



University of Idaho

Aquaculture Research Institute

Indirect criteria to select the trout lines to enhance the feed efficiency of plant based diet

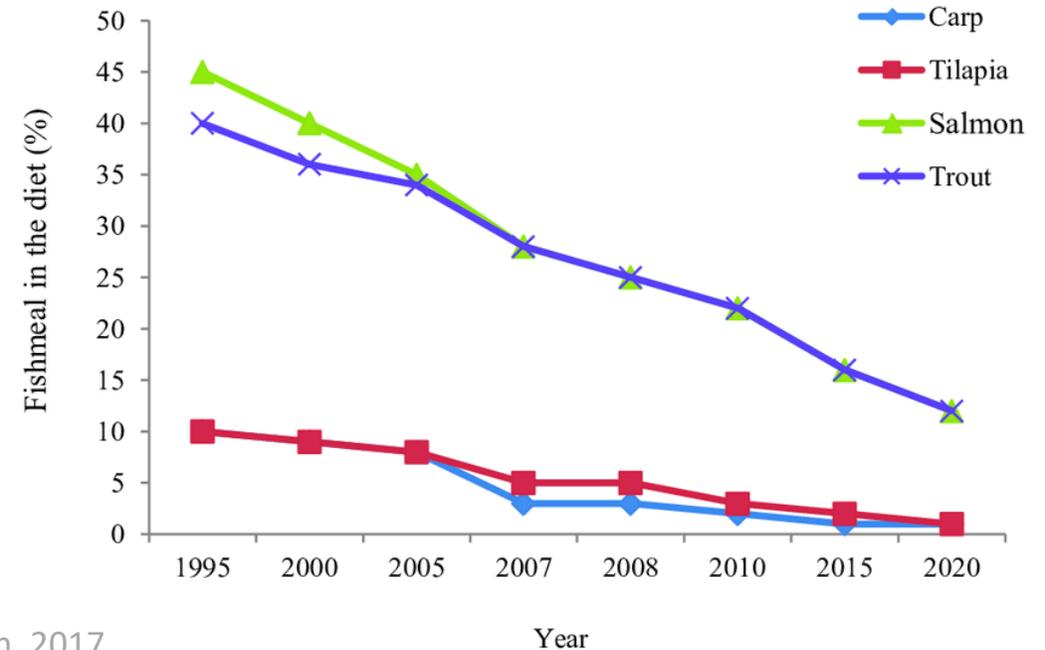
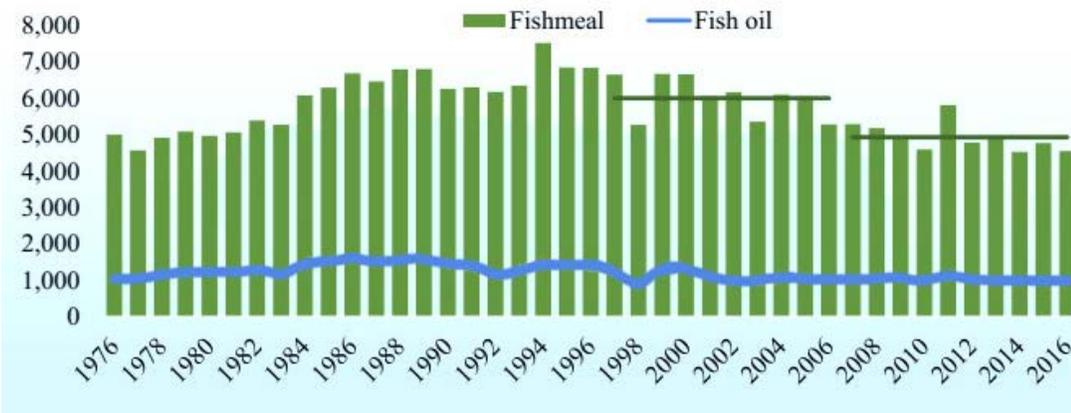
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Sustainable feed

- >60% of total production costs goes to fish feed
- Traditionally: Fish meal was major source for protein
- Currently: Plant protein is the number one ingredient in aquafeed

