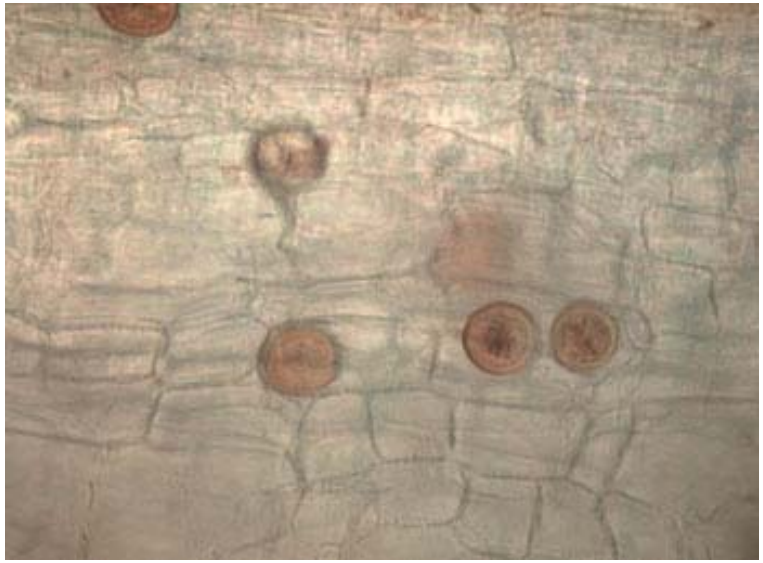
Phytophthora Ramorum Sporulation in Varying Salinities

By Katherine Patterson and Portia Leigh

Introduction

- Dispersal of *Phytophthora ramorum* genotypes
- Common carrier of disease: Rhododendron
- Origin of *Pr* unknown



Phytophthora ramorum chlamydospores in leaf tissue of rhododendron

Introduction

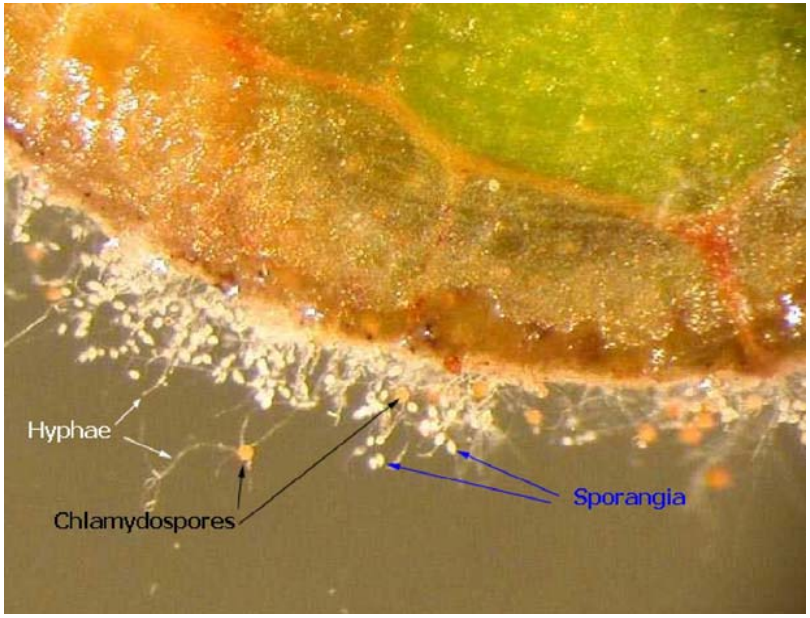
Lineage	Current distribution	Habitat	Mating type
EU1	Europe, North America	Gardens, Woodlands, Nurseries	A1
NA1	North America	Forests, Nurseries	A2
NA2	North America	Nurseries	A2

Phytophthora ramorum Multilocus Genotyping Database. May 2009. people.oregonstate.edu/.../PramorumUS-MAP.

