

Sinkers or floaters?

Contribution from salp pellets to the export during a large bloom event in the Southern Ocean

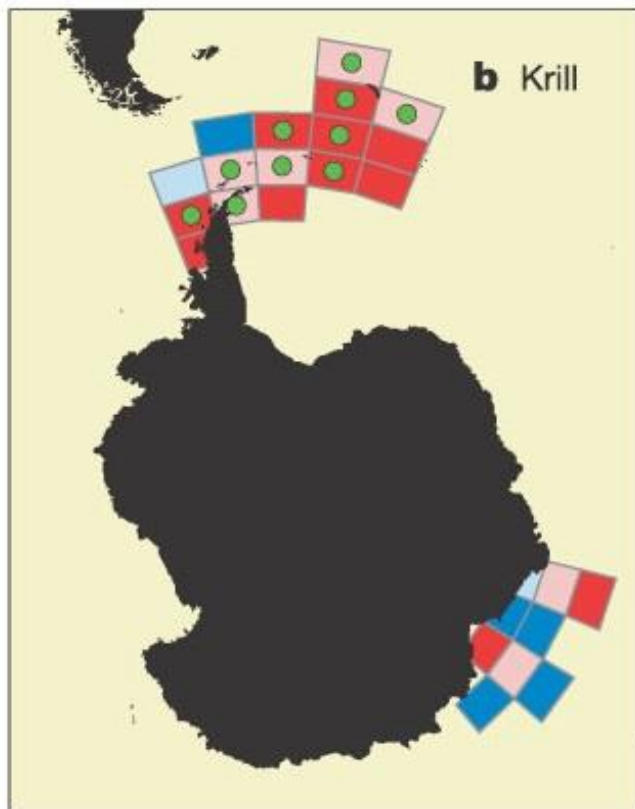
Morten Iversen, Evgeny Pakhomov, Brian Hunt, Helga van der Jagt,

Dieter Wolf-Gladrow, Christine Klaas

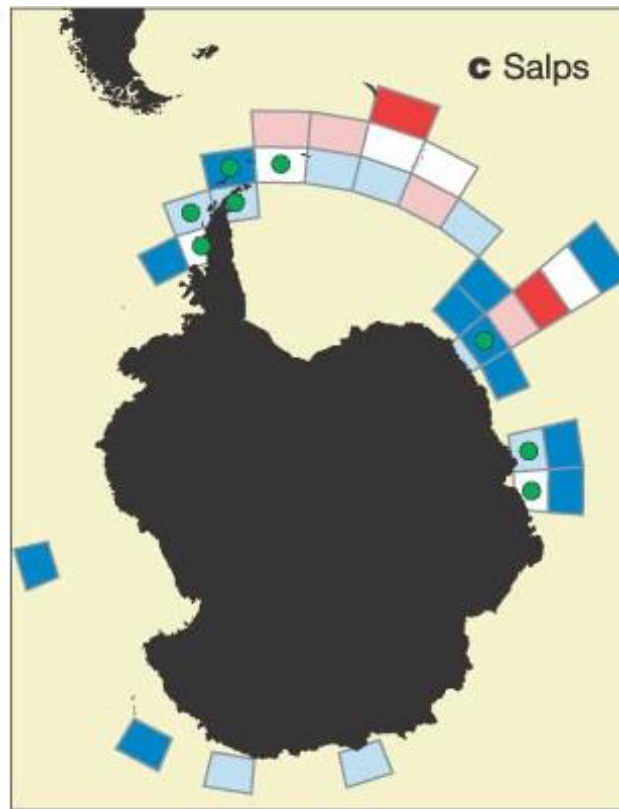
Shift from krill to salps

- Data from 1976 to 2003 (Atkinson et al. 2004)

Decline in krill



Increase in salps

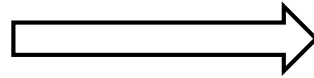


Density change per decade



Consequences for the ecosystem

Krill



Salps

This suggests that salp pellets are sinkers and that a dominance of salps in the Southern Ocean will:

- **Pack more phytoplankton into rapidly sinking pellet**
- **Enhance the export flux**
- **Increase the efficiency of the biological pump**

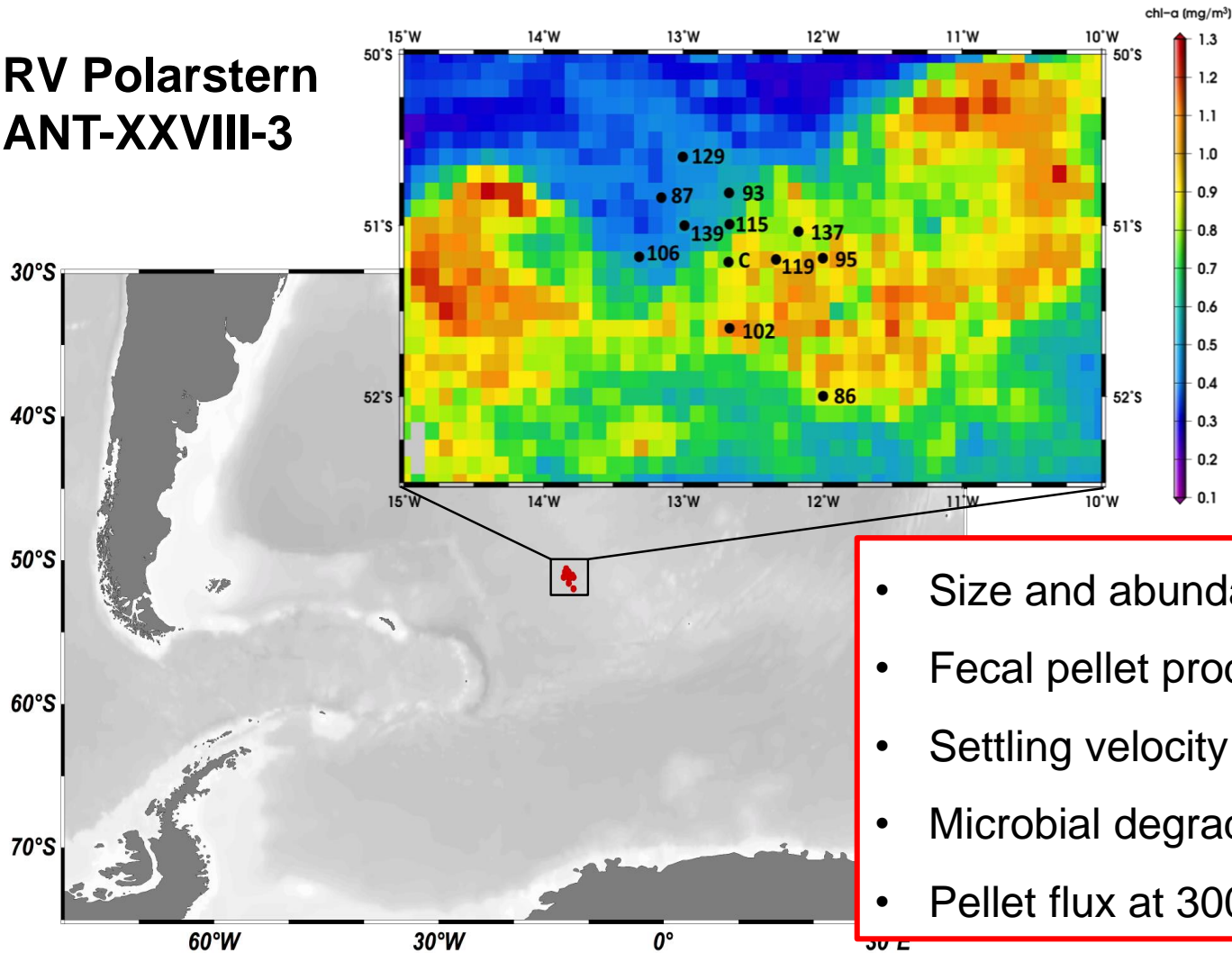
However!

