Toxic Heavy Metal Removal (of Arsenic, Cadmium, Mercury, and Lead) by Marine Phytoplankton

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Biology 498
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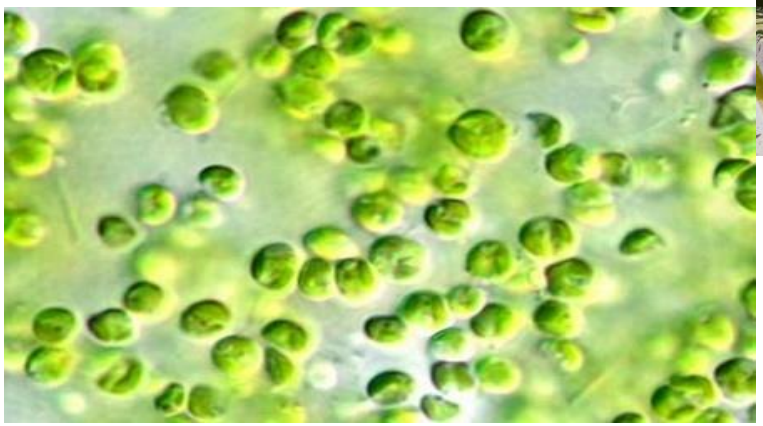
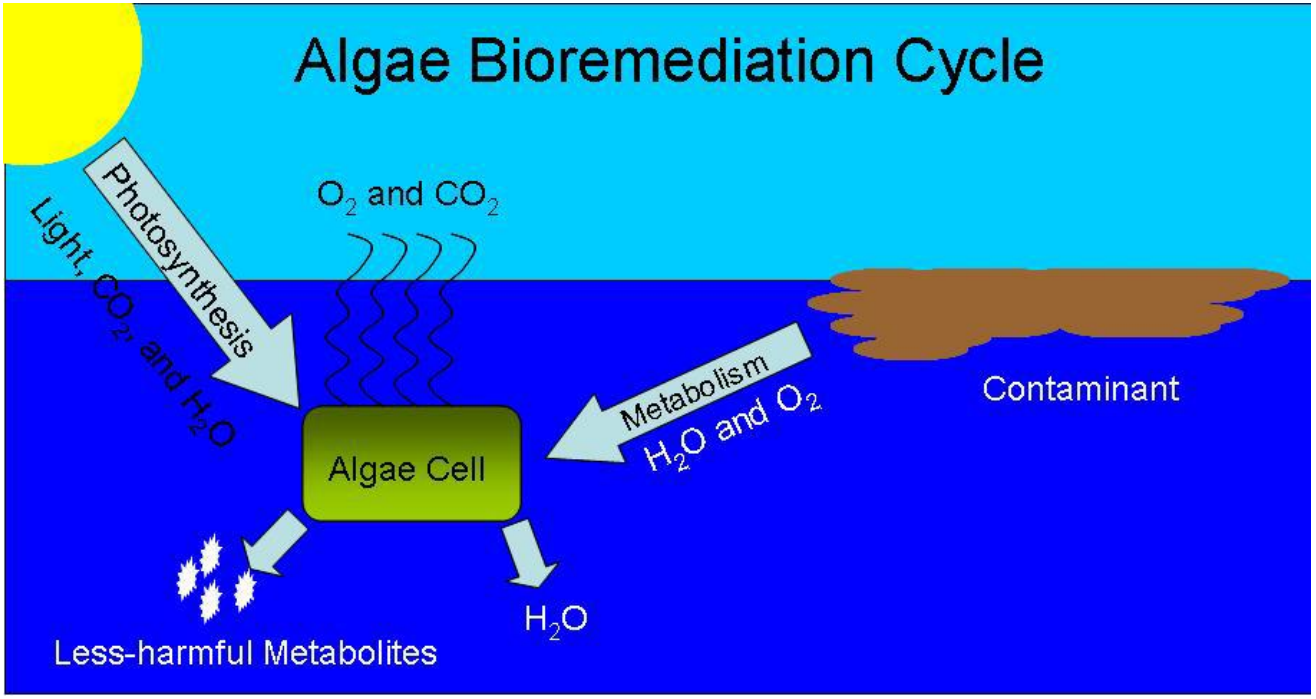
Marine Phytoplankton

