What really killed the sugar kelp?
Heat wave effect on *Saccharina latissima*

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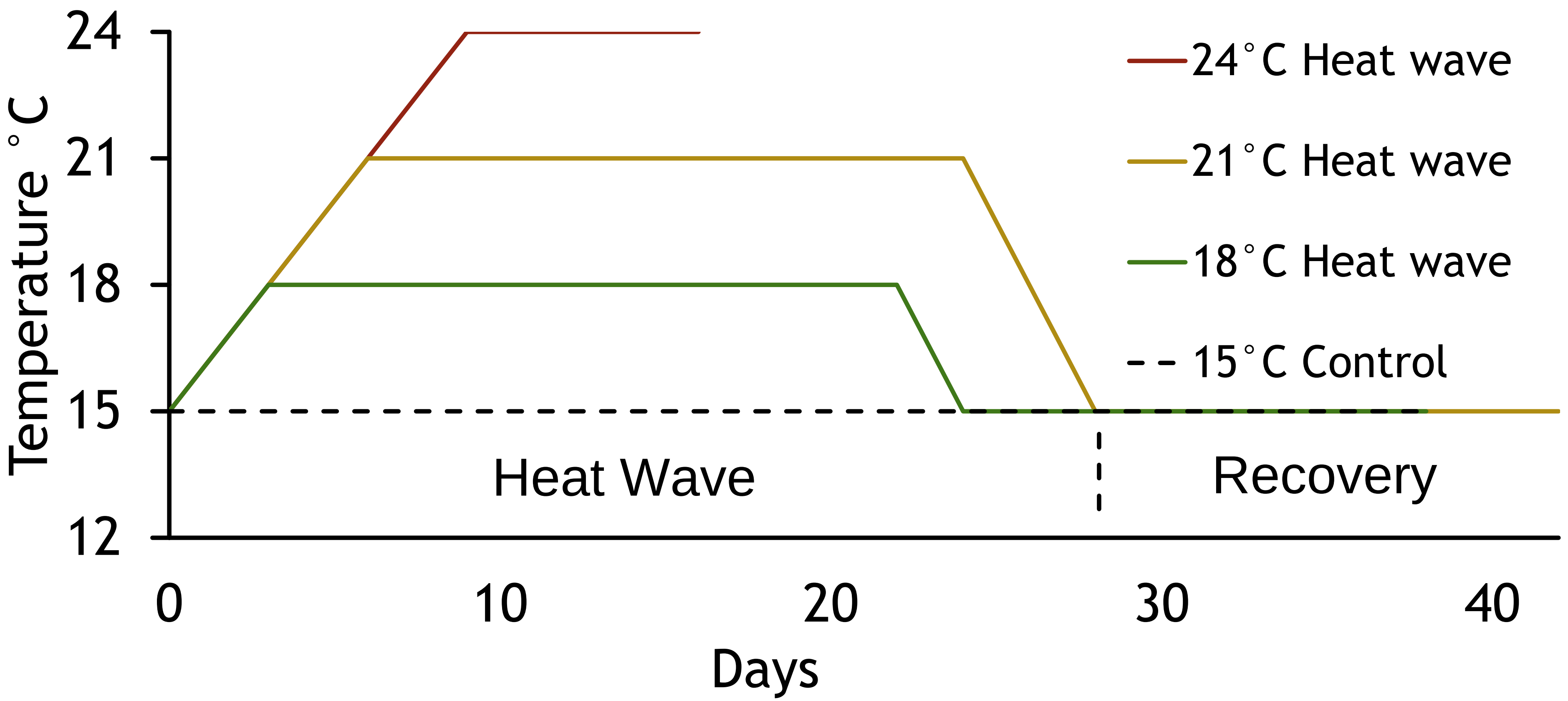
Saccharina latissima

