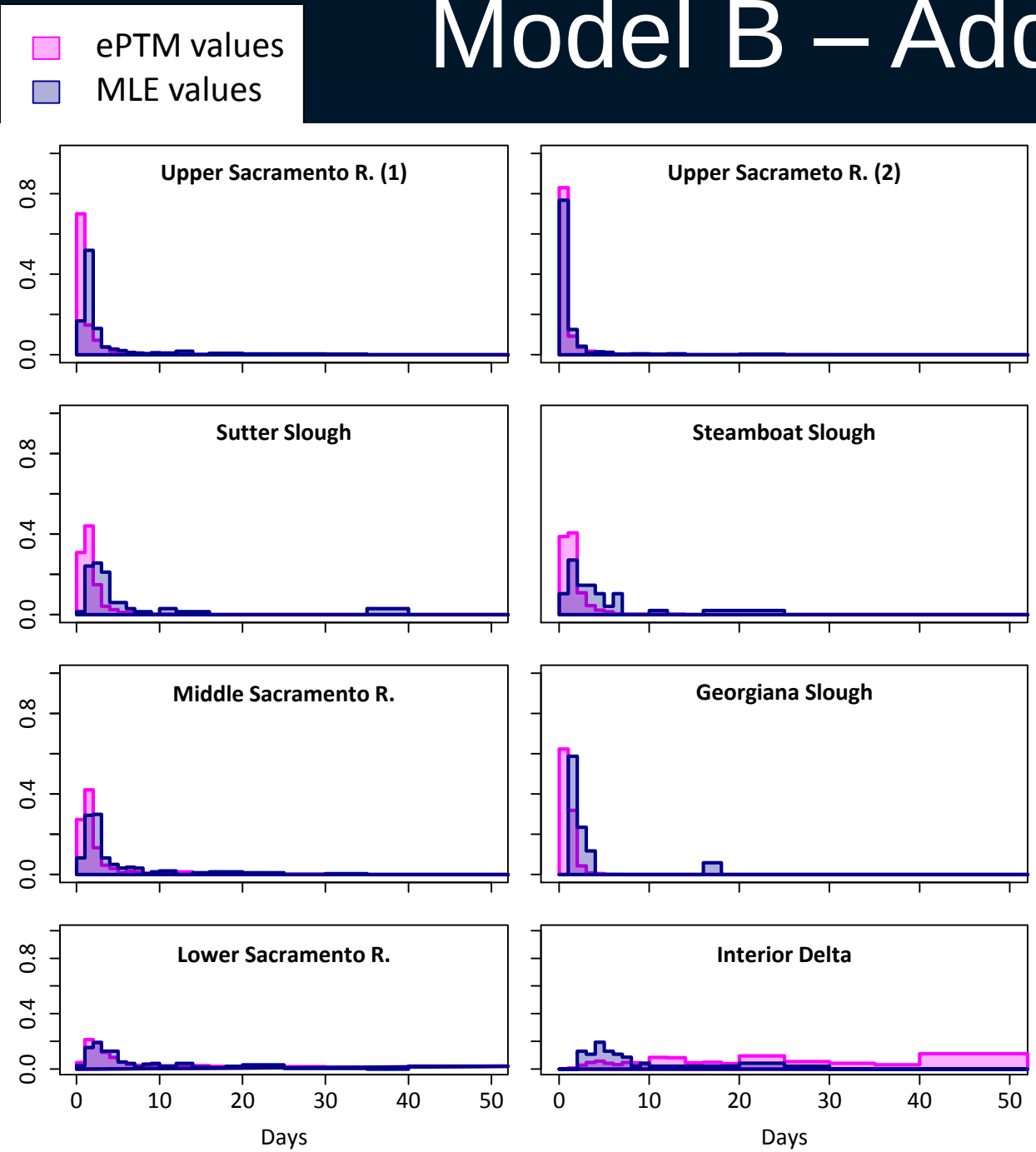
Model A – Survival only

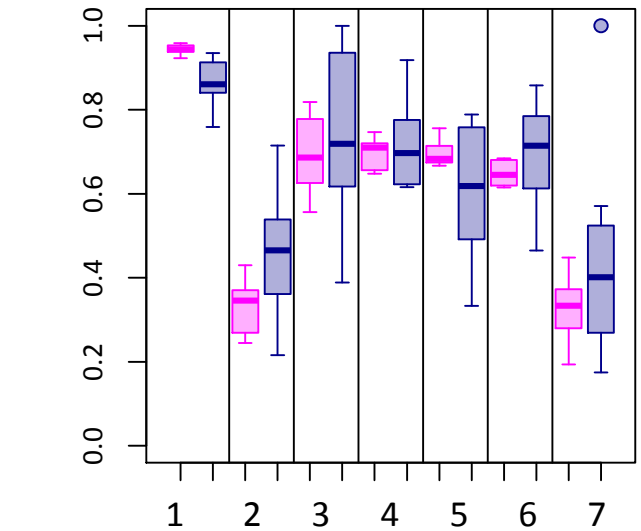


