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Université  
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Aquaculture (CEFRA)  
Aquaculture Research and Education Center

# Genetic improvement of growth in perch production: domestication, sex control, hybridization and strain selection

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# Introduction

- New and non-domesticated species in aquaculture



- Slow growth rate  $\Rightarrow$  low production rate: 350-400g m<sup>-3</sup>d<sup>-1</sup> even at high density (60-80kg m<sup>-3</sup>)
- Marketable fish : 100g
  - One year at 23°C in R.A.S.
  - 800 days under natural temperatures (4-25°C) in cages

➡ Limiting factor for commercial production of Eurasian perch



# Introduction

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- High growth heterogeneity: fast growing fish with high growth rate (0.6 vs 0.3g fish<sup>-1</sup>d<sup>-1</sup>)
- High growth potential of some individuals
- Growth dimorphism between sex and strains

Possibilities to improve growth

Based on genetic characteristics

- Domestication
- Sex control
- Hybridization
- Strain selection

# Domestication

- Process by which captive animals adapt to man and the environment he provides
- Without any selective breeding program
- Domesticated strain originated from the Meuse strain were constituted from generation to generation in CEFRA-ULG



Wild (Meuse strain)



F1



...



F4

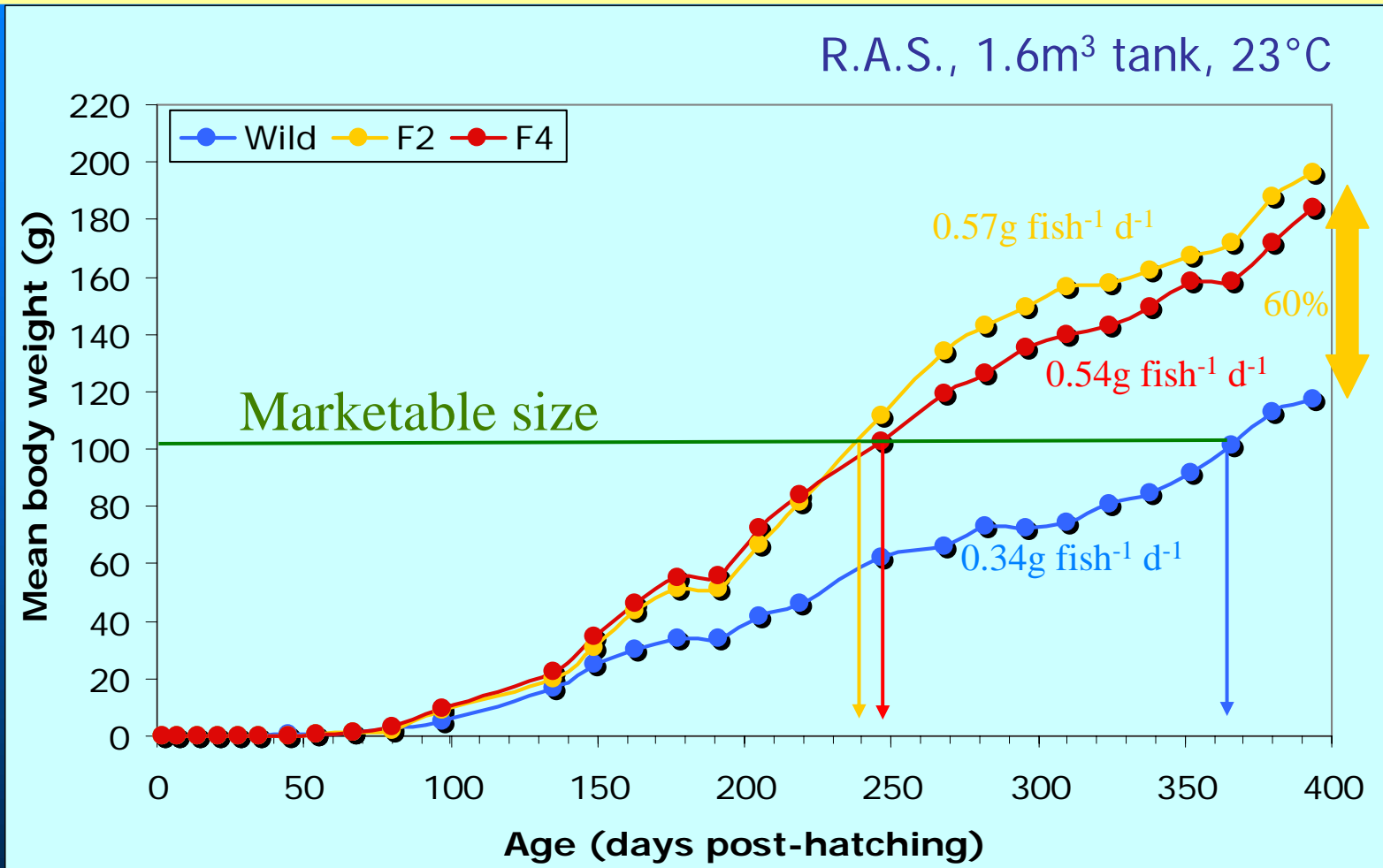
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# Domestication

