Quantitative trait loci (QTL) for body weight in Arctic Charr reared in different environmental conditions

Aquaculture in Canada

- Dominated by Atlantic salmon (*Salmo salar*)
- Decreased market value
- Overproduction and competition
- Alternative species

Charr Projects in Atlantic Canada

- Overall goal = commercial broodstock
  - Salinity tolerance
  - Flesh pigmentation
  - Cryopreservation
  - Sex control
  - Triploid induction
  - **Genomic evaluation**

Arctic Charr Aquaculture

- Benefits:
  - High stocking density
  - Grows well in cold water
  - “luxury” food item
- Problems:
  - Variable growth rates
  - Early maturation
  - Decreased flesh quality

How can Genomics help?

- Genetic evaluation of a broodstock can help identify individuals who are predisposed to a trait of interest

- When genetic selection is combined with traditional selection, selection intensity may increase rapidly

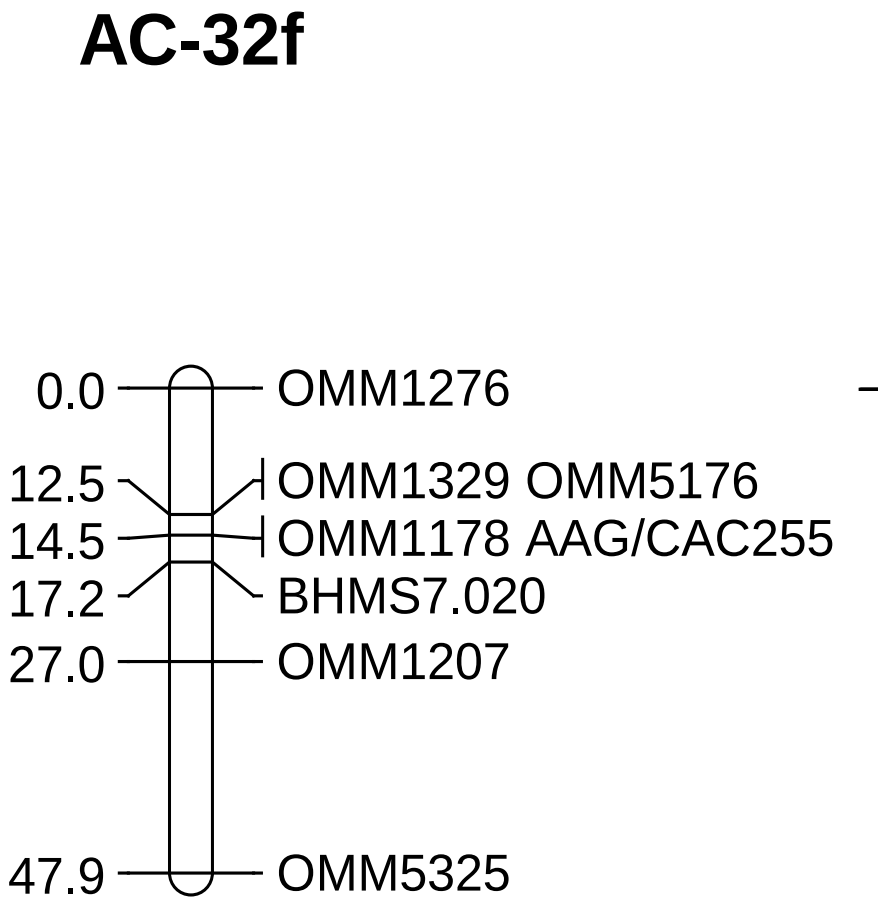
Analysis of a quantitative trait (QTL)

- QTL- genomic regions containing alleles that affect a quantitative trait (ie: body weight)

- If a marker is linked to a region coding for trait of interest – there is a statistical association between the phenotype and the alleles

Analysis of a quantitative trait (QTL)

