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European Regional Development Fund

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Larviculture: Case of pikeperch larvae production

University of Rostock

Aquaculture & Sea-Ranching

Faculty of Agricultural and Environmental Sciences

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Dr. Adrian Bischoff-Lang

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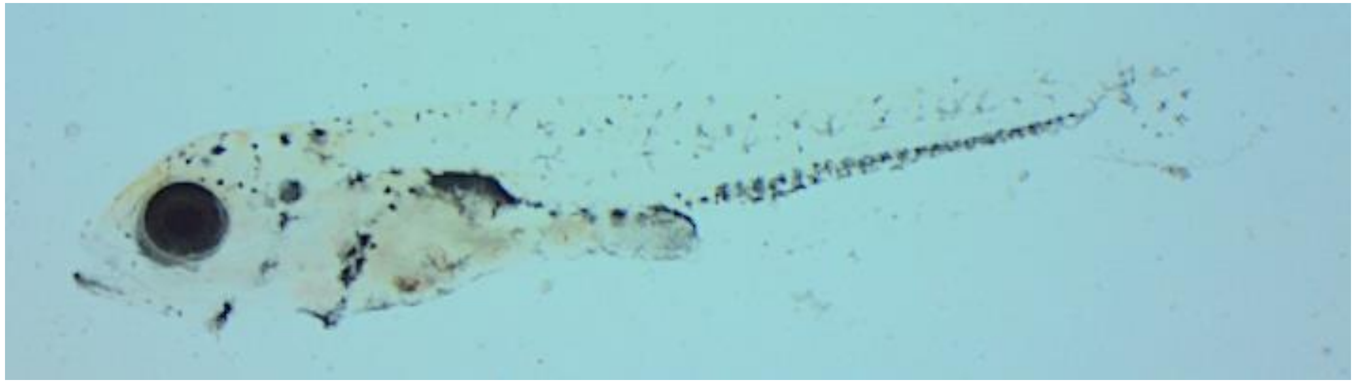


1. Larviculture

1.1. Definition, importance and bottlenecks

-**Larviculture** is the part of the aquaculture that deals with the culture of larvae under controlled hatchery conditions and requires specific culture techniques

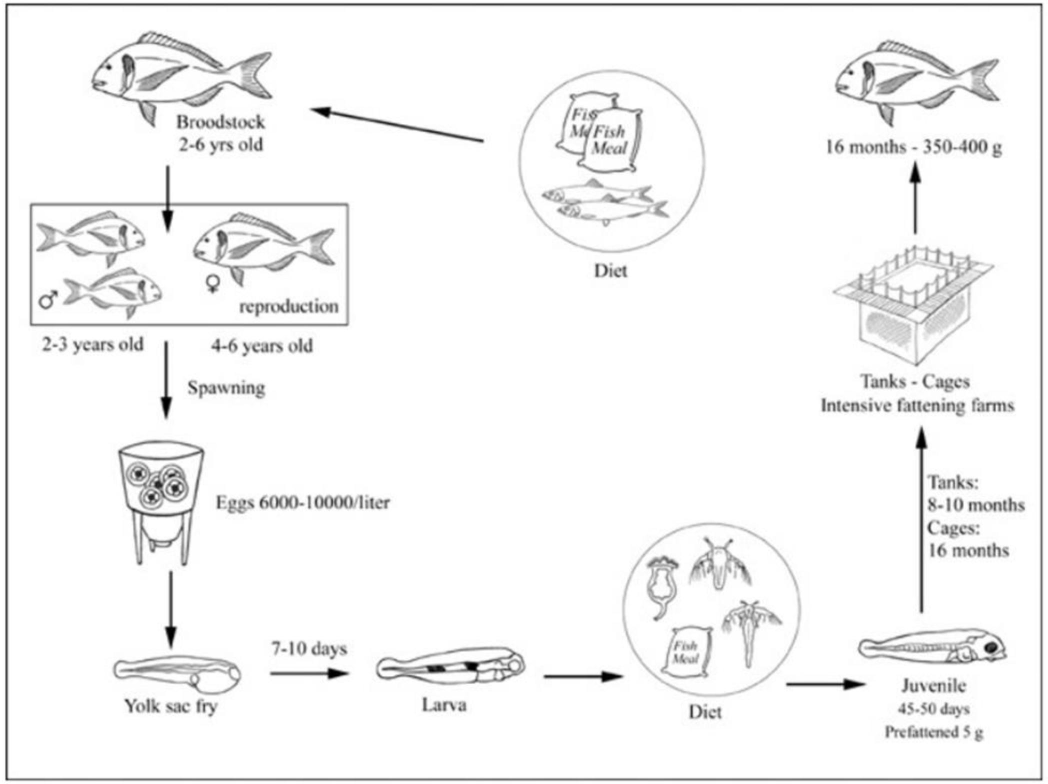
-Need of increasing the efficiency of the production from larval stage (low survival rates)

1. Larviculture

1.1. Definition, importance and bottlenecks

Before larval stage:

- Broodstock management: domestication and genetic background, rearing conditions, nutrition, health.



