

SURVIVAL ESTIMATE OF RUN-OF-RIVER TRANSPORTED YEARLING CHINOOK SALMON ORIGINATING FROM SNAKE RIVER BASIN IN THE LOWER COLUMBIA RIVER AND ESTUARY WITH EMPHASIS ON INCREASING UNDERSTANDING OF CAUSES OF DIFFERENTIAL DELAYED MORTALITY

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Overview

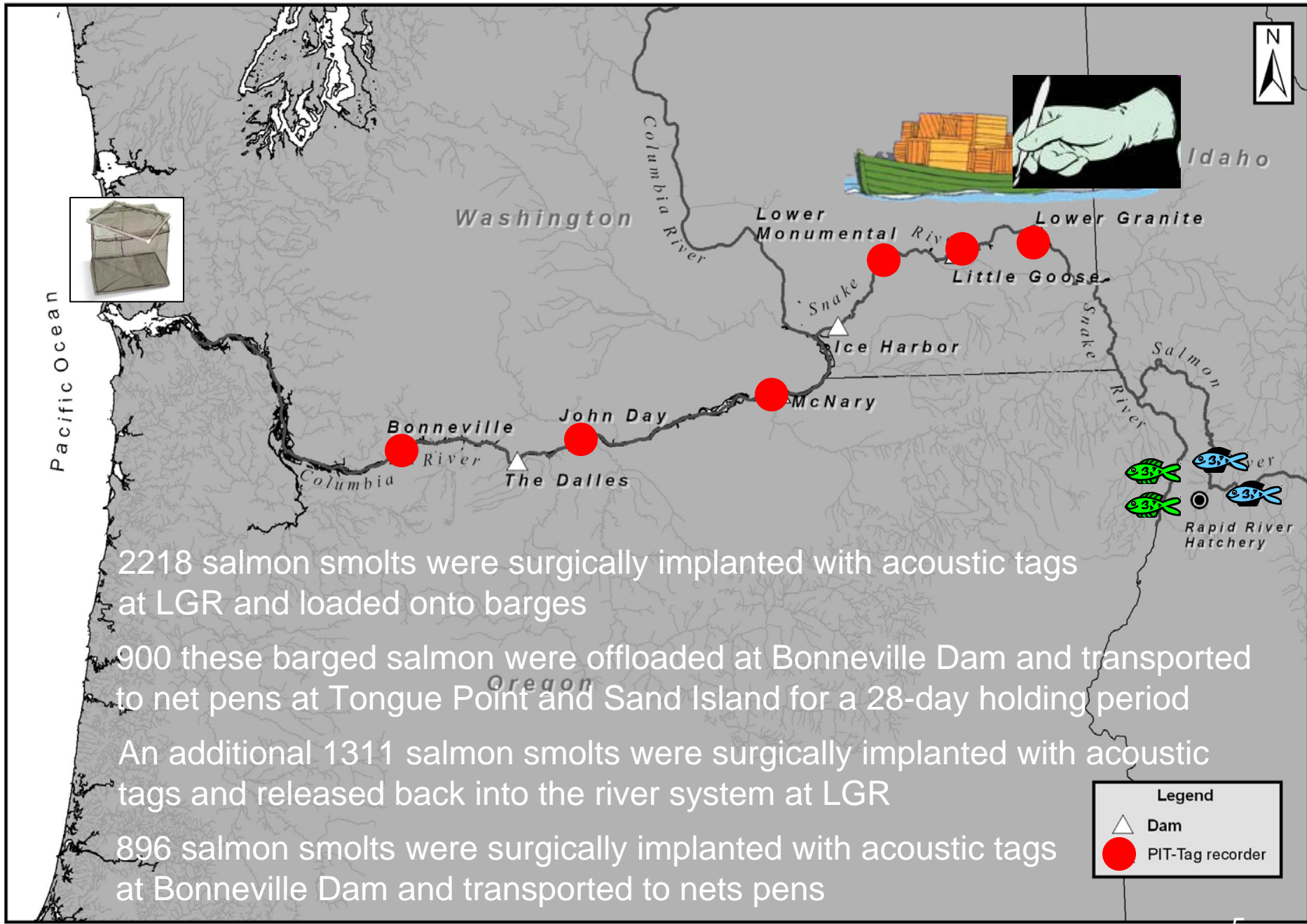
- Background
- 2008 Acoustic Tag Study Objectives and Methods
- Travel Times and Survival Estimates
- Net Pen Results
- Preliminary Analysis of Health Measures
- Conclusions

Background

- Laboratory Disease Challenge Studies
 - 2002 and 2006
- Net Pen Challenge Studies
 - 2007 and 2008
- Acoustic Telemetry Study
 - 2008

Acoustic Tag Study Objectives

- Estimate survival and travel time in JSATS-tagged transported run-of-river yearling Chinook salmon during transit through the lower Columbia River and Estuary;
- Use net pens to produce covariate information on fish health/pathology that may be related to
 - Survival estimates derived from surgically-tagged groups of fish
 - Potential net pen and tag effects of transported and in-river fish;
- Integrate survival, travel time, and net pen data to estimate the extent and potential causes of differential delayed mortality of transported and in-river run-of-river yearling Chinook salmon in the lower Columbia River and Estuary



2218 salmon smolts were surgically implanted with acoustic tags at LGR and loaded onto barges

900 these barged salmon were offloaded at Bonneville Dam and transported to net pens at Tongue Point and Sand Island for a 28-day holding period

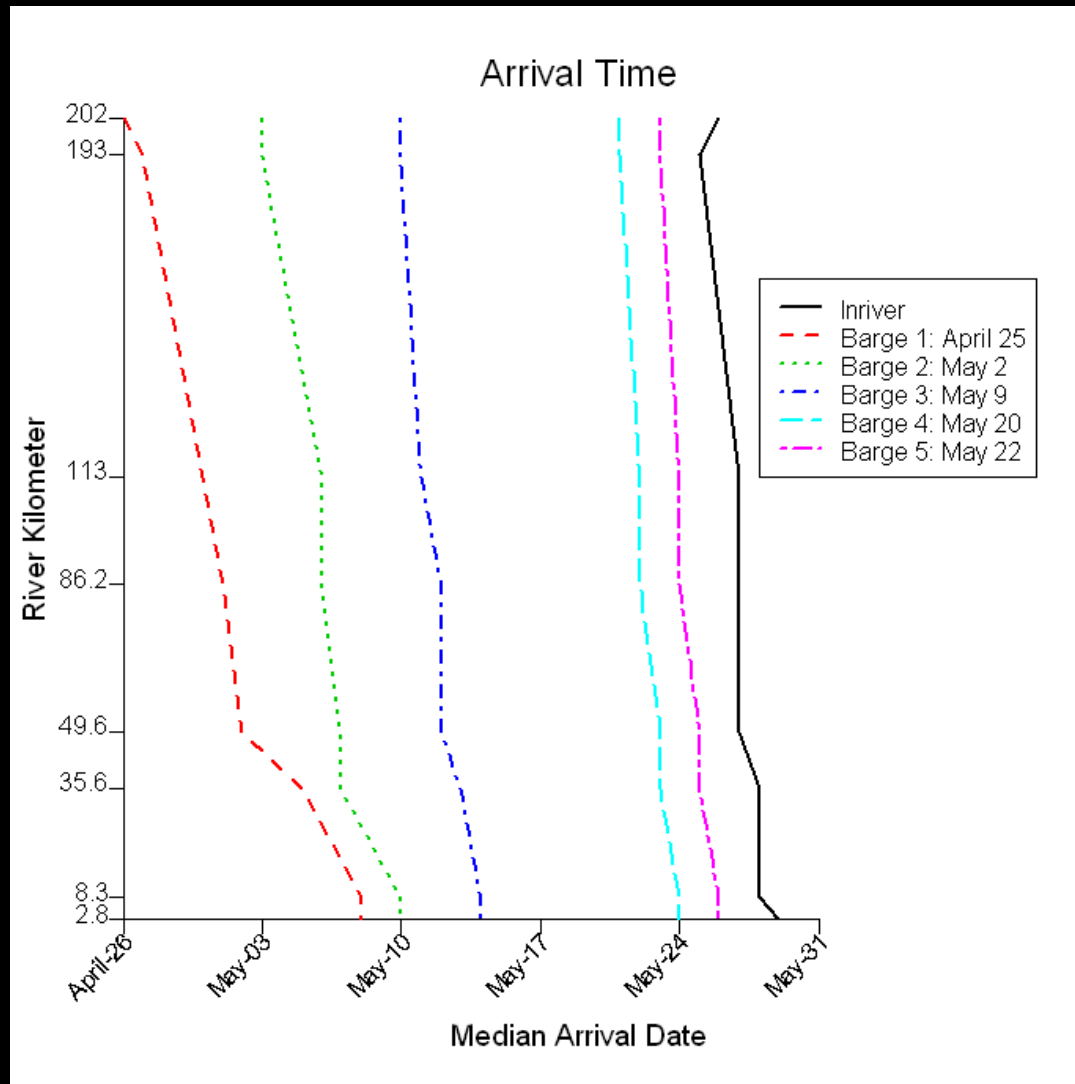
An additional 1311 salmon smolts were surgically implanted with acoustic tags and released back into the river system at LGR