Salp abundance, pellet production and pellet flux have never been measured simultaneously

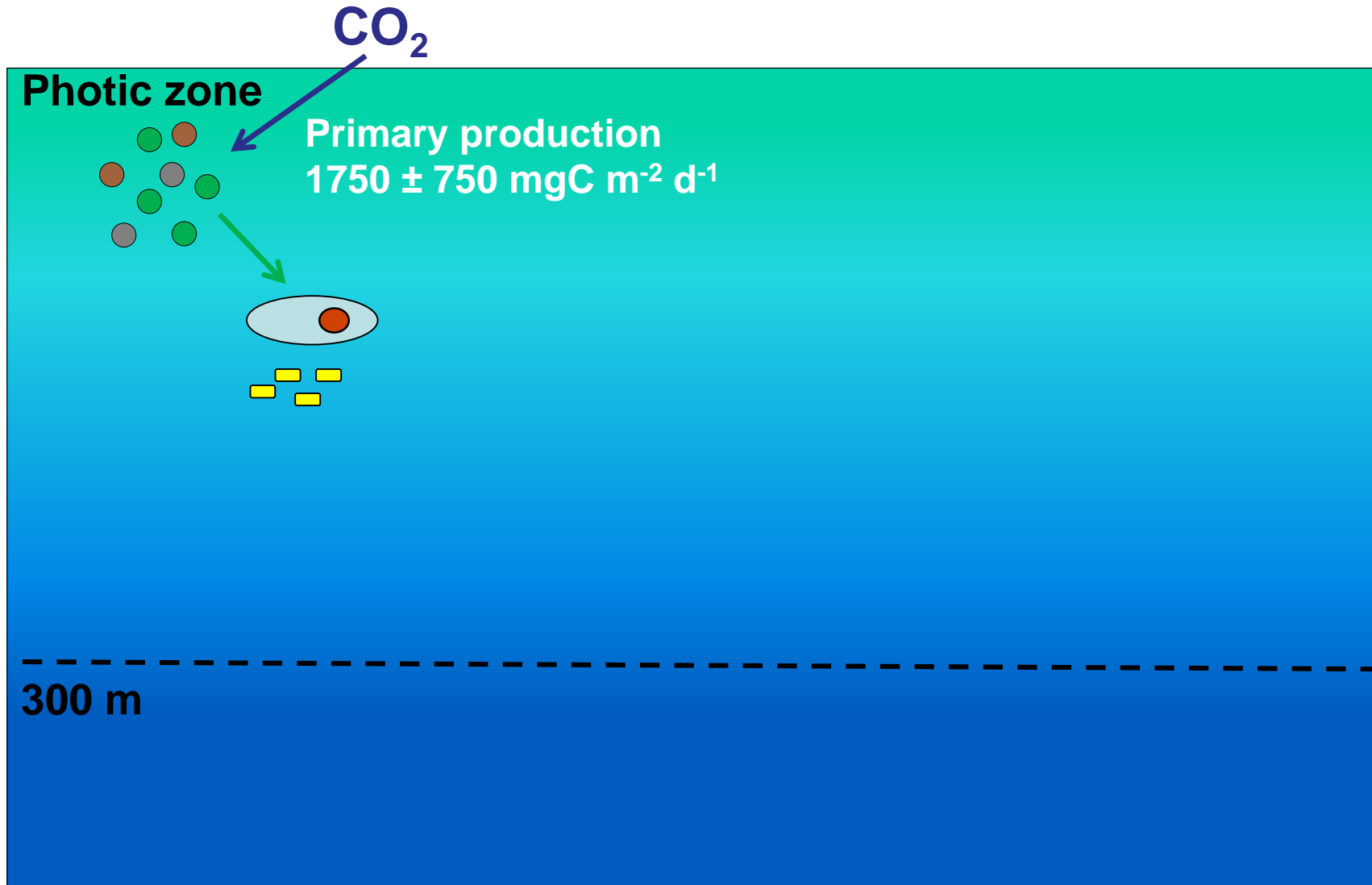
in

Role of salp pellets for export

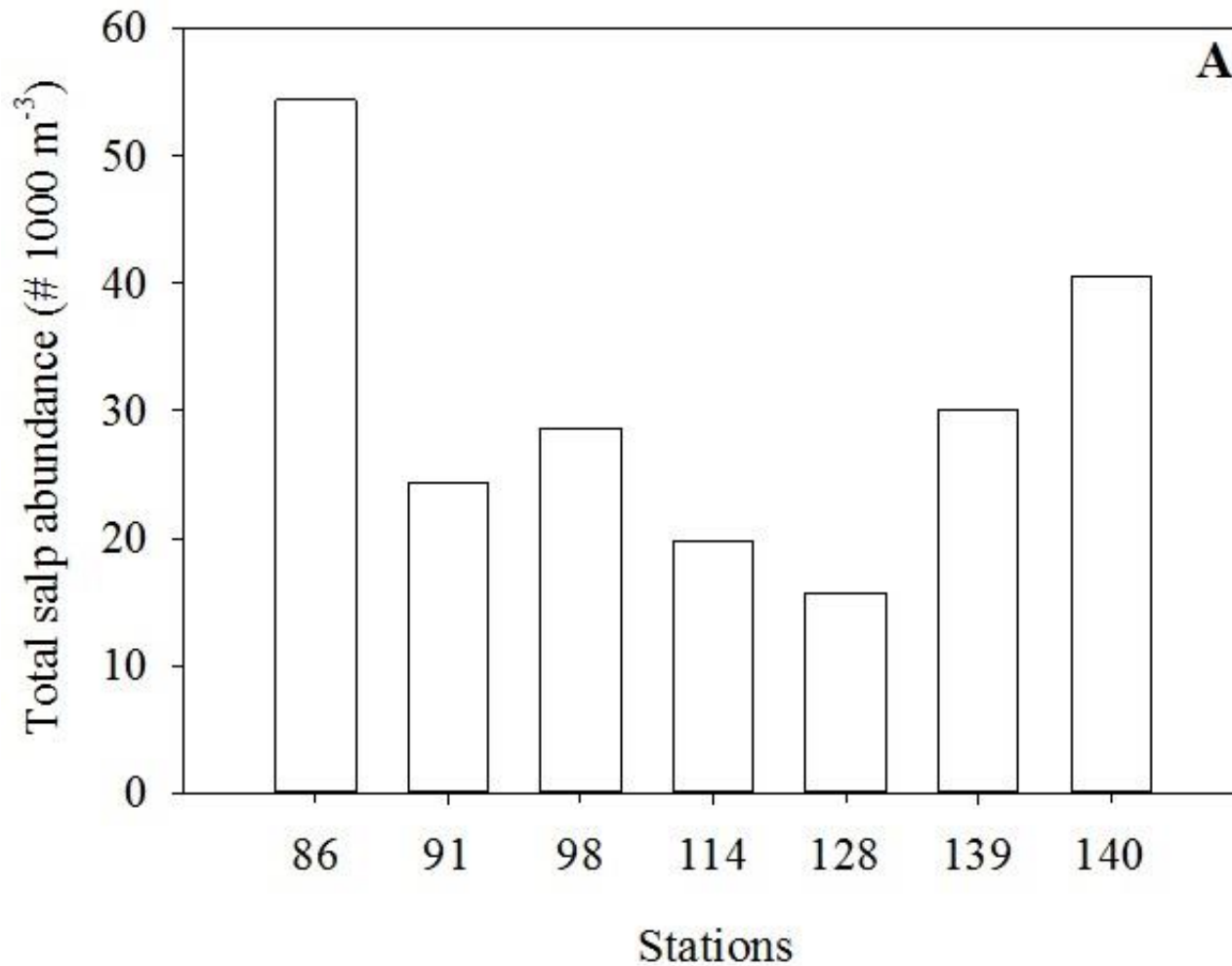
RV Polarstern ANT-XXVIII-3