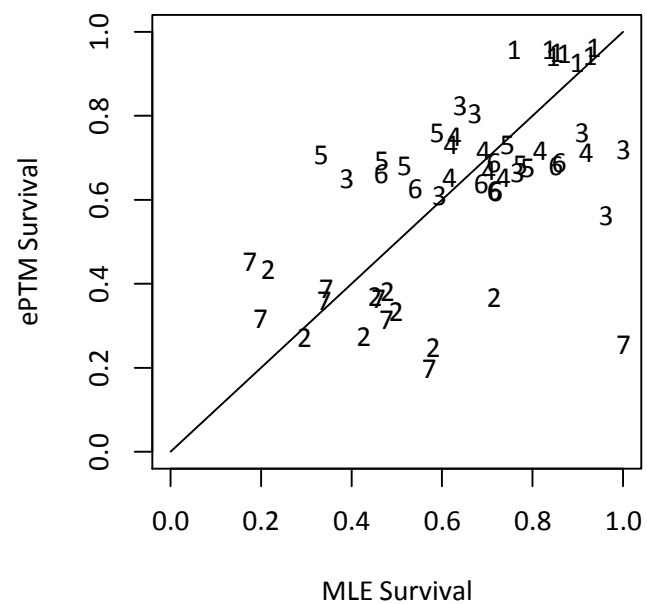




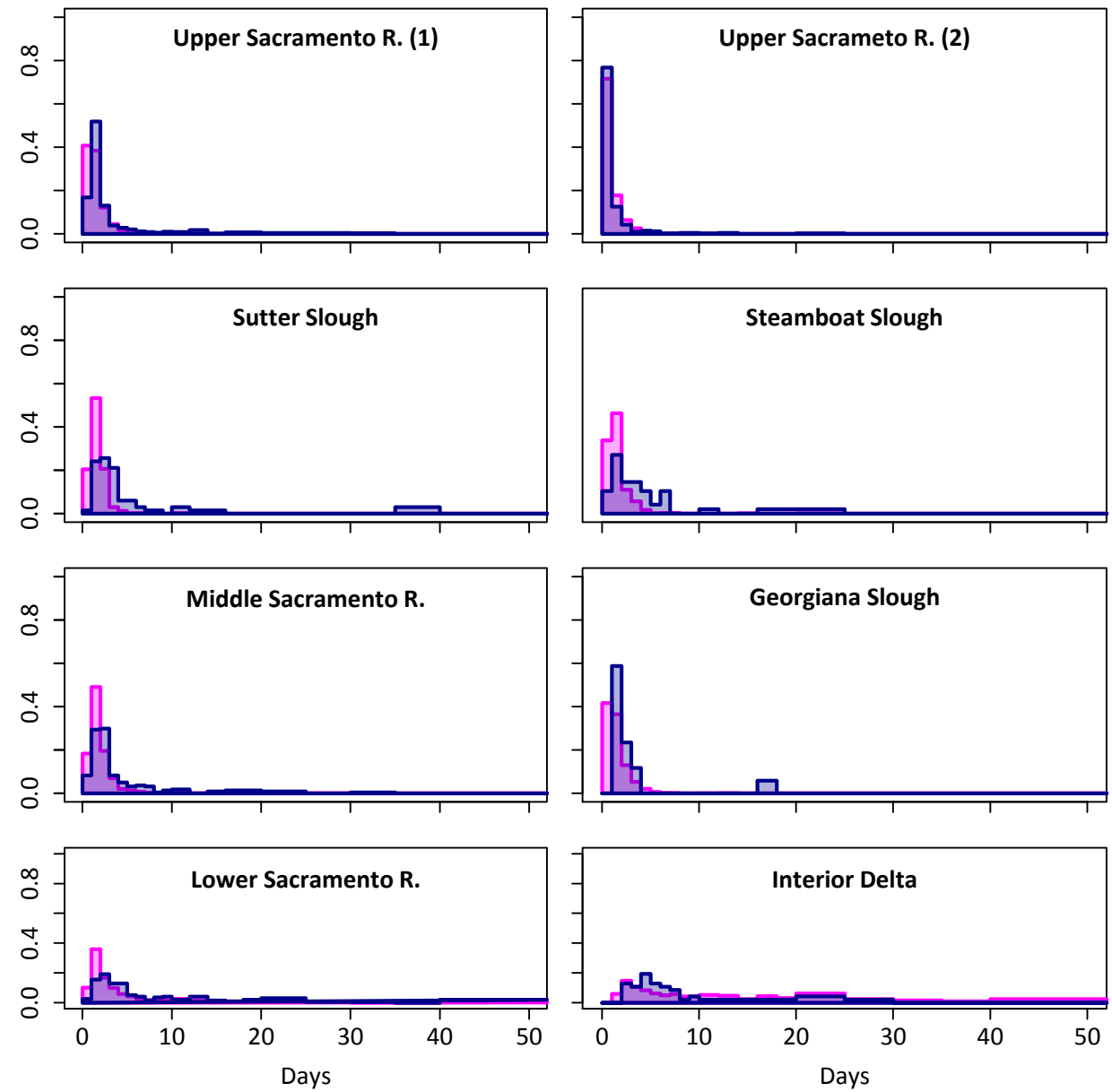
Model B – Add μ(v), σ(v)

