Progress at Production Scale with various *Artemia* Substitutes and Supplements for Marine Fish Larvae

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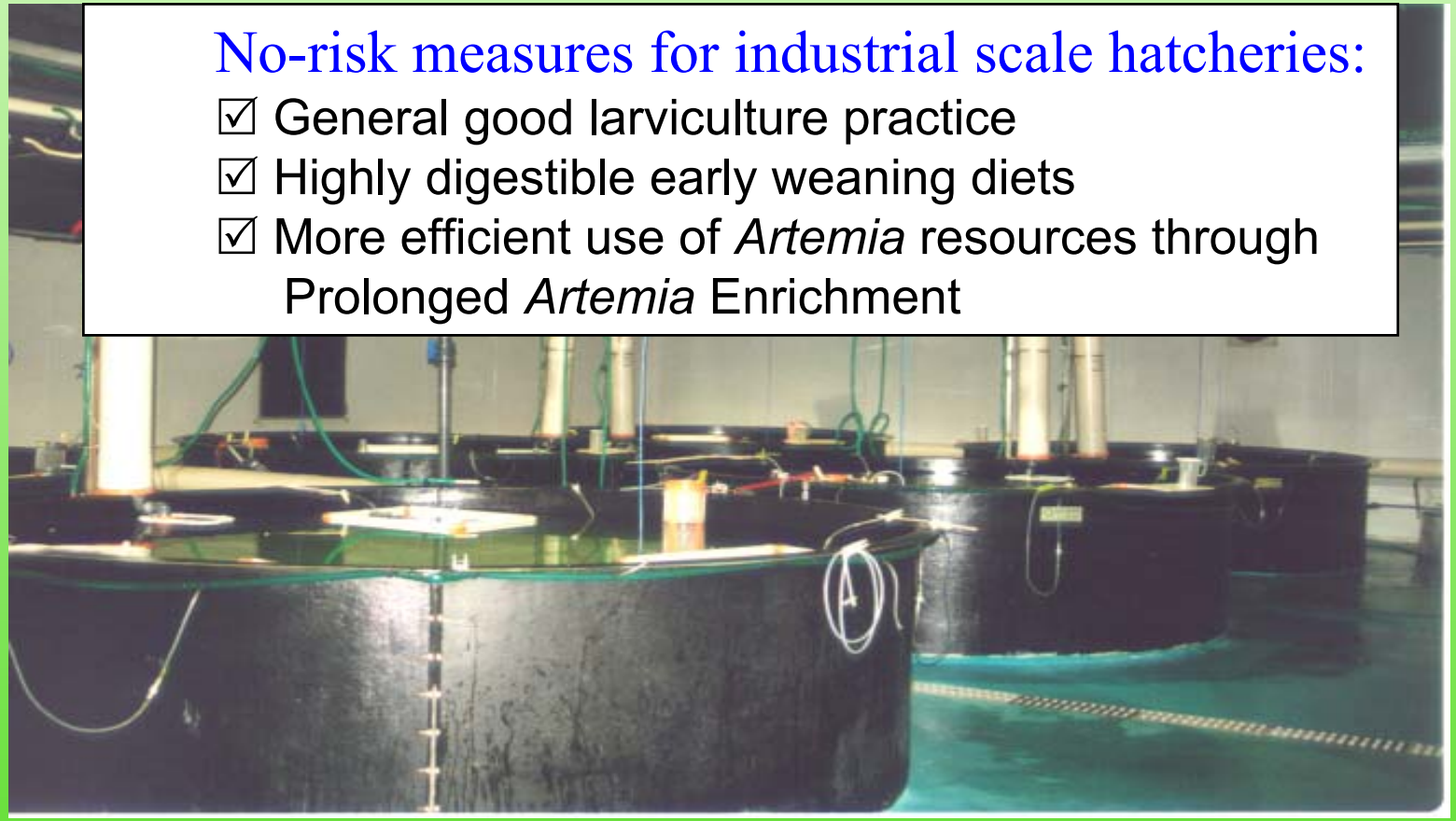
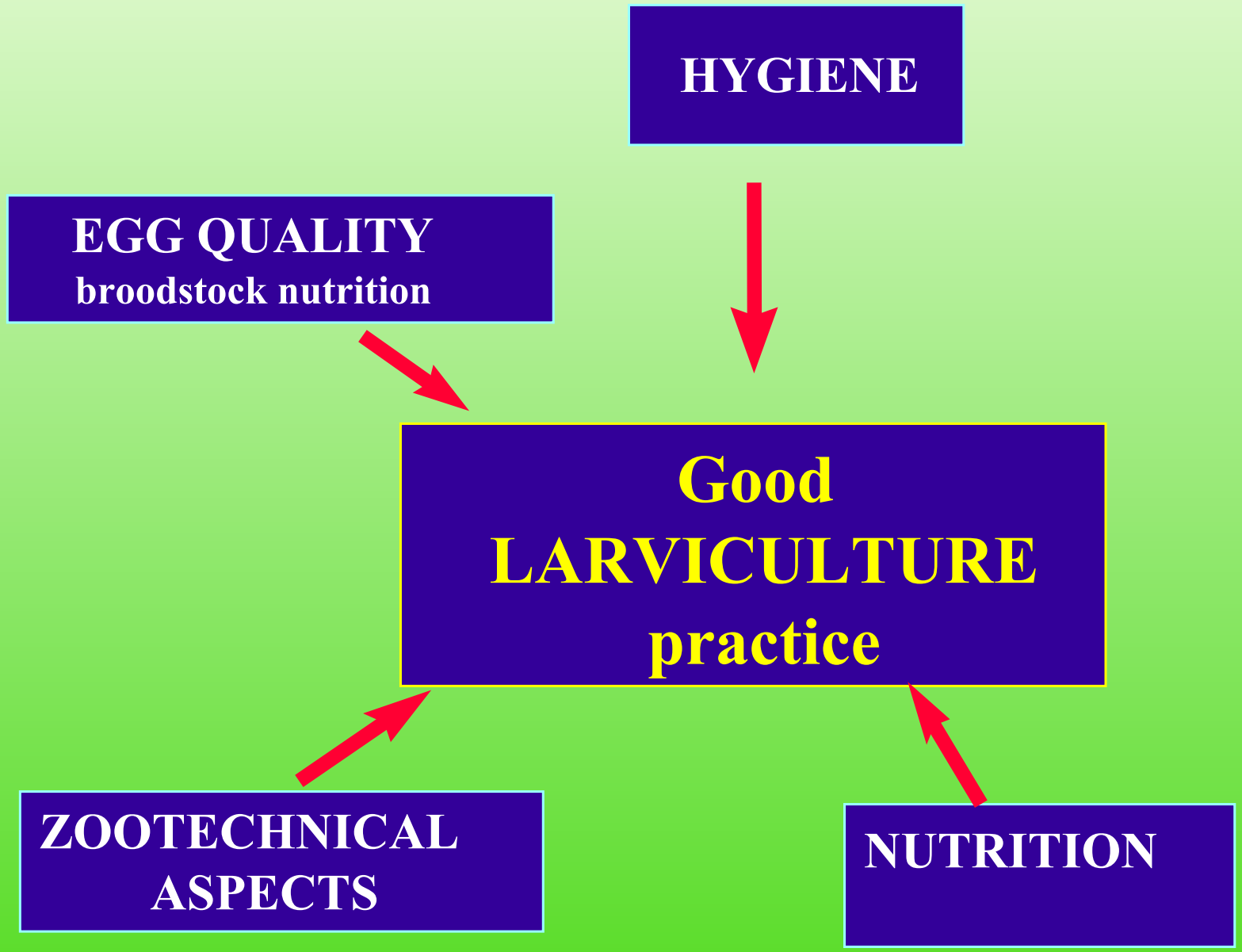
Introduction

