Pseudo-nitzschia species and domoic acid in south-eastern Vancouver Island January-July, 2016

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Overview

- Introduction
  - Where is domoic acid found?
  - Risks of domoic acid in the Strait of Georgia
- Research question
- Methodology
  - Identification of species
- Results
- Knowledge gaps
- Acknowledgements

Image: NASAearth Observatory

Introduction

Introduction

November 2015, Saanich Inlet, British Columbia

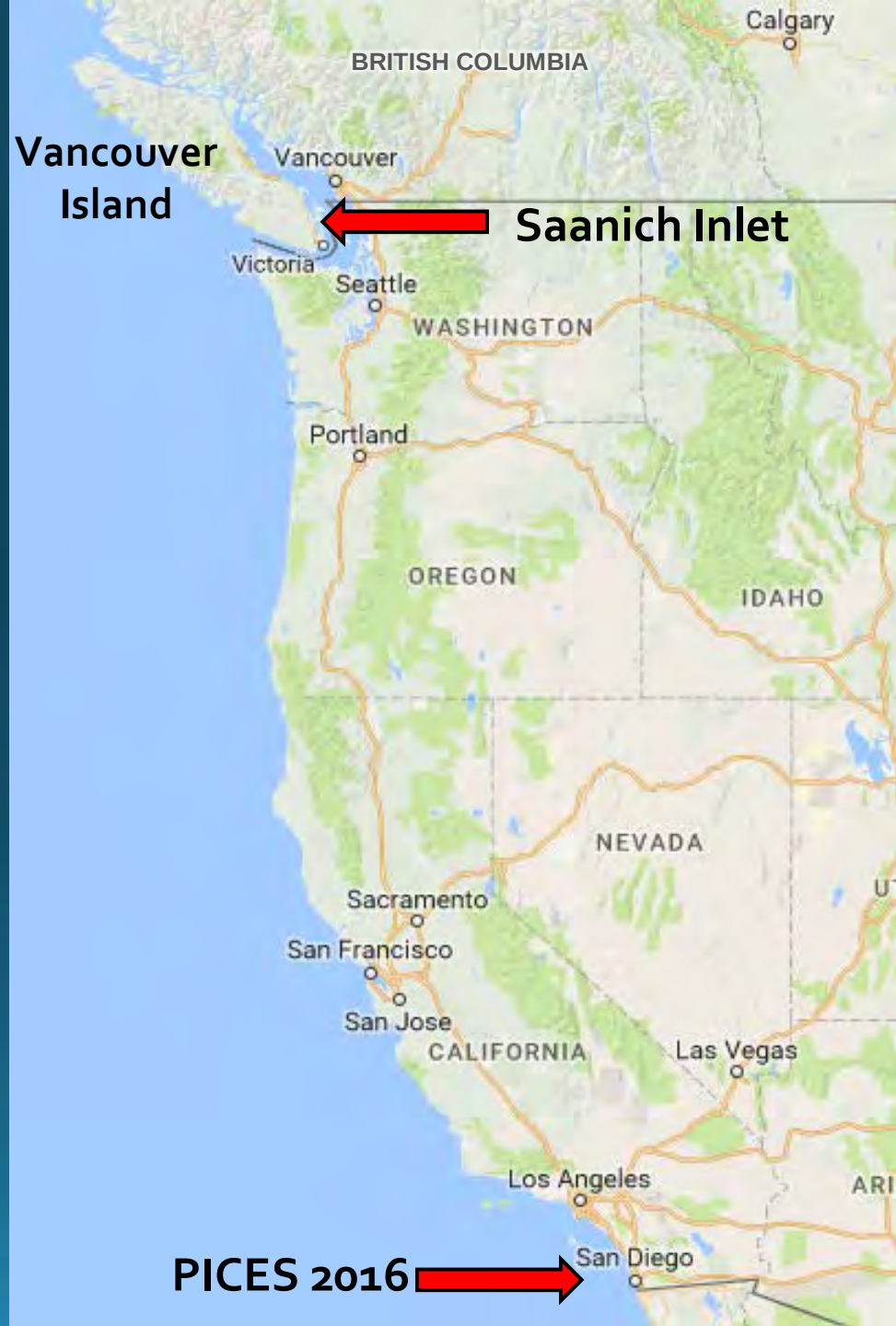
- Canadian Food Inspection Agency (CFIA)
- 54 µg/g domoic acid (DA) in mussel samples in Saanich Inlet
- First closure due to ASP for the area

SEM and Domoic Acid analysis

- Samples were collected by Harmful Algae Monitoring Program (HAMP)
  - Monitor aquaculture sites for harmful algae
- *Pseudo-nitzschia australis* was dominant species

P. australis was undocumented in the area

- Has been documented in Puget Sound and Strait of Juan de Fuca



Where is domoic acid found in eastern Pacific?

West coast of North America

- Especially in California
- Mostly caused by *Pseudo-nitzschia australis* in the USA, and by *P. pungens/multiseries* and *P. delicatissima* in Canada

Commonly on BC coast around Haida Gwaii and the west side of Vancouver Island

- Few closures
- No reported illnesses – recently some suspect

Pseudo-nitzschia species are cosmopolitan

- Domoic acid has been detected on nearly every continent

Potential risks of DA in the Strait of Georgia

- Health risk to recreational harvesters
  - ASP is a new health hazard
  - Possible non-reporting
  - Health risks from harvesting from closed areas
  - Tourist harvesting – might not be aware
  - Ecosystem wide impacts
    - i.e. Resident Killer Whale populations
- Economic consequences to aquaculture companies
  - Closure times depend on depuration rates of different shellfish species
  - Many coastal communities and first nations rely largely on shellfish harvesting (i.e.: clam beds)
  - Over 50% of BC shellfish aquaculture sites are in the Strait of Georgia

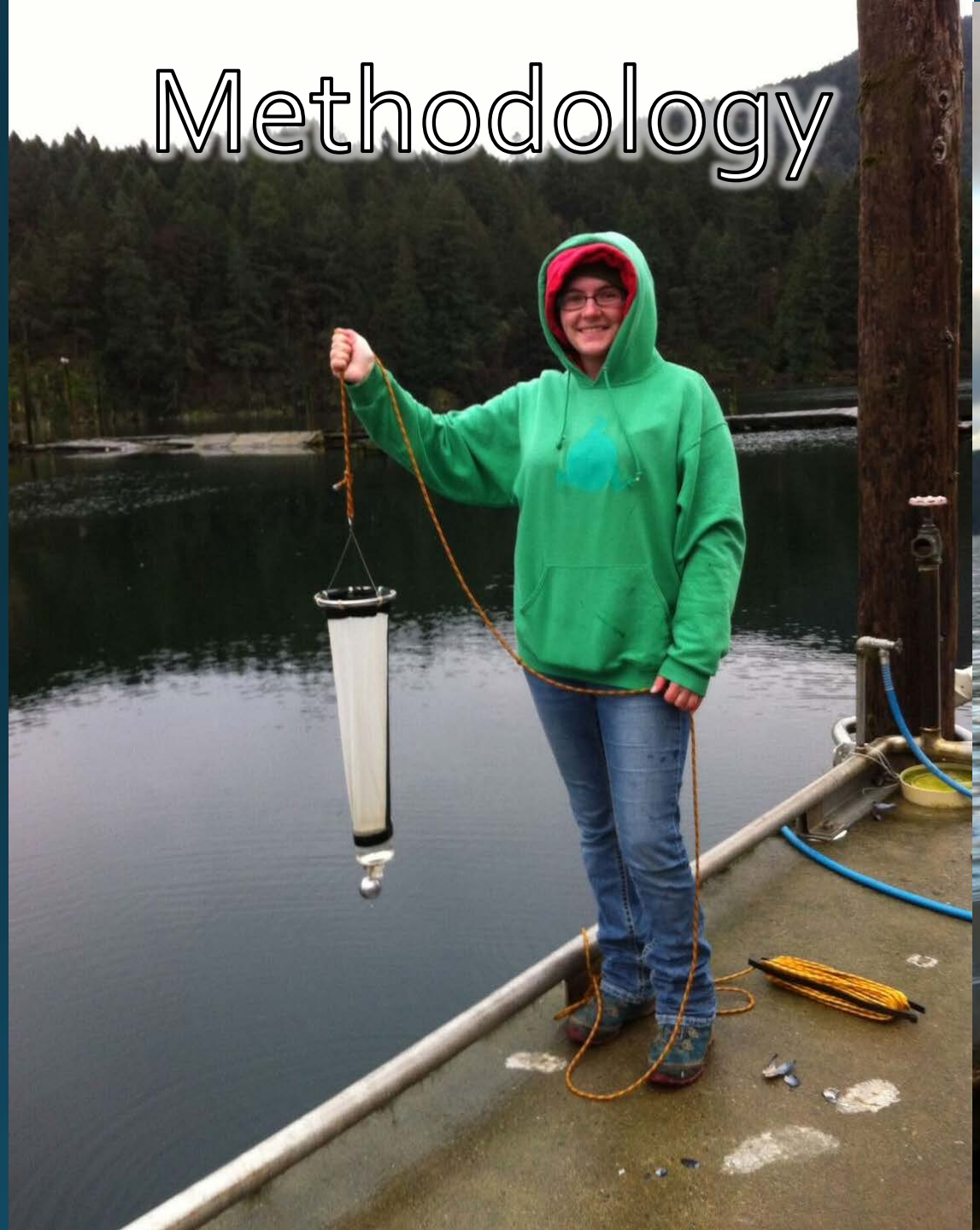
Image: Fisheries and Oceans Canada

First time *Pseudo-nitzschia australis* has been seen in eastern Vancouver Island!

Research Question

Will *Pseudo-nitzschia australis* reoccur in Saanich Inlet and the Strait of Georgia in 2016?