- aka microalgae
- Global importance
- Many human uses



Phycoremediation

- Using phytoplankton (microalgae) to remove contaminants



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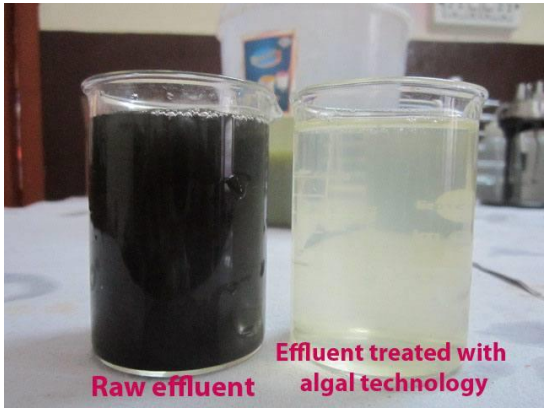


http://phycoremediation.in/pic8.jpg

Research Objectives

- To examine:
  - How well microalgae can sequester toxic metals
  - Differences between metals

- Gain insight on real-world applications

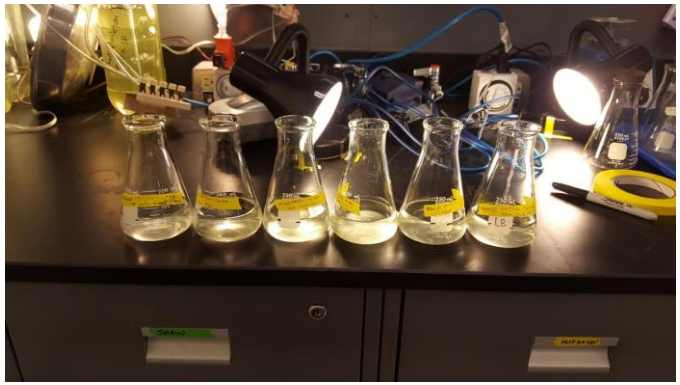
Experimental Design

- 2 species used
  - *Nannochloropsis sp.*
  - *Tetraselmis sp.*
- Grown in heavy metals @ 1 ppm
- Metal Treatments:
  1. Arsenic (As)
  2. Cadmium (Cd)
  3. Mercury (Hg)
  4. Lead (Pb)
  5. As + Cd + Hg + Pb

Methods

1. Growth in Metal Solutions
2. Harvest
3. Freeze Dry
4. Acid Digestion & Filtration
5. Analysis: Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES)