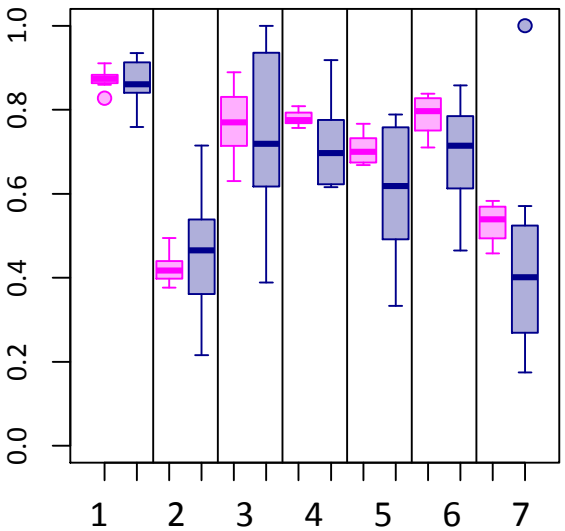


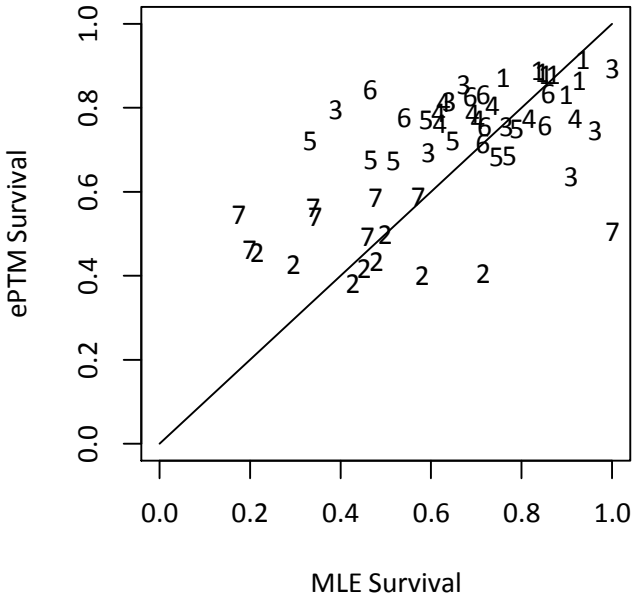




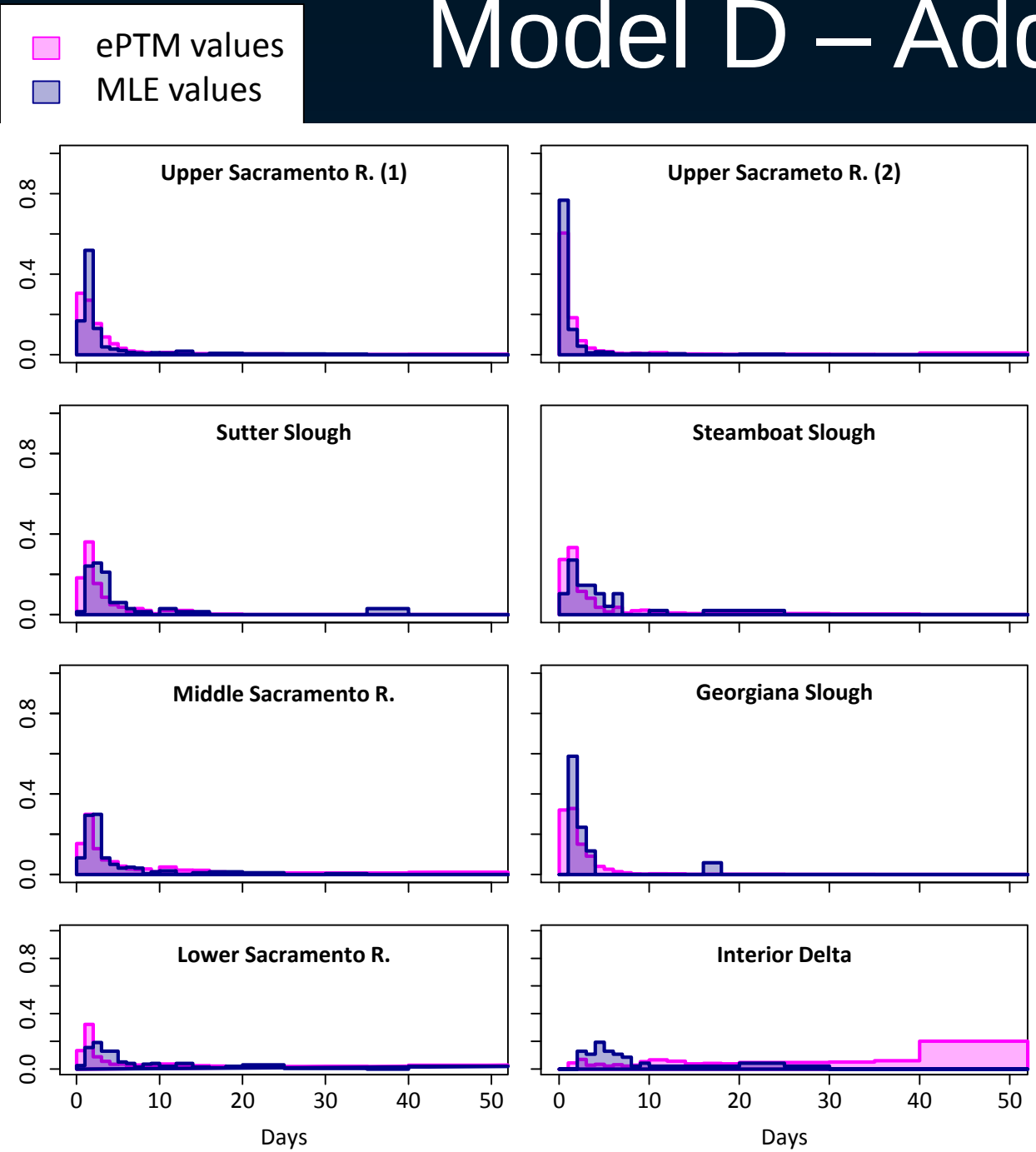
Model C – Add U(t)

