

**Evaluation of juvenile salmon passage
conditions at temporary spillway weirs at
McNary Dam:**

**Measuring the potential for injury with a
head trauma biomarker**

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December 4, 2007**

The Objective

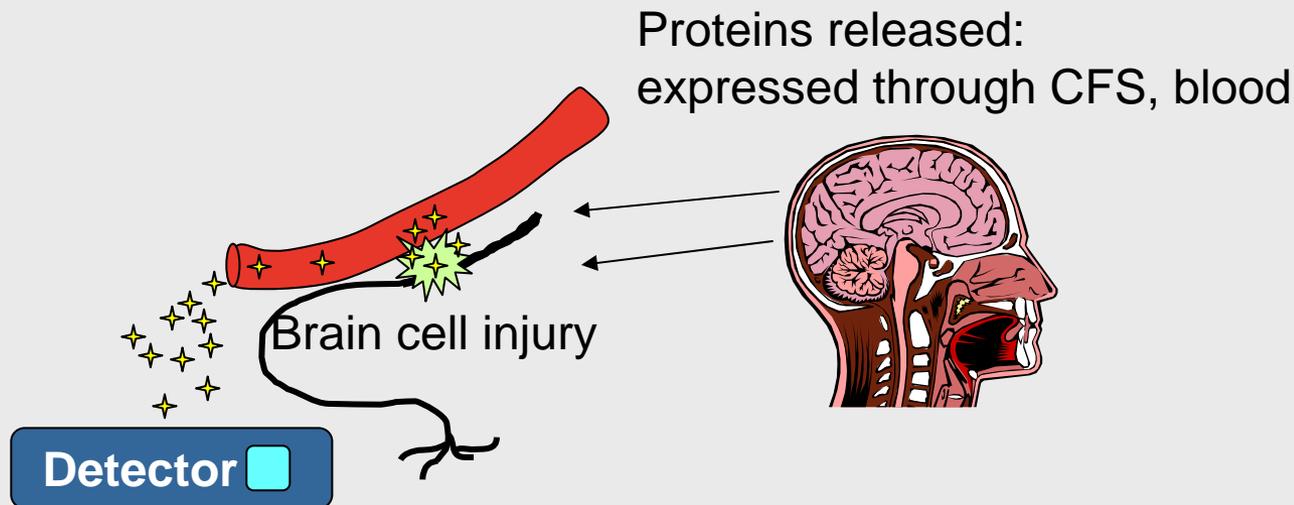
- ▶ Efficacy of TSWs for safe fish passage
- ▶ Comparison of potential injury between:
 - Spillway
 - TSWs

- ▶ Three methods
 - Balloon tag
 - Sensor fish
 - Brain injury biomarker

Biomarker = A biological measure that serves as a diagnostic indicator of condition or exposure

