

# Different cultivation methods for production of rotifers



Gunvor Øie  
SINTEF Fisheries and Aquaculture

# Rotifer production- rotifer strains

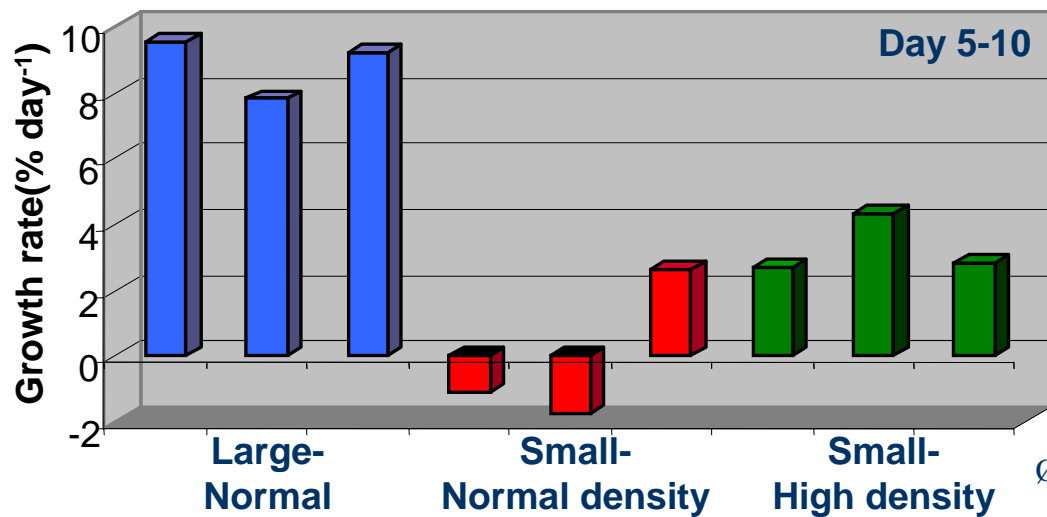
## Different rotifer species and strains:

- Different size
- Different optimum growth conditions
  - Temperature
  - Salinity
- Different growth rate
- Different nutritional content
  - Food quality and quantity



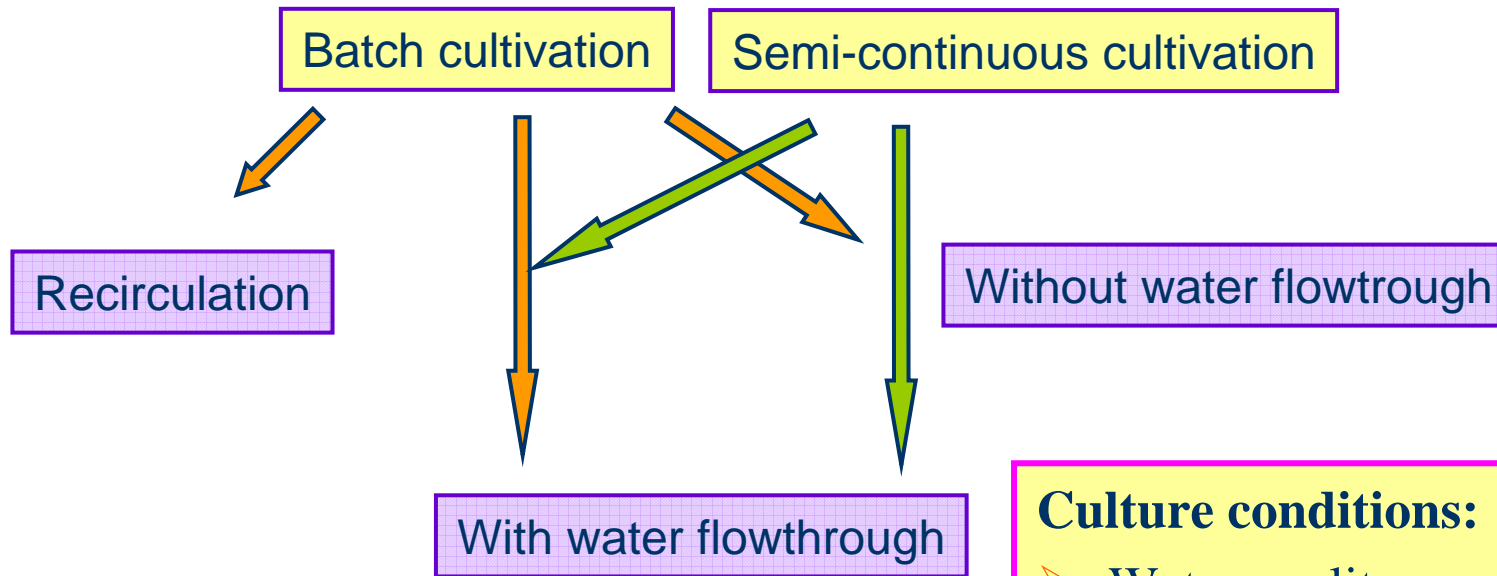
# Growth and survival of cod larvae fed *Brachionus nevada* or *Brachionus cayman*