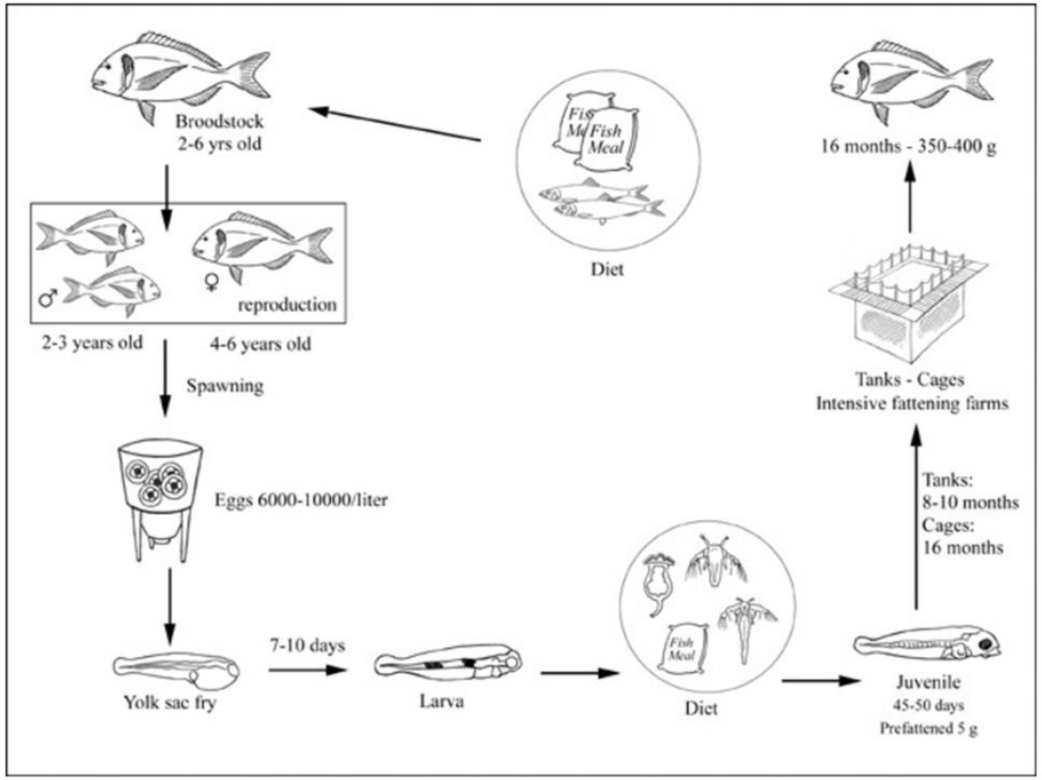
[FAO Fisheries & Aquaculture - Cultured Aquatic Species Information Programme - Sparus aurata (Linnaeus, 1758)]

1. Larviculture

1.1. Definition, importance and bottlenecks

Before larval stage:

- Controlled reproduction: breeder selection, protocols to induce gonad maturation, management of gametes and fertilized eggs.



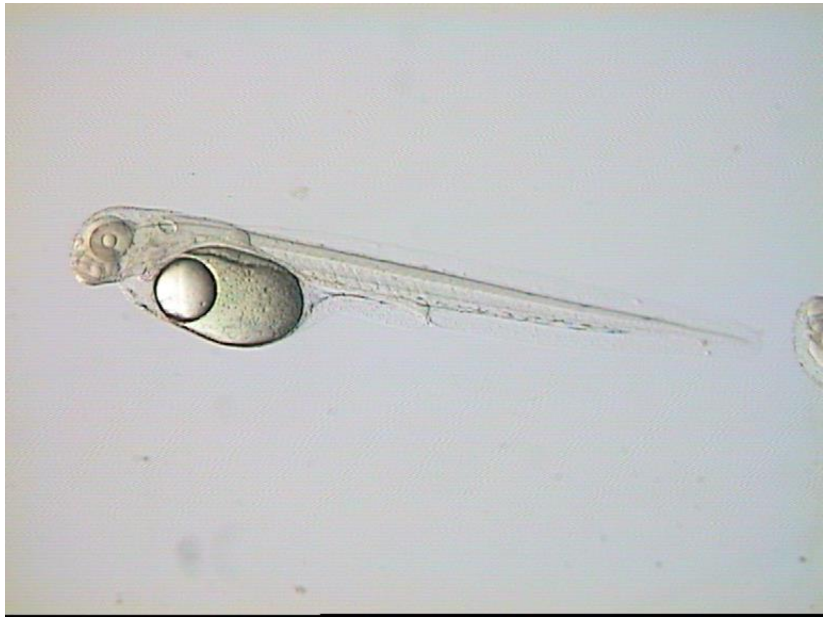
[FAO Fisheries & Aquaculture - Cultured Aquatic Species Information Programme - Sparus aurata (Linnaeus, 1758)]

