Changes of physiological status in Antarctic krill *Euphausia superba* in response to light regime simulation

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Introduction

- Overwintering success is a decisive factor that influences krill condition, recruitment and population size.

- Which physiological mechanisms allow krill to survive during winter when the ocean is covered by ice and food (phytoplankton) is scarce?

- The reduction in metabolic rates (30 – 50%) is discussed as a major physiological response to the Antarctic winter.

➢ **The mechanisms that causes the reductions are still not clearly known !**

Research Objectives

- Are reduced metabolic rates resulting from lower food availibility (starvation) or from major physiological changes (adaptation) ?
- Which environmental parameters may affect the metabolism ?
- Internal physiological processes in krill may be influenced or induced by the seasonal light regime in the Antarctic ?

➢ **Investigate the effect of simulated Antarctic light regimes on physiological parameters of krill.**

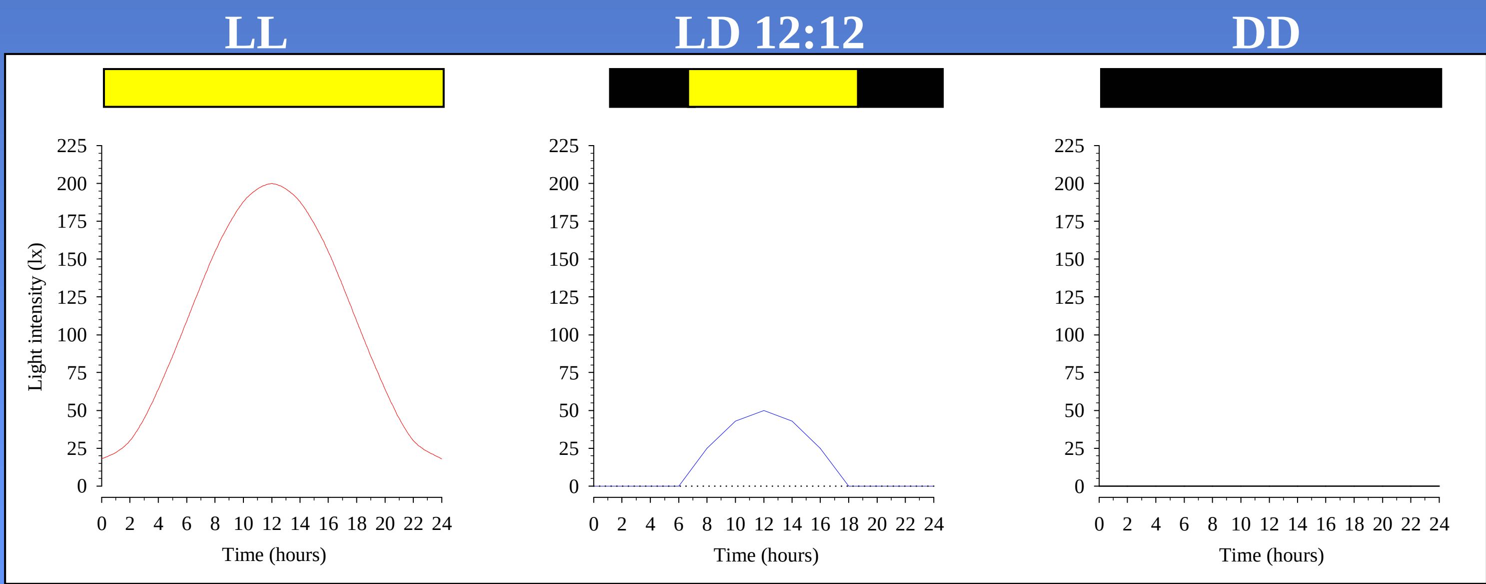
Methods

- Krill maintenance

7 Feb 2005	*Aurora Australis* on-board tank 200 L 0°C dim light	collection
17 Feb 2005	AAD holding tank 1670 L 0.5°C nLD	maintenance
30 May 2005 – **22 Aug 2005**	experimental tank I 100 L 0.5°C LL; 200 lx	**experiment**
	experimental tank II 100 L 0.5°C LD 12:12; 50 lx	
	experimental tank III 100 L 0.5°C DD	

Methods

- Experimental design
  - ➢ Simulated Antarctic light regimes for 12 weeks



➢ All three experimental stocks were fed daily the same food concentration !

