Advances in rainbow trout breeding

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Torben Nielsen

CEO, Veterinary and founder

The rainbow trout genetic business

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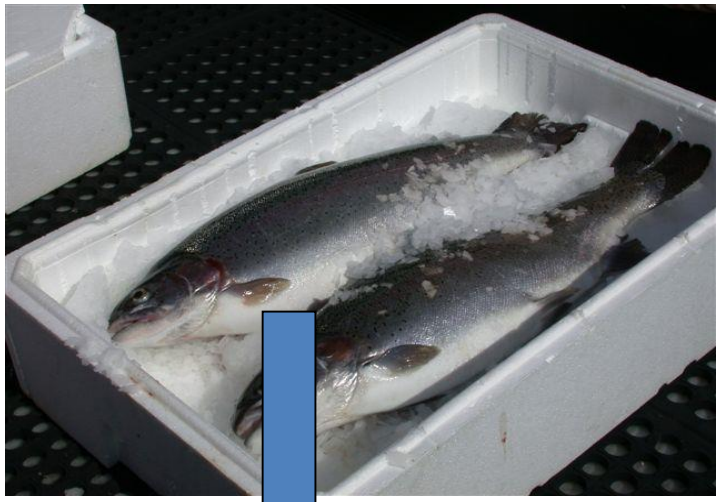
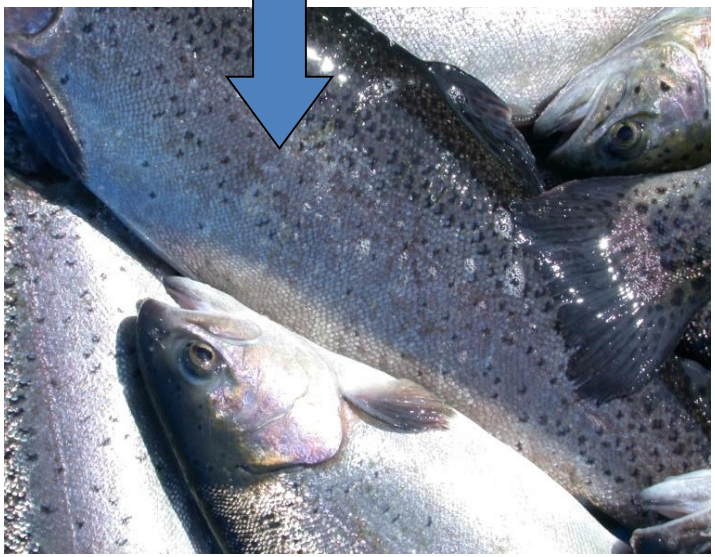
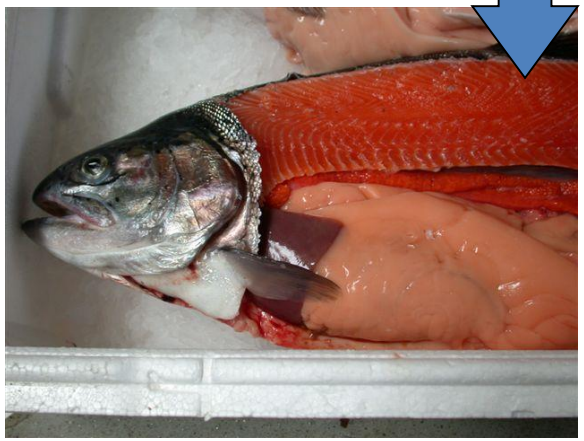
The Trout Breeding Company







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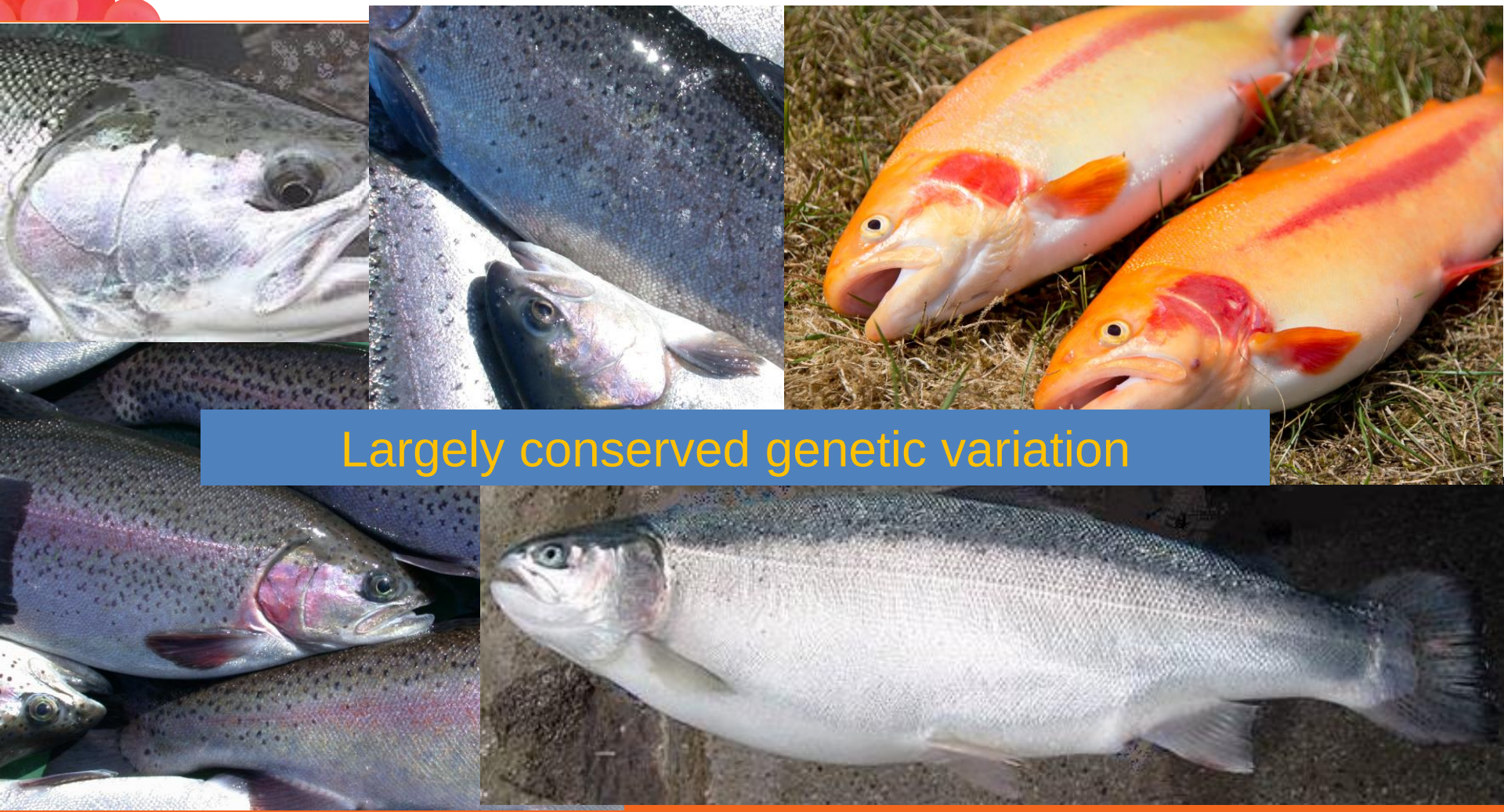