1. Larviculture
1.1. Definition, importance and bottlenecks

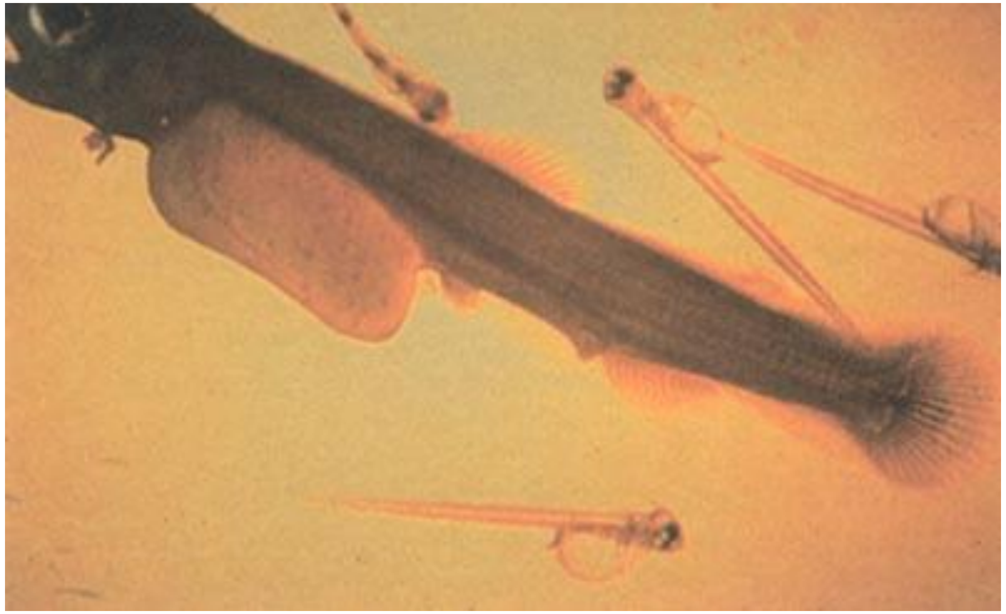
At larval stage:

- Quality

- Size



FAO Fisheries & Aquaculture - Cultured Aquatic Species Information Programme - Sander lucioperca (Linnaeus, 1758)



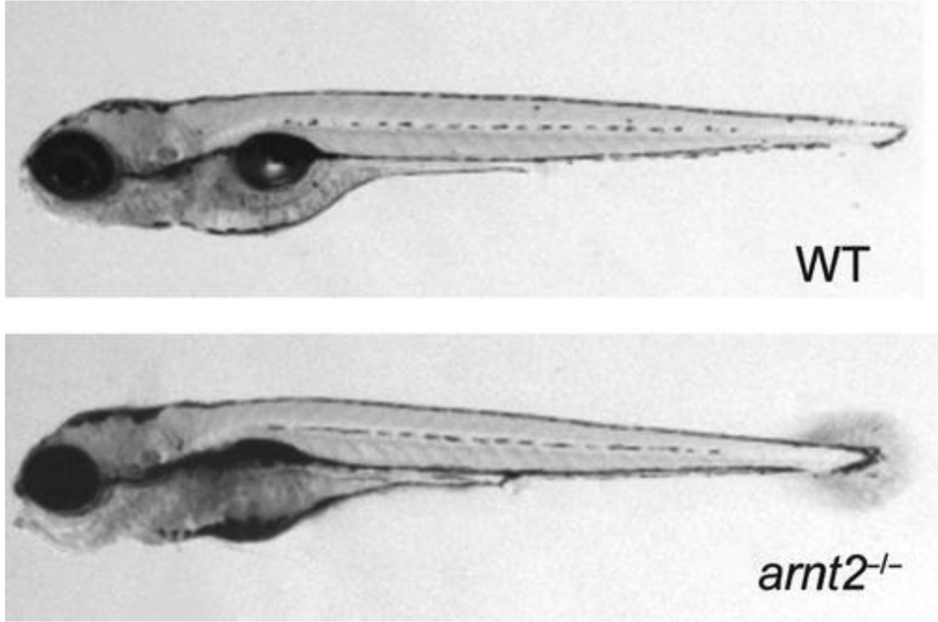
Salmon vs. Gilthead seabream w3732e02.jpg (400×244) (fao.org)

1. Larviculture

1.1. Definition, importance and bottlenecks

- Cannibalism

- Swimbladder inflation



ZFIN All Figures, Hill <i>et al.</i>, 2009

1. Larviculture

1.1. Definition, importance and bottlenecks

- Deformities

Kathryn Ellis/ Duke University Medical Center

1. Larviculture

1.2. Feeding as solution

- Timing
- Light intensity and light period
- Water flow
- Salinity
- Green water technique

