Salish Sea Bull Kelp Restoration Research

Braeden Schiltroth, MSc. Candidate
Simon Fraser University

Bill Heath, Ph.D
Project Watershed

Kelp Forests

- Habitat + Foundation
- Nurseries
- Food source
- Blue carbon
- Cultural Importance

Global Kelp Declines

- Australia
  - Regime shifts - tropicalization
  - Range shifts - distributional limits
  - Future conditions give turfs advantage

Connell and Russell,2010
Wernberg et al. 2016

- N California - over 93% reduction

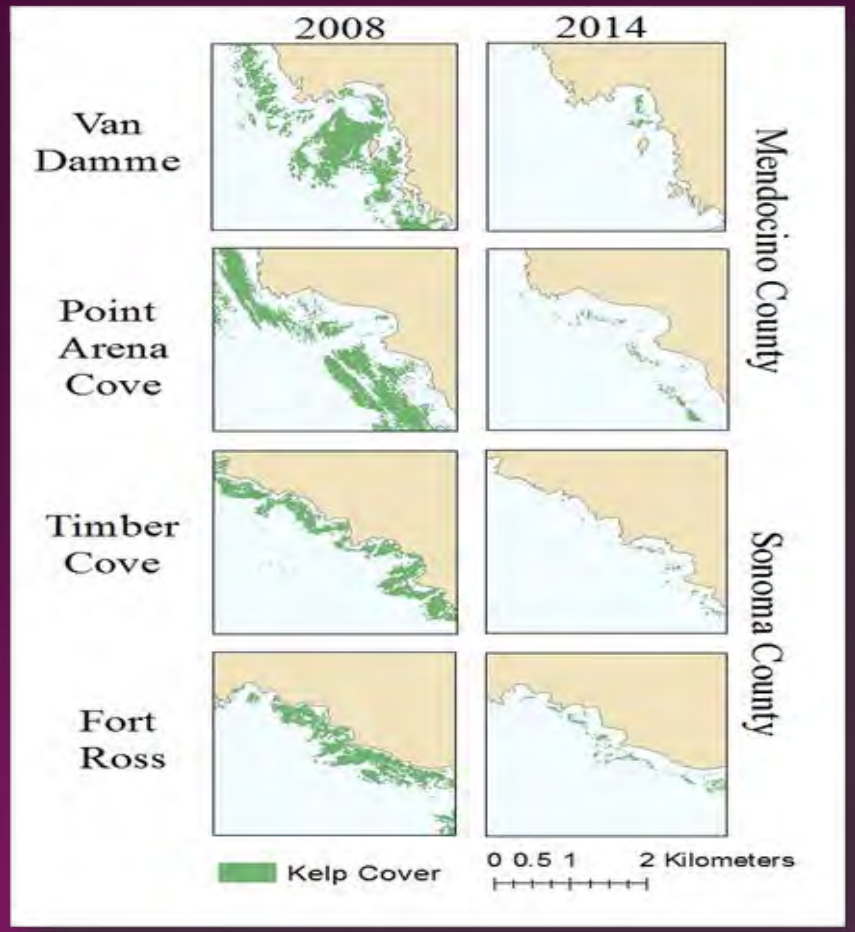
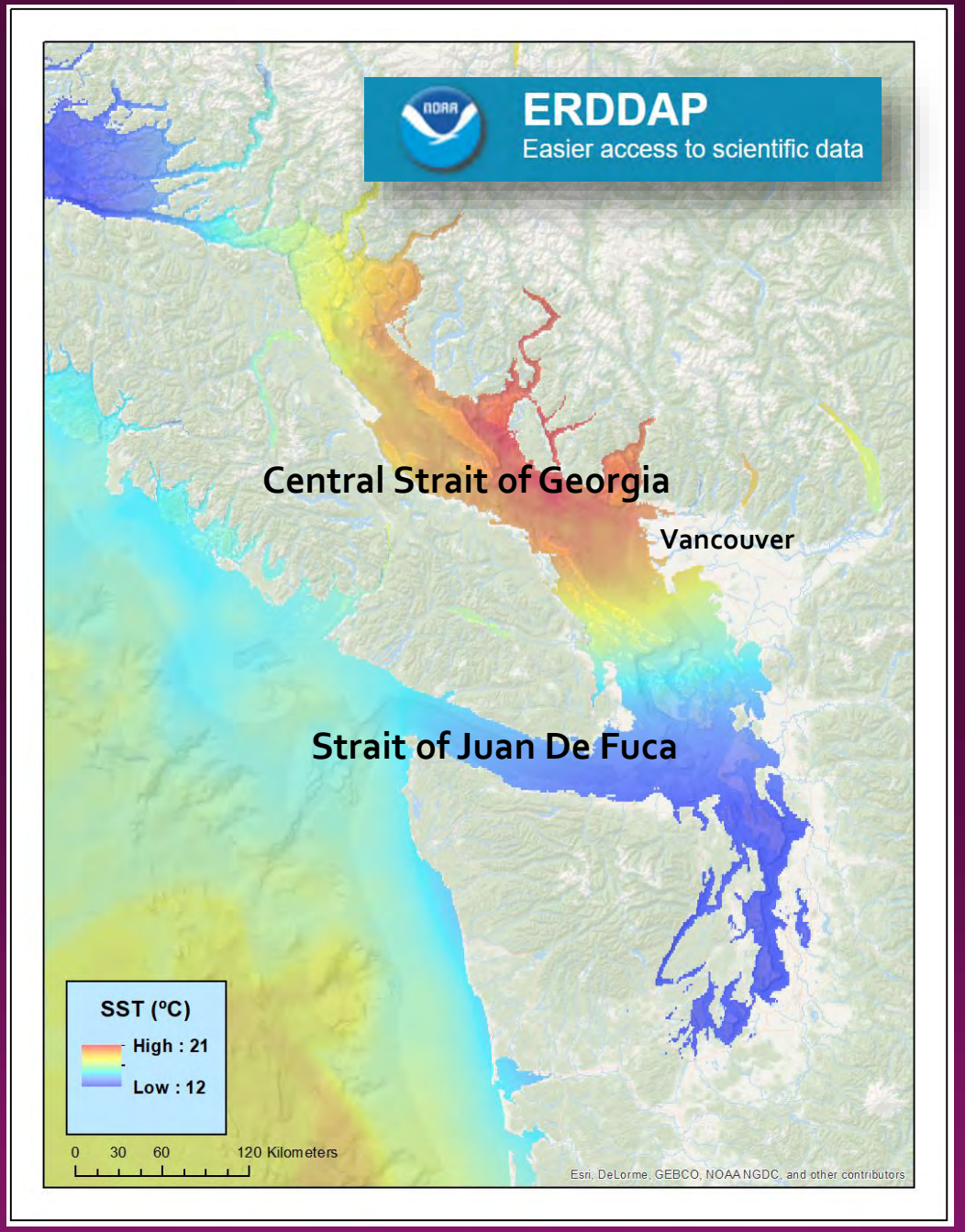


