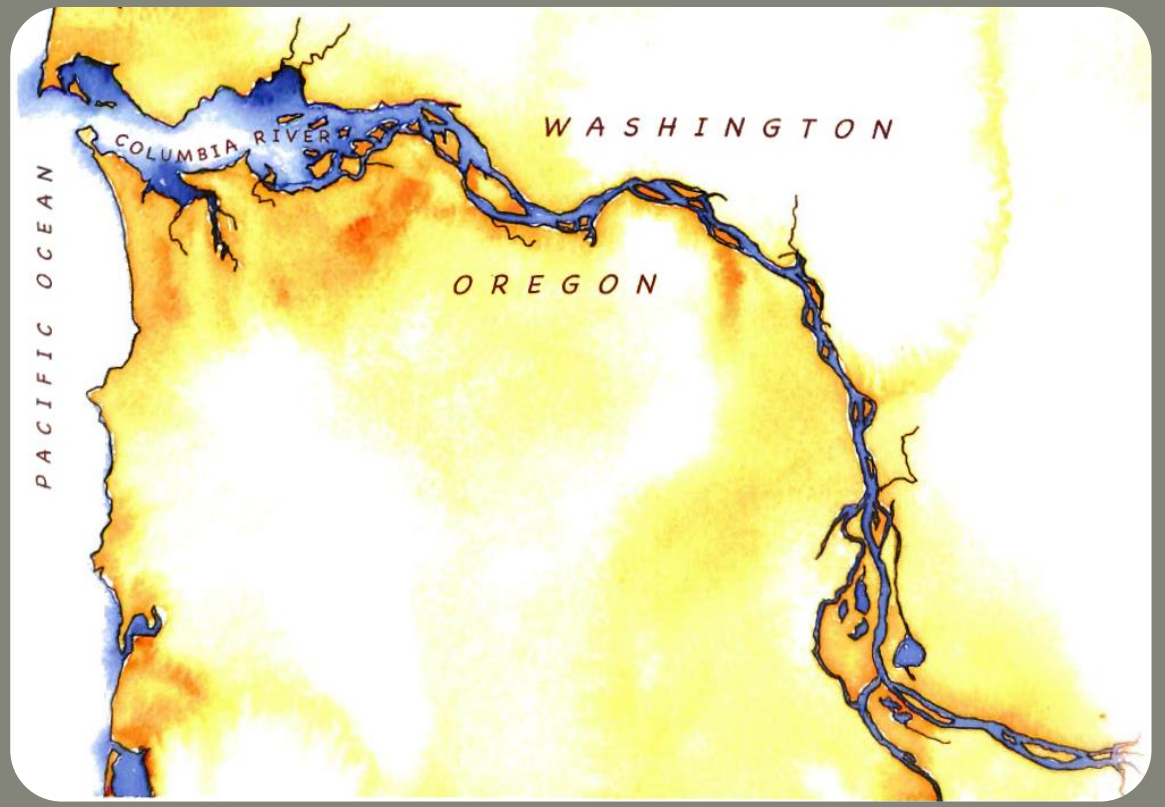
Diagnosing Problem Areas of the Lower Columbia River Federal Navigation Project.



WEDA Pacific 2018

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USACE Portland District
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Portland District

U.S.ARMY

INTRODUCTION

Objective

- Why does shoaling occur?
- How does shoaling change as a function of dominant forcing mechanisms?

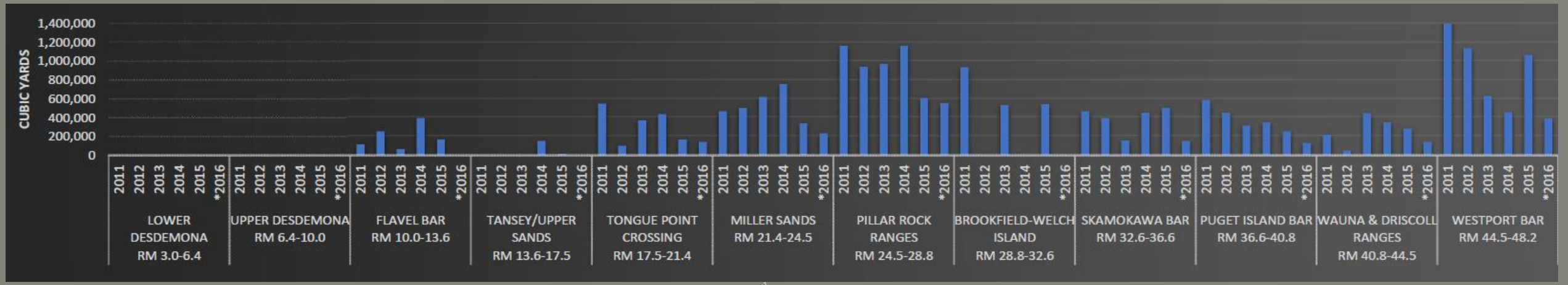
Purpose

- Provide guidance for dredging operations.
- Support future planning placement capacity.