Results	Large-Normal	Small-Normal density	Small-High density
Survival day 45 (% ± SE)	37±1	33±2	34±1
Growth rate day 5-10 (% day <sup>-1</sup> )	8.9	-0.06	3.3
Growth rate day 5-17 (% day <sup>-1</sup> )	10.6	5.9	8.9
Biomass, day 35 (µg DW larva <sup>-1</sup> )	1 335	1074	1157



Øie, Overrein, Olsen, Kui, & Reitan, 2003

# Rotifer production-cultivation technique



## Production tanks:

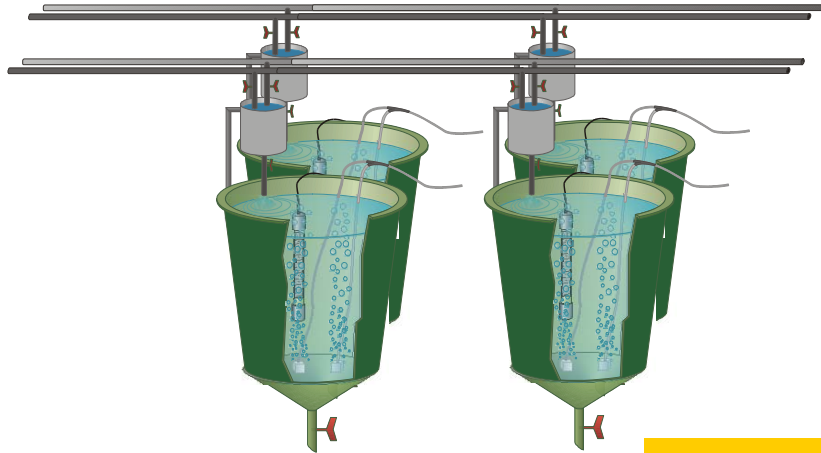
- 100 litre -300 000 litre

## Culture conditions:

- Water quality
  - pH 7.5-8.5
  - Ammonia  $<1 \text{ mg l}^{-1}$
  - Aeration and oxygen  $>4\text{ppm}$
- Organic particles
- Bacteria and other organisms

(Data from Støttrup and McEvoy: Live feed in marine aquaculture)

# Batch cultivation of rotifers



Growth for  
3-5 days



Washing



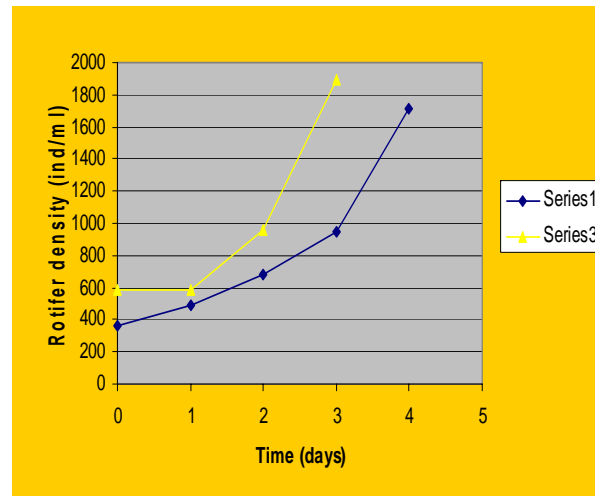
Enrichment



Washing and  
storage/feeding

## Control:

- Rotifer density, egg ratio
- Continuous feeding
- Oxygen
- Temperature
- Salinity



