

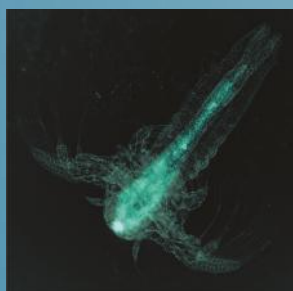
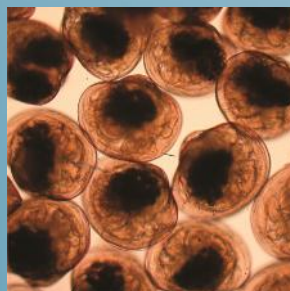
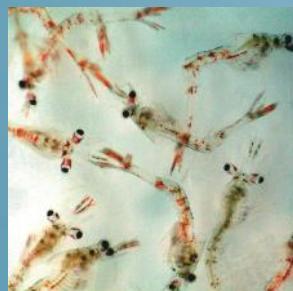
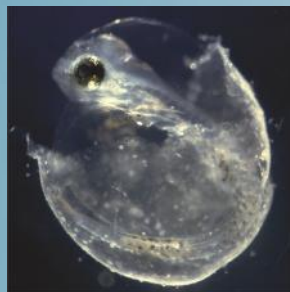
# larvi 2013

6th fish & shellfish larviculture symposium

Microparticulate enrichment of rotifers  
with taurine and other water-soluble  
substances and their subsequent effects  
on *Lepidopsetta polyxystra* larvae

Matt Hawkyard

ghent university, belgium, 2-5 september 2013



# **Microparticulate enrichment of rotifers with water-soluble substances and their subsequent effects on Northern rock sole (*Lepidopsetta polyxystra*) larvae.**

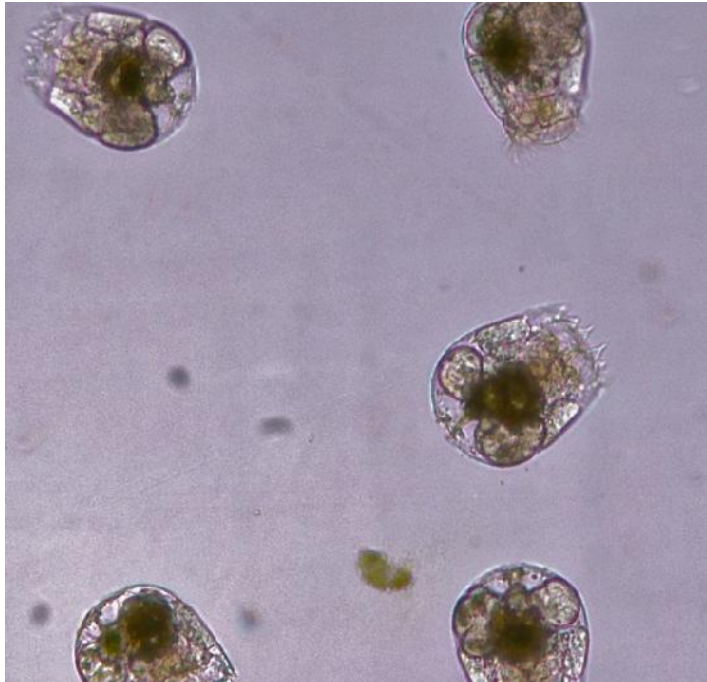
Matt Hawkyard, Ben Laurel,  
Yoav Barr and Chris Langdon



# Live prey enrichment



Rotifers  
(cultured live prey)



≠

Copepods  
(natural prey)



# Water-soluble nutrients in rotifers vs. zooplankton

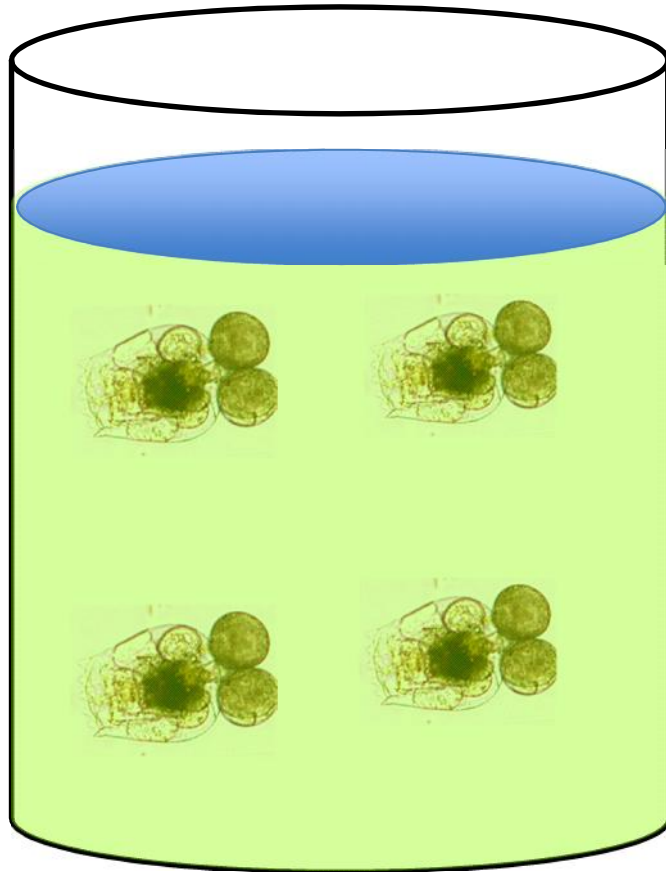
	Rotifers	Wild Zooplankton	NRC
Taurine	0	7.7	-
Selenium	<0.01	1.5	0.25-0.3
Iodine	3-8	50-350	0.6-1.1

Taurine in  $\text{g kg}^{-1}$  DW  
Iodine and selenium in  $\text{mg kg}^{-1}$  DW

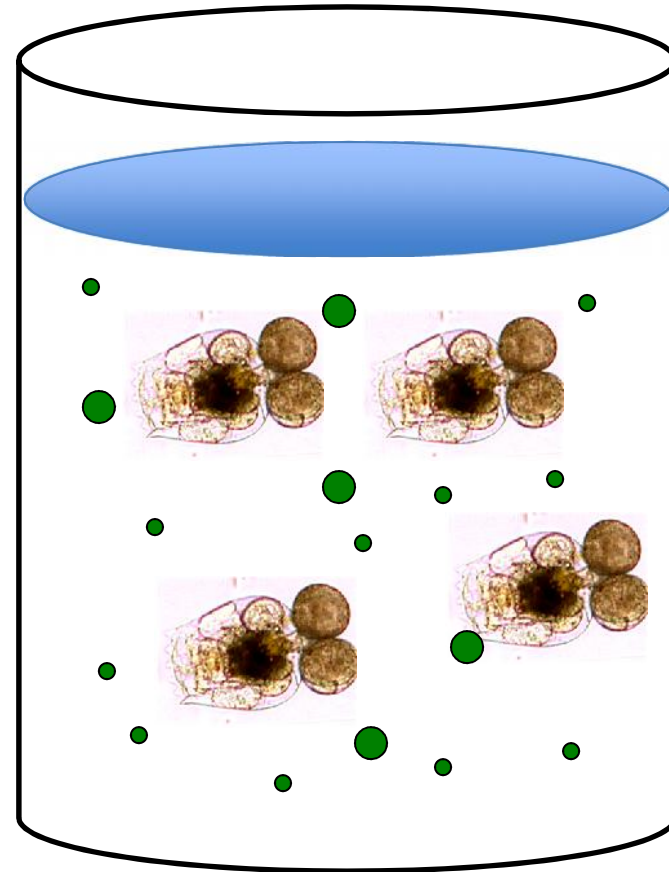
*Problem:* Water-soluble nutrients are difficult to deliver to marine organisms.