Methodology



Methodology

Sites of collection:

- Goldstream
- Mill Bay
- Cowichan Bay
- Genoa Bay
- Maple Bay
- Crofton

Methodology

Discrete samples and vertical net tow samples

- Discrete samples for cell concentration
- Towed samples for absence/presence of species

Samples collected for:

- Molecular identification
- DA concentration
  - (Not yet done)

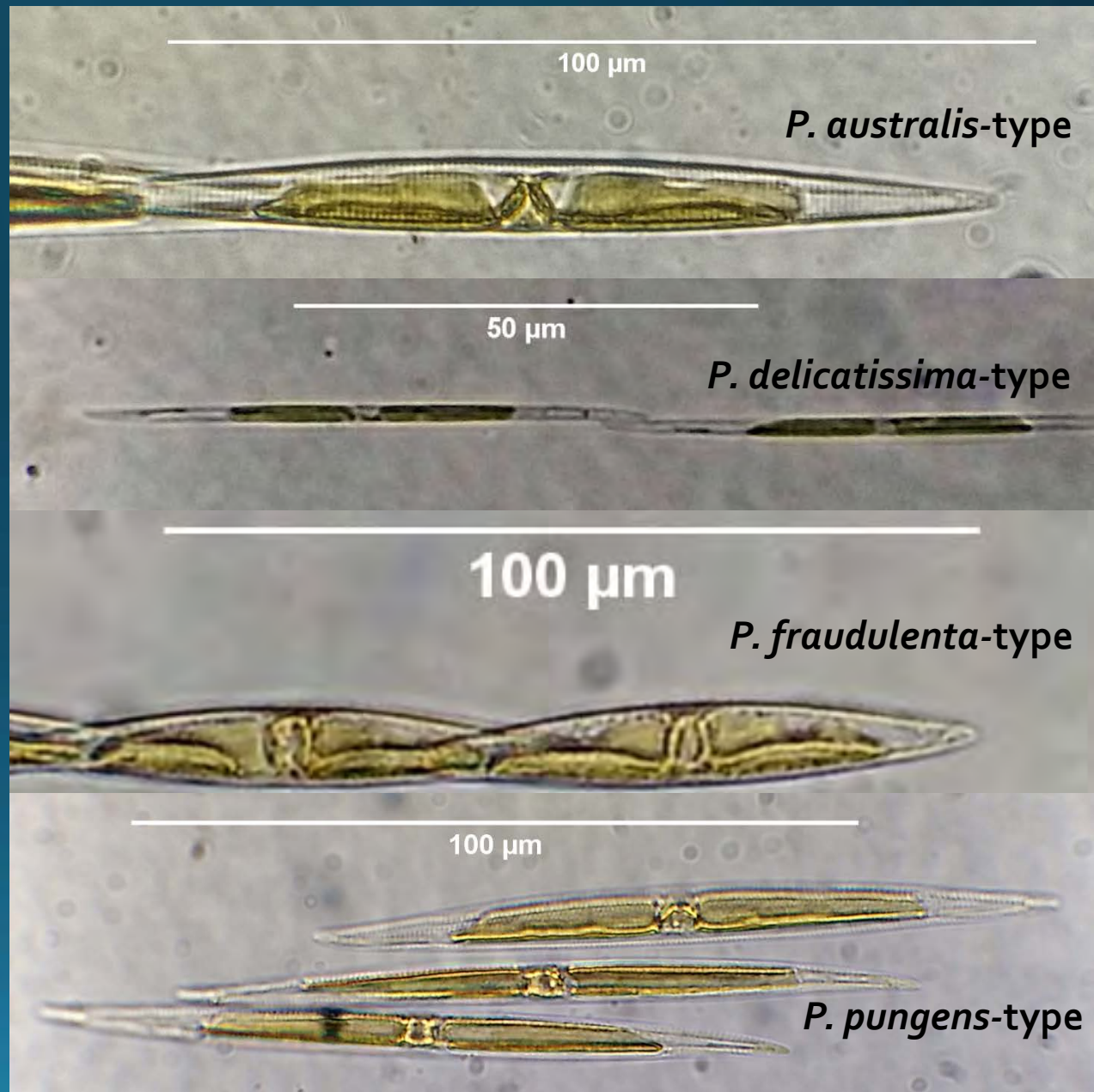
Identification with LM

Separated species into 4 groups:

- *P. australis*-type
- *P. delicatissima*-type
- *P. fraudulenta*-type
- *P. pungens*-type

Based on:

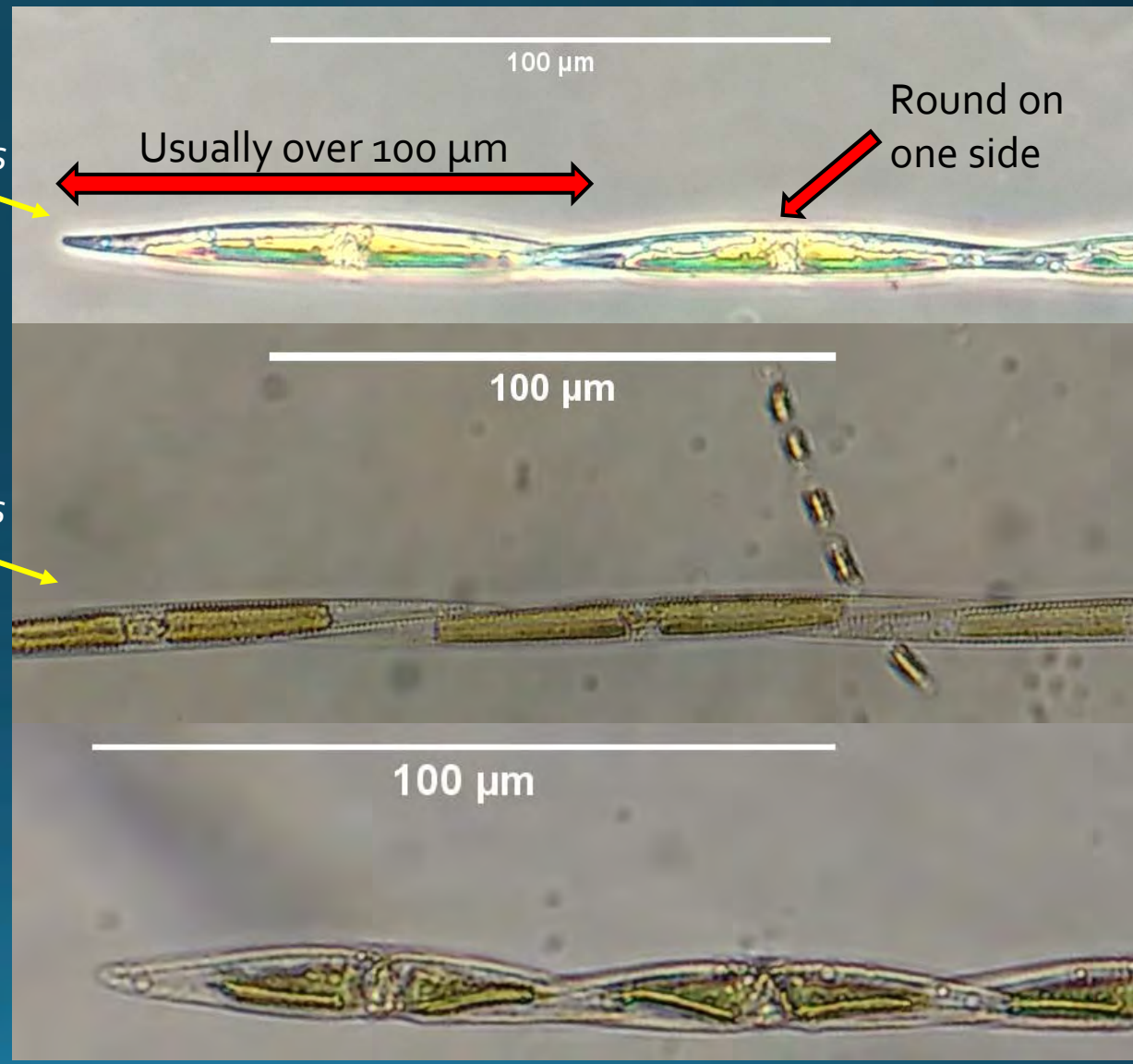
- Shape
- Length
- Striae density (lines on cells)

