

# The effect of hydrostatic pressure on grazing in three calanoid copepods

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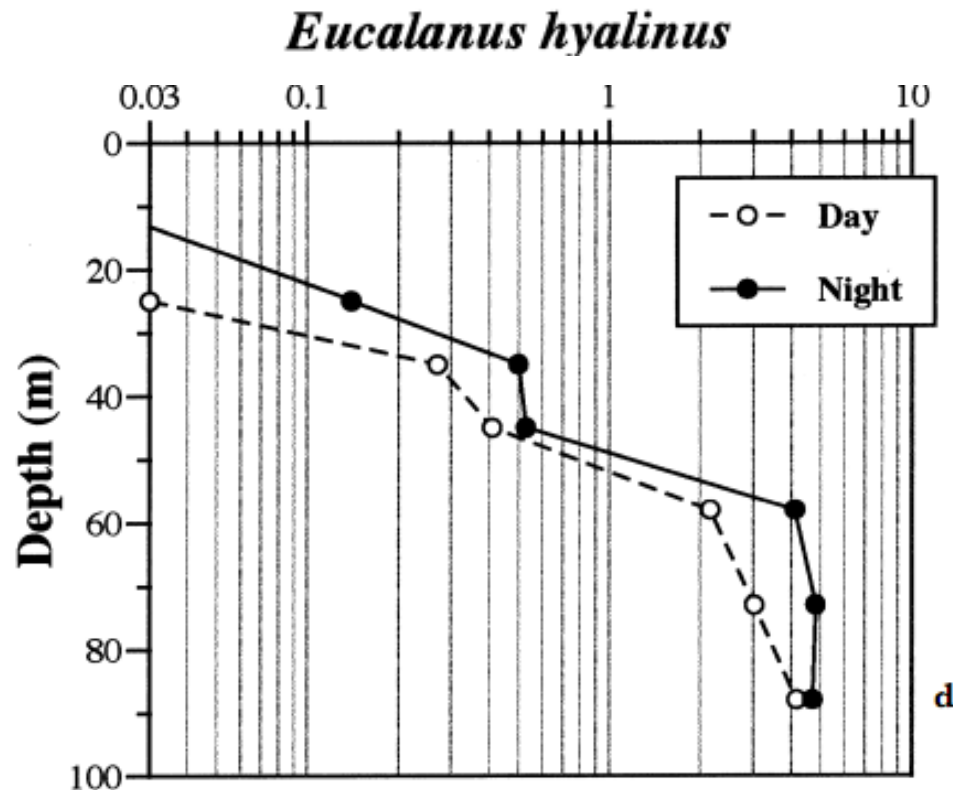


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# Depth difference among individuals

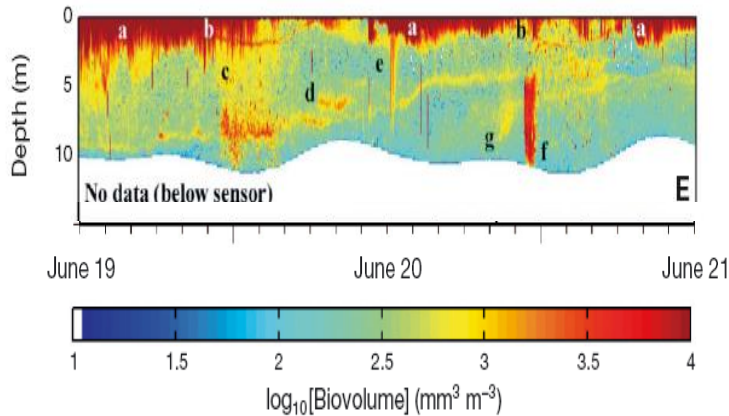
In many copepod species, different individuals belonging to the same species and life stage are distributed over a wide depth interval.



