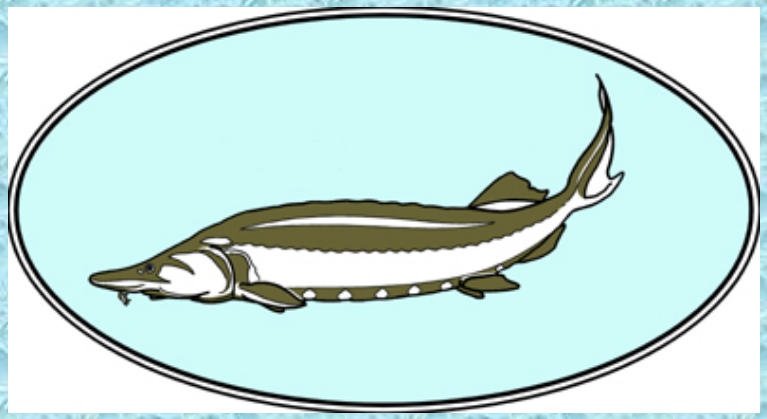
Rearing of salmonids and the actual questions about fish nutrition

Brande 2010



Suported by Biomar, NAZV No. QI91C001 “Optimalization of rearing conditions for salmonids in conditions of Czech republic with use of Danish technology with focus on quality of produced fish” and Research plan No. MSM6215648905 “Biological and technological aspects of sustainability of controlled ecosystems and their adaptability to climate change“, which is financed by the Ministry of Education, Youth and Sports of the Czech Republic.

The Danish model trout farm Pravíkov (ČR)

A first year and a plans for future.

Autors collective: Lang, Š., Vítek, T., Kopp, R., Ziková, A., Brabec, T., Pfau, R,. Mareš, J.

Project

- NAZV No. QI91C001 “Optimalization of rearing conditions for salmonids in conditions of Czech republic with use of Danish technology with focus on quality of produced fish”
  - Stocking density
  - Water inflow
  - Water flow speed
  - Waste sedimentation
  - Feed, feeding technics and regime
  - Quality of final products

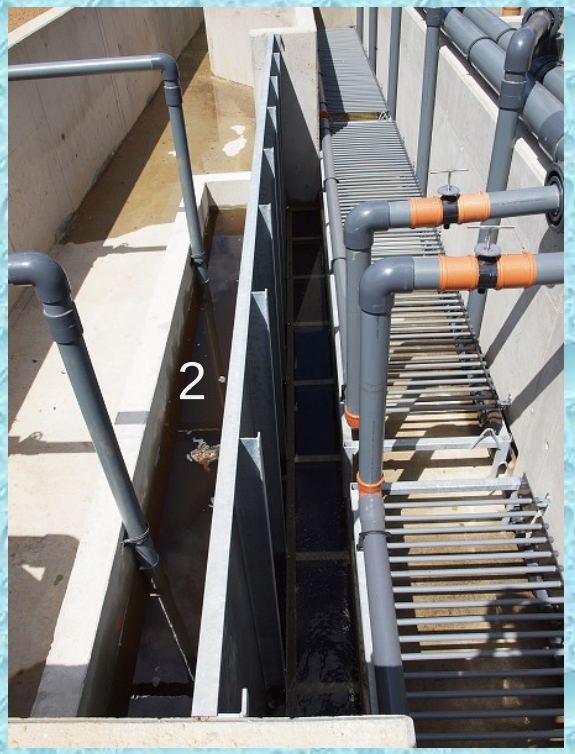
The farm

- 1000 m^3 of overall water volume
- 12 rearing channels - 11 x 2 x 2 m (1,7 m water)
- 2 types of water treatment units (Bio-filters)
  - 1^{ts} with floating elements →

  - 2^{nd},made of 8 departments, with sinking elements

The farm

- Behind the bio-filters
  - area with diffusors to aerate water and get rid of CO_2 [1]
  - and 4,5 m deep airlift; the engine for water circulation [2]



The farm

- Rearing channels[1] with diffusors[2]