- Breeders in R.A.S with a natural thermal cycle
  - Reproductive characteristics depending on the level of domestication are presented on a poster
- Comparative growth
  - Wild, F2 and F4 generation
  - R.A.S
  - 1.6m<sup>3</sup> tanks
  - 23°C
  - Stocking densities from 3000 to 310 fish m<sup>-3</sup>
  - Maximal food ratio



# Domestication

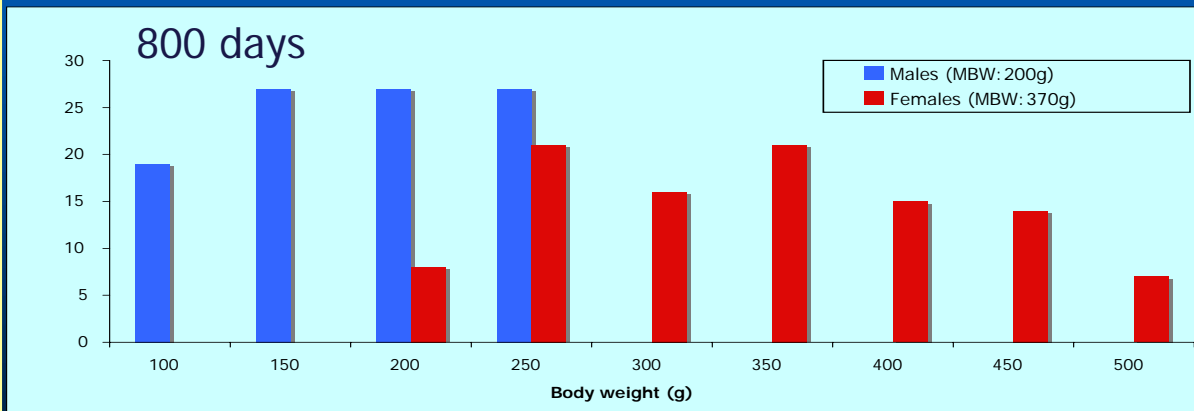
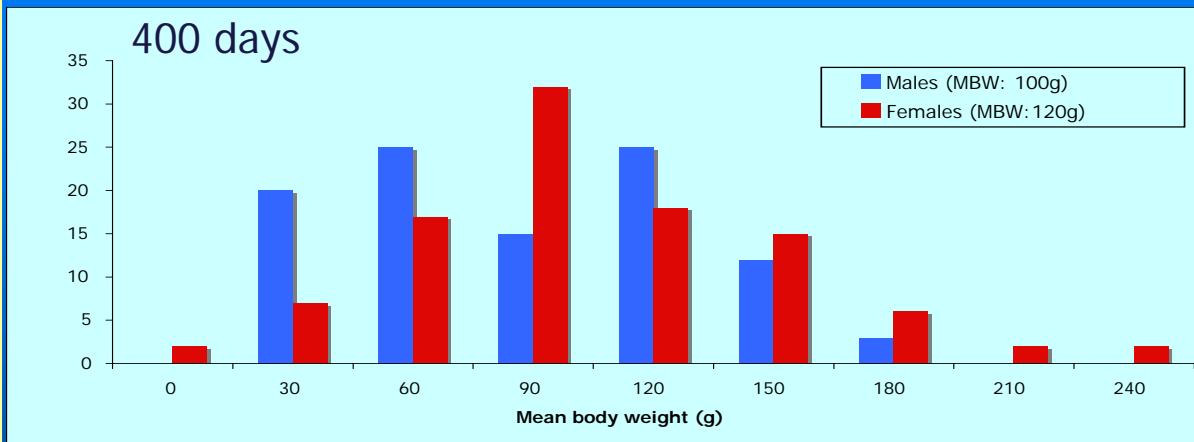


