Iteration #2 Results

STT Anadromous Fish Work Group

Application of Comparative Survival Study (CSS) Models to Iteration #2 Alternatives and Components

STT Meeting – March 22, 2013
Steve Haeseker, CSS Oversight Committee

About CSS (Comparative Survival Study)

- The CSS comprises a tribal, state and federal inter-agency scientific group
- The CSS analyzes empirical data from salmon, steelhead, sockeye and fall Chinook in the Columbia River basin to discern survival and productivity trends affected by mainstem Columbia River operations, and ocean environmental influences
- CSS analyses are presented in peer reviewed scientific journals including the Independent Scientific Review Group and reported on the Fish Passage Center website www.fpc.org

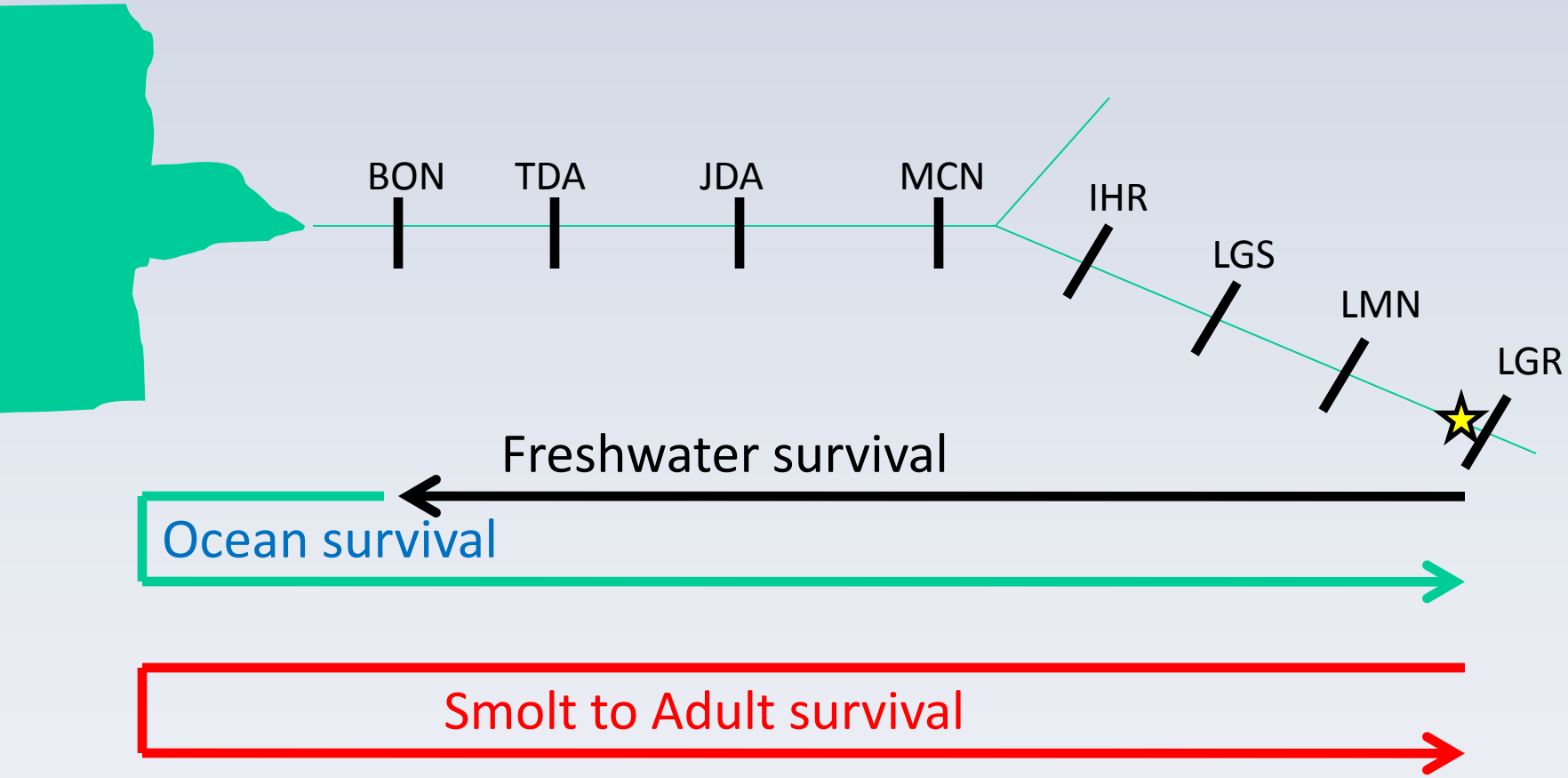
Outline

- Summarize findings on primary factors influencing survival of juvenile salmon and steelhead originating in the Snake River
- Apply similar methods and approach to Upper Columbia salmon and steelhead
- Apply these models to summarize Upper Columbia salmon and steelhead estimates of survival and productivity for Iteration #2 Alternatives and Components

CSS Snake River data (Haeseker et al. 2012 TAFS)

PIT-tag mark-recapture data from migration years 1998-2006

Up to four, two-week release cohorts per year, released at LGR



Analytical Methods

- Conduct multiple linear regressions between environmental variables and survival rates using multi-model inference tools
- In-river variables: dam spill %; water transit time time, day released, hatchery %
- Ocean variables: spring upwelling; summer pacific decadal oscillation (PDO); sea surface temperatures (SST)

