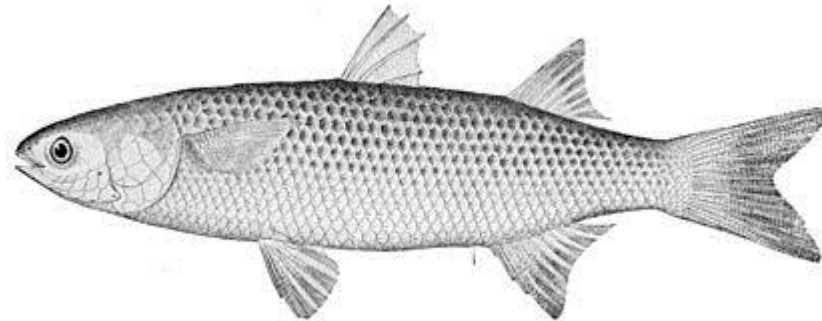


DESIGNING WEANING DIETS BASED ON THE ONTOGENY OF DIGESTIVE TRACT ENZYME ACTIVITY DURING THE CARNIVOROUS-OMNIVOROUS TRANSITION IN GREY MULLET (*MUGIL CEPHALUS*) JUVENILES

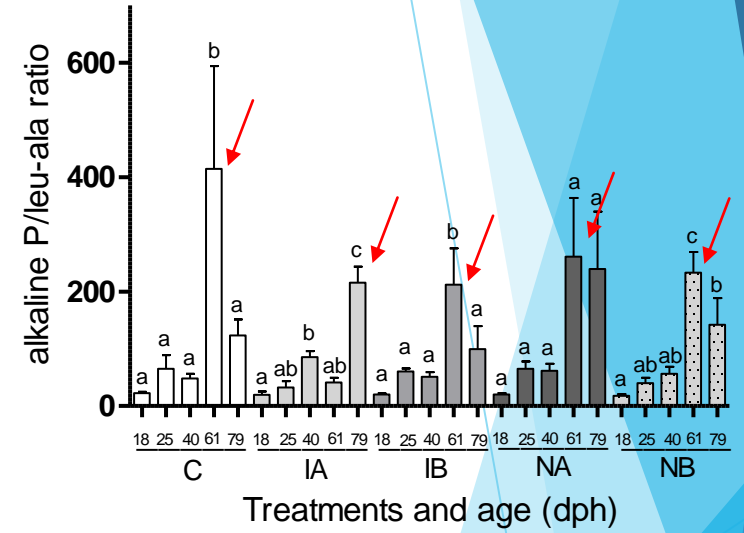
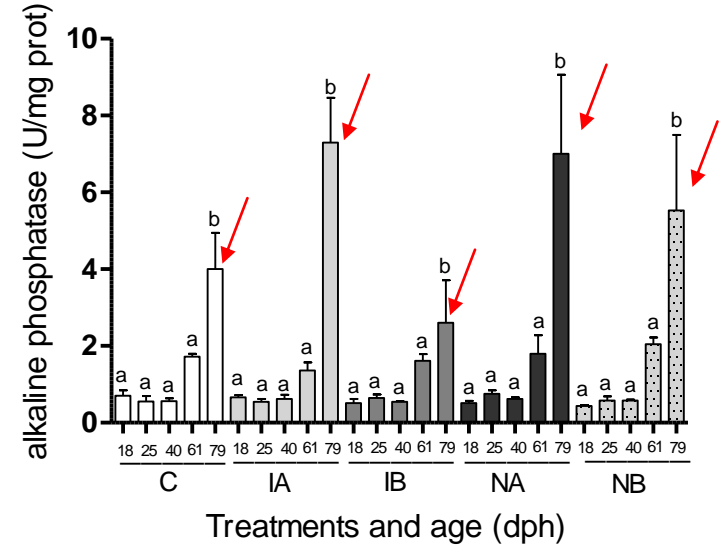
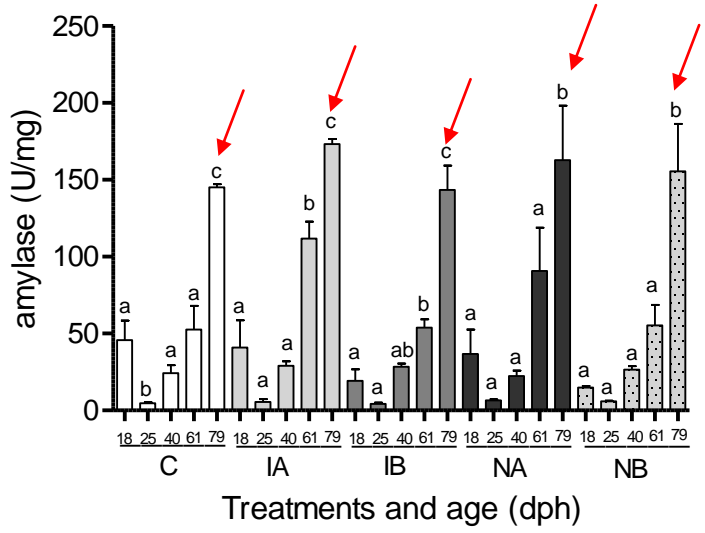
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Background

