

How Does Glacial Melt Influence Early Development of Kelp Communities in Kachemak Bay?

Sarah B Traiger

Brenda Konar

University of Alaska Fairbanks



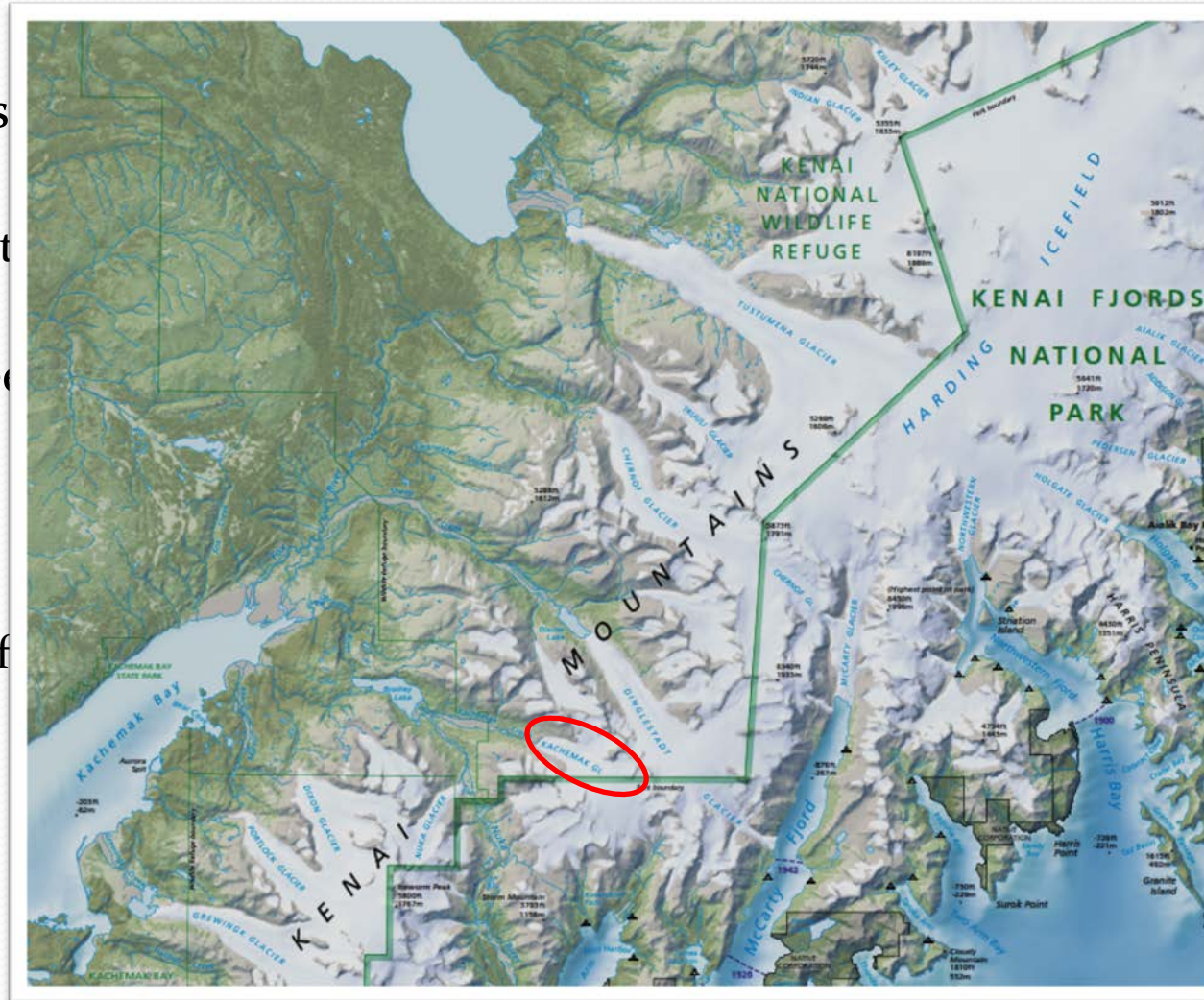
Introduction

- Harding Icefield, lost 34 km³ since 1950s
- Kachemak Glacier lost 16 m elevation (Adalgeirosdottir et al 1998)