Domestication allows to improve growth

# Sex control and all-female production

## ■ Sexual growth dimorphism

– Female > males about 20%



Female > males  
about 80%



All-female production : improvement of growth and productivity



# Sex control and all-female production

Ethical issues/Human consumption



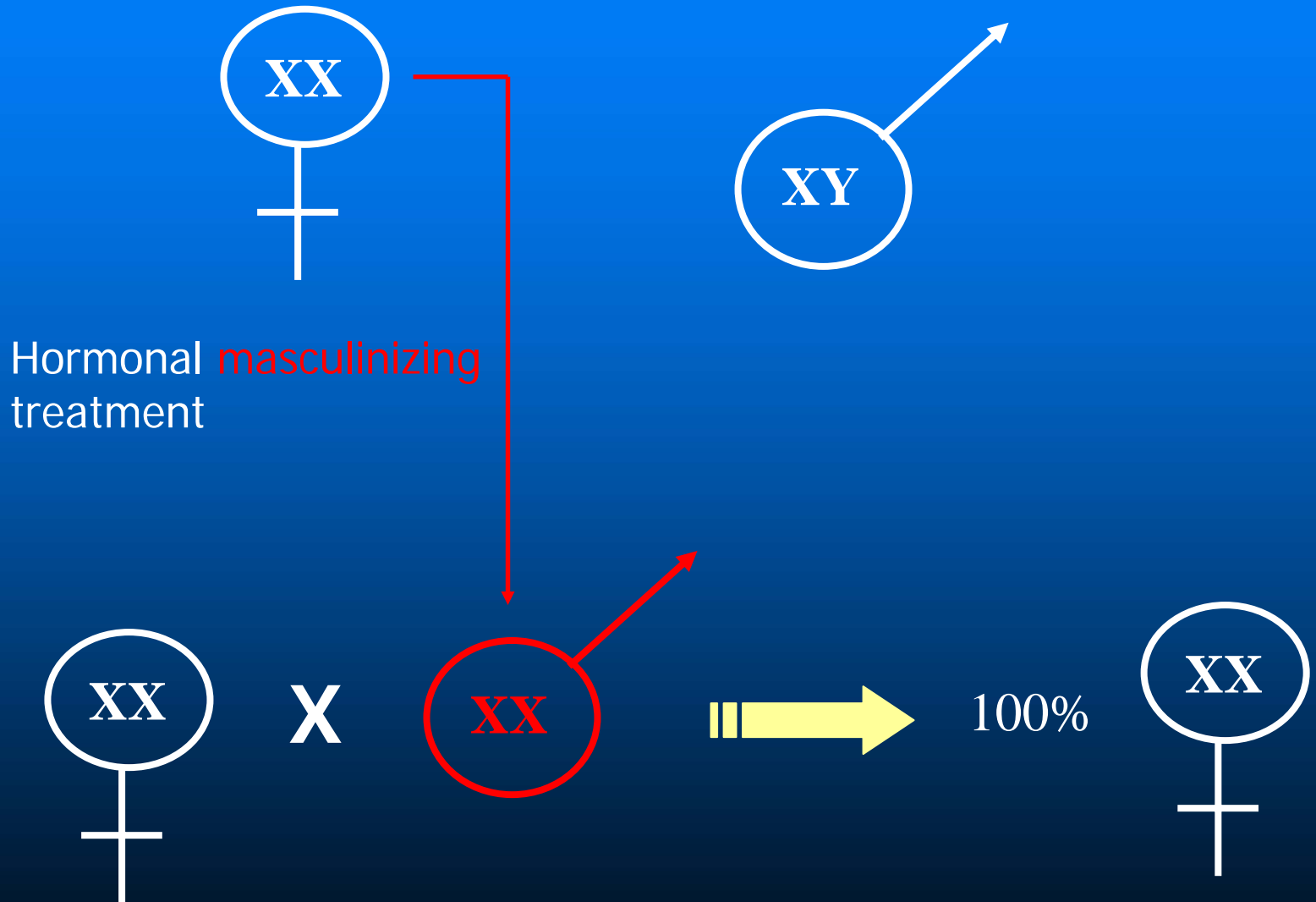
Direct treatment with feminizing hormones is forbidden