Means



No-risk measures for industrial scale hatcheries:

- ☑ General good larviculture practice
- ☑ Highly digestible early weaning diets
- ☑ More efficient use of *Artemia* resources through Prolonged *Artemia* Enrichment


HYGIENE
EGG QUALITY
broodstock nutrition
Good
LARVICULTURE
practice
ZOOTECHNICAL
ASPECTS
NUTRITION

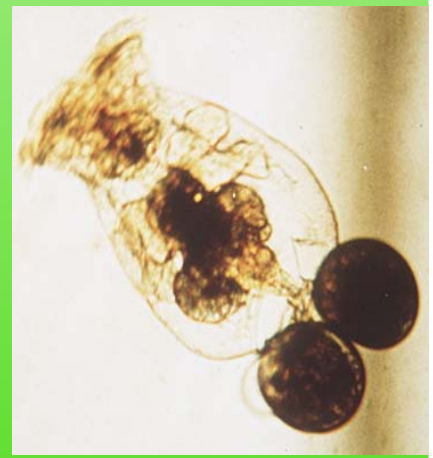
INVE

Reduction of the *Artemia* consumption

Indirect

Higher survival rates obtained through:

- high quality algae and rotifer
- minimizing mortalities during critical periods before *Artemia* feeding



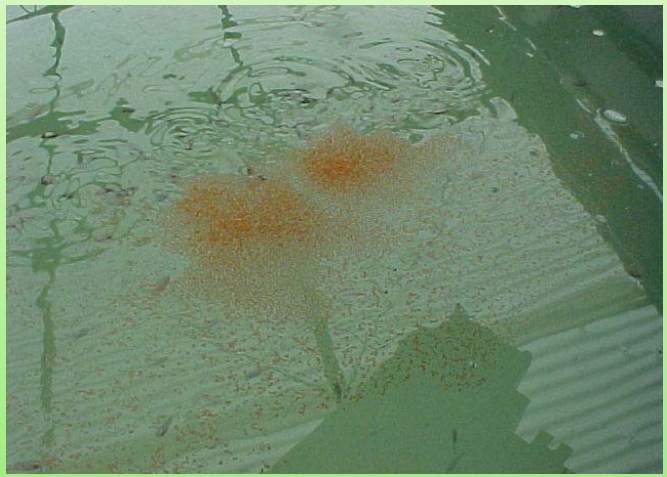
Direct

Correct use of a

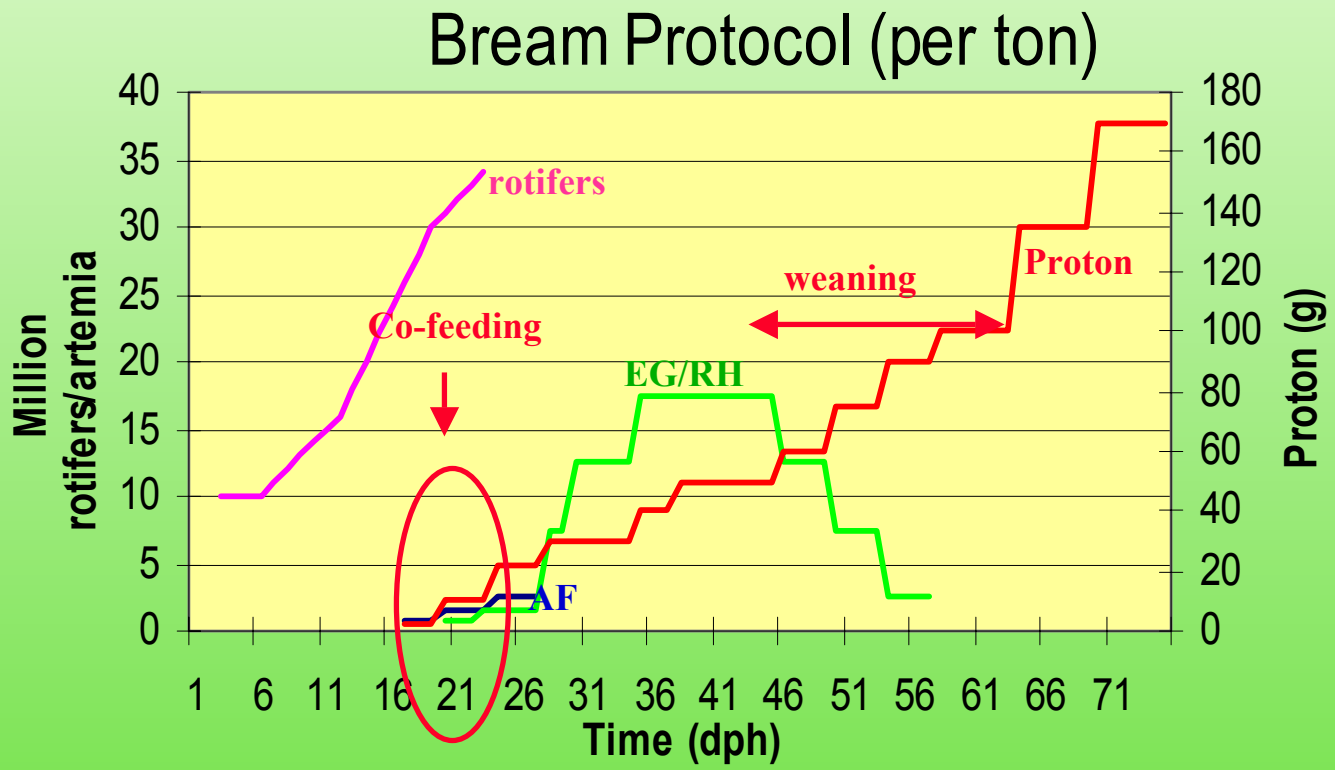
High quality early weaning diet

Characteristics:

- Excellent water stability, high dispersal and suspension capacity for the small sizes and slow sinking of the bigger sizes
- Narrow size distribution
- Free flowing product with excellent behaviour in the automatic feeders
- No oil leaching
- Dust free
- Manufactured under strict sanitary practices to ensure a pathogen free diet



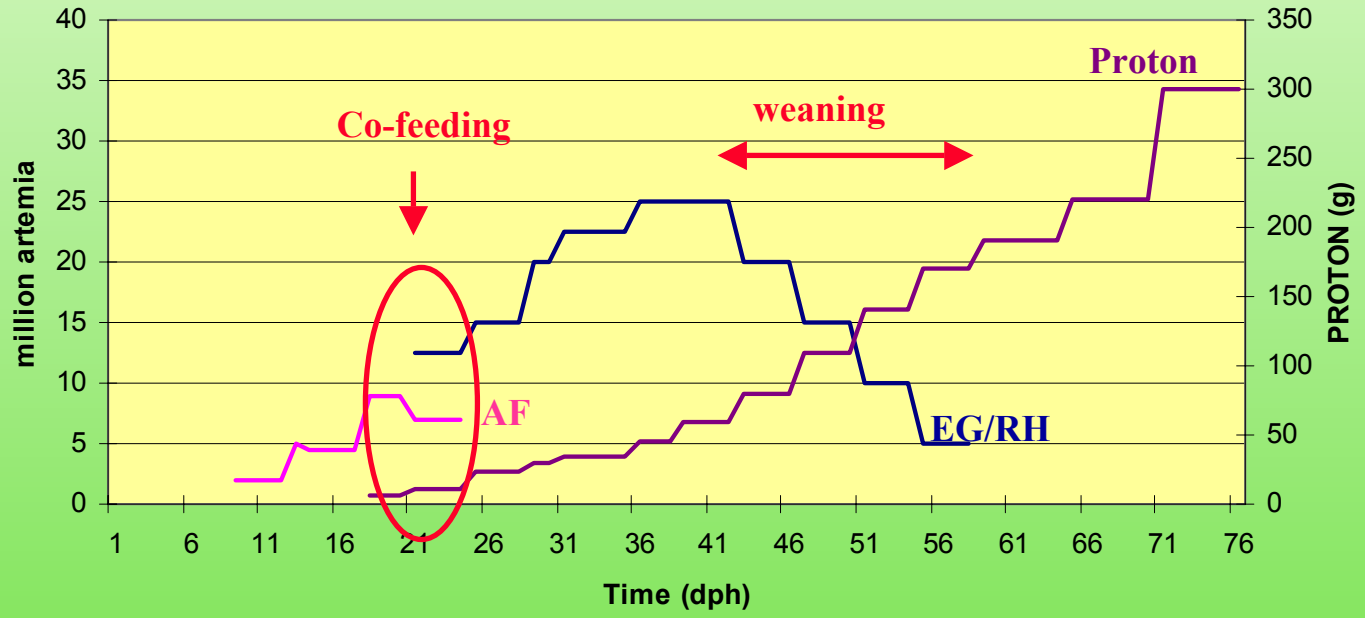
INVE



Artemia required per ton = 369 million = 1.35 kg cysts

15 000 l tank producing 300 000 fry will require **70** kg *Artemia* cysts per million fry

Bass protocol (per ton)



