

An application of ecosystem services provided by microalgae for bioremediation strategies

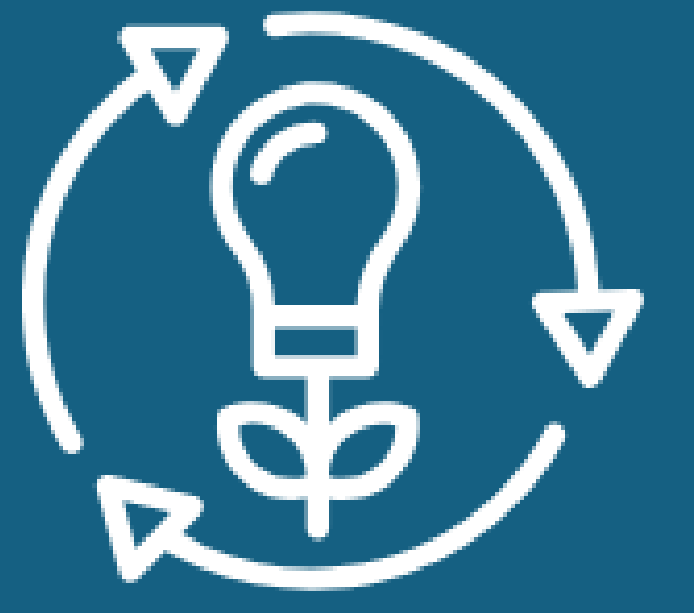


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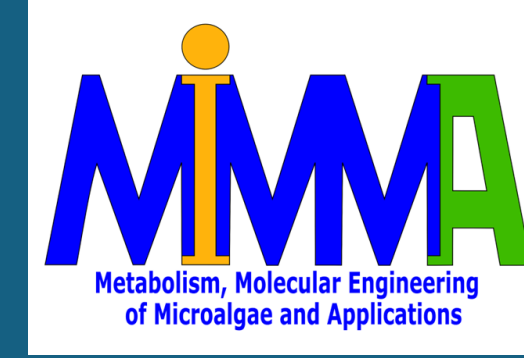
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1 BACKGROUND

Ecological services provided by diatoms



- Provisioning
- Regulating
- Supporting

Circular economy approach to water resource management



- Water preservation
- Wastewater reuse and valorization

2 AIMS

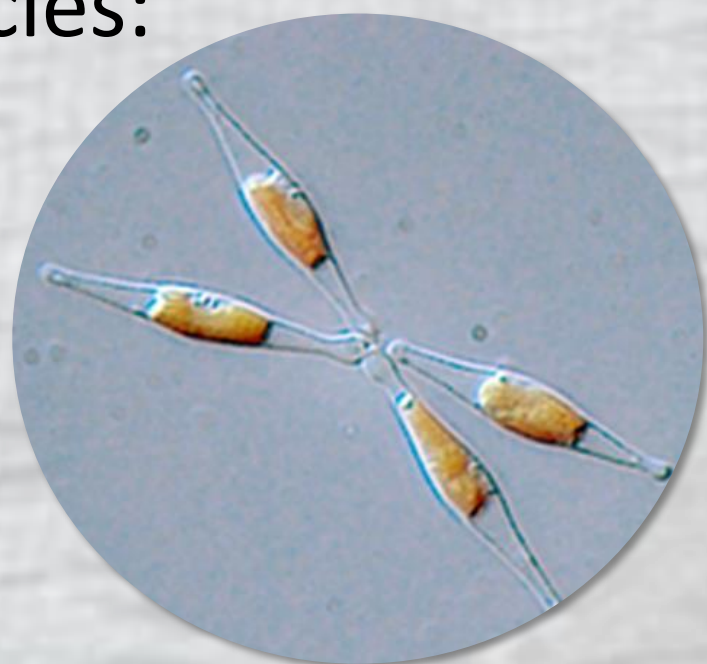
1. Test diatom growth response to increasing nutrient concentrations
2. Evaluate the bioremediation potential

3 METHODS

DIATOMS

One marine species and two benthic species:

- *Phaeodactylum tricornutum*: Pt1 strain adapted to freshwater
- *Achnantheidium sp.*
- *Planorhynchium frequentissimum*



