

# **FAMILY AND PLOIDY EFFECTS ON HATCHERY SURVIVAL, DEFORMITIES, AND PERFORMANCE IN ATLANTIC SALMON**



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## Genetic pollution by escapes

- Reduced fitness of wild population
- Reduced spawning (due to increased competition)
- Spread disease and parasite (ISA, BKD, IPN and Sea lice)

## Is Triploidy the solution?

- Tested in early 1990's to prevent maturation
- Abandoned in favour of photoperiod control
  
- Phenotypically similar, altered physiology?
  - Somatic growth- **less/equal/high**
  - Survival - **lower**
  - Deformity - **greater**
  - Flesh quality- **similar to diploid**
- Disease and stress resistance - **comparable**
- Environmental tolerance - **triploid less tolerant**



Food for thought: publicity over the Orkney fish breakout has raised the profile of ecological concerns.

## Stream of escaped farm fish raises fears for wild salmon

Natasha McDowell, London

The escape of an estimated 100,000 farmed salmon in the Orkney Islands, off the north coast of Scotland, has highlighted mounting concerns about the ecological impact of such incidents on natural salmon stocks.

A Scottish parliamentary committee is currently investigating the impact of fish farming. But the Scottish Executive, which has been responsible for fishing and the environment since its establishment in 1999,

parliament's committee on transport and the environment next month, will indicate where more research is needed to understand better the impact of escaped farm fish.

Although containment techniques for farm fish have improved, the number of escapees has not fallen because the industry is expanding, says Black. According to environmental groups, about a million salmon have escaped from farms in Scotland since 1998.

"So far, the government has done nothing

**Industry is now keen to investigate this avenue again**



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# SALMOTRIP:

## Feasibility study of triploid salmon production

FP6: EC Capacities Program (Jul 08 - Dec 10)

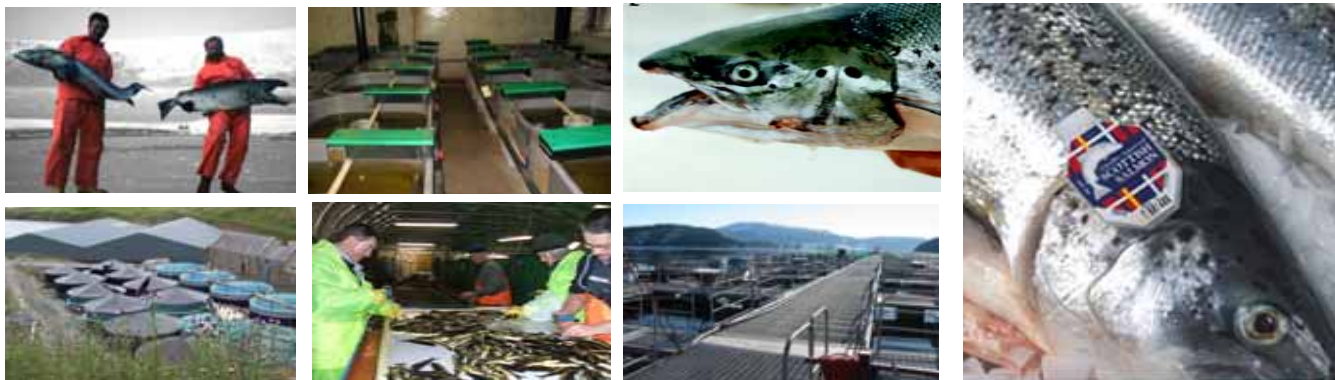
<http://www.salmotrip.stir.ac.uk>

### 5 Key areas of Research:

- Family-ploidy performance
- Culture sensitivity & deformity
- Out-of-season smolt production
- Commercial scale field trials
- Market Perception