→ **DMMP**

Introduction
Maintaining the Channel

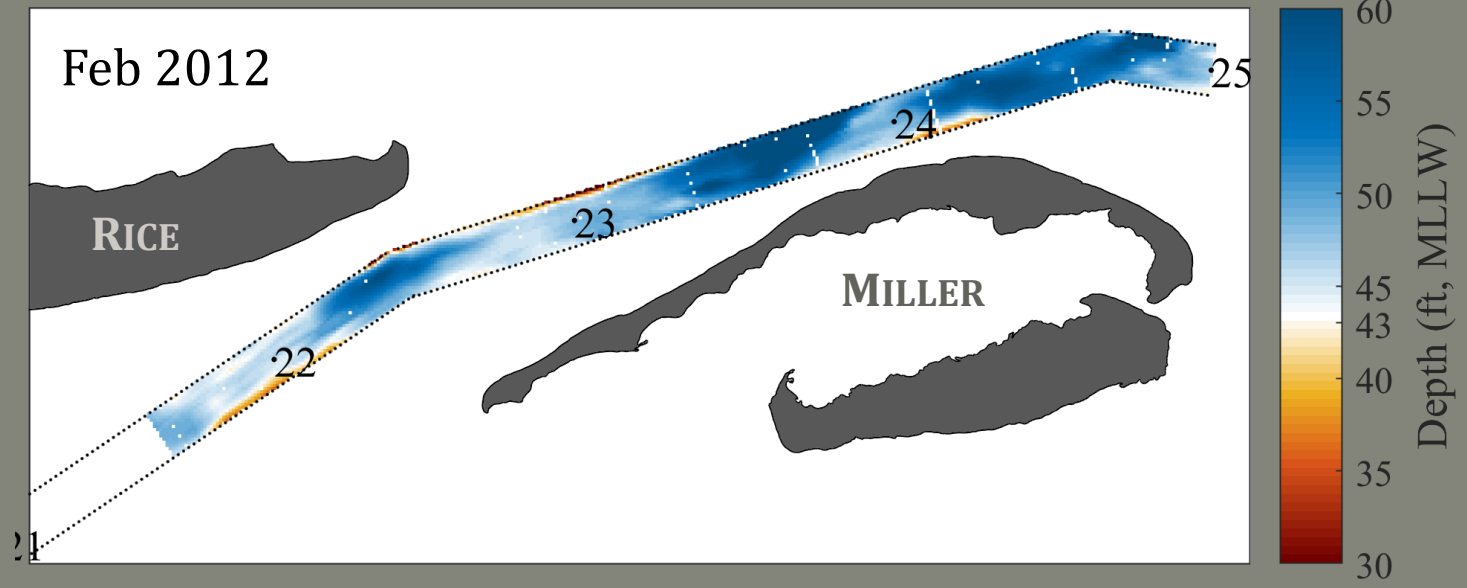
- Miller-Pillar (RM 21-29)
- We dredge here a lot!
- Full project is 6-8mcy
- This reach often more than 1mcy