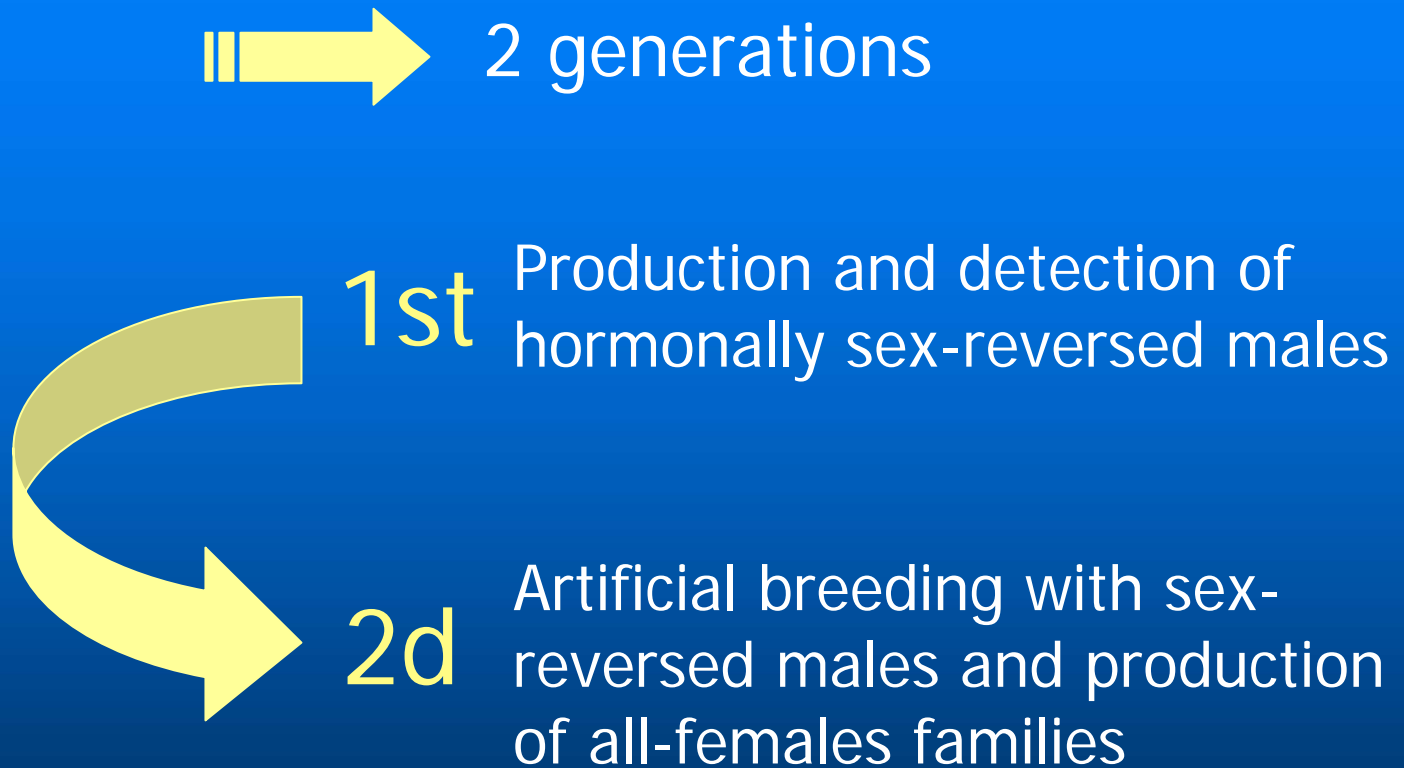
Alternative indirect methods



# Sex control and all-female production



# Sex control and all-female production



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# Sex control and all-female production

## ■ Production of functional hormonally sex-reversed males

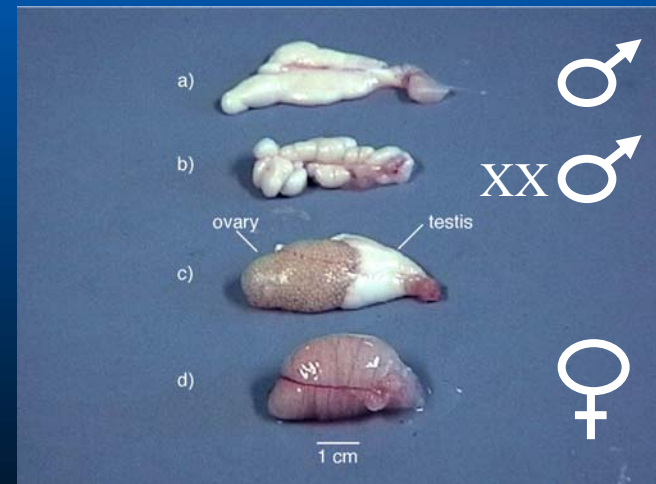
- $17\alpha$ -methyltestosterone
- Undifferentiated juveniles
- IMBW : 70mg (35dph at  $17^{\circ}\text{C}$ )
- $5\text{mg kg}^{-1}$  food
- 30 days duration



- 100% sex reversal
- 80% functional XX males

## ■ Detection of sex-reversed males

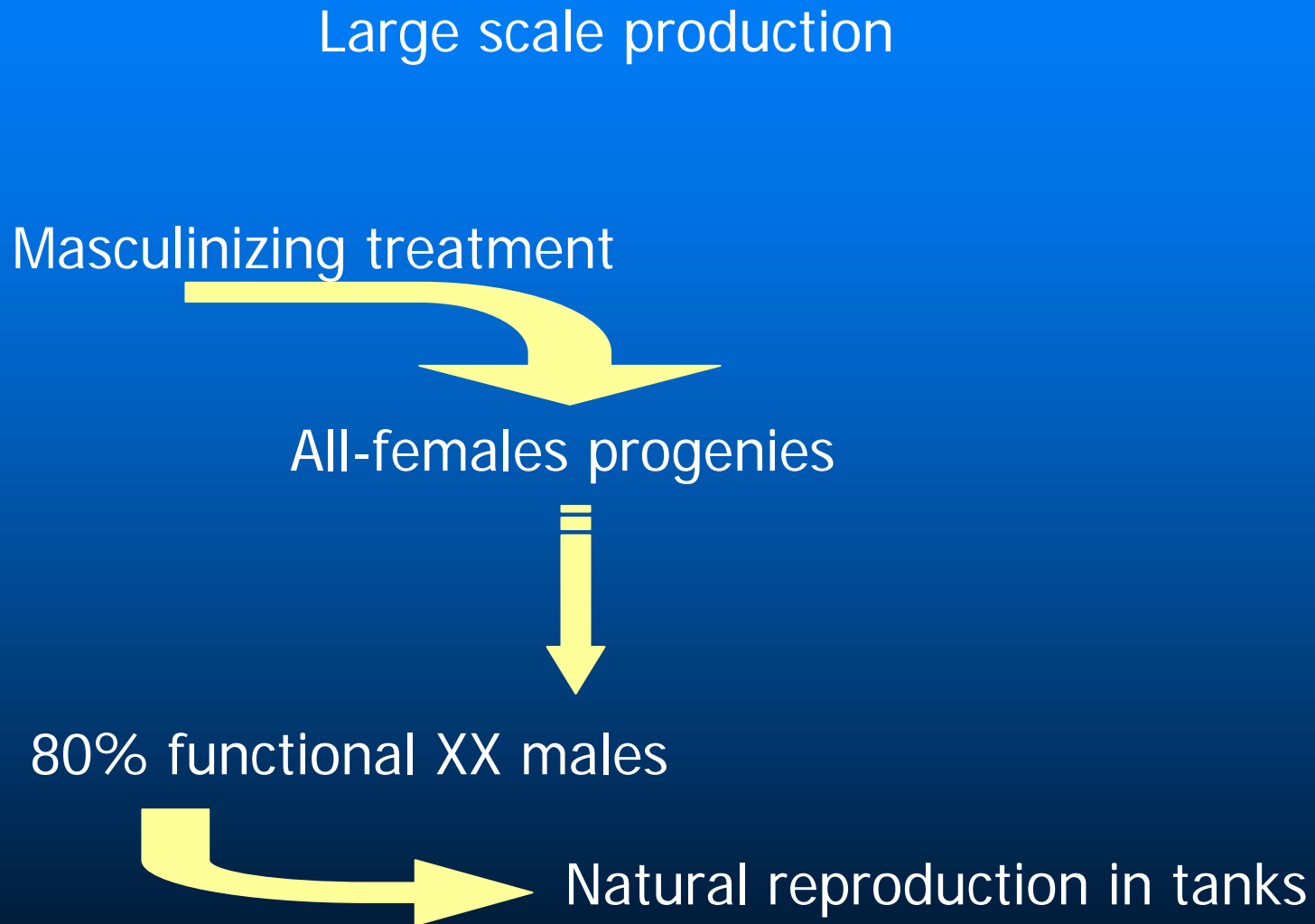
- Firstly based on the gonad morphology
- XX males x females
- 95-100% females progenies