# Rotifer production in Lofilab

## Cod production with copepods and rotifers



- Rotifer production in 4m<sup>3</sup> bags
- Batch production in 4 days (300 ind/ml to 1000 ind/ml)
- Continuous feeding with yeast and Algamac 2000

# Production of rotifer with *Chlorella* in Japan



- Two days production cycles
- 0,1  $\mu\text{m}$  filtered water
- Addition of HCl (pH control)
- Addition of pure oxygen
- Short-term enrichment
- Densities in lab. scale are 150 000 ind/ml
- Normal densities of “small” rotifers are 10-25 000 ind/ml
- Normal densities of “big” rotifers are 2-3000 ind/ml

(Yoshimura et al, 1996)

# Rotifer production in Fosen Aquasenter



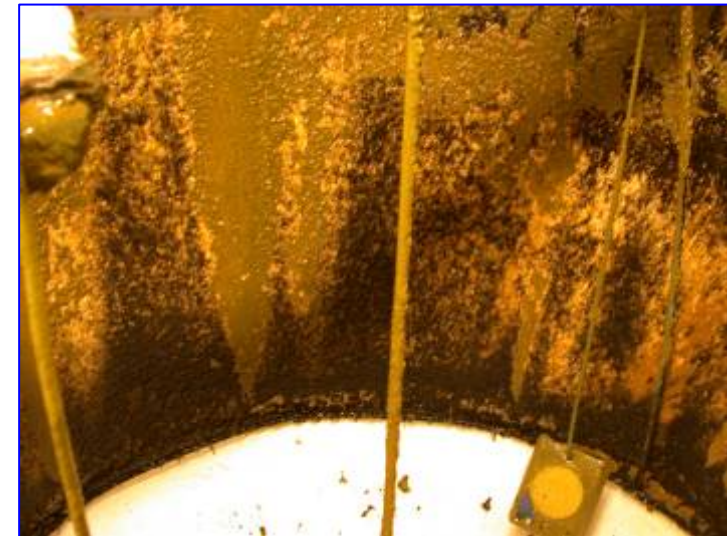
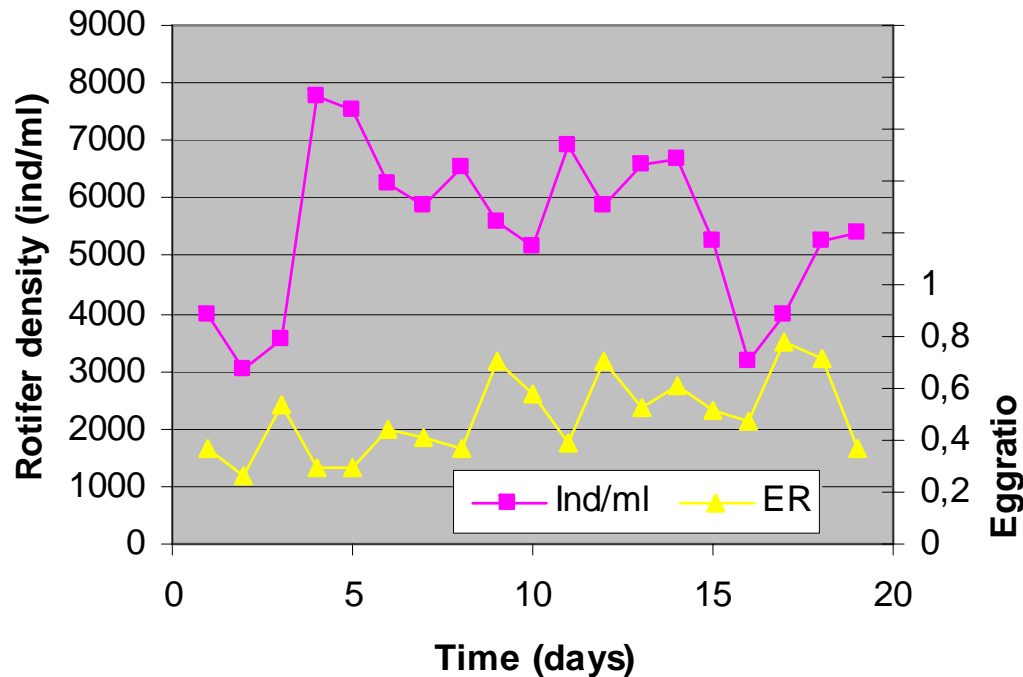
Rotifer production:

- Batch cultivation
- Semi-continuous production
- Semi-continuous production in a recirculation system



Foto: G.Øie)

# Semi-continuous production in Fosen Aquasenter



Inside the rotifer tank after 20 days cultivation. Cleaning arm in bottom of the tank.

