



UTF/077/ZAM: Technical Assistance to the Zambia Aquaculture Enterprise Development Project (ZAEDP)

Session 2

Importance of surveillance in aquatic animal health management
Dr Nihad Fejzic

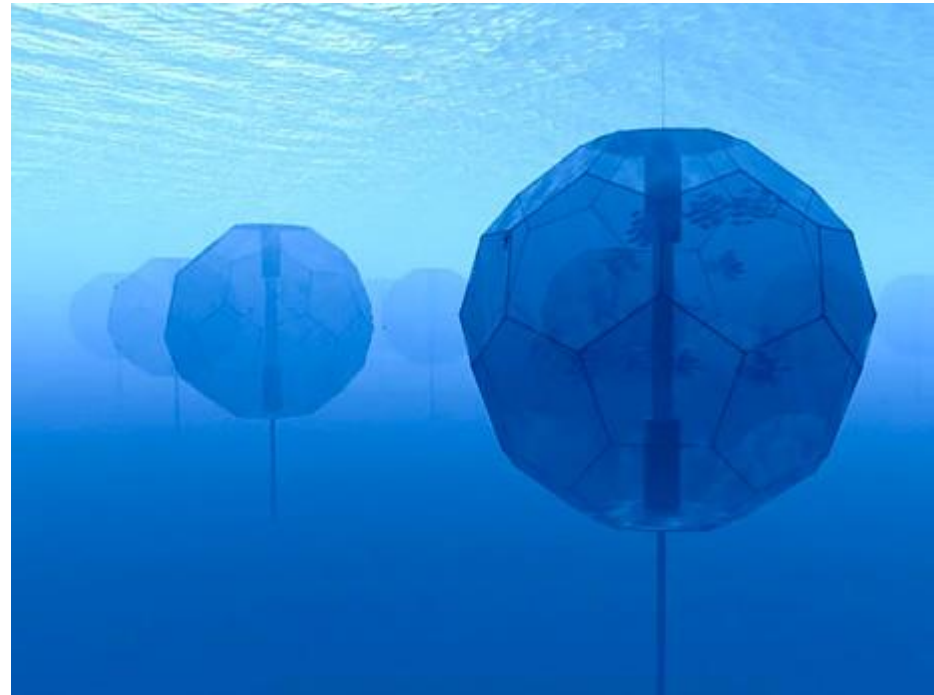
Presentation outline

- Challenges of AAD surveillance comparing to surveillance of terrestrial animal diseases
- Objective of AAD surveillance
- Key determinants of AAD surveillance
- Further work: EUS and TiLV surveillance plan and implementation

Aquatic vs. Terrestrial surveillance

- **Challenge 1 – Environment**

- Terrestrial sp. – housing, ventilation, lighting, feed and feed distribution, water
- Aquatic sp. – water is all
 - Fresh water, salt water
 - Still water bodies, rivers
 - Density



Aquatic vs. Terrestrial surveillance

- **Challenge 2 – Biology of host**

- Most terrestrial animals

- Warm blood
- Vertebrate
- Mammals
- Containment and biosecurity (movement, housing)

- Aquatic animals (and plants!)

- Cold blood
- Many invertebrates
- Fish, crustaceans, mollusks
- Farming integrated into environment



Aquatic vs. Terrestrial surveillance

- Challenge 3 – Diversity of pathogens

Aquatic Animal Health Code

Contents | Index 

PDF

CHAPTER 1.3.

DISEASES LISTED BY THE OIE

Preamble: The following *diseases* are listed by the OIE according to the criteria for listing an *aquatic animal disease* (see Article 1.2.1.) or criteria for listing an *emerging aquatic animal disease* (see Article 1.2.2.).

In case of modifications of this list of *aquatic animal diseases* adopted by the World Assembly of Delegates, the new list comes into force on 1 January of the following year.

Article 1.3.1.