Methods

- Weekly measurements

  - Feeding activity

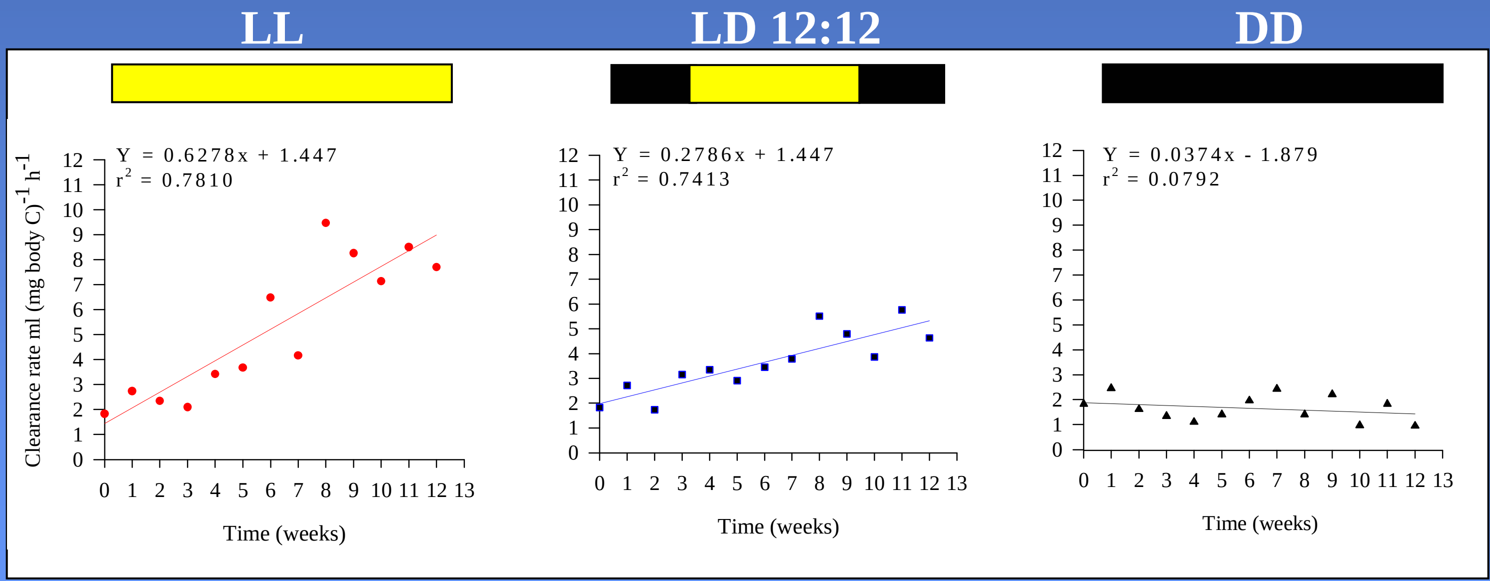
    Clearance rate
    Daily C ration
    Size of digestive gland