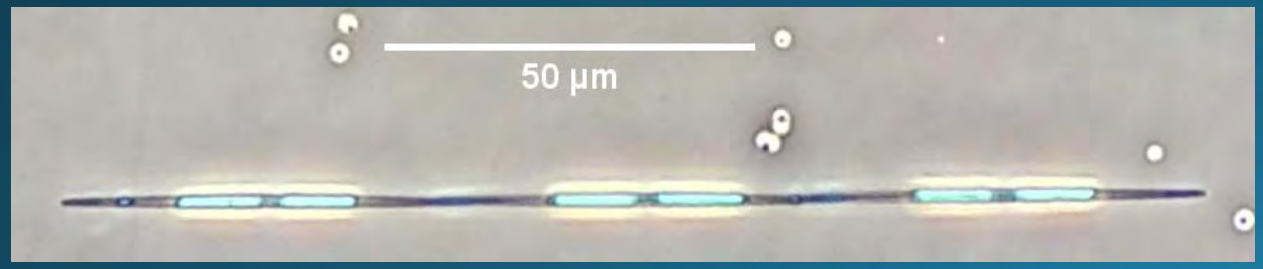


Methods of identification using LM

Shape and length

- *P. pungens* and *P. australis* are of similar length with different shapes





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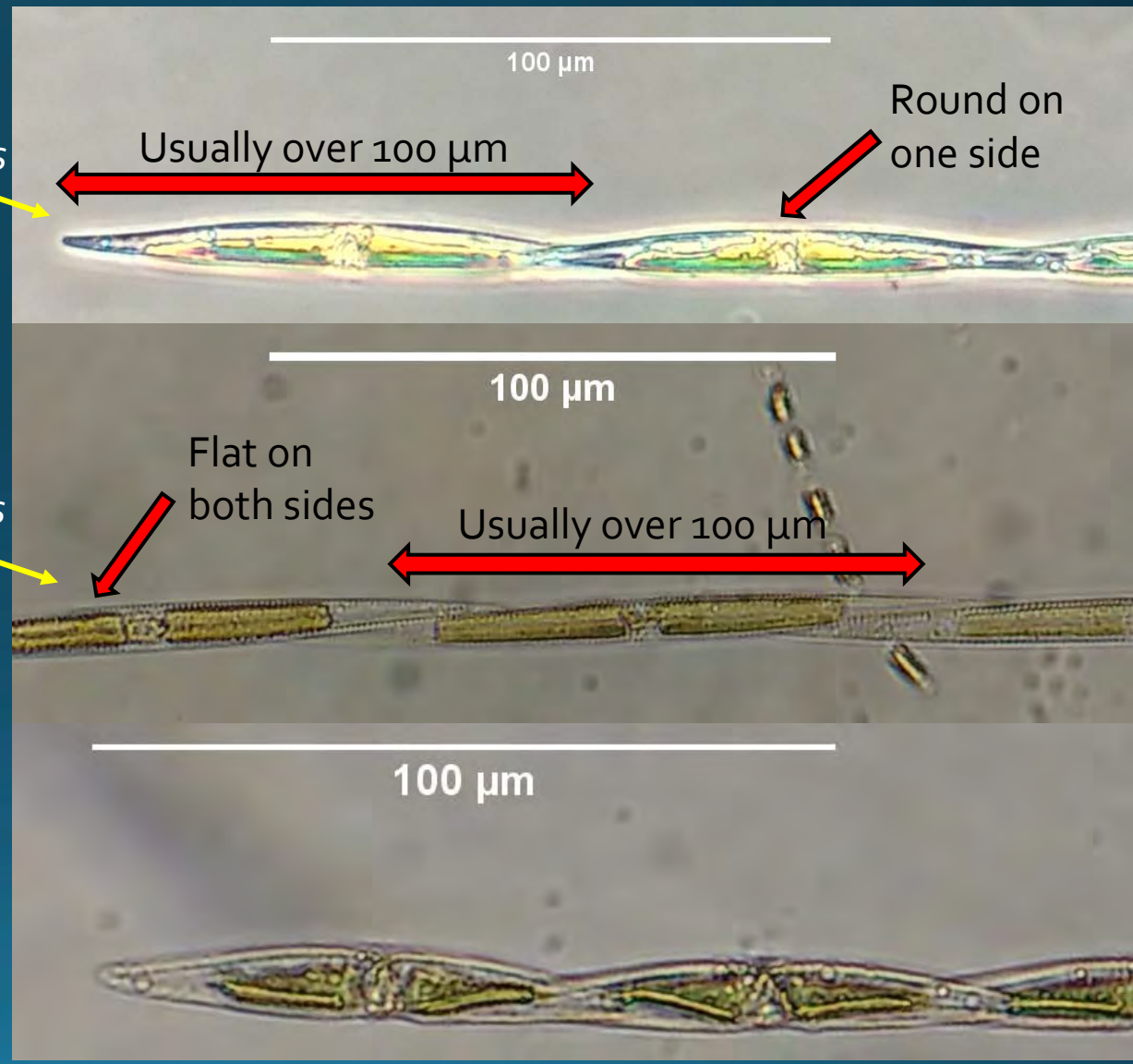
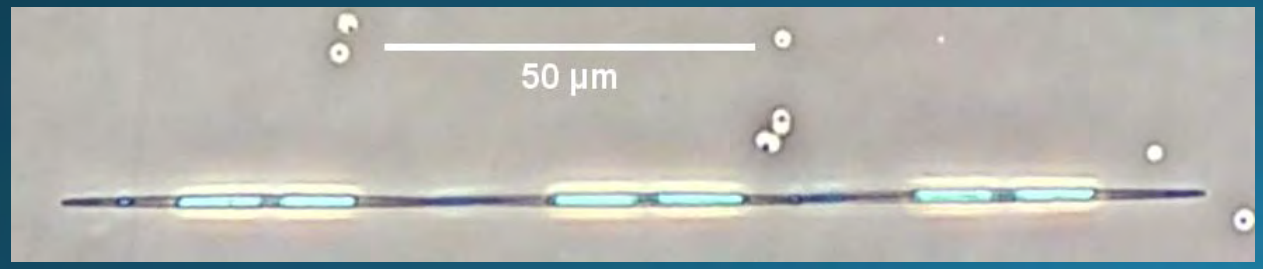
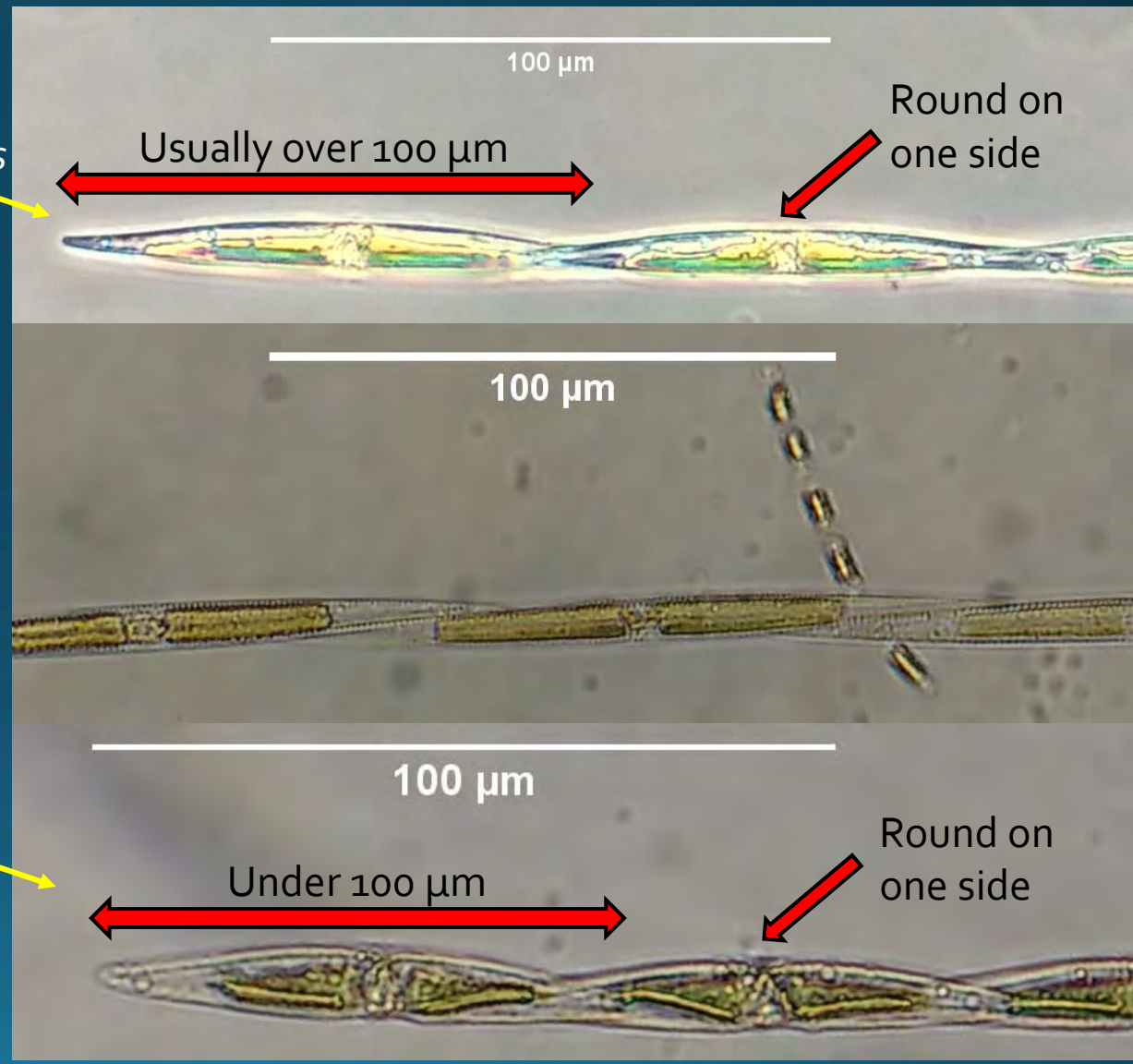


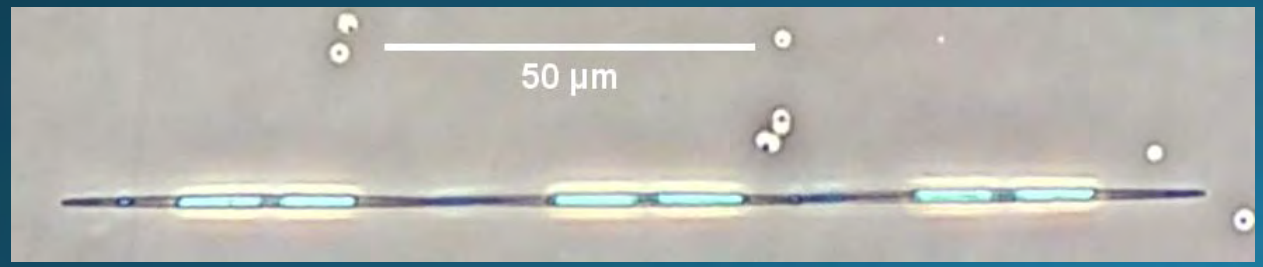


Methods of identification using LM

Shape and length

- *P. pungens* and *P. australis* are of similar length with different shapes
- *P. fraudulenta* is shorter – rarely longer than 80 µm with same shape as *P. australis*

