

# Biosecurity in RAS systems

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# Outline

- ▶ Biosecurity
- ▶ Special considerations for RAS



Source: AKVA.com

# Biosecurity

## Infectious Disease Components

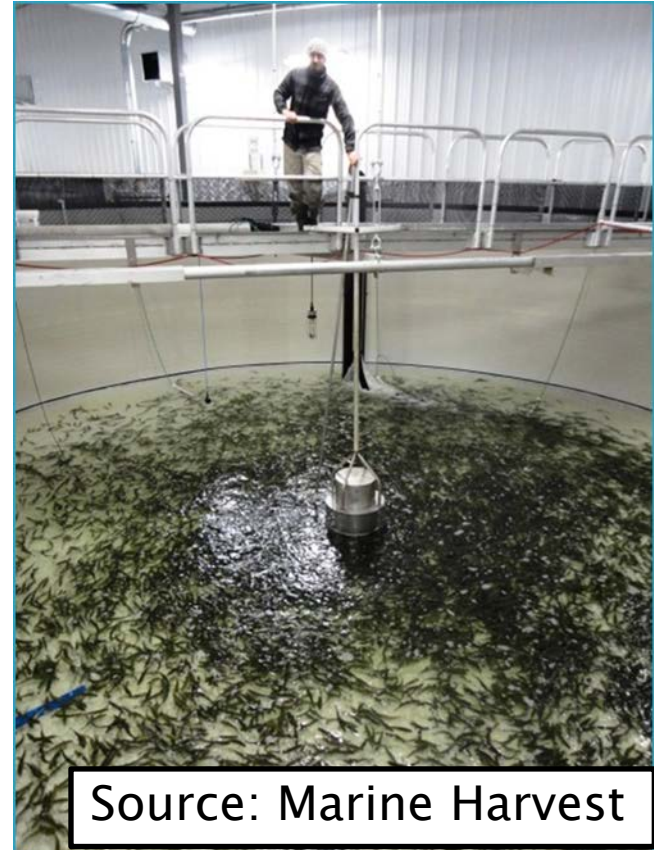
1. Bioexclusion
  - Prevention of pathogen entry
2. Biomanagement
  - Management of pathogens within a facility
3. Biocontainment
  - Prevention of pathogens release



Source: anonymous

# Biosecurity analysis

- ▶ Scenario
- ▶ Pathogens/diseases of concern
- ▶ Control points
- ▶ Mitigation measures



Source: Marine Harvest



# Physical layout – RAS



# Bioexclusion



# RAS Pathogen entry

<u>Route</u>	<u>Details</u>
Animals	Live fish, dead fish (and components) and live/dead eggs
Water	Incoming (influent)
Fomites	Equipment (large and small), clothing
Vectors	Biological –pathogen life cycle Mechanical – incidental carriers ( <u>staff</u> , visitors, predators, pests)
Feed	Pathogen not inactivated
Biofilter/biofilm	RAS

# RAS – additional considerations





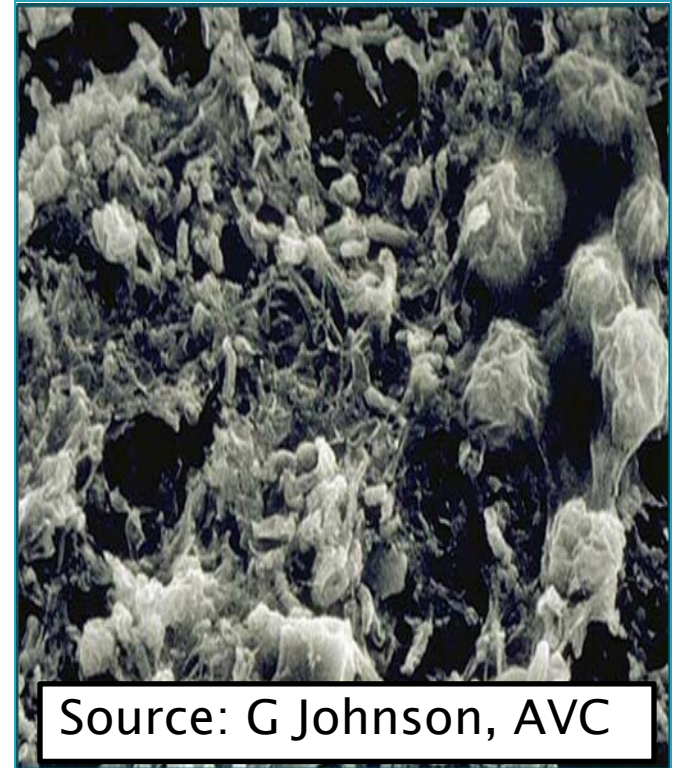
# RAS – emerging diseases

- ▶ Pathogens that are ubiquitous or commensal organisms
  - *Saprolegnia spp* in Atlantic salmon hatchery RAS
  - *Francisella noatunensis* in Tilapia RAS
- ▶ Persistent, sporulated, intracellular organisms
- ▶ Occult entry into RAS through water or fish GI, gills, mucous?
  - Not screened for