1. Larviculture

1.2. Feeding as solution

- Intake

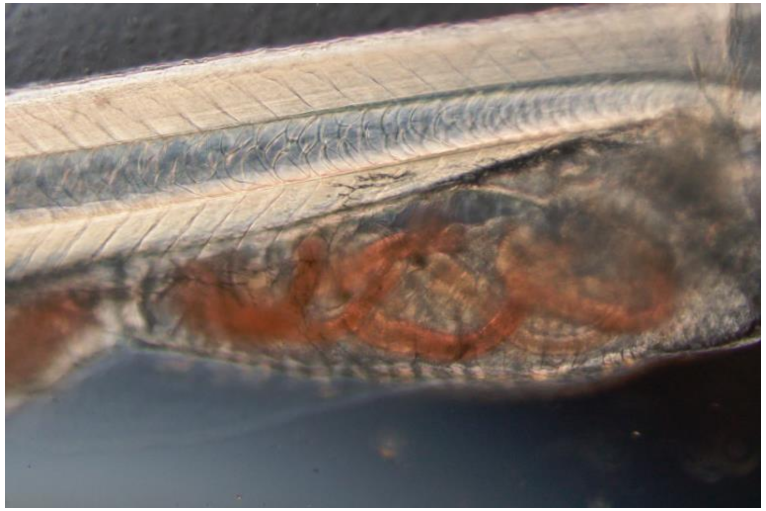
- Mouth opening

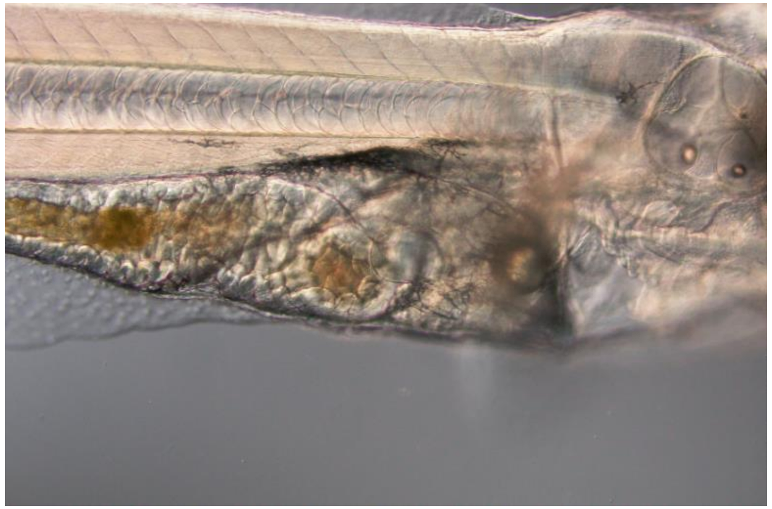
- Capacity to prey

- Digestion
- Nutritional requirements

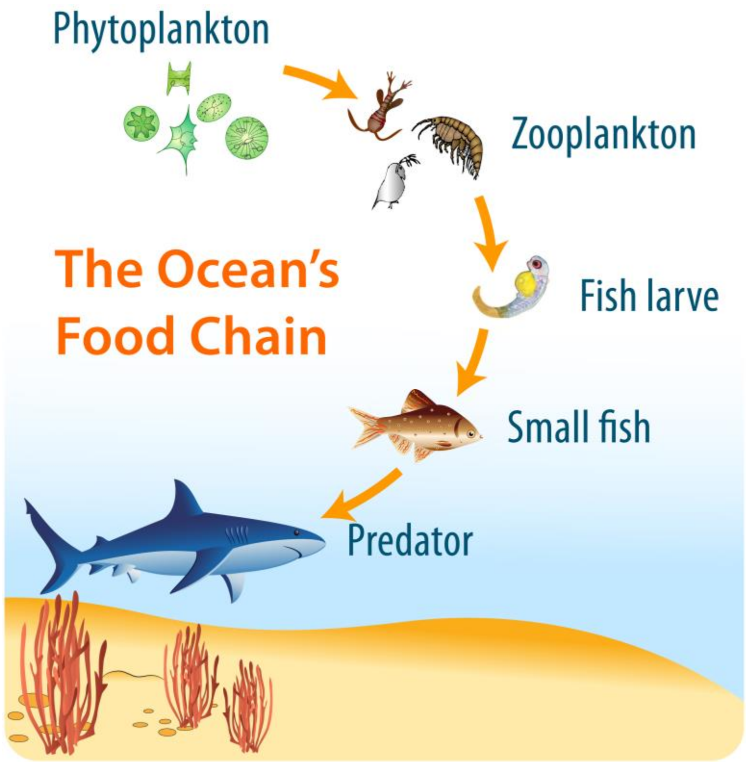
- Energy

- Nutrient

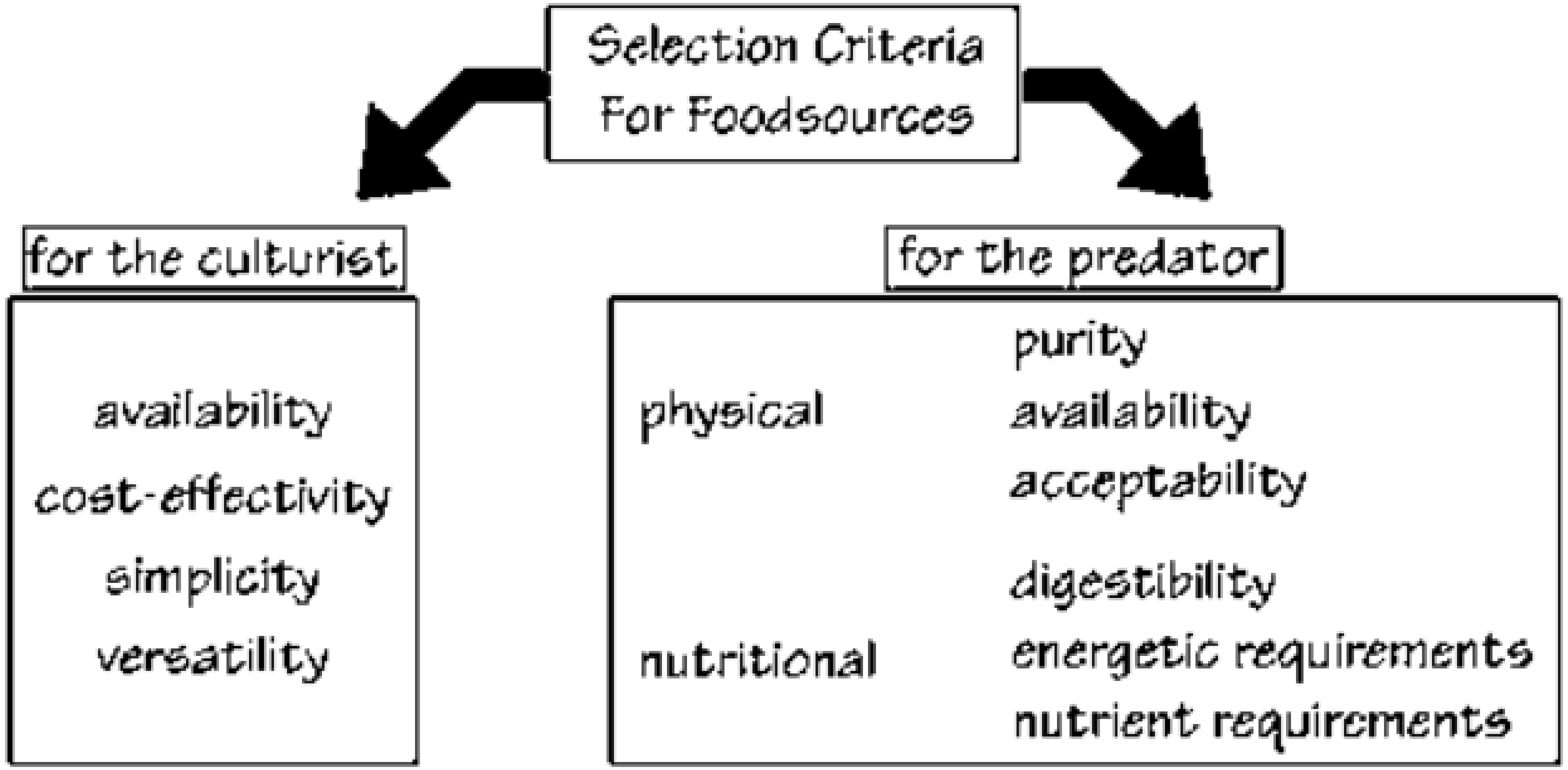




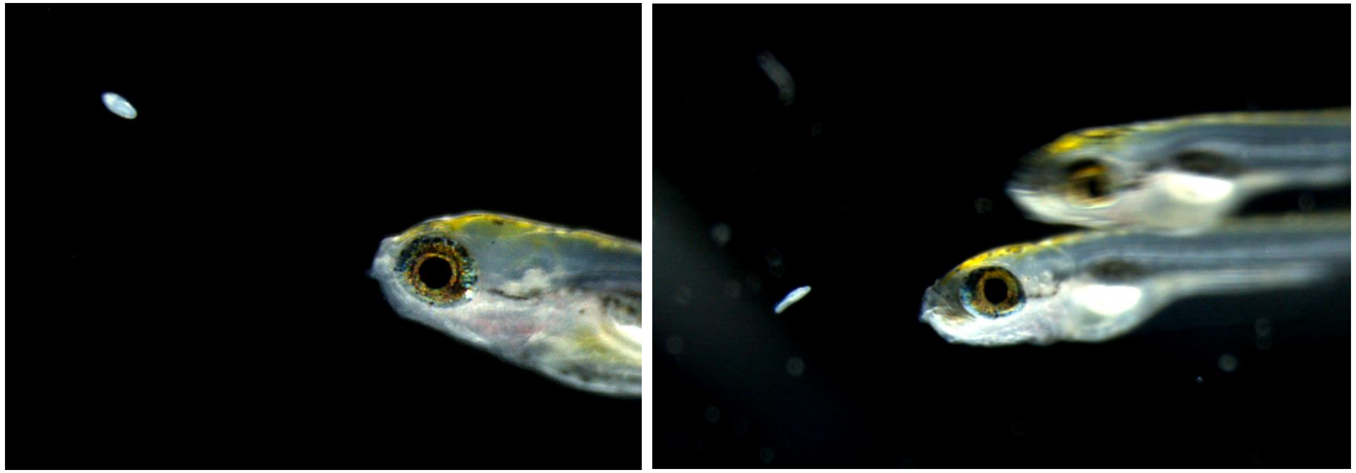
2. Live feed for larviculture



2. Live feed for larviculture
2.1. Selection criteria



2. Live feed for larviculture
2.1. Selection criteria



©National Institute of Genetics Zebrafish pictures – Fish thought (akiramuto.net)