- Grey mullet larvae strict carnivores feeding on zooplankton.
- After metamorphosis change to herbivorous/omnivorous diet-searching for less saline estuaries with higher primary productivity of micro and macroalgae.
- Earlier study investigated the effect of greening tanks with different concentrations of Isochrysis and Nannochloropsis during larval rearing on DT enzyme ontogeny in 25, 40, 61 and 79 dph juveniles.
- No clear effect of algae addition was observed on enzyme ontogeny but the DT enzyme ontogeny with age was revealed.

Earlier study



- Amylase activity steadily increased to peak at 79 dph. signaling herbivorous/detritivorous feeding,
- alkaline phosphatase (marker for BBM development) peaked from 61 to 79 dph.
- the AP/leu-ala ratio (indicator of gut maturation) peaked at 61 dph but then declined in 79 dph.

Background

- IOLR weaning protocol- mullet juveniles can be weaned off live *Artemia* to a dry, prepared diet from 24-37 dph.
- Results from the earlier study indicated this weaning period overlaps trophic shift from carnivory to a more carbohydrate rich diet.
- **Question:** Should the weaning diet satisfy a carnivorous, omnivorous or herbivorous mode of feeding?

Aim

Evaluate the effect of feeding a carnivorous, herbivorous or omnivorous weaning diet to juvenile mullet on;

- (a) growth, survival and population weight distribution
- (b) the ontogeny of pancreatic, brush border and cytosolic enzyme activity.