- Glacial discharge changes
 - ↓ nutrients, salinity
 - ↑ sedimentation, ↓ light

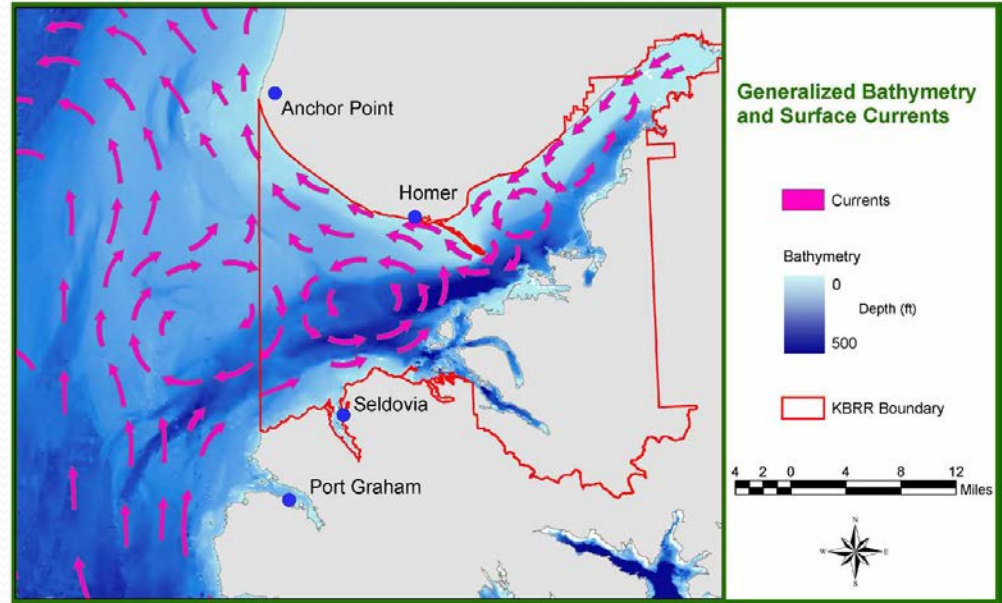
- Negative effects on seaweeds and sessile invertebrates

- Future changes
 - Increase spatial extent of discharge
 - Altered timing
 - Increase discharge



Introduction

- Kachemak Bay circulation

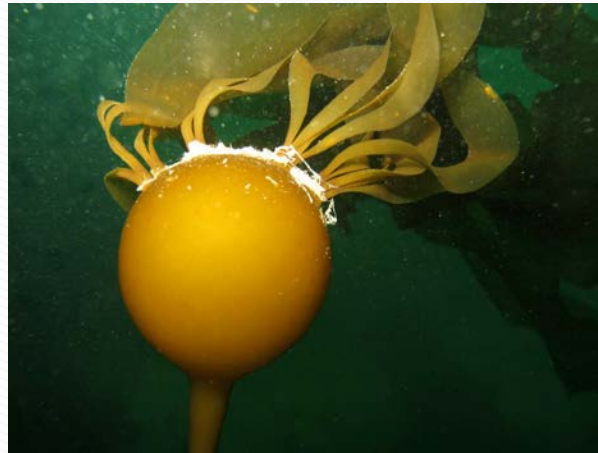


Field & Walker 2003

- Observed differences between inner and outer bay

(Spurkland & Iken 2011)

- Outer bay has more diverse and higher abundance of kelp
- Only *Saccharina latissima* in inner bay
- Only one small population of *Nereocystis luetkeana* in inner bay



Introduction

- Are these differences due to mortality over time or differences in initial recruitment?

Recruitment = the appearance of new individuals

Succession = how community structure changes over time

Research Questions:

1. How does recruitment and succession vary across Kachemak Bay?
2. Are environmental factors correlated to patterns of recruitment and succession?



Methods

Recruitment and Succession

- In March 2013 placed 6 cleared rocks at each site along 10 m depth contour
- April and biweekly May-Sept 2013 & 2014
- Counted all organisms and estimated percent cover on tops of each rock



