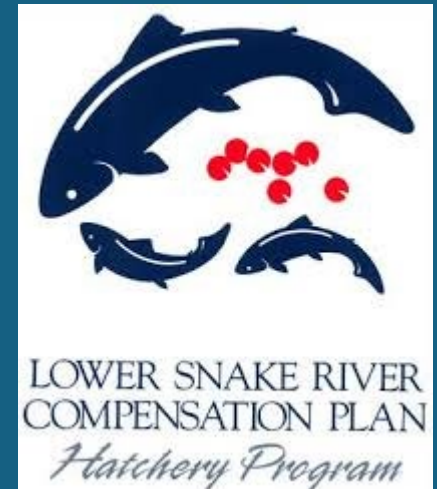


Juvenile Survival Estimation Methods

Eli Felts

Idaho Fish and Wildlife Conservation Office

LSRCP Meeting, April 2026



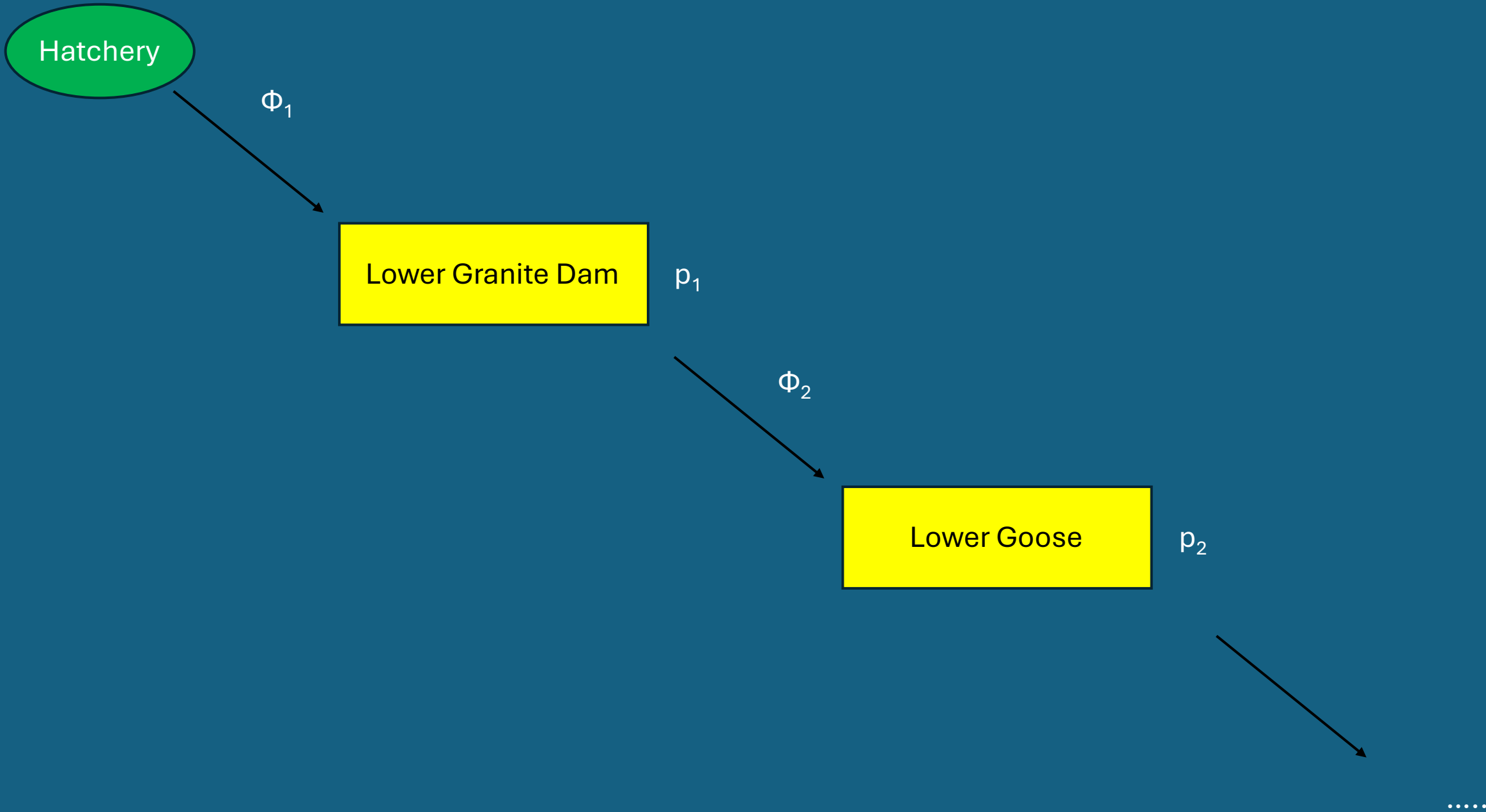
Juvenile Survival

- Important metric for hatchery performance
- Response variable when trying different rearing/release strategies
 - PRAS
 - Early/late timing