Largely conserved genetic variation

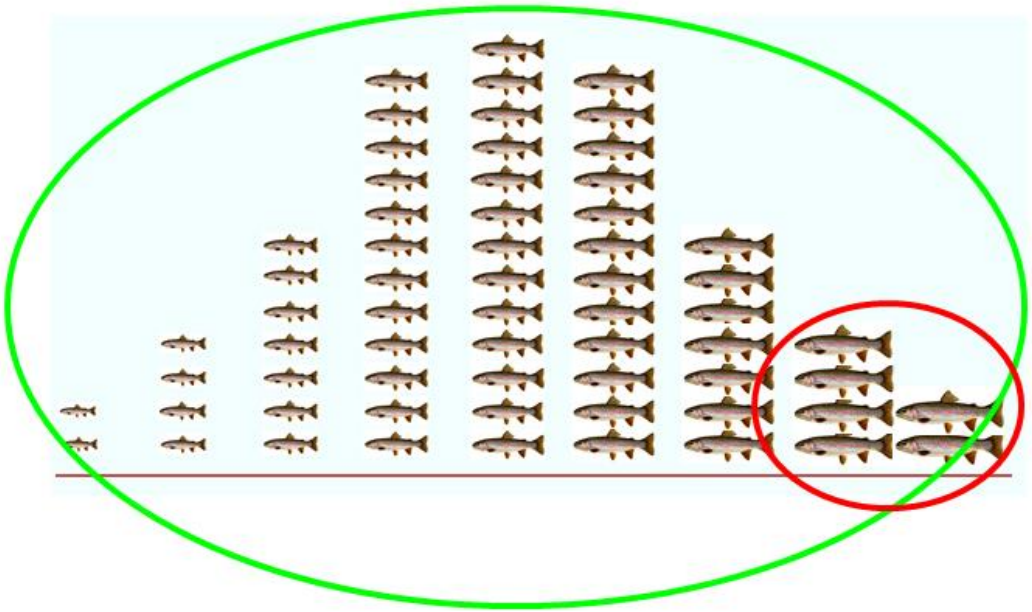
Product differentiation


Photo: Lerøy


Photo: ManuGro

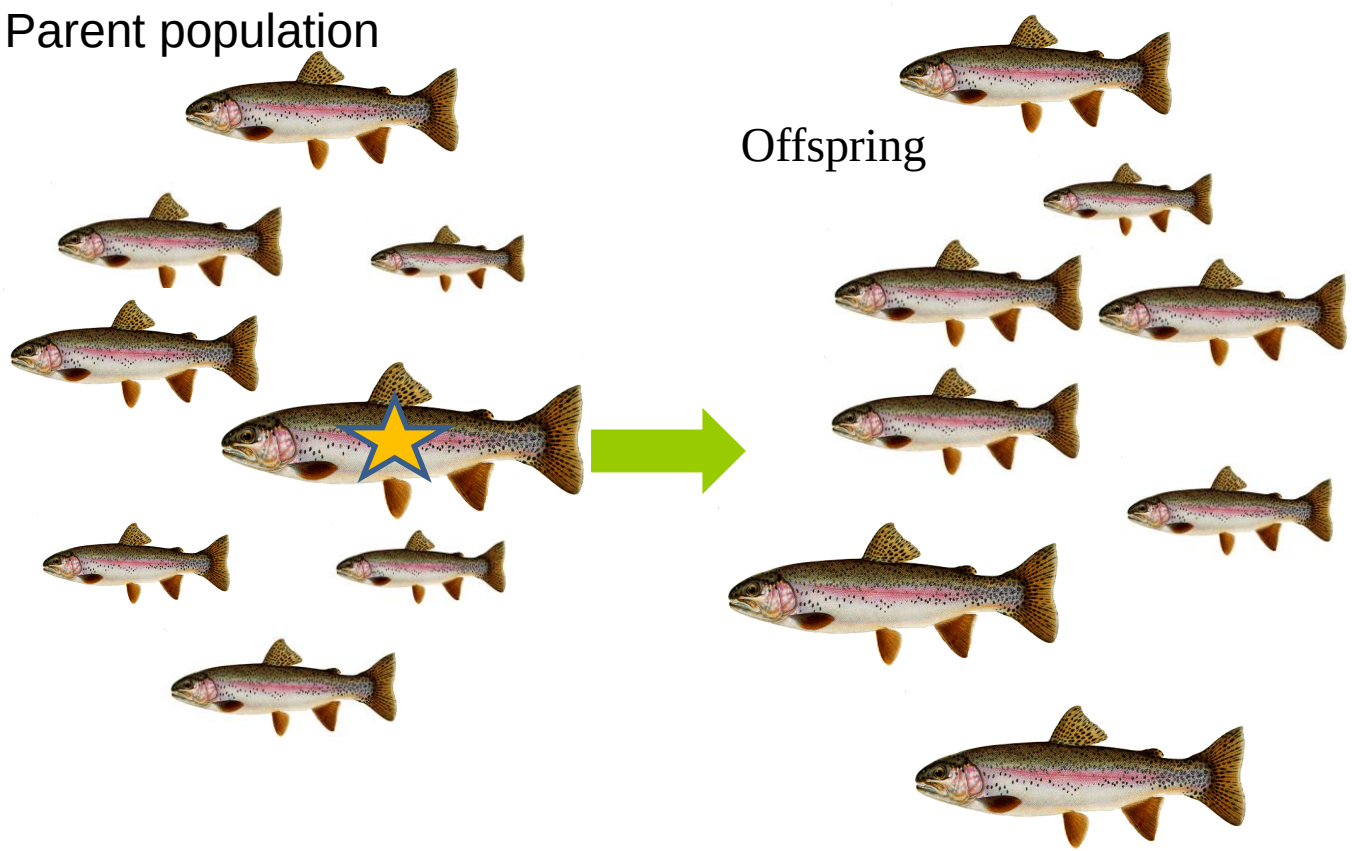
Trout reproduction and breeding

- Initial natural selection associated with domestication
  (reproduction, behaviour and robustness)
- **Phenotypic mass selection**