896 salmon smolts were surgically implanted with acoustic tags at Bonneville Dam and transported to nets pens

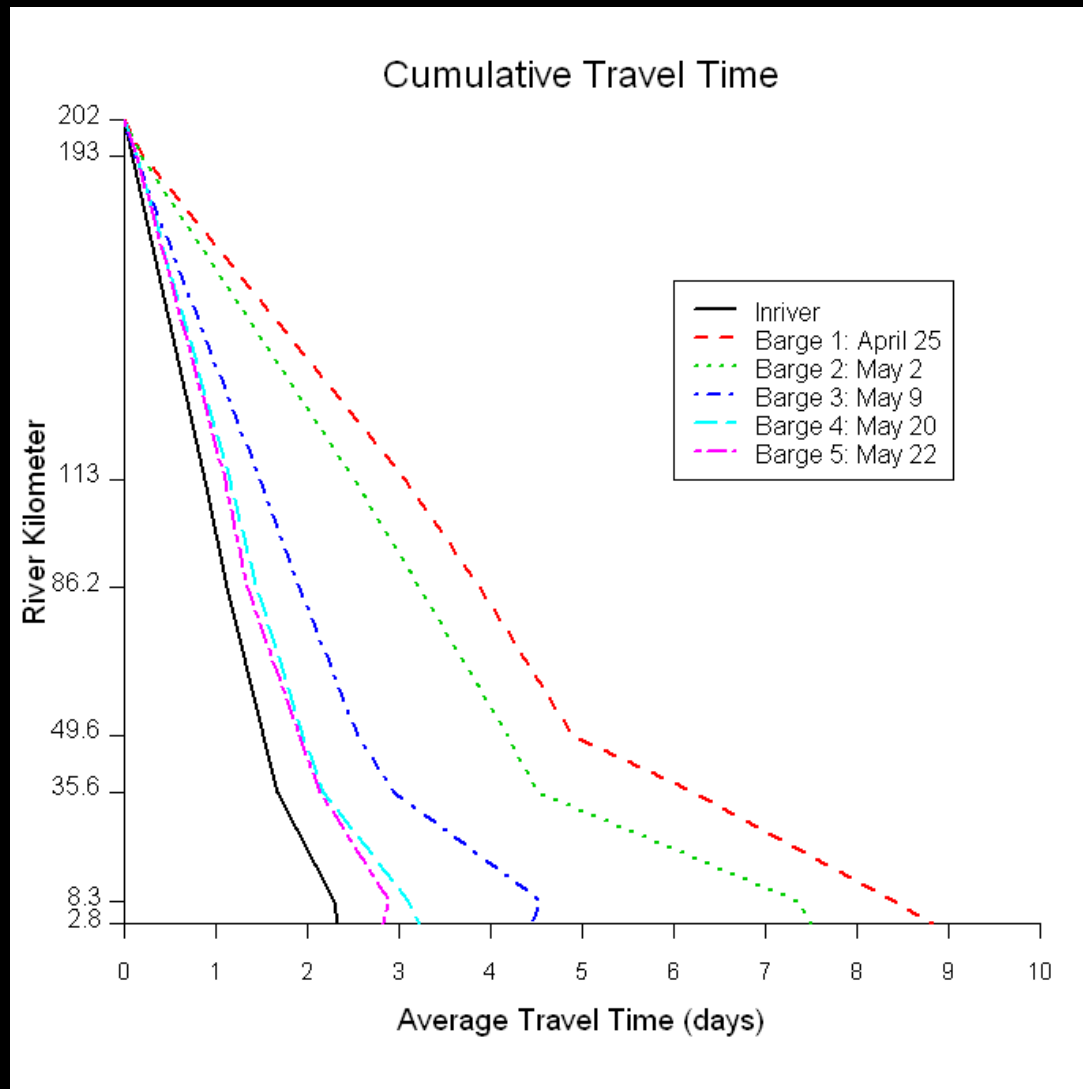
Legend

- △ Dam
- PIT-Tag recorder

Travel Time of Barged and In-River Fish Based on Median Arrival Date at Acoustic Arrays