Artemia required per ton = 637 million = 2.3 kg cysts

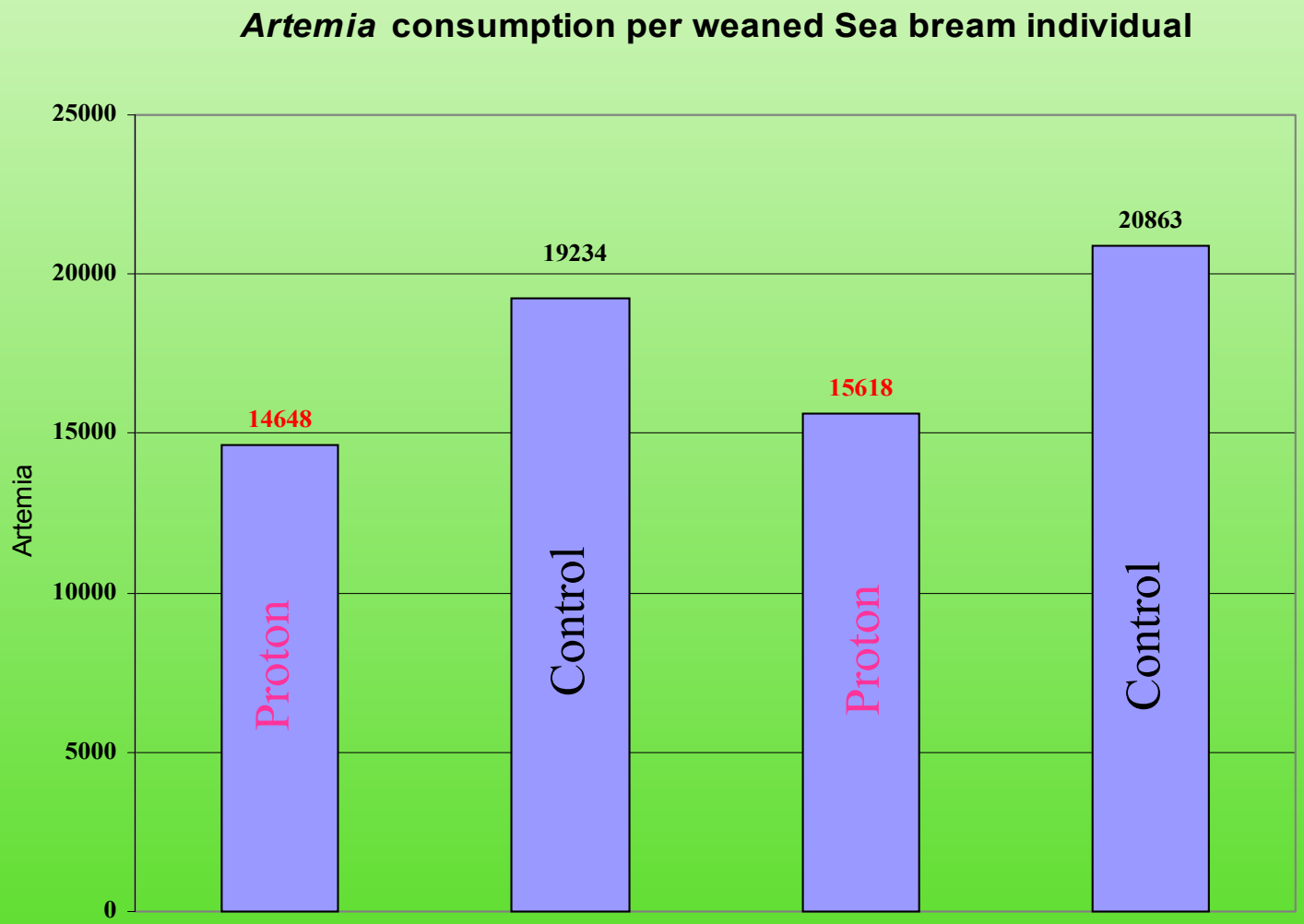
15 000 l tank producing 300 000 fry will require **115** kg *Artemia* cysts per million fry