Physical:

- Prey size
- Swimming behavior

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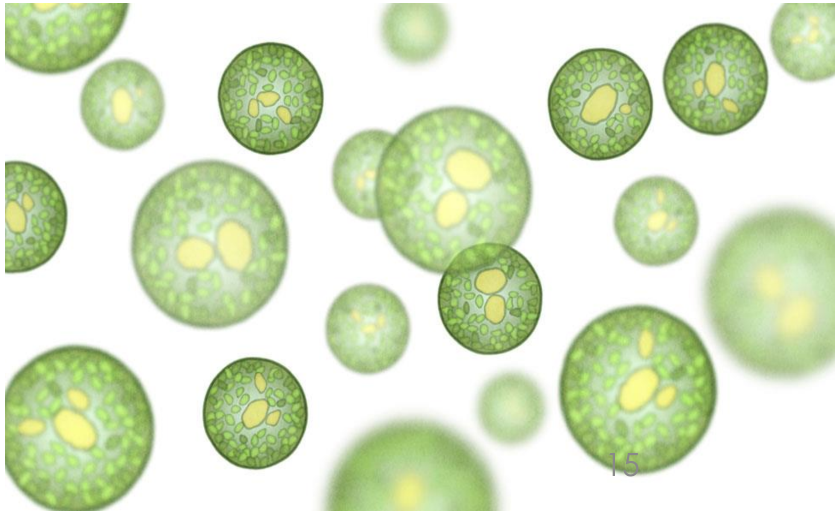
2. Live feed for larviculture

2.1. Selection criteria

- Nutritional profile (energy and nutrient composition)
- Microalgae

- Diet
- Enrichment
- Microbial interaction



2. Live feed for larviculture
2.2. Artemia

- Brine shrimp (crustacean)
- Globally found
- Dormant embryos or **cysts**
- Most used live feed in commercial hatcheries
- Non-selective filter feeder