1

2

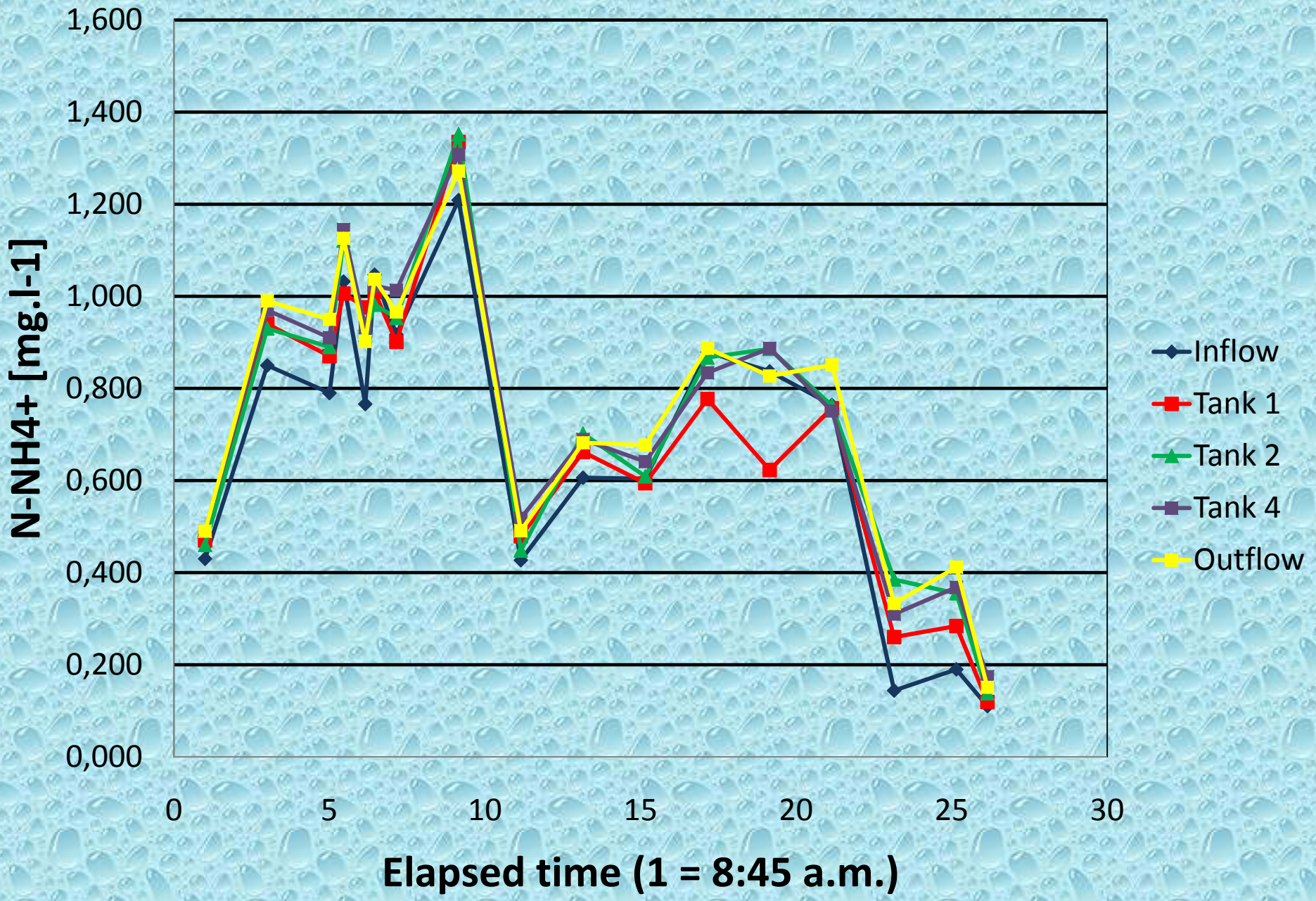
1st realized experiment

- 11th August 2009
  - 2 weeks after the end of first stocking (3 partial stockings, from 17th to 27th Jully 2009, there were 14,060 kg of fish)
  - Allmost 6 weeks after 3rd and definite filling by rearing water (bio-filter in running-up)
  - 24 hour observation was carried out

1st realized experiment

- Average temperature was 18.3 °C
- A contain of ammonia nitrogen was between 0.150 and 1.272 $mg.l^{-1}$ respectively (pH value 7.28)
- Nitrite nitrogen was from 0.316 to 0.445 $mg.l^{-1}$
- Conductivity was around 8 $mS.m^{-1}$
- Cl^- contain was **4.5 $mg.l^{-1}$**
- O_2 saturatoin was about 99 % in an inflow and did not fell under 85 % in an outflow of rearing area.