- Rotifer production (culture volume 1.8m<sup>3</sup>)
- cleaning arm in the bottom of the tank
- 20-30% harvesting per day
- Yeast, Clorella, vitamins and oil
- Daily production: 2.5 billion per tank

# Production of rotifer in a recirculation system

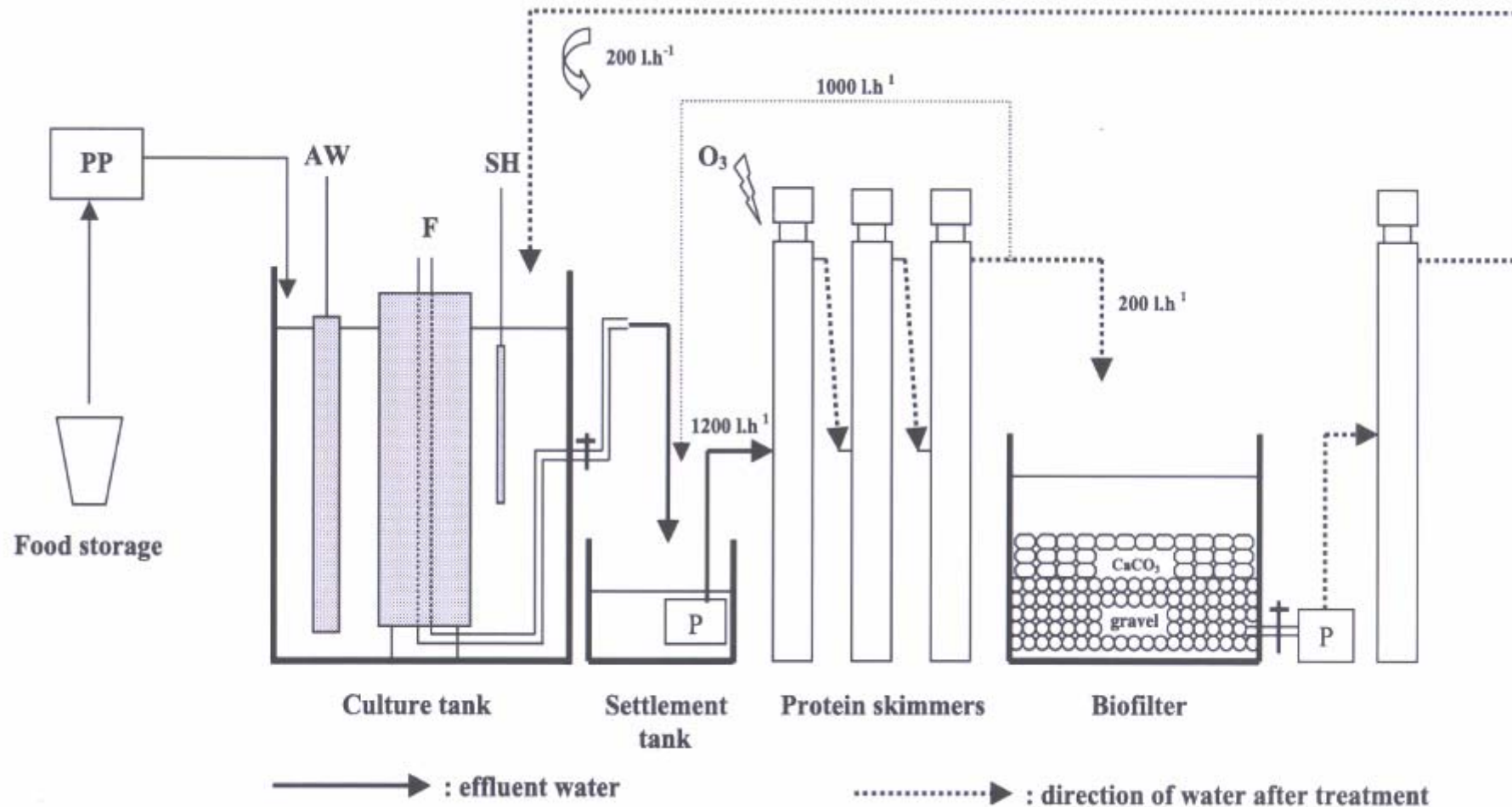