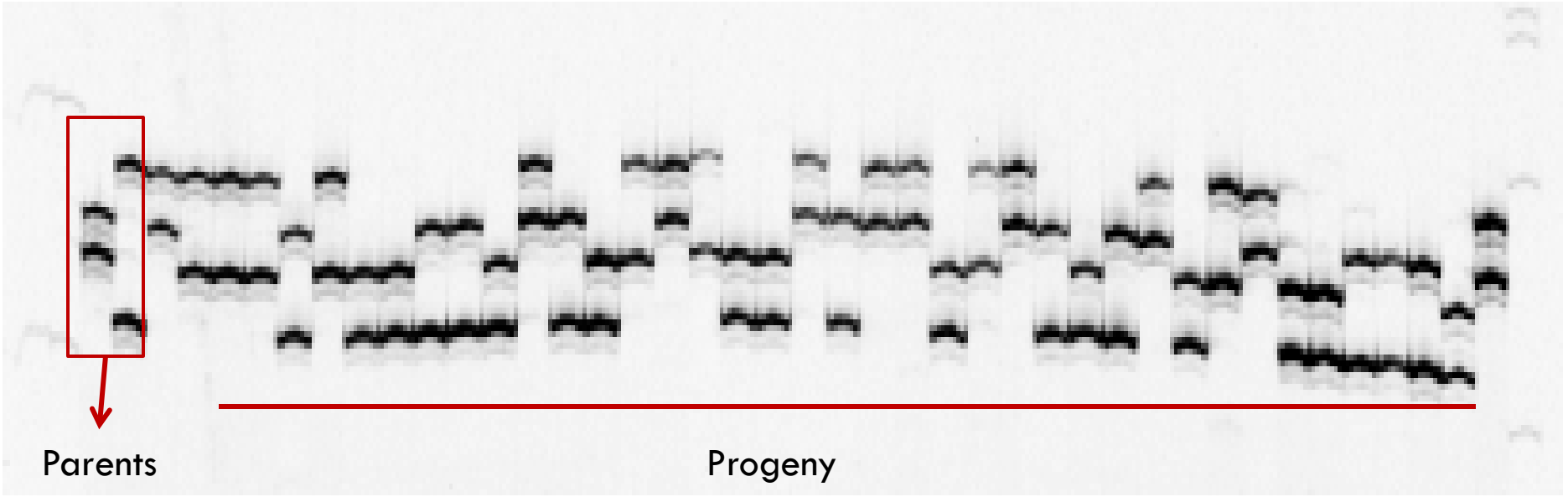
- Microsatellite markers – sequence repeats with variation in number of repeats
- Markers selected from QTL studies on AC, AS & RT



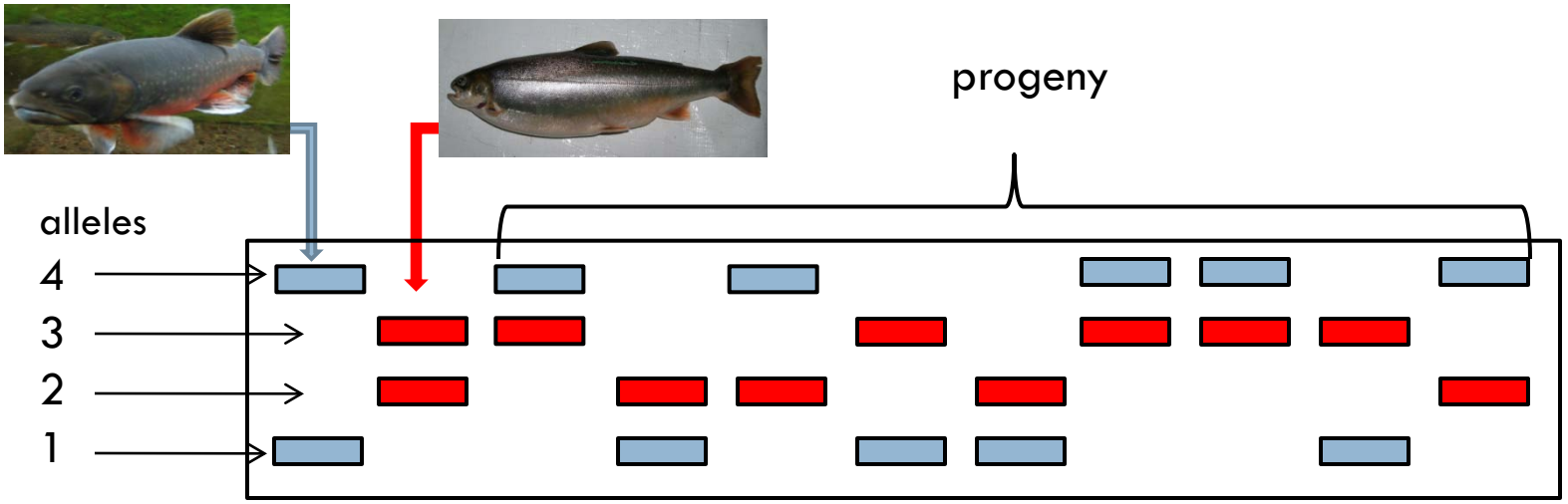
Analysis of quantitative trait (QTL)

