

Changes in the nutritional approach for  
culturing and enriching rotifers and Artemia:  
impacts on production efficiency and  
economics



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# Increase in scale and industrialisation of hatcheries



## Europe:

### Bass/bream

- Traditional old European markets :Existing facilities (improvement in technical equipment, specialisation)
- Growing new markets : New facilities
- **Rotifer needs** doubled in last 5 years (stagnation for the period 2000-2003; doubling in 2004-2005)

Daily needs at peak : 5-6 billion rotifers (10 million fry)

Daily max. capacity : 12-15 billion rotifers



### Cod

Commercial live food production started 3 yrs ago

**Estimated need for Europe: 10,000 billion rotifers  
(~20 ton)**



# Increase in scale and industrialisation of hatcheries

## Asia :

Existing traditional facilities (large concrete tanks)  
Probably a 10 fold increase in rotifers last 2-3 years

**Estimated need: 150,000 billion rotifers (~300 ton)**



## Increase in scale and industrialisation of hatcheries impact on culture requirements for rotifers



- Increase in rotifer production
- Shorter culture periods
- Easy use of products
- Reliable rotifer production
- Bacterial control
- Cost effective

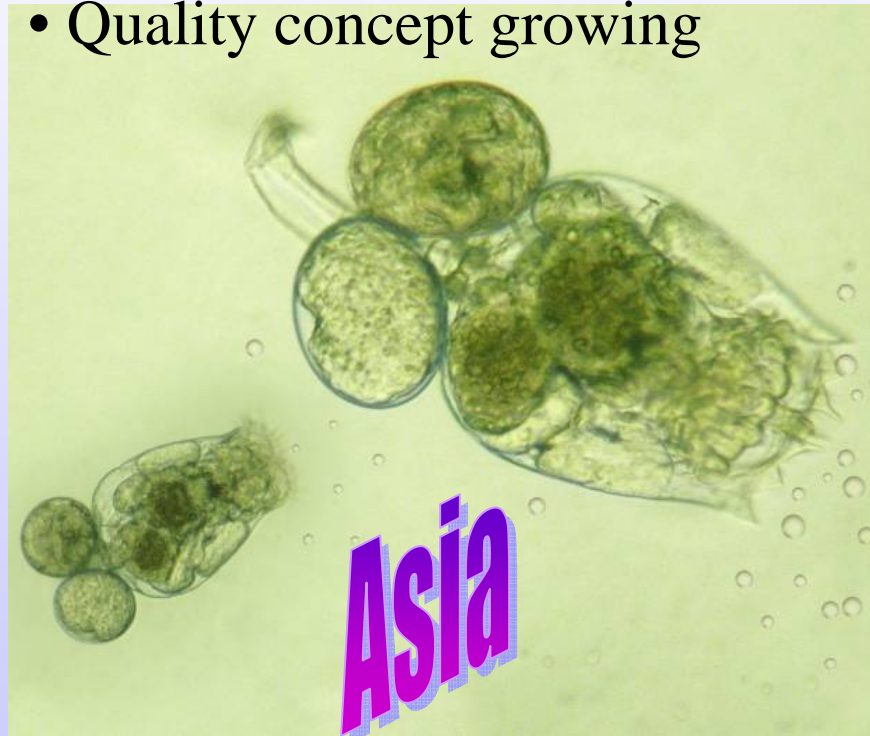


# Increase in scale and industrialisation of hatcheries

➔ impact on culture requirements for rotifers

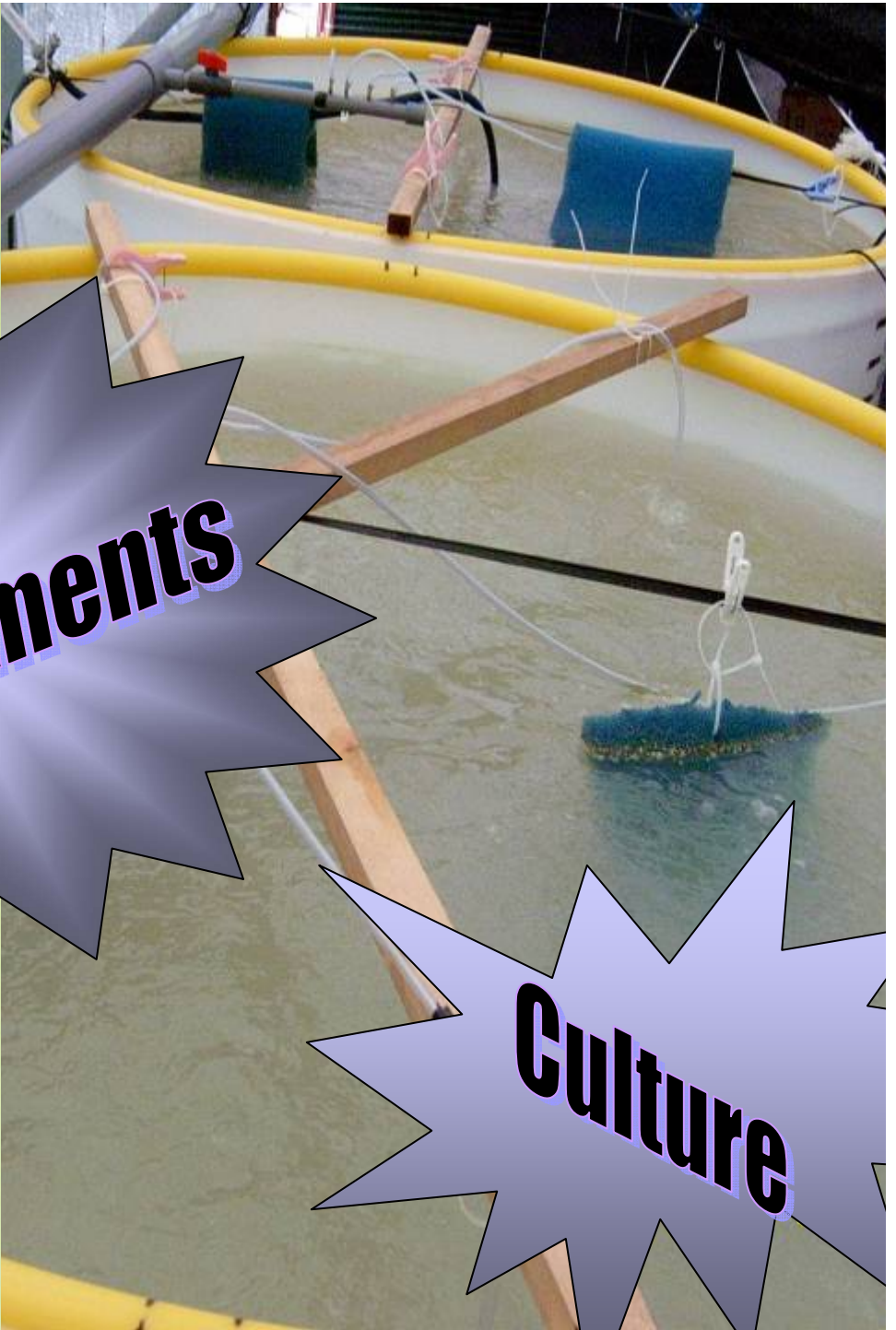


- Increase in rotifer production
- Cost effective
- Quality concept growing





**New  
developments**



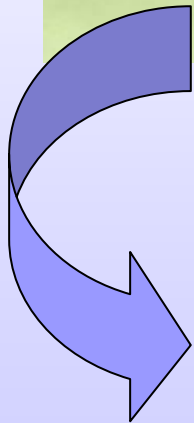
**Culture**



## Products : Europe



Algae & concentrates  
15-20%



80-85%



Off-the-shelf artificial diets



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# Artificial diets



Fish Nutrition



1991

First diet launched in 1991

What has been improved?