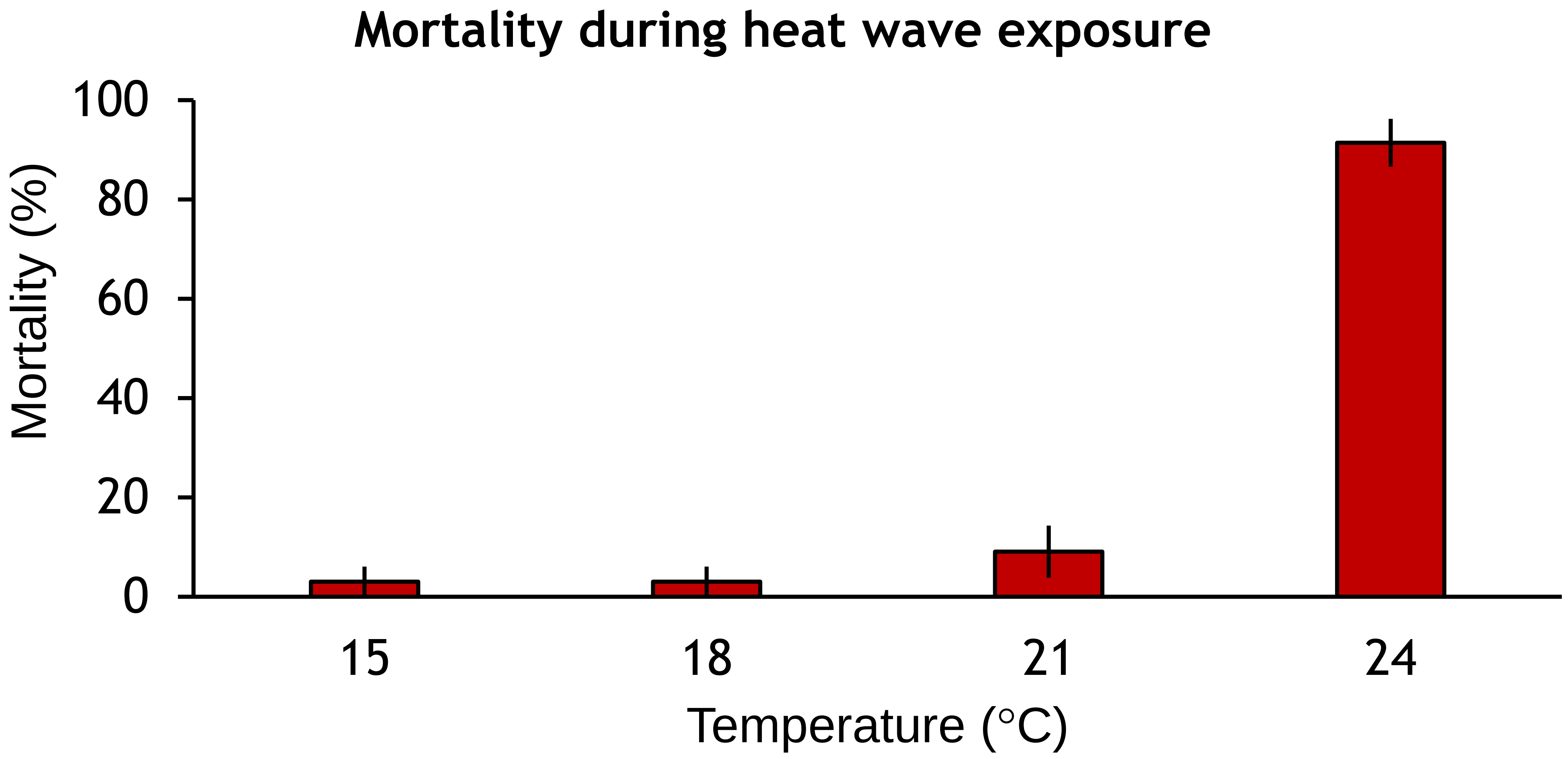
- Cold/temperate foundation species – widely abundant on the northern hemisphere
- One of the most important species of kelp for commercial cultivation in Europe and North America
- Drastic declines have been documented across northern Europe during resent years – most likely caused by the rising water temperature

Methods

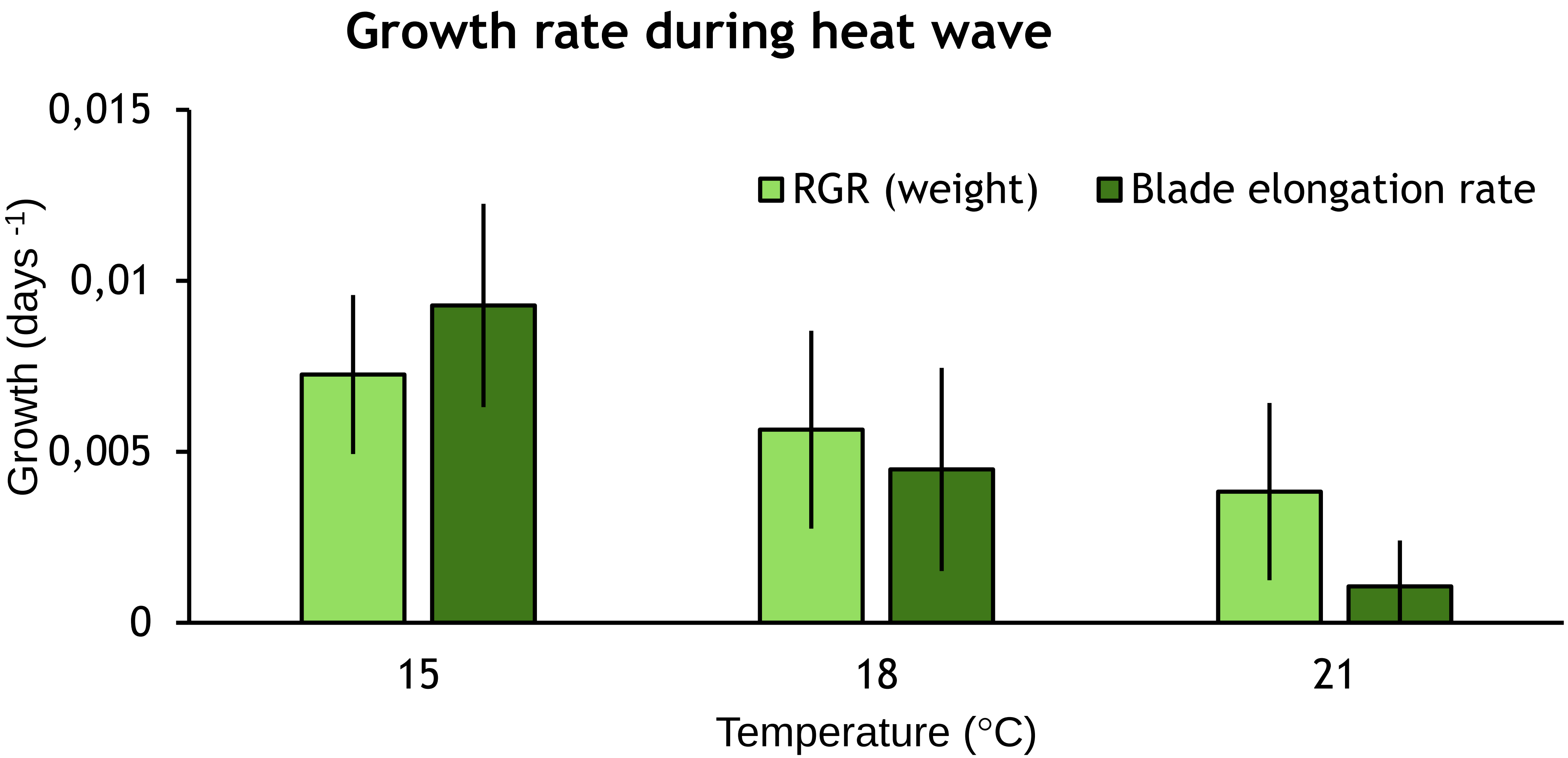
- Temperature development during heat wave simulation