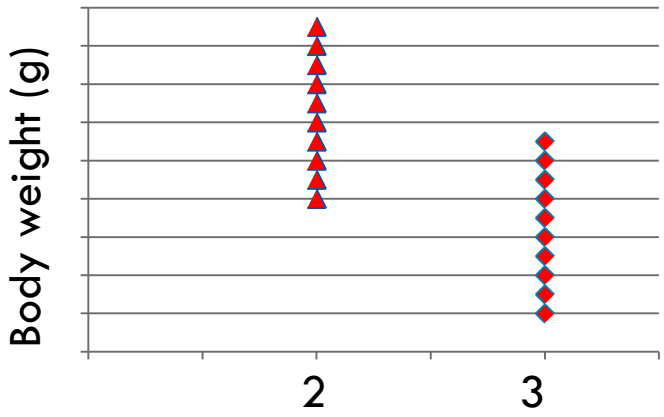
Analysis of a quantitative trait (QTL)

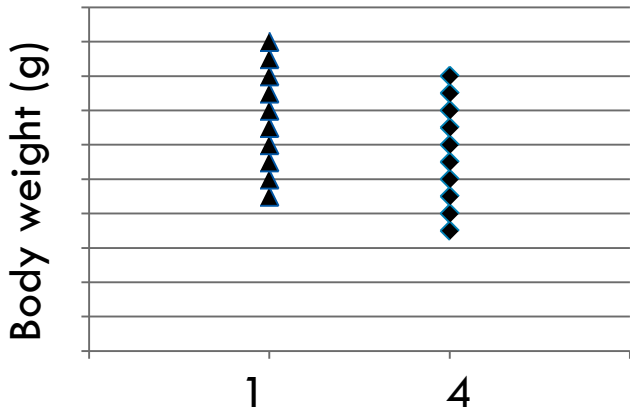
- Collect tissue samples, extract DNA
- Measure the trait of interest
- PCR reaction with marker-specific primers
- Visualize on acrylamide gel



Analysis of quantitative trait (QTL)