Diurnal changes of ammonia nitrogen in water



2nd realized experiment

- Test of influence of different stocking density to fish growth, health and changes of some hydrochemical parametres (O_2 saturation, pH, N-NH_4^+, N-NO_2^-) and quality of meet
- Five groups:
  - 6,000, 8,000, 8,000, 10,000 and 12,000 individuals
  - A medium weight of fish at the beginning was 0.095, 0.097, 0.10, 0.097 and 0.10 kg respectively
  - Feed – 1st , 2nd , 4th and 5th group Biomar R90
    - 3rd group Biomar Ecolife 56

2nd realized experiment

Rearing tank	4	5	6	7	8	Total
Feed	R90	Ecolife 56	R90	R90	R90	
Beginning 22.8.2009	12000	8000	10000	8000	6000	44000
Average weight	0,1	0,1	0,097	0,097	0,095	
kg of fish	1200	800	970	776	570	4316
Fed during test	852	655	720	662	577	3466
End 19.11.2009	9418	6275	6937	6256	4663	33549
Losses	2582	1725	3063	1744	1337	10451
Losses [%]	21,5	21,6	30,6	21,8	22,3	23,8
Average weight	0,175	0,182	0,18	0,175	0,17	
kg of fish	1648	1142	1249	1095	793	5926
Weight gain	448	342	279	319	223	1610
FCR	1,90	1,91	2,58	2,08	2,59	2,15

2nd realized experiment

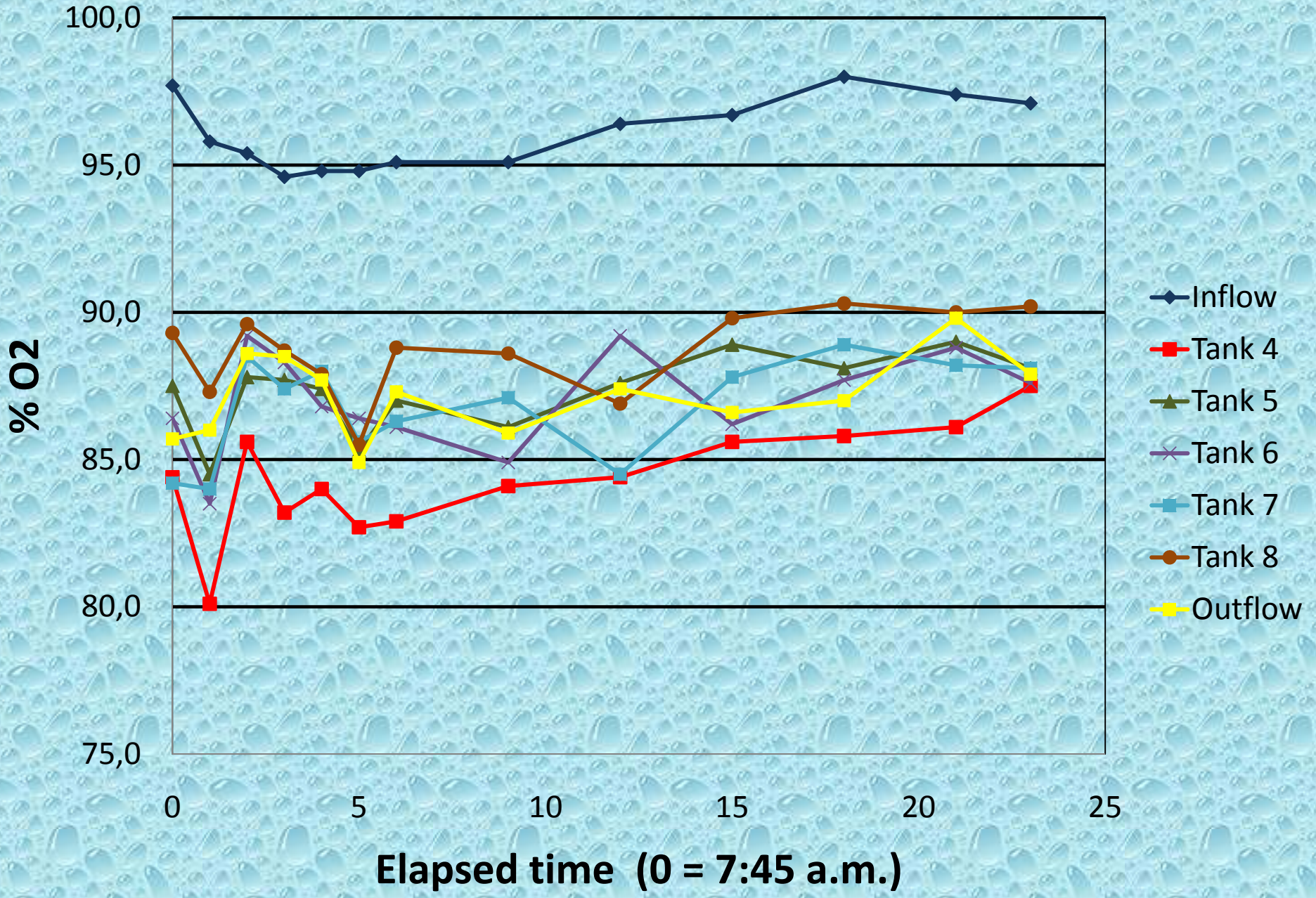
- Quality of meet
  - Contain of fat in meet, polyunsaturated fatty acids in fat, taste of meet, dry matter of meet, ash in meet
  - Samples from:
    - Pravíkov from flow-thru system
    - Pravíkov at the beginning of test
    - Pravíkov at the end of the test
    - Trout farm Skalní mlýn (flow-thru)