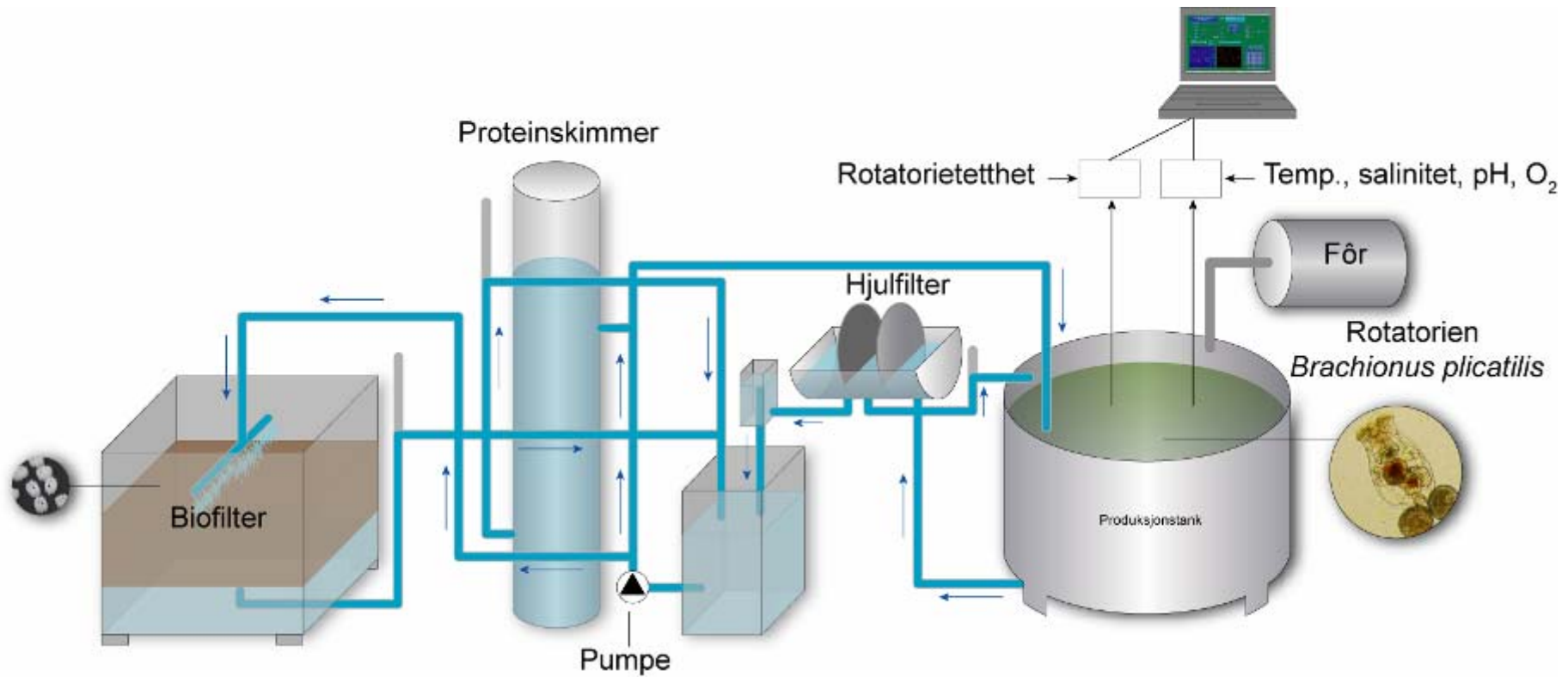


Fig. 1. Schematic overview of the recirculation system used for high-density rotifer production. PP: peristaltic pump, AW: air-water lift, F: nylon filter, SH: submerged heater, P: pump.