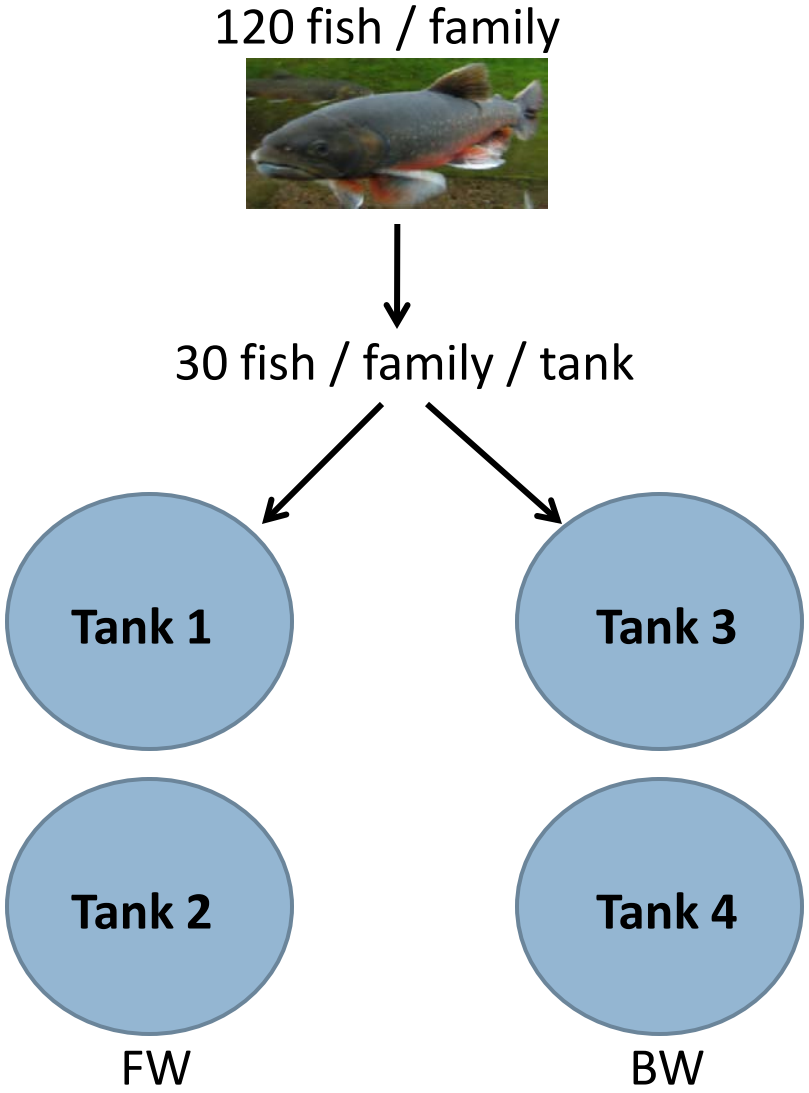


Background

- Pilot study found significant QTL for body weight on AC-8 (Moghadam et al. 2007)
- This study investigated 2 experimental Fraser strain families
- We wanted to see if this result would also be found in a larger number of families grown at a commercial site

Methods

- 30 full-sib families
- PIT-tag 120 fish from each family (n=3600)
- 4 - 16 m^3 tanks
- 2 environments (FW & 20 ppt BW)