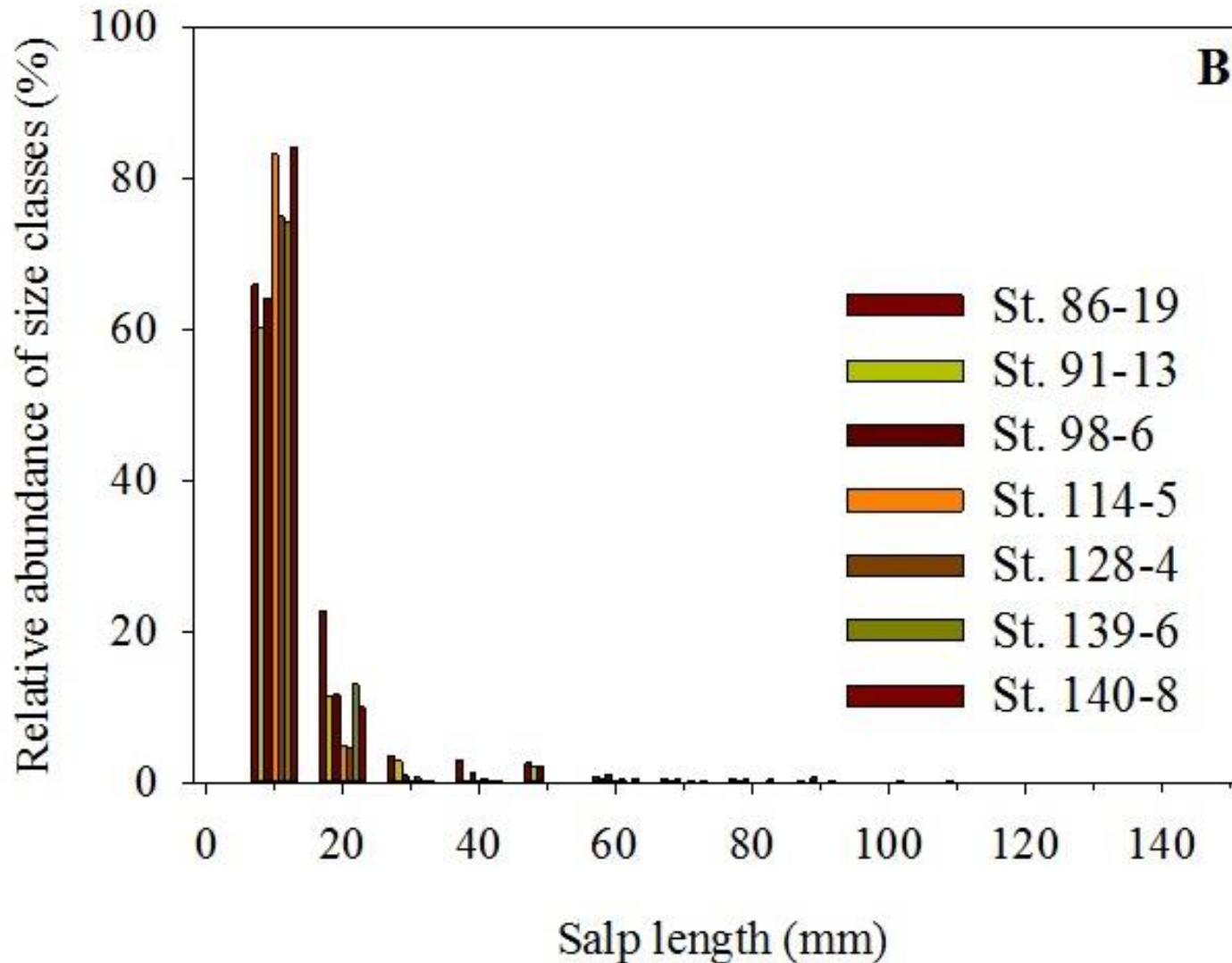
Role of salp pellets for export



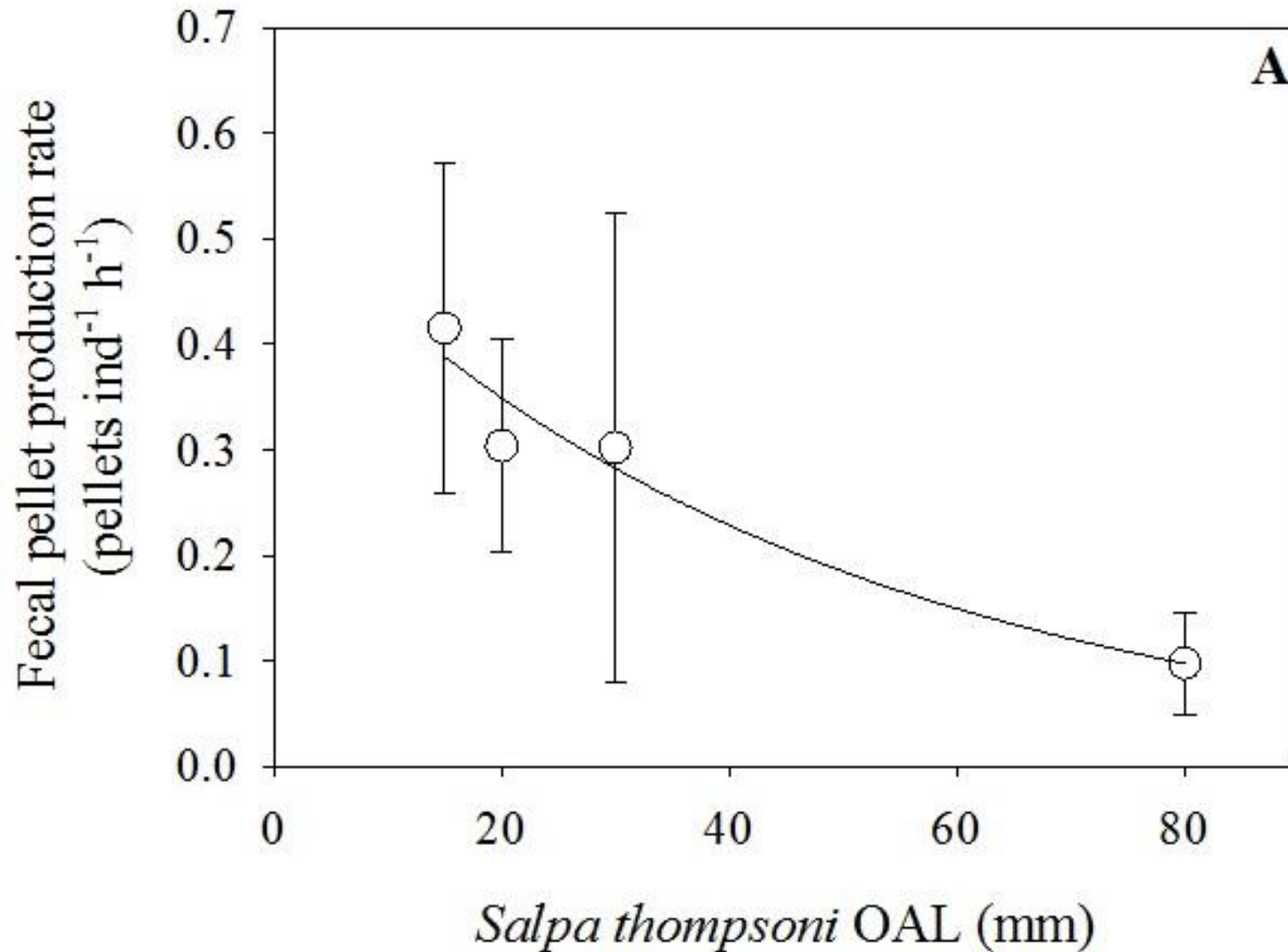
Salp abundance



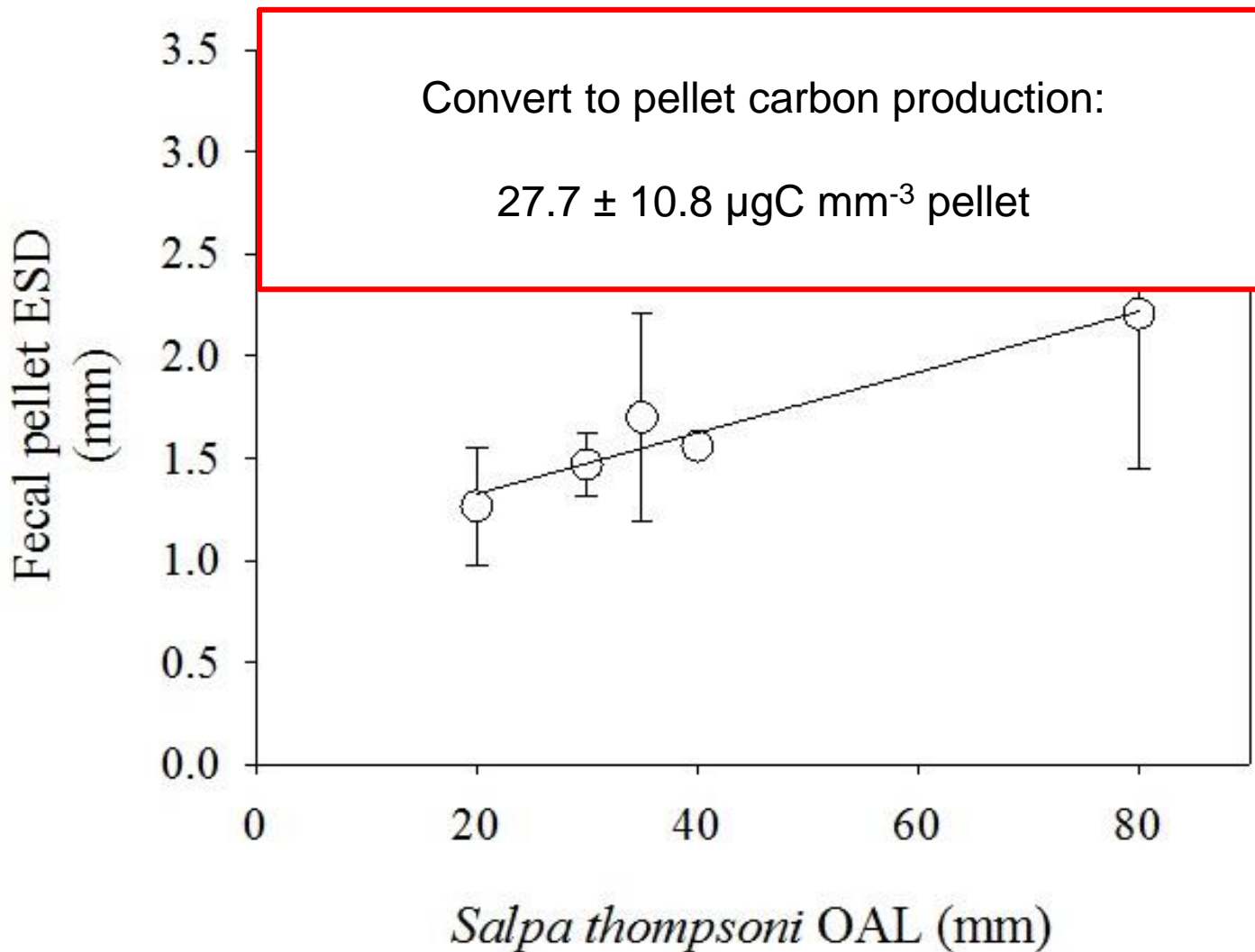
Salp size distribution



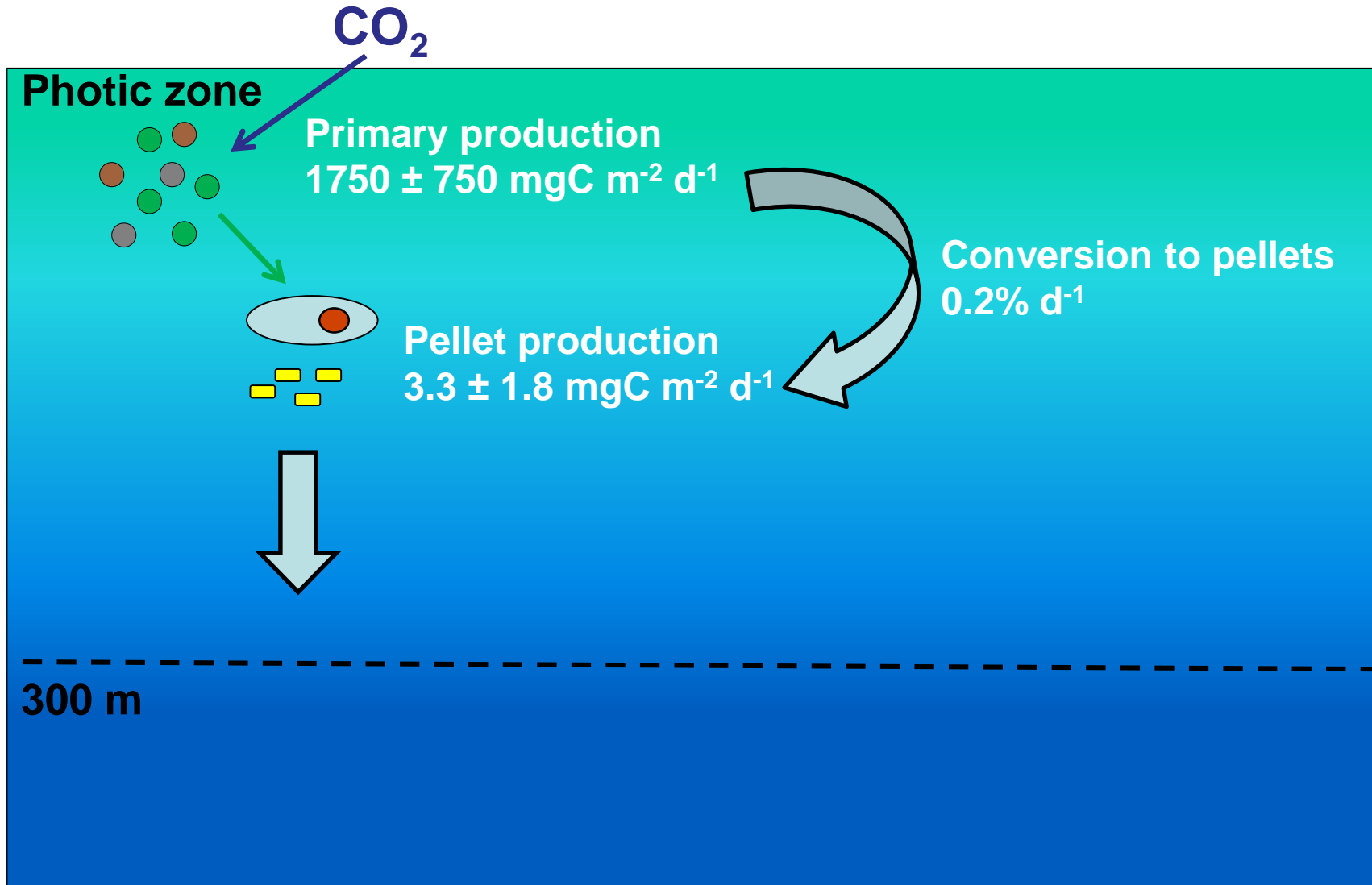