Introduction

- *Pr* belongs to kingdom Chromista (Stramenopiles)
- Related to diatoms and brown algae
- Pr are Oomycetes, or "water molds"
- Hyphae that grow through bark and leaf tissue
- Asexual reproductive structures:

  sporangia and chlamydospores

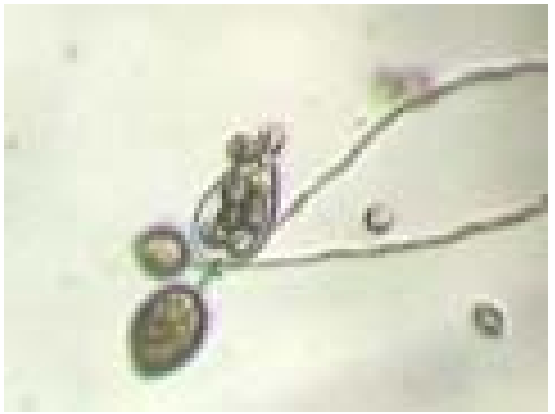


Jennifer Parke, Oregon State University

Introduction

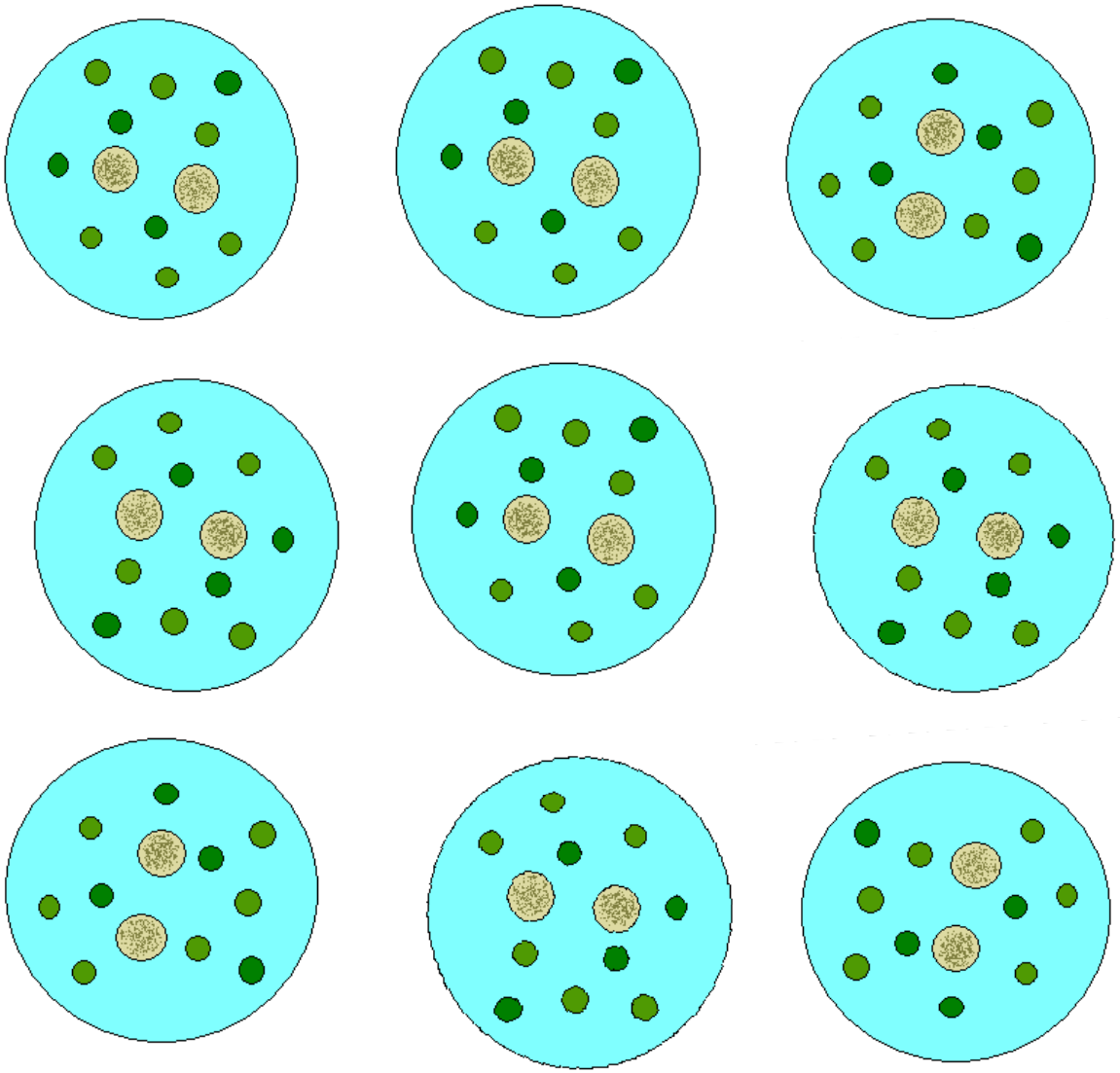
- Disperses readily in water
  - Do its spores survive and/or grow in salt water?
- Hypothesis: There will be spores present in Salt Water