2. Live feed for larviculture
2.2. Artemia

- **Decapsulation**:
- More energy content
- Disinfected
- Lower mobility

- **Hatching**:
- Less energy content
- Risk of gut obstruction for fish
- Higher mobility

Conseils Artémias - Page 2 (forumactif.fr)

2. Live feed for larviculture

2.3. Rotifers

- Main genus is *Brachionus*
- High density cultures
- Non-selective filter feeder
- Slow swim
- Resistant to abiotic factors

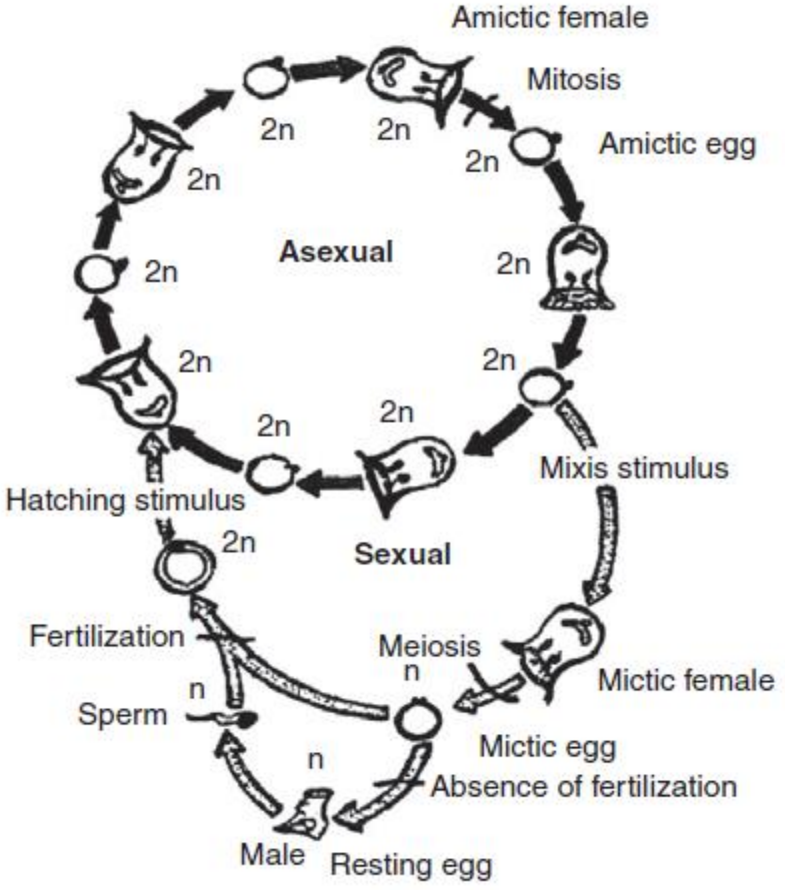


Fig. 5.1 Parthenogenetical and sexual reproduction of *Brachionus* sp. (modified from Hoff and Snell, 1987).

2. Live feed for larviculture

2.3. Rotifers

- Used for small larvae fish
- Suitable size

Woche 1		Woche 2		Woche 3	
Brachionus calyciflorus (GS 150-200 µM)					
Brachionus plicatilis (GS 150 - 200 µM)					
Apocyclops panamensis (GS 80 - 600 µm					
	Tisbe sp. (GS 150 - 800 µM)				
		Tigriopus californicus (GS 300 - 1200 µM)			
			Daphnia pulex (GS 500 - 3000 µM)		

2. Live feed for larviculture

2.3. Rotifers

- Culture techniques:
  - Batch culture
  - Semi-continuous
  - Continuous

- Fatty acids composition

2. Live feed for larviculture

2.4. Copepods

- Most abundant zooplankton
- Natural diet of fish
- Nutritionally adequate
- Culture technique
- Life cycle