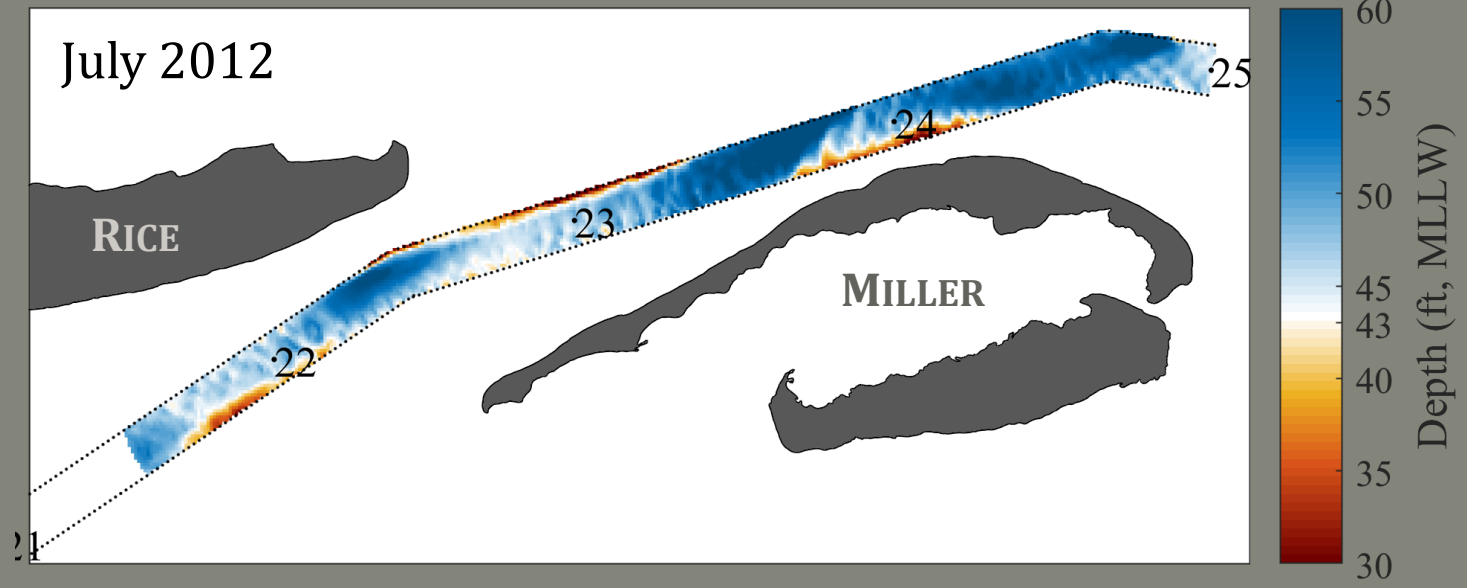


Introduction
Shoaling Patterns

- Dredge sand waves and fatty shoals

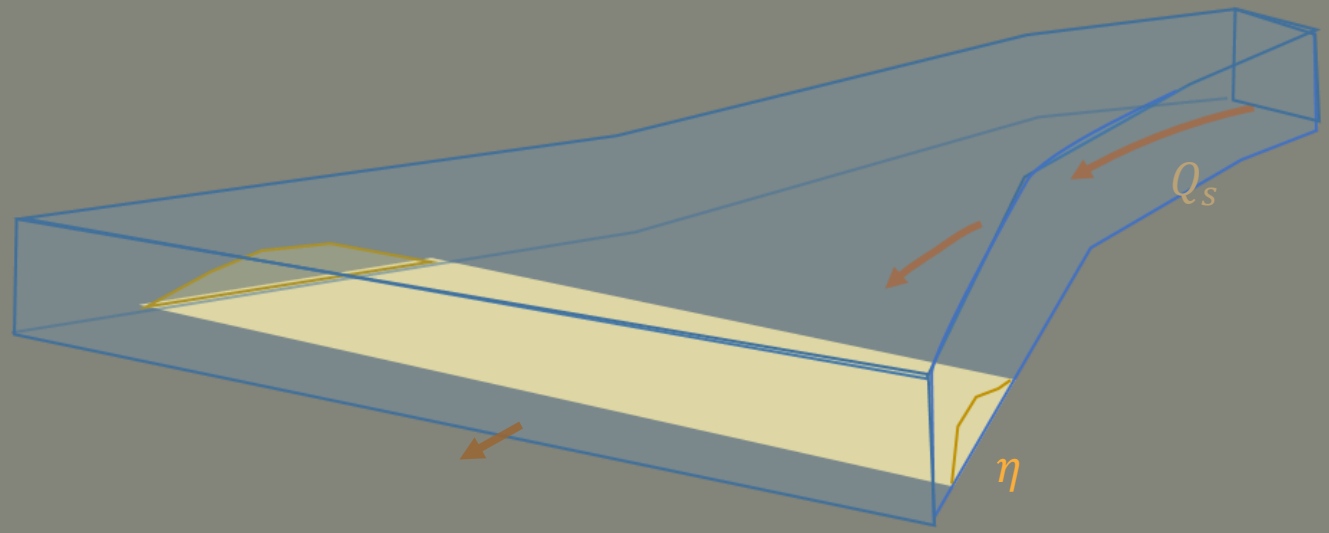
- 2012: net accumulation 287kcy over 5 months





WHY IS THERE SHOALING?

$$\frac{\partial \eta}{\partial t} = -\frac{1}{C_{bed}}\left[\frac{\partial V_s}{\partial t} + \nabla \cdot Q_s\right]$$



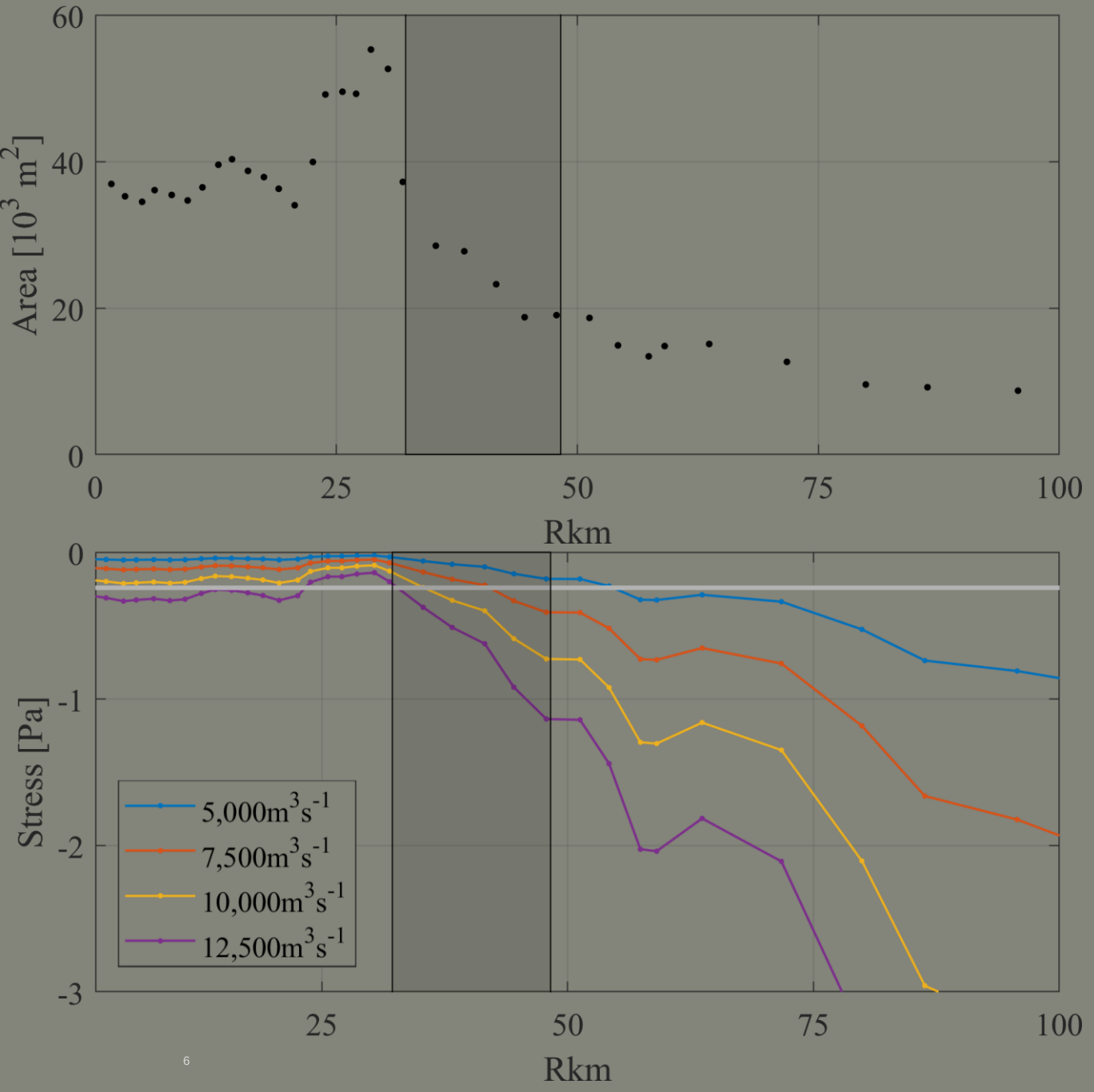
Changes in bed elevation = − Changes in water column concentration + Convergence of sediment fluxes

- Residual flow
- Tidal asymmetry

Why is There Shoaling?