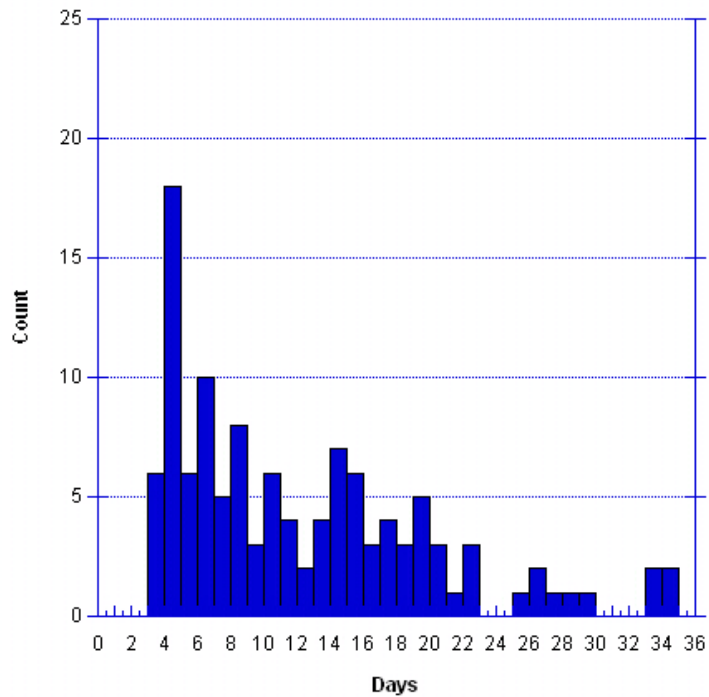


Average Lower River and Estuary Travel Time of Barged and In-River Fish

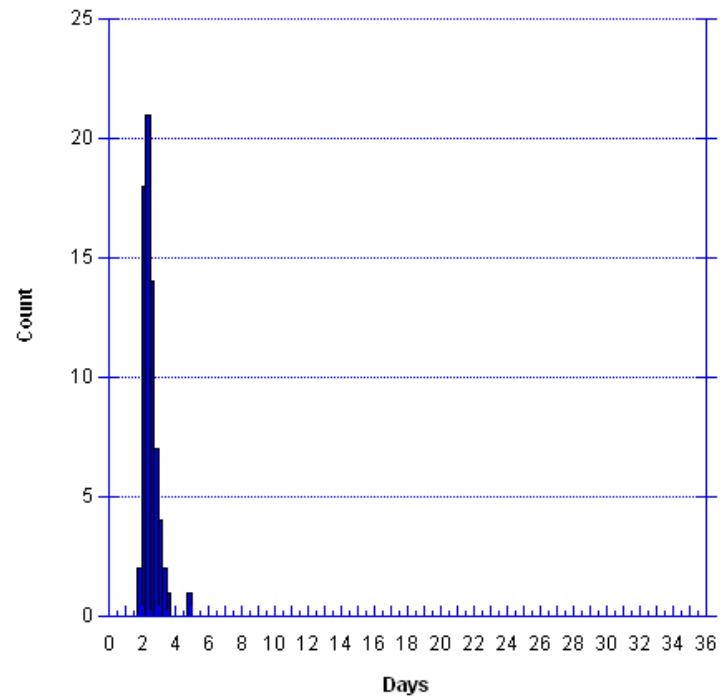


Distribution of Travel Times from Reed Island to East Sand Island for 4/25/08 Release Date

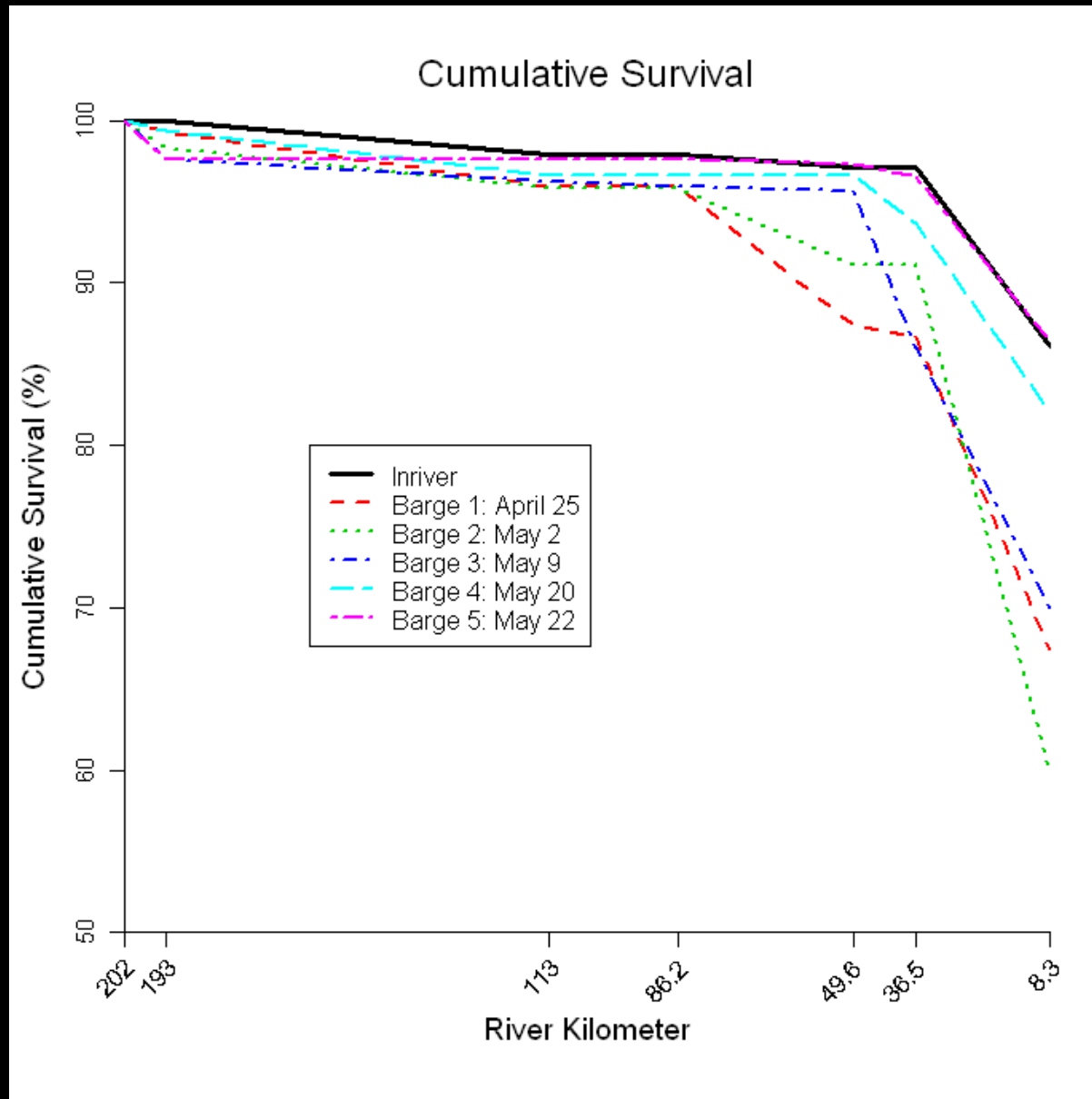
Barged



In-River



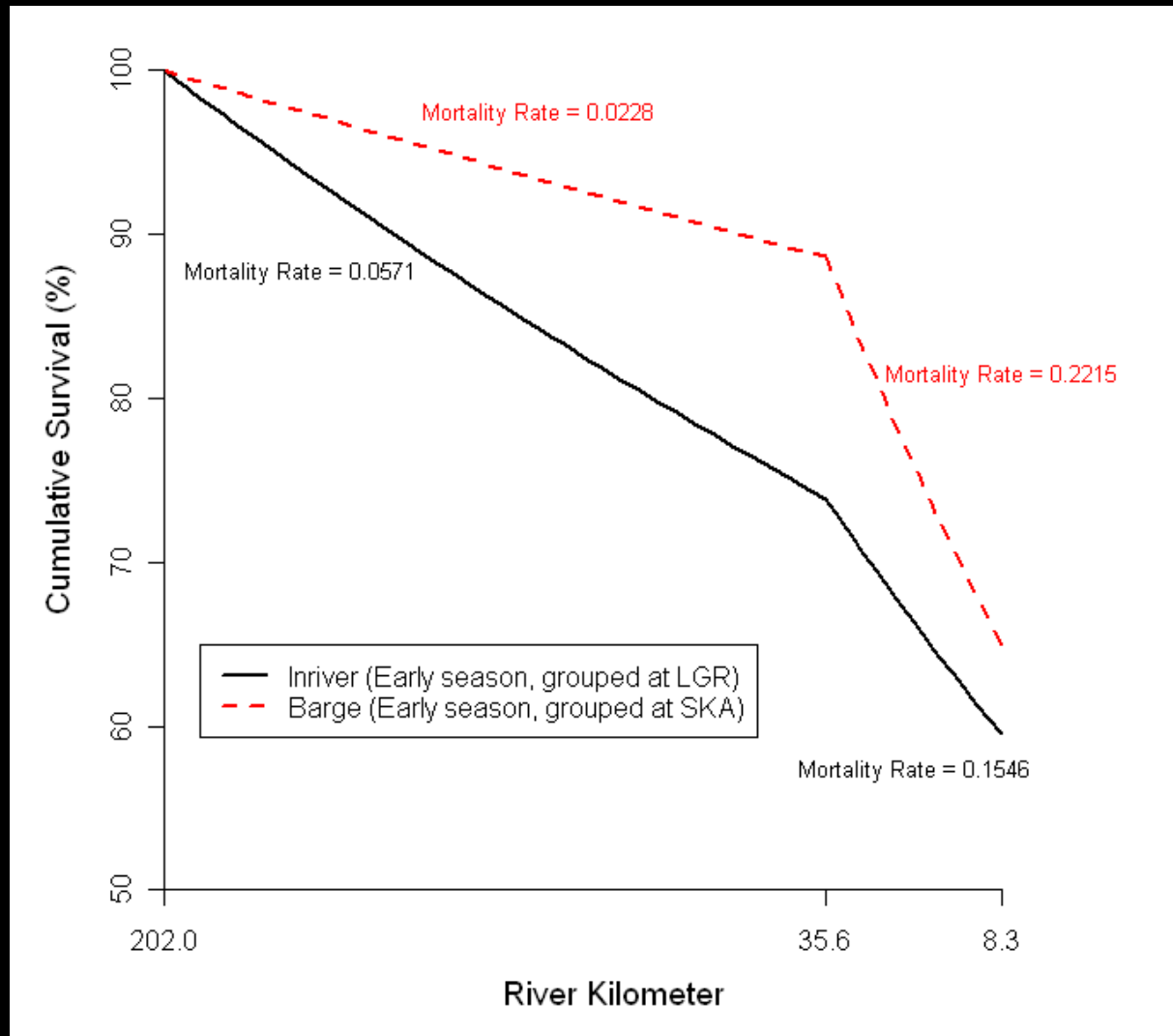
Survival of In-River and Barged Snake River spring/summer Chinook from Bonneville Dam to East Sand Island