Field verification Sea bream

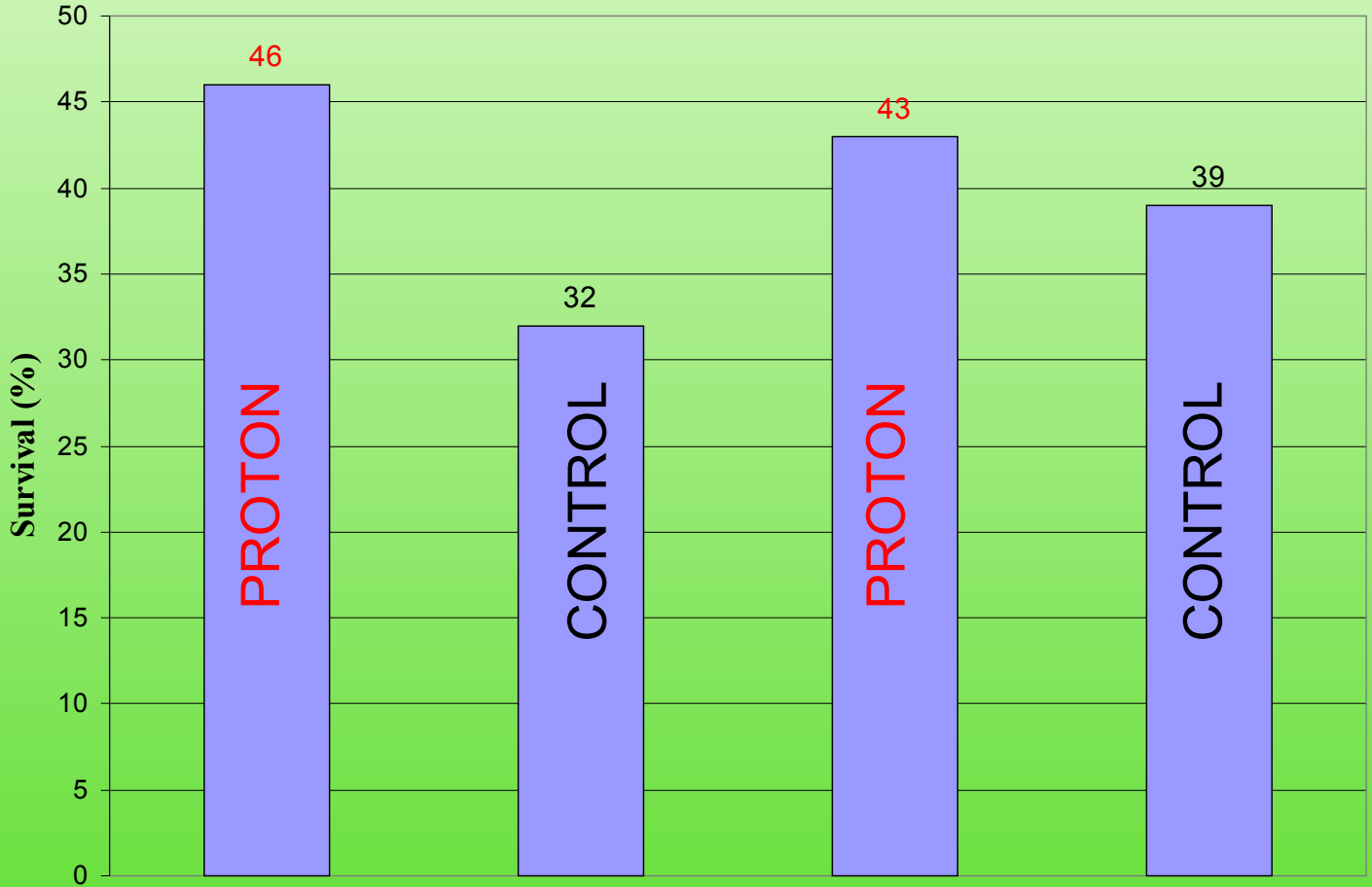
Trial set-up

- Tank size: 16 000 l
- Start density: 40 larvae/l
- Density during weaning: 15 larvae/l
- Feeding regimes:
  - Optimized Feeding regime using Proton in treatment tanks
  - Standard Feeding regime and diet in control tanks
- Duplicate tanks

Field verification Sea bream



Survival up to day 60



Typical cyst requirements* per million fry

Bream (kg)	Bass (kg)
<45	<70
55-70	100-115
90	154
135	230

