Food and Agriculture Organization of the United Nations

RAS today and tomorrow – current status and potentials for development

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FAO REU

What is RAS?

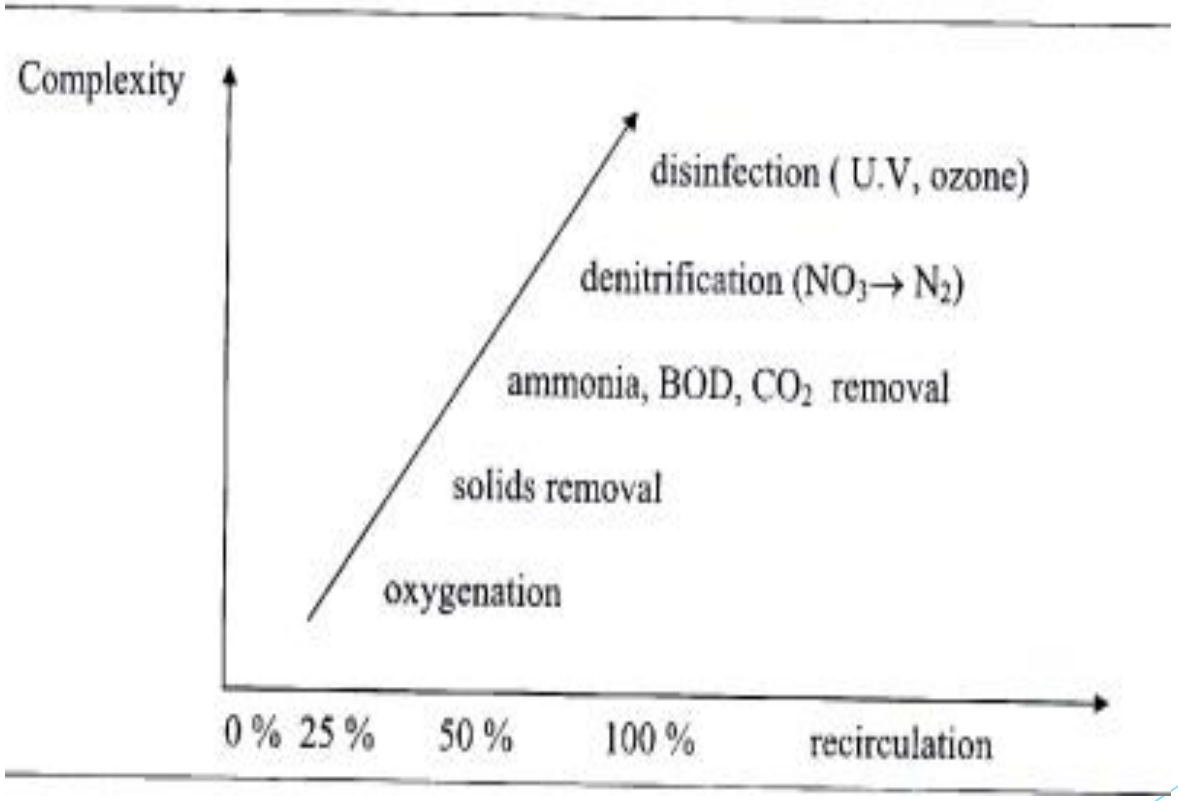
An aquaculture system where water is treated so can be used several times for production.

A fish rearing unit: supply the fish with water/oxygen
secure current
collect/remove suspended solids

Water treatment unit: mechanical and biological filtration
aeration/oxygenation
remove ammonia and CO_2
denitrification
disinfection

Different levels of water reuse

by HYDROTECH



Why RAS?

Advantages

- Water saving system
  - Traditional flow through (FT) trout farm 200-250 m^3 water/kg fish production
  - Serial reuse system: 90 m^3/kg
  - Partial reuse system: 10 m^3/kg
  - RAS: 3-5 m^3/kg (Catfish 0.1 m^3/kg)

  For comparison: 1 kg grain production requires 1.2 m^3 water
- Area requirement/water requirement
  - Pond production of carp: 2 m^3 water/kg fish, if production is 1 t/ha
  - RAS: 35-150 kg/m^3 fish production
- Year-round, more balanced production
- Controlled environment for fish, nutrient recycling is possible
- Controlled effect on environment (treatment of discharged water)
- Safe sea food (level of micro-pollution can be controlled)
- Significantly higher quantity of fish production/area
- Distance from consumers

Why no RAS?