Relative variable importance

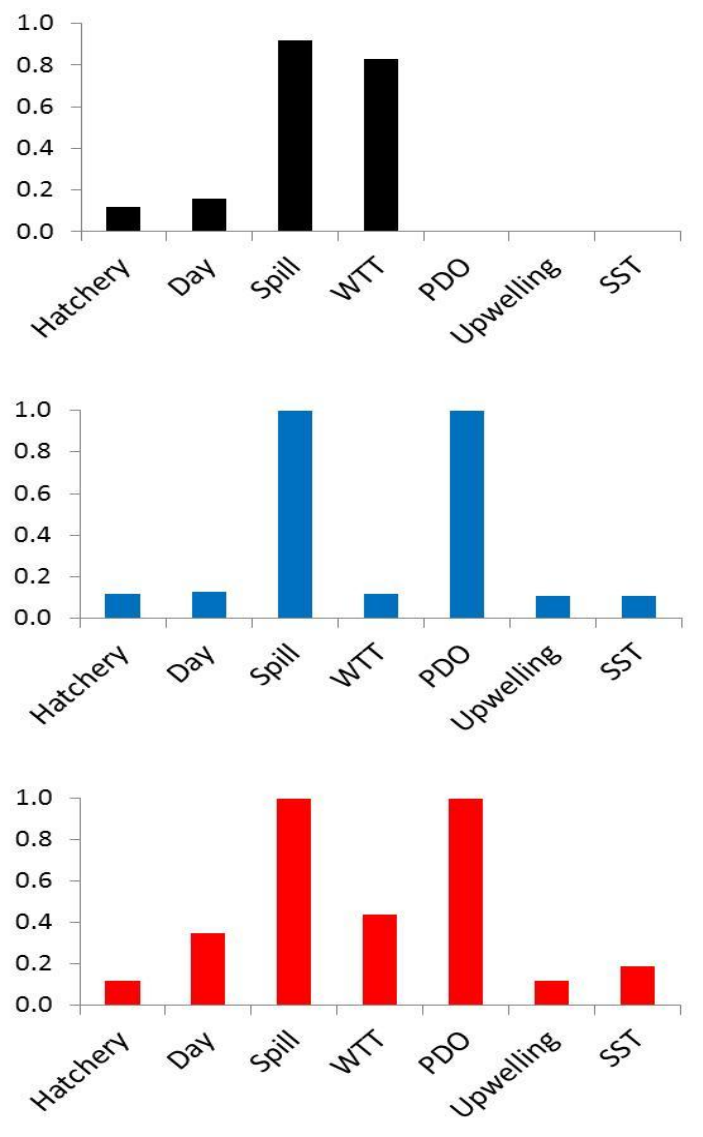
Chinook

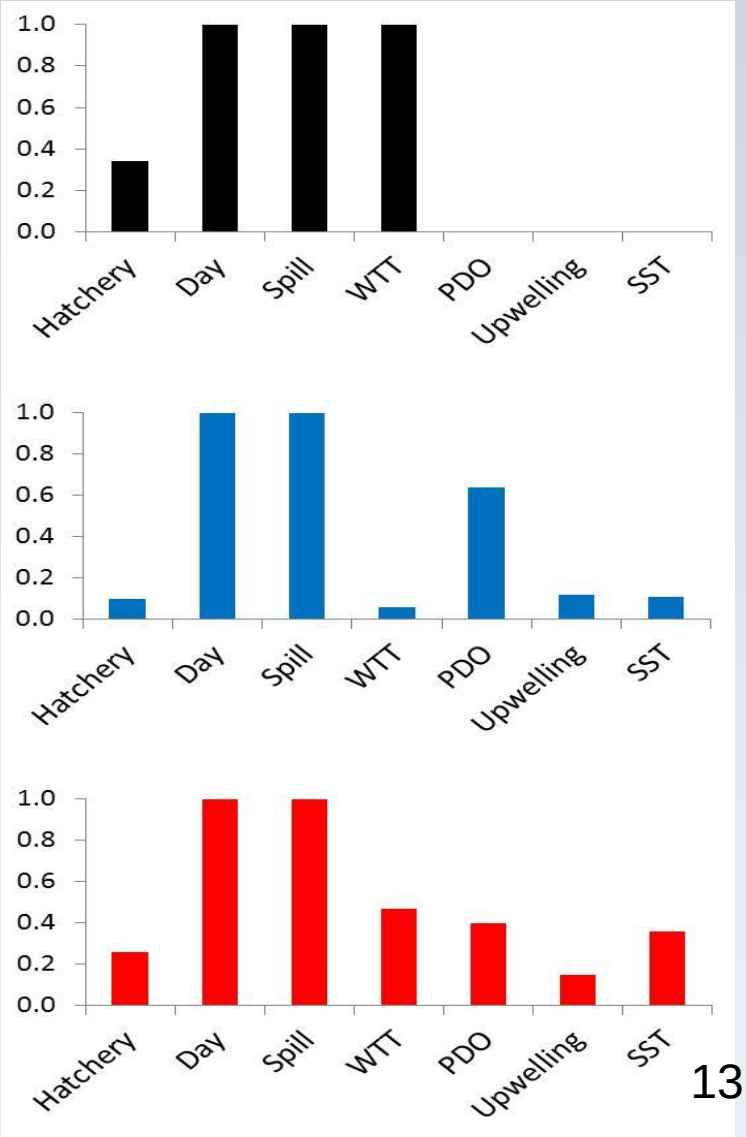
Steelhead

Freshwater survival

Ocean survival

Smolt to Adult survival





Key Conclusions from Haseker et al. (2012)

- Freshwater outmigration conditions (spill, water particle transit time) influence in-river survival rates
- Spill affects ocean survival rates
- Freshwater outmigration conditions (spill, water particle transit time) influence Smolt to Adult survival
- In-river reach survival rates are positively correlated with ocean survival rates
- Pacific Decadal Oscillation (PDO) influences Smolt to Adult survival and ocean survival rates

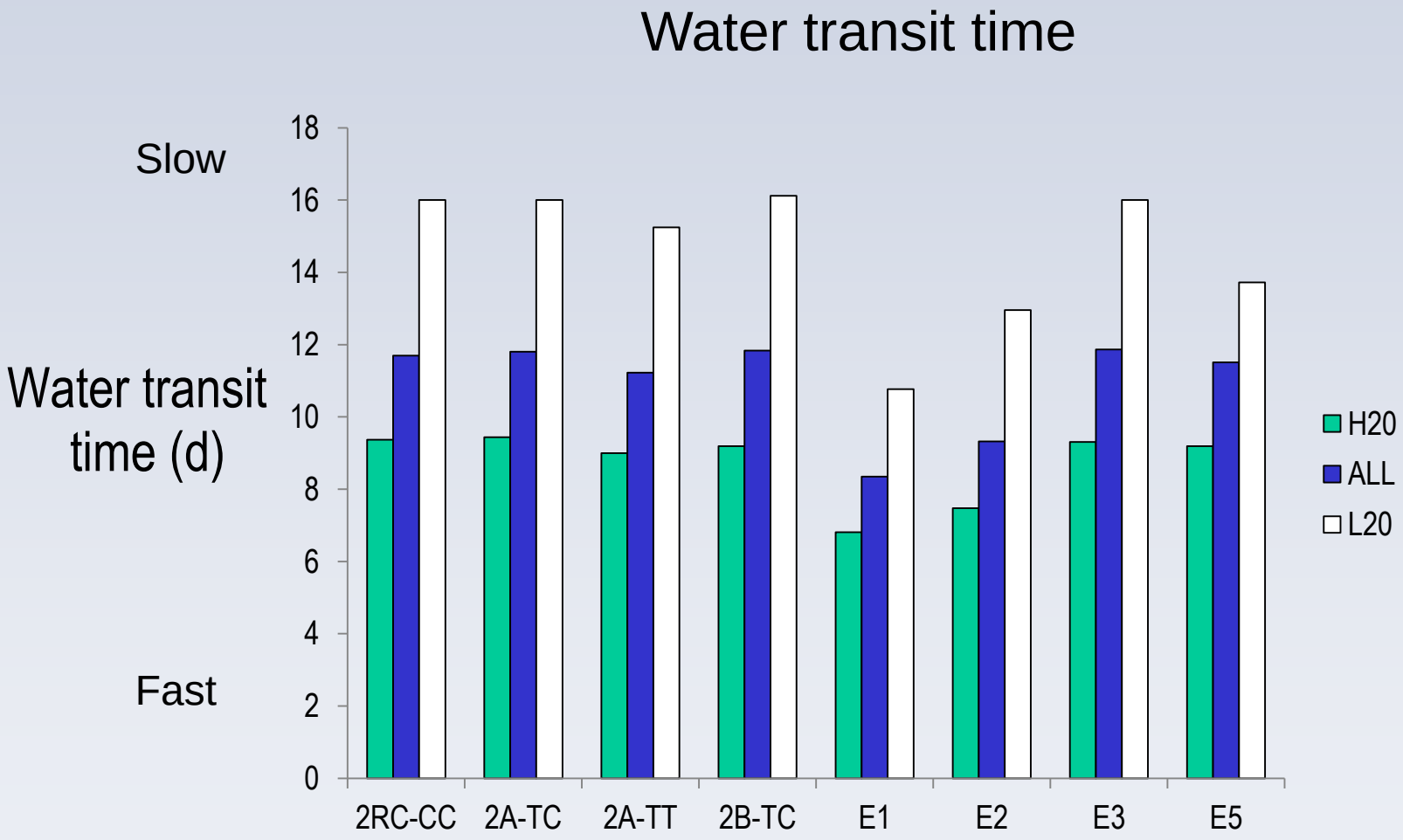
Overview of the Modeling

- Applied similar methods (Haeseker et al. 2012) to Upper Columbia PIT-tag data
- Used 70 year average, 20% high and 20% low flows from Iteration #2 hydroregulation model outputs
- Compared biological responses of Alternatives and Components relative to 2RC-CC