Industrial partners in  
UK, Norway and  
France



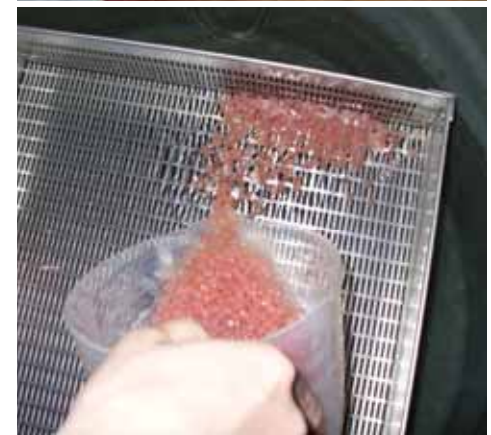


## 1) Experimental Trials

- 10 full-sib families (2 year Class) 10♂:10♀
- 1<sup>st</sup> week December 2007, 2008
- Pressure induction (2500eggs/ploidy/family)
  - 9500PSI 5mins 30mins PF @ 10°C
- Individual family rearing : Ploidy Discrete
- Incubation: temp control  $7.5 \pm 0.8$  °C
- Ongrowing: river water  $12 \pm 2.3$  °C
- 1<sup>st</sup> feeding: Constant light & 24 hour feed

## 2) Commercial Trial (2008 only)

- 45 (full & half-sib) families 15♂:45♀
- 500 eggs / family / ploidy
- Communal family rearing: Ploidy discrete
- Incubation / ongrowing: river supply  $10 \pm 4$  °C
- 1<sup>st</sup> feeding: Constant light & 24 hour feed



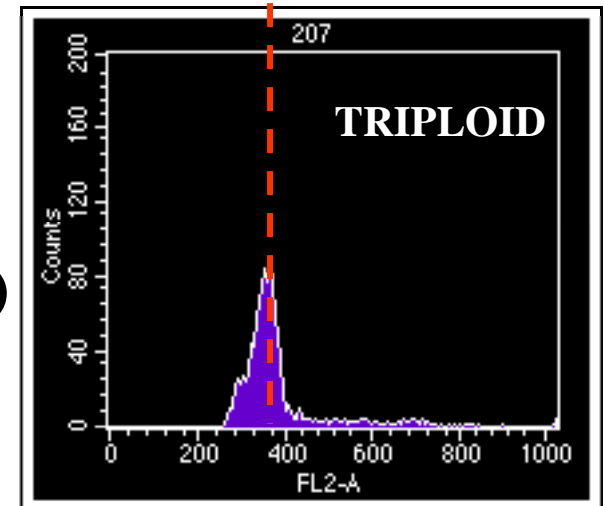
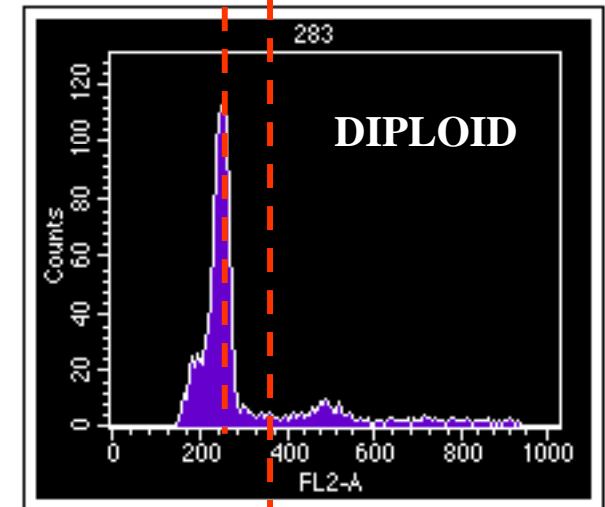


## Sampling Procedure

- **Oocyte diameter** (no correlation to fertilisation)
- **Daily egg picking / mortalities ~ survival**
- **Daily counting / classification deformity from hatch**
- **1-2 weeks Wt-L measurement (n=20-50)**