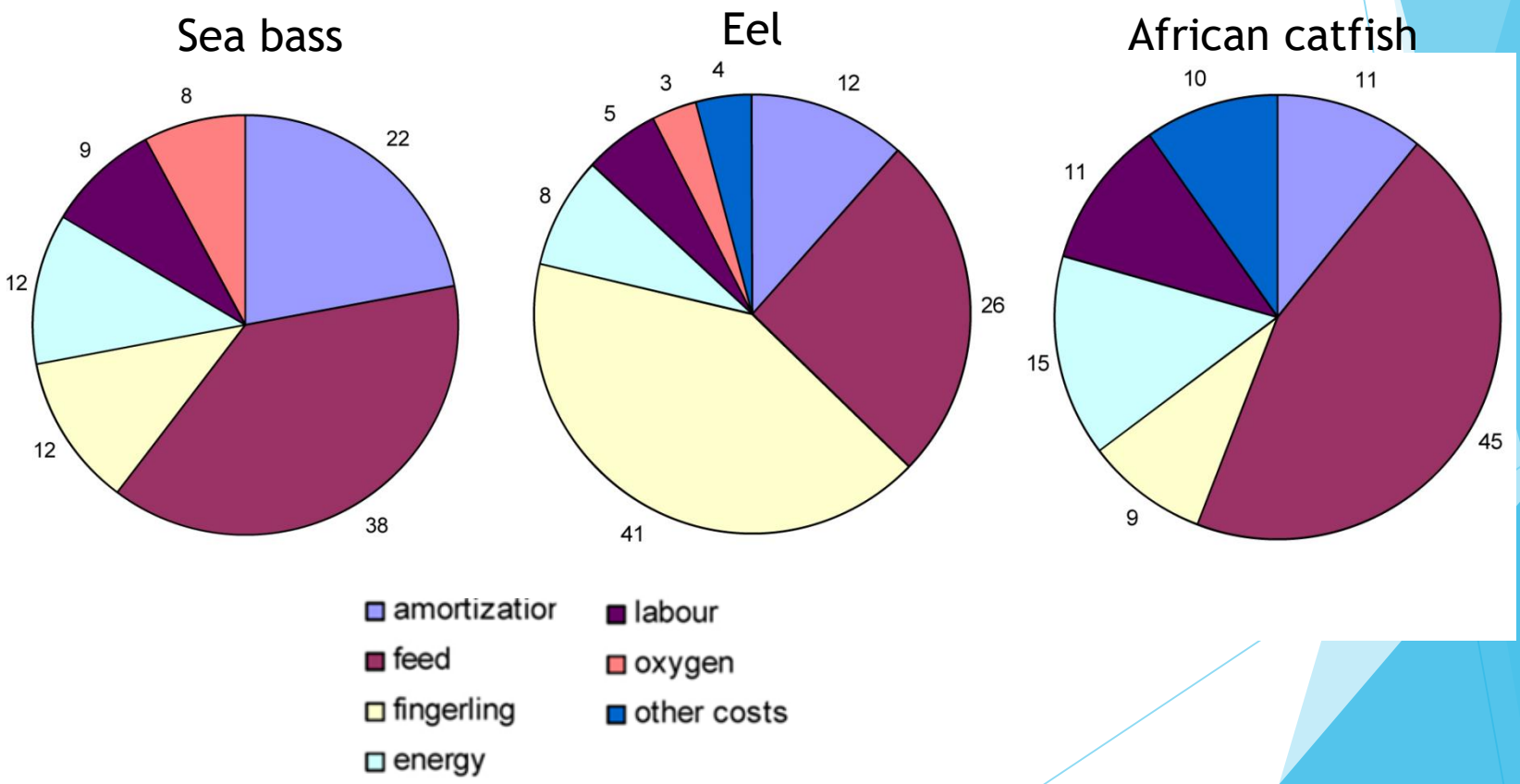
Disadvantages

- High investment costs
- Operational costs/kg fish are higher than in traditional systems
- High technical level - higher risks
- Biological risks
- Special knowledge for operation – qualified personnel
- Special management approach

RAS projects – reasons for failure

- Poor design: can lead to system failure and fish losses
- Running costs: being higher than expected
- Inexperienced staff: can lead to fish losses
- Unrealistic production schedules, sale forecasts and selling-prices
- Poor management decisions: eg. selecting a site with no proper water support
- Failure in introducing new products/species to markets
- No proper quality control of produced fish - eg. flavor

Relative cost breakdowns in % for production in recirculation aquaculture systems



Fish species to be reared in RAS

Suitability:

- Tolerance to over-crowding
- Tolerance to low water quality
- Tolerance to stress
- Acceptance of pelleted feed
- Fast growth
- Resistance to diseases
- Market acceptance

Commercially important species	
Salmon (smolt)	Perch
Eels	Raibow trout
Seabass	White fish
Barramundi	Murray Cod
Turbot	Jade perch
Sole	Silver perch
African catfish	Cobia
European catfish	Abalone
Tilapia	Shrimp
Sturgeons	Seahorses
Pike perch	Grouper
Ornamentals	Red drum

Future challenges for RAS development

Priorities:

- **Decrease environmental impacts:**
- Minimize Feed Conversion Ratio (FCR)
- Sludge used as fertilizer => introduction of sludge thickening
- Reduce energy use (airlifts with denitrification)
- Integrated Multi-Trophic Aquaculture (IMTA)
- **Increase waste removal efficiency (solids, nitrogen, phosphate):**
- New technologies for (fine) solid removal
- Combined removal of organic carbon and TAN
- Denitrification systems – using produced sludge as carbon source
- Better control of microbial communities in RAS (ANAMMOX)
- **Sensors, robots, artificial intelligence**
- Huge amount of real time data => remote control, predictions

Thank you for your kind attention!