Trout reproduction and breeding

- **Phenotypic mass selection**



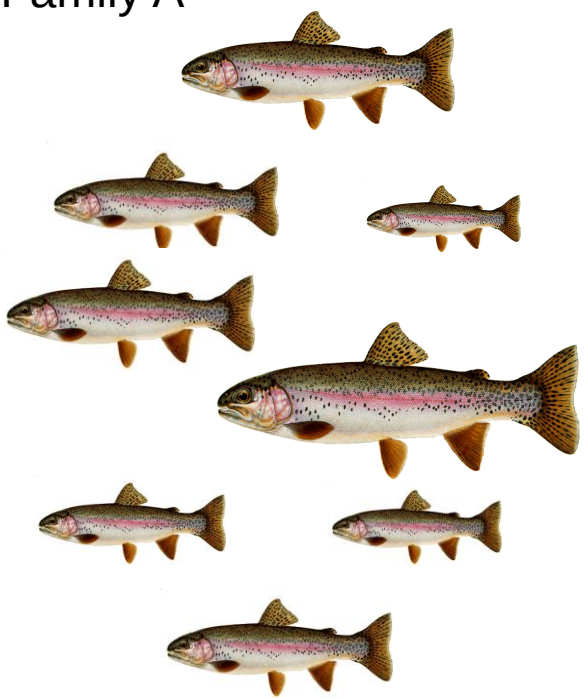
Advances in trout breeding

- **Family based selection (with individual tagging)**

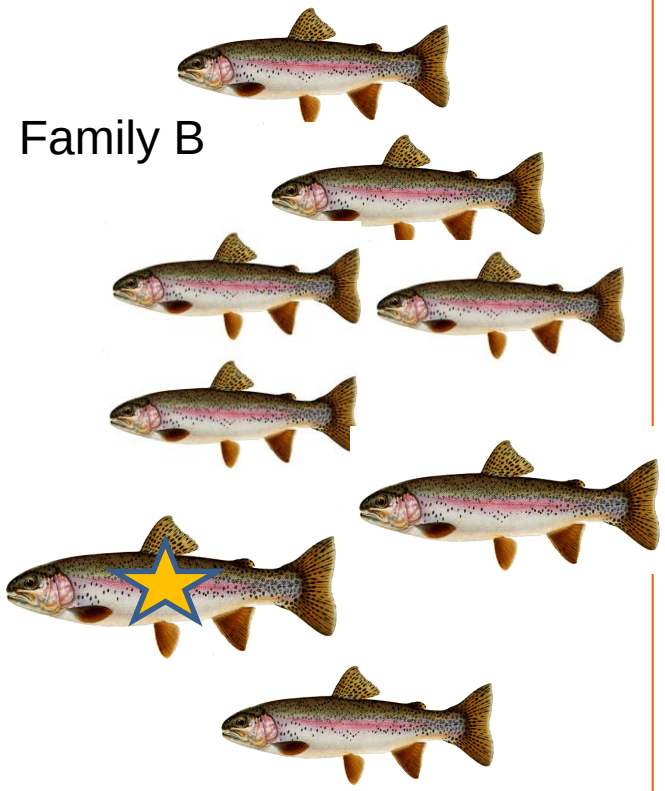
Advances in trout breeding

- **Family based selection**

Family A



Family B



Indirect family breeding
Saltwater tolerance

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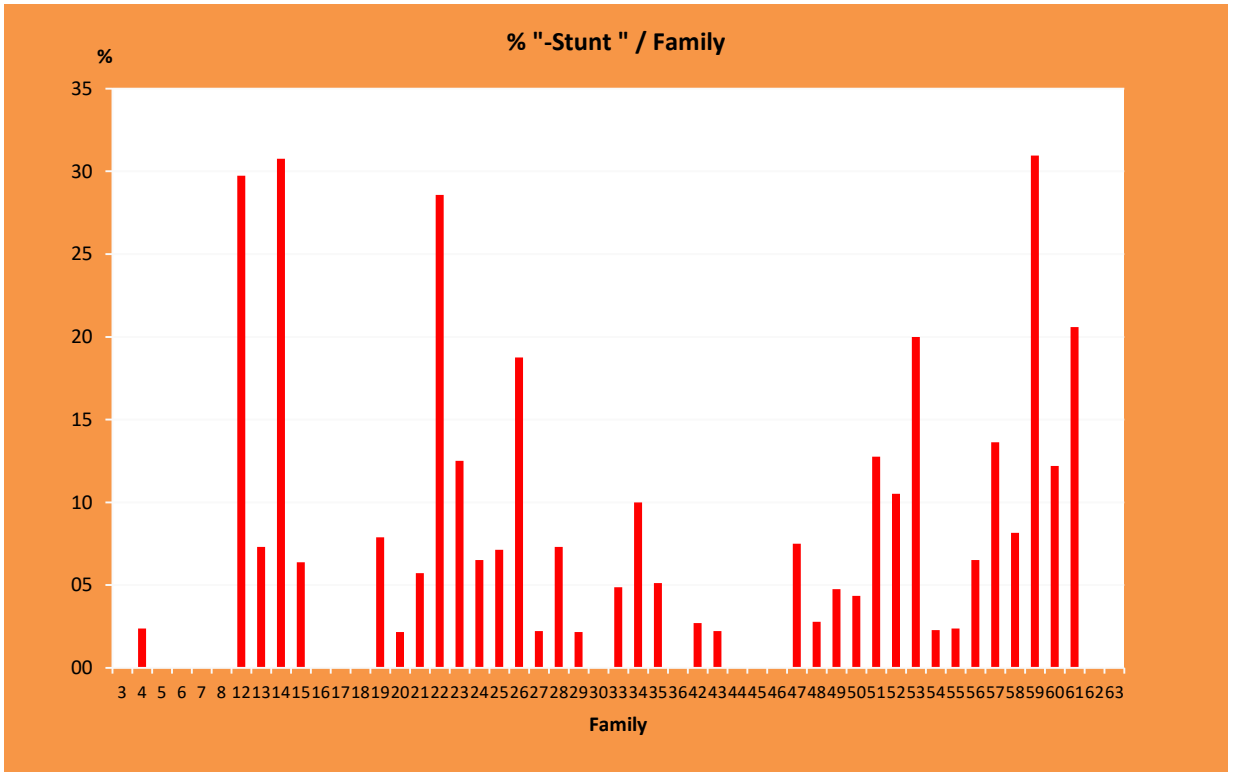
- Family based phenotypic mass selection with parallel saltwater evaluation.



Family breeding program with individual tagging

Reproduction:

50 – 200 families / generation

Separate families

Individual tagging of 50 – 500 candidates / family at 20 – 50 g

Ongrowing

Commercial or lab.-conditions?

<u>Phenotype testing</u>

Characterizing

FCR, SGR, disease resistance, pigmentation etc.

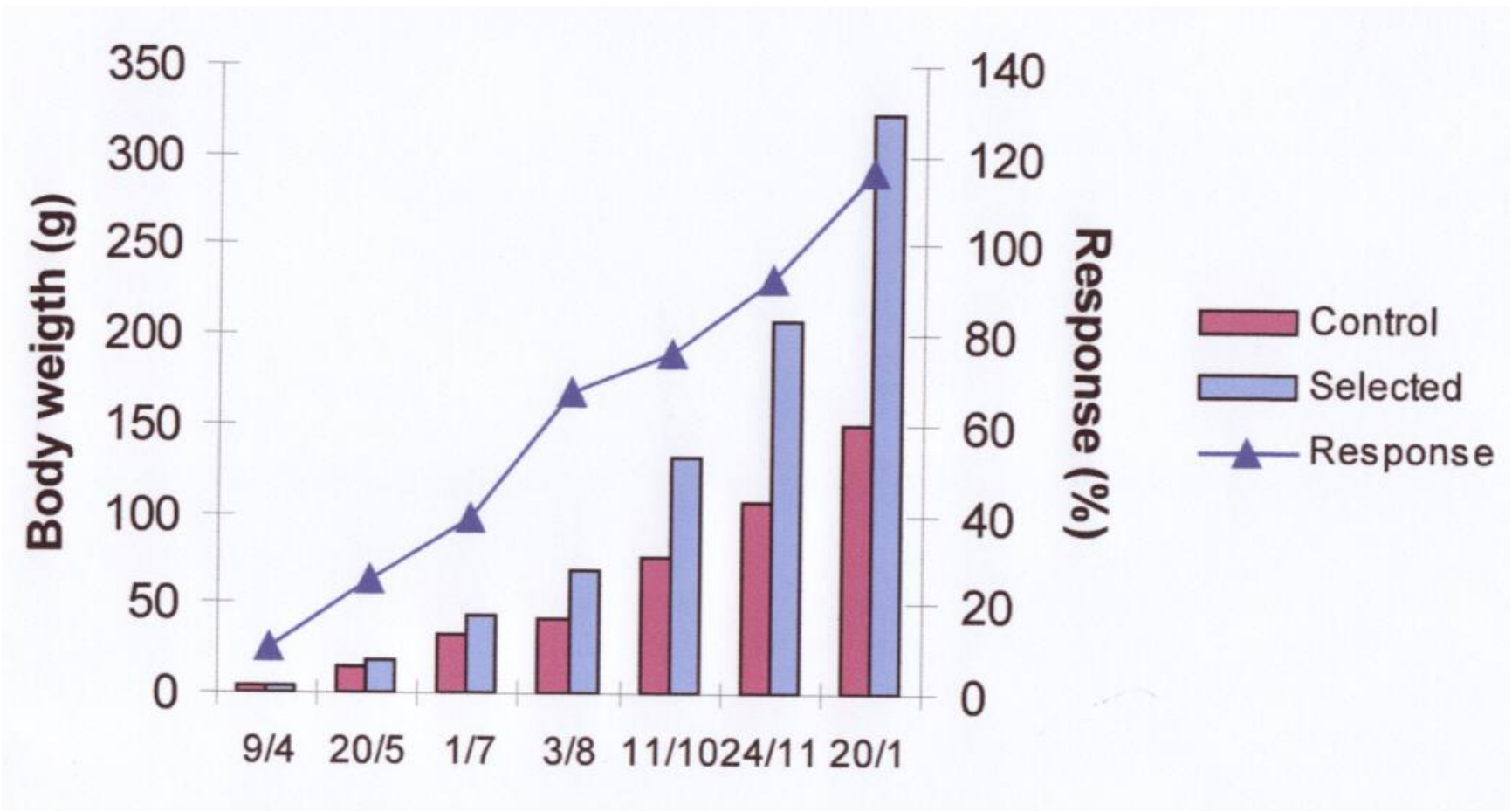
Parental assignment

Individual

indexing

Selection of 200 – 400 best candidates

Family breeding with DNA assisted parental assignment and inbreeding control (3 generations)



AquaGen Silver bright

- **Systematic breeding for growth in seawater for > 16 generations (since the 70'ties)**