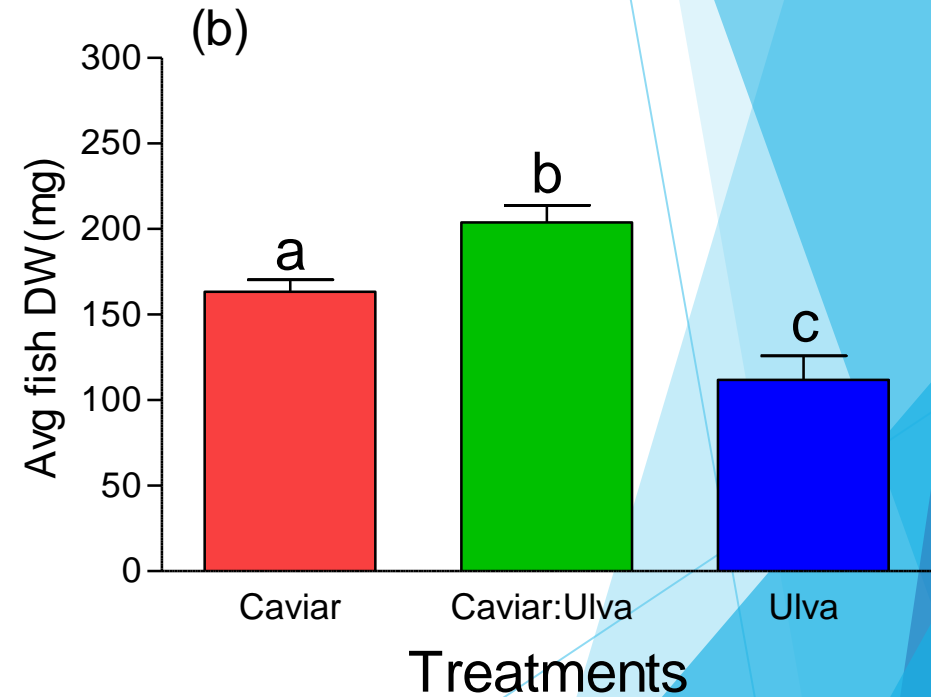
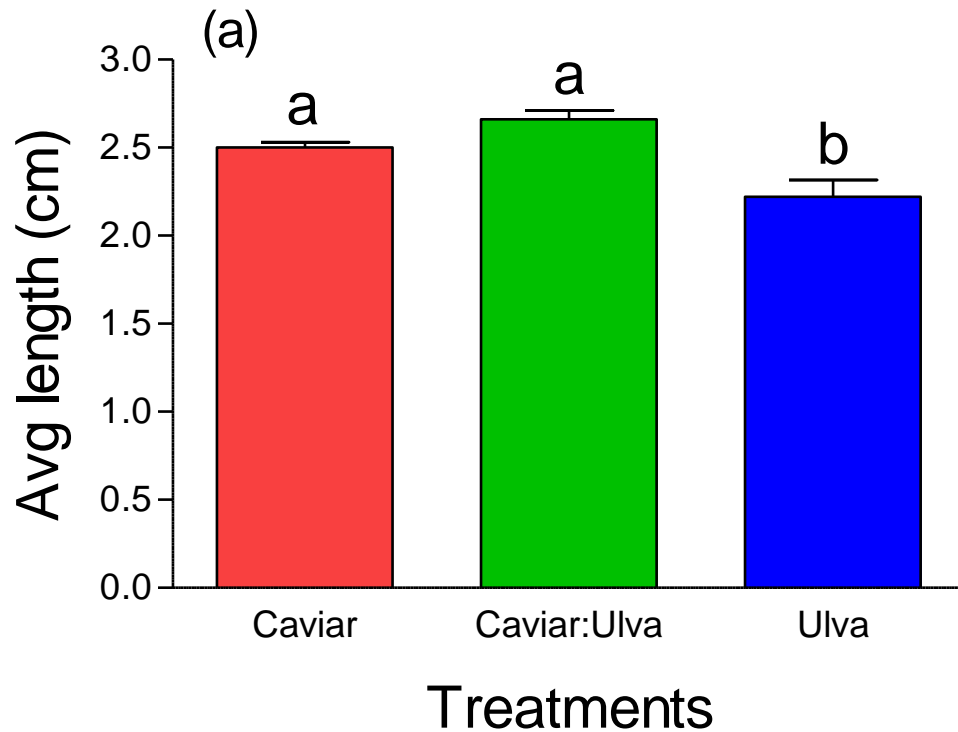
Experimental design

- Fifteen 17 l aquaria in a flow through system with 40 ‰, UV treated temperature (24.5 ° C) controlled seawater were stocked with eighty-five 23 dph larvae aquarium⁻¹.
- Tested three weaning dietary treatments, differing in their protein and carbohydrate content, in replicates of 5 aquaria treatment⁻¹.
- Diet 1 dried *Ulva lactuca* (35% plant protein, 56% carbohydrate),
- Diet 2 commercial starter diet “caviar” (Bernaqua, Belgium; 55% animal protein, 8% carbohydrate)
- Diet 3 1:1 w/w mixture of diets 1 and 2.