## Ploidy Verification

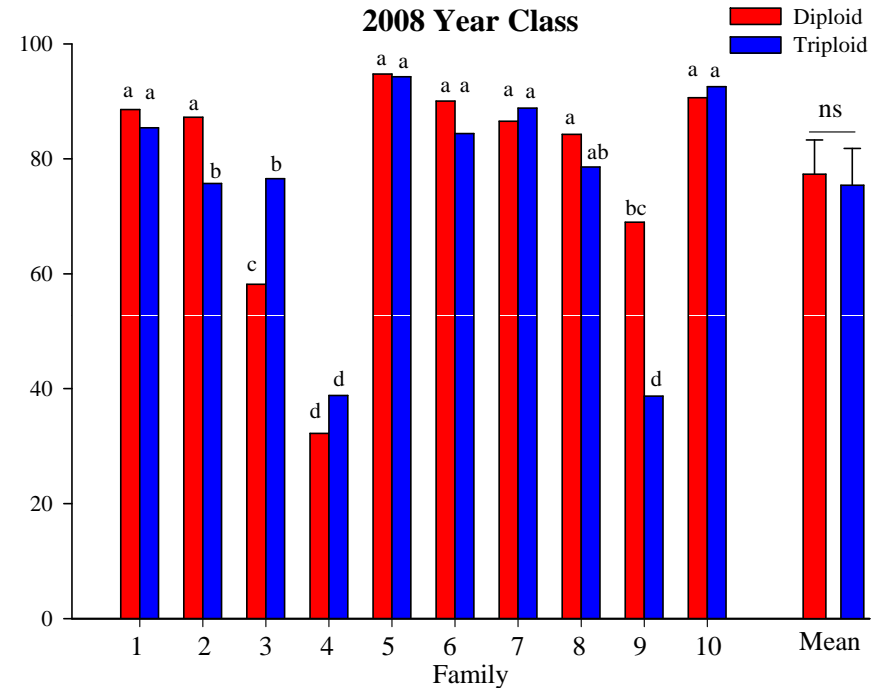
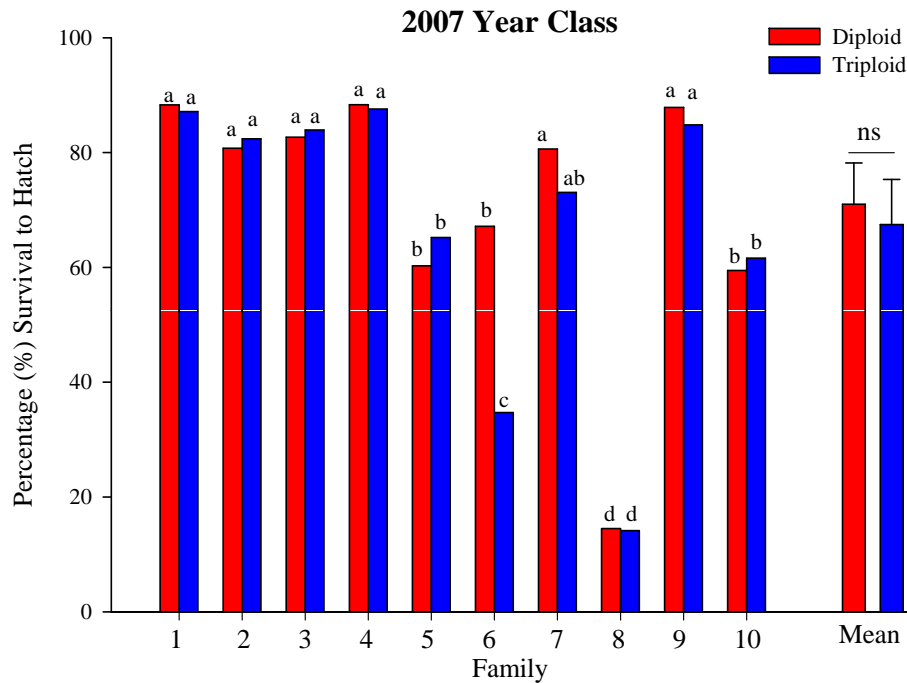
- **Flow cytometry & blood smears (n=100-200)**
- **100% triploid rate**