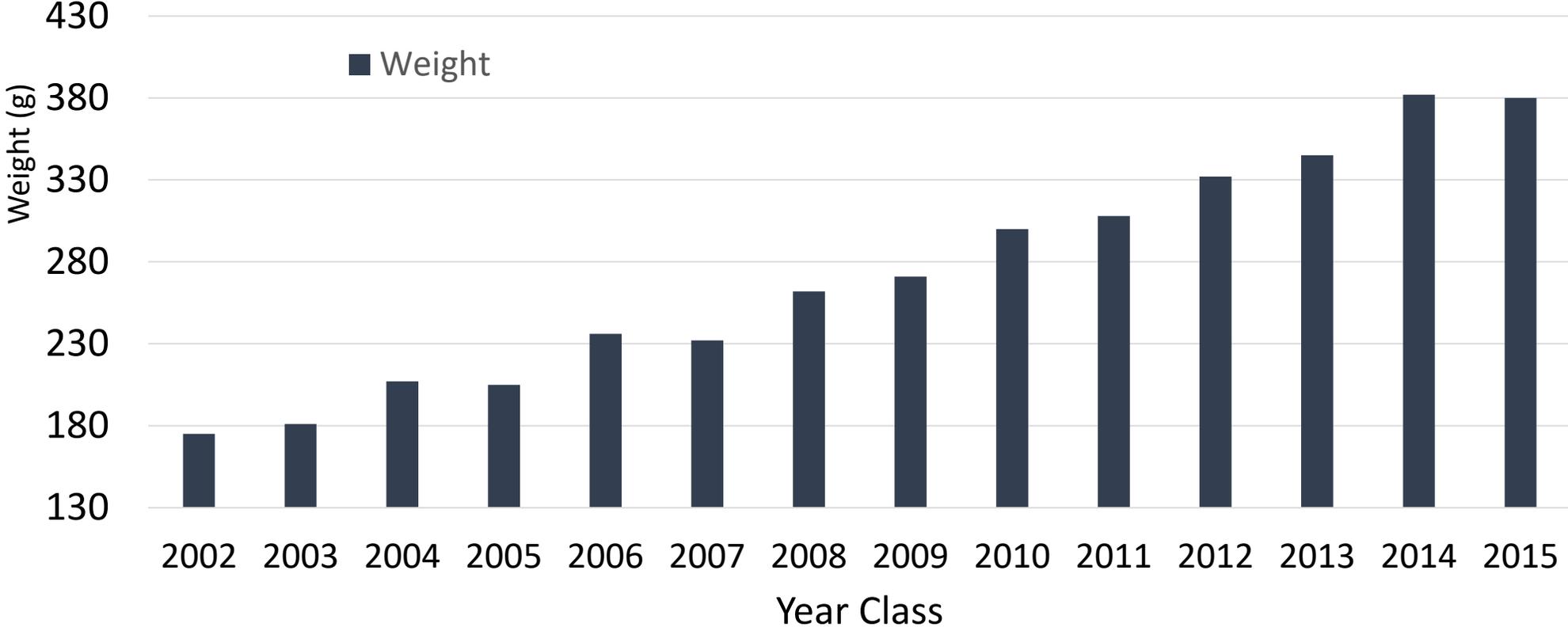
Global Fish Meal and Fish Oil Supply



A large pile of yellow soybeans is shown on a white surface. The beans are in sharp focus in the foreground and become increasingly blurred as they recede into the background. The lighting is soft and even, highlighting the smooth texture and natural color of the beans.

Rainbow Trout Selection for Plant Protein Utilization (UI-ARI and USDA)

