Assessing Uncertainty in S3 Fish Production Estimates

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Why Uncertainty?

Are the scenarios significantly different

Objective:
Determine the confidence about the fish production estimates among the alternative management scenarios

Types of Uncertainty

Parameter (statistical) uncertainty

- From fit to data (Pear Tree)
  - Survival and movement

Input uncertainty

- Sensitivity to input data

Model (structural) uncertainty

- Candidate models about salmon life-history
- Degree of belief in underlying hypotheses

"Latent" uncertainty – e.g., base assumptions

Methods

Parameter (statistical) uncertainty

- Draw 100 parameters – Multivariate Normal
- Run scenarios 100x with same parameters
- Allows for 1:1 comparison among scenarios

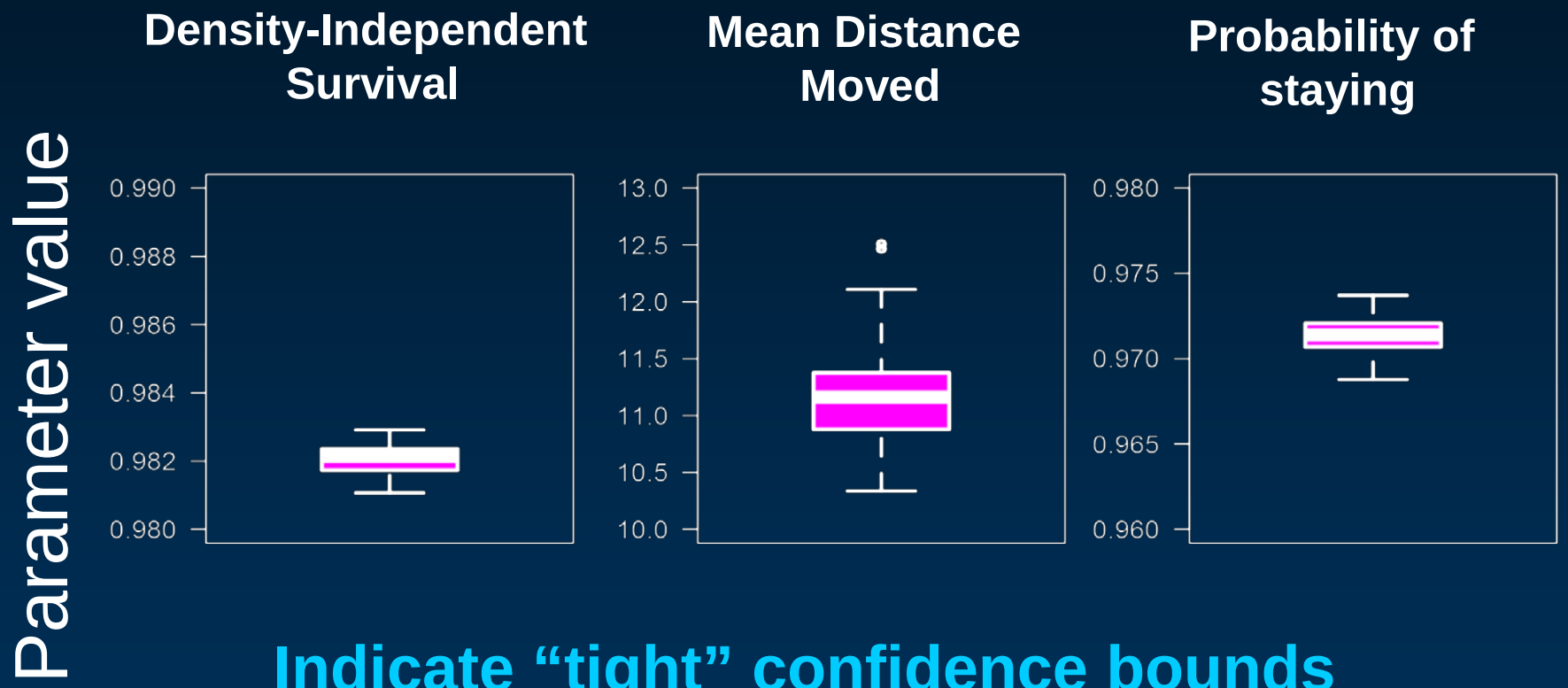
Input (sensitivity) uncertainty

- Demonstrate sensitivity of S3 to spawning inputs
- Run model at 0.5 and 2X observed spawning abundances

