Development and technology transfer of new technology for marine juvenile production

Methods, models and instrumentation developed at NTNU and SINTEF.

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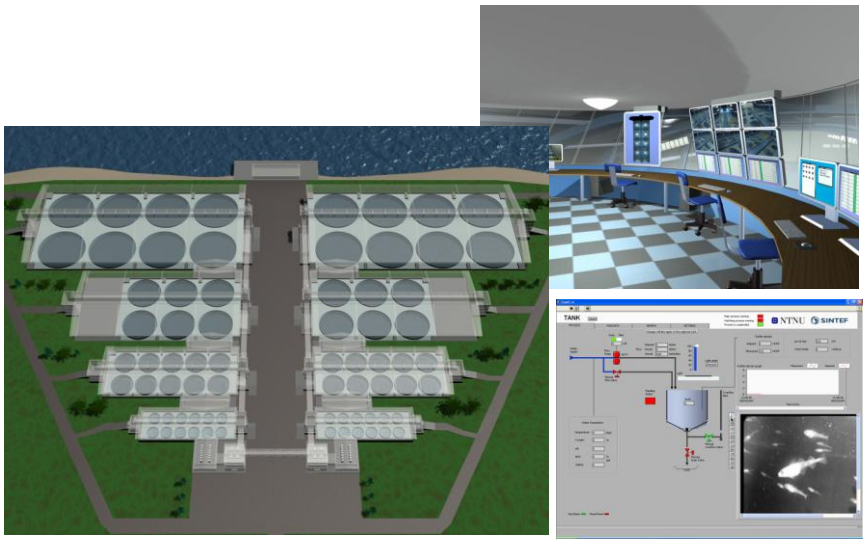
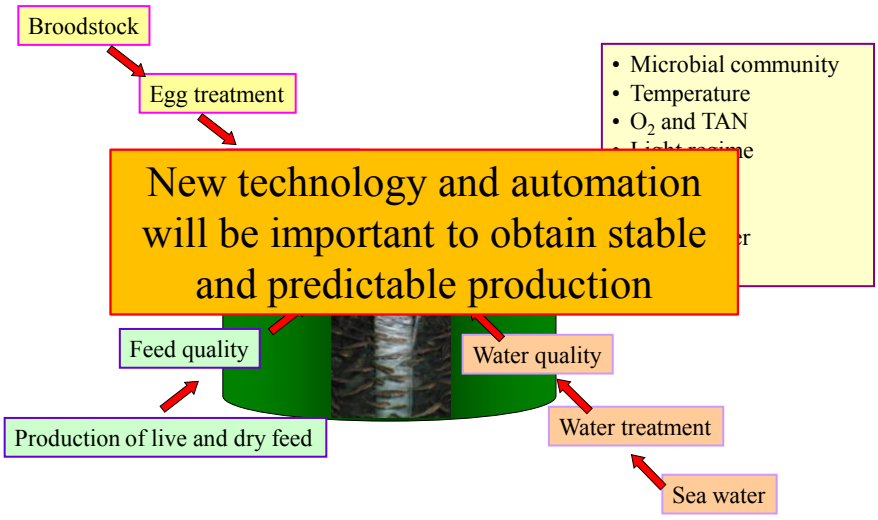
Overview

- Why automation?
- The next generation hatchery
  - Examples of new technology
    - Feeding system for livefeed
    - Intensive copepod production
    - Automatic feeding and monitoring system in fish tanks
    - Cleaning system for livefeed and fish tanks
  - Challenges with technology transfer to the industry

The Next Generation Hatchery



Production technology for marine juveniles



Why automation?

Some of the challenges faced by the Norwegian cod hatcheries:

- Variation in survival, malformation and growth
- Low stability in rotifer cultures
- High production costs

New technology and automation addresses all three issues through:

- Predictability and stability in the production
- Optimization
- Less manual work

Why is automation challenging in marine hatcheries?