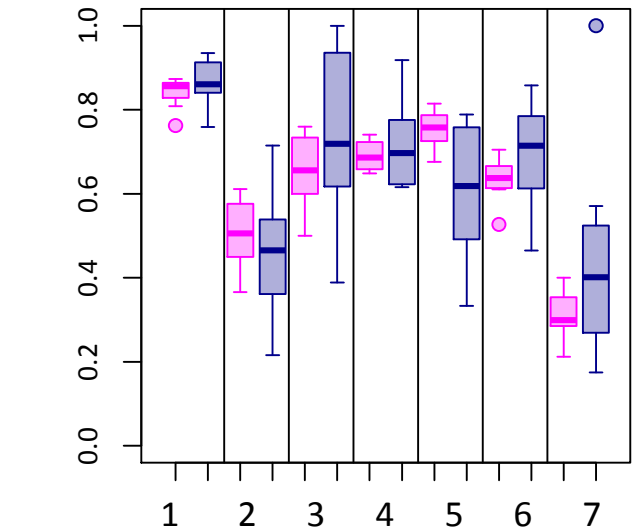


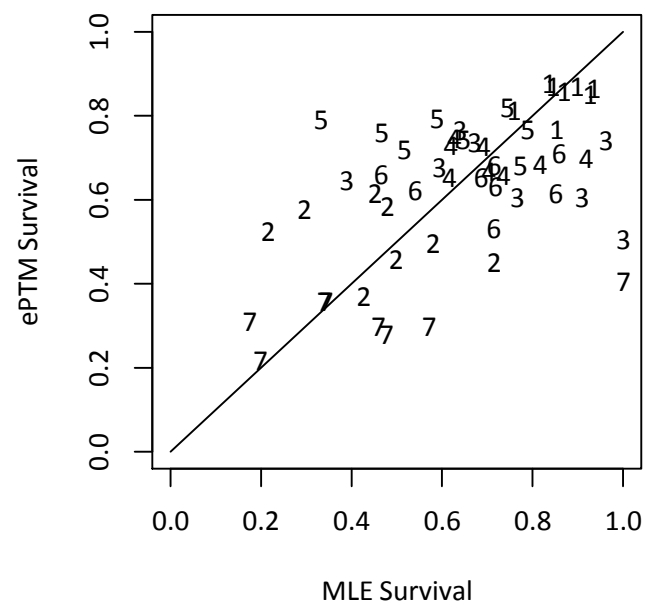