Size-dependend pellet production



Pellet size as a function of salp size

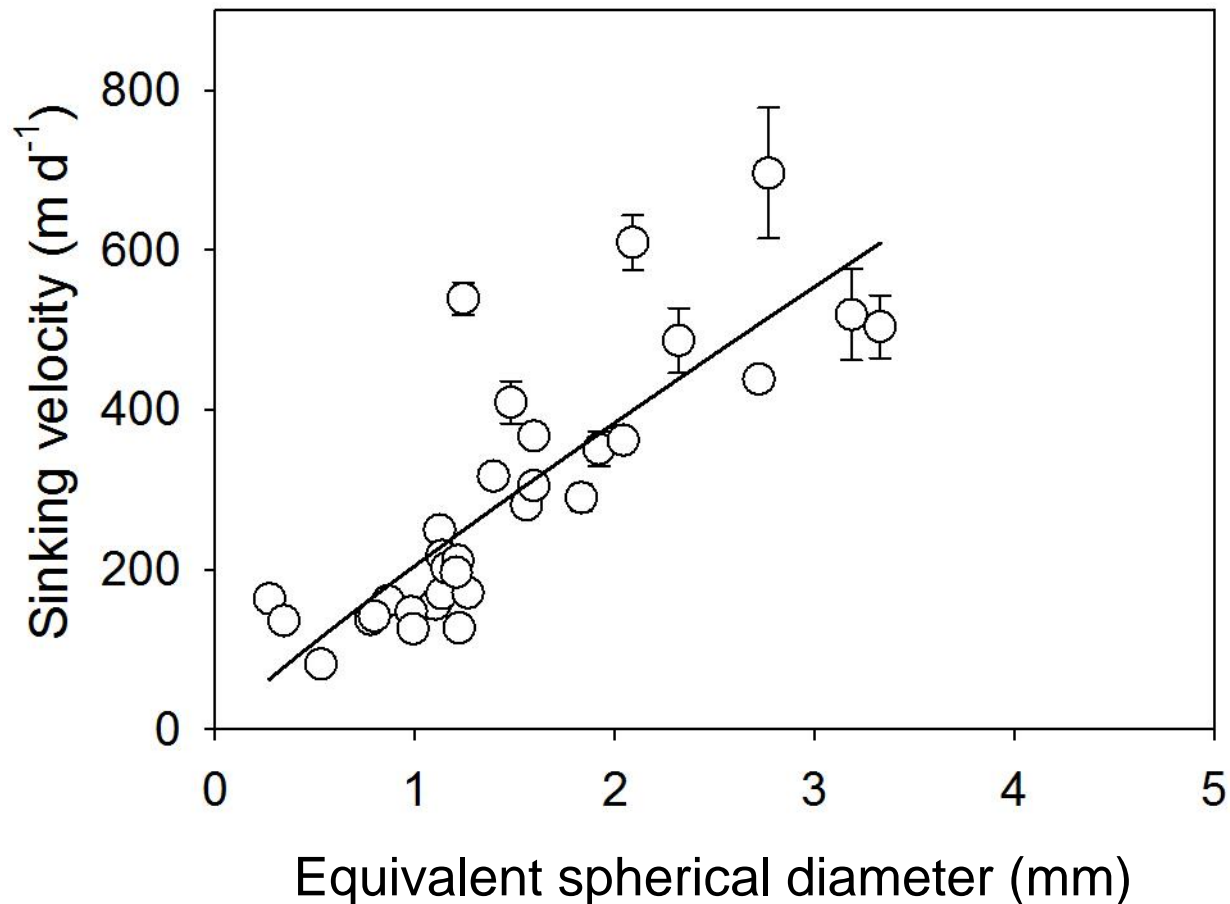


Role of salp pellets for export



Salp pellet sinking velocity

Flux = concentration x sinking velocity