biomarker for assessing sub-acute injury

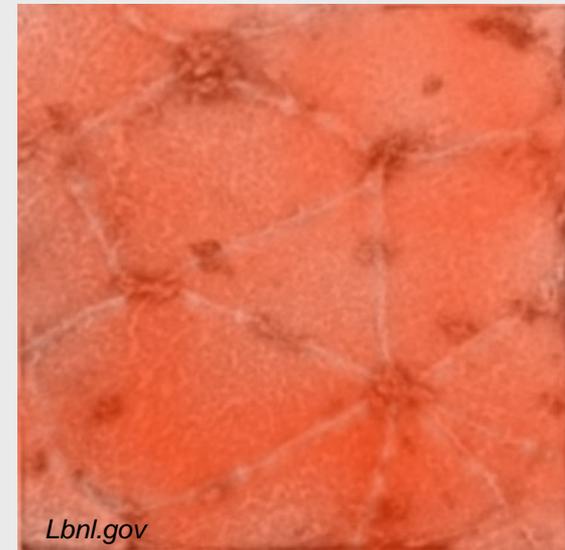
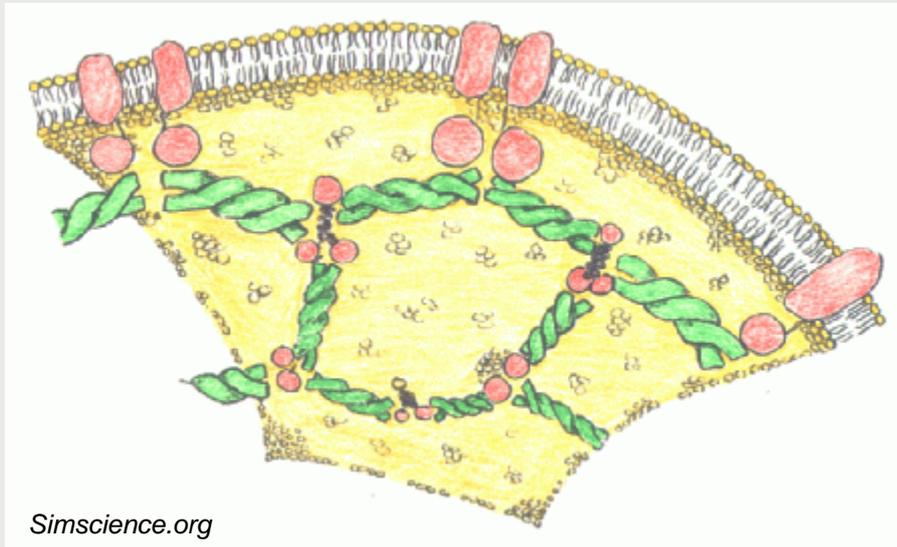
Candidate biomarker for human TBI