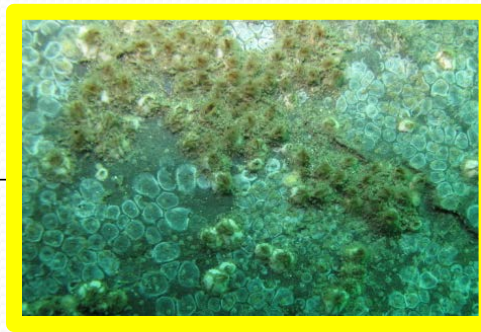
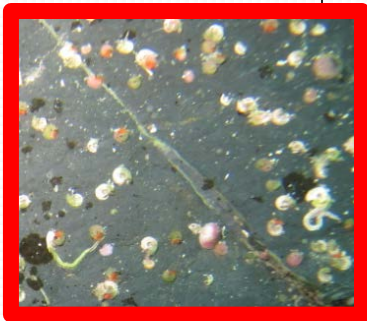
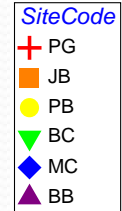
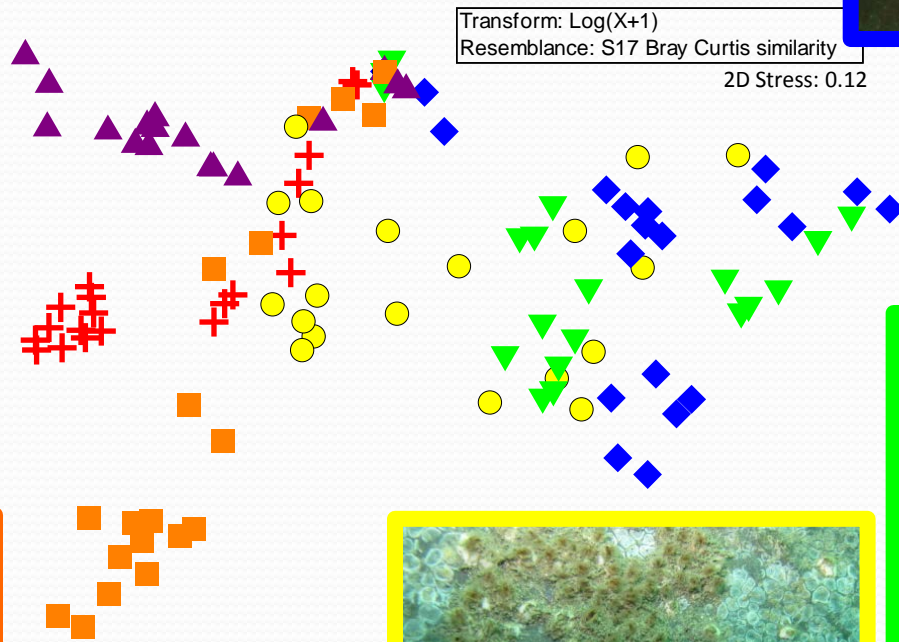
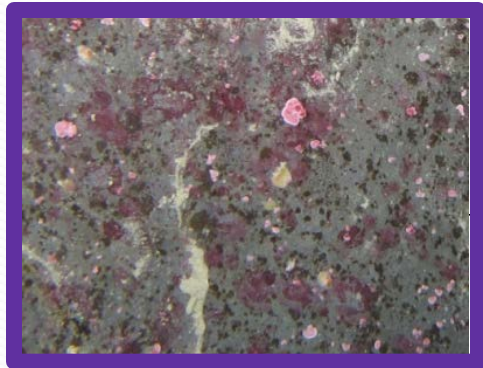
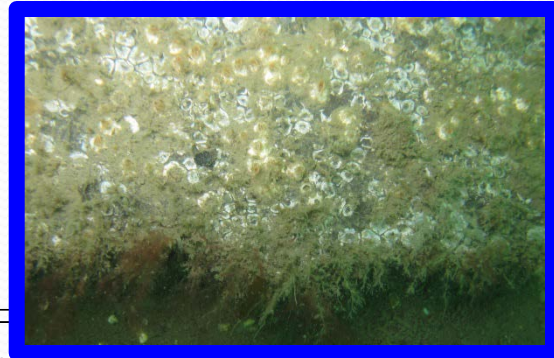
Environmental Variables

- April and biweekly throughout summer 2013 & 2014
- Sedimentation rate
- Temperature, Light, Salinity
- Nutrient Concentration



