April 6th, 10:30 AM - 10:45 AM

Kelp forest dynamics: links to climate and long term trends

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Kelp Forest Dynamics: links to climate and long term trends

Helen Berry, DNR Nearshore Habitat Program

Cathy Pfister, University of Chicago

Tom Mumford, Marine Agronomics

Photo credit: Tom Mumford
Kelp Forest Dynamics

• Links to climate?
• Trends over the last century?
  • Strait of Juan de Fuca
  • South Puget Sound
Kelp Forest Dynamics

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Photo credit: Tom Mumford
Bull kelp
*Nereocystis luetkeana*

Giant Kelp
*Macrocystis pyrifera*
Annual monitoring of floating kelp canopy area along strait and outer coast (1989-present)

Dynamics in kelp canopy area along strait and outer coast (1989-present)

- Stable, yet high variability
- Abundance of two species positively correlated ($p < 0.001$)
- Best predictor of abundance was previous year’s abundance
- Extreme lows in kelp abundance during extreme high temperatures (1997 and 2014)

Cross-correlation from ARIMA models - kelp canopy area and environmental variables

<table>
<thead>
<tr>
<th>Environmental Variable</th>
<th>Same year</th>
<th>1 year previous</th>
<th>2 years previous</th>
<th>3 years previous</th>
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</thead>
<tbody>
<tr>
<td>North Pacific Gyre Oscillation (NPGO)</td>
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Bold values are significant at $p < .05$

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* SST increased by 0.72°C during 1921-2015 (p < .001)

Kelp Forest Dynamics

- Links to climate?
- Trends over the last century?
  - Strait of Juan de Fuca
  - South Puget Sound
Floating kelp area along the strait over a century

Explore the maps at geo.wa.gov - search for “kelp forests”
Kelp canopy generally stable in strait - except perhaps at eastern boundary (ca. 1911 – present)

Kelp Forest Dynamics

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Photo credit: Tom Mumford
Changes in bull kelp distribution in South Sound? 1855-2017
Most sites absent recently in West and Central
After 1980, proportion of observations with bull kelp lower in West and Central
Concern over losses in inner reaches of Salish Sea

Candidate stressors:

- Elevated temperatures
- Urbanization
- Anthropogenic nutrients
- Sedimentation
- Over-fishing
- Community shifts
Kelp Forest Dynamics

- Climate drives kelp abundance
  - NPGO leading indicator along outer coast and strait
- Trends over last century are spatially distinct
  - Concerns about losses in the inner reaches

Photo credit: Tom Mumford