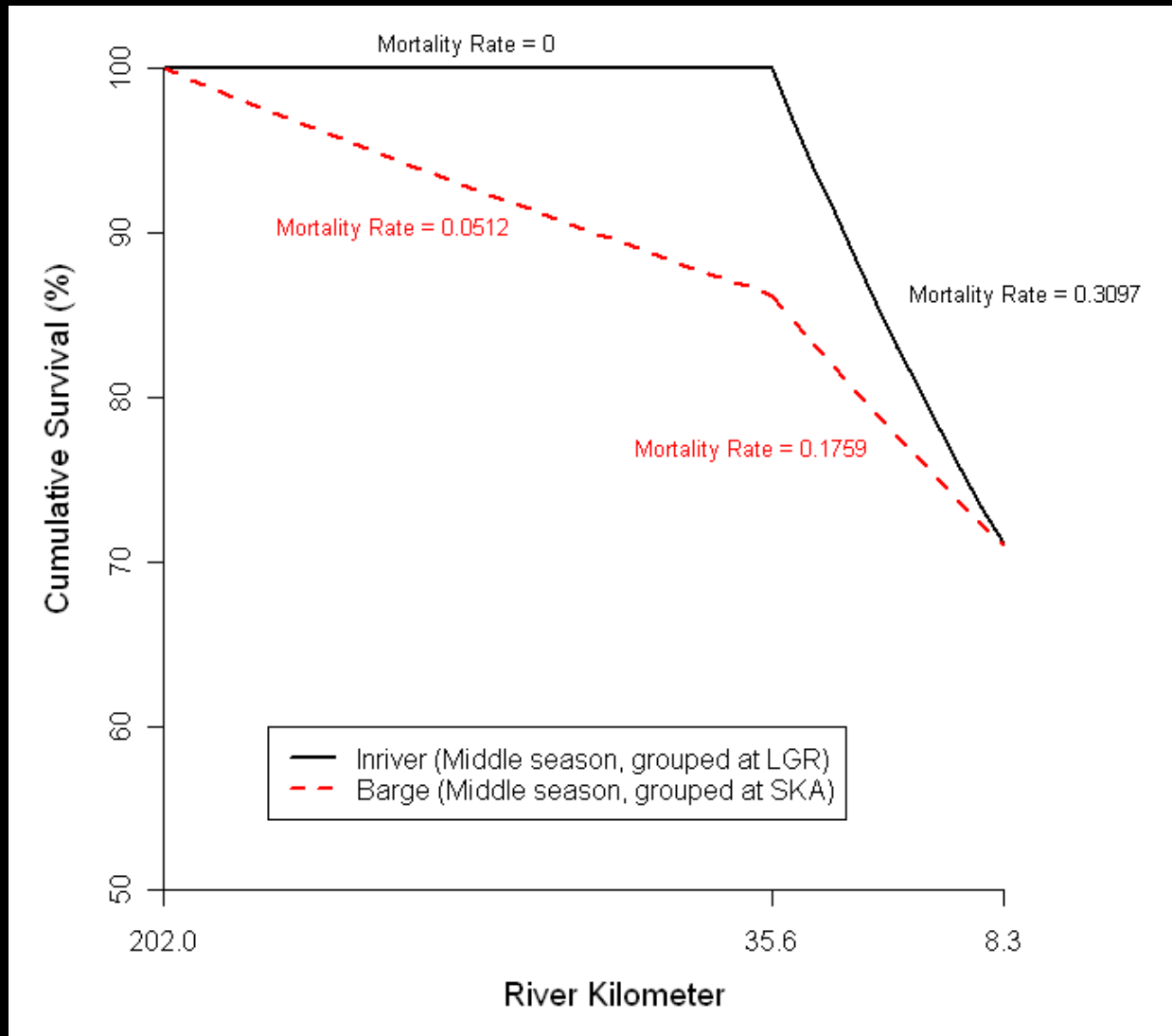
Early, Middle, and Late Designations

- Based on passage at LGR
- Early
 - Before 5/4/08
- Middle
 - Between 5/4/08 and 5/15/08
- Late
 - After 5/15/08

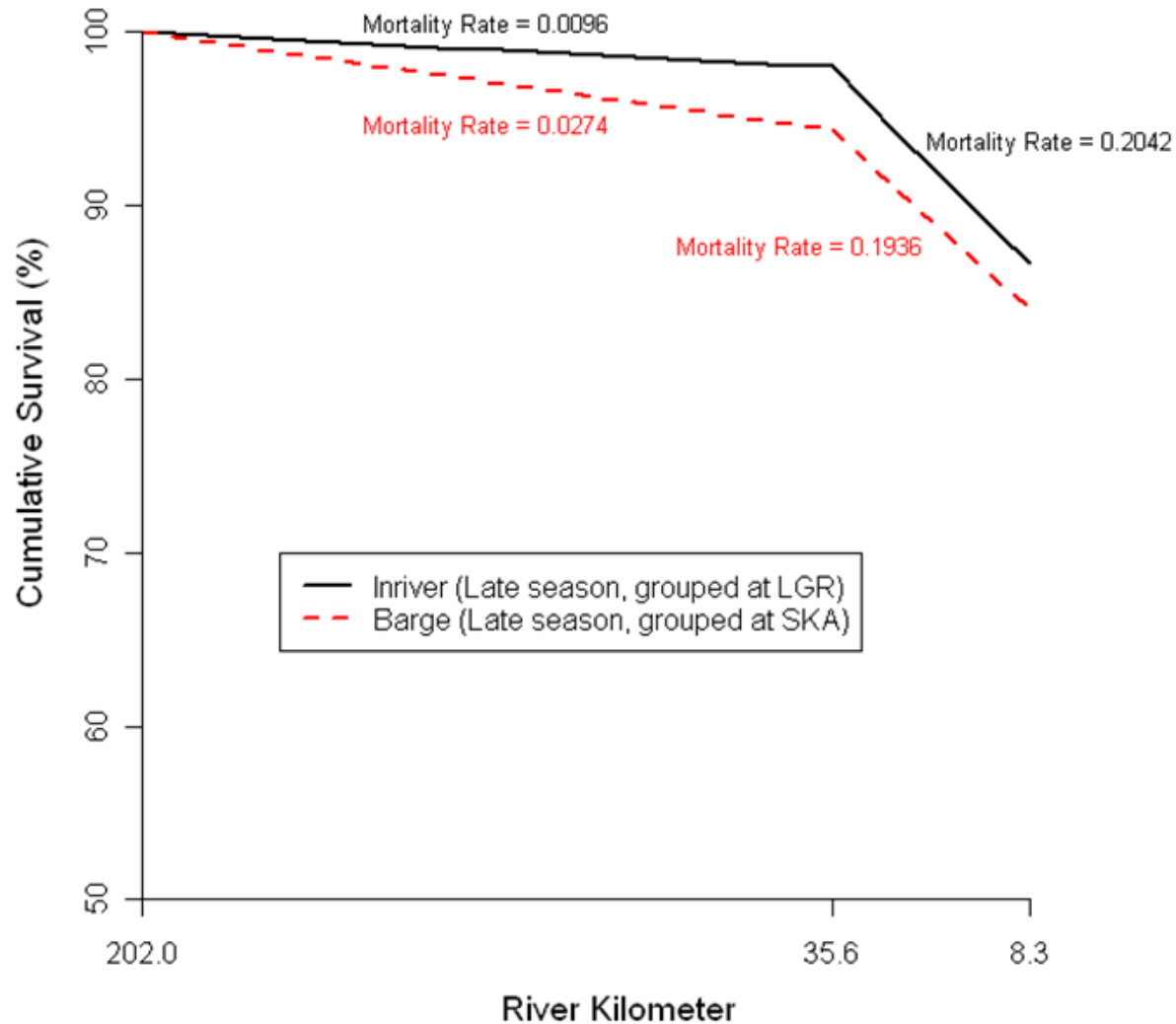
Cumulative Mortality of Early In-River and Barged Salmon