# Survival to Hatch

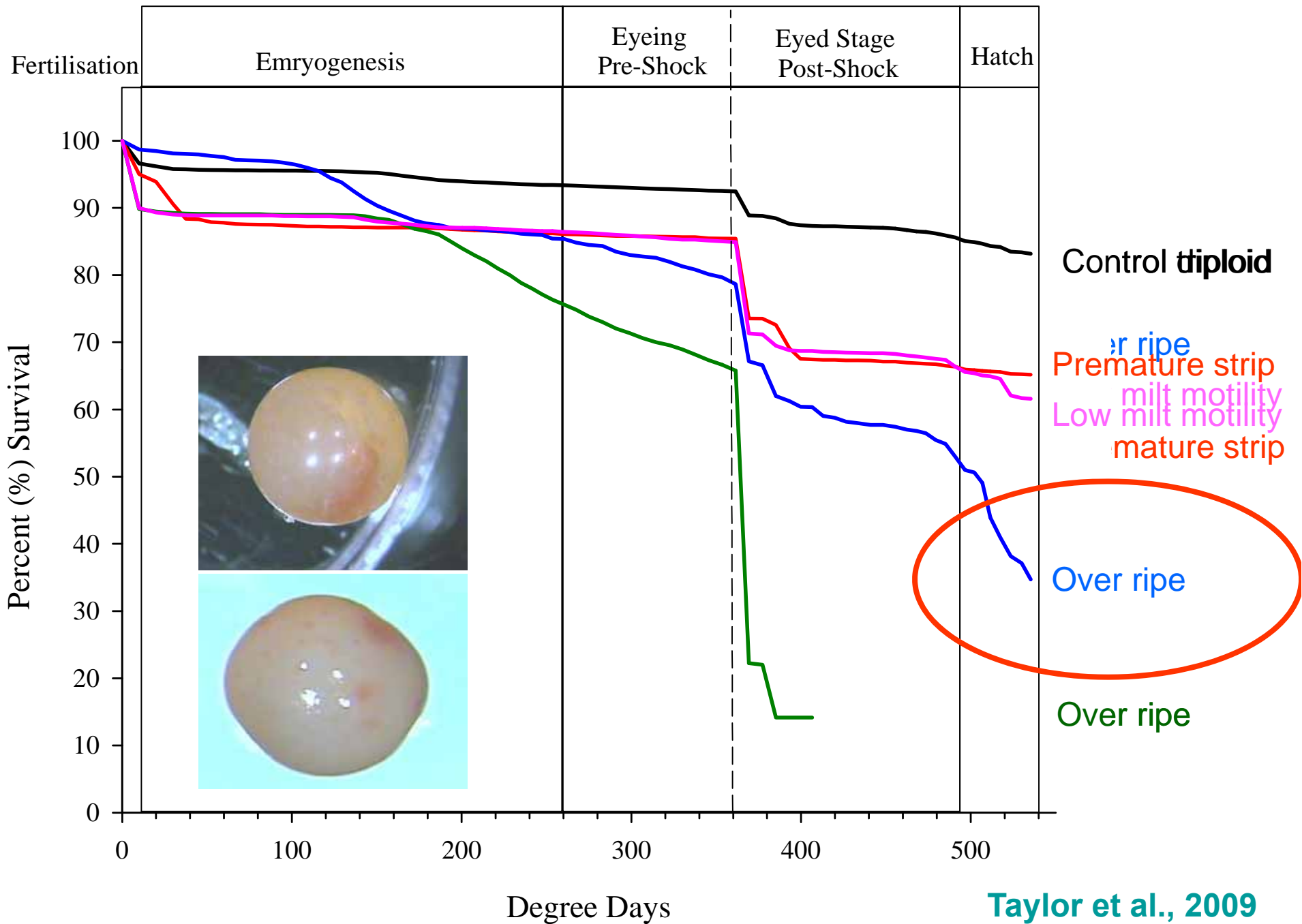


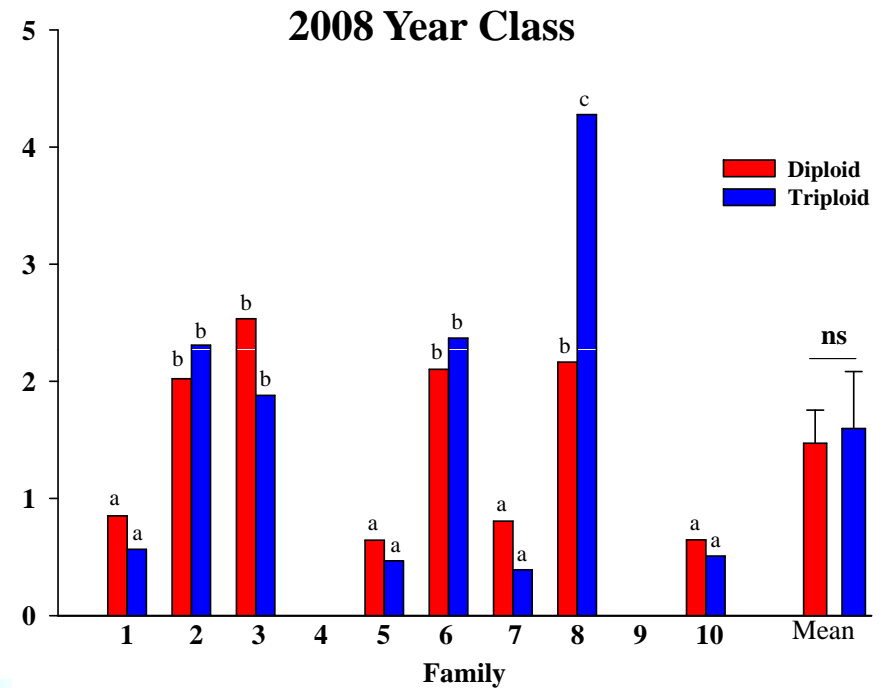
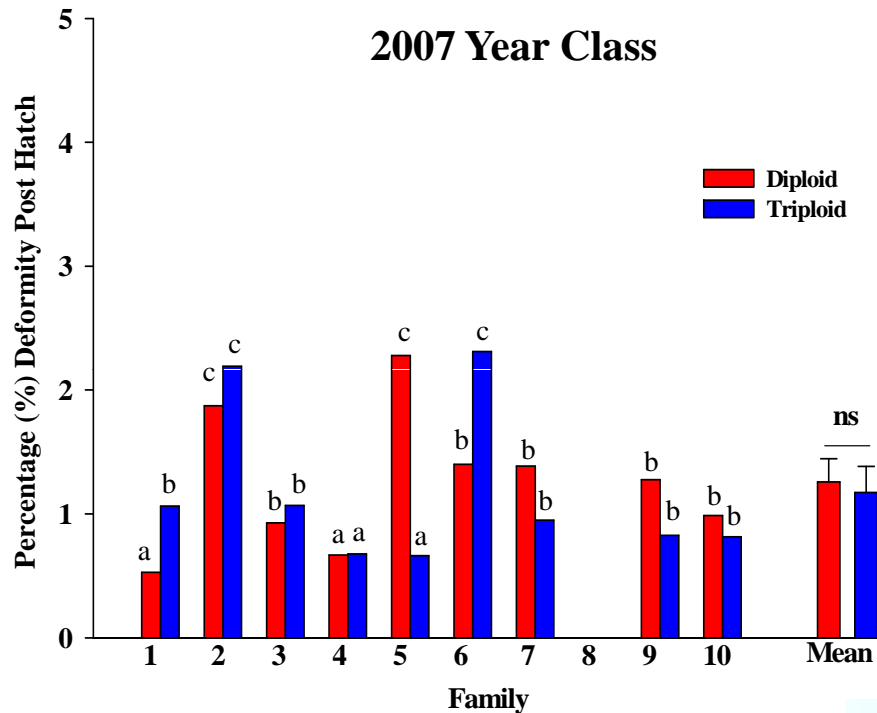
- No overall ploidy effect on survival
- Significant family effect on survival
- Correlation between gamete quality and survival