Estimation methods

- Typically, maximum likelihood estimation
 - Bayesian options also
- Two probabilities at each step (dams in our context)
 - Probability of survival (ϕ)
 - Probability of being detected (p)

<i>encounter history</i>	<i>probability</i>
111	$\phi_1 p_2 \beta_3$
110	$\phi_1 p_2 (1 - \beta_3)$
101	$\phi_1 (1 - p_2) \beta_3$
100	$1 - \phi_1 p_2 - \phi_1 (1 - p_2) \beta_3$



Tools for estimation

 COLUMBIA BASIN RESEARCH

UNIVERSITY of WASHINGTON
School of Aquatic and Fishery Sciences

Home / Columbia River DART (Data Access in Real Time)

DART PIT Tag Release and Observation Summary for Generating Survival and Travel Time Estimates with Tag File Selection

Data Courtesy of [Pacific States Marine Fisheries Commission](#)

PIT Tag Release and Observation Summary Queries

Tag Files for Generating Survival and Travel Time estimates | General Release and Observation Parameters

Define Fish Group

☒ By Release Parameters and Date Range ☐ By Observation Parameters and Date Range ("Virtual Release")

Select Release Year, Species, Run Type, Rear Type

2026 | 1-Chinook | No Selection-Run Type | No Selection-Rear Type

Select Tag Coordinator