The Biomarker

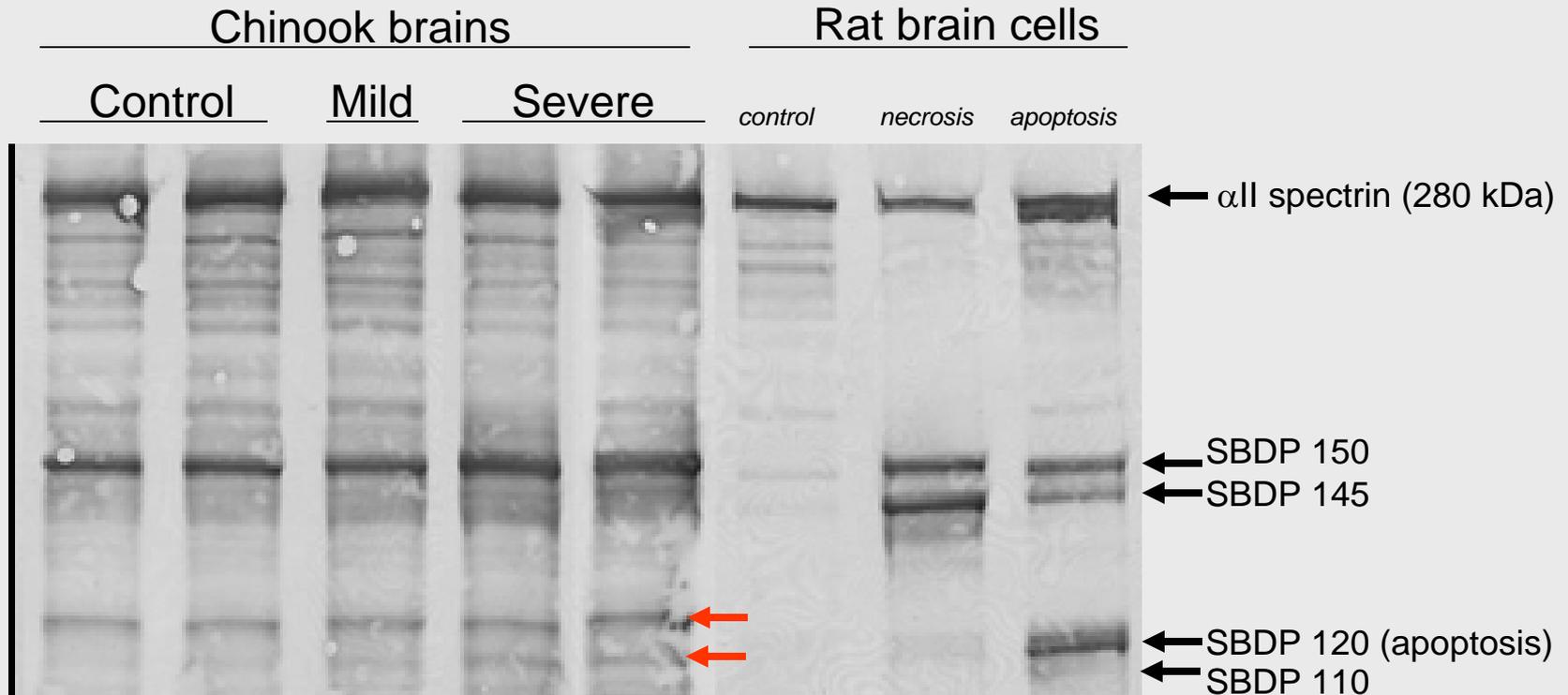
Alpha-II spectrin

- membrane cytoskeletal protein



- breakdown products are candidate surrogate markers of injury magnitude and outcome

The Biomarker in Fish



Testing the antibody for cross-reactivity in salmon

The Study

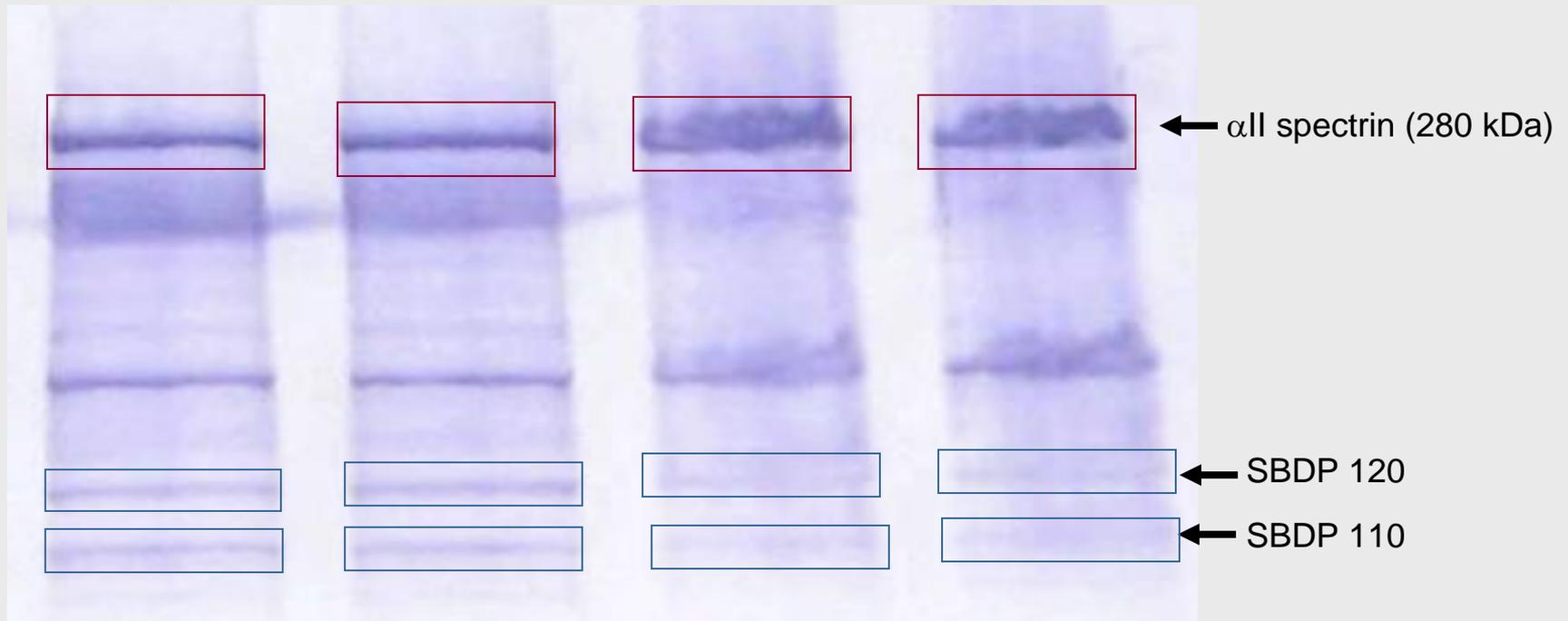
- ▶ 20-30 fish for each release type
 - Bypass control
 - TSW1 shallow and deep
 - TSW2 shallow and deep
 - SB21 shallow and deep
 - SB22 shallow and deep