Taylor et al., 2009



# Triploid



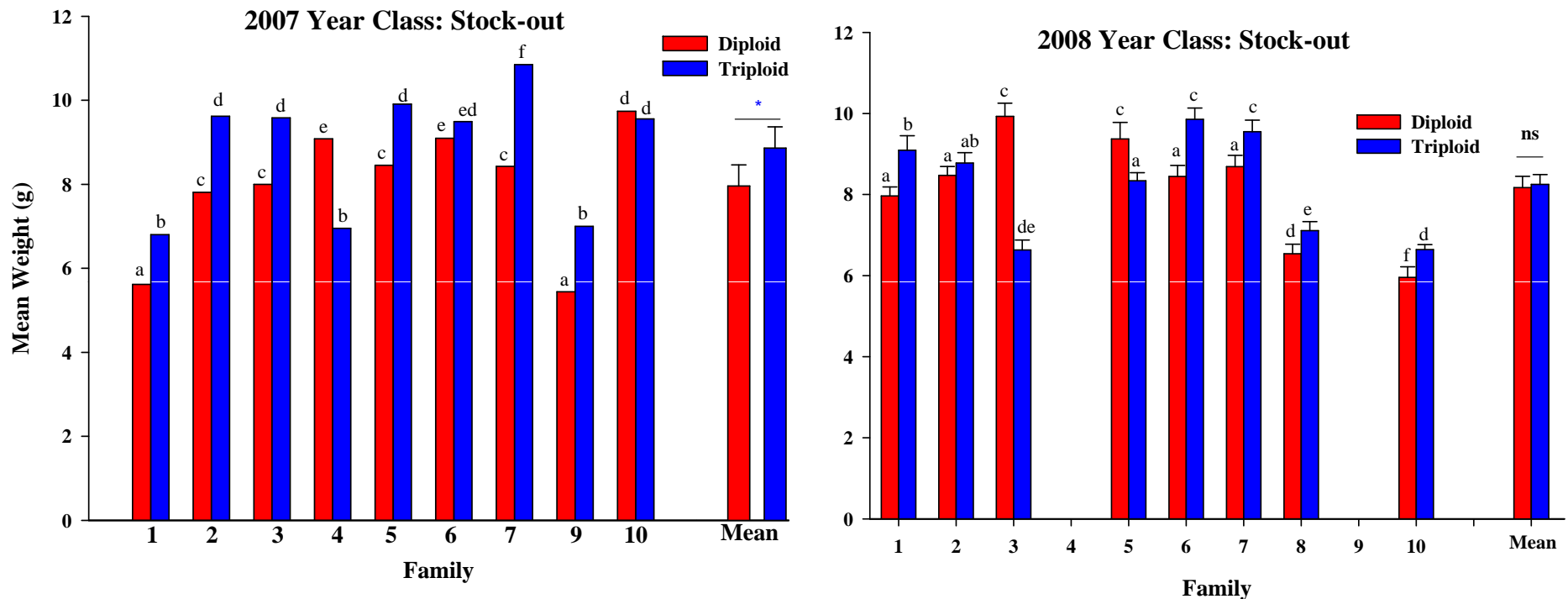


- No ploidy effect
- Significant family effect





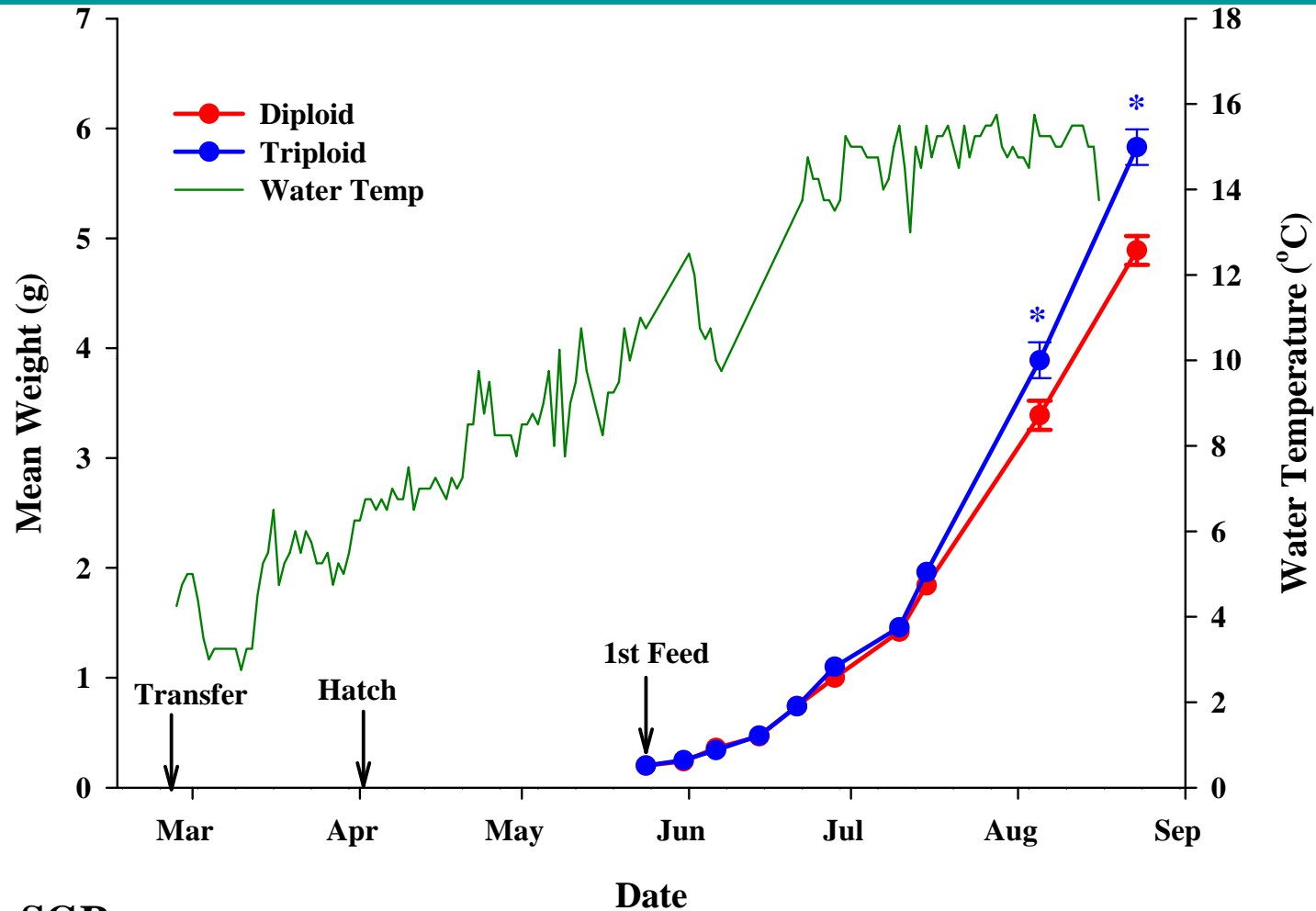
# Post-Hatch Growth



- Triploids significant smaller at hatch/first feeding
- Triploids higher SGR: comparable or higher weight at stocking
- Comparable mortality 2%
- Comparable deformity 4%
- Significant family effect on size at hatch and growth



