

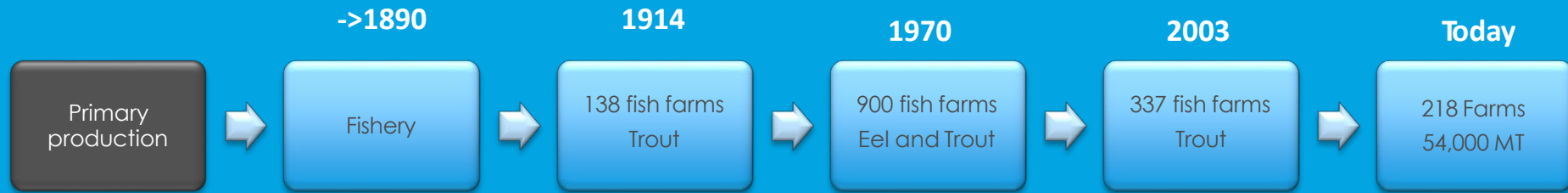
# Transfer of innovative freshwater aquaculture in developing countries

Jesper Heldbo  
AquaCircle





# Danish aquaculture took its beginning in 1894



→ **Reduced catches**  
The first pilot broodstock based on wild catch and simple "hatcheries" in drainage pipes in ponds

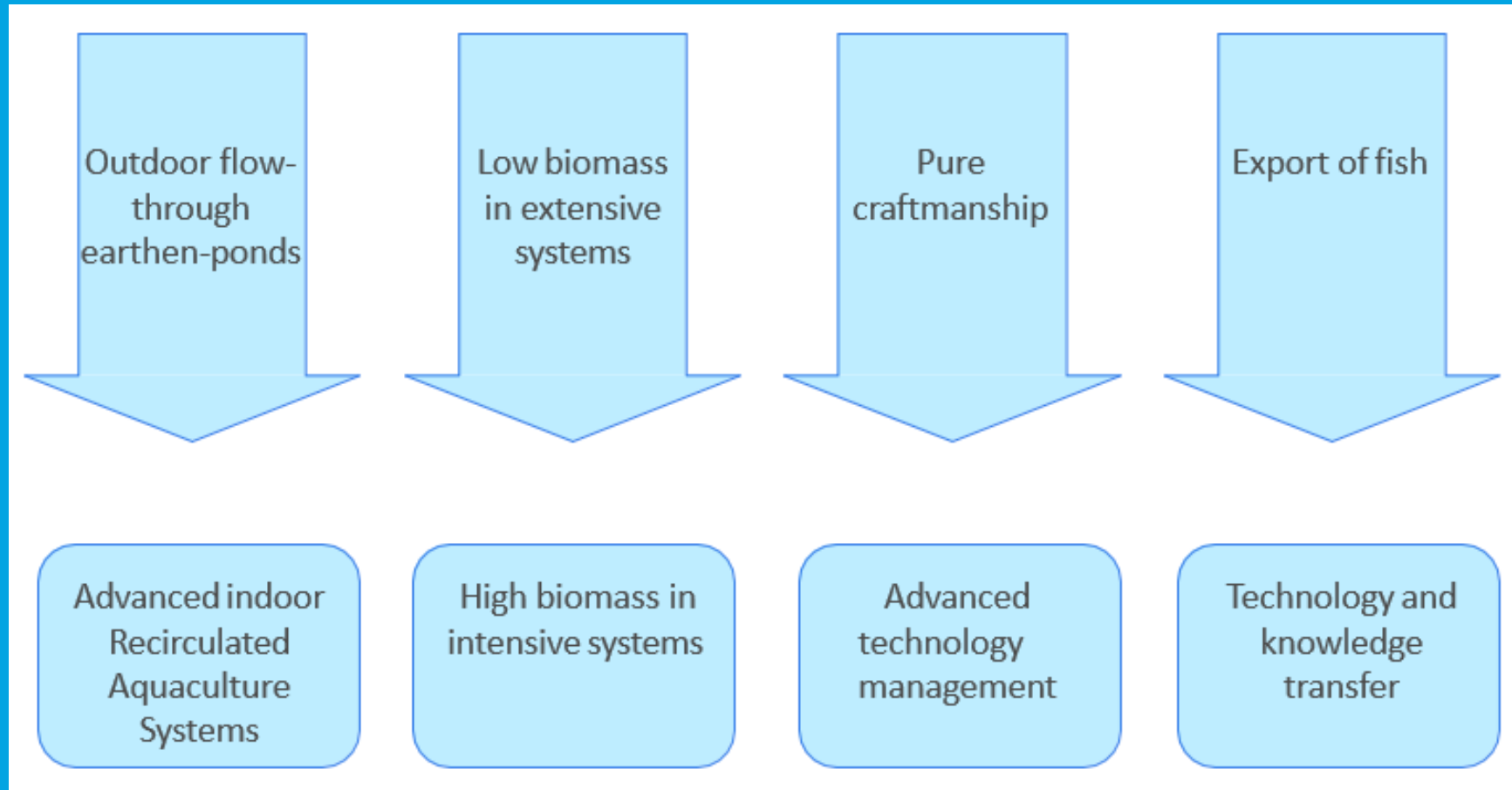
→ **Environmental Regulations**

- ✓ Farms closing
- ✓ Innovation of technology reducing the water consumption and discharge
- ✓ Same output over short time