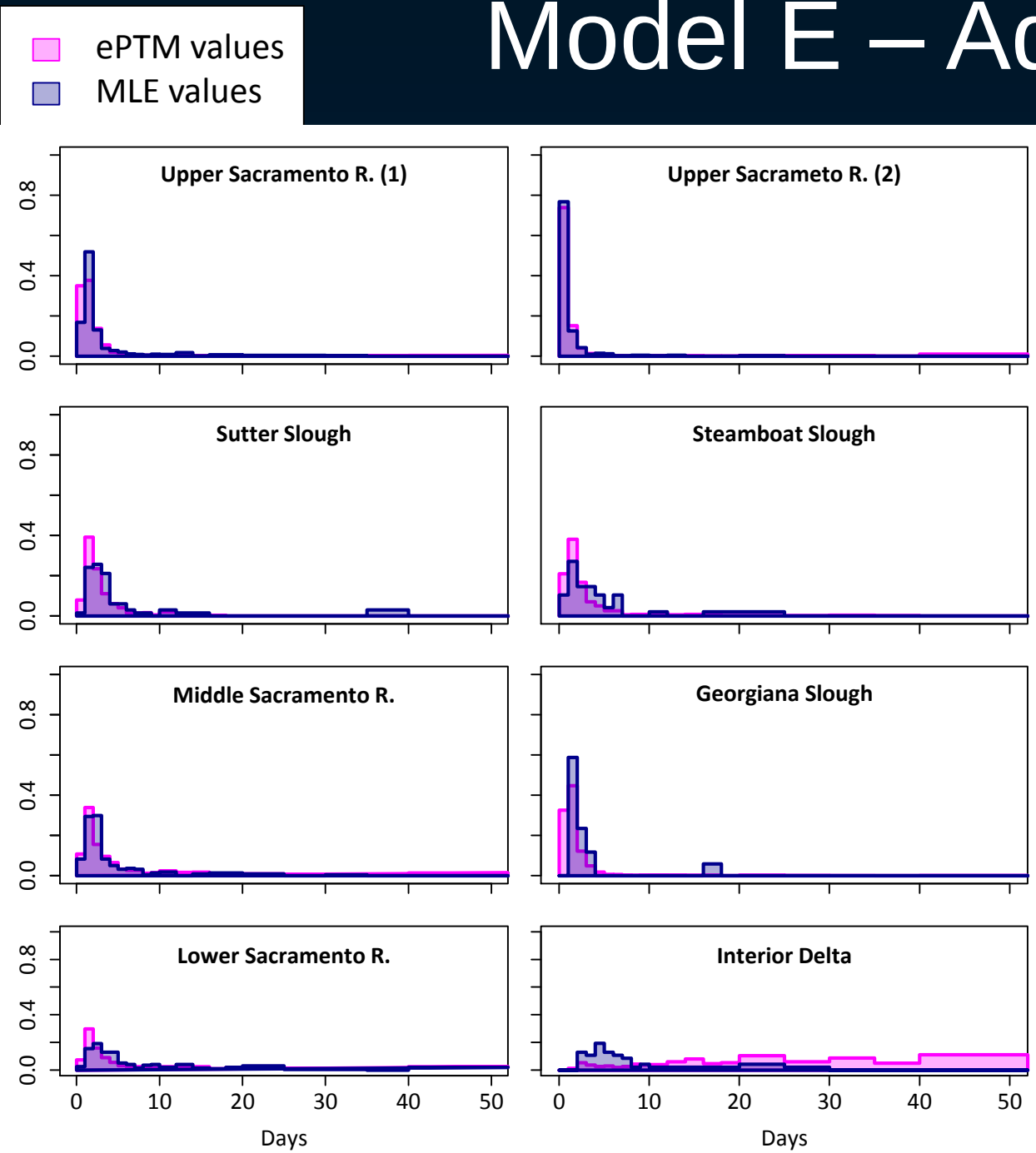
Model D – Add P(dir)