Image Courtesy of: M. Fredle-CDFW Aerial Surveys

Salish Sea

- *Nereocystis luetkeana* - major canopy forming species
- During summer months, the SST in the Central Strait of Georgia is **5 or 6°C warmer** on average than the Strait of Juan De Fuca



Project Goals

1) Identify temperature limits for early reproductive success in *Nereocystis*

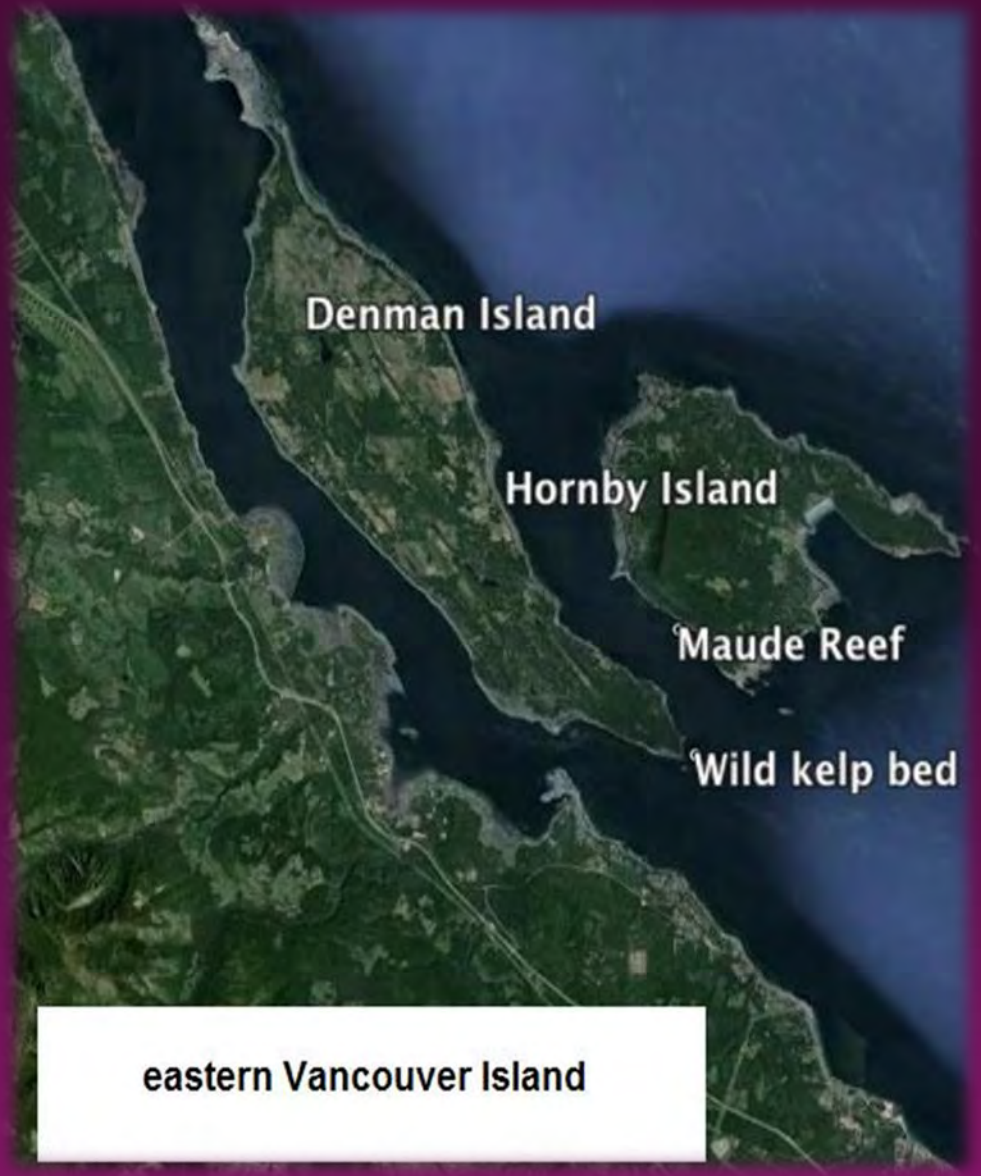
2) Evaluate whether certain kelp populations exhibit a resiliency to warm temperatures

