Effects of artificial light at night and warming on urchin herbivory and behaviour

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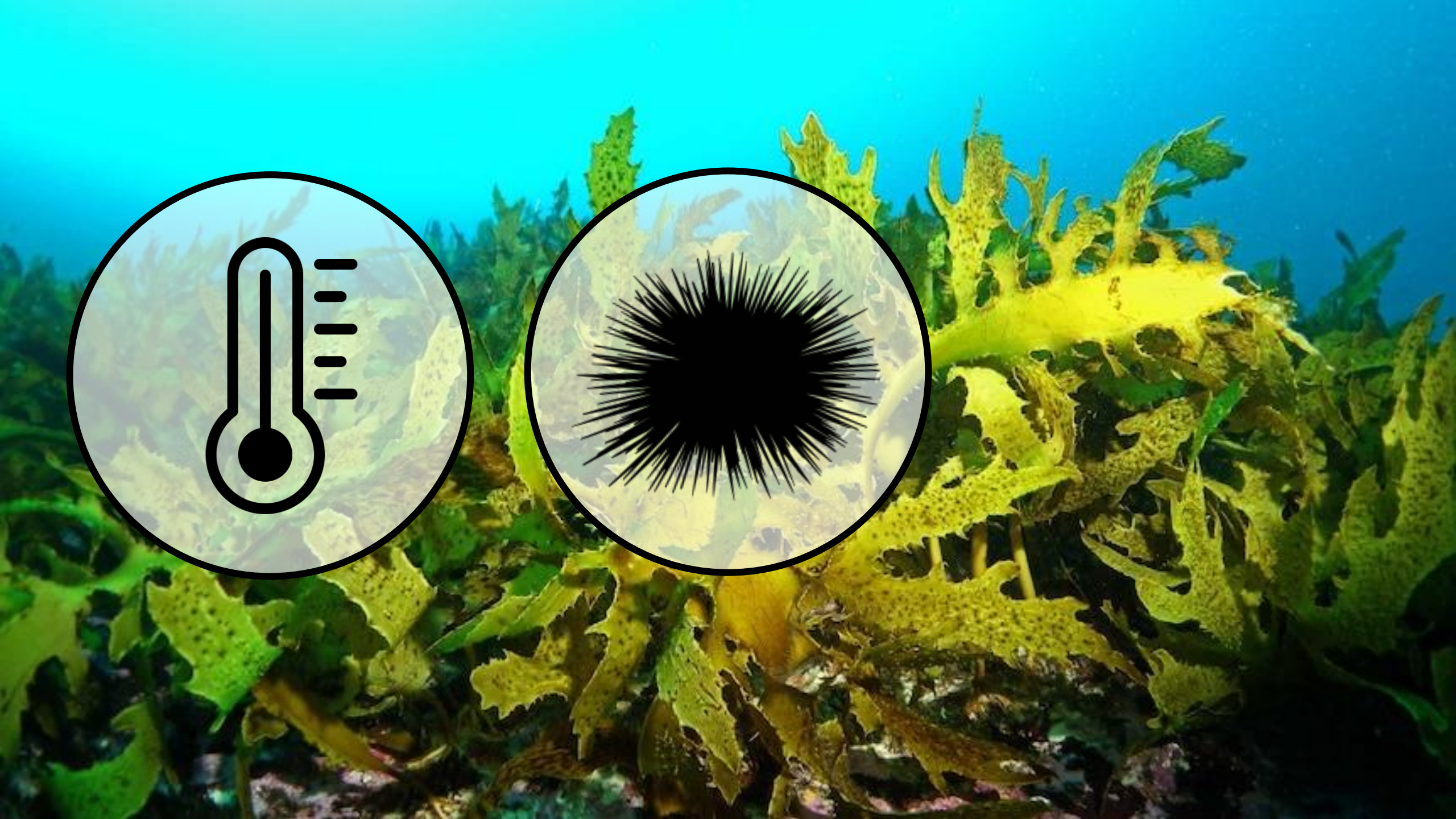
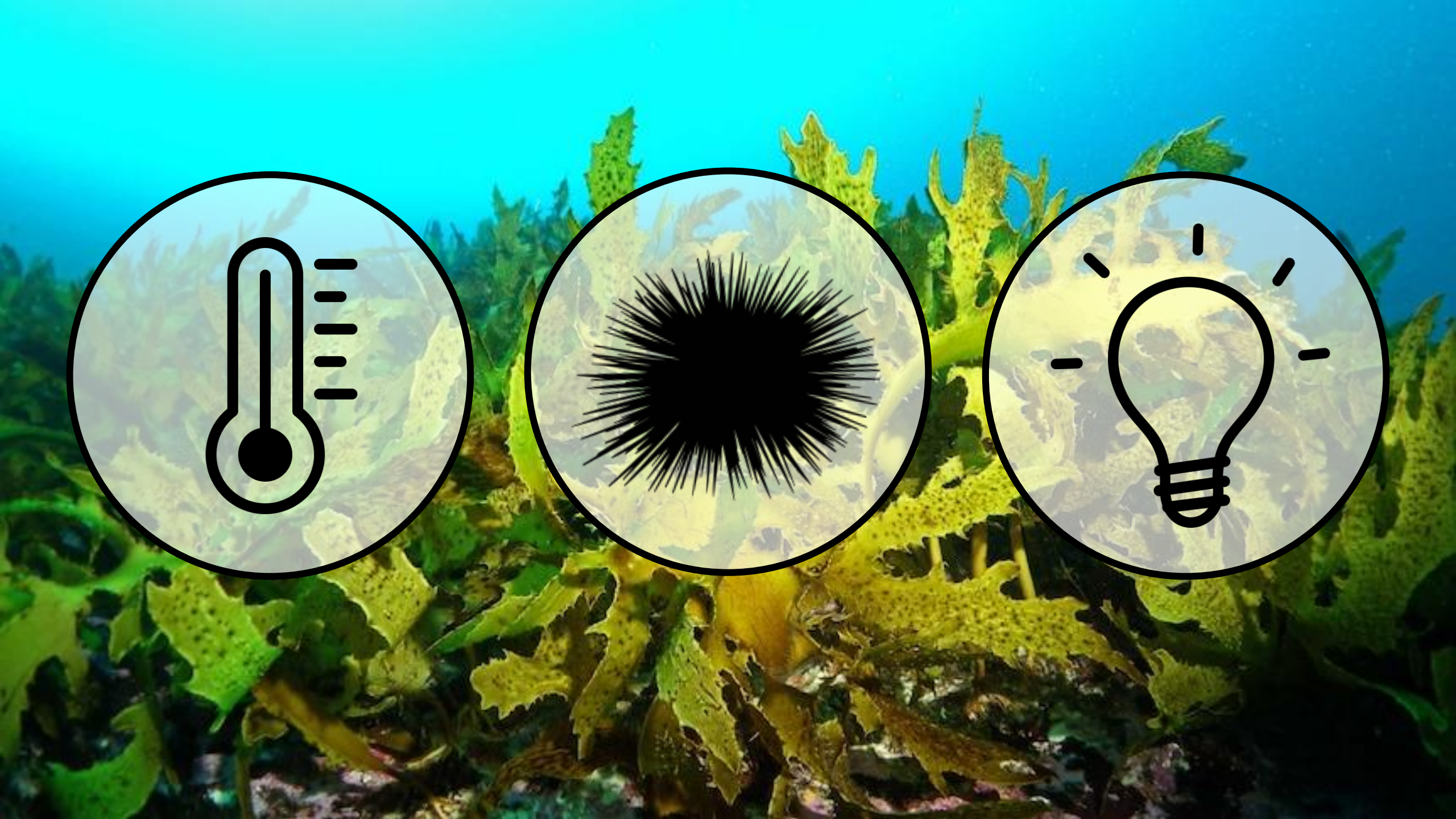
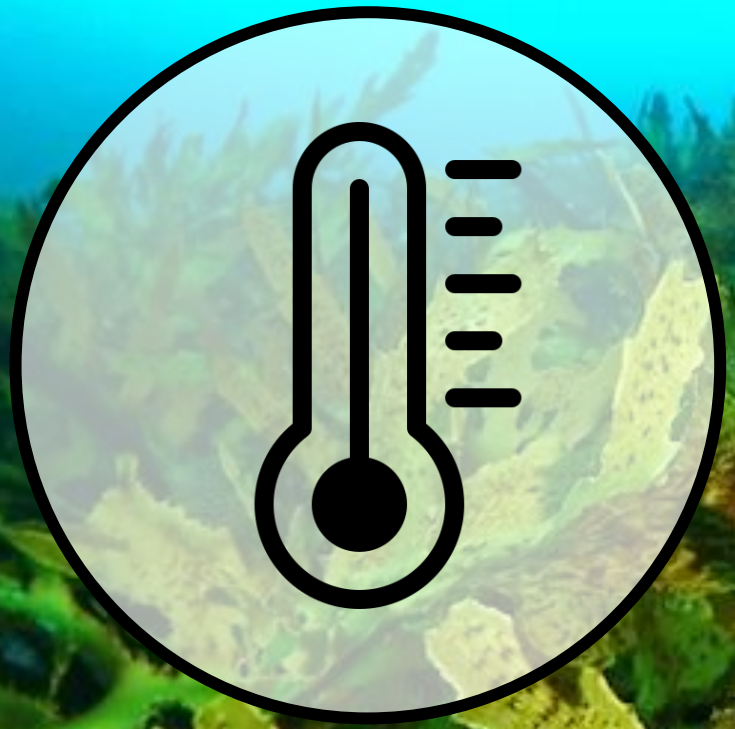
Artificial Light at Night (ALAN)

