

Use of RAS in Denmark

- 10 years of experience

Farmers Day, October 9th, DanAqua, Aalborg Denmark

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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

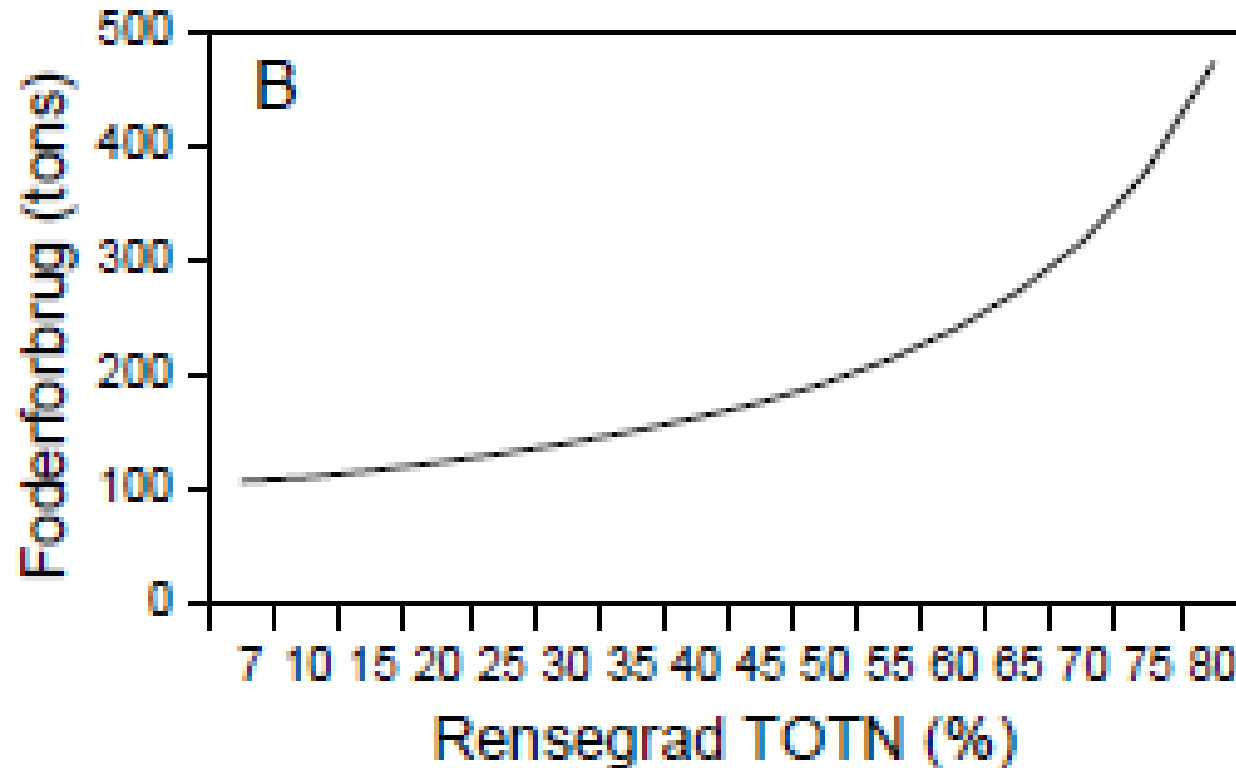
2002 working group: Key issue

*“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:

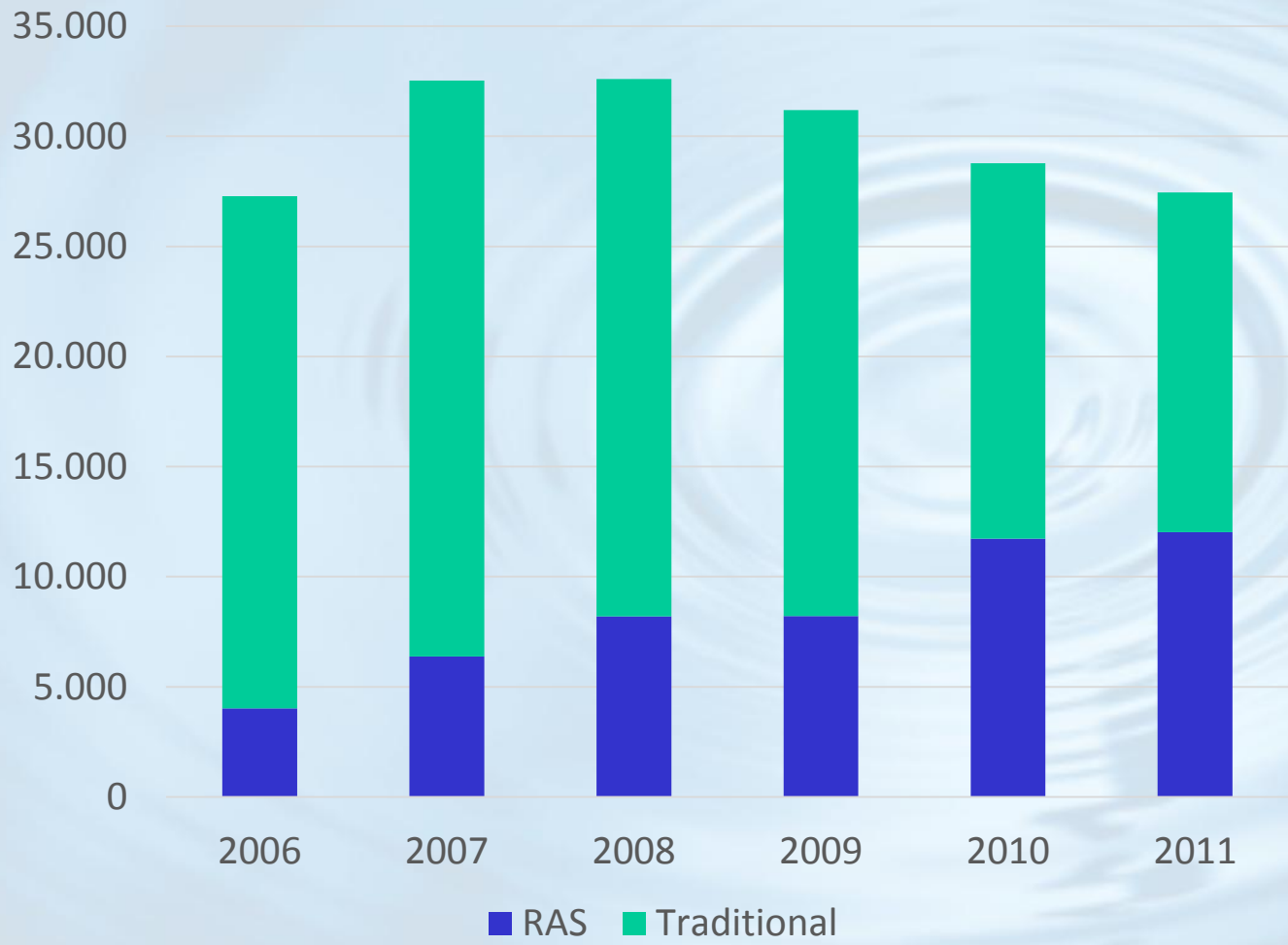
1. Technology: RAS (“Model fish farm type 1 and 3”)
2. Regulation: N neutrality: Higher efficiency => More feed