Results: Rock Community

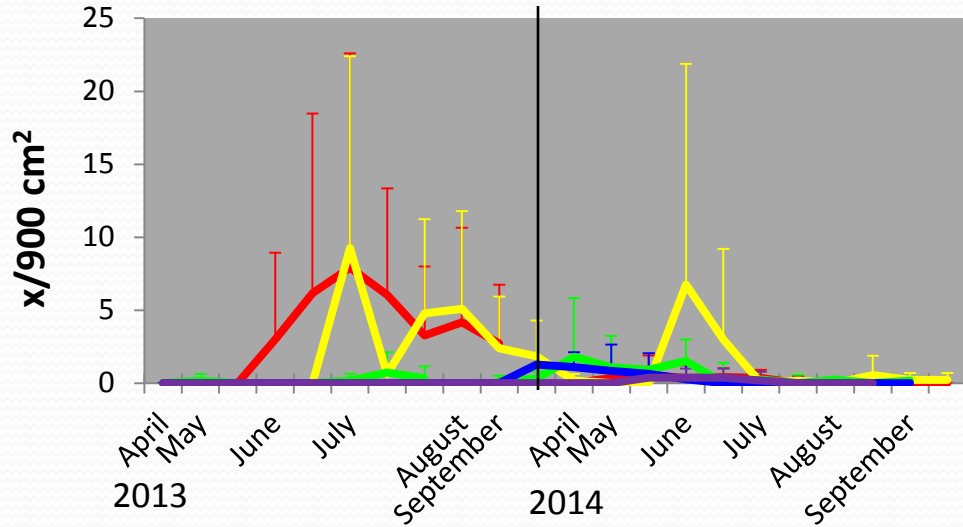
- Community structure differed among sites PERMANOVA, $p = 0.0001$



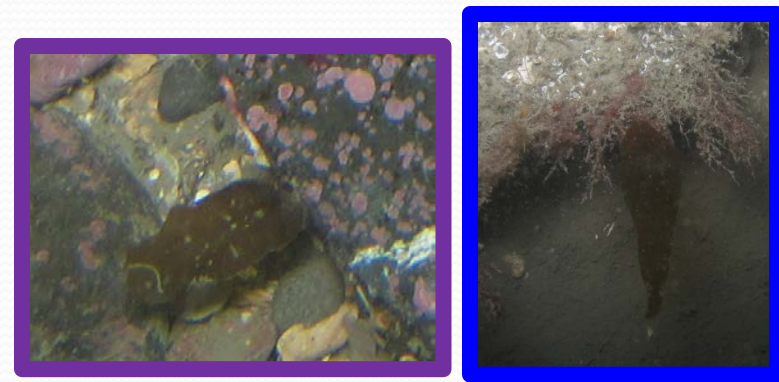
Results: Kelp recruitment



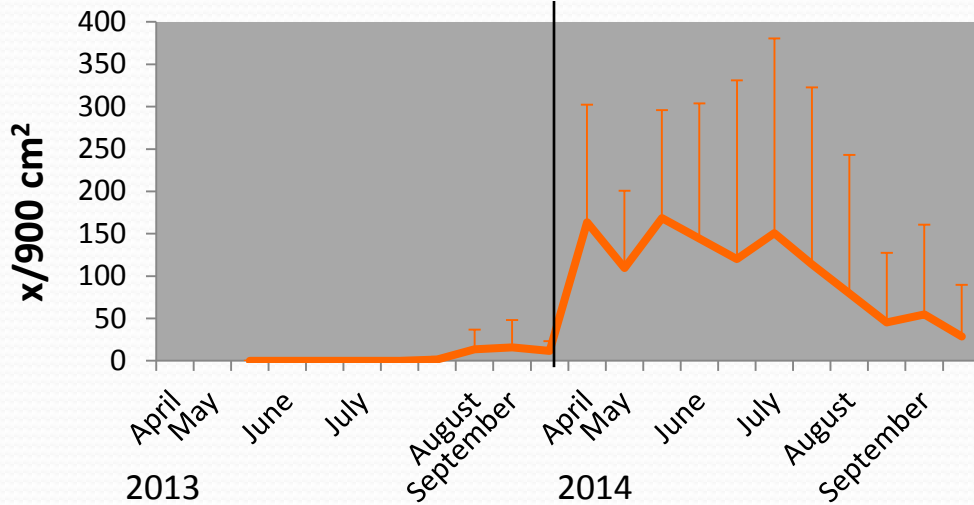
Kelp recruits (< 2 cm)



- PG
- PB
- BC
- MC
- BB



Kelp recruits (< 2 cm)