Aquatic vs. Terrestrial surveillance

- **Challenge 4 – Diversity of management systems**
 - Extensive systems
 - cages, still water ponds/reservoirs
 - *Tilapines, catfish, Cyprinids*
 - Semi-intensive systems
 - the ponds are fertilized
 - Exogenous feeding
 - Intensive systems
 - water flows in and out continuously
 - higher stocking densities
 - complete feeds and water aeration
- Integrated Multi-species Aquaculture

In summary: key challenges for surveillance planning for AAD

- Animals are kept in water
- Often in complex rearing system
- The size of the fish population on farm
- Accessibility for inspecting and sampling animals
- Some basic information relevant to planning such as expected prevalence in infected population and diagnostic test performance is often limited or not available

Principles of AAD surveillance

- Should be tailored designed
 - wide variety of species cultured, the pathogens and management systems
- Support to domestic production
- Tool to promote international trade (international disease reporting, OIE standards)
- Moving toward Output based approaches

Objective of AAD surveillance

- Objective of AAD surveillance
 - Dependent from disease presence/absence
 - Dependent from certification level (farm/region/country)
- **Disease present**
 - Reliably measure disease frequency/trends
 - Make corrective actions
 - Monitor effectiveness of DCP
- **Disease absent**
 - Demonstrate disease freedom
 - Early detection of disease

Objective of AAD surveillance

- Different certification level
 - **Farm accreditation/certification**
 - **National/regional disease free status**
- Monitoring of diseases in environment
- May target specific disease
- May include multiple diseases (even previously unknown/unseen)

Principles of AAD surveillance

PDF

CHAPTER 1.4. AQUATIC ANIMAL HEALTH SURVEILLANCE

Article 1.4.1.

Introduction and objectives

Surveillance activities may be performed to achieve any of the following objectives:

- a. demonstrating the absence of *disease*;
- b. identifying events requiring *notification* as listed in Article 1.1.3. of the *Aquatic Code*;
- c. determining the occurrence or distribution of endemic disease, including changes to their *incidence* or *prevalence* (or its contributing factors), in order to:
 - i. provide information for domestic *disease* control programmes,
 - ii. provide relevant *disease* occurrence information to be used by trading partners for qualitative and quantitative *risk assessment*.

Purpose/objective of AAD surveillance

- The objective of a surveillance system is the most influential in determining suitable design, so it should be considered before planning
- The objective of surveillance is closely related with disease mitigation, and can be in one of three stages:
 - Sustainment (to sustain free or low prevalence status)
 - Investigation (estimation of the level of occurrence)
 - Implementation

Principles of AAD surveillance



Principles of AAD surveillance

4. It would be impractical to try to develop a *surveillance* system for all the known *aquatic animal diseases* for which a country has *susceptible species*. Therefore prioritising the *diseases* to be included in a *surveillance* system should be conducted considering:
 - a. the needs to provide assurance of disease status for trade purposes;
 - b. the resources of the country;
 - c. the financial impact or threat posed by the different *diseases*;
 - d. the importance of an industry-wide *disease* control programme within a country or region.

Key determinants of AAD surveillance

1. Definition of population
2. Documentation of methodology, study design and analysis
3. Clustering
4. Design prevalence
5. Test characteristic
6. Sampling
7. Quality assurance systems

Review of available approaches/methodologies of surveillance

- Passive disease reporting
- Structured surveys - population based surveillance
- Sentinel surveillance
- Risk based surveillance
- Syndromic surveillance

Passive surveillance

Passive surveillance means that no special activity is undertaken by the collecting authorities to generate information - it usually comes from producers.

Advantages

- Ability to identify newly introduced exotic diseases
- Depend on producers
- Can detect any disease
- Meet basic requirements of the reporting system of OIE
- * Under reporting
- * Impossible to calculate the total number of cases
- * Is not able to demonstrate that a disease is not present in area
- * Can not provide representative information on the level of disease in the population, or the geographical pattern of disease.

Components of a passive or general reporting system

- Farmer/fisher reports
- Local fisheries and aquaculture officers
- Disease report form/outbreak investigation form
- Diagnostic laboratory
- Data management and analysis
- Reporting and feedback

Prevalence surveys

- Aim to estimate the proportion of the population that has a particular disease or status, at single point in time.
- Small area survey (simple or systematic random sampling)
- Large area survey (two stage sampling)
 - First stage: villages or farms
 - Second stage: ponds or cages in selected village

Sentinel surveillance

- Alternative for population based surveillance
- Selected individuals/establishments
 - Fewer resources - restricted number of samples
- Regular complete reports
- One or more diseases
- NONREPRESENTATIVE for entire population
- Suitable for high risk groups – exotic diseases, rare diseases

Risk based surveillance for AAD

- The new EU legislation (CD 2006/88/EC) requires that surveillance to maintain the disease status is risk based
- Suggested method by different authors for ranking fish farms for pathogen introduction and spread

- Risk base surveilliance
- Theory – EASY!
 - Looks where you expect disease to occur
 - More sensitivity with less samples
 - Efficient but cheaper
- Practice – LITTLE COMPLICATED!?
 - What is risk?
 - Where does it apply?
 - How to calculate sample size?