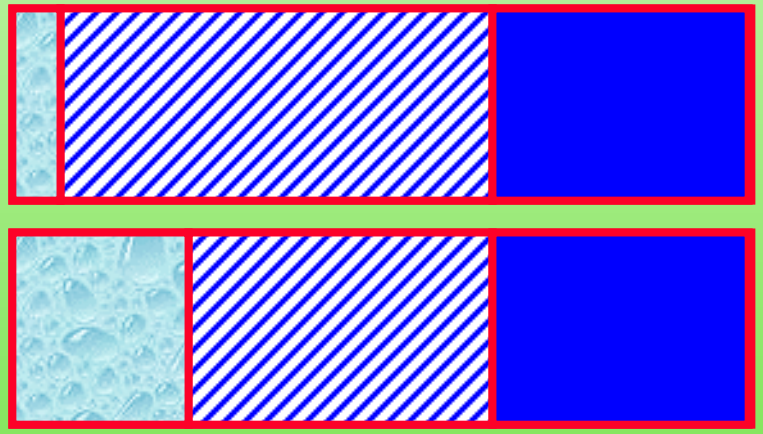
Further improvement through new diets

Possible today

* Calculated using cysts with a HE of 275,000 nauplii/gram

New Early Weaning Diets

Total Available Energy:



New early weaning diets

Standard Diet

Energy for maintenance

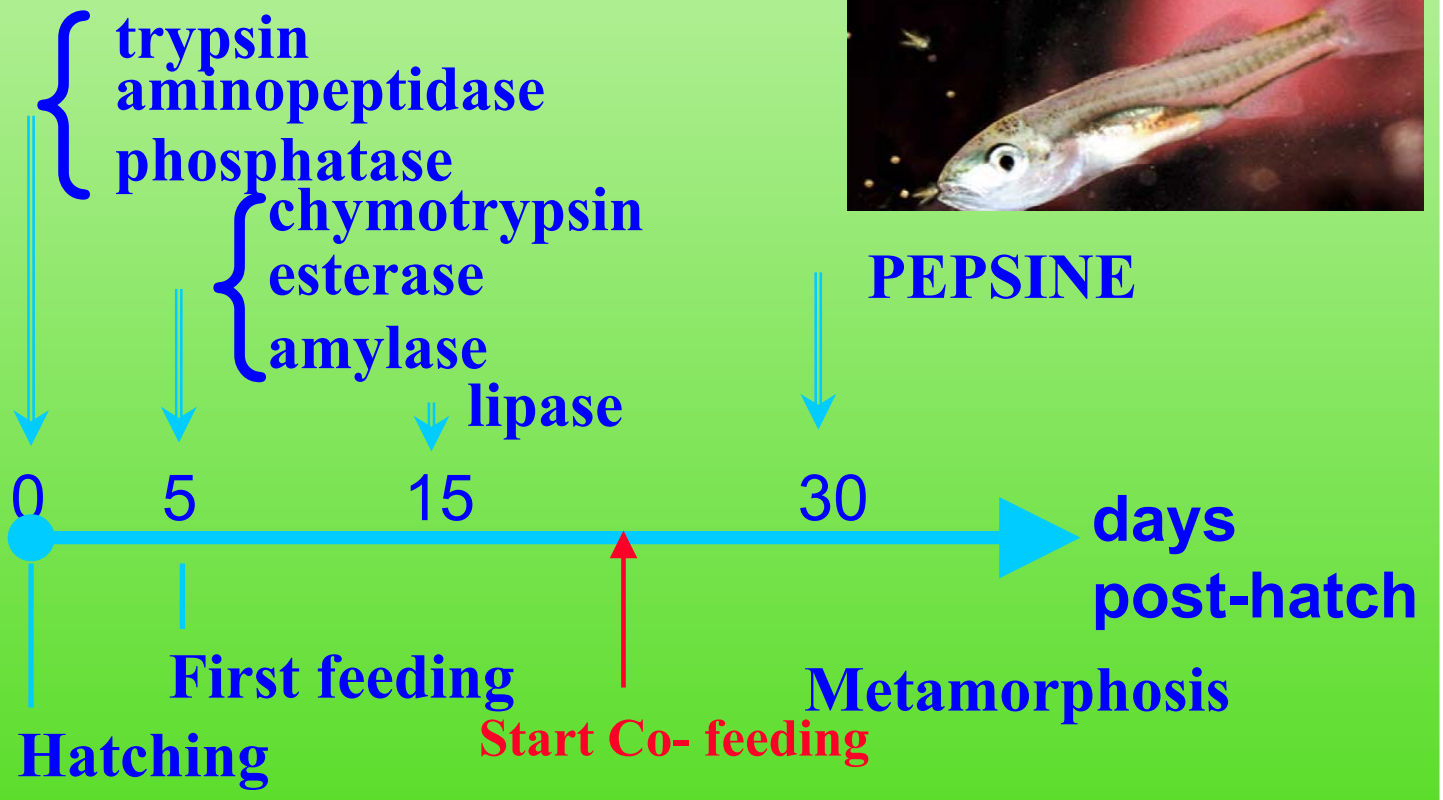
Energy for growth

Non-utilised energy

New Early Weaning Diets

Improved digestibility:

e.g. enzyme development in Sea bass



New Early Weaning Diets

Improved production technologies:

- reduced losses of essential components during processing
- limitation of “filling” material
- high quality raw materials

More efficient use of *Artemia*

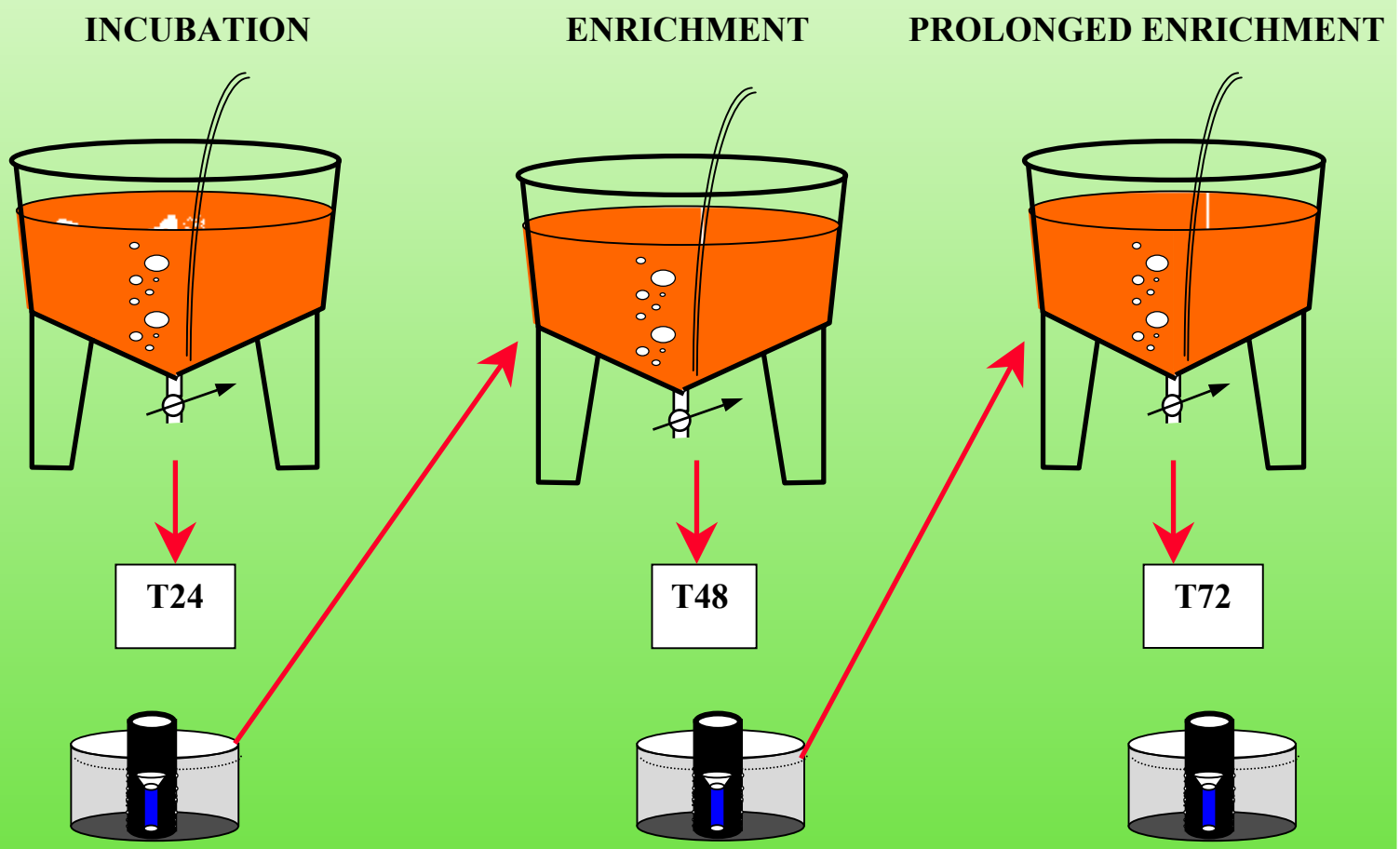
Prolonged *Artemia* Enrichment

- What?