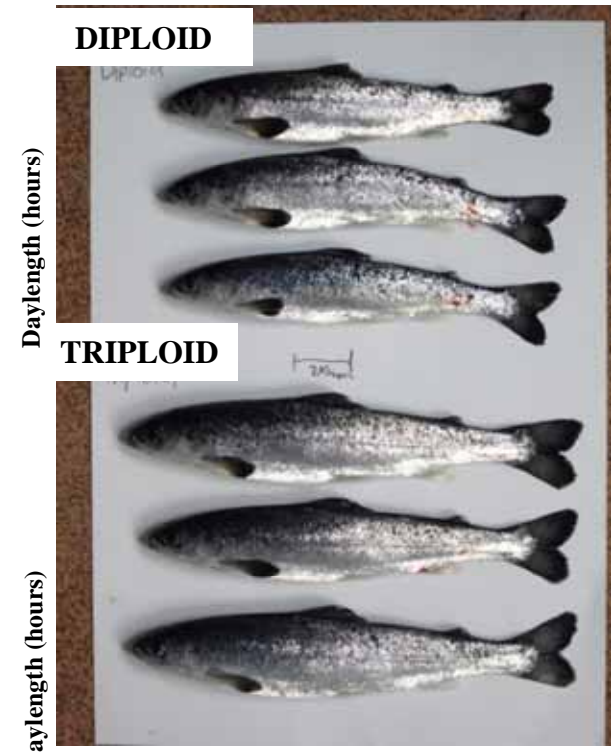
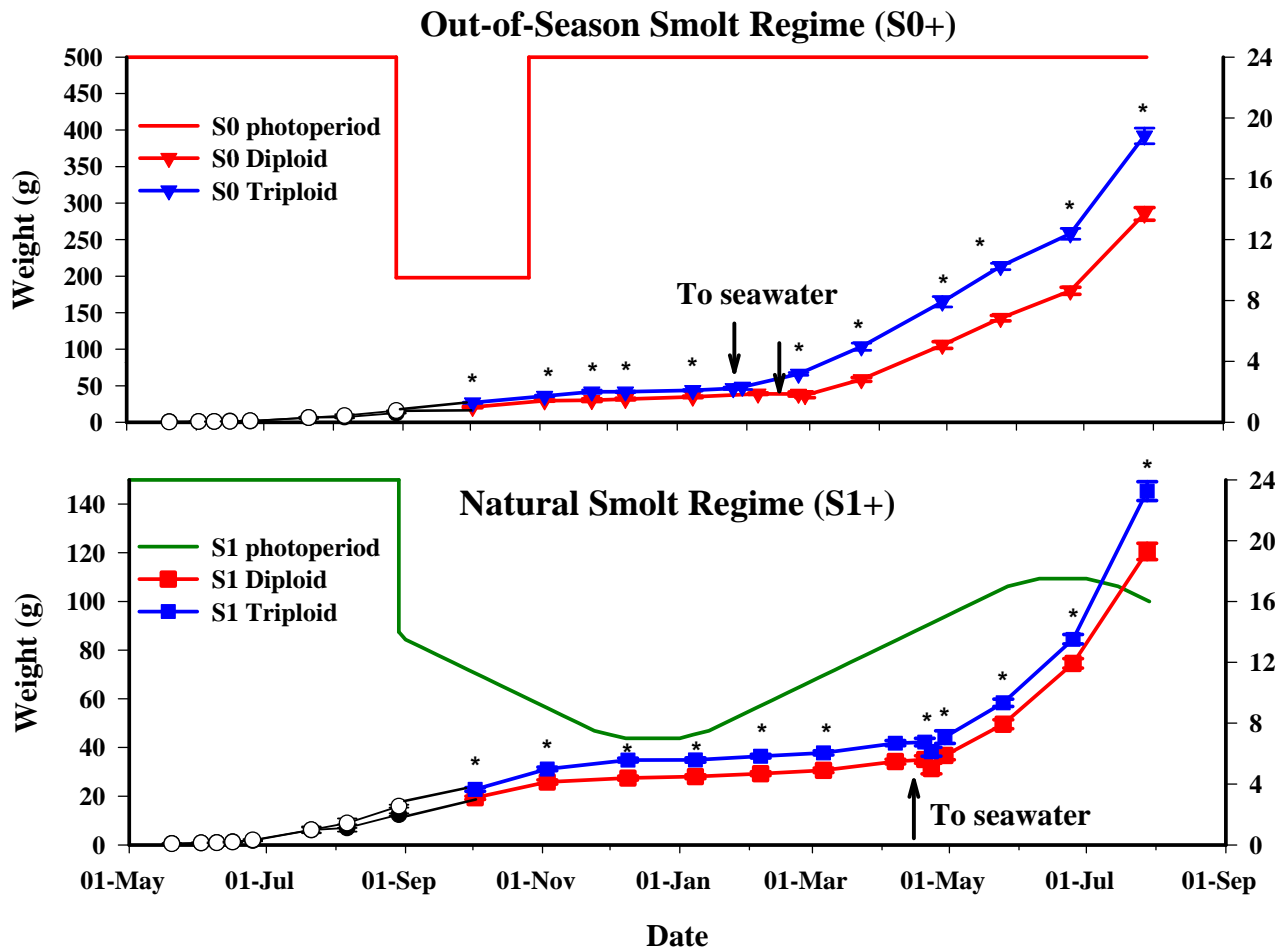
# Commercial Trial



- Higher SGR
- Lower deformity 50 vs 75%: Opercular shortening; environment vs. genetic?



# Post-Hatchery Growth



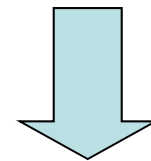
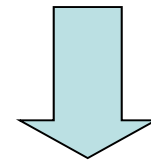
- Triploids higher SGR
- Significant family effect
- Survival 98-99%
- Deformity <4%

Taylor et al., 2009



# Conclusions

- **Triploids:**
- **Comparable survival**
- **Lower hatch weight**
- **Higher SGR during hatchery rearing**
- **Comparable deformity prevalence**
- **Strong family component**
- **Optimal gamete quality essential**
- **Differential gene expression**
  - **Life stage specific**



- **Future of triploid salmon looks promising**
- **Will be essential to monitor long-term performance**



# Future Directions

- **Future work to focus on:**
  - Family selection programs
  - Nutritional aspects
  - Immune function
  - Physiology & Endocrine function
  - Molecular mechanisms
- **SALMOTRIP**
  - Many components examined
  - Knowledge transfer to industry
  - Protect wild fisheries





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# Acknowledgements

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