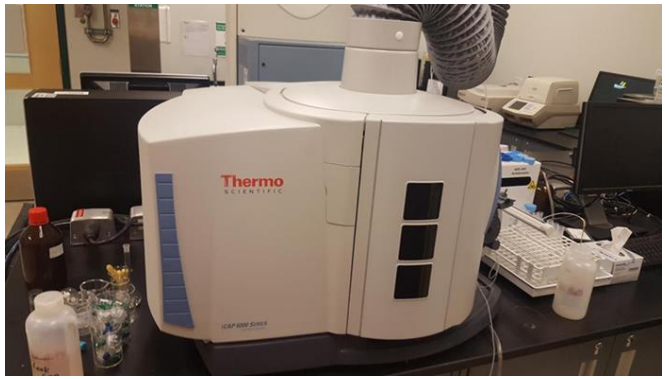
Methods

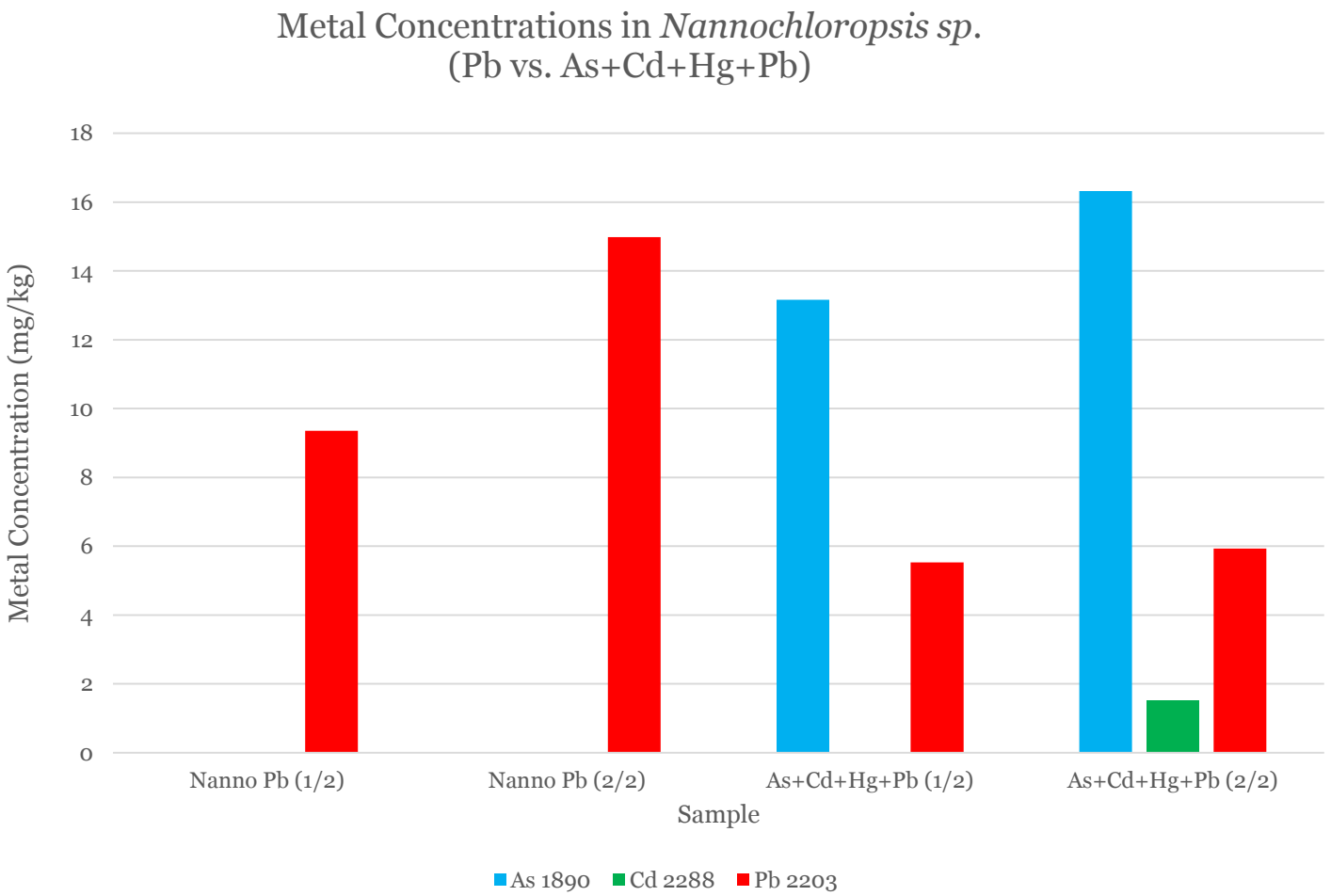


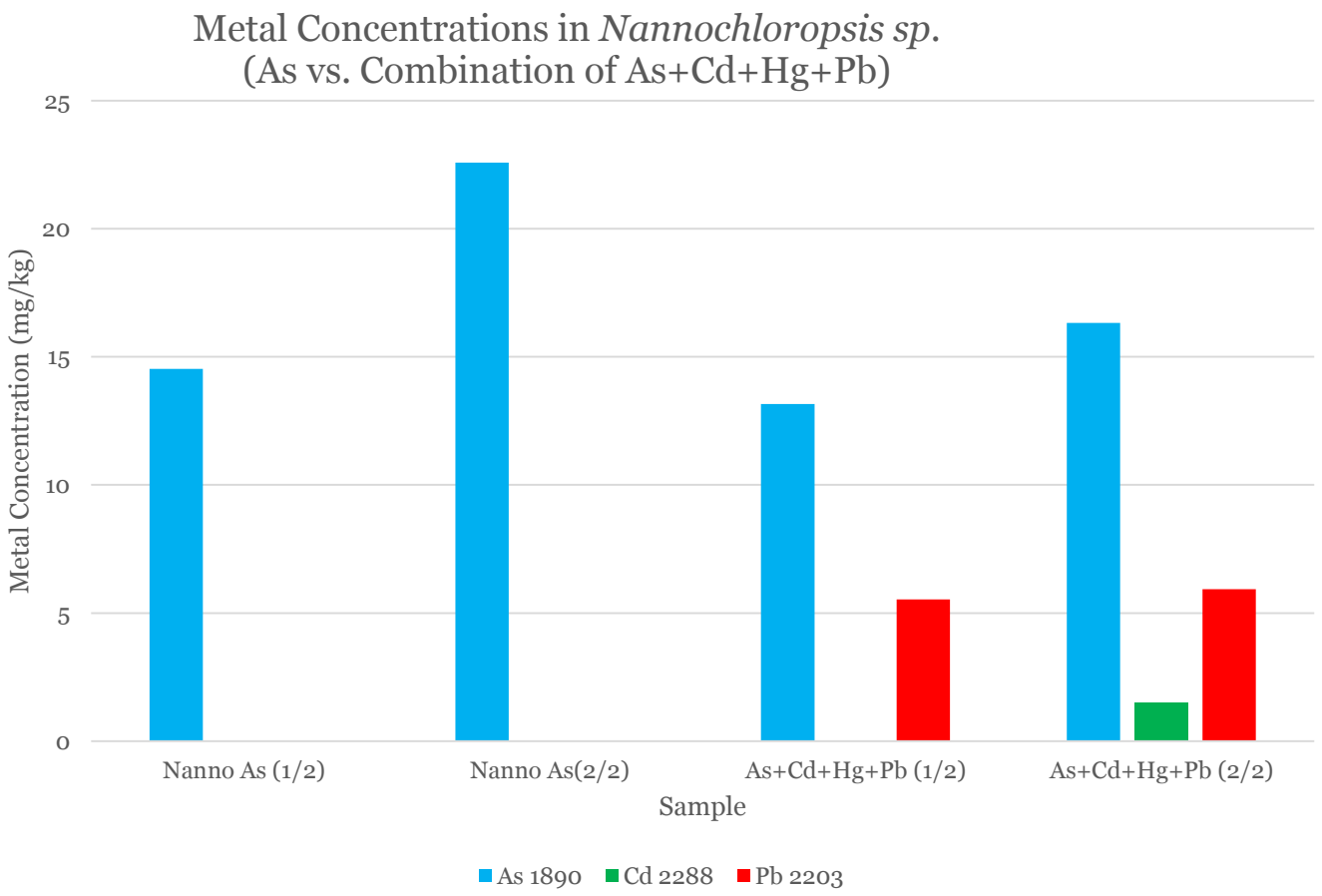

Rest Station


Tetra - Pb (½)
- Oct 23

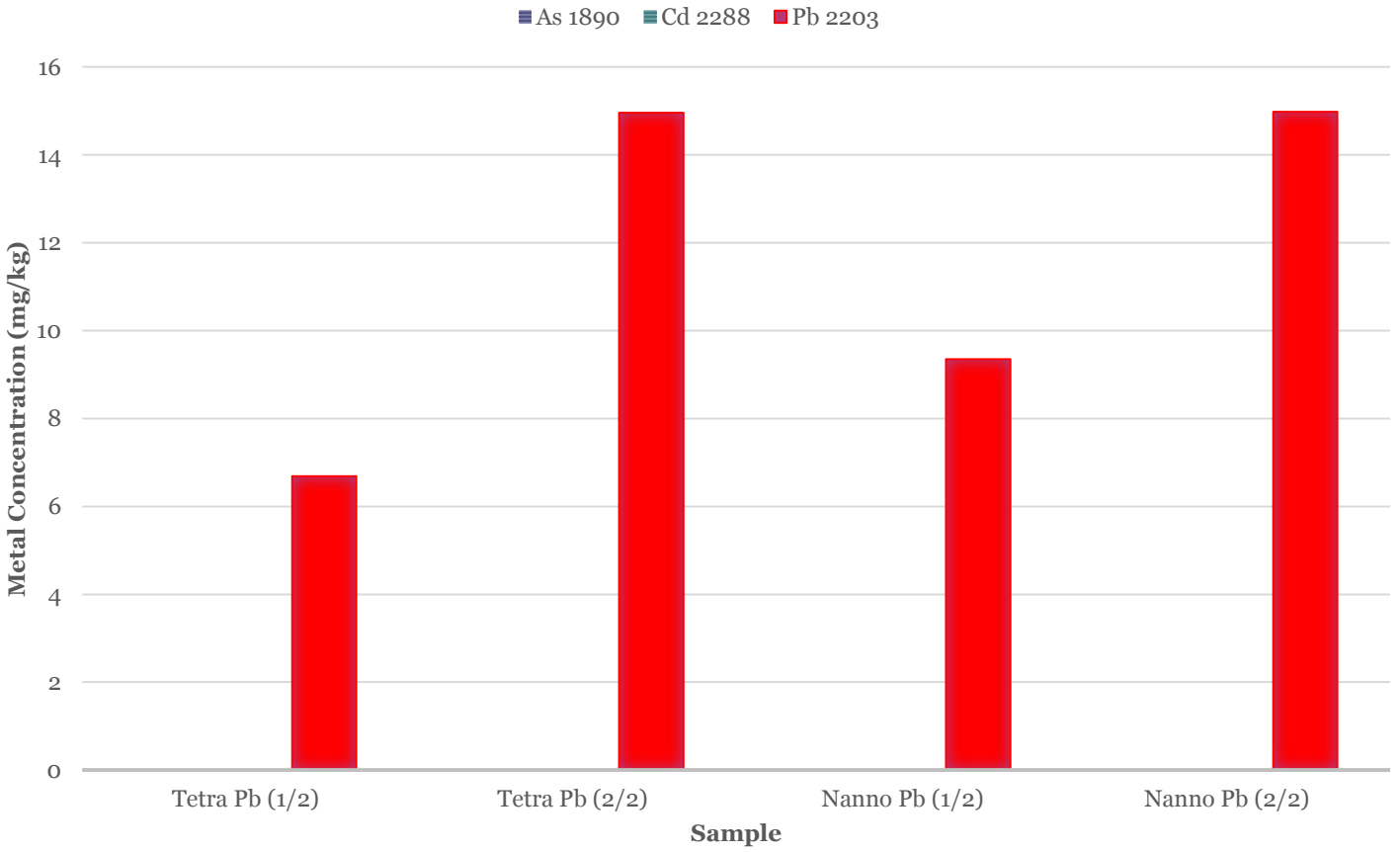

POWER
Stir
Heat
CORNING


Thermo
SCIENTIFIC

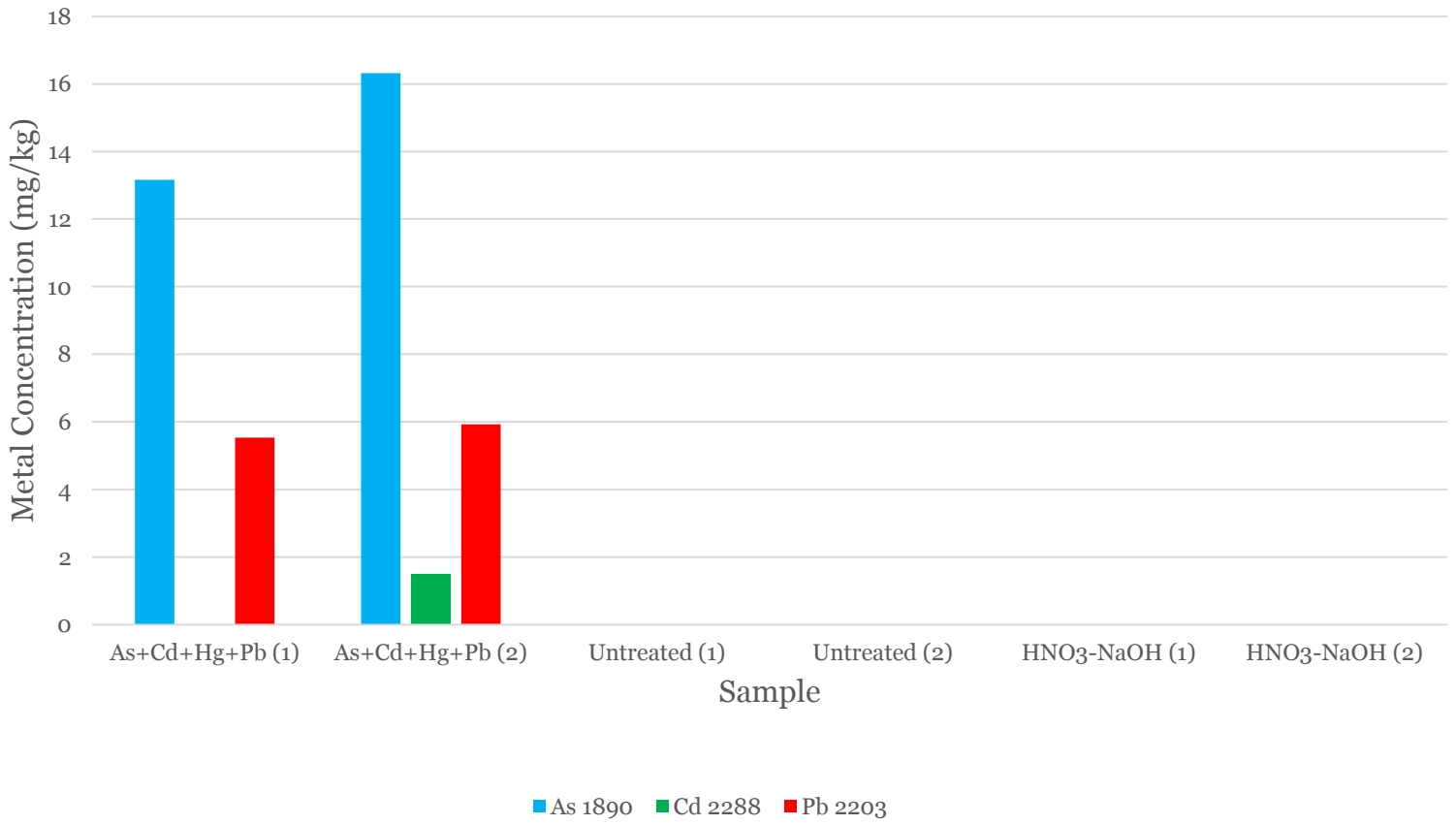

Metal Concentrations in *Nannochloropsis sp.*
(Pb vs. As+Cd+Hg+Pb)
