University of Idaho
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DIETARY REQUIREMENTS OF ORGANIC AND INORGANIC ZINC IN DIPLOID AND TRIPLOID RAINBOW TROUT (*Oncorhynchus mykiss*)

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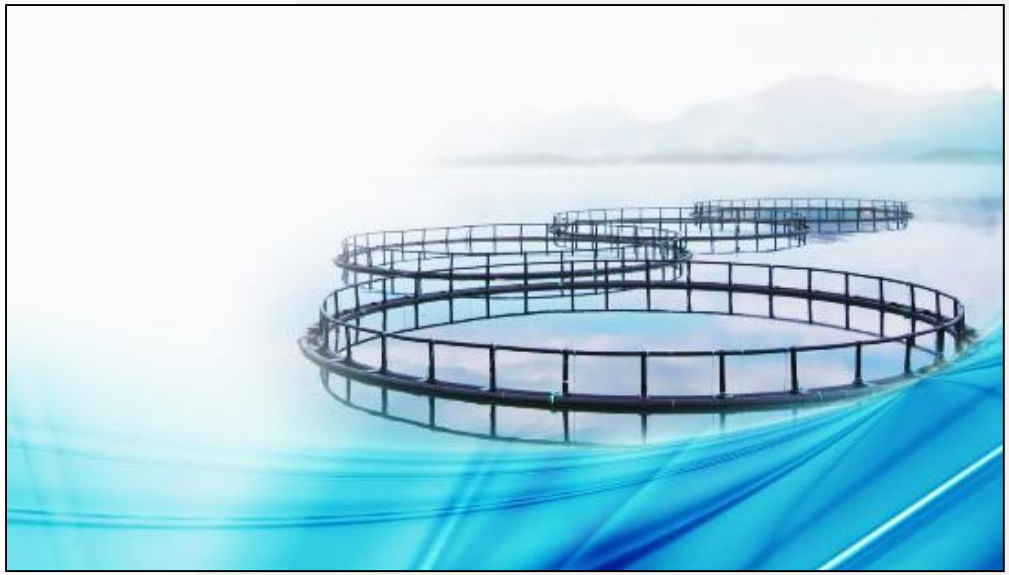
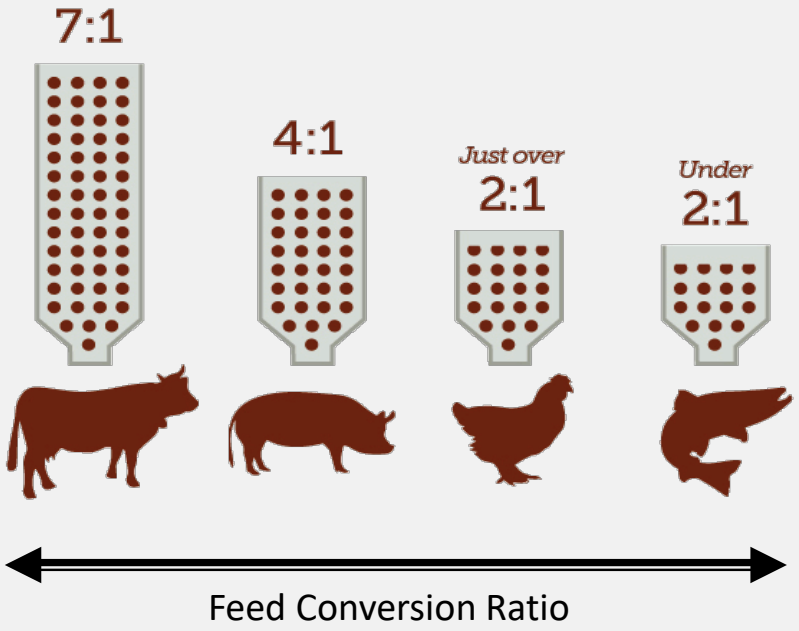
AQUACULTURE

- Fastest growing food sector
- Provides > 50% fish/shellfish consumed by humans
- Feed: 60-70% of total operational cost