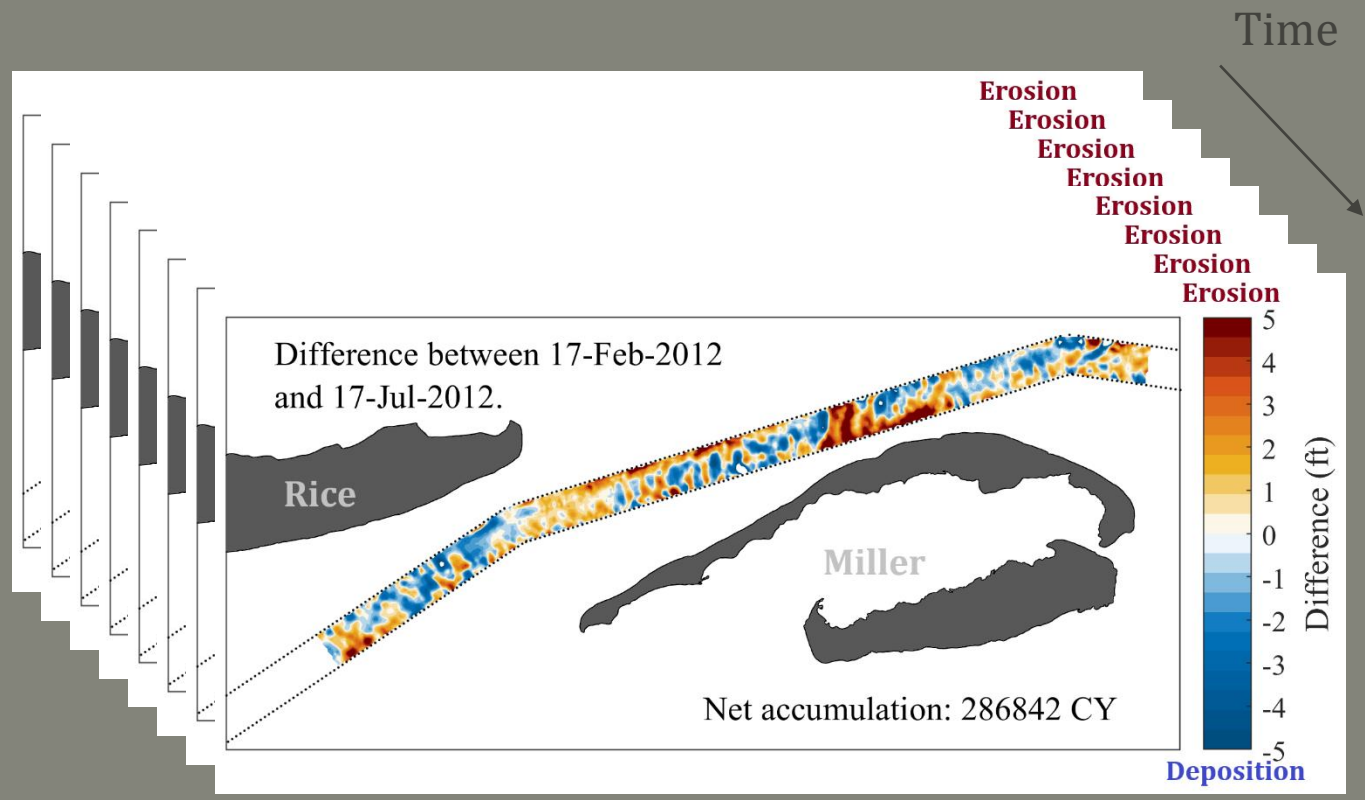
Hypothesis:

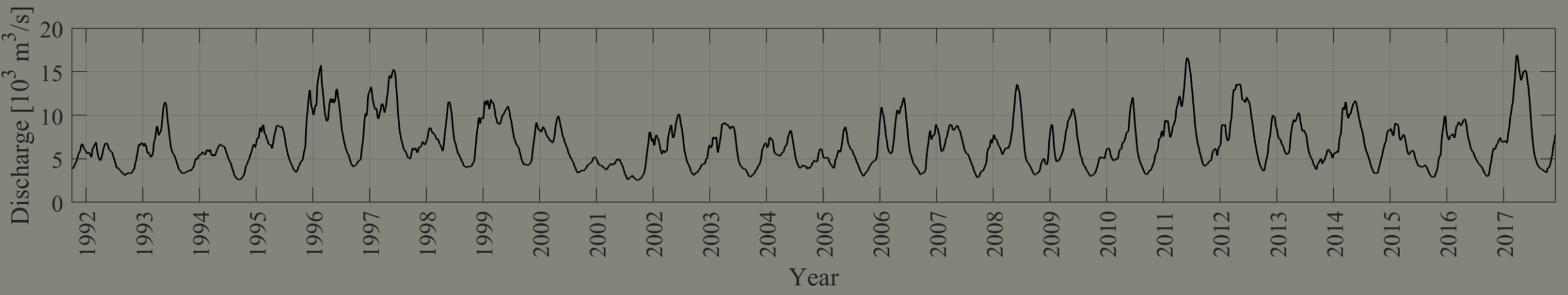
- **Expansion in cross section reduces bed stress → convergent sediment flux.**
- **Larger flows → more gradient in bed stress**
- **Should be able to predict shoaling with river flow**