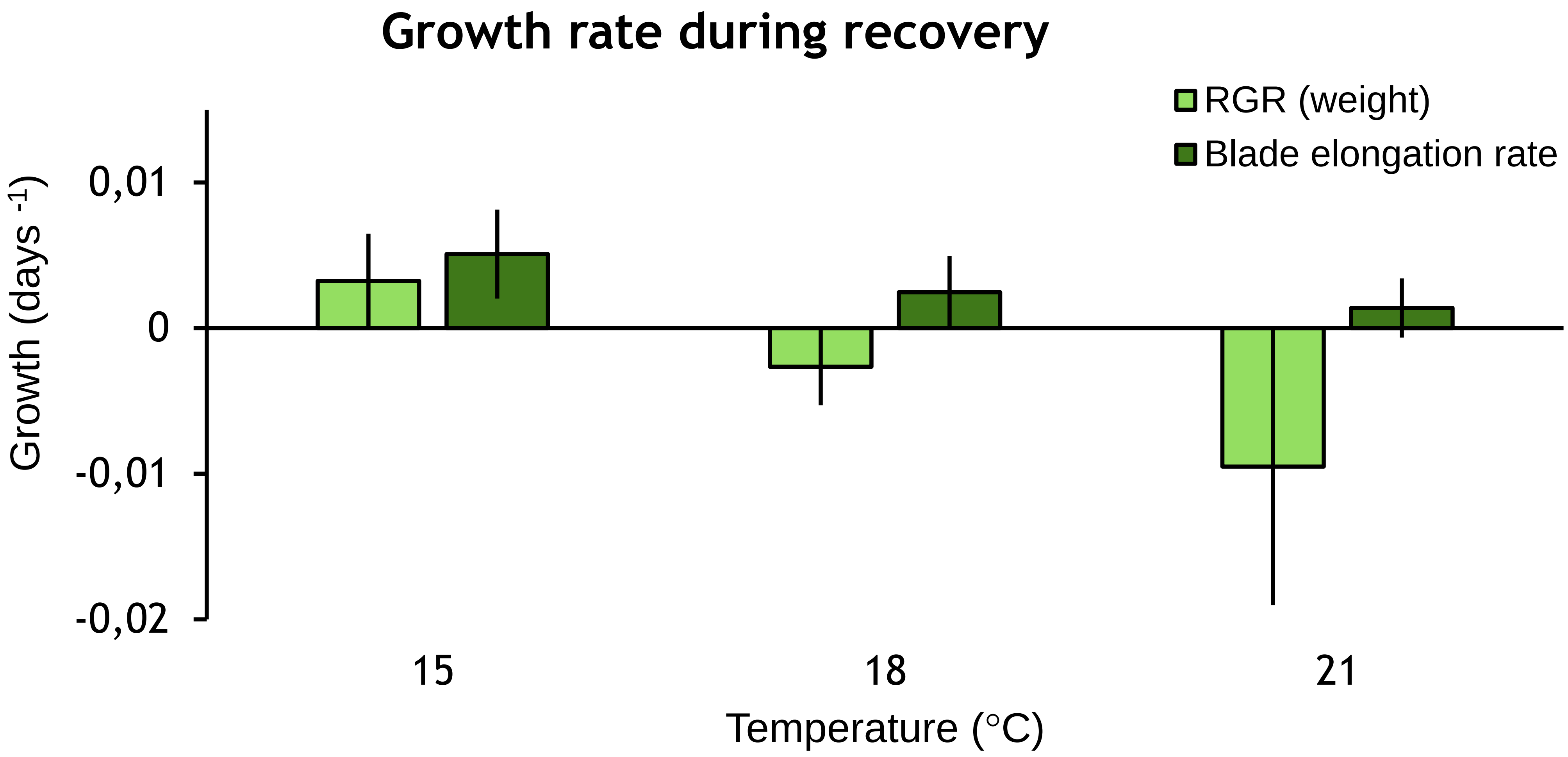
Results - Mortality



Results - Growth

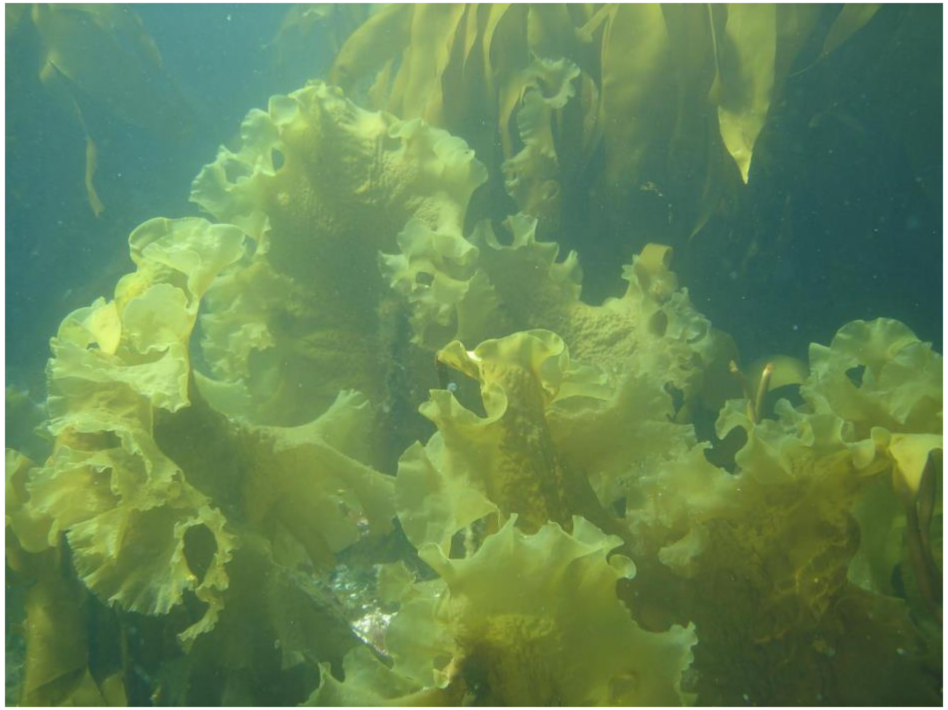