Oidtmann (2011): risk categorisation of farms

- Live fish and egg movements
- Exposure/spread via water
- Processing plant on site
- Geographical factors (flood risk)
- Mechanical transmission

Score for risk of introduction and spread are calculated separately and then combined to an overall score.

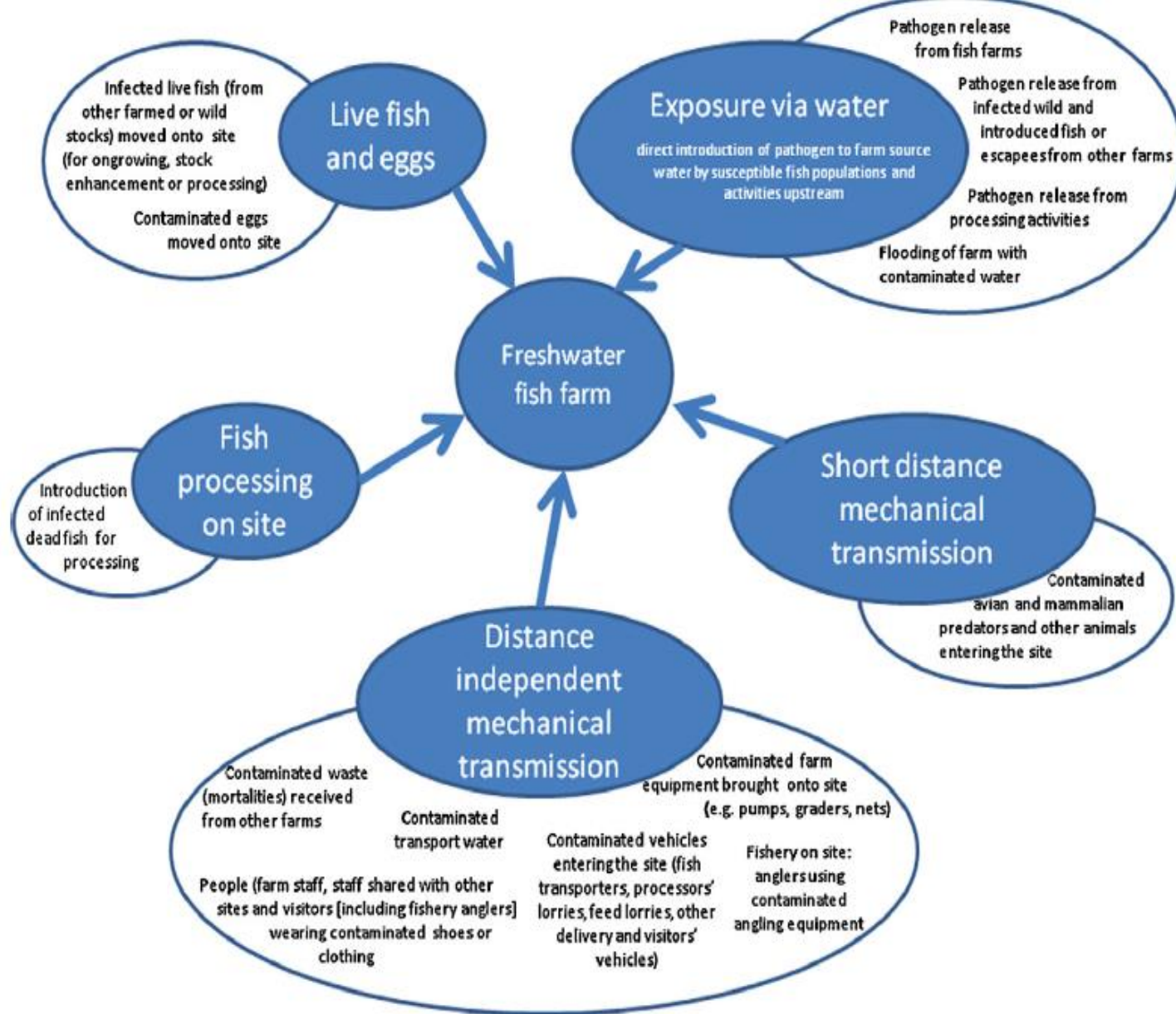


Fig. 1. Pathways of pathogen introduction to a freshwater fish farm. Freshwater fish farms may be exposed to multiple routes of pathogen introduction, which can be grouped into risk themes (risk themes shown as filled oval shapes surrounding the freshwater fish farm oval in the centre). Examples of pathways falling into each risk theme are listed in the white ovals attached to the respective risk theme oval. More detail on each risk theme is provided in the text.

Risk based surveillance

- Relative risk
- High risk: 10% animals, 80% prevalence
- Low risk: 90% animals, 20% prevalence
- True prevalence 17%
- Apparent prevalence 80%

Syndromic surveillance

- Early detection of outbreaks
 - a threshold number of early symptomatic cases
- Well-defined disease or clinical syndromes
- Indicates unusual clustering or sentinel cases
- Trends – size, spread and tempo
- Use existing health data

Before start to plan keep in mind special challenges of aquatic animals disease surveillance

- Pathogen exposure and transmission
- Likelihood of disease expression: Interaction pathogen-host-environment
- Population
- Diagnostic test sensitivity of test applied for surveillance
- Design prevalence
- Sample size
- Random sampling

Before start of planning

- Are we doing the **right thing**?
 - Are the results we see due to the programme/intervention/policy?
 - What would have happened in the absence of the programme?
- Are we **doing it right**?
 - Can we do things more effectively and/or efficiently?
 - Can we gain more for the resources we invest?

And more..

- Surveillance is an economic activity
 - Which surveillance?
 - How much surveillance?
- Surveillance is an economic activity
 - What is the value of information?
 - Who should pay for what?

Planning AAD surveillance

- Current status of disease
- Objective of surveillance