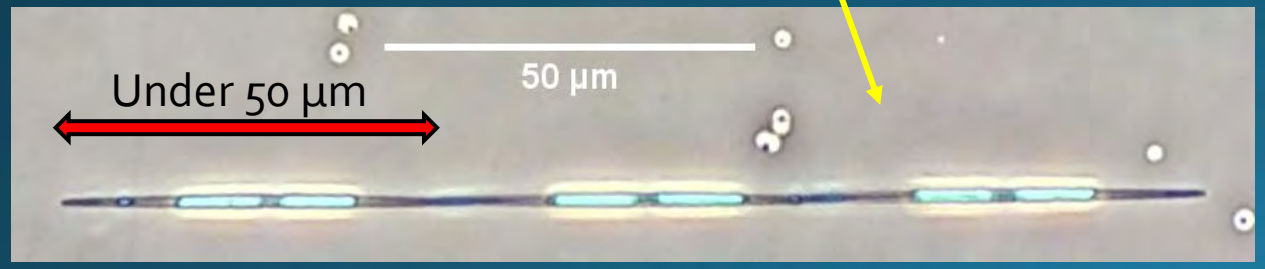


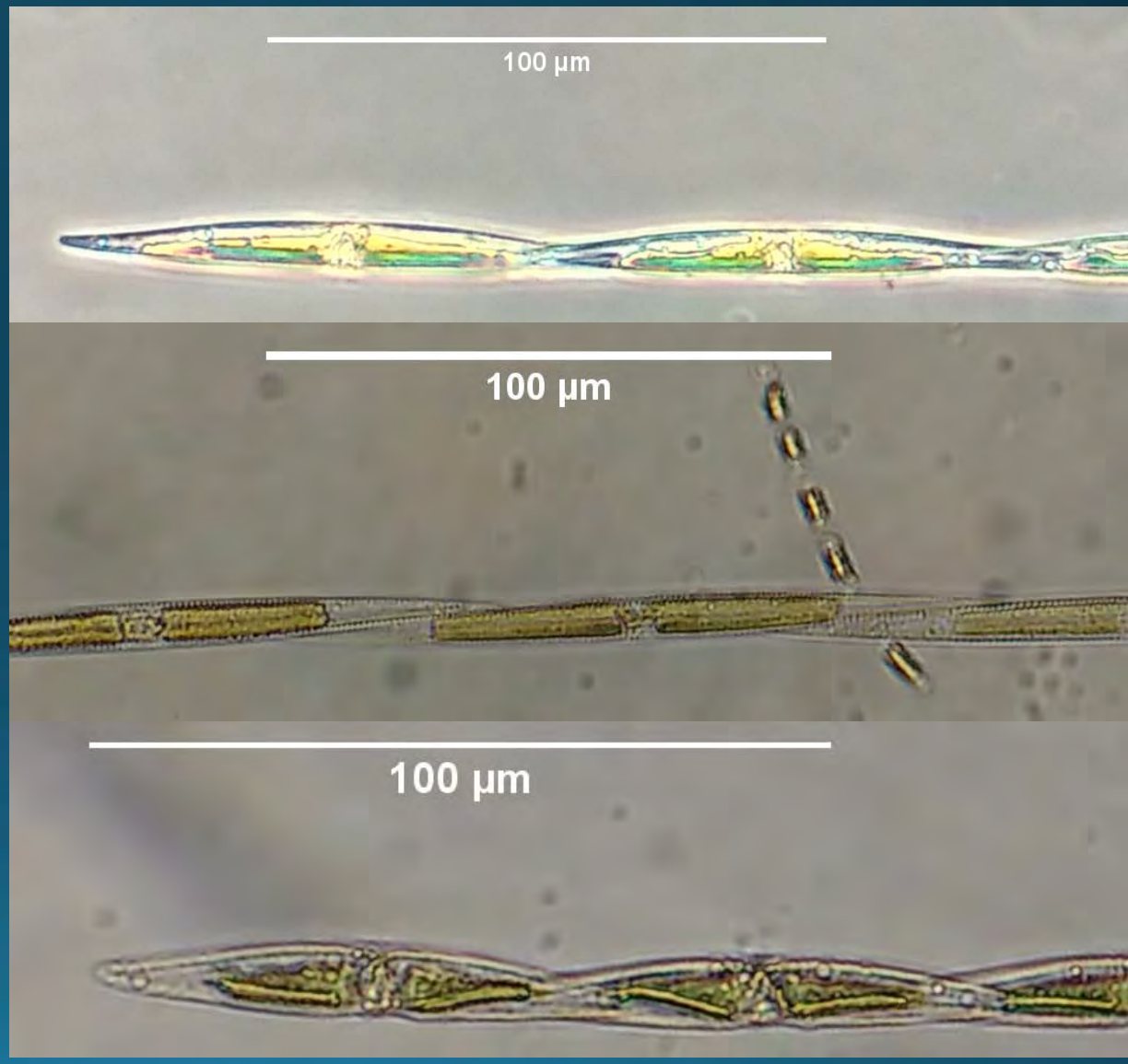


Methods of Identification using LM

Shape and length

- *P. pungens* and *P. australis* are of similar length with different shapes
- *P. fraudulenta* is shorter – rarely longer than 80 µm with same shape as *P. australis*
- *P. delicatissima*-type group is composed of species under 50 µm