Model (structural) uncertainty

- Use AIC model selection
- Compare 4 models
- Null, DD Survival, DD movements, and DD Survival and movement

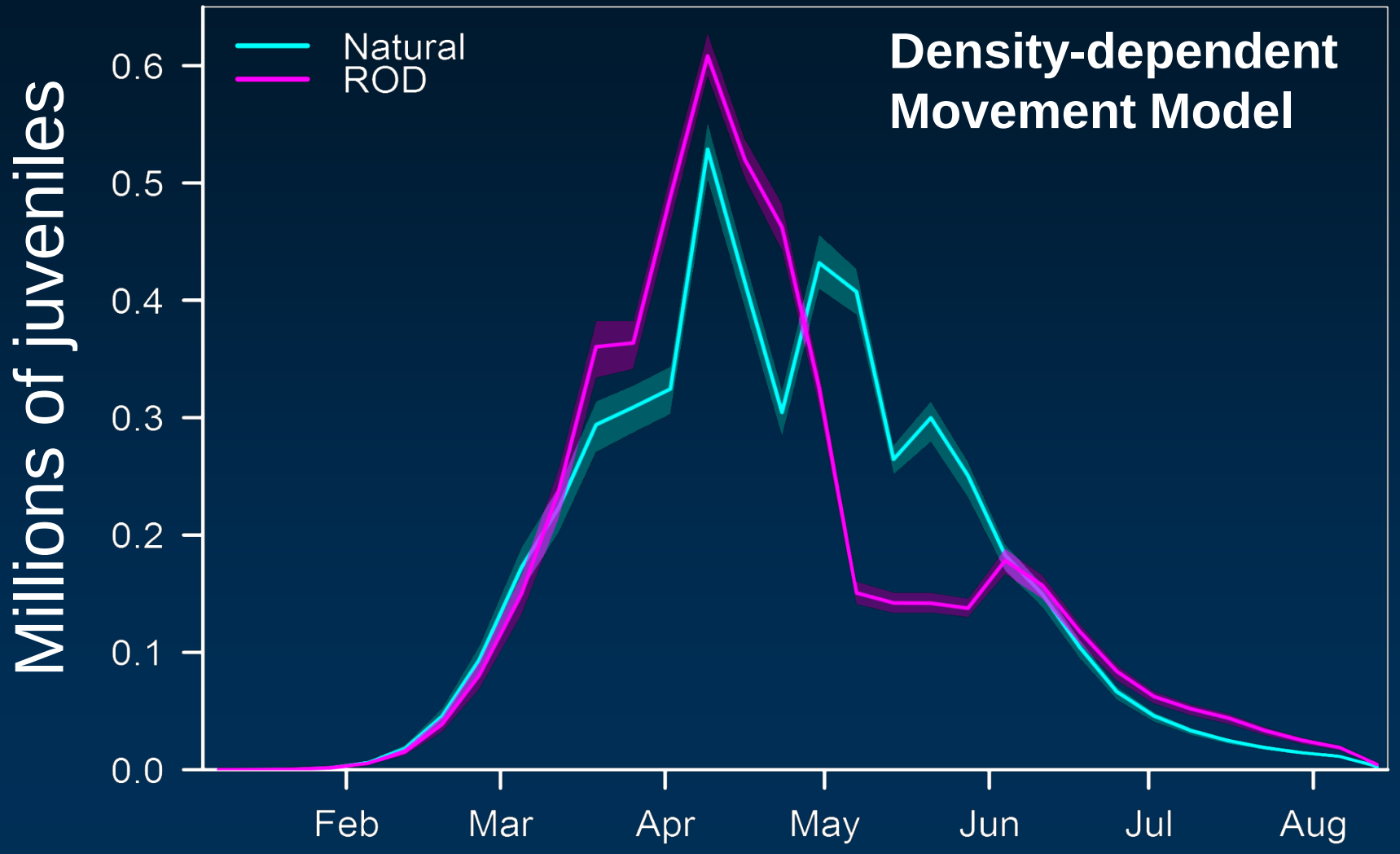
Random Draw of Parameters



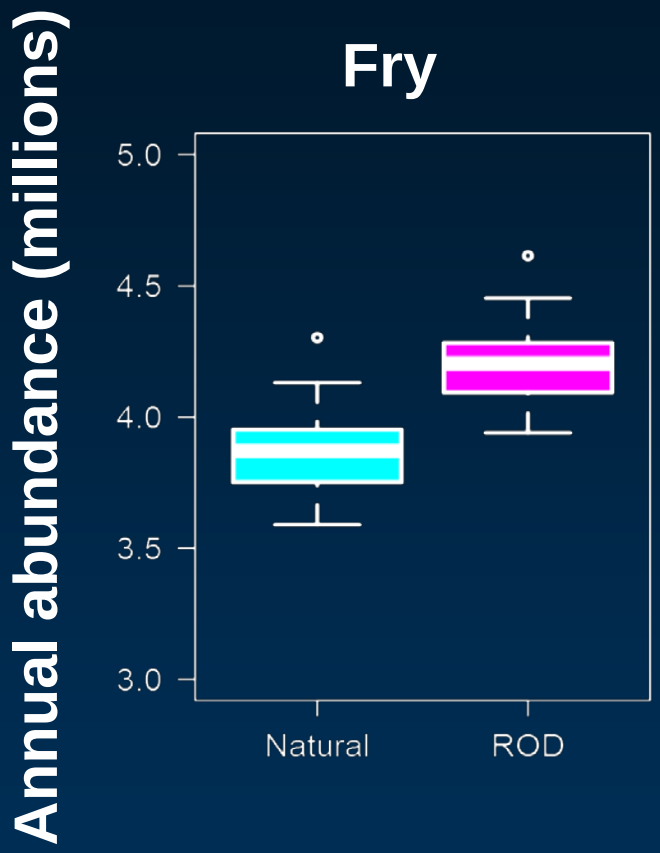