# Development of Danish Aquaculture





# Traditional flow-through farm with earthen ponds







# A modern Danish 'Model' trout farm

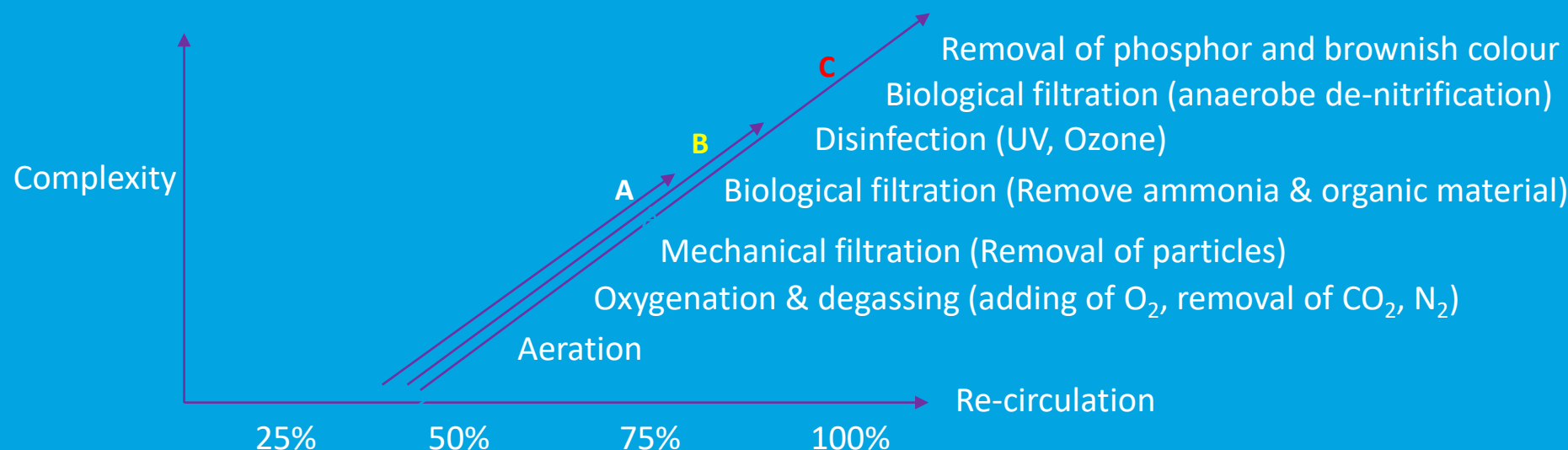


# Highly advanced indoor RAS facilities



# Degree of Re-circulation

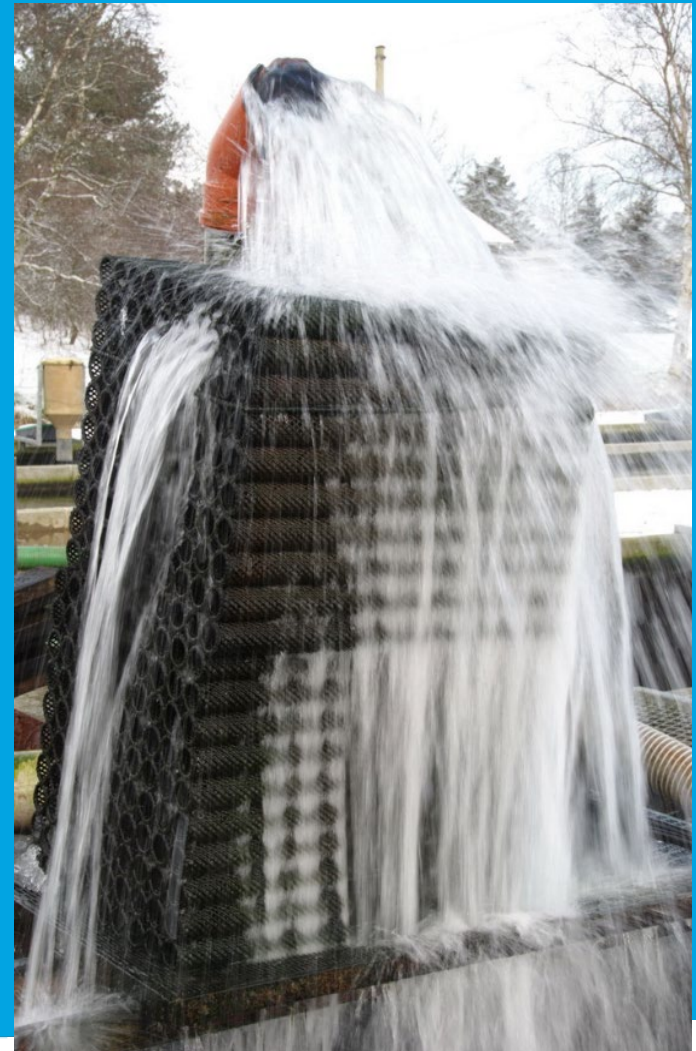
## Increasing use of technologies



|                         |                      |                                                 |
|-------------------------|----------------------|-------------------------------------------------|
| Flow through systems    | 40.000 - 50.000      | Litre of new water/kg fish produced/year        |
| <b>A: Semi RAS</b>      | <b>2.000 - 5.000</b> | <b>Litre of new water/kg fish produced/year</b> |
| <b>B: Moderate RAS</b>  | <b>400 - 700</b>     | <b>Litre of new water/kg fish produced/year</b> |
| <b>C: Intensive RAS</b> | <b>50 - 400</b>      | <b>Litre of new water/kg fish produced/year</b> |