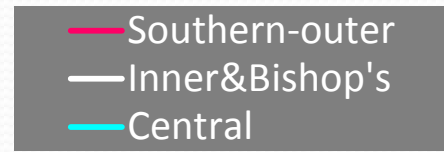
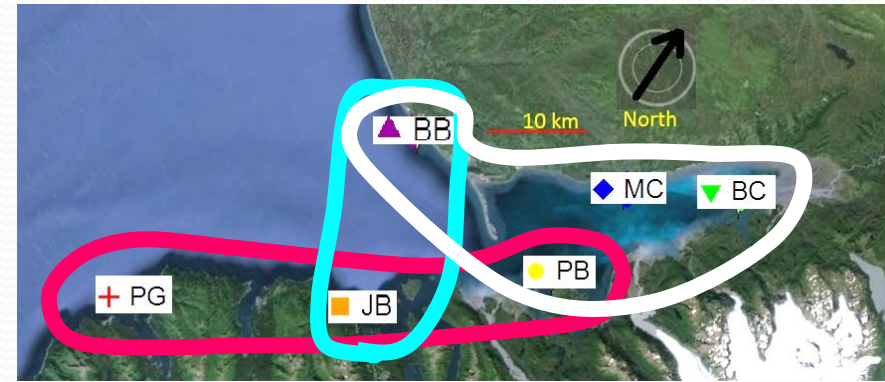
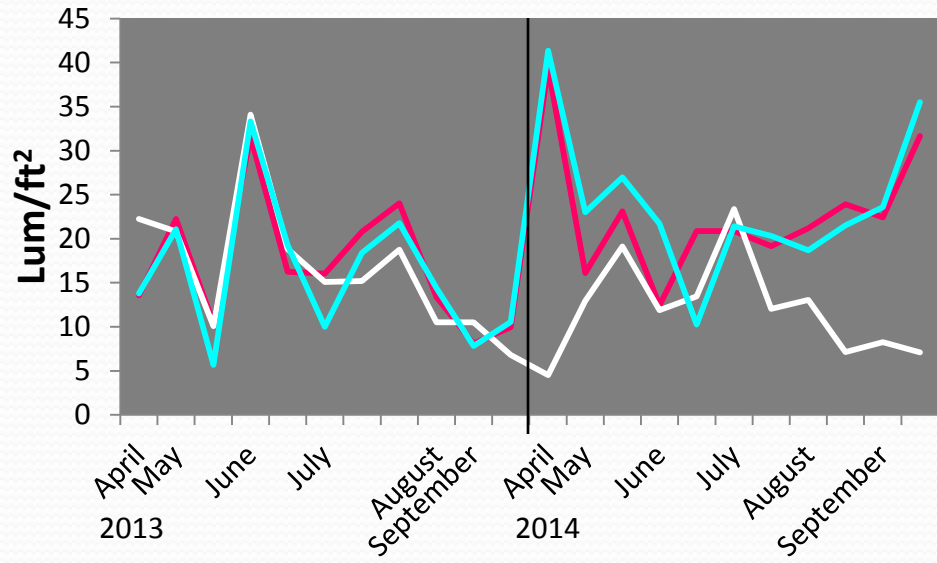
- JB



