DISEASE TRANSMISSION IN AQUATIC ENVIRONMENTS

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Objectives

- Introduction to disease transmission in aquatic environment
  - Health and veterinary practice in aquaculture
  - Similarities between terrestrial and aquatic perspectives

Epidemiology and Risk Assessment for Aquatic Animal Diseases

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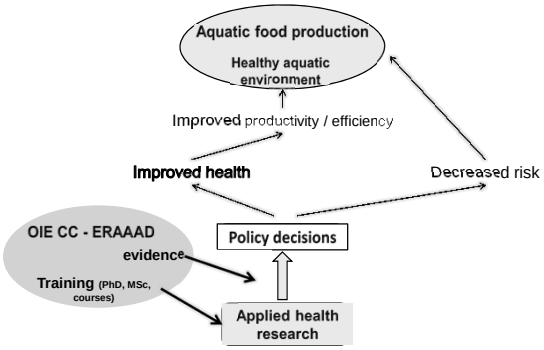
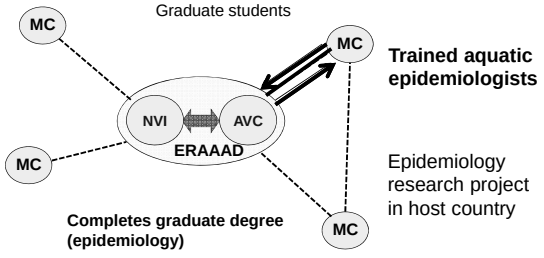


Concept of global network of competence



Outline

- Role of health professionals in detecting and managing disease
- Disease agent introduction and spread factors, between
  - Individuals
  - Groups on farm
  - Farms

Health Management in Terrestrial (Mammal / Poultry) Farming

Traditionally: responding to disease outbreaks

Past 40 years: gradual transition to scientific consultants on health, welfare and productivity

- Reproductive health of dairy herds
- Analysing production records to identify factors related to poor performing animals
- Interpretation and transfer of current scientific information to animal handlers who may not be scientifically trained

What is different about fish farming?

- What is the impetus for a fish farmer to call a health professional?
  - Dead fish
  - Sick fish – off feed
  - Choosing treatments
- What should they be called for?
  - Advice on optimizing health / productivity
  - Risk management and preventive medicine practices
  - Outbreak investigations

Infectious Disease Agents – introduction & transmission

- How are disease agents likely to be introduced to a facility?
  - Identifying / prioritizing & mitigating high risk activities (i.e. introduction)
- How likely are we to detect them when they are introduced?
  - Factors related to disease transmission and expression
  - Routine monitoring and response plans for suspected infectious disease outbreaks
- What capacity is there to contain an infectious agent and reduce new transmissions?
  - Identifying / prioritizing & mitigating high risk activities (i.e. transmission)

Transmission between individuals

- Need *effective* contact between infected and susceptible individuals
  - Dose exchanged (which is affected by disease agent, host response stages, proximity to infective material)
  - Pathogenicity of agent (more pathogenic leads to less duration / less dose needed for effective contact)
  - Duration of exposure (which is affected by animal densities, persistence of organism in environment)
  - Route of exposure (biological material most important)
  - Susceptibility of contact (immune response, weakened animals more susceptible)

Transmission at finfish facilities

- Effective contact through biological material in close proximity to susceptible individuals
  - E.g. exposure to blood/mucus (ingestion, gills) is greatest risk for ISAv transmission
  - Mortality disposal (divers), boat traffic, cannibalism, sea lice, proximity to processing plants
- Contact between multiple individuals possible
- Immune responses can be modified through vaccination (similar effect as reducing the "pathogenicity" of the agent)

Transmission between populations

- Exposure
  - Must know route of exposure, who is infected/infective
  - Exchange of individuals is greatest risk
  - Exchange of biological material is next greatest risk
  - Vectors or intermediate hosts is disease specific
- Prevalence of infected individuals will affect dose released from facility
- Disease resistance – if lower proportion of susceptible individuals, then can improve "herd immunity"

Transmission between populations

- Species barriers are very helpful
  - Most disease agents are species specific
- "Reservoir" species can introduce situation in which there is balanced host-pathogen relationship
  - But expose pathogen to new extremely susceptible host (which usually do not co-exist in wild so rarely have natural exposure)

Pathogen introduction

- Three primary areas of exposure
  - Animals, particularly wild animals (also eggs, juveniles)
  - Water source contamination
  - Personnel / equipment

Strict Biosecurity minimizes exposure to new pathogens to new disease agents

Transmission by personnel / equipment

- Footbaths & hand wash stations between areas of same facility
- Equipment, including boots
  - Personnel sharing (e.g. spawning or vaccination teams)
  - Restrictions on visitor access (recent visits to other facilities)
  - Known importance when facility has disease occurrence
    - Important when facility has unknown disease occurrence

Pathogen introduction

- Water source
  - Water with access for wild fish or birds
  - Pathogen contaminated water source
    - water treatment needed to kill pathogens

Pathogen introduction

- Fish sources – broodstock or new stock
  - New stock may have been exposed to wild fish / birds / water
  - Testing only ensures detectable disease levels
  - Vertically transmitted diseases are most important to progeny
    - Horizontally transmitted disease important for established hatchery stock

Pathogen introduction

- New stock sources
  - Pathogen-free certification (within positive area) often suspect
    - Must account for diagnostic test performance (ability to detect positives AND negatives; i.e. sensitivity & specificity)
    - Biosecurity barriers critical
    - Sampling process should be repeated over time before introduce new individuals
- Mortality monitoring is probably best "diagnostic test" possible when dealing with new species

Disease detection

- Diagnostic tests are imperfect
  - Particularly when attempting to detect asymptomatic individuals
- New cultured species *will* have new pathogens identified

Conclusion

- Pathogen transmission can occur with exposure to
  - Fish
  - Fish tissue / biological material
  - Contaminated water
  - Equipment
  - people
- Manage risk within the facility populations by
  - Reducing transmission factors
  - Improving host resistance