# Fine-tuning depth

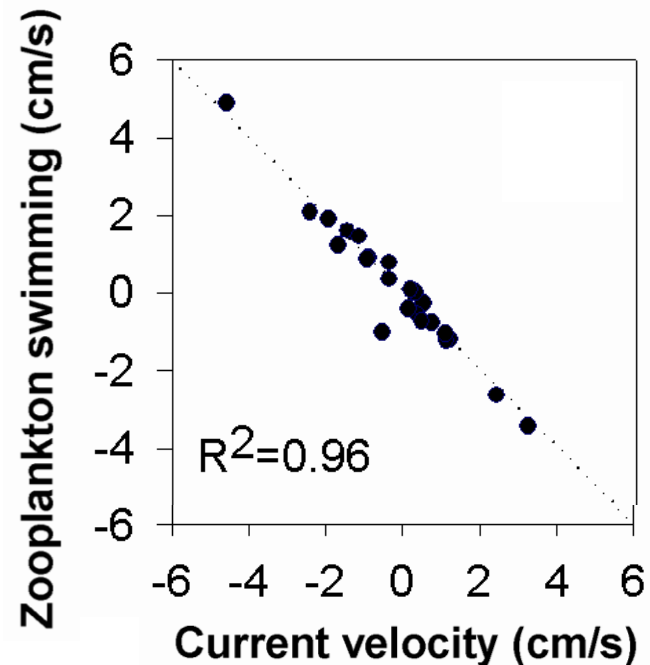
Copepods are able to fine-tune their depth to a high precision.

## Thin layers



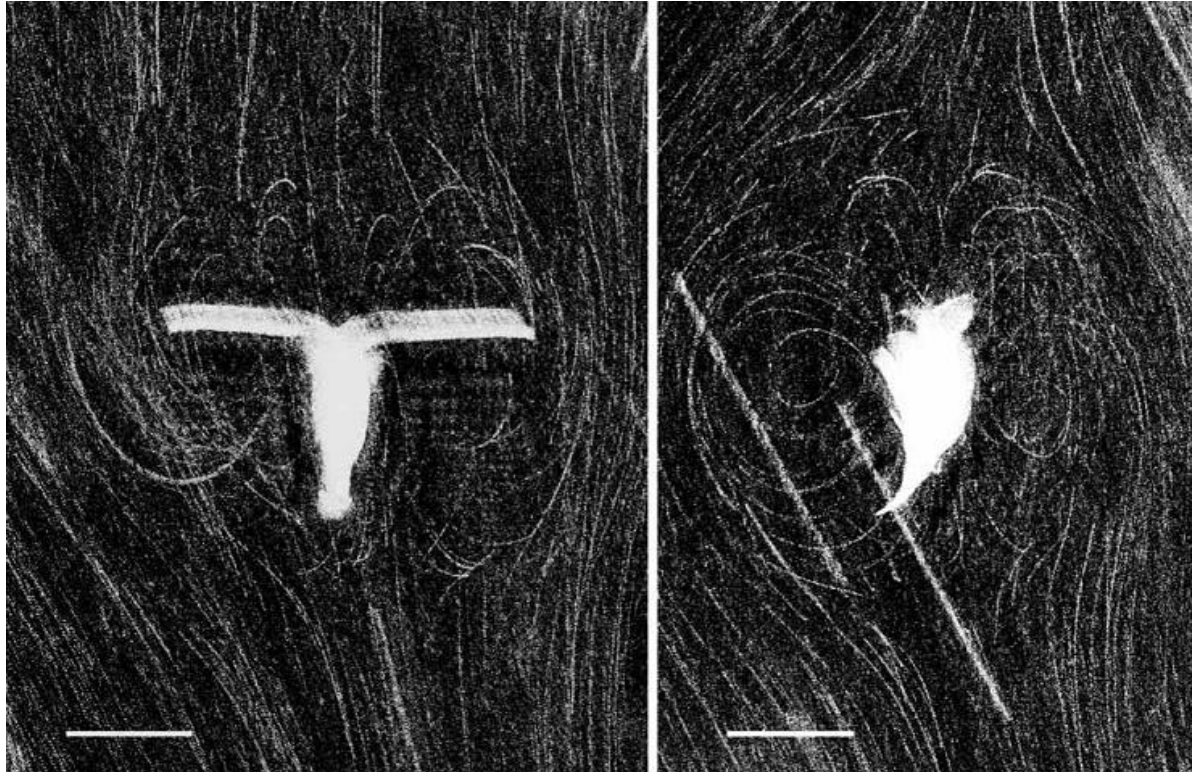
(McManus et al. 2003)