No Selection-Tag Coordinator

Select Release Location/Basin

Release Basin RKM: No Selection - Release Basin RKM

OR

Release Site: No Selection - Release Site

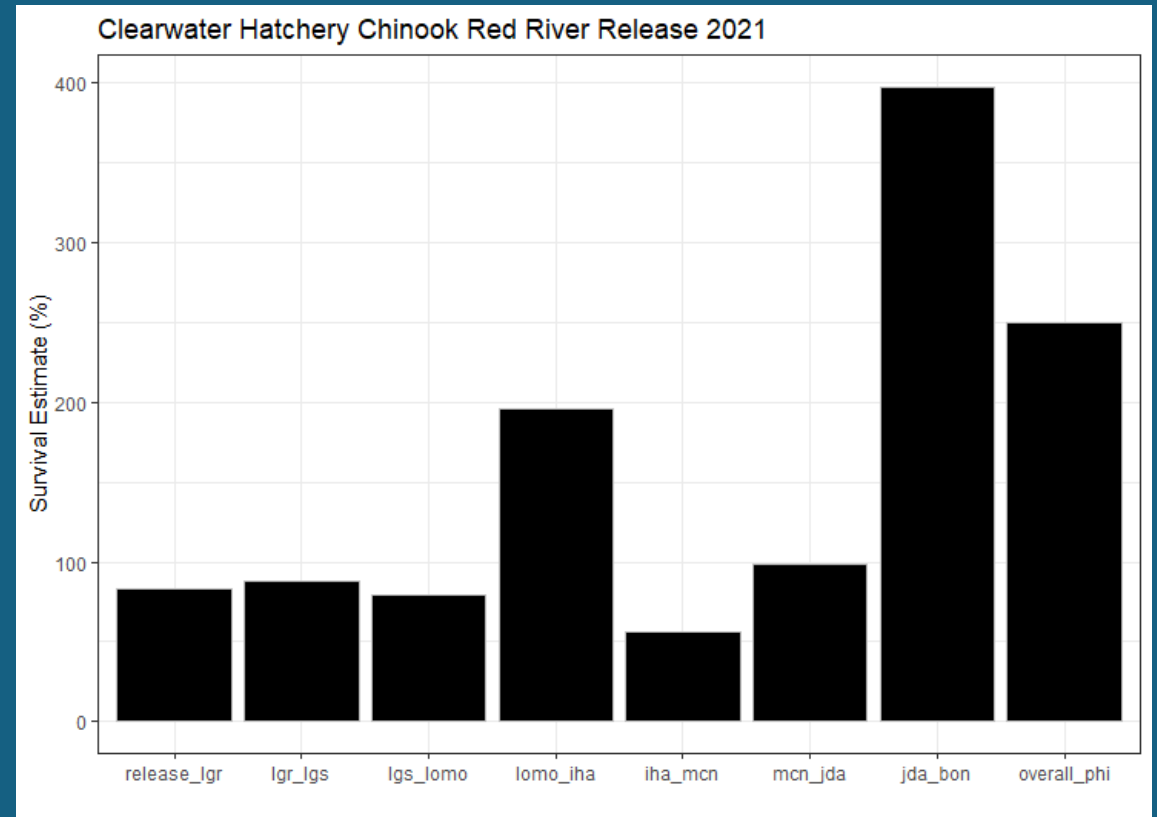
Restrict Query by Release Date Range

Select Date Range Type ☒ Within Calendar Year ☐ Span Calendar Years



DART Issues

- Difficult to identify groups that need to be split
 - Release groups
 - Any treatments specific to tagging files
- One group at a time
 - Results in clunky text files
- Trusting their PTAGIS queries
- **Estimates not bounded between 0 and 1**



How much of an issue is this?

- How does it affect main parameters of interest
 - Survival to Lower Granite Dam
 - Hydrosystem survival
- How prevalent are PTAGIS query issues?



Methods

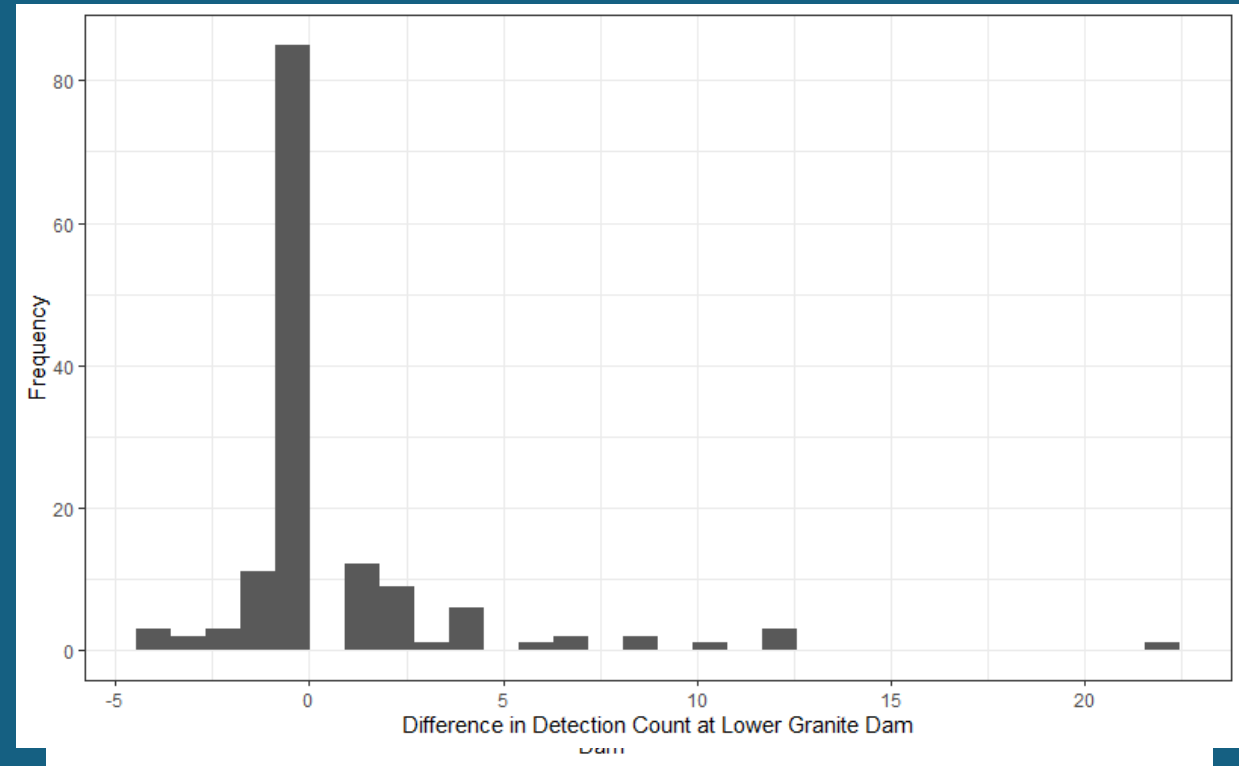
- Estimate survival for the hydrosystem
 - All release groups of steelhead and spring chinook
 - Dworshak, Clearwater and Kooskia
 - Two tools
 - DART
 - MARK (via Rmark)
- Benchmarks
 - Summaries of detections by dam – indicator of whether PTAGIS queries were the same
 - How long do they take to run?
 - Survival estimates – are they different?