Selection of trout reared on high soy diet

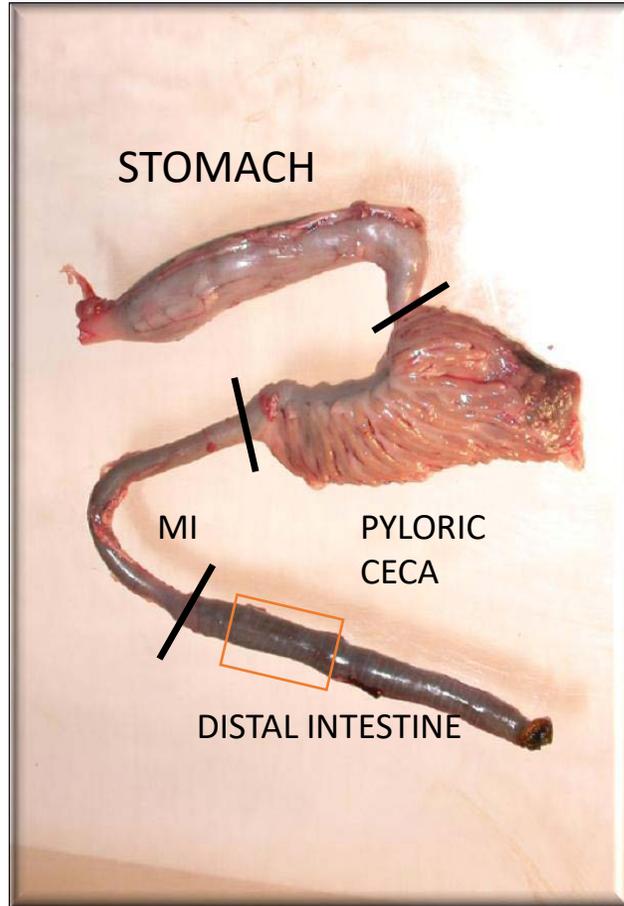


- Initial Average weight= 30 ± 1.6 g
- 5 month feeding trial

Unpublished data from ARI/USDA

Plant-based diet: 23% SPC, 25% soybean meal, 10% corn protein concentrate

Enteritic effect of high soy diet



supranuclear vacuoles

mucous cell hyperplasia

Lamina
Propria

lymphocytes

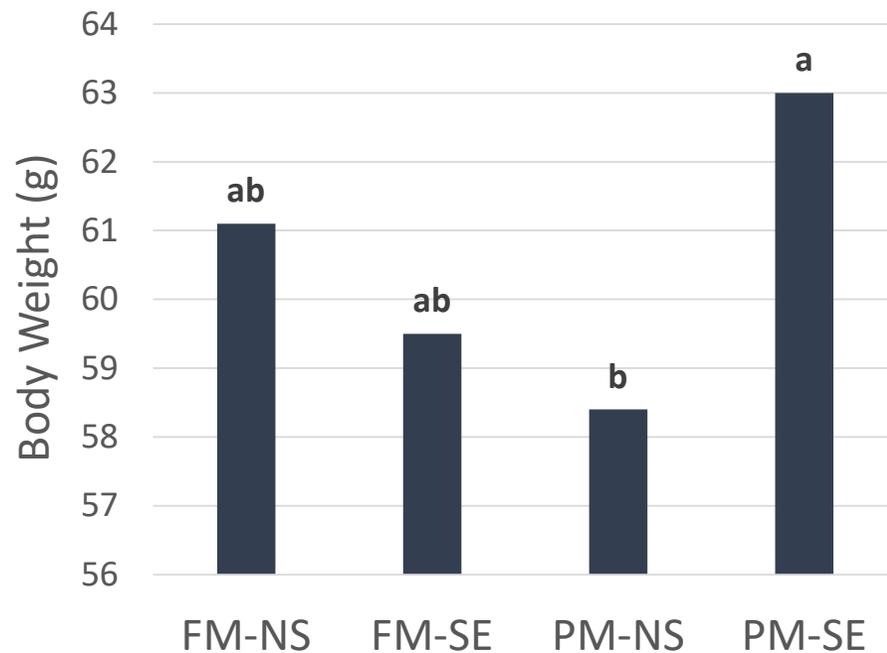
Selected-Plant meal

Submucosal layer

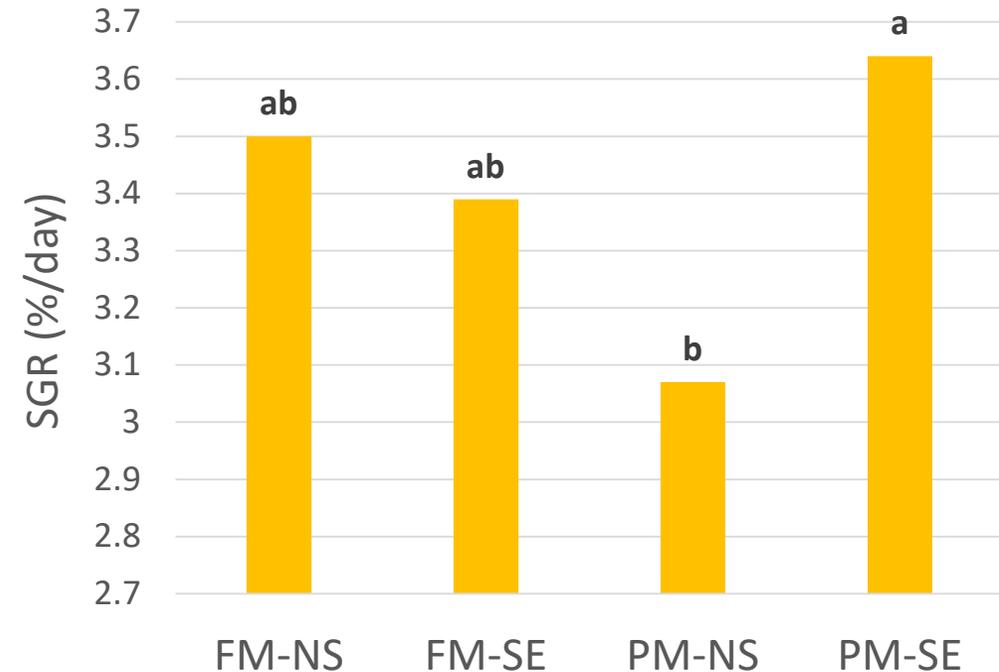
Nonselected-Plant meal

Growth performance results of the selected line

Final body weight