- old idea, new ecosystem
- establishing best measures

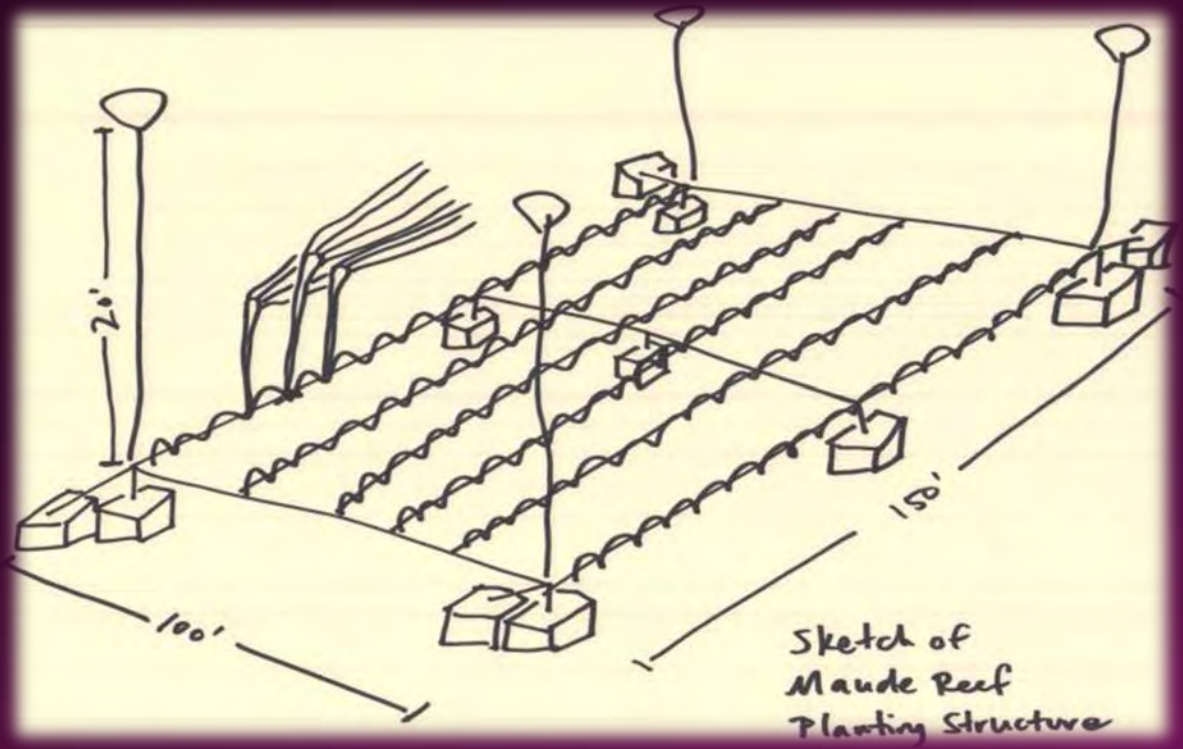
3) Establishing/Continuing Restoration

- culture & monitor kelp performance
- self-sustaining kelp bed

Restoration Sites 2011-17

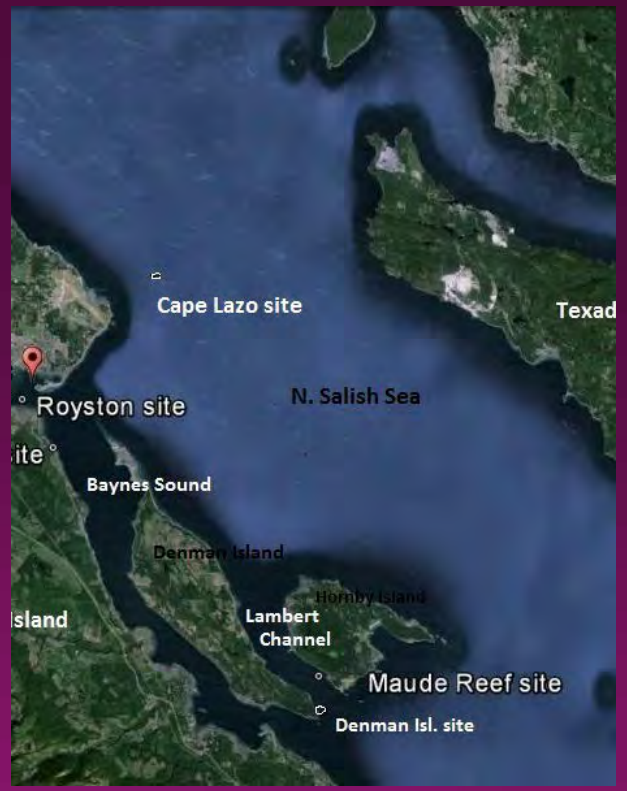


Kelp Culture Grid, Maude Reef

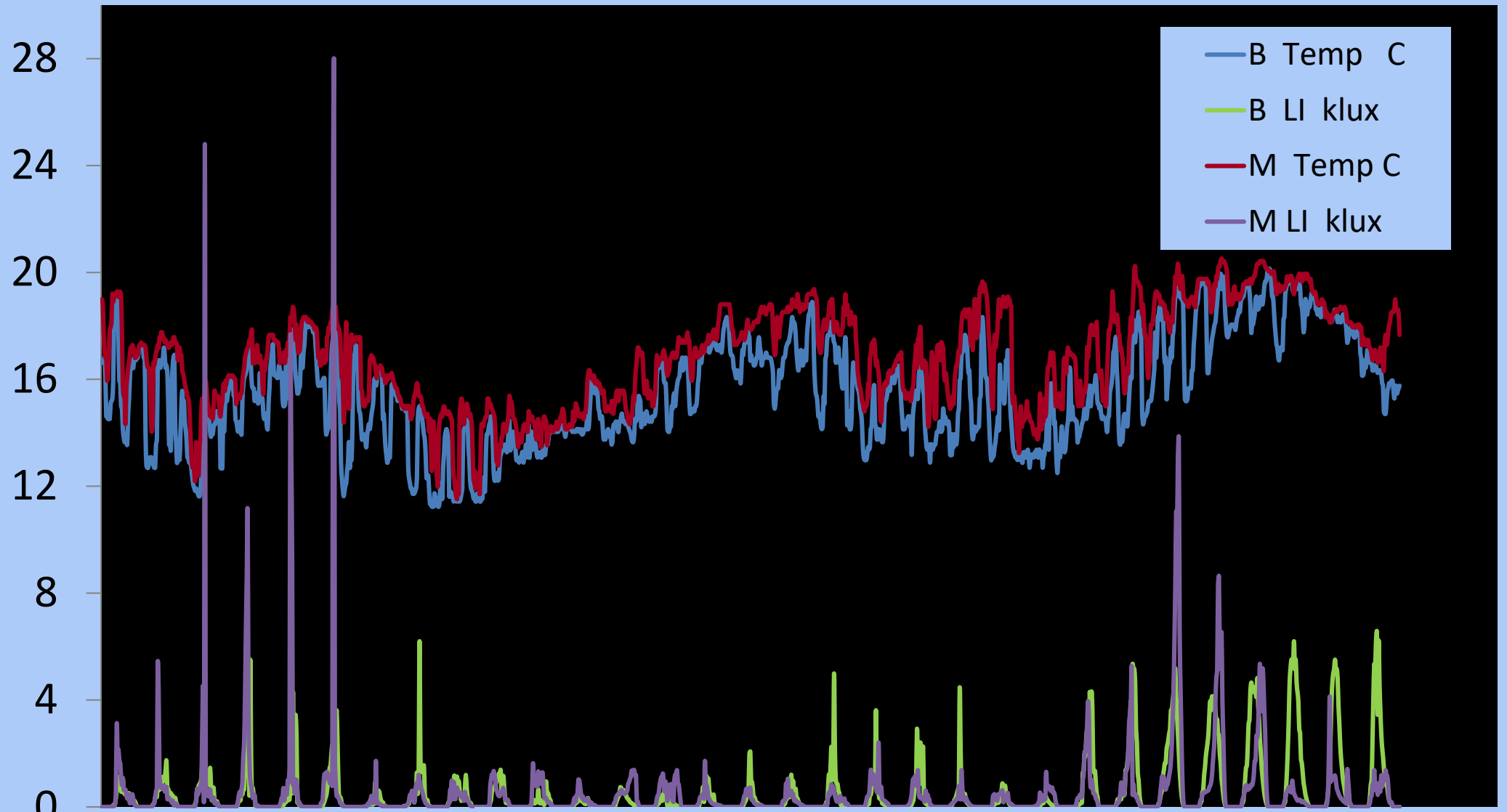


Growing Kelp

- Seeded spools of string are wound onto the culture rope and attached to a grid
- Then we hope for the best!
- Monitored by SCUBA every 2 months at the grid and at the Denman kelp bed



