

Stock-recruitment Relationships of River Herring in Relations to the Freshwater Phase



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Objectives

- * Assess the influence of both density-dependent and environmental effects on alewife and blueback freshwater survival
- * Establish empirical relationships between environmental forcing and river herring freshwater survival

Freshwater Survival Can be Affected by:



* Adult return to spawning habitat

Spring river flow and temperature



* Larval growth in nursery habitats

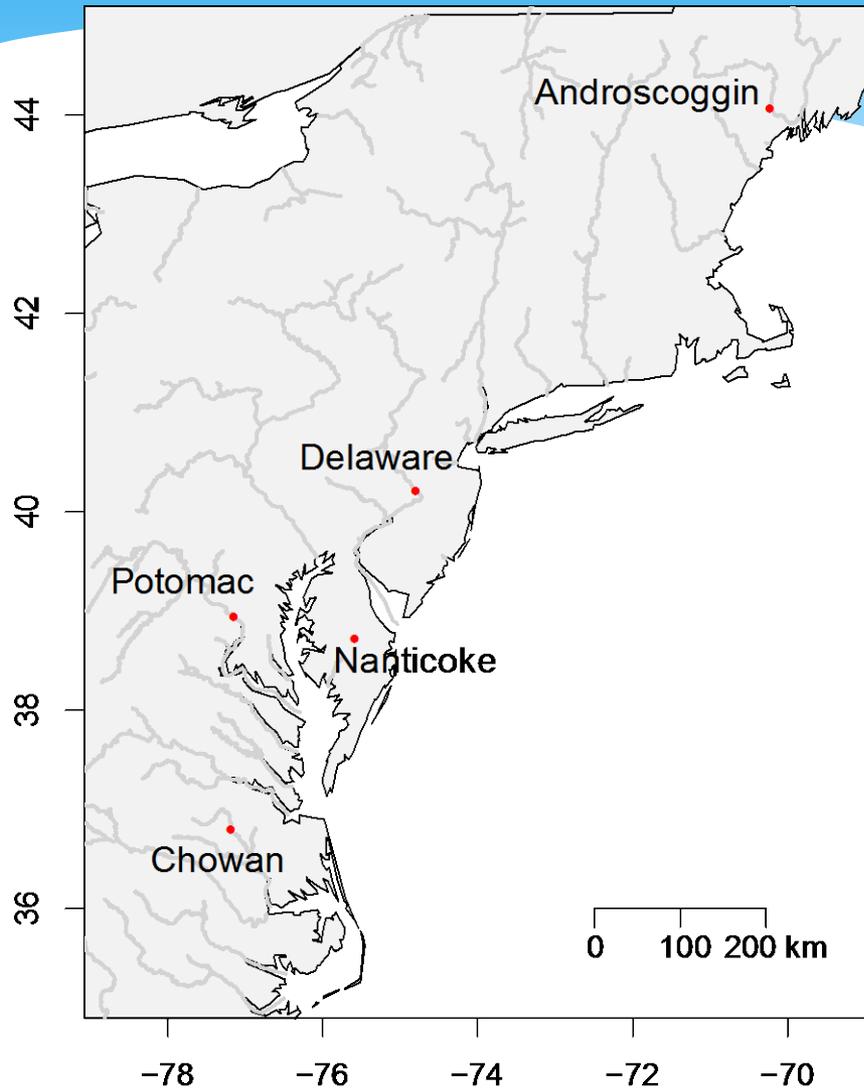