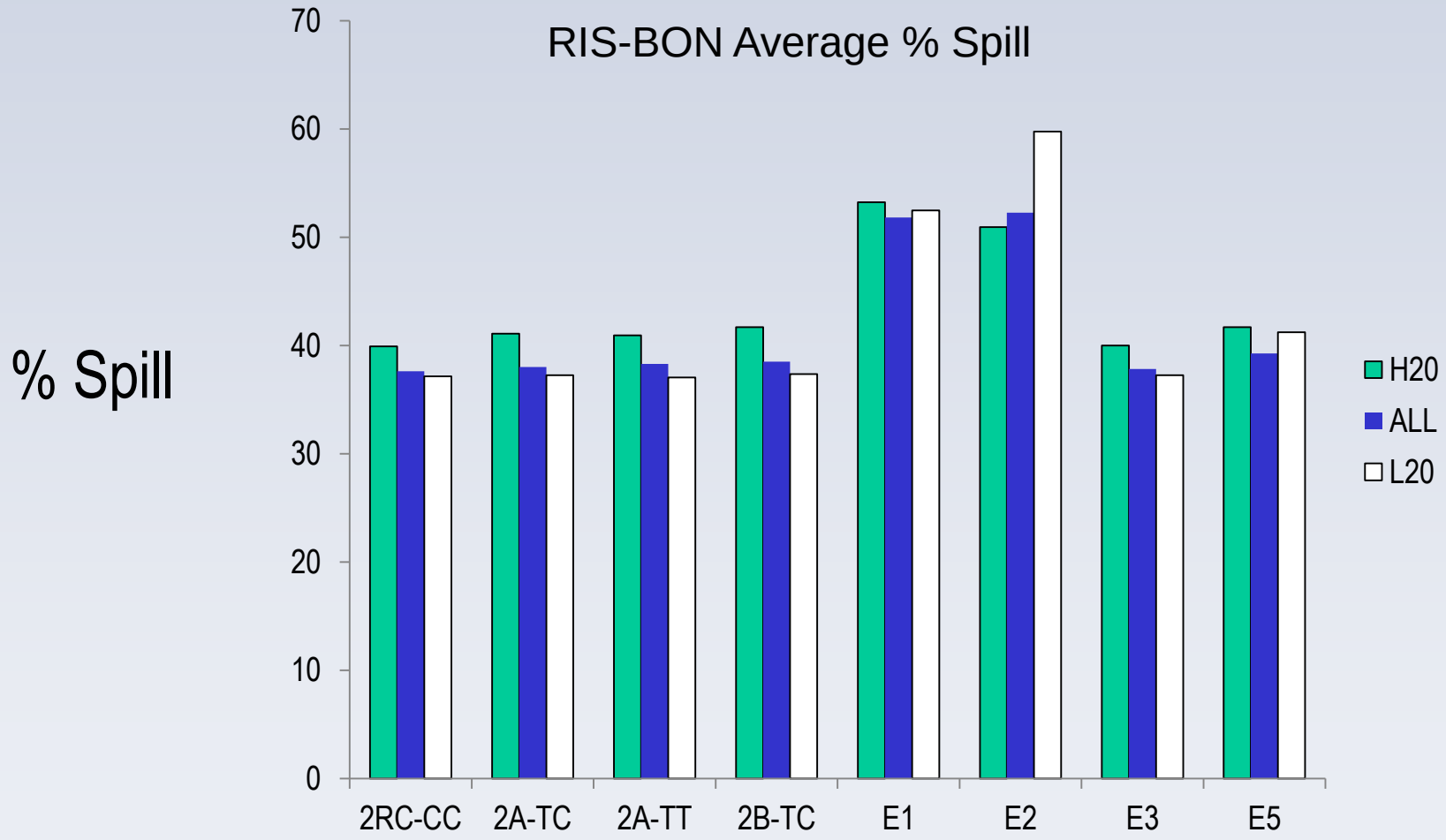
Overview of the Modeling

- Upper Columbia Spring Chinook and Steelhead focal stocks
- Used Upper Columbia juvenile PIT-Tag data from Rock Island to McNary Dam for fish travel time and survival
- Used Smolt-to-Adult Return rates from Rock Island Dam (smolt) to Bonneville Dam (adult)
- Evaluated projected Smolt-to-Adult Return rates across a range of ocean conditions (poor, average, good)

Model/Analysis Results

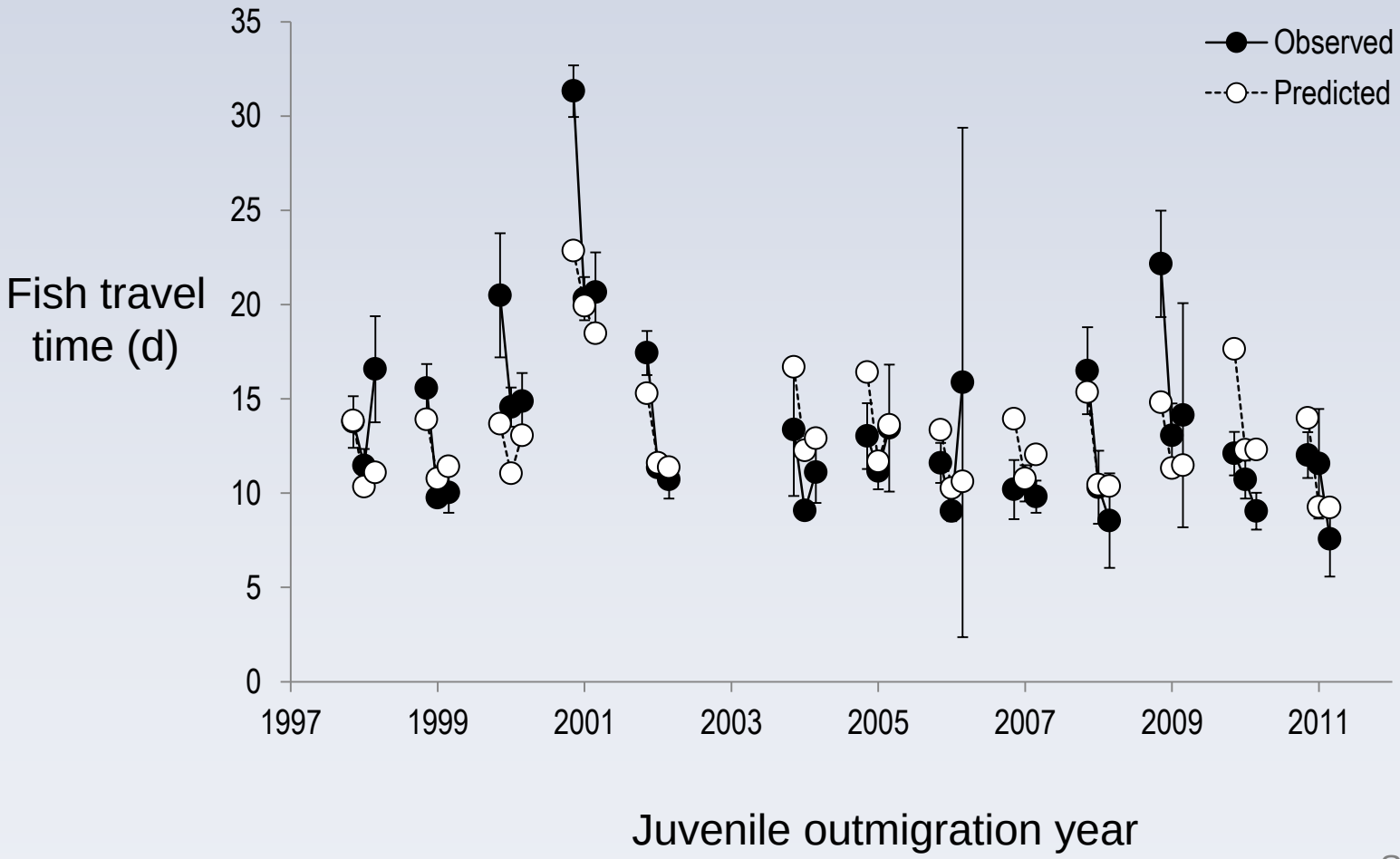


Model/Analysis Results



Juvenile Yearling Chinook,
RIS-MCN Fish Travel Time

Best Model = water transit time + day



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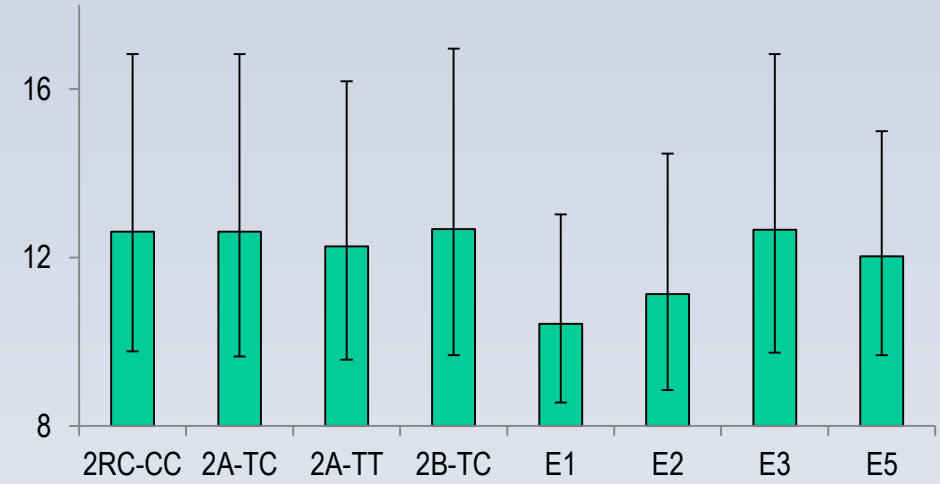
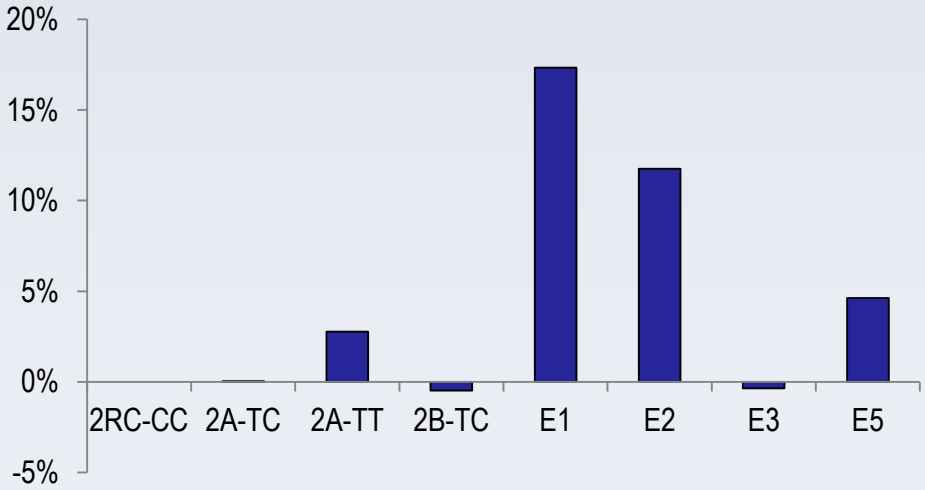
Yearling Chinook, RIS-MCN Fish travel time