## Depth retention



(Genin et al. 2005)

# Copepod feeding currents



Malkiel et al. (2003)

Density difference =  $\rho(\text{copepod}) - \rho(\text{water})$   
**“Anchor”**

**In theory, feeding currents depend on the “anchor strength”**

(Jiang and Strickler, 2005)

# Lipids, buoyancy and feeding currents

- less dense
- more thermally expandable
- more compressible

(Yayanos et al. 1978)



Buoyancy

Pressure

“anchor strength”

feeding currents

Individual grazing rates are expected to vary with depth

# Objective

To test the hypothesis that small changes in hydrostatic pressure affect grazing in three calanoid copepods.

# Study species

Norway, cold-water

Red Sea, warm-water

*Calanus helgolandicus*

*Pleuromamma indica*

*Rhincalanus nasutus*



“internal control”

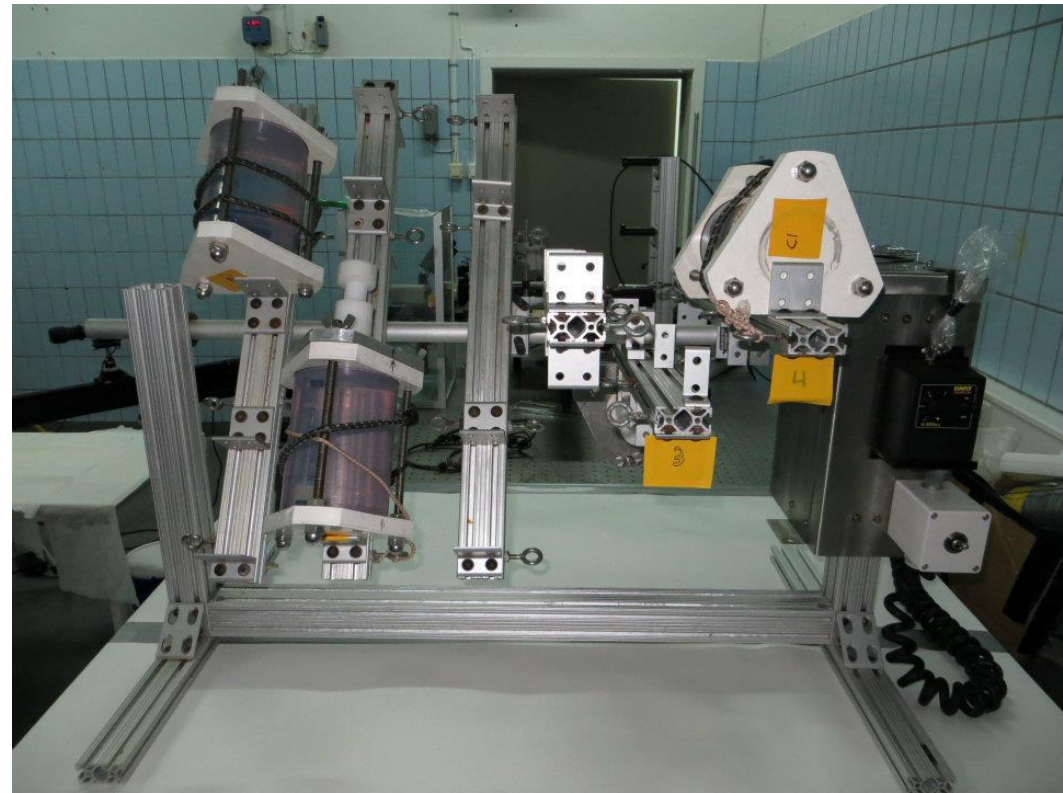
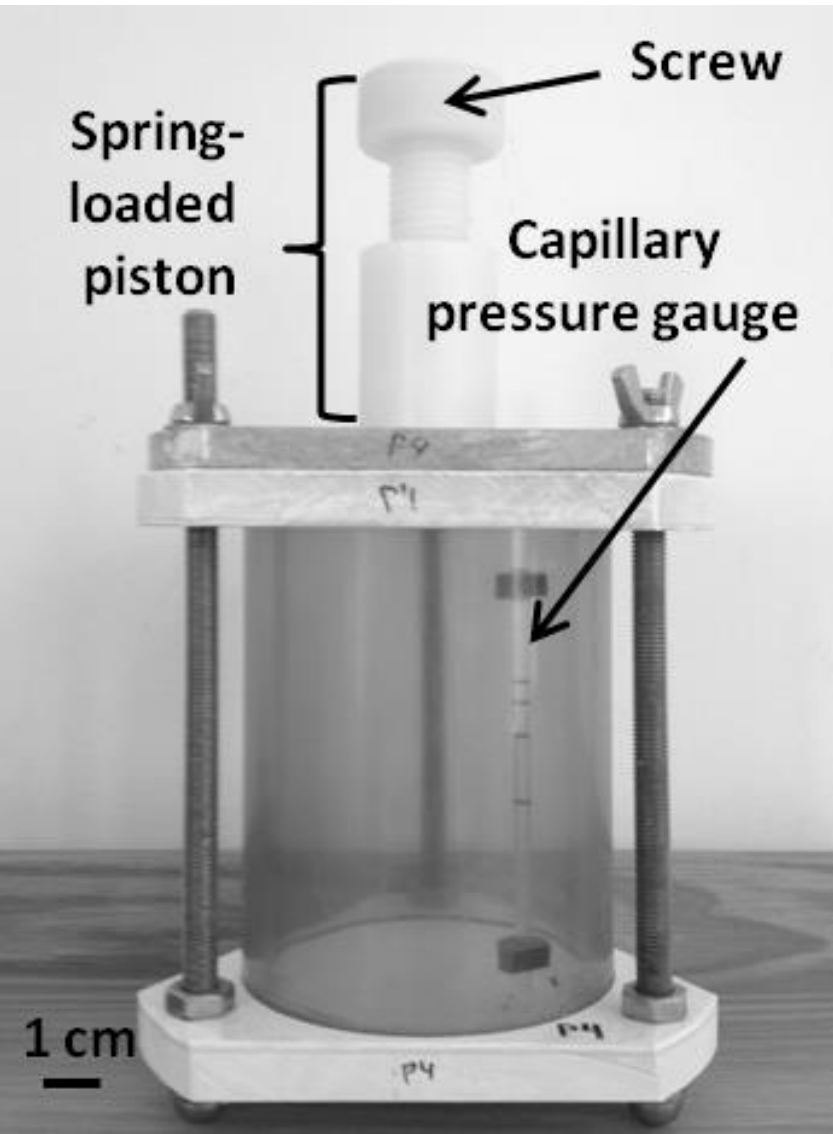
- up to 30% lipids
- lab-reared