Results - Growth



Summary

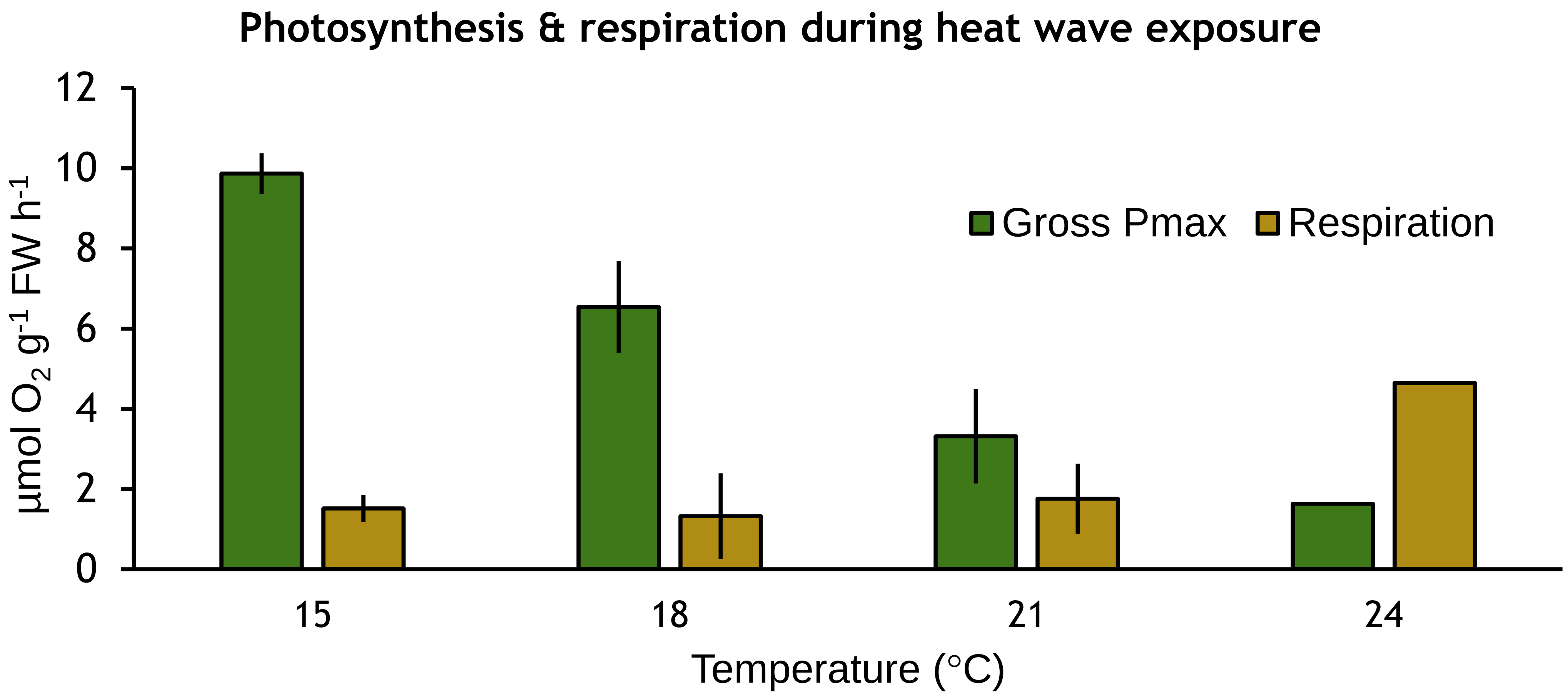
- High Mortality at 24°C
- Severe tissue loss at 21°C