2nd realized experiment

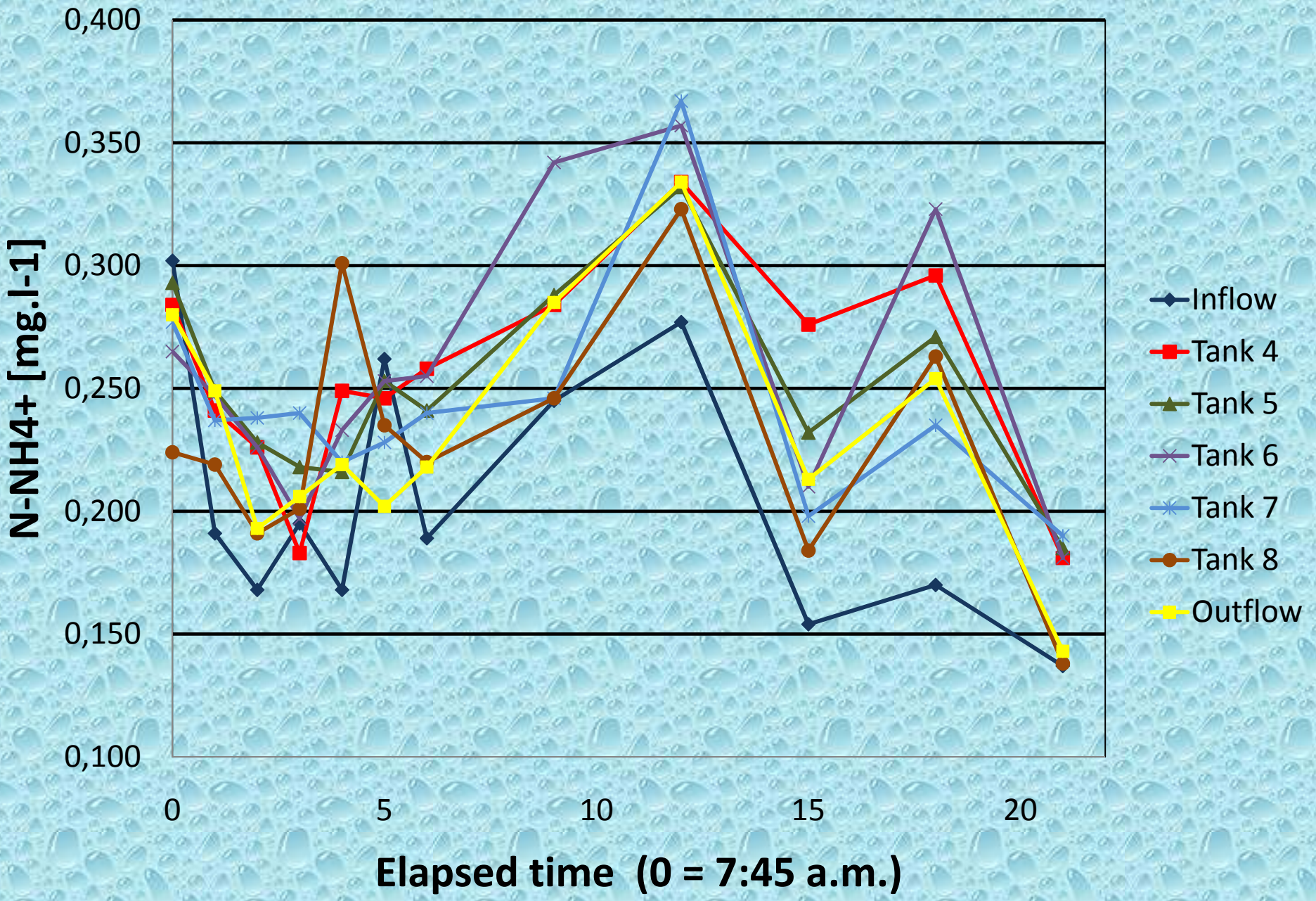
- 24 hour observation from 5th to 6th November 2009 was carried out as a part of a long-term experiment (8 weeks)