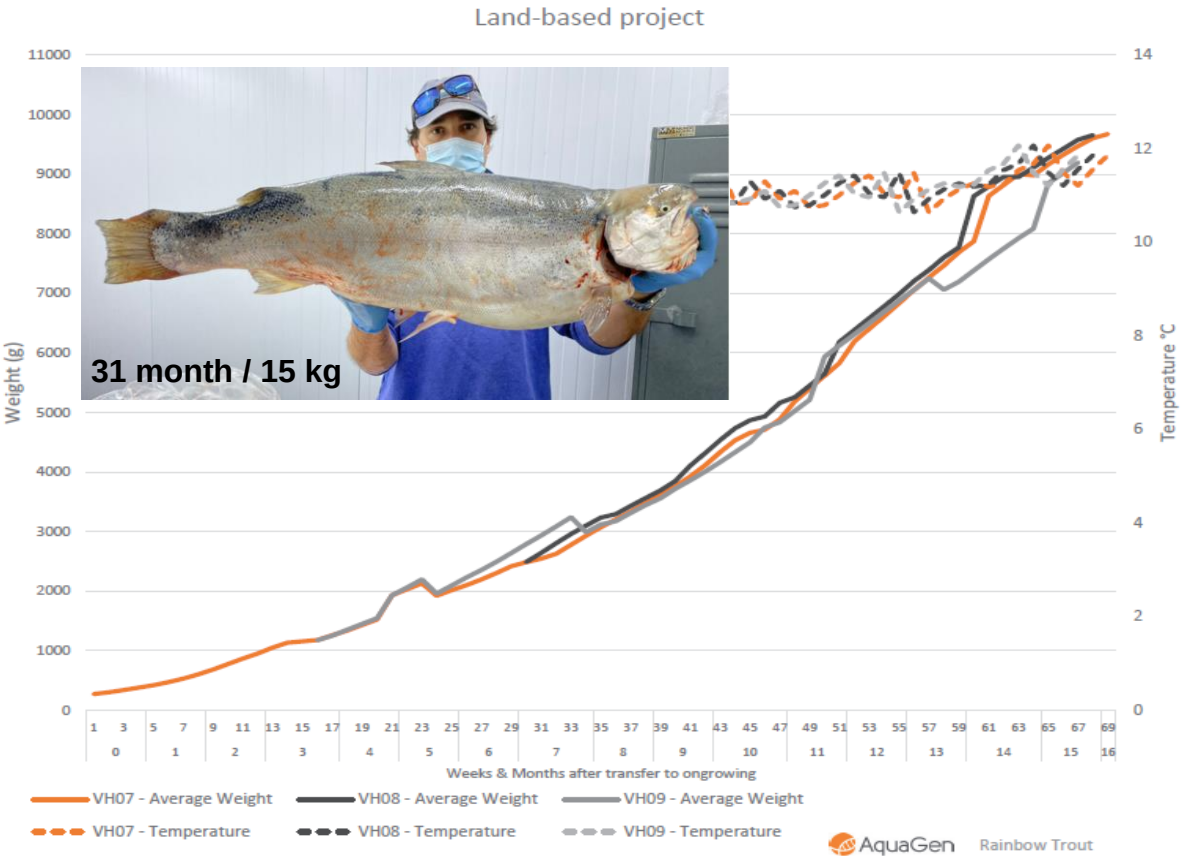
Family and / or QTL –selection for:

- **No second winter maturation**
- **RTFS- resistance**
- **IPN- resistance**
- **Pigment uptake**
- **Silvery skin**
- **Elongated body shape**
- **Saltwater adaptation**

AquaGen Silver bright

Ongrowing saltwater phase (RAS)

Project results: Ongrowing RAS - Growth



Three separate tanks, small variations, similar growth on two tanks, the third is not far behind