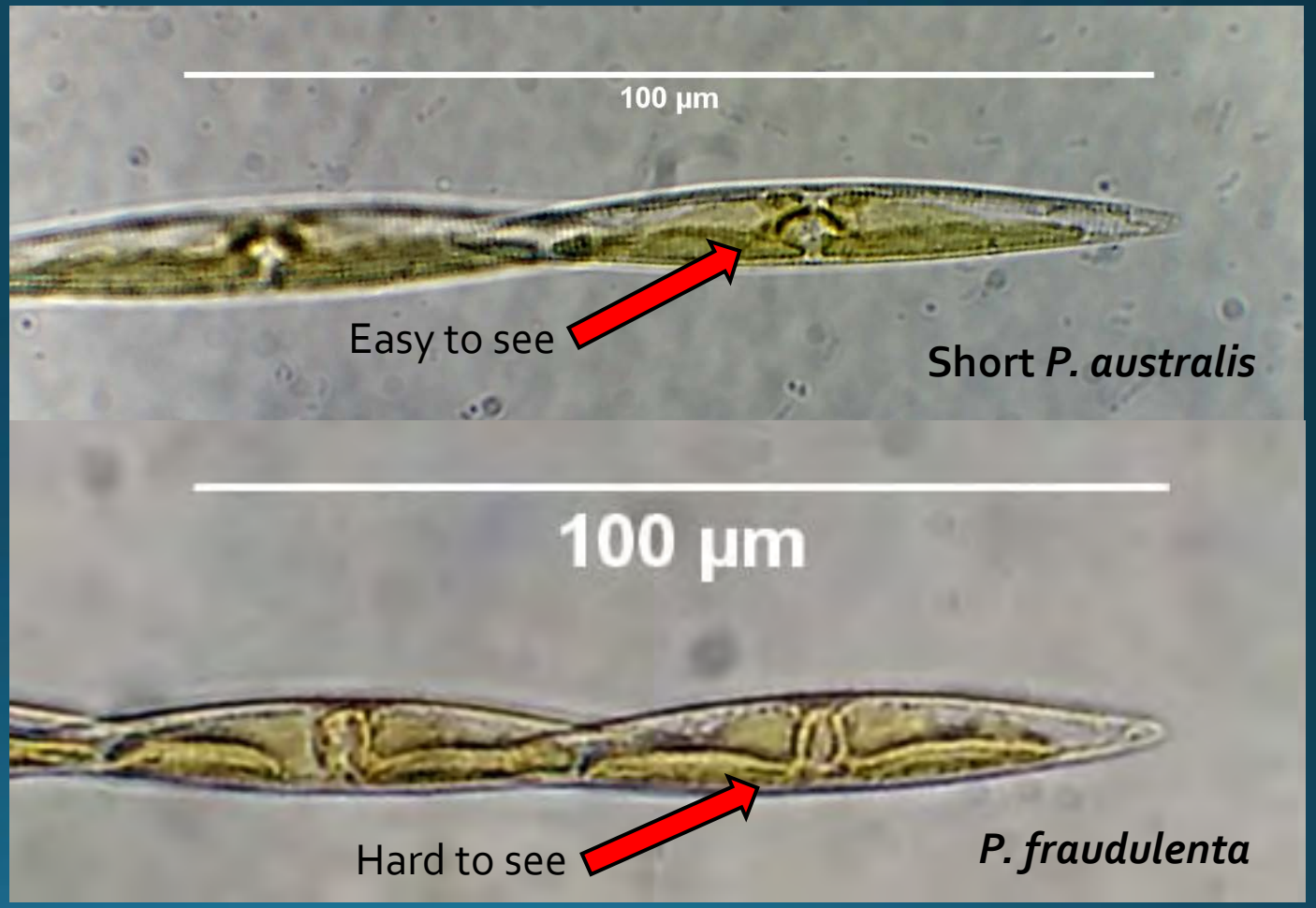




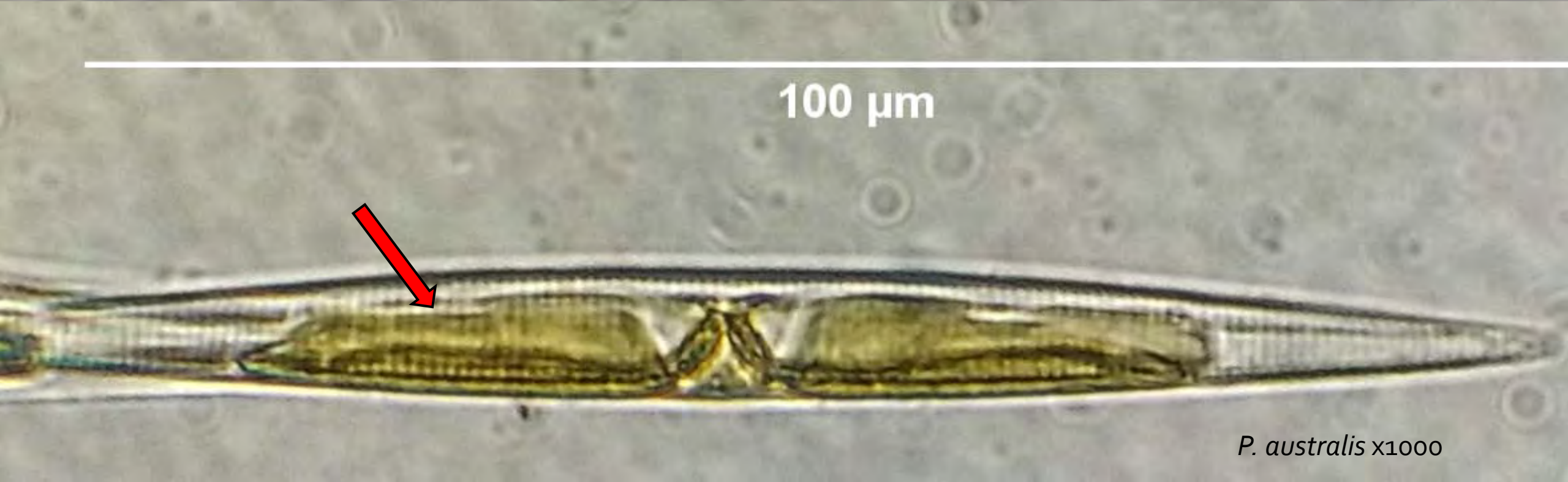
P. australis vs *P. fraudulenta* with light microscopy

P. australis and *P. fraudulenta* can be distinguished using striae density

- Striae are raised bars on cells
- Striae density used to ID *Pseudo-nitzschia* species in SEM
- Can be used in LM at 400X – 1000X magnification



P. australis x1000

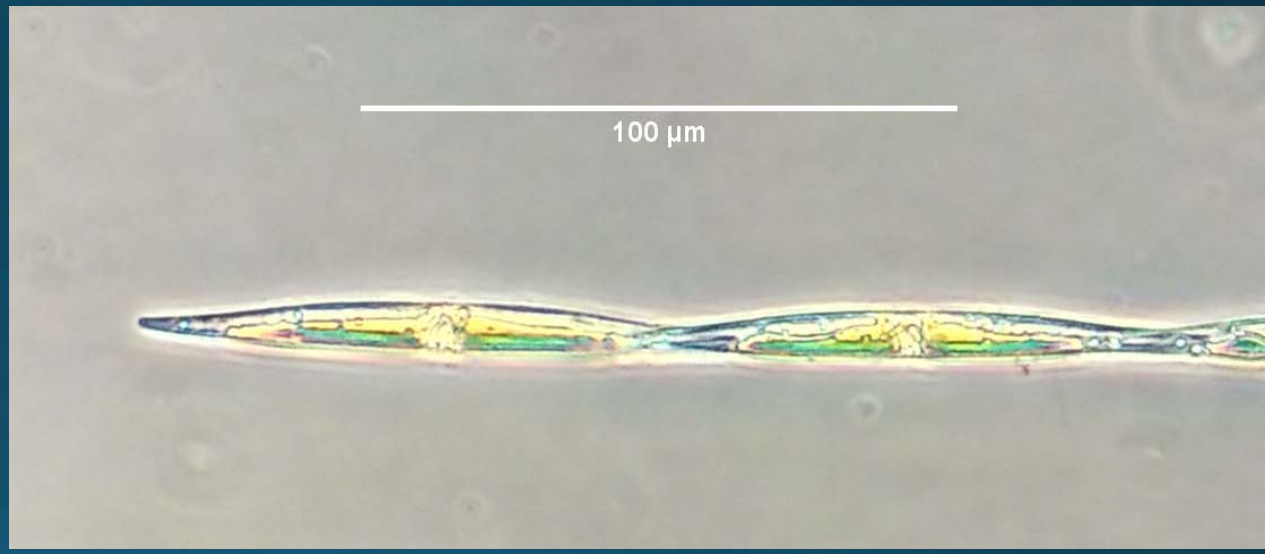


P. australis x1000

Results

Results

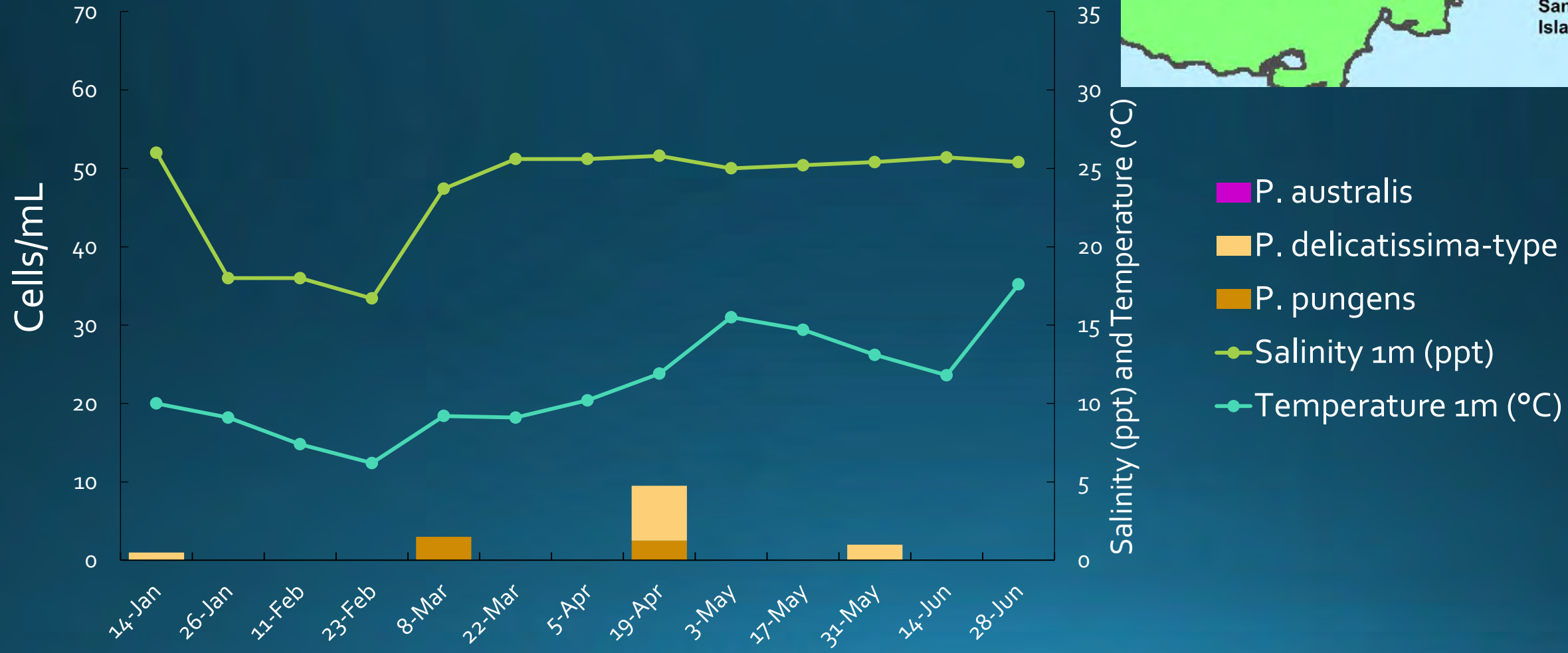
- Bi-weekly samples
  - Genoa Bay taken monthly due to distance
- *Pseudo-nitzschia* is counted as cells/mL of the average of the 1m and 5m discrete samples
- Salinity was taken at 1m
- Temperature was taken at 1m