Role of salp pellets for export

60-71% of the produced pellets were recycled in the upper 300 m

↳ Despite settling velocities larger than 300 m d⁻¹

?!?

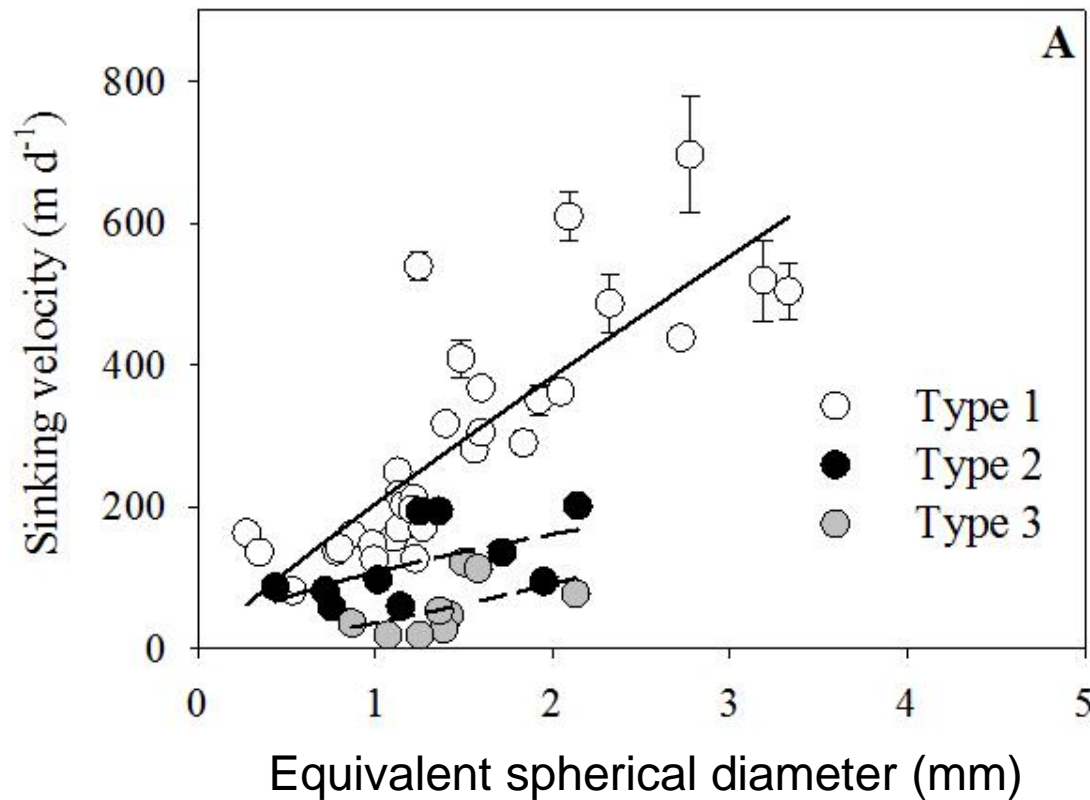
Could this be due to microbial degradation?