- almost no lipids
- freshly caught  
at sea-surface

- up to 30% lipids
- freshly caught  
at >400 m

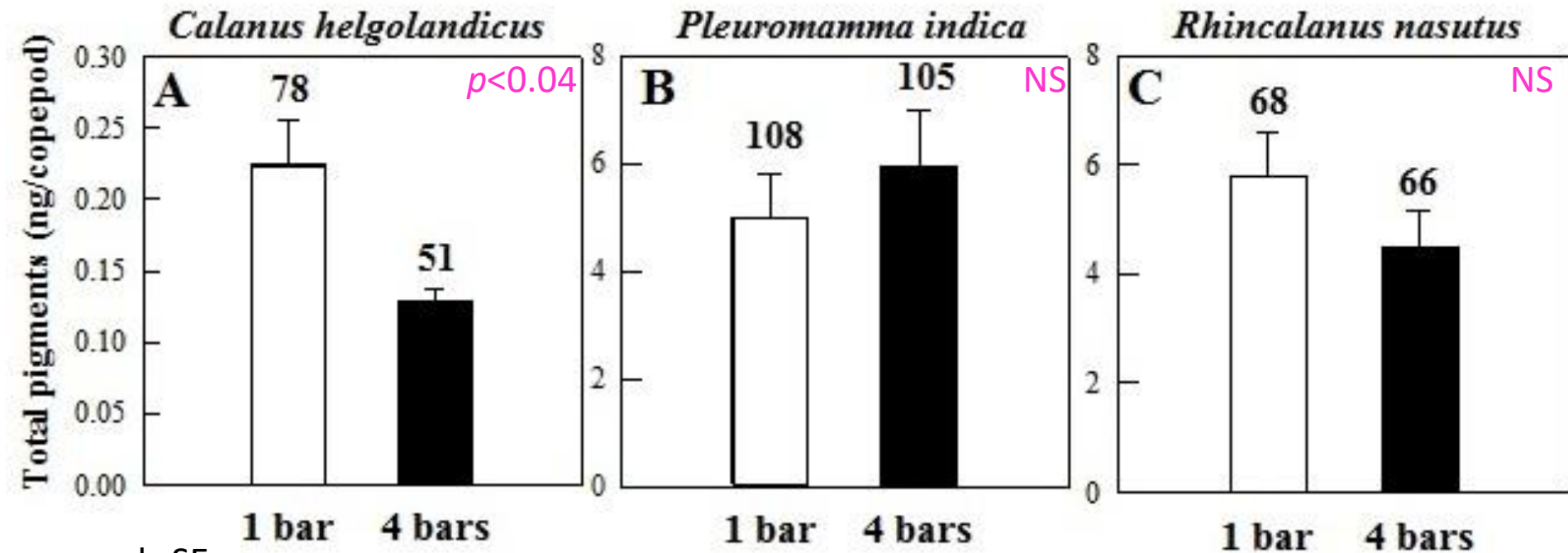
# Method – grazing experiments

- Two pressure levels: 1 and 4 bars
- Controlled temperature and food
- Gut pigments analysis of individual copepods





# Results



mean  $\pm$  SE

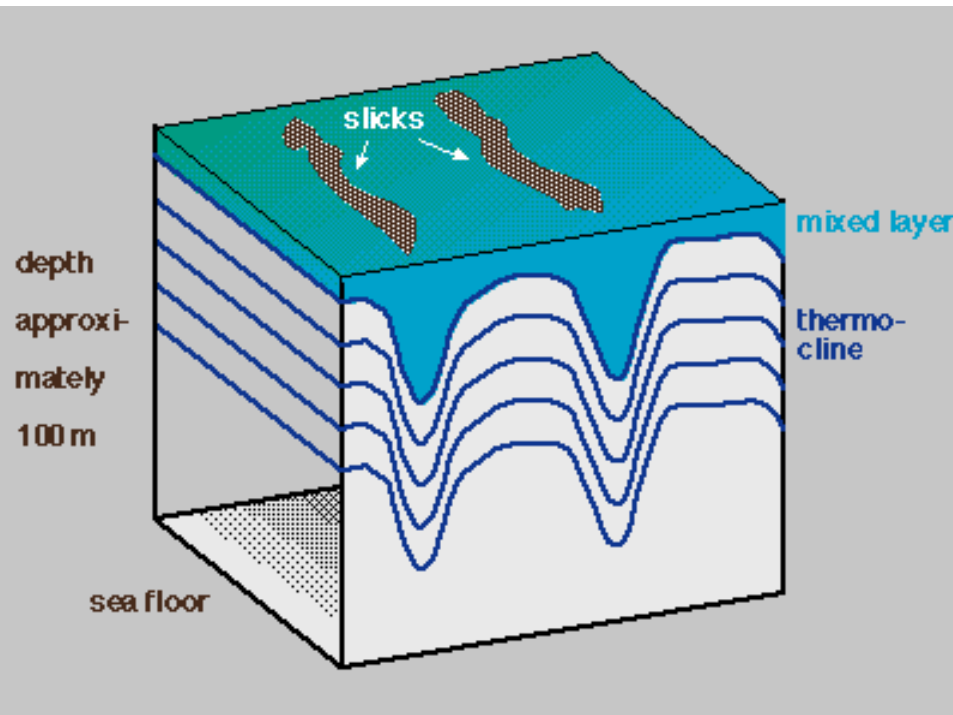


“internal control”