Testing Hypothesis
Bathymetric Surveys

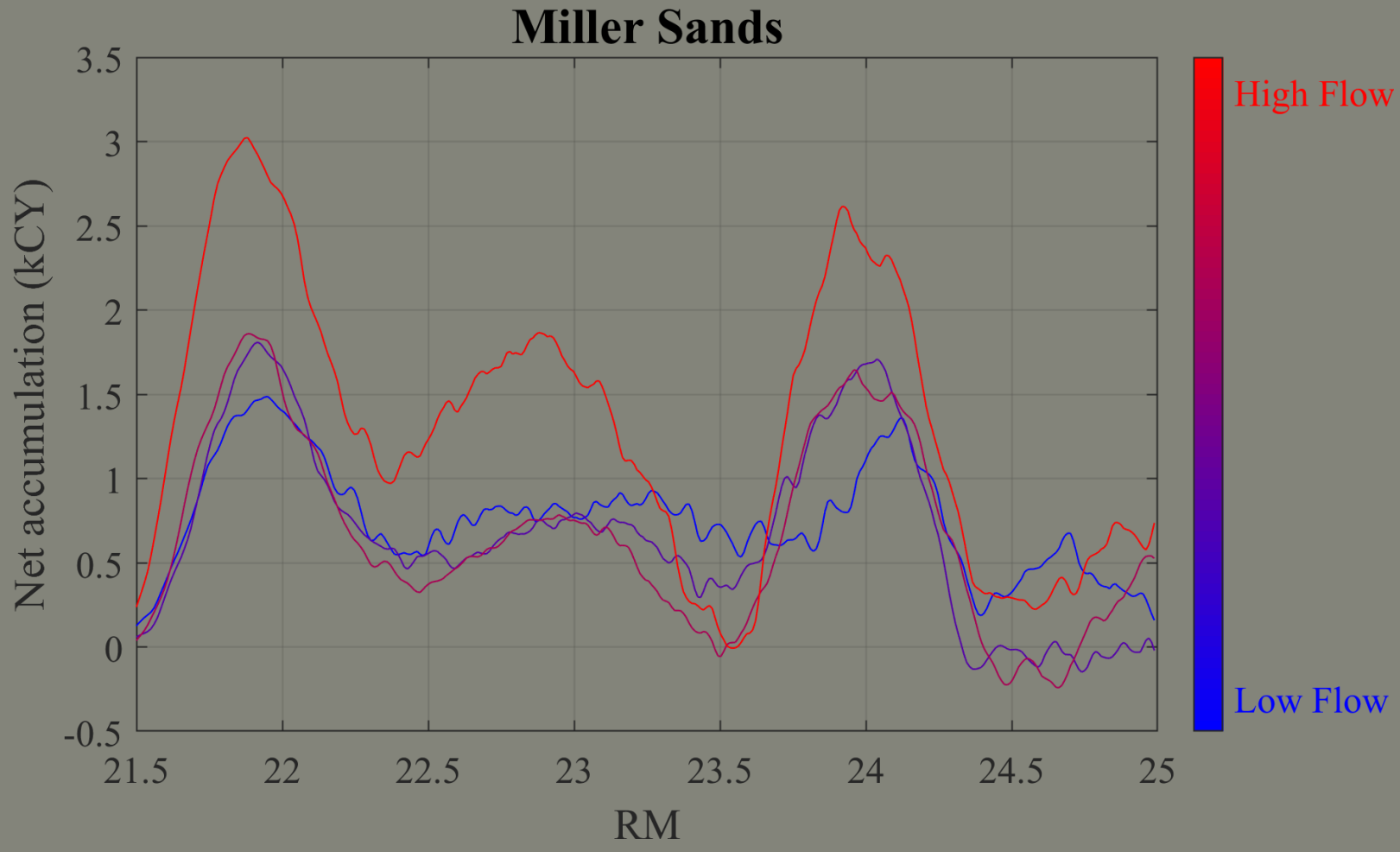
- **Calculate changes in bed elevation during winter and spring freshets**
- **Plot transect of shoaling**
- **Correlate shoaling with river flow**





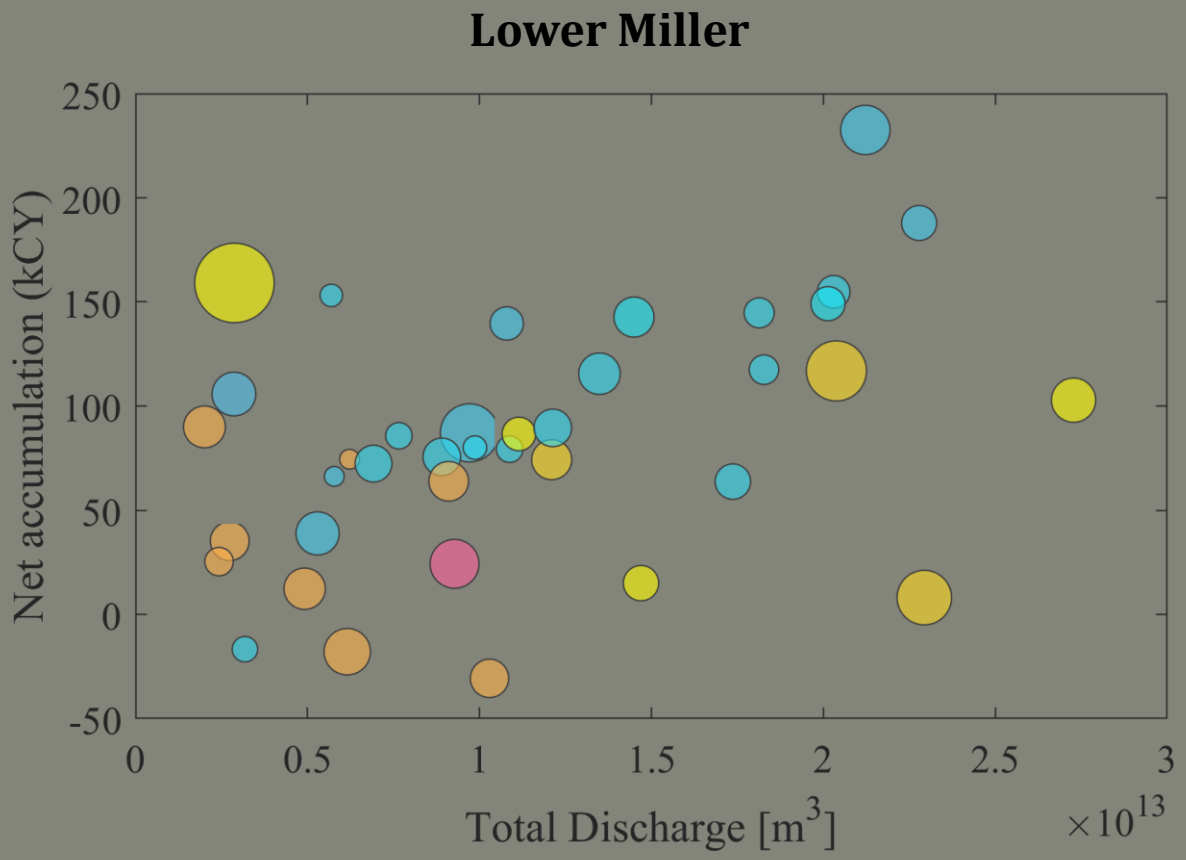
Testing Hypothesis
Bin-averaged transects