- ▶ Collected blood and brain tissue following balloon-tag 48 hr observation

Protein Isolation and Western Blot

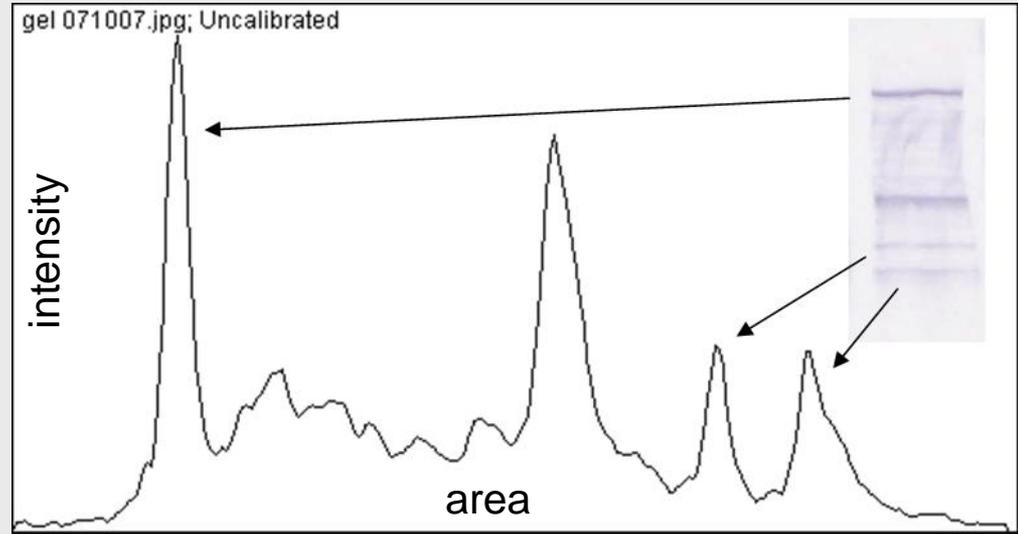
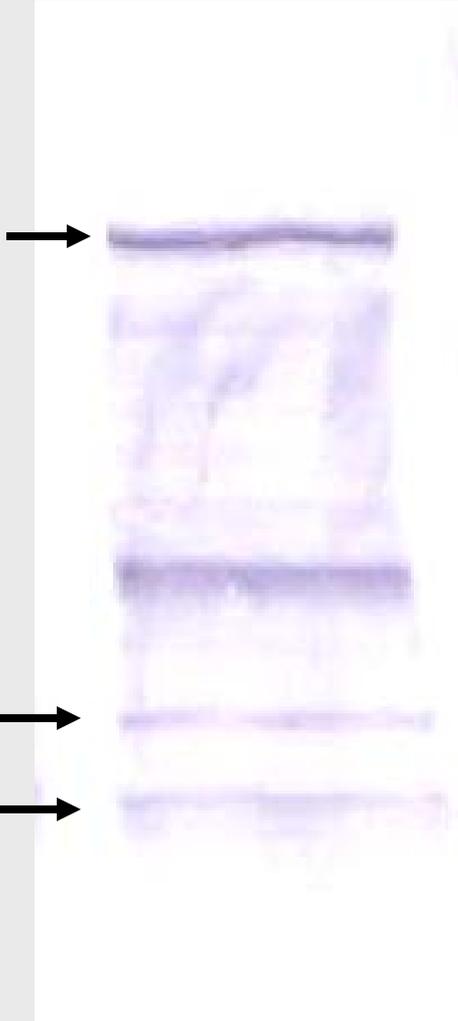
- ▶ Total brain tissue homogenization
- ▶ 20 μg total protein separations
- ▶ Western blot using biotinylated primary antibody with secondary detection via chromagen
- ▶ Digital images analyzed using ImageJ for densitometry of bands