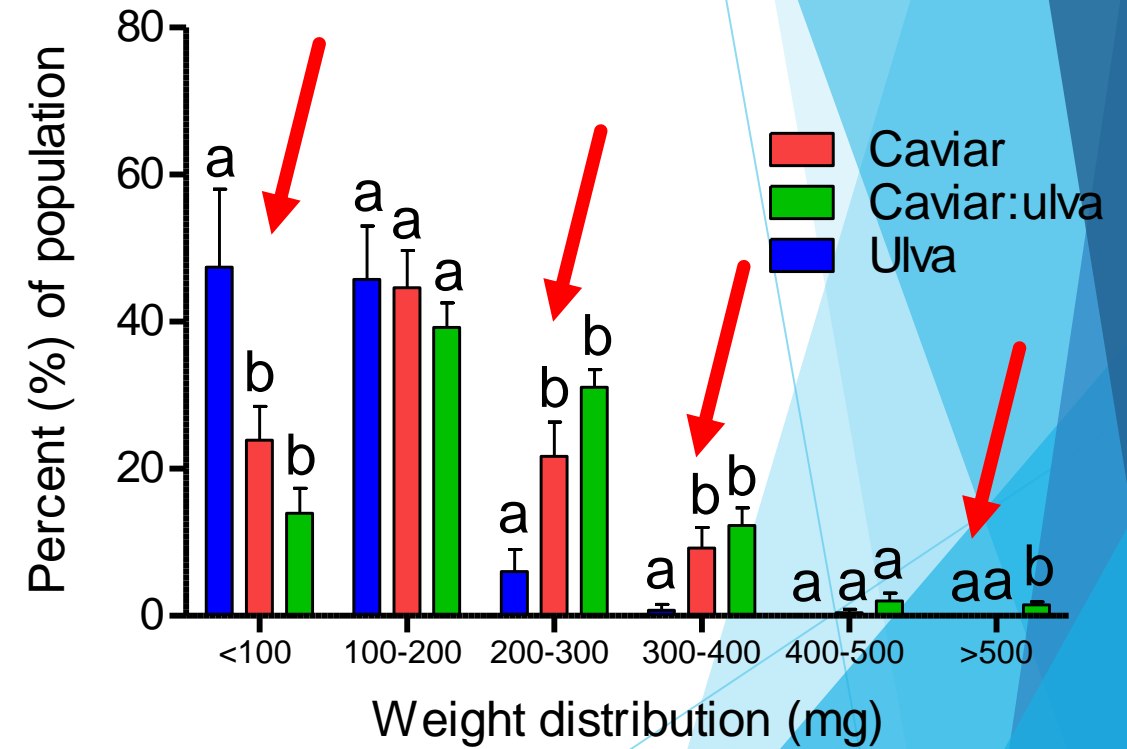
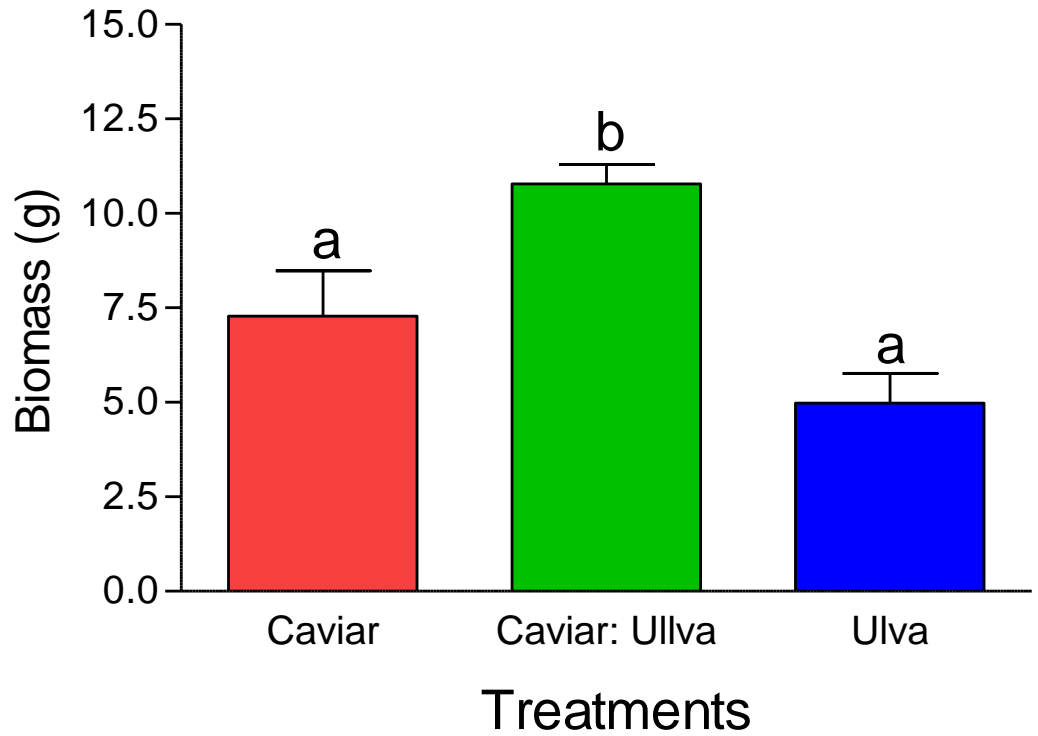
Dph	Rotifers	Artemia	Dietary treatments	Size (µm)	Nannochloropsis oculata
23	x2 day	x2 day	0	-	4x10 ⁶ cells\ml
24-25	x2 day	x2 day	X1	50-100	4x10 ⁶ cells\ml
26-33	0	x2 day	x2 day	100-200	4x10 ⁶ cells\ml
34-37	0	x2 day	x3 day	200-300	0
38-53	0	0	x5 day	200-500	0