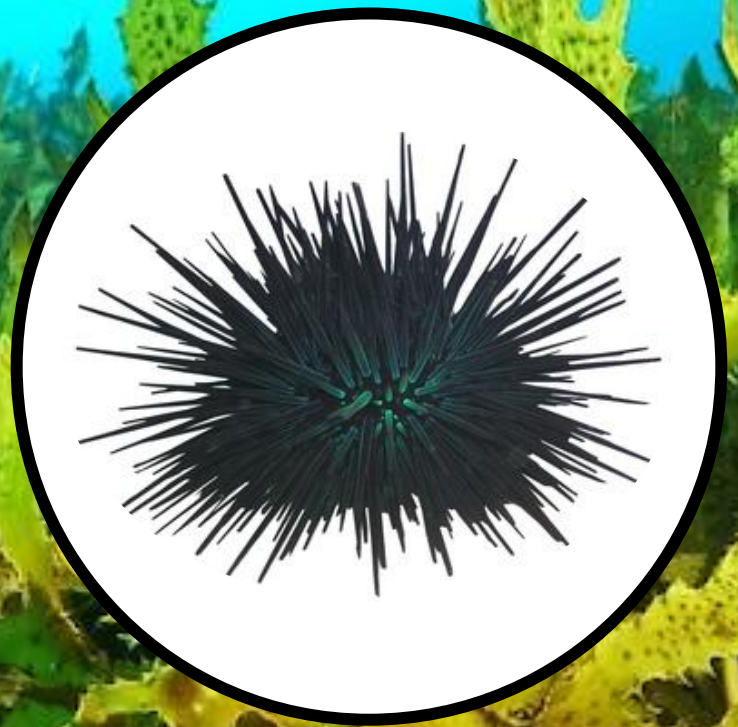
Marangoni, L.F., Davies, T., Smyth, T., Rodríguez, A., Hamann, M., Duarte, C., Pendoley, K., Berge, J., Maggi, E. and Levy, O., 2022. Impacts of Artificial Light at Night (ALAN) in marine ecosystems–a review. Global Change Biology.





Centrostephanus rodgersii





Ecklonia radiata

- Nocturnal
- Dominant grazer
- Range extender
- Fisheries species

AIMS

To assess the effects of ALAN and warming on:

1. Urchin herbivory rates
2. Somatic growth and survival of urchins
3. Sheltering, feeding and foraging behaviour
4. Kelp microbes, photosynthetic yield, and carbon and nitrogen content

Experimental Design

56 urchins

- 14 Warm/Dark
- 14 Warm/ALAN
- 14 Ambient/Dark
- 14 Ambient/ALAN

Experimental Design

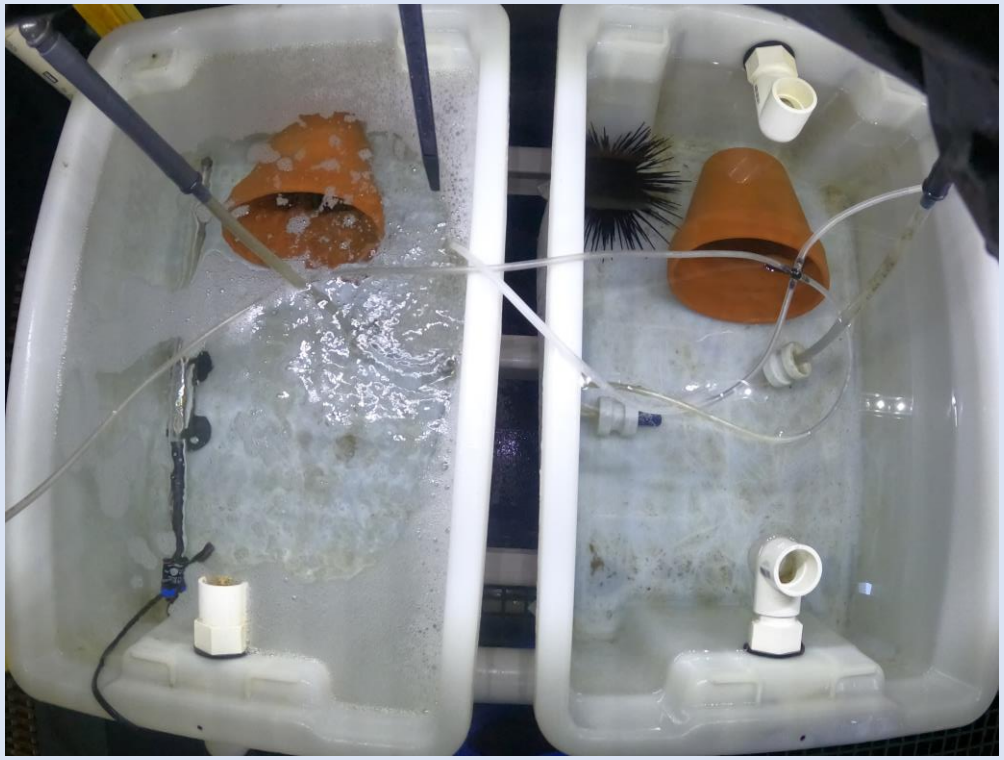
Per urchin treatment:

- n = 10 fed fresh kelp
- n = 4 fed treated kelp

8 treated kelp tanks:

- 2 Warm/Dark
- 2 Warm/ALAN
- 2 Ambient/Dark
- 2 Ambient/ALAN

Sampling



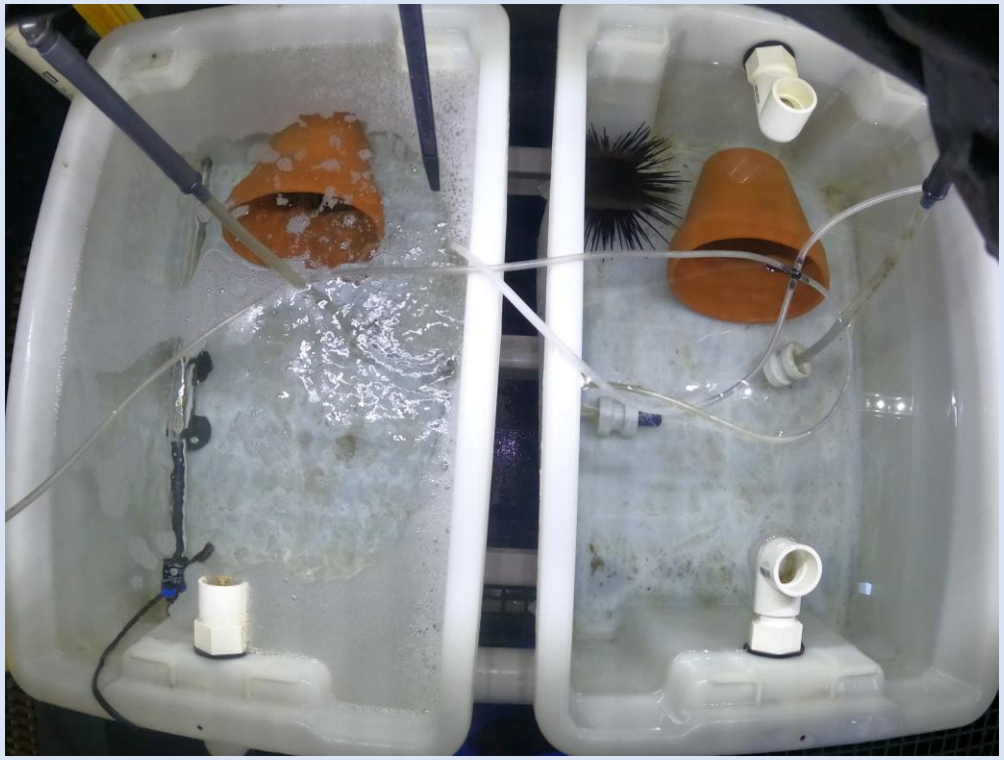
Urchins

- Consumption rates
- Behaviour
- Gonad yield

Kelp

- Photosynthetic Yield
- Microbial Community
- Carbon & Nitrogen

Sampling



Urchins

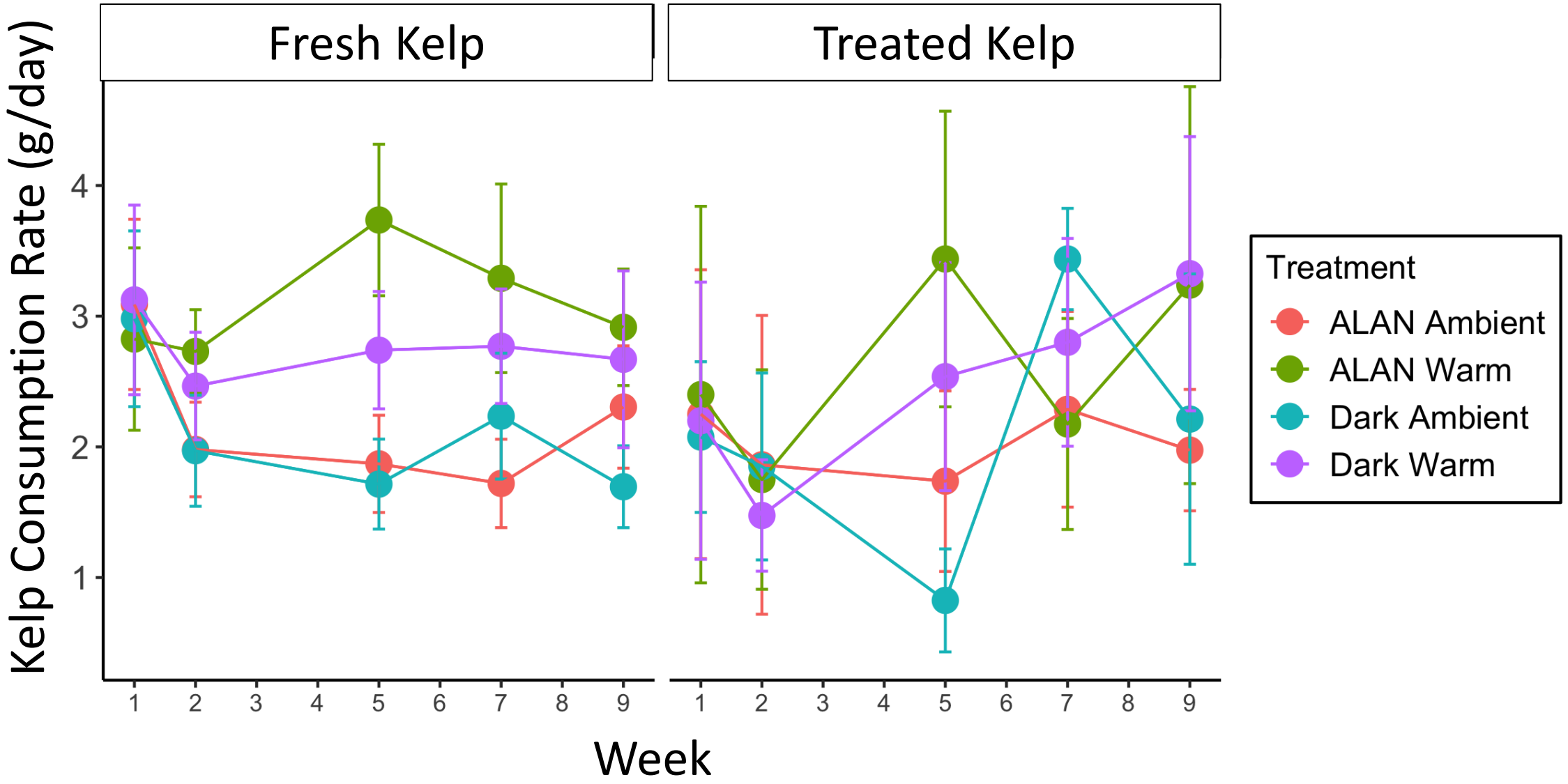
- Consumption rates
- Behaviour (subset)
- Gonad yield