Sporangia of *P. ramorum* containing zoospores.



Flagellated, swimming zoospores of *ramorum.*

Methods



Control (Fresh Water): NA1, NA2 and EU1 Genotypes (x3 replicates)

Brackish Water: NA1, NA2 and EU1 Genotypes (x3 replicates)

Seawater: NA1, NA2 and EU1 Genotypes (x3 replicates)

Methods

- Counts of sporangia and chlamydospores
- 30 µL of sample per slide
- 5 counts per replicate (genotype/treatment)

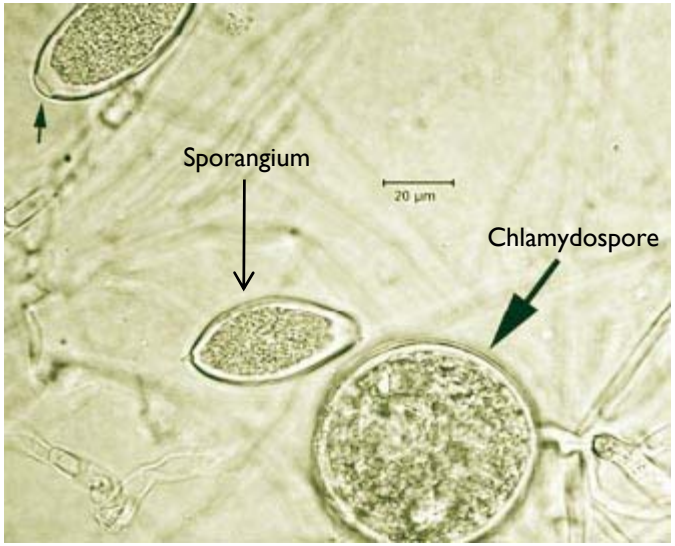
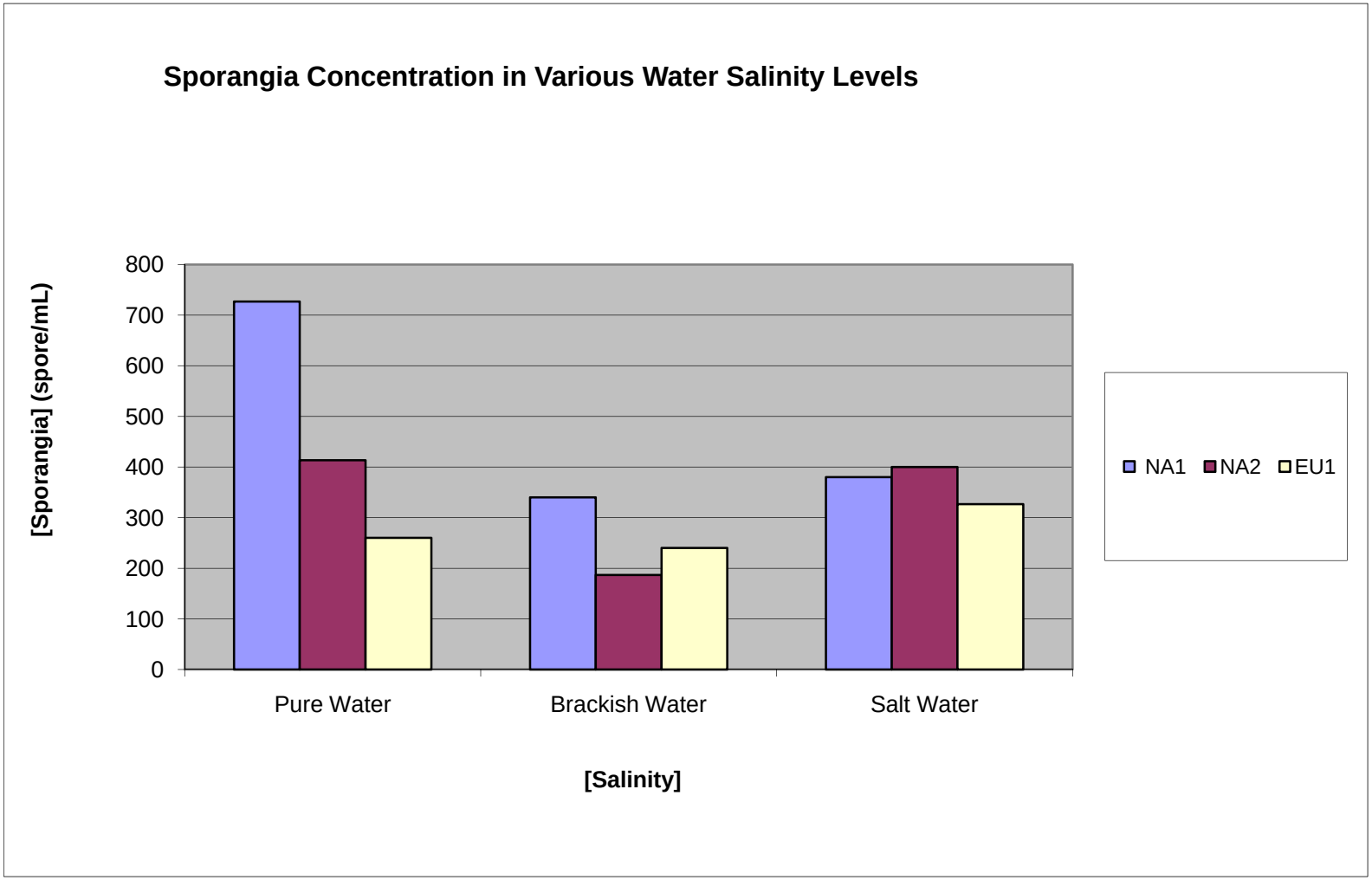
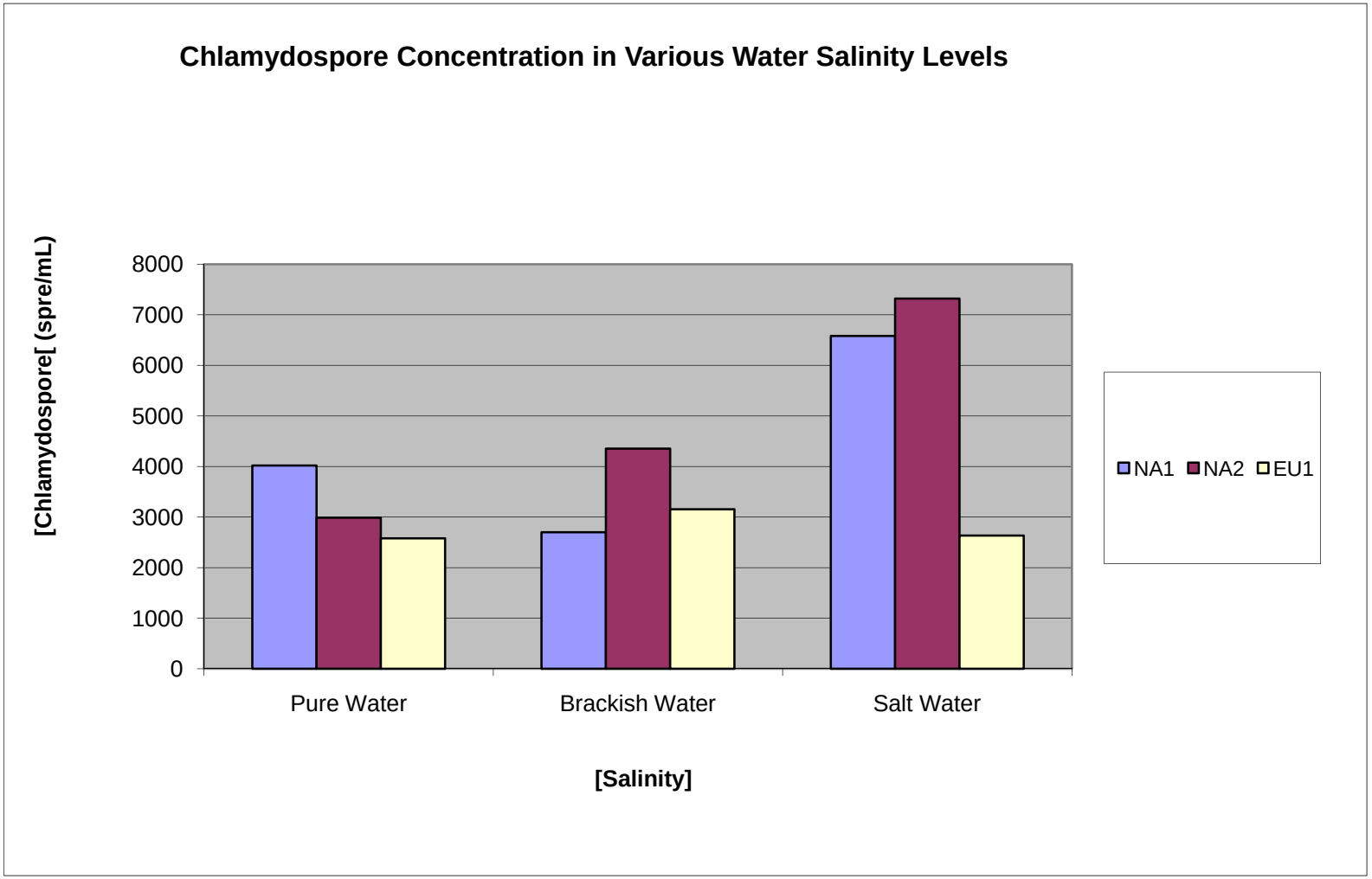


