

**The FINE FISH project:**  
**Improving sustainability  
of European fish aquaculture  
by control of malformations  
(2005-09)**

**Coordinator: Mr. Courtney Hough, Federation  
of European Aquaculture Producers (FEAP)**



## **FINE FISH**

- EU funded under 6th Framework program
- Initiated following identification of research priorities for the hatchery sector at the PROFET workshop in Bordeaux, France in January 2004
- Control of malformations was named by the workshop participants as one of the top three priorities for research within the European hatchery sector

- Malformations is a welfare concern
- The economic losses are severe
  - Juveniles must be discarded
  - Market-size fish get lower prices or cannot be sold
- Malformations show a constant presence in modern aquaculture, although levels of incidence may vary
- There are concerns about market reactions



- FINE FISH will use information across species to provide information on how to prevent malformations
- Three key areas of research
  - Rearing temperatures
  - Nutritional quality
  - Abiotic factors of tank environment, e.g.  $O_2/CO_2$ , water velocity/current strength
- Five species
  - Atlantic salmon, rainbow trout, cod, sea bass, sea bream
- Aims at providing guidelines on how to produce normal fish for each of the species

## FINE FISH partners:

FEAP	
Profunda	NO
Ferme Marine de Douhet	FR
AquaSearch ova	DK
Tinamenor	ES
Bolaks	NO
Viviers de France	FR
Brow Well Fisheries	GB
Andromeda	GR
Panittica Pugliese	IT
Pepite	BE
Royal Veterinary College	GB
UMR NuAGe (INRA)	FR
CCMAR	PT
NCM	IL
HCMR	GR
IFREMER	FR
University of Patras	GR
AKVAFORSK	NO



FINE FISH

is a collective research project



Collective research projects :

- Solving problems for an industrial sector
- Focus on applied research
- Requires extensive interaction between science and industry
- Requires extensive efforts by the industry:  
Half of the funding comes from industry activities

## Rearing temperatures and malformations - state of knowledge

	Eggs	First feeding	Juvenile rearing	Ongrowing
A.salmon	<8°C /FF	<12°C /FF	12-14°C ?/FF	?
Rainbow trout	10°C (8-12) /FF	?	?	?
Cod	4-6?	6 →12 /FF	?	?
Sea bass/bream	FF	FF	?	?

**FF: Ongoing experimental activities in FINE FISH**

## The European aquaculture industry is diverse

- Malformations is a common problem in all productions
- Further development of the industry requires a higher level of predictability and precision
- There is still much to be learned about the fish and their biological potential and limits

# Malformations - deformities

- According to the medical dictionary
  - **Malformations** happen early, i.e. during embryonic and early juvenile development, as the structures are formed
  - **Deformities** are changes that happen to a structure that is already there
- In practical life
  - **Malformations** are used in the south
  - **Deformities** are used by the English-speaking countries
- Here and now?
  - A complete mix

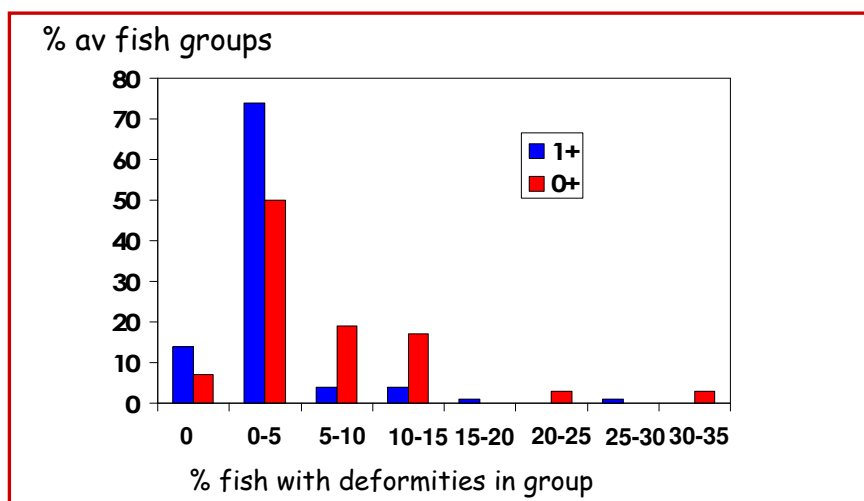
## History of A. salmon deformities in Norway - Research

- First project on effects of P deficiency 1993-1994
  - Motivated by nutritional considerations
- Observations of "shorttails" in commercial production 1994-1995
  - "Blame game" between egg producers, feed companies etc etc, still not over...
- Several epidemiological studies
- Experiments on egg production 1996-1999 (temperature etc.)
- Experiments on environmental conditions for juveniles 2000 -> now
- Studies on normal development
- Studies on potential molecular markers and disease mechanisms

## History of *A. salmon* deformities in Norway - results in the industry

- Difficult to get good numbers – the data kept within companies
- No public requirements for information
- Late 1990's: Emerging problem
- By 2000, some of the more acute problems were gone, in particular the ugliest fish weren't there anymore
- 2001-05: Problems in all companies, but some worse than others.

### *Prevalence of deformities* *Field data, commercial farms, mid-Norway 2003*



**1+:** 3,2% of fish with recorded deformities at 1,5-2 kg  
88% of groups had <5% fish with deformities

**0+:** 6,5% of fish with recorded deformities at 1,5-2 kg  
57% of groups had <5% fish with deformities

## History of A. salmon deformities in Norway - results in the industry

- Difficult to get good numbers – the data kept within companies
- No public requirements for information
- Late 1990's: Emerging problem
- By 2000, some of the more acute problems were gone, in particular the ugliest fish weren't there anymore
- 2001-05: Problems in all companies, but some worse than others.
- 2005-08: The situation has cooled down. Some companies have very good biological results, but some still struggle to get rid of the problem
- 2007-09: Some new deformities were observed

## Present situation

- Other issues have taken over the attention
- How much deformities remain?
  - Probably underestimated
  - "Anne"s story
- Total production in 2008: 800 000 tons
- Total salmon export value in Norway 2008
  - 20 bill. NOK
- If there is 1% potential improvement by further reduction of deformities..... ?

## Deformities in wild stocks

- The question is asked over and over again
- Extremely difficult to estimate
- Based on statistics from humans, 1-2% of any population is likely to be "born" with some congenital defect, some of which will decrease chances of survival
- We see most of the deformities observed in farmed fish also in wild fish, but not all
- **Number of fish with deformities should be low, and the type of deformities should be diverse**
- When numbers increase, and there is a systematic dominance of one or a set of deformities, then it is a sign that we do something wrong.

## This is a training course for the nerds!

- .... but it is aimed at serving the industry
- Feedback wanted
  - Anything, anytime
  - Questions, comments, objections
- Outcome
  - Reports, publications, web-info, CDs etc
  - **Suggested protocol for production of A. salmon**