  - Average temperature was 3.8 °C
  - Hole stock of the object was 8,136 kg
  - Conductivity was around 13 $mS.m^{-1}$
  - Chlorides was around 10 $mg.l^{-1}$

Diurnal changes in O2 saturation

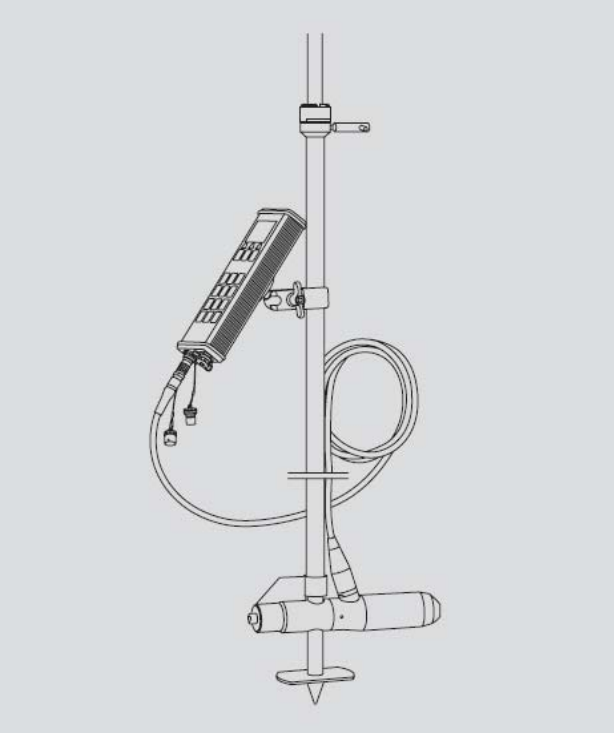


Diurnal changes of ammonia nitrogen in water



Flow velocity and discharge measurement

ADC – Acoustic digital current meter (OTT Messtechnik, Germany)



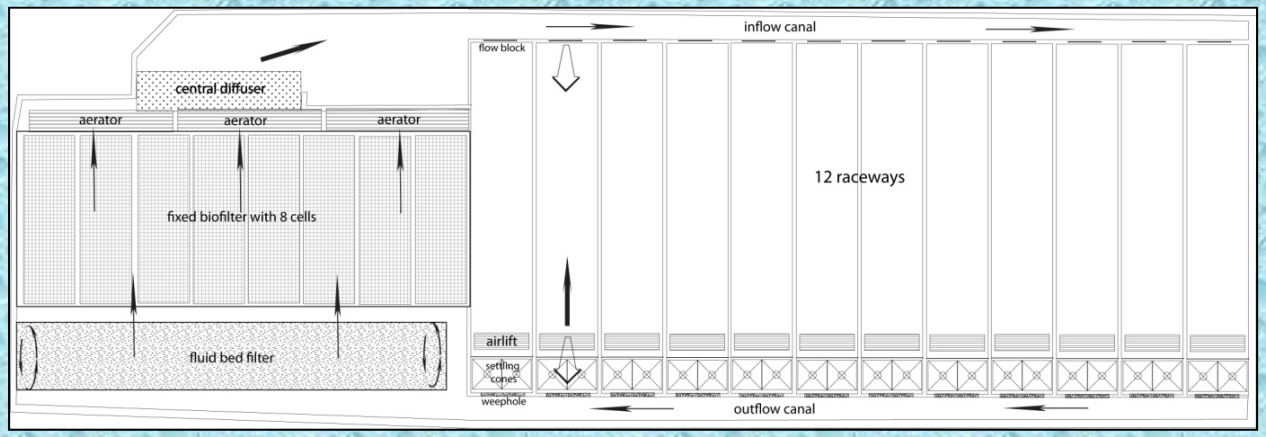
Used for discharge measurements in open channels according to the EN ISO 748