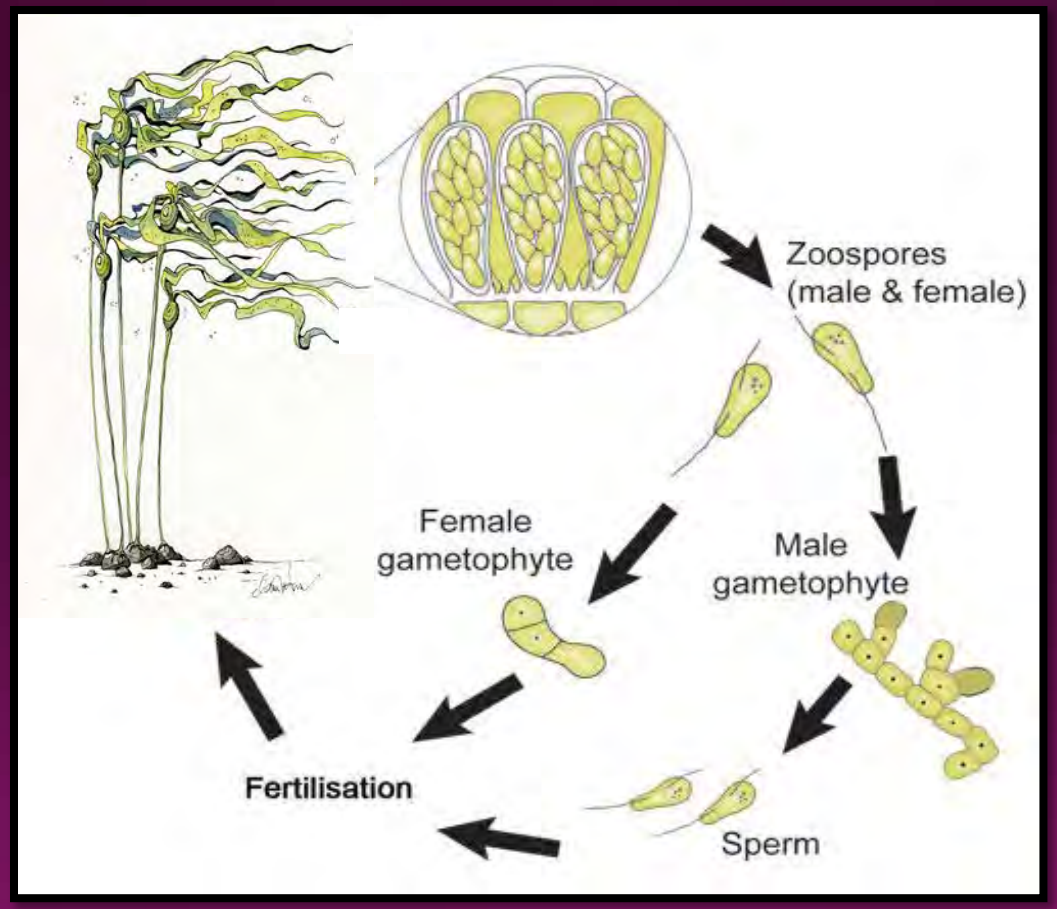
Temperature and Light Intensity at Bottom & Midwater at Maude Reef Grid site, July 2016



Sampling Interval (every 30 min.)
during July 1 to 31, 2016

Stress Resiliency

- Most susceptible stages
- Annual life cycle
- Rapid recovery in cool climate
- Suppressed recovery for up to two year from warm climate
- Canopy required to facilitate new recruitment
- Increased temperature may affect:
  - early developmental stages
  - sporophytic growth
  - cellular/tissue maintenance



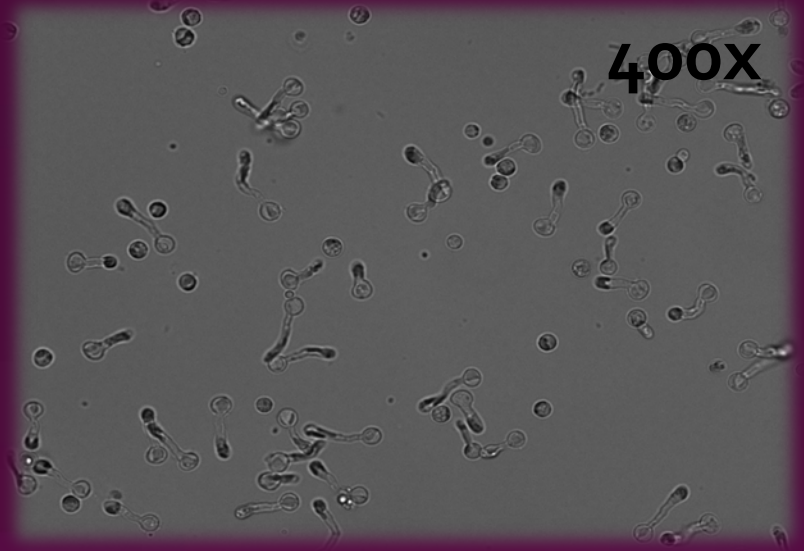
Graphic: Erika Mackay
Wernberg et al, 2010