Specific Growth Rate

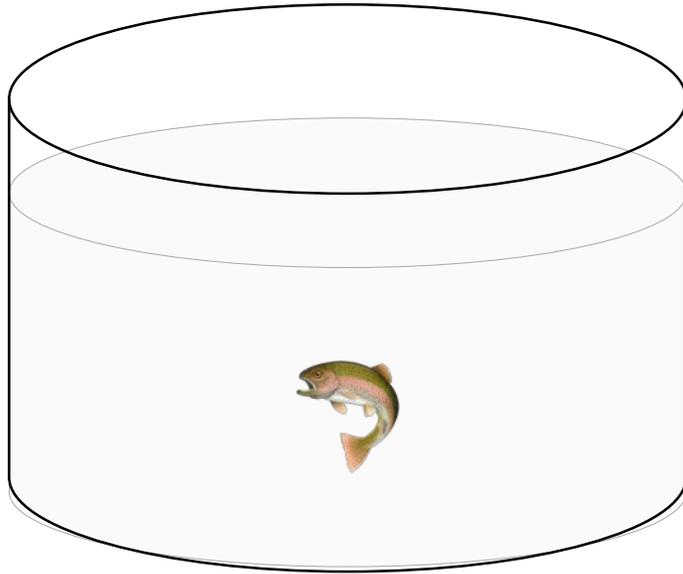


FM=Fish Meal
PM= Plant Meal
NS= Non-selected
SE=Selected

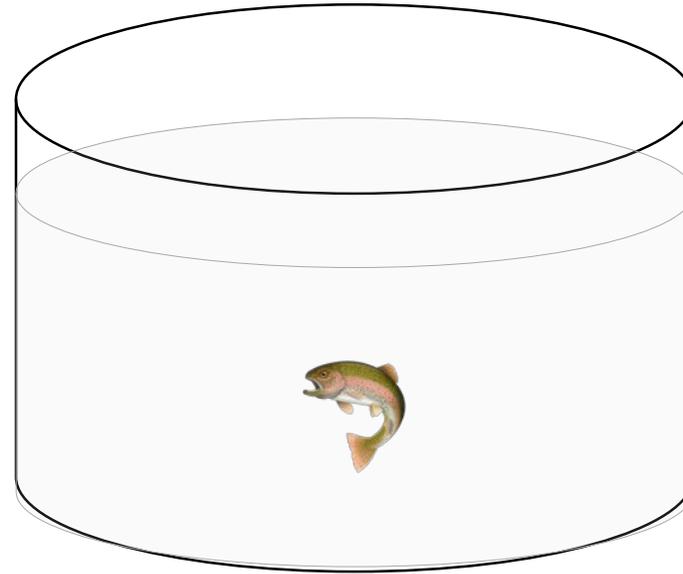
Unpublished data from ARI/USDA



Growth vs. feed efficiency?



A



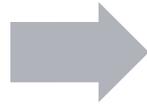
B

Research design



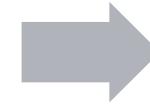
Phase I

- Fertilization
- PIT Tag implantation
- 1st Feeding challenge
- (6 months)



Phase II

- Acclimatization
- RFI records
- 2nd feeding challenge
- (8 months)



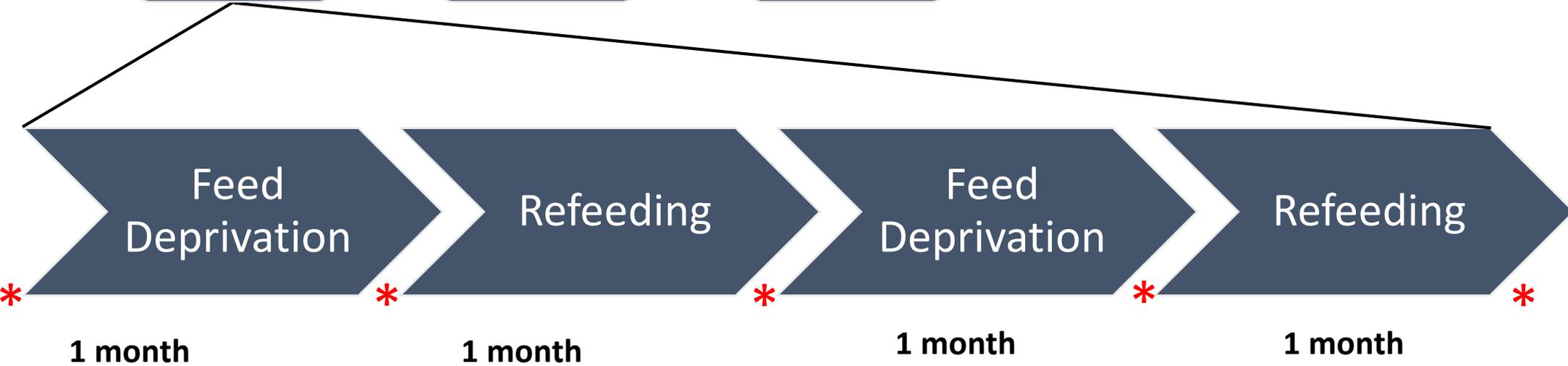
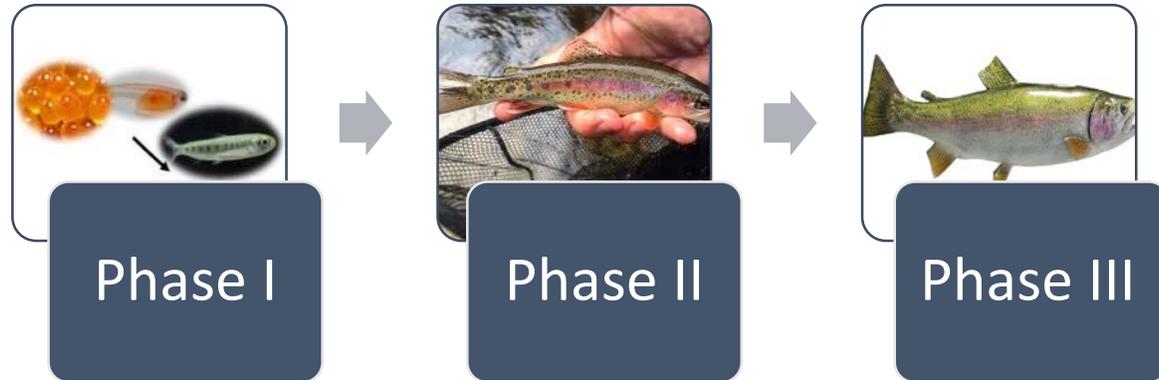
Phase III