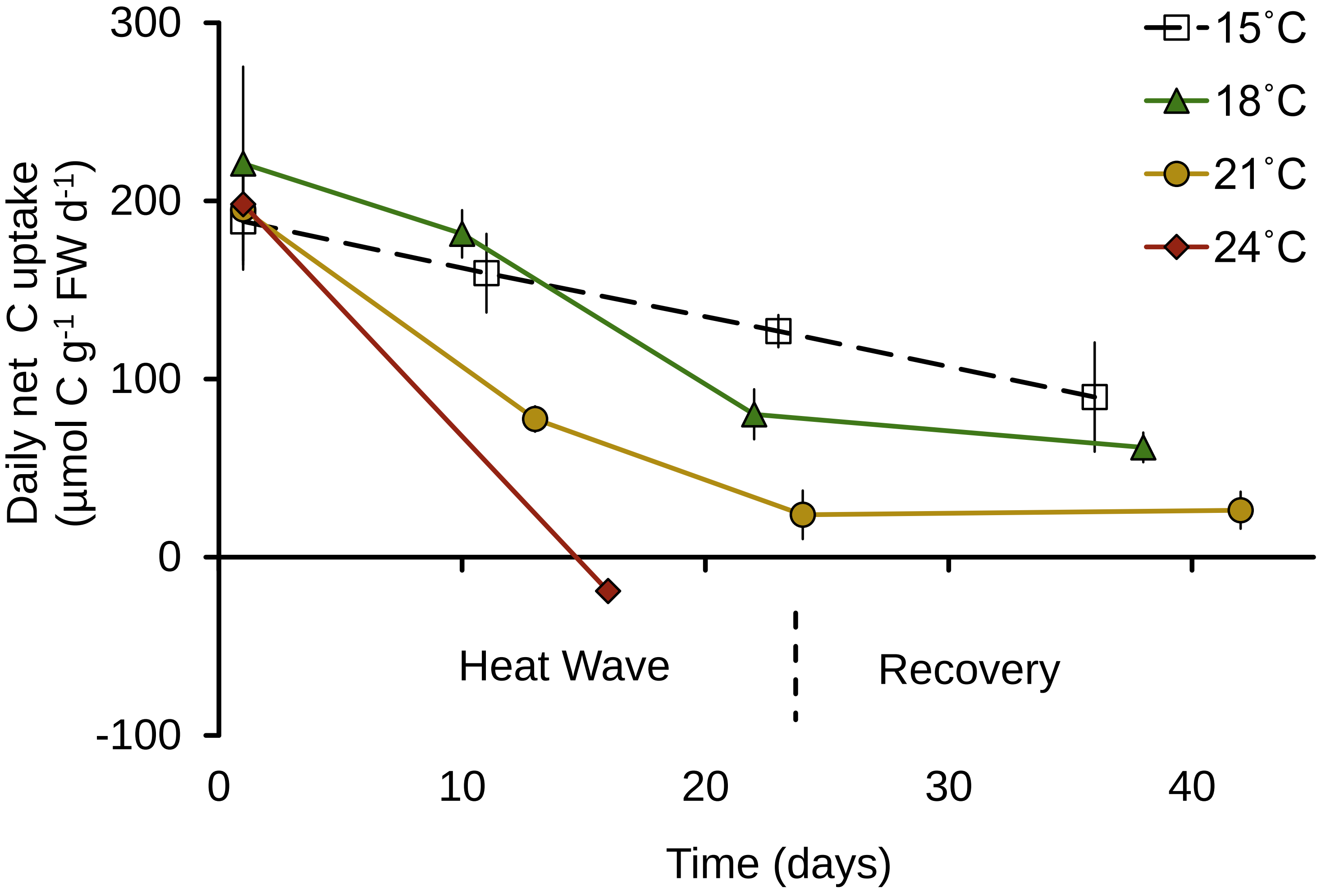
Hypothesis

- Carbon starvation

Results – Carbon balance



Results – Carbon balance



Results – Mannitol

- No temperature-related difference in mannitol levels