Fish travel time (d)

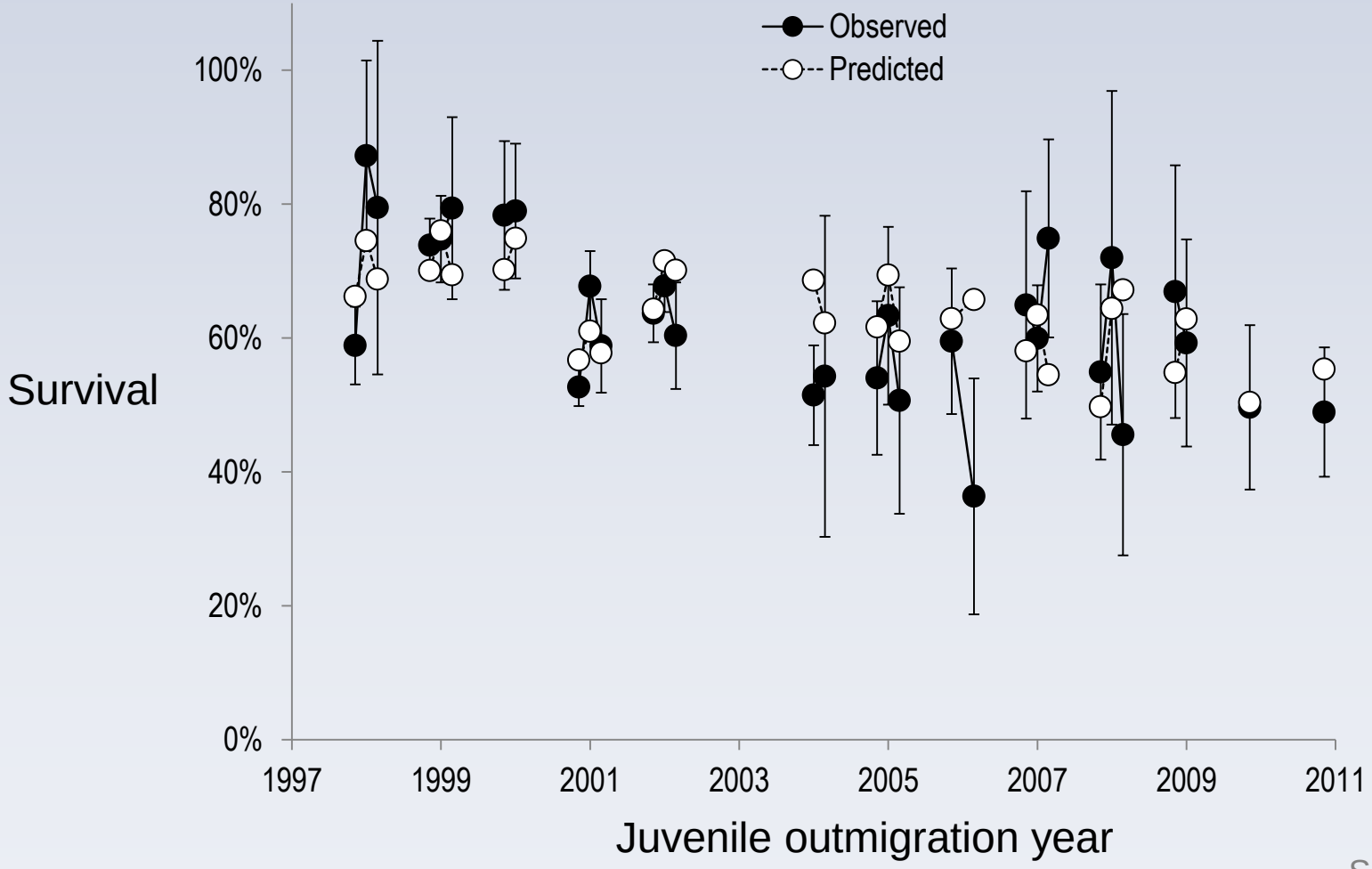


Relative improvement



Juvenile Yearling Chinook,
RIS-MCN Reach Survival

Best Model = day + spill + water transit time



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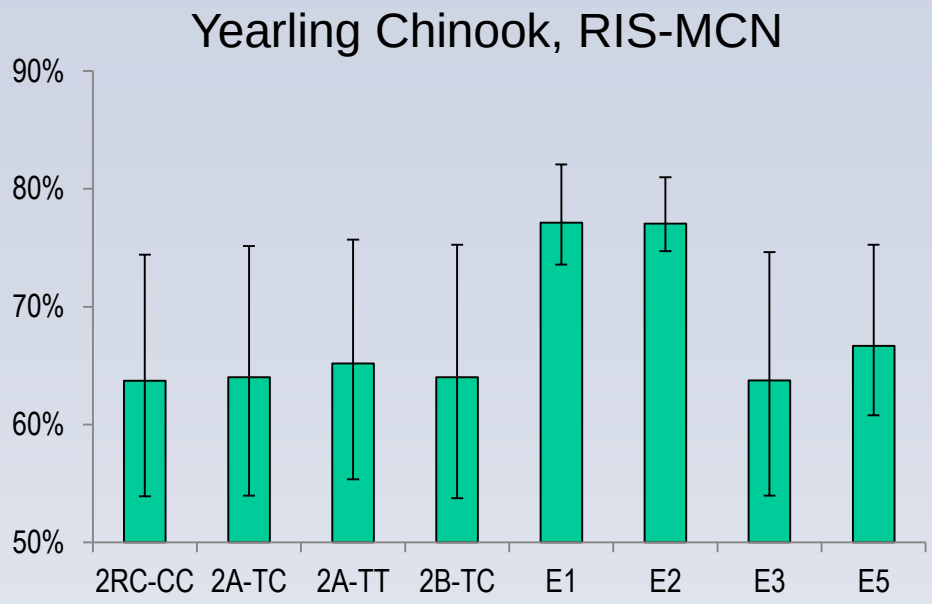
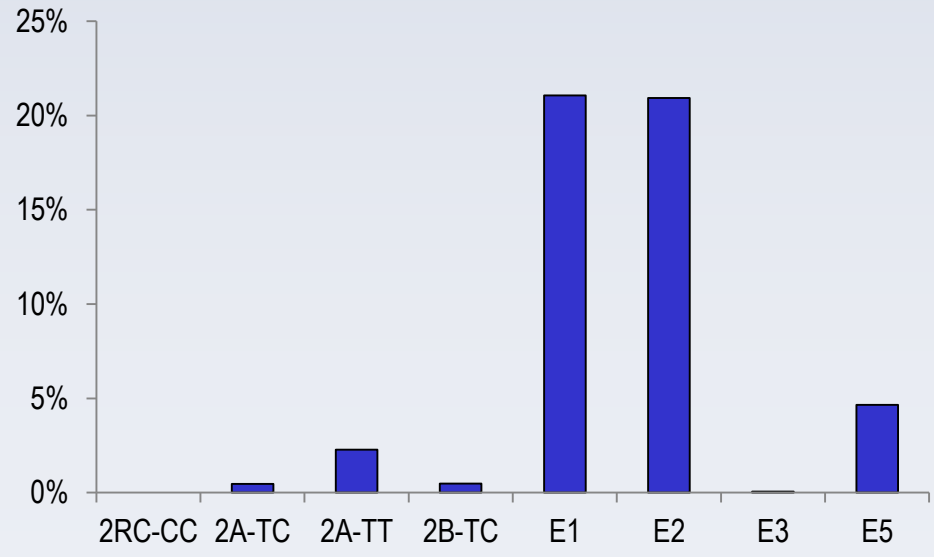
Survival