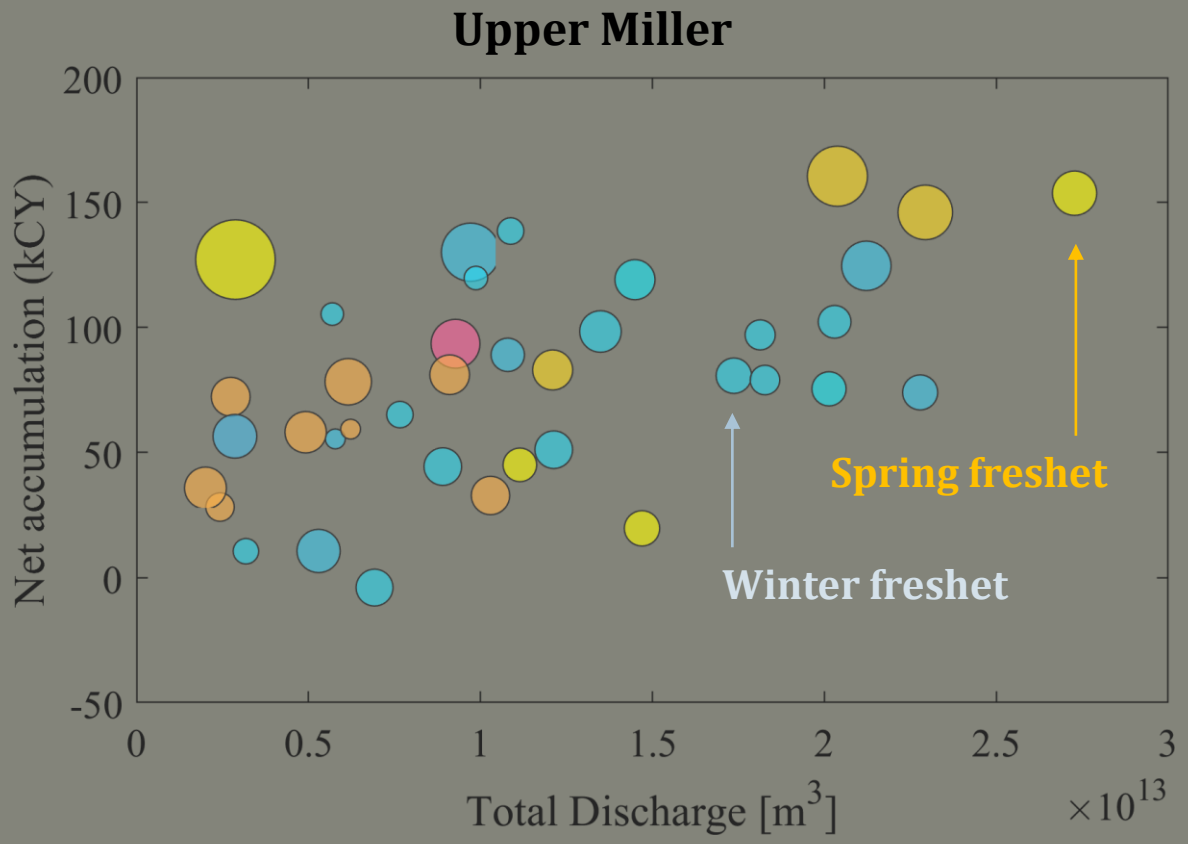
- **Shoaling transects bin-averaged according to integrated flow.**
- **High flows → more shoaling**
- **Each shoal responds differently**