Kelp

- Photosynthetic Yield
- Microbial Community
- Carbon & Nitrogen

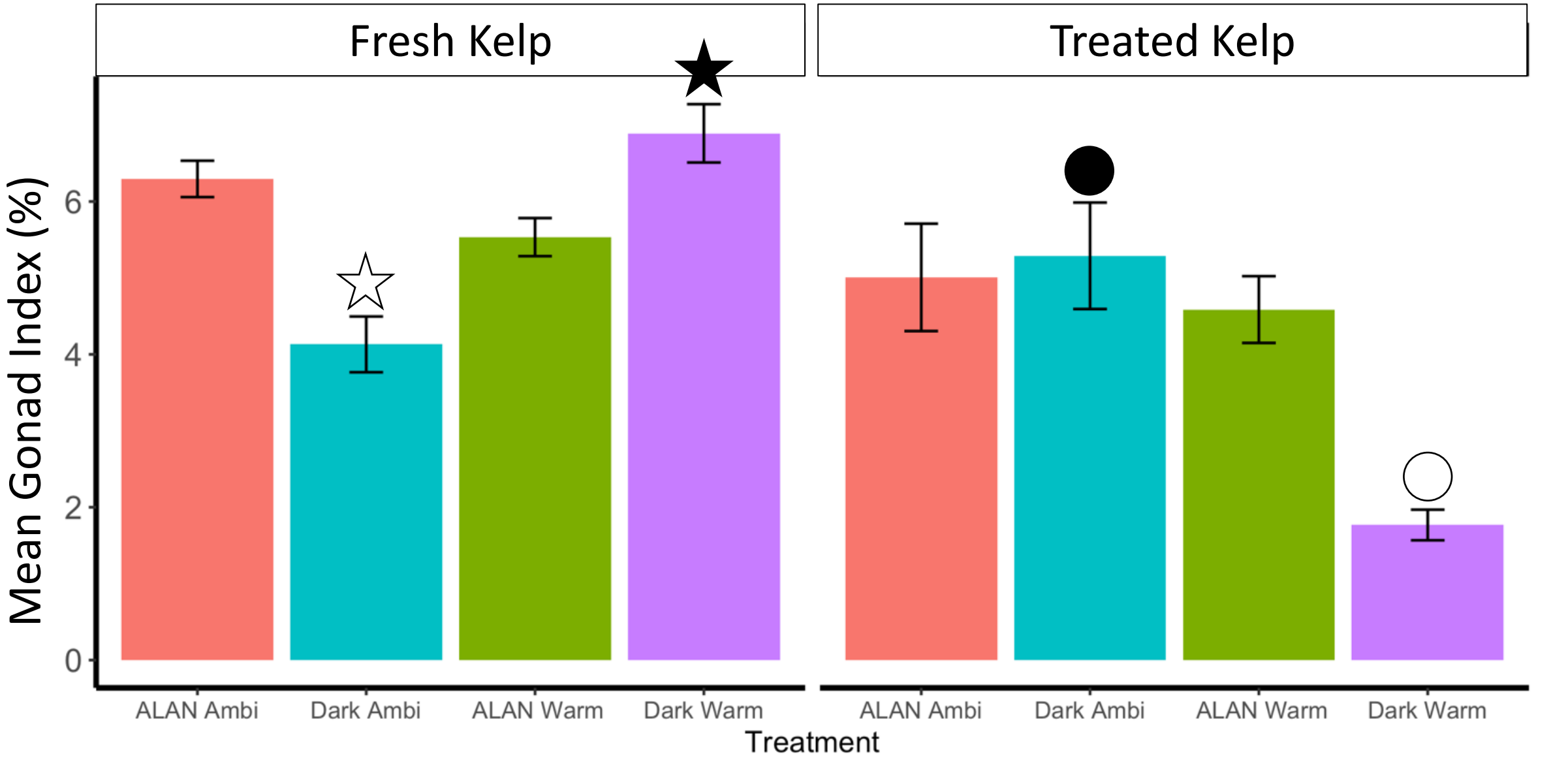
Aim 1: To assess the effects of ALAN and warming on urchin herbivory rates