3rd generation of products



2005



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# Evolution in culture performance

1st generation products : 200-600 rotifers /ml  
(1991-2000)

**Increase in productivity**

- Higher stocking density
- Faster growth

2 nd generation products : 500-1800 rotifers /ml  
(2000-2004)

**Increase in rotifer  
quality**

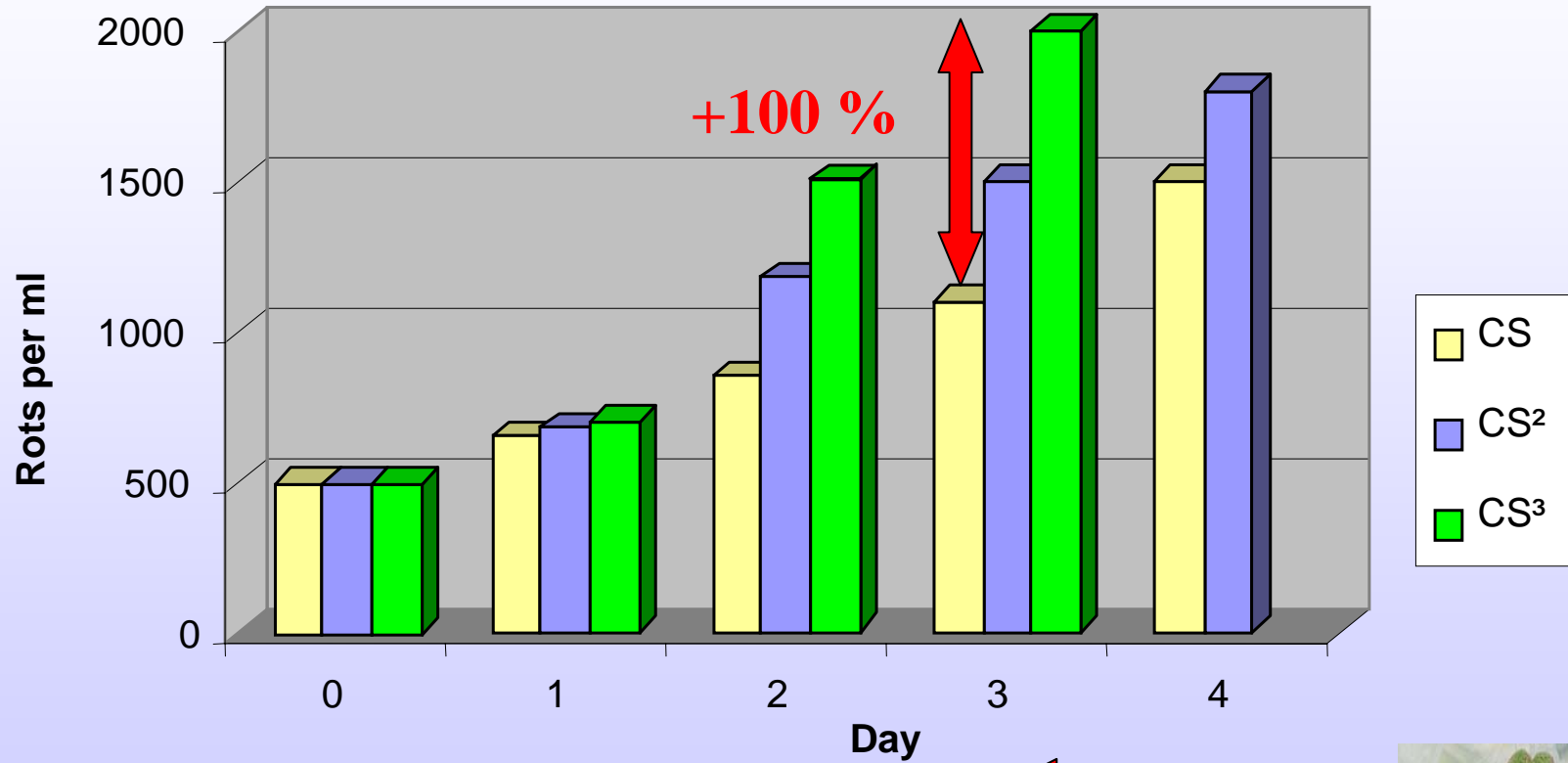
3 nd generation products : 500-2300 rotifers /ml  
(2004- )

# Gain on production output for rotifers

## 1<sup>st</sup>- 2<sup>nd</sup>-3<sup>rd</sup> generation



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← **One day less!**



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Culture Selco Plus

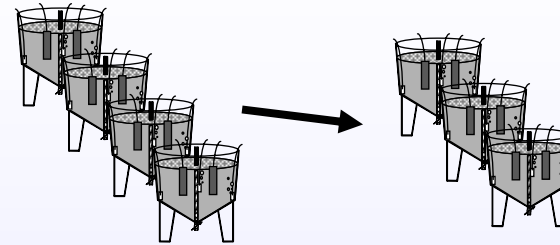
# Increased efficiency

Shorter culture cycles (3d comp. 4d)

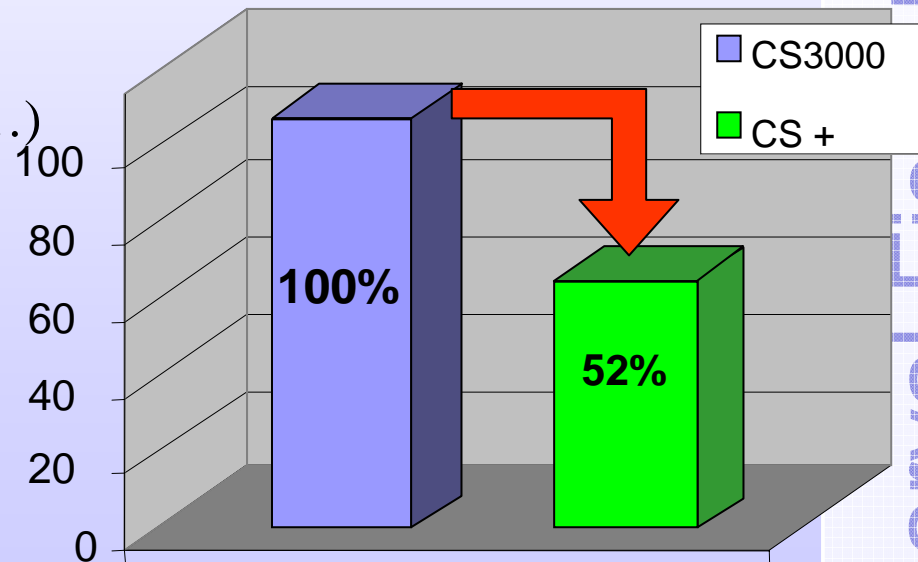


- Less tanks needed
- less food, better FCR
- diet improvement
- better water quality, faster filtration
- ...**increased efficiency** =

SAVINGS (heating, tanks, labour,...)