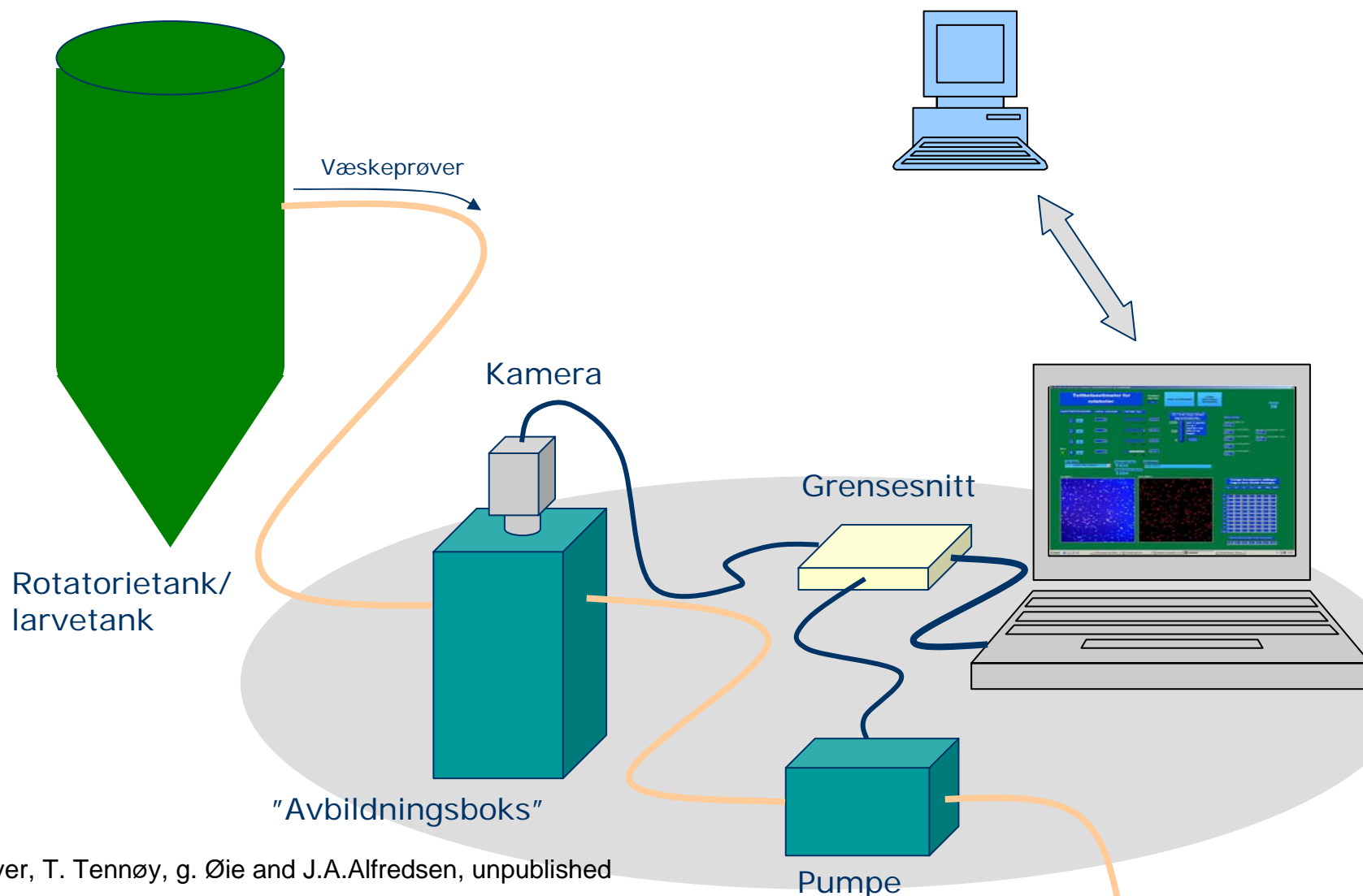
(Suantika et al. 2003)

# Production of rotifer in a recirculation system



(Rainuzzo and Kjøsnes, 2005)