Summer flow and temperature



* Juvenile emigration

Fall flow and temperature

Study Systems

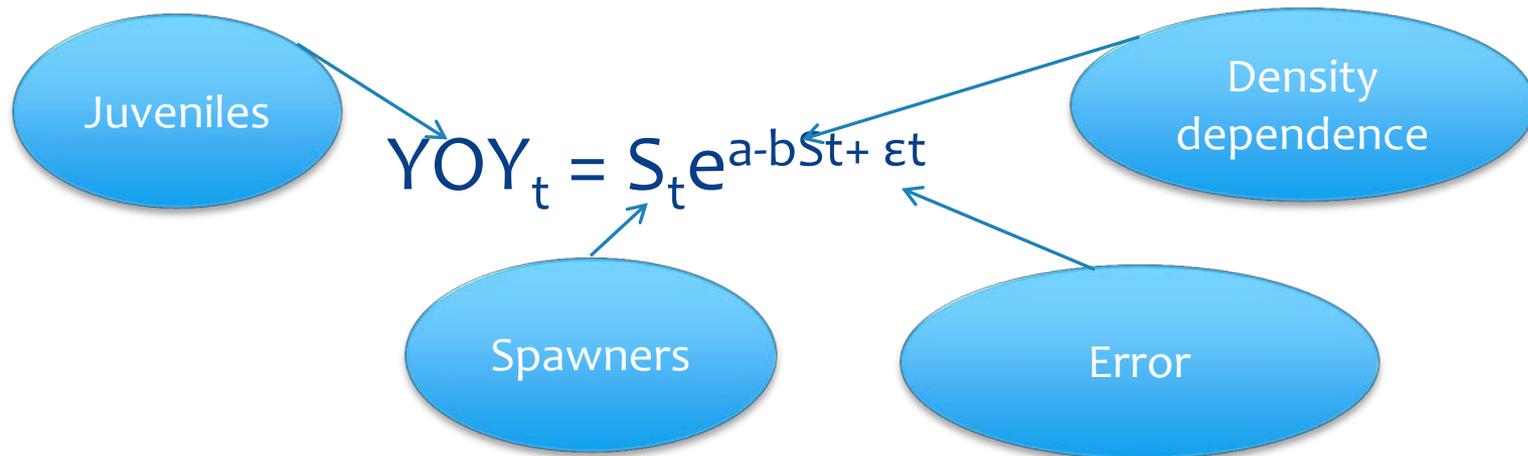


Data:

- * Young of the year
- * Spawner numbers
- * Monthly Mean flow
- * Monthly Mean Temperature
- * 1980-2010

Statistical Model

- * Environmentally explicit Ricker model
- * Includes both density dependent effects and environmental covariates



Statistical Model

Density Dependence
Only Model:

$$\log(\text{YOY}_t/S_t) = a - bS_t + \varepsilon_t$$



Freshwater
Survival
Ratio

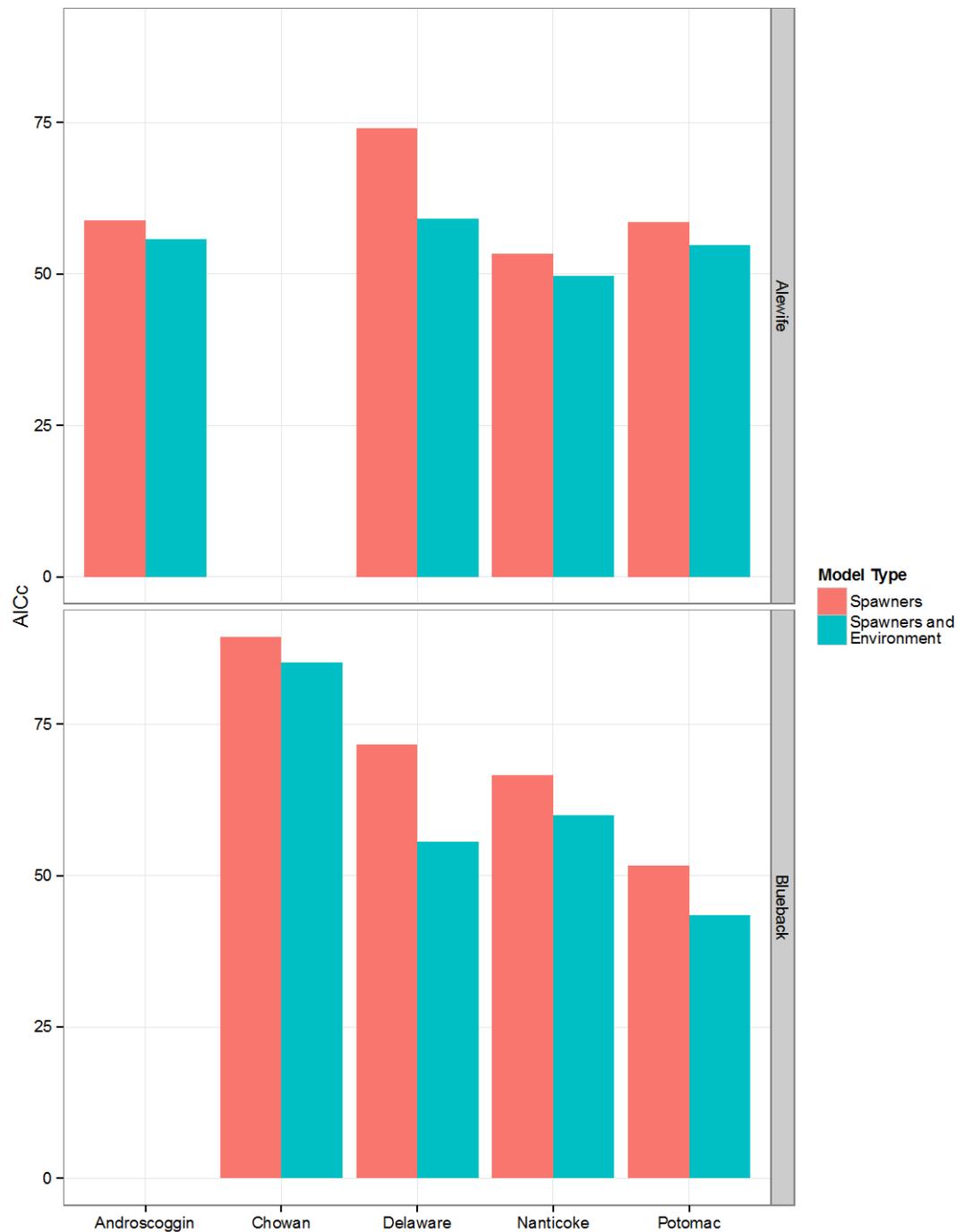
Environmentally Explicit
Model:

$$\log(\text{YOY}_t/S_t) = a - bS_t + s(C_t) + \varepsilon_t$$

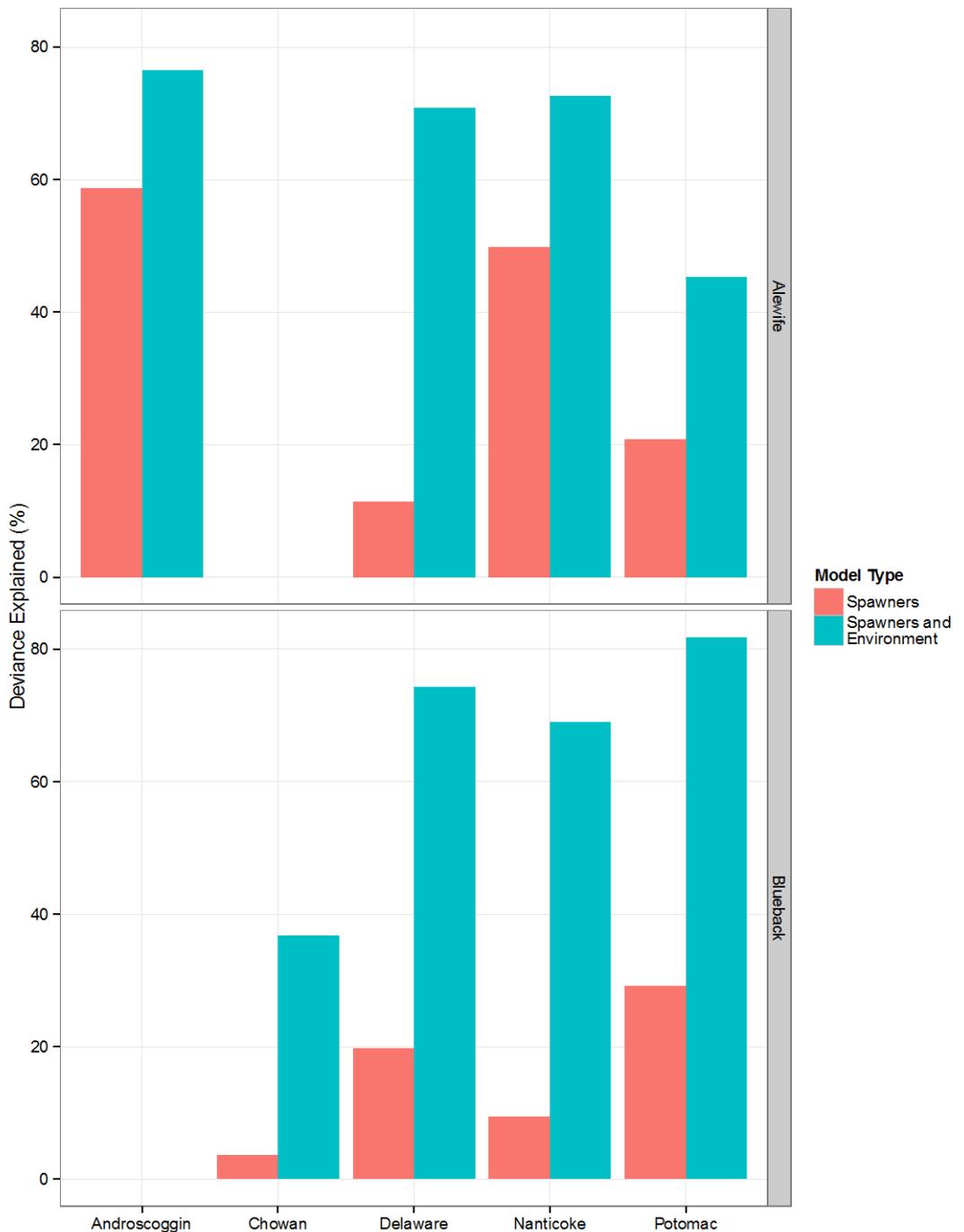


Environmental
Effects

- * Models with environmental covariates are better.
- * Have lower AICc



* Models with environmental covariates explain a larger amount of variability in freshwater survival