Sensor – depth, temperature sensors
pair of transducers – transmit two short ultrasound Impulses , receives reflections caused by particles in the water every 75 ms
Received signal amplification and digitalization
The time difference between two echos is used to Calculate flow velocity

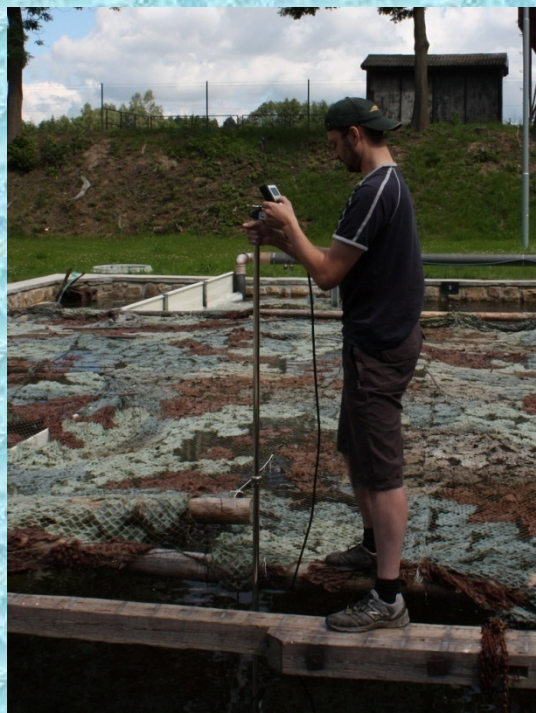
Handheld unit – leads the user through the discharge Measurement step by step, calculates the discharge
User enters necessary parameters (edges, method, distances)

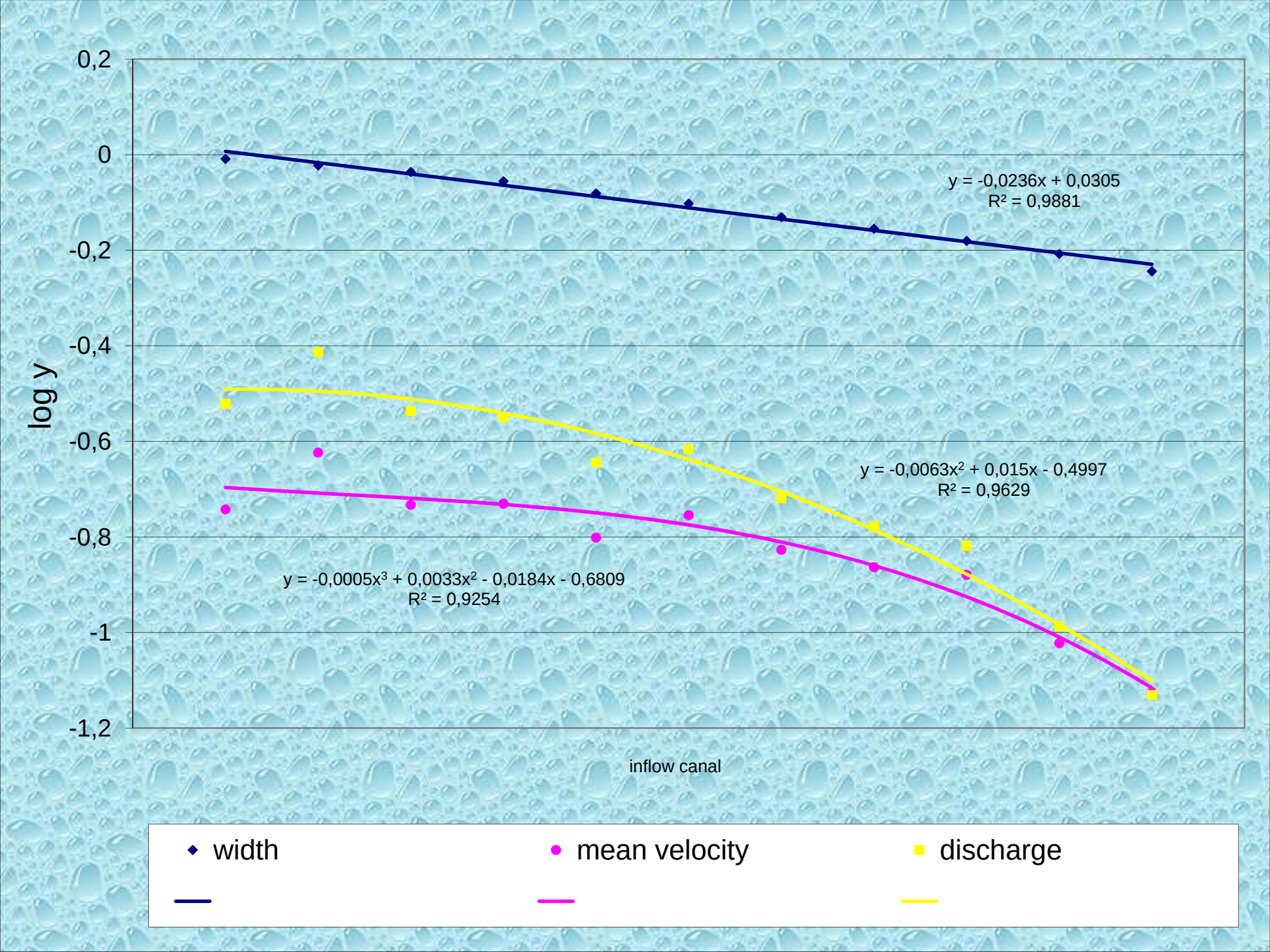
Field data could be transferred to the computer and processed using Q-Review software