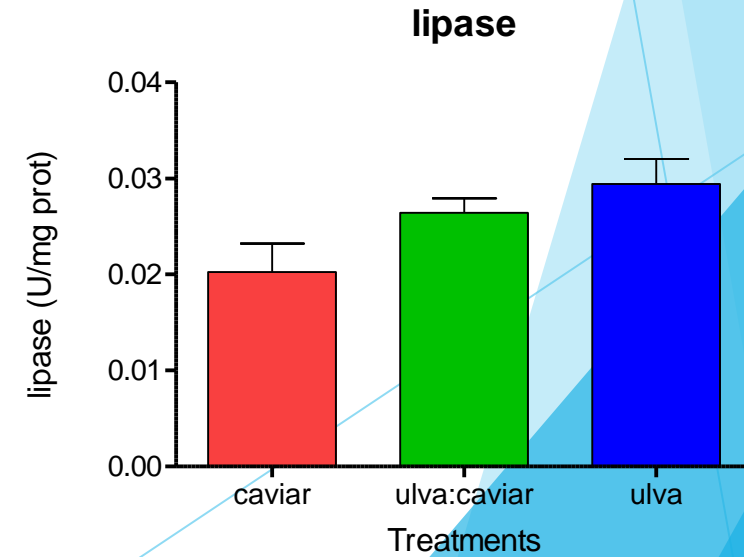
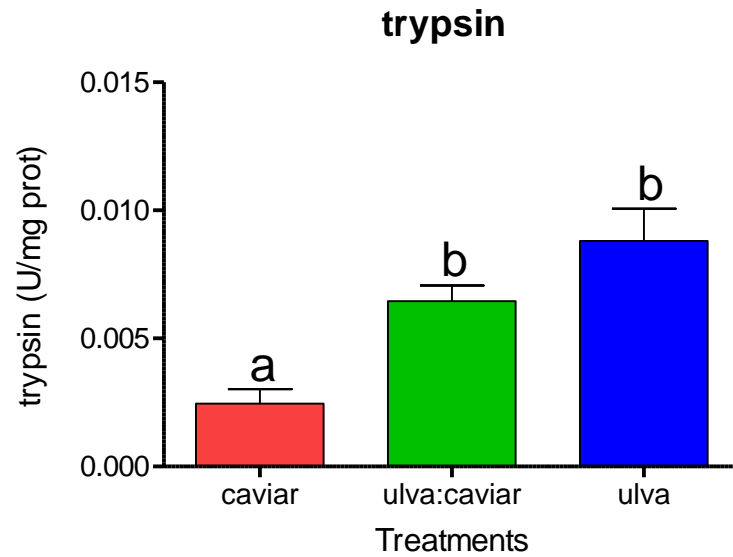
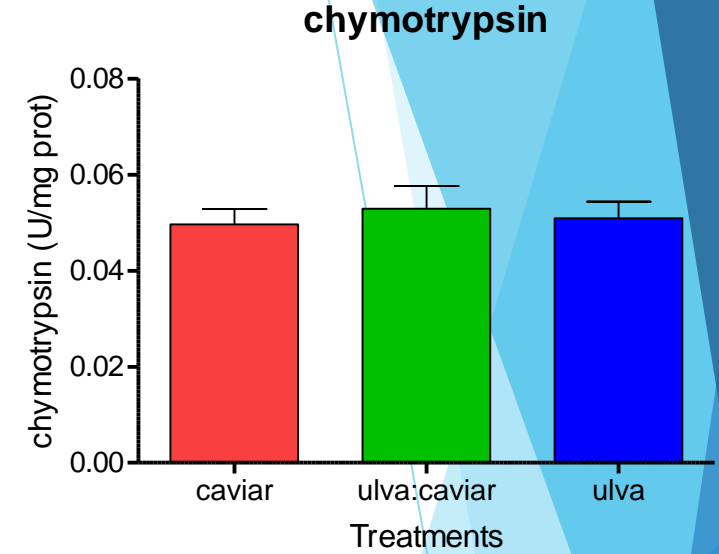
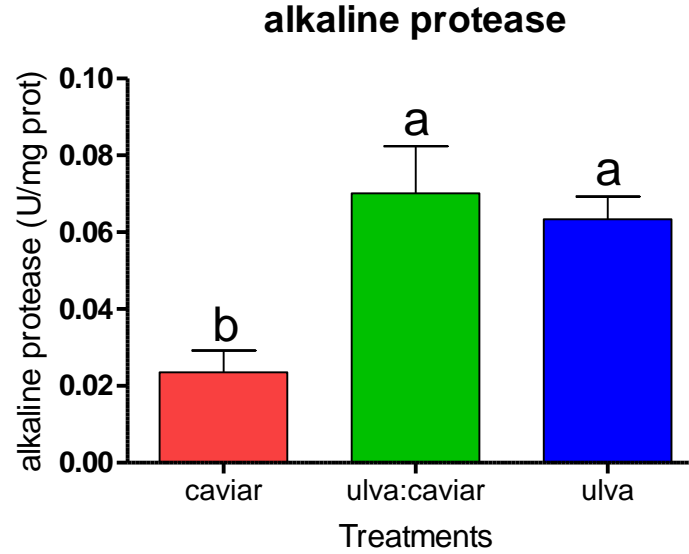