Microbial carbon turnover was 4-5% d⁻¹

Salp pellet types observed



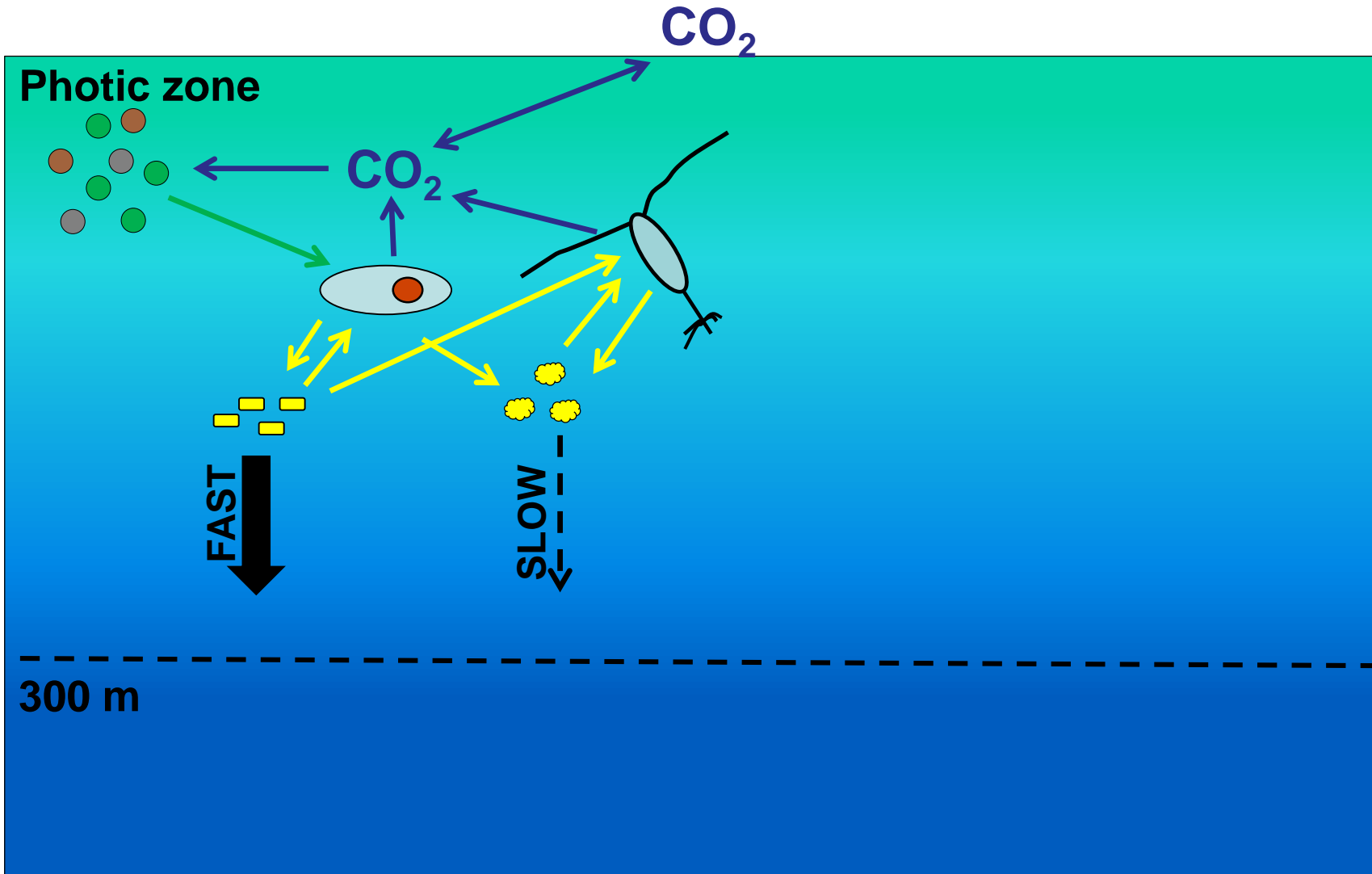
Salp pellet types observed



Microbial carbon turnover:

- Type 1: $4 \pm 1\% \text{ d}^{-1}$
- Type 2: $5 \pm 4\% \text{ d}^{-1}$
- Type 3: $5 \pm 5\% \text{ d}^{-1}$