SPIKED AQUACULTURE WASTEWATER

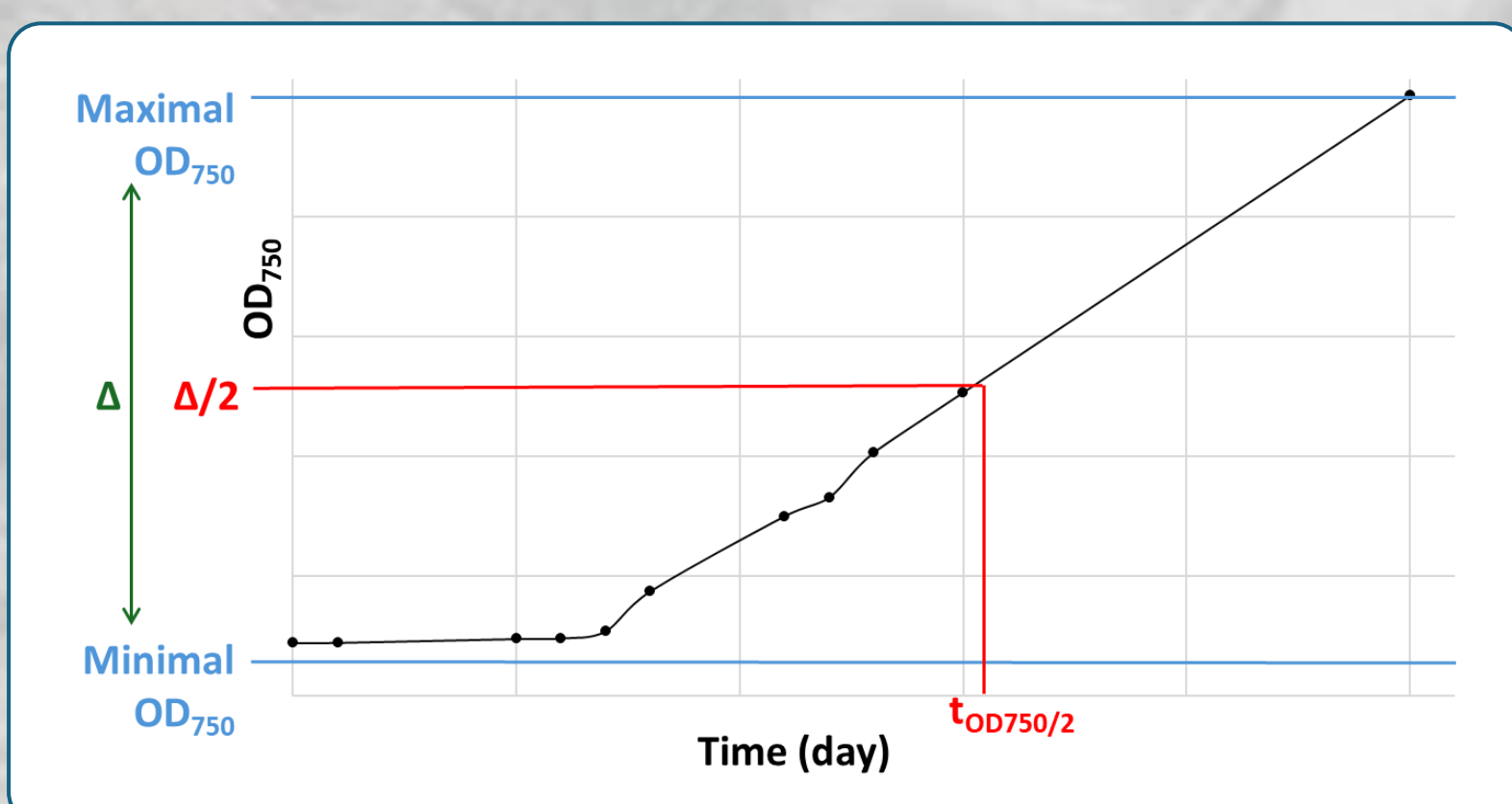
Aquaculture wastewater originating from trout farming may have high nutrient concentrations.

Spiked wastewater was enriched in NO_3 , with concentrations ranging from 0.15 to 48.84 mg/L.



Tests performed in multiwell plates:

- Absorbance at **Optical Density 750 nm**
- $t_{\text{OD750/2}}$ inferred from OD data