Relative improvement



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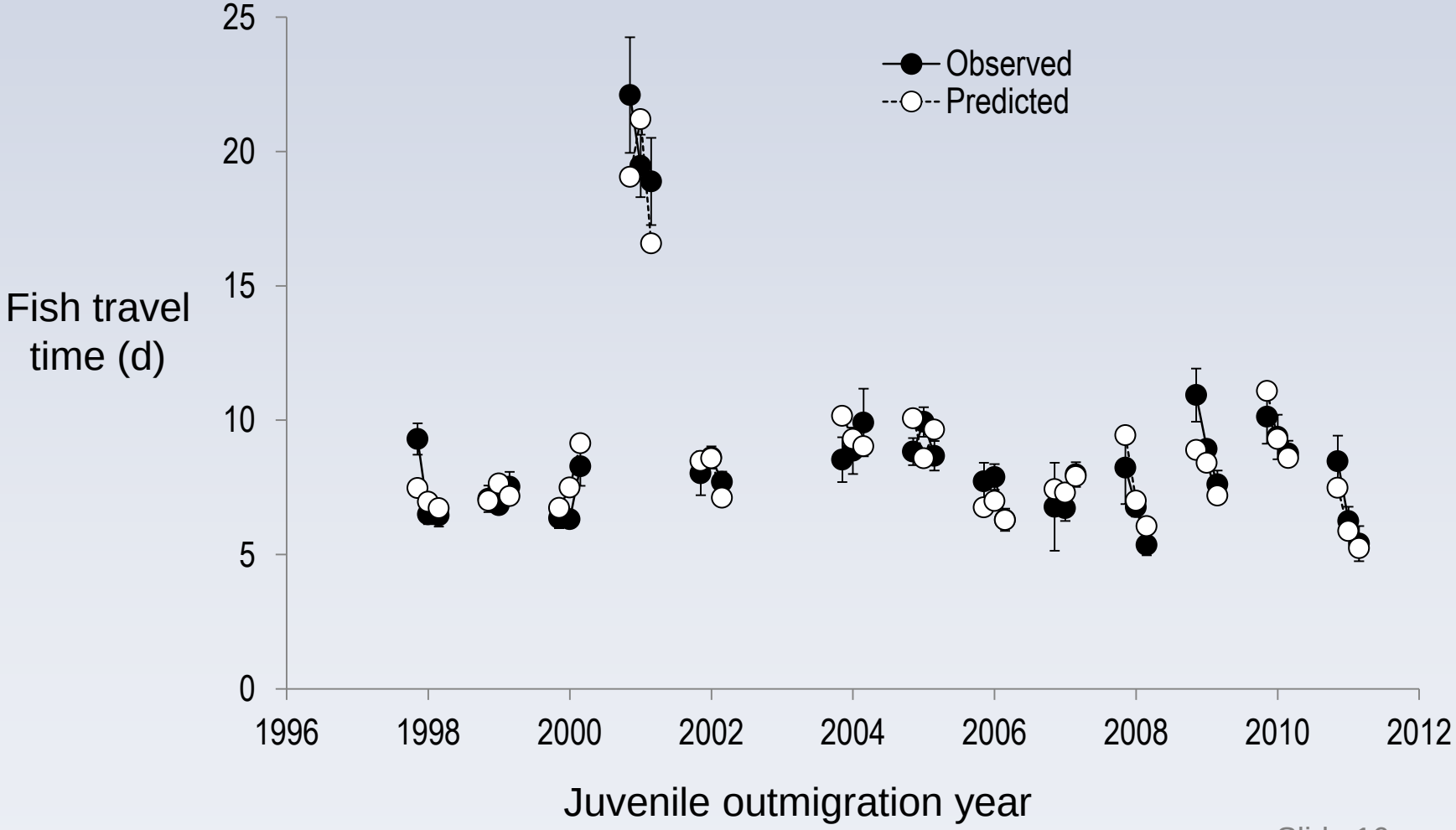
Juvenile Steelhead
RIS-MCN Fish Travel Time

Best Model = day + water transit time



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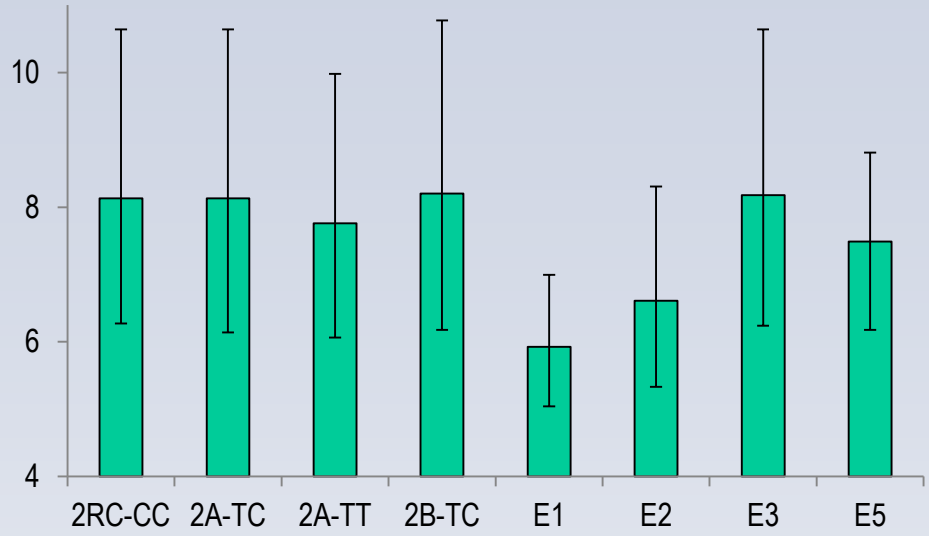
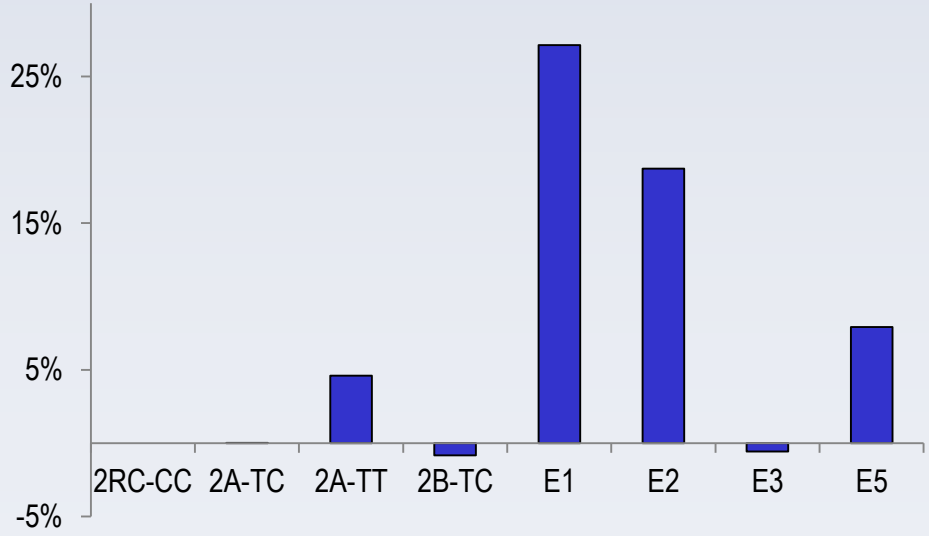
Steelhead, RIS-MCN Fish travel time

Fish travel time (d)