Metal Concentration (mg/kg)
18
16
14
12
10
8
6
4
2
0
Nanno Pb (1/2)
Nanno Pb (2/2)
As+Cd+Hg+Pb (1/2)
As+Cd+Hg+Pb (2/2)
Sample
As 1890
Cd 2288
Pb 2203


Metal Concentrations in *Nannochloropsis sp.*
(As vs. Combination of As+Cd+Hg+Pb)
Metal Concentration (mg/kg)
25
20
15
10
5
0
Nanno As (1/2)
Nanno As(2/2)
As+Cd+Hg+Pb (1/2)
As+Cd+Hg+Pb (2/2)
Sample
As 1890
Cd 2288
Pb 2203

Metal Concentrations in Lead (Pb) Samples for *Tetraselmis sp.* & *Nannochloropsis sp.*



Metal Concentrations of *Nannochloropsis sp*. treated with As, Cd, Hg, and Pb

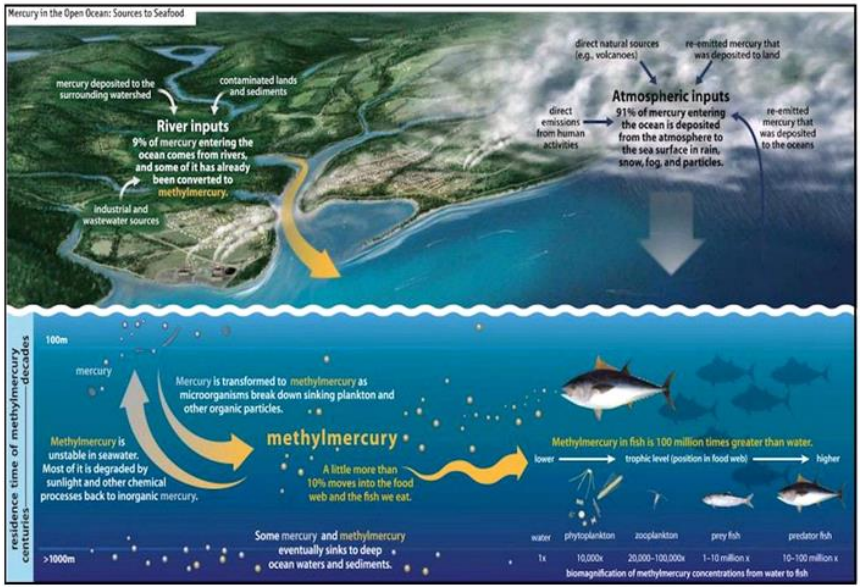


Results Compared to Hypotheses

- Differences in metal biosorption (H#1)
- Differences between species (H#2)
- With multiple metals in solution, there is selective uptake (H#3)

Significance

- Results: promising
- Real-world applications



Summary

- *Nannochloropsis sp.* a better candidate for phycoremediation of these metals
  - Pb and As
- Limitations
  - Hg results
  - Time
    - Sample size

Future Direction

- More research is needed
  - Larger sample sizes
  - Statistics

- Environmental importance

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Questions?