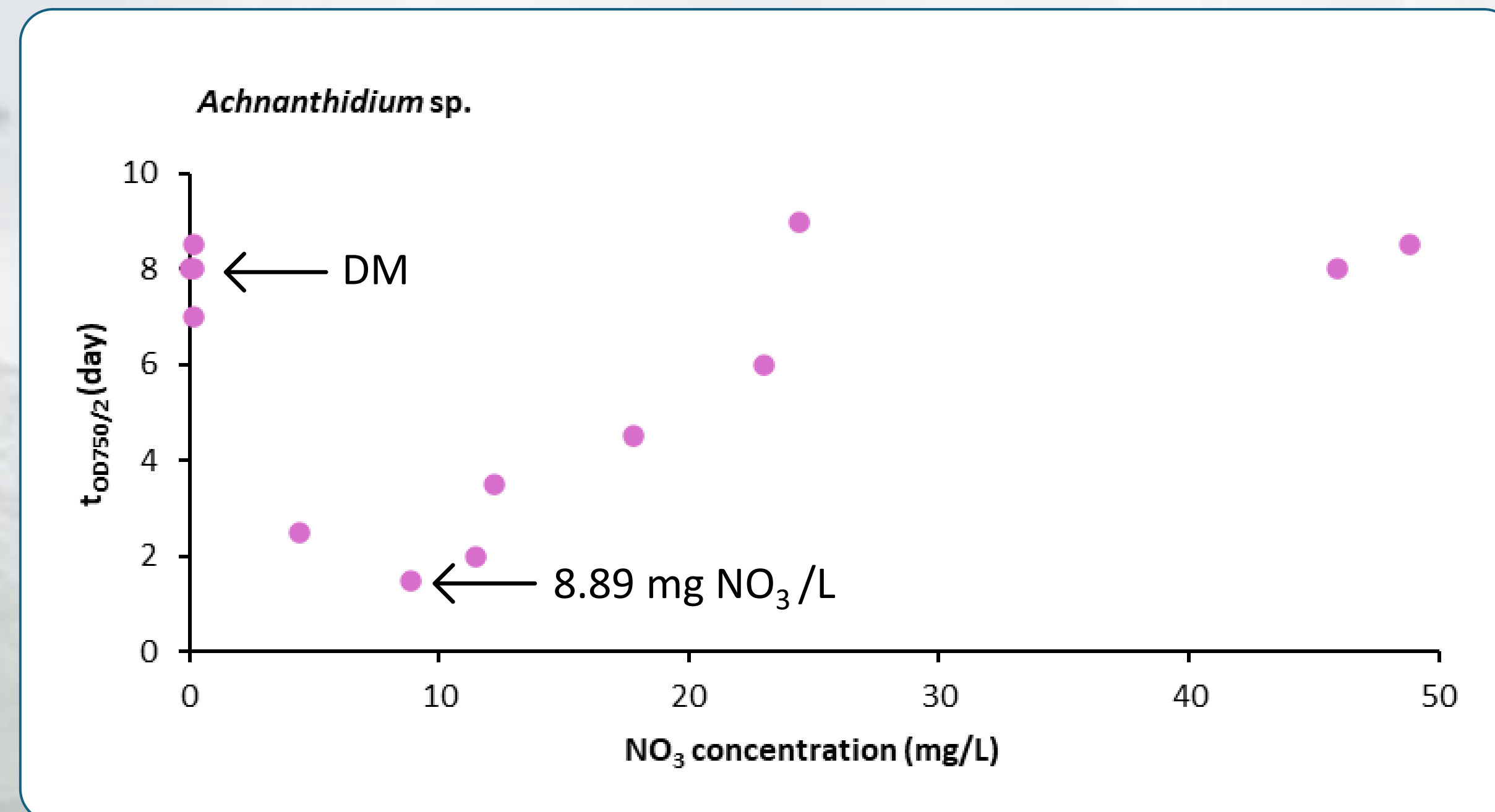
6 CURRENT EXPERIMENTATION

Growth and bioremediation tests in **Multi Cultivator 1000-OD** (PSI, Czech Republic)