## Food consumption

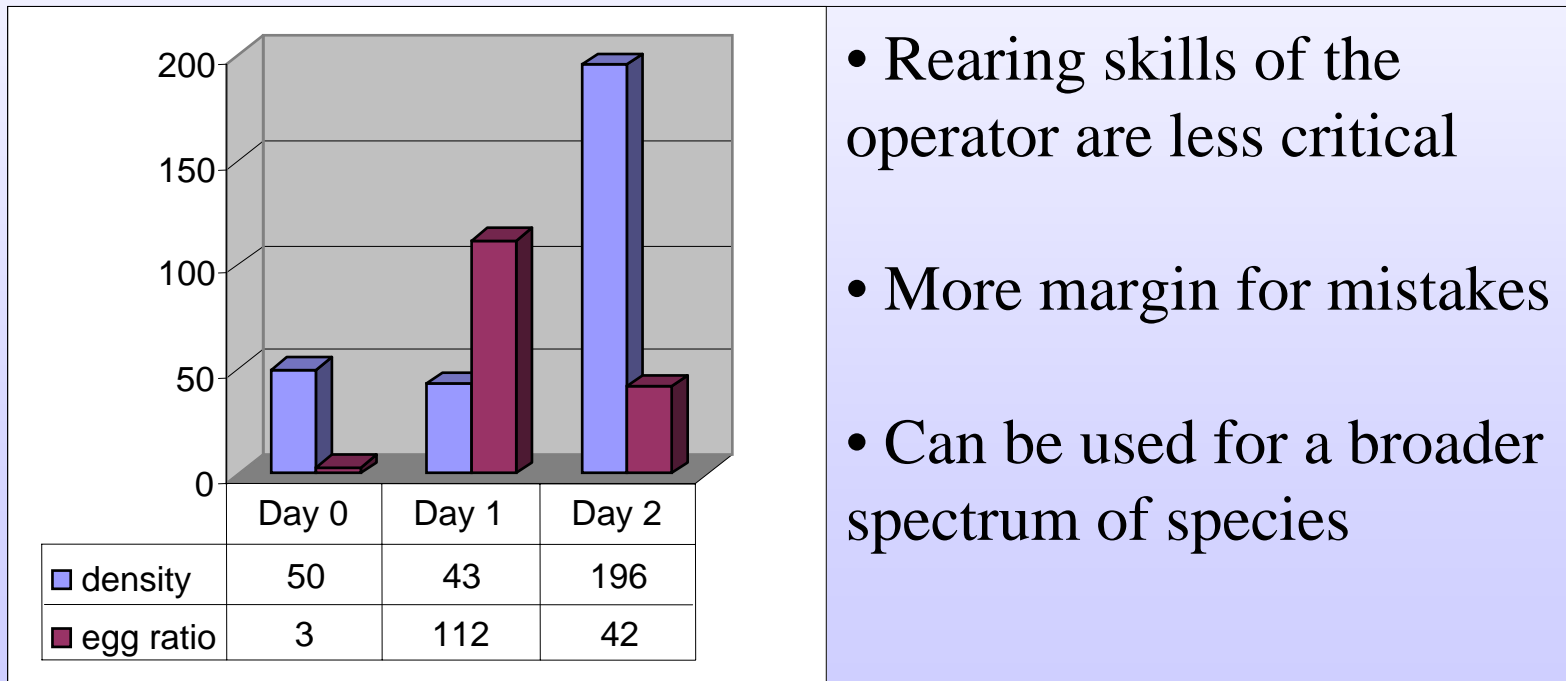


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# Increased quality of rotifers

- Better water quality results in increased rotifer viability
- Incorporation of fertility enhancers (conditioning)

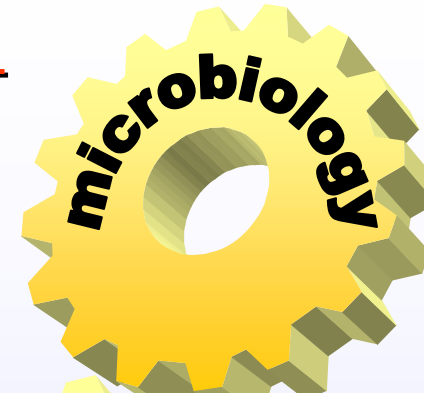
➔ Revitalisation of the cultures, less risk for crashes



- Rearing skills of the operator are less critical
- More margin for mistakes
- Can be used for a broader spectrum of species



# Success of 3rd generation CS+



- Control on bacterial development  
through the use of functional algal components  
→ 2-3 log differences in *Vibrio* counts

# 3rd generation rotifer enrichment?

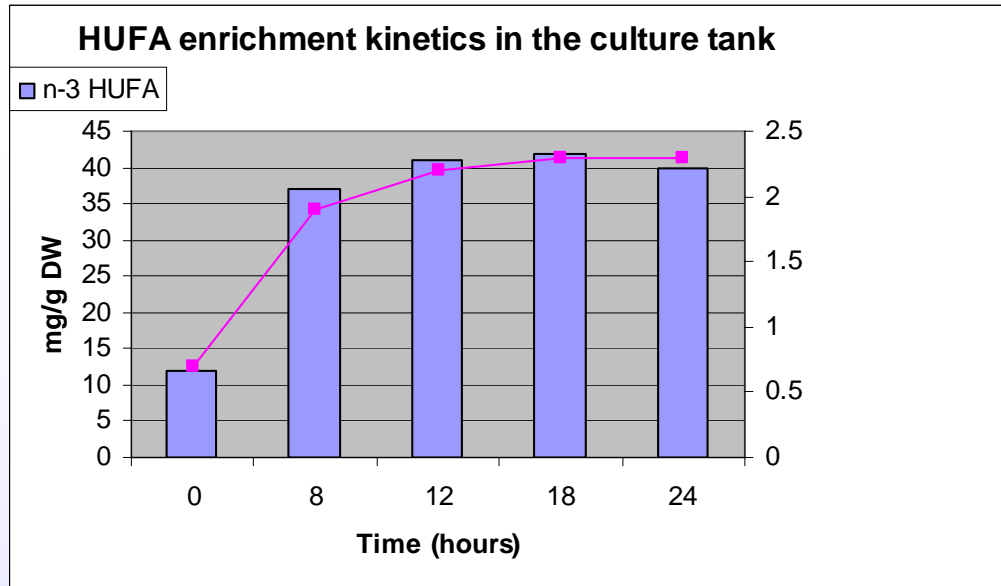
- Max. lipid/protein enrichment
- immunostimulation
- easy applications



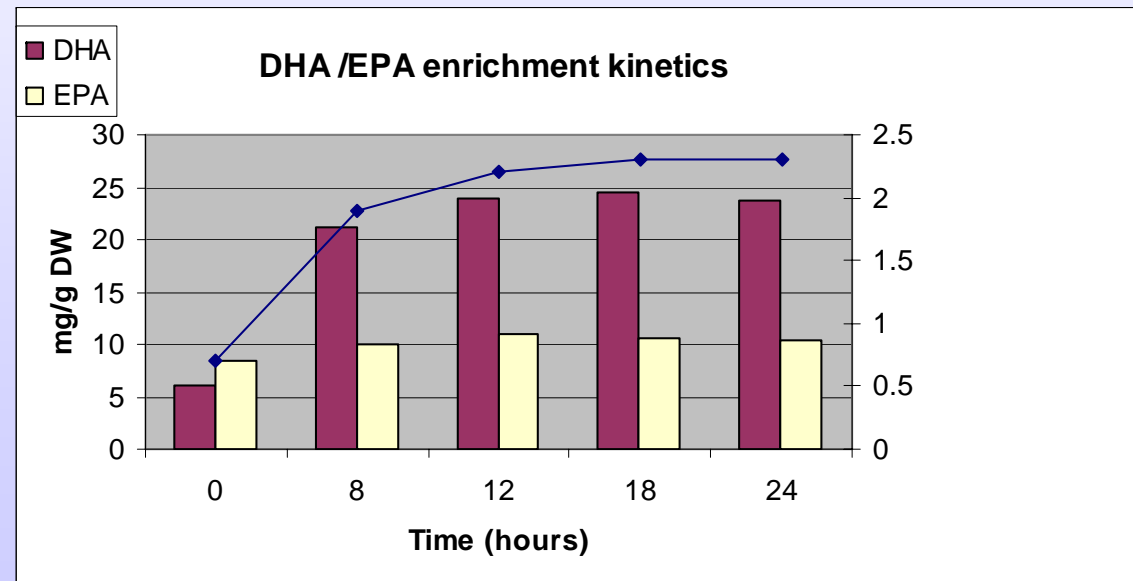
New technology : combines properties of liquid and dry enrichment products