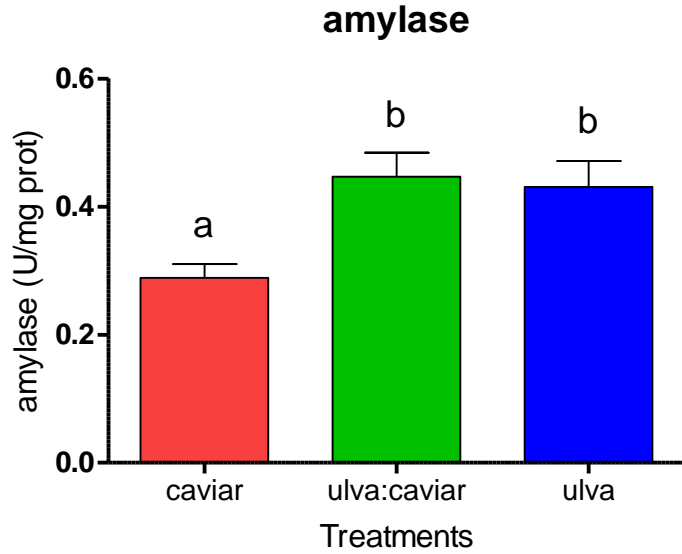
Effect of the Caviar, Ulva and Caviar: Ulva on (a) 53 dph fish length and (b) dry weight (DW) at the end of the experiment.