- Selection for lines
- Challenging with the same diet
- (4 months)

Phase I

Sample collection: 3 fish per tank

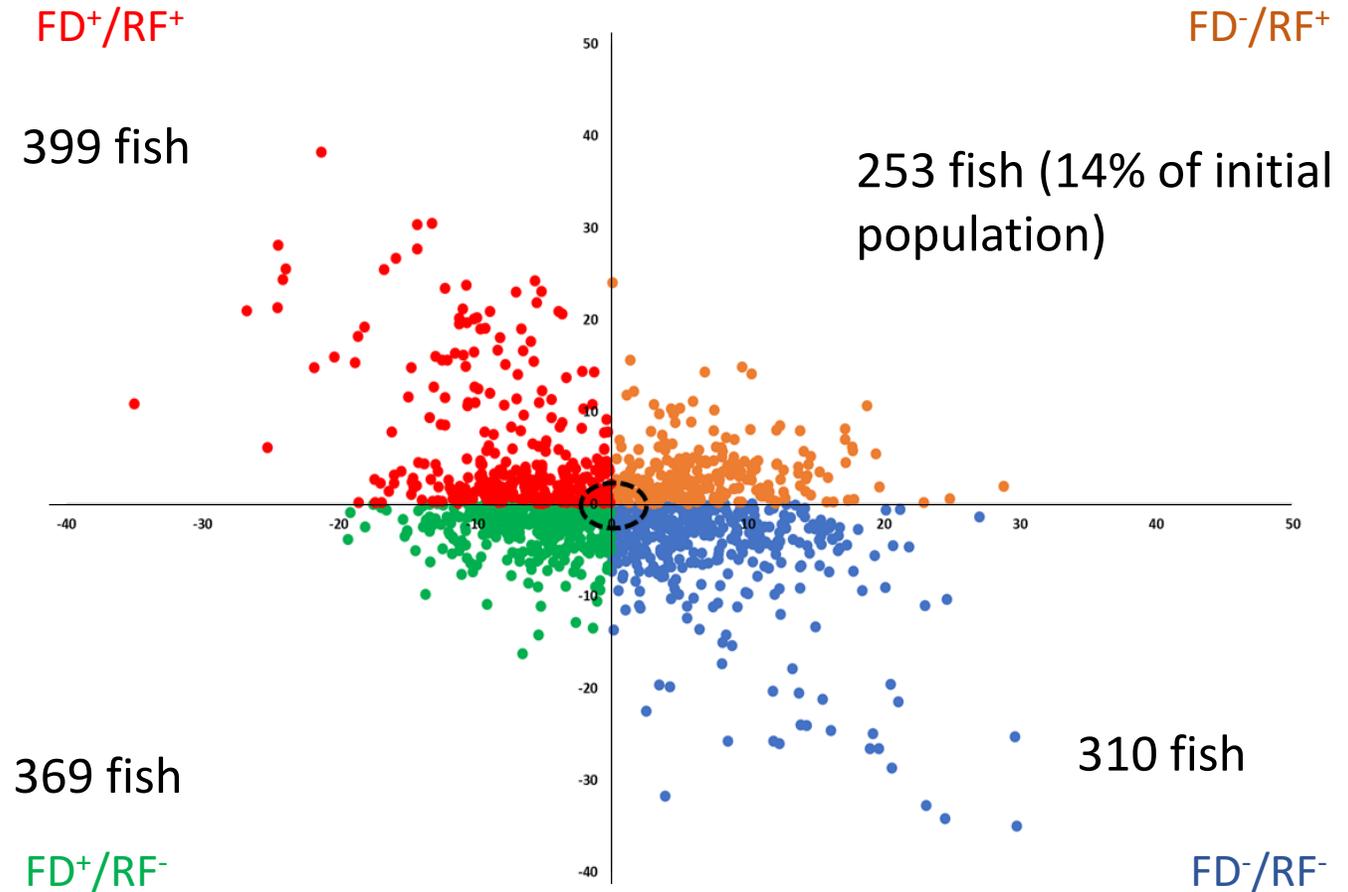
- Liver
- Muscle
- Digesta
- Distal intestine