10M

270g-4,5kg

12M

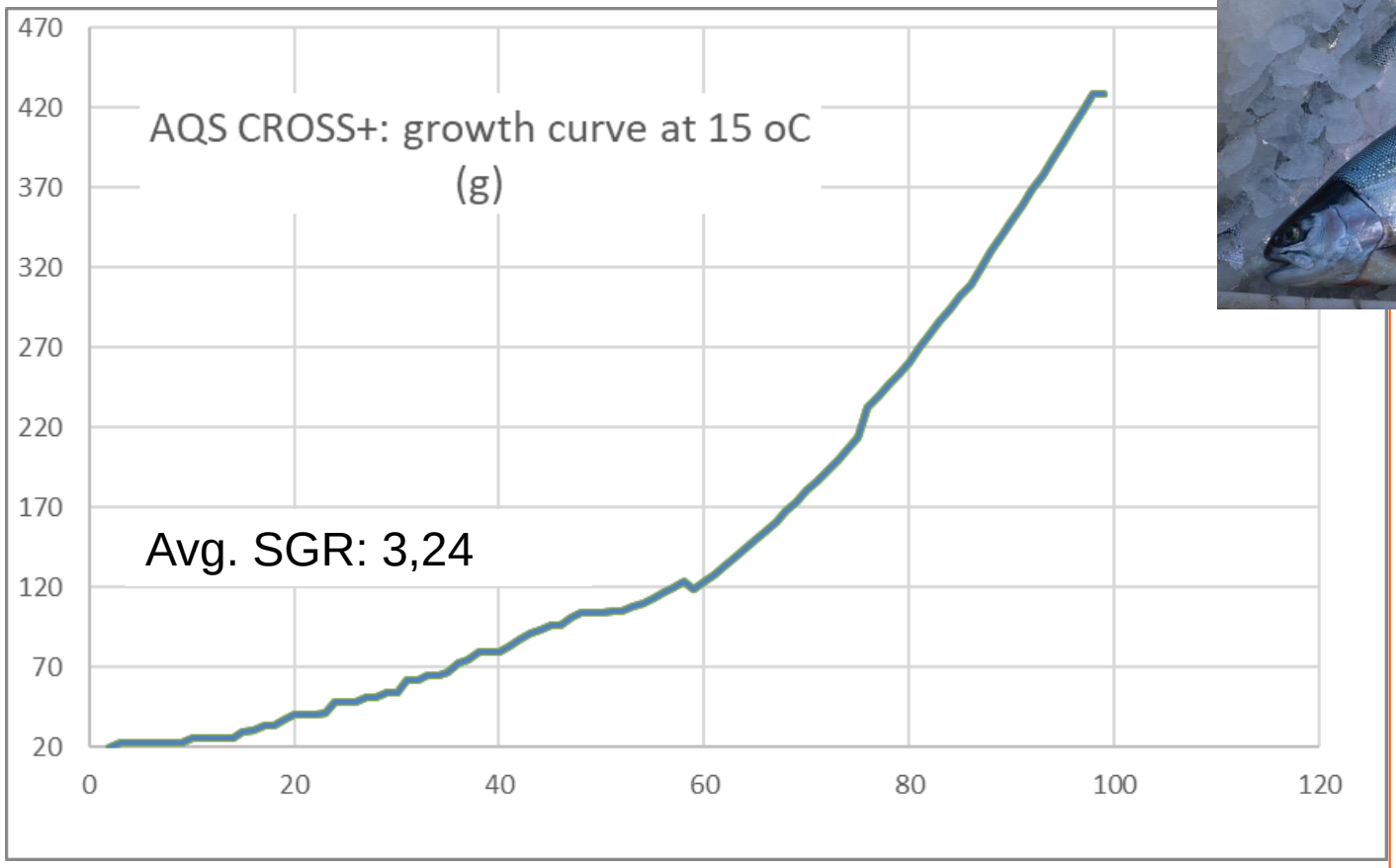
270g-6kg

14M

270g-8kg

AquaSearch CROSS+, saltwater growth performance example

20 g – 430 g in 100 days



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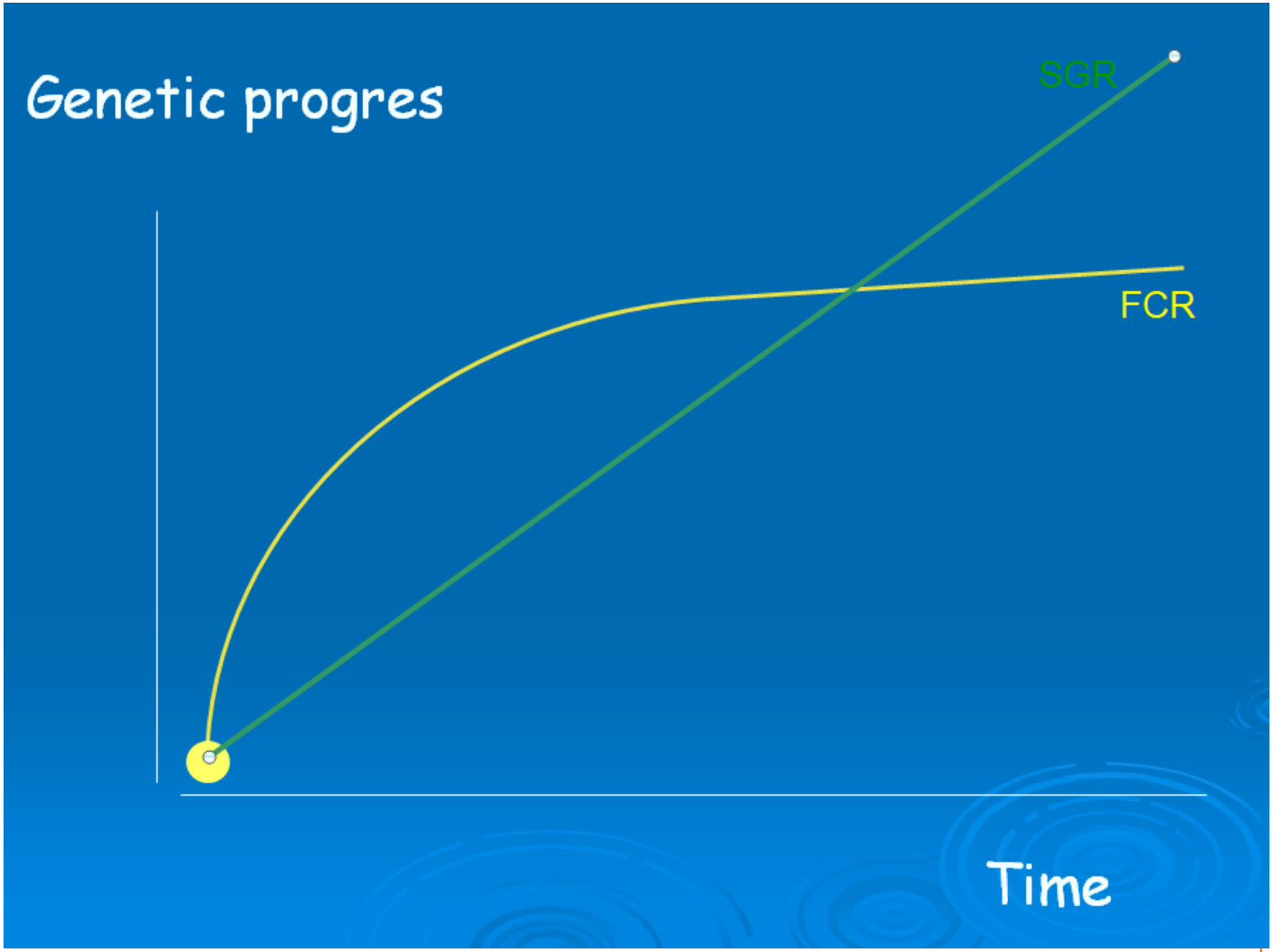
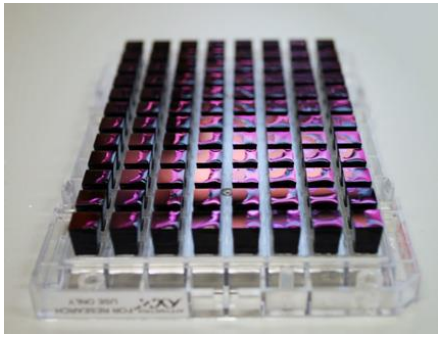


Advances in trout breeding

- **Marker assisted selection using QTL's** (quality trait loci)

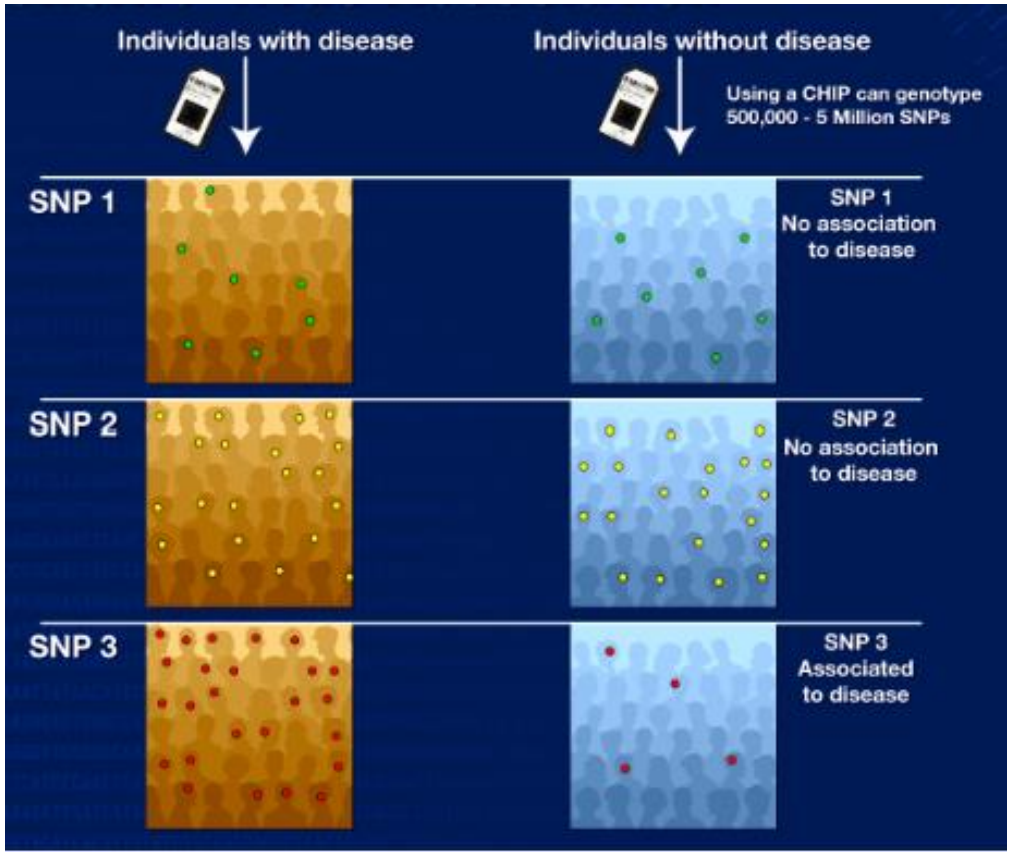
- Together with Affymetrix and CIGENE, AquaGen has developed a high-density genotyping tool (55.000 SNP-chip) for rainbow trout



- It has been used:
  - In work to improve the rainbow trout reference genome
  - To discover QTLs (genetic markers) for IPN-resistance
  - To discover genetic markers for Flavobacteriosis resistance
  - To discover QTLs (genetic markers) for vibriosis-resistance
  - To discover QTLs (genetic markers) for no 2nd winter maturation
  - To implement genomic selection for SRS resistance
- Several other traits are under investigation