P. australis

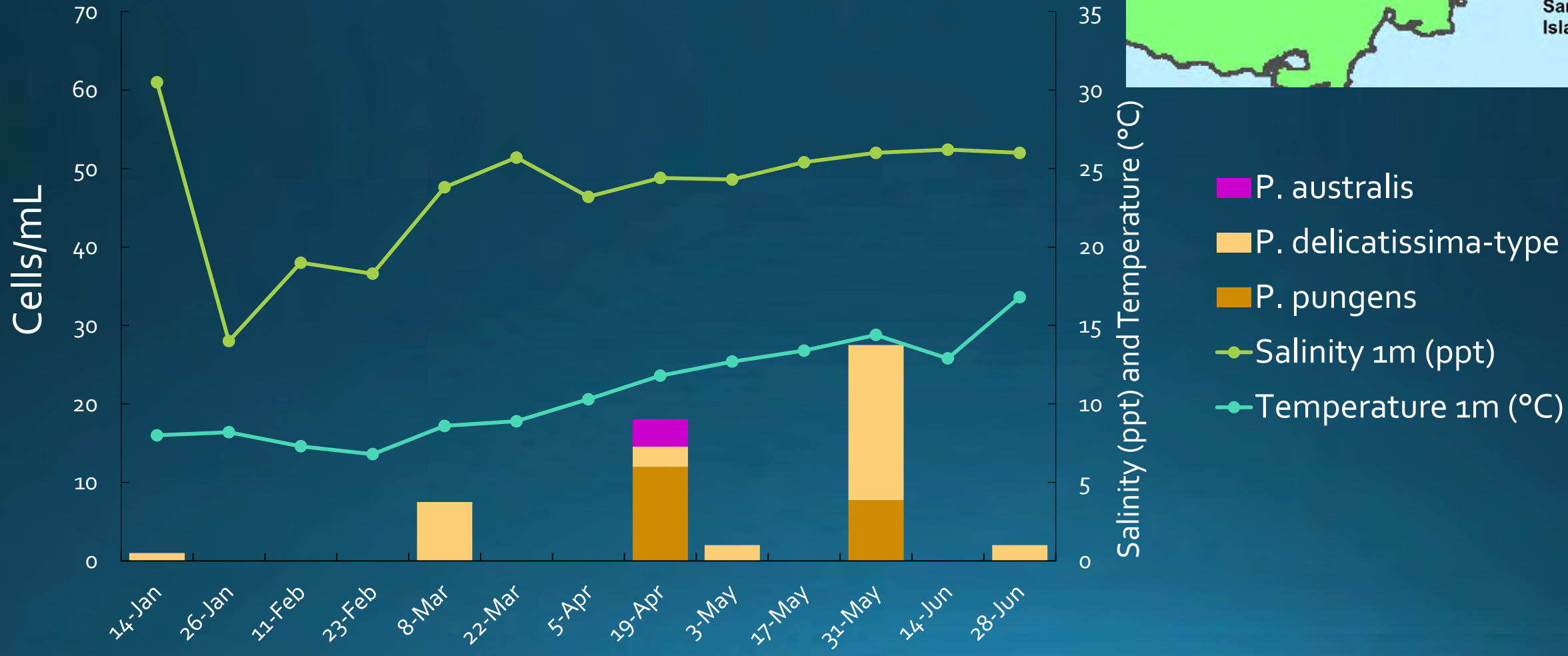
Results - Goldstream

Pseudo-nitzschia spp., salinity, and temperature



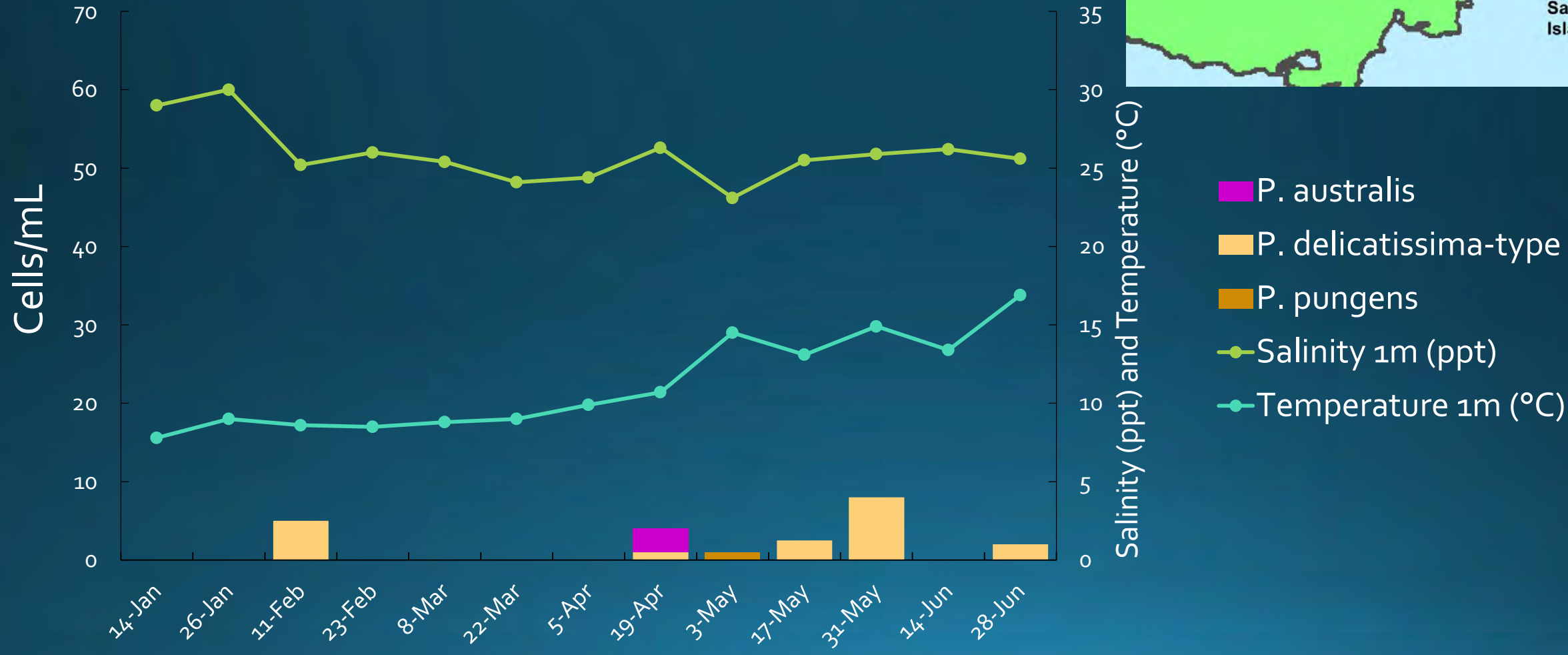
Results – Mill Bay

Pseudo-nitzschia species, salinity, and temperature



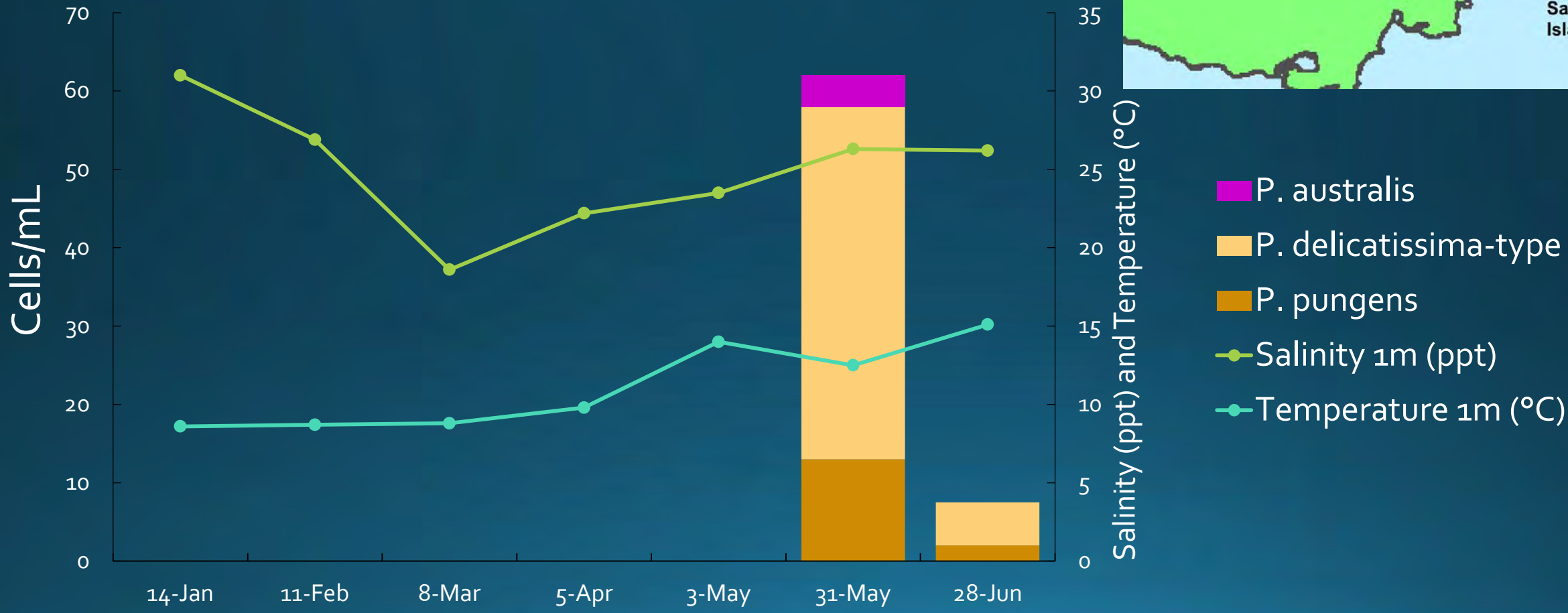
Results – Cowichan Bay

Pseudo-nitzschia species, salinity, and temperature



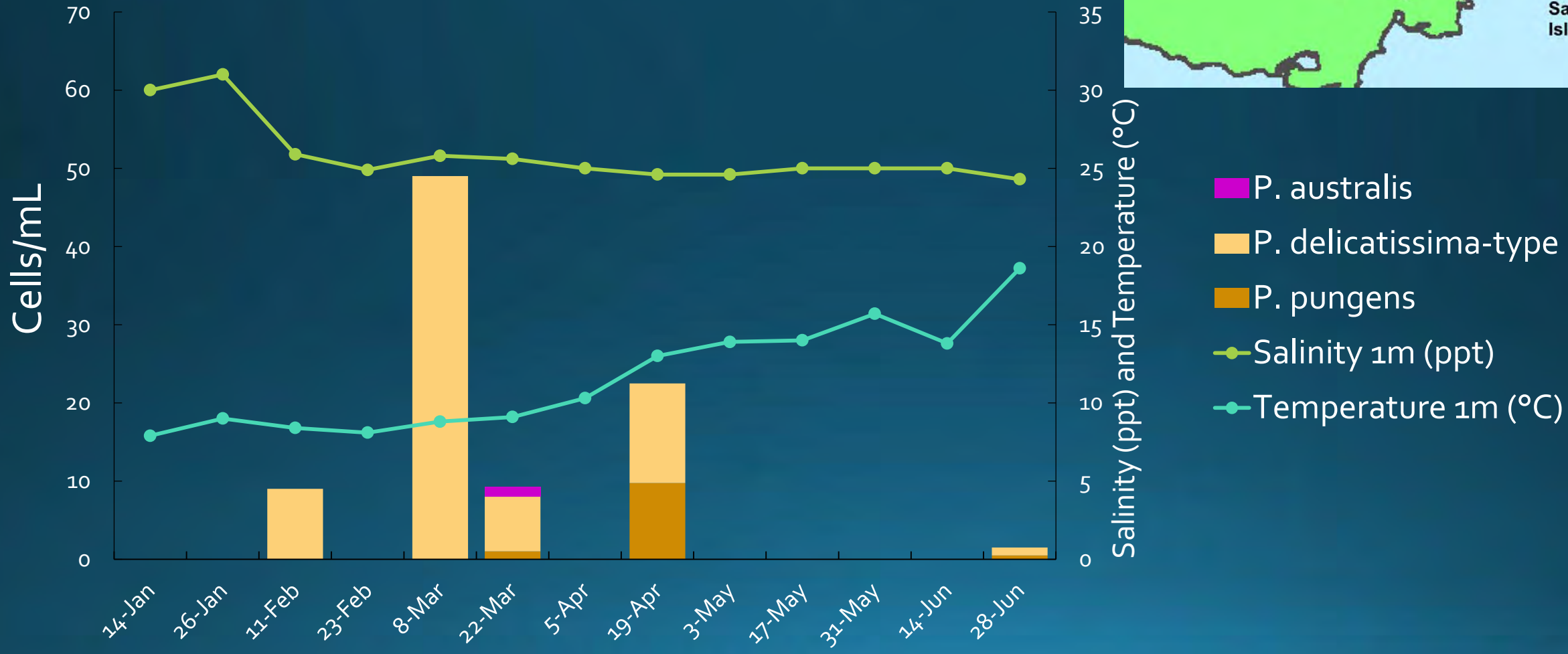
Results – Genoa Bay

Pseudo-nitzschia species, salinity, and temperature