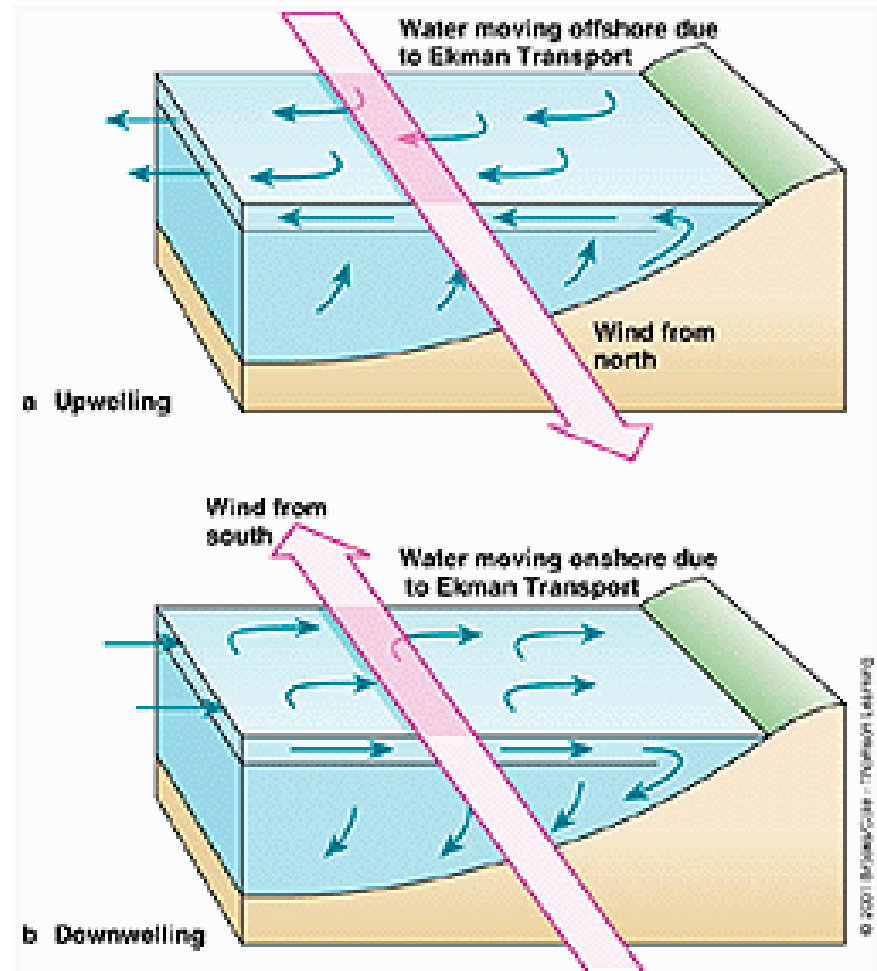
# Ecological implications

## Internal waves



<http://www.physocean.icm.csic.es/IntroOc/lecture10-en.html>

## Vertical currents



<http://www4.ncsu.edu/~ceknowle/Envisions/chapter09copy/part1.html>

# Summary and conclusions

- Hydrostatic pressure affects grazing in *C. helgolandicus* (2-fold decline at 4 bars)
- Pressure effect: lipid-dependent and species-specific
- More research on copepod lipid mixtures and their properties is needed
- Ecological implications: internal waves, vertical currents

# Thanks!

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# Results – substantial inter-individual variability

- Sometimes gut pigment content indicative of empty guts

*C. helgolandicus*: 31% at 1 bar,  
36% at 4 bars

*P. indica*: 0.9% at 1 bar  
3.7% at 4 bars

*R. nasutus*: all individuals fed

-Within a trial and within a treatment individual gut pigments differed by a mean factor of

*C. helgolandicus*: 14.6 (range 1-104)

*P. indica*: 45 (range 6-77)

*R. nasutus*: 16 (9-23)

(disregarding the non-feeding individuals)