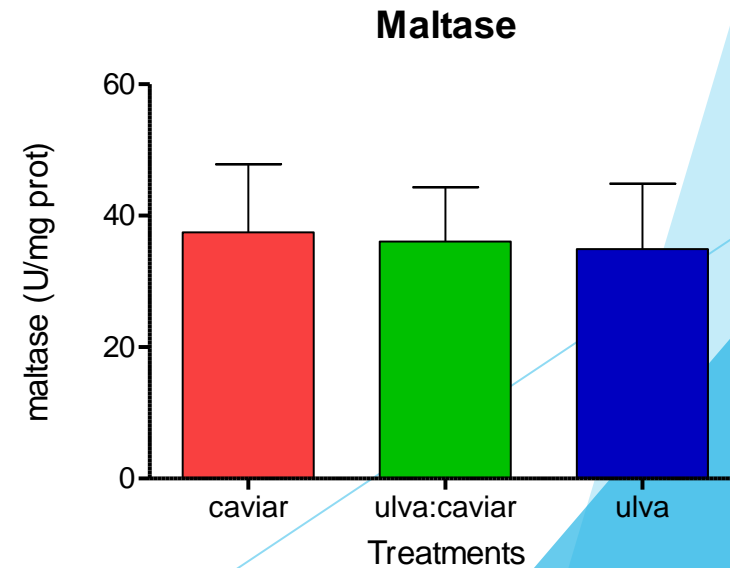
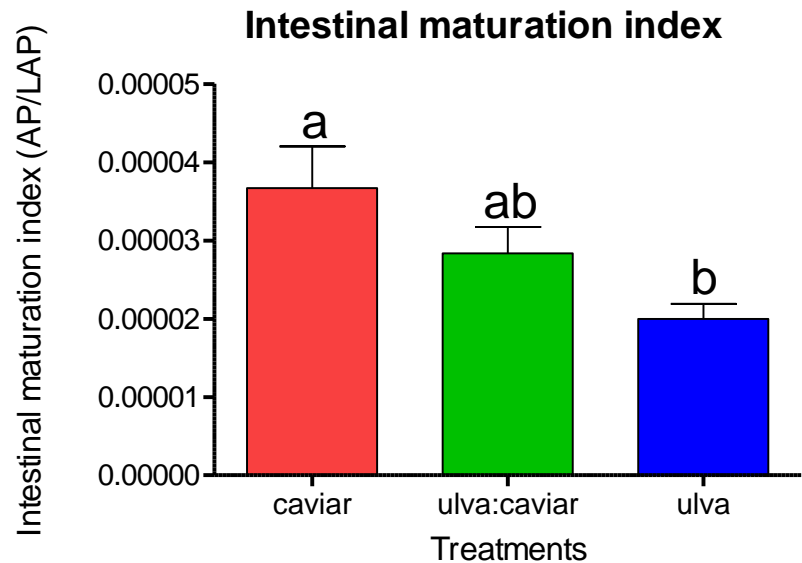
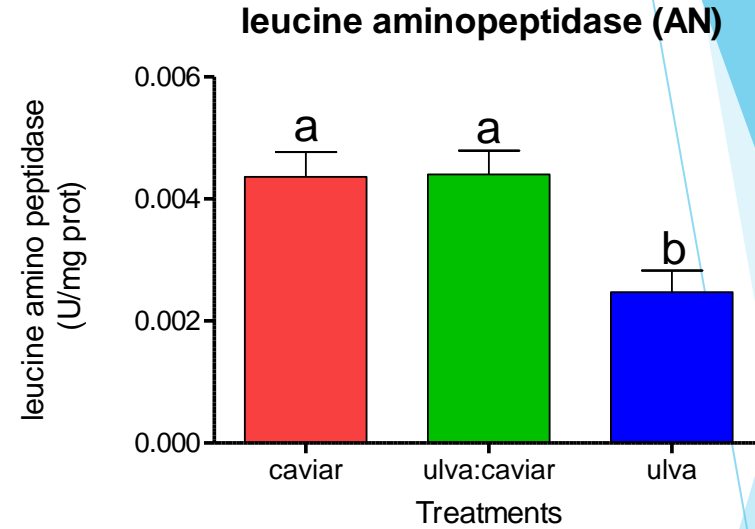
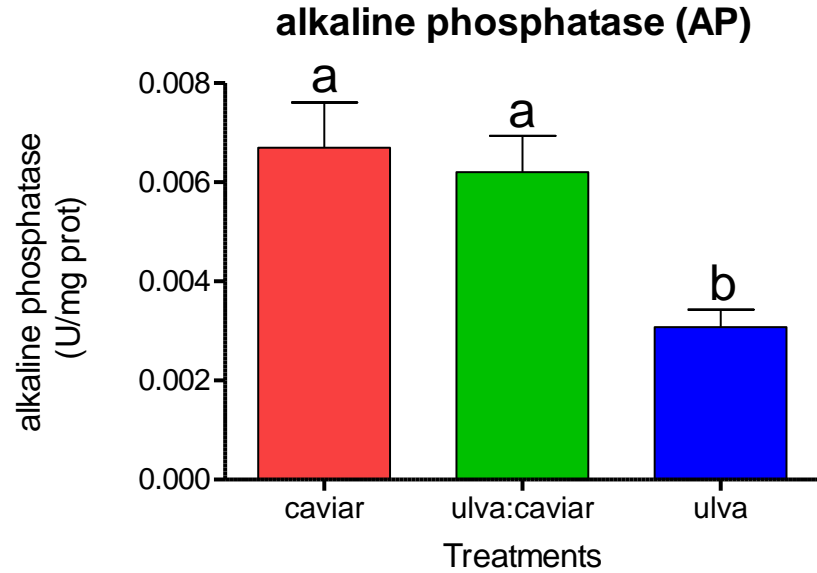
Effect of diets on biomass and weight distribution