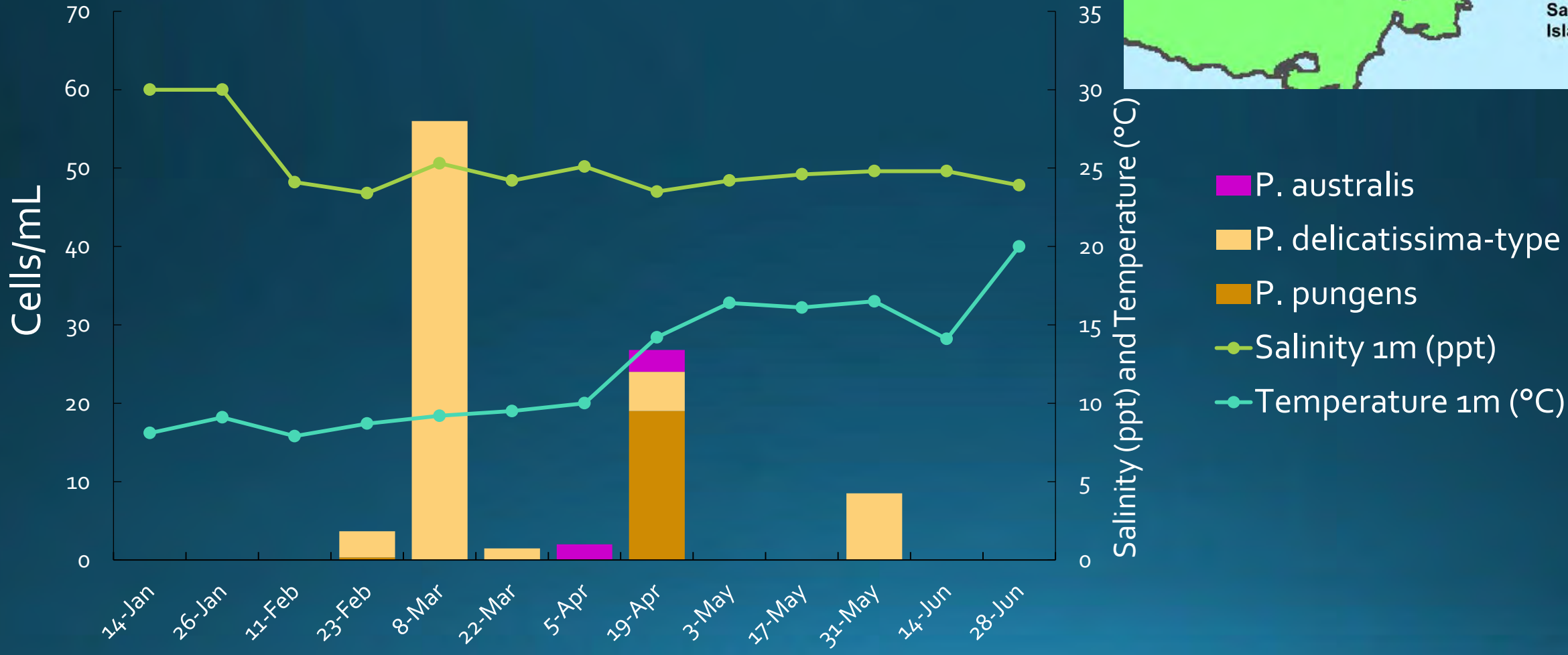
Results – Maple Bay

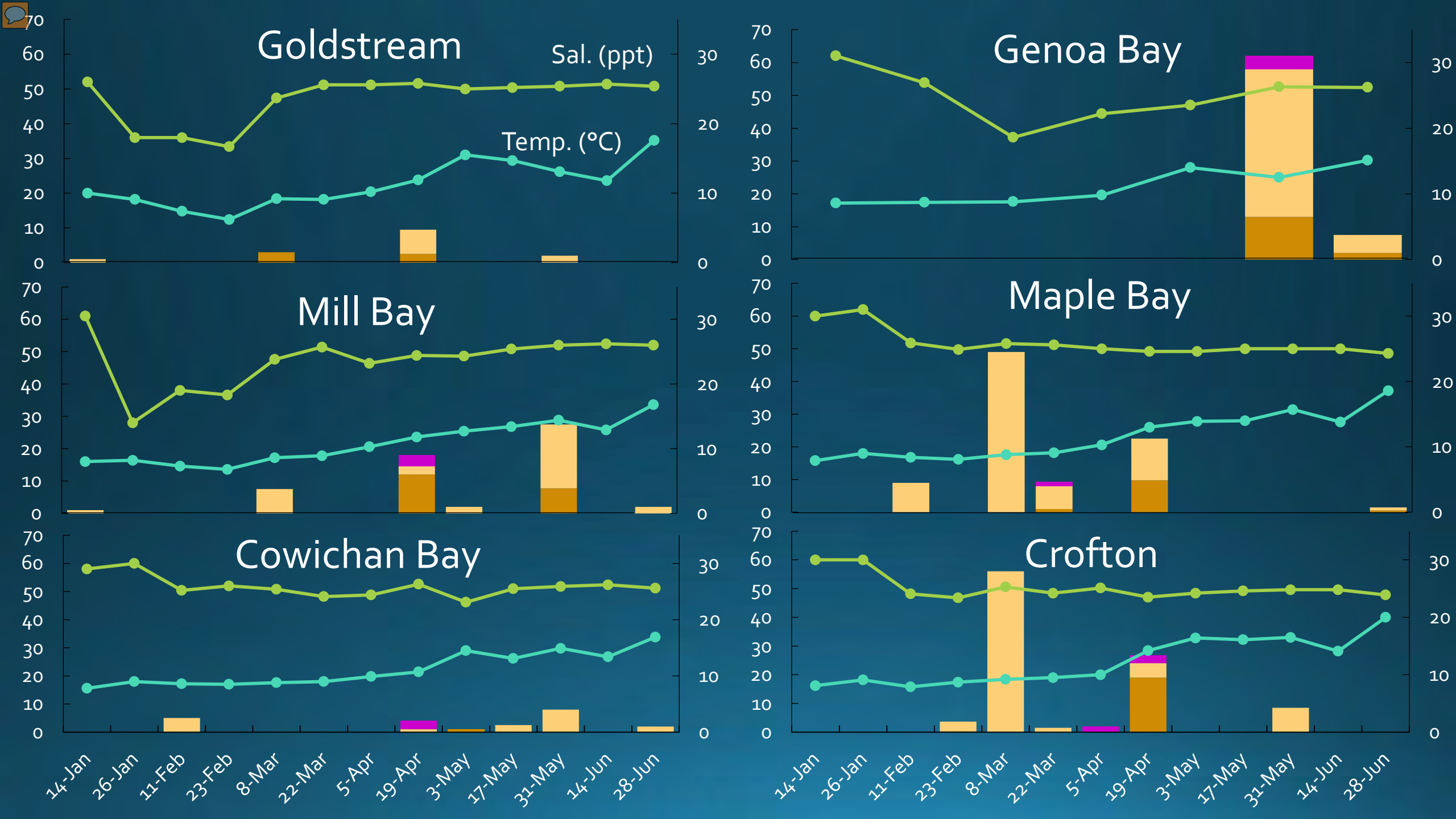
Pseudo-nitzschia species, salinity, and temperature



Results – Crofton

Pseudo-nitzschia species, salinity, and temperature




Goldstream
Sal. (ppt)
Temp. (°C)
Genoa Bay
Mill Bay
Maple Bay
Cowichan Bay
Crofton
0
10
20
30
40
50
60
70
14-Jan
26-Jan
11-Feb
23-Feb
8-Mar
22-Mar
5-Apr
19-Apr
3-May
17-May
31-May
14-Jun
28-Jun