# Dissolved (Aqueous) vs. Particulate enrichments

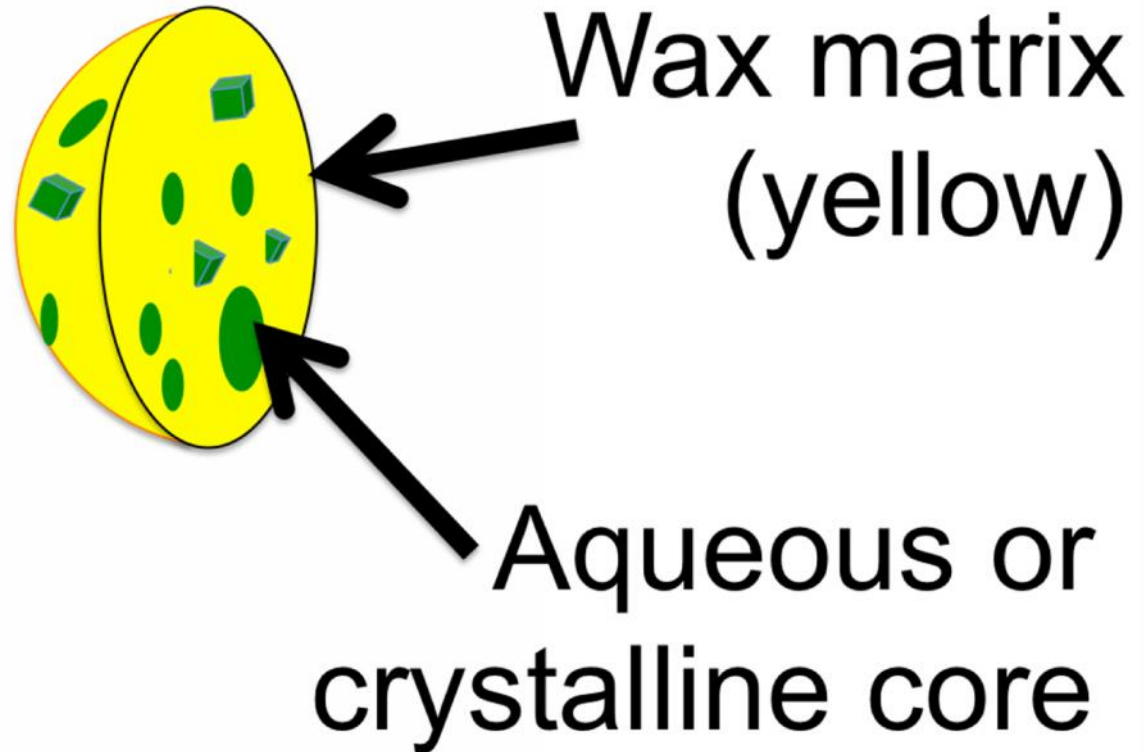
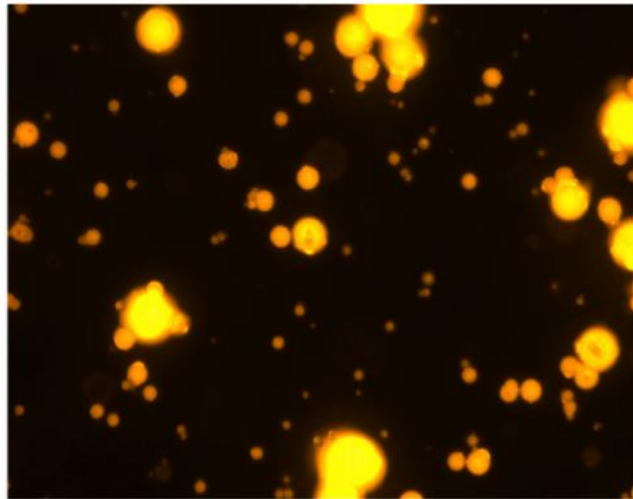
Dissolved  
nutrient(s)



Microparticles or emulsions  
containing nutrient(s)

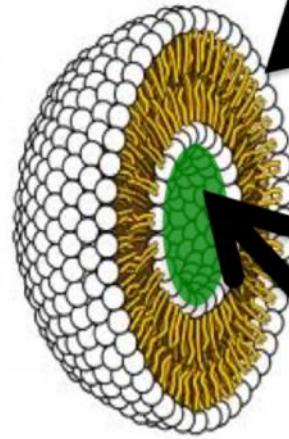
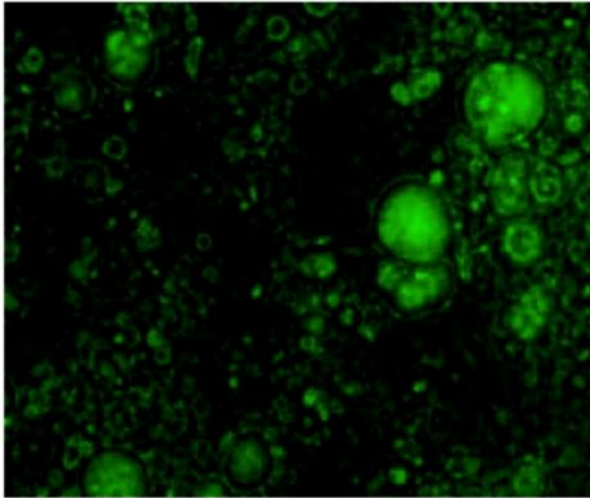


# Wax spray beads





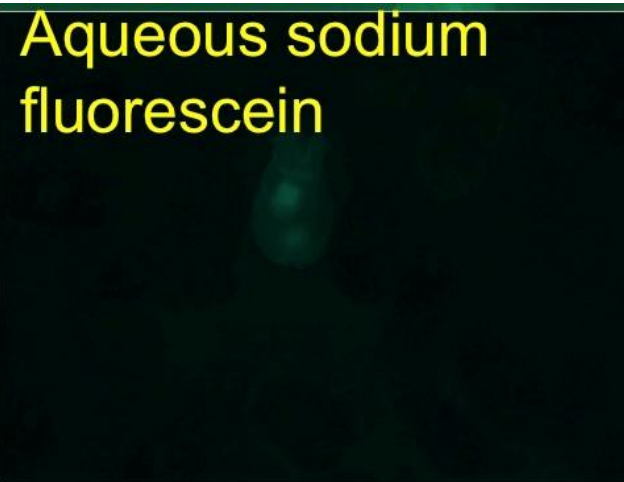
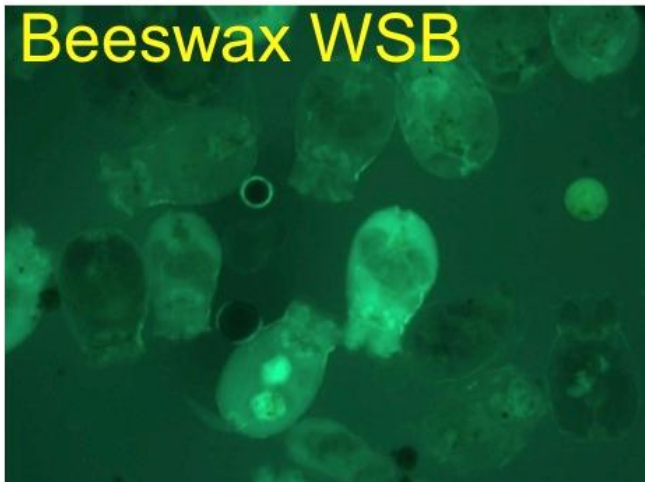
# Liposomes