Cumulative Mortality of Middle In-River and Barged Salmon



Cumulative Mortality Late In-River and Barged Salmon



Differential Delayed Mortality Based on AT Survival Fractions

| Season | Upriver | | Downriver | |
|---------------|---------------------------|----------------|---------------------------|----------------|
| | Survival ratio | P-value | Survival Ratio | P-value |
| Early | 0.9805 | 0.3905 | 0.7862 | 0.0029 |
| Middle | 0.8598 | 0.0007 | 0.9445 | 0.2159 |
| Late | 0.9569 | 0.2197 | 0.9791 | 0.3647 |

Differential Delayed Mortality Based on AT Survival Rates

| Season | Upriver | | Downriver | |
|--------|--------------|---------|--------------|---------|
| | Hazard ratio | P-value | Hazard ratio | P-value |
| Early | 0.3988 | 0.9936 | 1.4332 | 0.2800 |
| Middle | NA | NA | 0.5680 | 0.9693 |
| Late | 2.8732 | 0.4056 | 0.9483 | 0.5411 |

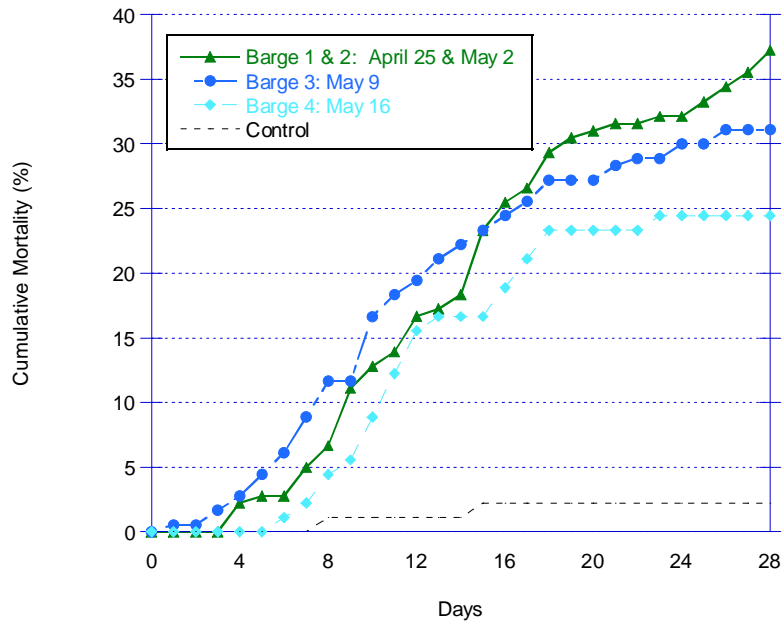
Overview of Estuary Net Pens 2008



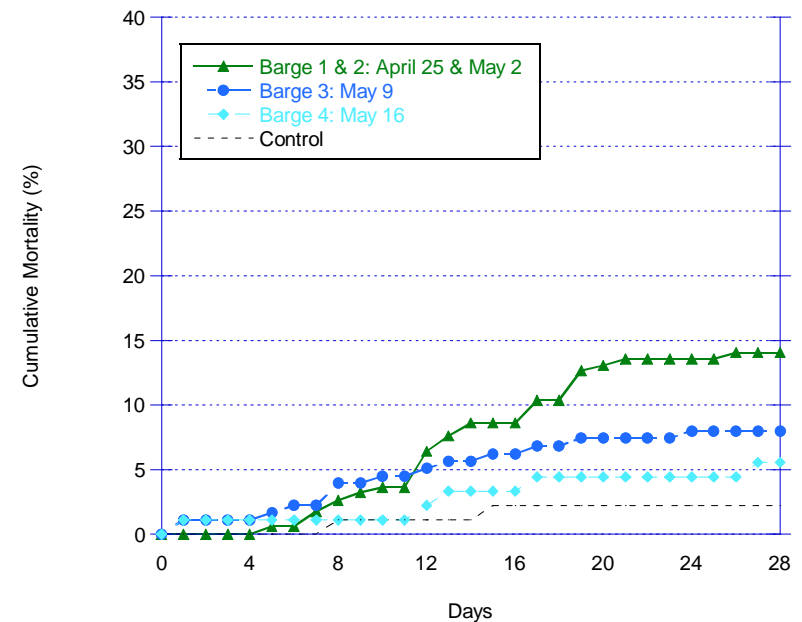
- Description:
 - 2 estuary net pen sites: 2008 - Tongue Pt. and East Sand Island
 - Barged and in-river fish placed in net pens
 - Fish held for 28 days
- Extent:
 - Mortalities collected daily
- Causes:
 - Histopathology
 - Pathogen prevalence

Preliminary Mortality of Barged Spring Chinook at Two Estuary Net Pen Sites: 2008