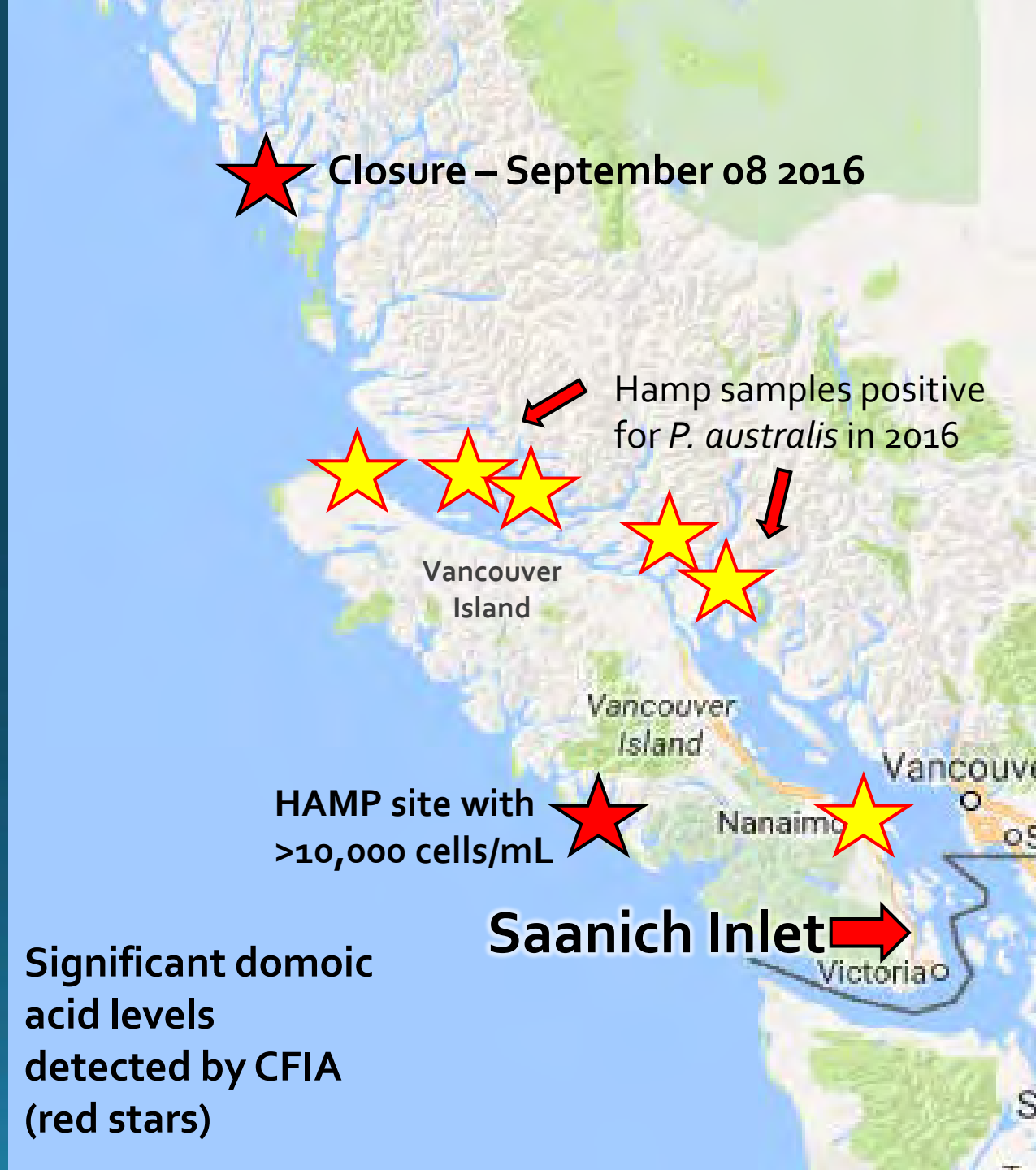
Summary of Results

- *P. australis* was present at all study sites from January – July, 2016
- *P. delicatissima*-type was most common *Pseudo-nitzschia* sp. in study area
- No DA was detected by the CFIA during study period in Strait of Georgia

Summary of Results

HAMP samples:

- *P. australis* at several sites on eastern Vancouver Island July – September
- Central Coast site concurrent with DA
  - 24.6 µg/g max - CFIA data
  - Possibly *P. delicatissima*
- DA in west coast of Vancouver Island sites in August
  - 8.2 µg/g Roderick Island max - CFIA data
- *P. delicatissima* in nearby HAMP site
  - >10,000 cells/mL



Conclusion

P. australis was present at least once at every site sampled from January to July, 2016

- Max concentration 20 cells/mL at Genoa Bay - Low

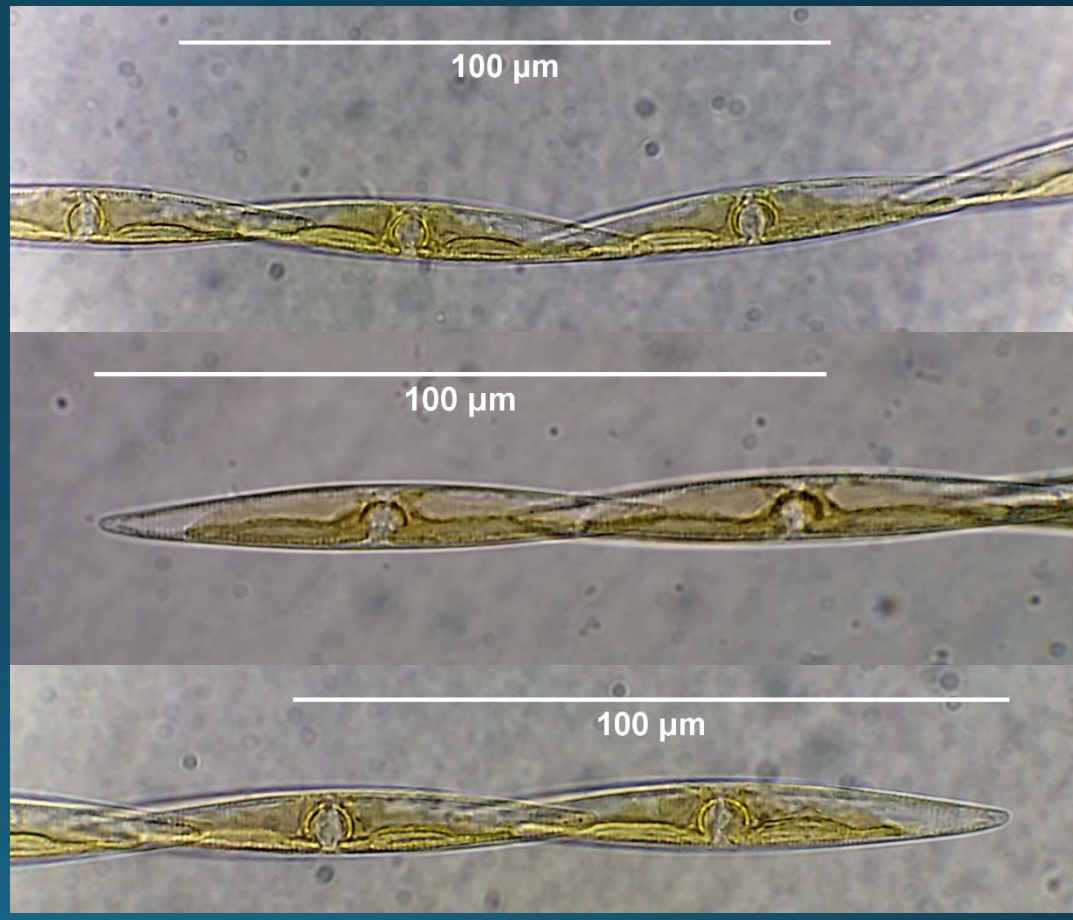
P. australis has been present in several HAMP samples

- All the way to the north of the island
- Moderate concentrations – max 160 cells/mL

Pseudo-nitzschia species did not appear to have a relationship with the measured environmental data

The presence of *P. australis* should be monitored

- Because of seemingly sudden appearance
- Due to potential health and fiscal risks



Above (all): *Pseudo-nitzschia australis*

Summary

- *Pseudo-nitzschia australis* was detected in Saanich Inlet in November 2015, causing the first closure due to ASP in the area
- Six month study was conducted to determine if the species would reoccur in Saanich Inlet
- *P. australis* was found at every site at least once
- *P. australis* was found all the way to the northern tip of the island in HAMP samples
- Concentrations were low
- Environmental data did not seem to have a relationship
- CFIA did not detect domoic acid in Georgia Strait during sampling period

Knowledge Gaps

How did *Pseudo-nitzschia australis* get into the Strait of Georgia?

- Carried in by currents from the large bloom last year?
- Carried in by artificial means such as ballast water?
- Cells already present and conditions became right for a bloom?

Will concentrations increase in the future?

- Will *P. australis* be identified at more HAMP sites?
- Will CFIA start detecting domoic acid in Strait of Georgia?

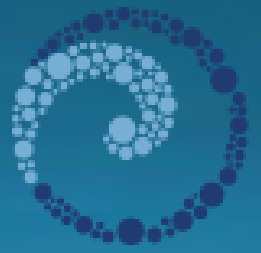
How can the effects on shellfish aquaculture and recreational harvesting be mitigated?

Acknowledgements

- NRC-IRAP – National Research Council Youth Project

- PICES 2016

- HAMP – Harmful Algae Monitoring Program and Microthalassia Consultants



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Thank you!

Questions?

Work et al (1993) - Epidemiology of Domoic Acid Poisoning in Brown Pelicans (*Pelecanus occidentalis*) and Brandt's Cormorants (*Phalacrocorax penicillatus*) in California

Effect of domoic acid on marine animals (above)

Photo: Dan Aryes, Washington Department of Fish and Wildlife