

Use of veterinary medicines in aquatic environments



Résistance aux antimicrobiens (RAM) en aquaculture

11 - 12 juillet 2024 Tunis, Tunisie



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Diseases



Biosecurity during major die-offs

- Water is excellent vehicle to transmit pathogens
 - Culture operations have less control (compared to research facilities) due to water volume, reduced opportunity to filter / disinfect
 - Exposure to other aquatic animal populations difficult to avoid



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Outline

- Role of health professionals in detecting and managing disease
- Disease agent introduction and spread factors
- Control options used in aquaculture



Transmission between individuals

- Need *effective* contact between infected and susceptible individuals

- Dose exchanged
- Pathogenicity of agent
- Duration of exposure
- Route of exposure
- Susceptibility of contact



Disease transmission

- 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



Species & yearclass separation

- Crucial to reduce / prevent exposure





Biosecurity – identifying control points

- *exposure* to
 - live or dead infected fish
 - Water contaminated with pathogen
 - contaminated equipment
 - contaminated people



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Risk factor management

- Minimizing stressful husbandry
 - Attention to water temperature for handling
- Remove dead animals promptly





Managing risk of disease

- Reduce exposure to environmental routes through strict biosecurity
- Reduce exposure by limiting introduction of animals
- Early detection of diseased animals and control through
 - Manage disease risk factors
 - Monitoring for emerging cases of infectious disease
- Control measures
 - Chemotherapies and vaccination



Disease control options

- Bath / immersion
 - Tarps, well-boats
- In-feed
 - Antibiotics, antiparasitics
- Injection
 - (Antibiotic), vaccines



- Local consumption
- Not part of international trade
- Large ponds
- Mortality collections / records difficult
- Movements recorded, but unknown number / size left in pond
- Aeration required for movements
- Runoff from agriculture fields possible

Pintado, Brazil

Bath / immersion considerations

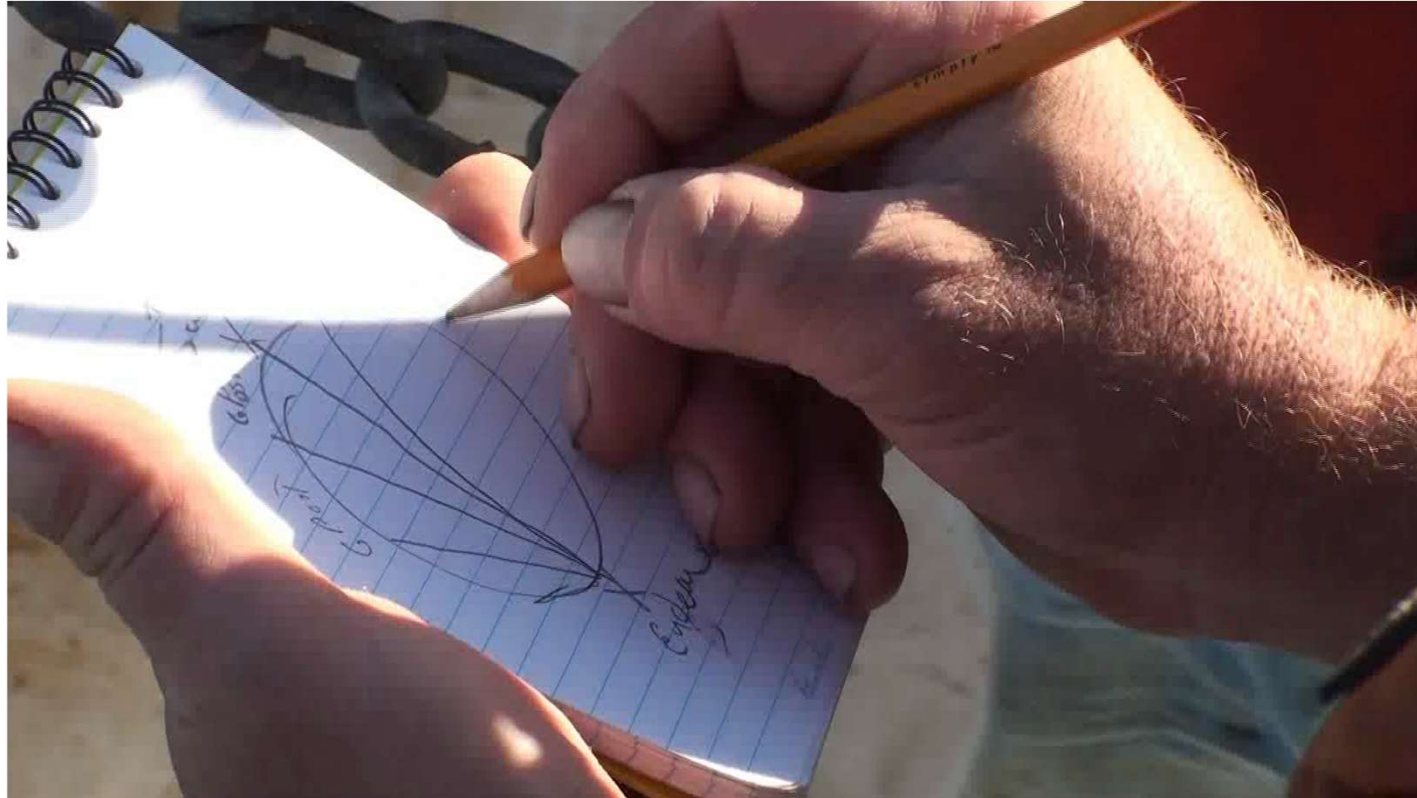
- Even distribution to sick and healthy fish
- Less absorption
 - Fewer food safety concerns
- More environmental concerns
 - Release of treatment chemical to environment
 - Non-target animals receive treatment
 - Resistance issues, especially for non-target organisms
- Dose / concentration difficult
 - Total volume of water varies by shape of enclosure
- Multiple users simultaneously
 - Compounds environmental release issues