  - Metabolic activity

    Respiration rate
    Malate dehydrogenase (MDH) activity

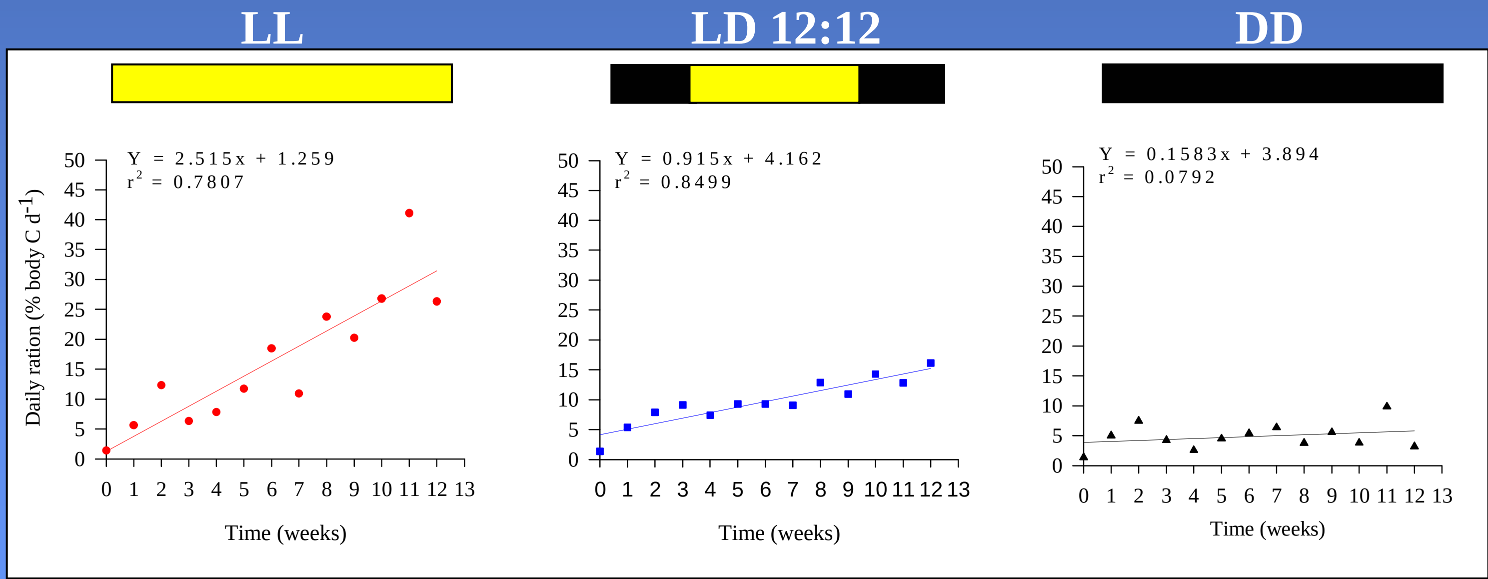
Results

- Feeding activity → Clearance rate



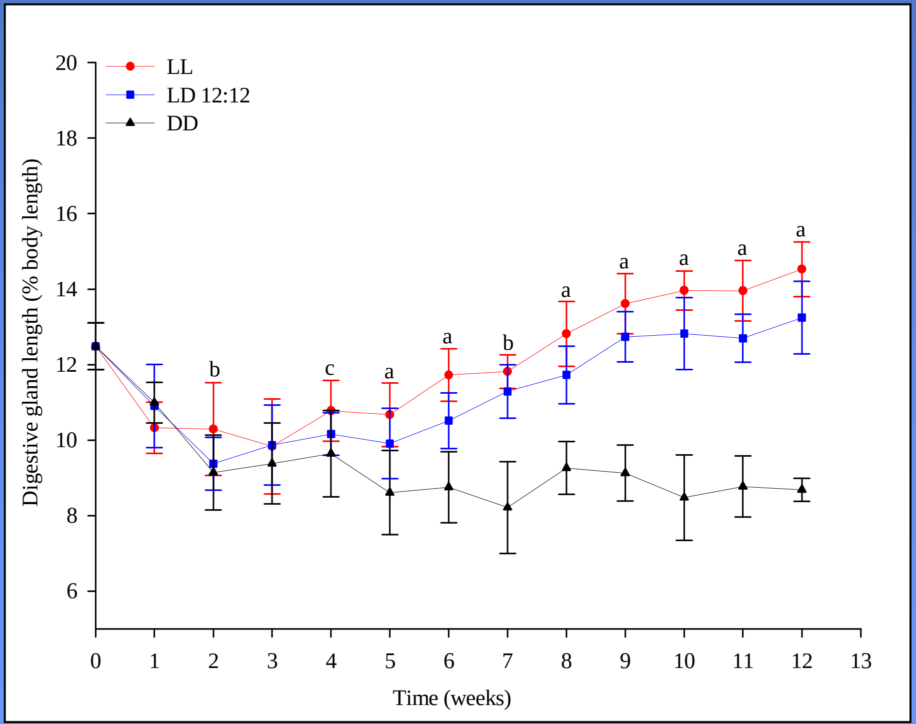
Results

- Feeding activity → Daily C ration



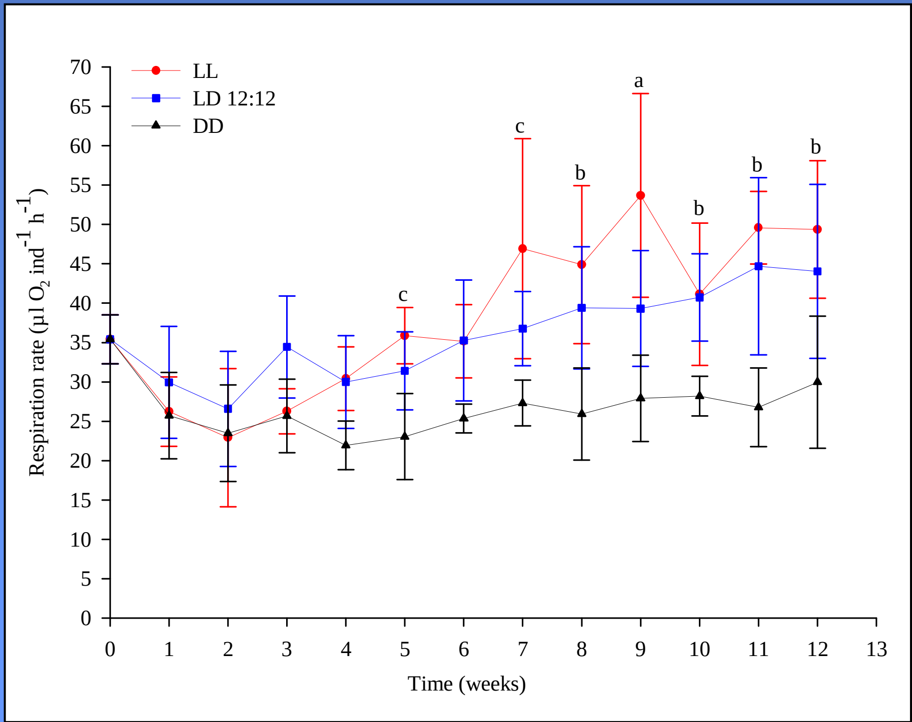
Results

- Feeding activity → Digestive gland size



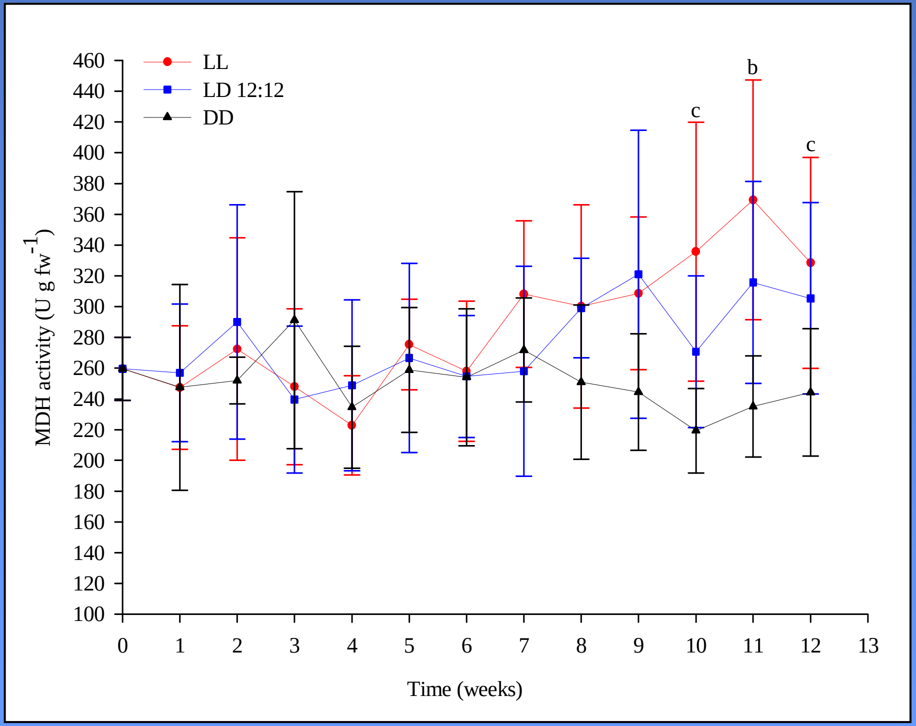
Results

- Metabolic activity → Respiration rate



Results

- Metabolic activity → MDH activity



Summary

- Changes of feeding and metabolic activity are not primarily the result of food supply !

- LL and LD 12:12 → showed an increase in all measured parameters over the experimental period.

- LD 12:12 → showed a more consistent increase and remained below those of krill held under LL.

- DD → did not respond to the high food availability.

➢ **Feeding and metabolic activity of krill were affected by the different simulated Antarctic light regimes !**

Conclusions

- Seasonal changes in the physiological status of adult krill appear to be more the result of seasonal adaptations in the animal physiology and behaviour irrespective of ambient food levels.

- The study underlines the important effect of the Antarctic light cycle on physiological parameters of krill such as feeding and metabolic rates.

➢ **This may indicate an inherent adaptational overwinter strategy triggered by the Antarctic light regime !**

Future work

- Characterization on the effects of light.

- What are the transducers for seasonal responses in relation to the Antarctic light regime (e.g. Melatonin, Serotonin) ?

➢ ~1 pg mg_{fw}^{-1} (eyestalks) and ~0.2 pg μl^{-1} (hemolymph) immunureactive melatonin (unpublished data).

- Investigate the nature of this hormone and its mode of action

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