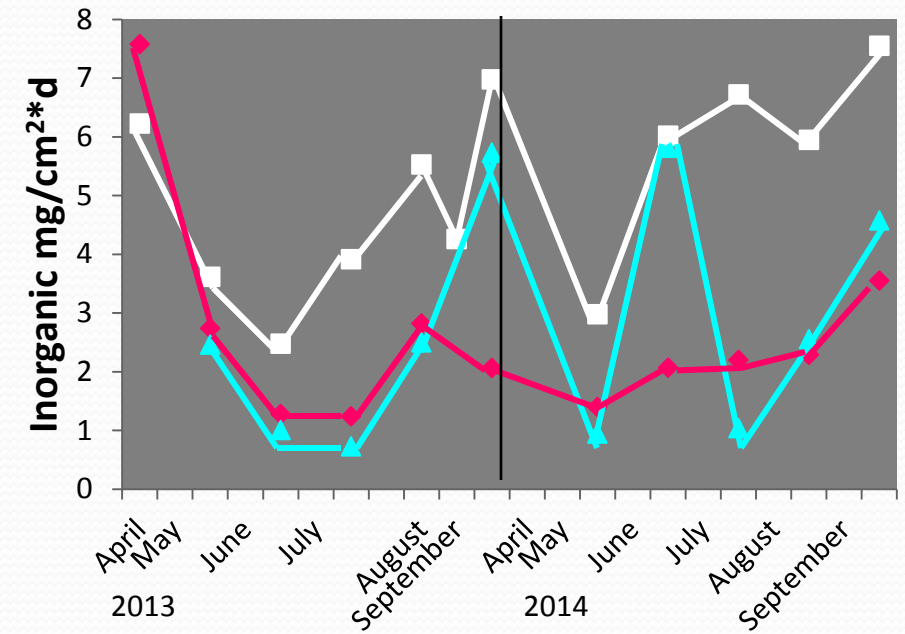
Results: Environmental Factors

PERMANOVA, $p = 0.003$

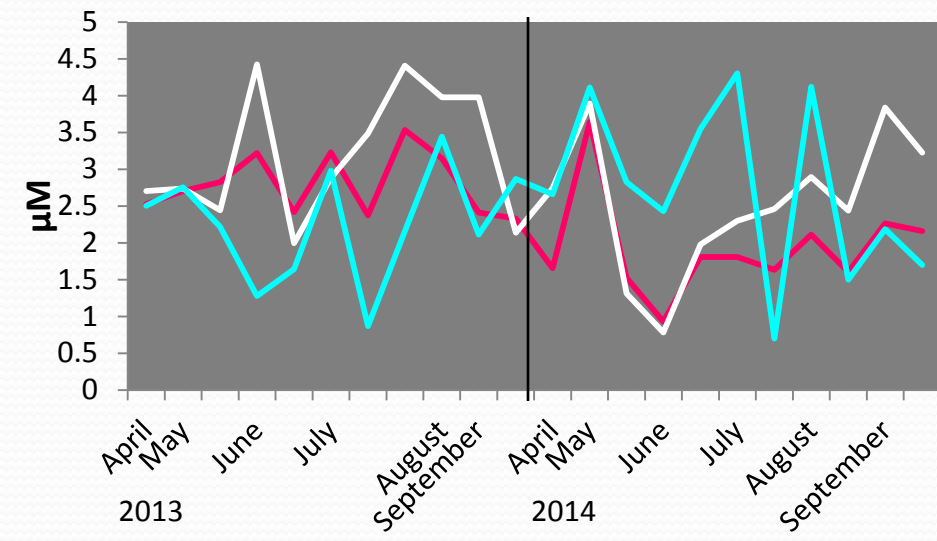
Irradiance



Inorganic Sedimentation rates

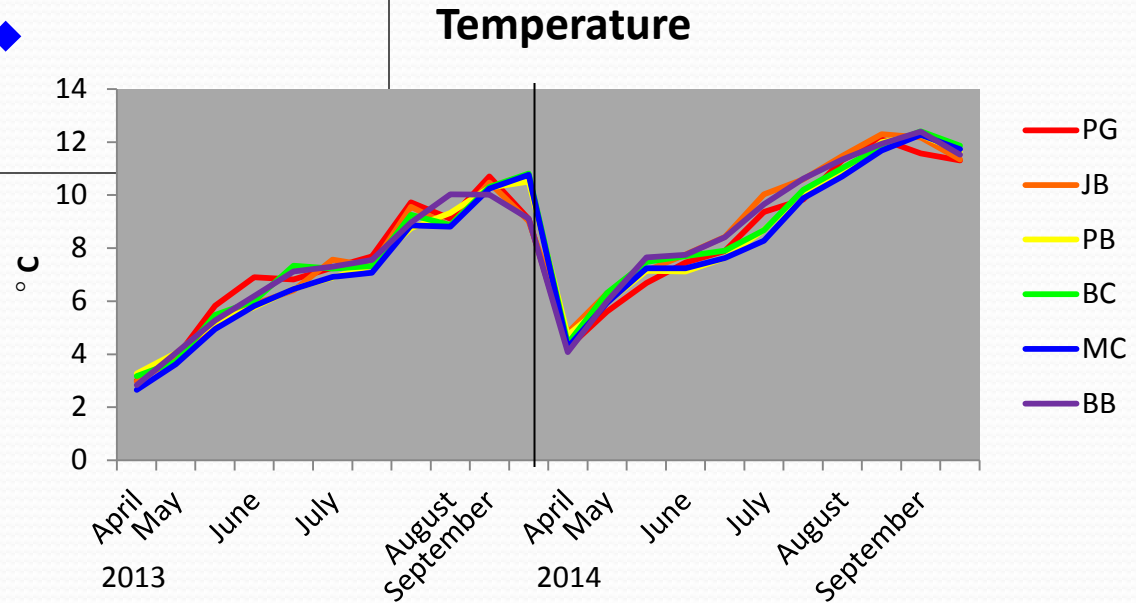