Role of salp pellets for export and recycling



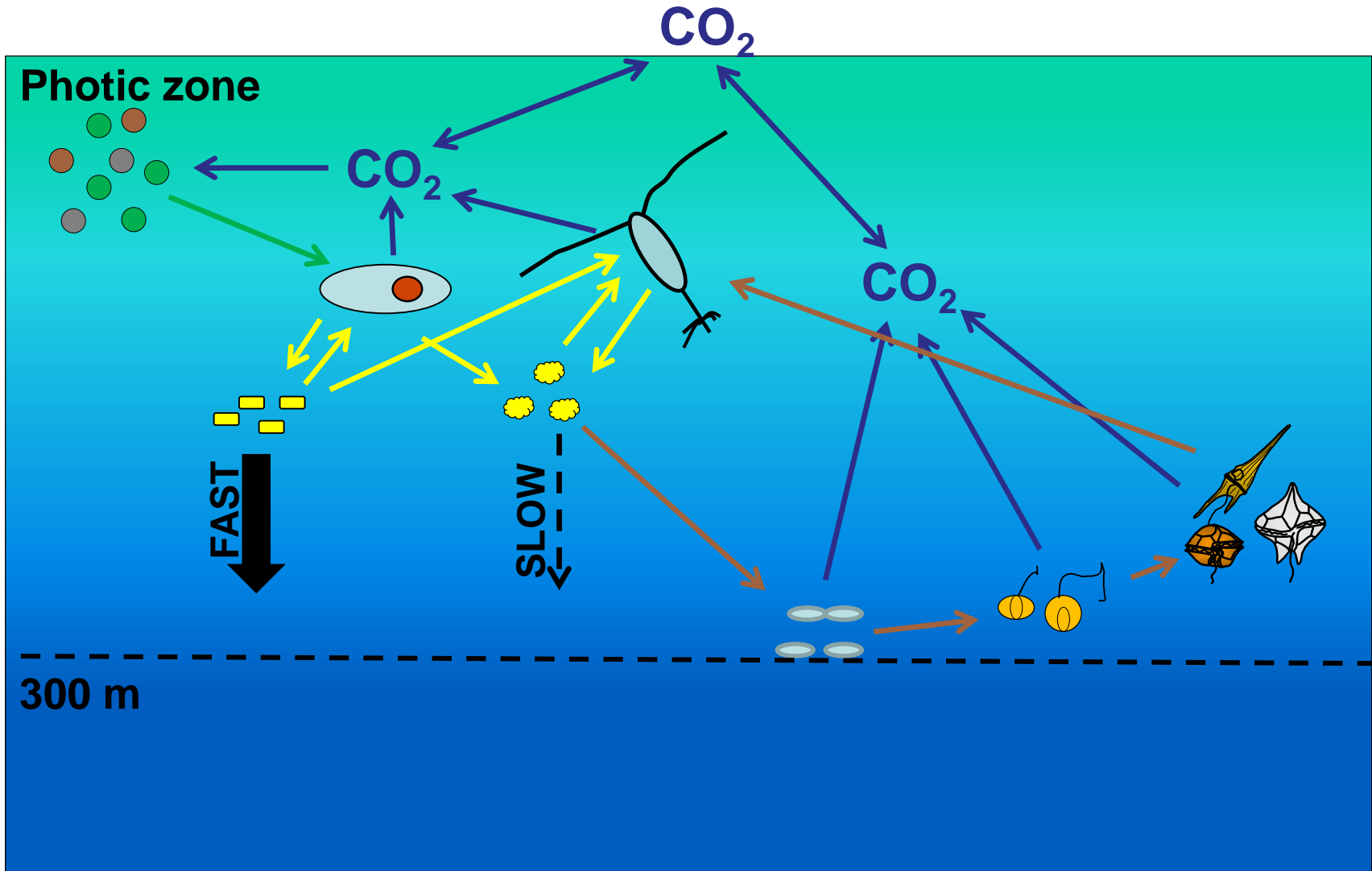
Copepod feeding on particles

Metridaeae feeding on settling particle

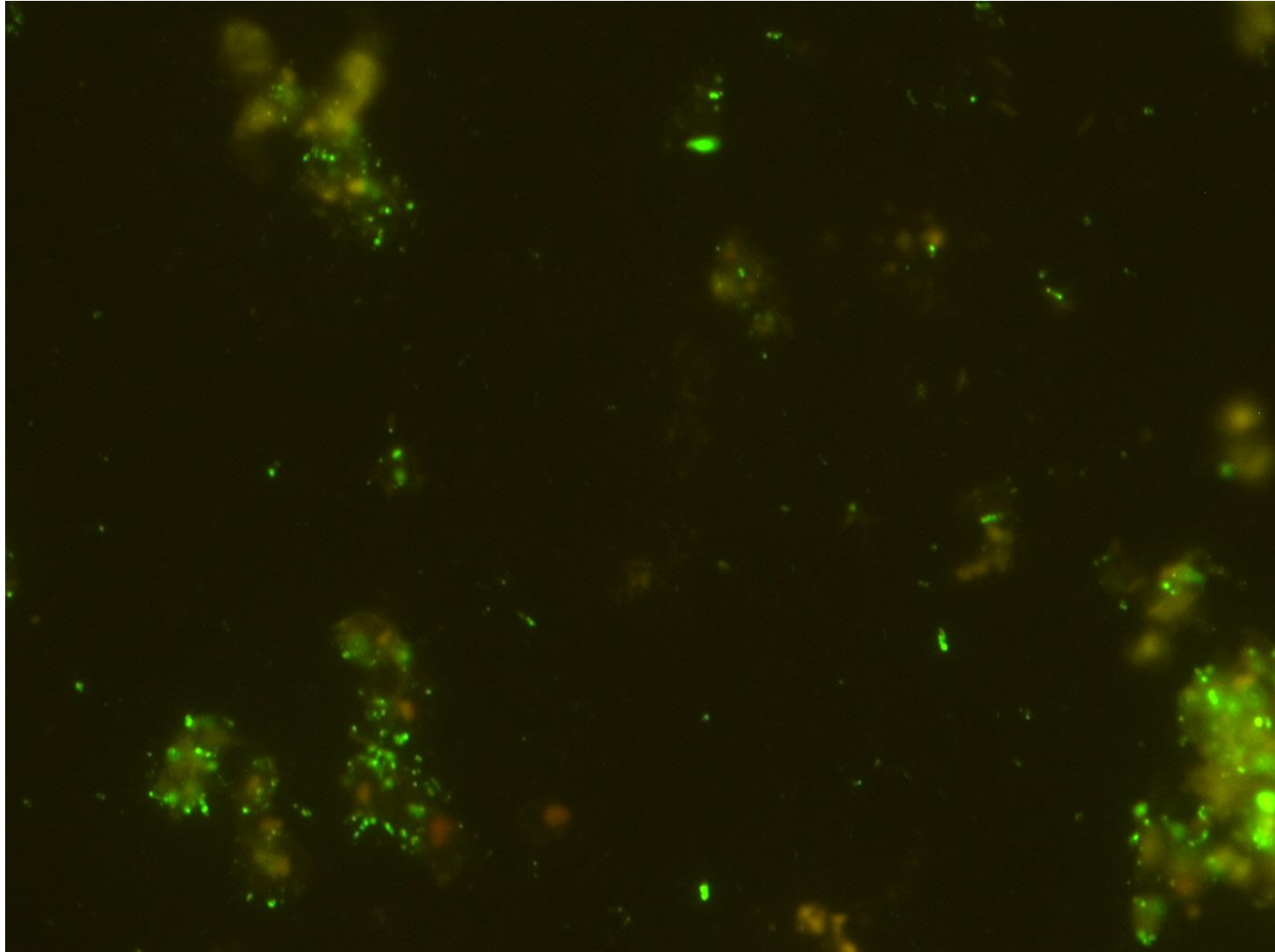
- Removal
- Fragmenting
- Loosening?