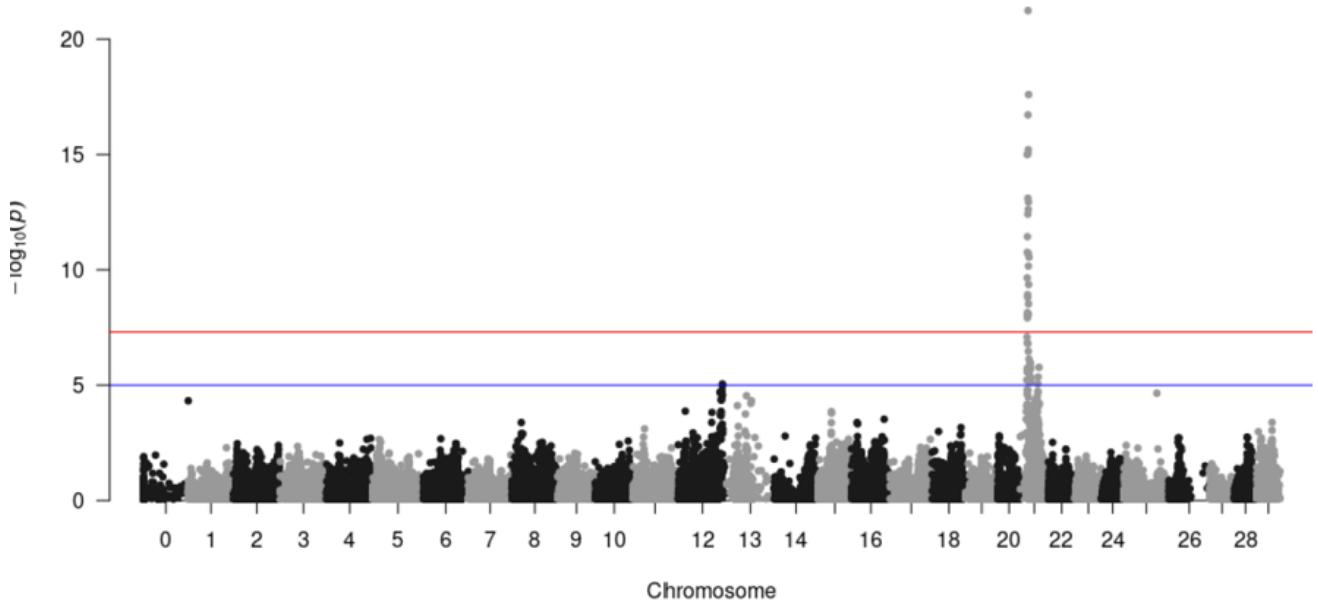
GWAS

Genome Wide Association Study



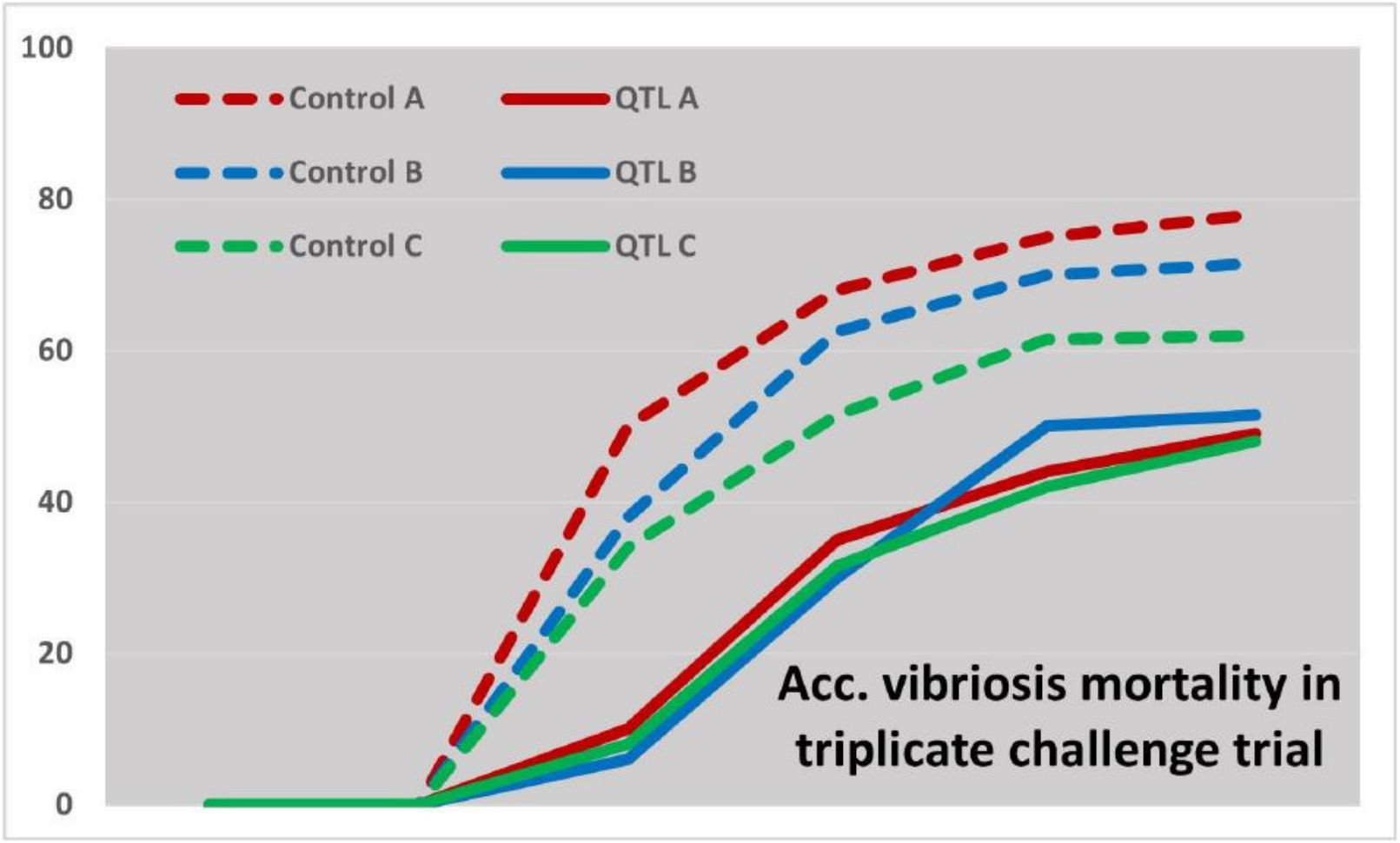
Advances in trout breeding

- **Marker assisted selection using QTL's**
  (Vibriosis resistance)



