Hatchery planning and management
Hatchery design
Hatchery types
Industrial
Hatchery types
Small scale
Intensive larval rearing systems

• Variable structures
• Sloping floors
• Open drainage
• Capped pipelines for ease of cleaning
• Ease of operation
• Variable salinity
• Heated and cooled water
• Aeration
• Oxygen
• Individual tank lighting
• Individual tank cleaning equipment
Hatchery types
mesocosm tanks
Nutrition

Food source in natural environment

maximum chances for meeting all nutritional requirements
Theory of Mesocosm fry production

Mesocosms are controlled blooms of phyto and zooplankton to allow the necessary supply of zooplankton with the necessary nutritional qualities and of a particle size small enough for the larvae to ingest.

• However, the zooplankton in mesocosms soon become depleted by the larvae.

• Therefore additional enriched rotifers and Artemia are added to supplement the feed requirement.

• When larvae are of a sufficient size, then inert feeds can be added and the fry weaned from live to dry feeds.
Theory of Mesocosm

Plankton

Hatched eggs

Eggs

Plankton

Algae
Theory of Mesocosm

Nutrients

Larvae
Plankton
Algae
Theory of Mesocosm

Rotifers  Artemia  Dry food
Mesocosm start-up Day -8 to +2

- Add nutrients
- Innoculate
- Algal bloom
- Zooplankton
- Zooplankton
- Zooplankton
Mesocosm start-up Day +2

- Algal bloom
- Zooplankton
- Larvae

Add larvae
Mesocosm operation - stasis

- Algal bloom
- Zooplankton
- Larvae
Mesocosm control – algae increase

- Low density of zooplankton
- High but not too high nutrient levels
- Low water flow rates
- High levels of sunshine (and artificial light at night).
Mesocosm control – algae decrease

- High density of zooplankton (and/or rotifers and Artemia)
- Low nutrient levels
- High water flow rates
- Shading.
Mesocosm control – plankton increase

- Low density of marine fish larvae
- Low water flow rates
- High algal concentrations.
Mesocosm control – plankton decrease

• High larvae or fry density predating on zooplankton
• High water flow rates
• Low levels of algae.
Mesocosm operation

- Algal bloom
- Zooplankton
- Larvae
Mesocosm operation - time

- Algal bloom
- Zooplankton
- Larvae
Mesocosm operation - time

- Water
- Algal bloom
- Zooplankton
- Larvae
- Dry feed
Intensive operation - weaning

Dry Food

Larvae
Monitoring and control

Sustaining the phytoplankton and zooplankton bloom will be undertaken by:

- Monitoring
- Algal concentration and type
- Zooplankton concentration
- Larvae and fry density
- Nutrient levels
- Oxygen levels
Monitoring and control

Controlling sustained blooms of algae and zooplankton will be undertaken by:

- Addition of specific nutrients
- Shading
- Artificial light (at night)
- Water flow
- Addition of enriched rotifers and Artemia
- Addition of dry feed
- Cropping of fry
Production cycle planning
# Production protocol

| DAYS | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| TEMP(°C) | 8  | 9  | 10 | 11 | 12 |
| LIGHT | Dark | Light (40w), Continously |
| AREATION | Little | Increasing |
| WATER EXCHANGE | Stagnant | 1/day | 1.5/day | 2/day | 3/day | 4/day |
| ALGEA | Isochrysis galbana |
| ROTIFERS | Brachionus plicatilis (store eller små) |
| ARTEMIA | Artemia (standard produsert) |
| DRYFEED | Dryfeed |
| SAMPLING: | Counting of rotifiers | x | x | x | x | x | x |
|          | Rot. counting in gut | x | x |
|          | Counting of death | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
|          | Carbon/Nitrogen | x | x | x | x |
|          | Pictures | x | x | x |

*Note: Days 1-4 and 11-12 are excluded for rotifers and gut counting.*
Daily feeding regime

• Larval status determines food requirement and feeding schedule

• 0800 - Tank inspection and cleaning.

• Tank by tank feeding requirement – feeding sheets.

• 0930 Larval inspection for live food diet uptake and remaining feed levels.