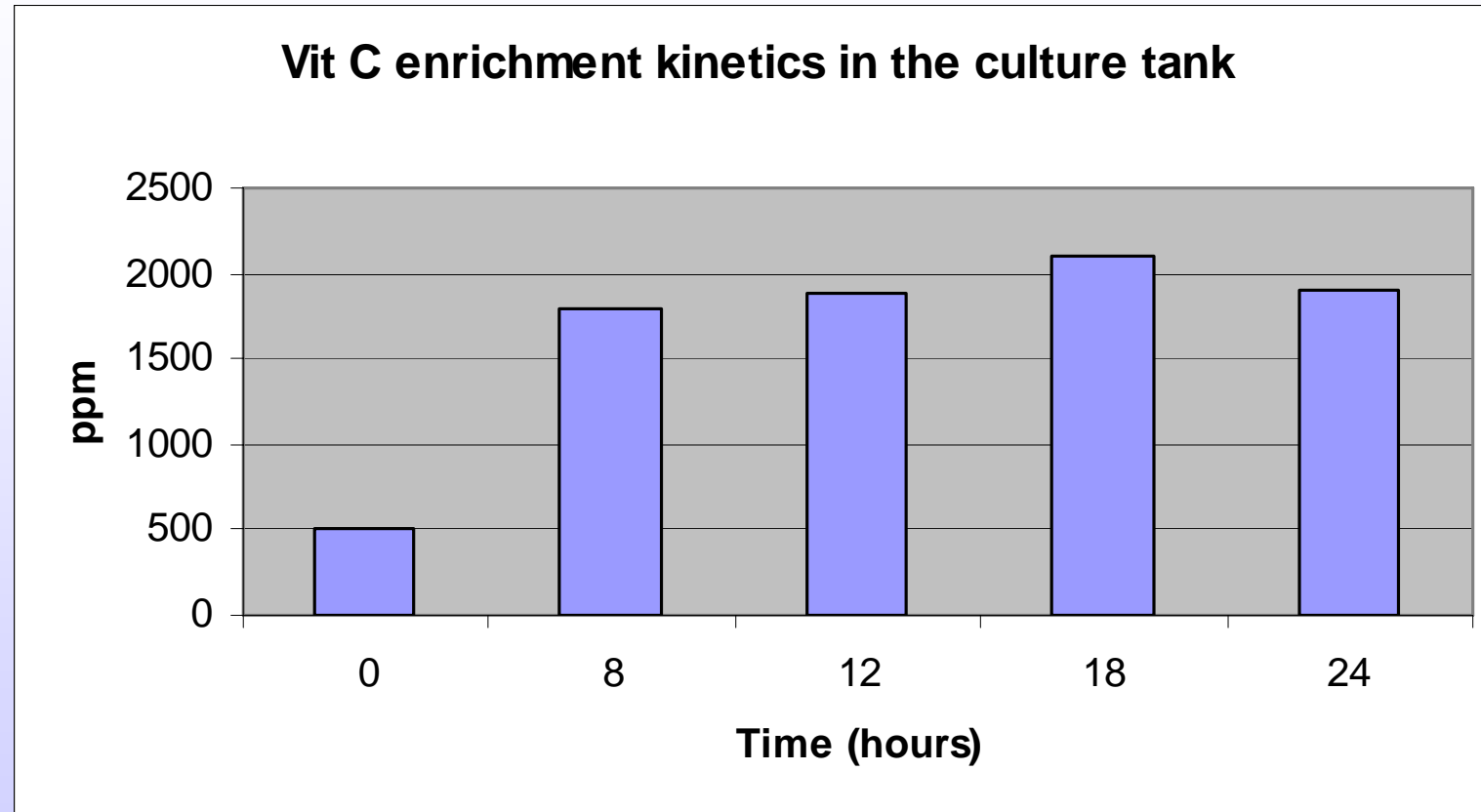
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**Results: 3rd generation enrichment**



## Results: 3rd generation enrichment

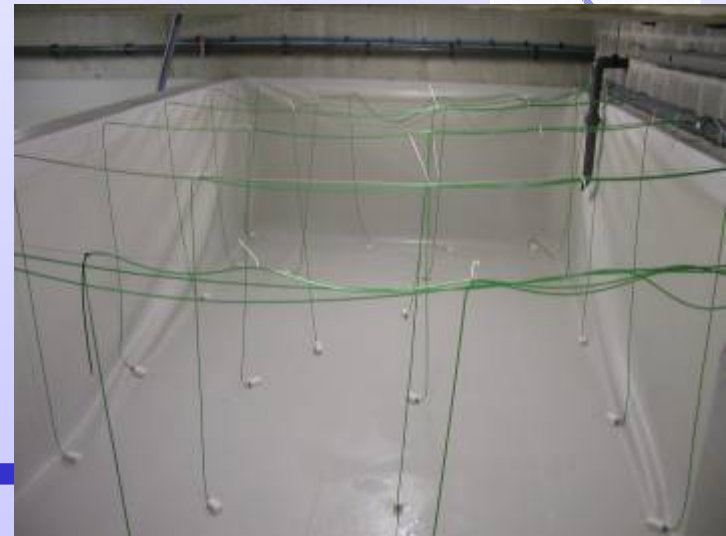


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# Applications for Asia with these new products?

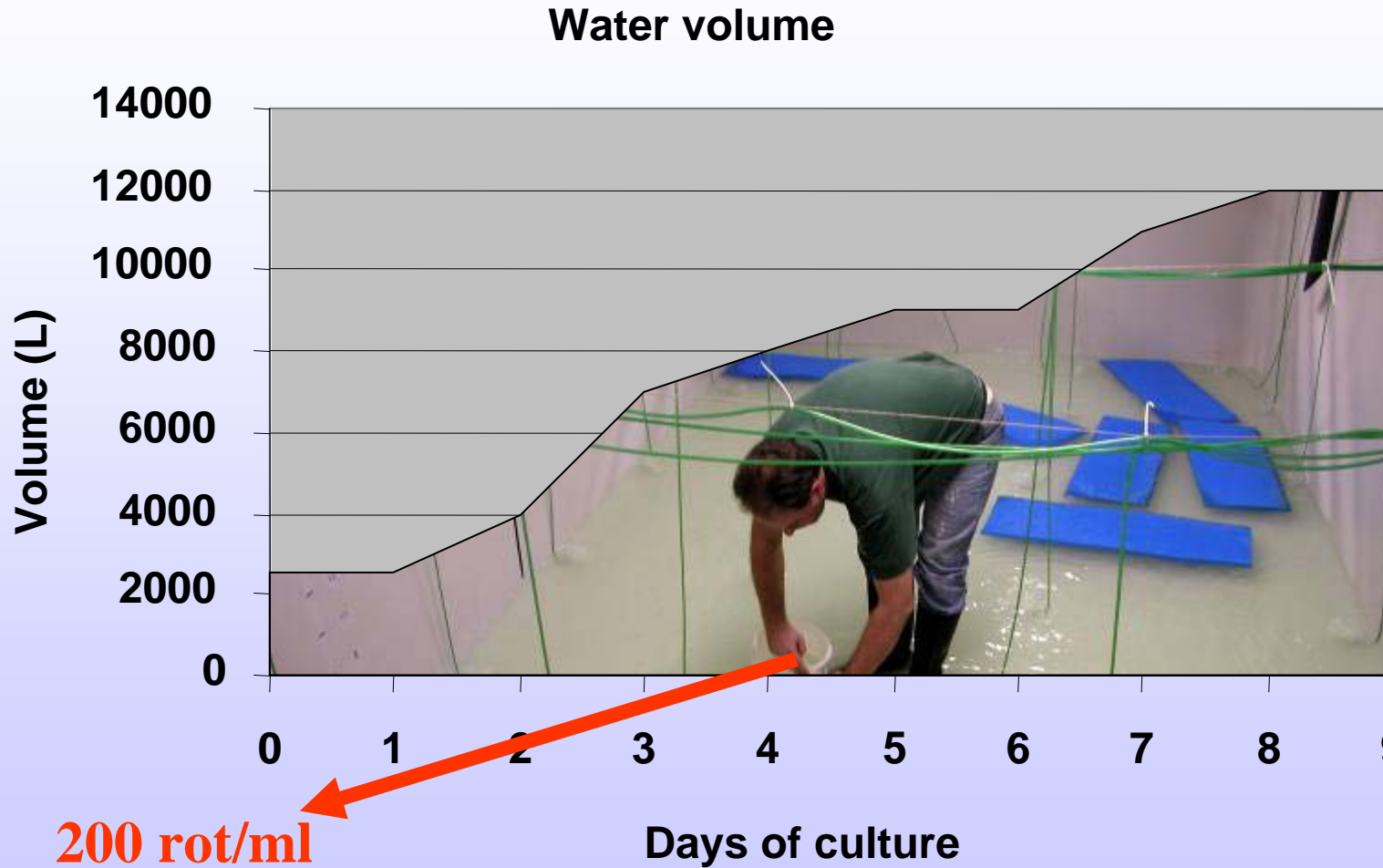
Culture in large tanks starting with low density rotifers