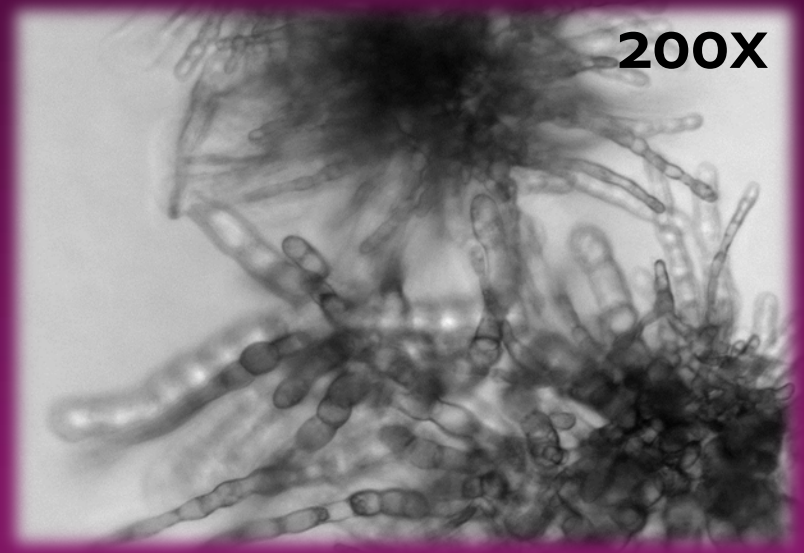
Collections

Preparation

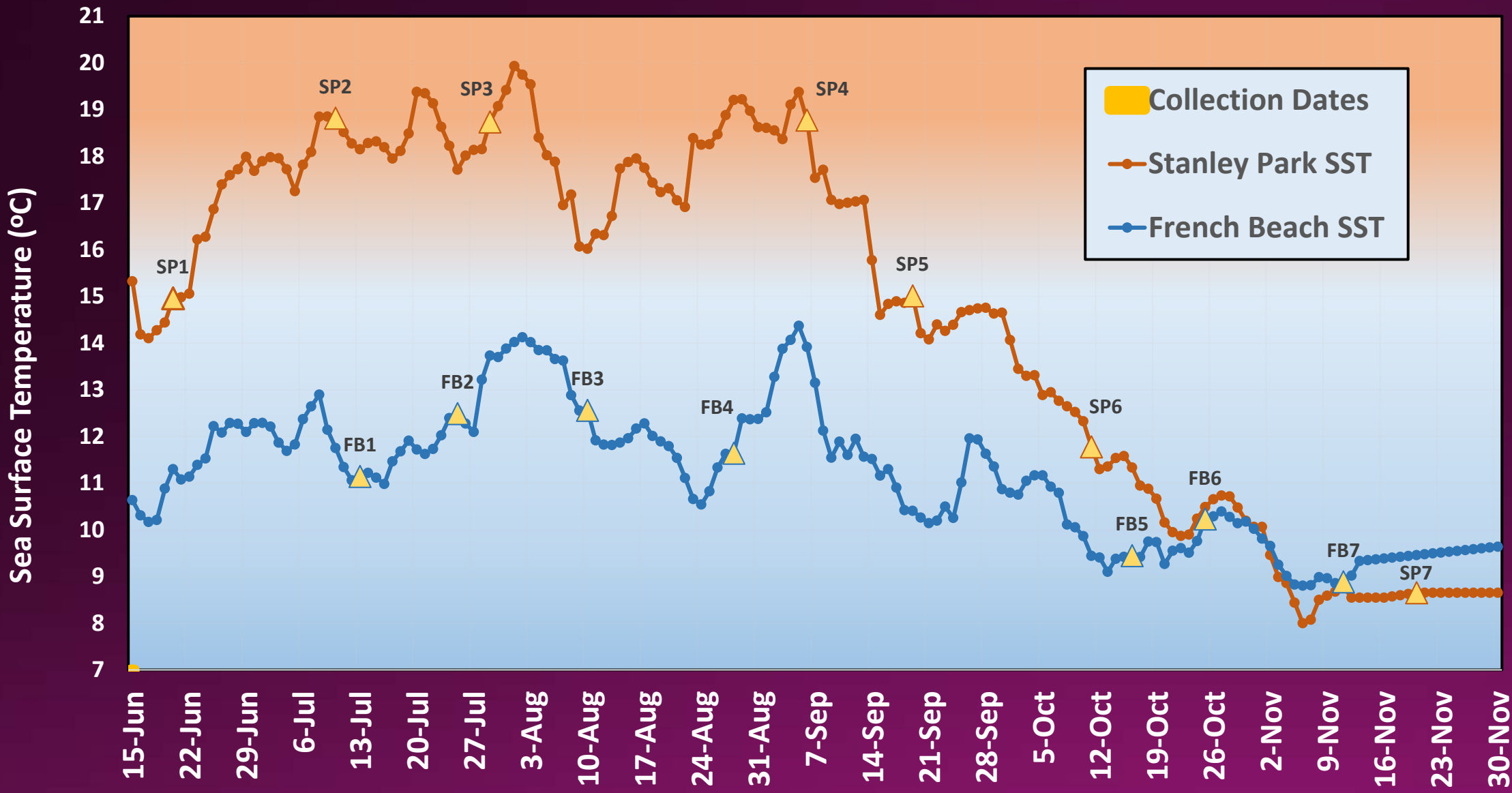
Evaluating Stress Resiliency In Kelp

- Quantitative measures:
  - spore density
  - germ tube formation/germination
  - gametophyte formation
  - viability
- Compare across populations/temp
- Does spore resiliency change as season progresses?