Phospholipid  
outer-  
membrane


Aqueous core


# Wax Spray Beads (WSB) vs. aqueous methods



# Liposome enrichment



 Water-soluble  
marker in  
aqueous core  
material

 Lipid-soluble  
marker in  
phospholipid  
membrane

# Larval growth trials

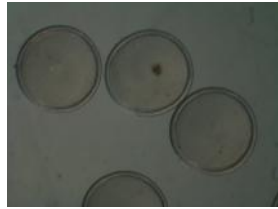
Objective: Evaluate effects of microparticle-WSB enriched rotifers on the growth of Northern rock sole larvae

Trial 1: Taurine-WSB

Trial 2: Taurine-liposome

# Northern rock sole (*Lepidopsetta polyxystra*)

Egg



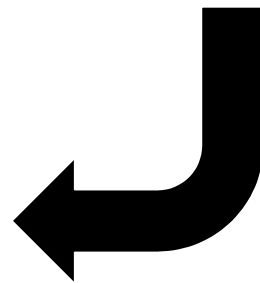
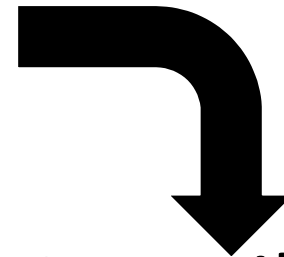
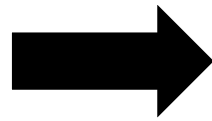
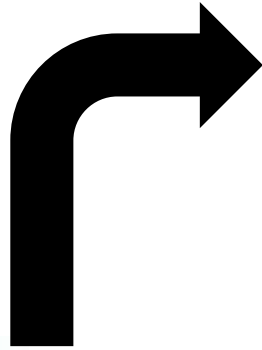
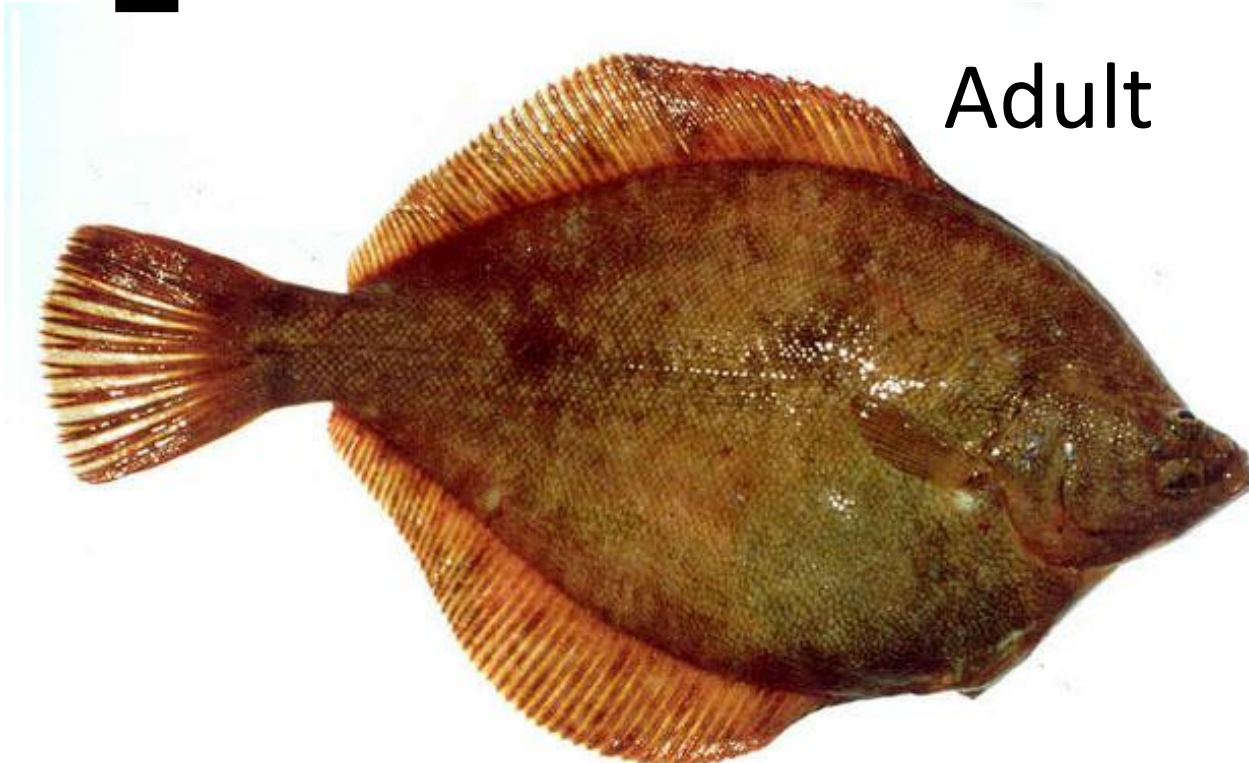
Larva