# Aeration & degassing

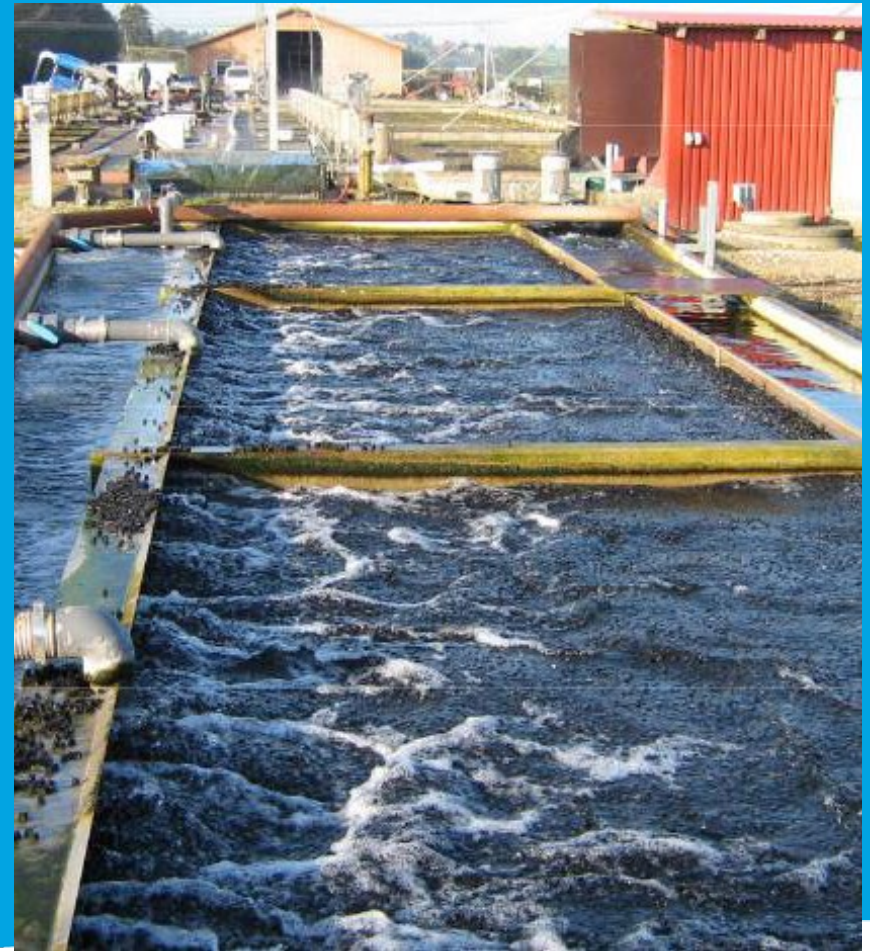


# Faecal traps

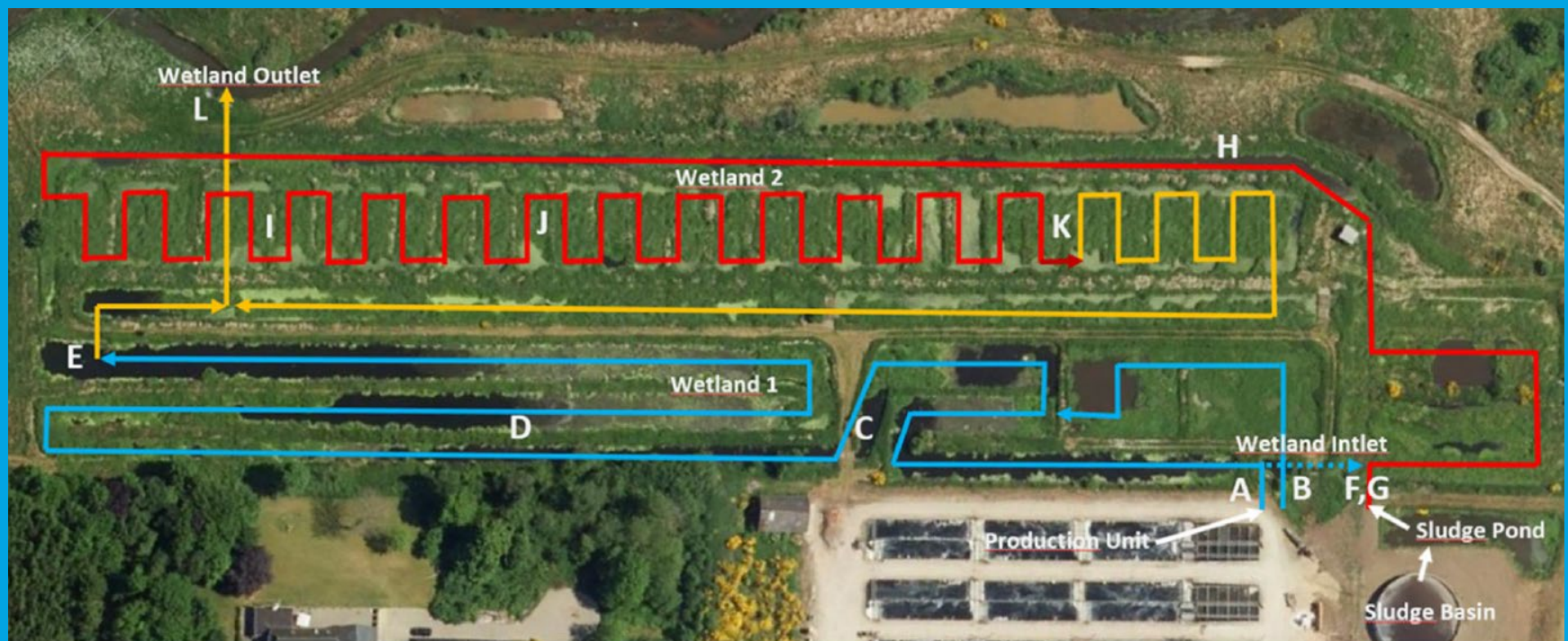




# Moving bead bio-filter



# Converting traditional farms







# Knowledge transfer



- Fast-growing freshwater fish like pangasius and tilapia represent a huge opportunity to grow more protein at a low environmental cost
- - and feed a global population that is expected to reach 10 billion by 2050