Testing Hypothesis
Correlation Between Shoaling and River Flow

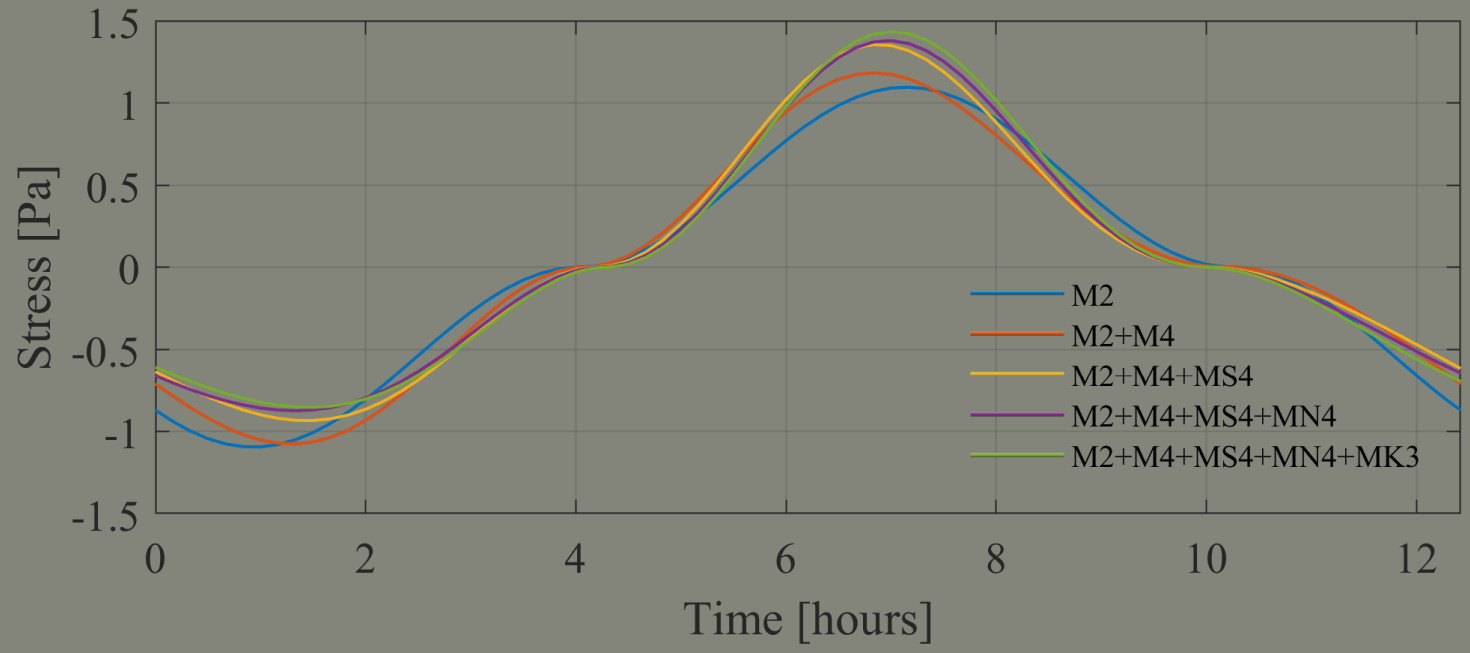
- **Correlation between shoaling and integrated flow**

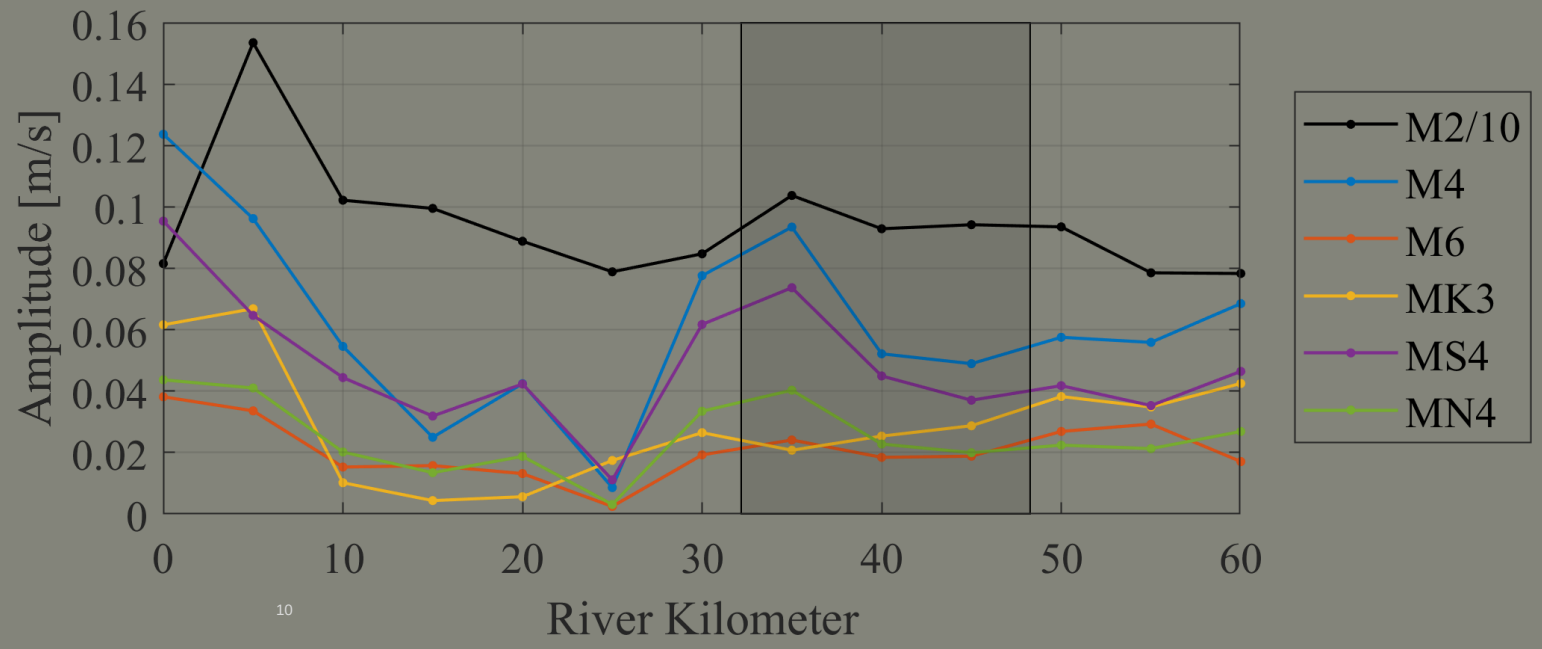




WHAT'S UP?