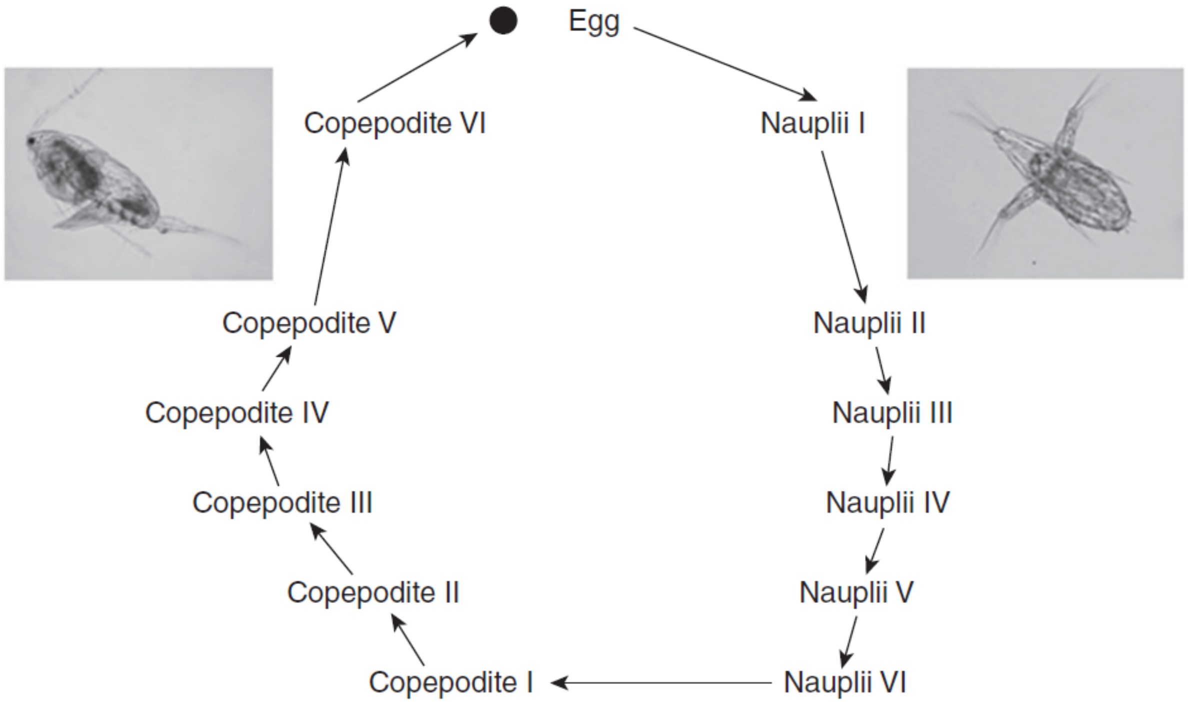


Fig. 5.3 Schematic life-cycle of a copepod.

2. Live feed for larviculture

2.4. Copepods

- Swimming behavior
- Nutrient composition

2. Live feed for larviculture

2.4. Copepods

- Three orders:
- Calanoida (*Acartia tonsa*, *Calanus* sp., *Eurytemora affinis*)
- Harpacticoida (*Tisbe* sp., *Tigriopus* sp.)
- Cyclopoida (*Apocyclops panamensis*)

2. Live feed for larviculture
2.4. Copepods

Apocyclops panamensis

- <u>Three diets</u>:
- **N100%** (*Nannochloropsis* sp. at 200.000 cells*mL^{-1}*day^{-1})
- **ISO100%** (*I. galbana* at 100.000 cells*mL^{-1}*day^{-1})
- **N+I** (*Nannochloropsis* sp. at 100.000 cells*mL^{-1}*day^{-1} + *I. galbana* at 50.000 cells*mL^{-1}*day^{-1})

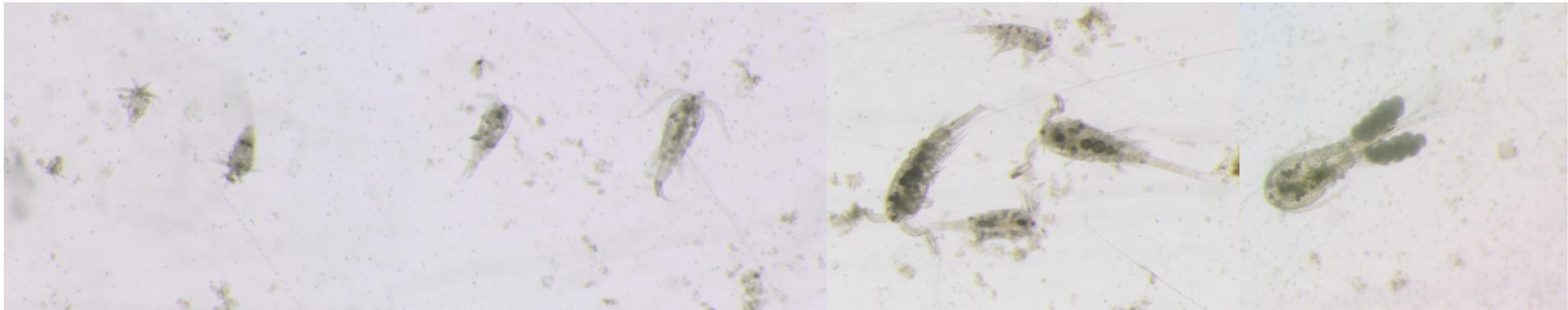
- The microalgae were culture to be in the exponential phase while feeding the copepods

2. Live feed for larviculture

2.4. Copepods

We can conclude that *A. panamensis* is a good candidate for aquaculture:

- Relative **high culture density**
- **Stable length** (posibility to filter per size) for feeding fish larvae and for maintenance
- Research about the **nutritional composition** should be done



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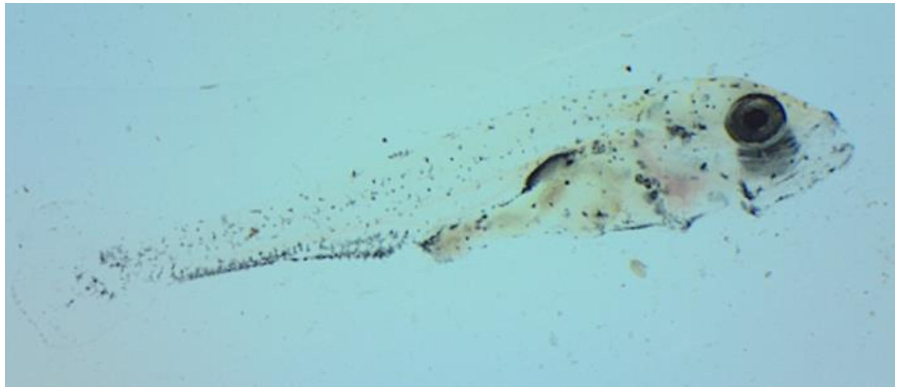
3. Pikeperch

3. Pikeperch larviculture

- The interest in sustainable production of *Sander lucioperca* has grown in recent years (FAO 2020).