Feed Conversion Ratio

Pounds of feed to produce one pound of animal protein



Source: http://www.earth-policy.org/books/pb2/pb2ch9_ss4

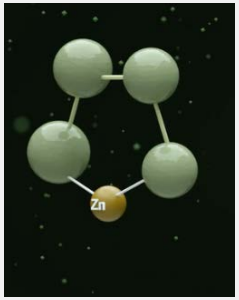
VARIABLES

Zn: Essential trace mineral

- Present in all organs, tissues and fluids
- Produce deficiency symptoms when removed

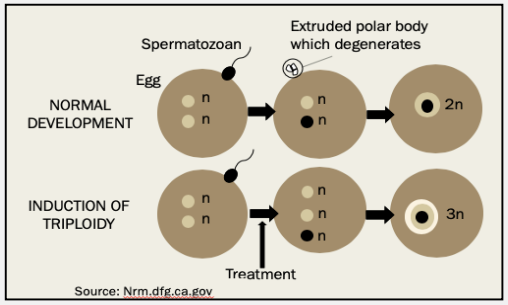
Organic: Chelated with other ingredients

- More bioavailable
- Organic = 15% Zn, Inorganic = 75-80% Zn



Triploids:

- Sterile
- Potential for faster growth
- May have different nutrient requirements

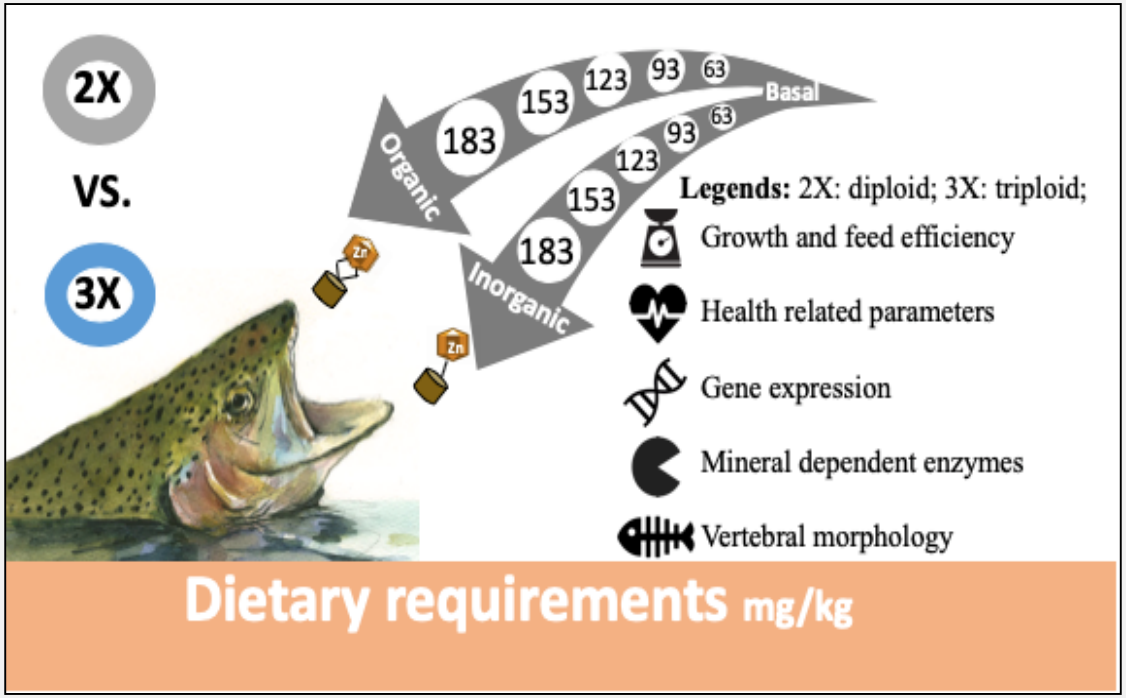


GOAL AND OBJECTIVES

To determine Zn requirements in a commercial strain of rainbow trout.