• Repeat above at 3 hourly intervals until 2300 hrs
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<th>November</th>
<th>01-Dec</th>
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<td>1125</td>
<td>990</td>
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**Identify maximum live food requirement**

**Identify weaning strategy and volumes**

**Identify nursery and sales strategy**
## Production scheduling

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<th>Date</th>
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<td>2-5g</td>
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<table>
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<th>Category</th>
<th>No of million fish per category</th>
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<td>1.0-1.9g</td>
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<tr>
<td>2-5g</td>
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</table>

Maximum stocking density

No of tanks required
Staff management
Impact of poor management strategies

Frequent problems encountered
- Inappropriate human resource management poor skills
- Lack of communication
- Lack of anticipation
- Lack of priorities
- Poorly identified departments activities and responsibilities
- Low personal motivation
- Resignation of key personnel and high staff turnover

How does this impact production?
- Ineffective staff performance
  - Delays in hatchery production, scheduling and productivity
  - Lack of accountability
  - Deviation from procedures and protocols
  - Inconsistent and variable stocking rates, feeding strategies, survival rates and quality parameters

Result:- Poor and variable survivals, low productivity, higher costs and periodic production failures - unsatisfied customers
Defining Management structures

- Review Organogram (Does it suit the philosophy of the company, flat or pyramid etc.)
  - Define clear job description, matrix of responsibilities and reporting systems (Clear, simple and easy to check and follow up)
  - Preparing production plan, organizing delivery plan for fish and stock hatchery accordingly (Focus targets, long term goals and identify resource requirements)
  - Carry individual interview with the Personal (Capabilities and suitability, commitment)
  - Organize weekly meeting with the Production Management Team (Improve communication, set and assess short term goals, problem identification and solving)
  - Reviewing Protocols and Developing the Operation Manual (Update technology and establish agreed standard operational protocols)
  - Giving specific personal training per each department as required (Innovation through education)
**Tasks**

- Elaborate yearly production planning, budgets and capital investments required
- Manage, support and actively lead the Production Management Team
- Identify and organise resources required in time
- Organise recruitment, training programmes and develop team spirit within group ethic
- Develop and implement new strategies and technologies

**Responsibilities**

- Planning, direction and control of the daily operations of the company
- Control and optimise production costs
- Continuously develop and control correct application of production protocols
- Elaborate Monthly Production Report, analyse and implement solutions and improvements
- Report to Administrator and Head office

**Competencies**

- Strong collaboration and communication with the Administrative Director and Head office
- Chair weekly Production Management Meeting
  - Leadership qualities and team builder

**Qualifications**

- Post-graduated in Aquaculture Management
- 10 years experience and proven track record of projects, production and human resources Management
  - Wide professional network
  - High organisational skills and efficient
  - High communication and computer skills
Problem identification and resolution strategy for SOP & QC

1. Data collection (Sampling)
2. Re-adjustment of production system & protocol / QC schedule (if required)
3. Definition of an existing protocol / QC schedule
4. Data analysis, discussion & literature review
5. Readjustment of protocol / QC schedule
6. Production trial set up
7. Data collection (Sampling)
Management of fry production

• Provide feed for larvae
  – Correct size
  – Correct nutritional quality
  – Correct frequency
  – Correct amount
  – Correct distribution

• To maximizing survival and growth.
  – Water quality
  – Biosecurity
  – hygiene

• To produce fry in a cost efficient manner
Management requirements of the hatchery

- All departments to work in close cooperation with each other to:
  - Organize production schedules and define targets for the hatchery concerning the future stocking programme for larvae.
- Organise
  - Staff working schedules and holidays
  - Ordering feed and materials
  - Ordering new equipment
  - Repairs and renewals.
- Develop annual and monthly budgets for the above
- Provide daily and weekly production schedules for the operation.
- Supervise operations and undertake quality control.
- Keep records stock lists and organize product supply.
- Provide monthly reporting on the above to the management with reference to the agreed budget.
- Supervise.
Definition of a good hatchery manager

- Organizational ability
- Attention to detail
- Tidy and clean working procedures
- Ability to follow detailed protocols
- Innovative crisis management ability
- Never leaves anything until tomorrow
Production cost estimation
Larval survival

- Collection of good eggs - 80% (60 to 100%)
- Incubation of eggs - 65% (50 to 80%)
- Hatched larvae to 8 mm - 45% (30 to 60%)
- Weaning 8 to 14 mm - 30% (10 to 50%)
- Nursery 14 to 40 mm - 65% (60 to 70%)

Total survival from stocked egg to 40 mm 8%
### Estimated product requirements, delivery times and logistics

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<tr>
<th>Item</th>
<th>Bream Quan./million</th>
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Note: The table provides estimated product requirements, delivery times, and logistics details for various items.
Sensitivity analysis
Larval feeding – day sheet

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Cause and cure

- Human error
- Mechanical error
- System overload and failure
- Third party problems (Electrical failure to sabotage)
- Management structures
- Maintenance, repairs and renewals
- Incorrect production programming
- Various
Costs of production – intensive marine fry production

Production costs US$ 0.17 per fry

- Salaries - Hatchery: 30%
- Feed: 18%
- Energy: 7%
- Chemicals: 3%
- Repair & maint: 3%
- Utilities: 6%
- Consumables: 3%
- Other: 3%
- Salaries - admin: 27%
- Transportation: 2%
Investment – intensive hatchery

Capital costs US$ 100,000 to 200,000 per million fry per year
Profitability

Sales price US$ 0.25 per fry with 5 cents profit