Juvenile



Adult





# Northern rock sole distribution



Image: Fishbase.org

# Taurine-microparticle feeding trial

**Trials occurred during rotifer phase ( $\approx 6$  weeks)**

**Larvae grown in 100 L tanks**

**Flow through system  $\approx 10^\circ$  C, 35 ppt seawater**

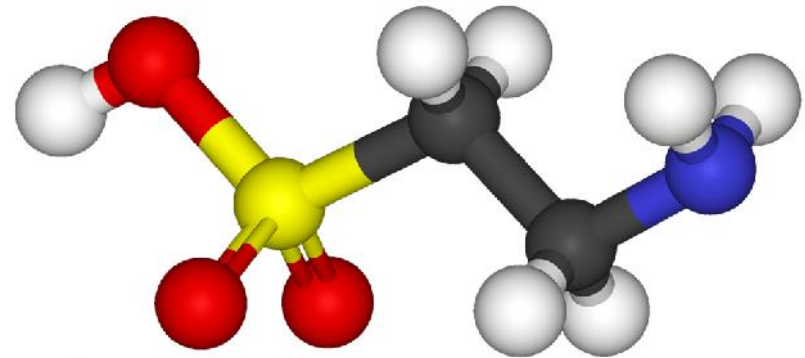


# Taurine

1. Low concentrations in rotifers

2. Sulfur amino acid

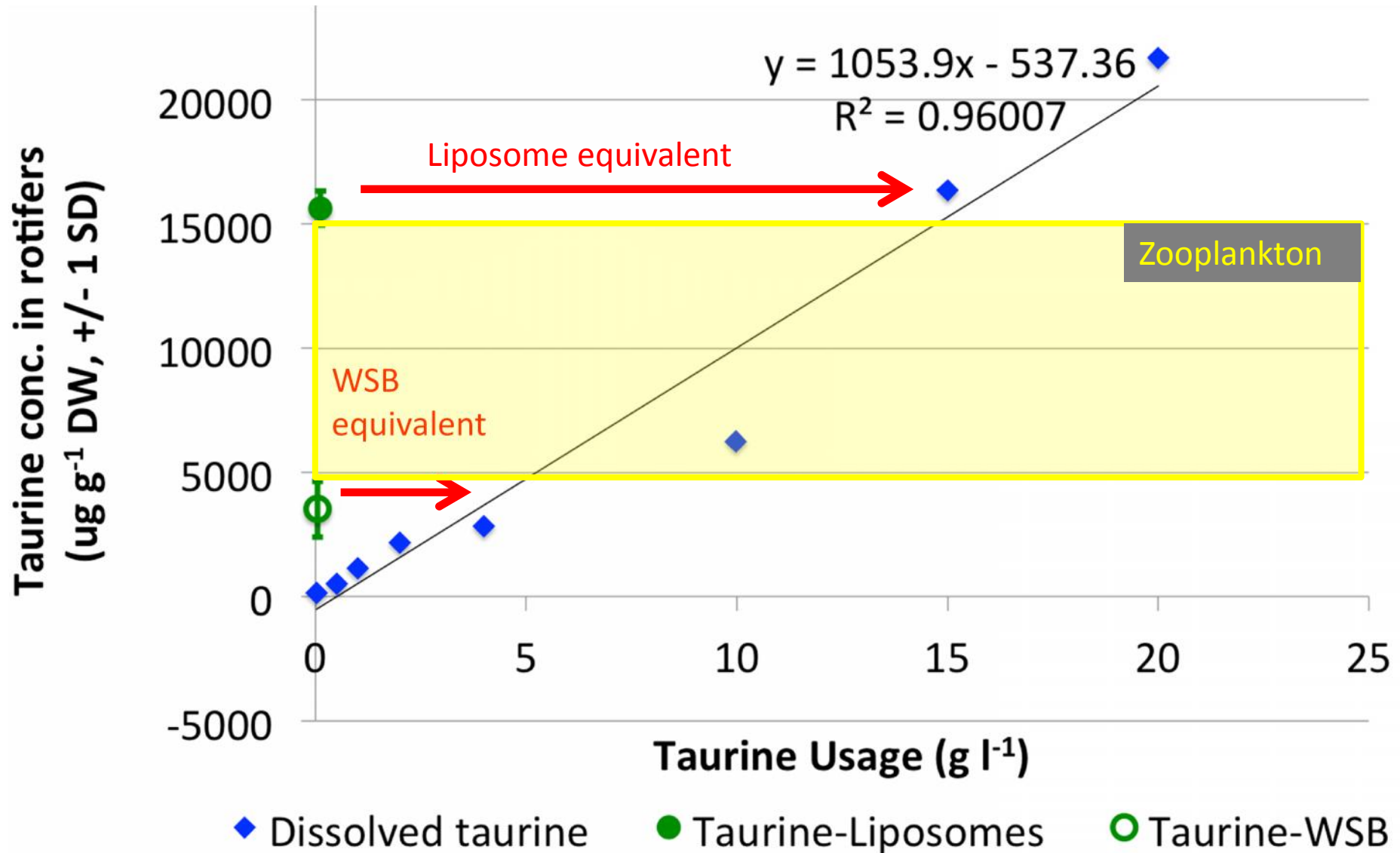
3. Not used in protein synthesis