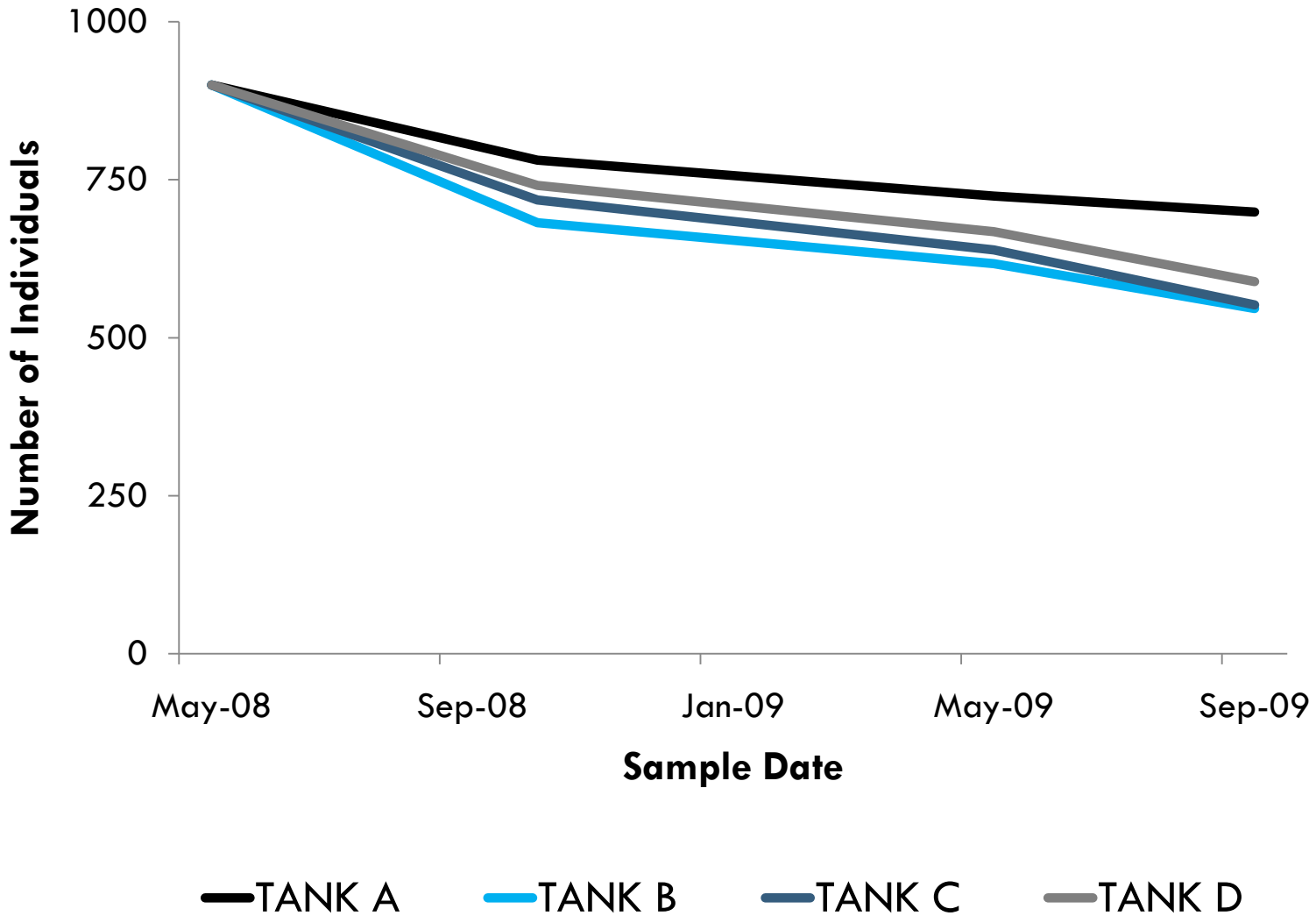


Can Aqua – Advocate Harbour

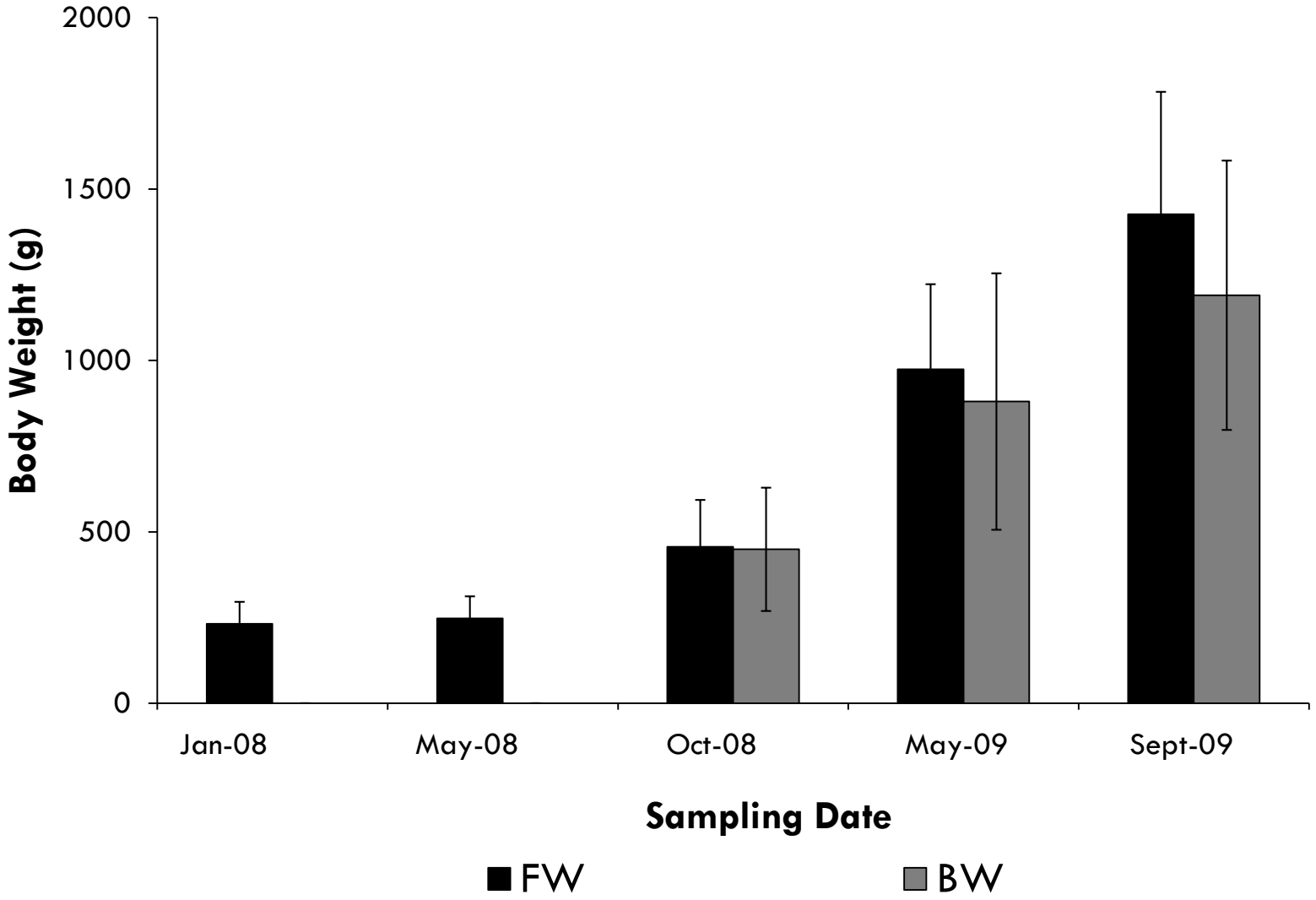
Progress

- 3600 fish were PIT-tagged, weighed, measured and transferred to CanAqua in February 2008
- Tissue samples collected
- All individuals genotyped for QTL markers
- Measured body weight, length and survival at 5 sampling dates