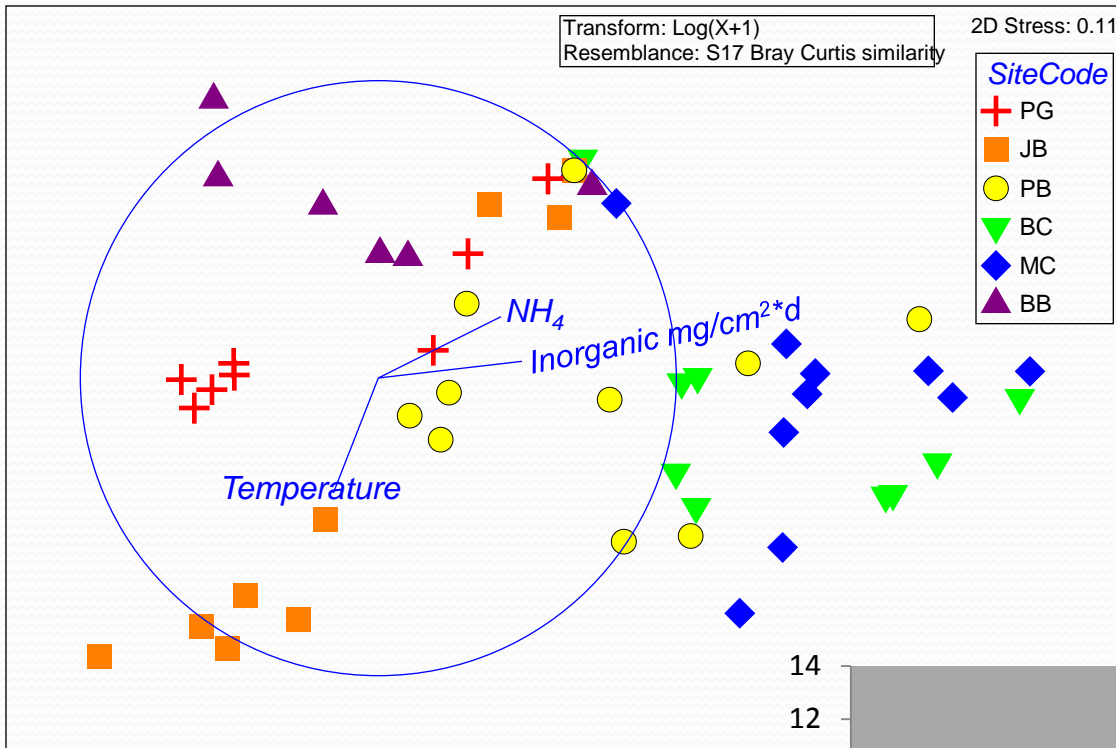


NH₄

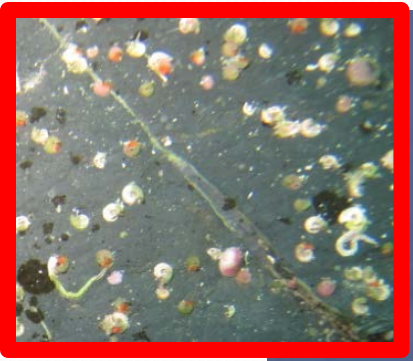


Results

- Environmental factors explained **28%** of variation in recruitment and succession (DistLM)