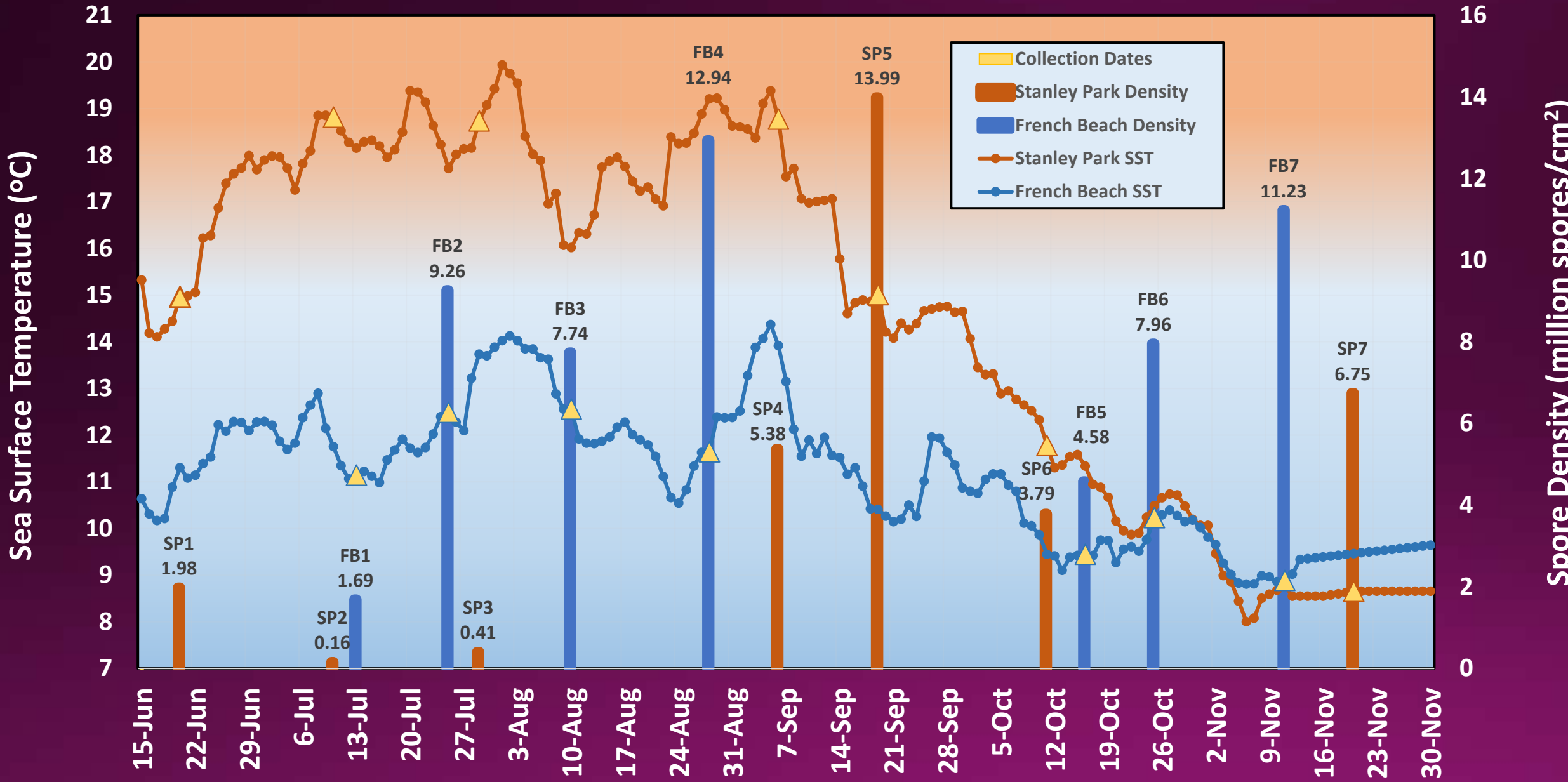




2017 SST for Stanley Park and French Beach

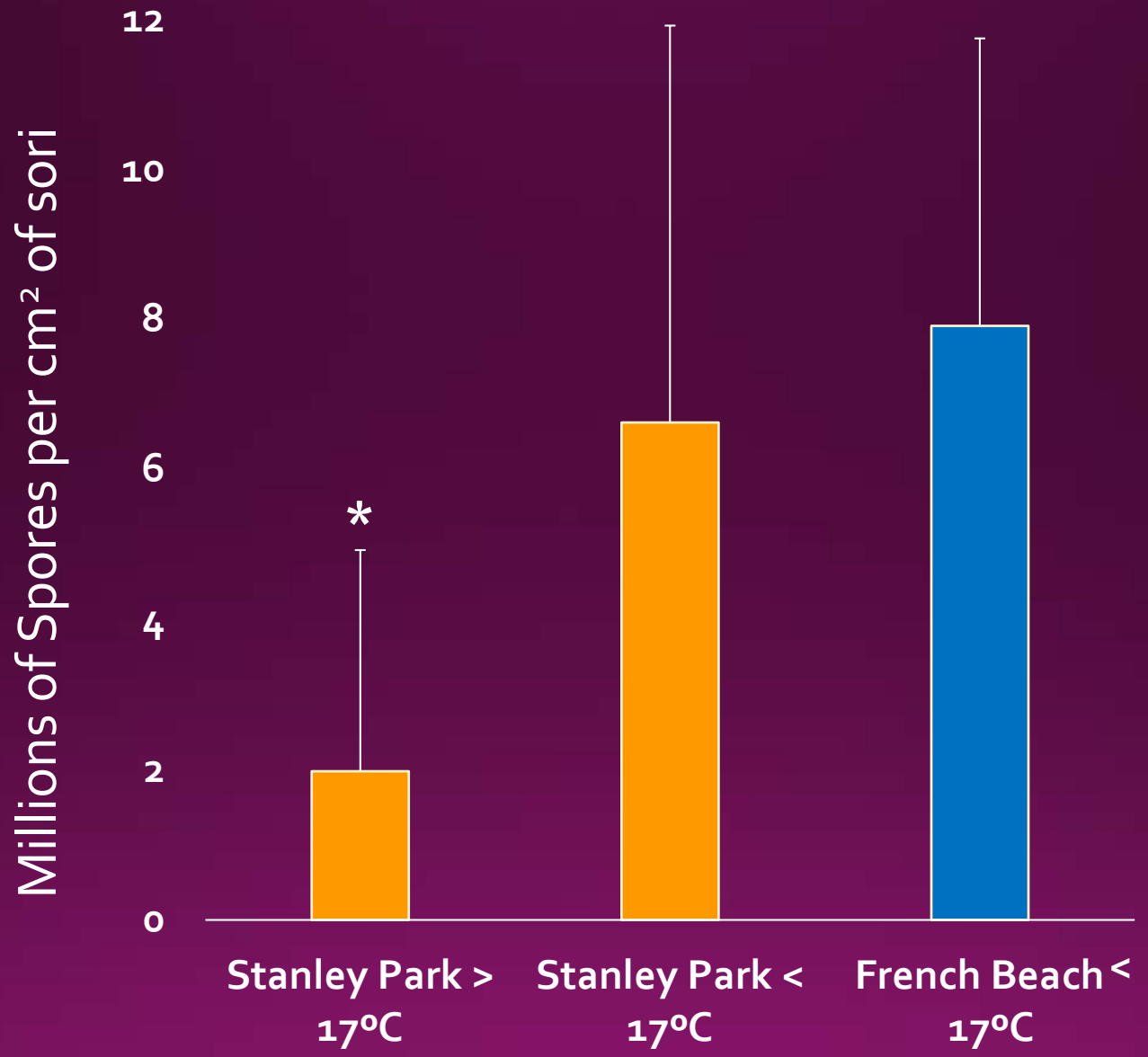


Salish Sea SST with Spore Densities



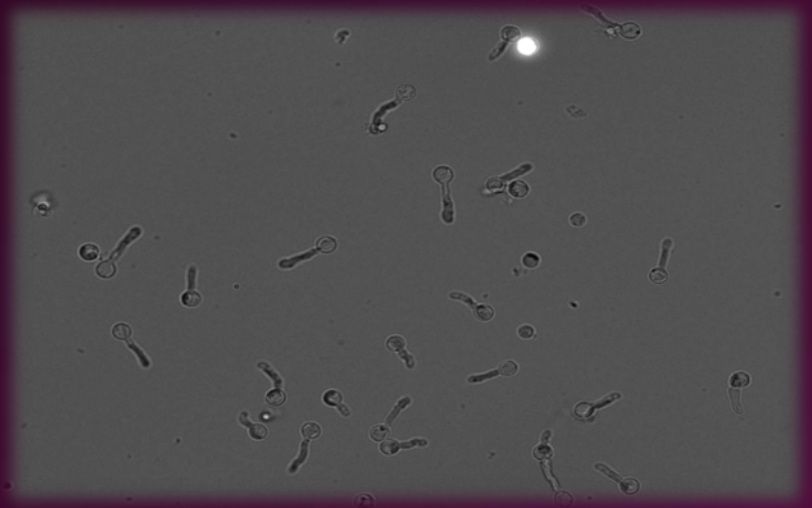