Indicate "tight" confidence bounds

- **Fit to a single year**
- **Include error in carrying capacity**

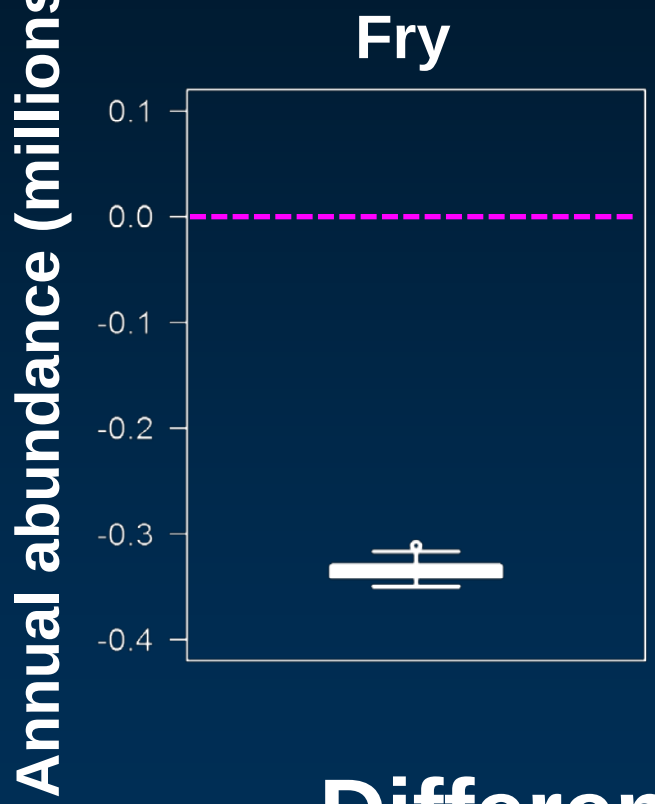
Weekly Abundance by Scenario



Annual Abundance by Scenario

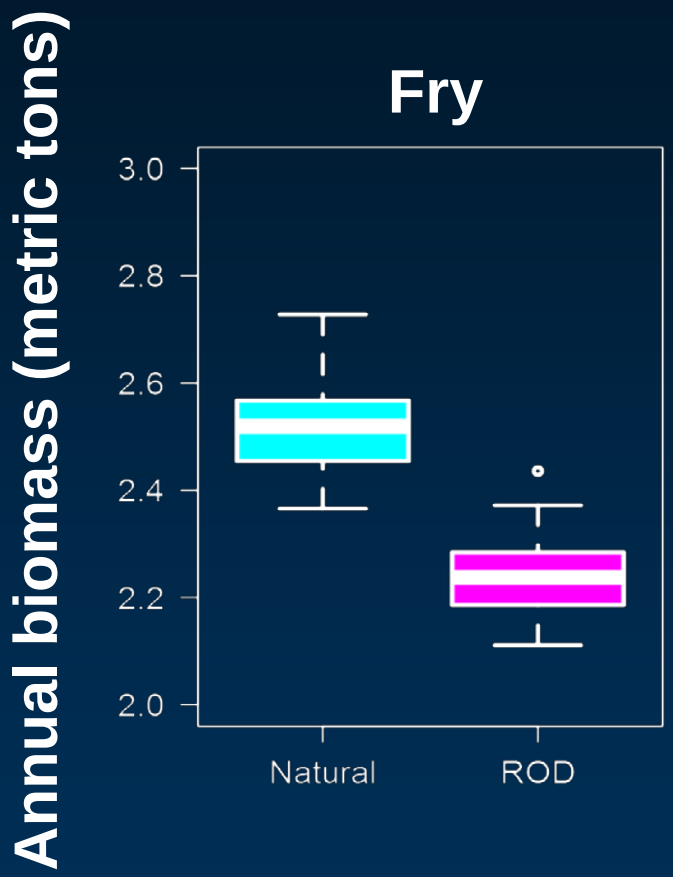


Scenario Differences
Abundance