# Technology transfer to Vietnam

## Pangasius in raceway system

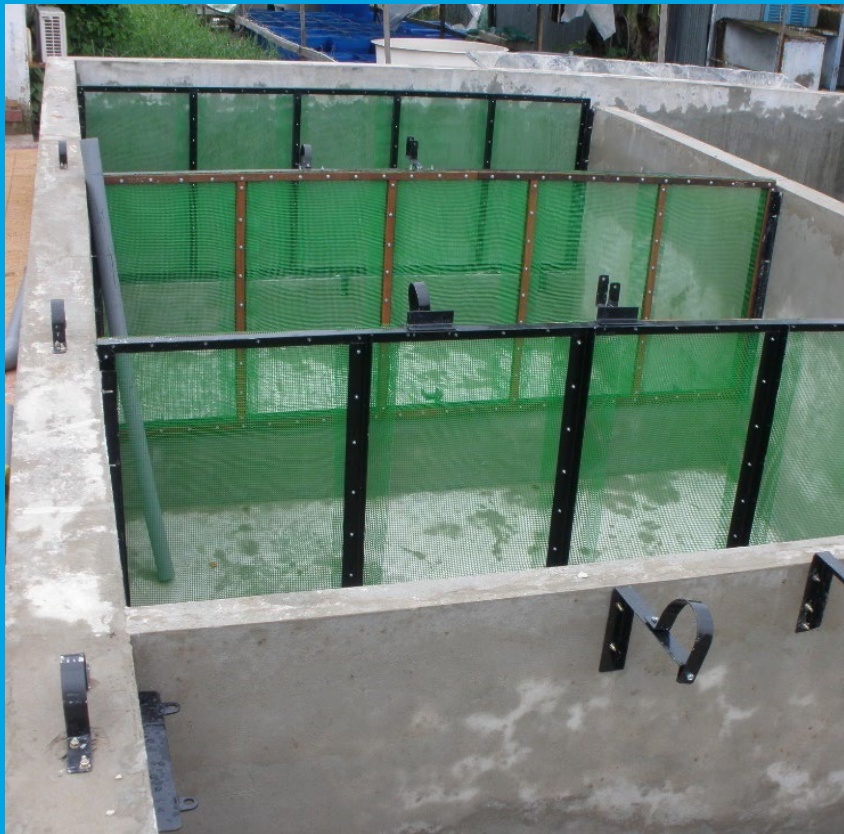






# Finished construction

Ready to receive fish



Up and running







# Results

- ✓ The production reached nearly 18 tons after only 6 months of culture, equalled to 30 kg/m<sup>3</sup>.
- ✓ The biomass of pangasius in intensive ponds equipped with aerators was 17.8 kg/m<sup>3</sup> – app. 60% lower.