Differential Biomarker Expression



Calculating Densities

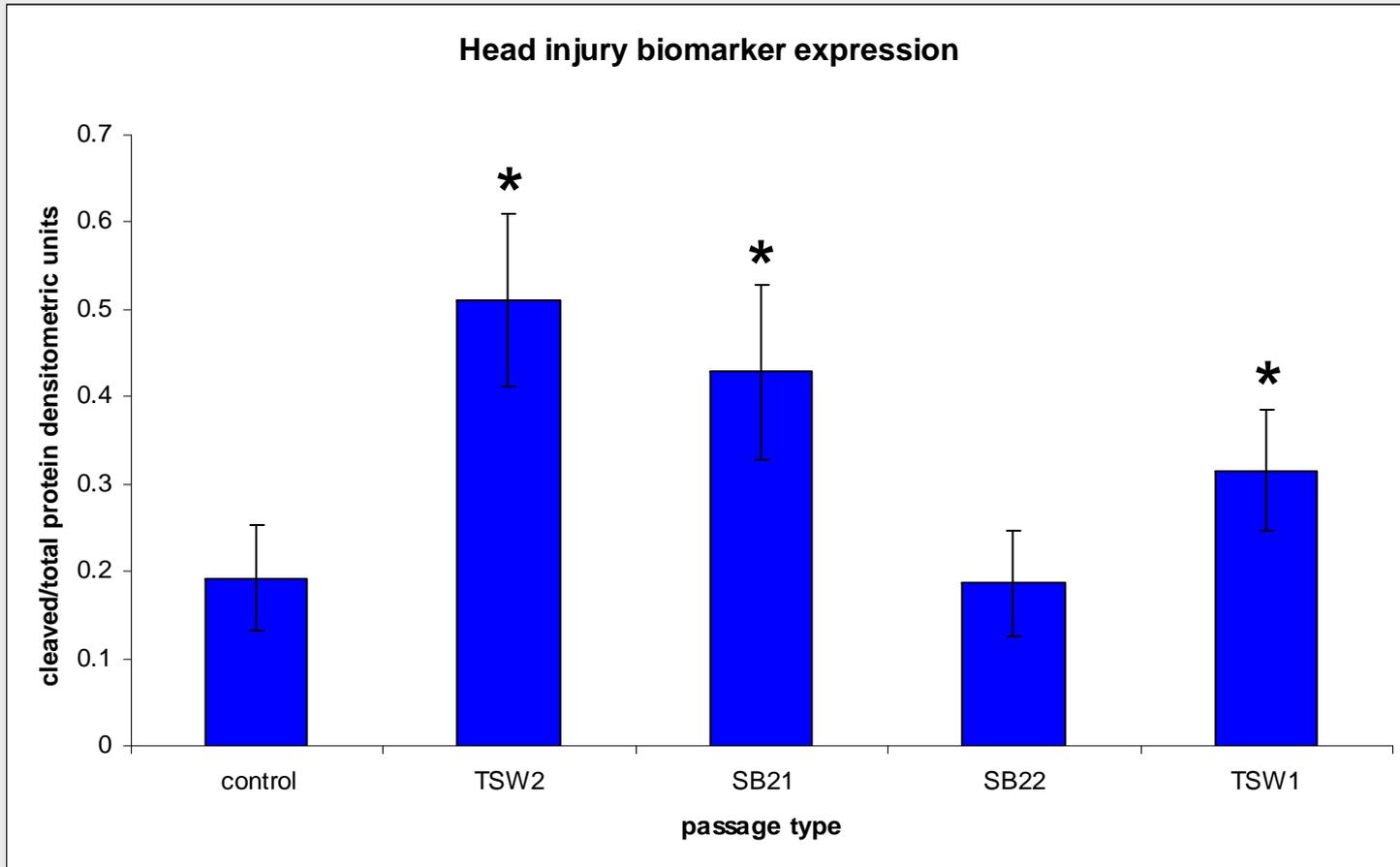
Intact 280 kDa
 α II spectrin