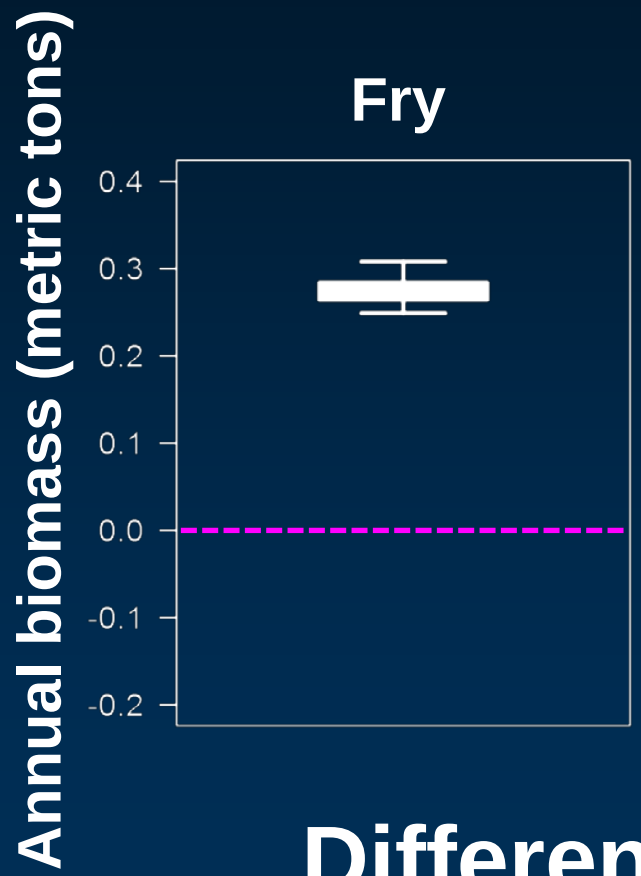


Difference (Natural – ROD)

Annual Biomass by Scenario



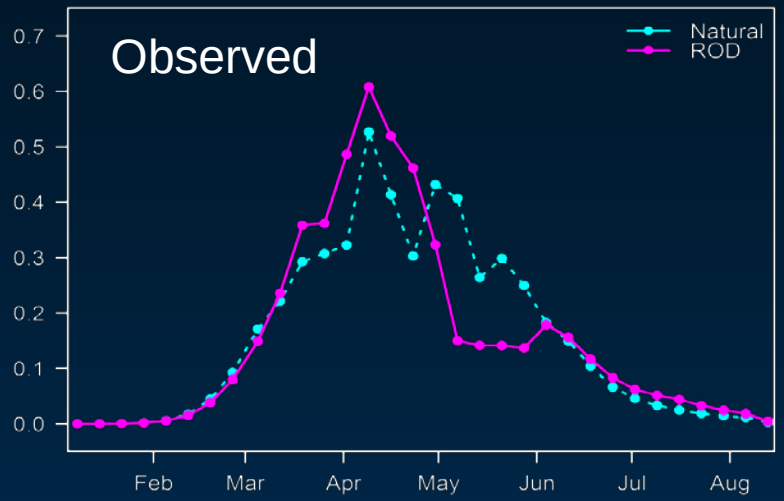
Scenario Differences
Biomass



Difference (Natural – ROD)

Input Uncertainty - Spawning

Juvenile abundance (millions)