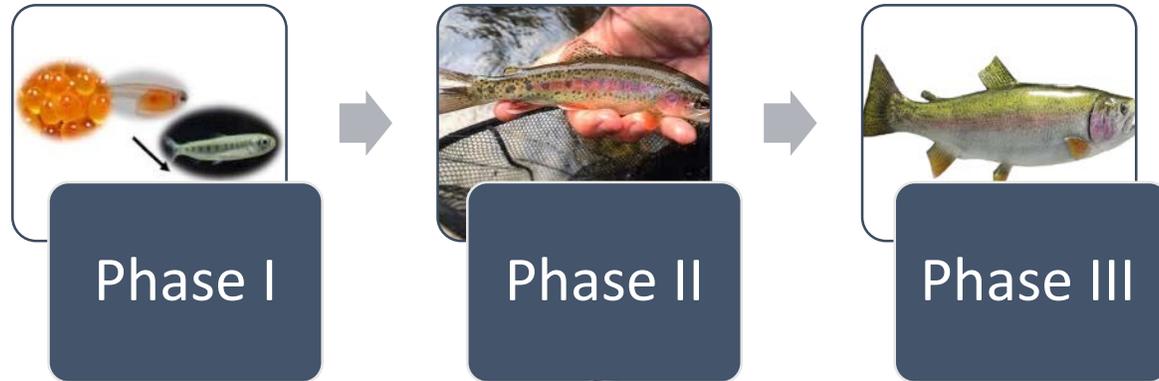
* Weighing fish individually (~1600 fish) and sample collection

Fish response to compensatory feeding regime

- Fish shows variation in weight gain and loss in response to FD and RF

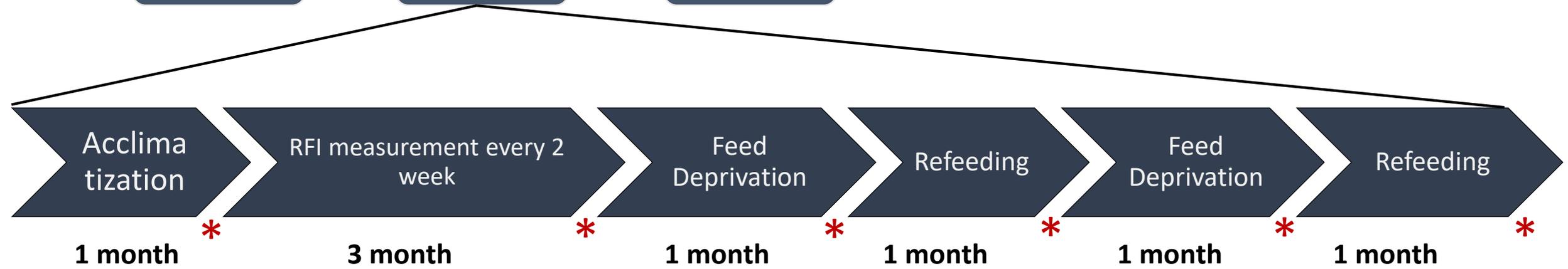


Phase II



Residual Feed Intake (RFI):
 $RFI = \text{actual feed intake} - \text{expected feed intake}$