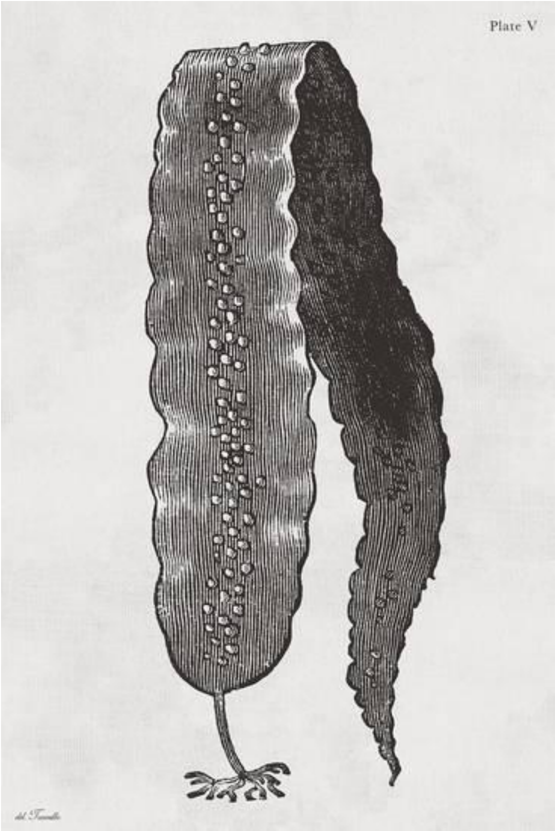
- Lowest observed levels: 4-5 % DW

Summary

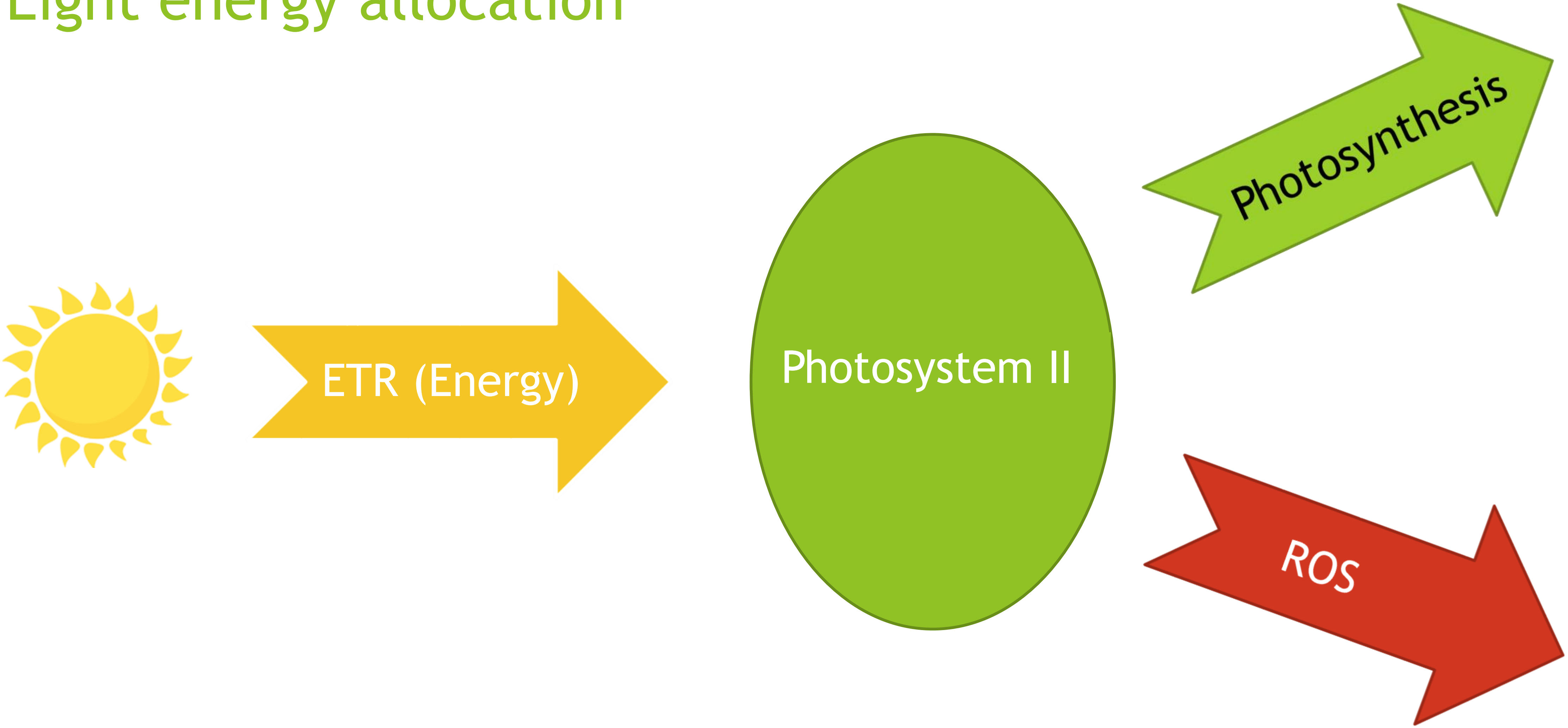
- High Mortality at 24°C
- Severe tissue loss at 21°C