Biomarker expression =

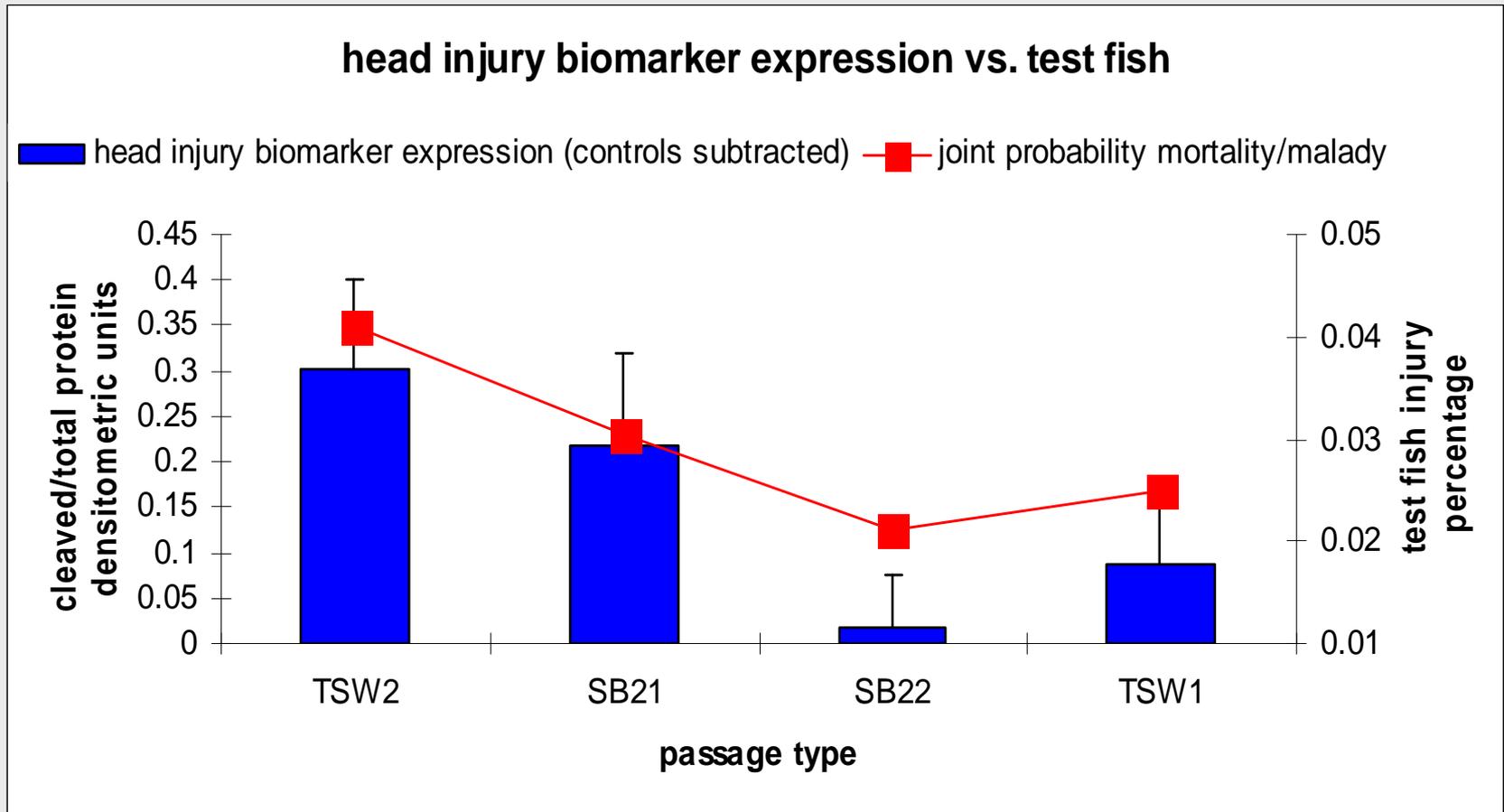
$$\frac{\text{SBDP 120} + \text{SBDP 110}}{280 + \text{SBDP 120} + \text{SBDP 110}}$$