1. Used for bile salt production,  
osmoregulation and neural  
functions

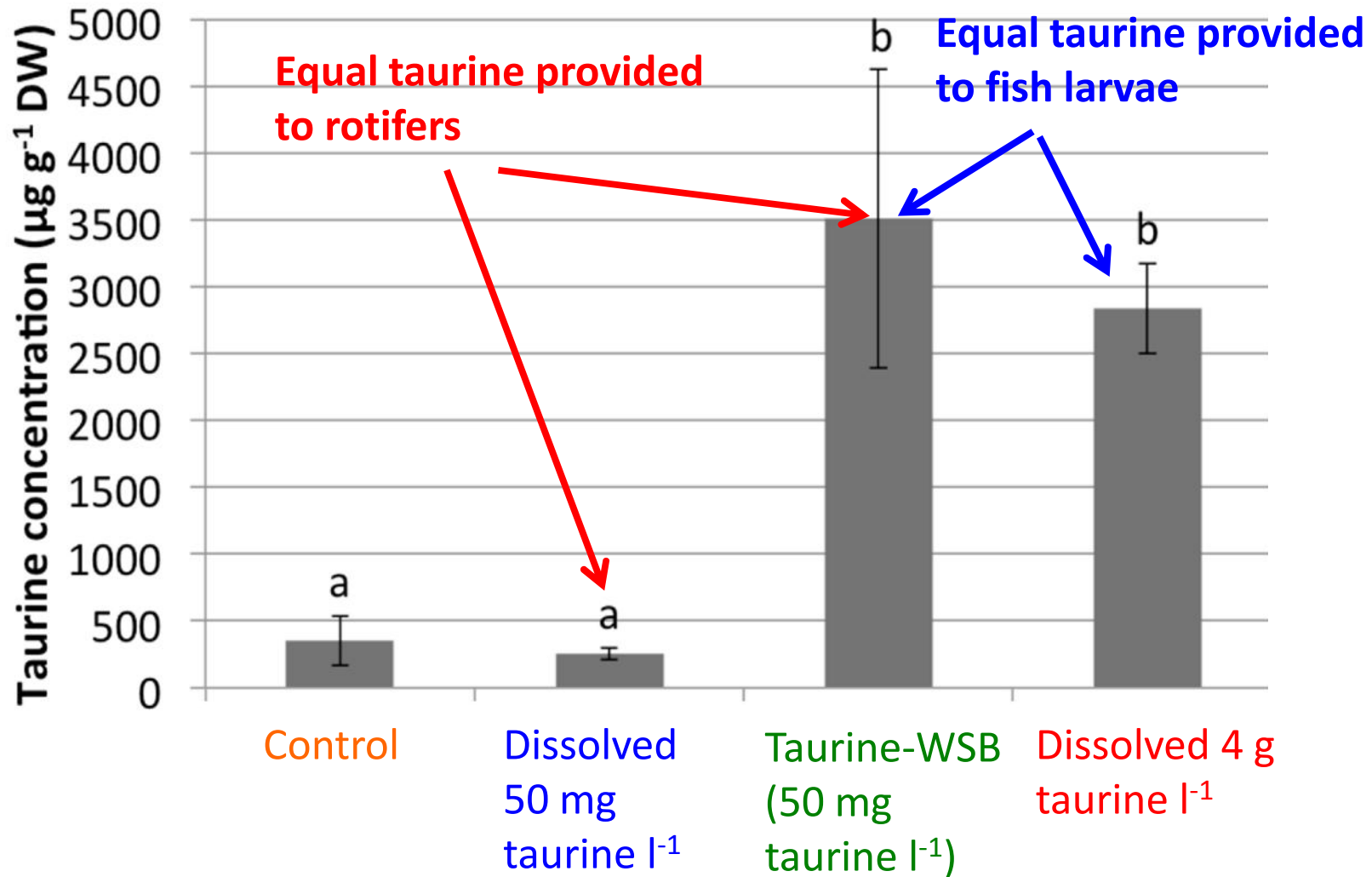


# Taurine enriched rotifers



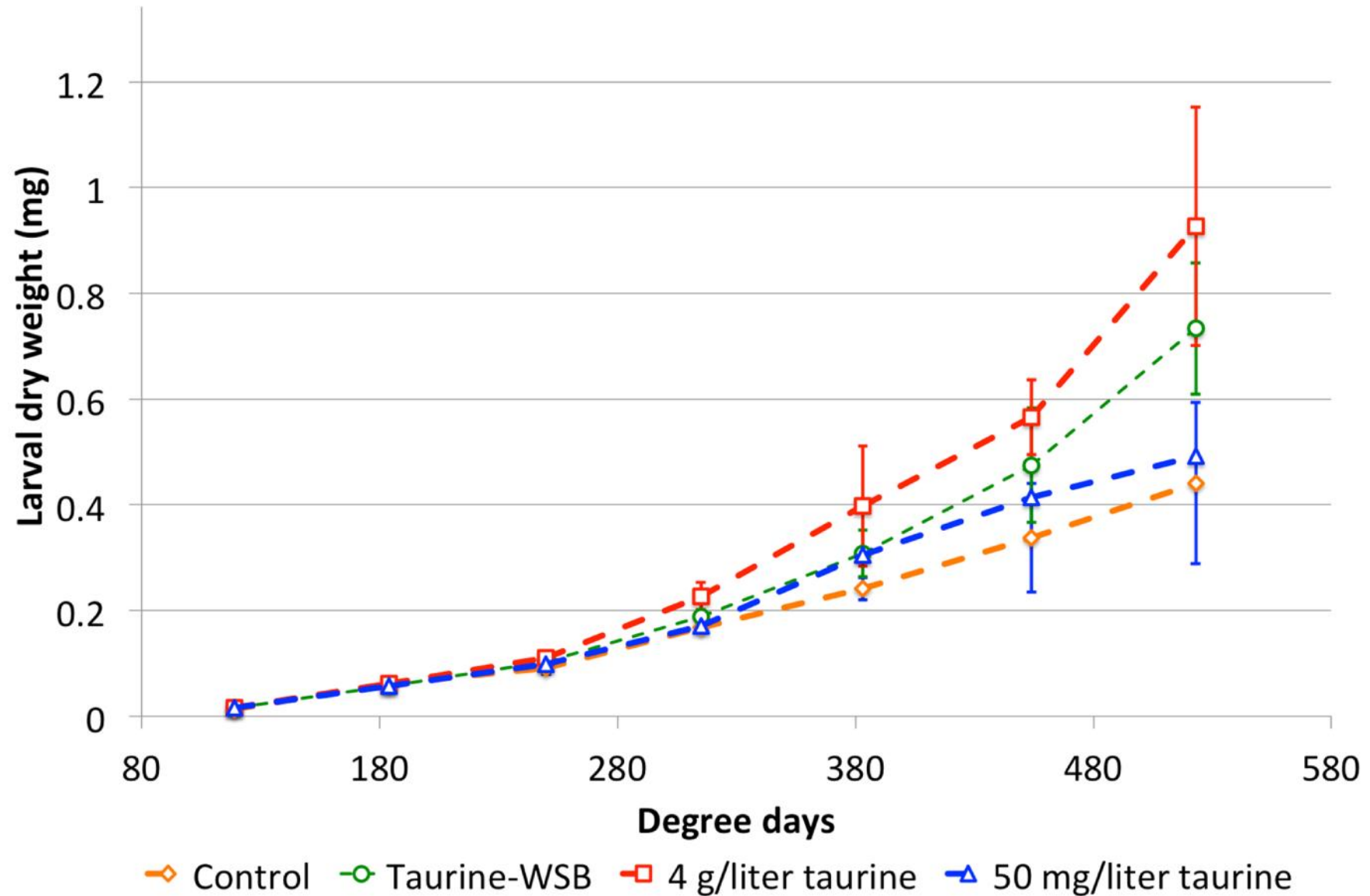
# Taurine-WSB feeding trial

# Taurine concentrations in enriched rotifers



Note: Rotifers in all treatments were enriched with microparticles (empty or taurine filled)

# Larval growth (DW) during WSB trial



Direct 4000 mg l<sup>-1</sup>



Taurine WSB



Direct 50 mg l<sup>-1</sup>



Control (no taurine)