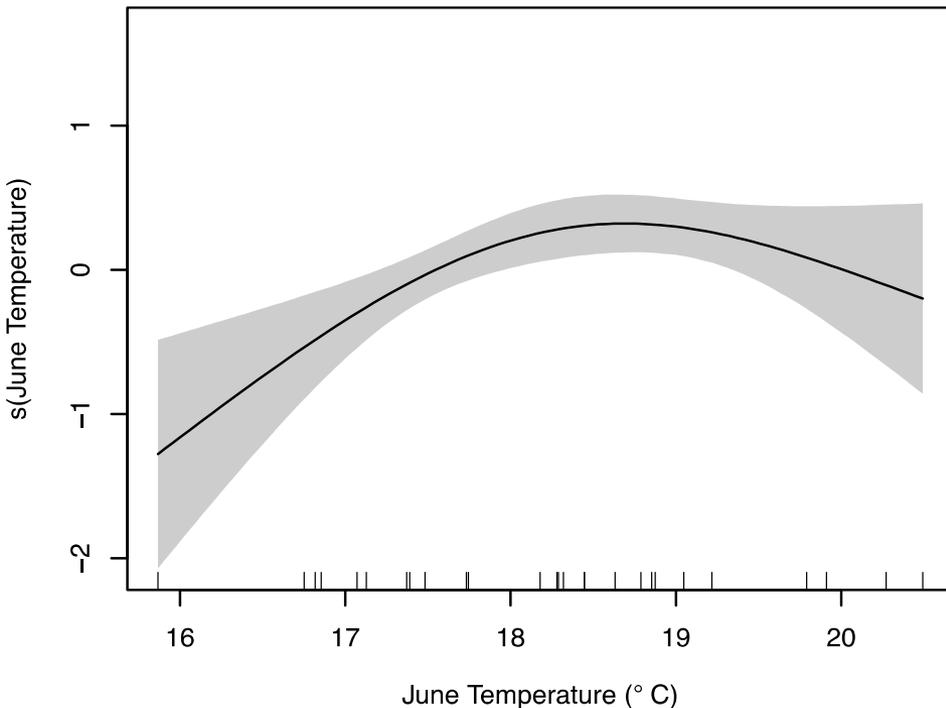
Mechanisms Impacting Freshwater Survival in Each System

		Return to spawning habitats	Quality of nursery habitats	Egress	Density Dependence
Alewives	Androscoggin		T	T	Y
	Delaware	R		T	Y
	Potomac		T		Y
	Nanticoke		T, R		Y
Blueback	Delaware	T, R			Y
	Potomac	R	R		Y
	Nanticoke		T, R		Y
	Chowan		T		Y