Relative improvement



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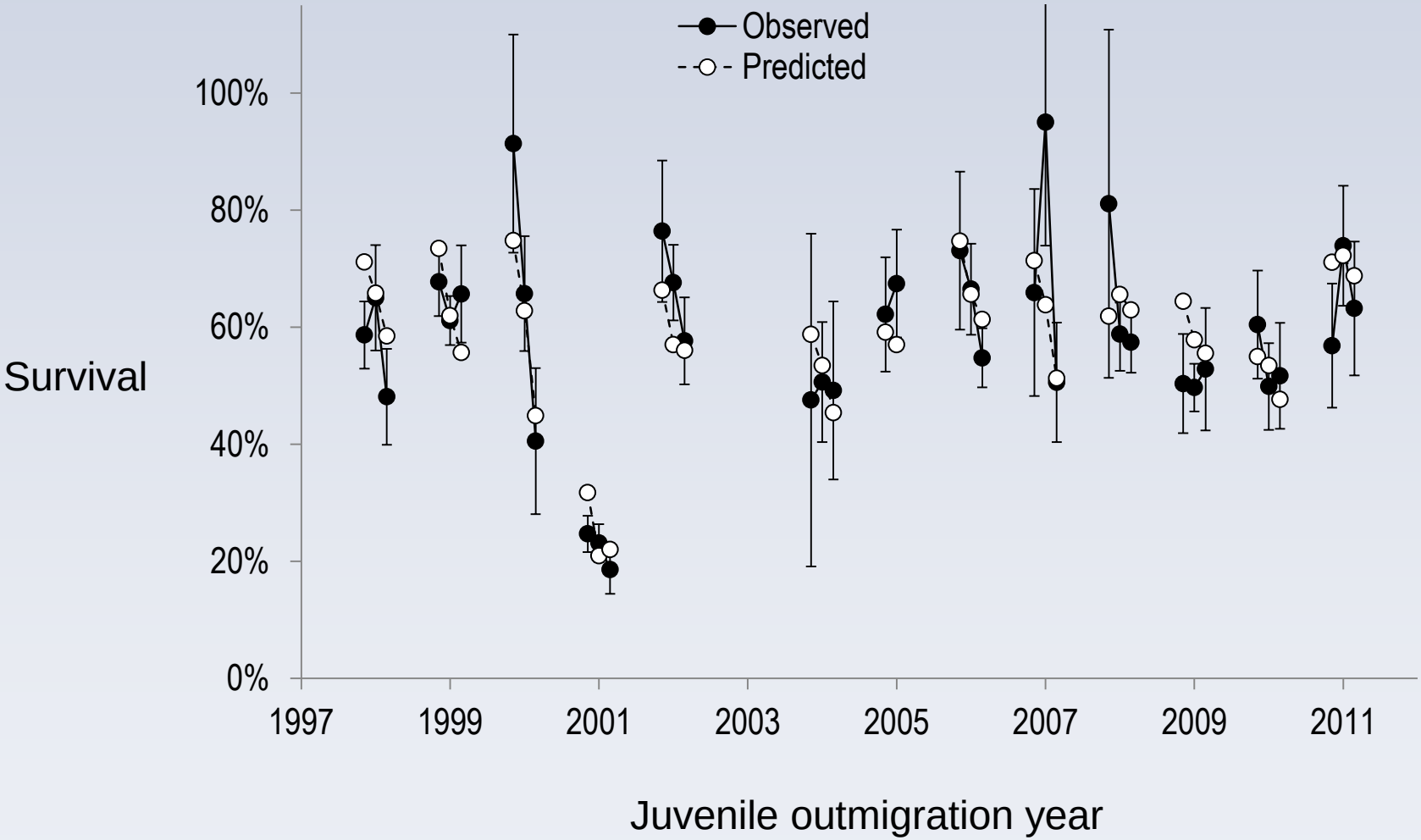
Juvenile Steelhead
RIS-MCN Reach Survival

Best Model = day + water transit time



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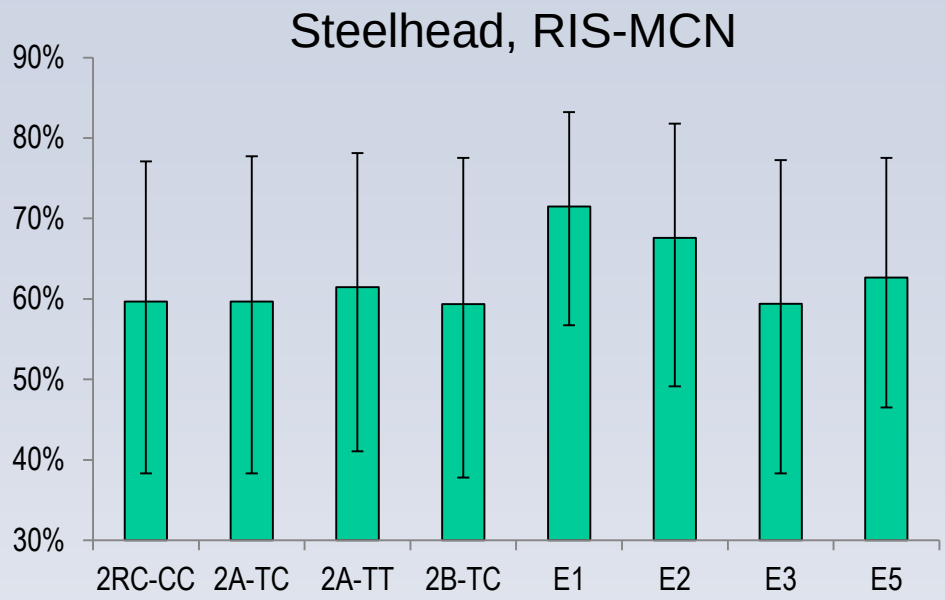
Survival



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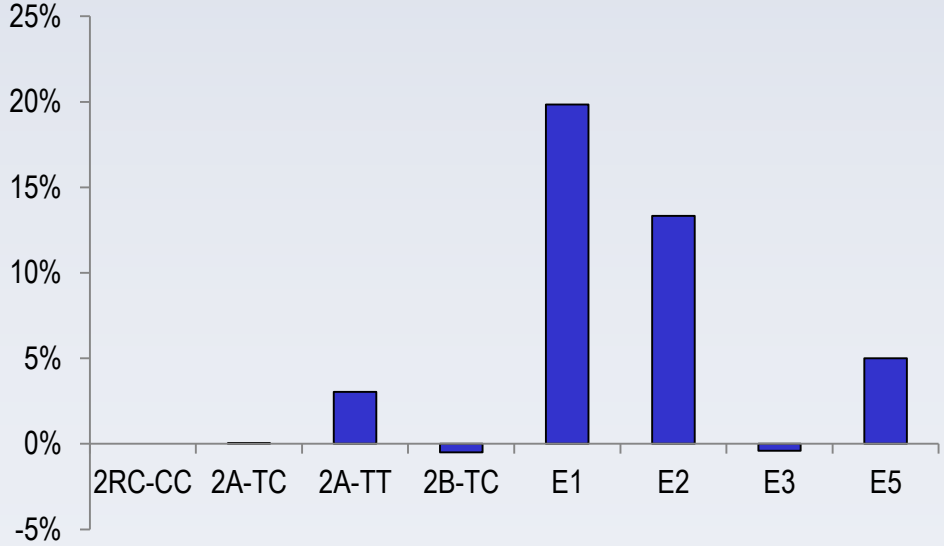
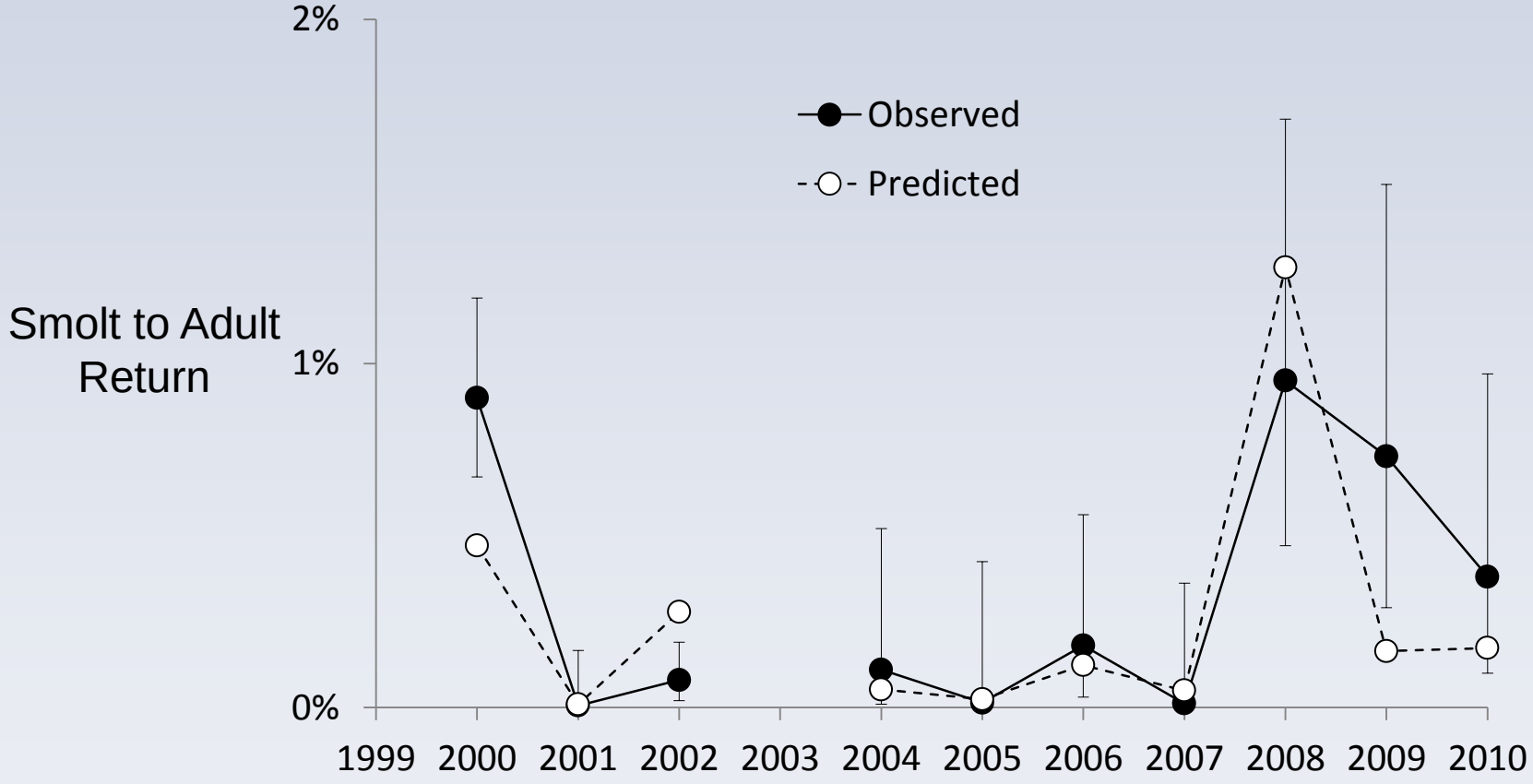