Tongue Point

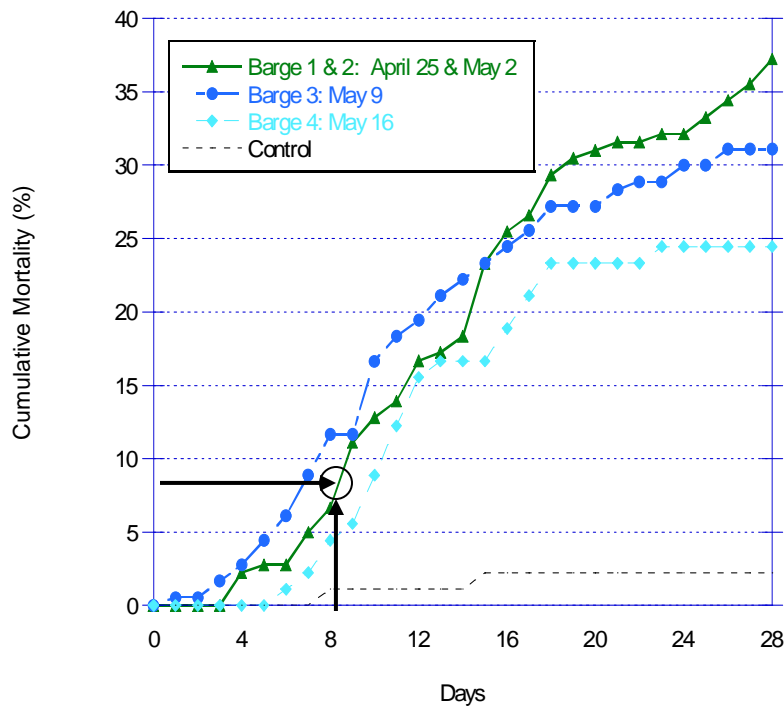


Sand Island

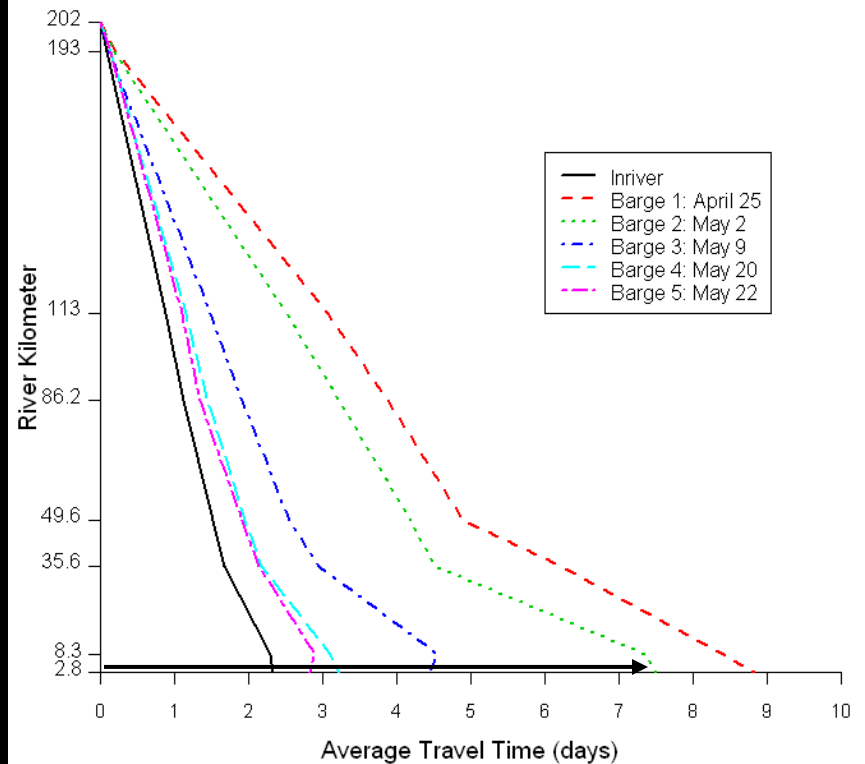


Estimation of Fraction of Total Mortality Observed in Barged AT Fish that was Captured in Estuary Net Pens