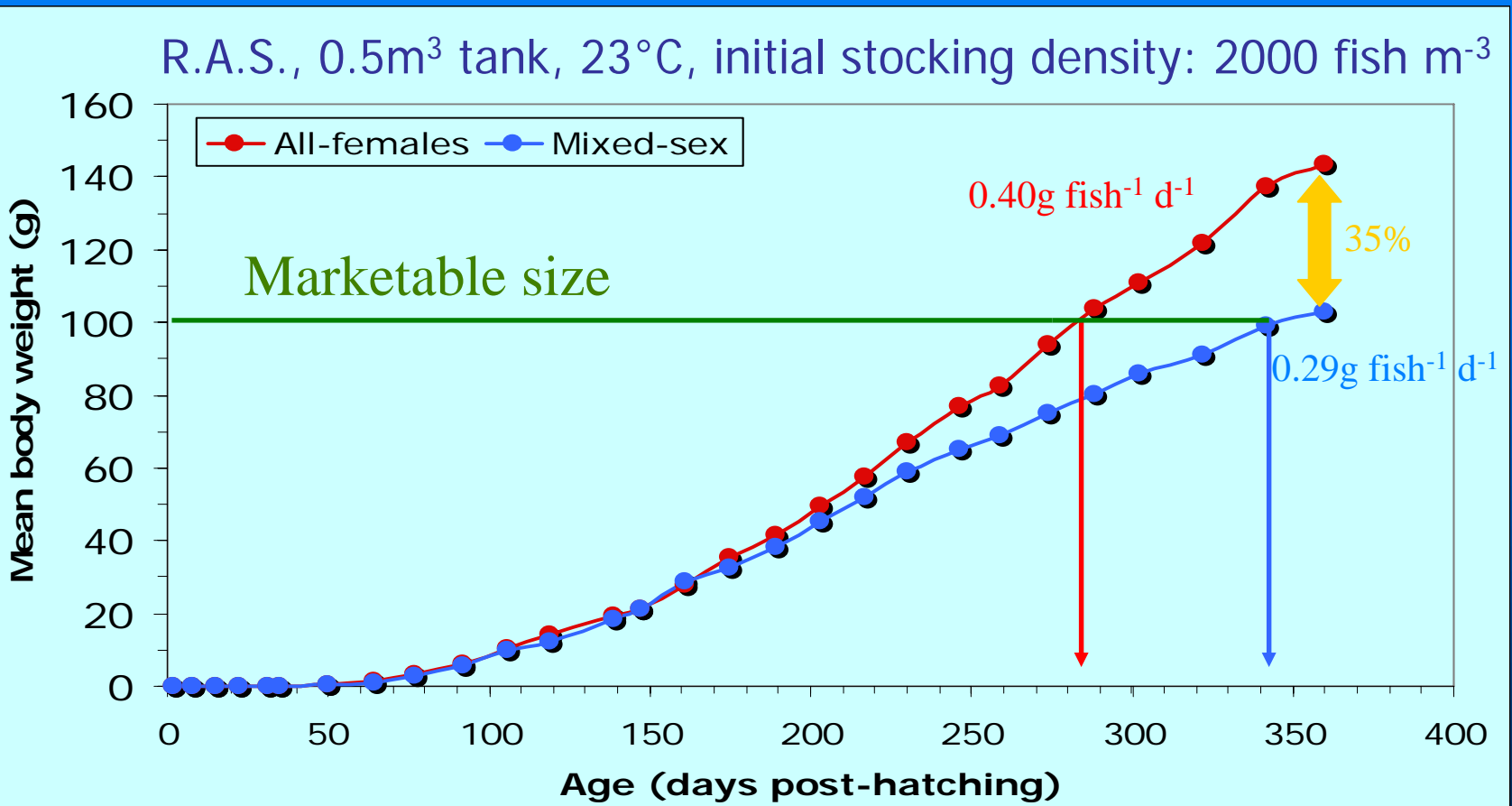


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# Sex control and all-female production



