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

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Introduction

- Harding Icefield, lost 34 km$^3$ since 1950s
- Kachemak Glacier lost 16 m elevation (Adalgeirosdottir et al 1998)

Glacial discharge changes environmental conditions:
- $\downarrow$ nutrients, salinity
- $\uparrow$ sedimentation, $\downarrow$ light

Negative effects on seaweed and sessile invertebrates

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

- Kachemak Bay circulation

- 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

Field & Walker 2003
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

Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity

SiteCode
PG  JB  PB  BC  MC  BB

2D Stress: 0.12
Results: Kelp recruitment

Kelp recruits (< 2 cm)

Kelp recruits (< 2 cm)
Results: Environmental Factors

PERMANOVA, p = 0.003

Irradiance

Southern-outer
Inner&Bishop's
Central

2014 2013

NH₄

Inorganic Sedimentation rates

2014 2013

Inorganic mg/cm²*d
Results

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

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

- Kelp 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
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