- Marine larval production involves complicated biological processes:
  - Variation in egg-, livefeed - or water quality results in different growth rates
  - Knowledge sometimes limits model development
- Monitoring and control require accurate measurements:
  - Need specialized instrumentation
  - Is it possible to estimate what we cannot measure?
  - Are the measurement methods cost effective?
- The processes consist of live organisms:
  - Special demands with regard to handling
  - Equipment and tubes must be kept clean
- Seawater is a very corrosive agent:
  - Electronic devices must be protected
  - Choice of materials is very important

Livefeed in marine juvenile production

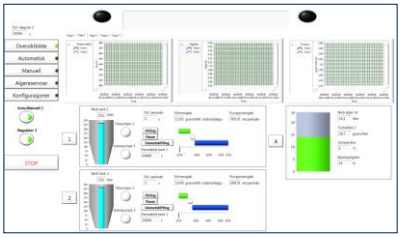
Marine fishlarvae need livefeed 10-40 days after hatching.

- Microalgae are used as “green water” or as food for the livefeed
- Normally rotifer are used in the first period, and then *Artemia*
- Different cultivation procedures and different diets are used
- We work with new technology and automation of this production

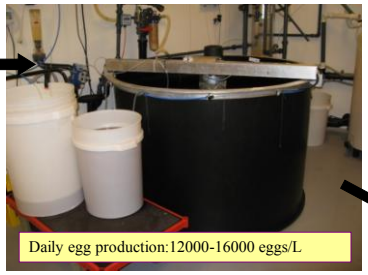
Automation in rotifer production

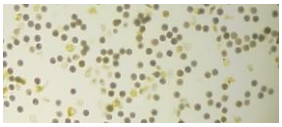
Advantages in process automation:

- Increased quality and stability
  - Increased stability in critical processes
  - Active suppression of disturbance
- Optimal control of processes
  - Effective inspection of process conditions
  - Good operator interface
- Improved basis for production planning, logistics and effective production
  - Consequence analysis of operation conditions by simulations
- Cost effective
  - Correct feed doses
  - Less manual work



Production of copepod eggs



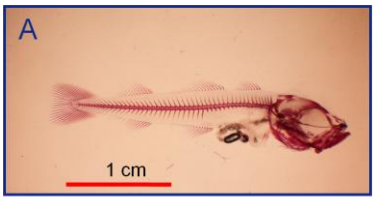


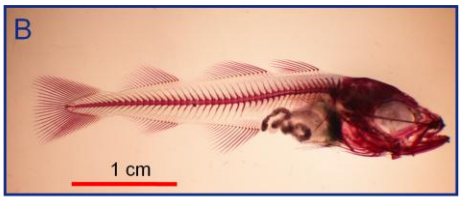
Copepod eggs are harvested daily. The eggs can be stored for several months at low temperature

The eggs will be send to a hatchery. Hatching after 24 hours. Fed to fishlarvae in critical periods

(Financed by: Innovation Norway and cod hatcheries)

Cod larvae (bone stained) 60 days after hatching





A: Cod larvae fed rotifers, B: Cod larvae fed copepods

Use of copepods as livefeed results in less malformation, higher survival, better growth and higher stress tolerance

Foto: Marit Hansen

Mandarin fish (*Pterosynchiropus splendidus)* feed copepod naupii (*Acartia tonsa*)

New technology in firstfeeding tanks

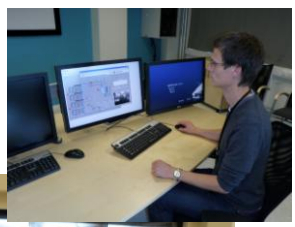
- Appetite Controlled Feeding
- Cameras for visual observation in each fish tank
- Cleaning systems for fish tanks

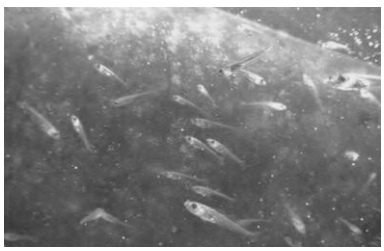
Appetite Controlled Feeding

Feeding robot from Storvik Aqua AS linked with rotifer density counter in order to control feed density in first feeding tanks

Example: Cameras for visual observation in each fish tank

Online images from larval tanks can be accessed over the network





Cleaning inside livefeed-or fish tanks

Technology transfer from the research project to the equipment industry

- Hard to find a equipment company to cooperate with
  - Small marked in Norway for marine juveniles
  - Few companies are working with this equipments
  - Insufficient contact between the researcher and the industry
- Unfortunately, this mismatch results in new technology in our laboratory, but not in to the hatchery industry