Photo by D. Rioux; courtesy NRCAN

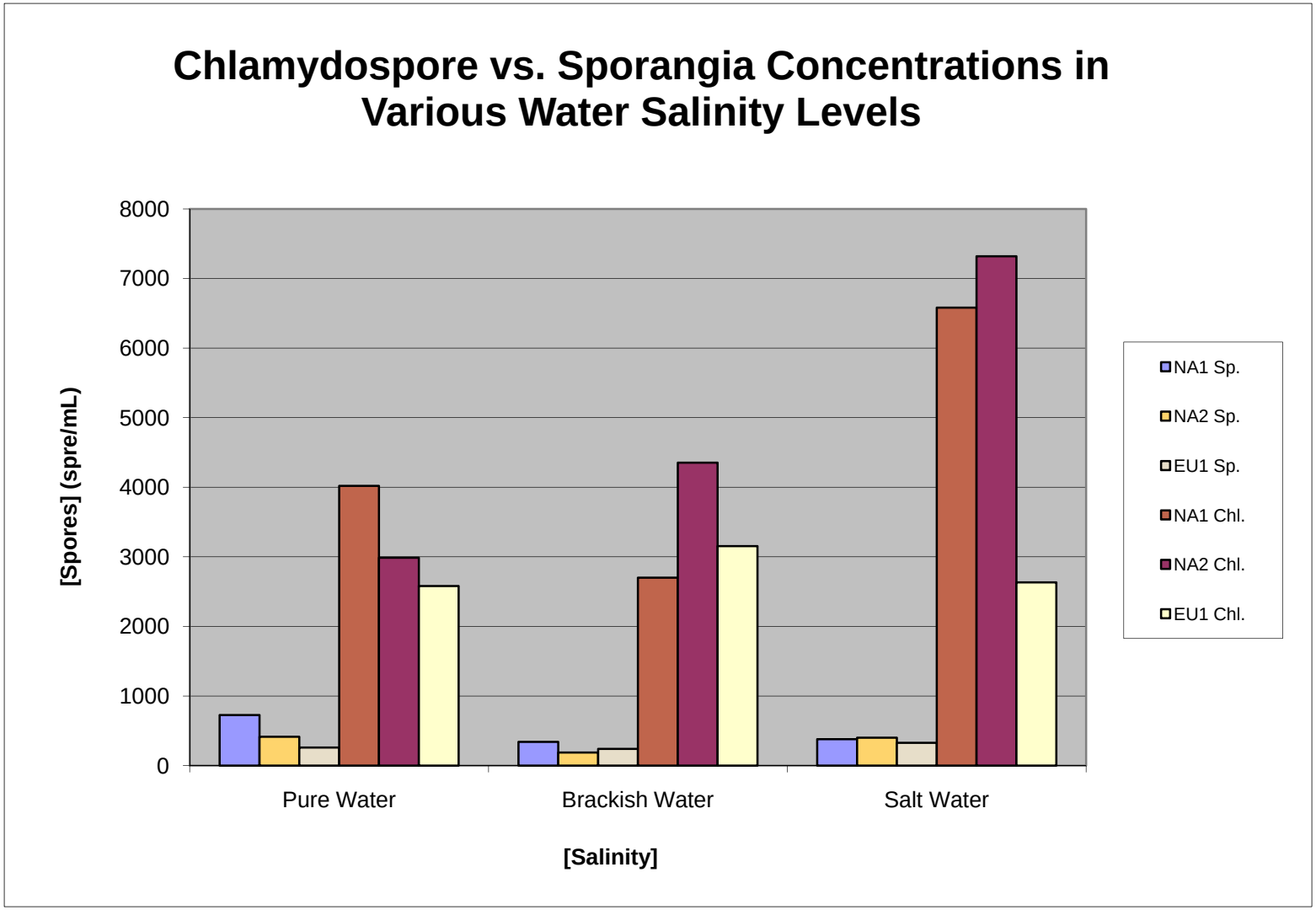
Results


Sporangia Concentration in Various Water Salinity Levels
[Sporangia] (spore/mL)
800
700
600
500
400
300
200
100
0
Pure Water
Brackish Water
Salt Water
[Salinity]
NA1
NA2
EU1

Results


Chlamydospore Concentration in Various Water Salinity Levels
[Chlamydospore[(spre/mL)
8000
7000
6000
5000
4000
3000
2000
1000
0
Pure Water
Brackish Water
Salt Water
[Salinity]
NA1
NA2
EU1

Results


Chlamydospore vs. Sporangia Concentrations in Various Water Salinity Levels
[Spores] (spre/mL)
8000
7000
6000
5000
4000
3000
2000
1000
0
Pure Water
Brackish Water
Salt Water
[Salinity]
NA1 Sp.
NA2 Sp.
EU1 Sp.
NA1 Chl.
NA2 Chl.
EU1 Chl.

Discussion

- A1 (Europe) and A2 (N. America) mating types incompatible
  - Outbreaks thought to have been separate introductions (Brasier 2003)
- How might these introductions have been made?

Discussion

- *P. ramorum* in Europe and N. America are considered invasive (Brasier and others 2004).
- Origin Unknown
  - *Pr* may have originated in Asia; transported on commercial or privately collected ornamental plants

Tanoak killed by P. ramorum. Courtesy UC Berkeley Photos

Discussion

- Halophytophthora have been found infesting tropical and subtropical mangroves (Hyde et al., 1998, Nakagiri et al., 2001).
- No published studies were found investigating halo tolerance of Pr.
- Spread?
  - Boat ballasts?

www.pkharbour.org/Ballast%20Water%20Issues.htm

Issues Related to our Findings

- Ballast water dumped from a single ship can contain hundreds of species of phytoplankton, zooplankton, larval fish and invertebrates.

- Globally, about 10 billion tons of ballast water is transferred each year

- Future studies

Sources

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- Goheen, E. M., Kubisiak, T. L., and Zhao W. 2005. The Search for the Origin of Phytophthora ramorum: A First Look in Yunnan Province. People's Republic of China.
- California Oak Mortality Task Force. 2004. www.suddenoakdeath.org/ppt/Virtual%20Training%20Part%201.ppt
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- Nakagiri, Akira, T. Ito, L. Manoch, M. Tanticharoen. 2001. A new *Halophytophthora* species, *H. porrigovesica*, from subtropical and tropical mangroves. Mycoscience **42:** 33-41.