Pamona, antibiotic immersion; Vietnam



Tarping for sea lice treatment (salmon)





Wellboat sea lice treatment (salmon) with hydrogen peroxide



In-feed considerations

- Treat part of population with appetite
 - Sick fish tend to go off feed
 - Remain untreated to re-expose once medication finished
 - Requires early detection and treatment to maximize delivery



Antibiotic treatments – in-feed

Advantages

- Simultaneous treatment for multiple cages / tanks
- Stressful fish handling avoided

Disadvantages

- Only fish with appetites will be treated
 - Sick fish off-feed
 - Water temperature affects appetite
- Residues / withdrawal times
- Environmental release
 - Uneaten feed, metabolites, feces
- Resistance development
- Many species / environments / conditions make it impossible to have label claim supported for each

Bioavailability and metabolism

- Water temperature dependent
 - Often measured in degree-days
 - Low temperatures slow metabolism
- Changing temperature
 - Most impact if temp high when eating medication, then drop temp for metabolism



Extra-Label Drug Use

- Common in aquaculture
 - Lack of specific size, temp, condition, species, dose, etc on label
 - Veterinary responsibility (including food safety, target animal safety, environmental) to apply knowledge from one to another situation
- Financial incentive lacking for pharma to test in all different situations
 - Aquaculture is limited market
 - Each country manages their own registration





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In-feed considerations

- Water temperature affects absorption and metabolism / elimination
 - Withdrawal times affected
 - Also affects appetite
 - Dose is by biomass so may need to deliver dose in less feed (i.e. more concentrated); affecting acceptance



In-feed considerations

- Delivery often through oil component of feed
 - Loss of drug into water possible
- Elements (e.g. Na, Ca) in feed or water can affect bioavailability of drug
- Withdrawal times based on calculated drug elimination period, affected by
 - Dose (eg double dose?)
 - Population structure (eg greater size variation within group)
 - Hierarchies of appetite (some fish eat more feed)
 - metabolism (eg disease, water temp)

In-feed considerations

- Sampling for estimating residues challenging
 - Random sample usually impossible
 - Representative sample?
 - Cost for testing and waiting for results on large populations
- Residues real challenge if need to change harvest schedules



Injection considerations

- Rarely inject antibiotics
 - Primarily restricted to broodstock
 - Eg erythromycin injections for vertical BKD prevention
- Most commonly used for vaccines
 - Intra-peritoneal injections

Injection considerations

- IP injection vaccination
 - Process is less costly than immersion vaccine for larger fish
 - Better immune responses, more prolonged
 - Adjuvants important component of many formulations
 - Many vaccines are bacterins or killed virus
 - Immune response times usually measured in degree-days (to reflect water temperature affect on responses)



Vaccination

- More vaccines available
- Immersion (gill absorption)
- Recent developments in-feed vaccine delivery
- Handling animals has impact
- Most effective is IP injection
- Anesthetic usually required



Conclusions

- Use of veterinary medicines in aquatic food animal production is relatively common
 - Frequently without diagnosis
- Delivery of drug to appropriate individuals is challenge
- Treating at population-level
 - Average dose, average metabolism, average depletion
- More common uses
 - In-feed for antibiotics
 - Bath for anesthetics, pesticides
 - Injection for vaccination
- Water temperature affects pathogen and host metabolism AND treatments