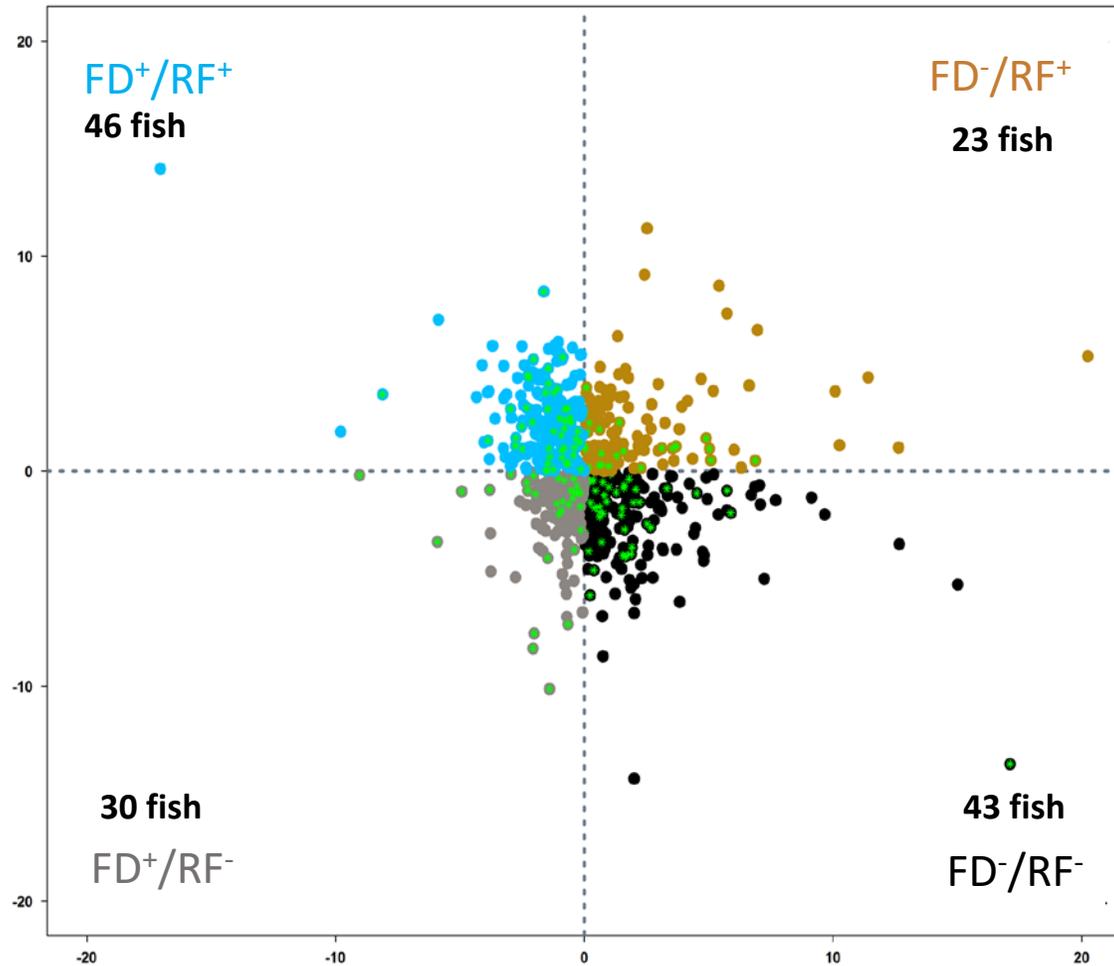
Helland et al., 1996



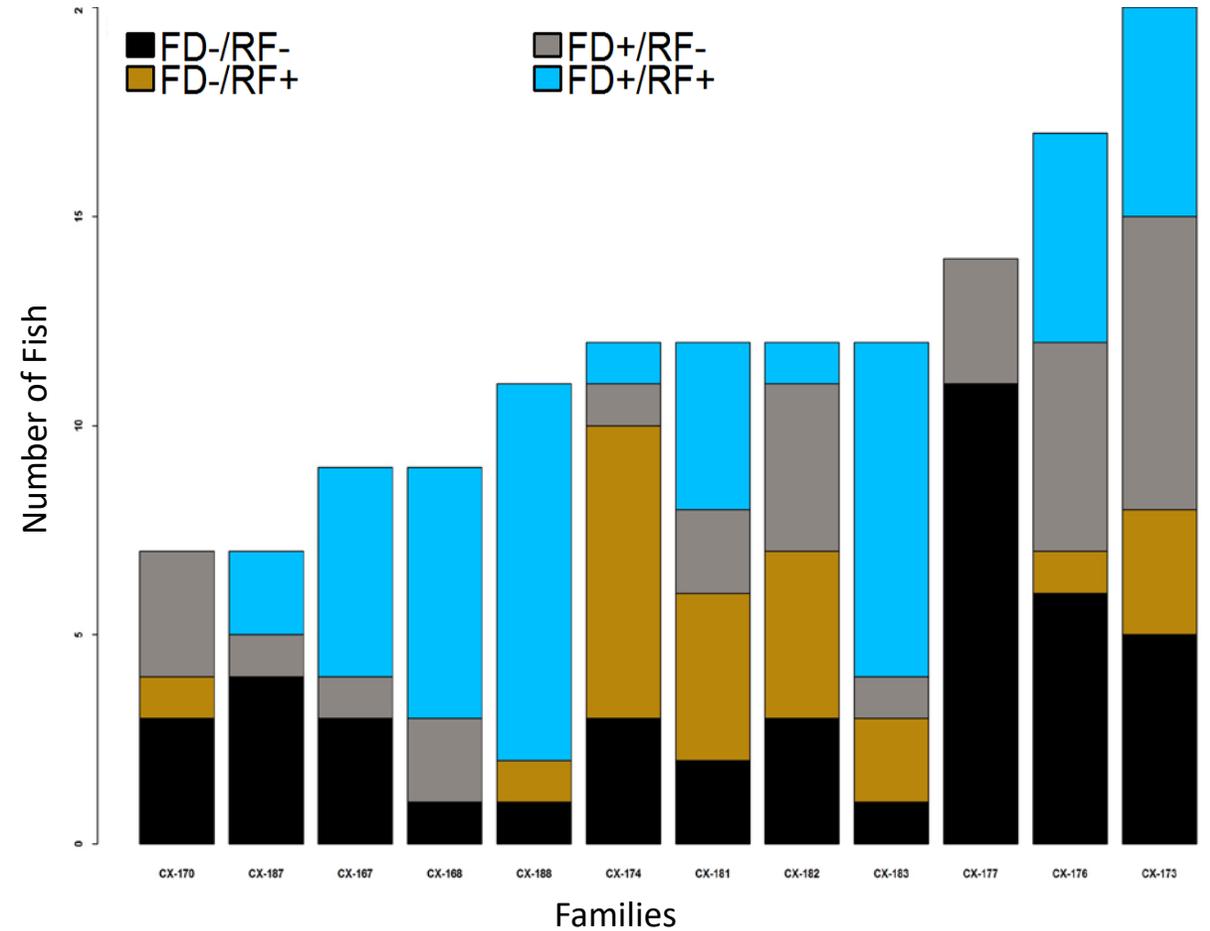
* Weighing fish individually (~1000 fish) and sample collection