Time to run 145 release groups

- RMark ~ 5 minutes
- DART
 - Each release group ~ 2 minutes = 300 minutes (5 hours)

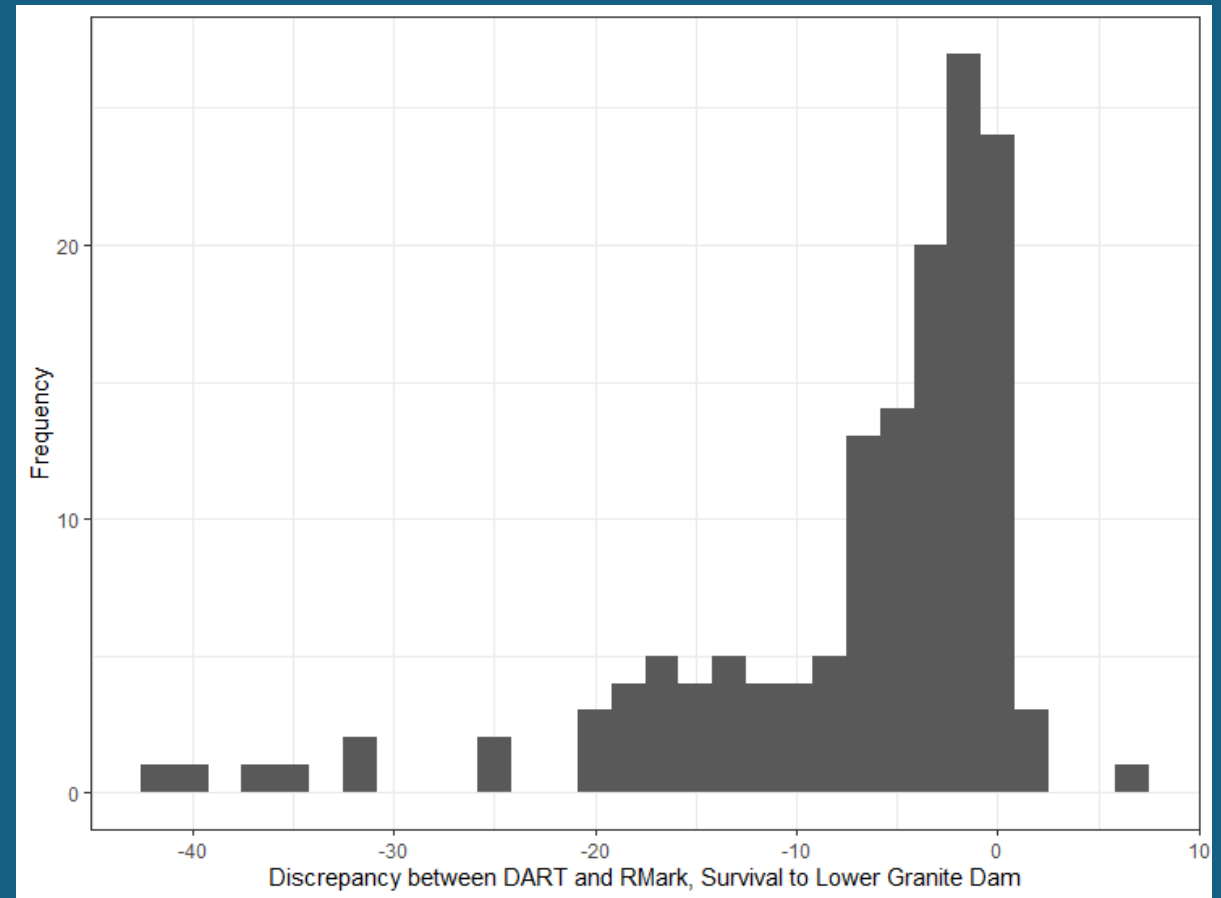
Results

- First checked detection counts at Lower Granite between my query and DART
 - Check that the same data are feeding into estimates
- 3 release groups very different (312 – 2,753 at Lower Granite)
 - All 2025, not sure why this happened
- Otherwise, essentially the same