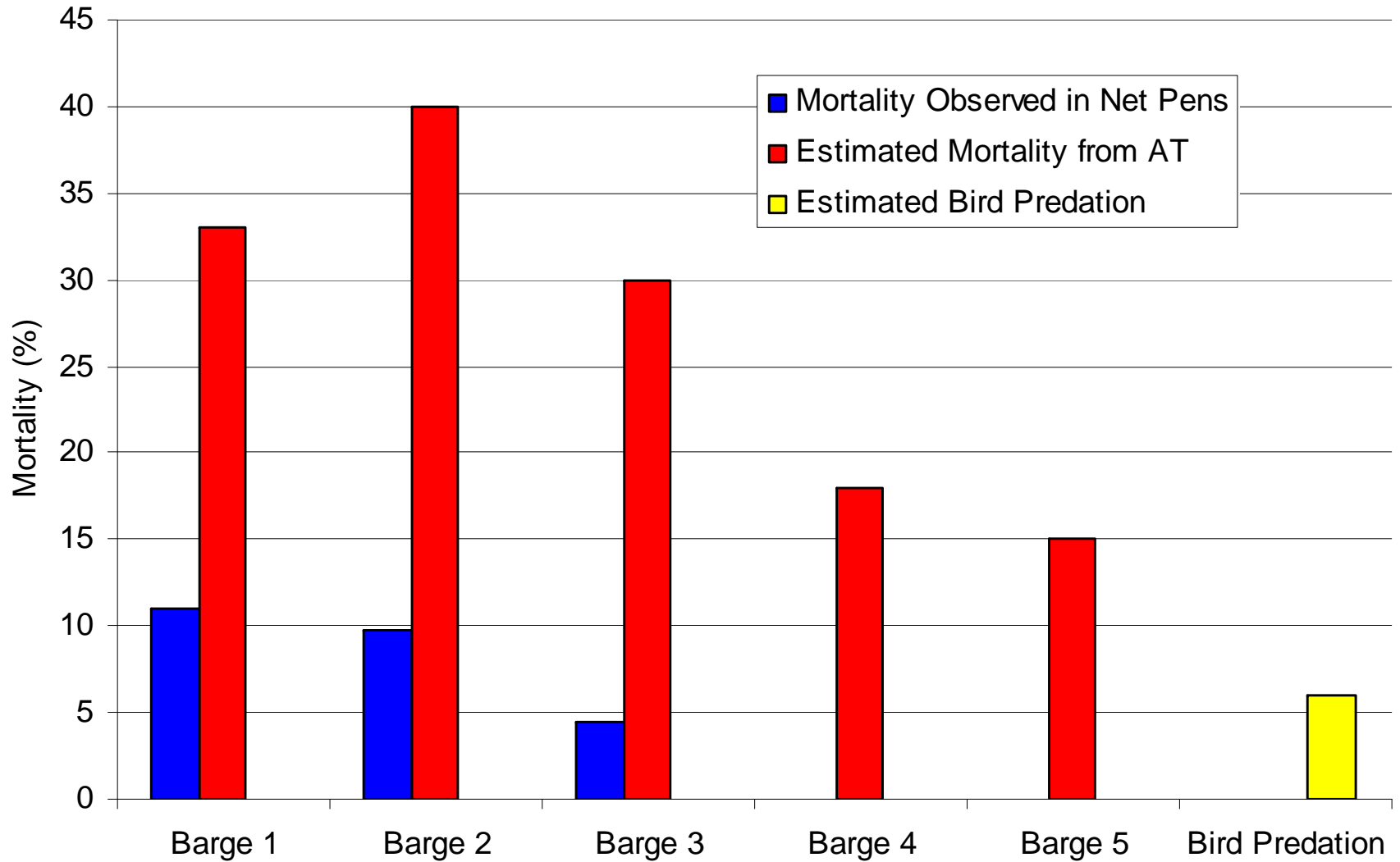
Tongue Point



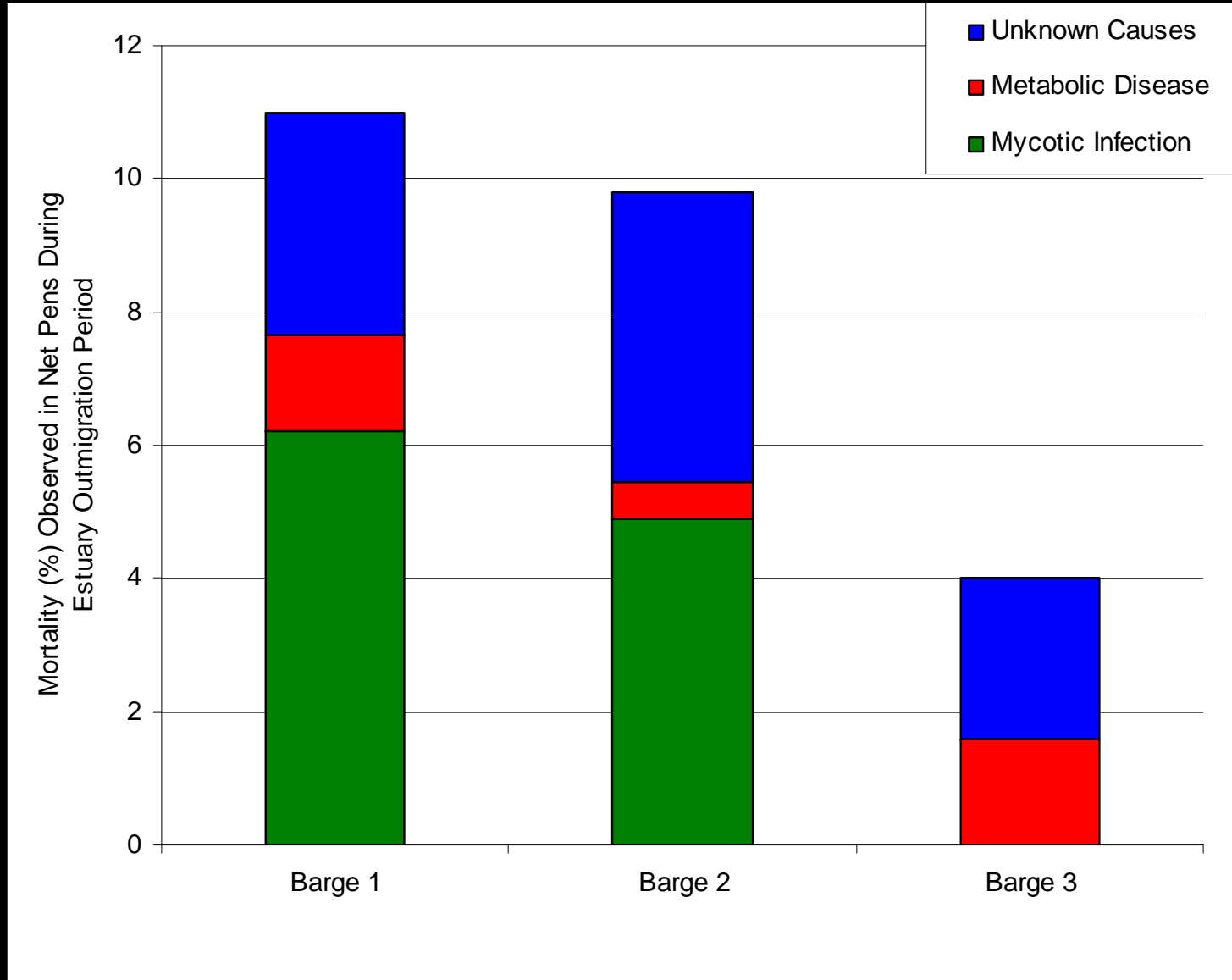
Cumulative Travel Time



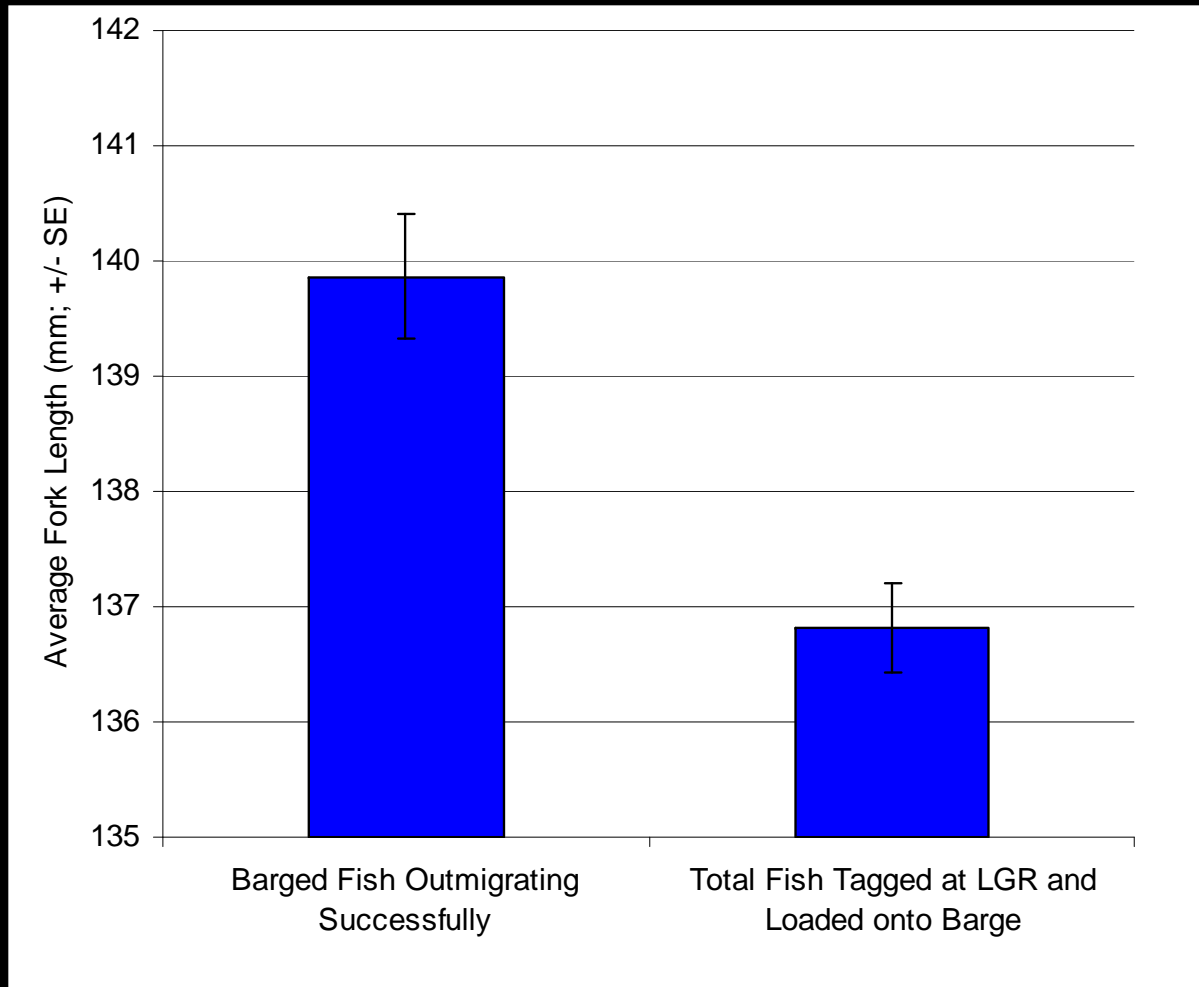
Comparison of Mortality in Net Pens with Actual Mortality in the Lower River and Estuary