Spore Density

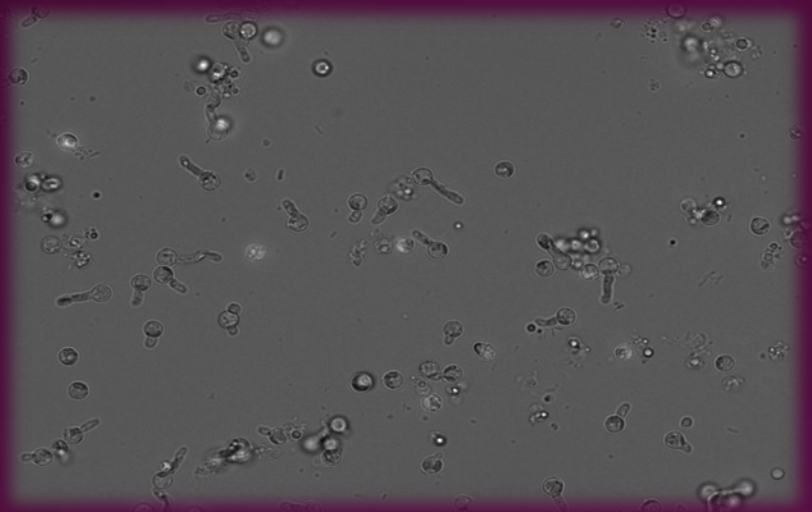
- Difference in spore release with warm SST
- 17°C appears to be approaching the upper limit for spore production
- Direct or indirect effect?