MEASUREMENTS

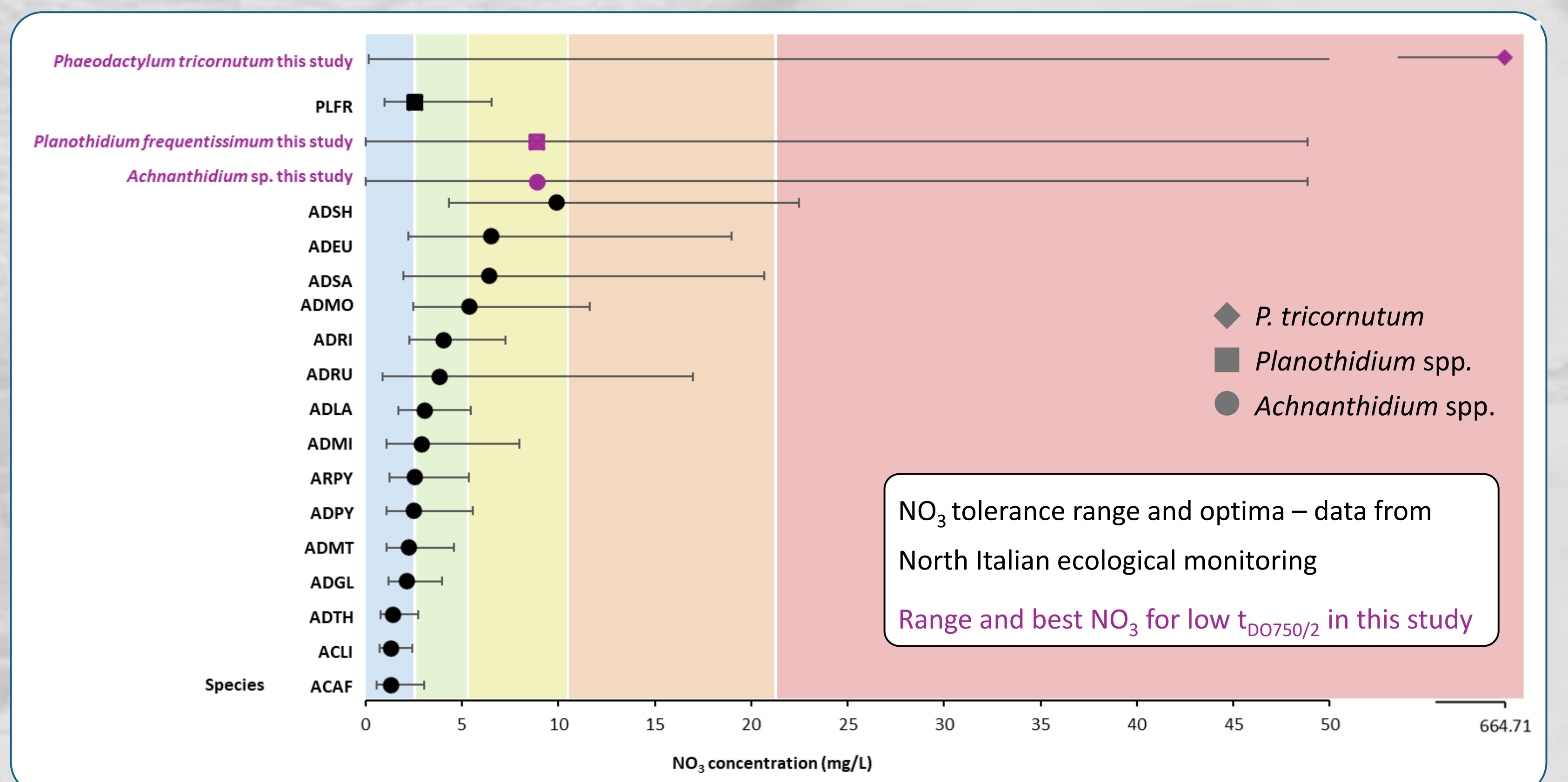
Concentrations of NO_3 and PO_4 , chlorophyll fluorescence, lipids content, fluorescent spectrum, pigments

4 RESULTS



ACHNANTHIDIUM SP. AND PLANORHYNCHIUM FREQUENTISSIMUM

- In this study, 8.89 mg NO_3 /L is the best concentration for unialgal culture
- Diatom Medium (DM), consisting of 0 mg NO_3 /L, determines high $t_{\text{D0750/2}}$



LIMeco index (Italian regulation, D.M. 260/2010)

Ecological status	High	Good	Moderate	Poor	Bad
NO_3 mg/L	< 2.64	≤ 5.28	≤ 10.56	≤ 21,12	> 21,12

NO_3 concentrations from this study are consistent with tolerance ranges and optima values for species in natural biofilms (data from North Italy)

PHAEODACTYLUM TRICORNUTUM

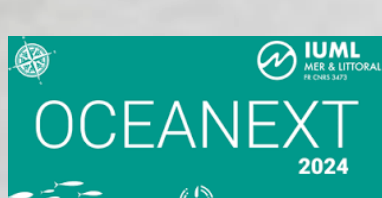
- Pt1 demonstrate growth in a wide NO_3 concentration: 0.15 – 664.71 mg/L
- F/2 Medium consisting of 664.71 mg NO_3 /L determines the lowest $t_{\text{D0750/2}}$
- Results are consistent with Scarsini et al., 2022: cell division rate is similar in a range 0.15 – 13 NO_3 mM

5 CONCLUSIONS

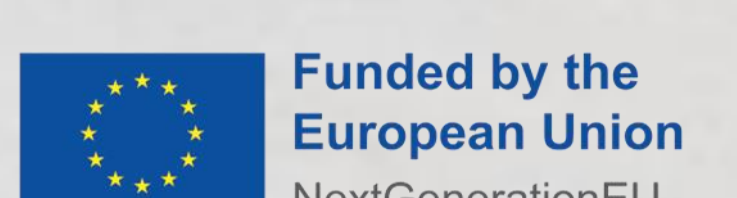
- *Achnantheidium* and *Planorhynchium* species demonstrate the ability to grow in **waters with moderate-to-bad ecological status** in both monospecific strain (this study) and diatom communities (data from North Italy)
- *Phaeodactylum tricornutum* is known for growing in high NO_3 concentration



The three species are suitable candidates for bioremediation trials



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