Pancreatic enzymes



Brush border and cytosolic enzymes



Summary

- Fish fed the caviar:ulva diet grew best (length, dry weight, tank biomass)- not a strict herbivore at this stage.
- Fish fed Ulva resulted in significantly higher numbers of smaller fish (<100 mg) and lower numbers of larger fish (200-400 mg).
- Fish fed caviar and caviar:ulva resulted in significantly larger fish (300-400 mg)
- Increasing dietary cho:pro ratio significantly increased pancreatic amylase, protease and trypsin. Chymotrypsin and lipase independent of cho:pro ratio.
- BBM enzymes alkaline phosphatase and leucine aminopeptidase increased nutrient absorption and maturation with higher dietary accessible protein in nutrient dense diet.
- Decreasing AP/LAP (leucine alanine peptidase) with increasing CHO suggests gut maturation decreases with more ulva in diet.

Conclusions

- Enzyme specific activity affected by feed composition.
- Most effective diet was omnivorous based, in terms of DW, length, tank biomass, size distribution and enzyme capability.

Recommendation

- Recommend an omnivorous weaning diet (*ca* 45% protein, 32% carbohydrate) during this stage of development in juvenile grey mullet.

Take home

- Optimum diet -considerable levels of protein for growth and starch to provide glucose for energy to spare protein from catabolism and direct it toward growth.
- Mimic natural omnivorous diet of mullet in estuaries.

Thank you