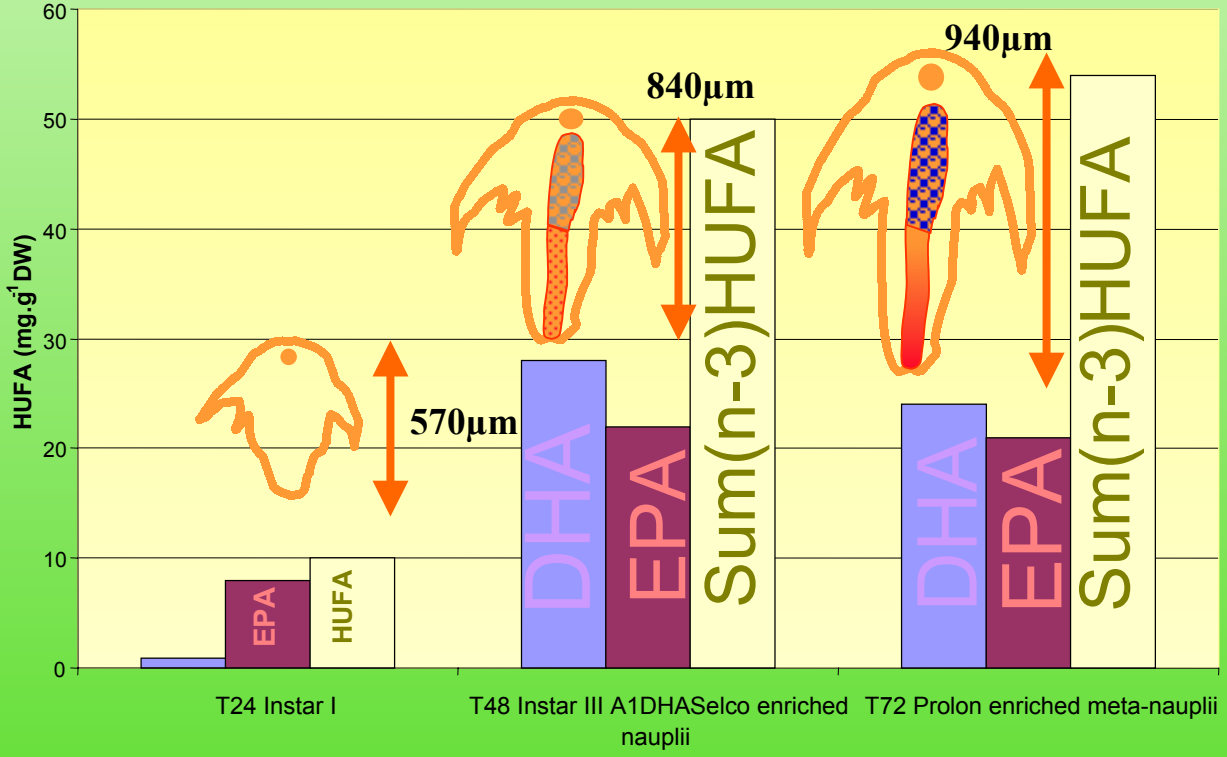
Prolonged *Artemia* Enrichment is performed with PROLON, a combined grow-enrich formula for *Artemia* Instar II-III nauplii

- Application

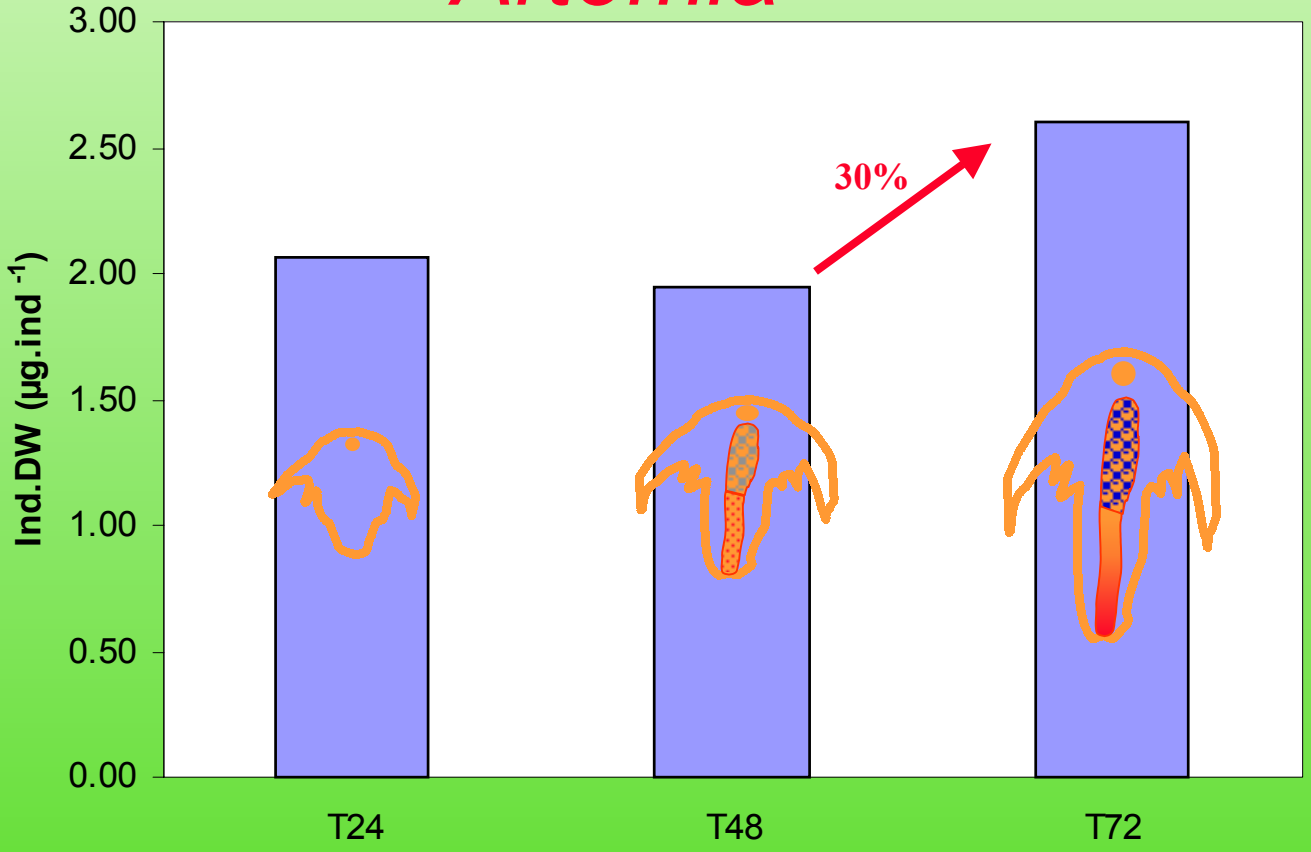
The Prolonged *Artemia* Enrichment is performed after a standard enrichment


INCUBATION
ENRICHMENT
PROLONGED ENRICHMENT
T24
T48
T72

Prolonged enriched *Artemia* meta-nauplii



Individual dry weight increase of the *Artemia*



Prolon application in the feeding regime

- Sea bream:

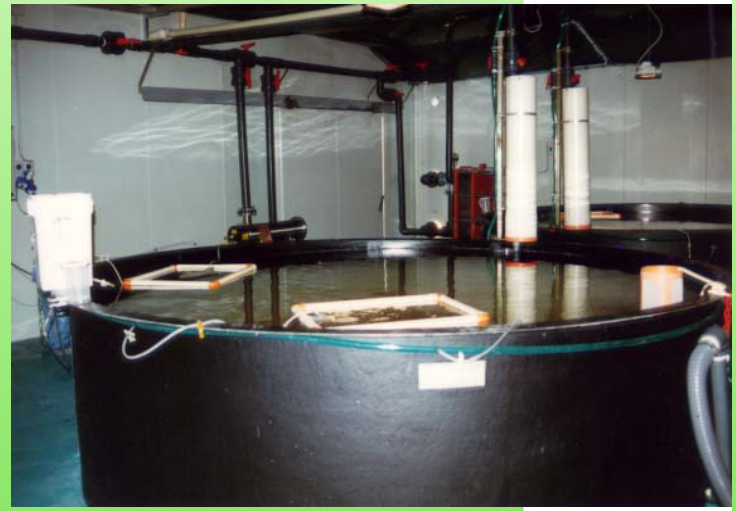
30% reduction in number of nauplii per day from day 35 onwards compared to the control feeding regime

- Sea bass:

30% reduction from day 30 post-hatch onwards

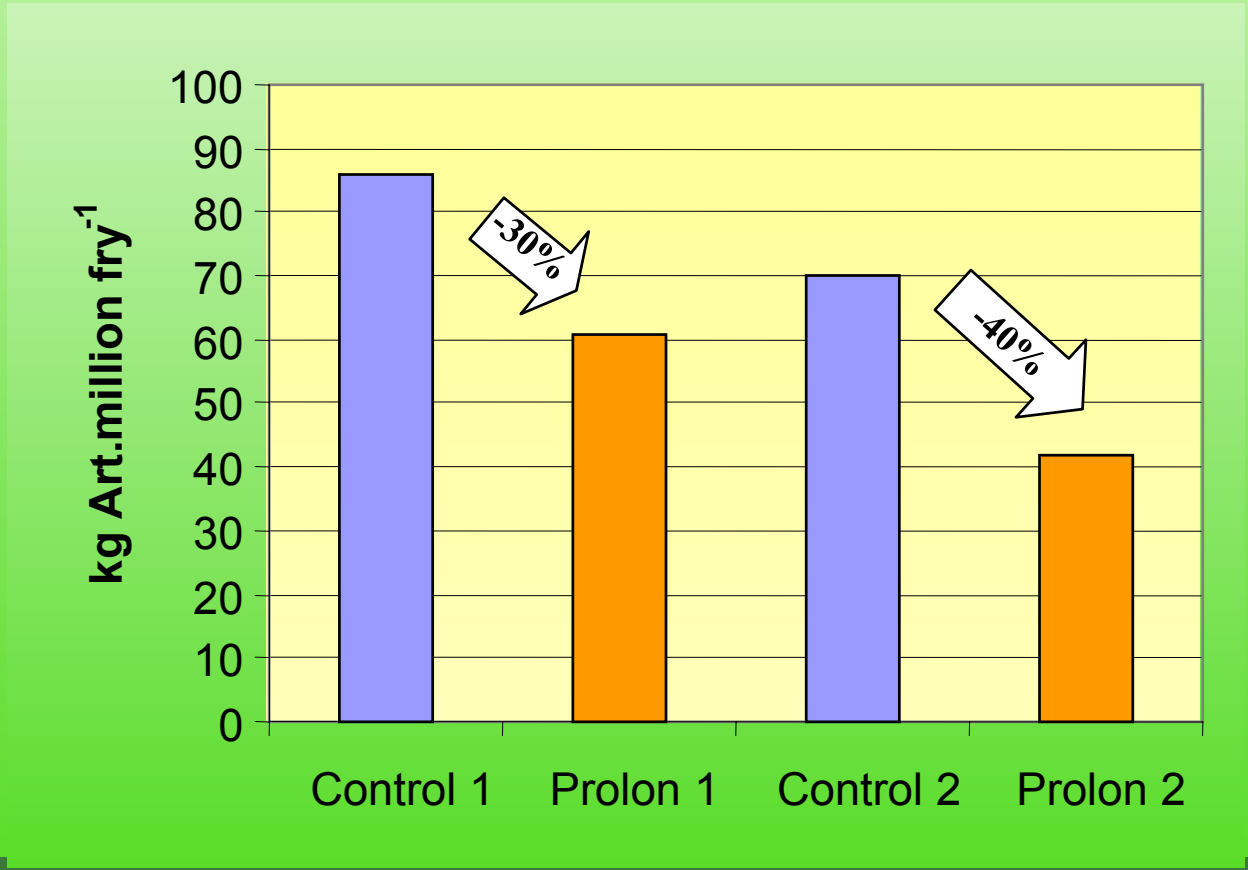
Last Artemia feeding (end weaning) at day 57 post-hatch

Verification Seabream commercial scale trial



- Set-up
  - 6000 l tanks
  - 2 control tanks, 2 PROLON tanks
  - 900,000 Seabream larvae stocked per tank, originating from the same batch
  - same external conditions (water temperature, DO levels, same water quality)
- Feeding regimes
  - Control: standard feeding regime for high density
  - PROLON: from day 35 onwards: 30% less Artemia nauplii are fed compared to the control

Artemia consumption using Prolon Bream



Prolon

Other beneficial effects:

- ☑ Equal to higher biomass production per larval rearing tank
- ☑ Lower incidence of lordosis
- ☑ Less fry showing an incomplete operculum
- ☑ Higher stress resistance

Conclusions

- With the existing knowledge and techniques, *Artemia* consumption in industrial scale hatcheries can be reduced down to around 45kg per million Sea bream fry and 55kg per million Sea bass fry
- Remaining question: further or complete reduction of *Artemia*: at what risk?
  - effect on larval survival?
  - larval growth rate?
  - effect on larval quality:
    - ∞ deformities?
    - ∞ stress and disease resistance ?
    - ∞ performance in grow-out?