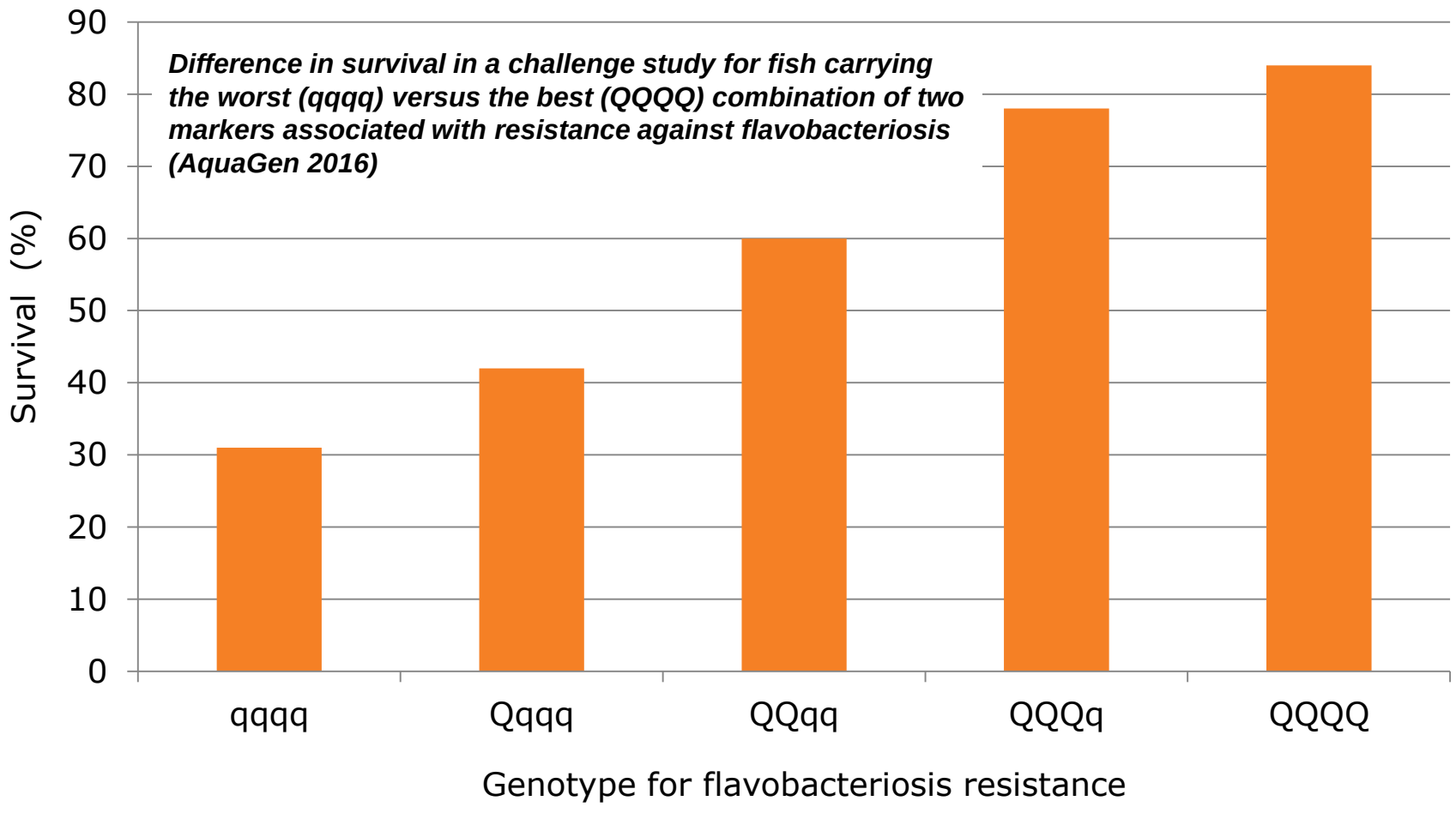
Laboratory validation

Vibrio-resistance



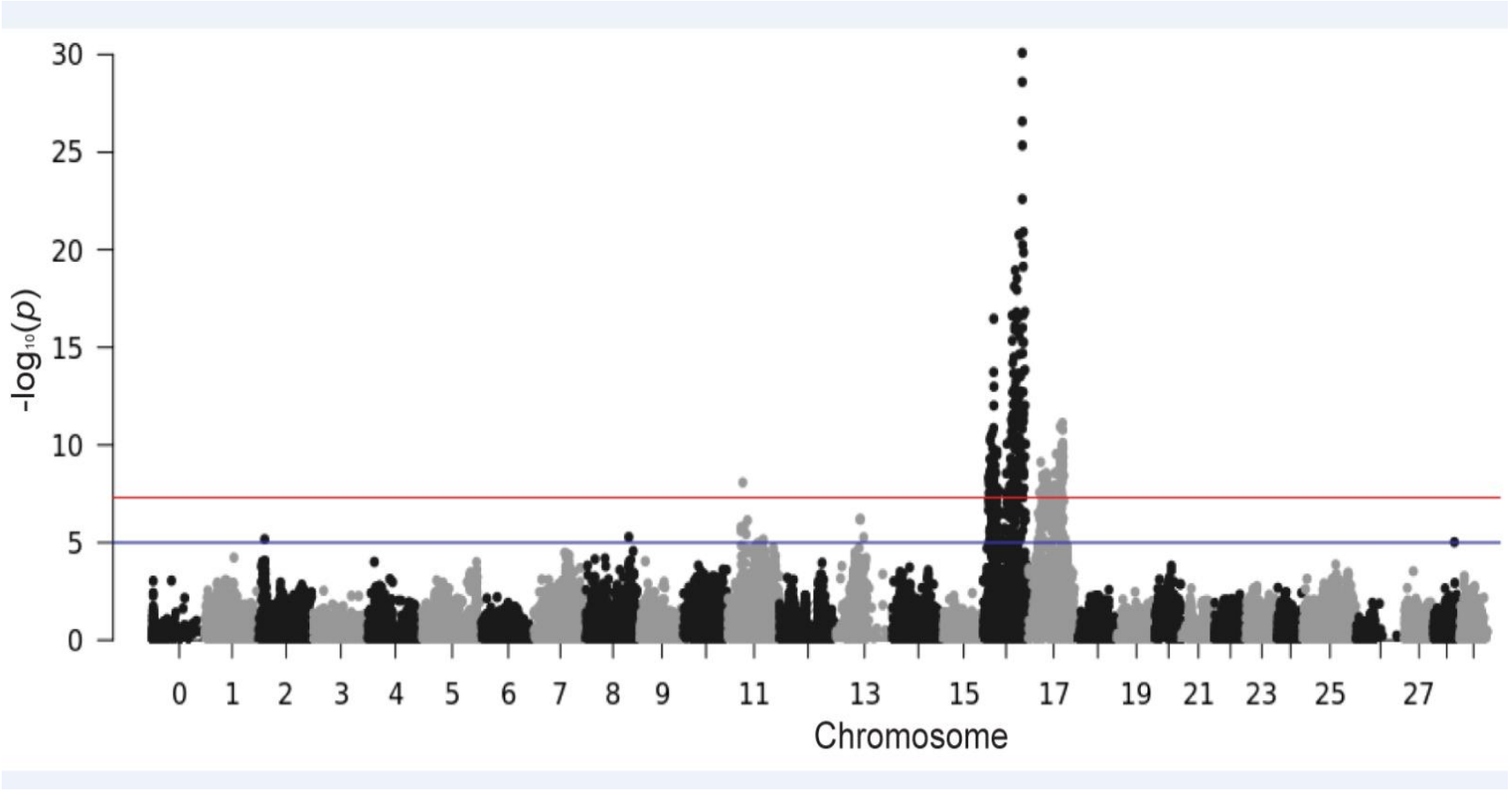
RTFS resistance genetic markers

The two first QTL's detected.



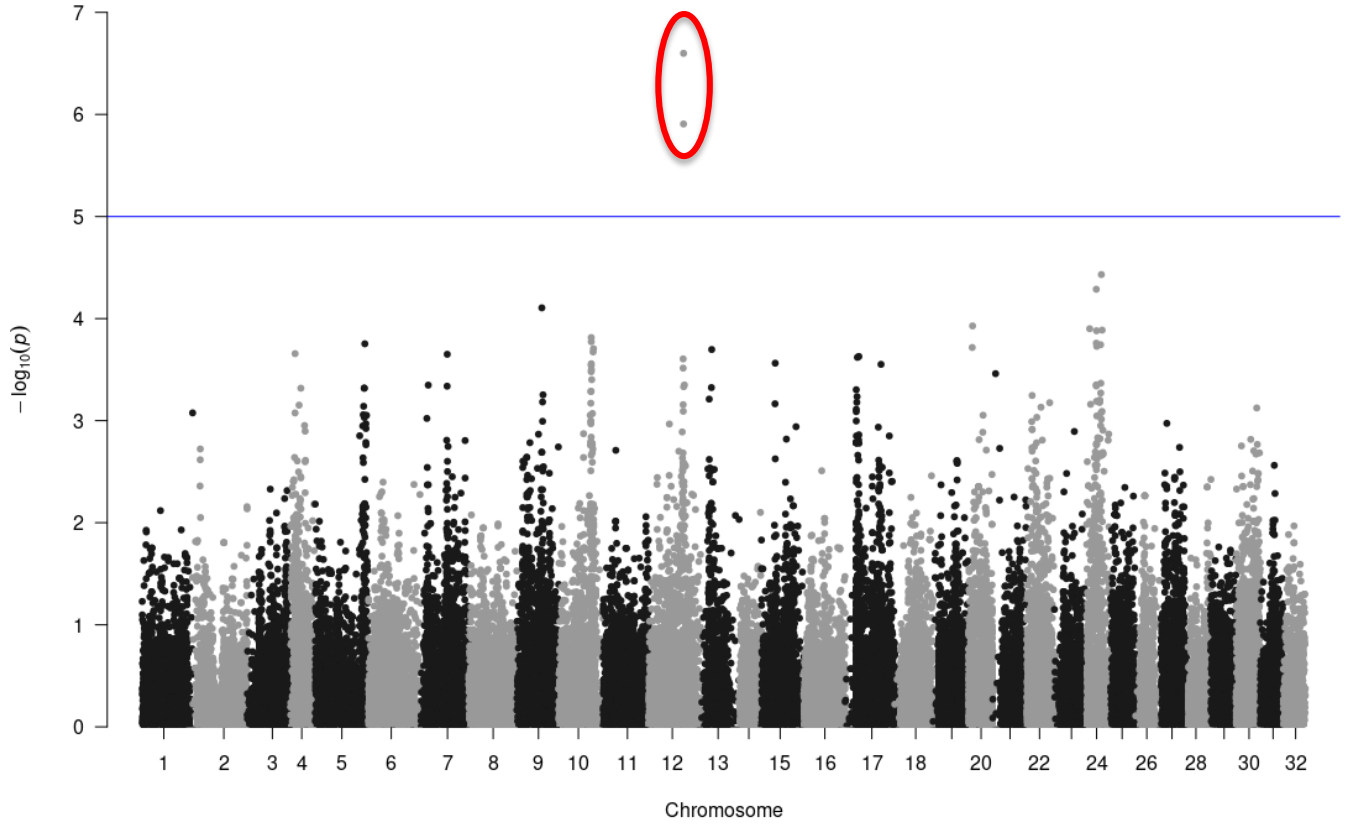
Marker Assisted Selection

Natural resistance against, White spot disease (Ich)