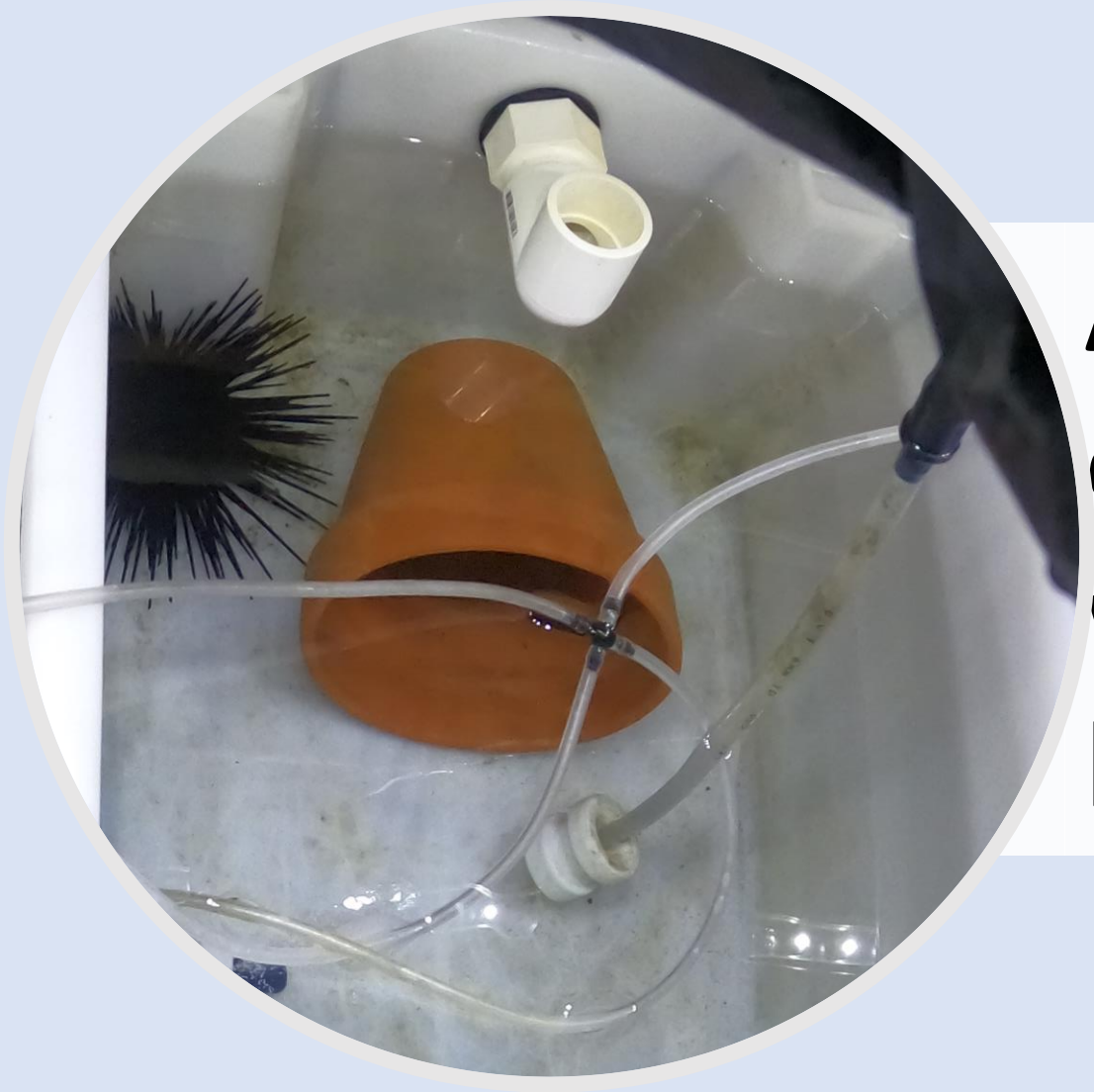
Consumption rates higher in ALAN vs Dark Treatments
Consumption rates higher in Warm vs Ambient Treatments



Aim 2: To assess the effects of ALAN and warming on somatic growth and survival

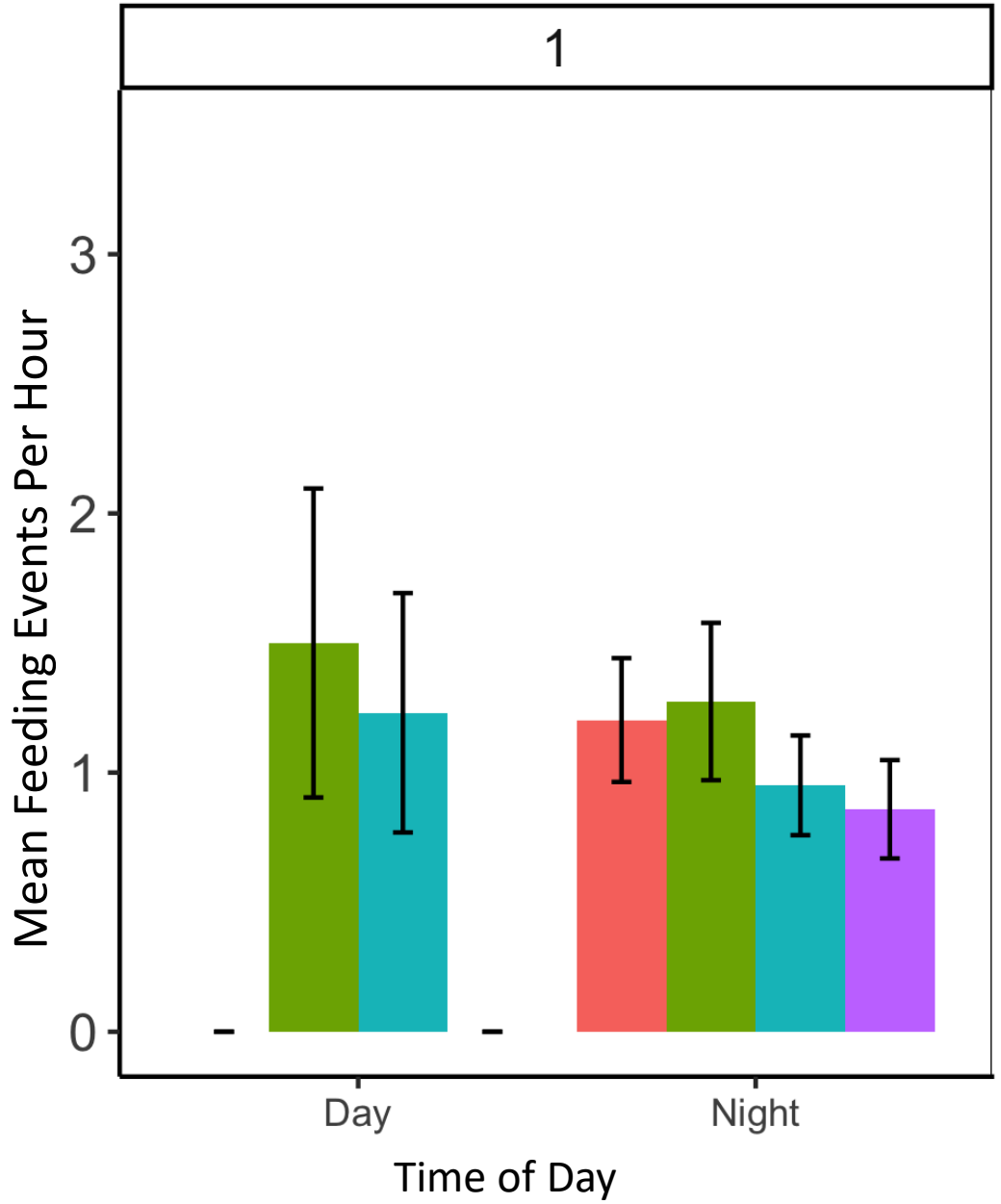
Gonad Index: Interaction between Kelp * Temperature * Light