# All-females production



➡ Sex control allows to improve growth

# Hybridization

- Done with culture fish to improve the growth performances due to heterosis
- Perch: artificial reproduction



*P. fluviatilis*

X

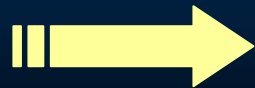
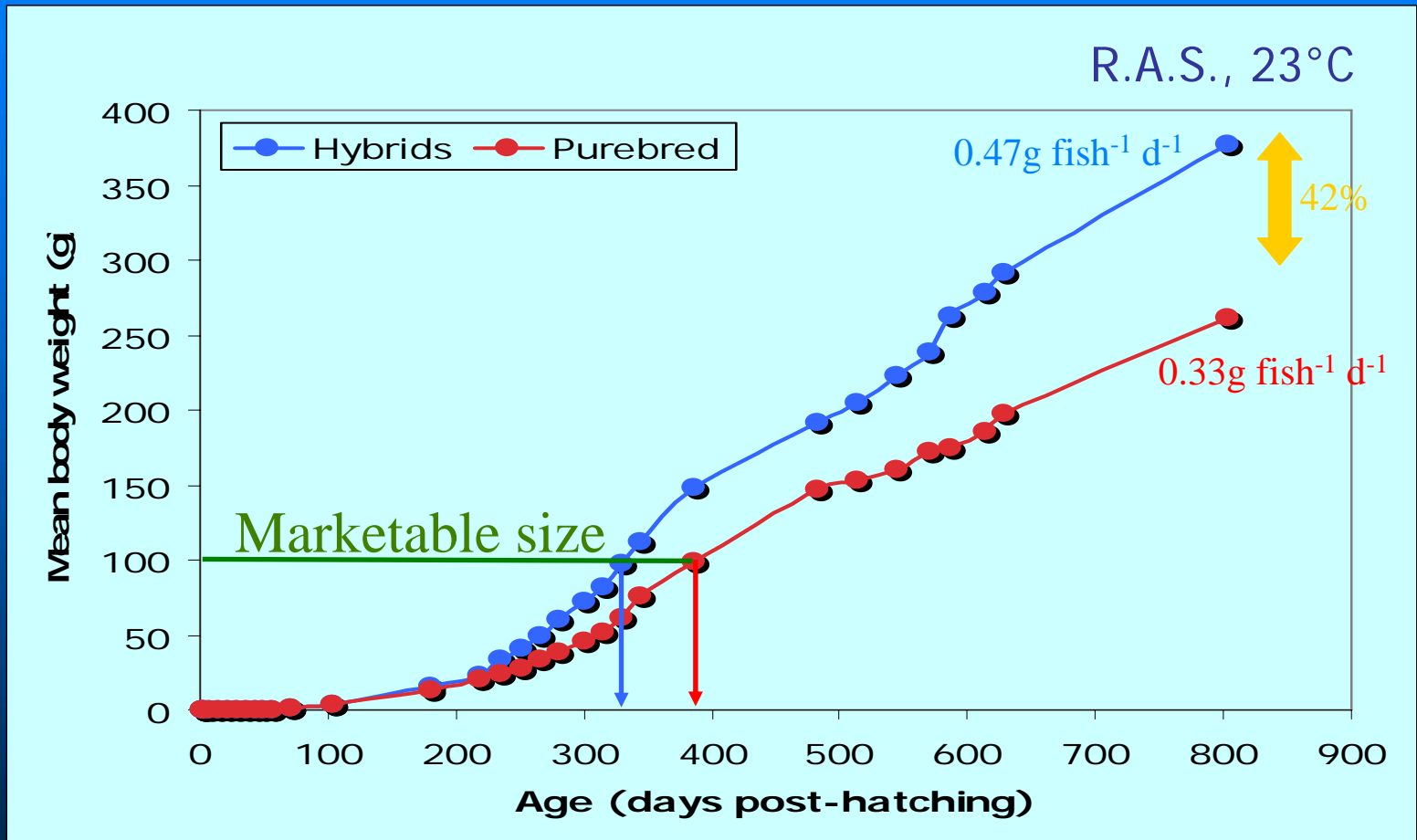


*P. flavescens*

- Comparative growth
  - Hybrids vs purebred *P. fluviatilis*
  - R.A.S
  - 23°C
- 0.5m<sup>-3</sup> tanks
- Stocking density: 1000fish m<sup>-3</sup>
- Maximal food ratio