Biomarker Expression Significance



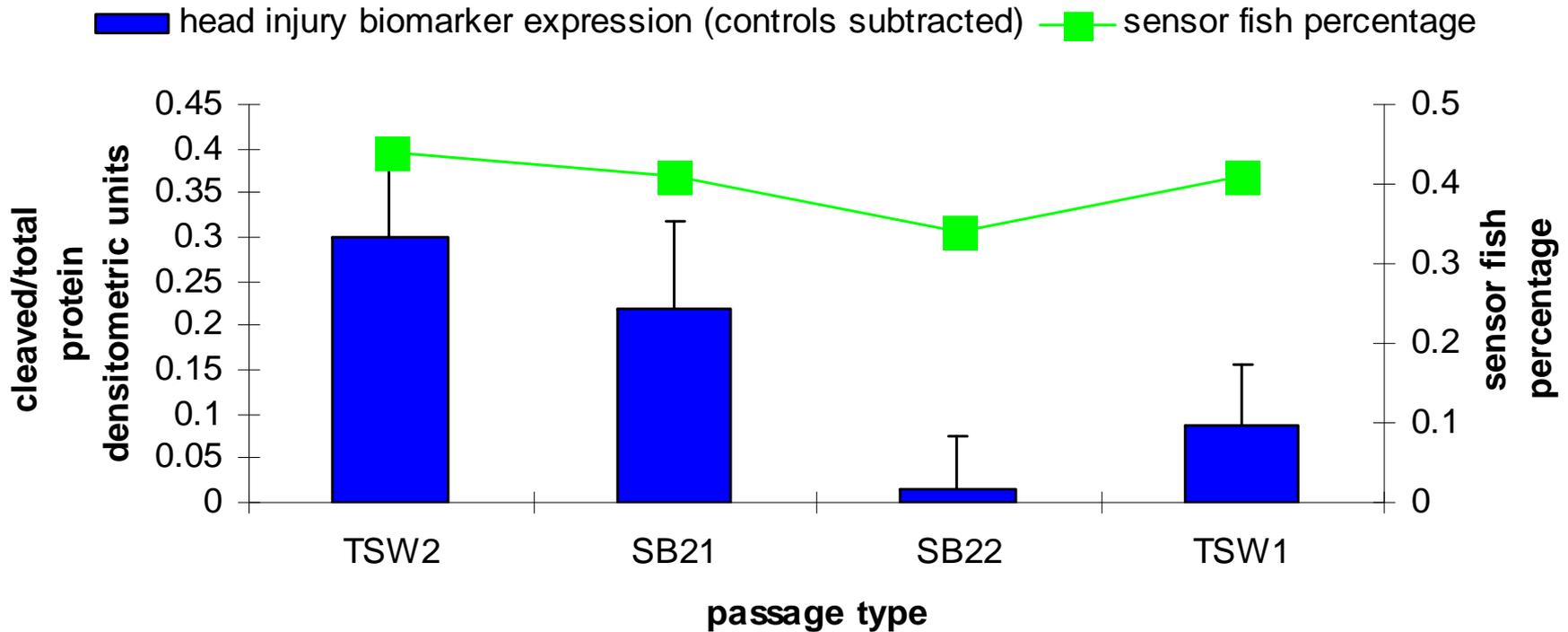
* $p < 0.001, n = 19, 20$

Comparison with Balloon Tag Study



Comparison with Sensor Fish

head injury biomarker expression vs. sensor fish



Includes tailrace events, significant acceleration magnitude

Conclusions

- ▶ SBDP expression for brain injury correlates with decrease in observed mortality/malady and sensor fish magnitude for SB22 and TSW1 compared to other SB and TSW2.
- ▶ Biomarker data reflects injury only at 48 hours
 - Metric can be tested earlier
 - Hold fish longer to assess survival or persistence of expression
- ▶ Value
 - Shows promise for assessing optimal passage conditions
 - Potential for detection in blood; non-lethal sampling

Thanks to....

- ▶ Matt Bleich
- ▶ Nate Phillips
- ▶ Joanne Duncan



- ▶ Paul Heisy
- ▶ Steve Adams



- ▶ Ann Setter