Germination

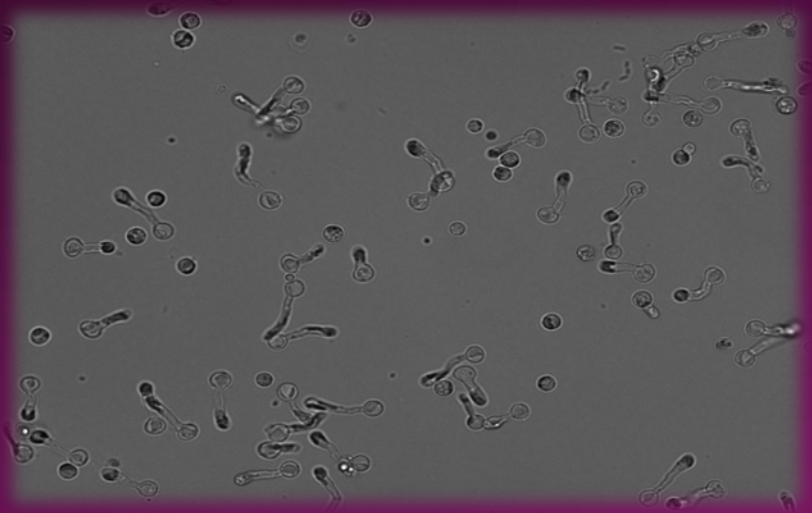
10°C

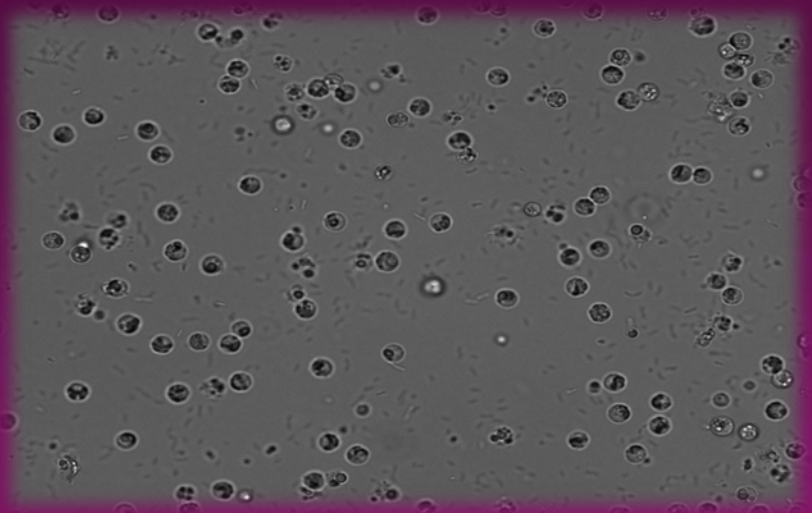




17.5°C

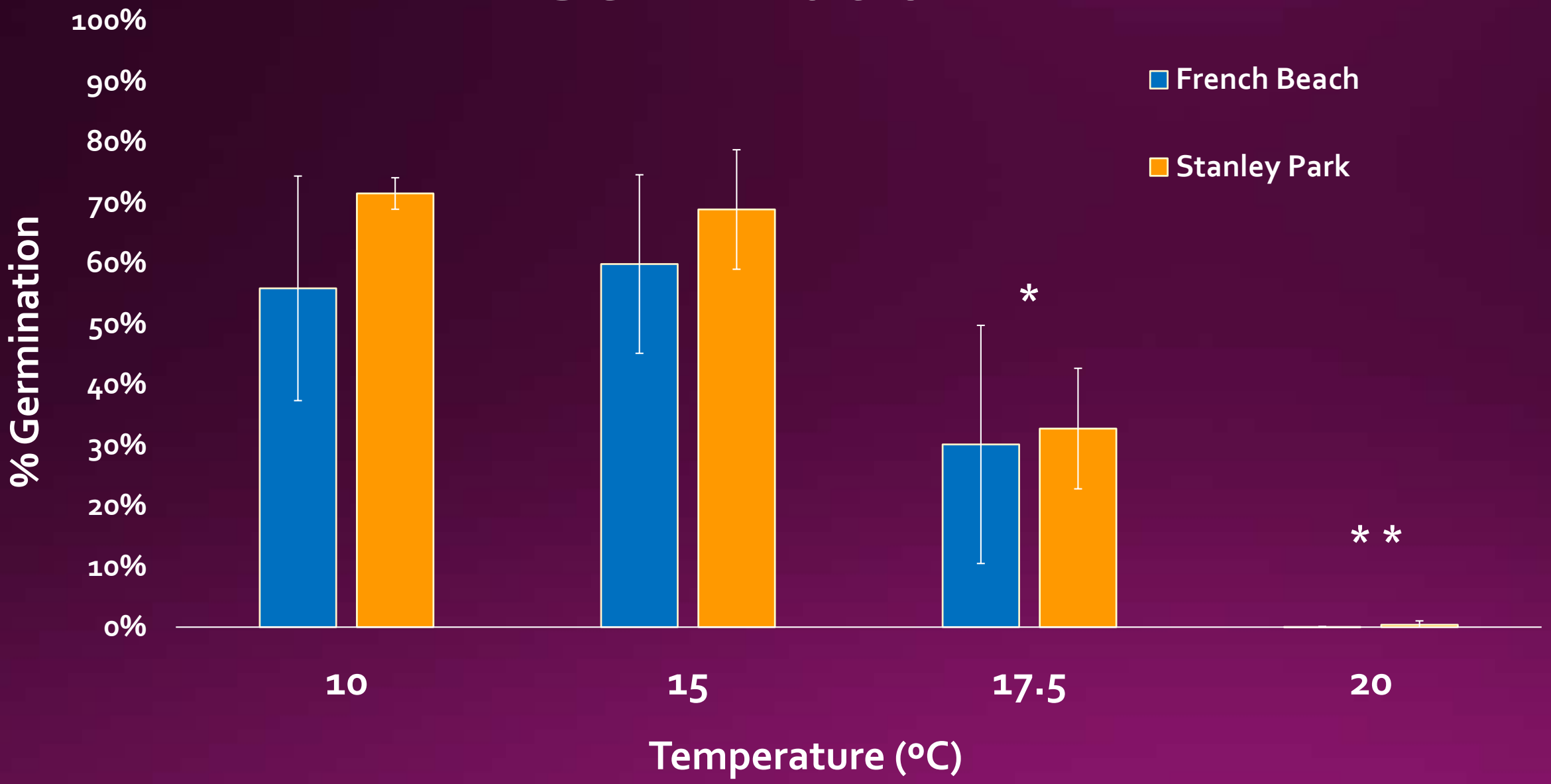
15°C





20°C

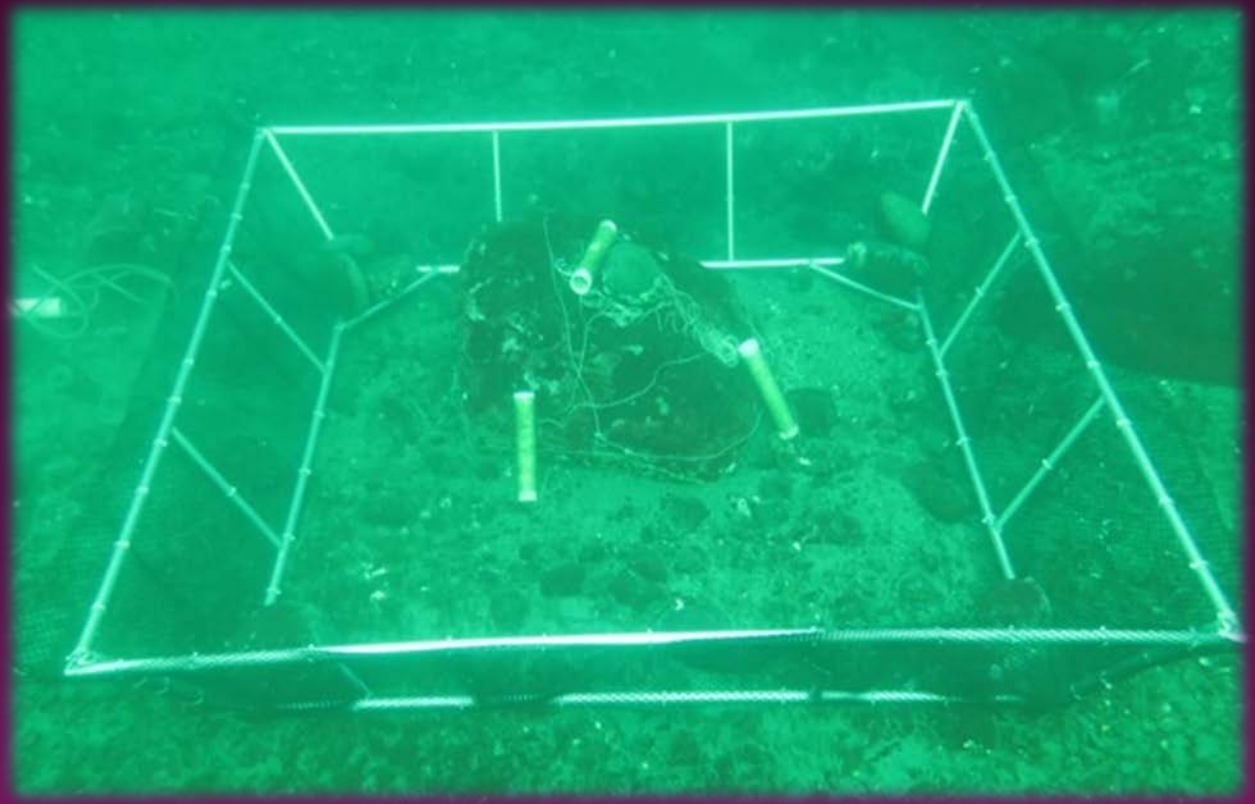
Germination



Conclusions

- Salish Sea is exposed to different temperature regimes throughout the summer
- 17°C appears to be the upper limit for spore formation
- At 17°C spore germination also decreases significantly, whereas 20°C kills off spores
- Warm conditions lead to shortened reproductive season for *Nereocystis*, potentially impacting recruitment
- Can achieve good growth and reproduction at restoration sites, but are unable to recolonize

Next steps: Urchin Exclusion Pens



Acknowledgements

- Dr. Sherryl Bisgrove
- Pacific Salmon Foundation
- Nile Creek Enhancement Society
- Project Watershed
- Amanda & Rob Zielinski
- Canadian Kelp Resources Ltd.
- Green Seas Kelp Co.
- Fisheries and Oceans Canada


Questions?