- Data type and sources
- Population, coverage, representativeness
- Approach/methodology

Example: Farm accreditation (one stage structured survey)

- Objective: surveillance to prove that individual farm is free from TiLV (**disease freedom**)
- Survey standards:
 - 95 % confidence that disease will be detected if present
 - The power of survey at 95 % (type II error meaning there is a 5 % chance of concluding that farm without infected animal is infected)
- Once farms have been surveyed without detecting disease they are recognised as free, as long as they maintain a set of minimum biosecurity standards

- Target population all fish on farm (i.e. 4 tanks, total 15,250 fish)
- DP 2 %
- Diagnostic test:
 - Gross pathology
 - Histopathology
 - Elisa
 - Sn? Sp?
- Sample size: 169 fish

Sampling

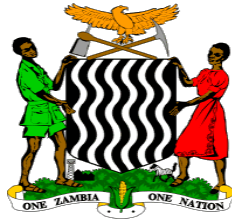
- 4 tanks: 1,850; 4,250; 4,270; 4,880)
- Total: 15,250 fish
- Simple random sampling
- Proportional stratified sampling will guarantee that each tank is represented
- First tank $1850/15,250 = 12,13\%$ (21 fish)
- How to select fish from tank?
 - During harvest or or routine management (systematic sampling: 21 from 1850 means interval of 88)
 - Capturing (dip net at different locations)

Analysis

- If the calculated sample of 169 is used, and **no positive** reactors are found, the the survey will have a confidence of 95%.

Example 2: National freedom (two stages structured survey)

- Objective: surveillance to prove that country is free from TiLV (**disease freedom**)
- Approach:
 - Sampling villages at the first level, and ponds at second
 - The unit of observation and analysis is pond (infected or not infected pond)
- Survey standards:
 - 95 % confidence that disease will be detected if present
 - The power of survey at 95 % (type II error meaning there is a 5 % chance of concluding that farm without infected animal is infected)
- Once farms have been surveyed without detecting disease they are recognised as free, as long as they maintain a set of minimum biosecurity standards



UTF/077/ZAM: Technical Assistance to the Zambia Aquaculture Enterprise Development Project (ZAEDP)

Thank you for your attention