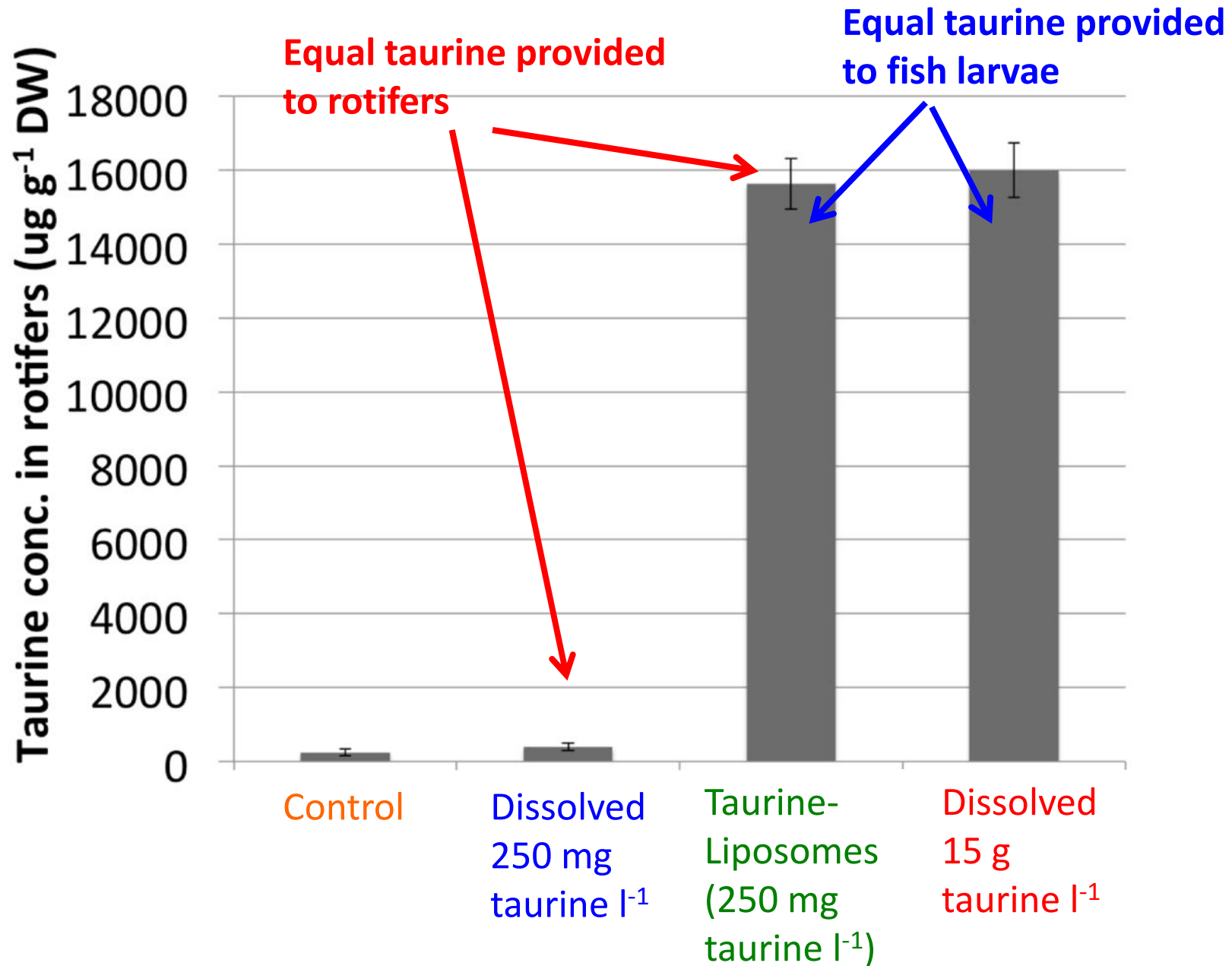


3 mm

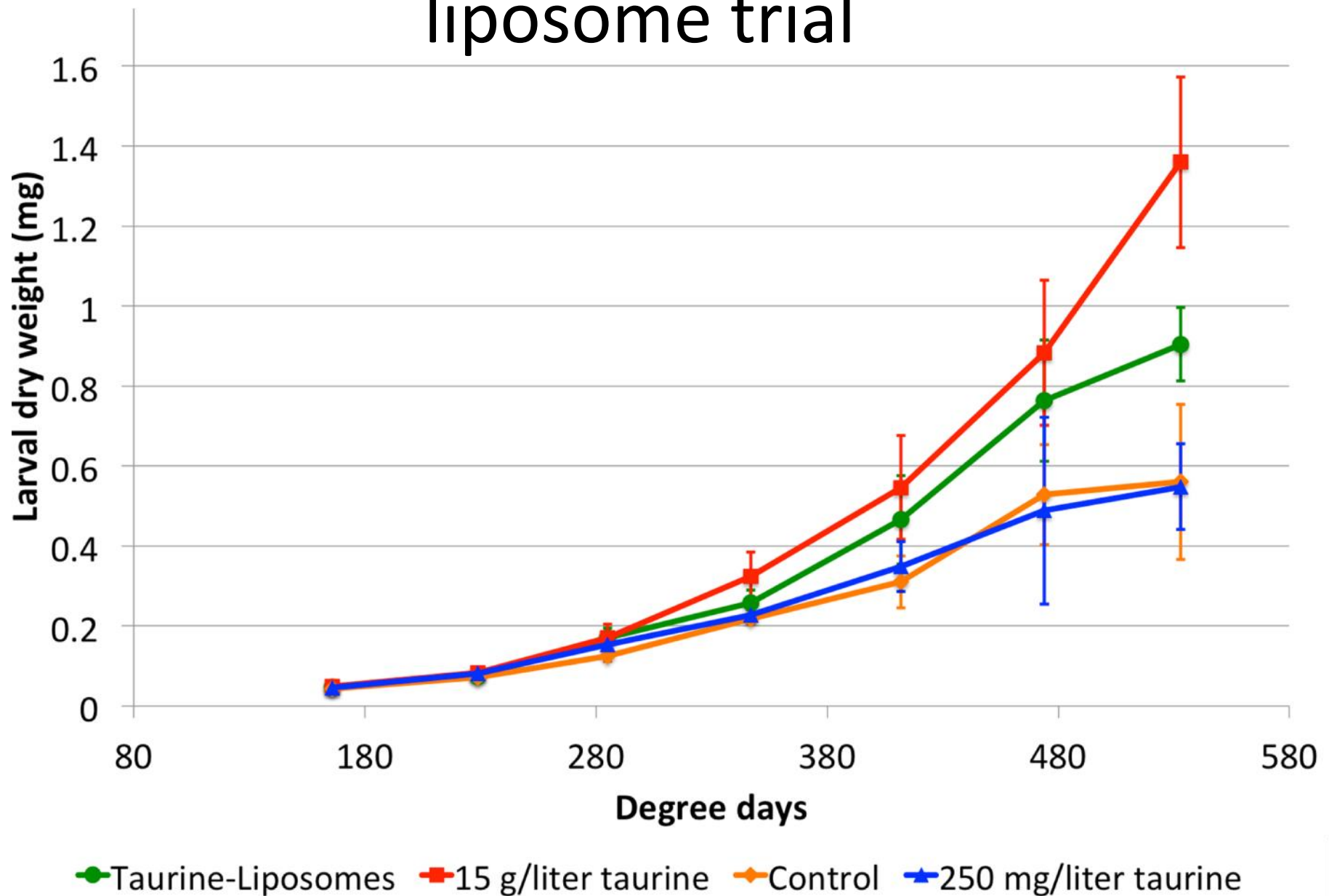


# Taurine-liposome feeding trial

# Taurine concentrations in enriched rotifers



# Larval growth (DW) during taurine-liposome trial





# Summary

- Microparticles were more efficient for enriching rotifers with water soluble substances than immersion techniques
- Larval rock sole grew better when rotifers were enriched with elevated concentrations of taurine
- Rock sole fed microparticle-enriched rotifers showed intermediate growth response when compared to the aqueous-taurine enriched rotifers

# Benefits of microparticles

- Reduced costs:
  - 92% to 95% reduction in materials costs
  - Reduced time to weaning
- Potential benefits:
  - Reduction of bacteria in rotifers
  - Delivery of additional nutrients or antibiotics/vaccines

# Acknowledgements



United States  
Department of  
Agriculture

USDA: Agriculture  
and food research  
initiative (AFRI):  
**Competitive grant**  
**#2012-67015-19454**



NOAA National  
Marine  
Aquaculture  
Initiative



West Coast  
Association of  
Marine Labs:  
*Travel Award*



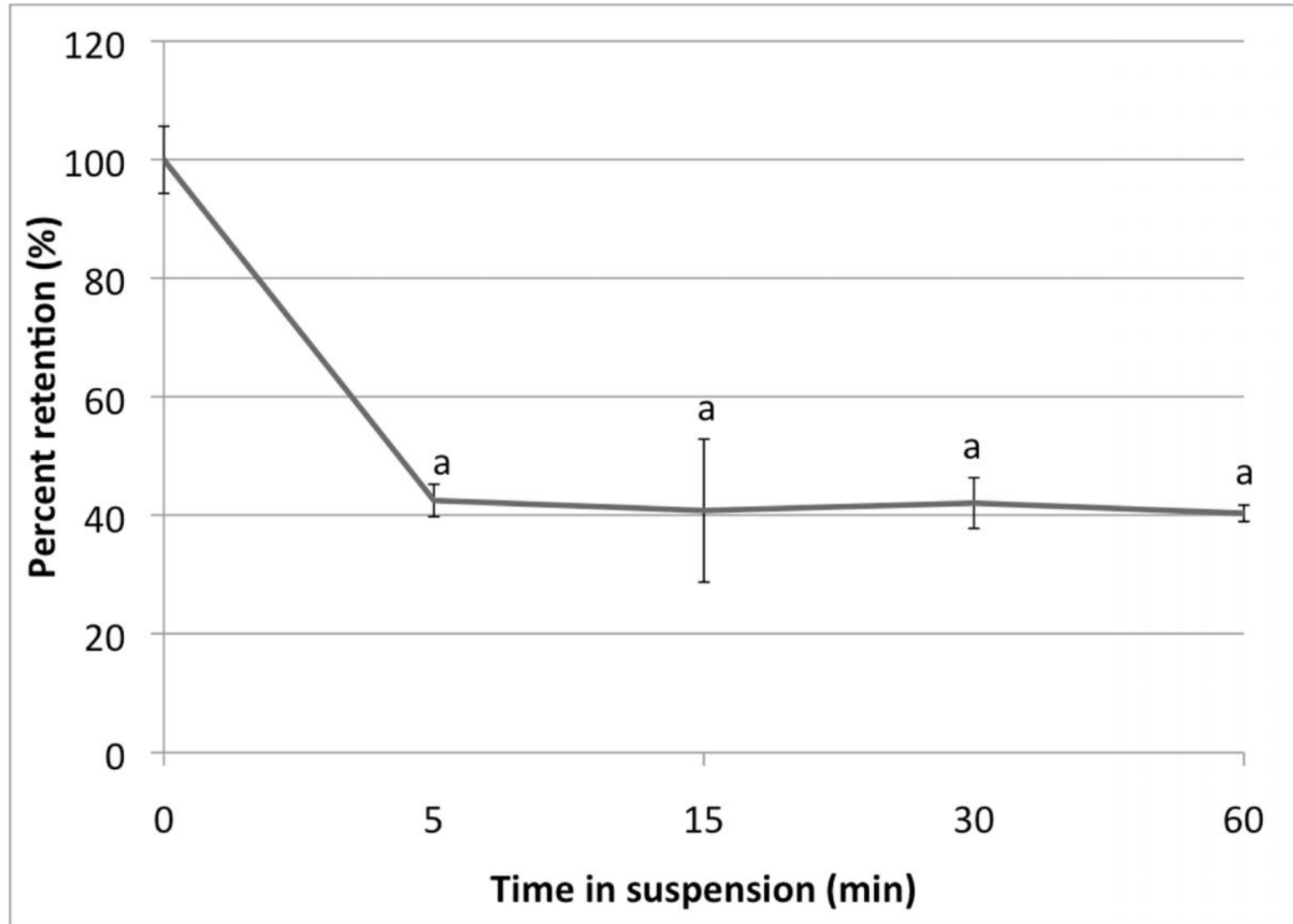
Hatfield Student  
Organization:  
*Travel Award*