Fish response to compensatory feeding regime was re-evaluated

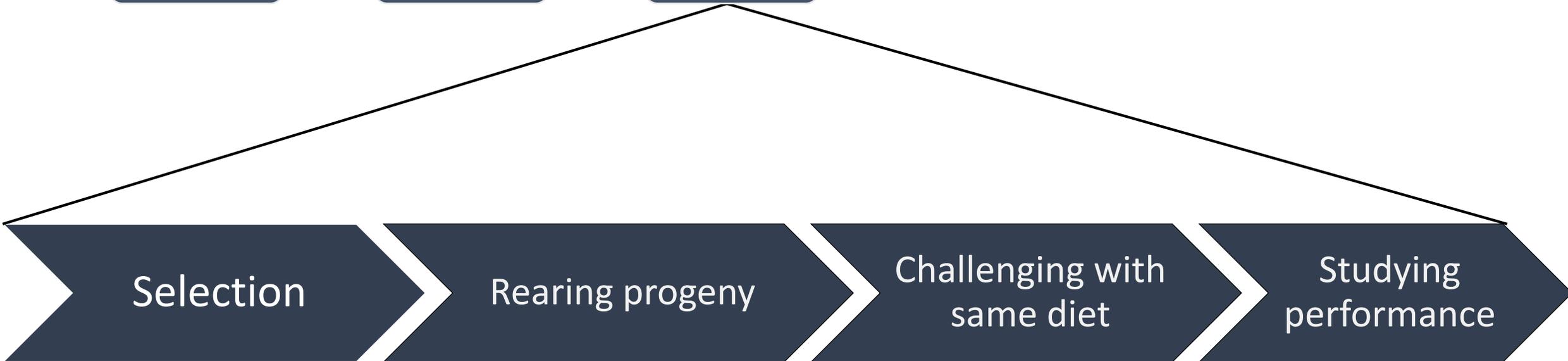
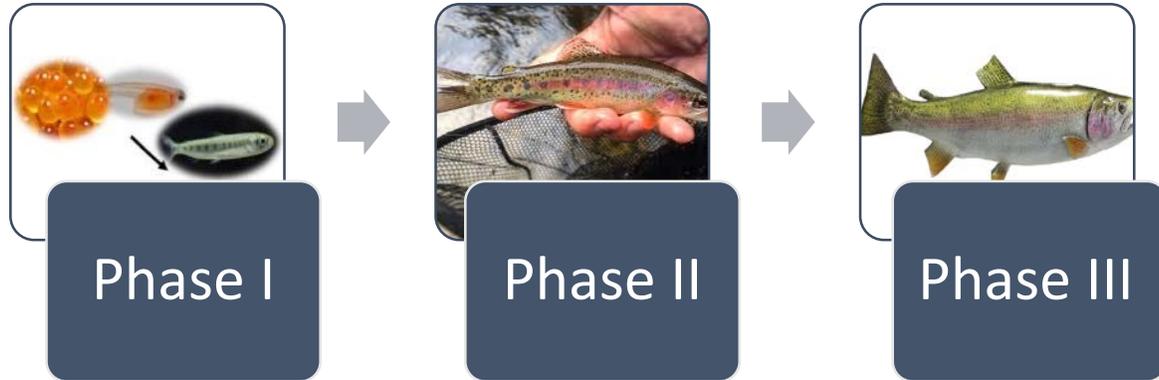
Fish selection after 2nd challenge



Distribution of individuals across the groups from different families



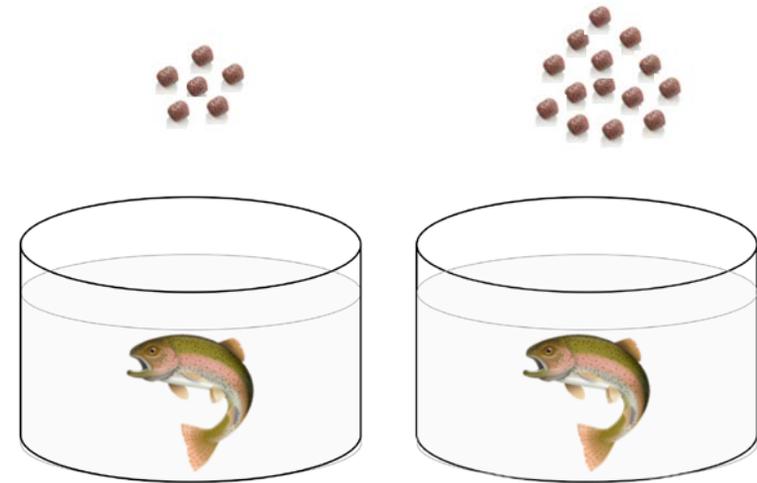
Phase III



Expected outcomes and Benefits

- Genetic improvement of rainbow trout for efficient high soy diet utilization

- **10-20% increase in feed efficiency**
- **Lower the cost of production**
- **Sustainable aquaculture**
- **Can be applied for other commercial fish**





Thank you!



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