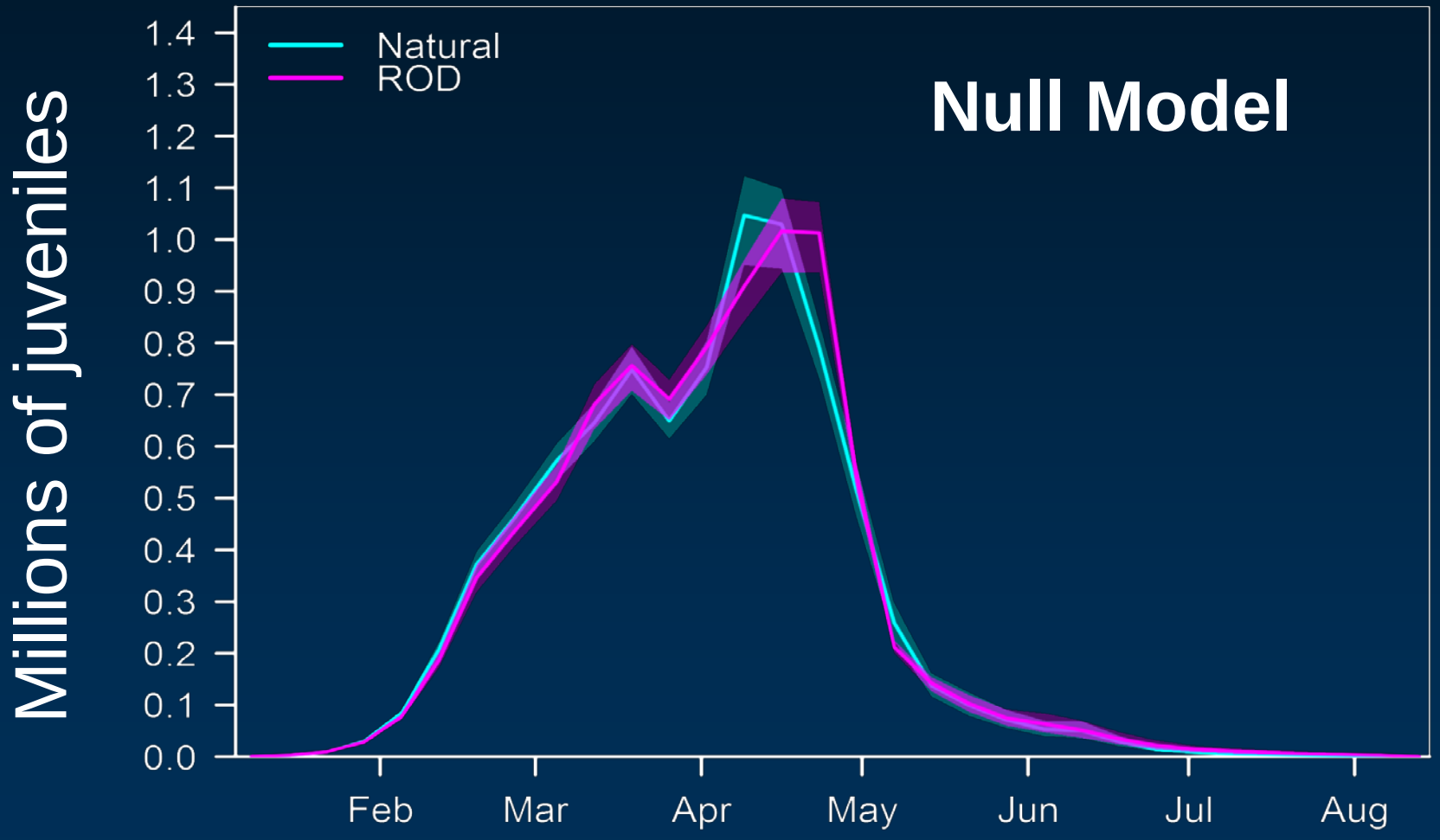


	Abundance (millions)		Biomass (metric tons)	
Obs	5.03	4.99	7.37	5.51

Model Uncertainty

Model	AIC	ΔAIC
Null	1022.2	0.00
DD movement	1025.4	3.17
DD movement and survival	1037.8	15.61
DD survival	1041.9	19.68

Weekly Abundance by Scenario



Conclusions

Parameter uncertainty

- “tight” confidence bounds (ambitious?)

Input uncertainty

- Difference in biomass, but not abundance

Model uncertainty

- Null model was best model (fit to 1 year)
- Density-dependent movement was best mechanistic model
- Natural hydrograph produced larger and more abundant juveniles