Hypotheses

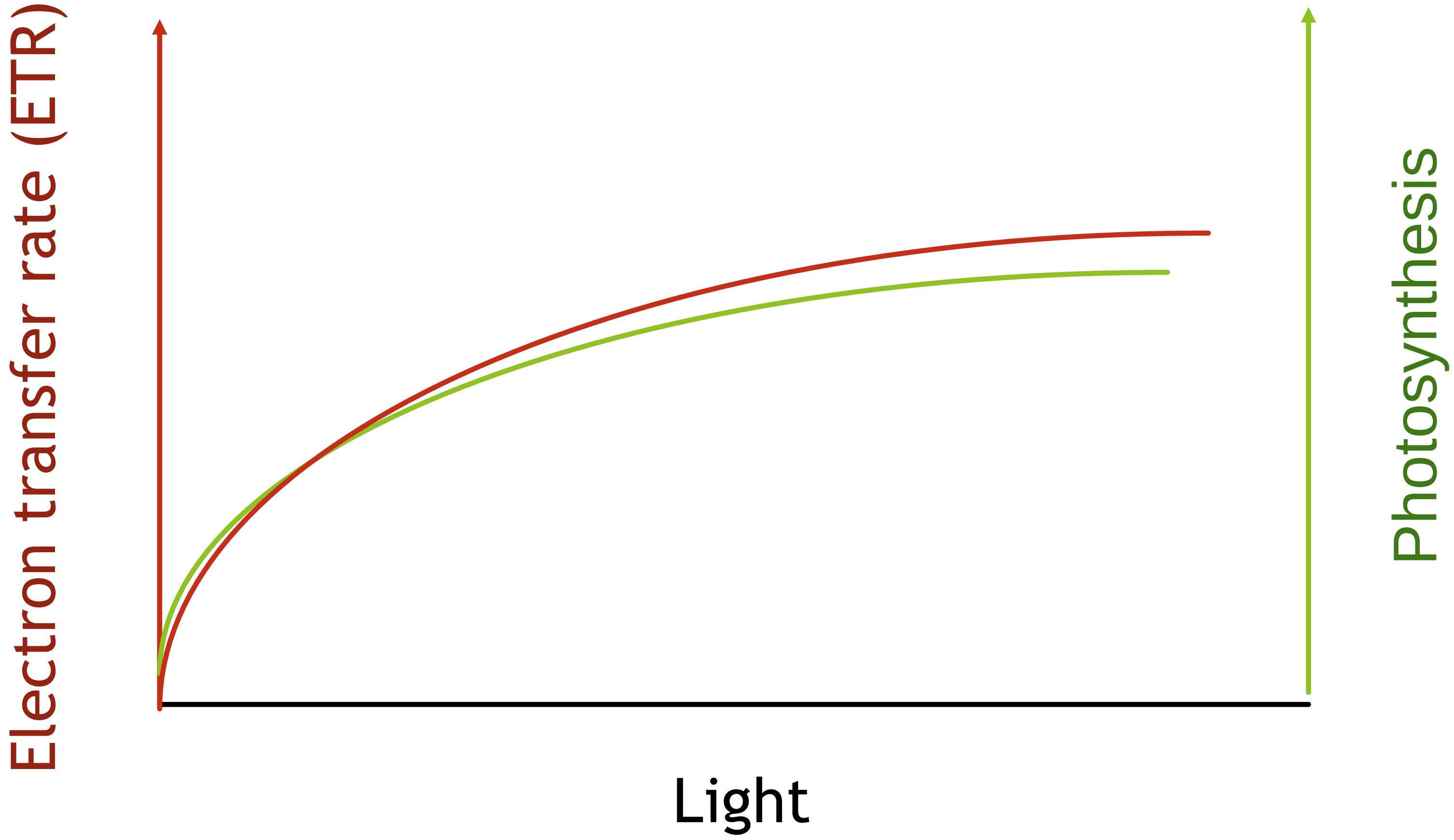
- Carbon starvation
- Oxidative stress



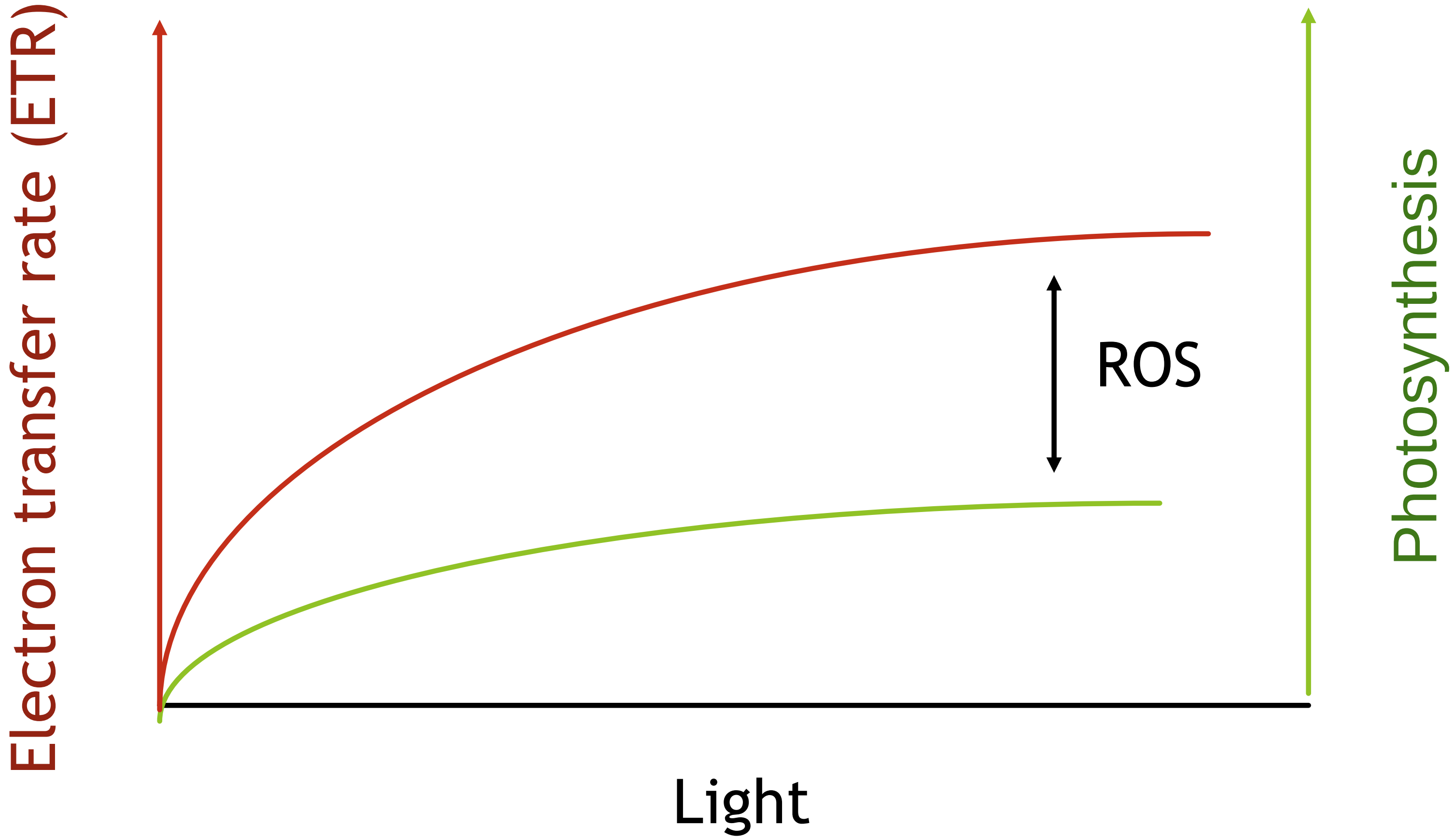
Light energy allocation



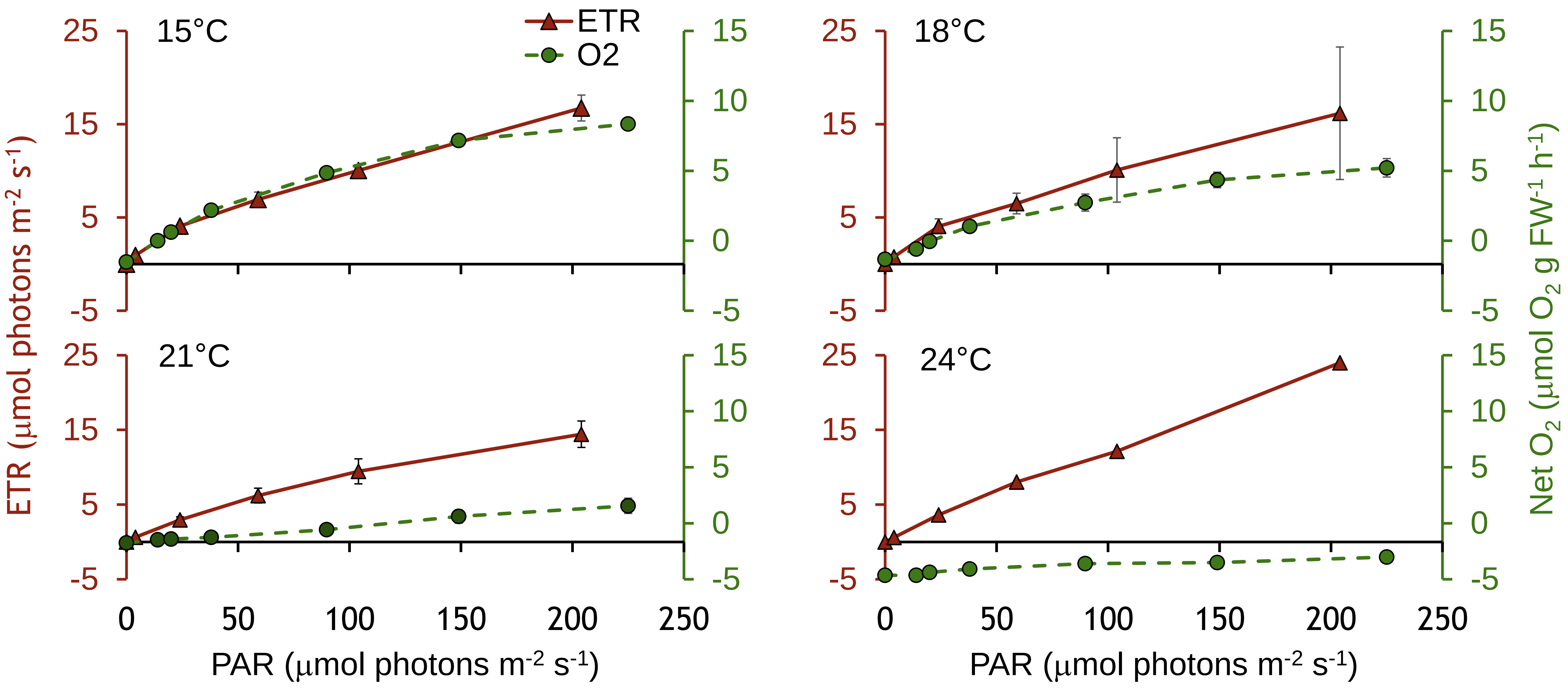
Healthy state



Stressed state



Results – ETR vs. photosynthesis



Conclusions

24°C	*Saccharina latissima* unable to survive.
21°C	Not directly lethal, but growth and photosynthesis were severely reduced, and the algae started to dissolve.
18°C	No significant effect on *Saccharina latissima*.

Perspectives

- Norway: Shift from sugar-kelp to ephemeral algae

- 21°C Heat wave – a probable scenario considering the Danish summer of 2018

- True temperature survival limits – interaction between temperature and light in relation to oxidative stress

References

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