Role of salp pellets for export and recycling

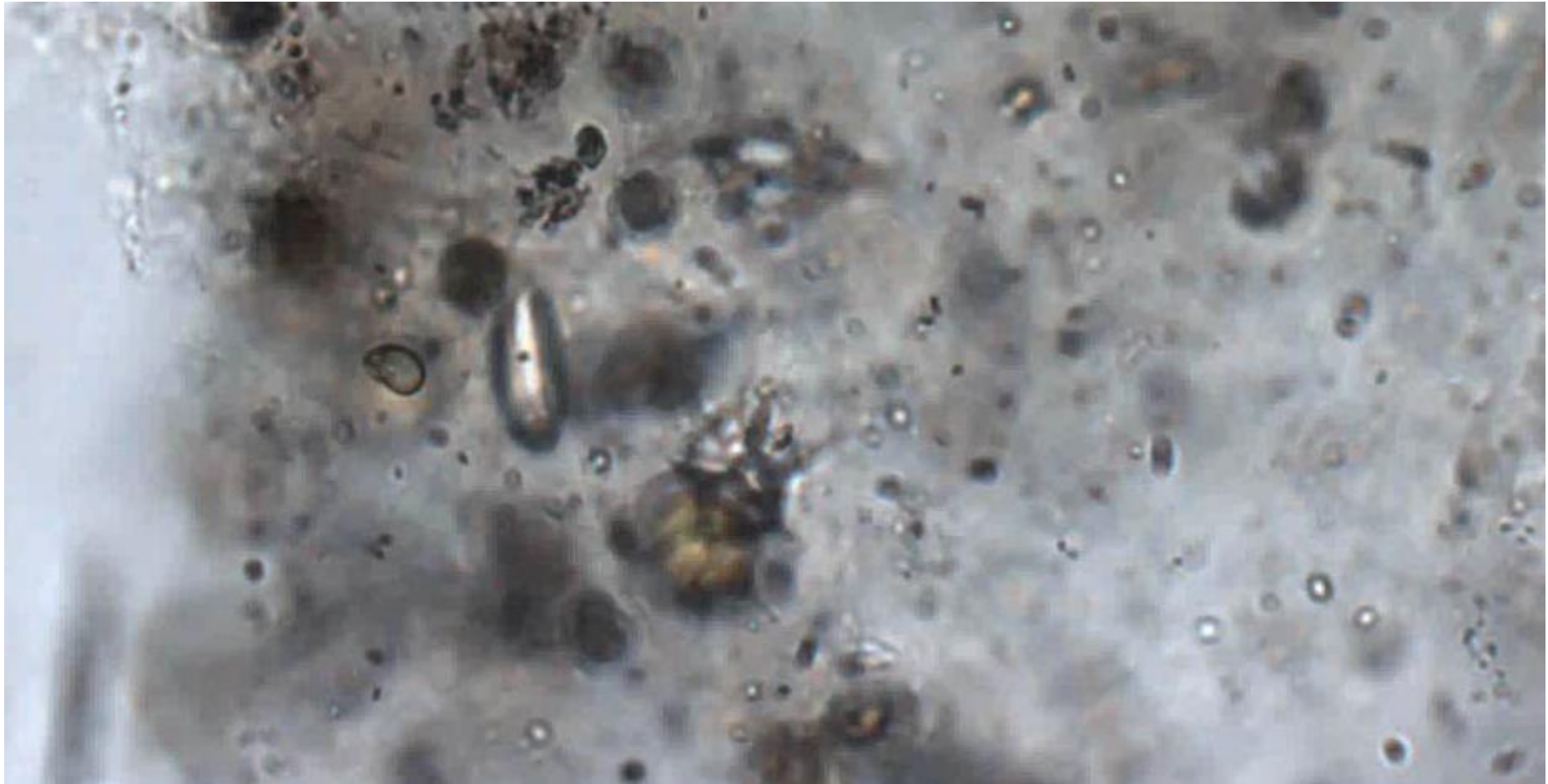


Bacteria attached to particle



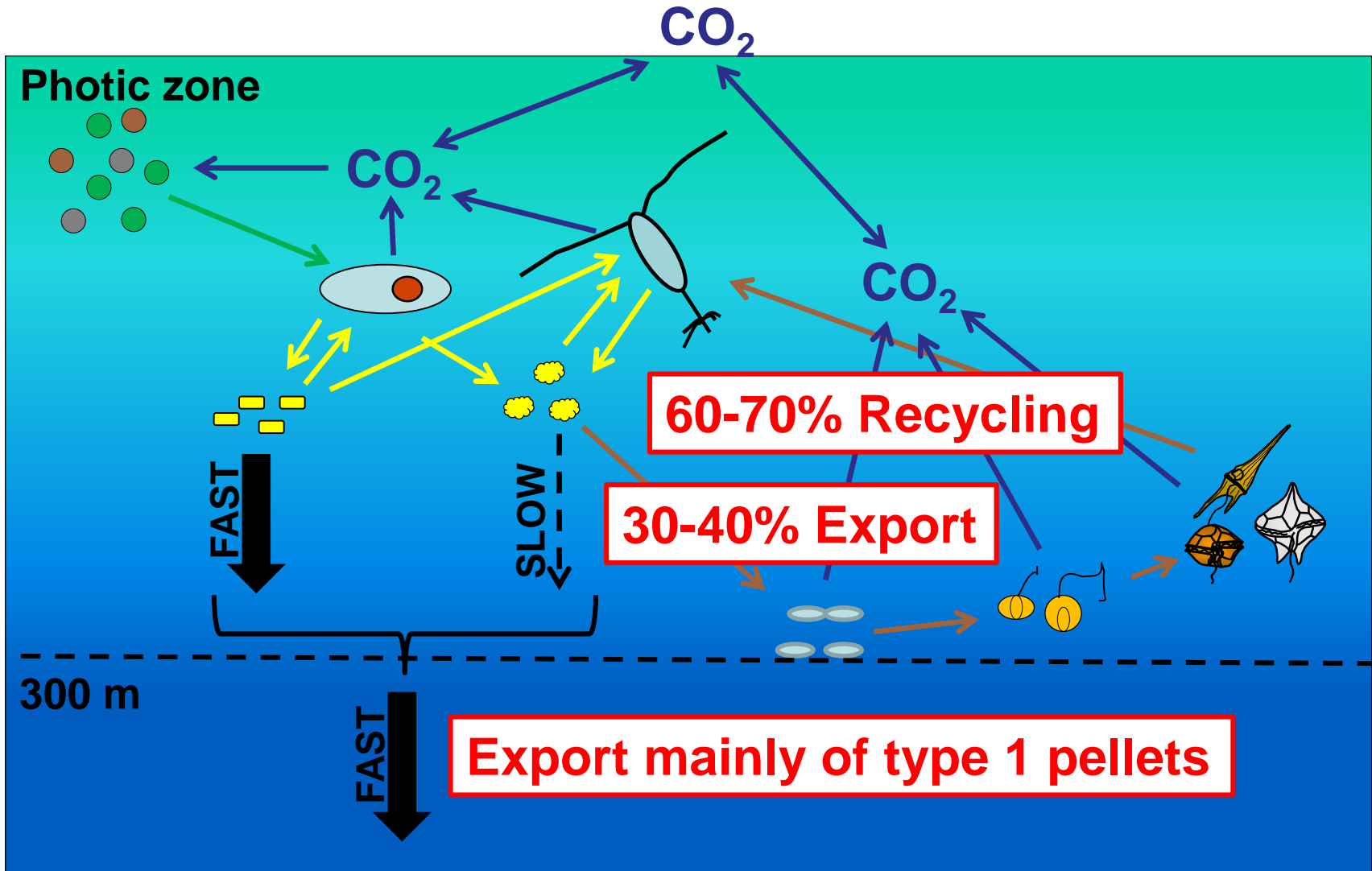
(Clara Flintrop)

Nanoflagellates and ciliates



100 μm

Role of salp pellets for export and recycling



Conclusions/summary

- Indications for high fragmentation and recycling of salp pellets in the upper water column.
- Salp pellets in the Southern Ocean seem to be fragile packages of small particles.
- Salp pellets could make small plankton an accessible food source for zooplankton that could otherwise not feed on the small particle sizes.
- Salp pellets may be important 'floaters' that only account for a modest portion of the carbon flux in the Southern Ocean.
- They often break apart in conventional traps which makes them difficult to quantify
→ gel traps and *in situ* cameras are non-destructive methods to measure the contribution of salp pellets to the total POC flux.

Thank you