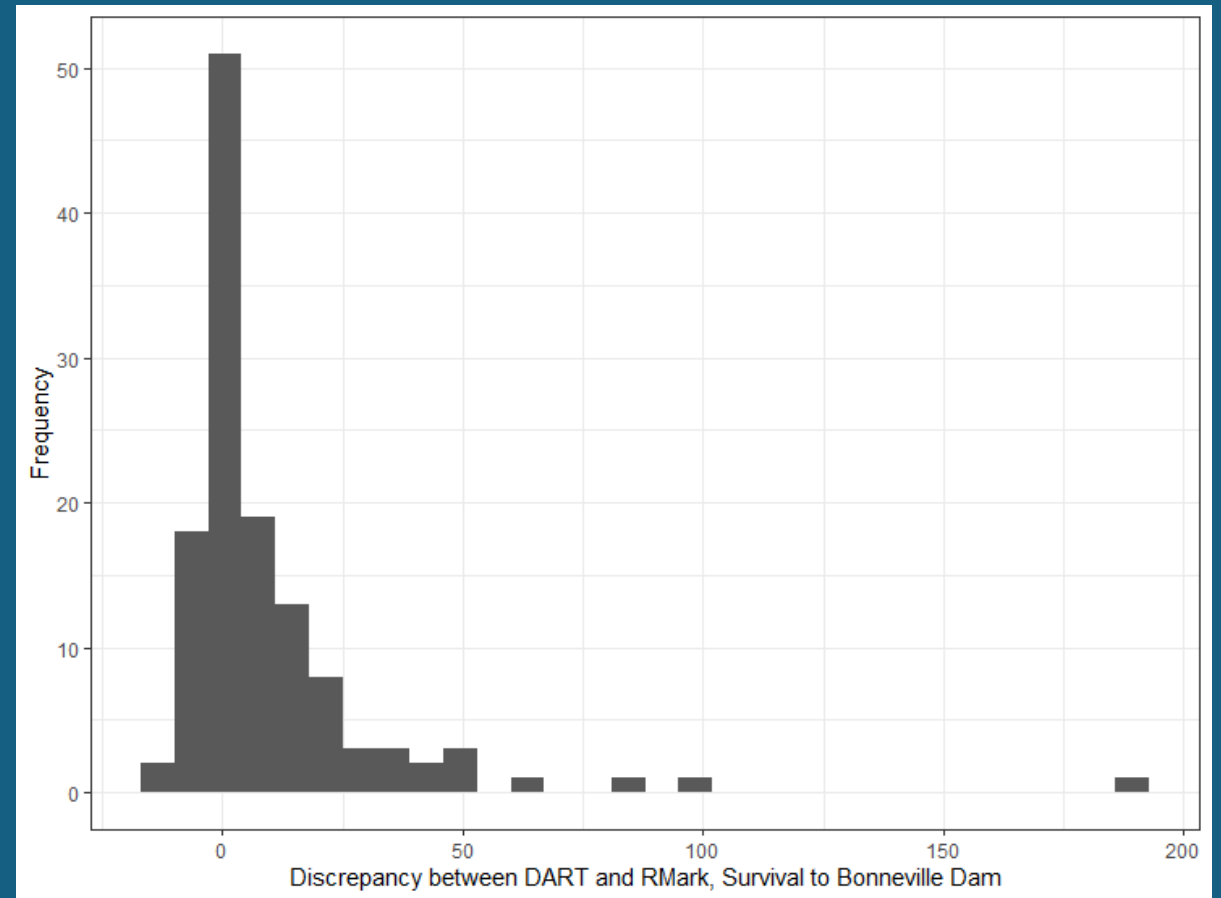
Results – Survival to Lower Granite

- DART estimates biased low
- Likelihood is driven by products of all parameters, not just one dam
 - One parameter is allowed to take on impossible values = distortion in other parameters



Results – Total Survival

- DART estimates biased high
 - Distortions throughout the process
 - Survival > 1 directly inflates total survival
 - Compensation elsewhere (i.e. lower survival to LGR) often insufficient



Summary

- Probably stay away from DART
- RMark sufficient for most applications
 - More efficient process once the basic structure is built