Use of RAS in Denmark
- 10 years of experience

Farmers Day, October 9th, DanAqua, Aalborg Denmark

Brian Thomsen, M.Sc., EBA, MBA, GDBA
The Danish Aquaculture Organisation
A little bit of history......

1989: Fish farms become regulated by fixed feed quotas

1994: 1. National working group identifies the growth potential

1997: National plan for developing aquaculture

1999: FAO points to the need for increased growth in aquaculture

2000: EU identifies the growth potential

2001: Number of farms: - 25 %; production: - 7 %

=> 2. National working group established
“whether freshwater fish farms can be designed in such a way that production can be increased without causing unacceptable discharge of nutrients and whether the approval system can be made more streamlined thus avoiding appeals”.

**Strategy:**

1. Technology: RAS (“Model fish farm type 1 and 3”)

2. Regulation: N neutrality: Higher efficiency => More feed
The concept of “N-neutrality”

(But the farmer had to apply for more feed)
Profitability (%)
Management issues (type 3)

1. Production capacity often higher than anticipated (winter!)
2. More airlifts ensures more stable $O_2$ level
3. Periodic treatment of biofilter with $H_2O_2$ (more stable $O_2$ level)
4. Increased $O_2$ supply to biofilter (nitrification > 60% $O_2$)
5. Change from fixed to moving bed (less sludge)
6. Cover dams (water temperature variations, no direct sunlight)
7. Focus on water from sludge treatment
8. Ongoing improvements
Veterinary issues (type 3)

**Benefits:**
1. Reduced water intake: Options for using non-infectious water
2. High and constant $O_2$ level: Less stress (red mouth disease)
3. Water temperature: More constant and higher during winter

**Drawbacks:**
1. Gill problems => formalin
2. Farms not emptied: New fish are exposed to present pathogens
3. BKD is more widespread
Regulation and growth

**Command and control: Feed quota:**
- A certain environmental standard
- Inflexible and rigid
- No incentive for improvement

**Incentive based system: Emission permits (N):**
- Can ensure economical optimal allocation of production/pollution
- Flexible
- Strong incentive for improvement

*We need innovation in regulation!*
Regulatory issues

1. Application procedure for “more” feed not flexible enough
2. Waterframework directive: National reduction in N discharge
3. Farm design fixed by regulation: No flexibility/innovation

=> RAS farmers could not increase production: 3. Working group:

February 2012:
1. Output based regulation: N emission permits
2. More flexibility in farm design

Pending:
1. N permits not entirely in place
2. 7 “knotty” regulation problems
Conclusions

1. Technology works – but room for improvement
2. Investments in RAS are profitable
3. Limited to large scale – demand for low scale innovations
4. Gill problems persist
5. More advanced types are underway
6. Regulation is critical!