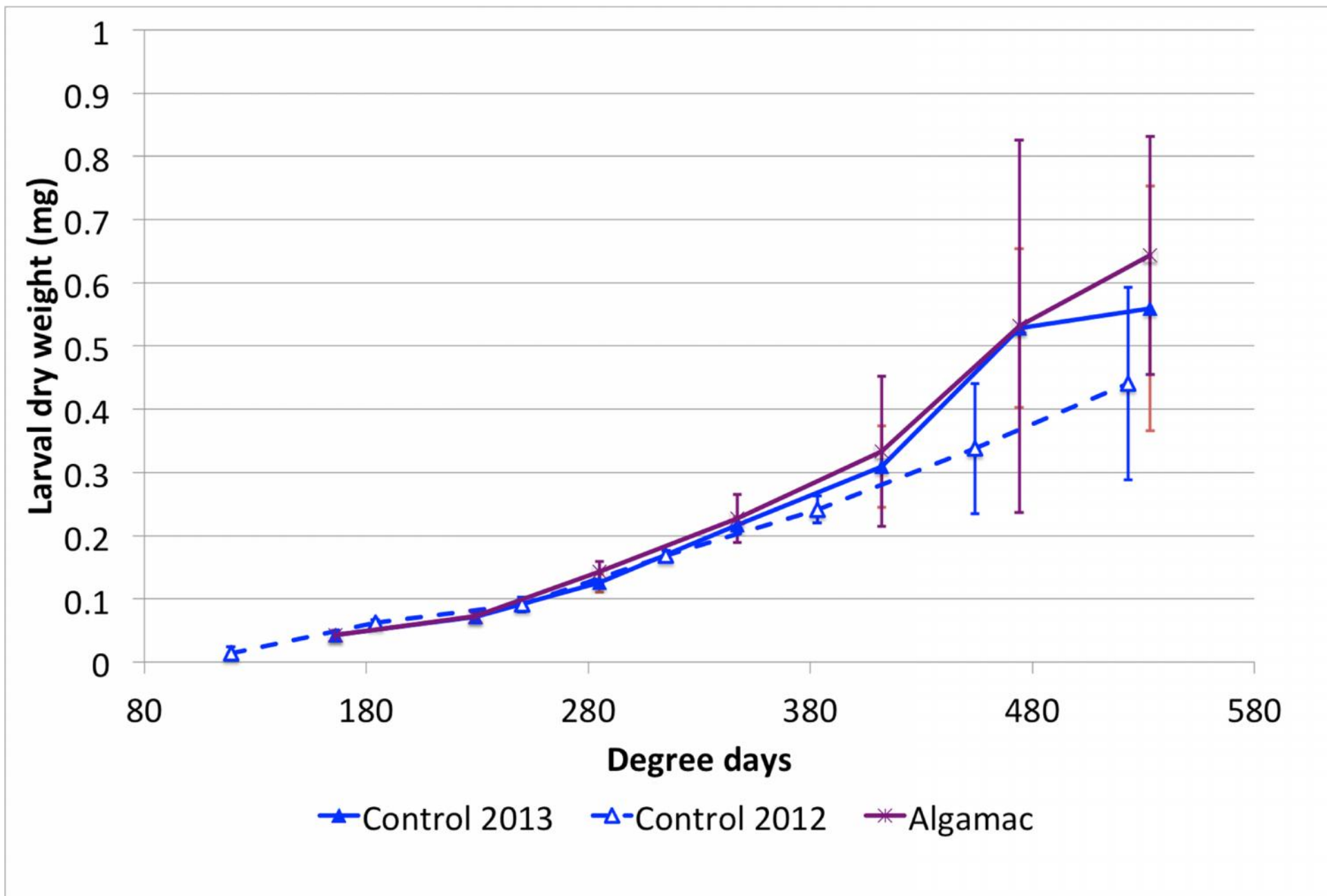
Questions?