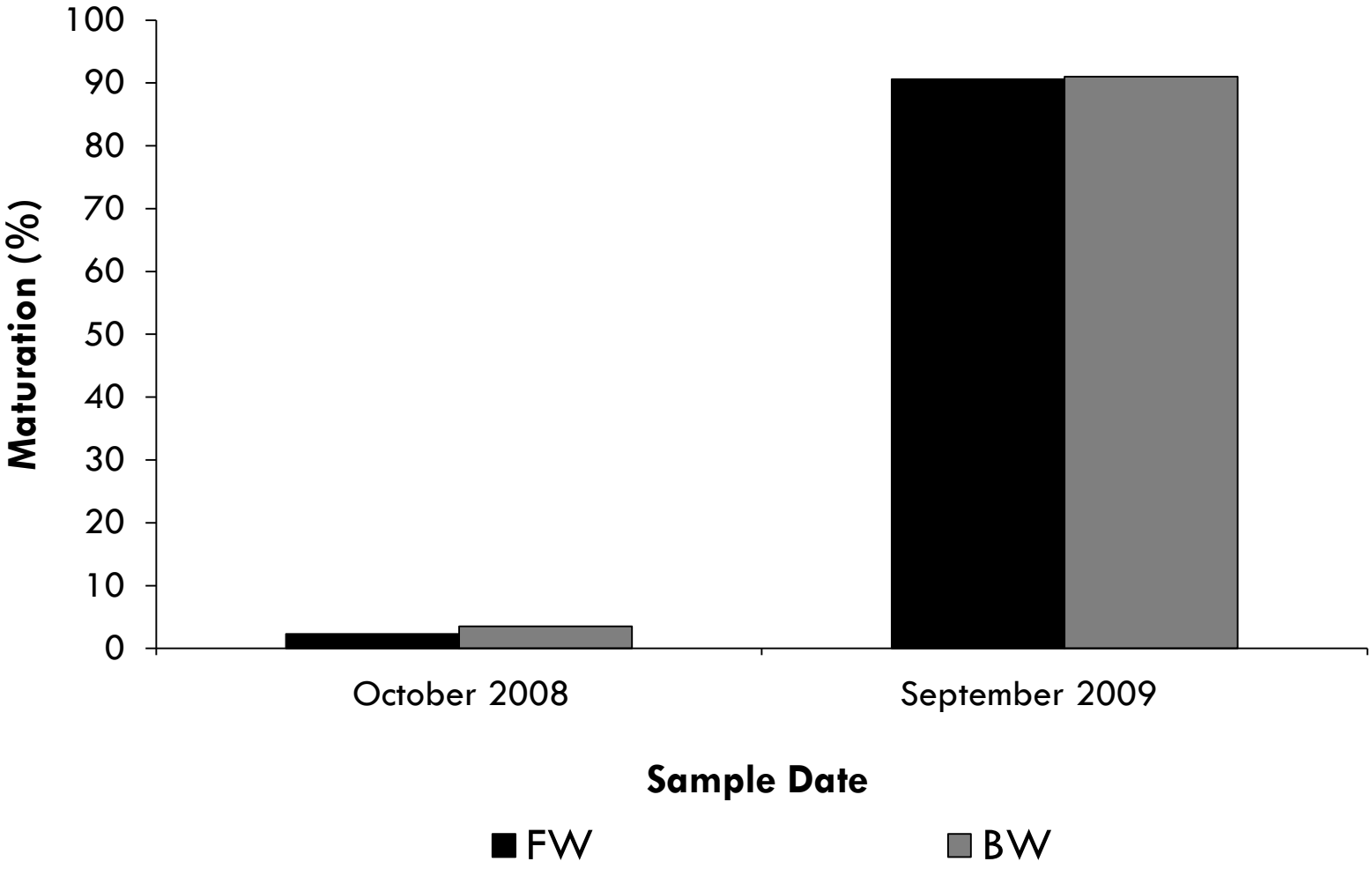
Preliminary Results - Survival



Preliminary Results – Body Weight

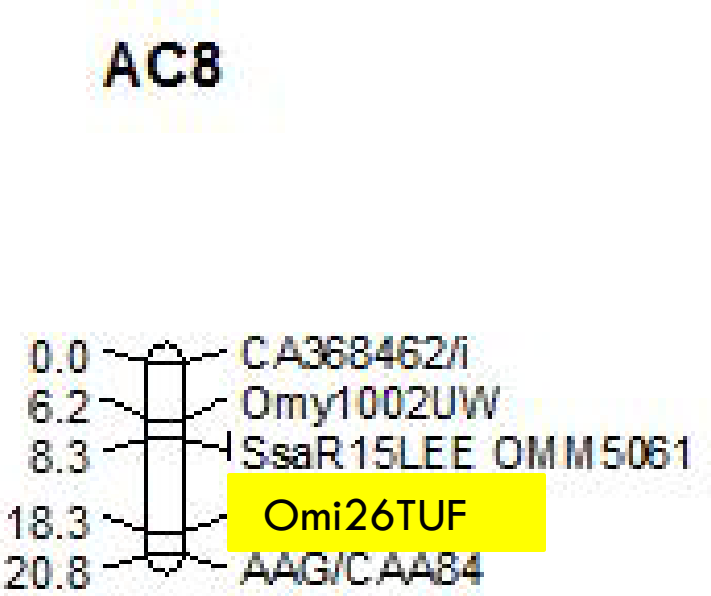


Preliminary Results - Maturation



Preliminary Results - Genetics

- Most significant QTL is on AC-8
- Found in multiple families in both males and females
- QTL accounts for 8-17% of the variation in body weight



Application & Goals

- Significant QTLs can help direct selection through Marker Assisted Selection (MAS)
- Overall goal = select for fast growth & reduced early maturation
- The specific objectives of this project are to determine if QTL for body size and early maturation already identified from genome scans have detectable effects across families and environments

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