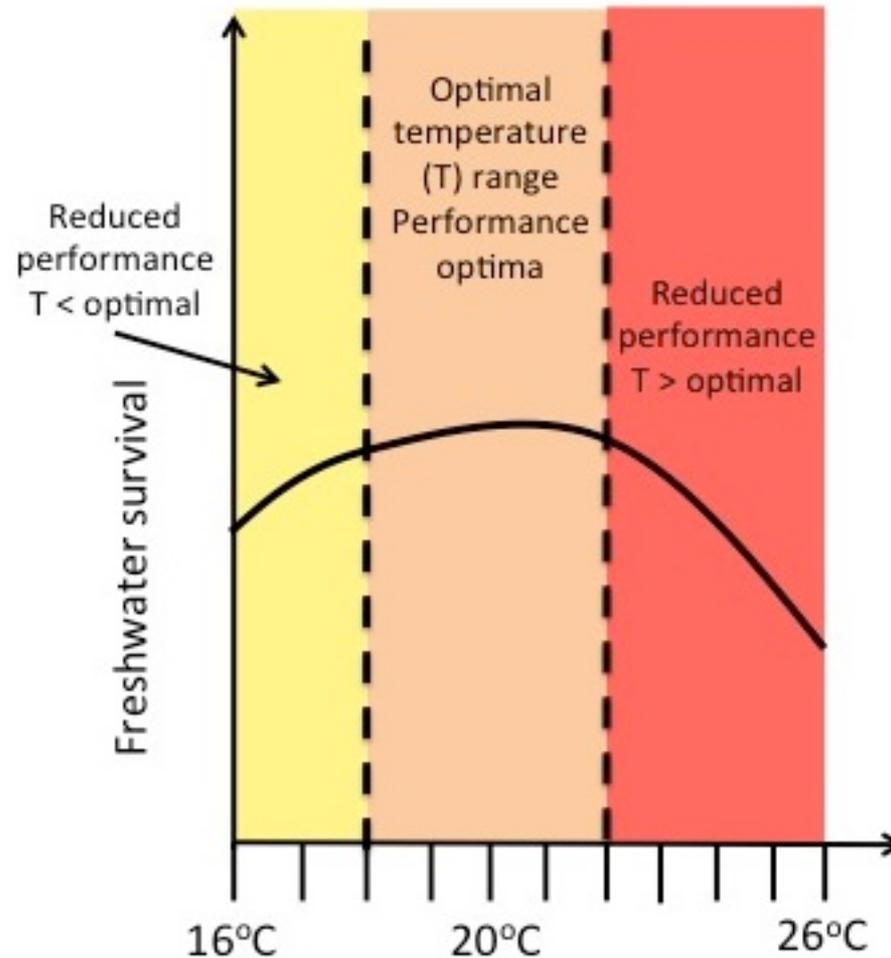
Temperature in Nursery Habitats

Opposite effect of spring temp on survival rates associated with a latitudinal temperature gradient

**Androscoggin
Alewife**



Conceptual Understanding



Conclusions

- * Freshwater survival influenced both by density dependent processes and environmental variation
- * System specific differences in environment-survival relationship
- * In most system, the period of larval growth in nursery habitats is critical to freshwater survival

Future Work

- * Refine understanding of the mechanisms that underlie the emergent environmental dependencies
- * Field/laboratory studies focused on river herring tolerance to low/high temperature and on the thermal sensitivity of prey-predator interactions

Questions/Feedback?

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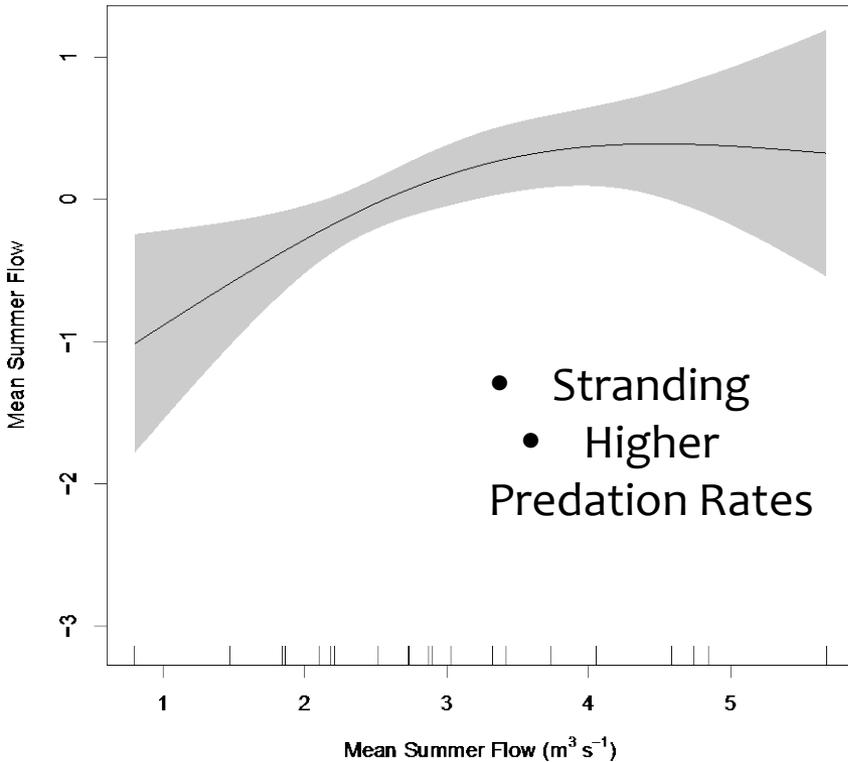


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River Flow in Nursery Habitat

**Nanticoke River
Blueback**



**Potomac River
Blueback**