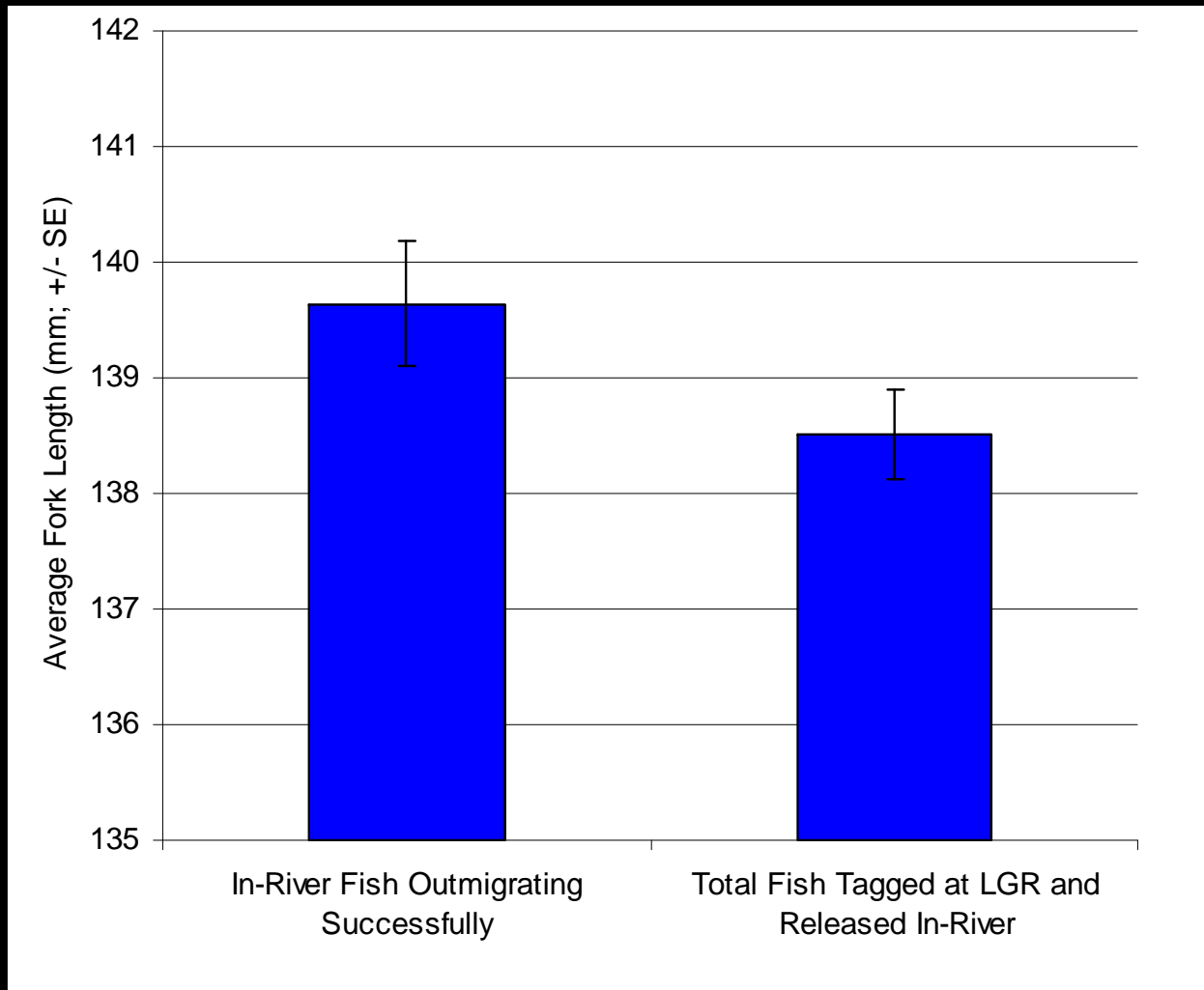
Preliminary Health-Related Causes of Mortality in Barged Fish in Estuary Net Pens



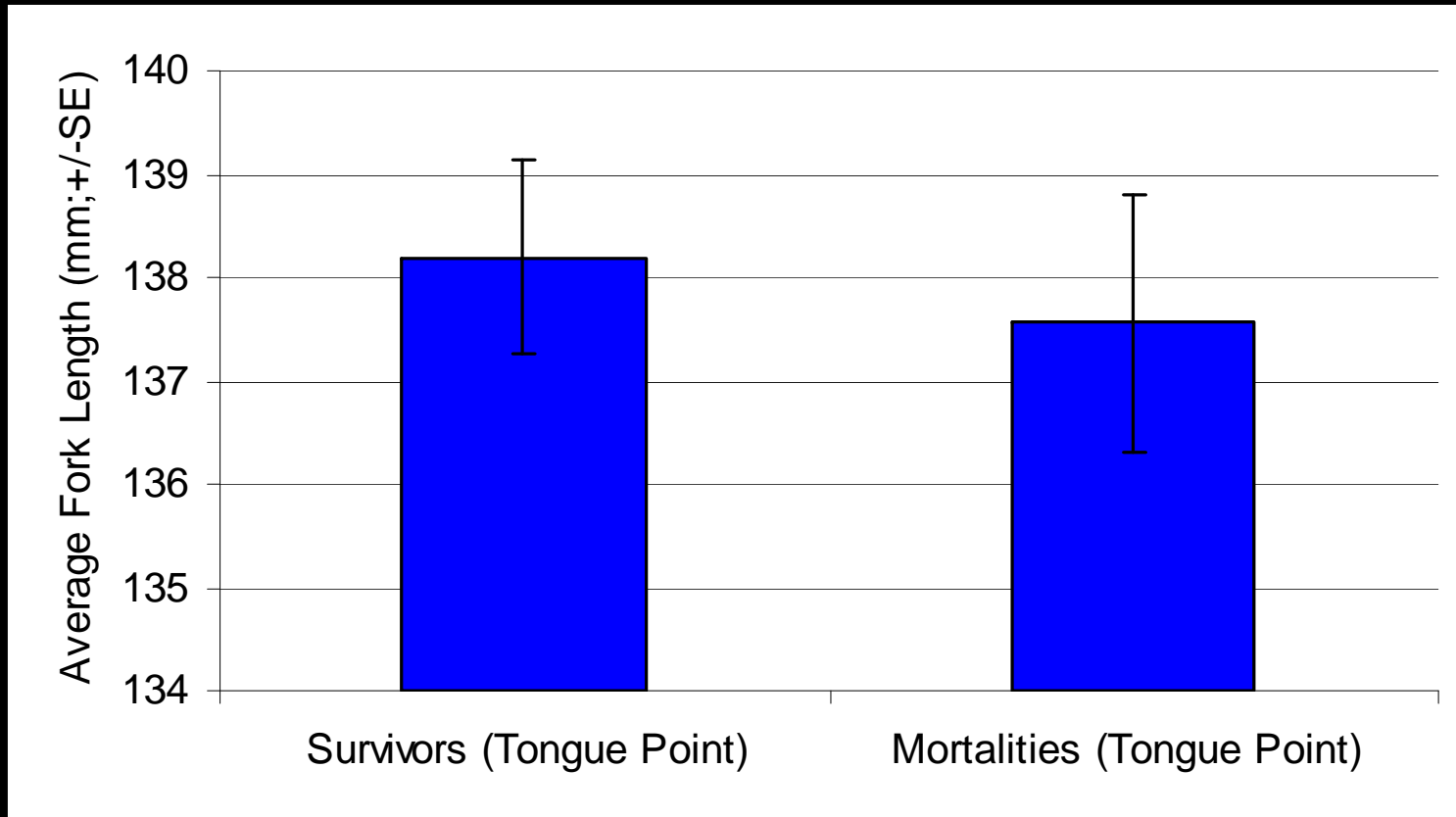
Comparison of Barge Fish Length at LGR and Outmigration Success



Comparison of In-River Fish Length at LGR and Outmigration Success



Fork Length Comparison of Fish Tagged at LGR in the Estuary Net Pens



Conclusions

- Travel time of barge fish in the lower river and estuary decreases over the outmigration season
- Mortality of both barged and in-river fish is greatest in the last 36 km of the estuary
- Mortality of barged fish is greater than in-river fish in the lower river and estuary, with statistically significant differences in differential mortality the last 36 km early in the season
- Health related causes of mortality may account for up to 1/3 of the overall mortality of barged fish in the lower river and estuary early in the season
- Size dependent mortality apparent in the river and estuary may be occurring in the estuary net pens

Acknowledgments

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Questions