- **River flow is not full picture.**
- **Tidal asymmetry**
- **Lateral and local effects**



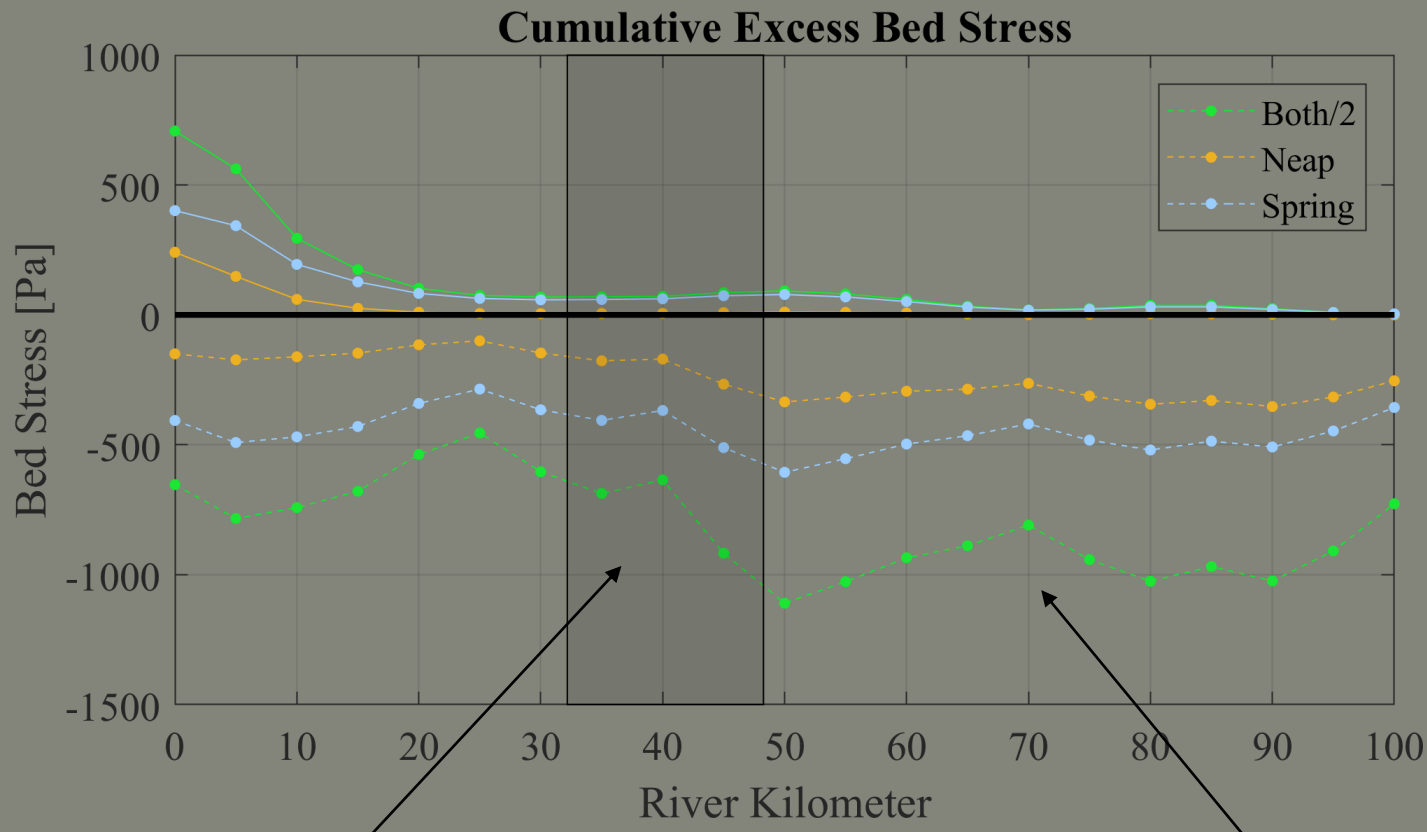


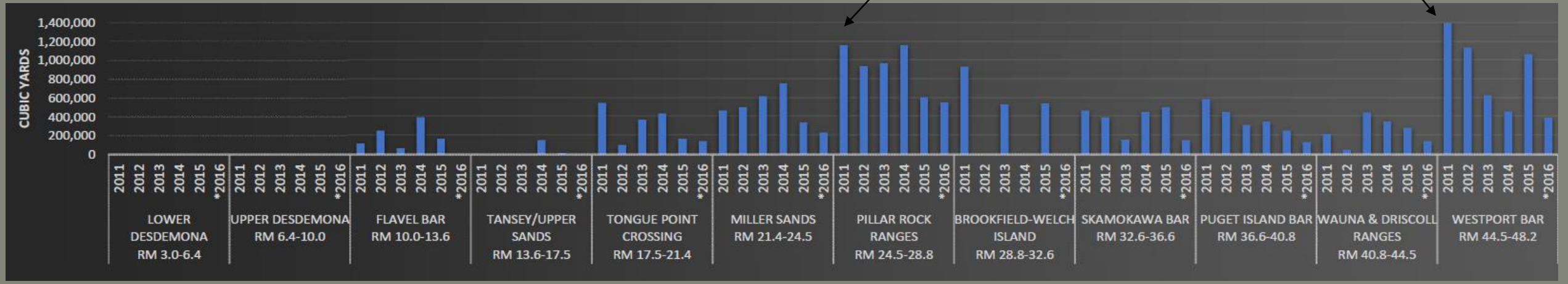
SUMMARY

- **We dredge a lot!**
- **Simple tools can prove to be useful in understanding complex processes**
- **River flow is first order process → shoaling (40-53% (70%) of variance)**
- **Tidal asymmetry appears to contribute to convergent sediment fluxes**
- **More to this problem**

Next Steps

- **Application to other reaches.**
- **Other stuff.**





THANKS!

- **WEDA**
- **NWP**
- **Alyssa Moore**
- **Lumas Helaire**

Questions?

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