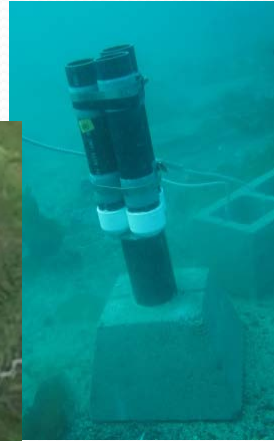
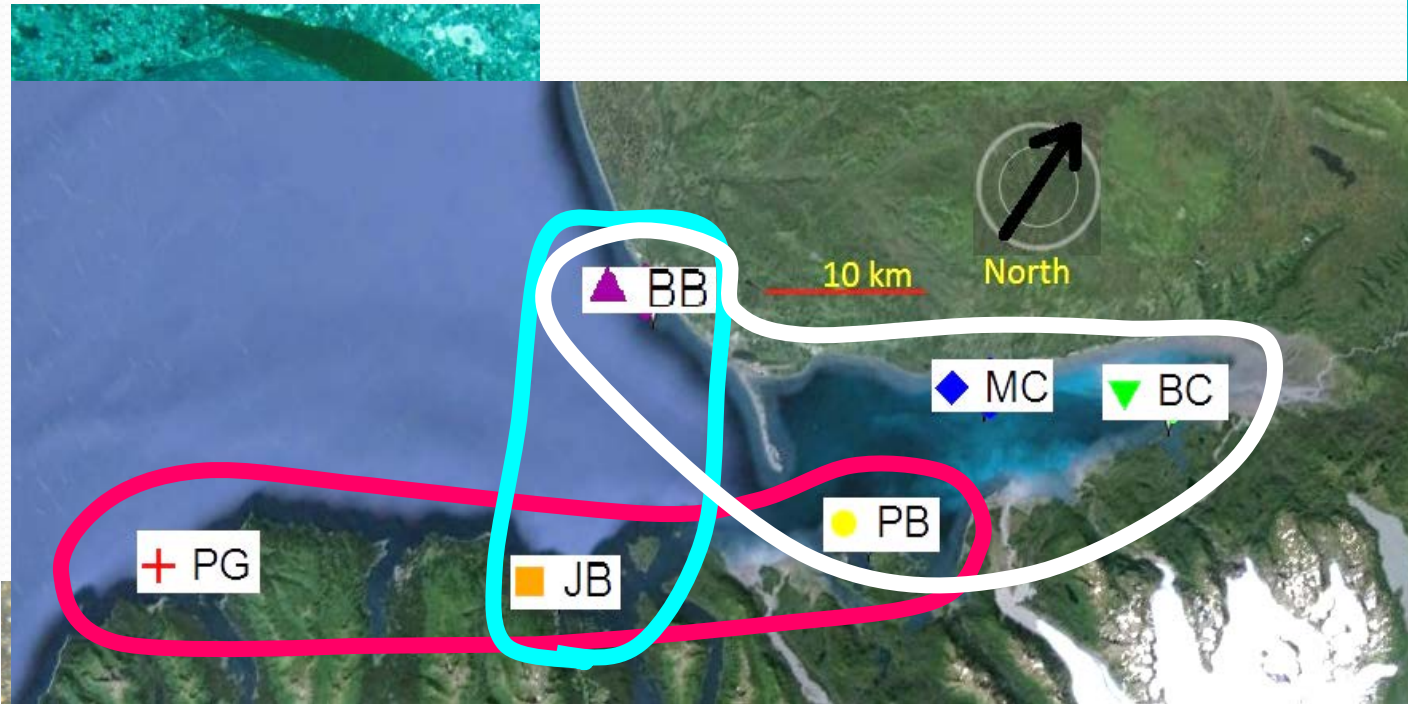


Summary



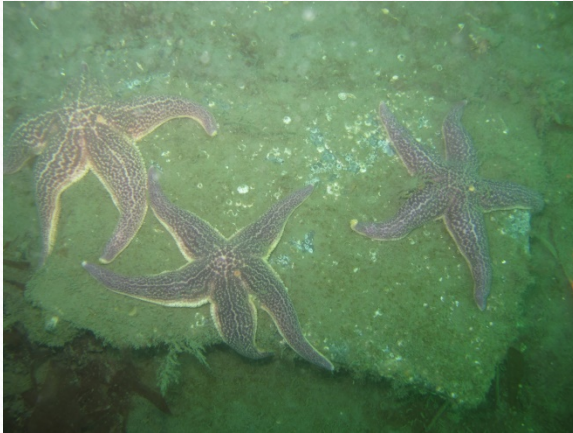
Summary

Start



Conclusions

- Environmental factors don't explain everything
 - Other important factors?



- Keep populations at glacially-influenced sites at risk to disturbance



Next Steps

- Time Series analyses
- Influence of mobile invertebrates and nearby kelp
- Quantify kelp microscopic stages across Kachemak Bay using genetics



Acknowledgments

Robert & Kathleen
Bryd Student
Competition



Kasitsna Bay Lab:

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Hans Pedersen
Connie Geagle
Kris Holderied

Committee Members:

Stephen Okkonen
Sarah Hardy

Volunteer divers:

Katrin Iken
Lander Ver Hoef
Alexandra Ravelo
Kim Powell
Richard Doering
Eric Wood

Anne Benolkin
Alyssa Lind
Elizaveta Ershova
Martin Schuster
Ira Hardy
Shae Bowman