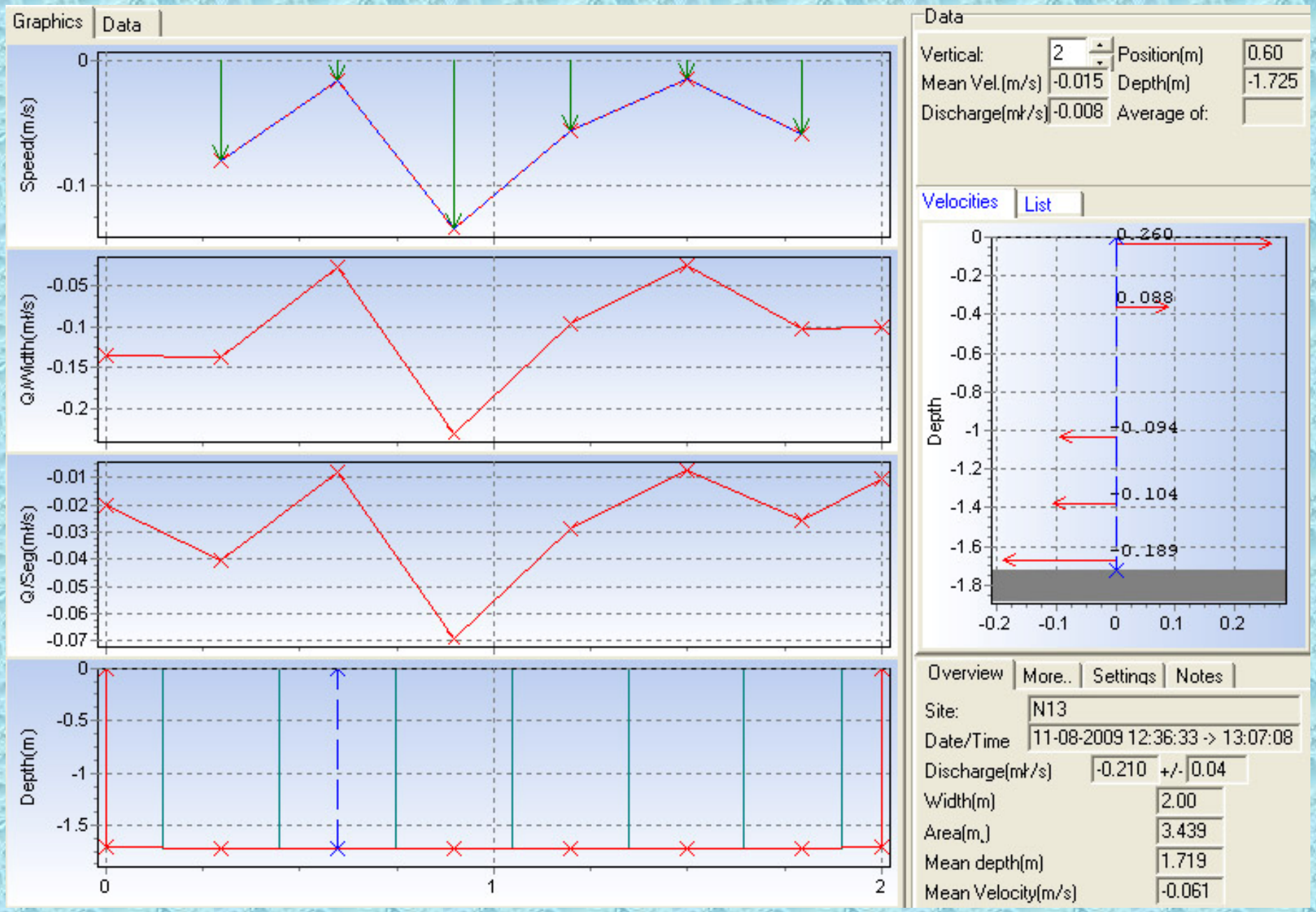
Three reference points – flow velocity conditions in whole the system and
The in the individual rearing tank
The distribution of the water to the particular rearing tanks through the inflow canal
The sedimentation velocity – measured from 10 to 60 cm above sedimentation cones