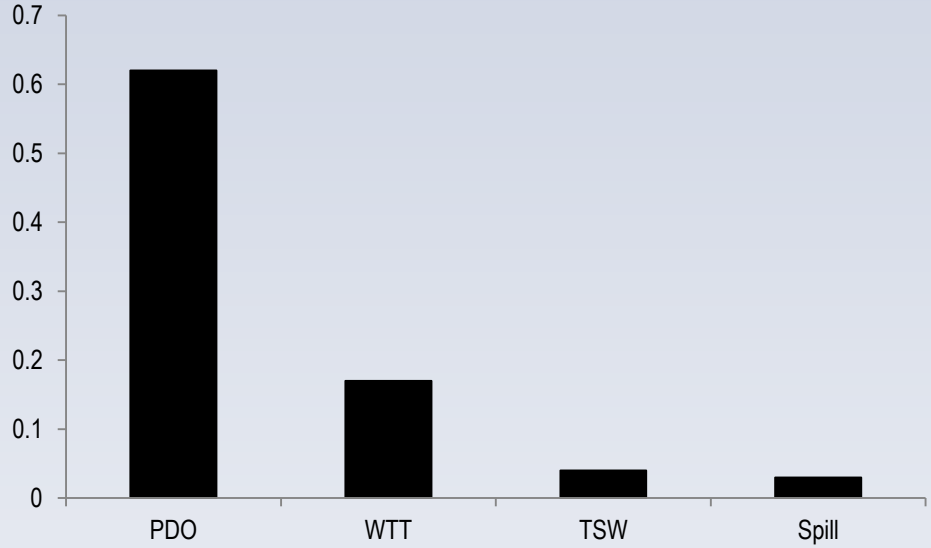
Yearling Chinook, $SAR_{RIS\text{-}BON}$



Yearling Chinook, Smolt to Adult Return$_{RIS\text{-}BON}$

Multi-model inference results

Relative variable importance



Effect - - + +

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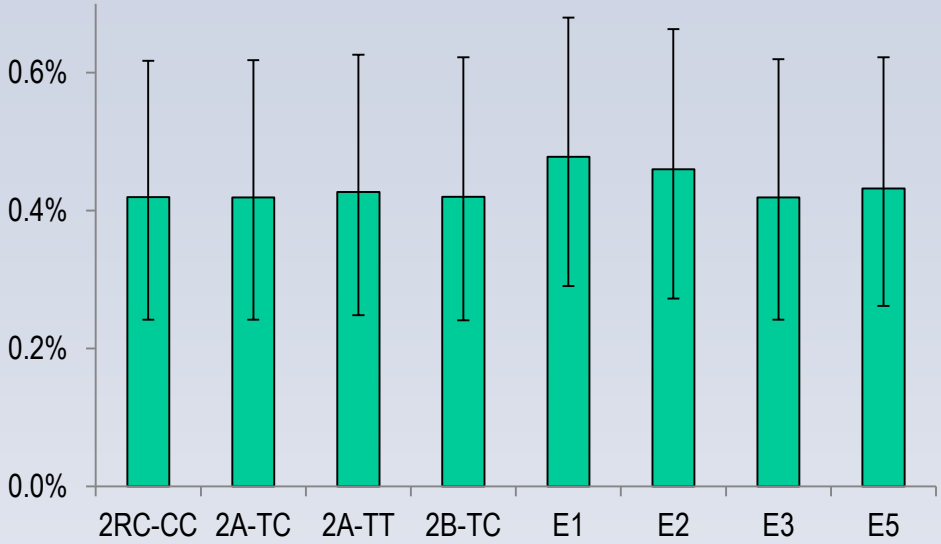
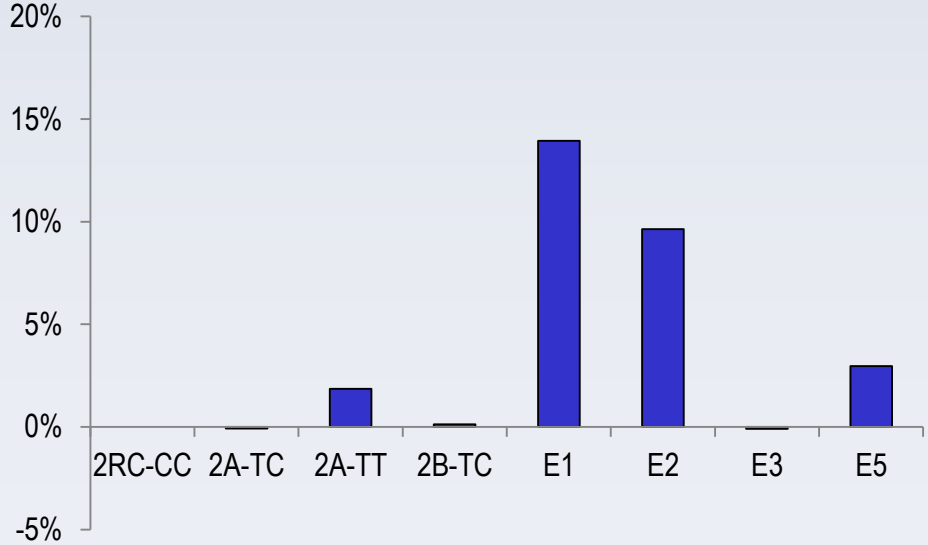
Yearling Chinook, $SAR_{RIS\text{-}BON}$