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# Hybridization

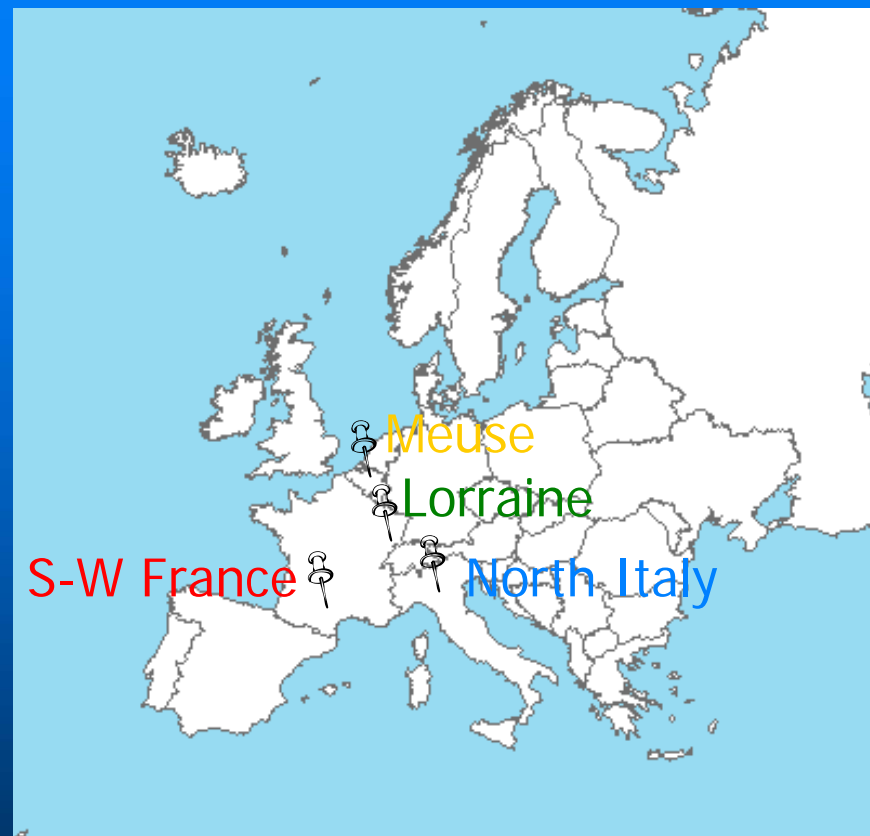


Hybridization allows to improve growth

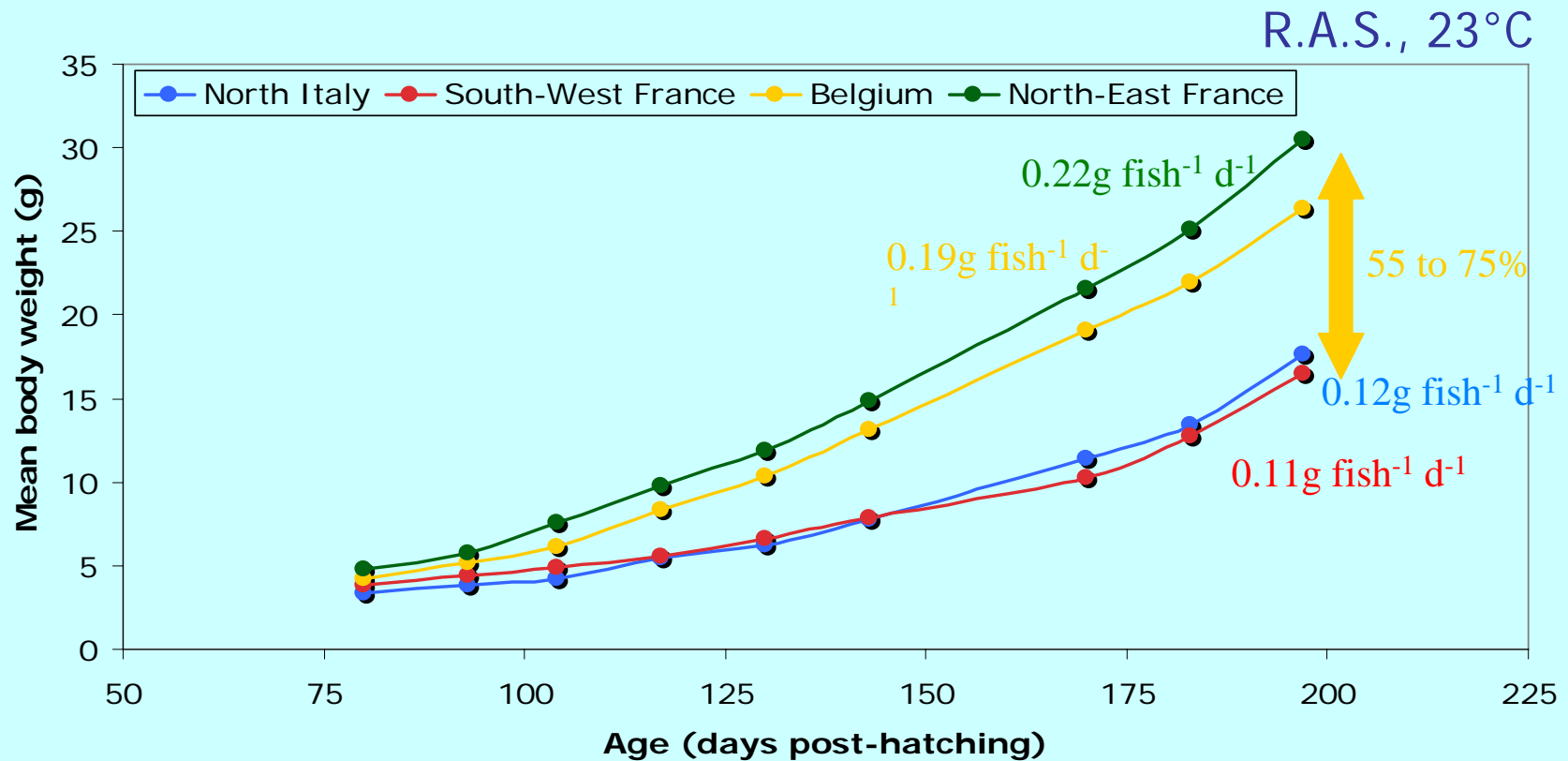
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# Strains selection