- ✓ Mortality rate was app. 3% compared to app 18 % in ponds.
- ✓ Specific growth rate (SGR) was 1.7 %/day compared to 1.4 % in ponds.
- ✓ FCR was reduced from 1.7 to 1.4.
- ✓ No drugs or chemicals were used.



# Results



# Transfer of knowledge and technologies to Vietnam





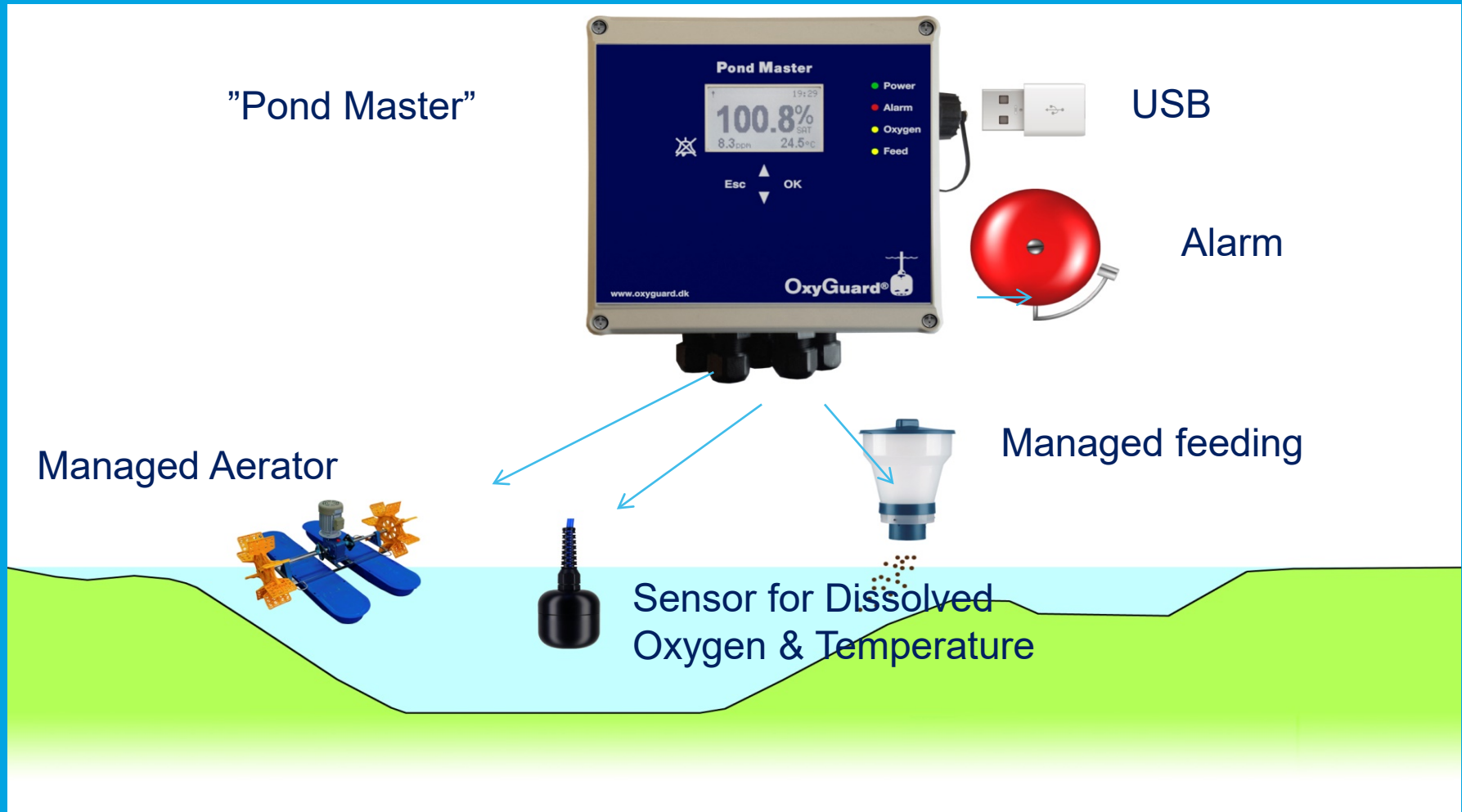
# Transfer of knowledge and technologies to Vietnam



