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Seasonal dynamics of oceanographic conditions, phytoplankton, and zooplankton in the Malaspina Strait, Strait of Georgia

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Speaker
Svetlana Esenkulova, Karyn Suchy, Ian Perry, Kelly Young, Maycira Costa, Ryan Flagg, Moira Galbraith, and Isobel Pearsall

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Seasonal dynamics of oceanographic conditions, phytoplankton, and zooplankton in the Malaspina Strait, Strait of Georgia

Svetlana Esenkulova¹, Karyn Suchy²,³, R. Ian Perry³,⁴, Kelly Young³, Maycira Costa², Ryan Flagg⁵, Moira Galbraith³, and Isobel Pearsall¹

¹Pacific Salmon Foundation; ²Department of Geography, University of Victoria; ³Institute of Ocean Sciences, Fisheries and Oceans Canada; ⁴Pacific Biological Station, Fisheries and Oceans Canada; ⁵Ocean Network Canada
Citizen Science 2015 - 2017

- Physical and chemical parameters
- Nutrients
- Phytoplankton
- Zooplankton

~80 locations
February – October
~ 2/3 times a month

Data: http://www.oceannetworks.ca  http://sogdatacentre.ca/
pearsalli@shaw.ca – Dr. Isobel Pearsall
Citizen Science 2015 - 2017

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Malaspina Strait data

Sites: IS-2 (~500m from the shore, depths <30m), IS-3 and IS-4 (>1500 m, >300 m)

Citizen Science:
CTD: temperature, salinity, Chl
Nutrients: NO$_3^-$, PO$_4^-$ (0 and 20m)
In situ Phytoplankton (0 m)
In situ Zooplankton (tow sample)

Additional data:
Fraser River discharge (at Hope)
Air temperature, precipitation (Powell River)
Hours of sunshine, wind (Vancouver)
Upwelling index
Trends

Water Temperature (°C)

Salinity (ppt)

Fraser River daily discharge at Hope, (m³/s)
Nutrients data by Dr. Rich Pawlowicz, UBC

Trends

NO3+NO2 (uM)

PO4 (uM)

Chl


2015  2016  2017

20 m  0 m

20 m  0 m

1m  20 m
In situ phytoplankton biomass index at 0m

2015

2016

2017

Diatoms
Dinoflagellates
Raphidophytes
Silicoflagellates
Other

IS-2

IS-3
In situ phytoplankton biomass index at 0m

2015

2016

2017

Stronger bloom

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Diatoms

Dinoflagellates

Raphidophytes

Silicoflagellates

Other

Diatoms

Dinoflagellates

Raphidophytes

Silicoflagellates

Other
In situ phytoplankton biomass index at 0m

2015

2016

2017

lot of silicoflagellates

lot of silicoflagellates

Diatoms
Dinoflagellates
Raphidophytes
Silicoflagellates
Other

Diatoms
Dinoflagellates
Raphidophytes
Silicoflagellates
Other

Diatoms
Dinoflagellates
Raphidophytes
Silicoflagellates
Other

Diatoms
Dinoflagellates
Raphidophytes
Silicoflagellates
Other
Total phytoplankton biomass index per year

**2015**
- **Diatoms**

**2016**
- **Diatoms**
- **Dinoflagellates**
- **Raphidophytes**
- **Silicoflagellates**
- **Other**

**2017**
- **Diatoms**
- **Dinoflagellates**
- **Raphidophytes**
- **Silicoflagellates**
- **Other**

**IS-2**
- Diatoms
- Dinoflagellates
- Raphidophytes
- Silicoflagellates
- Other

**IS-3**
- Diatoms
- Dinoflagellates
- Raphidophytes
- Silicoflagellates
- Other
Zooplankton biomass (mg m$^{-3}$)
Zooplankton biomass (mg m$^{-3}$)

2015

2016

2017

Higher biomass

Amphipods

Copepods

Crabs

Euphausiids

Jellies

IS-2

IS-3
Total zooplankton biomass per year

2015
- Jellies

2016
- Copepods
- Crabs
- Euphausiids
- Jellies

2017
- Amphipods
- Copepods
- Crabs
- Euphausiids
- Jellies

IS-2
- Amphipods
- Copepods
- Crabs
- Euphausiids
- Jellies

IS-3
- Amphipods
- Copepods
- Crabs
- Euphausiids
- Jellies
### Exploratory statistics, Spearman Rank Order Correlation

<table>
<thead>
<tr>
<th></th>
<th>IS-2 % Diatoms</th>
<th>IS-2 % Dinoflagellates</th>
<th>IS-3 % Diatoms</th>
<th>IS-3 % Dinoflagellates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temp at 1 m</strong></td>
<td>-0.514</td>
<td>0.397</td>
<td>-0.626</td>
<td>0.275</td>
</tr>
<tr>
<td><strong>Temp at 20 m</strong></td>
<td>-0.266</td>
<td>0.183</td>
<td>-0.486</td>
<td>0.278</td>
</tr>
<tr>
<td><strong>Salinity at 1 m</strong></td>
<td>0.199</td>
<td>-0.199</td>
<td>-0.062</td>
<td>0.332</td>
</tr>
<tr>
<td><strong>Salinity at 20 m</strong></td>
<td>0.211</td>
<td>0.213</td>
<td>-0.443</td>
<td>0.049</td>
</tr>
<tr>
<td><strong>Chl a at 1 m</strong></td>
<td>-0.003</td>
<td>-0.100</td>
<td>-0.03</td>
<td>-0.093</td>
</tr>
<tr>
<td><strong>Chl a at 20 m</strong></td>
<td>0.341</td>
<td>-0.091</td>
<td>0.384</td>
<td>-0.112</td>
</tr>
<tr>
<td><strong>Large calanoids</strong></td>
<td>0.412</td>
<td>-0.130</td>
<td>0.394</td>
<td>-0.241</td>
</tr>
<tr>
<td><strong>Medium calanoids</strong></td>
<td>0.475</td>
<td>-0.324</td>
<td>-0.116</td>
<td>0.116</td>
</tr>
<tr>
<td><strong>Small calanoids</strong></td>
<td>-0.049</td>
<td>0.236</td>
<td>-0.150</td>
<td>0.378</td>
</tr>
<tr>
<td><strong>Non-calanoid copepods</strong></td>
<td>-0.102</td>
<td>0.294</td>
<td>-0.372</td>
<td>0.376</td>
</tr>
<tr>
<td><strong>Juvenile euphausiids</strong></td>
<td>0.472</td>
<td>-0.277</td>
<td>0.546</td>
<td>-0.102</td>
</tr>
</tbody>
</table>
Summary

• This work integrates numerous data sets produced by the SSMSP

• We have 3 year series of data for oceanographic parameters, phytoplankton and zooplankton for 3 sites in Malaspina Inlet (can include Baynes Sound in future)

• Our data shows very noticeable annual variability

• Preliminary statistical analysis has promising results

• In depth work will be lead by Dr. Karyn Suchy (UVic, IOS)

Thank you

Questions?