1. Organic vs. inorganic zinc
2. 2X vs. 3X ("Genetically similar")

Troutlodge



MATERIALS AND METHODS

FEED FORMULATION

- Basal diet 33 mg/kg Zn
- 43% crude protein [isonitrogenous]
- 20% lipid [isolipidic]
- Incremental organic (Alltech)/inorganic ($ZnSO_4$) Zinc

Basal	Inorganic					Organic				
A	B	C	D	E	F	G	H	I	J	K
Zn_{33}	Zn_{63}	Zn_{93}	Zn_{123}	Zn_{153}	Zn_{183}	Zn_{63}	Zn_{93}	Zn_{123}	Zn_{153}	Zn_{183}

MATERIALS AND METHODS

SAMPLING

11 fish

3 fish

11 fish

3 fish

11 fish

3 fish

9 fish

- Standard/total/fork length and K
- Whole body proximate

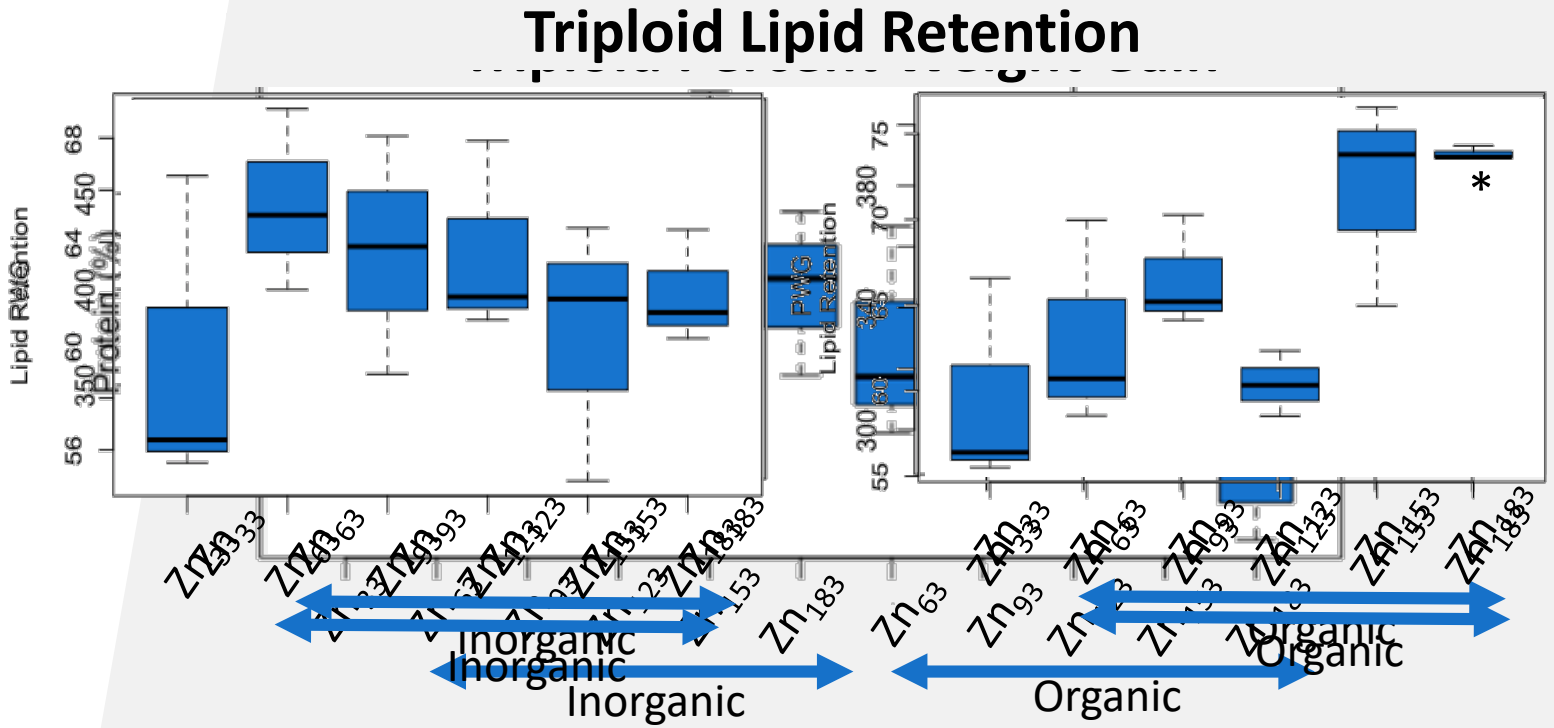
9 fish

- Caudal blood drawn for analysis of zinc dependent enzymes
- Tissues removed for liver, vertebrae, and whole-body zinc analysis
- Tissues removed for RNA extraction
- Distal intestine histology