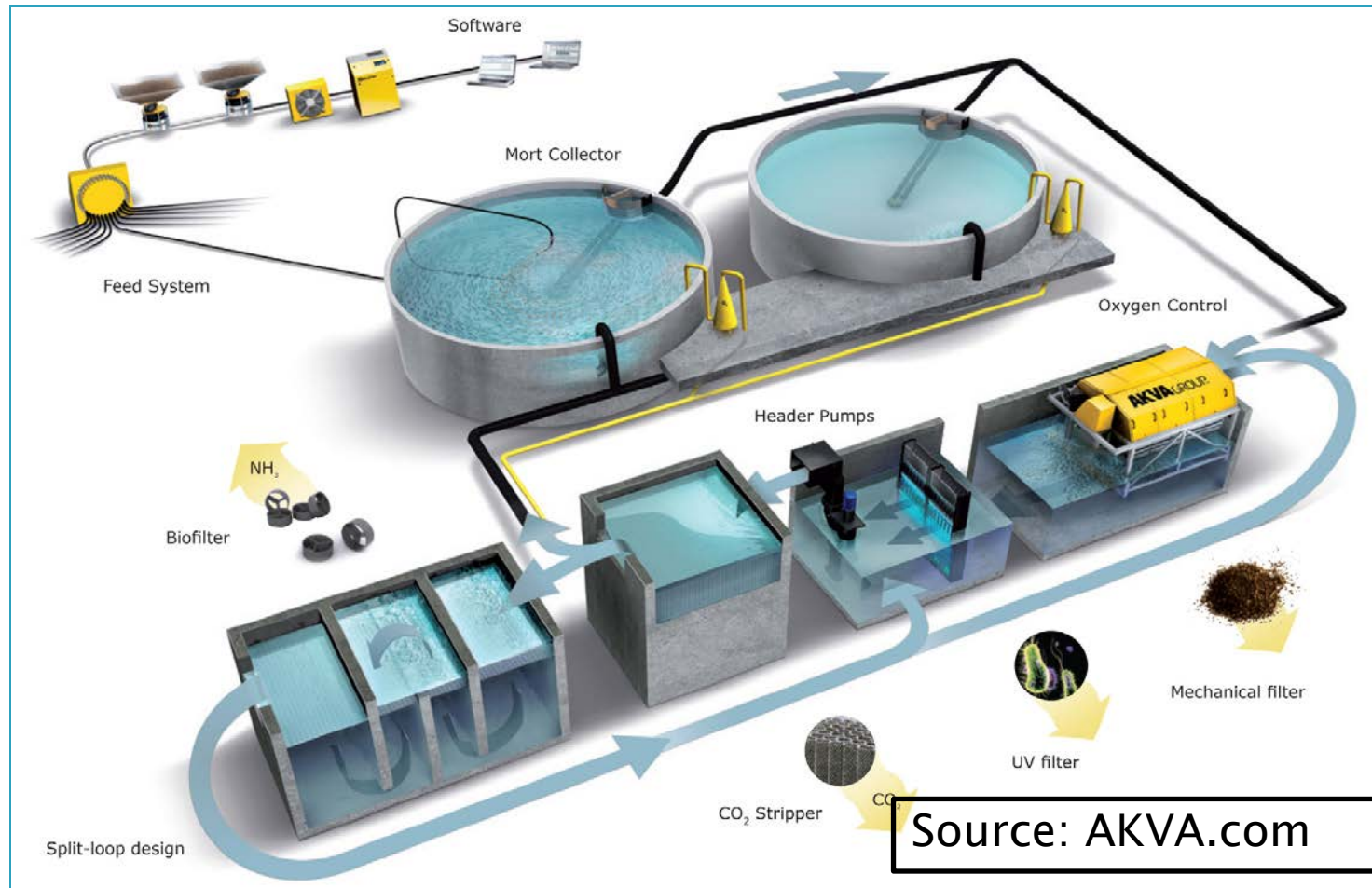
# RAS – complicates infectious disease management