Aim 3: To assess the effects of ALAN and warming on urchin behaviour

Feeding Behaviour: Interactions between Time of Day, Light, Week, Temperature



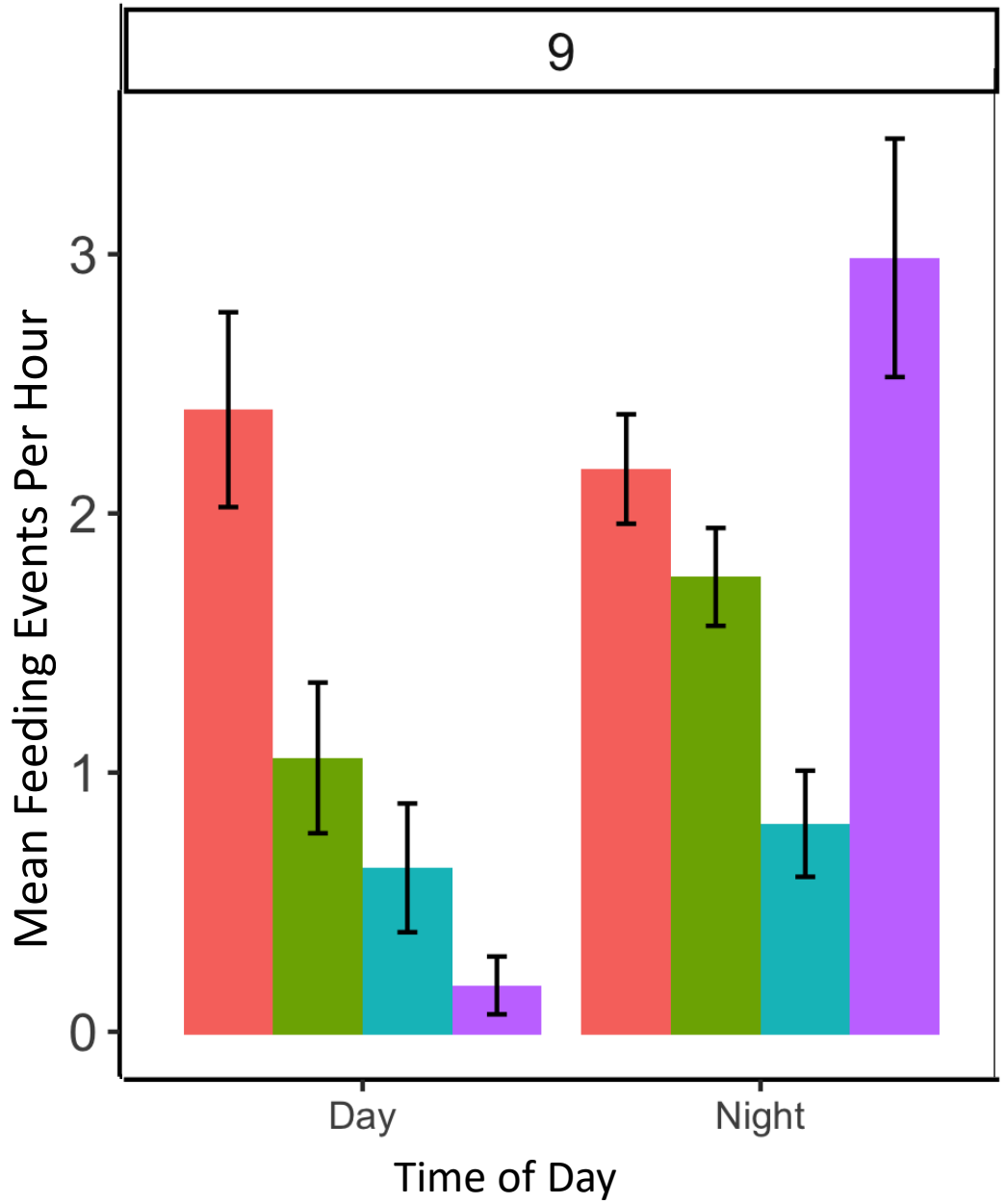
Week 1:

- Day = Night for all treatments

Treatment

- ALAN Ambient
- ALAN Warm
- Dark Ambient
- Dark Warm

Feeding Behaviour: Interactions between Time of Day, Light, Week, Temperature

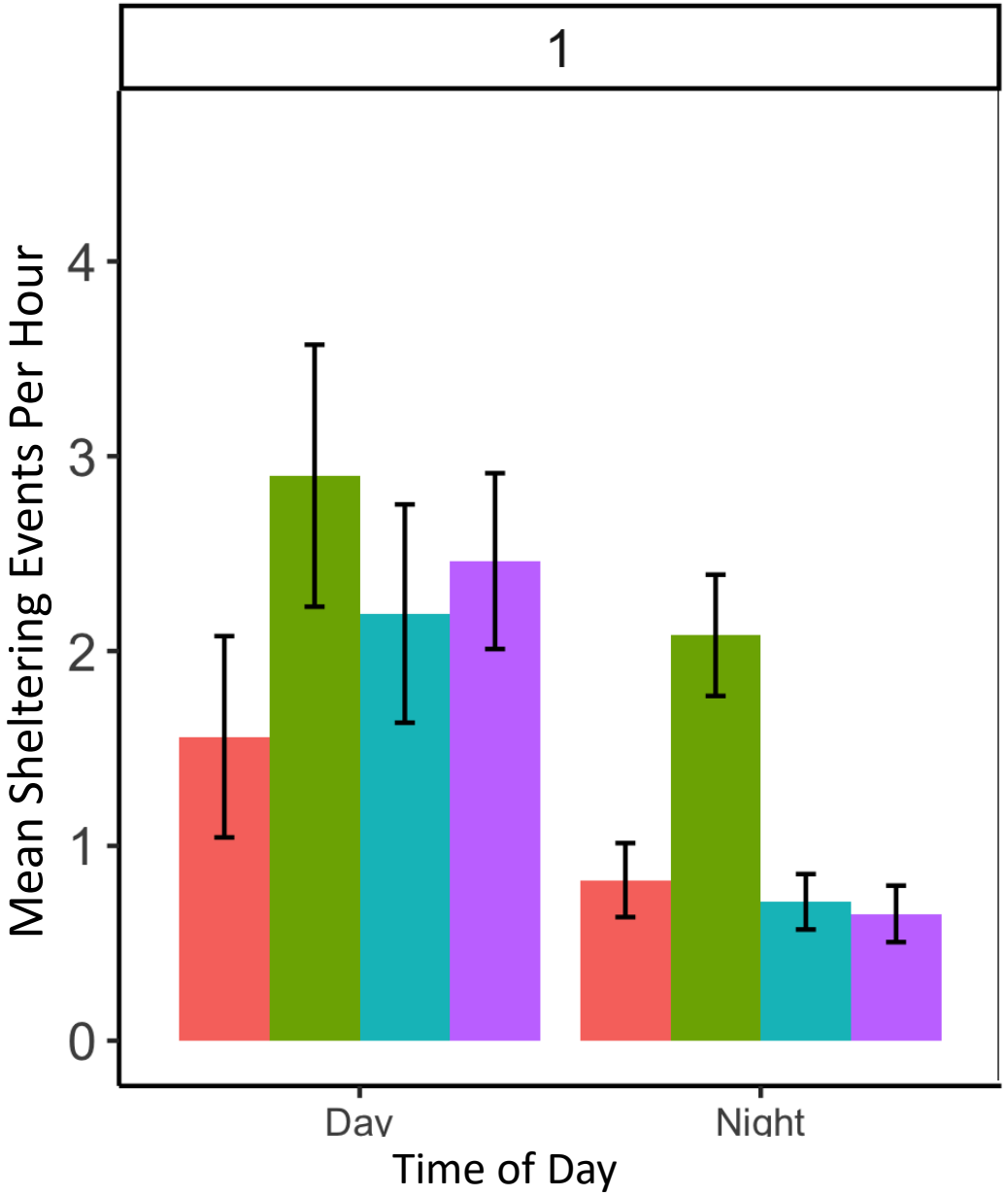


Week 9:

- Warm: Night > Day
- Ambient: Night = Day
- ALAN: Night > Day
- Dark: Night > Day

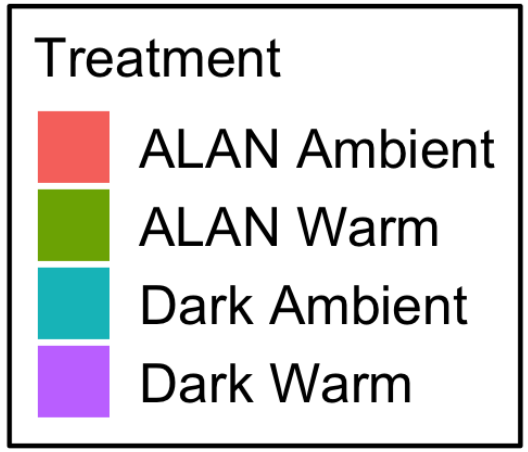
Treatment
ALAN Ambient
ALAN Warm
Dark Ambient
Dark Warm

Sheltering Behaviour: Interaction between Light, Temp, Time of Day, Week

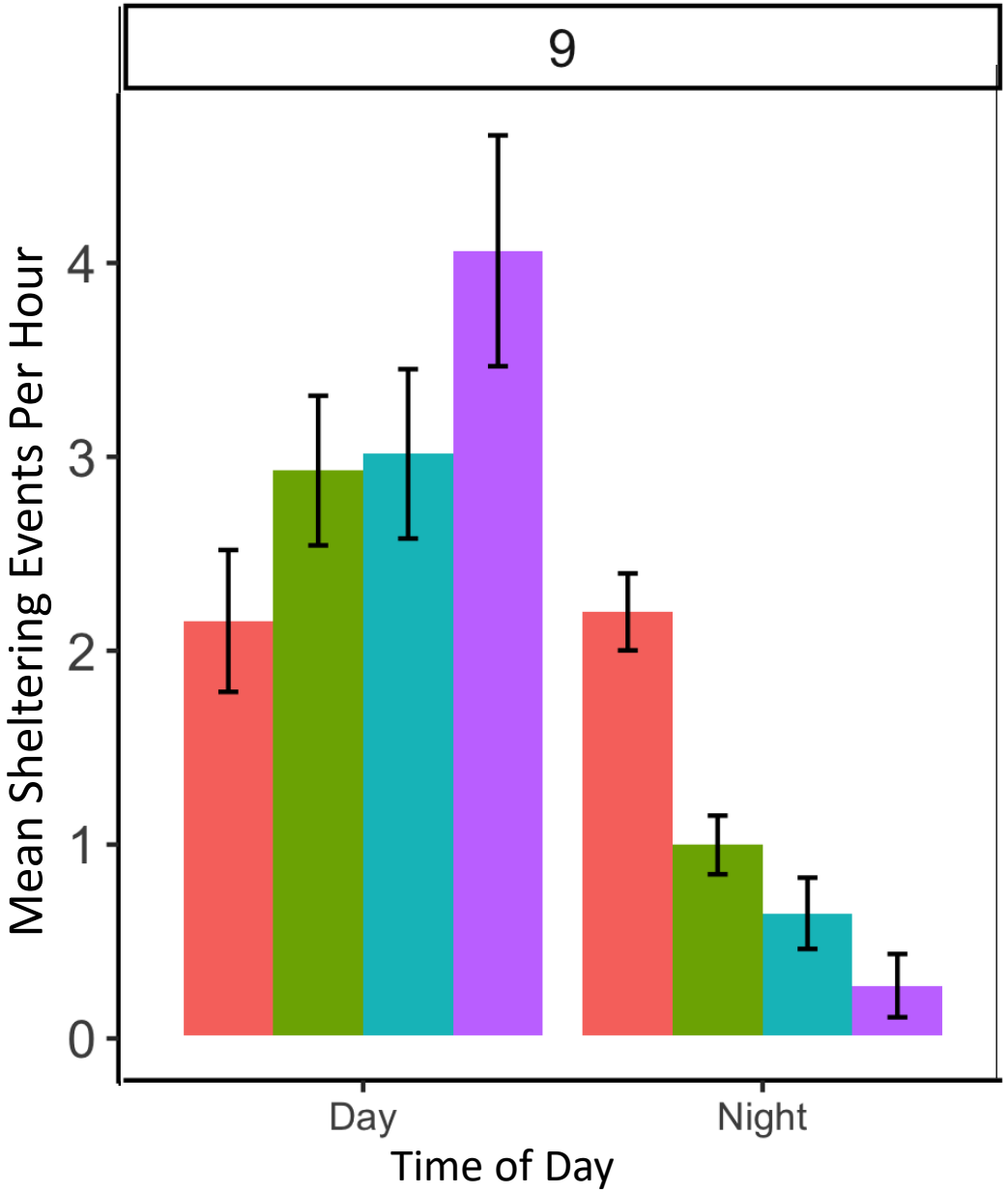


Week 1:

- Day > Night for all



Sheltering Behaviour: Interaction between Light, Temp, Time of Day, Week



Week 9:

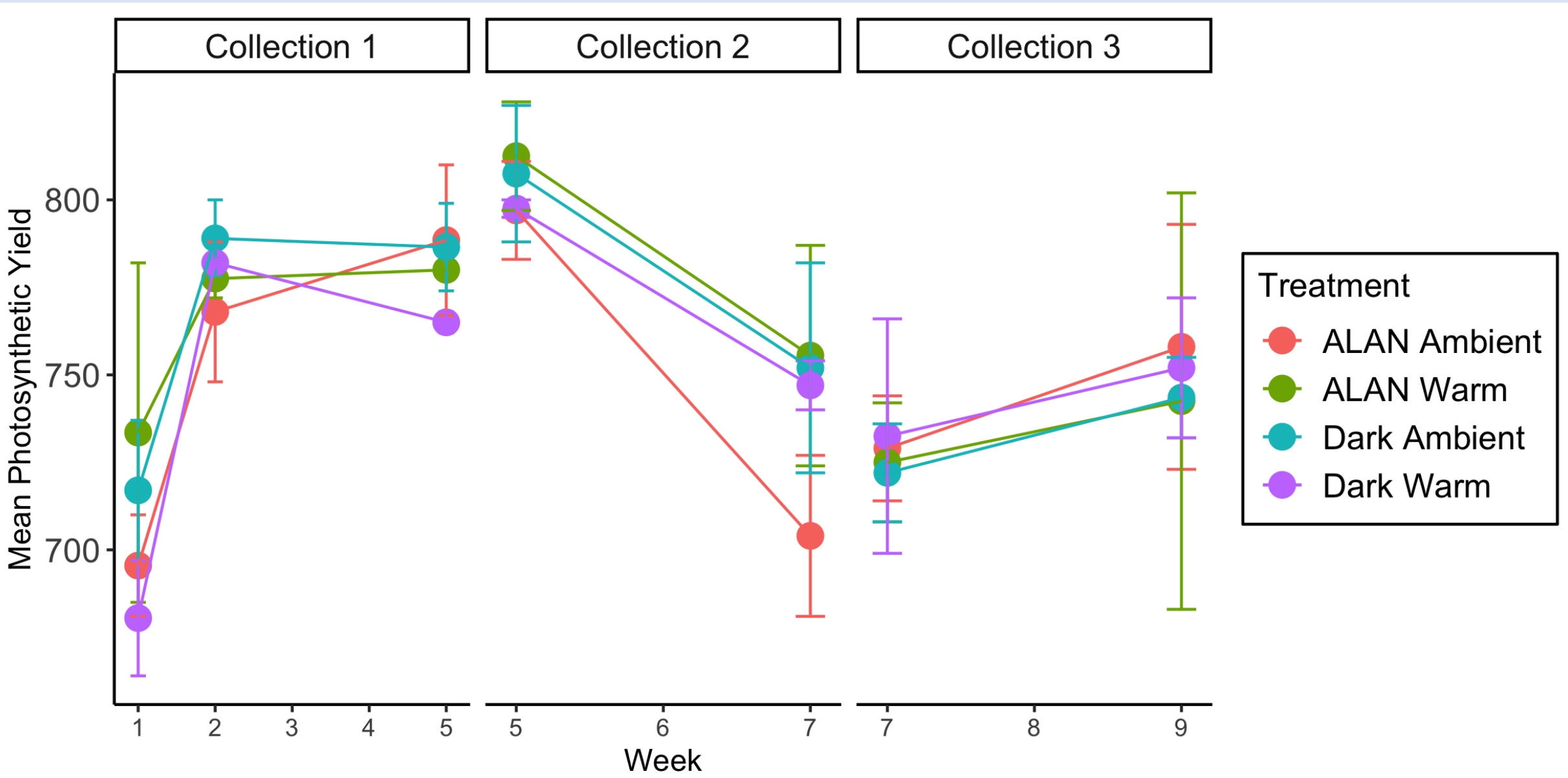
- Day > Night for all
- Week 9 Warm Day > Week 1 Warm Day

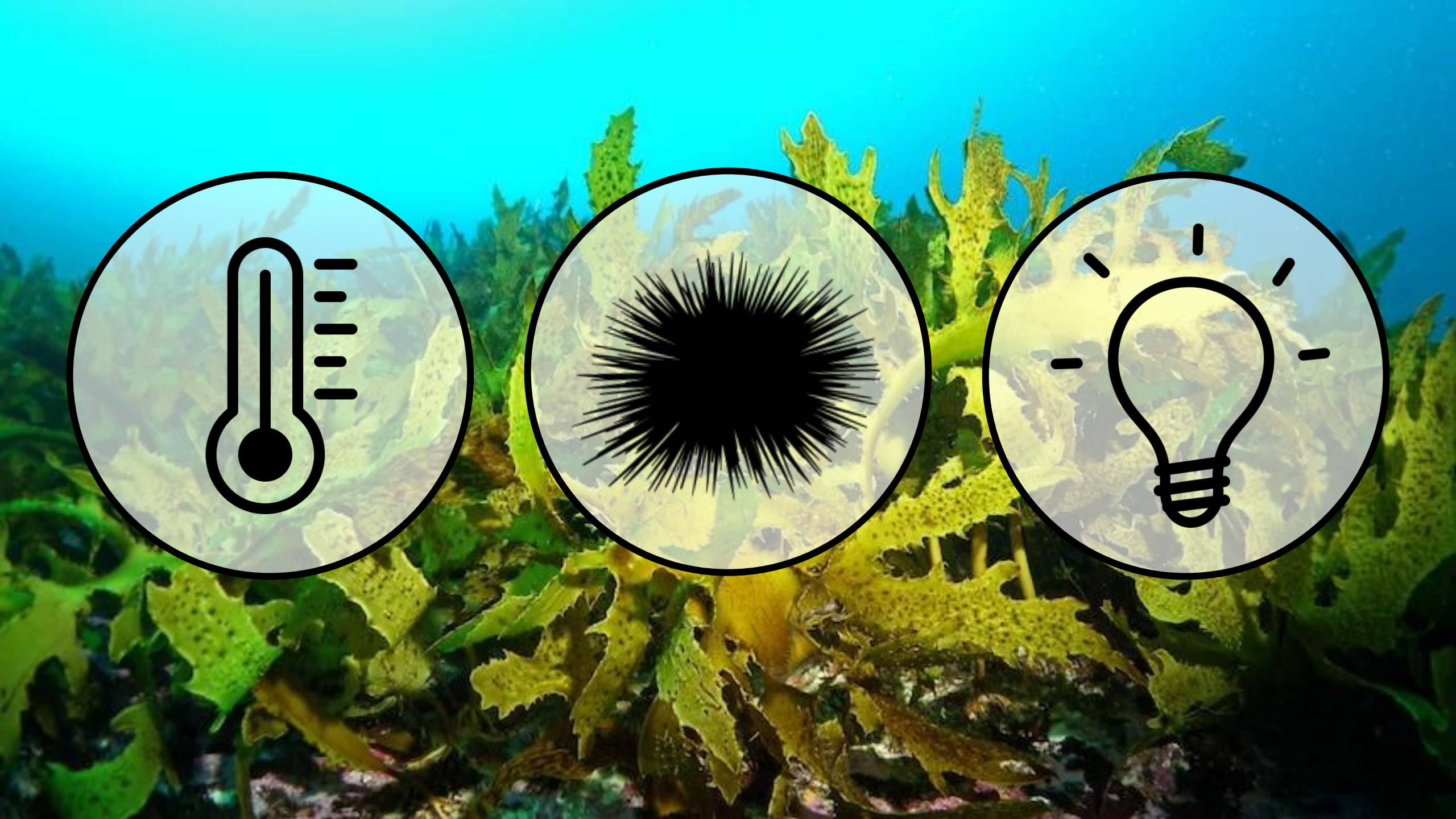
Treatment

- ALAN Ambient
- ALAN Warm
- Dark Ambient
- Dark Warm

Aim 4: To assess the effects of ALAN and warming on kelp photosynthetic yield

Kelp Photosynthetic Yield: No effects





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