# Rotifer counting by camera



M. Alver, T. Tennøy, g. Øie and J.A.Alfredsen, unpublished

# User interface

Virtuelt instrument som estimerer rotatorietettheten i en væskestrøm

## Tetthetsestimator for rotatorier

Iterasjoner siden start: 19

START ESTIMATOREN      STOPP (Etter denne iterasjonen)      AVSLUTT

ALGORITMEFORKLARINGER:    ANTALL INDIVIDER:    TETHET IND/

1	Vis	217	1195,91
2	Vis	178	980,98
3	Vis	216	1190,40
4	Vis	41	225,96

På/Av

TETTHETSESTIMAT INDIVIDER/ML: 1122

Snitt av algoritme 1, 2 og 3. Algoritme 4 kan skrus på med knoppen

ANDRE VERDIER

Volum i synsfeltet (ul): 181,45

Oppløsning x-retning bilde 1: 1057      Størrelse x-retning bilde 1 (mm): 14,23

Oppløsning y-retning bilde 1: 1047      Størrelse y-retning bilde 1 (mm): 14,09

Oppløsning x-retning bilde 2: 1055

Oppløsning y-retning bilde 2: 1048

Velg vanning: Før/Etter bilde, algoritme 1

Rørets dybde (mm): 0,90500

Arbeidsmappe: Z:\My Vis\data

Oppløsning (mm/piksel): 0,01346

Før/Bilde 1      Etter/Bilde 2

Førrige iterasjoners målinger  
Lagres hver tiende iterasjon

Alg 1   Alg 2   Alg 3   Alg 4   Min   Max   Snitt

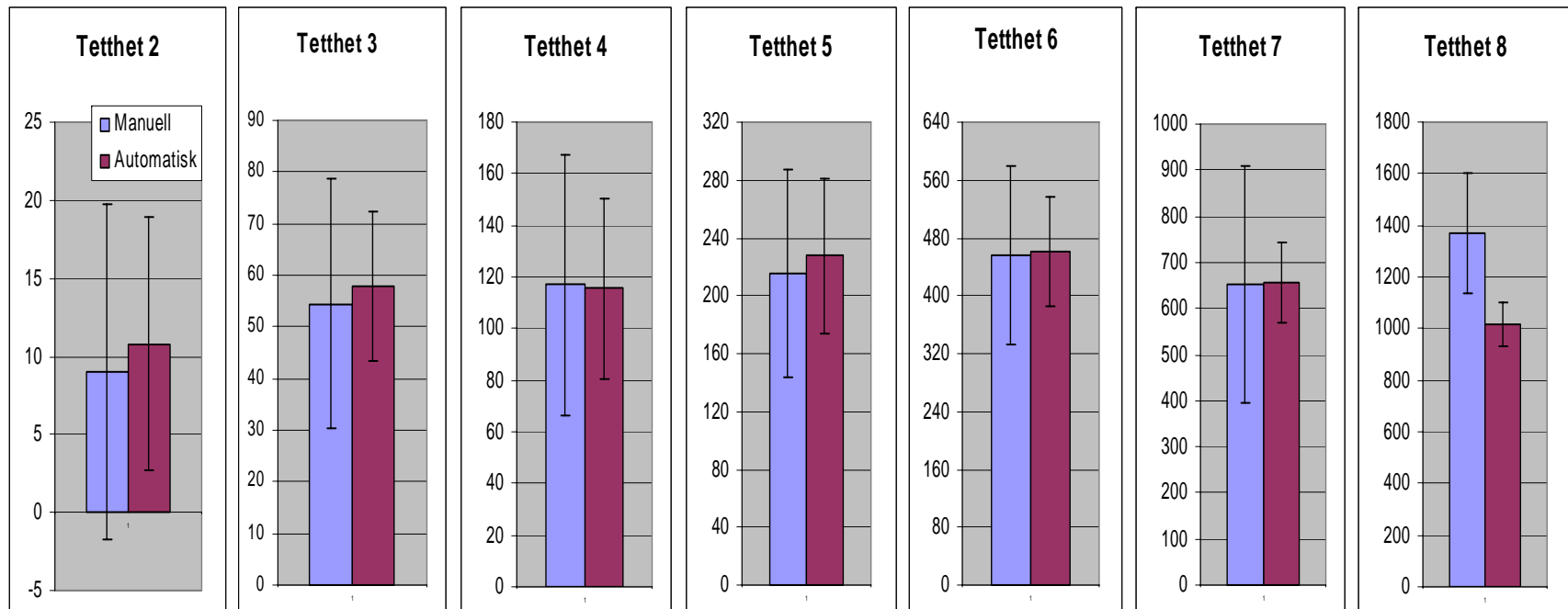
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0



Gjennomsnittresultater forrige 10 iterasjoner:

1056   870   1073   238   238   1077   1000

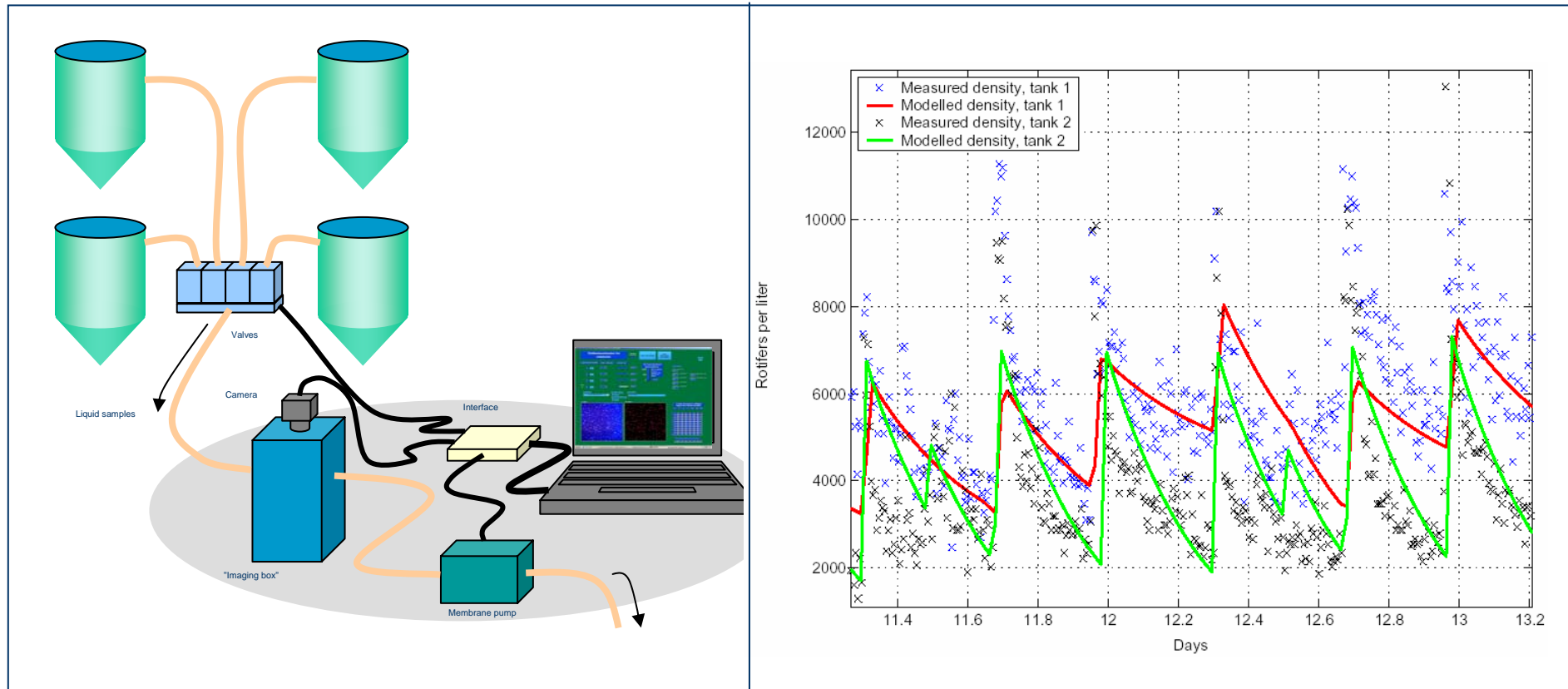
Windows taskbar: Start, C:\Documents and Sett... Oversikt test4.xls, tetthet12-manuelt-1-2.xls, LabVIEW, Torodd Tenney - Micro...

# Rotifer density in production tanks with different rotifer density



 Manual countings  
 Automatic countings

# Monitoring the rotifer density in fishtanks



(Alver, Alfredsen and Øie, unpublished data)

# What is important in high density rotifer production in the future?

- Monitoring and automatic regulation of:
  - Oxygen
  - pH
  - NH<sub>3</sub>
  - Salinity and temperature
- Automatic counting
  - Rotifer density
  - Eggratio
  - Swimming velocity
- Procedures for cleaning tanks
- Microbial control