- ▶ Biofilter start up
- ▶ Biofilter at risk with certain flow-through treatments
- ▶ Development of reservoirs
  - Lack passive management through new water (dilution)
- ▶ Biofilm maturation – shedding and sequestration




Source: G Johnson, AVC

# Biofilter and biofilm (B&B)



# Managing disease by managing the RAS environment

- ▶ Change of tactics
    - Focus on biomanagement as well as bioexclusion
    - Importance of biofilm
  - ▶ Characterize microbial populations in B&B
    - Metagenomics
  - ▶ Cleaning the entire system “in vivo”
  - ▶ Physical access to all parts of the system
    - Inspection and sampling ports
- 



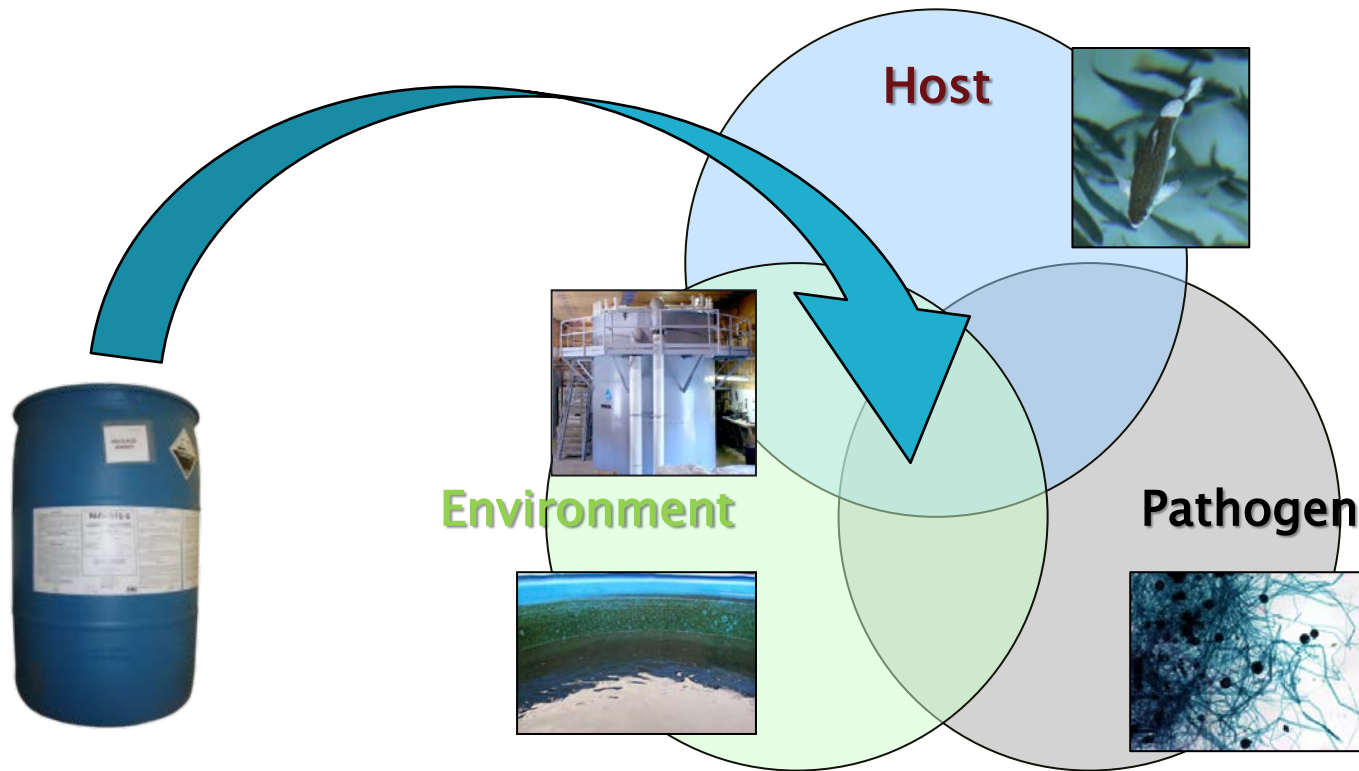
# Managing disease by managing the RAS environment .../2

- ▶ Redundancies, plumb in parallel and bypasses for isolation, C&D, treatments
- ▶ Modularize the system
- ▶ Targeted in-water treatments for water, B&B
  - Chemical
  - Biological (e.g., phages)



# Developing our understanding

- ▶ Solutions for the ENTIRE system –include B&B



# Developing our understanding

- ▶ Multidisciplinary team
- ▶ New approaches
- ▶ New treatment regimes
- ▶ Incorporate lessons from agriculture
  - Livestock
  - Crops



# Questions?

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