- The costs of pikeperch production are still high due to the lack of stable production volume (Policar et al. 2019)



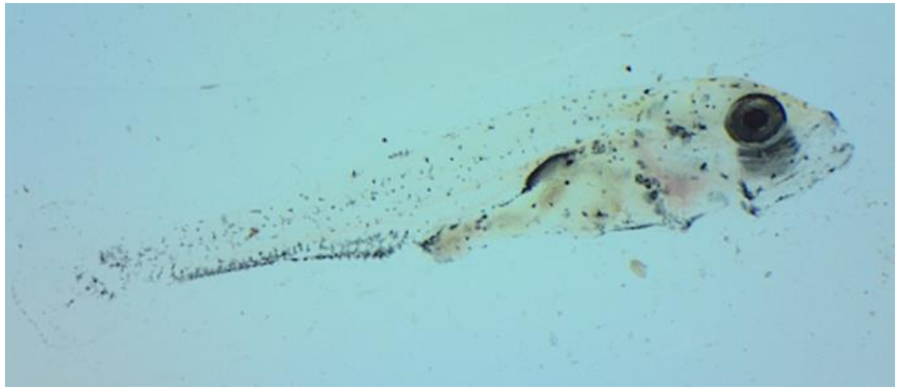
- Potential areas for improvement are the broodstock management, the controlled reproduction and **the larval culture**

- More effort should be done to find the **nutritional requirements** of pikeperch larvae

3. Pikeperch larviculture

Diets for pikeperch larvae:

- *Artemia* sp. (Bischoff et al. 2018, Yanes-Roca et al. 2018)
- *Brachionus plicatilis* (Imentai et al. 2019a, Imentai et al. 2019b, Imentai et al. 2020, Yanes-Roca et al. 2018, Yanes-Roca et al. 2020)
- *Brachionus calyciflorus* (Kubitz et al. in preparation)
- *Brachionus diversicornis* and *Brachionus quadridentatus* (Xu et al. 2017)



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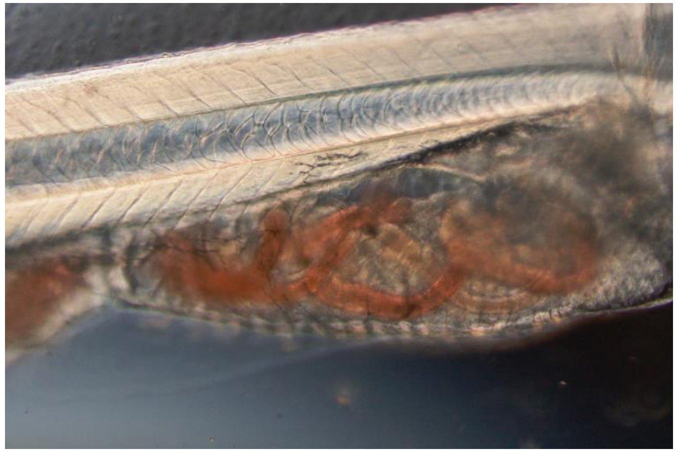
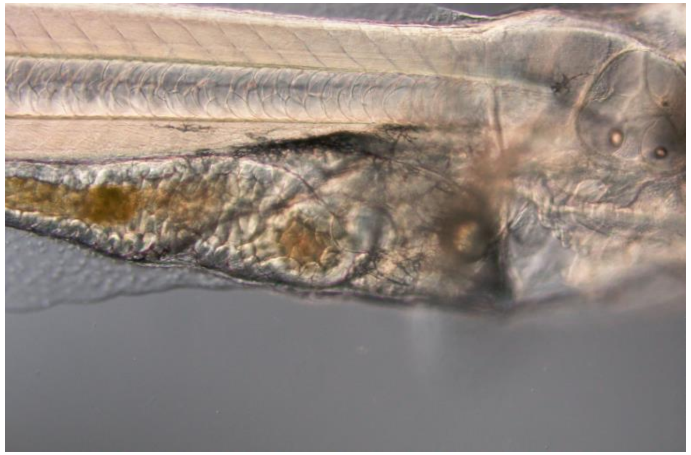
3. Pikeperch larviculture

- Our aim was to investigate the effect of different diets with the rotifer *Brachionus plicatilis* and the copepods *Apocyclops panamensis* on the survival and growth rates of pikeperch larvae

- **For the period of 4-10 dph**: our study can indicate this threshold in *Brachionus plicatilis* quantity. There is a point at which the fish larvae cannot ingest more food.

- In relation to this fact, it is essential to take into account the larval stocking density in relation with the food availability. Like this, every larvae get enough food





3. Pikeperch larviculture

- In another experiment, we could see at dph 7 that the larvae can ingest *Apocyclops panamensis*. The larvae excreted the copepod almost completely.

Conclusion

Larviculture technique:

- **Rearing system and rearing conditions**
- **Appropriate live feed**:
  - Size/swimming behavior
  - Nutritional value (Microalgae diet)
  - Production effectivity-costs
- **Fish larvae feeding protocol (when, what, how much,…):**
  - Mouth opening
  - Digestive development
  - Energy and nutritional requirements
  - Capacity to prey

Conclusion

Live feed in larviculture as a solution for production:

- Increasing survival and growth rates
- Increasing nutritional value of fish as products for the market
- Increasing health, welfare and sustainability

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Thank you for your attention

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