The concept of “N-neutrality”

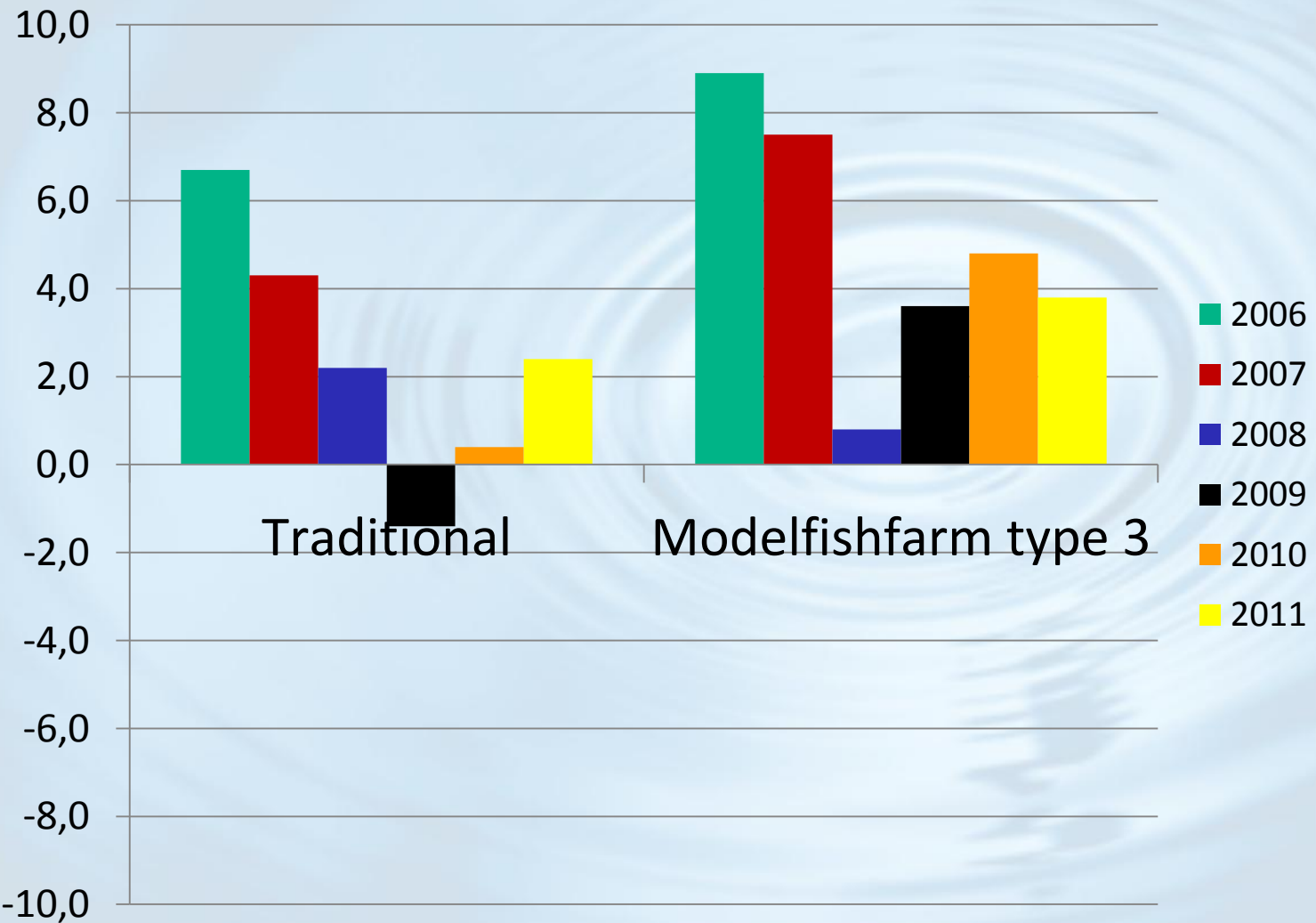


(But the farmer had to apply for more feed)

Development



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 biofilitre with H_2O_2 (more stable O_2 level)
4. Increased O_2 supply to biofilitre (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 O₂ 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!**