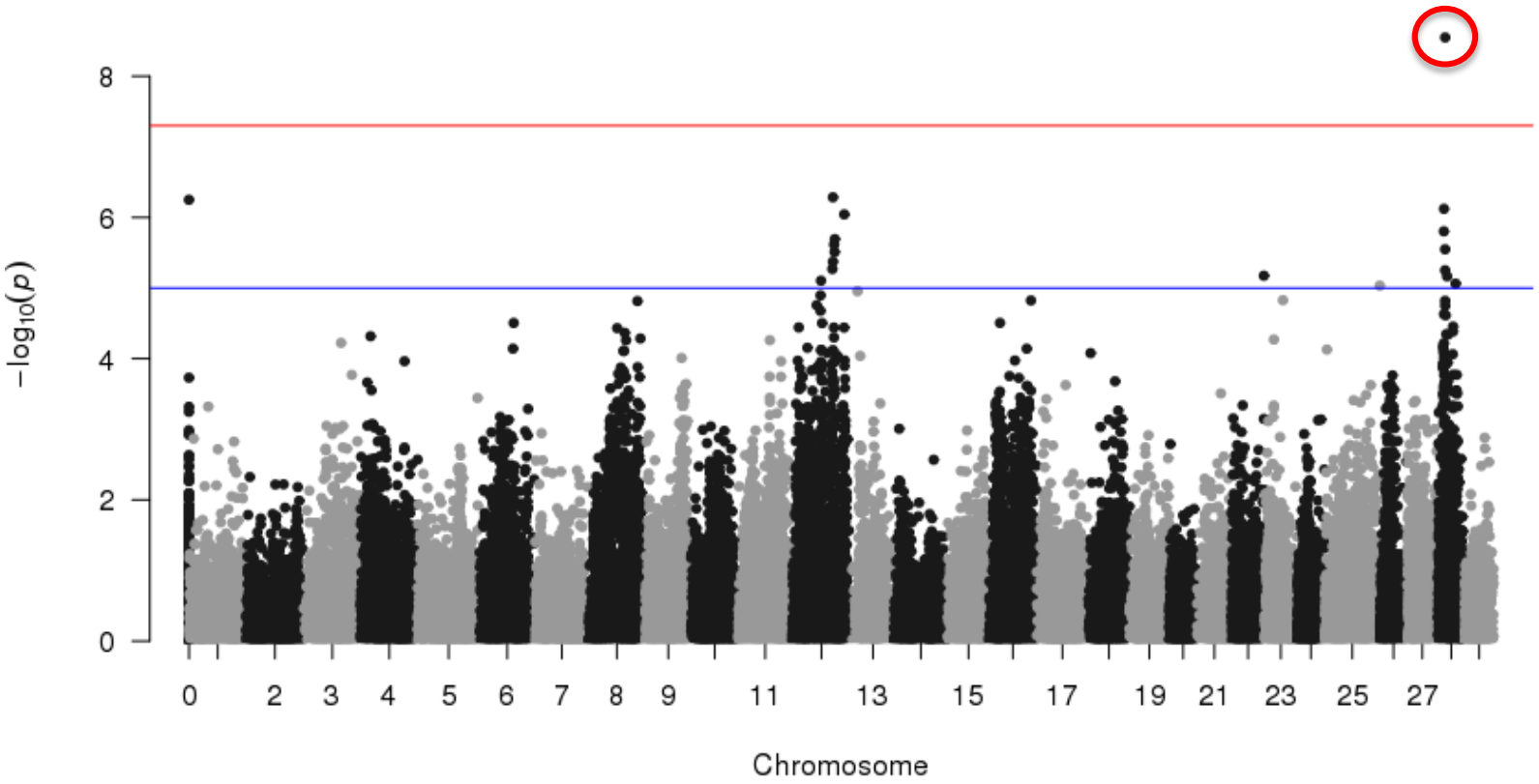
Marker Assisted Selection

Natural resistance against VHS



Marker Assisted Selection

No second winter maturation



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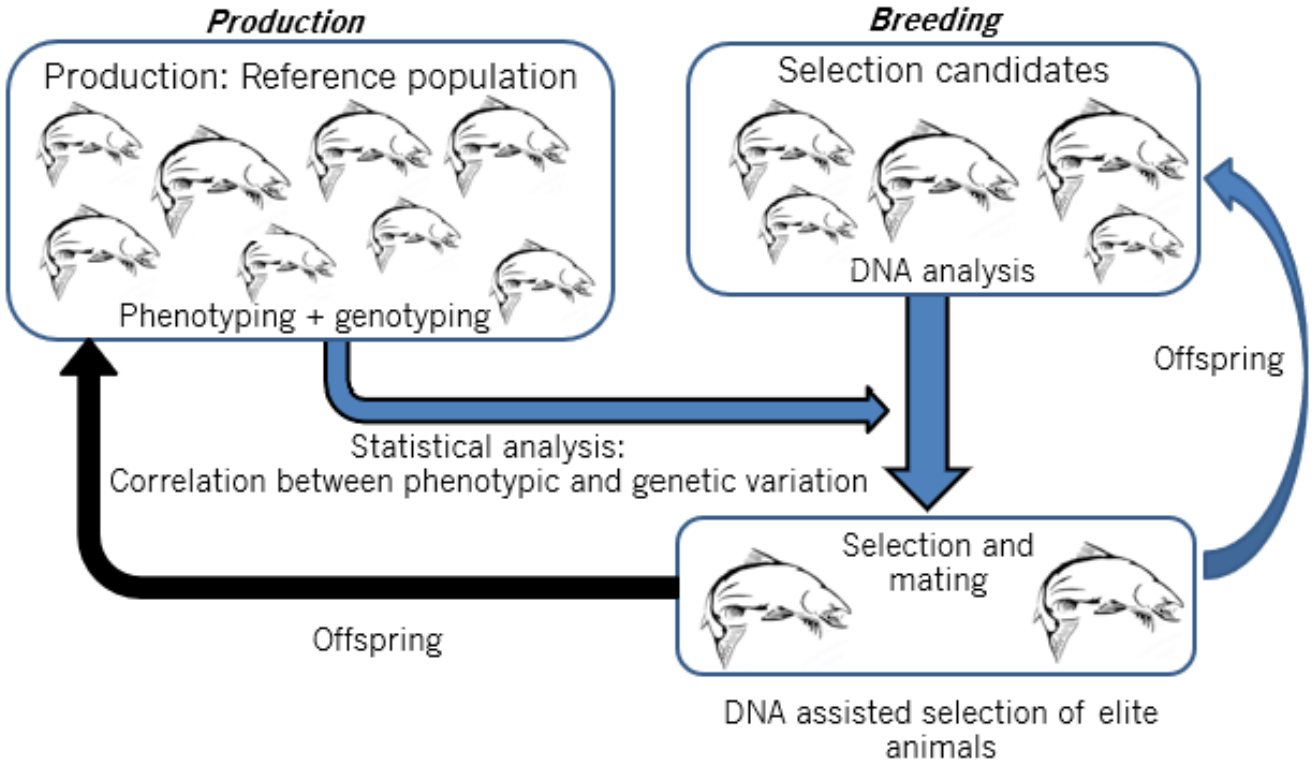
- **Genomic selection**



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