**INVE**  
Advanced Solutions  
for animal rearing

Nutrition

# Experimental set-up and water treatment



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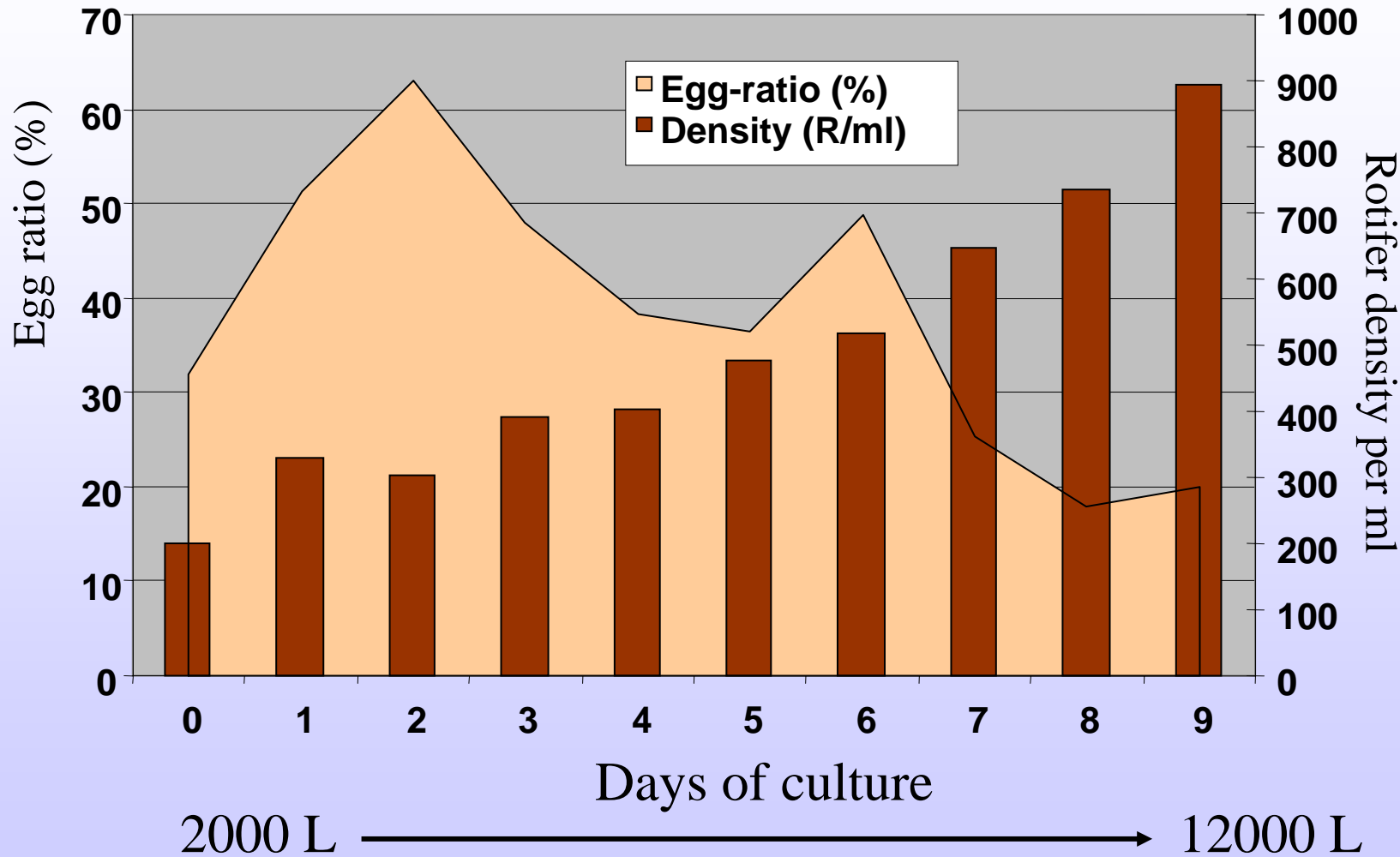


Culture Selco Plus

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# Results on growth and fecundity

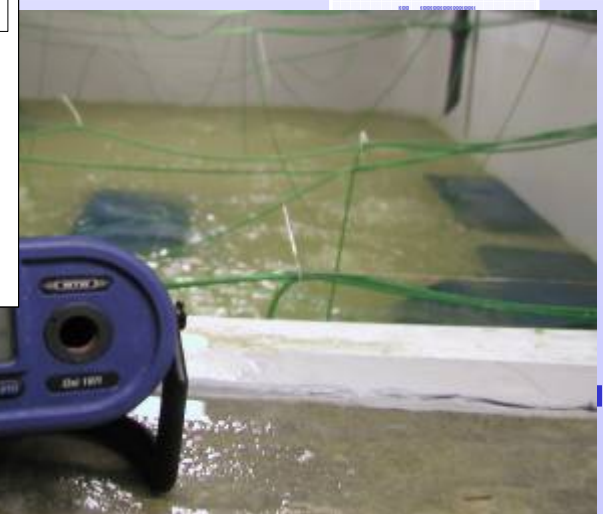
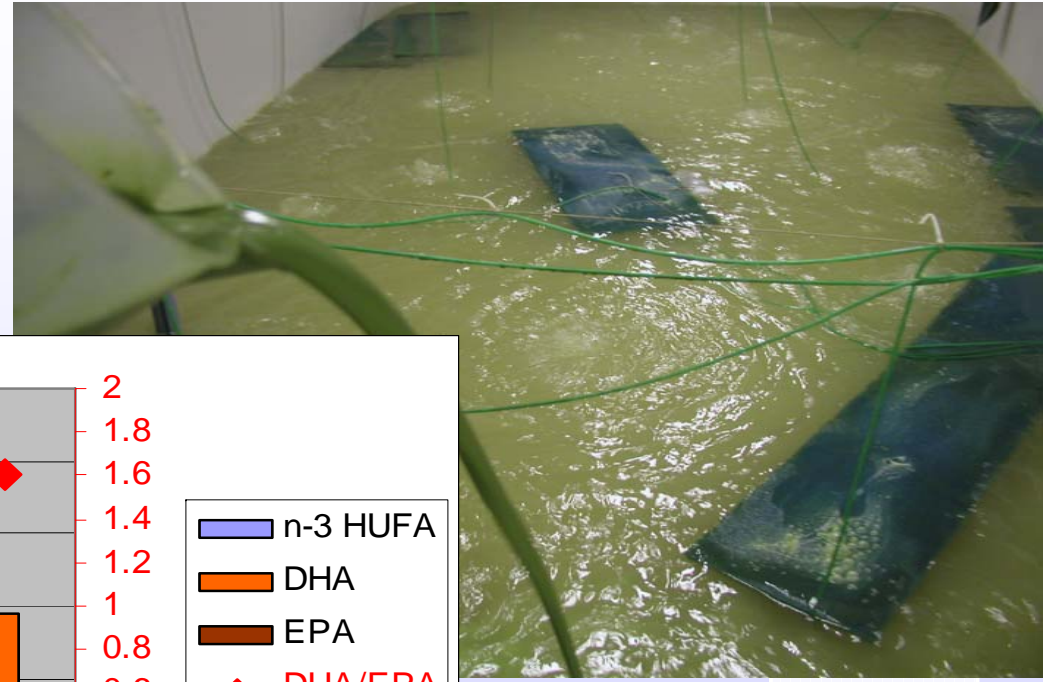
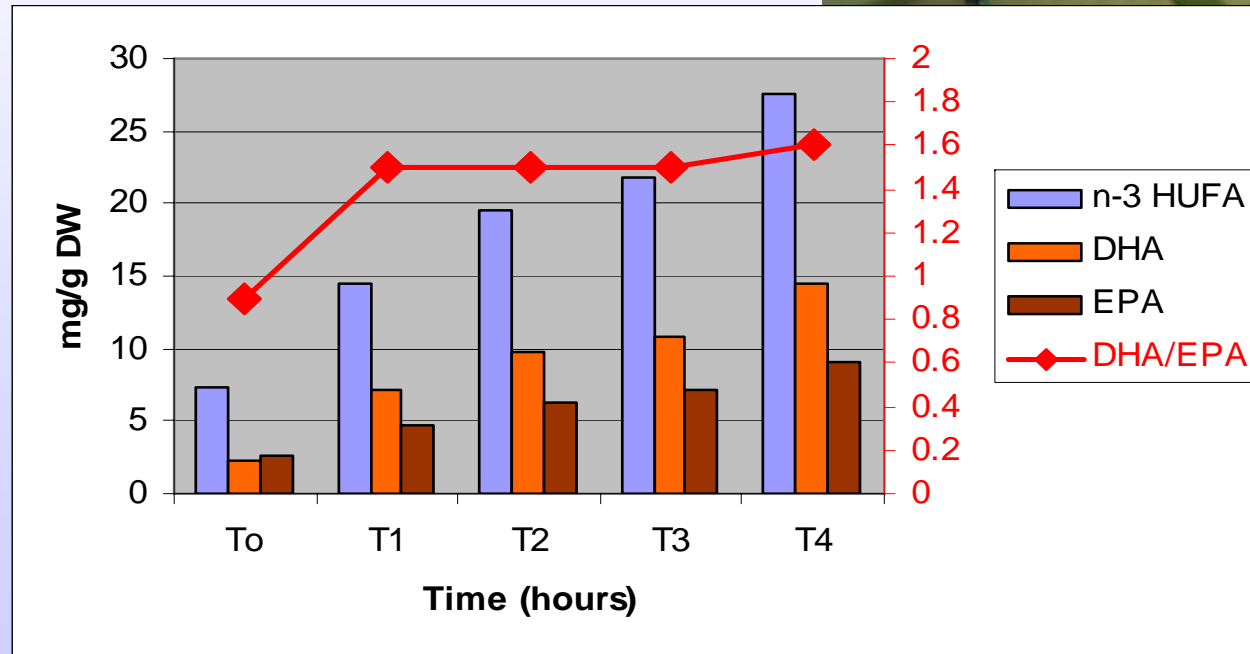