- Wild European strains
  - Spawn catch into the wild
  - Juveniles growth in R.A.S
  - 23°C
  - 0.5m<sup>-3</sup> tanks



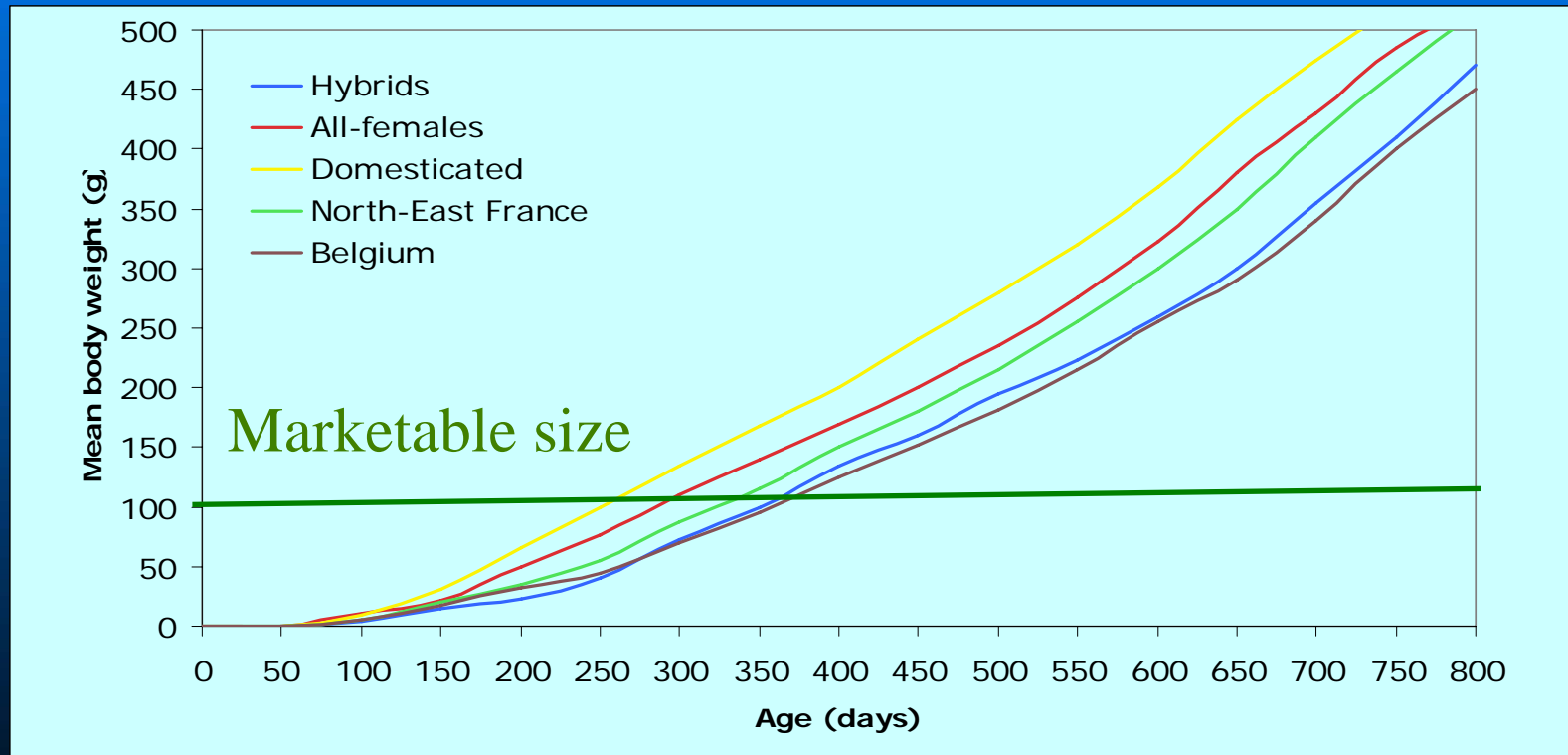
# Strains selection



Selection of the best strain allows to improve growth

# Conclusions

- Domestication, all-female populations, hybridization and strains selection alone or in combination induce:
  - A positive response to short-term
  - A significant increase of growth in intensive culture



# Conclusions

- **More informations are needed about:**
  - The additional effect of these 4 factors on growth
  - A probable family effect
  - The identification of the best strain regarding intensive rearing conditions (first step to start a selective breeding program)
- **In future, selective breeding program:**
  - Exploitation of the genetic part of the high growth heterogeneity of perch
  - Determination of the heritability of this quantitative trait
  - Directional selection
- **Flesh quality**

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Thank you for your attention