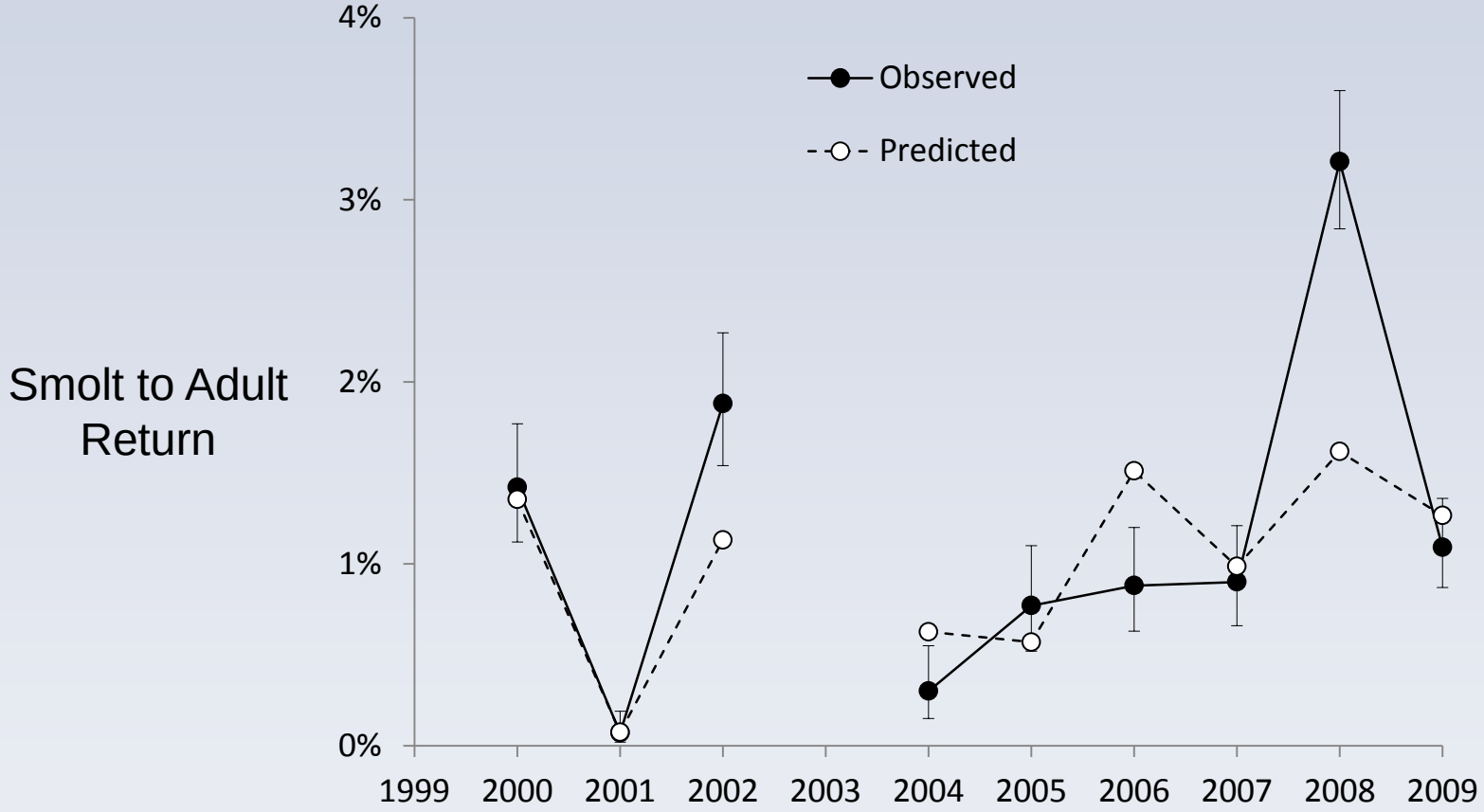
Smolt to Adult Return



Relative improvement



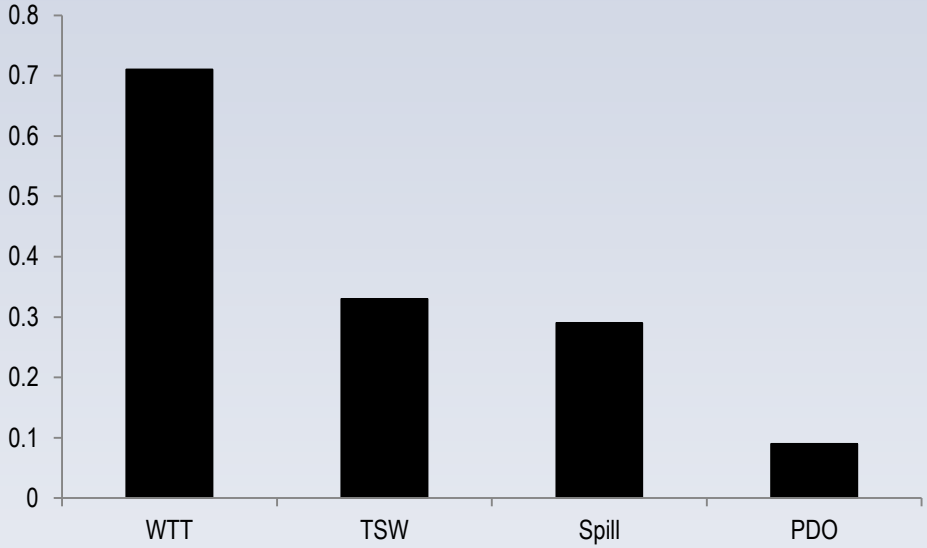
Steelhead, Smolt to Adult Return



Steelhead, Smolt to Adult Return

Multi-model inference results

Relative variable importance



	WTT	TSW	Spill	PDO
Effect	-	+	+	-

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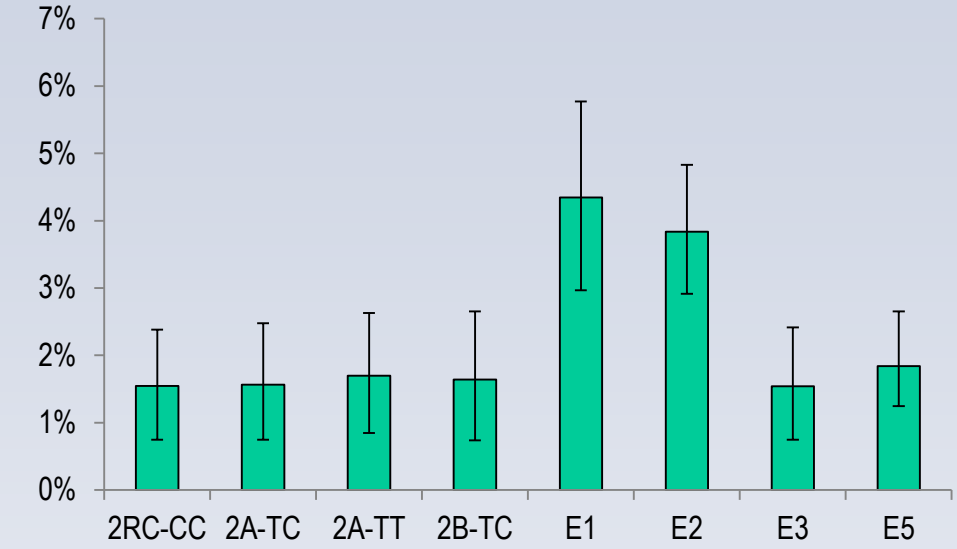
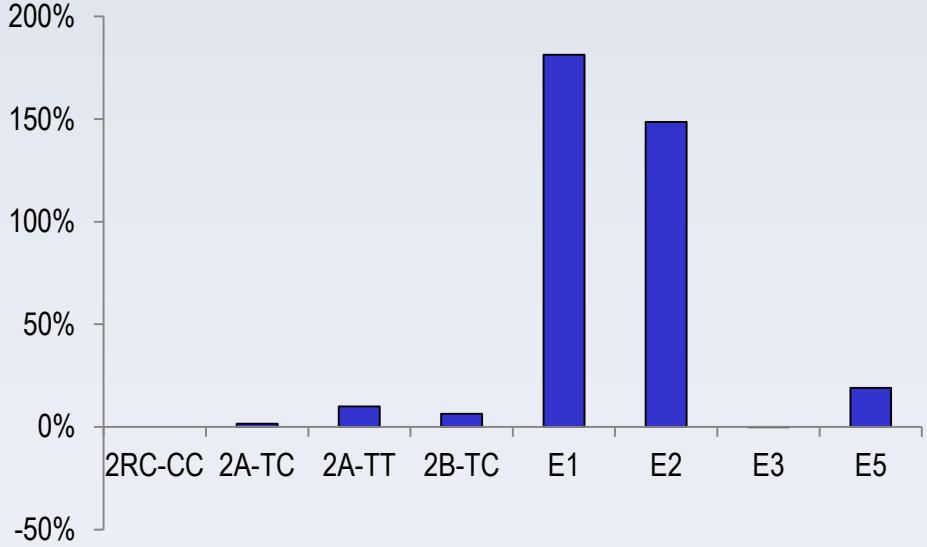
Steelhead, Smolt to Adult Return

Smolt to Adult Return



Relative improvement



Summary

- Water transit time and spill positively influence fish travel time, in-river survival, and Smolt to Adult Returns of steelhead and Chinook
- Components E1 and E2b predicted highest in-river survival, fastest migration rates and highest Smolt to Adult Returns for steelhead and Chinook
- Only the E1 and E2b components approach the NWPCC SAR goal of 2-6% for Upper Columbia Steelhead
- None of the alternatives or components meet the NWPCC goal of 2-6% for Upper Columbia Chinook