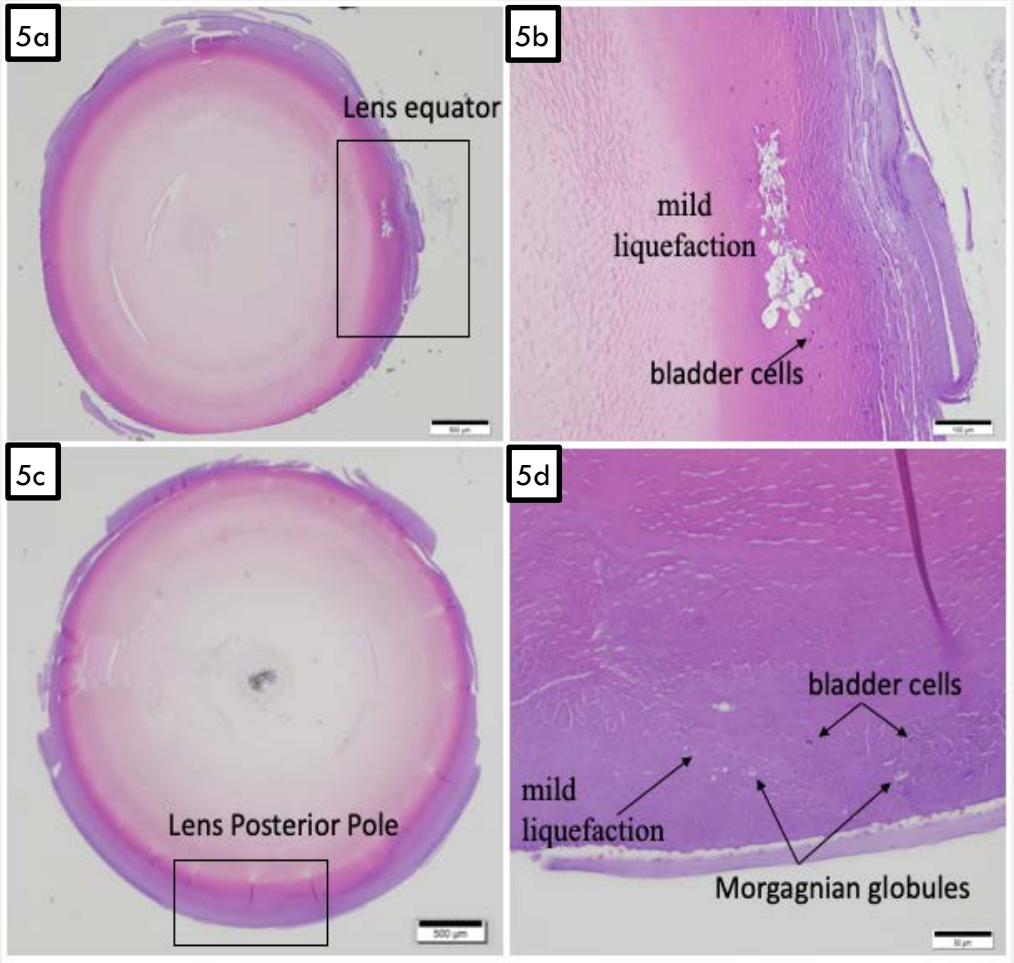
9 fish

- Cataract formation and lens histology

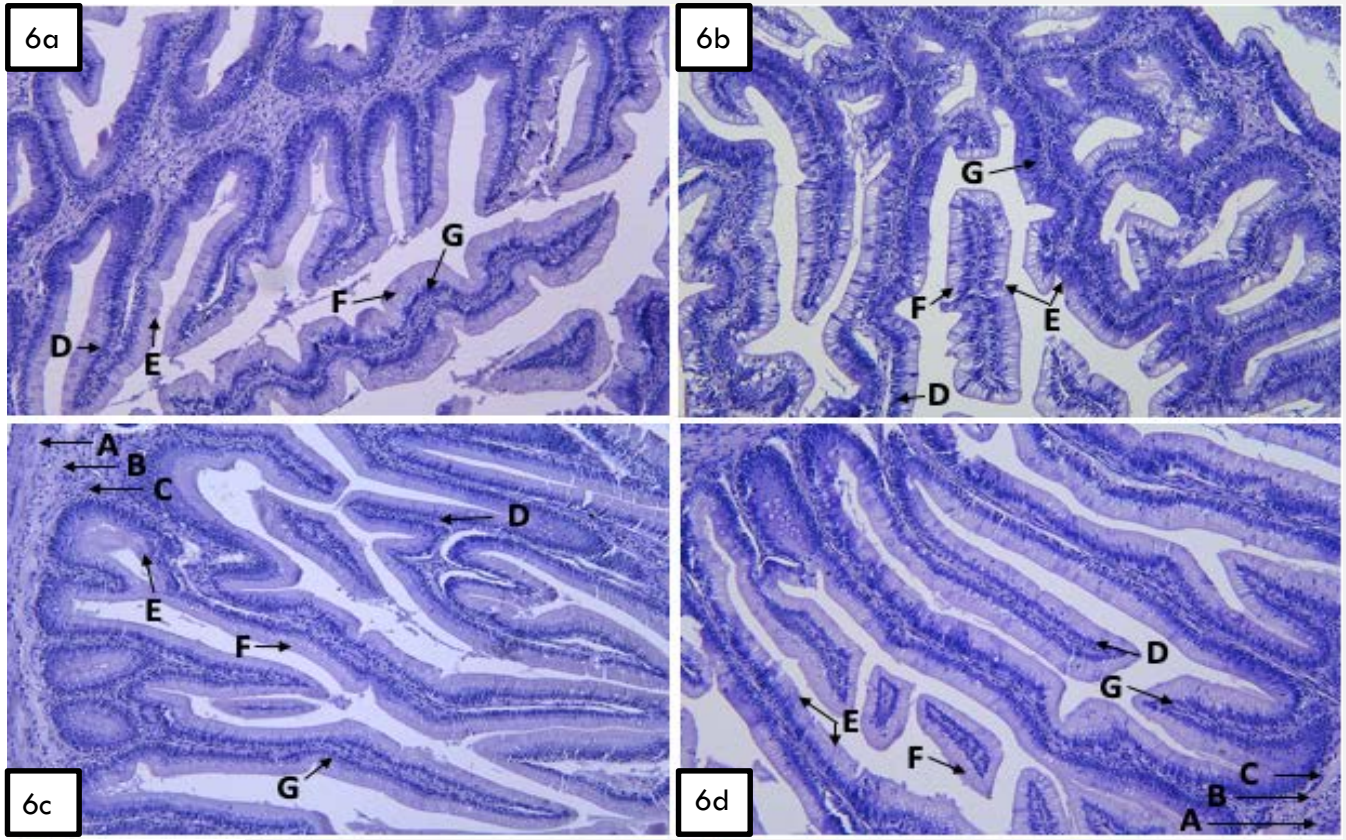
RESULTS


Triploid Lipid Retention
Lipid Retention
Protein (%)
PWG
Lipid Retention
Zn63
Zn93
Zn123
Zn153
Zn183
Inorganic
Inorganic
Inorganic
Organic
Organic
Organic

CATARACTS AND LENS HISTOLOGY



DISTAL INTESTINE HISTOLOGY



6a: Diploid control
6b: Triploid control
6c: Diploid organic Zn_{183}
6d: Triploid organic Zn_{183}

Intestinal morphology are labeled as follows:
A: Serosa
B: Muscularis
C: Submucosa
D: Lamina propria
E: Goblet cell
F: Absorptive vacuoles
G: Epithelial layer

CONCLUSIONS

1. Zinc requirements for fish tended to be higher in the inorganic diets when compared with organic diets
2. No significant growth differences were seen between treatments for zinc type, amount, or ploidy
3. Organic diets yielded significantly higher lipid retention and whole-body protein content
4. Skeletal and operculum deformities varied between treatments, more deformities were observed in triploids
5. No significant differences were seen in cataract formation or lens histology
6. No significant differences were seen in distal intestine histology

ONGOING ANALYSES AND FUTURE RESEARCH

- Ongoing analyses:
  - Mineral analysis
  - Fatty acid analysis
  - Gene expression
    - Oxidative stress related
    - Bone development
    - Growth
  - Determination of antioxidant enzyme activity
  - Bone density (X-ray)
- Future research:
  - ✓ Digestibility study
  - ✓ Increase genetic variability
  - ✓ Fillet quality

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