# Transfer of knowledge and technologies to Vietnam



# Transfer of knowledge and technologies to Vietnam







# Transfer of knowledge and technologies to Vietnam

At a public owned shrimp hatchery, whiteleg shrimp (*Litopenaeus vannamei*), in Ben Tre province, we introduced a raceway system for growing PL from PL 15 to stocking size. The system worked well and improved the survival.



# Transfer of knowledge and technologies to Vietnam

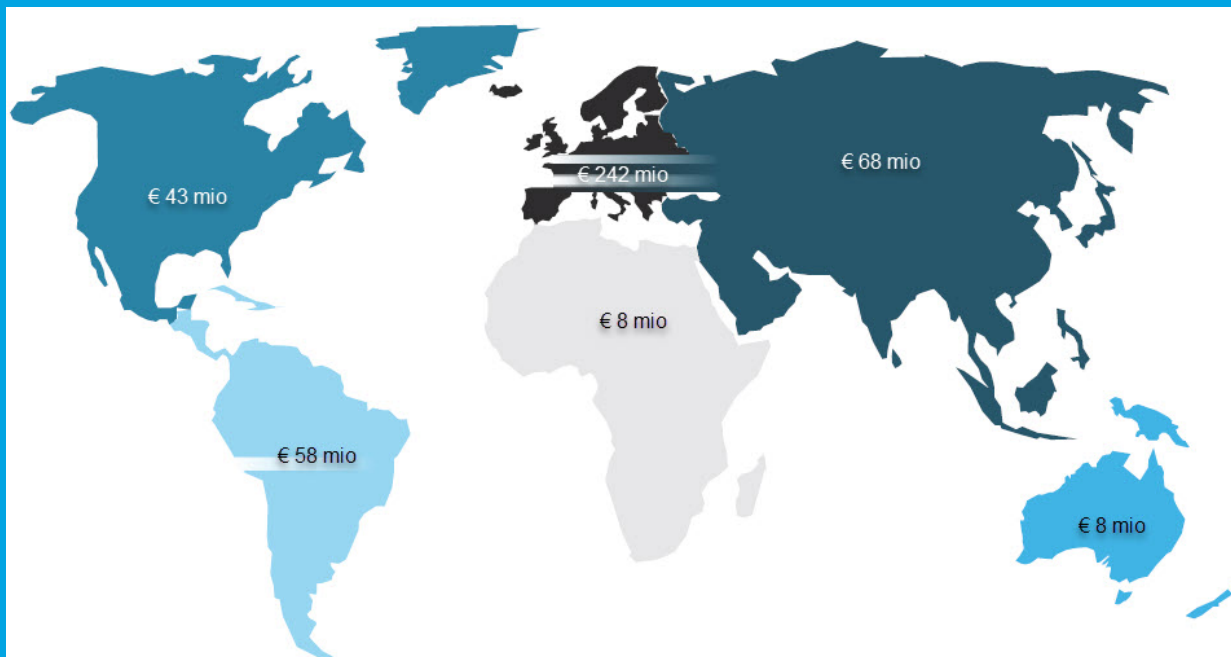
Intake water of poor quality



Sedimentation, mechanical filtering, ozonation and UV treatments was introduced.



# Technology Transfer



Value of Danish export of aquaculture technologies – € 403 millions – not including fish or feed (2017).