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# Enrichment in the tank on day 9



## Enrichment kinetics



# Conclusion

- Culture Selco Plus and Protein Selco Plus offer a variety of new culture applications in intensive and extensive rotifer culture (e.g. : length of rearing cycle, in tank enrichment)
- Easy to use and reduce the workload
- Excellent nutritional and physical characteristics



# Innovations for Artemia

- **Species specific selcos**
- **Quality improvers**

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# SPECIES SPECIFIC SELCOS



nutrition

THE FIRST  
SPECIES-SPECIFIC  
ARTEMIA ENRICHMENTS

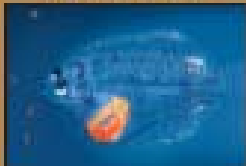
SERRANI SELCO'



SPARI SELCO'



PLANI SELCO'



GADI SELCO'



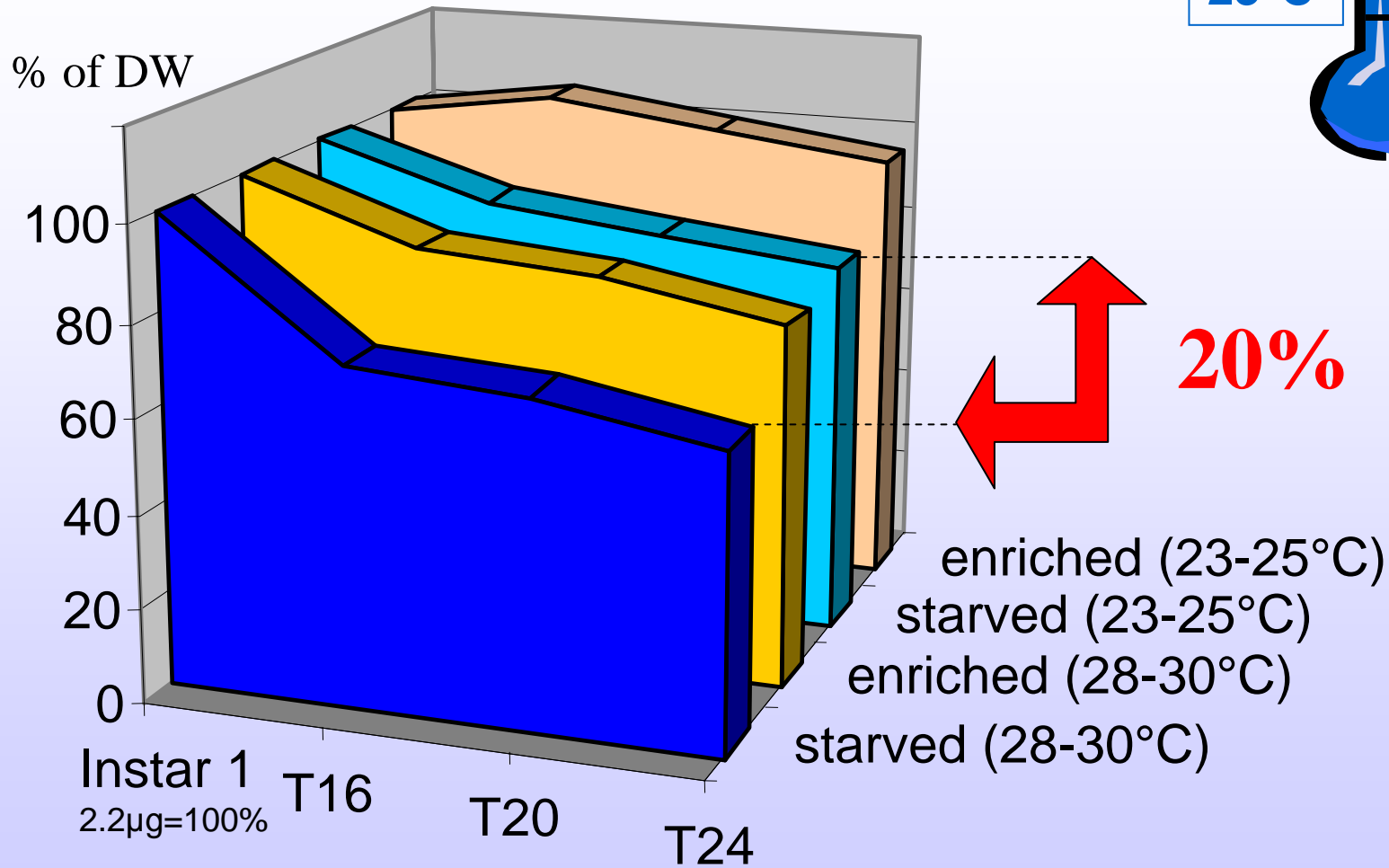
Easy  
Easy Easy  
Easy

- no mixing required

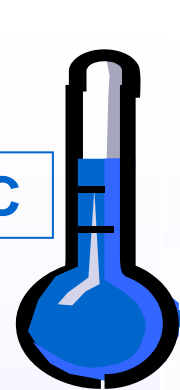
- cold & short application



# Enrichment at colder temperature



23°C



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# Species Specific Selcos

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## Why short & cold enrichment?

Harvest at 20h ( before 24h )