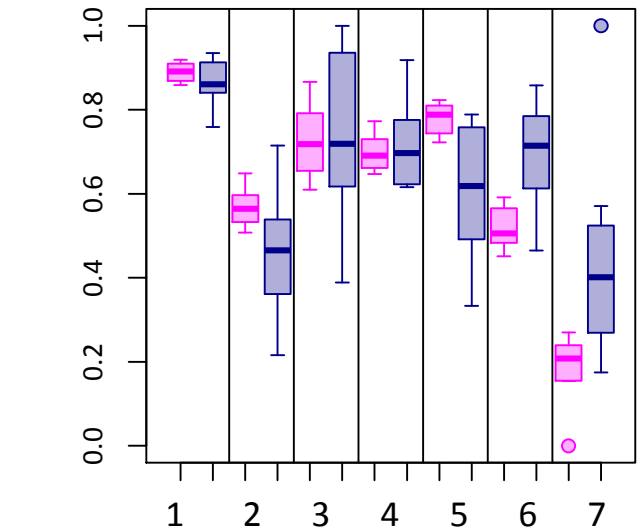


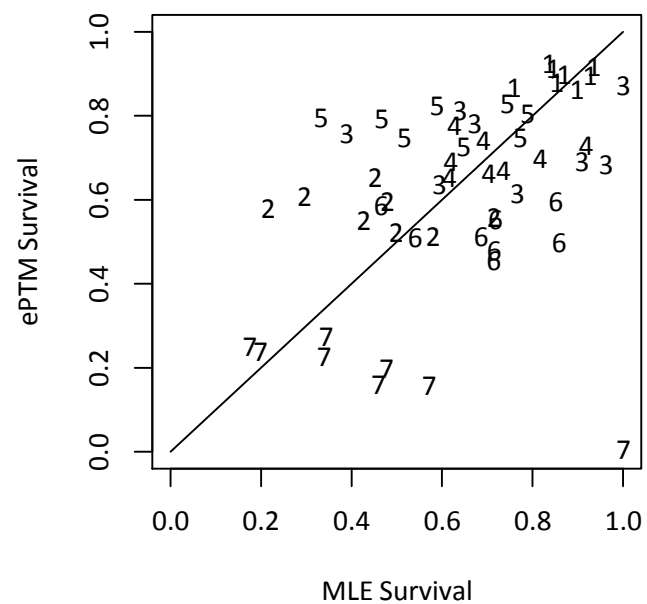




Model E – Add P(day)







Parameter estimates

Model	μ(v)	σ(v)	U(t)	P(dir)	P(day)
D	0.00 0.01 0.02	0.92	0.23	0.49	NA (1)
E	0.14 0.11 0.11	0.97	0.60	0.22	0.02 0.08 0.10

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Conclusions

- Which model is best? This can depend on the criteria used for selection
  - Log-likelihood score v. goodness of fit
  - Travel time fit v. survival fit
- Relatively simple suite of behavioral parameters can match complex, varied, multimodal travel time distributions
- Model fitting only as good as the data we fit to
  - Will be important to validate findings as new data are collected

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Questions?