Central diffuser provides discharge 312 l/s,
maximal opening of the flow block in first
Raceway cause inflow 78 l/s, flow velocity and
discharge decreases along inflow canal




0,2
0
-0,2
-0,4
-0,6
-0,8
-1
-1,2
log y
y = -0,0236x + 0,0305
R² = 0,9881
y = -0,0063x² + 0,015x - 0,4997
R² = 0,9629
y = -0,0005x³ + 0,0033x² - 0,0184x - 0,6809
R² = 0,9254
inflow canal
width
mean velocity
discharge


Graphics
Data
Speed(m/s)
0
-0.1
Q/Width(m²/s)
-0.05
-0.1
-0.15
-0.2
Q/Seg(m³/s)
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
Depth(m)
0
-0.5
-1
-1.5
0
1
2
Data
Vertical:
2
Position(m)
0.60
Mean Vel.(m/s)
-0.015
Depth(m)
-1.725
Discharge(m³/s)
-0.008
Average of:
Velocities
List
Depth
0.260
0.088
0.094
0.104
0.189
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-0.2
-0.1
0
0.1
0.2
Overview
More..
Settings
Notes
Site:
N13
Date/Time
11-08-2009 12:36:33 -> 13:07:08
Discharge(m³/s)
-0.210
+/-
0.04
Width(m)
2.00
Area(m²)
3.439
Mean depth(m)
1.719
Mean Velocity(m/s)
-0.061

Constraints of measurements using ADC

The Effect of diffuser on flow velocity in the rearing channel – contraflow in the raceway in the surface volume until depth of 60 cm, the outflow from the raceway stay unaffected
Measurement is corrupted by fish movement near the sensor – reliable only in the raceway without fish

Measurements of the airflow in the pipe near regulation valve – vane wheel flow sensor FA (Höntzsch) – callibrated also for water (only surface layers)

Future plans

- Try to found how to regulate exactly the low pressure diffusers in rearing tanks and their influence to water flow speed and sedimentation
- Specify the ideal stocking densities for the exact system in different seasons of year and for different fish weights and kinds.
- Find how are nutrition facts of produced fish influenced by hydrochemic parameters and used feed

Future plans

- Observation of hydrochemic parameters diurnal dinamics and their corespondation with used feed, feeding technics and different stocking densities
- The influence of different flow speed on production and welfare of reared fish
- The influence of different rearing conditions to blood plasma electrolytes

Aknowledgements

- The observations is supported by of project NAZV No. QI91C001 “Optimalization of rearing conditions for salmonids in conditions of Czech republic with use of Danish technology with focus on quality of produced fish” and Research plan No. MSM6215648905 “Biological and technological aspects of sustainability of controlled ecosystems and their adaptability to climate change“, which is financed by the Ministry of Education, Youth and Sports of the Czech Republic.