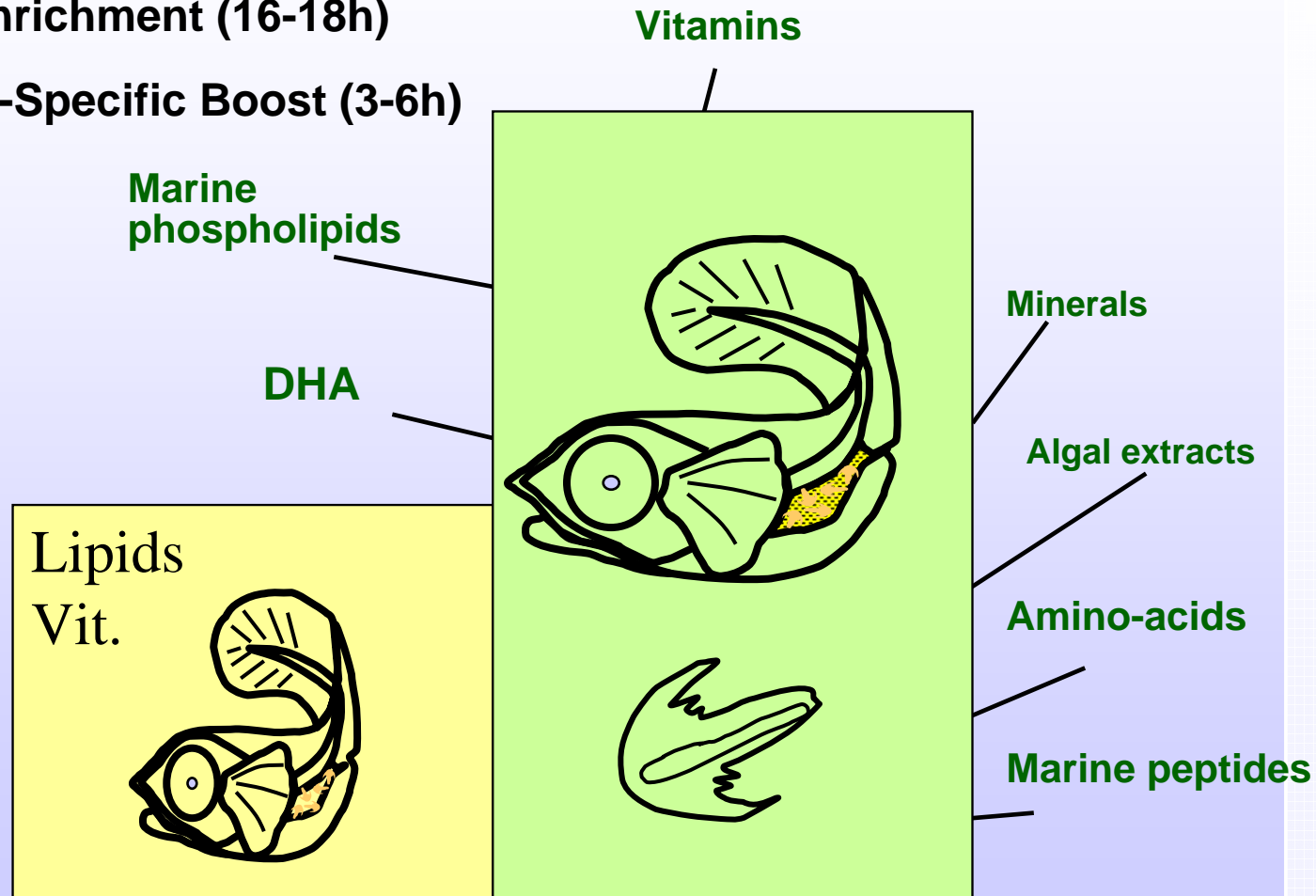
Temperature 23-25°C ( before 28-30°C )

- a reduction of the energy losses due to metabolic activity
- a reduction of the catabolism of DHA and phospholipids
- savings on operating costs (lower temperature, oxygen consumption)
- more adapted, smaller prey-sizes for young larvae
- better pigmented
- a reduced risk for losses and harming during enrichment and harvest

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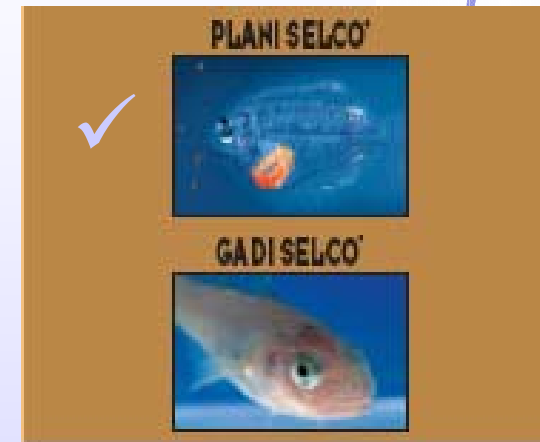
# Enrichment kinetics :

- Basic enrichment (16-18h)
- Species-Specific Boost (3-6h)



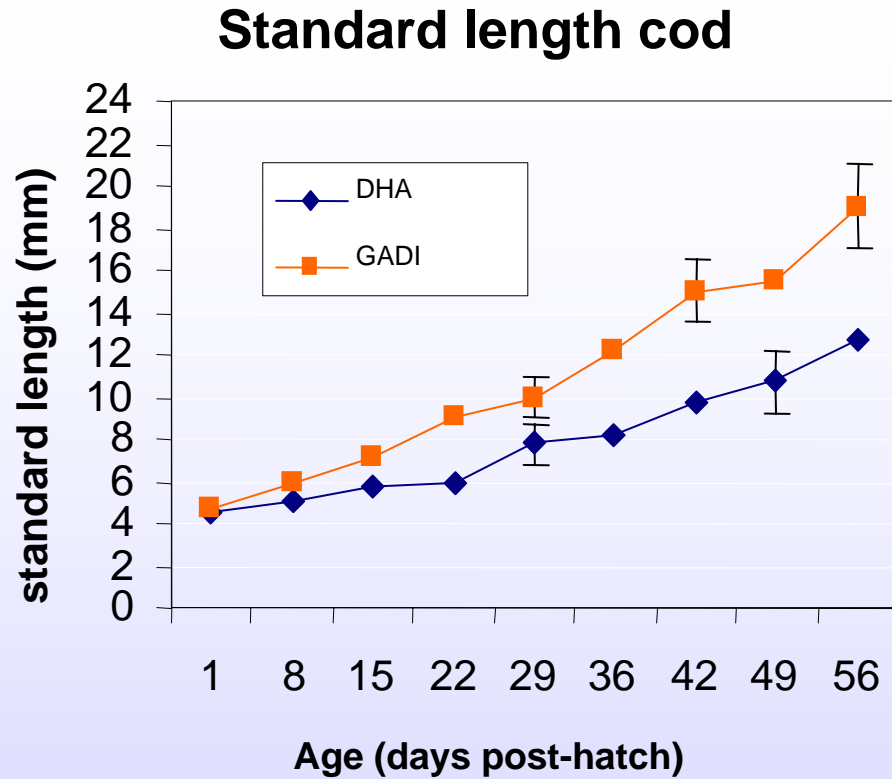
## Example Species specific selco:

| COMPOSITION  | PLANI SELCO     | GADI SELCO      |
|--------------|-----------------|-----------------|
| Moisture     | 29%             | 27%             |
| Crude lipids | 56%             | 69%             |
| Crude ash    | 2%              | 0.5%            |
| Phosphorus   | 0.2%            | 0.2%            |
| Vit. A       | 750,000 IU/kg   | 1,500,000 IU/kg |
| Vit. D3      | 150,000 IU/kg   | 150,000 IU/kg   |
| Vit. E       | 3,600 mg/kg     | 3,600 mg/kg     |
| Vit. C       | 1,500 mg/kg     | 1,500 mg/kg     |
| Antioxidants | Ethoxyquin, BHA | Ethoxyquin, BHA |
| Sum(n-3)HUFA | 200 mg/g dwt    | 300 mg/g dwt    |
| DHA/EPA      | 3               | 2               |

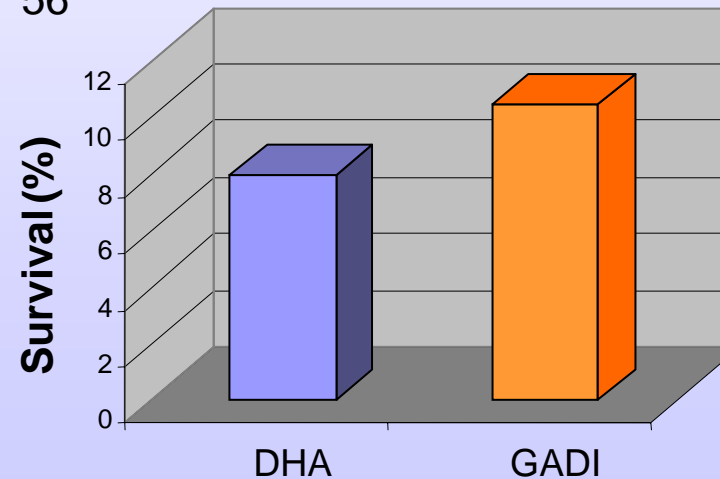


- Marine oils and phospholipids adjusted to needs (low lipid, high DHA/EPA, low ARA)
- Mixture of algae containing DHA, antioxidants, vitamin precursors
- Essential minerals, trace elements (Zn, iodine, Se,.....)
- Vitamin adjustment for optimal pigmentation and structural development

## Effect of Species Selco on fish (Gadi Selco)



### Survival cod



Case study : Cod

Memomorial University of Newfoundland,  
Ocean Science Center

# Should we always think lipids for enrichment?



Lipid enrichment



Quality improvers:

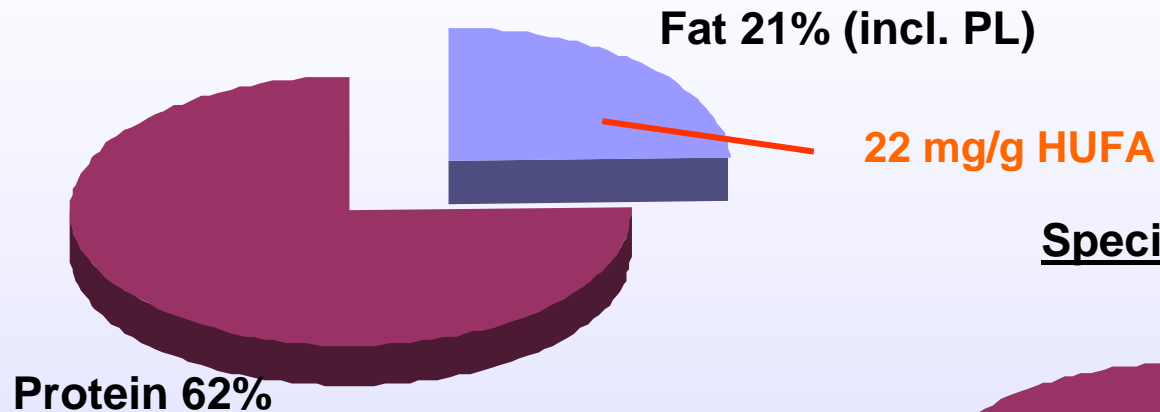
- growth
- stress
- deformities
- ...



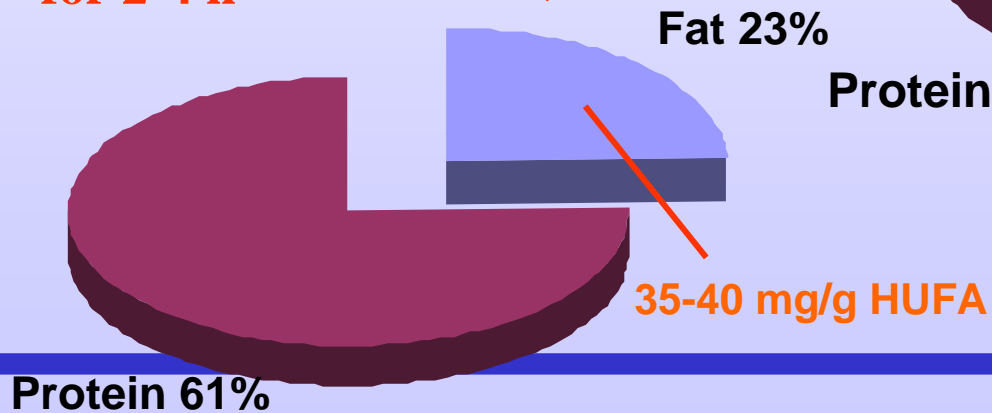
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# Effect of QUALITY improvers : Short time enrichment (20 h)

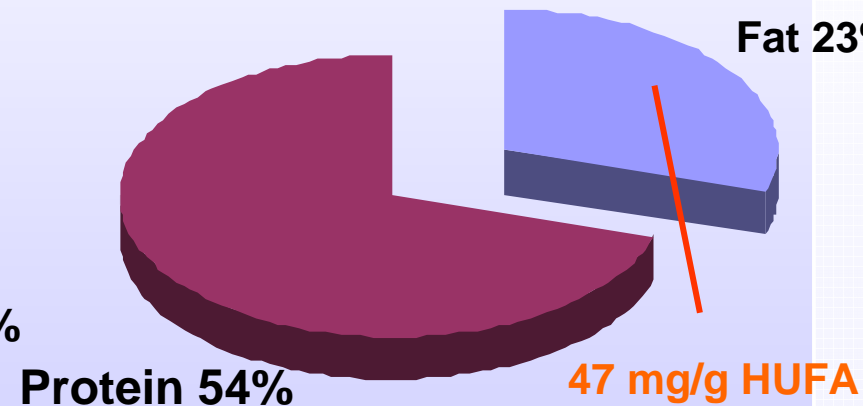
## Quality improver 20 h



Species specific selco  
for 2-4 h



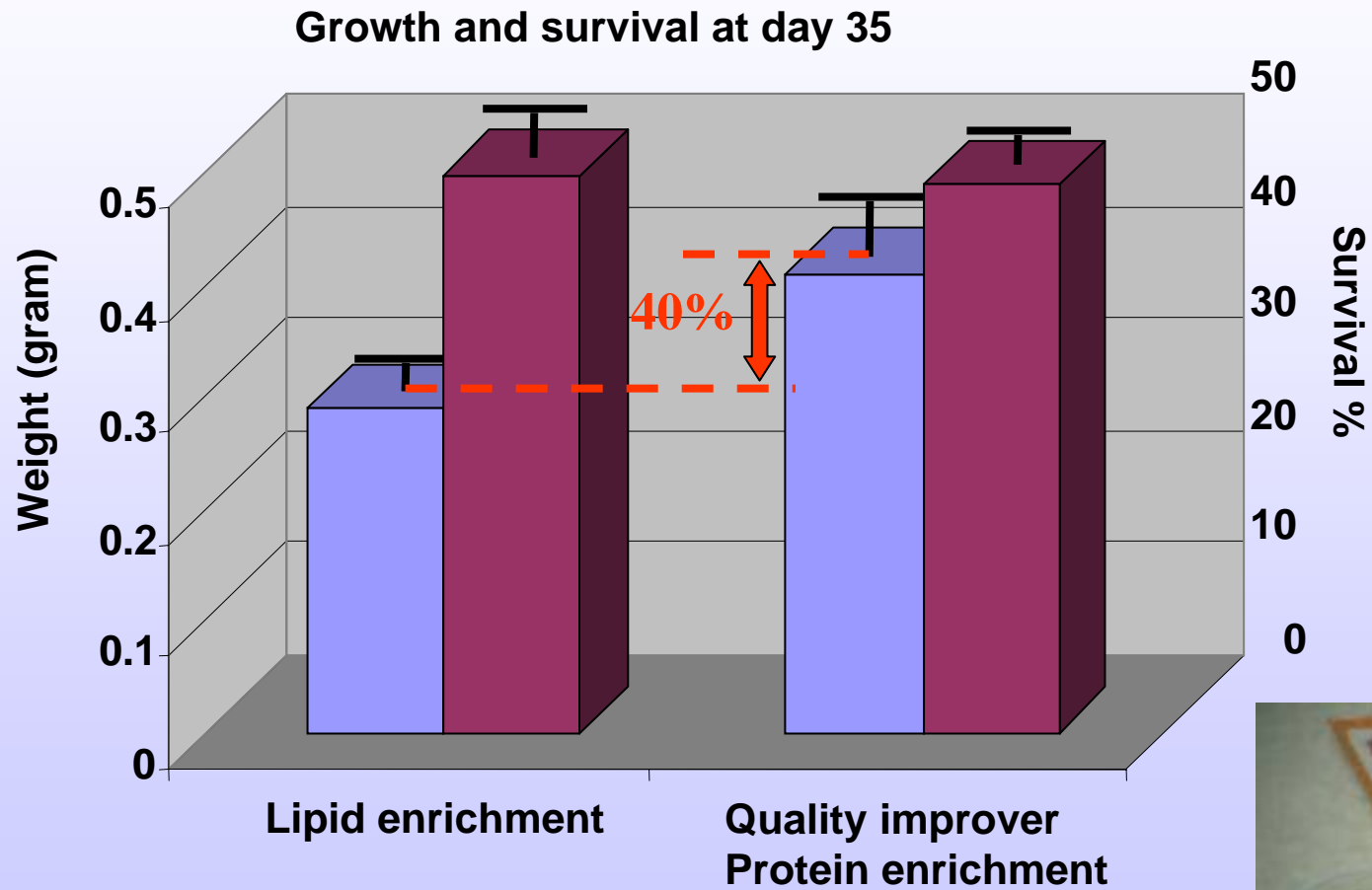
## Species specific selco 20h



# Effect of QUALITY improvers on fish :

Case study cobia : Virginia Tech, Virginia Seafood

Agricultural Research and Extension Center



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# Conclusion

- Easy selcos : basic selcos focussing on lipid enrichment
- Species specific selcos: lipid selcos with species specific features
- Quality improving selcos : adjust the protein/lipid ratio in Artemia and transform it to a balanced diet



Thank you



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