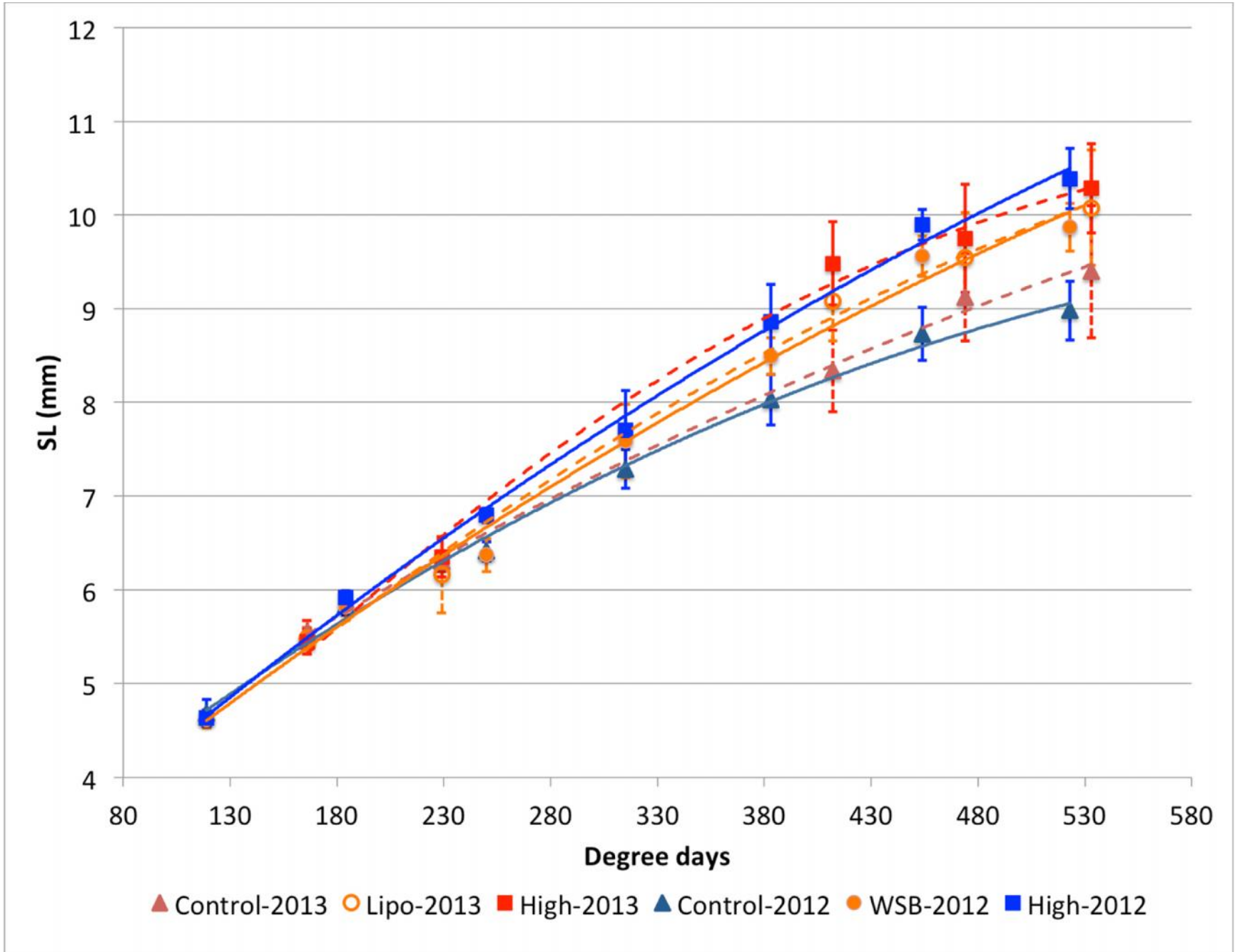
# Lipids

- Rotifers in all treatments were fed microparticles (empty or taurine containing)
- ½ of the rotifers fed to fish were fully enriched with Algamac (taurine concentrations are reported for experimentally enriched rotifers only, i.e. dietary taurine concentrations are ½ of those reported)
- There was no difference in the growth rates in fish fed 50% Algamac/50% microparticle enriched rotifers (Controls) when compared to those fed 100% Algamac

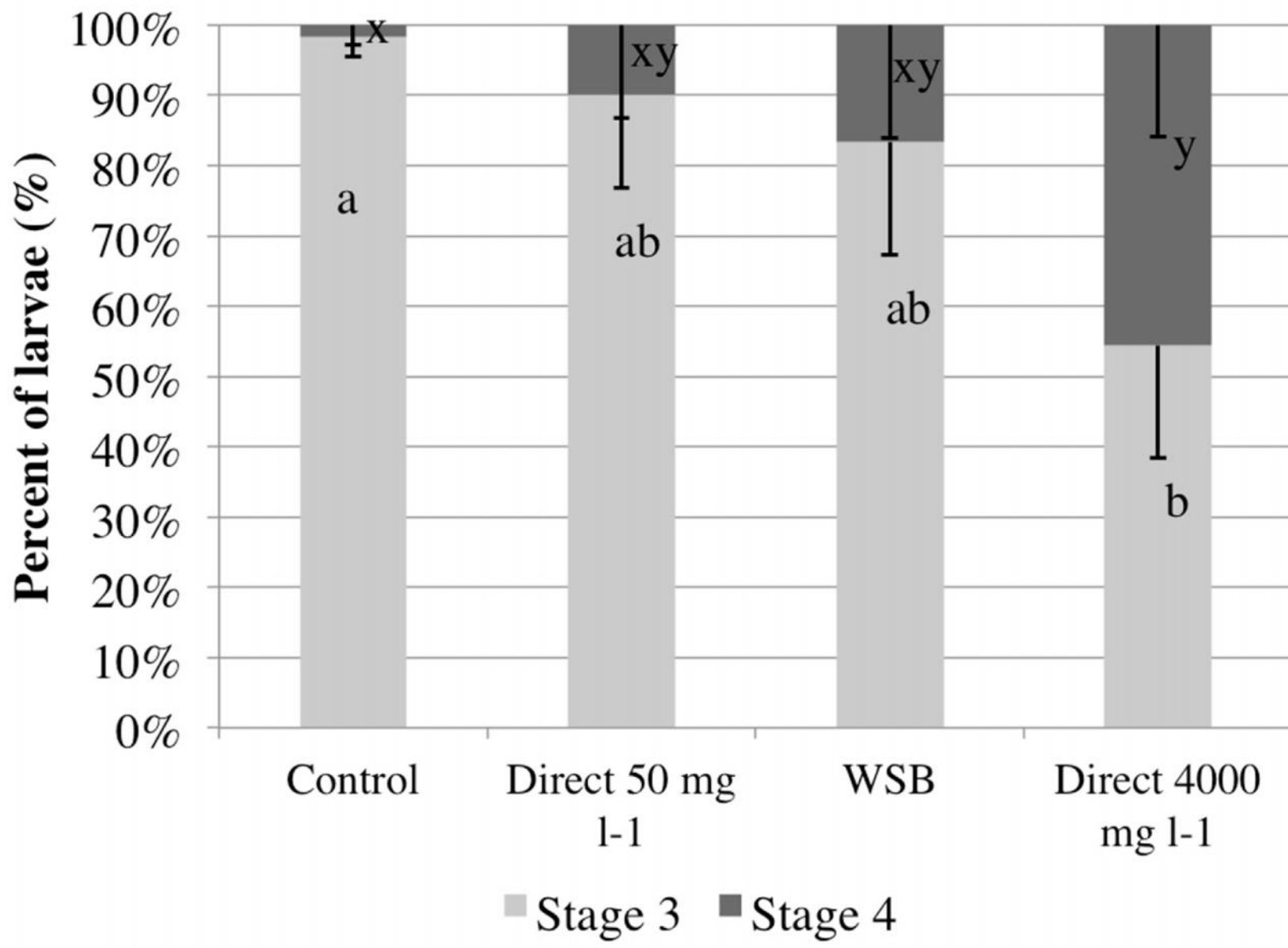
# Taurine leakage from WSB











# Cost (million rotifers<sup>-1</sup>)

	<b>Taurine-WSB</b>	<b>4 g Aqueous Taurine</b>	<b>Taurine-Liposome</b>	<b>15 g Aqueous Taurine</b>
Taurine (329.00 USD KG <sup>-1</sup> )	0.016 USD 0.012 EUR	1.32 USD 0.99 EUR	0.08 USD 0.06 EUR	4.93 USD 3.70 EUR
Phospholipid (650 USD KG <sup>-1</sup> )	-	-	0.16 USD 0.12 EUR	-
Beeswax (150.00 USD KG <sup>-1</sup> )	0.05 USD 0.04 EUR	-	-	-
Solvents (40 USD l <sup>-1</sup> )	-	-	0.20 USD 1.50 EUR	-
<b>TOTAL</b>	<b>0.07 USD 0.05 EUR</b>	<b>1.32 USD 0.99 EUR</b>	<b>0.44 USD 0.33 EUR</b>	<b>4.93 USD 3.70 EUR</b>